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Liquid footprints : water, urbanism, and sustainability in Roman Ostia

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Liquid Footprints

Water, Urbanism, and Sustainability in Roman Ostia

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Preface

The eminent position of water in the Roman world embedded it within every aspect of its culture and history. Multi-faceted combinations of cultural, technological, religious, and natural factors have always influenced the reactions to this universal human need. While resource usage has always been the most pressing concern of human communities, the global community of the 21st century is becoming increasingly aware of the fragility of essential resources such as clean air, food, and water. Global warming and related violent weather episodes, economic upheaval, and military action related to water resources are pressing realities by the end of this century, although they are already present in numerous sub-sections of the globe. It is clear that resource usage is, just as all aspects of human activities, experienced through a host of (un)conscious decisions motivated by social culture, technology, and the object's physical properties.

The path to this 21st century moment of resource awareness has recently been trailed by the growth of sustainability and development studies. The present study does not use "sustainability" as an amorphous buzzword, or to ask to what degree we are more or less like the Romans in terms of resource usage patterns. Rather, it aims to create a methodological bridge between the rich archaeological evidence from Roman urban sites and the burgeoning field of contemporary urban resource management. The decadence of Roman water usage is an oft-quoted proverb cited to complicitly support the perennial nature of human water waste; the opulent bath buildings of Rome and their landscape striding aqueducts conjure up ideas of an extremely wasteful society oblivious or ignorant of their local landscapes. Indeed, numerous Roman authors themselves praise the conquest of Roman architecture over the landscape.[1] However, the context of these Roman *encomia* have become increasingly scrutinized following the explosion of literary, historical, and archaeological research conducted in the past century.[2]

This study explores the limits and expressions of Roman resource usage and identifies how Roman cities managed issues of water supply, usage and drainage. It questions how the urban landscape of a Roman city reacted to changing hydraulic needs. Rome's imperial harbor city of Ostia has been chosen as the case study for this project, as more than a century of excavation has revealed an incredible wealth of water features from nearly all periods of Roman history. As part of its mandate to identify the means by which Ostia reacted to its constant need for water, this work acts as a case study for elucidating Roman perceptions of the environment, the (un)sustainability of Roman urbanism, and historical patterns of resource usage.

Initially acting as a military and economic base around the late 4th century B.C., Ostia developed into a thriving harbor of Rome in the late Republican and early Imperial period. The urban fabric of Ostia changed in the 2nd century, and despite a slight urban reduction in the 3rd century, a thriving population of wealthy senators and merchants continued to inhabit the city well into the 6th century.[3] Unlike the abrupt finale of Pompeii, life at Ostia slowly dwindled away until the site was largely abandoned in the 9th century, with the inhabitants clustering around the nearby church of St. Gregory.[4]

[1] E.g. Rutilius Namatianus, *De redito suo* I.15-19 for the topos of Rome's hydraulic glory still used in the early 5th century.

[2] See e.g. Bruun 2016, Sachs 2010.

[3] Procopius, *De bello Gothicus* 1.26.7-13, 5.26.8-19 for Ostia during the Gothic wars.

[4] See Boin 2013 and Lavan 2012 for an update on the archaeological and cultural manifestations of the Late Antique and Early Christian community at Ostia.

Throughout the centuries of habitation at Ostia, the population waxed and waned like the flow of the Tiber, the city's mercurial neighbor.[5] This dynamically changing population, coupled with culturally specific expressions of hygiene, entertainment, and living standards, created the need for an equally responsive hydraulic system, acting in constant dialogue with the larger socio-economic trends in the Mediterranean world.

An introductory chapter (Ch. 1) presents a review of Roman water research, sketching out the development of the field from the Roman writer Frontinus to recent advances in geological analyses. Following this is a presentation of the extensive archaeological work already carried out on the water systems of Ostia. This not only acknowledges the achievements of previous hydraulic researchers, but contextualizes the present study. The history of the excavation of Ostia is briefly described, as the excavation preferences, especially of the mid-20th century, shaped the urban form of Ostia in a profound way. These choices had important consequences for our understanding of Roman urbanism from the 3rd century and later. Delving deeper, the environmental setting of Ostia is presented, to show how many different types of water existed within, below, and around the city. While the literature on the urban development of Ostia is immense, it is summarized here to bring out the larger urban forces at play in different periods of the city's life. This also provides a larger structure within which to place the city's numerous infrastructure networks.

The following chapter (Ch. 2) lays out the theoretical and methodological underpinnings of the study as a whole. In this chapter, we introduce the theoretical framework of this study, engaging with recent debates in materiality and phenomenology, as well as recent developments in socio-cultural studies to demonstrate new ways of thinking of, and with water. This approach opens up myriad horizons for questioning our current and past relationship with water. Shifting from the cultural to the urban, we present recent work on Roman urbanism and approaches to modern urban infrastructure, such as urban metabolism. Expanding in scale, we present a brief introduction of sustainability and, more precisely, sustainable resource management to investigate how urban water usage is studied today. Combining these different streams of inquiry, we present the methodology created for this study, the Roman Water Footprint, which offers a framework for creating a holistic snapshot of water usage in a Roman city. In this way, we can apply an approach used in studying aspects of modern water to our investigation of Roman water usage.

With the theoretical and historical framework laid out, the three case studies are presented. These city blocks, designated III, i, IV, ii, and V, ii, are spread out across Ostia, and have different chronological and archaeological resolution (fig. 0.1). Every structure at Ostia is labeled using a three-part system created during early excavations, which describes the city in terms of five larger zones (regione), the city block (insula), and finally the individual structure within each *insula* (e.g. Regio II, iv, 2 for the Terme di Nettuno). This system will be retained in the present work for clarity, and to more precisely locate individual water features. Every case study is composed of two parts. In the first part (3.1, 4.1, 5.1), the architectural chronology and hydraulic evidence for each building is described. In the second part (3.2, 4.2, 5.2), the hydraulic infrastructure of the entire insula is contextualized with wider cultural and paleo-environmental data available for Ostia.

[5] Meiggs 1973, 532 for 50-60,000 inhabitants in the Antonine period, although this is based only on the 69 ha intramural area.

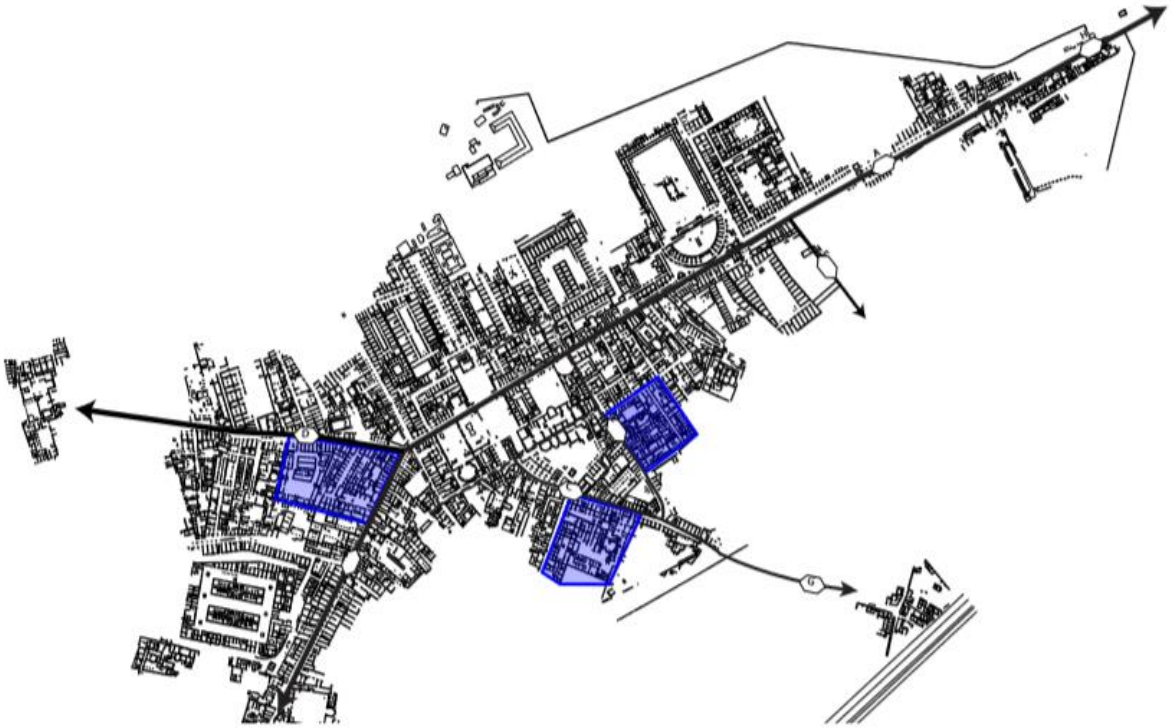

Figure 0.1: Insulae studied in this study.

These three types of data are inserted into the Roman Water Footprint methodology, as outlined in Chapter 2. This method highlights different scalar levels of the infrastructure systems, moving from an individual lead pipe to the level of a bath building, and finally to the level of an entire city block. By assembling all contemporary water features within the insula, these chapters demonstrate urban changes at the level of an entire city block, as well as how water usage in each city block changed through time.

Insula III, i (Ch. 3) is located in the western part of Ostia, where the east-west section of the *decumanus maximus* turns obliquely to the southwest and towards the coast. This insula contains a diverse assemblage of structures, and has attracted most attention for its so-called Basilica Cristiana. The choice of this insula comes from its wealth of surviving structures from the 3rd and 4th centuries AD. The excavation history, chronology, and identified water features are laid out for every building of the insula. Its meager list of past publications makes it a good methodological comparison with the better published insulae discussed in this study.

Insula IV, ii (Ch. 4) is an interconnected group of buildings located along the southern stretch of the *cardo maximus*, and was highly integrated into the urban network. Recent archaeological and socio-spatial research on this block has created a detailed picture of the historical development of movement patterns within the block, as well as within Ostia as a whole.[6] This *insula* comprised structures of domestic, religious, industrial, and entertainment purposes, which all interacted to create a space of dynamic structural and spatial exchange. The diversity of structures present in this block and the distribution of water features make it an excellent case study.

Insula V, ii (Ch. 5) is arguably one of the most well-studied insula in the entire Roman world. It lies southeast of Ostia's forum, and like *insula* IV, ii, also contains a variety of structures. Building upon the meticulous publication organized by Johannes Boersma in 1985, urban survey and archival work undertaken by the author identified important new water features. This chapter incorporates the excavation and restoration carried out by Roberto Petriaggi in the 1990s, which revealed an entirely

[6] Stöger 2011.

new structure underneath a seemingly empty building, as well as a network of sewer channels. The evidence from this insula provides new material to the discussion about Late Antique infrastructure of Ostia, and adds important new dimensions to the chronology and distribution of Ostia's little explored sewer network.

Chapter 6 presents the analyses of large scale trends of urban water usage at Ostia. This is done by comparing the same Roman Water Footprint in all three insulae, so that Roman Water Footprint #1 of insula III, i is compared to Roman Water Footprint #1 in insulae IV, ii and V, ii. This spatial comparison highlights common trajectories and particular differences within separate areas of the city. New perspectives on the role of water in Ostia's history are given, creating a more nuanced picture of urban life in Ostia. Rather than a city of discretely separated homes, workshops, and religious buildings, the hydraulic evidence presents a city in which neighboring buildings of different functions share water systems, Republican water features stubbornly influence Late Antique building layout, and sewers are found "floating" above the street.

Chapter 7 demonstrates the potential for increased collaboration between urban specialists of all time periods. Implications for the dialogue between 1st and 21st century water usage are explained, and some final remarks are made regarding the further development and future application of the Roman Water Footprint.

Several appendices conclude this study, with Appendix 1 providing a list of terminology used throughout this work. This is given to ensure clarity, or at least consistency in the use of terms like, "basin", "downshaft", or "drain". Appendix 2 presents several pieces of epigraphic data identified from the three insulae studied. Appendix 3 lists every water feature identified for each insula, as well as some additional information for each water feature. All photographs in this study were taken by the author unless otherwise notes.

"According to others, the gods live in the buckets that rise, suspended from a cable, as they appear over the edge of the wells, in the revolving pulleys, in the windlasses of the norias, in the pump handles… in the reservoirs perched on stilts over the roofs, in the slender arches of the aqueducts, in all the columns of water, the vertical pipes, the plungers, the drains, all the way up to the weathercocks that surmount the airy scaffoldings…"[7]

Chapter 1: Introduction

1.0: General Introduction

Water is such a deeply ingrained aspect of all civilizations that any study dealing with water can be quickly overwhelmed by data. This is especially true for Roman civilization, where water was many things to many people: political power, divinity, recreation, destruction, or basic survival. The definition and perception of water varied across the multicultural and geographically dispersed territory of the Roman Empire, changing through time as well. So how should we proceed? We start by looking for traces of where water was, what it did, and what kind of footprints it has left behind in the archaeological record. A single city, Ostia, is the focus of this study, more particularly, three city blocks of Ostia. Instead of focusing on the difficulties of dividing water into discrete categories, perhaps now is the "opportunity for open imagination", and to see the overwhelming diversity of categories into which water seeps as precisely the way to form a better understanding of it.[8] To this end, this research has deliberately engaged with modern sustainable resource studies, which have begun to view water as the overwhelming and amorphous thing that it is.

This introductory chapter presets several main topics, which act as the foundation for the subsequent chapters and the work as a whole. It begins by outlining the history of how water in the Roman world has been studied in the past, and situates the study of water in Ostia within the wider context of Roman hydraulic research. Following this, the site of Ostia is introduced, with an overview of its history of excavation, its landscape, and its urban development. In this way, Ostia's dynamic relationship with Rome and with wider socio-technological trends is highlighted. Continuing on from the historical and environmental context, larger diachronic trends in Ostia's hydraulic infrastructure are presented. As a result, the detailed information on individual buildings and their water systems in subsequent chapters can be placed in a dialogue with the broader socio-environmental history of Ostia, as well as within the field of Roman hydraulic research.

1.1: History of Roman Water Research

The study of water in the Roman world originated with the Renaissance fascination of the Roman ability to harness resources and landscapes on a massive scale.[9] This was partly caused by the repair and creation of aqueduct lines in Rome by several Popes to feed the growing population. As with other contemporary trends in the early development of archaeology, the water supply of Rome was seen initially from an external and monumental perspective. Together with the effusive praises of numerous ancient authors on the harnessing of nature and the luxury it afforded (to those who could afford it), the landscape-spanning arches and opulently marbled bath buildings fostered romantic images of

[7] Calvino 1974, 20, describes the fictional city of Isaura.

[8] Bachelard 1965 [1942 original], 301, *"The mirror which a fountain provides then, is the opportunity for open imagination."* While applying a Freudian lens to water, dreams, and 19th century literature, Bachelard offers a deep study of the personal and emotional experiences possible with water, and how writers like Edgar Allen Poe used sensory experience with water (e.g. a still pond at night) to communicate unconscious feelings.

[9] Coates-Stephens 2003 shows that knowledge on the functioning of aqueducts was never "lost" after the collapse of the Western Roman Empire, but continued through more diversified and small-scale systems, from the 7th and 8th centuries throughout the Medieval and Renaissance periods.

togate Romans enjoying their *otium*.[10] Aqueducts themselves were principally studied from an architectural point of view, although Rodolfo Lanciani's 1881 work serves as the benchmark of Roman hydraulic studies for its dual examination of the physical components of Rome´s water system and an early commentary on Frontinus.[11] The *De Aqueductu Urbis Romae* of Frontinus seemed to offer a straightforward textbook based on his personal experience as the *curator aquarum*, the figure in charge of water supply to Rome from 97-103 AD.[12] Frontinus provided information on a diversity of topics relating to Rome's water supply, from the amounts provided by each aqueduct, to water theft, to organizing maintenance crews, and even to relevant water laws.

The excavations of Pompeii and Herculaneum revealed traces of complex water distribution systems on an urban level, especially with their water towers.[13] These brick and tufa piers are spread across the city, and help to maintain the aqueduct´s water pressure across the changing topography of the city, while at the same time reducing the full force of the aqueduct from bursting pipes.[14] Together with the bundles of exposed pipes poking up through the streets in both of these cities, Roman water systems began to be appreciated for their small scale uses as well as for the monumental aqueducts. However, this focus on urban water systems has remained mostly restricted to Pompeii and Herculaneum.

While interest in monumental bath buildings and aqueducts continued to foster hydraulic research throughout the early 20th century, it was not until the late 1980s that hydraulic studies developed into a more substantial research field.[15] As a result, research concentrated upon questions such as the symbolic value Roman water systems, how aqueducts functioned, and about ancient hygiene.[16] Critical examinations of the technical statements and numerical figures presented by Frontinus appeared, resulting in a cascade of literature interpreting his 1st century AD descriptions on technical hydraulic components and its accompanying administrative functions.[17] The disconnect between archaeological evidence and Frontinus' text is now resolved by seeing the *de aquae ductu* less as a literal handbook, but part of a larger genre of elite technical treatises in the 1st century AD.[18] New studies of aqueduct lines in Ephesus and Constantinople continue to demonstrate the complexity and creative solutions utilized by Roman hydraulic engineers to transport water on a measured gradient across hundreds of kilometers.[19]

---

[10] Such as Pliny the Younger's description of his Laurentine villa (*Ep*. 1.9): *"The sea and shore are truly my private Helicon, an endless source of inspiration. You should take the first opportunity yourself to …. devote yourself to literature or to leisure".*

[11] Lanciani 1881.

[12] Bruun & Saastamoinen (eds.) 2003 complied several valuable articles dealing with aspects of Frontinus' life. No study of Roman water systems should proceed without a (critical) reading of Frontinus.

[13] Camardo *et al.* 2006 for the two water towers in Herculaneum; Ohlig 2001 for an overview of the urban system of Pompeii; Olsson 2015 for the water towers of Pompeii (updating Larsen 1982).

[14] Kessener 2003 for functional issues of operating these systems; 2013 for a modern example of this system in Palermo.

[15] Ashby 1935, and Van Deman 1934 created invaluable studies on the aqueducts of Rome, tracing every known section of these supply lines in the area around Rome.

[16] DeLaine's 1997 study on the process of construction of the Baths of Caracalla remains a standard work in understanding thermal structures; Scobie 1986 based its extrapolations almost entirely on poetic statements such as Seneca's soundscape of a bath (*Ep*. LVI, 1), and Martial's roadside urine jars (*Ep.*VI, 93, 1).

[17] Bruun 1991; Bruun 2003 traces the manuscript tradition of the *de Aquae Ductu Urbis Romae* and its reception in early Renaissance technological treatises, especially Alberti's *Decem libri de re aedificatoria* (ca. 1450); Hodge 1992 for a still accessible handbook on Roman aqueducts; Nikolic 2011 explores Vitruvius' technical terminology.

[18] Many of Frontinus' terms are still debated, and even parts of his "ideal" water management systems have rarely been archaeologically discovered (e.g. bronze taps). Frontinus' *de aquaeductu* was part of a larger genre of "expert" writings, such as the *de architectura* of Vitruvius, whose Book VII also deals with issues of water supply and management.

[19] For Ephesus see: Pickett 2016, Thür 2006, Wiplinger 2006; for Constantinople see: Bono *et al.* 2010, Crow 2006, 2012a, 2012b.

Specialist conferences on hydraulic aspects of Roman archaeology followed suit, with the Germany-based Frontinus Gesellschaft and the Deutsche Wasserhistorische Gesellschaft coordinating several conferences.[20] The field of Roman water research continues to expand, with specialist works on Roman rivers, Roman health, and Roman bathing produced in the last 20 years.[21] Dedicated handbooks on Roman technology and individual hydraulic components in the early years of the 21st century have provided a much-needed synthesis of the wide ranging spatio-temporal developments in ancient technology.[22] A burgeoning trend in Roman hydraulic research is the numerous studies on ancient latrines and hygiene, presenting an incredible new window into the cultural attitudes and urban development of these crucial urban systems.[23] Studies dealing with Roman water usage across a wide geographical and temporal range have contextualized many aspects of Roman water within their larger urban, religious, and technological settings.[24] Reflecting the collaboration between archaeologists and hydraulic engineers, several recent studies of ancient Roman and Greek hydraulic systems have made use of computational fluid dynamic models.[25] These digital models are used by hydraulic engineers to design contemporary water systems, to predict places where pipes may burst, or where reservoirs may overflow. As so little contemporary ancient material regarding water technology remains, these digital models inform us as to the practical and technical limits of Roman engineering knowledge, by indicating more precisely the material and design limits of ancient water features (Fig. 1.1).

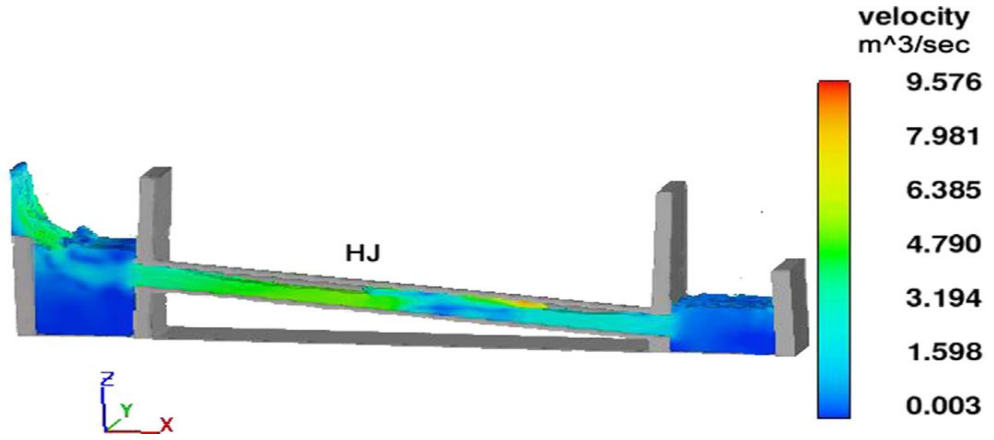

Figure 1.2: Computational Fluid Dynamic model of a steeply sloping pipe in the city of Petra. This model shows the velocity of water flowing from one basin to another, and the point at which a hydraulic jump (HJ) occurs. This jump in water pressure could break or damage the pipeline (Ortloff 2014, 95, Fig. 7).

These digital studies go beyond flow rate calculations and demonstrate how small-scale changes can dramatically impact the overall system. This shifts the focus from descriptive to prescriptive, presenting the limits within which a hydraulic system could function. The development of hydraulic technology has been and continues to be explored from diverse angles, but the central idea of understanding the technological aspects of water continually return to their inseparability from active cultural values. These technologies can only be created, exist, and ultimately survive due to their appropriateness and (real or perceived) usefulness; modern definitions of efficiency, cost, or yield are seldom the reason for

[20] Key publications of these conferences are: De Haan & Jansen 1996, Jansen 2000, Ohlig 2008, Ohlig *et al*. 2002, Wiplinger 2006.
[21] Aldrete 2007; Dessales 2013; Hermon 2010; Rogers 2013.
[22] Important handbooks are: Oleson 2008, Taylor 2010, Wikander 2000; De Haan 2010 offers an overview of private bath-buildings; Stein 2014 gives an excellent study of Roman water pumps.
[23] The work of Gemma Jansen and Ann Koloski-Ostrow established the foundation for this research field; Hobson 2009; Jansen 2002, 2006, Jansen *et al.* 2011; Koloski-Ostrow 2015 all deal with issues of ancient hygiene and sewers.
[24] Wilson-Malouta 2013 on water lifting machines in North Africa.
[25] Haut & Viviers 2007 (Apamea); Locicero 2017 (Ostia); Ortloff 2014 (Petra); Ortloff & Crouch 1998 (Priene); Ortloff & Kassinos 2003 (Aspendos); Tseropoulos *et al*. 2013 (Knossos).

the spread of hydraulic technology in the ancient world.[26] It is the aim of this research to highlight the technological choices made in hydraulic systems in terms of their local and wider context.

1.2: Water Research in Ostia

While issues relating to the water system of any city cannot be extricated from larger works on urbanism, the following section outlines the main corpus of literature dealing specifically with aspects of the acquisition, distribution, and removal of water within Roman Ostia. This also provides an updated *status quaestionis* on the water systems of Ostia. The broader academic trends in analyzing the hydraulic features of Rome have also been applied to the study of Ostian hydraulics, such as the focus on monumental bath buildings, and the isolation of such structures from their neighboring buildings. Following the 18th century work of G. Marini, one of the first to consider the wealth of information available from this category of urban evidence, Wickert's publication of the two C.I.L. XIV Supplement volumes analyzed the known brick stamps from Ostia.[27] These were fundamental in dating many hydraulic structures in Ostia.

One of the first monographs on Ostia was created by Paschetto in 1912. In it he collected all evidence of lead pipes, wells, basins, fountains, and sewer lines known in Ostia up to that point.[28] The monograph published on the archaeological remains of the city by Giuseppe Calza in 1953 revealed a much wider system of water management, especially in light of his extensive excavations between 1938-1942.[29] The fundamental text in English on Ostia was produced by Russell Meiggs, which described the historical, textual, and archaeological evidence of Ostia in its wider Mediterranean setting. His discussion on the baths and fountains describes their integration into the urban landscape.[30] Bruun's 1991 work addressed the corpus of lead *fistulae* pipes from Ostia, offering important conclusions on their chronology, ownership, and production.[31] This added an incredible depth and breadth of knowledge to the subject, which had been touched upon briefly by Barbieri in 1953. Further research of lead pipes in Ostia was carried out by Geremia-Nucci.[32]

While individual bath structures and cisterns were studied,[33] a catalogue of known hydraulic features in Ostia was only created in 1996, by Ricciardi & Scrinari.[34] This work remains fundamental in enumerating many hydraulic features now obscured or destroyed by the tenacious plant growth of the site, yet its catalogue-style layout created a very fragmentary picture for Ostia's water usage. Additionally, many of its functional and dating criteria were unclear, and many of its conclusions have since been revised. The 2002 work of Gemma Jansen dealt with numerous aspects of water in Ostia, and compared its hydraulic strategies with those of Pompeii and Herculaneum. Her work demonstrated the futility of using any single site as a "typical" proxy for water usage in Roman cities, and advocated instead for considering a flexible range of possibilities given local geology, technology, and unique urban characteristics.[35]

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[26] Greene 2000 summarizes the development of this technologically informed paradigm, starting from Finley 1973; Tàbara & Ilhan 2008 for the minor role biophysical constraints actually play in transitions to different types of water sustainability.

[27] Wickert, L. 1930 (C.I.L. XIV, Suppl. 1); *ibid.* 1933 (C.I.L XIV, Suppl. 2).

[28] Paschetto 1912, 247-259 contains all evidence of water at Ostia known at that time.

[29] Calza *et al.* 1953. This will be referred to in all subsequent references as SO 1.

[30] Meiggs 1973, 44-48, 404-420.

[31] Bruun 1991; Bruun 1998 focuses on the prosopography of an Tiberius Claudius Aegialus known from a lead pipe under the Terme di Nettuno.

[32] Barbieri 1953; Geremia-Nucci 2001, 2006 for an updated study of the lead pipes housed under Ostia's Capitolium; Schiøler 1971 attempted to use electrical currents to trace the path of buried lead pipes.

[33] Cicerchia & Marinucci 1992 for the Terme del Foro; Nielsen & Schiøler 1980 for the Terme del Mitra; Medri & Di Cola 2013 for the Terme del Nuotatore; Poccardi 2001, 2006 for overviews of baths in Ostia.

[34] Ricciardi & Scrinari 1996, with the data collected between 1980-1986, and the book written in 1991. This will be referred to in all subsequent references as RS I or RS II.

[35] Jansen 2002 is the fundamental text for Ostia's urban water supply.

Jansen's approach and data have been crucial in carrying out this research. Projects relating to individual aspects of the water system of Ostia continued, such as the work of Bukowiecki, Doublouz, and Dessales, who studied the aqueduct lines supplying the city. They researched the monumental urban cistern (*castellum divisorium*) next to the city's eastern gate (Porta Romana), and demonstrated the clever repurposing of Ostia's defunct Republican city wall to transport water to areas farthest from the aqueduct's arrival point.[36] Several studies dealing with the *fullonicae* brought to light the ingenious systems of water divisions and reuse present in these industrial complexes in Ostia.[37] Numerous smaller articles on more specific aspects of the water system of Ostia continue to proliferate.[38]

Building upon this diversity of published and archival material dealing with the issue of water in Ostia, this research offers a new perspective on urban water usage through the incorporation of 21st century approaches to water management. It offers a highly detailed diachronic study of water systems in diverse areas of the city, and places the abundant archaeological material from Ostia into dialogue with leading methods for assessing the factors and long-term effects of water usage practices. As high resolution data for resource consumption and the urban distribution of hydraulic elements at Ostia are unevenly available, this study achieves the dual goal of updating the current *status quaestionis* of hydraulic knowledge of Ostia, while identifying how these systems changed over time in reaction to shifting economic, cultural, and demographic needs. Researching the complete cycle of water usage in an urban environment is indebted to pre-existing studies on aspects of water flow from Ostia. The present research builds upon these earlier studies through its incorporation of contemporary strategies for examining water usage, yet the diachronic systems approach taken here would not be possible without the work of the scholars named above. This complementary approach seeks to integrate all available evidence of the city's hydraulic infrastructure, and as the following chapter demonstrates, this holistic perspective can offer new theoretical and methodological perspectives. However, in order to contextualize Ostia's water system, its history of excavation and local landscape will first be introduced.

1.3: History of Excavation

"Nelle antiche fontane tornerà a scorrere l'acqua…"[39]

The excavation history of any ancient site contributes an equal understanding of the area as the material produced thereof, given its long-lasting effect on the site. Ostia is no exception, as it offers a window not only into Roman urban development, but also into the development of the Italian state. While the prominent role of archaeology in 18th and 19th century Italian nationalism can only be touched upon here, an outline of Ostia's excavation history is given to demonstrate the changing choices made by succeeding generations of archaeologists, and the resulting tableau of the city. Following the gradual abandonment of Ostia that was completed by the 9th century, the city was already ruinous in some sections, and became used mostly for the harvesting of lime and building materials in the 12th and 13th century.[40] The Renaissance saw a more systematic harvesting of material and antiquities for papal and private collections. As the Papal States dealt with fluctuating levels of Napoleonic control, Pope Pius VII supported excavations at Ostia beginning in 1801, inspired no doubt by the rediscovery of Pompeii in the mid-18th century by de Alcubierre and Weber. These Ostian excavations were led by Carlo Fea, but directed by Giuseppe Petrini, and ended in 1805.[41]

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[36] Bedello *et al*. 2006; Bukowiecki, *et al*. 2008, but hinted at by Jansen 2002, 149, 151 and Ricciardi & Scrinari, Vol I, 98, 120, 130, 170; Vol. II, 272.

[37] Flohr 2013; Pietrogrande 1977.

[38] Bedello Tata & Fogagnolo 2005 for the water wheel in the Terme dei Cisiarii (II, ii, 3); Schmölder 2000 on the public wells and nymphaea at Ostia; Stevens 2005 for water in the Case a Giardino (III, ix).

[39] Calza 1940a, 39.

[40] Heres 1998, 143: C.I.L. XIV, 105 for Ostian inscription in Florence's cathedral in 1296, and for the cathedral of Amalfi (S. Andrea) in the 13th century (C.I.L. XIV, 430); Meiggs 1973, 102.

[41] Rinaldi 2012, 2, Fig. 1 for a detailed overview of Ostia's excavation history in the 19th century.

After a nearly twenty year lacuna, another five year excavation was begun by the Cartoni brothers (Pietro and Felice), aided by Pietro Tonelli, and sponsored by the newly elected bishop of Ostia, Giulio Della Somaglia. This excavation was much less systematic than the previous work of Fea and Petrini, and instead favored more private and lucrative interactions with the church, to which the majority of inscriptions and statuary were given.[42] While previous work had fragmentarily delved around the center of Ostia and its *decumanus maximus*, Bartolomeo Pacca focused his research from 1831 on the marginal areas of the city. Pacca shared his papal patron's appreciation for the domestic proximity of antiquities, and had nearly 250 inscriptions and numerous sculptural works from Ostia placed in his private villa on the Via Aurelia, which acted as a private museum.[43] Excavations in 1855 continued under Pietro Ercole Visconti, and were published by his nephew Carlo Ludovico Visconti in 1857 with the support of Pope Pius IX. A good deal of correspondence emerged from Visconti's relationship to the pope, however this is mainly dedicated to the organizational and bureaucratic aspects of the excavation.[44] With the *Risorgimento* and the creation of a new Italian government in 1870, the papal directed excavations came to an end. The newly created *Soprintendente per gli Scavi e i Monumenti di Roma* continued the excavation at Ostia in 1871 under Pietro Rosa, offering work at Ostia as paid employment for the residual population of revolutionaries remaining in Rome.[45] Despite Rosa's zeal to continue revealing portions of Visconti's unexcavated structures, his exploration of the northern limit of the city weakened the riparian bulwark, and caused irreparable riverine damage to numerous structures. As opposed to Rosa's almost complete lack of recording, Rodolfo Lanciani took over the Ostia excavations from 1877 until 1889, together with his meticulous system of recording. Lanciani identified the serious temporal discontinuities present in the levels of excavation of the structures at Ostia and attempted to connect these discrete trenches. Luigi Borsari and Giuseppe Gatti performed several emergency trenches between 1897-1905 to deal with flooding events of the Tiber. Following this short intermediate period came the tenure of Dante Vaglieri in 1907, who directed more care at individual structures, especially in the area north of the *decumanus maximus* from the Porta Romana to the Caserma dei Vigilies.[46]

After Vaglieri's sudden death in 1912, Ostia became a thoroughly "modern" excavation site with a team composed of Guido Calza, Italo Gismondi, and Raffaele Finelli.[47] Calza continued the meticulous work of Vaglieri until the pace of excavation sped up dramatically during 1938-1942, when Ostia was planned to play an important role in Mussolini's *l'Esposizione Universale Roma*, which ironically never occurred.[48] The removal of much Late Antique and Republican material dates to this period, as the 2nd century AD habitation level was considered more reflective of the Fascist interpretation of the mores and accomplishments of Roman antiquity (Fig. 1.2).[49] Ostia was slated to act as one of many Roman sites portraying an Italy poised between Roman glory (*romanità*), and the Fascist desire to expand upon this

[42] Marini-Recchia *et al*. 2002, 250 also focuses on the 18th century excavation of Ostia.

[43] Marini-Recchia *et al*. 2002, 259. Much of the material from Pacca's villa ended up in the collection of the wealthy Viennese Trau family, which sold most of the works in 1937 to various museums and private collectors.

[44] Marini-Recchia *et al*. 2002, 261. These letters contain valuable historical data, such as the yearly organization of a group of prisoners brought from Rome to work on the dangerously malarial site in return for a reduction in their sentence.

[45] Rinaldi 2012, 3 for Fea's involvement in Ostia's excavation.

[46] Olivanti 2002 describes the recycling of excavation spolia for *bonifica* drainage projects of the malarial swamps around Ostia; Paribeni 1916 continued this trend, sending soil from the temple of Hercules ("Volcano") to Rome for road building and other infrastructure projects.

[47] SO 1, for Calza's personal description of his sudden change in role, and the continued assistance of the site's excavation supervisor, Roberto Paribeni. The creation of ceramic storage, an on-site library, and archives were cutting edge at the time and continue to be a trove of information for modern researchers.

[48] Bakker 1987 provides eye-witness testimony of this excavation from a surviving excavator from this period; Calza 1940a, 39; Calza 1938 (GdSc 25, 2 (3-10-1938)): *"In seguito al lavori dell'Esposizioni Universale, sulla zona Ostiense, il Duce ordina il proseguimento degli scavi di Ostia, affinche la zona del mare e la cittá antica riacquistano il loro splendore"*; Giardina & Vauchez 2000, 234.

[49] SO 1, 44-52 for Calza's decisions on striking a balance on what to excavate, remove, or preserve while excavating 18 ha and 600 thousand cubic meters of soil in four years.

version of the past for future success.[50] Calza's work remains a benchmark in all studies of Ostia, yet the excavation and mimetic reconstruction that occurred under his guidance must be seen as one of the most dramatic post-depositional event to have occurred at the site.

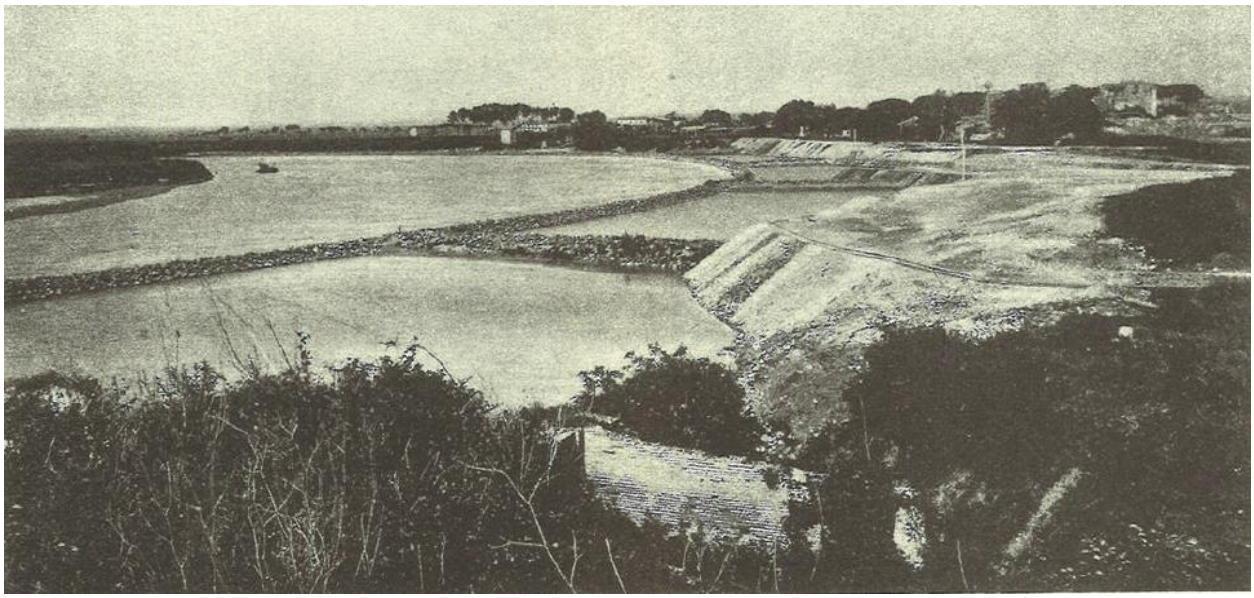

Figure 1.3: Reinforcement of the Tiber's south bank using soil and material from Calza's excavation, with Ostia´s Capitolium in the background (SO1, Tav. XIII).

After the Second World War, Ostia has developed into an archaeological site researched by numerous foreign teams together with the cooperation and assistance of the *Soprintendenza*. Various smaller-scale excavation projects have been carried out, and the past two decades have witnessed a swath of non-invasive surveys, which demonstrate the incredible distribution of structures within the city wall and beyond in every direction, including the north bank of the Tiber.[51] This brief overview of Ostia's excavation history shows the diverse research agendas and historical forces that have been at work in the recent past. These have dramatically impacted the preservation of hydraulic evidence from the city, as the majority of lead pipes known from previous excavations were rarely recorded, or if so, were recorded without proper context. Along the same lines, the wider scholarly distaste for ancient sewer systems stunted the growth of this discipline until relatively recently. The present study offers a *status quaestionis* on the hydraulic evidence of Ostia, and builds upon this rich research tradition to combine many discrete elements of the city's water system.

1.4: Landscape

Ostia is located about 23 km west from Rome, or a five hour walk along the ancient Via Ostiensis toward the seaside. Water surrounded Ostia in nearly all directions, and offered a changing combination of hydraulic opportunities and challenges, with abundant ground water but frequent flooding. Marine erosion beginning after the 8th century BC caused coastal sand ridges to be eroded, which caused the coastal freshwater delta to become brackish in the 6th century B.C.[52] Salt water depositions created ideal conditions for the development of the *stagno Ostiense* marsh and rampant malaria, which persisted into the early 20th century. This coastal formation process also created the underlying topography of

[50] Nelis 2011, 136: especially through the increasingly standardized glorifications of archaeological discoveries in the pseudo-scientific journal *L'Urbe* from 1936 onwards.

[51] Cébeillac-Gervasoni *et al.* 2006, 138-142 for epigraphic evidence on Ostia's Tiber bridges found by modern dredging; see Heinzelman 2001, *ibid. et al.* 2002 for preliminary results, although it is unclear at the time of writing (ca. 15 years after the geophysical fieldwork), whether a final publication is still forthcoming; Sonnemann *et al.* 2015 for geophysical study of the unexcavated area directly bordering *insulae* IV, ii-iv.

[52] Belotti *et al*. 2011, 1112.

Ostia, as a cluster of low alluvial mounds that rose only a few meters above sea level.[53] These mounds are located at the confluence of the ca. 400 km long Tiber River and the Mediterranean Sea. This powerful river acted as an important economic and communication route between Ostia and Rome, while equally inflicting severe flooding events on these cities well into the mid-19th century.[54]

However, anthropogenic and tidal forces caused the yellow silt ejected from the river to inhibit the harbor capabilities of Ostia already by the 2nd century AD, and pushed the modern coastline to lie currently 4 km away from the ancient city.[55] The orientation and location of the ancient coast can be seen today in the position of a modern highway leading to Rome's main airport, Fiumicino. The topographical choice of location must also have been augmented by the abundance of high quality groundwater, easily accessible through the alluvial soil of the Tiber delta (Fig. 1.3).[56] Like numerous other coastal Mediterranean cities, the site-selection process of Ostia allowed the city to take advantage of both its natural resources and economic capabilities.[57] About 13 km south-east of Ostia, the limestone deposits of the Malafede hills are rich in natural springs,[58] which were later tapped for aqueduct lines to Ostia, Portus, and the villa communities to the south.[59]

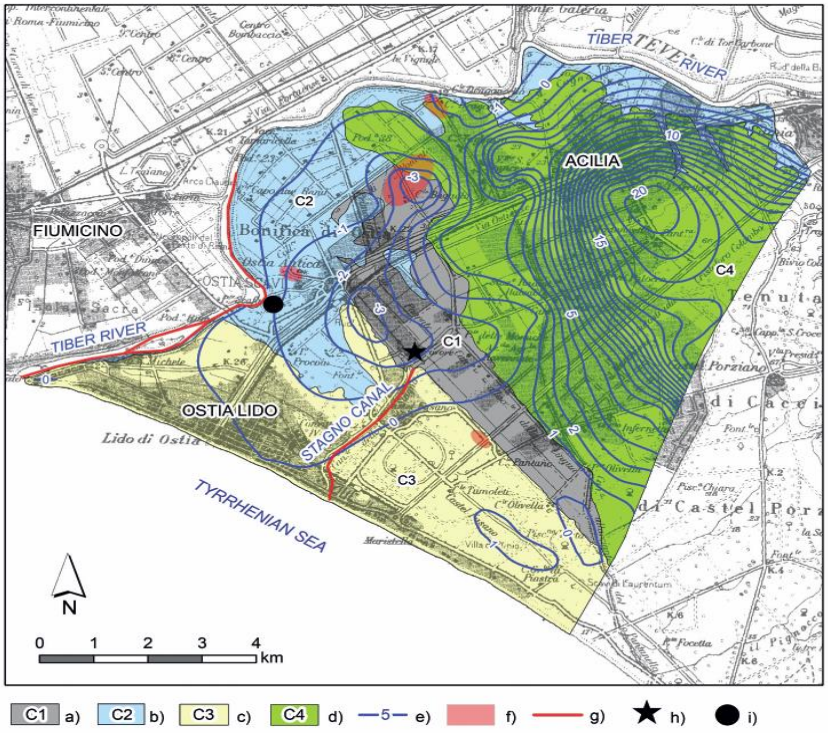

Fig. 2 - Left bank of the Tiber River delta: hydrogeological setting. a) Heterogeneous deposits to backfill quarries HOLOCENE; b) Sandy, silty and clayey alluvial deposits HOLOCENE; c) Sandy beach deposits HOLOCENE; d) Heterogeneous clastic deposits (Sandy- silt and clay deposits interbedded with gravels) PLEISTOCENE; e) piezometric surface (equidistance: 1 m); f) high salinity areas; g) the seawater's rise in the Tiber River and Stagno Canal; h) Ostia reclamation's water pumping station; i) archaeological site of Ostia Antica.

Fig. 2 - Assetto idrogeologico del settore sinistro del Delta del Fiume Tevere. a) Depositi di bonifica OLOCENE; b) Depositi alluvionali sabbiosi, siltosi e argillosi OLOCENE; c) Depositi sabbiosi di spiaggia OLOCENE; d) Depositi clastici eterogenei (depositi sabbioso-siltosi e argillosi intercalati con ghiaie) PLEISTOCENE; e) superficie piezometrica (equidistanza:1 m); f) salinizzazioni della falda localizzate; g) risalita del cuneo marino nel Fiume Tevere e nel Canale dello Stagno; h) Stazione di pompaggio delle Idrovore di ostia; i) sito archeologico di Ostia Antica.

Figure 1.4: The hydrogeological composition of Ostia and the surrounding area. The archaeological site of Ostia is indicated by the dark circle (Mastrorillo *et al.* 2016, 37, Fig. 2).

[53] Arnoldus-Huyzendveld & Paroli 1995, 2014 for the coastal dynamics around Ostia; Jansen 2002, 124.
[54] Aldrete 2007; Calenda *et al.* 2009 for the 19 m tall *muraglioni* built between 1880-1890 to redirect the Tiber's flood waters, which can reach a height of 17 m a.s.l.
[55] Verg. *Aen.* VII, 31 "*multa flavus haerena in mare prorumpit*"; For detailed geoarchaeological studies of Ostia's river harbor basin see Goiran *et al.* 2014; Hadler *et al.* 2015; Salomon *et al.* 2018; Vittori *et al*. 2015; Pepe *et al*. 2016; Wunderlich *et al.* 2017.
[56] Mastrorillo *et al*. 2016 for a recent update of Arnoldus-Huyzendveld & Paroli 1995.
[57] Crouch 2003 for a geologically focussed approach to Greek and Roman urban site-selection.
[58] Bedello Tata, M. *et al.* 2006; Carlut *et al.* 2009; See Sürmelihindi & Passchier 2013 for a detailed overview of the formation process of sinter ($CaCO_3$) in Roman channels.
[59] Grandi & Pellegrino 2006, 496-500; Lauro 2006, 501-506.

1.5: Urban Development of Ostia

A brief description of the urban development of Ostia, must be prefaced by two salient points. The first relates to the incredible distribution of unexcavated structures highlighted by recent geophysical surveys on both sides of the Tiber.[60] These demonstrate that a serious revision or at least re-conceptualization of urbanism, movement, and economy in Ostia is necessary. The amount and location of currently excavated structures must be seen only as a minimum level, and cannot be securely used as a basis for population figures, resource usage volumes, or economic definitions.[61] Secondly, as discussed above, the excavations dating from the 1938-1942 period represent a very distinct idea of how a Roman city *should* have looked at a very static moment in time by creating an ahistorical amalgam of Trajanic, Hadrianic, and Late Antique buildings. While wide swaths of the city were revealed that would not be visible today, equally large quantities of architectural and archaeological material were discarded, following contemporary political forces and archaeological practices. This point is not made to sentimentally cringe at the archaeological practices of the past, but rather to make clear that the visible urban evidence from Ostia is as much a product of 20th century perceptions and reconsolidations as the depositional processes of *la vita quotidiana* in the Roman city.[62]

Ostia originated as one of several Roman littoral fortifications to defend the burgeoning military and economic networks of the city of Rome in the early Republican period. The oldest evidence for settlement in the area comes not from Ostia, but from the site of Ficana, slightly further inland than the river estuary, with a small settlement and necropolis dating to the 2nd half of the 4th century B.C.[63] There was a distinct need for the establishment of *coloniae maritimae*, given the contemporary power of the Syracusan fleet, which had recently sacked the Etruscan city Pyrgi and blocked the establishment of a Roman colony on Sardinia.[64] Although ancient literary sources continued to attribute the founding of Ostia to the legendary king Ancus Marcius in the 7th century B.C.,[65] the tufo blocks of the initial *castrum* and the associated ceramic material suggest a construction date in the late 4th century B.C.[66] This coastal defense was previously organized by the harbors of the cities allied to Rome, and the Ostian venture was organized by the *duoviri navales* from Rome in 311 B.C.

The rectangular *castrum*, or military fort of Ostia, was laid out along pre-existing coastal communication routes, with the *cardo maximus* aligning with the road to the *ager Laurensis* to the south (Fig. 1.4). The oblique line of this road continued toward the mouth of the Tiber through the city along the later Via della Foce. The *decumanus maximus* was connected to the road leading from Rome to the Mediterranean Sea, which later became the *via Ostiensis*. This road crossed the marshes to the east of

[60] Stöger 2011, 215-219 for an incorporation of geophysical data into the study of movement patterns in the intramural area of Ostia; Pellegrino *et al.* 1995 for the area within the original oxbow of the Tiber.

[61] Wilson 2014 critically examines the dangers of proxies in shaping our perception of the Roman world.

[62] The work on Mussolini and his *disiecta membra* approach to Roman archaeology is vast. For a contextualized approach see Giardina & Vauchez 2000, 212-13; SO 1, 40 for Calza's statement even though the war efforts accelerated excavation at Ostia, they were done "*con criteri rigidamente scientifici*".

[63] Martin 1996 for an excavation underneath the *castrum* walls; Zevi 2002, 16.

[64] De Ligt 2014 discusses land division strategies of Rome's early maritime colonies, and the privelege of *vacatio militiae* (exemption from military conscription) allowed only to Ostia and Antium during the Second Punic War (Liv. 27, 38); Sewell 2014 for an updated assessment on non-Roman (i.e. Macedonian) influences for Rome's first colonies; Diod. Sic., XV, 27, 4.

[65] The list of ancient sources referring to Ostia's foundation is vast and a selection is given here to demonstrate the temporal breadth and recurrence of this perception: Cic. *Rep*. II, 3, 5 and II, 18, 33; Dion Hal. *Ant. Rom.* III, 44, 3; Enn. *Ann*. 2, fr. 22; Festus, *Gloss. Lat.* 214; Florus I, 4; Livy I, 33, 9; Pliny *HN* III, 56; Strabo, *Hist.* V, 3, 5. Epigraphic evidence at Ostia also reflects the attribution of the city's founding to Ancus Marcius, e.g. C.I.L. XIV, 4338.

[66] Adembri 1996 for 4th century ceramics (Faliscan, Etruscan, Attic); Cornell 1995, 321 dates this between 380-350 B.C.; Sewell 2010 for a wider Mediterranean context of urban planning, beyond a linear Greece-to-Rome model; Sole 2002 for an overview of Republican structures in Ostia; Zevi 1996, 70 dates the castrum to 300 B.C..

the city, rife with malaria until the 20th century, despite several ancient land-fill projects with material from Rome.[67]

The creation of the office of *quaestor Ostiensis* in 267 B.C. highlights the growing localized power (or at least organization) of the fleet necessary for the ensuing Punic Wars.[68] Following these wars, Ostia had the opportunity to develop its commercial activities, profiting from the much-needed grain and slaves (among other goods) flowing through its harbor from Sicily and Africa. The civil wars that tore across Italy in the 1st century B.C. were not kind to Ostia, and during the reign of Sulla (63-58 B.C.), a perimeter wall enclosing 69 ha was created.[69] These walls became a statement more of civic pride than strictly defensive structures.[70]

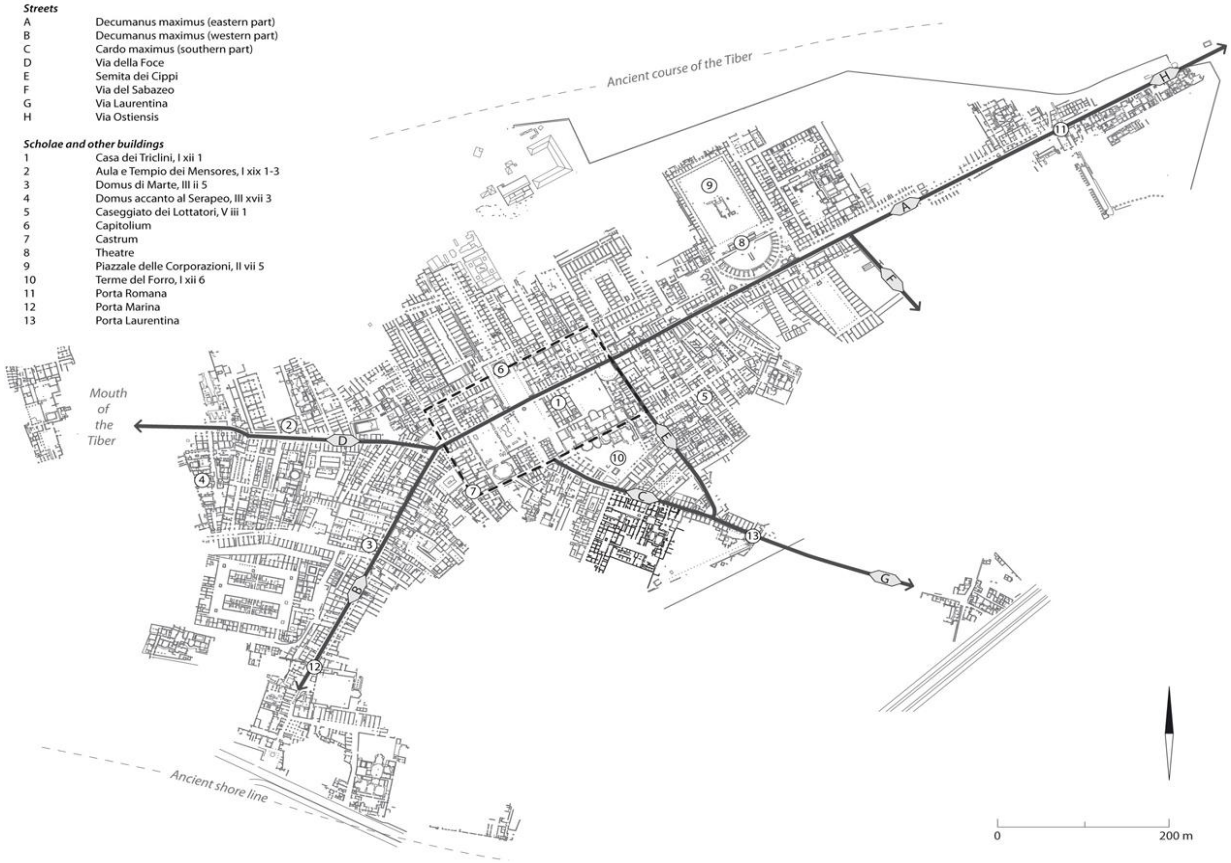

Figure 1.5: Plan of Ostia's excavated structures (after Stöger 2011, v, Fig. 0.1).

It was not until the late 1st and 2nd centuries A.D. that the urban infrastructure of Ostia began to develop more rapidly, experiencing a building boom. A large number of bath buildings, grain storage (*horrea*), religious buildings, and multi-story domestic structures date to this period of prosperity for the city. It is also the period best represented by the current state of archaeological preservation at the site.

Already in the early 2nd century AD, the Tiber delta's progradation and the creation of Portus a short distance to the north dramatically reduced the initial *raison d'etre* of Ostia. However, Ostia and Portus functioned together, and their architectural and cultural interconnectivity is being further brought to

[67] Much of this overview is based on Meiggs 1973, 21; Tac. *Ann*. XV, 43, 3 for material from the 64 AD fire dumped in the marshes; Tac. *Hist*. IV, 53 for material from a Vespasianic rebuilding of the capital also dumped here.
[68] This office is referenced in the mid-1st B.C. inscription of P. Lucilius Gamala (C.I.L. XIV, 375); Cicero (*Mur.* XVIII), defines this Ostian position as undesirable and lacking any real glory or importance (*non tam gratiosam et inlustrem quam negotiosam et molestam*).
[69] Zevi 1996, 89 dated these walls to the activities of Cicero, and not to Sulla, as was previously believed.
[70] For the symbolic nature of late Republican and early Augustan fortification walls, see Gros 1992, 223.

light by recent work at Portus.[71] As the city moved into the 3rd and 4th centuries there is a final push of urban development, although on a reduced scale, demonstrated by the erection of statues in the forum and the creation of new private and public buildings. From the 3rd century until the 6th century AD, Ostia witnessed several Christian martyrdoms, as well as the death of Monica, the mother of St. Augustine.[72] Christian dedications continued into the 6th and 7th century AD, although Procopius noted the declined character of the city during the Justinianic wars.[73] The integration of Christian festivals with pre-existing Ostian festivals and games testifies to the dynamic cultural landscape of the city, although interestingly, none of the temples of Ostia were converted into Christian churches.[74] A Christian basilica was built in the south-eastern part of the intramural area of the city, confirming written sources that Constantine had done so.[75] The Christian community slowly moved south-east of the long defunct Republican walls and around the church to the drowned St. Aurea, martyred under Claudius Gothicus (AD 268-70).[76] This church became the focal point of the clumsily named settlement of Gregoriopolis, after Pope Gregory IV (AD 827-44). As a final moment of historical glory, Ostia was home to the AD 849 battle where the Aghlabid Saracens of North Africa and Sicily attempted a sea battle against an Italian coalition force (including Pope Leo IV), but were destroyed by a storm; the violent scene was later immortalized by Raphael in a fresco in the Vatican Museum in Rome (Fig. 1.5).[77] The fortification of Gregoriopolis was rebuilt between 1503-1513 by Pope Julius II. A major earthquake in 1557 shifted the course of the Tiber about one kilometer to the north, rendering the tower useless for defensive purposes.[78]

[71] Bruun 2002 for the *portus utriusque* discussion; Keay *et al.* 2014a combines satellite imagery with ground penetrating radar to highlight the potential for non-destructive research methods at Portus.

[72] August. *Conf*. IX, 11, 27 for Monica's death in AD 387 while waiting for the ship to Hippo; To relieve himself of grief, Augustine offers an unexpected yet unconvincing etymology of the Greek word "*balneon*", which he sees as meaning "a place for staving off grief"; Boin 2013, 212 for martyrdom of Cyriacus and Aurea, whose church still stands in modern Ostia; Cébeillac-Gervasoni *et al.* 2006, 152 offer a brief discussion of this inscription; Meiggs 1973, 475, saw this paralleled in an inscription at the Forum Baths that named a basin there as a "λουτρον ἀλεξιπονον", or "a basin for driving away grief".

[73] Procop. *Goth.* I, 26,7-13; V, 26, 8-19; VI, 7, 1-3.

[74] Boin 2013, 237; Prudent. *Perist.* II, 353-56 for local religious tension at Ostia over the traditional worship of Vulcan; see Bruun 2012a and Rieger 2004 for a discussion on the pagan-Christian religious interaction in Ostia.

[75] Heinzelmann *et al.* 1997 for the basilica near the Porta Sabazeo; for a detailed discussion of the mis-attribution of the Constantinian basilica to III, i, 4, see Chapter 3 in this work.

[76] Bauer 2003, 54 for the martyrdom of St. Aurea.

[77] Located in the *Stanza dell'incendio del Borgo.* The prisoners captured from this battle built the Leonine wall of Rome, incorporating the Vatican into the Aurelian fortification of Rome.

[78] Pepe *et al.* 2016 carried out pollen coring of the previous oxbow of the Tiber, known as the "Fiume Morto".

Figure 1.6: The Battle of Ostia, as painted by Raphael. The Borgo is depicted in the left of the painting in its position directly on the Tiber river.

1.6: Overview of Ostian Water Infrastructure

Ostia was always a city with water at the core of its identity. Its location beside the Tiber and on the Mediterranean coast afforded it the opportunity to work together with these natural forces for its urban growth and to develop its Mediterranean wide connections. The Tiber continued to experience dramatic flooding events, especially as a result of the widespread agricultural development of land along the upper course of the river.[79] While this topic has garnered several specialist monographs for Rome, Ostia has not received similar fluvial attention, although it has been suggested that flooding was responsible for the widespread redevelopment of the area north of the forum, or for the successive raising of discrete areas of the city over time.[80] The water systems of Ostia were built almost continuously over the city's life, however the system as a whole can be divided into four major phases, when large-scale additions or transformations took place.

1.6.1: 4th century B.C.- AD 50

The initial *castrum* settlement was furnished by wells dug into the groundwater stratum, which can fluctuate up to ca. >0.5 m a.s.l. (Fig. 1.6).[81] Several of these wells exist in the Republican houses built in Regio I and many coeval wells distributed through the city were subsequently raised over the centuries.[82] Adding to this, we can imagine water from the Tiber itself being used for many purposes, although one wonders at the water quality downstream from Rome, where the majority of urban waste

[79] For Roman rivers and flooding: Aldrete 2007; Campbell 2012; Wilson 2008 argues that agricultural expansion and deforestation along the Tiber valley promoted flooding events; Miliaresis 2013, 288 gives a contrary view based on a calculation of the required timber for bath buildings.

[80] DeLaine 2002, 71; Hori & Lavan 2015, 626-632 use the elevation model produced from laser scanning data to hypothesize about the effects of Tiber flooding across Ostia's low relief.

[81] Mastrorillo *et al*. 2016, 36 for a study of the piezometry, or underground dimensions of the groundwater reserve at Ostia.

[82] e.g. RS I, sch.1-10 (pp. 21-27).

was dumped (e.g. corpses, industrial waste, latrine effluvia).[83] Yet, we must suspend modern biases placed upon the perception of water quality, and especially (conflicting) ancient sources discussing the perception and subdivision of water for different purposes.[84] River water of a quality far below modern (i.e. Western, urban) hygienic standards was used until relatively recently in many global cities, and in many places still is. While larger industrial structures and bath buildings continued to run on groundwater throughout the complete history of Ostia, few bathing structures survive from the early imperial period outside of structural fragments as these were built over by later structures.[85]

1.6.2: AD 50-200

The first half of the 1st century AD saw a dramatic turn for the hydraulic possibilities of the city, as the first aqueduct line was created, drawing water from the Malafede hills ca. 13 km to the east of the city. Evidence for the oldest piped water into Ostia comes from an inscribed lead *fistula* pipe from the so-called Macellum (IV, v, ii), which mentions C. Cartilius Poplicola and an associated *balneum*.[86] This indicates that there was flowing piped water in Ostia already from the late-Augustan period. Repair to this first line was undertaken by Vespasian, recorded in a monumental inscription.[87] Monumental cisterns were built in the early 1st and early 2nd centuries AD that were connected to the aqueduct lines, and acted as localized distribution points for various hydraulic needs.[88] The archaeological remains suggest three separate lines to the city, contrasting with the earlier interpretation of a single line based on the visible brick arches.[89]

[83] Gal. *De alimentorum facultatibus* III, 29, 722 on the poor quality of fish downstream from Rome.

[84] For appreciating diverse definitions of "clean" and "dirty" water, see Kamash 2008 and Rogers 2013; Frontin. *Aq.* XCII for different types of water quality and usage in Rome.

[85] The Terme delle Provicie under the Via della Vigile gives an indication of the ground level change at this moment (ca. 1. m). The palaestra of the Terme di Nettuno (II, iv, 2) lies ca. 2 m above an earlier monumental cistern.

[86] C.I.L. XIV, 4711.

[87] For the inscription see Cébeillac-Gervasoni *et al.* 2006, 147: Imp(erator) Caesa[r Vesp]asianu[s Aug(ustus) pont(ifex) max(imus) trib(unicia) pot(estate)/ VIII imp(erator) XVI[I(?) p(ater) p(atriae) co(n)s(ul) VIII] aquaeductus in colonia ost[iensi---].

[88] The Porta Romana *castellum* is the most important cistern of the entire city.

[89] Bukowiecki *et al.* 2008, 51 for a helpful chart of the different aqueduct lines constructed at Ostia.

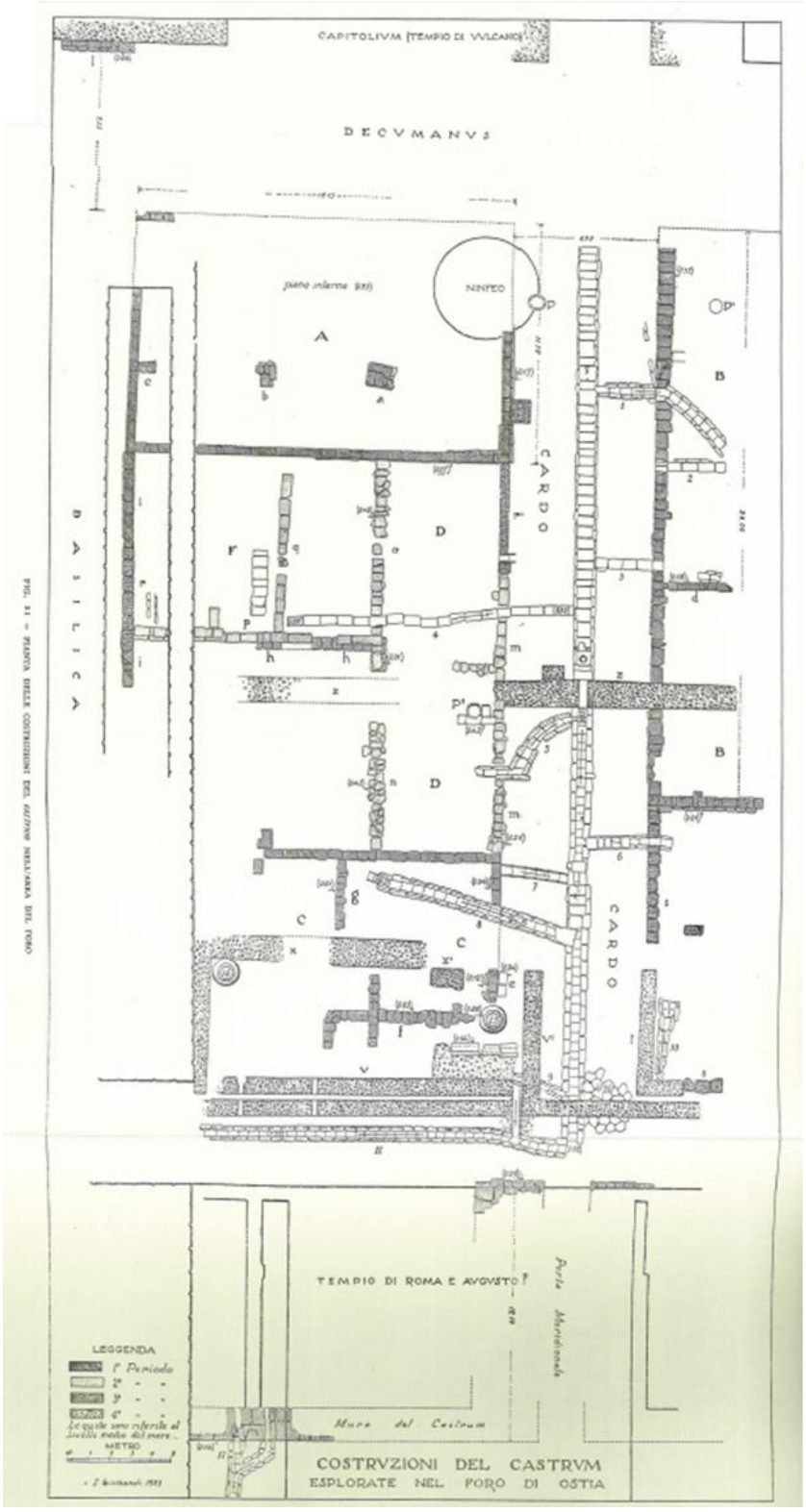

Figure 1.7: Republican wells (indicated by "P") and sections of sewer system identified in the southern part of Ostia's forum (SO 1, Fig. 21). This sewer drained to the south, under the castrum gate.

While the larger hydraulic structures of Ostia received varying degrees of attention as they were discovered, a substantial number of inscribed lead pipes were originally disposed of without much documentation. These pipes (*fistulae*) constitute an important micro-scale level of information regarding urban water distribution, and where present can identify a combination of ownership,

individual workshops, or the official responsible for the supply.[90] A sewer line was installed in the 1st century AD, although little is known of this system beyond scattered marble manhole covers and dispersed sewer sections.[91] Only a rough trajectory of its path is known. Branches of this sewer system were created at moments when large areas of the city were raised. An extensive sewer system would have been necessary for waste removal, as the soft underlying geology and the high level of ground water would have ruled out the use of cesspits like at Pompeii. Ostia's sewer likely flowed out in several different directions, taking advantage of the underlying micro-topography of the city. One branch led to the Tiber as the Cloaca Maxima did in Rome. Although this would put the city at risk of severe sewage problems during flooding, it seems that such an issue was considered a normal part of urban life, if we observe the literary and archaeological evidence of Rome's attitude to flooding (Fig. 1.7).[92] Recent excavations in Ostia's river harbour have confirmed this idea, identifying a sewer drain blocked with the same fill material as the harbour itself.[93] Additional sewers along the periphery of the city support this multi-directional solution to the lack of topographical relief within the city.[94]

1.6.3: AD 200-300

The 3rd century, but especially around the time of the Severan emperors, witnessed many large-scale changes at Ostia. The extramural arches visible to the east of the city are remains of the aqueduct line created in the 3rd century AD. About a dozen brick piers survive directly to the east of the Porta Romana *castellum*, and several arches are preserved in the Medieval Borgo.[95] The oldest historical description of this final aqueduct line comes from notes made by Pope Pius II (1458-1464), who described the incorporation of the aqueduct line into the reconstruction of the nearby medieval Borgo, as well as where the remains of arch bases made contact with the Republican city wall.[96] Many bath buildings were repaired in this period, and others show signs of modification, especially with the creation of apsidal rooms and smaller basins. A little studied feature of Ostian hydraulic architecture are the rectangular or semi-circular shafts which run vertically within the walls of many structures.[97]

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[90] Bruun 1991, 70 for difficulties in interpreting the epigraphic and prosopographic data on lead fistulae.

[91] A growing body of evidence suggests that the position of the marble manhole covers and street-slopes identified by Jansen 2002 can no longer be taken at face value, as the majority of Ostia's streets are now thought to have been completely re-laid in the 20th century.

[92] Aldrete 2007, 126, 142, 204-229 outlines the presence of contemporary Roman technology to avert the reintroduction of the daily 50, 000 kg of human waste and immense volume of sediment (10.6 million metric tons per year) into Rome during a flood but the lack of action; Pliny *HN* 36, 104 on the Cloaca Maxima backing up during a flood.

[93] Heinzelmann 2001, 324; Heinzelmann & Martin 2002, 8 for a sewer line sloping down toward the river harbor basin with the same sedimentation stratigraphy as the basin itself.

[94] Bukowiecki *et al*. 2008, 92 for a sewer in the city gate south of the Porta Romana castellum; David *et al.* 2014 for a sewer section in the Terme del Sileno along the ancient shoreline outside the Porta Marina.

[95] Bukowiecki *et al*. 2008, 170: this aqueduct line is more precisely dated to the Severan period; RS I, 91, Fig. 129, 130; The brick piers are heavily overgrown, yet accessible if one ventures through the densely forested area south of the Via delle Tombe. The aqueduct arches are incorporated into the east side of the convent of the Sant' Aurea church, and are visible from the Via Gesualdo in modern Ostia Antica.

[96] Olivanti 2006, 511-517 for the 1547 map of Eufrosino della Volpaia showing the aqueduct piers following the road from Ostia to Rome.

[97] DeLaine 1997, 153 calls these "down-drains", and suggests a Flavian origin of these features.

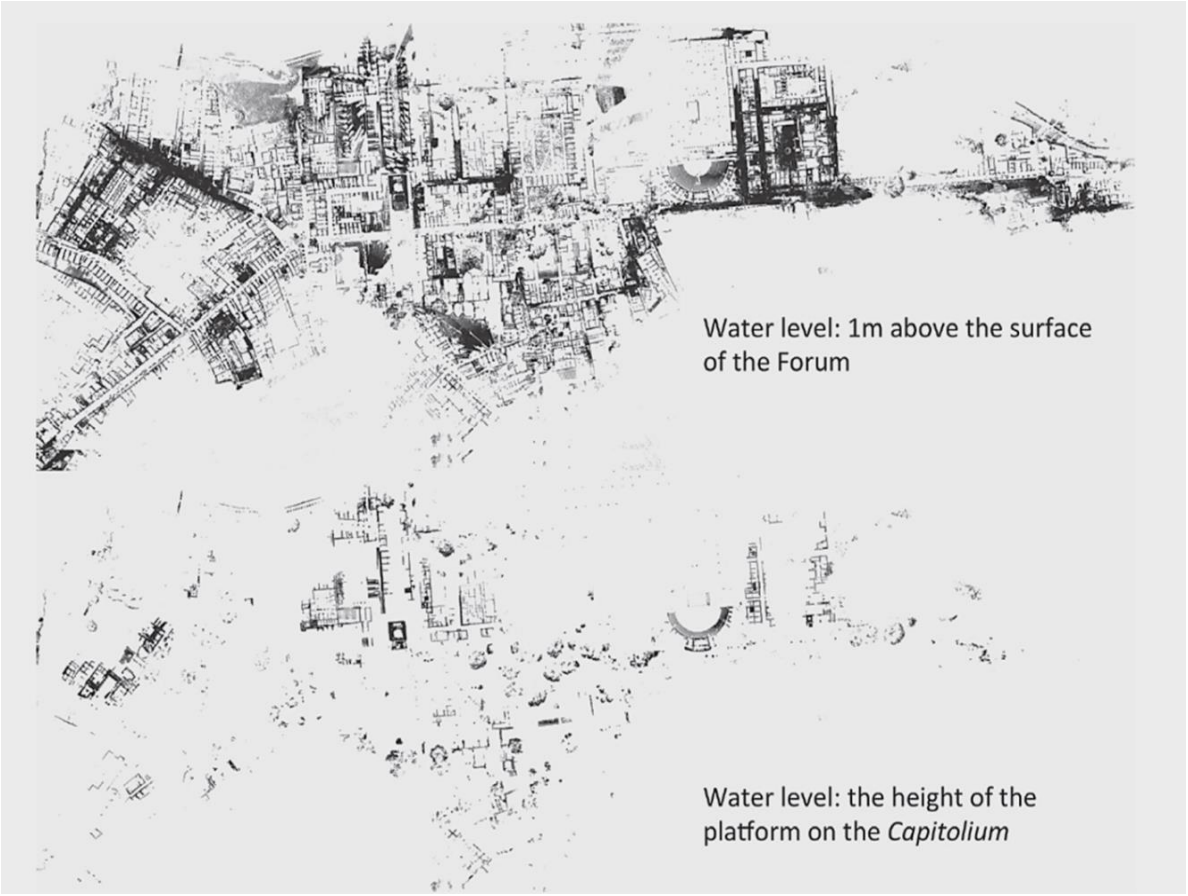

Figure 1.8: Model of Ostia with 1 m of flood water above the surface of the Forum (ca. 7 m a.s.l.) at top, and with water at the height of the Capitolium's platform (ca. 12.4 m a.s.l.) (after Hori & Lavan 2015, 627, Fig. B7).

No cohesive typology of these exist, but the shafts have been discussed recently in relation to toilets and kitchens on upper floors, as well as for the drainage and collecting of rainfall (Fig. 1.8).[98] Often they are present for the entire surviving vertical section of a wall, although they are also known to run partially up the wall before penetrating into another room.

However, the presence of calcium carbonate (sinter) accumulation in only some of these may point to another usage. As the accumulation of sinter in general is a proxy for the concentrated and long-term presence of water flowing from limestone sources (e.g. aqueducts), such sinter within these channels would point to embedded lead or ceramic pipes. As is known from the general layout of Roman dwellings, kitchens, toilets, and drains are often centralized around each other. Although the degree of access to non-limestone based (i.e. karstic) ground water sources versus public fountains is debatable, thick sinter accretions occur only from the (semi)frequent flowing of aqueduct water, as is well known from not only the large cisterns at Ostia, but from aqueducts across the Roman world.[99] Although sinter can form by leaching trace elements of calcium out of mortar and other building material, the amount of eroded

[98] Andrews 2006, 52-62 provides a thorough analysis of the development and function of upper-floor rooms in Herculaneum; Stevens 2005, 119 for external recesses for supply and internal recesses for drainage; Trusler & Hobson 2017 give a well-structured analysis of these down pipes in Pompeii.

[99] Grewe 2015, 290-383 for a comprehensive overview of the use of sinter as a building material instead of marble in dozens of churches in Germany, the Netherlands, and even in England where it was used to pave part of the floor in the Cantebury cathedral.

mortar necessary to form such thick deposits would surely leave a clear absence from the building's structure.[100]

Within Roman domestic and public structures, drains were not divided into used (grey) water and other categories of waste water. Thus, it is surprising that sinter would accumulate only in certain corners of (some of) these shafts if they were merely open vertical drains for mixed waste, or mixed types of water. In Pompeii, several of these piers with embedded rectangular recesses have been securely identified as supporting small, localized *castella aquae*, maintaining water pressure through a system of inverted-siphons and distribution basins.[101] Discussions pertaining to piped aqueduct water on upper floors often rest on height calculations of the terminal *specus* of a city's aqueduct line, however, Roman water technology was not so static and inflexible. Especially at Ostia, where there are several medium sized bath buildings supplied by ground water elevated by water wheels or norias, we should not be surprised to find independent pressure systems created within a city, independent of the initial aqueduct channel (*specus*) height (Fig. 1.9).[102] This suggests a re-framing of how we view life on upper-floors of Roman buildings, especially the large city blocks known in many parts of the Roman Empire.

Figure 1.9: Examples of downshafts extending above the ground floor, at left in the Forum baths (I, xii, 6), at right in the Caseggiato dell Serapide (III, x, 3). In the image at right, note the preserved circular ceramic pipe within the masonry shaft.

[100] Andrews 2006, 59 offers this unconvincing mortar-leaching hypothesis in his study of vertical pipes in Herculaneum.

[101] Ohlig 2001, 352; Peleg 1996; Peleg 2006 for studies of this inverted siphon technology.

[102] Bukowiecki *et al.* 2008, 157 for detailed heights of the aqueduct at the Porta Marina castellum; RS I, 149-155 for total height of Mithras baths water wheels.

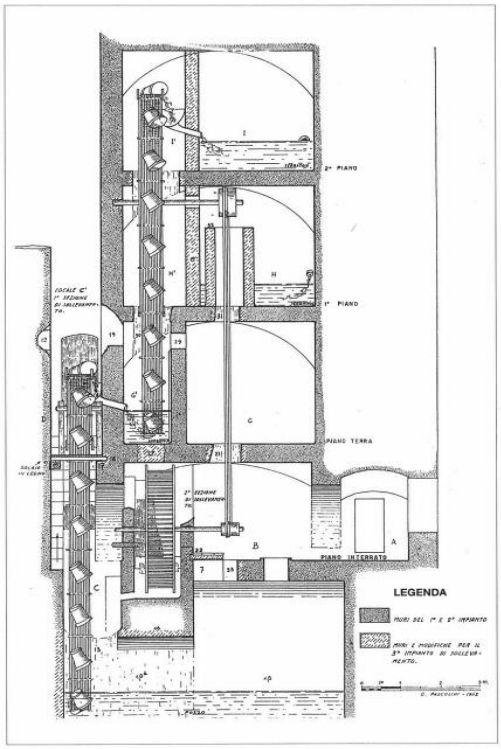

Figure 1.10: Multi-level noria of the Mithras Baths at Ostia, with a total height of ca. 15 m (RS I, 155, Fig. 236).

1.6.4: AD 300-600

Throughout the dynamic urban developments in Ostia, water was used, recycled, and wasted in a variety of culturally defined ways, reflecting an acute awareness of not only the value of water, but also its diverse possibilities for reuse.[103] The continuing modification of the acquisition system of the city is mirrored in the continual creation and rebuilding of the city's numerous bath structures, which persisted well into the 4th and 5th centuries AD.[104]

From the 6th century onwards, the aqueduct lines slowly fell into disrepair, and the population returned to provisioning themselves from the abundant ground water supplies, which in fact had never been absent from the city's landscape.[105] In the late 6th or early 7th century AD a fountain house was built in front of the theater along the *decumanus*, under the arch of Caracalla, and augmented by an honorific plaque to St. Cyriacus, an early bishop of Ostia.[106] The creation of public amenities remained an expression of power, now manifested by local bishops or the Pope. Water systems become more diverse without the benefit of the aqueduct, and there is a strong continuity of rain-water collection in this period.

This broad overview of Ostia's urban and hydraulic history has shown that water was anything but static in the life of the city. Habits, objects, and buildings related to water supply, usage, and drainage were constantly changing and reacting to each other. Ostia was a watery city, yet despite this abundance of waters, the inhabitants developed many nuanced approaches to managing and interacting with

[103] Niaounakis 2011 for the application of waste water from the production of olive oil, with 200 l of oil producing 450 l of waste water.
[104] August. *Conf*. IX, 12, 32 for Augustine visiting a bath building in Ostia to deal with the recent death of his mother, Monica; Poccardi 2006, 228-235 for these Late Antique baths.
[105] RS I, sch. 21a, 21b, roughly built wells located in the middle of the *decumanus maximus*, with serious implications for urban movement.
[106] C.I.L. XIV, 5232.

different types of water. With this background, the challenges of identifying and interpreting traces of water in Ostia's urban fabric are now introduced.

1.7: Data Collection

This research begins initially by recording the existing hydraulic features that have left physical traces within the excavated urban area of Ostia. Three city blocks of Ostia (*insulae* III, i; IV, ii; V, ii) were chosen for as case studies in order to give a representative sample of the detailed hydraulic changes made. The main difficulty with this process is the absence of high-resolution chronological data for many structures. However, the choice of which city blocks to investigate was guided by pre-existing research. The three city blocks selected have been published to an increasing level of detail: *insula* III, i is the least published, *insula* IV, ii has been more thoroughly researched, and *insula* V, ii is published in the greatest detail.[107] This also presents a feasibility test for the methodology, to prove its functionality with different quantities and qualities of input data. The preserved water features range in size from individual lead pipes to monumental bath buildings, and detailed information (e.g. measurements, archival material) on individual drains, pipes, and basin in each *insula* may be found in Appendix 3. In addition to identifying previously unpublished water features, numerous primary site visits to Ostia were essential to verify existing hydraulic features. A singular obstacle to the detailed examination of the surviving structures is the plant-growth of Ostia, composed of wild fig and umbrella pine trees, tenacious vines, and wild fennel. Given the exposed nature of the city and its vicinity to the sea, these are ubiquitous and in some cases have completely obscured entire buildings (Fig. 1.10).

Figure 1.11: Aerial view of *insula* IV, ii seen in 1995 at left (Mannucci 1995, Pl. 44), and in 2015 at right (Sonnemann 2015). The boxes indicate areas of dramatic plant removal (at left), and plant growth (at right).

The author carried out a systematic visual analysis of the standing structural remains. Excavation was not carried out as part of this project, but the internal sections of channels were investigated where possible, by looking through the "man-hole" covers of larger sewers: the entrance holes for water in these cover stones are often long and narrow (Fig. 1.11). An improvised and low-cost tool was utilized

[107] Major publications of each respective *insula*: III, i: Rose 2005; IV, ii: Stöger 2011; V, ii: Boersma 1985.

by the author to peer inside these channels, to ascertain their orientation, and in most of the cases, their internal composition and dimensions.[108]

A comment will briefly be made here of the difficulties in interpreting the archaeological evidence of Ostia based on the high amount of restored architecture within the city. For nearly every structure in Ostia, the architectural remains were carefully "fixed" or re-built during or immediately after their excavation. These 19th and 20th century skilled brick-layers and masons used ancient bricks and materials in these reconstructions, making the identification of the original aspects of any wall a challenge. A careful diachronic study of this mimetic restoration technique was lacking in Ostia until recently, and now offers a guiding hand to both new and seasoned researchers for interpreting the complex stratigraphy within the standing walls.[109] The difference between an original and ancient wall is possible by a detailed look at the size and colour of the bricks, the composition and thickness of the mortar, and by identifying ancient brick stamps (Fig. 1.12).

Figure 1.12: Example of a man-hole cover at Ostia (in IV, ii, 1), with its lozenge shaped openings of ca. 3 x 10 cm.

In addition to the archaeological material, relevant literary descriptions of the city were examined for any mentions of local water features, although these rarely gave any direct reference to standing remains.[110] Epigraphic material on dedicatory plaques, statue bases, and funerary inscriptions are valuable troves of information that provide more detailed information on individual structures and on the urban water supply as a whole.[111]

[108] An extendable mirror of the type used for auto-repairs was extended into the channels. By shining a flashlight onto the mirror, light was reflected into the dark spaces of a sewer or underground channel. Visual inspection could then ascertain structural characteristics of the sewers. A metallic measuring tape was then extended and wedged between the parallel walls of the channel to measure its approximate dimensions.

[109] Rinaldi 2012 for a detailed study of the development of restorations and heritage management at Ostia; Heres 1982 still remains a fundamental reference.

[110] August. *Conf.* IX, 23 for an unknown bath building in Ostia; *Dig.* VIII, 2, 13 for an Ostian bath building putting its hot *tubuli* pipes against a shared wall; Livy *Epit.* XXIV, 96 for a flood in Ostia.

[111] Bruun 1998; Cébeillac-Gervasoni *et al.* 2006; Van der Meer 2012; C.I.L. XIV, 4711, 1 for an otherwise unknown *balneum* at Ostia.

Figure 1.13: A section of mimetically restored wall, with modern repair on the left and ancient masonry on the right (Rinaldi 2012, 24, Fig. 3).

Study of the epigraphic stamps on lead *fistulae* distribution pipes from Ostia have been crucial in this respect.[112] Beyond the primary material evidence from the site, this study incorporates archival material from earlier excavations of the site, including a detailed examination of the *Giornale di Scavi*, the unpublished daily notes of the site's excavation.[113] As the names of roads, buildings, and entire areas of Ostia changed during the decades, deciphering these notes can be a challenging but rewarding process. The photographic archives and office of plans at Ostia were equally important to this research, as they preserve evidence of lost or destroyed parts of the city. A database of known hydraulic features was created by combining the archival evidence with field survey and previously published material. This produced comprehensive distribution maps of water features within the studied *insulae* in Ostia, which are vital for understanding their temporal and spatial distribution.

1.8: *insulae* in Roman cities

As the central case studies of this thesis are city blocks, or insulae, a brief mention will be made to define what constitutes an "*insula*". Although the term is used extensively by primary ancient sources, it can signify a wide range of architectural configurations, from a group of buildings bounded by streets, to a single multi-storey building, or even to a group of buildings within a city block. In reaction to the 2nd century AD population boom caused by the expansion of Portus, numerous multi-story *insulae* were created in Ostia to house the blossoming middle class.[114]

If we look at *insulae* in their single-structure form, the highest floors were in general poorly built, cramped, and often inhabited by the lower or middle class of Roman society. From Rome come the oft-quoted passages and seemingly non-functioning laws describing the slum-like nature of these structures that frequently collapsed or facilitated destructive widespread fires.[115] Wealthier people who also owned the street-front shops usually inhabited the lower levels of the building. There are of course notable exceptions to this trend, and the so-called *medianum*-style of *insulae* at Ostia have larger rooms

[112] Barbieri 1953, Bruun 1991, and Geremia-Nucci 2006 are key sources for Ostian *fistulae*.
[113] For the sake of convenience, the Giornale di Scavi is referenced throughout this work as "GdSc".
[114] Juv. *Sat*. VIII, 171-76 for a (*popina*) portrait of an Ostian pub populated by assassins, coffin-makers, sailors, fugitives, and eunuch priests of Cybele; Juvenal describes the disgraceful nadir of a boastful high-class youth.
[115] Strabo, 235 for 70 ft. max height of buildings in Rome.

and windows, private entrances, and wall paintings.[116] As for the larger spatial definition of *insulae*, we see a wide variation in the number and composition of structures within an area similar to what we would call a city block. There are about 70 *insulae* at Ostia, and they show a remarkable diversity in their contemporary styles, functions, and internal layout.[117] Differing from our modern conception of the division of urban space, we see noxious fulleries next to whirring granaries, and inns sharing a courtyard with a mystery cult.

From a hydraulic perspective, this diversity of structures makes for an interesting reaction to the quotidian needs in bringing, using, recycling, and removing water from any single structure. As discussed above, Ostia was a city with a great deal of flexibility in its choice of water sources, allowing property owners to freely sink one or more wells to reach the ca. 1-2 m groundwater level. Although most *insulae* had aqueduct-connected fountains, wells, or rainwater basins, ornamental and practical fountains were also located along many of the main streets and especially at intersections and gates.[118] Some of these barrel-vaulted fountains (bauletto) can still be observed in Ostia, together with rope marks on their travertine lips and overflow spouts with concave depressions for the collection of water (e.g. Case a Giardino: III, ix, xx).[119]

1.9: Conclusion

While the temporal development of this system will be elaborated upon in subsequent chapters, at this point it is the continuing flexibility of the hydraulic systems of Ostia that should be emphasized. There was never complete dependence on any one single form of water, but rather a range of options for dealing with domestic, religious, industrial, and entertainment needs, themselves dynamically changing together with the cultural composition of Ostia. With the site's historical and geographical background introduced, the subsequent chapter lays out the theoretical perspectives of this work, and introduces a new methodology for conceptualizing the water system of the three *insulae* under study. The archaeological and archival material follow this, building up to a final analysis that will change our conception of water in Ostia, presenting Roman cities as more flexible and opportunistic than has been previously believed.

[116] DeLaine 2004; Gering 2002 on the Case a Giardino; Stevens 2005; See discussion on IV, ii, 5 below for a *medianum* style building.

[117] Packer 1971 for the insulae of Ostia.

[118] Meiggs 1973, 239, *"Water could not be piped to the upper floors, and tenants had to draw their supplies from a public source."*

[119] RS II, Fontane sch.12, 14, 22, 34, 45(?), 53, 57, 59, 98, 106, 111, 119, 127, (n =14). For the concave depressions see Jansen 2002, 144.

"Indeed, we have become so accustomed to the presence of water in our daily life that it has been a long time since we have questioned its existence… Invisibility is indeed the height of conquest."[120]

Chapter 2: Theory and Methodology

2.0: Introduction

This chapter introduces the theoretical framework of this study, engaging with leading developments in archaeological theory to demonstrate new ways of thinking of, and with water. Such an approach offers new horizons for contextualizing our past and present relationship with water beyond increasingly more detailed technical or architectural studies. While it is tempting to place this study in opposition to the traditional technically focused approach, creating a dichotomy between the social and the technological would only reinforce this isolated view. Focusing only on the perception of water in the Roman world, or the social aspects of hydraulic systems would swing the pendulum too far in the other direction. The aim of this study is to identify fragments of the physical hydraulic infrastructure of Ostia, how this system changed over time, and most importantly, why this change even occurred at all.

After introducing several ancient and modern perspectives on water, relevant aspects of modern urban infrastructure studies are then presented. Expanding in scale, a brief introduction to the field of sustainable resource management is then presented, in order to investigate how urban water usage is studied today. Combining these different streams of inquiry, we present the methodology for this thesis, the Roman Water Footprint. This framework was created by the present study in order to develop a holistic and diachronic view of water usage in a Roman urban context. In this way, we can apply the diversity of approaches used in studying modern aspects of water to the investigation of Roman water usage.

2.1: Water and Culture

Studies regarding the diverse perceptions of water for past and present societies are numerous.[121] A brief overview is given here to contextualize this study´s methodology, as well as to demonstrate future directions for exploring water in the Roman world. Previous hydraulic research in archaeology has tended to view water as a neutral or easily defined substance, and not as a culturally reflective object. However, by engaging with current debates in materiality and phenomenology, this study also includes some of the ontological aspects of water. In this way, it explores how the conception of what exactly water is (or is not) has changed dramatically over time, reflecting the culturally circumscribed and often paradoxical nature of water.[122] The perception of water has experienced many theoretical iterations. Pre-Socratic philosophers like Empedocles and Anaxagoras advanced different materials to support an elemental monism of the universe. Rejecting mythological causes for change in the natural world, Thales of Miletus proposed water as the singular underlying element of the universe, although other candidates vied for supremacy.[123] The interpretation that elements are animate in some sense

[120] Goubert, J.-P. 1986, 24.

[121] Mithen 2012 compares water and power in different ancient societies, developing the view advocated by Wittfogel in his seminal 1957 work, *Oriental Despotism*.

[122] Aldrete 2007; Chang 2012; Hodder 2012; Kamash 2008.

[123] These Pre-Socratic views are recorded by Aristotle (*Metaph.* 983b6, 8-11, 17-21) and Vitruvius (*De arch*. VIII, 1). The latter details the preferences of each of the Seven Sages (e.g. Heraclitus suggested fire), and Empedocles suggested there were four prime elements (air, fire, earth, water).

(hylozoism), continued into later Platonic and Stoic thought.[124] Early Christian writers equally used the multiplicity of waters as metaphors for divine power.[125] Literary references from all periods of antiquity regarding different waters span the genres of law, medicine, philosophy, history, and religion.[126] However, central to the ancient perception of water was its locality and heterogeneity, with impressive catalogues and debates over which qualities and individual water sources were considered "best" for different uses.[127]

The perception of what exactly water "is" began to change with the theories and experiments of the Scientific Revolution in the 17th century. With the development of modern chemistry, water underwent an epistemological revolution by its new name: H_2O. Especially into the 19th century, water was increasingly seen as a homogeneous and universal force to be calculated and utilized in the Industrial Revolution. The personalities and local qualities of waters were no longer viewed as "scientific" enough, beyond how they measured up against "pure" H_2O. Bodies of water that were seen previously as beneficial, or moody, or cursed, were now calculated in terms of volumes, discharges, or economic potential. Water, and more broadly, Nature, were abstracted, and devoid of any human settlements or actions. This development has been called "modern water", and continued to change into the 20th century, when it became more connected with the activities and authority of the state.[128] This occurred together with the invention of the water cycle model in the early 20th century, and the contemporary creation of Hydrology as a discipline apart from Earth Sciences (Fig. 2.1).[129] The creation of "modern water" by 20th century scientists was framed as the end of a linear development of water development, judging antique and Renaissance views against how close or far away they lay from the "obvious" water cycle.

[124] Although the idea that all things imbued with life is one of the main teachings of Stoic thought, the term "hylozoism" was only coined in the 17th century by Ralph Cudworth.

[125] August. *Conf.* XIII, 20; Linton 2010, 119-125 outlines the resurgence of this idea in the 17th-19th centuries, where natural theologians in Europe proposed that only God could have the power to create all the natural water systems in the world and to keep them in constant balance.

[126] Plin. *HN.* XXXI; Frontin. *Aq*. XCII; Hp. *Aer*. 7-9; PGM I, 76-79 for lecanomancy (divination by water in a bowl); Suet. *Aug*. 82; *Cod. Iust.* VIII, 3, 17; Juv. *Sat*. V, 51. This subject has yet to be treated as a whole, given the wide array of Latin and Greek literary genres it covers.

[127] Frontin. *Aq.* XCII for different uses of water from the aqueducts of Rome.

[128] Linton 2010, 47; Linton & Budds 2014 expands on the relational-dialectical approach to water and society.

[129] Linton 2010, 148-161 for a thorough discussion of the development and success of the water cycle model. The absence of people, social systems, or even technology idealizes water processes, and removes human action and responsibility from water. A drought can then be blamed on "nature", instead of improper infrastructure management or economically unequal access to water.

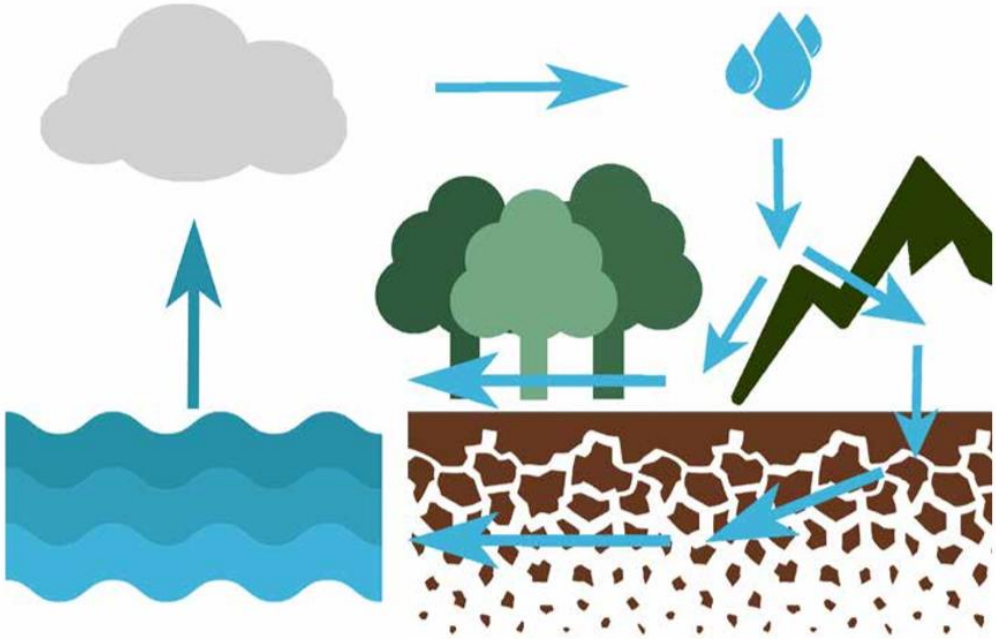

Figure 2.14: The water cycle, as originally outlined by Horton. The absence of people or cities, or different (non-European) geographies makes this model difficult to apply to diverse cultures and regions.

In its current iteration, water continues to be abstracted from its place of origin, towards a market-environmentalist model, with serious implications for social equality and environmental sustainability.[130] However, a new approach, the hydrosocial cycle, has become increasingly investigated and critiqued in the past ten years.[131] This approach moves beyond seeing hydrology (or hydraulic infrastructure) and social sciences as two discrete fields that should be simply combined.[132] Instead, it investigates the process through which water and society (re)make each other over space and time. In this way, "water" represents the constantly negotiated intersection of social structures, technology, and the physical properties of water.[133] After re-examining how the definition of water has changed so frequently and drastically even in the past few centuries, the potential limits of taking a 21st century Western approach to studying water in the Roman world become increasingly more clear.[134]

More recently, Latour's interpretation of the agency of inanimate objects has generated a growing number of debates under the banner of materiality studies.[135] In terms of natural resources, this swinging of the pendulum towards a materiality that eschews the symbolic and representative must be

[130] Alberti 2014, 161; Bakker 2010 for the market-environmentalist model.

[131] Swyngedouw's (2004) idea of hybridized water is key here; for an earlier form of this global view, see Bachelard 1942 for the influence of water on 19th century literature and on the 20th century psyche: *infra* pp.295, *"A mythology of waters, in its entirety, would be only history."*

[132] This dualist view is also termed socio-hydrology, and comes more from an earth sciences approach. It seeks to integrate (or translate) cultural values, norms, and perceptions into quantitative values; see Pande & Sivapalan 2017 for an overview of socio-hydrology and its methods.

[133] Linton 2010, 69 outlines this model.

[134] Chang 2004 explores the same topic for the modern systems for measuring temperature; Chang 2014 convincingly argues against *only* seeing water as H_2O.

[135] Hodder 2012; Latour 1993, 6; Versluys 2014; this approach views objects as active agents entangled in a variety of relationships to other objects, people, and systems, rather than as passive vehicles for other symbols or statements.

wary of replacing one material monism with another.[136] It may be more practical (and realistic) to adopt a position of complementary discourse. This multiplicity or democracy of views has been advocated by, among others, Wittgenstein's idea of complementary discourse, which sought a dialogue between science, biology, and politics, in order to understand different yet interrelated aspects of human culture.[137] The collaborative aspects of complementary discourse have developed further into the theoretical approach of critical realism, which also advocates for using multiple simultaneous systems of practice to highlight different aspects of the archaeological record.[138] This does not imply a relativistic approach, but rather a scientific opportunism that continually (re)considers new and untested conceptions, regardless of how unusual they may first appear.[139] This approach seeks to undermine traditional theoretical dichotomies, like man-nature, subject-object, past-present. By expanding the definition of what water is, or could be, water continues to be used as a lens with which to explore increasingly diverse fields of research.[140] The academic playing field between human and non-human agents has started to become more balanced, provoking new questions on the agency of water, and the ethical ramifications of our relationship to it.[141] For the Roman world, this involves interpreting urban evidence of water systems on Roman terms: a river is not just an economic route for moving goods, but is also an object of cultic worship, an ally in military successes, and with defined realms of legal practice.[142]

While not focusing directly on water, there has been a longer tradition in archaeological research of giving (or recognizing) the agency of the landscape in human cultural actions. The assertions of phenomenology stress the impossibility of objectivity in the experience of any landscape.[143] Following this, there is an increasing awareness of the limits of valuing man-made modifications to the landscape over natural ones. The move away from descriptive or social constructionist views of a place has much to gain from the integration of changing sensory, meteorological, or temporal conditions. Culturally specific viewpoints of nature differ in time and space, yet despite these differences, the consistency of the physical characteristics of water allow for a measure of intercultural comparison.[144] All cultures create avenues of social interaction with water based on its different uses.[145] When human cultures interact with naturally existing water systems, there are often modifications or wholesale changes made

[136] Heidegger 1977 [1954], 9, sardonically uses the transformation of the Rhine river into an energy source to show how modern science *"entraps nature as a calculable coherence of forces"* to prove to ourselves that *"our system of ordering nature is the best."*

[137] Bintliff 2000, 163.

[138] Wallace 2011 sketches the binary structures of Western philosophy (e.g. logical-illogical, true-false), and how to use critical realism to question these dichotomous positions when investigating archaeological material.

[139] Lehoux 2012 uses a similar method to interrogate Roman world views, which seem paradoxical to us, such as the incredible technical skills in engineering, but contemporary belief in one-legged civilizations.

[140] Scherer *et al*. 2015 connects changing isotopic values of oxygen ($\delta^{18}O$) in Mayan skeletal evidence with changing water acquisition patterns; Recent advances in researching water in planetary dynamics is equally robust and frequently makes its way into global news (e.g. Ojha *et al*. 2015).

[141] Ertsen 2016 places hydraulic infrastructure in dynamic dialogue with socio-cultural mores; Kamash 2008 with examples from dams in the Roman Near East; Neimanis 2017 develops a posthuman feminist interpretation of 21st century water usage: *infra* pp. 24 *"… changing how we think about bodies means changing how we think about water."*

[142] Campbell 2012 on legal definitions of when a river is public or private; Le Gall already in 1952 emphasized the mutually important economic and religious role of the Tiber river.

[143] Tilley 2008: The main methods of phenomenology in an archaeological context involve interpreting sensory experiences of landscapes, and how these (mostly visual and objective) experiences impact our understanding and perception of a landscape.

[144] Strang 2005, 2008, develops an anthropological approach to the water-culture intersection, highlighting similarities in water usage habits in a northern Australian aboriginal community (Kowanyama), and in a village in southern England (Stour Valley, Dorset).

[145] Neimanis 2017, 28 calls this the *"fluid turn"*; Rogers 2013 for *"waterscapes"*; Strang 2006 and Edgeworth 2011 for *"fluidscapes"*.

to the system. This in turn creates new system parameters for the human community and influences future levels of interaction between cultural and the natural elements.[146] This dynamic process is called human niche construction, and is situated within post-modern perspectives on the role of the daily actions of individuals.[147] Earlier scholarship on the role of water saw it from a top-down and often colonial perspective, regarding the implementation and running of a larger scale water system as the basic unit for control of an empire.[148] Human niche construction views water systems not as atemporal or monolithic objects, but rather as the constantly changing product of daily or seasonal choices by people interacting with the water system. While researching the monumental aspects of an aqueduct or irrigation network addresses its structural form, investigating systems of political management, maintenance, or changing daily habits gives a more dynamic and bottom-up view of water systems.

Water is thus a useful lens for investigating the dynamic dialogue between past human cultures and landscape, given its complete diffusion within all human physical and societal existence.[149] Although there are limits and serious criticisms of the phenomenological approach to landscape presented above, this study attempts to access some of these perceptions as they applied to resource usage by interrogating the role of water in Roman culture. A full account of the Roman interpretation of nature and landscape would be as varied as the geography over which the cultural blanket broadly termed "Roman" occurred. However, there are several clusters of ideas around which we can gain an insight into the Roman perception of the environment. In the Roman world, water played a central, although sometimes contradictory role in religion, imperial power, settlement planning, farming, and economics.[150] By investigating the Roman perception of water from a Roman perspective, we can start to fully appreciate the diversity, complexity, and flexibility of Roman urban water systems.

2.2: Sustainability and its Application to Roman Urbanism

The historical events that led to our current urban situation are complex and multi-faceted. The role of Roman urbanism and hydraulic technology within this story is equally complex, but a brief overview will demonstrate how we can begin to contextualize our stance on the hydraulic past. Early studies of Roman aqueducts and bath buildings were contemporary with the creation of the early sewer lines in European capitals.[151] Together with extant monumental water structures visible across Europe, this created a misrepresentation of Roman water systems as decadent, luxurious, and strictly monumental. This monumental approach also accounts for the traditional academic focus on aspects of supply.[152] Given the nascent state of urban infrastructure in the 17th century, this uptake is not surprising. However, in our 21st century globalized world, where water, waste, and infrastructure are all increasingly contentious issues, the basic assumptions of our urban infrastructure are being questioned. When we combine this contemporary perspective with the evidence of past diversity of water systems, it then appears that the "modern" city has in most cases tried to replicate *just* the monumental aspects of ancient cities. This could be part of the reason for current issues of water misuse, such as the lack of awareness for the actual value of water, as well as the chronic overconsumption that characterizes

[146] Edgeworth 2011 for the anthropocene modification of almost all global rivers.

[147] Ertsen 2010 for examples of this process in irrigation systems; Laurence & Trifilò 2015, 100 extend this to individual urban actors at the local and global scale in the Roman world; Wilkinson *et al.* 2012 review 9000 years of water management systems in Iran.

[148] Purcell 1996, 200 for Roman mastery over nature as setting poor examples for modern colonial landscape modifications; Wittfogel 1957.

[149] Eliade 1958, 188: *"Water symbolizes the whole of potentiality; it is the fons et origo, the source of all possible existence."*

[150] Bruun 2015 gives an overview of the legal issues of water in Roman agriculture; Hughes 2014 for an overview of environmental issues in the Greek and Roman world.

[151] Euzen & Haghe 2012 for Paris; Gierlinger *et al*. 2013 for Vienna.

[152] Ancient drainage and waste systems have only begun to be researched, especially by Hobsen 2009, Jansen (2002, 2011), and Koloski-Ostrow (2015).

Western water usage. The point here is not that we tried to emulate the Romans, but rather that when modern cities were built, the full complexity, flexibility, and diversity of Roman urban infrastructure was largely unknown. Recent research suggests that water supply, usage, and drainage systems in the future will have a strong tendency towards decentralized, hybrid systems that are more local.[153]

There is no doubt that the effects of resource shortages are a distribution curve well known to populations of all cultural and global timescales. The dramatic figures of growing water scarcity and resulting human illness and fatalities are often cited as examples for the high degree of waste existing in certain neighborhoods of our global city.[154] However, the majority of unsustainable resource usage comes not from a lack of sufficient technological means, but rather from culturally (and economically) bounded ideas of what "normal" resource use is (e.g. flushing a toilet with potable water).[155] A tide of reports from the UN and other international bodies continue to stress that sustainable water usage is a central challenge to growing global population and rapid urbanization.[156]

2.2.1: Systems Theory and Urban Metabolism

In order to schematize hydraulic systems, systems theory and network theories have long been in dialogue with complexity theory, which views human societies as open systems without equilibrium.[157] This evolved out of post-processual stances on subjective approaches to the past; it is more realistic to acknowledge the lacunae we have for the Roman world, and despite the presence of functioning systems, to assume a lack of order, cohesion, or uniformity. The feedback loop method of approaching archaeological material and past environments was inherently part of the post-processual rejection of overarching governing historical processes. It emphasized the malleable relationship between physical systems and cultural systems of organization or hierarchies.

When systems theory was applied to cities, they were seen to function like human bodies, being composed of numerous interlocking systems that require energy and produce waste.[158] This development of urban (socio-)metabolic studies works by analyzing the feedback mechanisms and affordances of resources and systems. Several recent studies have attempted to extend the study of resource usage from the modern period into the past by using iterative regressive models. These create increasingly older views of cities by georeferencing features of the modern landscape and projecting them into the past.[159] These highlight how and when crucial urban structures changed over time (e.g. streets, roads, ports). In the same vein as the cultural turn in sustainability studies, urban metabolism has included a socio-metabolic approach that can identify the manner in which human societies organize their growing exchanges of energy and materials with the environment. While the approach taken by urban metabolism studies has prodded earlier systems theories into a more complex and integrated direction, its modern focus studies the city in the present moment. In this case, man (or a body) may be the measure of all things, but borrowing a riddle from antiquity might help us to structure this principle in a way more conducive to archaeological material (Fig. 2.2). As part of the story of Oedipus, the sphinx asks Oedipus "What goes on four legs in the morning, two legs at midday, and three legs at night", with "man" as the answer. Oedipus' answer highlights how something singular can change

[153] Poustie *et al.* 2015 empirically assess mixtures of centralized and decentralized systems of urban infrastructure in constructing *ex novo* water systems in Port Vila, Vanuatu.
[154] Galli & Mattoon 2013, 8 identified 1971 as the year when global consumption surpassed available sustainable biocapacity; Jones 2010, 5: 700 million people daily drink water contaminated with fecal matter.
[155] Benedickson 2007, 78-97 for the implications of the modern flushing toilet.
[156] 1992 UN Rio convention; *Climate Change 2014: Mitigation of Climate Change*; Water management is explicitly dealt with in UN 2015, Goal 6; UN 2016, secs. 72, 73, 119, 120, 122.
[157] Bentley 2003, 10 provides an introduction to applying complexity theory to archaeological material.
[158] Haberl *et al*. 2013, 32 examine the socioeconomic metabolism of Vienna, comparing its change from agrarian to industrial society (1830-200).
[159] Orengo & Fiz 2007 apply this regressive model to Tarragona in Spain.

some attributes over time while retaining others.[160] If we extend the analogy between a human and a city further, urban metabolism can give a good view of the current systems of the body-city, but has difficulty in tracking past structural changes. In other words, it cannot see changes or continuity between earlier versions of the body-city (i.e. infant, adult, elderly). However, the present study expands the approach of urban metabolism into a diachronic perspective, not privileging any one period of the city's life. If Ostia is conceptualized as a body with water flowing through its veins, then one of the aims of this study is to identify parts of the city's circulatory system, and to investigate how this system changed over time.[161]

2.2.2: Sustainability and Water Accounting Methods

Having introduced the approaches of archaeological theory and urban planning that are used in this study, we introduce its third and most important theoretical pillar, leading approaches to water and urbanism in the contemporary urbanizing world. The perspectives of sustainability and sustainable resource accounting offer a bridge for connecting hydraulic infrastructure with a social approach to water. The broad developments of sustainable resource management are here introduced in order to provide a background for this project's methodology, which was directly inspired by 21st century approaches to urban water management. The idea of resource sustainability and a global perspective of resource usage crept into mainstream and scientific ideology from the 1980's onwards.[162] In the mid-1990s, the idea of attempting to quantitatively identify global resource demand in terms of the available biocapacity resulted in the creation of the Ecological Footprint model.[163] This model attempts to calculate the "biologically productive land and sea area -the ecological assets- that a population requires to produce the renewable resources and ecological services it uses".[164] The Ecological Footprint method attracted critics questioning the reliability of the figures produced, since such calculations require huge amounts of data, numerous assumptions, and a variety of variables. Nevertheless, while resource accounting continues to refine its methodology and data sets to explore the human-nature dialogue, the main point here was to create a relative order of magnitude figure for personal, national, and global resource usage. These figures can then be compared against each other to identify previously hidden habits and trends in ecological resource usage.

[160] The riddle itself is never mentioned directly in Sophocles' drama, but is only alluded to.

[161] This analogy is borrowed from Aristotle's *de partibus animalium* III, 5, 668a: "The system of blood-vessels in the body may be compared to those water-courses which are constructed in gardens: they start from one source, or spring, and branch off into numerous channels, and then into still more, and so on progressively, so as to carry a supply to every part of the garden." Similar body-city comparisons of water and waste are made in Cic., *Nat. D.* II, 254, 141 and Ov., *Met.* IV, 121-4.

[162] Chambers *et al*. 2000 for an overview of Ecological Footprints and Sustainability.

[163] Rees & Wackernagel 1992, 1996.

[164] Galli & Mattoon 2013, 3.

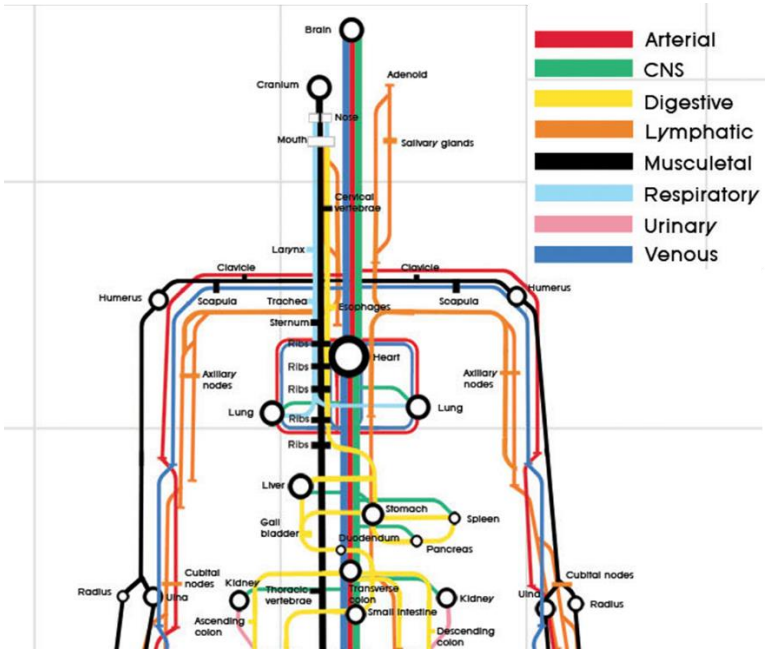

Figure 2.15: The biological systems of the human body conceptualized as a subway map (Sam Loman, *Underskin*, http://www.just-sam.com/just-sam/illustration.html).

2.2.2.1: The Water Footprint

Following similar research questions, the Water Footprint model was created in the early 2000s, and attempted to calculate the total volume of freshwater used to produce goods consumed by a group (e.g. family, city, country, etc.).[165] This diverged from the previous tact of studies dealing with modern urban water usage, which focused more on supply systems. The Water Footprint method took a systems approach and broke down all water into three categories: grey water, green water, and blue water (Fig. 2.3). By dividing the flow of water into these broad categories, this method attempted to identify how much water ("virtual water") was needed to make an object, like a pair of jeans, or a pizza. The goal was to measure the global debt, surplus, and trade of water in economic terms. The Water Footprint method achieved the goal of identifying different types of water and calling for more robust water accounting standards. But the accuracy of its accounting techniques has been rightly criticized, both for the homogenous assumptions made for the data, but also for its lack of local environmental or social factors.[166] As a result, this method has had little purchase in the wider hydrological science community.

[165] Hoekstra 2009; Hoekstra *et al.* 2011 for the Water Footprint method.
[166] Chapagain & Tickner 2012 outline the major criticisms of the Water Footprint method.

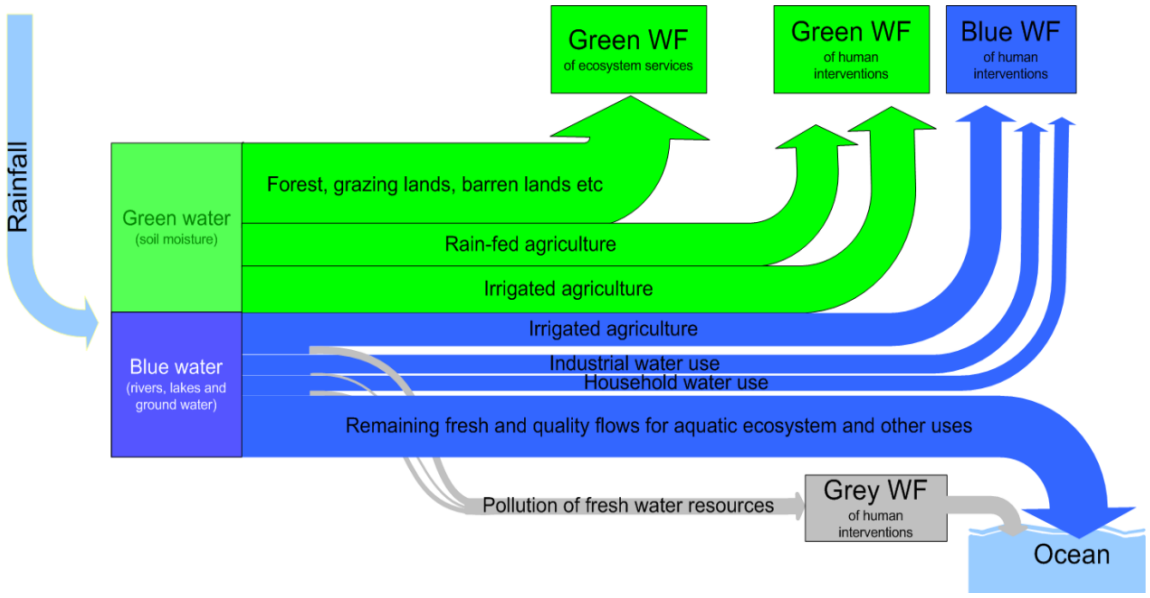

Figure 2.16: Parts of the Water Footprint model and the hydrological cycle, with Green, Grey, and Blue water separated (Chapagain & Tickner 2012, 565, Fig. 1).

2.2.2.2: The City Blueprint

The holistic integration of urban hydraulic systems with environmental and socio-economic factors was first proposed by Dutch researchers as a response to the failings of the Water Footprint model.[167] Their City Blueprint method used eight broad categories (with 24 sub-indicators) to assess the hydraulic sustainability of a city, comparing indices like water security, biodiversity, and governance. While the authors of the City Blueprint method admit that the resulting figures are only the tip of the iceberg, such an intra-city comparison has never before existed. This method has continued to develop since its inception, and its main success was in creating an easily applicable framework with which to compare cities across the world. It also identifies otherwise invisible interconnections between diverse water-related factors, such as the age of a sewer system, public participation, and energy recovery (Fig. 2.4).[168] These aspects are usually treated by specialists in widely different fields and are rarely presented together.

[167] Van Leeuwen *et al.* 2012. A similar model had already been advocated in the 1990s under the heading of of Integrated Water Resources Management (IWRM). This approach became the dominant global policy approach to dealing with the ecological, cultural, and economic values of water. Yet IWRM was criticized for defining water as an abstract "economic" good, and for lacking a method to translate global concepts to local applications; See Koop & Van Leeuwen 2015a, 4631 for a critique of IWRM.

[168] Van Leeuwen 2013; Koop & Van Leeuwen 2015a, 2015b; Van Leeuwen *et al.* 2016.

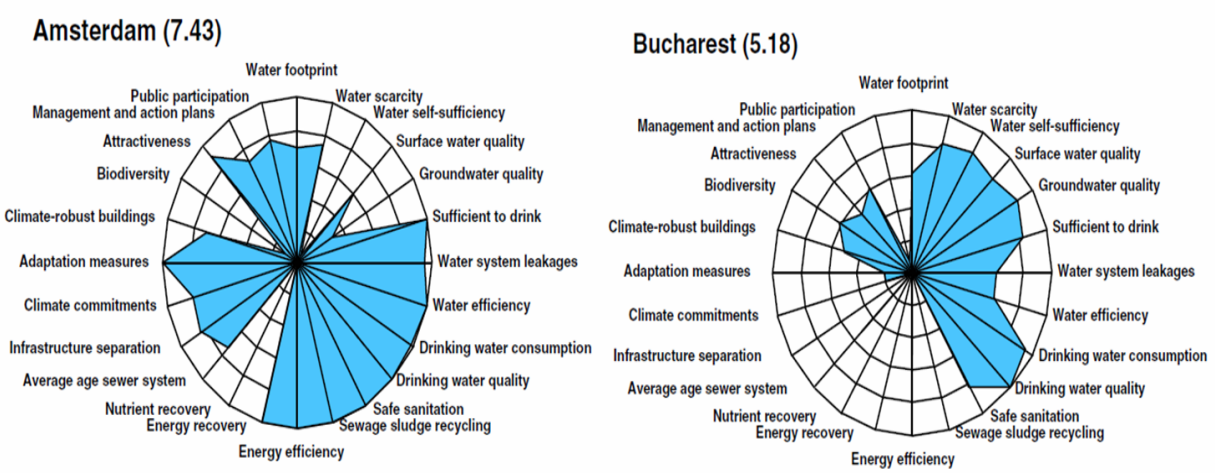

Figure 2.17: Examples of two City Blueprint analyses comparing Amsterdam and Bucharest. The categories with more filled-in areas represent a more sustainable score. By taking an average of the values, a city receives a score out of 10; in these examples, Amsterdam scores higher (7.43/10) compared with Bucharest (5.18/10) (Van Leeuwen 2013, 5196-97, Fig. 2).

Theoretical approaches in archaeology in the late 20th century have also reacted to this global environmental turn by developing an increasing dialogue and cooperation with civil engineering, geology, and urban planning. However, like all instances of initial communication between groups, issues of definition, perception, and intention must be navigated before meaningful dialogue can occur. While Mediterranean archaeology bears a host of ideological, political, and cultural baggage the subject of sustainability equally possesses a unique historiography and cultural framework, which is perhaps made more dynamic by its short life span. So then, to what degree (if at all) can the methods of sustainable resource usage be applied to past societies, and more specifically to Roman urbanism? Is sustainability too socio-temporally bounded as a 21st century world-view to have any meaning for the Roman world? This requires a definition of resource sustainability to see whether such a term can, in fact, be applied to the past. Most research on ancient resource usage usually revolves around three key issues: environmental awareness, recycling, perception of landscape.

2.2.3: Factors of Ancient Sustainability

It is well-attested from literary sources that Romans were keenly aware of their environment and the effects of farming, mining, and weather upon their local area.[169] The pressures of food and water supply for any large city will necessarily cause responsive political, military, or technological actions, whether that entails territorial expansion to ensure grain supply, or the construction of aqueducts from more and more distant sources. Although the Romans did not have our global view of the earth and its resources, they were well aware of the tenuous nature of resource supply, and wanted to ensure the growth of their cities and civilization. This local and seasonal information was often used in designing urban infrastructure, although the degree of diversity between these systems has received little previous attention. A well-known example comes from the aqueducts supplying Rome itself. The Porta Maggiore in Rome preserves evidence of two superimposed aqueduct channels, the Aqua Claudia and the Aqua Anio Novus. Each aqueduct line comes from a different spring, and while it would have been easier to just combine the two lines, the waters were considered diverse enough to keep them separated (Fig. 2.5).[170]

[169] Thommen 2014 and Hughes 2014 provide a useful general overview of the subject.
[170] Linton 2010, 82 for an overview of ancient attitudes to aqueduct waters.

Figure 2.18: The Porta Maggiore in Rome, seen from the Roma Termini train station with two superimposed aqueduct channels to ensure that the different types of water remained separated from each other.

In terms of recycling, there weren't many materials the Romans did not recycle or reuse, and some recent studies have gone so far as to label Roman cities as "self-cleaning".[171] Metal was costly to produce and would not be simply thrown into a landfill; wood was utilized for building projects or to light household fires or stoves. Organic waste could be consumed by slaves, livestock, or used to make agricultural compost. Even human waste could be utilized in a number of creative and lucrative ways.[172] Many Roman cities possessed landfills, and their excavation has revealed a rich source for understanding urban life.[173] Landfills were usually reserved for objects that could not be used or re-purposed for any other process, as with the oil-soaked amphorae sherds of Monte Testaccio in Rome.[174] This is not to say that Roman cities were "clean" by today's standards; the water and air pollution caused by cities dumping waste into rivers and smoke from innumerable oil fires certainly was a reality of urban life.[175] Water itself was reused, as is visible from the drainage systems of numerous Roman bath buildings, in which the water used in bathing was directed to flush out communal latrines. The increasing evidence of cisterns in the Roman world also points to a clear awareness of fluctuating periods of available supply.[176]

The most difficult aspect of understanding resource usage is identifying how a group thinks about its landscape. In trying to discover the complex and contradicting ways that water was viewed in the Roman

[171] Rodríguez-Almeida 2000; Mart. *Ep.* I, 41, 3, X, 3-4; Juv. *Sat*. 5.46f.

[172] Flohr & Wilson 2011 and Munro 2012 outline examples of these practices.
[173] Tarrats 2000 for excavations of the landfills of Tarraco (mod. Tarragona).
[174] Tarquini *et al.* 2014 for a non-invasive approach (infrared spectroscopy) to identify the provenance of different oils preserved on amphora sherds at Monte Testaccio.
[175] For literary mentions of the smog of Rome: Rut. Namat. *De Reditu* 1.193-94; Hor. *Carm*. III, 29.
[176] Bruun 2000, 220 offers some early points of discussion regarding water supply and scarcity, quoting Hodge 1992, 280: "If this second alternative were true (i.e. that the distribution was cut off for the night, in order to meet the next day's demand), it would of course imply a whole philosophy of water supply radically different from the continuous off-take principle traditional to Roman aqueducts. It would imply the acceptance of storage against future needs and something akin to the recognition of peak and off peak hours, an *un-Roman philosophy*", emphasis added by present author.

world, even a cursory glance reveals how amorphous this topic is, extending into the fields of class studies, economics, usage habits, and religion. From archaeological and literary sources we can infer a general Roman worldview about water: all types of water (i.e. rain, sea, river, marsh, fresh, foreign, bought, etc.) could be polyvalent, magical, possessing individual personalities and responses. Any investigation of water infrastructure and usage in the Roman world must take these diverse perceptions into account.

The theoretical framework of this study takes into account the diverse perceptions of how water has been viewed throughout time. By taking a position of active critical realism described above, it is possible to approach the subject of water and urbanism in the Roman city from the contrarian positions of the Romans, allowing for a multiplicity of views. The same democracy of views is advocated for by sustainable resource management studies in the current urbanizing world. These too, have started to turn away from Western normative ideas about what water "should be", and more towards what water is, and the multiplicity of identities that water can have. The recently developed City Blueprint model offers a structure with which to understand the amorphous nature of water in current cities. Given that the same multiple qualities of water are beginning to be identified in the Roman world, we are led to the point from which we can start to translate the approaches of the present into the Roman world.[177] This results in a dynamic dialogue between modern and ancient water habits, usages, and methods of calculations.

2.3: Methodology - The Roman Water Footprint

Given the theoretical framework outlined above, how can a 21st century model, with all its embedded assumptions, be applied to the Roman world? This can be achieved by combining aspects of different modern systems, namely from the Water Footprint method, and the City Blueprint model. The water footprint of a group is the quantitative indication of how much water is used within a given space and time, and is measured over the complete supply chain. The parameters for assessing the water footprint of any city are flexible, and depend on which scales are chosen for investigation.[178] In the context of this study, the systems perspective of water usage has been taken from the Water Footprint model, by tracing the path of water along its complete progression of water flow (acquisition, distribution, usage, waste, recycling). But, this study departs from the water accounting aspect of modern water footprints, as such a level of detailed economic and systemic information is absent for Roman cities. Several modern studies have attempted to generate population figures or average daily intake/usage amounts based on individual aspects of Roman water usage, such as aqueduct volume, cistern size, or length of lead pipes.[179] The resulting figures vary wildly given that the central variable in these calculations is often the "minimum daily requirement" of water, or "need". This value is difficult to estimate even for our contemporary world, given the differences in minimum water considered essential for daily life in, for example, Mongolia, Portugal, or Egypt.

Combining the volumes of known basins to arrive at population figures would seem to miss the mark. While detailed measurements of individual water features have been taken for the water features identified in this study, they are used more to identify changes to the system as a whole in terms of distribution and number of water features. Rather, this study is concerned with the archaeological traces of all types of water usage and how the number and distribution of these changed over time. To achieve this, the central inspiration for this project's methodology comes from the City Blueprint method's attempt to combine water systems with cultural and environmental factors. Following the data acquisition methods outlined in Chapter 1, the chronological beginning of every water feature is recorded in the first part of each chapters (Chapters 3.1, 4.1, 5.1). Every part of the identified hydraulic

[177] Hartley 1953, 1, "The past is a foreign country: they do things differently there."
[178] Hoekstra 2009; Hoekstra *et al.* 2011.
[179] Dessales 2008 for Pompeii.

system is situated within four separate time slices, demarcated by periods of substantial hydraulic change within Ostia's archaeological record.

1) Initial settlement (4th century B.C.) until the aqueduct is created (ca. AD 50).

2) Response to increased water demand (ca. AD 50- 200).

3) Last urban "push" of development (AD 200-300).

4) Late Antique modification of urban space and demographic reduction (AD 300-600).

2.3.1: Water Features

Every water feature identified in this study is given a Feature Number that pertains only to the block under discussion.[180] For clarity and ease of identification, a chart and accompanying map are provided for each building to aid the reader in locating individual water features. Water features are described following the pre-established numerical order of the rooms in each building. After the description of all water features within a given building, the features are organized into temporal phases to present the diachronic hydraulic history of each building in the city block under question. Each of the three case studies (*insulae* III, i; IV, ii; V, ii) are described in three chapters split into two parts. The first part of each chapter (3.1, 4.1, 5.1) presents the chronology and water features from each building. The second section of each chapter (3.2, 4.2, 5.2) combines the water histories of the individual buildings to create a unified picture of water in each of the four water footprint phases across the entire insula (Fig. 2.6). In this way, the reader can access different spatial scales of detail (e.g. individual lead pipe, to the level of the building, the insula level), or temporal scales (e.g. all of the water features in an *insula* in one period, or diachronically). In the diachronic discussion in Chapter 6, the water footprints of all three insulae are compared to each other to present a wider picture of the hydraulic landscape of Ostia in the four different time periods.

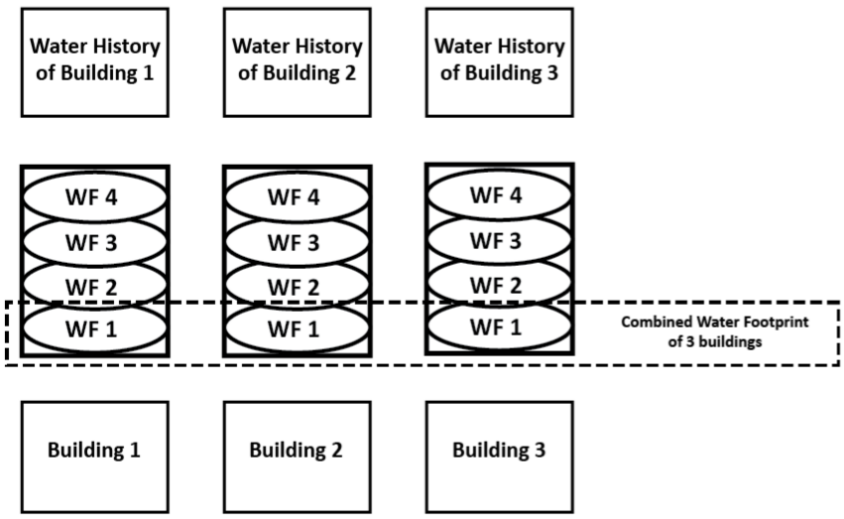

Figure 2.19: Schematic plan of the Roman Water Footprint's methodology.

[180] In this way, Feature 26 in *insula* III, i has no connection to Feature 26 in *insula* IV, ii.

2.3.2: Temporal Duration

The division into four large periods reflects definitive historical moments when the hydraulic system of Ostia significantly changed, and thus has left traces in the archaeological record.[181] This aspect of the methodology focuses on the hydraulic infrastructure, and presents the situation in each period, moving away from a linear (i.e. rise-decline-fall) interpretation of the evidence. Although each water feature has a moment of creation, many of them continue to function into later periods of time. Identifying this duration resolves the issue of how to interpret and contextualize an Augustan well that functions in a Late Antique structure (Fig. 2.7).[182] Where the duration of a particular water feature is unknown, the wider history of a building can be informative regarding whether or not such a feature could function at a later moment.

III, i, 4 Room #	Feature	Feature No.	Initial Water Footprint Phase	RWF period 1	RWF period 2	RWF period 3	RWF period 4
1	rect downshaft	16	2	x	**2**	3	4
3	semi-circ pool	17	4	x	x	x	**4**
3	nymphaeum	18	4	x	x	x	**4**
3	channel	19	4	x	x	x	**4**
3	channels	102	4	x	x	x	**4**
3	downshaft	20	2	x	**2**	3	x
3	sewer	100	2	x	**2**	3	4
11	well	21	1	**1**	2	3	4
III, i, 5 Room #	**Feature**	**Feature No.**	**Initial Water Footprint Phase**	**RWF period 1**	**RWF period 2**	**RWF period 3**	**RWF period 4**
7	well	77	1	**1**	2	x	x
22	basin	31	3?	x	x	**3**	x
24	basin	76	3?	x	x	**3**	x

Figure 2.20: Example of temporal duration identified for several water features in insula III, i.

2.4: Indicators of the Roman Water Footprint

With the temporal aspect clarified, the functional methodology of this project, the *Roman Water Footprint* method will now be introduced. This method was devised by the present study and is based on three major indicators: Infrastructure, Culture, Nature (Tab. 2.1). The criteria for each indicator will be discussed, together with the varying number of sub-indicators it possesses. The majority of the sub-indicators count either the number of a certain kind of water feature, or the different types of a water feature. Given the lack of specific evidence for environmental and cultural data, several proxies are used. Although some of the indicators may appear broad, they were developed to be transparent, accessible, and most importantly, transferable to other urban case studies and other scales of investigation.

[181] For a more detailed description of each hydraulic period, the reader is invited to consult the preceding chapter.
[182] See Appendix 3 for the temporal duration of each feature.

Indicator	Sub-Indicator	Data
Infrastructure	Supply Systems	Rain Water
		Ground Water
		Aqueduct
		Total # of Supply Features
	Usage Systems	Number of Leisure Water Features
		Number of Industrial/Economic Water Features
		Number of Domestic Water Features
		Total # of Usage Features
	Drainage Systems	Sewer
		Downshaft
		Drains
		Total # of Drainage Features
	System Resilience	Number of Types of Supply
		Number of Types of Usage
		Number of Types of Drainage
		Total System Complexity
		Total # of Features
Culture	Private Oriented-insula	Total # of Features
	Public Oriented-insula	Total # of Features
	Private Oriented-Ostia	Total # of Features
	Public Oriented-Ostia	Total # of Features
Nature	External	Tiber River Floods
	Internal	Urban Garbage
		Urban Health (# of Baths)

Table 2.1: Roman Water Footprint framework.

2.4.1: Infrastructure

2.4.1.1: Supply Systems

The hydraulic infrastructure within the city of Ostia is extremely lacunose, but numerous scattered elements remain of the city's supply, usage, and drainage of water. Dedicated systems were built to collect and channel rain water, aqueduct water, and ground water. The easily available and high quality of the groundwater at Ostia promoted its use throughout the city's history, even supplying bath buildings.[183] From epigraphic and iconographic sources, we have evidence that water from the Tiber River, the city's nearby marshes, the sea, and perhaps even water purchased from elsewhere could be used depending on the intended activity.[184] The acquisition of these types of water supply leaves little indication in the archaeological record, and thus cannot be quantified. However, this study assumes

[183] Bedello Tata & Fogagnolo 2005 for the ca. 5 m water wheel in the Terme dei Cisiarii; RS I, 21-68 for wells.

[184] For the buying of water, see Jansen 2002, 154 discusses the epigraphic evidence surrounding Lucifer Aquatarius; for the unexpected uses of marshes see Horden & Purcell 2000, 63 for ancient uses of marshes as part of the *"the exploitation of minutely subdivided polycultures"*.

that water from these sources was constantly used throughout the life of Ostia, acting as a baseline for the city's water needs.

2.4.1.2: Usage Systems

Once water arrived to a structure, it could be used in many different ways. For the purposes of this study, three broad categories of water usage are applied: leisure, industrial/economic, and domestic. While each of these categories carries scholarly baggage with it, they are used here to highlight not only the division of water between these different activities, but also to emphasize examples where water is shared between buildings of a different primary function. This approach also defines water where it is used: a domus house that has a street-front taberna can have both domestic and industrial/economic water usage. Many (sub)categories could easily be added under this heading, but this broad division is intended to give a general overview to usage trends in structures/insulae over their entire life. The specific spatial context of each water feature is explained in the relevant chapters. By dividing the usage features into these functional categories, it reduces the weighting of more visible and luxurious features like *nymphaea*, and brings the more hidden or less glamorous parts of the hydraulic system into focus. The types of usage is also calculated to show the potential diversity in different structures and at different time periods.

2.4.1.3: Drainage Systems

After water had been used, it left its container either directly into a sewer, or first passed through a secondary system of drains. These drainage features range in size from the small outlets of a fountain basin, to vertical downshafts, and to larger sewer systems draining multiple structures. Known information about the wider urban sewer system is described in the relevant chapters. As the sewers under the streets were built by the city, they are not included in the Roman Water Footprint calculations, which takes the individual *insula* as the scale of investigation. Little is known about the historical development of Ostia's sewer network, but any available evidence is included to contextualize each city block with its local sewer network.

2.4.1.4: System Resilience

The final sub-indicator for Infrastructure pertains to the resilience of the system. Resilience is here calculated as a product of the overall complexity of the system. Complexity in this sense represents not just the total number of water features in a building or city block, but also what kinds of water features are present. So, the number of types of each part of the hydraulic system (supply, usage, drainage) are added up. Each of these categories has 3 types, and thus, the maximum possible score is 9/9; this indicates that all possible types of supply, usage, and drainage are present in the building or city block. The greater diversity a system has, the more sustainable it is, given that it can adapt to seasonal and annual variations, or maintenance issues. This also reflects how dependent a building is on a certain system; if the diversity is high, then there is minimal dependence on any single part of the system.[185] Also, by seeing how complex or diverse a building's water system is, it is also possible to see how these combinations of types changed over time. The total number of features is also calculated to give an idea of how representative the complexity is: if one building has a very low complexity, this may be a result of its connection to neighboring buildings, or simply an absence of material. Many modern studies stress the need for expanding urban centers to invest in more diversified and decentralized systems of water acquisition and drainage.[186] A diversified and decentralized infrastructure requires more private activity, but reduces the chance of widespread supply problems if one part of the system is disrupted. In the

[185] Ertsen 2016, 503 outlines the modern biases of defining what "complexity" means for past civilizations, and the potential opportunities in studying water systems through the perspective of human and non-human agencies.
[186] The study of "resilience" in combining natural and social science has been expanding since the 1970s. See Schwanen 2016 for an overview; see Bichai *et al.* 2015 and Liu *et al.* 2012 for research into alternative water supply sources in Australia and China respectively.

same way, identifying smaller scale systems and how they changed over time provides a higher chance of detecting the actions of individuals or groups of individuals.

2.4.2: Culture

An examination of the role of water in different periods of Roman and Ostian culture would require a separate study into changing cultural perceptions of water. Yet, creating a baseline assessment of Ostian perception of water is pivotal to this study in order to integrate the hydraulic infrastructure with its contemporary cultural landscape. This involves using the sub-indicators of "private" and "public" as proxies for the role, or at least the presence of different social applications of water.

2.4.2.1: Public and Private Investment in the *insula*

The broad labels of public and private are contentious, especially when dealing with the non-binary division of Roman domestic space, or evidence of joint industrial-domestic-religious activities.[187] To begin exploring why certain types of water features were used, every water feature identified by this study is labeled "public" or "private". In this way, water features in a taberna are defined as "public", those in a domus are defined as "private", and those in an industrial/economic building are "public". This approach means that if there is a domus, water features inside are private; but if the domus has a taberna that has water features in it, those are labeled public, since they are involved more with public life. While the exact definition of the functional aspects of every room and building can be further explored, these broad categories strive to highlight similarities and differences between contemporary structures with different primary activities.[188] Detailed discussion on the chronology and function of each building can be found in Chapters 3.1, 4.1, and 5.1. The current evidence from Ostia indicates that resource usage is not solely based upon the amount of available resources, but is largely determined by cultural habitus.[189]

2.4.2.2: Public and Private Investment in Ostia

The public-private division of the water features in the *insula* is then compared to those of the city, in order to contextualize the insula within the wider urban and historical context of the city. Data on the public/private labeling of water systems of Ostia as a whole come from the work of Ricciardi & Scrinari; while their data sets are fragmentary and highly problematic, they represent the only large data set available for Ostia as a whole for such broad comparisons.[190] The broader context of a given time period is necessarily the same in each of the case studies, so the character of Ostia in the Severan period acts as a temporal background for each insula. Yet, by identifying the public-private balance in each *insula* and comparing it to the public-private figures of Ricciardi & Scrinari for the wider city, this aspect of the Roman Water Footprint draws into relief the unique relationship between the *insula* and the wider city.

2.4.3: Nature

2.4.3.1: External Environmental Factors

Discussions about nature in the Roman world usually fall between the paleoenvironmental or phenomenological boundaries. In offering a well substantiated yet culturally appropriate view of water in the Roman world, a medium between these poles is proposed here. Roman perception of what classified a water source as "clean" or "dirty" differed largely from ours, and this multiplicity of water

[187] Bablitz 2015, 63 identifies archaeological and literary examples of a private domus used for holding law trials with witnesses, judges, and other accoutrements; Nevett 2010, 90-104; Speksnijder 2015, 87.
[188] The categorization of each water feature (as private or public) can be found in Appendix 3.
[189] Haberl *et al.* 2013; Tàbara & Ilhan 2008.
[190] The author compiled a database of public-private water features based on the attributions presented in RS I and II; Jansen 2002, 129, 169 (note 57) rightly cautions against an uncritical reading of the data in RS.

usage is incorporated into the present study.[191] This is most evident in dealing with the Tiber River. Rivers classified by modern Western standards as "heavily polluted" continue to be used well in to the modern era for non-drinking purposes.[192] In the case of Ostia, the role of the Tiber as a water source has not been given its due owing to an economic focus on the river as a highway. Several recent studies on the development of the Tiber river, the inland salt marshes, and the wider geomorphology of the Tyrrhenian coast continue to offer incredible new dimensions into the environmental context of Ostia.[193] While not dealing specifically with Ostia, detailed studies of the Tiber river's turbulent interaction with the ancient city of Rome are used as proxy data by this study. This pertains mostly to the historical frequency of flooding events in Rome, which occurred irregularly, and are even more irregularly documented by ancient sources.[194] The effect of flooding on Ostia has only begun to be understood, but the high groundwater and vicinity to the sea suggests that flooding and its after effects would certainly have been a concern for the city.[195] In fact, once the riverine sections of the city were excavated to its Roman levels, flooding continued to occur in the 20th century. These flood events (e.g. 1915, 1938, 1941, 1948, 2012) were recorded in archival photographs at Ostia, which showed the extent and depth of water accumulating in the freshly excavated areas (Fig. 2.8).

2.4.3.2: Internal Environmental Factors

Turning from the external to the internal, studies of faunal depositions within Ostia are used in the Roman Water Footprint to approximate the degree of urban health in different periods. This data comes from recent osteo-zoological research, which collected available faunal material from previously excavated sites across Ostia.[196] The context of each of these deposits differ, with an uneven spatial and temporal distribution of the material, as well as the amount of preserved material. The majority of the faunal material comes either from distinct phases of building and leveling, or from the periphery of the city, such as the Porta Marina *castellum* or along the Via Laurentina (Fig. 2.9).

[191] Kamash 2008; Hughes 2014, 177; Frontin. *Aq.* XC-XCII assesses the poor quality of the water from the Anio Vetus aqueduct for drinking, but proposes its use for urban gardens and the lowest level of activities (*sordidiora ministeria*).

[192] Rivers like the Ganges continue to be used for a variety of cultural purposes, irrespective of the level of chemical pollutants; Euzen & Haghe 2012, 239 for changing attitudes to Parisian water choices in the 17th- 20th centuries. Despite numerous advances in water purification technology, that study showed that 42% of Parisians (in 2007) disliked their tap water in favour of bottled water.

[193] Mastrorillo *et al*. 2016; Sadori *et al.* 2016 for the pollen and ostracod evidence from cores.

[194] Aldrete 2007, 242-243 for the chronology of floods in ancient Rome; Several inscriptions found at Ostia refer to the position of *curator alvei Tiberis et riparum*, the position created by Tiberius to manage the course and banks of the Tiber river (e.g. AE 1975, 134, 135).

[195] See Aldrete 2007, 129-158 and Hammond *et al.* 2015 for a discussion on how the after-effects of floods are just as destructive as the flood event itself; Hori & Lavan 2015, 626-631 test different flooding hypotheses for Ostia based on recent laser scanning data.

[196] MacKinnon 2014, 187-195 for further description of biases inherent in the data. Much of the material comes from the more recent excavations of the DAI-AAR.

Figure 2.21: View of the decumanus maximus of Ostia flooded in 2012 (M. David).

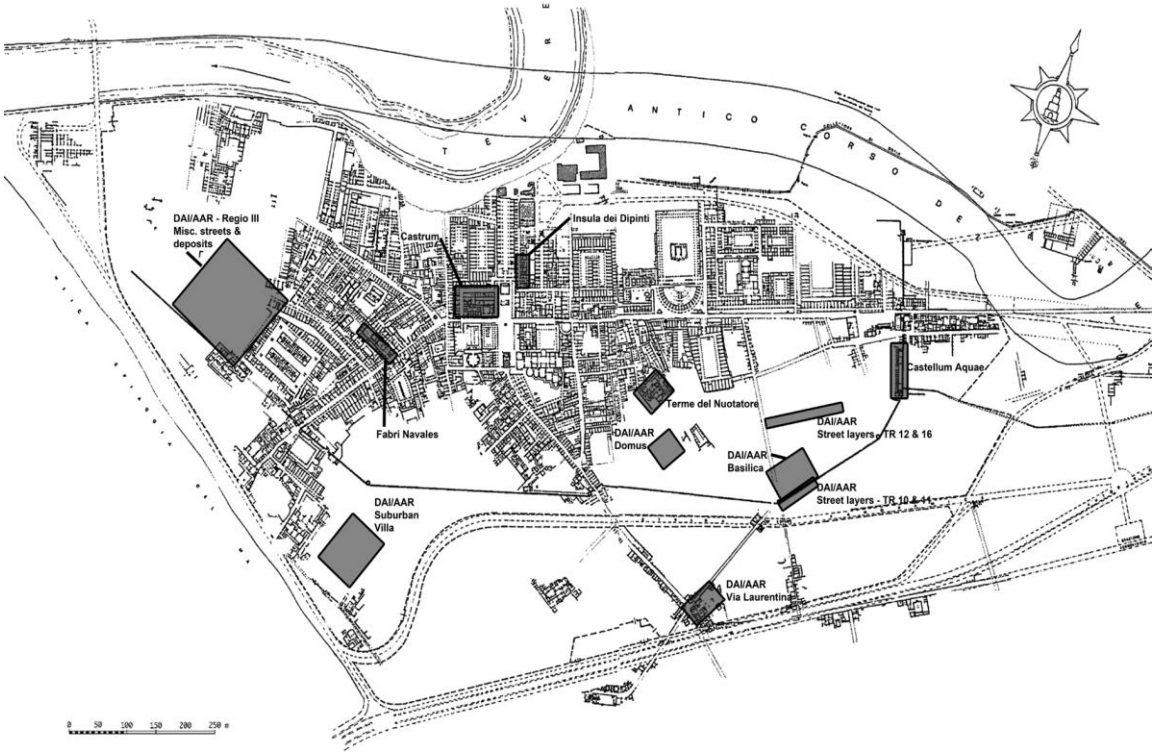

Figure 2.22: Areas of Ostia with osteo-zoological material studied by MacKinnon (MacKinnon 2014, 178, Fig. 1).

The quality of the data are similar to many other classes of information at Ostia, with the majority coming from the 2nd-4th centuries. However, the larger trends in the data do reflect the changing urban shape of Ostia, and can be integrated into the Roman Water Footprint framework. The osteological data

of MacKinnon are here translated in order of their relative increase, to reflect trends on a scale that is compatible with the periods demarcated by the Roman Water Footprint. A value of 1 is given to the material from RWF #1 (4th century B.C.- AD 50) as it has the lowest amount of recorded information, and a value of 3 is given to the subsequent RWF #2 (AD 50-200) given the more than exponential growth in this period. A value of 4 is assigned to RWF #3 (AD 200-300) as it represents the maximum amount of osteological waste identified in the city. A value of 3 is assigned to RWF #4 (AD 300-600) to represent the slight decline but general continuity of material in this period. While the breadth of the categories employed here does not do justice to the detailed nuances of MacKinnon's analyses, or to the wider study of Roman waste habits, they add an important dimension to contextualizing the city's hydraulic system.[197] This is especially the case when waste deposits occur together with collapsed or abandoned buildings, increasing the chance for spreading infectious diseases.

More critical assessments of urban health and hygiene in the Roman world have been debated since the 1980s,[198] but recent research into the presence of ancient parasites has painted a very different picture of a Roman urban environment.[199] Bath buildings are often considered one of the most visible symbols of *romanitas*, and many studies on Roman baths directly connect the opulence of their internal decorations with a supposedly modern level of hygiene and cleanliness.[200] However, some recent research has seen past the marble veneer to the much more important social role of bath buildings, as places for displays of wealth, social status, and for many other non-washing related activities.[201] Although much more could be and has been said on this topic, water, especially in thermal establishments, is often the central vector for the spread of urban parasites.[202] While there are many other ways Romans could encounter endoparasites (e.g. tapeworms, whipworms), or ectoparasites (e.g. lice, fleas, bed bugs), Roman literature and paleoparasitology are full of examples of unhygienic activities occurring in the tepid pools of a bath building (Fig. 2.10).[203] It is unknown how often the water within bath basins was changed, but the lack of chemical additives implies a high degree of infectious diseases within bath water. In terms of the Roman Water Footprint, the number of bath buildings in the city will be used as a proxy for Urban Health, however with an *inverse* meaning (Fig. 2.11).[204] The higher the number of bath buildings, the *worse* the possible health of the urban population is interpreted to be, as there will be an increased risk of coming into contact with water-borne infectious diseases. This approach may seem contrary to the general perception of bathing in the Roman world, but the

[197] Rodríguez-Almeida 2000, 123-127 for Roman cities as "self-cleaning" by means of internal recycling practices.
[198] Scobie 1986 is the fundamental text in this debate; Jansen 2000a for a more updated position on the debate, especially in terms of literary references dealing with waste and pollution in ancient cities.
[199] Mitchell 2015 collects evidence from across the Roman world of preserved parasite remains; Williams *et al*. 2017 for the identification of intestinal parasites (especially roundworm and dysentery causing parasites) in Sagalassos: a strong stomach is recommended when reading such reports.
[200] Zajac 1999 for Roman baths as symbols of euergetism and personal legitimation, and less about cleanliness. She connects this modern perception of baths as places dedicated to hygiene with 19th century European mentality of viewing the cleanliness of the poor as a part of "the public good", and part of normative behaviour and public order; Tac., *Agr.* I, 20 for this view of baths.
[201] Fagan 2011 gives an excellent overview of Roman literary sources dealing with the social aspects of Roman bathing culture (e.g. Mart. *Ep.* II, 42); see also Fagan 2000 and Jansen 2000b for aspects of the ancient hygiene debate; Smith & Kahila 1992 for the discovery of 100 infant skeletons deposited in the sewer of a late Roman bath building in Ashkelon, Israel.
[202] Aspöck *et al.* 2011; Jansen 2000a.
[203] Aus. *Ep.* 106 sometime sick were unclothed and washed their *ulcera scabie putrefacta* in hot pools; Cels. *de Med.* prescribed a trip to bath for open wounds, diarrhea, or other skin infections; Artem. *Oneirocritica,* I, 64 states that very sick people should bathe, but be clothed so as not to offend other bathers with the sight of their infirm bodies.
[204] Medri & Di Cola 2013, 101 for the temporal duration of all known bath buildings in Ostia, with the newly discovered evidence of the Terme del Sileno (IV, ix, 7) included (David *et al.* 2014); the publication of Poccardi's 2006 work on the baths of Ostia may shift these figures slightly, but their overall temporal distribution is unlikely to be affected.

increasing evidence from paleoparasitology and studies of drainage systems of bath buildings strongly suggest that this perspective should be added to our understanding of Roman thermal establishments. Such a metric is included in the Roman Water Footprint to give at least a baseline indication of the water-related health of the population of Ostia.

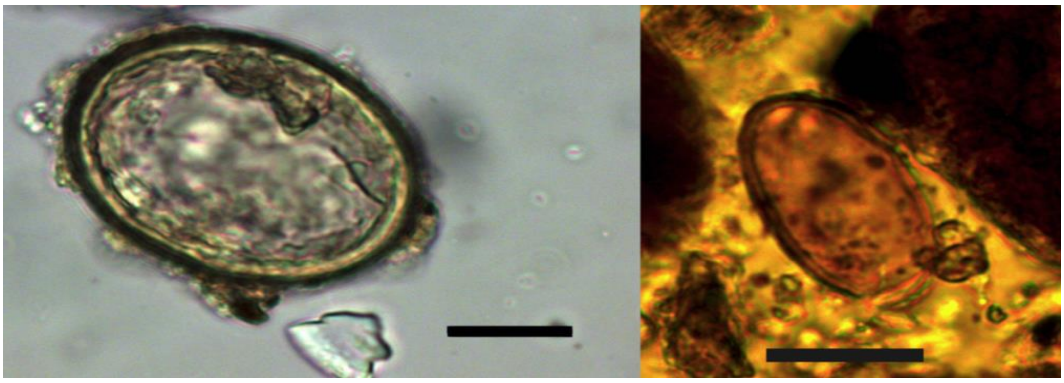

Figure 2.23: Intestinal parasites identified from the Roman latrine in the Imperial Baths of Sagalassos. At left a roundworm (*Ascaris*) egg, at right the egg of lancet liver fluke (*Dicrocoelium sp.*). The black bar indicates 20 µm (Williams *et al.* 2017, Figs. 4 and 5).

All data on the hydraulic infrastructure (supply, usage, drainage, system resilience), social data (public, private), and natural data (internal, external) are gathered together and entered into the Roman Water Footprint framework (Tab. 2.2). The temporal dimension for each of these indicators allows them to be separated into four contextualized "snapshots" of water usage in the area under study. The individual footprints can then be evaluated cumulatively to create a collated water footprint history for each insula.[205]

[205] See Chapters 4, 6, and 8 for the cumulative assessment of the Roman Water Footprints of each case study.

	50 BC-0	AD 41-70	AD 70-98	AD 98-117	AD 117-138	AD 138-192	AD 193-235	late 3rd century AD	4th century AD	5th century AD	6th century AD
Baths known only epigraphically	x										
Terme delle Provincie (under Via dei Vigili, II, iv, 2)		x	x	x							
Terme Domizianee (under Terme di Nettuno, II, iv, 2)			x	x							
Terme dell'Invidioso (V, v, 2)		x	x	x	x	x	x				
Terme del Nuotatore (V, x, 3)			x	x	x	x	x				
Terme di Buticosus (I, xiv, 8)				x	x	x					
Terme della Basilica Cristiana (III, i, 3)				x	x	x	x	x	x		
Terme delle Sei Colonne (IV, v, 11)				x	?						
Terme di Porta Marina (IV, x, 1)				x	x	x	x	x	x	x	x
Terme sotto il Foro della Statua Eroica (I, xii, 2)					x	x	x	x			
Terme del Mitra (I, xvii, 2)					x	x	x	x	x		
Terme di Nettuno (II, iv, 2)					x	x	x	x	x		
Terme dei Cisiarii (II, ii, 3)					x	x	x	x			
Terme Marittime (III, viii, 2)					x	x	x	x	x		
Terme dei Sette Sapienti (III, x, 2)					x	x	x	x			
Terme della Trinacria (III, xvi, 7)					x	x	x				
Terme del Perseo (outside Porta Laurentina)					x	x	x	x	x		
Terme del Sileno (IV, ix, 7)					x	x	x	x	x	?	
Terme del Faro (IV, ii, 1)						x	x	x	x	x	
Terme del Foro (I, xii, 6)						x	x	x	x		
Terme della Via di Iside (IV, v, 6)						x	?				
Terme del cd. Palazzo Imperiale						x	?				
Terme Bizantine (IV, iv, 8)						x?	x?	x	x		
Terme del Filosofo (V, ii, 7)								x	x		
Terme in Via della Foce (Piccole, I, xix, 5)								x	x		
Terme Domus dei Navalia									x		
Terme Domus dei Dioscuri									x		
Terme dello Scheletro (IV, ix, 6)									x	x	

Figure 2.24: Chronology and duration of bath buildings at Ostia (David *et al.* 2014 and Medri & Di Cola 2013, 101, Fig. 1.55).

III, i Roman Water Footprint # 2 (50-200 AD)			
Indicator	Sub-Indicator	Data	Quantity
Infrastructure	Supply Systems	Rain Water	0
		Ground Water	4
		Aqueduct	7
		Total # of Supply Features	11
	Usage Systems	Number of Leisure Water Features	5
		Number of Industrial/Economic Water Features	3
		Number of Domestic Water Features	1
		Total # of Usage Features	9
	Drainage Systems	Sewer	22
		Downshaft	11
		Drains	6
		Total # of Drainage Features	39
	System Resilience	Number of Types of Supply	2
		Number of Types of Usage	3
		Number of Types of Drainage	3
		Total System Complexity	8
		Total # of Features	59
Culture	Private Oriented-insula	Total # of Features	20
	Public Oriented-insula	Total # of Features	39
	Private Oriented-Ostia	Total # of Features	122
	Public Oriented-Ostia	Total # of Features	72
Nature	External	Tiber River Floods	6
	Internal	Urban Garbage	3
		Urban Health (# of Baths)	21

Table 2: Example of the Roman Water Footprint methodology, with data from insula III, i in its AD 50-200 time slice.

2.5: Conclusion

With the Roman Water Footprint methodology in mind, the following chapters introduce the three case studies, in which the archaeological evidence for hydraulic infrastructure from all periods of each city block's life are identified. The structure of each of these three case studies is consistent, to provide an accessible format for readers interested in differing scales of detail. The Roman Water Footprint acts as an initial step for integrating different scales and types of data pertaining to water in Roman cities. The application of modern water accounting and sustainability models is a novel approach to ancient urban studies, and presents a new face of Ostia's urban fabric. Beyond the technical hydraulic information, this method presents new insights into urban life of Ostia, bringing together several different types of information. The Roman Water Footprint offers a new perspective for the study of any building or group of buildings in Ostia, joining large scale infrastructure projects like aqueduct lines with local decisions, like where to build a bar counter. It is hoped that this method will continue to develop and refine its indicators, retaining its transferability and accessibility. Following the trace of water through these structures and through time gives us a window into the daily hydraulic negotiations and choices made by the inhabitants of the city. Our previous understanding of Ostia's urban fabric becomes enlivened when we imagine diversified networks of water flowing behind walls, under floors, underground, across streets, and around the city on its Republican walls. This bottom up approach highlights the decisions and systems created by individual people at specific moments, and creates a more contextualized picture of how Ostia existed in different periods of its life.

Ch. 3: Insula III, i

3.0: Introduction to insula III, i

For each of three insulae treated in this thesis, the initial part of this chapter is to be read together with the subsequent section, in which the hydraulic infrastructure of each individual building is integrated into the Roman Water Footprint methodology. In this way, the physical infrastructure of the insula is contextualized within the broader social and environmental milieu of Ostia, and how this changed over time. Insula III, i presents a mix of domestic, luxury, and industrial structures, with evidence ranging from the 1st century B.C. to the 5th century AD. The buildings were almost all excavated in the 1938-1939 period by Calza, who began investigating the triangular area between the already excavated Tempio di Ercole, the Cassegiato del Serapide, and the *decumanus maximus* (Figure 3.25).[206] Surely the most research attention has been given to building III, i, 4, the "Basilica Cristiana", as an inscription discovered here was thought to directly refer to the building activity of Constantine. The *mithraeum* located in III, i, 6 attracted early attention because of its rare preservation of frescoes within perhaps the earliest mithraeum in the city. The remainder of the buildings have been studied to a quite fragmentary degree, although Peter Rose dealt with aspects of this city block in his doctoral thesis in 2005.[207] While offering a useful starting point, his focus on wider urban trends in the 2nd to 4th century act as too broad a lens for the present study. In terms of water features, the majority are present in connection with the bath building (III, i, 3), yet their distribution across all the buildings of the city block hint at an unexpected connectivity between structures of a diverse nature, as well as with upper floor apartments.

Figure 3.25: Location of insula III, I within Ostia.

[206] GdSc 24, 105 (17-12-1938).
[207] Rose 2005.

The area occupied by insula III, i is bounded by two important streets in Ostia, the Via della Foce and the western extension of the Decumanus Maximus (Figure 3.26).

Figure 3.26: Identified water features in insula III, i for all time periods (after SO 1, Plans 2, 6, 7).

The former represents a pre-Ostian road leading from the inland agricultural plains towards the mouth of the Tiber River, and the latter comes from the extension of the east-west road of the original Republican castrum of Ostia towards the sea shore. Where these two roads split is the Bivio del Castrum, an important communication node throughout the history of Ostia, where a fountain was built in the 1st century B.C., and a large nymphaeum installed in the 4th century AD.[208] Some isolated Augustan and Republican structures remain in this insula, although the majority date to the Trajanic-Hadrianic period, when the area had more buildings of industrial and public function. Recent research has identified that many of the buildings along the Via della Foce were abandoned in the 3rd century and remained so until the 4th century, when new structures were built above the rubble layer. During this abandonment period, a large-scale event such as a flood or earthquake likely caused the collapse of many buildings in Regio III. Regio III in general saw a wider phase of construction in the late 4th and early 5th century.

3.1: Methodology

The methodology for assessing and contextualizing the hydraulic history of this insula is the same as for the subsequent case studies. Data comes from primary fieldwork, archival photographs and plans, as well as from a fresh reading of previous research. Arbitrary numbers have been given to each water feature that pertain only to this block.[209] For clarity and ease of identification, a chart and accompanying map are provided for each building to aid the reader in locating individual water features. Water features are described following the pre-established numerical order of the rooms in each building. After the spatial description of all the water features of a given building, the features are organized into temporal phases in order to present the diachronic hydraulic evidence of each building in insula III, i.

3.1.1- Water Features of insula III, i

Although the insula sits at a roughly NE-SW orientation, in this study the Via della Foce will be taken as north, and the Decumanus Maximus as east for ease of description.

The discussion of each building is in the following order:

History of Excavation and Restoration

Location in insula

Phasing and Comments

Water Features Chart

Description of Water Features

Infrastructure Chronology

Conclusion

[208] RS II, 48 (sch. 38) for the Bivio del Castrum; RS II, 195 (sch. 2) for nymphaeum I, xiv, 1.
[209] See Appendix 3 for master list of water features.

III, i, 1: Caseggiato

Figure 3.27: Identified water features in III, i, 1 (after Rose 2005, App. 1, 170).

Location in insula

Building III, i, 1 is located in the northeastern part of the insula, with numerous doorways opening both onto the Via della Foce and the Decumanus Maximus (Figure 3.27). To the south it has doorways connecting it to III, i, 2 and III, i, 3, and to the west there are doorways open to the Mitreo degli Pareti Dipinti (III, i, 6).

History of Excavation and Restoration

The building was first excavated by Calza.[210] Several small trenches were dug in 1977, uncovering traces of earlier structures, as well as sections of the sewer system. Some restorations occurred in 1998. The difference in the contemporary ground level of ca. 50 cm between the rooms of the building reflect the erratic excavation of this building. The discrepancy between the level of the Via della Foce and the thresholds on the north side of the building substantiates this hypothesis.

[210] SO 1, 148 for Calza's comments on insula III, i.

Phasing and Comments

The building has several rooms of a distinctly taberna-like shape, and the presence of dedicated staircases in the backs of these rooms indicates perhaps a joined ownership of ground floor shops with upper floor apartments. The building is divided into an eastern and western section by hallway 11, which gave access to the internal courtyard of the baths. Additional access to the baths was originally possible through rooms 10 and 14, but these were blocked up at a later period, contemporary with the insertion of several piers in room 12. The majority of the building is composed of a similar brickwork, dated by Rose to the period of Marcus Aurelius, in the second half of the 2nd century AD.[211] The southern doors in rooms 10 and 14 were blocked in *opus vittatum*, and three brick piers were installed in room 12. These were dated roughly to the 3rd century, but should be attributed instead to the 4th century when compared with more securely identified wall blockings.[212] Several doorways were broken through the earlier walls dividing rooms 6-7, 7-8, and 10-11, which may also belong to this later period. A splayed "gola di lupo" window present in the west wall of room 18 was blocked up with rough tufa cobbles, which may be connected to the removal of an earlier staircase in room 18. This lost staircase (together with a downshaft) indicate an earlier division of the upper floor of this part of the building into two separate apartments: the removal of the staircase may indicate that the upper floor became one single space, or alternatively, the absence of any upper floor in a later period.

Water Features Chart

The following hydraulic features are located in building III, i, 1 (Table 3.3).

III, i, 1 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
5	rectangular downshaft	N threshold into room 1a	1	2
7	channel	internal face of S wall	2	2
9	drain	internal face of S wall	3	2
10	sewer	W side of room; S threshold into room 11	84	2
10	sewer	W side of room; N threshold into room 11	85	2
11	marble gutter fragments	room 11 threshold into street	89	3
11	sewer	S end of room 11	81	2
12	sewer	room 12 threshold into Via della Foce	82	3
13	rectangular tubuli	S wall; SE corner	4	2
14	rectangular downshaft	surface find	44	x
14	water boiler	E side; threshold into room 11	83	2
18	rectangular downshaft (?)	S wall; SE part	5	2

Table 3.3: Identified water features in building III, i, 1.

[211] Rose 2005, App. 1, 8.

[212] Rose 2005, 60 broadly dates these changes to AD 200-300.

Description of Water Features

In the southwestern corner of room 5 is a rectangular downshaft (feature 1), which is of the tile type, meaning that it was not created as part of the wall, but rather that it was created as a space between two sections of wall, and has *bipedales* as its backing.[213] A similar downshaft (feature 2), is present in the northwestern corner of room 7, directly west of the heavily restored staircase. It differs from feature 1 in that is has an internal coating of calcium carbonate (sinter). A third tile downshaft (feature 3) is present in the south wall of room 9, although in this case the downshaft is not found in connection with a staircase. An additional downshaft (feature 4) is located in the northeast corner of room 13, and, like feature 2, there is a thick coating of calcium carbonate preserved along its height. Although the shaft itself is rectangular, at the current floor level there is a semi-circular shape preserved in the hydraulic mortar, perhaps indicating the presence of a now-lost ceramic pipe (Figure 3.28). The presence of at least one oxidized iron nail in the wall directly adjacent to the downshaft indicates that there would have been some kind of maintenance cover obscuring the downshaft from view. The final downshaft (feature 5) identified in this building is poorly preserved, but the *in situ* tile backing proves its identification.

Figure 3.28: Downshaft in room 13 (feature 4) with preserved semi-circular outline and calcium carbonate coating.

From the plans of an unpublished excavation in the late 1970s, several fragments of a sewer system were identified (Figure 3.29). A central sewer branch (feature 81) slopes downwards in a south to north direction underneath hallway 11, and three secondary sewer drains empty into it: two from room 10 (features 84 and 85), and one from room 14 (feature 83). Only feature 83 is indicated as having a cappuccina roof, and it is unclear to what these sewers were connected. In the same campaign, two sections of sewers (features 82, 89) were also uncovered near the Via della Foce. Feature 82 appears to be exit under the street threshold of room 12, and feature 89 is present where room 11 meets the street, however, both of these sewers lie at a *higher* depth than sewer 81. The final water feature identified in this building is a fragment of a marble water channel (feature 44) located on the surface in room 14. It is included here given its similarity to *in situ* channels discovered in other buildings of the study.[214]

[213] The same type of downshaft is known across the insula, as well as in other buildings treated in this thesis (e.g. Chapter 7: V, ii, 3, (feature 60)).

[214] Gering 2013, 269 identifies similar channels as recycled roof-elements used in a Late Antique context.

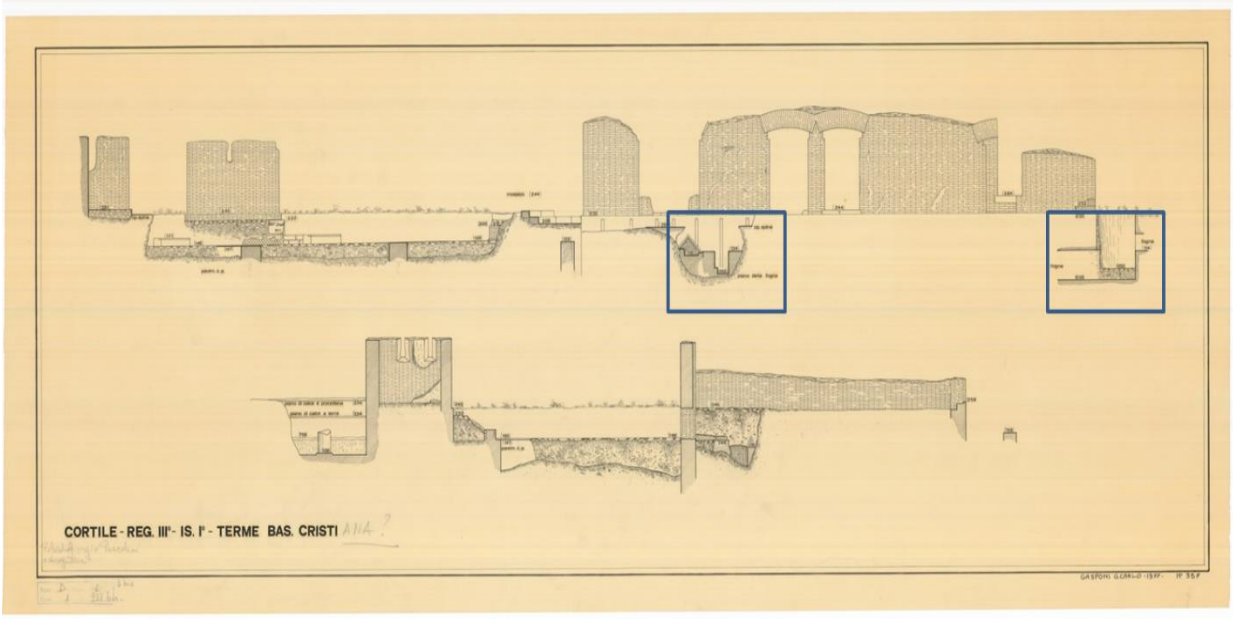

Figure 3.29: Cross section through room 15 of the Terme della Basilica Cristiana, and the western side of room 11 of III, i, 1 (Archivio Disegno 937).

Infrastructure Chronology

Roman Water Footprint #1 (4th century B.C.- AD 50)

No known water features.

Roman Water Footprint #2 (AD 50-200)

The majority of the water features identified in this building can be dated to this phase. The sewer line 81 can be dated to the Trajanic period due to its connection and likely origin with the first phase of the Terme della Basilica Cristiana (III, i, 3). The remaining downshafts and shorter stretches of sewer (features 83, 84, 85) date to the end of the 2nd century.

Roman Water Footprint #3 (AD 200-300)

The marble water channel (feature 44) may date to this period given its similarity to those discovered in the Terme della Basilica Cristiana. In this period, downshaft 5 ceased functioning with the removal of the staircase in room 18; this removal is contemporary to the *opus vittatum* blockage of the window in the west wall of room 18. Sewer lines 82 and 89 were created in this time period, at a higher depth than the internal sewer system of building III, I, 1, suggesting that these (features 81, 83, 84, 85) were no longer functioning.

Roman Water Footprint #4 (AD 300-600)

No known water features.

Conclusion

Although only drainage features are preserved in this building, the downshafts help to identify the presence and number of upper floor apartments, as so many nearby downshafts would otherwise imply an overly complicated roof structure. The combination of vertical downshafts and staircases support the division of the upper floor into multiple apartments: four in the eastern half and perhaps two in the western half. Located at a crucial point in the city's larger system of movement, these apartments would surely have been prime real estate for any kind of shops. The evidence for calcium carbonate (sinter) within only some of the downshafts also hints at a division of upper floor water usage. As known from

other buildings discussed in this study, such shafts can be evidence for upper floor toilets.[215] This building was surely connected to buildings III, i, 2 and 3, although exactly how remains unclear. Given that rooms 10 and 14 were open to the courtyard of the baths until the insertion of an *opus vittatum* wall, an industrial function for the secondary sewers (features 83, 84, 85) seems unlikely. At least with sewer 81 we can see that its position dictated the initial location of the corridor of the later building.

III, i, 2: Tabernae

Figure 3.30: Identified water features in III, i, 2 within box (after Rose 2005, App. 1, 171).

Location in insula

Building 2 is located on the eastern side of the insula, with five rectangular rooms opening onto the *decumanus maximus* (Figure 3.30). The building is connected by a doorway in room 1a to III, I, 1 to the north, and through room 4 to the Terme della Basilica Cristiana (III, i, 3). The western wall of the building also acts as a dividing wall between the rooms of building 2 and the internal courtyard of the baths.

[215] Hobson 2009, 71-77 for upper floor toilets, with evidence from Pompeii and Roman Britain.

History of Excavation and Restoration

The building was originally excavated by Calza, but was restored in 1959. This building was included in the excavation project of the late 1970s together with buildings III, i, 1 and III, i, 3. A widespread restoration also occurred in 1998.[216]

Phasing and Comments

Augustan period shops were first present here, as was revealed by the 1977 excavations (Figure 3.31).[217] These rectangular rooms lay further back from the street, with their thresholds located roughly under the current western wall of the building. Perhaps also from this early time period, projecting walls with travertine piers were built out into the present *decumanus*. These seem to extend from room 4 of III, i, 2, and room 3 of III, i, 3, and may be similar to the preserved walls identified projecting from III, ii, 3, across the *decumanus* from the Schola di Traiano (IV, 5, 15).[218]

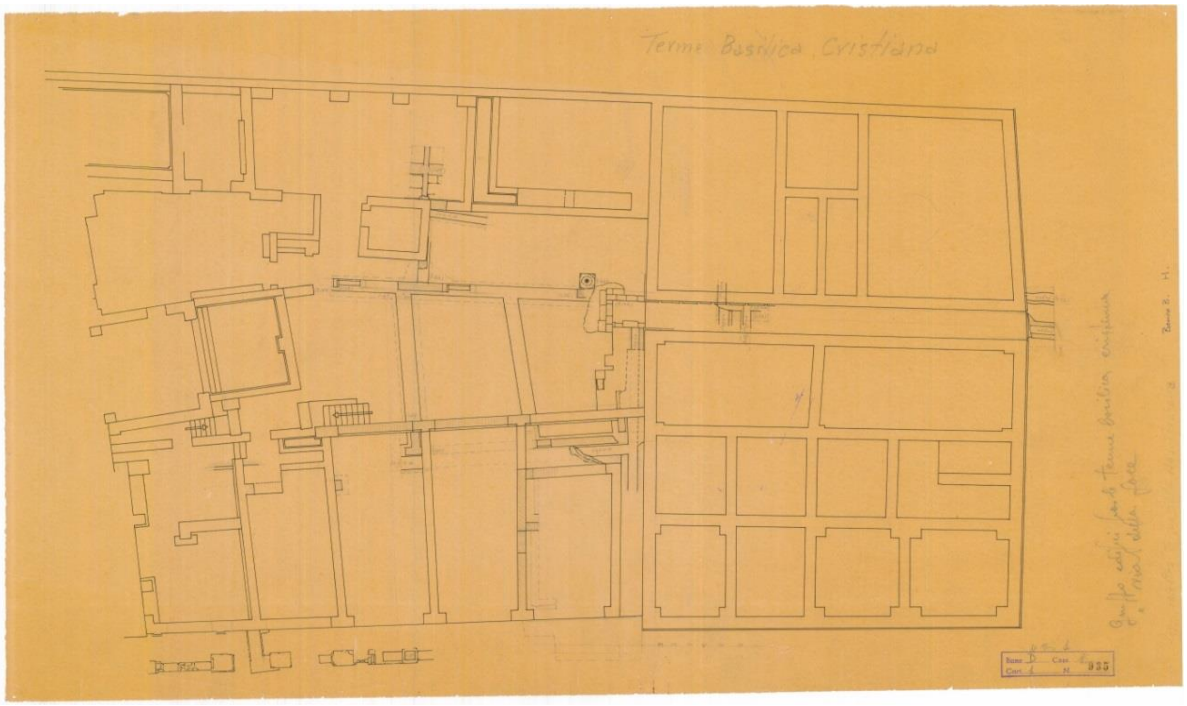

Figure 3.31: Schematic drawing of buildings 1, 2, 3, in insula III, i with earlier structures present. The *decumanus maximus* runs parallel to the bottom of the image (Archivio Disegno 935).

In the Trajanic period the building gained its western wall, with two splayed windows in the western wall of room 1. The western wall of rooms 1 and 2 are the same, both with a bonding course of tufa stones halfway up their height, with their foundation visible, and with short projecting piers. This tufa bonding course is also visible on the west face of the same wall (i.e. from room 15 of III, i, 3). The western wall of room 3 does not have these tufa stones, nor is its foundation level visible, but it also has a projecting pier. At a later point, the walls dividing rooms 1-2-3 and 4 were added in brick, with a doorway left open between rooms 3 and 4. In the 4th century, this doorway was closed with an angled *opus vittatum* wall, and an *opus vittatum* pier was installed in room.[219] Two additional support walls in a similarly rough *opus vittatum* were added: one placed to support the newly erected wall between rooms 3 and 4, and a second continuing the western wall of the building.

[216] Rose 2005, App. 1, 9 for the history of this building.
[217] Archivio Disegno 935 and 937; SO 1, 127 for these tabernae.
[218] Tomassini 2016, 3 for the same kind of projecting piers with tufo columns in the domus under the Domus delle Tabene Finestrate (IV, v, 18), the Domus dei Bucrani, and the Domus del Portico di Tufo.
[219] Rose 2005, App. 1, 10.

Water Features Chart

The following hydraulic features are located in building III, i, 2 (Table 3.4).

III, i, 2 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
1	sewer	N threshold into room 1a	87	2
3	channel	internal face of S wall	6	4
4	drain	NE corner of room	7	2?
4	basin/latrine	NE corner of room	90	4

Table 3.4: Identified water features in building III, i, 2.

Description of Water Features

In room 1a, stretch of a sewer line was identified (feature 86), that sloped downwards from west to east: as this sewer line begins in the courtyard of the baths it will be discussed in the subsequent section. Where room 1 meets room 1a, another sewer line (feature 87) was discovered, which runs parallel to the Trajanic west wall of the building. The sewer was also identified in the north part of room 3 and appears to have sloped downwards from south to north. Within the southwestern corner of room 3 an *opus vittatum* wall was installed, and a rectangular channel (feature 6) was included that sloped down into the northwestern corner of room 4. Directly south of this drain, a low basin (feature 90) was installed against the western wall.[220] This basin is very poorly preserved and may also have acted as a single seater latrine in a later period. Between this basin and the spur of a wall in the north side of room 4, a stretch of sewer (feature 7) was identified with a cappuccina roof. The sewer is filled with rubble and its eastern extension is not currently visible, if it is present at all. The sewer continues to the west running for at least 2.50 m, and ca. 1.00 m below the current ground level, although its internal slope is unknown.

Infrastructure Chronology

Roman Water Footprint #1 (4th century BCE-mid 1st century CE)

No known water features.

Roman Water Footprint #2 (Mid-1st-late 2nd century CE)

Sewer 87 dates to this period, as it predates the insertion of the dividing walls between the rooms of the building, and since it respects the line of the thresholds of the Augustan shops. Sewer 7 also dates to this period, likely acting as the drain for the Trajanic baths.

Roman Water Footprint #3 (3rd century CE)

No known water features.

Roman Water Footprint #4 (4th-6th century CE)

The drain passing through the wall between rooms 3 and 4 can be dated to this period, as it is contemporary with the *opus vittatum* wall itself. The creation of the small basin/latrine (feature 90) can be dated contemporary to or slightly after this period, as it abuts the wall. The creation of these water features in this location argues for the continued functioning of the Trajanic drain (feature 7).

[220] RS II, 91 (sch. 78).

Conclusion

The water features preserved in building III, i, 2 testify to the close and long-lasting connection with its neighbors III, i, 1 and III, i, 3, which will be discussed in the subsequent chapter.

III, i, 3: Terme della "Basilica Cristiana"

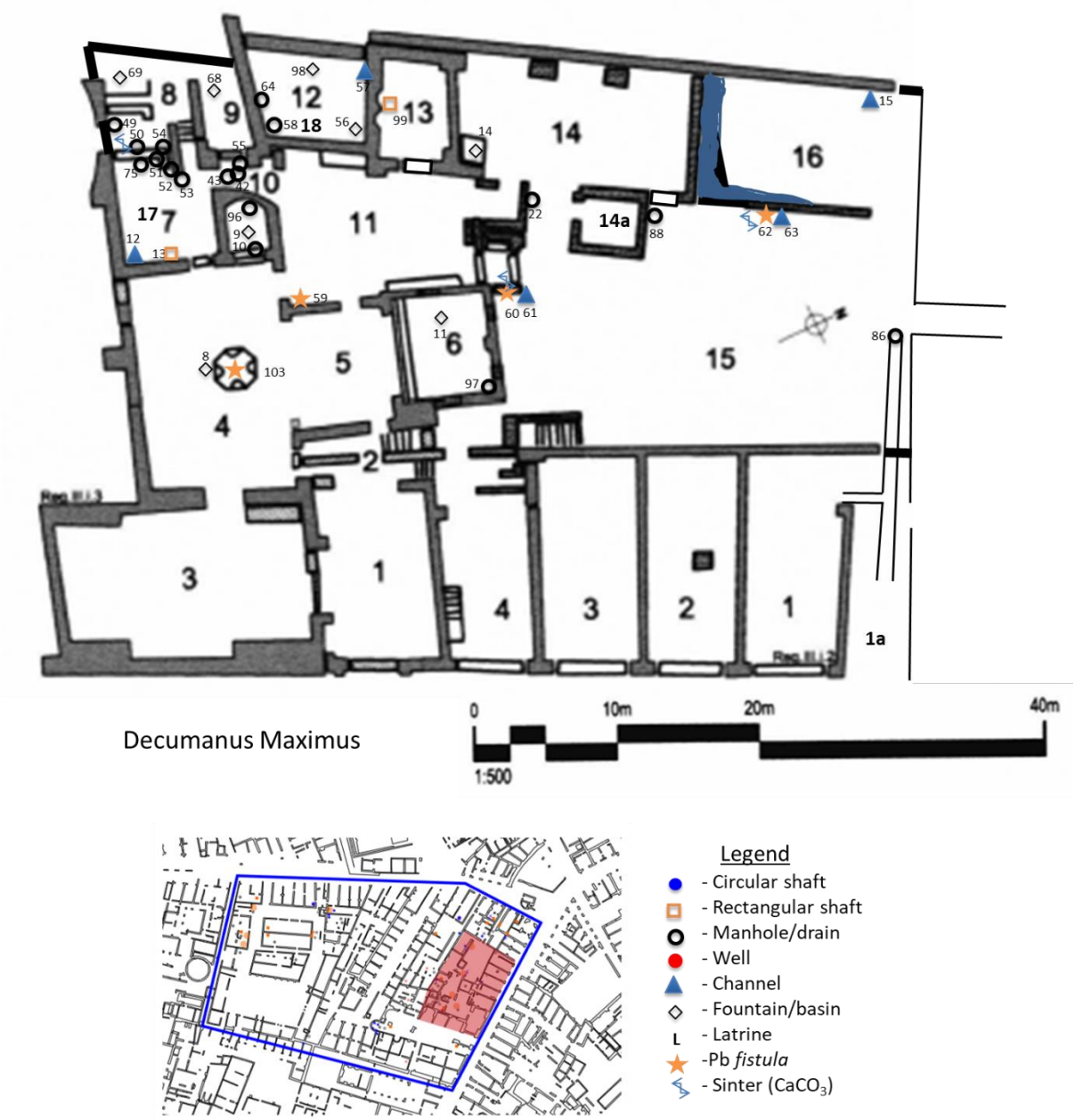

Figure 3.32: Identified water features in III, i, 3 (after Rose 2005, App. 1, 171).

Location in insula

The baths of the "Basilica Cristiana" are located on the eastern side of the insula (Figure 3.32). It is bordered to the north by III, i, 1, to the east partially by III, i, 2, to the south by the "Basilica Cristiana" (III, i, 4), and to the west by the Mitreo degli Pareti Dipinti (III, i, 6). The baths are open to the *decumanus* through a hallway and staircase in building III, i, 2, and through building III, i, 1.

History of Excavation and Restoration

Excavated initially in 1939 by Calza, the building was first called the "Terme della Fortuna" as a statue of Fortuna was found nearby.[221] Certain walls were already recovered in 1939, with other sections repaired in 1959. Several small trenches were dug in 1977, uncovering traces of earlier structures as well as sections of the sewer system.

Phasing and Comments

This building has received a fair amount of scholarly attention compared to the rest of the buildings in insula III, i because of its connection to the Domus Tigriniani (i.e. Basilica Cristiana) next door. Although the phasing of the domus will be discussed further in the subsequent section, it is mentioned here because interpretations of this bath building have traditionally hinged on the dominance of the neighboring domus. Given their extent, the subterranean rooms have been assigned separate room numbers by this study, with room 17 located under room 7, and room 18 under room 12.

The Augustan tabernae mentioned above in connection with III, i, 2 were located ca. 70 cm underneath the current ground level of courtyard 15. In the Trajanic period, the ground level was raised to the current level by two successive strata of fill.[222] Sections of *opus latericium* walls and piers are present, such as the eastern wall of room 15, and the northeast pier of room 11.[223] The first phase of the baths were installed in this period, with an even higher ground level to the south (rooms 1-13), that was built against the earlier domus in buildings III, i, 4 and III, i, 6.[224] The bath building is of the asymmetrical retrograde form.[225] The insertion of a bath building by constructing above existing structures is known from other baths in Ostia, although this construction method is more commonly applied to the early and mid-3rd century (e.g. Terme del Filosofo (V, ii, 6-7)). This ground raising allowed the new bath building to put its service space underground (under room 7) for its three hot pools to the south; additionally, the space under room 12 was turned into a double-roomed cistern (room 18).[226]

In the early 3rd century, black and white mosaics with figural and geometric designs were installed at this time in rooms 4, 5, and 11 (Figure 3.33).[227] The original frigidarium basin that had occupied room 5 was filled in and shifted to the north, inserted between earlier brick piers. The walls dividing rooms 14 and 16 from room 15 date to this period, as does the small windowed room 14a.[228] The bath could still be entered through building III, i, 1, and through the southernmost room of III, i, 2.

[221] GdSc 24, 115 (17-1-1939), where a wealth of funerary inscription was found in connection with an unclearly specified basin: *"Dalla zona con vasche sul lato Nord del decumano…"*; GdSc 24, 135 (23-5-1939).

[222] Rose 2005, 41, 92 states the baths were entered through the elevated threshold on the east side of room 1 at this period, although evidence of contemporary structures at the current (ca. 1.5 m lower) ground level makes this suggestion untenable.

[223] Gorgato 1998, 78 suggests a Trajanic bath building here would have formed a nice parallel with the Trajanic Terme dei Sei Colonne (IV, v, 10) directly across the *decumanus*.

[224] Poccardi 2006, App. II, 92-99.

[225] Poccardi 2006, App. II, 92; SO 1, 127, 233-235; SO 4, 92-93.

[226] For bath buildings placing caldaria basins on the south side to maximize natural solar heating, see Ring 1996. Munro 2012 testifies to the value of window glass and its potential recycling in the Late Antique period.

[227] Clarke 1979, 50, Figs. 67, 68 for these mosaics; SO 4, Tav. 141.

[228] Poccardi 2006, 92-99 for this bath building. A similar small room with several windows was also installed in the eastern area of the Terme dei Sei Colonne in this period.

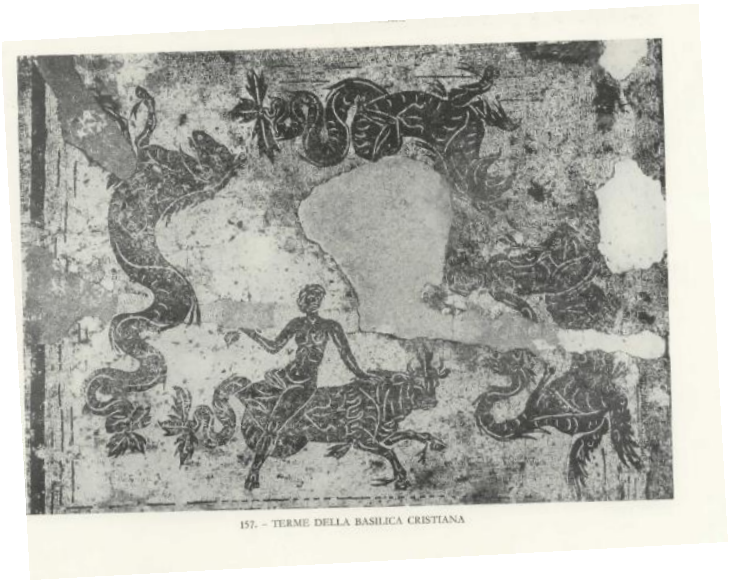

Figure 3.33: Mosaic added in the early century in room 4 of III, i, 3 (SO 4, Tav. CXLI).

From the latter, patrons could enter the baths proper through stairs in the south and west sides, or continue directly into the small palestra (room 15). To maximize access, a doorway was added on the east side of room 1, as proved by the "floating" brick piers there, which was closed at a later period. In the later 3rd or early 4th century, some additional small sections of walls in *opus vittatum* were added, notably by the closure of room 16 from 15, and the restriction of room 2. Ascending staircases were added on the north side of room 2 and the southeast corner of room 15, reinforcing the suggestion that the baths continued to be accessed from the *decumanus* at this time. The roughly gouged out impression of a staircase on the west wall of room 11 indicates the presence of at least one additional upper floor in this part of the building at this time. In the late 4th or early 5th century the creation of the Late Antique domus to the south definitively expanded over the three *caldaria* on the south side of the bath building, ending its thermal functions. Evidence for some kind of continuity in the bath building structure comes from the insertion of features called Late Antique "benches" by other studies, which are located along the north and south walls of room 11 and in room 16. Where known from other buildings in Ostia, they are dated to the 5th or 6th century.[229]

[229] See Chapter 7 for these features in V, ii, 8, V, ii, 11, and V, ii, 13.

Water Features Chart

The following hydraulic features are located in building III, i, 3 (Table 3.5).

III, i, 3 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
4	fountain	N threshold into room 1a	8	3
4	channel	internal face of S wall	103	3
4	drain	W side of room	9	3
4	drain	E side of pool	10	3
4	drain	W side of pool	96	3
5	marble gutter fragments	SW corner	65	x
6	pool	entire area	11	3
6	drain	NE corner	97	3
7	rectangular tubuli	S wall; SE corner	12	3
7	rectangular downshaft	E wall	13	3
8	water boiler	SW corner	69	3
8	drain	S wall; SE part	49	2
8	sewer	E wall	50	2
8	drain	E wall, NE corner	54	3
9	cistern	entire room	68	2
10	manhole shaft	N end of hallway	42	2
10	sewer	bottom of shaft in room 10	43	2
10	channel	in W wall of feature 42	55	2
11	Pb fistula	E wall; SE corner of room	59	2
11	sewer	in vestibule between rooms 11 and 14	22	2
12	cistern	entire room	98	2
12	drain	S wall	64	2
13	downshafts(?)	S wall	99	2?
14	basin	SE corner	14	4?
14a	sewer	external N wall	88	2
15	Pb fistula	SW corner	60	2
15	channel	SW corner	61	2
15	Pb fistula	W wall S part	62	3
15	channel	W wall S part	63	3
15	sewer	N part; E of threshold into III, i, 1	86	2
16	double tubuli	W wall N part	15	2?
17	drain	N wall entrance hallway	51	2
17	sewer	NW wall	52	2
17	basin	NW corner	53	2
17	ceramic pipe	NW corner	75	3
18	cistern	area under room 12	56	2
18a	channel	NW corner	57	2
18b	drain	S wall (E section)	58	2

Table 3.5: Identified water features in building III, i, 3.

Description of Water Features

At the bath's entrance from the *decumanus*, one can either pass through building 2 (its room 4) or up the stairs into room 1. The first water feature comes from an octagonal fountain in the center of room 4 (feature 8), which originally was decorated in marble and had a pressurized lead pipe spouting vertically at its center (feature 103).[230] On the western side of room 4 is a cold plunge pool (feature 9) that has drains at different heights on its eastern and western side.[231] The eastern drain (feature 10) slopes down to the east for ca. 1.00 m before turning to the north, while the western drain (feature 96) slopes down to the west, emptying into the sewage shaft in room 10 (feature 42). Possible supply channels for lead pipes are present in the north and south walls of the basin, although they could not be confirmed at present.

In the southwestern corner of room 5 are four sections of segmented marble gutters (feature 65), that are recorded here since similar channels are known in context from latrines (as sponge gutters), and from other Ostian bath buildings to drain *caldaria*.[232] Taking up the entire area of room 6 is the large cold pool 11, which was originally covered with marble panels and has a drain in its northeastern corner.[233] This drain (feature 97) exits the wall of the pool at the current ground level. Directly northwest of the pool is a broad step giving access between rooms 11 and 15, with a wall that continues the western wall of the basin. Set within this wall is a rectangular channel (feature 60) containing a short section of a lead fistula pipe (feature 61) coated with calcium carbonate, which may have supplied basin 11. The southwest corner of the bath building has the highest concentration of water features of any area of the entire insula, namely due to the underground service room 17, present under most of room 7 (
Figure 3.34).

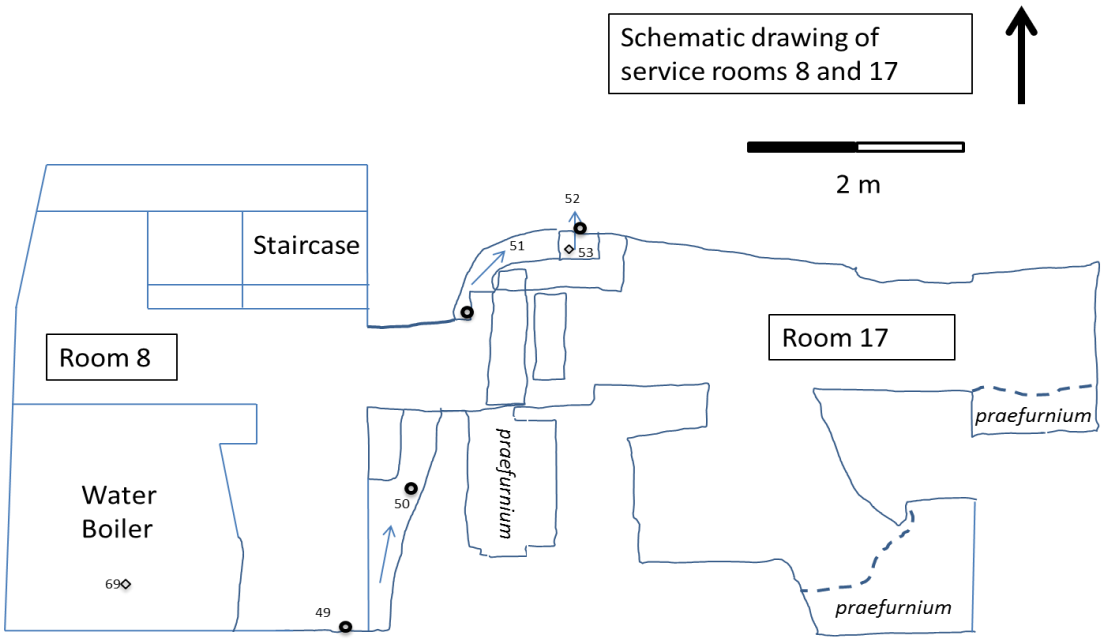

Figure 3.34: Schematic ground plan of service rooms 8 and 17.

[230] RS II, 91 (sch. 79) where it's described as having a "bird-bath" shape.
[231] Based on the height from the pool's floor to its top step, it has an estimated internal volume of 4.8 m^3 (=4800 liters).
[232] Gering 2013, 269 gives a good description of similar gutters found in both these contexts in the Terme del Foro (I, xii, 6).
[233] Based on the height from the pool's floor to its top step, it has an estimated internal volume of 26.25 m^3 (= 26, 250 liters).

In the southeastern corner of room 7 is an isolated column made of three rectangular tubuli (feature 12); this may be left over from the earlier hypocaust system here, functioning as an type of exhaust pipe. However, its incorporation into a wall formed *after* the destruction of the hot pools may represent a later repurposing or recycling of the tubuli to drain roof water.[234] Along the same wall is the vertical impression of a rectangular downshaft (feature 13). The impression in the masonry is very poorly preserved and is quite restored, yet a similar interpretation is given for this water feature as for the previous one. Descending several stairs on the west side of room 7, we come to the service area of room 8.[235] In the southwest corner is the foundation for a water boiler (feature 69), although modern concrete restorations have obscured its characteristic horseshoe shape and smaller *praefurnium*.[236] It was installed against existing south and west walls of the room, and its lower eastern wall is clearly the remains of a foundation layer (a 60 cm bulging agglomeration of bricks, tiles, and tufa). No evidence of water supply or distribution are preserved, and the water boiler perhaps assisted the hypocaust system of the baths. On the southern wall of room 8 is the preserved impression of a vertical drainage pipe (feature 49), which continued descending at a roughly 45° angle into the southeast corner of the room (Figure 3.35).[237] Supporting this identification, the roughly semi-circular channel that is cut into the brick wall ends directly above a sewer line (feature 50). This short cappucina sewer section slopes down towards the north and exits directly into the doorway between room 8 and the underground room 17.

Figure 3.35: Southeastern corner of room 8 in the Terme della Basilica Cristiana, showing drain 49 descending into the horizontal drain 50.

[234] C. Harvey, personal comment, based on his doctoral research on *tubuli* in Roman Jordan.

[235] See Appendix 2 for the brick stamp discovered underneath this staircase.

[236] GdSc 32, 107 (20-6-1959) describes finding a large number of lead fragments around the boiler during excavation; Poccardi 2006, 95 for this water boiler; See in the present work Chapter 7, Terme del Filosofo (V, ii, 6-7) for an additional water-boiler foundation.

[237] See Chapter 5, Terme del Faro (IV, ii, 1) feature 65 for the same kind of feature and context.

The current ground level of this doorway is ca. 60 cm lower than the bottom of the sewer channel, which is covered by a flowing accretion of calcium carbonate. Any draining liquids in this channel likely spanned the hallway through a now-lost section of channel. On the wall opposite the mouth of the sewer, but at a lower ground level, is a channel dug into the north wall of room 17 (feature 51). This channel curves toward a drainage basin (feature 53), which was built over the highest travertine step leading into the room. From here, the waste would exit to the north into a sewer section (feature 52) built under a relieving arch in the northwest corner of room 17 (Figure 3.36). Adding to this concentration of drainage features is a vertical ceramic pipe inserted into the western floor of room 7 (feature 75), which exits almost directly above drain 42. Another rectangular channel is present in the western wall of room 7, passing horizontally through its western wall. This channel (feature 54) enters room 8 above the doorway into room 17 and is likely connected to the other drainage features here.

Figure 3.36: Section of drainage system in room 17 of the Terme della Basilica Cristiana, with arrows indicating the flow of waste material into basin 53, and out through drain 52.

Directly north of room 8 is room 9, which was a cistern (feature 68), with a thick coating of *opus signinum* in its corners; it retained its previous ground level ca. 1.20 m lower than in room 8. In the narrow hallway leading from rooms 7 to 11 there is a square drainage shaft (feature 42) preserved in the restored concrete floor. A cappuccina sewer line runs in a south-north direction (feature 43), and a smaller flat roofed drain enters the western wall of the drainage shaft (feature 55). The latter may have acted as an overflow drain from cistern 68, lying directly to the west of the drainage shaft. At the bottom of the drainage shaft, a final fourth drain (feature 96) is present at the current ground level, which drains the adjacent *frigidarium* 9.

Continuing north into courtyard 11 there is a fragmentary section of a lead fistula pipe preserved in the southeast corner (feature 59). Located directly north of the brick pier, the pipe likely served the original frigidarium basin located in room 5. The ascending line of imbrex tiles inserted against the east wall of room 11 indicates how the pipe was embedded within the wall (Figure 3.37). This supply line was broken off and covered up when the cold pool was shifted to the north.

Figure 3.37: Terme della Basilica Cristiana: southeast corner of room 11 (seen from the west), with feature 59 indicated by the black box.

Returning to the west side of room 11 there are two superimposed cisterns. The first lies slightly above the current ground level (feature 98), and occupies the entire space of room 12. The *opus signinum* corners, doubled walls, and lack of a door testify to its function, as does a preserved outflow drain it the southern wall (feature 64), which drains into cistern 68 (Figure 3.38).[238]

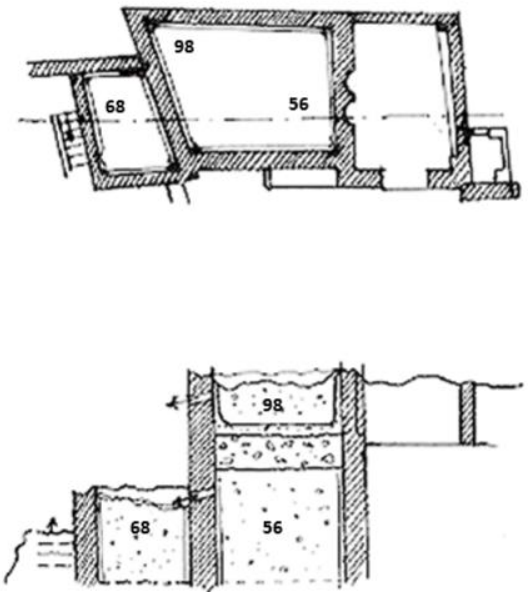

Figure 3.38: Plan and cross section of the three basins 68, 56, and 98 (after RS I, 161, Fig. 254).

Directly below cistern 98 is another cistern (feature 56) of similar dimensions. This cistern is composed of two barrel vaulted rooms (ca. 2.00 m tall) connected by a small square passageway. Its inflow pipe is visible in the upper northwest corner of the cistern (feature 56), and its drainage pipe (feature 57) is present in the south wall of the eastern section (Figure 3.39).

[238] RS I, 162 also mentions two additional holes in the brickwork of the walls for the entrance and exit of water, although these could not be verified by the present study.

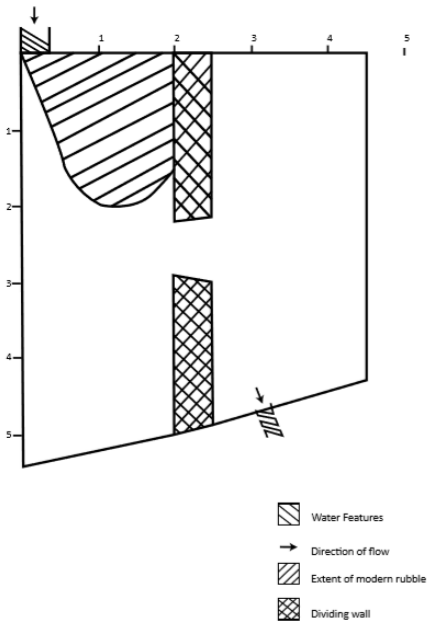

Figure 3.39: Schematic ground plan of room 18, directly under room 12.

With an estimated capacity of ca. 34, 000 litres, this lower cistern alone could have supplied the two preserved cold baths (Figure 3.40).[239] Superimposed cisterns are known in many other bath buildings in Ostia, with some filled by pressurized lead pipes and others by means of water wheels or norias.[240]

Figure 3.40: Internal view of eastern (left) and western (right) chambers of cistern 56, looking south.

North of these superimposed cisterns is room 13, which has two poorly preserved concave depressions on its south wall (feature 99). While appearing innocuous enough, similar irregularly cut out sections are known from other buildings in this study, and are thought to be the remaining impressions of vertically placed ceramic drainage pipes.[241] That being said, these features are much less well preserved and less deeply cut than the other known examples. Passing from room 11 into room 14 is a small vestibule with an east-west wall. Passing under this wall in a south-north direction is the remains of a cappuccina sewer (feature 22), although the peak of the *bipedales* is visible only for 10 cm above the current ground level. Entering room 14, there is a fountain basin made of *opus vittatum* installed in its

[239] Basin 9 (4800 liters) + Basin 11 (26250 liters)= ca. 31,050 liters, although it must be stressed that the given basin volumes represent a *minimum* volume.
[240] Medri & Di Cola 2013, 88 for the elevated cistern of the Terme delle Nuotatore (V, x, 3); RS I, 163 (sch. 33) for Terme delle Sette Sapienti (III, x, 2); RS I, 158 (sch. 30) for the Terme di Nettuno (II, iv, 2).
[241] See Chapter 7, V, ii, 9, features 17, 101, 102, 103 for an additional example of this phenomenon.

south eastern corner (feature 14).[242] Although it is heavily restored, its *opus signinum* coated corners assist in identifying it as a fountain basin.

The very small room 14a divides the opening between room 14 and 15. Exiting the northern doorway of room 14 into room 15, a flat-roofed sewer (feature 88) is visible directly east of the travertine threshold. The extension of this sewer line for several meters to the north is known from archival drawings. Continuing along the western wall of room 15 there is evidence that a wide doorway connecting rooms 15 and 16 was closed in two different moments. In the first of these, the wall was closed by an extension of *opus latericium*, and set within the bottom section of this wall was a channel (feature 63), containing a lead fistula pipe section (feature 62) (Figure 3.41). The pipe enters the brick channel at a roughly 45° angle, and has a coating of calcium carbonate on its inner surface; the lack of nearby water features and a later masonry bench in room 16 make it difficult to establish the function of this lead pipe.

Figure 3.41: View of the western wall of room 15 in the Terme della Basilica Cristiana. Changes to the masonry wall are visible in the image on the left, and a detailed look at the embedded lead pipe on the right.

The 1970s sondages revealed a stone platform surrounded by a mosaic at the intersection between the bath building and III, i, 1 (Figure 3.42). Directly south of this platform is a sewer line (feature 86), which runs to the east and continues into room 1a of III, i, 2. The final feature in this building comes from the western wall of room 16, and is composed of two truncated sections of tubuli (feature 15) (Figure 3.43). Similar to the discussion above pertaining to feature 12 (in room 7 of these baths), these features are not directly connected with any known hypocaust heating system, or with any nearby hydraulic system. They are included here as they may be evidence for some kind of later rain diversion system.

[242] RS II, 92 (sch. 80).

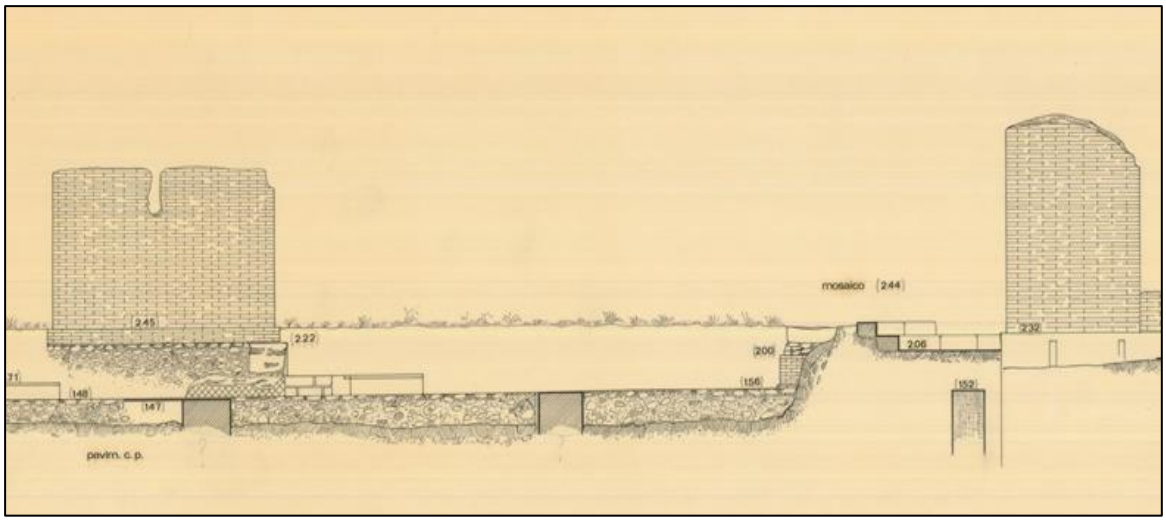

Figure 3.42: Cross section showing the single window on the east side of room 14a, the courtyard of room 15, and the entrance to building III, i, 1 fronted by the mosaic platform at furthest right (Archivio Disegno 937).

Figure 3.43: View of feature 15 from the west and above, in room 16 of building III, i, 3.

Infrastructure Chronology

Roman Water Footprint # 1 (4th century B.C.- AD 50)

No known water features.

Roman Water Footprint # 2 (AD 50-200)

Many of the water features date to the creation of the Trajanic bath building. The single cistern 68 and the superimposed cisterns 56, 98 all date to this period to supply the 4 contemporary basin (3 *caldaria*, 1 *frigidarium*). The supply and drainage features of the cisterns also date to this period (features 64, 57, 58). The concave depressions in the south wall of room 13 (feature 99) may also date to this period but their poor state of preservation obscures any present conclusions. The *frigidarium* basin (feature 11)

occupied room 5 in this period, and was supplied by water through the lead pipe in room 11 (feature 59). In turn, the pipe perhaps connected with features 60 and 61. Large parts of the drainage system of the building date to the Trajanic period. The vertically descending channel in the south wall of room 8 dates to this period (feature 49), when it drained the western hot basin that later became room 7 of building III, i, 4. This emptied into the larger cappuccina sewer in the west wall of room 8 (feature 50). This sewer continued through channel 51, into basin 53, heading north through sewer 52 (Figure 3.44). Passing through the bottom of shaft 42, this sewer line connected with the sewer section 43 continuing north.[243] Overflow water from cistern 68 passed through channel 55, joining this sewer line. This sewer sloped down to the north, passing through feature 22, and out the northern wall of room 14a with section 88. Crossing courtyard 15 at a northeast angle, the sewer connected under the stone platform at the junction between buildings III, i, 1 and III, i, 3. It is unclear which of the two branching lines the sewer followed: either through sewer 81 in III, i, 1, or through sewer 86 leading out through III, i, 2. The double tubuli described in the west wall of room 16 may date to this period as they are securely built as part of the wall (feature 15).

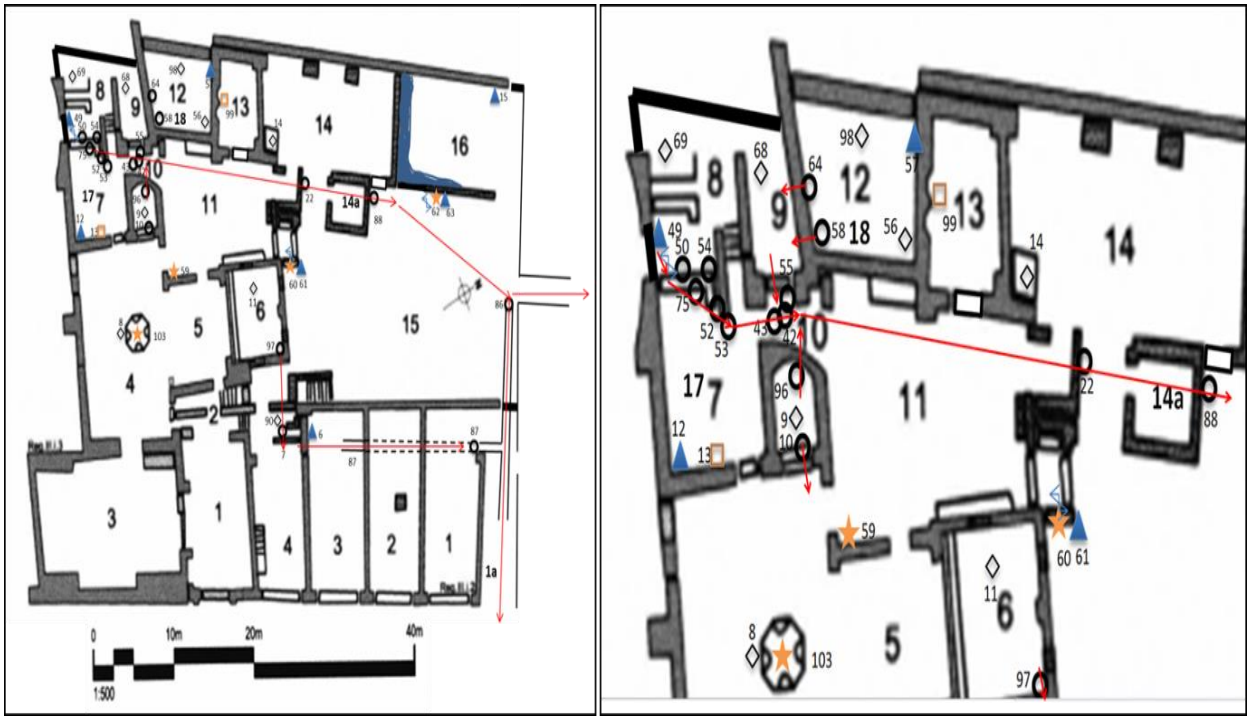

Figure 3.44: Drainage features identified within III, i, 3.

Roman Water Footprint # 3 (AD 200-300)

It is here hypothesized that in the early 3rd century, when the bath underwent structural changes, that the westernmost and central hot pools were already defunct, but not yet destroyed, and that only the easternmost hot pool continued to function.[244] Evidence for this comes from the western and eastern walls of room 7; these walls are located directly perpendicular to the threshold into the western and central hot pools, impeding access to them. The ground level in room 7 is also preserved to a greater height than the surrounding rooms, with a thick layer of rubble fill preserved along the western side of

[243] GdSc 24, 125 (20-1-1939): The initial excavation of this area described a reused funerary plaque as a sewer cover that the author believes sat over this sewer line, (AANNIUS SYMPH…/FECIT SIBI ET…/AANNIO ARTEMISIO ET…/ AANNIO SALVIO FILISFT/ANNIAE FEICLAE CONIVGI .--------…BERTIS LIBERTABVS/ …TERISQVE EORVM/ …P XXII IN AGR. P. XXIIII).

[244] Calza 1940b, 77 hinted at this when he offers evidence of other early Christian churches taking advantage of out of use bath buildings, dating the probable abandonment in this case to the late 3rd century.

the room.[245] Set into this rubble floor are the drains 54 and 75, which empty into the central sewer system of the previous period and testify to some kind of continued water usage and drainage in this room. The two *tubuli* sections in room 7 (features 12, 13) could have continued to direct heat from the still functioning hot pool (i.e. the easternmost one) to warm up room 7.[246] The contemporary creation of basin 9 (and its drains 10 and 96) helped to enclose room 7. The western wall of basin 9 was already present in the Trajanic phase, with the curving wall helping to funnel movement to the westernmost hot basin. However, in this phase, room 8 became a service room, and access from room 11 became restricted.[247] Support for this comes from the water boiler (feature 69) in the southwestern corner of room 8; the inconsistency between the foundation courses of the boiler and the current ground level in room 8 argue for a higher ground level when the boiler was created.

With the shifting of the frigidarium basin from room 5 to 6 in this period, the lead pipe in room 11 (feature 59) was perhaps redirected to supply the octagonal fountain in room 4 (features 8 and 103). This would be possible before the laying of the early 3rd century marine mosaic here: the mosaic respects the newly created walls of room 7, supporting the interpretation of the closure of the central and western *caldaria* in this period. In any case, the cold pool 11 was created in this period, with its drain 97. Connection between this pool with the large cappuccina sewer (feature 7) is likely given their vicinity, although it would require an additional vertical pipe. The final feature from this time period comes from a short fragment of lead pipe that was set into a channel in the west wall of room 15 (features 62, 63). The dating of this fistula comes from the short section of brick wall used to reduce the opening between rooms 15 and 16.

Roman Water Footprint #4 (AD 300-600)

The only water feature dating to this period is a small basin that was installed in the southeast corner of room 14 (feature 14). It is heavily restored but indicates structural continuity into the 4th century.

Conclusion

The bath building has definite connections with all of its neighboring structures, which will be discussed in the following chapter. While an earlier Trajanic phase has left some skeletal evidence, this bath has much more in common with other 3rd century thermal structures in the city. The elevated construction of bath buildings in the 3rd century is well attested at Ostia. These were usually smaller sized buildings, with smaller hot and cold pools. Although there is no doubt of the impact resulting from the creation of the Domus Tigriniani in the late 4th or early 5th century, it may not have been as dramatic as is usually interpreted.[248] Perhaps some or all of the hot pools had ceased to function already in the later 3rd century, and the bath building was quite small when the owner of the domus wanted to take over the ruined rooms more than a century later. While the connection between the baths and the domus is undeniable, the bath building has a much more complex and dynamic history beyond the domus.

[245] Above a partially preserved black and white mosaic.
[246] Even if the easternmost hot pool did not exist, these tubuli are contemporary with the south and east walls of room 7, which block access to the central hot pool and to room 4.
[247] The eastern wall of room 9 appears to have a closed up doorway at a lower level than hallway 10.
[248] Calza 1940b, 82 described the process as *"una violenta manomissione e devastazione"*.

III, i, 4: Domus Tigriniani ("Basilica Cristiana")

Figure 3.45: Identified water features in III, i, 4 (after Rose 2005 App. I, 172).

Location in insula

The building is located in the southeastern section of the insula with two broad entrances to the *decumanus maximus* (Figure 3.45). It is bordered to the north by the bath building of the same name (III, i, 3), to the west by the Mercato III, i, 7, and to the south by building III, i, 5.

History of Excavation and Restoration

The building was first excavated by Calza in 1939, and contemporary restoration work began. Upon finding several semi-circular apses and an inscription listing the four rivers of paradise, Calza interpreted the building as the basilica built by Constantine.[249] This building has perhaps received some of the most scholarly focus of any building at Ostia, with numerous subsequent studies generating literary, art

[249] GdSc 24, 109 (10-1-1939); Calza 1940a, 39: *"Un basilica Cristiana e un battistero si stanno appunto scoprendo in questi giorni"*; Calza 1940b as the first full publication on the building; Calza 1940c for discussion of the concrete capping of the standing walls.

historical, architectural, and archaeological evidence against Calza's initial claim.[250] The geophysical work of Heinzelmann actually located this building in the unexcavated southern area of the city's intramural area.[251] The building under discussion is now widely accepted as being one of the many elaborate Late Antique domus structures known in the city, and the christogram present on its central lintel block is frequently cited in discussions of the Christian history of Ostia.[252]

Phasing and Comments

As intimated by the history of excavation, debate over the phasing of this building has gone through many iterations, but a concise summary will be given here as it pertains to the structure's hydraulic history. The oldest structural evidence comes from a Republican caseggiato identified under III, i, 4 (150-100 B.C.).[253] This domus continued to exist when a small street was created, which connected the *decumanus maximus* with the southern part of III, i, 7 (see below). This street has been otherwise unnamed by previous researchers; for the sake of convenience and clarity, the present author proposes to henceforth call this street the "Vicolo degli Tigriniani".[254] Across this new street, a row of tabernae and a small caseggiato were built, forming the early skeleton of building III, i, 5. In the Trajanic period, a small domus was created with 5 rooms (rooms 10, 13, 14, 15, 12) around a central courtyard (room 11), and was entered down a narrow hallway (room 9).[255] In the early 3rd century, the hallway was removed, with the southern walls of room 8 and 9 created. The central courtyard was either completely or partially blocked off from the surrounding rooms. The most dramatic phase came in the late 4th or early 5th century, when the domus expanded across the Vicolo degli Tigriniani, installing two apses on its southwestern side and blocking up all the doorways of the defunct tabernae to the south (i.e. of III, i, 5).[256] The creation of apses, once seen as a proxy for Christian religious buildings, is now appreciated for its wider architectural spread in contemporary Ostia. The three hot rooms of the bath building were appropriated by the new domus. The southern "apse" is in fact a large nymphaeum, framed by the architrave that carries an inscription which seems to identify the owner of the domus, together with a christogram and the four rivers of paradise.[257] The architrave is reused and perhaps identifies a Tigriniani family, otherwise unknown at Ostia.[258] Whatever the religious affiliation of the owner, the house is resolutely a private Late Antique domus. The building was connected in some way with Ceionius Rufius Volusianus, whose name and initials (VC) were found on a reused column in the Domus Tigriniani, as well as on dozens of stored columns within the neighboring Tempio dei Fabri Navales (III, ii, 1).[259]

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[250] Brenk & Pensabene 1998-99 offer the most comprehensible treatment of the different strands of evidence; Manzione 1992 wrote his dissertation on this building.

[251] Bauer & Heinzelmann 1999; Heinzelmann *et al.*1997.

[252] Bakker 1987 records that Becatti was also married in the Basilica Cristiana; Bauer 2003; Boin 2013; The building is still the central stop of many (Christian) tour groups in Ostia, with guides continuing to explain it as the *actual* basilica of Constantine in Ostia.

[253] Heres 1980, 87; SO 1, 234.

[254] The street is known by various permutations of "the-street-later-covered-by-the-Basilica-Cristiana", despite this event happening five centuries after its creation.

[255] Manzione 1992, 21 identified a polychrome mosaic floor in rooms 11 and 15 from this period.

[256] Gering 2013, 263 identifies numerous similar road blockages in the contemporary neighborhood of Regio III in Ostia; Heres 1982, 464-471, no. 65.

[257] Interpreted by some as: IN Chi-Rho GEON FISON TIGRIS EUFRATA TIGRI[N]IANORUM SUMITE FONTES. The christogram has provoked several interpretations of the building as a Schola dei Catecumeni, Christian library, martirium, collegium of Christian heretics, a xenodochium. The block is in fact recycled, and carries a partial inscription from the 1st or 2nd century: [---]S ALEXANDER [---] AMMIVS [---] IGENIVS [---] V C [---] STINIANVS.

[258] Brenk & Pensabene 1998-1999, 284 for the wider epigraphic evidence on Tigranes. In the *True Story* of Lucian (Vol. 1, bk. 2, sec. 20), the ghost of Homer tells the protagonist that his name in real life was actually "Tigranes".

[259] He is known from many early 4th century inscriptions around Ostia; see Cébeillac-Gervasoni 2006, 138 (AE 1975, 134), 203-205 for more information on Volusianus.

Water Features Chart

The following hydraulic features are located in the Domus Tigriniani, III, i, 4 (Table 3.6).

III, i, 4 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
1	rectangular downshaft	internal face of N wall, E side	16	2
3	basin	S wall W side	17	4
3	nymphaeum	W apse	18	4
3	channel	S wall, W side	19	4
3	channels	W apse	102	4
3	rectangular downshaft	pier in NW of room	20	2
3	sewer	runs E-W across room 3	100	2
11	well	in center of room	21	1

Table 3.6: Identified water features in building III, i, 4.

Description of Water Features

A brick wall divides the northern and southern entrances to the building. On the north side on the wall in hallway 1, a rectangular downshaft (feature 16) was built into the wall. The upper part is reconstructed, but at the current ground level a semi-circular impression is preserved in the bottom of the channel, which may indicate the previous presence of a vertical ceramic pipe. Continuing to the west and into room 3, a small semicircular basin (feature 17) was installed into one of the earlier doorways of the south wall. From the earlier interpretation of the building as a basilica, this basin was interpreted as a *baptisterium*, although, like the identification of the wider building, this can no longer be sustained. With one lower basin and a broad step, it appears more like a small nymphaeum basin (Figure 3.46).[260] Further to the west along the same southern wall is a rectangular channel(feature 19), formed between a horizontally placed *bipedalis* and a large block of travertine. The presence of a channel within the foundation level of the wall, and directly adjacent to the nymphaeum argues for its connection to this large water feature.

[260] Calza 1940b, 70; RS II, 213 (sch. 11a).

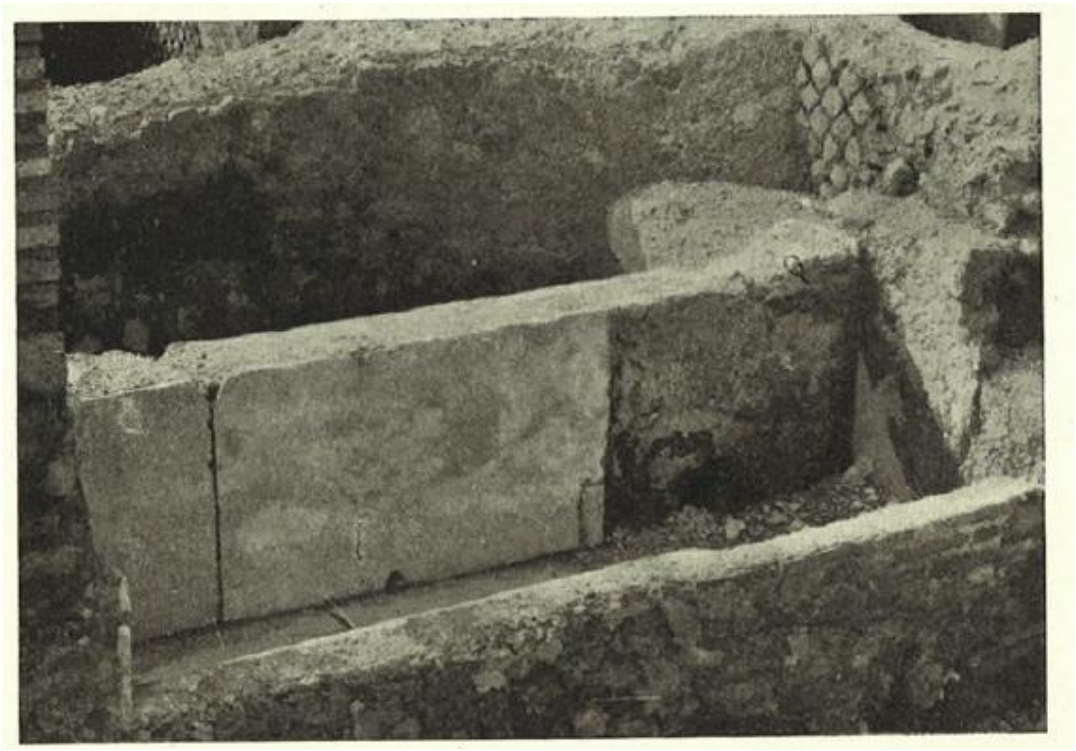

Figure 3.46: Basin 17 of building III, i, 4 seen from the north (Calza 1940b, 71, Fig. 8).

From an archival photo taken during its excavation, a vertical impression is visible in the mortar directly above feature 19, as are two sections of travertine blocks (Figure 3.47). When travertine blocks are used to block up a doorway (as they do here), they are usually placed at the bottom as supporting structures, with the upper courses consisting of bricks or tufo cobbles of some type.[261] The presence of two blocks with a narrow space left between them could imply that they supported the 90° bend of a lead supply pipe. The nymphaeum itself (feature 18) was decorated with marble paneling, and statues likely adorned the three niches (Figure 3.48). The creation of domestic nymphaea with alternating rectangular and semicircular niches are a well-attested feature of late antique domus buildings at Ostia. Also like other Late Antique nymphaea, the external wall of the apse was apparently not meant to be seen, and is a mixture of amphorae sherds and fragments of bricks and tufo. Piped water would continue through channels of various sizes (feature 102) through the four piers dividing the niches, falling into the marble clad basin, and perhaps extending further. The preserved height and position of the marble paneling argues not only for a higher ground level at its time of construction, but also for some kind of interstitial wall.[262] This ca. 64 cm difference in height from the bottom the nymphaeum's basin and its contemporary floor suggests a now-lost connection to the sewer directly underneath the basin. Within the brick pier dividing room 3 from 4 is a rectangular downshaft (feature 20). While the top of the shaft was restored at the period of excavation, the shaft was filled *in antiquo* with tufa blocks (Figure 3.49).

[261] The doorway was blocked between the north wall of room 15 in the neighboring III, i, 5 and building III, i, 4.
[262] Calza 1940b, 69; Calza 1941, 141; similar basins are present in the Domus del Ninfeo (III, vi, 1-3) and Domus di Amore e Psiche (I, xiv, 5).

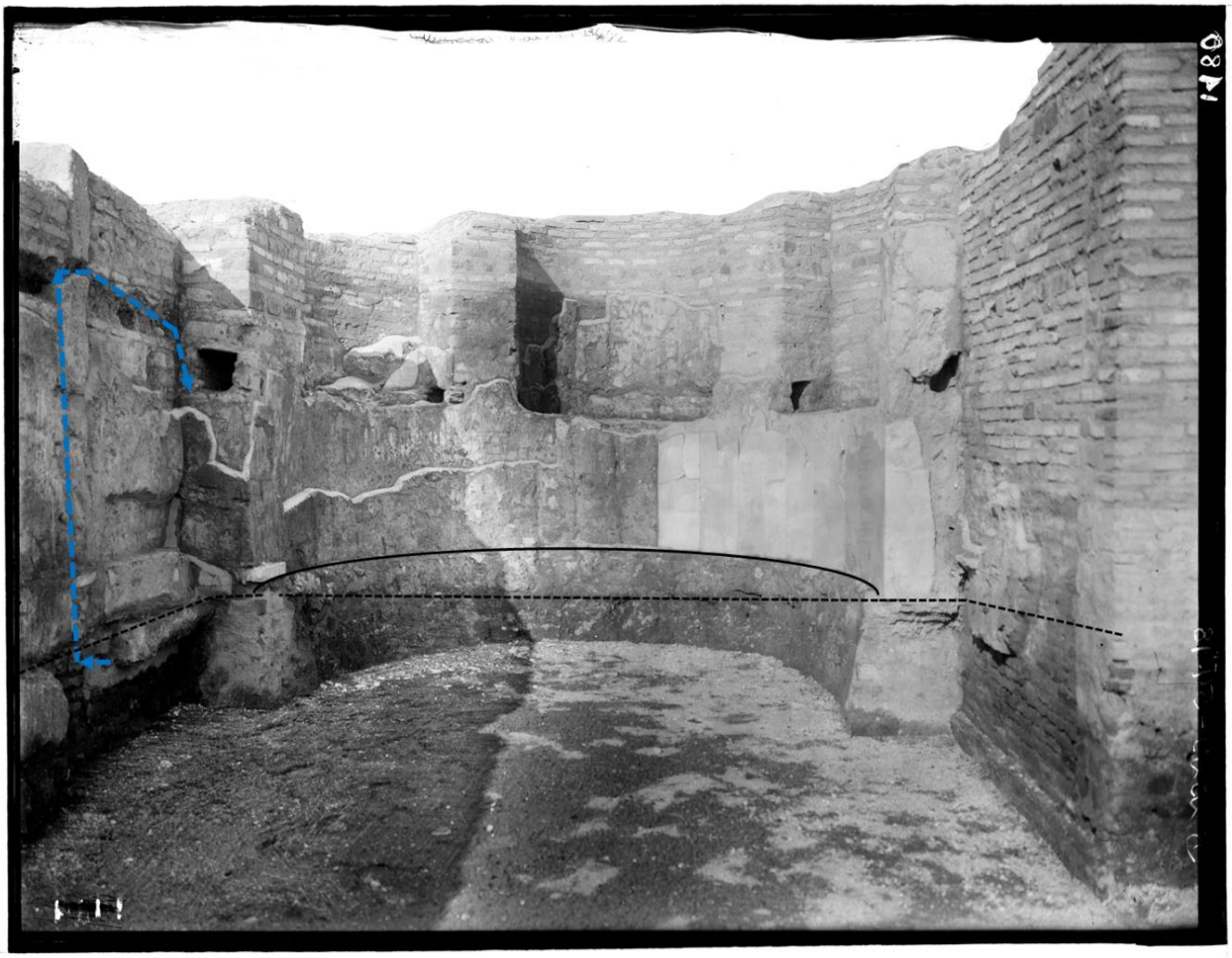

Figure 3.47: Nymphaeum 18 seen from the east: reconstructed ground level in small dashed lines, hypothesized path of lead pipe in thicker dashed lines (after SBAO B2929).

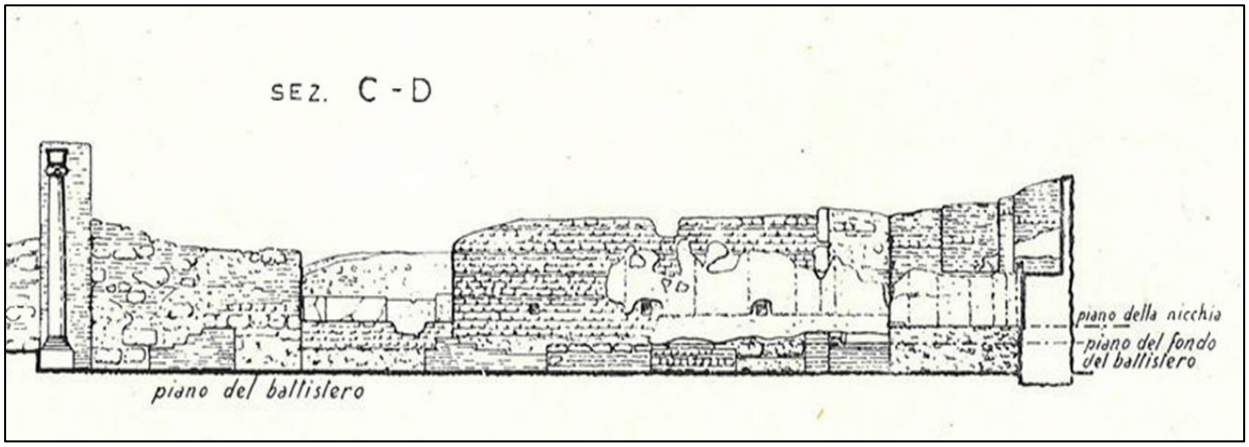

Figure 3.48: South facing cross section of room 3, with the varied ground levels indicated on the right (Calza 1941, Tav. IV).

Figure 3.49: View of downshaft 20 from the south, with its later blockage of tufa blocks.

A sewer line (feature 100) runs in an east-west direction across room 3, parallel to the south wall of the building. The sewer line continued to the west into building III, i, 7, and sloped downwards to the east towards the *decumanus*.[263] During excavation of this sewer, coins from the late 2nd to early 3rd century were identified within the fill.[264] Progressing through room 8 into the smaller rooms of the domus, we find a well (feature 21) set into the floor of room 11. This 1.00 m diameter well opening takes up the majority of the room's area.

Infrastructure Chronology

Roman Water Footprint # 1 (4th century B.C.- AD 50)

The well (feature 21) dates to this period, although it was likely modified in later periods.

Roman Water Footprint # 2 (AD 50-200)

The sewer line (feature 100) dates to this period, when it ran underneath the Vicolo degli Tigriniani, contemporary with the Trajanic modifications to the domus (in rooms 8-15). The two downshafts (features 16, 20) also date to the Trajanic period: the wall of feature 16 was originally part of a room projecting from the bath building, and the wall of feature 20 was part of the taberna that flanked the opening to the Trajanic domus. These downshafts were located on external walls that faced the Vicolo

[263] See below building III, i, 7 (feature 29); RS II, 95 (sch. 85) mentions the sewer; GdSc 24, 147 (24-8-1939), describes the sewer as passing to the southeast toward the Via della Foce, which is inconsistent with the orientation of the building: *"Si sta scavando la fogna dietro l'absido della chiesa Cristiana che passa proprio sotto al l'abside stessa costruita chiudendo la strada primitive a cui apparteneva la fognatura. La fogna dopo l'abside minore o abside che permitto chiamare del battistero piego a SE* ***verso via della Foce*** *come la strada anche qui fiancheggiata da botteghe."* Emphasis added; Calza 1940b, 68.

[264] GdSc 24, 147 (24-8-1939) identified coins from Faustina the Younger (ca. 130-175 AD) and Julia Mammaea (ca. 180-235 AD) within the fill of the sewer, offering a *terminus post quem* for its blockage.

degli Tigriniani, and were perhaps for rain drainage. They drained into sewer 100, and out towards the decumanus maximus.

Roman Water Footprint # 3 (AD 200-300)

The only water feature renewed in this time period is the sewer (feature 100), which was connected to the southern basin of III, i, 7. However, the numismatic evidence suggests that at least parts of sewer 100 were blocked by the mid-3rd century.

Roman Water Footprint #4 (AD 300-600)

With the creation of the Domus Tigriniani, the large nymphaeum(feature 18) was installed together with its internal channels for a supply pipe (feature 102). Water arrived at the nymphaeum through feature 19, which came through the narrow blocked up hallway 15 of III, i, 5. Additionally, the presence of water channels running around the upper ring of the nymphaeum (feature 102) may indicate that, in addition to water emptying into a central basin, there was a second basin located in front of the current one. Given the amount of water present here, a section of sewer 100 must still be functioning, sloping downwards towards the *decumanus*. The smaller semicircular basin (feature 17) was also installed in this period, in the doorway of an earlier taberna. This basin also likely drained into sewer 100. While downshaft 16 perhaps continued to function with its connection to feature 100, downshaft 20 was blocked up in this period with a tidy column of tufa blocks.

Conclusion

Although the final phase of the building's life has garnered the most attention, the desire to use and respect the presence of pre-existing hydraulic features played a role in the final shape of the Domus Tigriniani. Inside the domus itself, the well continued to be used in rooms which seem quite cramped in their final phase when compared to the open spaces of the rest of the domus. With the closure of downshaft 20, rain water no longer ran through the house, with the extra water perhaps cascading over into the abandoned rooms of III, i, 5.

III, i, 5-Caseggiato

Figure 3.50: Identified water features in III, i, 5 (after Rose 2005, App. I, 173).

Location in insula

Building III, i, 5 forms the southeastern border of the insula, bordered to the north by the Domus Tigriniani (III, i, 4) and the Mercato (III, i, 7), and to the west by III, i, 8 (Figure 3.50). Only one room opens onto the decumanus, with the remaining rooms accessible from the Domus Tigriniani, the Mercato, or from the courtyard of the Tempio dei Fabri Navales (III, ii, 2).

History of Excavation and Restoration

The building was excavated by Calza and in 1961.[265] Further restorations occurred from 2001-2005. The building is so overgrown at present as to make many rooms unreachable.

Phasing and Comments

The structural history of this building is closely tied to the phasing of its northern and southern neighbors, attested by the varying ground levels and threshold heights within the building. The first phase of construction dates to the late Republican period (100-50 B.C.), when a small caseggiato was built facing the decumanus (rooms 1-5); this building had several tabernae opening onto the small Vicolo degli Tigriniani, which connected the decumanus to the Mercato (III, i, 7), and building III, i, 8.[266] In the mid-2nd century, the building assumed its current shape, continuing to channel movement through two hallways (room 6 and 15) from the area of the later Tempio dei Fabri Navales to the Vicolo degli

[265] GdSc 32, 161 (26-6-1961), calls the building: *"…ambienti fra il Tempio dei Fabri Navales e la Basilica Cristiana"*.
[266] Heres 1980, 87, her phase 1a.

Tigriniani.[267] The connection between building III, i, 5 and the Tempio dei Fabri Navales changed in the 3rd century, when the area around the temple was used as a garbage dump for food and butchering waste.[268] The front rooms (1-5) were heavily rebuilt in the 3rd century as well. In the late 4th-early 5th century, the Domus Tigriniani was created to the north, blocking many of the previous tabernae on the northern side of the building. The building was apparently out of use at this time period, attested by the unfinished external faces of the small apse built projecting into room 10.

Water Features Chart

The following hydraulic features are located in building III, i, 5 (Table 3.7).

III, i, 5 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
7	well	NE corner	77	1
22	basin	SW corner	31	3?
24	basin	SE corner	76	3?

Table 3.7: Identified water features in building III, i, 5.

Description of Water Features

All of the building's water features are no longer visible, with only brief descriptions available from earlier studies. In room 7 there is a well (feature 77) that perhaps dates to before the building was incorporated into its neighbors. The other two water features are rectangular basins located in room 22 (feature 31), and room 24 (feature 76). No evidence of supply or drainage were identified for either of these basins.

Infrastructure Chronology

Roman Water Footprint # 1 (4th century B.C.- AD 50)

The well (feature 77) perhaps dates to this period, as it existed before the building assumed most of its present shape. An earlier date is substantiated by its currently inaccessible position: based on the history of other wells included in this study, wells often survive wider structural changes, ending up in seemingly strange places.[269]

Roman Water Footprint #2 (AD 50-200)

No known water features.

Roman Water Footprint # 3 (AD 200-300)

Equally poorly preserved, the basins 31 and 76 are dated to this period as they lie in rooms oriented towards the southern part of the Mercato (III, i, 7), which underwent structural changes in the 3rd century (see below III, i, 7). A tentative reading could see these as quasi-tabernae/industrial buildings, given the function of the Mercato.

[267] Rose 2005, App. I, 18; SO 1, 127, 233.
[268] MacKinnon 2014, 179 for the Tempio dei Fabri Navales; Rose 2005, 54 for a 1.20 m height difference between the contemporary ground levels in the Tempio and in room 6 of building III, i, 5.
[269] See Chapter 5 in the present study for the well in the Caupona del Pavone (IV, ii, 6, feature 51).

Roman Water Footprint #4 (AD 300-600)

No known water features. Based on the closure of the doorway between III, i, 5 and the Tempio dei Fabri Navales in this period, the well would have become obsolete.

Conclusion

Building III, i, 5 was outward facing for the majority of its life, with a tight mix of shops, residential spaces, and connecting hallways. The largest change likely came gradually in the late 3rd or early 4th century when the building became slowly abandoned; at the end of that century the Domus Tigriniani blocked all the northern rooms of the building. It is unknown whether the basins in the west (features 31, 76), or the shops in which they are located, continued to function after the creation of the domus' nymphaeum.

III, i, 6-Domus e Mitreo degli Pareti Dipinte

Figure 3.51: Identified water features in III, i, 6 (after Rose 2005, App. I, 174).

Location in insula

Building III, i, 6 is located along the northeastern side of the insula, with three main entrances onto the Via della Foce (Figure 3.51). The building is also highly accessible through its neighbor to the east, building III, i, 1 (rooms 15, 16, 17). Its eastern wall is shared with the baths (III, i, 3). To the south it is bounded by the Domus Tigriniani (III, i, 4), and to the west by the Mercato (III, i, 7).

History of Excavation and Restoration

Originally uncovered in connection with the spreading excavation along the Via della Foce in 1939, the building has undergone numerous restoration works since its discovery.[270] The most recent comes from a 2010-2013 study that digitally documented the standing remains and consolidated some of the walls.[271] At the time of writing the building is currently undergoing further restoration.

Phasing and Comments

Based on the nature of the *opus incertum* used, the earliest phase of the building dates to the end of the 2nd century B.C., when a Republican house was built here.[272] This phase may be connected to the construction of the large temple of Hercules directly across the street. The building was largely rebuilt in the 1st century B.C. together with the creation of the neighboring Mercato (III, i, 7). In the 1st century AD the building assumed its domus shape with its tufo colonnade and central well, and a tablinum in room 2. In the Trajanic-Hadrianic period the building gained many walls in *opus mixtum*, namely with the two tabernae installed on the Via della Foce.[273] The mithraeum, which is now considered to be (one of) the first in Ostia, was installed in 162 AD based on the dating of a dedicatory Mithraic inscription.[274] This broke up the earlier tufa colonnade by removing one pier, and by incorporating the remaining columns into the *opus vittatum* walls on the eastern and northern side of the mithraeum proper. A second phase of the mithraeum dates to the Antonine period, when the typical Mithraic benches were installed, and the eponymous frescoes were added to the walls. The *thronum* type of altar was added (with projecting pilasters), and decorated with Mithraic spolia.[275] Graffiti were carved into the plaster walls *in antiquo*, although these are barely legible today (Figure 3.52). In the 3rd century, the two front rooms (10 and 11) were added, which opened both onto the Via della Foce and towards the internal open area of the building. The final phase of construction comes in the 4th century with the insertion of the *opus vittatum* walls dividing rooms 6-7-8-9 from each other.[276]

[270] GdSc 24, 123 (20-1-1939); GdSc 28, 101 (Feb. 1939) for its excavation.

[271] Davidde Petriaggi *et al.* 2013, 550: a study conducted by the Istituto Superiore per la Conservazione ed il Restauro (ISCR) identified past restoration works in this building in 1939-40, 1947, 1959, 1961, 1966, and 1989-90.

[272] Davidde Petriaggi *et al.* 2013, 549; GdSc 29, 46 (28-1-1947) describes objects (e.g. bronze coin, iron key, crescent shaped bronze pendant) purposefully cached within this earliest wall; Rose 2005, 28 identified this as one of the earliest buildings in Region III; SO 1, 233 dated this phase to the second half of the 2nd century B.C.; Tomassini 2016, 10 compares the early Augustan *emblema* in *opus vermicatum* in IV, 5, 18 to one found in III, i, 6.

[273] White 2012, 486: the phasing of this building follows that of White.

[274] SO II, 67; White 2012, 462 for C. Caelius Ermeros, who also dedicated inscriptions at the Mitreo Visconti.

[275] White 2012, 450 for a similar early altar style at Ostia in the Mitreo Aldobrandini and the Mitreo degli Animali (see Chapter 5 in the present study for IV, ii, 11). For the spolia reused in the altar: Soli [Inv(icto) Mithrae]/ L(ucius) Semproniu[s…]/thronum [et …]/ [*vv*] S(ua) [P..].

[276] Rose 2005, 66 for these walls.

Figure 3.52: Examples of inscribed graffiti in III, i, 6 Examples of inscribed graffiti in III, i, 6 (Ostia Graffiti Project, #G0150 at left, and # G0151 at right).

Water Features Chart

The following hydraulic features are located in the Mitreo degli Pareti Dipinti, III, i, 6 (Table 3.8).

III, i, 6 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
3	well/pit	S side of room	23	2
4	well	S side of room	24	1
5	sewer	W side of room (?)	112	1
7	rectangular downshaft	internal face of N wall	25	4?
9	semi-circular downshaft	internal face of N wall	26	4?
10	basin	NW corner of room 10	27	3?
10	ceramic pipe	NW corner of room 10	104	3?
10	ceramic pipe	NW corner of room 10	105	3?
10	drain	NW corner of room 10; internal face of wall	45	3?
11	basin?	E wall	32	3?

Table 3.8: Identified water features in building III, i, 6.

Description of Water Features

At the furthest south part of the mithraeum, directly in front of the altar is a circular well (feature 23). Nearly half of the identified mithraea in Ostia have a functioning or ritual well within their *spoleum* (main ritual area).[277] The well is covered by a circular marble plaque perforated by a central circular hole, and is located next to a short travertine "base" that also has a centrally perforated hole through its length.

[277] This includes the recently discovered Caupona e Mitreo del Marmi Colorati (IV, ix, 5) (David *et al.* 2014). While these wells and basins may be connected to an episode in the mythology of Mithras, it is worthwhile here to note the conscious presence of water in the narrow confines of mithraea.

Exiting the mithraeum into room 4, a circular well (feature 24) with a plain travertine head is located roughly in the center of the room. Although the well is nearly completely filled with modern rubble, its *opus reticulatum* walls are visible; in contrast with the majority of other wells reexamined in this project, no ceramic supply pipes were visible within the walls of the well. A flat roofed drainage channel (feature 112) was briefly mentioned in the 1959 excavation notes, although its exact location wsa unspecified. From the excavation notes, it began on the *left* side of the portico somewhere near the earliest *opus incertum* walls of the building. In the Giornale di Scavi, directions are often given facing the building from the street.[278] This would place the channel within the southern stretch of room 5, on the eastern side of the portico, and sloping downwards toward the Via della Foce.

Moving towards the street, a rectangular downshaft (feature 25) is poorly preserved on the north wall of room 7. Although the downshaft was built at the same time as the rough *opus vittatum* wall, the wall to the east of the downshaft lies at a slightly different orientation. A roof tile was built into the bottom of the downshaft, which continues outwards towards the north through a circular hole. The exit hole appears reconsolidated with modern concrete on the external face of the wall. Another downshaft is present on the northwestern wall of room 9 (feature 26). This feature is even more poorly preserved than the previous one, namely because it was not built at the same time as its wall, but was roughly cut into the wall at a later phase (Figure 3.53). It is semicircular for its entire height, and continues into the ground.

Figure 3.53: Building III, i, 6, with the remains of a downshaft (feature 26), viewed from the south.

Each of the two tabernae opening onto the Via della Foce have their own basin. The basin in the northwest corner of room 10 (feature 27) is much better preserved, and was built against the existing west and north walls of the room. It is made of *opus latericium* and its internal space was divided into three smaller internal basins at a later period.[279] No supply source is known, and the inner corners are coated with *opus signinum*. The two basins closest to the street each have their own internal drains (features 104 and 105). Both are circular ceramic pipes passing through the east wall of the basin but at different heights. On the north wall directly next to the basin is a rectangular channel passing at a NW-SE angle through the wall (feature 45); the Via della Foce face of this channel has been blocked by

[278] Gdsc 32, 106 (19-6-1959): *"Nel peristilo delle domus del mitreo delle pareti dipinti sotto l'alo* ***sinistra*** *del porticato si e'rinvenuto* ***un canaletto rivestito di mattoni*** *che ha inizio delle parete in opera incerta."* Emphasis added.

[279] RS II, 93 (sch. 82b) for a detailed schematic of this basin.

modern restoration work. The final water feature identified in this building is another rectangular basin (feature 32), which is only known from Calza's 1953 plan. The basin was located against the east wall of room 11, several meters in from the street.

Infrastructure Chronology

Roman Water Footprint #1 (4th century B.C.- AD 50)

The well in courtyard 4 (feature 24) dates to this early period when it served the Republican domus. The creation of the sewer line 112 is dated to this period, as it would have drained the space of the brick-pillared portico, or perhaps an earlier impluvium pool here.

Roman Water Footprint # 2 (AD 50-200)

The well in room 3 (feature 23) can be dated contemporary with the creation of the mithraeum. The well in courtyard 4 (feature 24) was modified at this time period with the creation of its travertine well-head.

Roman Water Footprint # 3 (AD 200-300)

The walls of room 10 and 11 act as the *terminus post quem* for these features. Basin 27 dates to this period, when it was first created as one large basin. This was then divided into two communicating basins with a drain (feature 104) almost below the current ground level. At a slightly later phase another wall was added, creating a third basin that did not communicate with the other basins, and had its own drain into room 10 (feature 105). Contemporary with basin 27 is channel 45, which perhaps held a supply pipe for the basin. In room 11, basin 32 was perhaps also installed in this phase.

Roman Water Footprint # 4 (AD 300-600)

The two downshafts (features 25, 26) date to this period, and given the height of their exit holes, testify to a contemporary higher ground level in the building. It is possible that sewer 112 was still functioning from the Republican or early Imperial period, collecting the material from these downshafts.

Conclusion

The water features of this building are quite disconnected. The presence of two downshafts indicates an upper floor of some kind, although the lack of any staircases both within the building and in neighboring buildings makes their composition unclear. The waste from the downshafts perhaps continued toward and through hallway 5 toward the Via della Foce, implying that a 1st century B.C. sewer system was still functioning into the 4th century.

III, i, 7: Mercato

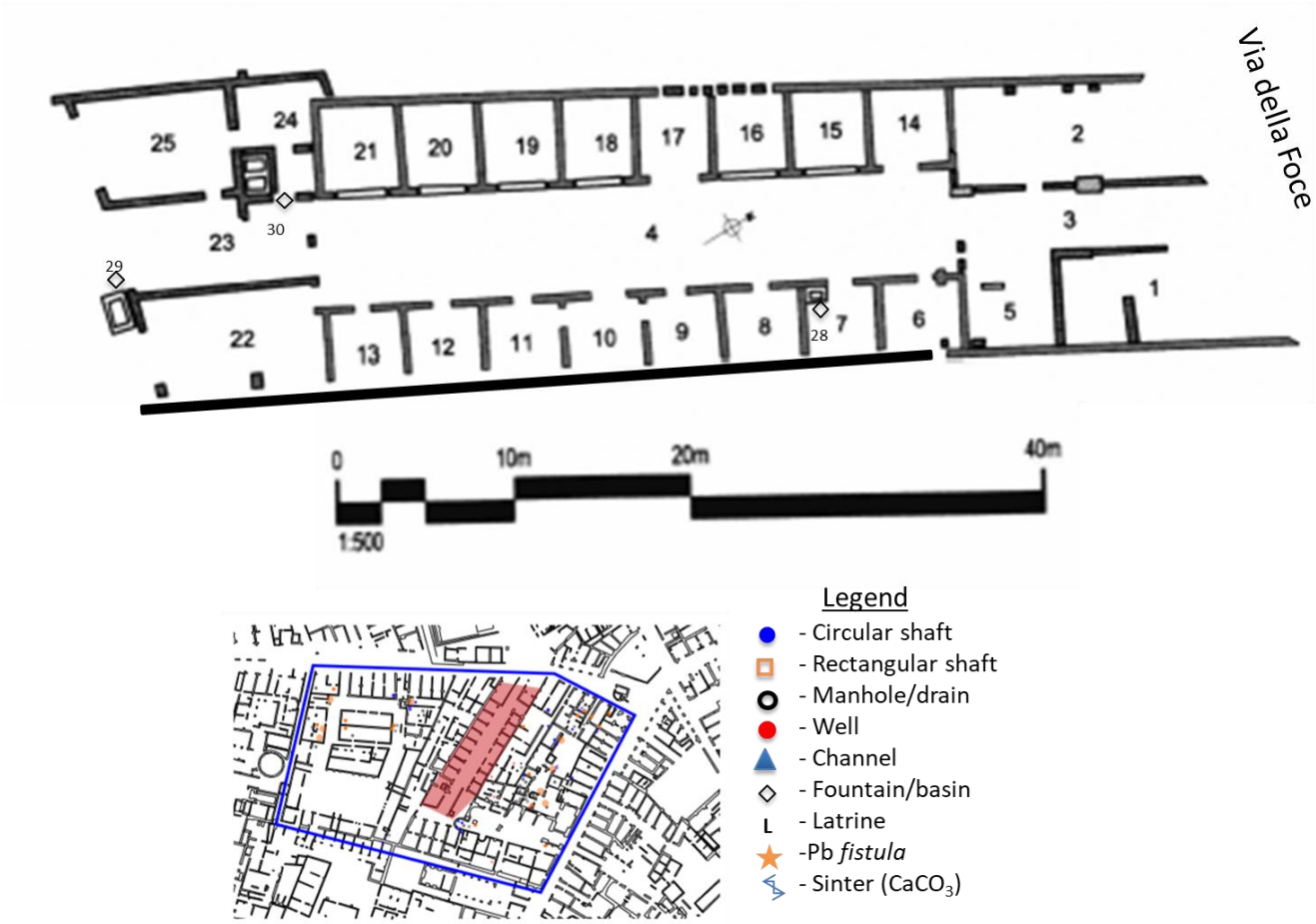

Figure 3.54: Identified water features in III, i, 7 (after Rose 2005, App. I, 175).

Location in insula

The Mercato is located in the northeast part of the insula, with three rooms opening onto the Via della Foce (Figure 3.54). It is bordered to the east by buildings III, i, 4 and III, i, 6, to the south by III, i, 5, and to the west by III, i, 8.

History of Excavation and Restoration

The building was excavated by Calza in 1939,[280] with several restorations occurring in 1961 and 1997, identifiable by modern brick stamps.

Phasing and Comments

The building's original construction phase dates to the Trajanic period, when other industrial structures were built nearby.[281] The eastern wall was built against the earlier Republican walls of the early domus in III, i, 6 (see above). The building is divided into an eastern and western section, with eight small rectangular rooms opening onto the central courtyard. At the southern end of this row of shops are two large spaces, each with their own water basin. The western wall of rooms 16 and 17 each have four rectangular "shafts" built into them; all of these "shafts" lack a back wall and have a rectangular

[280] GdSc 24, 133 (5-5-1939) for the initial excavation.

[281] Boersma 1985, 213 saw this building as comparable to the Trajanic phase in the Domus del Protiro (V, ii, 4-5), and the Terme del Filosofo (V, ii, 6-7); Flohr 2013, 210 for the wider area as industrial, including the creation of the *fullonica* in the space behind and under the Tempio dei Fabri Navales (III, ii, 3); SO 1, 110, 126, 235 for a date in the Trajanic period.

travertine block at their bottom, all of which lie at different heights. They may possess some kind of hydraulic function, and are mentioned here for their curious appearance (Figure 3.55).

Figure 3.55: Vertical "shafts" in the west wall of room 16.

The building was modified in the 3rd century, when the rooms fronting the Via della Foce were created (1-3, 5), and the southern rooms (22-25) added.[282] Large tufa blocks were incorporated into walls of rooms facing the Via della Foce, which likely originated from the original *castrum* wall of Ostia, and may have had some kind of symbolic meaning for the later structures.[283]

Until the late 4th or 5th century, the southern extent of the building had an intersection between the central corridor of the Mercato and the Vicolo degli Tigriniani (see above III, i, 4). This intersection also connected with the southern extent of building III, i, 8, and must have created an excellent space for commercial movement. When the Domus Tigriniani occupied the Vicolo, it obstructed this movement. When this happened in the late 4th or early 5th century, the Mercato surely was not functioning to the same degree as in the 3rd century. The new nymphaeum of the Domus Tigriniani jutted into the southern part of the Mercato and the unfinished exterior of this apse would indicate that it was not meant to be seen (Figure 3.56).

[282] Rose 2005, App. I, 24 for this chronology.
[283] Boos 2012, 151 discusses the Republican sacred area directly across the street from building III, i, 7, that has several structures upon foundations of the same tufo blocks.

Figure 3.56: Room 22 seen from the west, with the rough exterior of the apsidal nymphaeum of III, i, 4 on the right. Basin 29 is visible on the left side of the image.

Water Features Chart

The following hydraulic features are located in building III, i, 7 (Table 3.9).

III, i, 7 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
7	basin	SW corner	28	2
22	basin	external SW corner	29	3
24	basin	SE corner	30	3

Table 3.9: Identified water features in building III, i, 7.

Description of Water Features

In the southwest corner of room 7 is a small rectangular basin (feature 28), that was built against the existing southern and western walls of the room. Heavily restored in 1961, the basin is composed of tufa cobbles, and has no surviving evidence of supply or drainage.[284] At the southern end of the building is a large rectangular basin (feature 29), which was built against the southwestern wall of room 22, and restored in 1997. The basin is composed of bricks, and it is known to have drained into the sewer running under the Vicolo degli Tigriniani.[285] The final water feature from this building is another basin (feature 30), located in room 24.[286] The basin is divided into two smaller basins, yet they are connected by a small section of ceramic pipe at the basin's floor.

[284] RS II, 94 (sch. 83) describes a drain but this could not be verified by the present study.
[285] RS II, 95 (sch. 85), see above, III, i, 4, feature 100.
[286] The supply and drainage of this basin is unclear and may have been obscured by 1961 restorations.

Infrastructure Chronology

Roman Water Footprint # 1 (4th century B.C.- AD 50)

No known water features.

Roman Water Footprint #2 (AD 50-200)

Basin 28 is dated to this period together with the creation of the building.

Roman Water Footprint #3 (AD 200-300)

The two basins in the south part of the building (features 29, 30) are identified as contemporary with the creation of this entire southern section. Feature 30 is quite roughly built and may date to a later period. Basin 29 drained into sewer 100, which continued to the east under the Vicolo degli Tigriniani

Roman Water Footprint #4 (AD 300-600)

No known water features.

Conclusion

The mirroring tabernae suggest a concentration of industrial activities within this building; one hypothesis would see the larger doorways along the western side as an indication of where work was carried out, with objects sold in the smaller rooms along the eastern side.[287] Whatever the case, the activities here remained stable for several centuries.

III, i, 8-Caseggiato

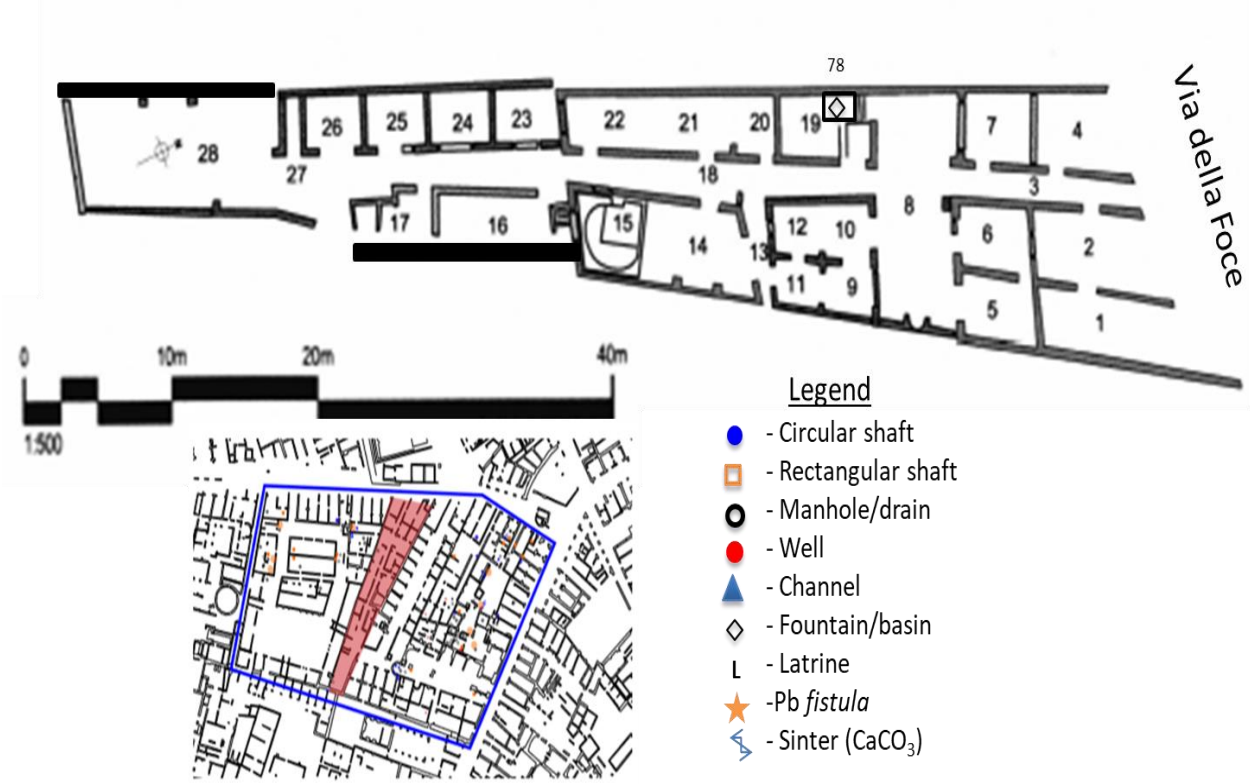

Figure 3.57: Identified water features in III, i, 8 (after Rose 2005, App. I, 176).

[287] Rose 2005, App. 1, 23.

Location in insula

Building III, i, 8 is a long rectangular structure that tapers at its southern extent (Figure 3.57). It divides the insula into its eastern and western half, opening onto the Via della Foce to the north, and connected in its southern rooms to III, i, 5 and III, i, 7. It is bordered to the east by III, i, 7, to the south by III, ii, 10, and to the west by III, i, 9 and 15.

History of Excavation and Restoration

The building was likely excavated by Calza during his 1939 work of uncovering the space between the Via della Foce and the *decumanus maximus*, although no explicit descriptions were recorded.[288] In 1961, the walls dividing rooms 23-28 were completely reconstructed. During fieldwork conducted in spring 2016, several brick piers along hallway 18 had recently collapsed due to plant growth, revealing partial brick stamps.[289]

Phasing and Comments

The first phase of building comes from ca. 125 AD when the *opus mixtum* walls were built, and included a high number of relieving arches down the entire eastern side of the building.[290] Four internal staircases indicate upper floors (rooms 1, 16, 19, 27), although in room 27 this staircase likely connected building 8 and 9. The building is divided into an eastern and western half by a central hallway. After a series of *tabernae* facing the street, room 8 contains a poorly preserved pseudo-aedicula.[291] The eastern wall of the aedicula room contains the four "shafts" mentioned in the context of the previous building (III, i, 7, rooms 16 and 17). From a later period, perhaps in the 3rd or 4th century, *opus vittatum* walls closed the street opening of room 1 and the south wall of room 7. A very rough conglomeration of tufo blocks was used to close the doorway between rooms 2 and 6, but the south face of this wall is in a rough *opus vittatum* appearance, which may indicate that room 2 was out of use. The bowl-shaped "bench" and lack of door in room 15 loosely resembles the lime-kiln room known in the Caseggiato del Serapide.[292] When comparing the current heights of buildings 7, 8, and 9, their internal topographies vary considerably. While the street fronts of all of these buildings match the level of the Via della Foce, only the north and south sections of buildings 7 and 8 are the same, and the ground level in the middle of the buildings seems to have a concave shape.[293] While some of this variation is surely due to modern excavation and restoration, the presence of a staircase in the southwestern area of the building implies that at least buildings 8 and 9 were connected between these disparate ground levels.[294]

Water Features Chart

The following hydraulic features are located in building III, i, 8 (Table 3.10).

[288] GdSc 24, 133 (5-5-1939) for excavation of this area.
[289] See Appendix 2 for this brick stamp.
[290] SO 1, 235.
[291] Bakker 1994, 219, Pl. 21 dates the installation of the *aedicula* to the same time period as the first building phase.
[292] Rose 2005, 66 dates the lime kiln to broadly "post 300 AD"; *ibid*. App. I, 27 sees staircase 16 for access only to dump material into the lime-kiln; a similar round structure is known from II, viii, 9 in Ostia, yet its function is also unclear.
[293] Causing an internal "step" down in floor heights, descending by roughly 1.5 m between building 9 and 8, and down by the same interval from building 8 to 9.
[294] A similar height difference for contemporary buildings is also known between the Campo della Magna Mater (IV, i) and the Terme del Faro (IV, ii, 1). See Chapter 5 infra for discussion.

III, i, 8 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
19	basin	NW corner	78	3

Table 3.10: Identified water features in building III, i, 8.

Description of Water Features

One water feature was identified in this building, although it is known only from the maps in the Scavi di Ostia I. A rectangular basin with two internal basins (feature 78) was installed in the northwest corner of room 19.[295] Based on its position under a staircase, the basin was interpreted as having an industrial function.

Infrastructure Chronology

Roman Water Footprint # 1 (4th century B.C.- AD 50)

No known water features.

Roman Water Footprint # 2 (AD 50-200)

No known water features.

Roman Water Footprint #3 (AD 200-300)

As the basin is not preserved, it can only be relatively bdated after the creation of the building in the Hadrianic period. It is dated broadly to the 3rd century by this study based on the more securely dated basins of a similar shape known from other buildings in the insula.

Roman Water Footprint #4 (AD 300-600)

No known water features.

Conclusion

Despite being destroyed in this case, such double basins are known from III, i, 6 in a (semi)industrial setting, and in III, i, 14 in a similar position underneath a staircase. The internal connectivity of the building with the Mercato (III, i, 7) suggests that building III, i, 8 also primarily had a commercial nature, perhaps with the pseudo-aedicula in room 8 acting as a related shrine.

Buildings 9-15 make up the western part of the insula and they were not integrated with the eastern half of the insula other than by a single late staircase (Figure 3.58). The buildings form a "micro-insula", with a row of tabernae (building 14), internal medianum-style apartments (buildings 11, 12, 13), and several narrow buildings encircling an open courtyard (buildings 9, 10, 15).[296]

[295] RS II, 95 (sch. 86a-b) for this basin.

[296] SO 1, 126, where this unit is called, *"È uno strano complesso edilizio che svolge su tre lati di un'area scoperta dei lunghi ambienti…"*

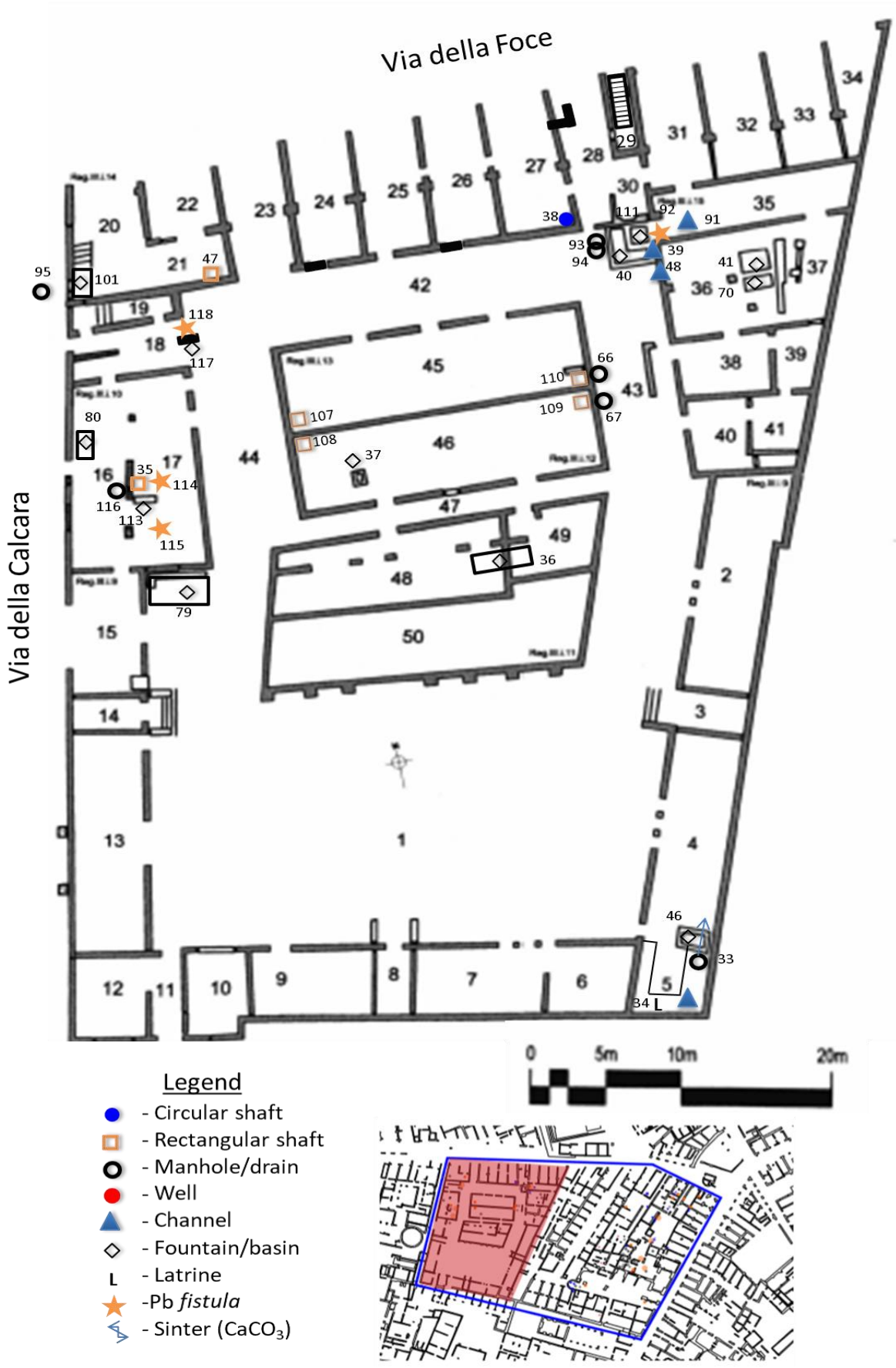

Figure 3.58:Identified water features in III, i, 9-15 (after Rose 2005, App. I, 177).

III, i, 9

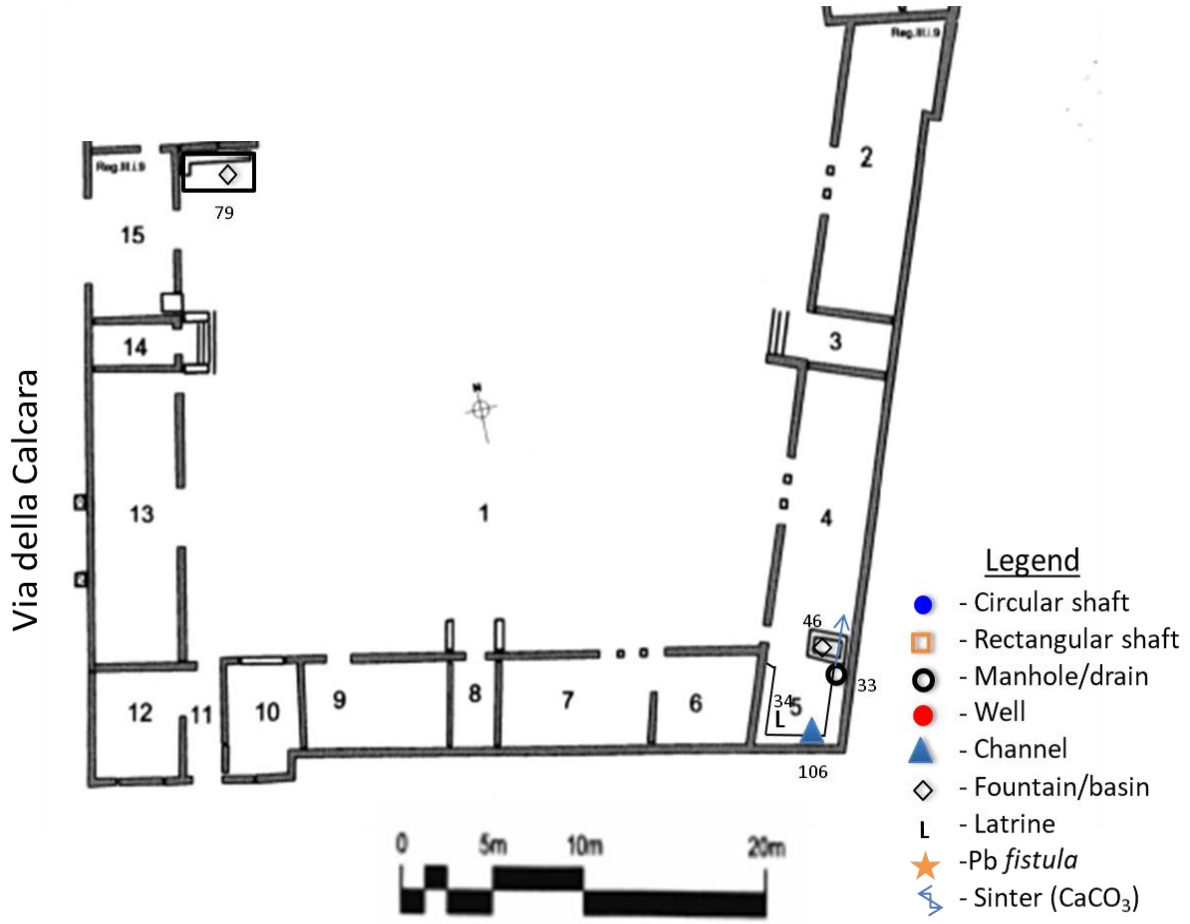

Figure 3.59: Identified water features in III, i, 9 (after Rose 2005, App. I, 177).

Location in insula

Building III, i, 9 is located in the southwestern part of the insula, and is bordered to the east by building III, i, 8 (Figure 3.59). Forming the entire southern section of buildings 9-15, it comprises the large southern courtyard (room 1), and the rectangular rooms surrounding this space to the south, east, and west (rooms 2-15). Building 9 is well connected to the other buildings of the western section of the insula, but also to the open courtyard of III, ii, 10 to the south, and to the Via del Calcara that divides insula III, i from III, x.

History of Excavation and Restoration

Excavated by Calza in 1939, substantial parts of building 9 were restored in 1961, including the internal walls of the latrine.[297]

Phasing and Comments

The majority of the building is dated to the Trajanic period.[298] Some fragmentary evidence for later phases comes from the *opus vittatum* and tufa rubble walls present in rooms 9 and 10. Pairs of *opus vittatum* piers were added in the doorways of rooms 2, 4, and 6-7, perhaps in the 3rd century; several

[297] GdSc 24, 131 (18-4-1939) describes *"dalla botega* (III, 1, 14, room 20?) *che si apre sulla Via della Foce in angolo con il vicolo* (Via della Calcara?) *che porta al santuario delle 3 navate…"*; ibid *"dagli sterro dell'area con magazzini tra il Decumano e la casa dei Sette Sapienti…"*.
[298] Rose 2005, App. I, 29.

of these piers were rebuilt in the 1960s (Figure 3.60). As said above, the ground level is higher in building 9 than in neighboring building 8, but even so, the current ground level in building 9 is an additional ca. 30 cm above the level of courtyard 1.[299] Three broad podia (rooms 3, 8, 14) are placed between the long portico-style rooms (rooms 2, 4, 13), perhaps indicating a commercial function for this building.

Figure 3.60: Building III, i, 9, room 2, with actual and restored sections indicated (Rinaldi 2012, 116, Fig. 2).

Water Features Chart

The following hydraulic features are located in building III, i, 9 (Table 3.11).

III, i, 9 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
5	drain	NE corner of latrine channel	33	2
5	latrine	S wall of room 5	34	2
5	channel	W-S-E walls	106	2
5	basin	E wall of room 5	46	2
15	double basin	external E wall	79	3

Table 3.11: Identified water features in building III, i, 9.

Description of Water Features

In the southeast corner of room 5 is a multi-seater latrine (feature 34), opening onto the eastern portico (room 4). The latrine was built as a unit when the ground level of the entire area was raised. To avoid liquids from seeping through the channel wall into the neighboring buildings, a secondary wall of *opus reticulatum* was installed against the existing walls of room 5. The latrine resembles many others known

[299] The ground level in building 9 is ca. 1. 50 m higher than in the open courtyard of insula III, ii directly to the south.

at Ostia, with a U shaped channel placed underneath a line of seats.[300] The central channel of the latrine (feature 106), is present on the west, south, and east sides of the latrine, sloping down towards the northeast corner. From here, the material from the latrine would enter a cappuccina sewer (feature 33), which could be traced to the north for an additional 5.00 m (Figure 3.61).[301] The sewer likely transported its contents through the open spaces of this part of the insula, and towards the Via della Foce.

Figure 3.61: External (left) and internal (right) views of sewer 33.

Figure 3.62: Looking south at the latrine and its water basin.

Directly in the northeast corner of the latrine is a rough basin made of tufa stones that was built against the east wall of room 5 (Figure 3.62). Despite being extensively restored in 1961, some original *opus signinum* is preserved against the internal east wall of the basin.[302] The basin likely acted as a supply for the latrine channel; water must have flowed around a (now lost) sponge-gutter to the northwest side

[300] See Chapter 7 in the present study for the better preserved latrine of the same kind in the Terme di Filosofo (V, ii, 6-7).

[301] Modern concrete from the 1961 repairs was added to bond the *bipedales* of the *cappuccina* to the internal ceiling of the sewer.

[302] RS II, 96 (sch. 87) for this basin.

of the latrine channel (feature 106) before exiting down into the channel itself.[303] Moving to the western side of the building, a large double basin (feature 79) was installed in the corner formed between room 15 and the south wall of building III, i, 10. Identified mostly on the presence of some hydraulic mortar on is northern face, the basin is otherwise destroyed.[304]

Infrastructure Chronology

Roman Water Footprint # 1 (4th century B.C.- AD 50)

No known water features

Roman Water Footprint # 2 (AD 50-200)

The latrine and its capuccina drain date to this period, when the building was first created following a raising of the ground level. Slightly after this, the rectangular basin was added in connection with the latrine.

Roman Water Footprint # 3 (AD 200-300)

The double basin built in the northwest corner of the building perhaps dates from this period (feature 79). This date rests on its similarity with more closely dated double-basins within this insula.

Roman Water Footprint # 4 (AD 300-600)

No known water features.

Conclusion

Building 9 seems to have had a public function based on its wide colonnaded porticoes, large courtyard, and the multi-seater latrine in its furthest southeast corner. The double basin likely had a public function, as it was located along a transitory route from the Via della Foce, through this part of the insula, and toward the neighboring courtyard in III, ii, 10.

[303] The estimated volume of this basin is 1 m^3 (= 1000 liters).

[304] RS II, 97 (sch. 88), who likewise questions whether this is a basin at all.

III, i, 10:Taberna

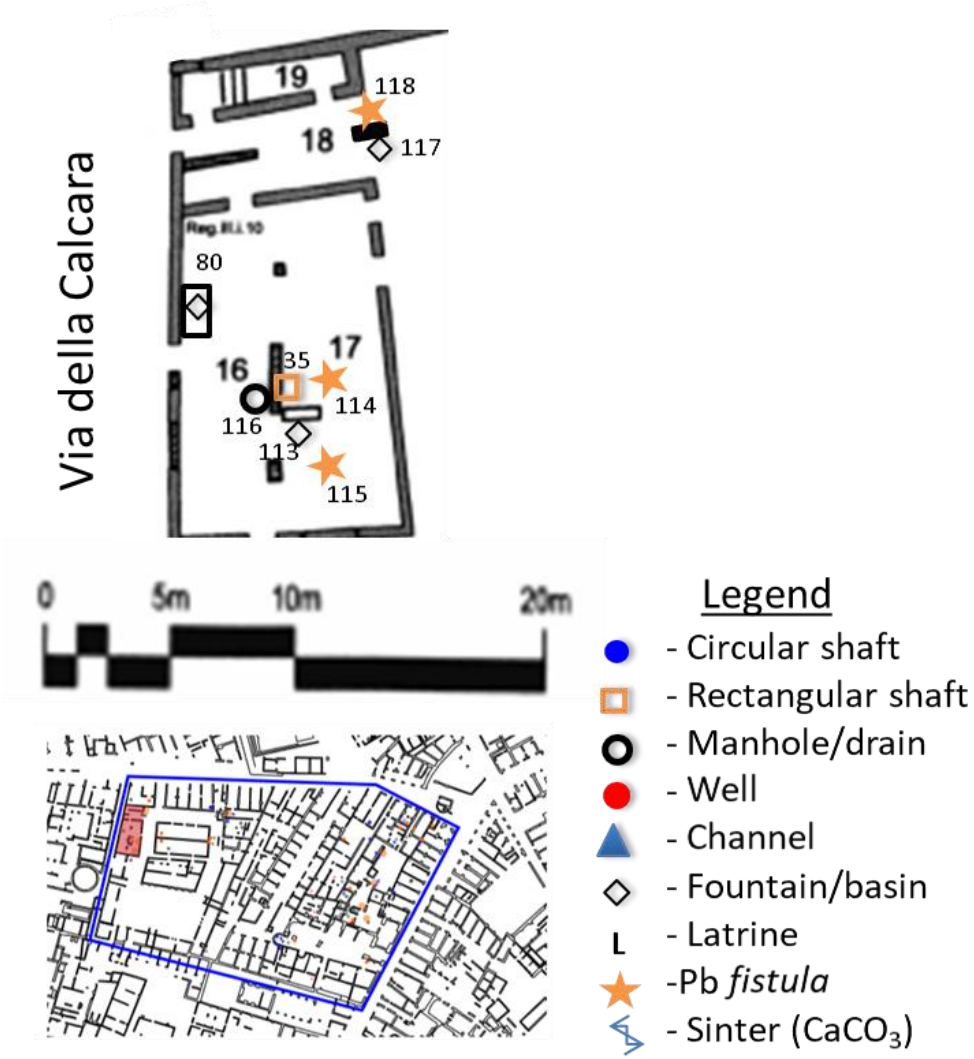

Figure 3.63: Identified water features in building III, i, 10 (after Rose 2005, App. I, 177).

Location in insula

Building 10 is located along the western edge of the insula, and is bordered to the west by the Via della Calcara, which divides *insula* III, i from the Caseggiato dell Serapide (III, x, 2) (Figure 3.63). It is bounded to the north by III, i, 14, to the east by the wide corridor 44, and to the south by building III, i, 9.

History of Excavation and Restoration

The building was excavated by Calza as part of the 1939 campaign described in the previous building, and also underwent restorations in 1961.

Phasing and Comments

Like the other buildings in the 9-15 complex, building 10 originally dates to the Trajanic period.[305] A mosaic from this time period indicates that the building was divided into three rooms. This building has several windows opening onto the central open area in this part of the insula, and may have already been a bar in this period. The installation of the *opus vittatum* dividing walls and piers date to the 4th century. The western wall of the room was also built in *opus vittatum*, particularly the section north of the western doorway. This section of wall continues north until room 21; a staircase was built at this

[305] Hermansen 1982, 149-151; Rose 2005, App. I, 32; SO 1, 125-126, 235.

time against the south wall of room 21. This staircase granted access to an apartment that likely covered rooms 16-18.[306] The current bar counter also was added in this period. Given that the present height of the Via della Calcara is ca. 60 cm below the floor in building 10, this floor level can be taken to indicate the (under-excavated) ground level of the street in the 4th century.

Water Features Chart

The following hydraulic features are located in building III, i, 10 (Table 3.12).

III, i, 10 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
16	basin?	W wall; N of doorway	80	4
16	sewer	E side of room	116	2
17	rectangular downshaft (?)	W wall on internal spur	35	4
17	basin	within bar counter	113	4
17	Pb fistula	NE of bar	114	2
17	Pb fistula	S of bar	115	2
18	fountain	E side of room	117	4?
18	Pb fistula	within basin	118	4?

Table 3.12: Identified water features in building III, i, 10.

Description of Water Features

On the west side of building is a small basin (feature 80), which was built against the western wall of room 16, directly north of the door leading out to the Via della Calcara. Several decades ago, this basin was visible to a height of only a few centimeters.[307] A flat roofed drain (feature 116) runs along the western side of the *opus vittatum* piers in the center of the building. Originating from the bar counter, the drain is known to have continued to the north.[308] Built into the western wall of room 17, a rectangular downshaft (feature 35) is located directly north of the bar counter (Figure 3.64). The upper part of the downshaft, appears to have been restored, with the lower part completely removed together with the eastern face of the wall itself.

[306] The staircase in room 20 of III, i, 14 would lead to rooms above rooms 20-22. See subsequent chapter for the temporal connection between buildings 10 and 14.
[307] Hermansen 1982, 151; RS II, 97 (sch. 89).
[308] Hermansen 1982, 150.

Figure 3.64: Downshaft 35 and the bar counter in room 17 (looking southwest).

The bar itself had a shallow basin located underneath its vault (feature 113), which provided water to visitors to the bar.[309] This basin was supplied by two lead pipes. One of these came from the northeast (feature 114) and likely continues towards the eastern doorway of the building. The second (feature 115) comes to the basin from the south, possibly originating from the Via della Calcara.

Directly north of room 17 is the small corridor 18, connecting the Via della Calcara to the internal area of buildings 9-15. A small fountain (feature 117) was installed here, with a basin at ground level and covered by a brick arch (Figure 3.65). Although only the concrete core of the fountain is preserved, a lead supply pipe (feature 118) is known from its north side.

Figure 3.65: View of fountain 117 from the south (from http://www.ostia-antica.org/regio3/1/1-10.htm).

[309] Hermansen 1982, 150, 151, fig. 85 is the main reference for the water features connected to the bar basin.

Infrastructure Chronology

Roman Water Footprint # 1 (4th century B.C.- AD 50)

No known water features.

Roman Water Footprint # 2 (AD 50-200)

Two of the lead supply pipes (features 114, 115) date to this period as they lie under the Trajanic mosaic, and led to an earlier bar counter, which was replaced in the 4th century. To ensure the drainage of this bar, the sewer 116 was installed, running to the north, and perhaps eventually out to the Via della Calcara sewer (see section III, i, 14 below).

Roman Water Footprint # 3 (AD 200-300)

No known water features.

Roman Water Footprint # 4 (AD 300-600)

The preserved bar basin (feature 113) dates to this period, when the bar counter was built against the slightly earlier *opus vittatum* piers. Within one of these piers is downshaft 35, which was installed in this position to take advantage of the Trajanic sewer line created for the earlier bar. Perhaps to increase the supply of water in this internal taberna, the small basin (feature 80) was installed directly next to the door entering from the Via della Calcara. Additionally, the lead pipe fed fountain in room 18 (features 117, 118) is dated to this period.

Conclusion

Building III, i, 10 maintained its bar function from its creation at least until the 4th century, serving the surrounding residential structures. New supply and drainage features were installed in the 4th century, implying a new division of the apartments above room 16 and 17; this new upper-floor division was supported by the line of *opus vittatum* piers. These new water features demonstrate the continuity of previous water features, but also the flexibility to place features like downshafts in otherwise unusual positions.

III, i, 11: Edificio

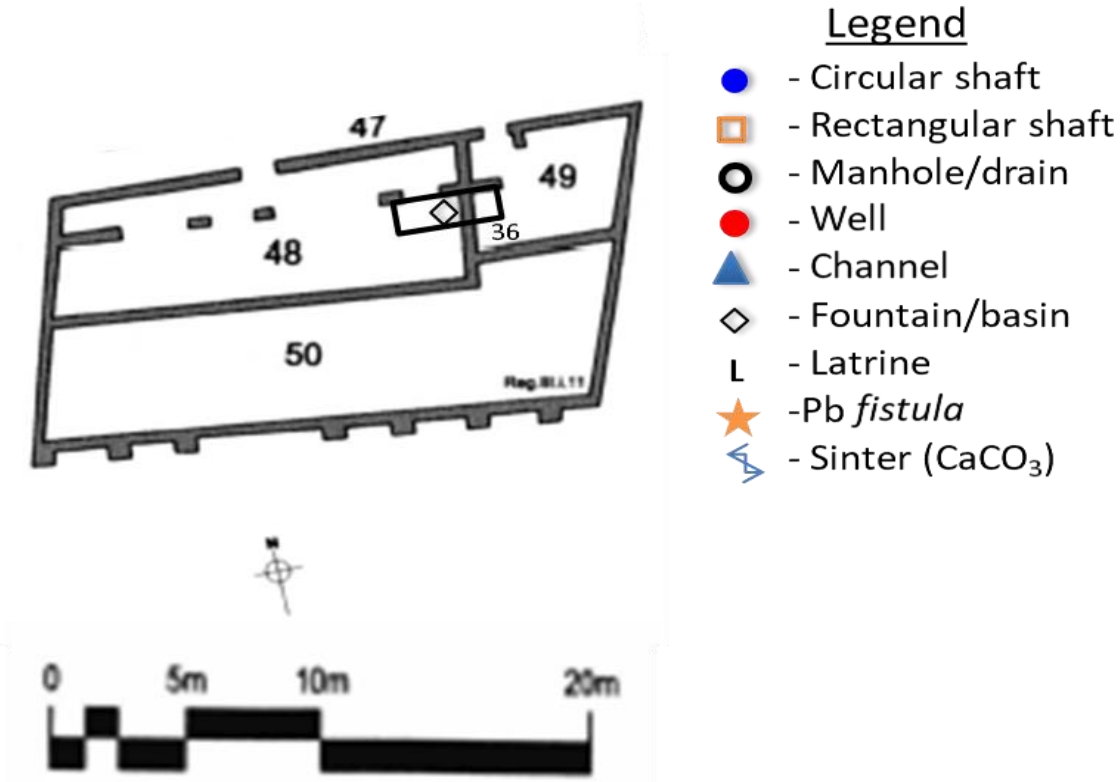

Figure 3.66: Identified water features in III, i, 11 (after Rose 2005, App. I, 177).

Location in insula

Building 11 is located in the western part of the insula, in the middle of the large courtyard as part of the western "micro-insula" (buildings 9-15) (Figure 3.66). It is surrounded on all four sides by corridors, lying south of building III, i, 12, west of building III, i, 9, and east of building III, i, 10.

History of Excavation and Restoration

No explicit mention is made of the excavation of this building, but it was likely part of the same 1939 campaign as the neighboring buildings. The building was extensively restored in 1961, especially the line of *opus vittatum* piers and parts of the external wall of the building.

Phasing and Comments

The outer walls of the building are Trajanic, and have protruding contraforte piers on its external southern wall. At a later phase, perhaps in the 3rd century, an internal line of *opus vittatum* piers was added parallel to the north wall of the building. The wall dividing room 48 from the other two rooms appears to have been added slightly later, as it is built against one of these piers.

Water Features Chart

The following hydraulic features are located in building III, i, 11 (Table 3.13).

III, i, 11 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
49	cistern	W side of room	36	3

Table 3.13: Identified water features in building III, i, 11.

Description of Water Features

The only water feature known from this building is an underground cistern (feature 36). Accessible only from a rectangular area in room 49, the room slopes down to the west (under room 48) for an additional ca. 4.20 m before opening into a rectangular cistern.[310] This underground cistern has a barrel vault supported by *opus mixtum* walls, with both the walls and arch covered by a thick layer of *opus signinum* (Figure 3.67, Figure 3.68).[311] The cistern and its entrance vestibule are filled with a significant amount of plant and soil debris, and certainly cover deeper levels of the entire space, and perhaps also a descending staircase. No evidence of water supply or extraction were identified.

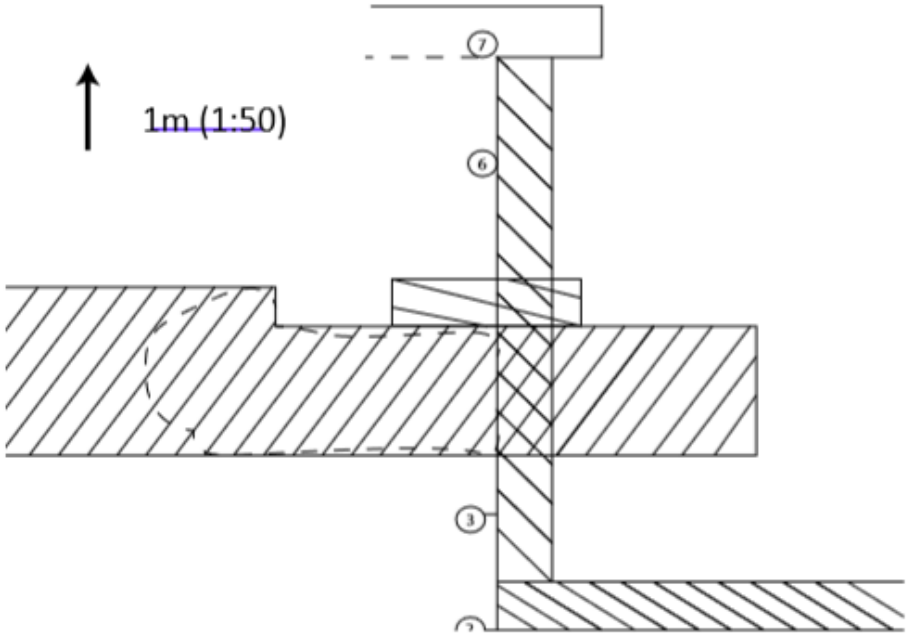

Figure 3.67: Schematic plan of the cistern (feature 36) underneath building III, i, 11. Dashed lines indicate extent of rubble fill.

[310] If filled to the ceiling, the cistern would have an estimated capacity of 5.37 m^3 (=ca. 5370 liters).

[311] RS II, 99, fig. 166 perhaps refers to this feature, and not to the staircase directly south of the courtyard fountain in corridor 43 (feature 40): *"Nei pressi sul lato destro della vasca* (= feature 40) *vi è una scaletta che scende ad un locale sotterraneo mai esplorato, potrebbe essere una cisterna del tipo usuale ad Ostia, che raccoglieva sia acqua piovana, che acqua dalla rete idrica urbana"*.

Figure 3.68: Internal views of cistern 36 in III, i, 11: west (at left), lower west corner (bottom right), east (above right).

Infrastructure Chronology

Roman Water Footprint # 1 (4th century B.C.- AD 50)

No known water features.

Roman Water Footprint #2 (AD 50-200)

No known water features.

Roman Water Footprint # 3 (AD 200-300)

The underground cistern is broadly dated to this period, with the *opus vittatum* pier acting as its *terminus post quem*.

Roman Water Footprint # 4 (AD 300-600)

No known water features.

Conclusion

This underground cistern space calls to mind several other similar subterranean spaces at Ostia, such as the well room in the Domus del Protiro (V, ii, 4-5, feature 23).[312] In the latter, a well from the 1st century AD was consciously preserved throughout the entire remaining history of the building, despite evidence for additional water provisioning by rain and aqueduct water. Perhaps in this case there is a similar continuity of water features, and this cistern was originally a "bauletto" style fountain of the 1st century AD that survived the ground raising in this area. Access to the cistern seems to have been restricted by the creation of room 49.

[312] See Chapter 7 in the present study for this space and the associated systems of supply.

III, i, 12-13: Caseggiati

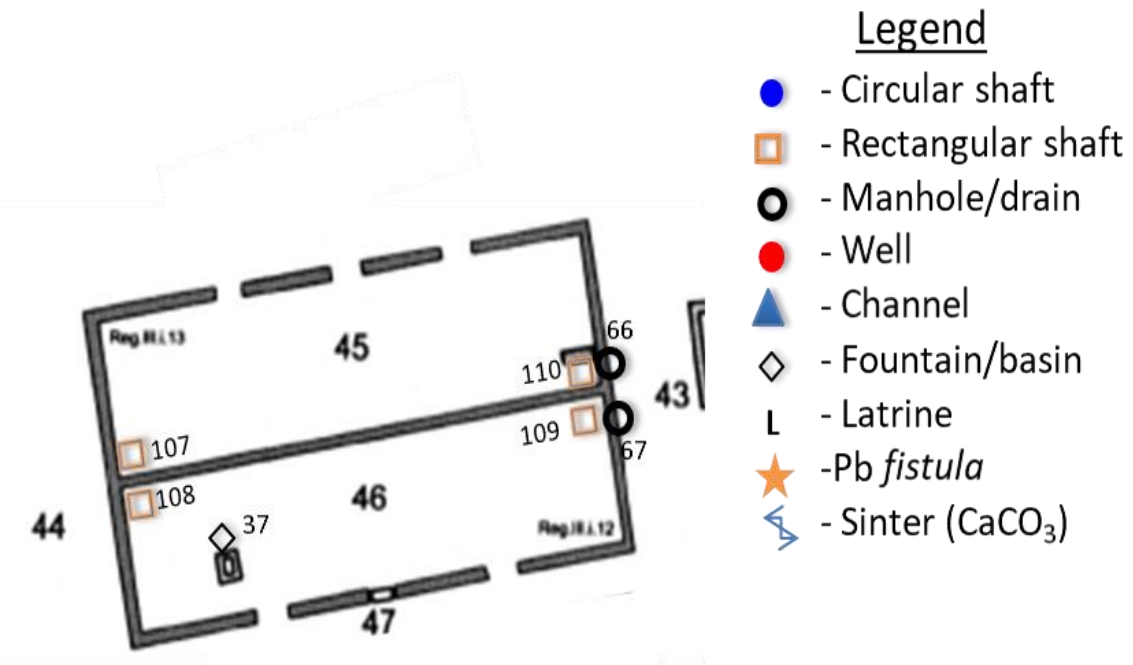

Figure 3.69: Ground plan of buildings III, i, 12-13 as they are today (after Rose 2005, App. I, 177).

Location in insula

Buildings 12 and 13 are taken as a unit given their joined history (Figure 3.69). They are located in the northwestern part of the insula, and are roughly in the center of the large complex of buildings 9-15. The buildings are surrounded on all sides by hallways of varying sizes and lie across from III, i, 14 to the north, III, i, 15 to the east, III, i, 11 to the south, and III, i, 10 to the west.

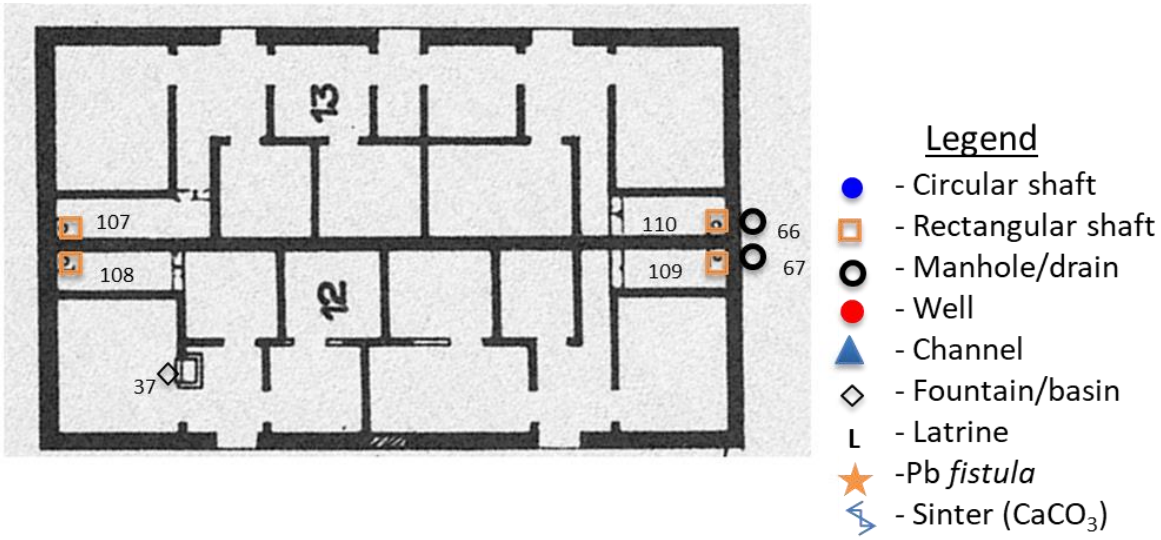

Figure 3.70: Identified water features in buildings III, i, 12-13, with walls recorded by Calza (after SO 1, Plan 7).

History of Excavation and Restoration

Excavation of the buildings occurred under Calza in 1939, who identified the numerous internal rooms in both buildings. Restoration of the building occurred in 1961 and in 1981 (Figure 3.70).

Phasing and Comments

The outer walls of these buildings date to the Trajanic period with an *opus reticulatum* quoined into a *opus latericium* wall. Both the inner and outer faces of these walls are heavily eroded, but preserve widely-arcing relieving arches on the east and west sides. The wall dividing the northern and southern sections of the building was added slightly later, likely when the numerous internal walls were added. None of these walls are preserved today, but they appear to have resembled the *medianum*-style apartments known at Ostia.[313] In a final phase, *opus vittatum* extensions were added onto the northern doorways of room 45, reducing their span. This may be contemporary with the blocking up of several southern doorways of tabernae in III, i, 14 (see below).

Water Features Chart

The following hydraulic features are located in buildings III, i, 12, 13 (Table 3.14).

III, i, 12-13 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
45	sewer	SE corner external	66	2
45	downshaft(?)	SE corner of room	107	2
45	downshaft(?)	SW corner of room	110	2
46	basin	W side of room	37	2
46	cappucina sewer	NE side external	67	2
46	downshaft(?)	NW corner of room	108	2
46	downshaft(?)	NE corner of room	109	2

Table 3.14: Identified water features in building III, i, 12-13.

Description of Water Features

In the eastern section of room 46 is a small basin (feature 37), which is heavily restored (Figure 3.71).[314] The destruction or poor conservation of the numerous walls within buildings 12 and 13 make it difficult to assign any further context to this basin. In the northwest corner of room 46, a downshaft (feature 108) was recorded by Calza in his original plan.[315] A matching downshaft (feature 107) was likewise identified by Calza in the southwest corner of room 45. This combination of downshafts on either side of the dividing wall between the two buildings is also present on the eastern side of the building.

[313] SO 1, 126, 235; Examples of *medianum* apartments are known at the Case a Giardino (III, ix, 13-20), and Casete Tipo (III, xii, 13), V, iii, 4.
[314] RS II, 98 (sch. 90).
[315] SO 1, 126.

Figure 3.71: Basin 37 seen from the west, as seen in 2017.

In the northeast corner of room 46, a downshaft (feature 109) was described by Calza, however, in this case, support for Calza's identification comes from a cappuccina sewer that passes our into corridor 43. This sewer (feature 67) goes horizontally through the east wall of room 46, with about one-third visible above the current ground level. The exact same situation is present in the southeast corner of room 45, with the presence of a downshaft (feature 110) substantiated by a preserved cappuccina drain (feature 66).

Infrastructure Chronology

Roman Water Footprint #1 (4th century B.C.- AD 50)

No known water features.

Roman Water Footprint #2 (AD 50-200)

All of the water features date to the first creation of the building, although modern excavations and restorations make it difficult to hazard additional interpretations.

Roman Water Footprint #3 (AD 200-300)

No known water features.

Roman Water Footprint #4 (AD 300-600)

No known water features.

Conclusion

The number and distribution of vertical drains would suggest a division of the upper floor into several apartments, however, the lack of preserved staircases makes this difficult to substantiate. We can then interpret the drains as transporting rain water off of the shared roof of buildings 12 and 13. Although cappucina drains were not identified along the western face of the buildings, we can assume that features 107 and 108 also drained into a sewer running under corridor 44.[316] Also, the position of the cappuccina drains on the eastern side of the buildings suggest a higher ground level in the Trajanic period than at present.

[316] Stevens 2005 for the role of drains in reconstructing upper-floor spatial divisions of the Case a Giardino.

III, i, 14: Botteghe

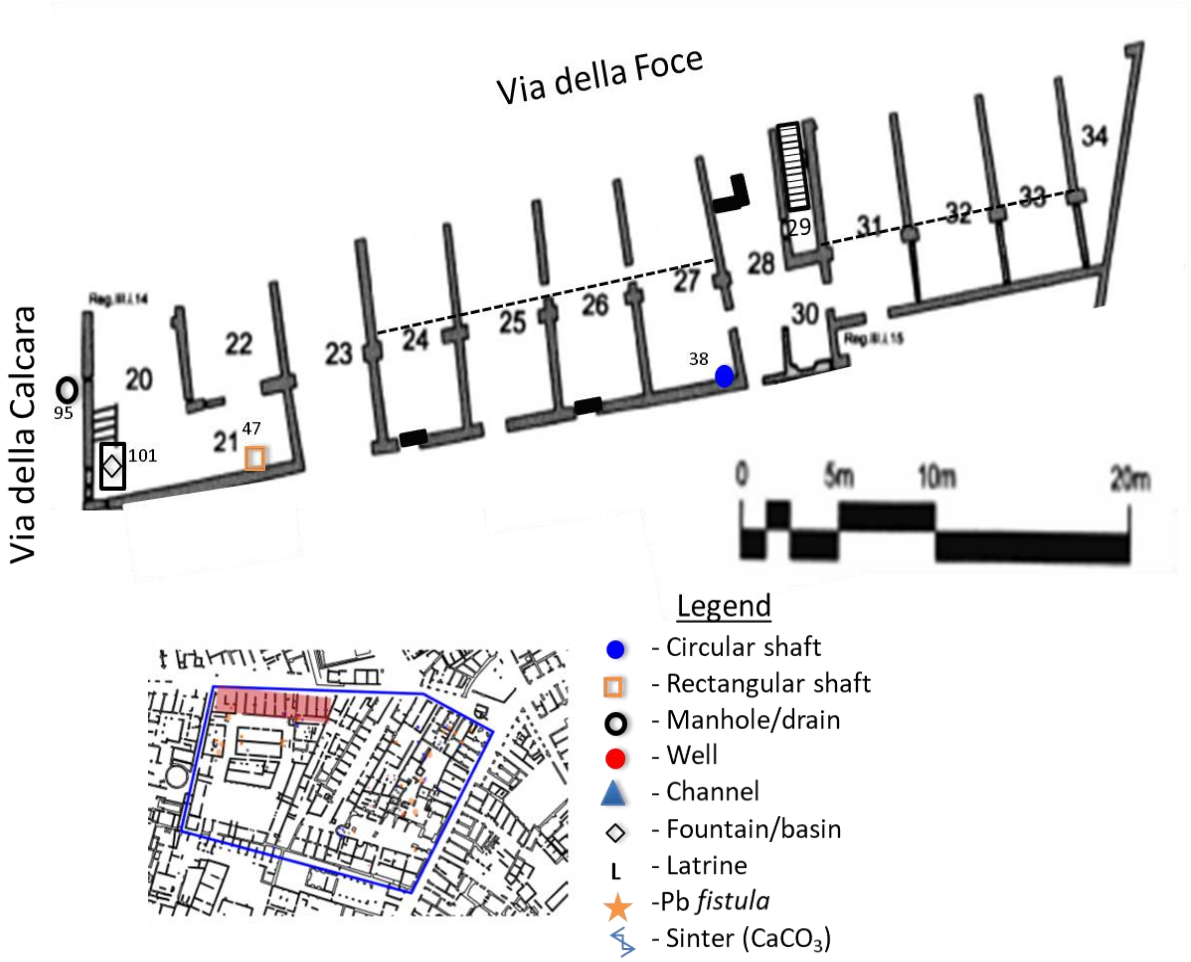

Figure 3.72: Identified water features in III, i, 14, with dashed line indicating the original southern limit of the tabernae (after Rose 2005, App. I, 177).

Location in insula

Building III, i, 14 forms the northern section of the western part of the insula, and is bordered to the east by III, i, 8, to the south by III, i, 15 and III, i, 10, and to the west by the Via della Calcara (Figure 3.72).

History of Excavation and Restoration

The excavation of the Via della Calcara had already occurred in 1938, with Calza excavating and restoring the line of shops in 1939.[317] Many sculptures and epigraphic fragments were found at this intersection of the Via della Foce and the Via della Terme di Mitra.[318] Several restorations occurred in 1961.

Phasing and Comments

The original skeleton of the building dates to the Trajanic period, when the face of the western section of the insula was composed of a line of tabernae.[319] Staircases in rooms 20 and 29 offered access to upper floors. In this initial period, the south wall of the tabernae only reached as far back as the piers visible in the dividing walls. Rooms 20-22 existed in their present shape, except that there were

[317] GdSc 27, 98 (29-10-1938) for the Via della Calcara; GdSc 24, 155 (24-8-1939).
[318] GdSc 28, 15 (29-7-1938).
[319] Rose 2005, App. I, 37 sees them as the same project begun under Trajan and finished by Hadrian; SO 1, 235 dates building 14 to Hadrian (ca. 125 AD) and building 15 to Trajan.

doorways open to the Via della Calcara, and south into corridor 42. In a second phase, perhaps in the 4th century, *opus vittatum* extensions were added onto all of the tabernae walls, creating additional back rooms and projecting the tabernae into the narrow hallway of the inner part of this building complex. The central part of the many of the walls dividing the tabernae are built of *opus reticulatum*, while the southern sections of these dividing walls are in *opus vittatum*. In the case of room 20, *opus vittatum* was also used to block up the western and southern doorway of the room. In a later phase, a passageway was roughly broken through the walls between rooms 25-26-27, and access was restricted between the tabernae and the internal space of the large courtyard (through rooms 24 and 26). The southern wall of the entire line of tabernae is very eroded.

Water Features Chart

The following hydraulic features are located in building III, i, 14 (Table 3.15).

III, i, 14 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
20	basin	SW corner of room	101	4
21	rectangular downshaft	S wall of room	47	4
27	semi-circular downshaft	SE corner	38	4
Via della Calcara	sewer	runs N-S in street	95	2
Via della Foce	sewer	runs E-W under street	73	2

Table 3.15: Identified water features in building III, i, 14.

Description of Water Features

Running under the Via della Foce is a sewer line that was identified by Calza, with a list describing its brick stamps (feature 95).[320] Directly west of room 20 is the Via della Calcara, which has a sewer line (feature 95) running along at least part of its length. Evidence of this sewer comes from the room to the north of the lime kiln in the Caseggiato del Serapide (III, x, 3) (Figure 3.73), where a flat roofed channel slopes down under the Hadrianic taberna into the Via della Calcara. Little more can be said at present about this sewer, other than that it should lie below the current level of the Via della Calcara.

[320] GdSc 27, 99 to 101 (29-10-1938).

Figure 3.73: The northeast room of the Caseggiato del Serapide (III, x, 3) with the west wall of room 20 of III, i, 14 in the background. The sewer in the Caseggiato heads into the Via della Calcara, leading to the Via della Foce, at the left side of the image.

In the southwest corner of room 20 a rectangular basin (feature 101) was recorded by the initial excavators. Installed against a closed door and under a staircase, no evidence of water supply or drainage is known from this basin (Figure 3.74).[321] Continuing along the southern wall or room 21, there is a rectangular downshaft (feature 47) (Figure 3.75). Almost directly in the southeast corner is the impression of rectangular tubuli built into an *opus vittatum* wall blocking up the southern doorway of room 21. The small size of the opening (ca. 13 x 17 cm) would confirm its interpretations as a sequence of vertical tubuli, although these are usually found in connection with hypocaust systems.

Figure 3.74: External eastern wall of room 20, showing the blocked doorway with the upper brick section of the fill restored. Note the height of the travertine blocks on either side of the doorway.

[321] RS II, 98 (sch. 91) for this basin.

Figure 3.75: Building III, i, 14 with the preserved imprint of downshaft 47, seen from the north.

In a much better state is the circular downshaft in the southeast corner of room 27 (feature 38). Contrary to the other downshafts discussed in this study, this one was not placed into an existing masonry shaft, or into a hacked out niche, but rather was added to the external corner of the room. A rough conglomerate of tufa cobbles and brick fragments was used to build up the backing for a circular ceramic pipe, a segment of which is preserved at the current ground level (Figure 3.76). The entire internal surface of the pipe contains a thin (ca. 1 cm) yet consistent coating of calcium carbonate. The pipe likely continues into an underground sewer channel, which heads towards the Via della Foce. Better preserved examples of these downshafts added to the exterior of buildings is known from other places in Ostia (Figure 3.77).[322]

[322] Trusler & Hobson 2017 document the same type of masonry-enclosed downshafts added in Pompeii.

Figure 3.76: Building III, i, 14, with downshaft 38 added onto the southeast corner of room 22.

Figure 3.77: Masonry downshaft added on to the external wall of Caseggiato I, ix in Ostia, with the internal circular ceramic pipe visible through the broken *opus vittatum* masonry.

Infrastructure Chronology

Roman Water Footprint # 1 (4th century B.C.- AD 50)

No known water features.

Roman Water Footprint # 2 (AD 50-200)

The sewer lines under the Via della Foce (feature 73), and under the Via della Calcara (feature 95) date to the Trajanic period, dateable by the numerous brick stamps identified and recorded by Calza. The Via della Calcara sewer drained into the sewer line under the Via della Foce.

Roman Water Footprint #3 (AD 200-300)

No known water features.

Roman Water Footprint #4 (AD 300-600)

With the blocking up of the doorways in room 20 and 21, new water features were added (features 101, 47). Slightly after the tabernae were extended to have a second back room, the circular downshaft was built against the southeast corner of room 27.

Conclusion

The line of tabernae show a late renovation of space on the ground floor and at an upper level. The division of the upper floor spaces can be substantiated by the location and distribution of downshafts. It is at present unclear how the drainage of the Terme dei Sette Sapienti (III, x, 2) connected to the sewer under the Via della Calcara, given the discrepancies in height. The tabernae fronted the Via della Foce, which continued to be important into the Late Antique period, despite the closure of the Via della Foce.[323]

[323] Gering 2013, 273 for a detailed micro-history of the Via della Foce in the 3rd-5th centuries.

III, i, 15: Caseggiato

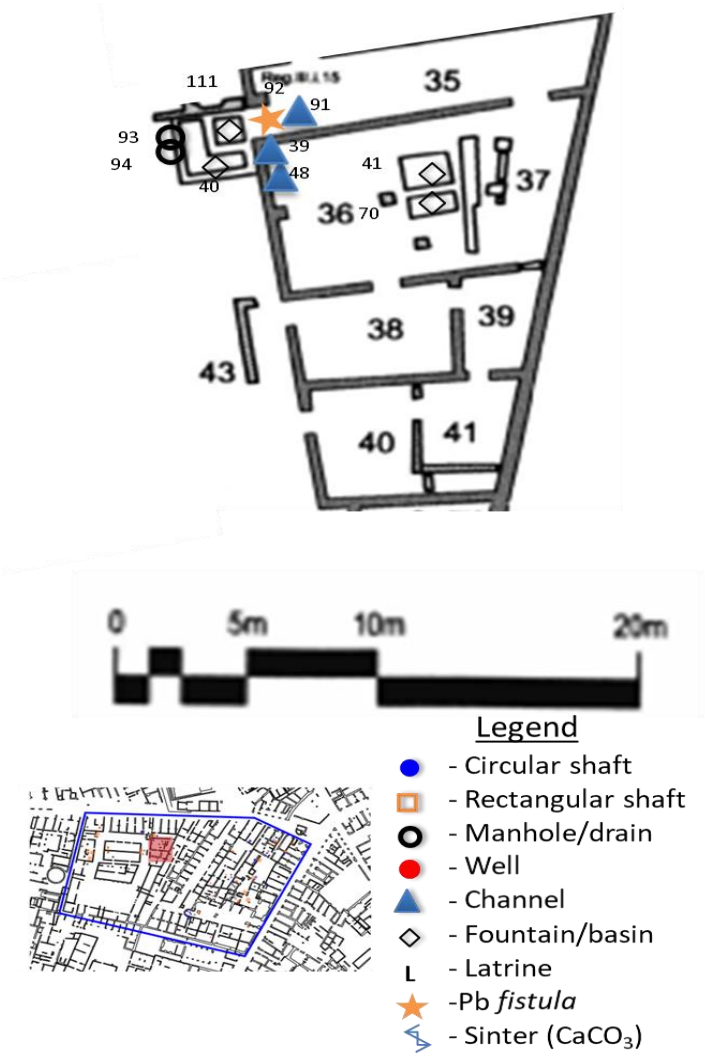

Figure 3.78: Identified water features in III, i, 15 (after Rose 2005, App. I, 177).

Location in insula

Building 15 is located in the northwestern part of the insula, and is part of the western group of buildings III, i, 9-15 (Figure 3.78). The building is bordered to the north by III, i, 14, to the east by III, i, 8, to the south by III, i, 9, and to the west by corridor 43 and III, i, 13.

History of Excavation and Restoration

As with the other buildings in the III, i, 9-15 micro-insula, this building was likely also excavated in the 1938-1939 period by Calza, although no direct reports were written. Isolated restorations occurred in 1961, especially to fountain 40, but also to several walls within the building.

Phasing and Comments

The first phase of building III, i, 15 was dated by Calza to the Trajanic period.[324] Rose saw this building as a unit with III, i, 14, with both buildings begun under Trajan and finished by Hadrian. The building is quite inward facing. In a later phase, a staircase was added to the west of room 38, indicating an upper apartment, which perhaps covered rooms 38-41. The insertion of an *opus vittatum* pier south of the

[324] Rose 2005, App. I, 37; SO 1, 235.

pair of basins can also be dated to this period. The courtyard fountain was also created in this period in the corner formed by the external walls of rooms 30, 35, and 36.

Water Features Chart

The following hydraulic features are located in building III, i, 15 (Table 3.16).

III, i, 15 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
35	Pb fistula	SW corner of room	92	4
35	channel	SW corner of room	91	4
35	fountain lower basin	external face of W wall	40	3
35	fountain upper basin	external face of W wall	111	4
35	drain	external W face basin	93	3
35	sewer	external W face basin	94	3
36	channel	W wall- higher channel	39	3
36	channel	W wall- lower channel	48	3
36	basin	E side of room	70	2
36	basin	E side of room	41	2

Table 3.16: Identified water features in building III, i, 15.

Description of Water Features

In the northwest corner of corridor 43 is a roughly rectangular fountain. The fountain has one lower basin in an L shape, and an upper rectangular basin (Figure 3.79).[325] The lower fountain (feature 40) is made of *opus latericium* and was built against the existing external walls of rooms 30, 35, and 36. The upper basin (feature 111), is made of *opus vittatum* and lies at a higher level than the lower basin. On the external northeast side of the fountain, a flat roofed channel (feature 91) was identified at the current ground level. Visible from the west side of room 35, this channel extends to the west for ca. 2.00 m under the fountain basins (feature 91). A fragment of a lead fistula pipe (feature 92) was preserved inside the channel (Figure 3.80).

[325] RS II, 98 (sch.92) for this two-level fountain.

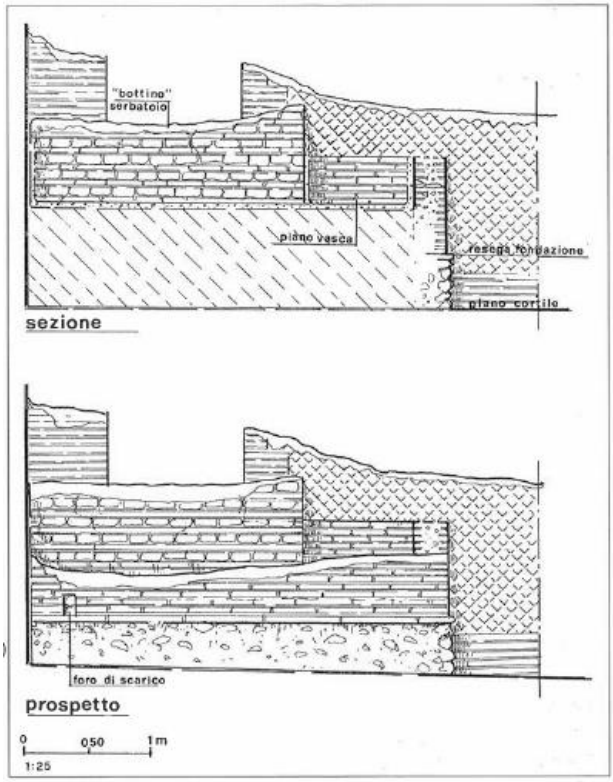

Figure 3.79: Cross section and west face of fountain in building III, i, 15 (RS II, 99, Fig, 164).

Figure 3.80: Lead pipe (feature 92) within channel on the east side of fountain 40.

Continuing along the external east side of the fountain, two circular channels are present in the northwest corner of room 36. These two channels are located near the current ground level, and are superimposed (feature 39, 48). The channels continue to the west for a short distance (ca. 45 cm), and in both channels the thick internal coating of hydraulic mortar has preserved the clear impressions of small lead pipes. Moving to the west side of the fountain two drainage features are also superimposed. Draining the L shaped basin is a circular ceramic pipe (feature 93). Although this pipe has a thin coating of calcium carbonate, it is securely set into the 1961 restored brick work, and it is unknown whether it retains its original placement. Almost directly below this pipe is the opening of a cappuccina sewer (feature 94), with the top of its brick channel visible and continuing ca. 0.60 m to the east under the L shaped basin (Figure 3.81). The cappuccina sewer is set within the foundation level of the fountain, with the ground level resting below the circular ceramic pipe (Figure 3.82).

Figure 3.81: West face of the fountain 40 with two superimposed drainage features.

Along the eastern side of room 36 are two rectangular basins located ca. 1.00 m below the current ground level of the room. A narrow wall added at a later point divided the large basin into two smaller ones (features 40, 71). The basins and the wall dividing room 36 and 37 were restored in 1961, but no evidence of supply or drainage is visible, although the basins are filled with organic debris.[326] Although these twin sunken basins have the same shape as those identified as rinsing basins in fulleries, further excavation is required to identify their true function.[327]

[326] RS II, 99 likewise doubts their identification as basin.

[327] Flohr 2013, 96 for the functioning of fulleries; Pietrogrande 1976 for the major study on Ostian fulleries.

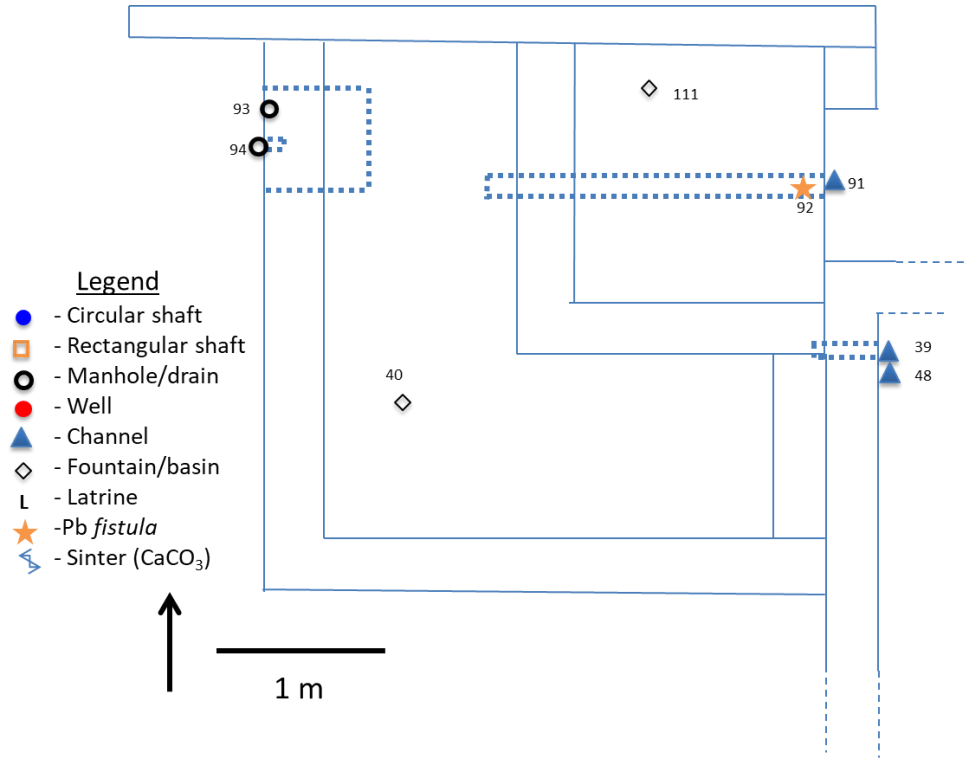

Figure 3.82: Ground plan of features associated with fountain 40.

Infrastructure Chronology

Roman Water Footprint # 1 (4th century B.C.- AD 50)

No known water features.

Roman Water Footprint # 2 (AD 50-200)

The two sunken basins in room 36 perhaps date to this period, as they are built into the lower floor of the room.

Roman Water Footprint # 3 (AD 200-300)

The fountain was inserted in this time period, but at this point it was just the lower basin (feature 40). At this time it was supplied by pipes that would have been located in room 36 (features 39, 48). The two superimposed drains on the western side (features 93 and 94), also date to the initial creation of the fountain.

Roman Water Footprint # 4 (AD 300-600)

In this period the fountain gained its upper basin (feature 111), with a narrow brick ledge inserted between the upper basin and the southern wall of the lower basin. This is located directly where the previous supply pipes were located and likely blocked the functioning of these pipes. In this period, the upper fountain was supplied with pressurized water via the lead pipe in the eastern face of the basin (features 91, 92). The two sunken basins in room 36 were likely still functioning at this time period, as the rough *opus vittatum* wall dividing rooms 36 and 37 respected the position of the basins.

Conclusion

Placed directly south of the entrance, this fountain would have been of central importance to the western section of the insula both when it was created, and in the subsequent centuries. It continued to be modified, and was connected to the larger system of drainage in buildings III, i, 9-15.

3.1.2: Data Conclusion

Insula III, i preserves a unique combination of hydraulic elements. These extend from the Republican to the Late Antique period, and are preserved in domestic, industrial, and religious contexts. The insula was clearly divided into an eastern and western half for its entire life, with no architectural or hydraulic connection between these two halves. Despite these differences, the insula was outwardly focused from the beginning and remained throughout its entire life, with tabernae lining the street fronts on two sides of the insula. This is partially a result of its location at the crossroads of the several major streets in the city, but it may also be a success of their initial creation: the long and successful history of tabernae, especially along the Via della Foce, were enough to ensure that this feature of the insula's personality continued to be connected to the flow of goods and people into the Late Antique period, surviving a widespread earthquake, and even the blocking of the street at the Bivio. This outer shell of tabernae fostered several domestic buildings, but there were anomalous and disconnected from their commercial neighbors. This changed slightly into the 3rd and 4th centuries, when domestic buildings overran their neighboring buildings. Hydraulically speaking, the insula is composed of several sub-units that remained fixed in their constellations for much of their life, and did not interact with other sub-units. The thermal complex (buildings III, i, 1, 2, and 3) did not interact with the neighboring domus buildings (III, I, 4 and 6), until the last phase of its life and the bond between the buildings of the thermal complex had broken down.

With the identification and chronological phasing of the hydraulic systems of each building, the following chapter will place water features of the same chronological period in context with each other to identify wider trends of supply, usage, and drainage within the insula as a whole.

3.2: Roman Water Footprints of insula III, i

3.2.0: Introduction

In section 3.1, the individual hydraulic elements of all buildings in *insula* III, i were identified and placed within the hydraulic history of individual buildings. In this section, water features from all buildings that date to the same time period will be examined together, to present an overview of the hydraulic landscape of *insula* III, i throughout its life.[328] The infrastructure data is then inserted into the Roman Water Footprint framework, as outlined in Chapter 2. The Roman Water Footprint combines the archaeological traces of water with contemporary evidence for water in Roman culture, and in the local environment of Ostia. Juxtaposing these three types of evidence produces a holistic view of water in the *insula* at different periods of its life. In the final part of this section, trends in the wider hydraulic biography of the insula will be discussed.

[328] For more specific chronologies or technical details of individual water features or individual buildings, the reader is invited to consult section 3.1.

3.2.1: III, i Roman Water Footprint 1 (4th century B.C. – AD 50)

Figure 3.83: Water features identified in insula III, i between the 4th century B.C. and AD 50 (after SO 1, Plans 2, 6, 7).

III, i Roman Water Footprint # 1 (4th BC-50AD)			
Indicator	Sub-Indicator	Data	Quantity
Infrastructure	Supply Systems	Rain Water	0
		Ground Water	3
		Aqueduct	0
		Total # of Supply Features	3
	Usage Systems	Number of Leisure Water Features	0
		Number of Industrial/Economic Water Features	0
		Number of Domestic Water Features	0
		Total # of Usage Features	0
	Drainage Systems	Sewer	1
		Downshaft	0
		Drains	0
		Total # of Drainage Features	1
	System Resilience	Number of Types of Supply	1
		Number of Types of Usage	0
		Number of Types of Drainage	1
		Total System Complexity	2
		Total # of Features	4
Culture	Private Oriented-insula	Total # of Features	4
	Public Oriented-insula	Total # of Features	0
	Private Oriented-Ostia	Total # of Features	36
	Public Oriented-Ostia	Total # of Features	17
Nature	External	Tiber River Floods	21
	Internal	Urban Garbage	1
		Urban Health (# of Baths)	3

Table 3.17: Roman Water Footprint #1 from insula III, i.

3.2.1.1: Infrastructure

The water system of the insula is very disparate in this period (Figure 3.83), and is known only from the existence of three wells (Table 3.17). Especially in the late Republican and early Augustan period, wells can often be associated with private houses. New wells were certainly dug at later points in the city's history, yet some are easier to date to this early period given their awkward incorporation into later structures. No usage features are known for this period, but a sewer line was identified in the Domus e Mitreo degli Pareti Dipinti (III, i, 6) in connection with its early brick portico. Several wells and small sections of sewers are known in a public setting from within the *castrum*, but little else is known of Ostia's hydraulic provisioning at this time.[329] In terms of system resilience, the overall complexity of the insula's infrastructure is very low at this point (2/9), implying that the majority of people depend on the Tiber river for their daily water supply. This low evidence of diversity is also a result of the low number (n=4) of identified water features in this period.

3.2.1.2: Culture

The insula is located right at the point of initial urban expansion outwards from the gates of Ostia's *castrum*. The insula's stronger weighting toward private features instead of public appears to fit the general trend of Ostia's contemporary water investment. Archaeological evidence suggests that domestic structures were dominant in the expanding city before the creation of the aqueduct; the absence of more industrial/economic structures does not necessarily reflect the urban reality. A similar *ex silentio* caution can be applied to the wider drainage system of the city. The existence of a small

[329] SO 1, 73 for these early wells in Ostia's forum.

section of the sewer system known from within the early levels of the forum does not necessarily imply that an early sewer network was also created across the wider city.

3.2.1.3: Nature

The flooding data of the Tiber River appears unusually high when compared to other time periods, but this is partly due to the larger size of the time period.[330] While in general, flood events at Ostia would not have been as severe as those in Rome, in the late Republican and early Augustan period, Ostia was at its lowest level of relief, ca. 2.00m a.s.l; as the insula lies only ca. 150 m from the river's banks, it would surely have been affected by any kind of flood. The difference in height between Republican and Imperial (i.e. Trajanic) Ostia can be observed by standing on the Via della Foce and looking ca. 1.5 m down to the ground level around the Tempio di Ercole, which preserves the Republican city level (Figure 3.84).[331]

Figure 3.84: Height difference between the Via della Foce (at left), and the Republican ground level around the Tempio di Ercole (at right).

Continuing with the river, Rome is becoming increasingly densely inhabited, with a dramatic boom through the late Republican and early Augustan period. This growth in population was surely accompanied by a contemporary expansion of industrial and domestic waste, the majority of which would have entered the Tiber. It is difficult to gauge the degree to which the Tiber would have been polluted in this period, but the lack of any external water sources at Ostia in this period suggests that the majority of the population depended on river water for their daily necessities.

Evidence for internal waste deposits is lowest in this period, although this is certainly a result of taphonomy and archaeological investigation than the actual situation.[332] An interesting note here is that the inhabitants of Ostia were consuming more pork than compared to the rest of contemporary Italy, and that there is a complete absence of preserved fish bones from this period. This trend continues throughout the city's life, and may be another piece of evidence to help determine the level of pollution of the Tiber river, or at least point to over-fishing of riverine resources. The number of bath buildings

[330] Aldrete 2007, 242-243 records 21 floods between the 3rd century B.C. and AD 50, however many of these floods should be counted with caution, as evidence of their occurrence comes from mytho-historical literary sources.
[331] Boos 2012 offers an overview of the chronology and research history of this entire Republican sacred area, which includes the Tempio di Ercole, Tempio dell'Ara Rotonda, and the Tempio Tetrastilo; Rieger 2004 gives an overview of these Republican sanctuaries in Ostia.
[332] MacKinnon 2014, 187-189 for a detailed examination of the faunal evidence at Ostia; Rowan 2014 for the wealth of socio-cultural evidence available from fish bones in the Herculaneum sewer.

also is the lowest in this period, with only three fragmentarily known baths. This points to a lowered chance of spreading water-borne diseases. As mentioned in Chapter 2, this does not imply that there were not a myriad other ways for these diseases to transfer, rather, that a major vector for internal parasites was not yet present.

3.2.1.4: Conclusion

The state of the insula in this period reflects well the wider evidence for Ostia's urban situation. The water features are mostly part of domestic buildings, and are isolated from one another. Yet, they are loosely clustered along the Via della Foce and the Decumanus, substantiating evidence for early development along these streets. Water supply systems of this period are often private, and are securely connected in other parts of the city with larger domus houses. The existing and nascent population could not have all been provisioned from the three wells in the forum, and certainly accessed water from the Tiber river. The large allotment of public land demarcated by the *cippi* of Caninus facilitated this, leaving ample access to the river.[333] The high number of flooding events may have made this relationship complicated at times.

[333] Bruun 2012, 26 where Roman law categorizes perennial rivers as *res communes omnium*; C.I.L. XIV 14, 4702 for the *cippi* of Caninus.

3.2.2: III, i Roman Water Footprint 2 (AD 50-200)

Figure 3.85: Water features identified in insula III, i between AD 50-200 (after SO 1, Plans 2, 6, 7).

3.2.2.1: Infrastructure

All hydraulic systems increase both in number and diversity in this period (Figure 3.85). With the creation of two urban aqueduct lines, the insula's hydraulic infrastructure exponentially expands (Table 3.18).[334] In insula III, i the highest concentration of water features in this period comes from the creation of the Terme della Basilica Cristiana (III, i, 3) in the Trajanic period. The baths add many features of supply, usage, and drainage to the insula, and create important hydraulic connections to its neighbouring buildings (tabernae III, i, 1 and III, i, 2). The central sewer line of the bath travels through the main hallway of III, i, 1, acting as the collector for several secondary sewers and downshafts from upper floor drainage. The bath building's water features will continue to influence the architectural layout of this part of the insula for the remainder of its history. Indeed, it appears from the architectural and hydraulic evidence that the definition of the bath building already in this period should be expanded to include the neighbouring buildings III, i, 1 and III, i, 2, making it more of a thermal complex than an isolated structure. The perceived isolation of the bath building is likely the result of the scholarly focus on the later phases of the Domus Tigriniani (III, i, 4) directly to the south. In the same period (i.e. the Trajanic period) as the bath's creation, the Domus Tigriniani was rebuilt to open its twin tabernae onto the Vicolo degli Tigriniani.

III, i Roman Water Footprint # 2 (50-200 AD)			
Indicator	Sub-Indicator	Data	Quantity
Infrastructure	Supply Systems	Rain Water	0
		Ground Water	4
		Aqueduct	7
		Total # of Supply Features	11
	Usage Systems	Number of Leisure Water Features	5
		Number of Industrial/Economic Water Features	3
		Number of Domestic Water Features	1
		Total # of Usage Features	9
	Drainage Systems	Sewer	22
		Downshaft	11
		Drains	6
		Total # of Drainage Features	39
	System Resilience	Number of Types of Supply	2
		Number of Types of Usage	3
		Number of Types of Drainage	3
		Total System Complexity	8
		Total # of Features	59
Culture	Private Oriented-insula	Total # of Features	20
	Public Oriented-insula	Total # of Features	39
	Private Oriented-Ostia	Total # of Features	122
	Public Oriented-Ostia	Total # of Features	72
Nature	External	Tiber River Floods	6
	Internal	Urban Garbage	3
		Urban Health (# of Baths)	21

Table 3.18: Roman Water Footprint # 2 from insula III, i.

[334] Bukowiecki *et al*. 2008, 57 for these aqueduct lines.

These tabernae in turn faced the mirroring tabernae of III, i, 5 across the street with its narrow passageways. There is a clear mix of domestic and economic activities occurring here, which is not unusual for Roman urbanism, but in this insula, the focus on the Domus Tigriniani has largely obscured this local concentration of economic activities. Ground water from wells continued to be used alongside the aqueduct supply. This practice will continue for the entire history of Ostia, and indicates a conscious choice of diversity, rather than a mere accretion of supply features. A connection to the aqueduct line across the insula is supported by the presence of calcium carbonate in sewers and in several downshafts (e.g. features 2, 4, 50). In terms of usage there is a jump from 0 to 9 features in this period, with more industrial and leisure water features installed. The creation of the western micro-insula (III, i, 9-15), dates to this period, with its wide diversity of structures and water features. The multi-seater latrine in III, i, 9, the bar in III i, 10, and the *medianum*-style buildings III, i, 12 and 13 substantiate the mixed nature of this area. The number of drainage features (n=39) far outstrips the other categories of infrastructure, with the major sewer lines acting as the most important elements. The sewer lines from this period continue to function for the remainder of Ostia´s life, at least in this part of the city.[335] Secondary sewers were installed also at this time under the Vicolo degli Tigriniani and the Via della Calcara (Figure 3.86). In the micro-insula (III, i, 9-15) a sewer line beginning at the multi-seater latrine (feature 33) likely entered the southern courtyard, continuing in a northward direction toward the Via della Foce. The drainage features on the east side of buildings III, i, 12 and 13 (features 66, 67, 109, 110) also connected to this sewer line. Across the insula, drainage of rain or upper floor waste was directed through 11 downshafts into secondary sewer lines which connected to the main lines. The low relief of Ostia, especially in this period, makes these drainage systems crucial to the functioning of the city block. There are increased hydraulic possibilities available by means of the aqueduct lines, and the entire infrastructure of the insula reaches a level of complexity that it will maintain for the remainder of its existence (8/9). But this increase in complexity is a result of the larger scale creation of drainage features. There are few internal sources of water supply, meaning that many of the inhabitants of the insula had to seek their daily water from other public sources, perhaps at the Bivio del Castrum.[336]

[335] GdSC 27, 99 to 101 (9-10-1938) for Trajanic brick stamps found in this sewer, mentioning Arria Fadilla.
[336] For the Bivio, see: Schmölder-Veit, A. 2009, 93, 98; RS II, 48; SO 1, 95.

Figure 3.86: Major sewer lines in insula III, i in AD 50-200 period (after SO 1, Pl. 2, 6, 7). Known sewer sections indicated by solid lines, hypothesized sewer lines indicated by dashed lines.

3.2.2.2: Culture

The first and second century are the main boom period in the life of Ostia, when the city expands architecturally, demographically, and technologically.[337] Large multi-story insulae are built across the city, numerous religious and public buildings are built, and economic/industrial activities expand together with the development of the guilds (*collegia*).[338] These widespread changes are also reflected in insula III, i. The eastern half of the insula is almost completely outward facing, with the baths and tabernae surrounding the small domestic "pocket" of the Domus Tigriniani (III, i, 4) and the Domus e Mitreo degli Pareti Dipinti (III, i, 6). Tabernae were created along almost the entire northern and eastern faces of the insula. An L shaped street ran from the Via della Foce to the Decumanus, running south through the Mercato (III, i, 7) and turning to the east through the Vicolo degli Tigriniani (Figure 3.87). Although the wider function of building III, i, 8 is unclear, its row of tabernae in the southern portion of the building (rooms 23-28) indicate that this building too was part of this cluster of tabernae around the domus and the bath building.

[337] Heinzelmann 2002 and Delaine 2002 for the causes and symptoms of this *bauboom*.
[338] For *collegia* see Meiggs 1973, 311-336; Tran 2008 looks at the *collegia* of the *horrearii* and the *mensores* at Ostia.

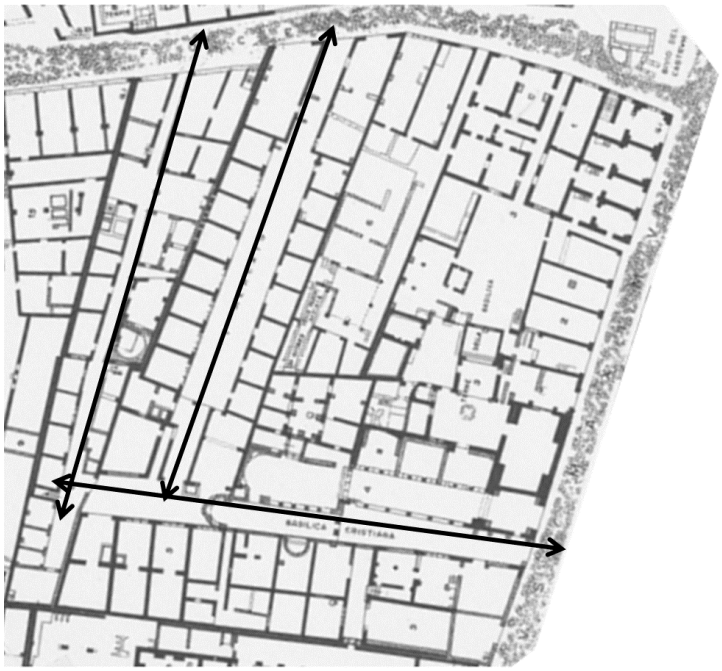

Figure 3.87: Eastern half of insula III, i in Roman Water Footprint #2, showing main roads through buildings 1-8.

There are nearly double the number of public water features compared with private ones in insula III, i. This runs contrary to the wider trend in Ostia, which had a greater contemporary presence of private water features (Table 3.19). As mentioned in chapter 2, the division between public and private is related to the interpreted function of a building in a certain time period. While these labels are problematic in the Roman world, they were consciously applied by the author so as to indicate the general state of the insula, and its water features in a given period.

		Roman Water Footprint # 2 (50-200 AD)
Private Oriented-insula	Total # of Features	20
Public Oriented-insula	Total # of Features	39
Private Oriented-Ostia	Total # of Features	122
Public Oriented-Ostia	Total # of Features	72

Table 3.19: Private and Public focus in water features within insula III, i and in contemporary Ostia.

3.2.2.3: Nature

The amount of downstream pollution has increased from the previous period, with Rome also continuing to grow at a fast rate. The added development of agricultural land further up the Tiber valley perhaps also contributed to the decreasing quality of the river water. The creation of the *Fossa Traiana* at Portus, and the slowing down of the river's current at Ostia may also have played a factor in the silting up of Ostia's delta.[339] Literary references to the high number of collapsing buildings point to the housing pressure facing Rome.[340] There is less flooding in this period, with only 6 floods recorded during this 150

[339] Wilson 2008 for agricultural irrigation infrastructure in the Tiber valley; Keay *et al.* 2014b for an overview of the channel networks at Portus.

[340] Strabo *Geog*. V, 3, 7 and Suet. *Aug.* 39for Augustus limiting the building height in Rome to 70 Roman feet; Ulpian Dig. XXXI, 1, 2, 4 for this law passed in 6 B.C. (*de modo aedificiorum Urbis*).

year period, with individual floods at Rome recorded in greater detail.[341] In terms of the internal urban situation, the amount of faunal evidence jumps dramatically from the previous phase, with much of the material coming from fill deposits connected with the large building projects in this period.[342] There are also concentrations of certain types of faunal material at the periphery of the intramural area of the city, like the high density of bovine long bones, jaws and skulls assembled in one of the tabernae extending from the castellum at the Porta Marina (Figure 3.88).[343]

Figure 3.88: Cattle bones recovered from the Porta Marina Castellum (Bukowiecki *et al.* 2008, 180, fig.89).

Together with the urban growth in this period comes the maximum number of contemporary bath buildings, with 21 functioning in this period. This was a result of the introduction of the second aqueduct line, which directed water around the city along the Republican city walls. The calcium carbonate ($CaCO_3$) forming from the dissolved limestone in this water is an invaluable tool for identifying the presence of non-local water.[344] Several bath buildings at this time are also using water-lifting machines to augment their aqueduct supply.[345]

[341] Aldrete 2007, 242 for reconstructions of the spatial distribution and duration of individual floods in Rome.
[342] MacKinnon 2014, 189-192 for the faunal evidence, especially in Hadrianic building projects.
[343] Bukowiecki *et al.* 2008, 180, 232; Mackinnon 2014, 180.
[344] Carlut *et al.* 2009 performed the only chemical analyses of this material so far at Ostia, with samples from the large *castellum* at the Porta Romana. These analyses substantiated the archaeological evidence for the introduction of an additional aqueduct line.
[345] E.g. Terme del Mitra (I, xvii, 3), and Terme delle Sei Colonne (IV,V,10-11).

3.2.2.4: Conclusion

In this period there is little interaction between the eastern and newly created western sections of the insula, although new building projects occur across both parts of the block. With the large jump in complexity of the insula's system and the contemporary building projects came a contemporary rise in the likelihood of contracting water-borne diseases; the high number of bath buildings and population combined with rapid building projects suggests a bustling but increasingly susceptible population.

3.2.3: III, i Roman Water Footprint 3 (AD 200-300)

Figure 3.89: Water features identified in insula III, i between AD 200-300 (after SO 1, Plans 2, 6, 7).

III, i Roman Water Footprint # 3 (200-300AD)			
Indicator	Sub-Indicator	Data	Quantity
Infrastructure	Supply Systems	Rain Water	0
		Ground Water	2
		Aqueduct	14
		Total # of Supply Features	16
	Usage Systems	Number of Leisure Water	8
		Number of Industrial/Economic Water Features	10
		Number of Domestic Water Features	4
		Total # of Usage Features	22
	Drainage Systems	Sewer	26
		Downshaft	12
		Drains	13
		Total # of Drainage Features	51
	System Resilience	Number of Types of Supply	2
		Number of Types of Usage	3
		Number of Types of	3
		Total System Complexity	8
		Total # of Features	89
Culture	Private Oriented-insula	Total # of Features	20
	Public Oriented-insula	Total # of Features	69
	Private Oriented-Ostia	Total # of Features	101
	Public Oriented-Ostia	Total # of Features	49
Nature	External	Tiber River Floods	2
	Internal	Urban Garbage	4
		Urban Health (# of Baths)	16

Table 3.20: Roman Water Footprint #3 from insula III, i.

3.2.3.1: Infrastructure

The largest hydraulic change in this period comes with the large modification to the Terme della Basilica Cristiana (III, i, 3) (FIg. 3.89). Two cold basins were added at the same time as two of the hot basins on the south side of the building were removed (Table 3.20).[346] The removal of these hot basins happened at the same time as the destruction of the twin tabernae of the Domus Tigriniani (III, i, 4). Perhaps the domus had already begun to take over some rooms of the bath in this period; this would make the late 4th early 5th century phase of the domus much less dramatic than has been previously interpreted (Figure 3.90).[347] Similar to other 3rd century thermal structures, the baths in this time period took advantage of

[346] In figure 4.8 the two cold basins are labelled *"vasca"*, and the two hot basins removed are indicated by *"a"* and *"b"*.

[347] Such as in Brenk & Pensabene 1998-1999 and Poccardi 2006, 92-99.

previously existing supply and drainage structures in its restructuring, by building upwards instead of adding new basins.[348]

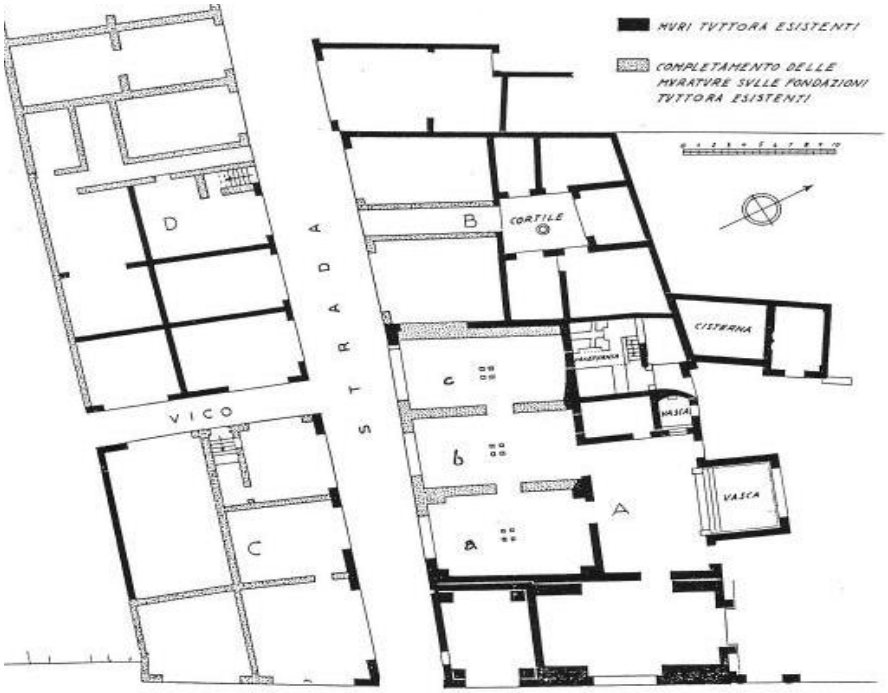

Figure 3.90: View of the Vicolo degli Tigriniani, the Terme della Basilia Cristiana (III, i, 3) denoted by "A", and III, i, 5 indicated by "C" and "D". (Brenk & Pensabene 1998-1999, Abb. 1).

Across the insula there is double the amount of features (from 7 to 14 features) connected to the aqueduct line compared to the previous Roman Water Footprint period (AD 50-200). Ostia received its third and final aqueduct line at this time, with an elevated channel reaching the Republican city wall on a series of arches, two of which are preserved in the wall of the Medieval Borgo.[349] In the western half of the insula, the water supply of the multi-seater latrine in III, i, 9 and the small bar in III, i, 10 apparently was insufficient to provide for all the activities occurring in these buildings. A rectangular fountain basin (feature 40) was installed along one of the main entrances to this half of the insula from the Via della Foce (Fig. 3.91). This newly built fountain was supplied by the aqueduct line, and drained out to an earlier sewer that ran out toward the Via della Foce.[350] A large but poorly preserved double basin was also installed on the south side of the bar (III, i, 10; feature 79). It's position facing the open southern area of this part of the insula suggests it was for the use of a wider number of people.

[348] See the example in Chapter 5.1 of the Terme del Filosofo (V, ii, 6-7).
[349] Bukowiecki *et al*. 2008, 59 for the technical specifics of this aqueduct line.
[350] See Figure 3.86 for the details of this sewer line.

Figure 3.91: West face of the double fountain (feature 40) installed in III, i, 15. The fountain is indicated by white dashed lines and the passageway out to the Via della Foce indicated by the yellow lines.

Water usage across the insula more than doubles (from 9 to 22 water features) in comparison with the previous Roman Water Footprint phase, with increases in all types of usage. Many large basins were built at this time and have been broadly interpreted as "industrial" given their location in connection with tabernae-like rooms, although as ever these labels require further unpacking. The L-shaped street running through III, i, 7 and the Vicolo degli Tigriniani described above becomes restricted but still passable with the infilling of the open square joining these two streets. Within the tabernae fronting this square are several large basins (features 29, 30, 31, 76). Curiously, the twin tabernae projecting south of the Domus Tigriniani are destroyed at this period, with their space absorbed into a kind of courtyard for the domus. Other large basins were installed in III, i, 6 along the Via della Foce, as well as under a staircase in III, i, 8. Perhaps as part of the water supply issue discussed in the previous period, an underground cistern was constructed in III, i, 11 (feature 49), but this was only large enough to support a very localized area. The fact that this cistern can be accessed only through a narrow entrance could support the interpretation that its contents were only available for those living in the *medianum* set of buildings (III, i, 11-13), with the newly established fountain basins (features 40, 79) serving the rest of the users of this western part of the insula.

There is a slight growth in the number of drainage features in this period, with the majority of drainage in the insula connected to the functioning of the Terme della Basilica Cristiana (III, i, 3). In one of the newly created cold basins (feature 9), we have two drains at different levels within the same cold pool (features 10, 96), which may indicate that the pool was not completely drained each time.[351] Contemporary with the addition of drainage features, several in III, i, 1 go out of use in this period. Small sondages in the 1970s of the Via della Foce directly in front of this building identified two small stretches of sewer lines (features 82, 89) that lie at a *higher* level than the earlier sewer running through the main hallway of III, i, 1 (feature 81).[352] This sewer (feature 81) is interpreted as one of the sewer lines draining

[351] A similar division of drainage levels is known from the nymphaeum discussed in V, ii, 8. See Chapter 5.1 for the nymphaeum in the Domus della Fortuna Annonaria (V, ii, 8), room 15, feature 90. This nymphaeum could drain either into a secondary basin at floor level as part of the nymphaeum (feature 15), or could pass through a drain into the sponge basin (feature 88) part of the latrine in room 16.

[352] See Chapter 3.1, building III, i, 1 for specific references to these water features.

the Trajanic phase of the Terme della Basilica Cristiana (III, i, 3). With its closure, the drainage features in building III, i, 1 would have nowhere to discharge their waste. The closure of the downshafts must be indications of changes in the living situation or architectural layout of the upper floors of III, i, 1. The drainage of the bath then changes to the sewer (feature 86) that runs out through III, i, 2 toward the *decumanus*. This is a clear example of the adaptation possible in drainage systems.

All of the drainage features of III, i, 12 and 13 are believed to still be operating in this period. This is inferred from the creation of the drains in the courtyard basin (feature 40), which is thought to connect with the 2nd century sewer line of the multi-seater latrine. If the latrine sewer is still working, then the drains from III, i, 12 and 13 could still be functioning as well. In this phase, the insula has 50 % more water features than in the previous period (from 59 to 89 features), with many previously created features continuing to function into this period. The diversity of the system remains at the same level as in the previous phase (8/9), but there is a definite shift towards more economic/industrial features, exemplified by large, often multi-chambered basins.

3.2.3.2: Culture

The number of public water features in the insula continued to grow, nearly doubling from the previous phase (from 39 to 69), while the amount of private investment remained stable compared to the previous period (20 features). This is largely a result of the complete remodelling of the insula's bath building and the rise in publically oriented industrial/economic activities (i.e. tabernae). This runs contrary to the wider trend in Ostia in this period, where private investment trumps public investment 2:1 (Table 3.21).

		Roman Water Footprint #3 (200-300 AD)
Private Oriented-insula	Total # of Features	20
Public Oriented-insula	Total # of Features	69
Private Oriented-Ostia	Total # of Features	101
Public Oriented-Ostia	Total # of Features	49

Table 3.21: Public and Private investment within insula III, i and in Ostia between 200-300 AD.

Especially around the beginning of the 3rd century, there is a further push of investment by the Severans across Ostia, within the city and along the coastal Via Severiana.[353] Importantly for insula III, i, movement along the Via della Foce becomes blocked with a wall built projecting from III, i, 1 (Figure 3.92). This caused the *decumanus maximus* to become more trafficked, with more investment visible in the eastern half of insula III, i.[354]

[353] Turci 2014 for information on the Terme di Musiciolus, a Late Antique bath building inserted into a Severan structure near the Synagogue along the Via Severiana.

[354] Stöger 2011, 214, using Space Syntax to quantitatively confirm that this part of the decumanus is one of the most spatially integrated in the city's movement network.

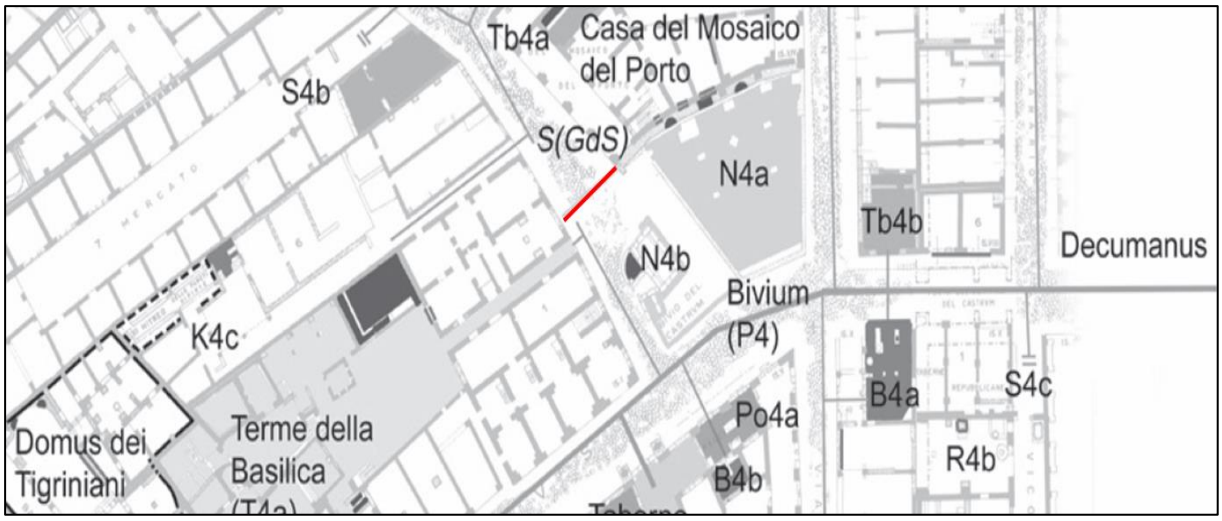

Figure 3.92: Road blockage across the Via della Foce from room 12 of III, i , 1 across to the Casa del Mosaico del Porto (I, xiv, 2), with the wall indicated in red (Gering 2013, 264 (fig. 9), 273, 275).

3.2.3.3 Nature

In this period, the number of flooding events is at its lowest for the Roman period, with only two recorded flooding events.[355] Although the number of floods are low, the amount of pollution in the Tiber is thought to still be at its 2nd century level. While fraught with many interpretative issues, Rome's *Forma Urbis* appears to represent a still vibrant and diverse city with multi-story insulae.[356]

The highest number of garbage dumps within the city is known from this time, although as mentioned in section 3.1, this is a result of a wider trend of abandonment in Regio III in this period.[357] The archaeological evidence is supported by the osteological evidence, which is at its highest identified level in this period. While the faunal evidence is unevenly distributed across the city, evidence from the Tempio dei Fabri Navales, which lies directly next to building III, i, 5, preserves a very high number of animal remains.[358] The number of functioning bath buildings across the city is slightly reduced in comparison with the previous Roman Water Footprint period. However, the number is still quite high, with 16 functioning bath buildings in this period, and points to continued rates of water-borne health issues.

3.2.3.4: Conclusion

Together with the renovation of the baths, this period continues the mostly outward facing aspect of the insula, with more industrial and economic structures added. While the degree to which the western section of the insula (III, i, 9-15) was affected by the 3rd century phase of abandonment remains unknown, several large water basins were added. Perhaps these responded to new activities occurring in the broad porticoes of III, i, 9. The western half of the insula appears to be a more inward-facing microcosm with its own bar, domestic spaces, and its own industrial and public features. The eastern half of the insula is resolutely more outward facing, with more tabernae and public buildings. The partial blocking of the Via della Foce and the raised ground level toward the end of the 3rd century reinforced the east-west architectural division that was already present in the 2nd century. When combined with the other natural factors outlined in this period, it is the most unhealthy urban situation in the city's history.

[355] Aldrete 2007, 242-243 for flooding evidence in Rome.
[356] Battistin 2015 for a recent look at deciphering the types of insulae depicted on the *Forma Urbis*.
[357] Rose 2005, 61, although the degree to which this was present in insula III, i requires more targeted research.
[358] MacKinnon 2014, 179, 184: the Tempio dei Fabri Navales has the highest number of identified specimens (NISP) of any animal in any time period, with a strangely high number of 143 identified dog specimens.

3.2.4: III, i Roman Water Footprint 4 (AD 300-600)

Figure 3.93: Water features identified in insula III, i between AD 300-600 (after SO 1, Plans 2, 6, 7).

III, i Roman Water Footprint # 4 (300-600 AD)			
Indicator	Sub-Indicator	Data	Quantity
Infrastructure	Supply Systems	Rain Water	0
		Ground Water	2
		Aqueduct	15
		Total # of Supply Features	17
	Usage Systems	Number of Leisure Water Features	9
		Number of Industrial/Economic Water Features	8
		Number of Domestic Water Features	6
		Total # of Usage Features	23
	Drainage Systems	Sewer	22
		Downshaft	14
		Drains	13
		Total # of Drainage Features	49
	System Resilience	Number of Types of Supply	2
		Number of Types of Usage	3
		Number of Types of Drainage	3
		Total System Complexity	8
		Total # of Features	89
Culture	Private Oriented-insula	Total # of Features	20
	Public Oriented-insula	Total # of Features	69
	Private Oriented-Ostia	Total # of Features	63
	Public Oriented-Ostia	Total # of Features	36
Nature	External	Tiber River Floods	6
	Internal	Urban Garbage	3
		Urban Health (# of Baths)	14

Table 3.22: Roman Water Footprint #4 from insula III, i.

3.2.4.1: Infrastructure

Ground water continues to be used in minor quantities alongside the slight growth in aqueduct-fed features (Table 3.22). This is most clear in the Domus Tigriniani, with the ca. 1.00 m well in the center of the domus used at the same time as the large semi-circular nymphaeum (Figure 3.93). Large domestic nymphaea are one of the characteristic features of Late Antique Ostia. The nymphaeum in III, i, 4 is aqueduct fed, and with its marble panelling, statuary, and (likely) cascading water, it would have been quite impressive. As mentioned in the previous section, this late 4th- early 5th century AD development of the domus took over the rooms of building III, i, 5, which had already been abandoned in the 3rd century. The supply line to the domus' nymphaeum was installed through the likely abandoned building III, i, 5 (Figure 3.94).

There is an increase in domestic usage in this period connected with the expansion of the Domus Tigriniani, namely with its semicircular basin (feature 17), and the large nymphaeum (feature 18). New fountains were also installed in several parts of the insula. Despite the minimal hydraulic information preserved in III, i, 7 and III, i, 8, there is evidence for structural continuity into this period. In both buildings, the rooms fronting the Via della Foce received late structural additions, which continued further into the street than the present reconstructions suggest (Figure 3.95).[359] While the expansion of the Domus Tigriniani over the Vicolo degli Tigriniani certainly was a major moment in the life of the insula, perhaps the impact of this has been overestimated by modern scholarship, which often excluded

[359] Likely the result of the choices of 20th century excavation of this area.

the local spatial context of the domus. This is surely the case in buildings III, i, 7 and III, i, 8, where economic activities continued as they had for centuries, although without a physical connection through the Vicolo degli Tigriniani. This interpretation supports the late dating of a staircase inserted in the southern part of building III, i, 8. This staircase indicates a direct reaction to the blocking up of the Vicolo degli Tigriniani, offering the only physical connection between the two halves of the insula.

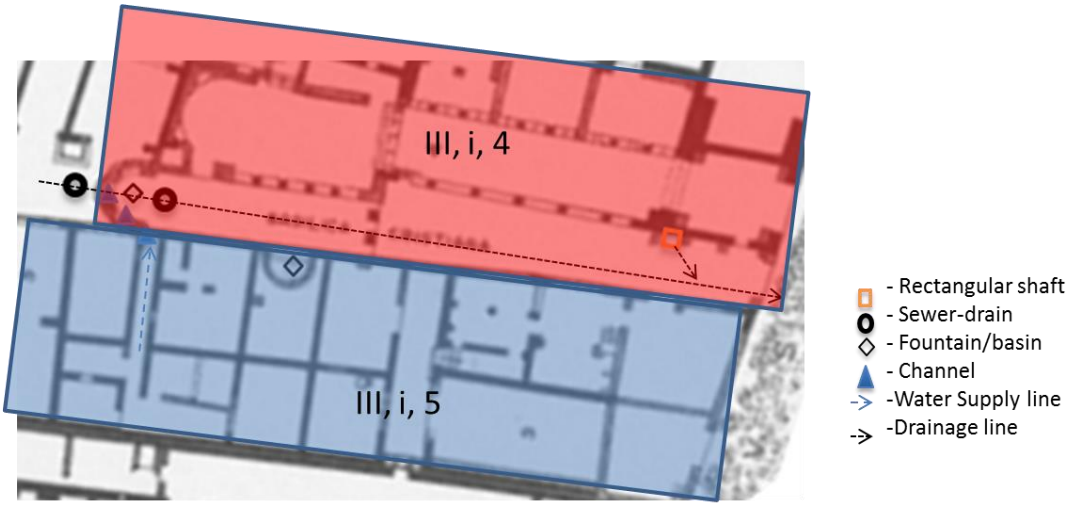

Figure 3.94: Selected water features showing the interaction between the Basilica Cristiana and building III, i, 5. Drainage systems indicated in black, and supply systems indicated in blue (after SO 1, Plans 2, 6, 7).

Figure 3.95: View south into Room 2 of III, i, 7, with the cores of the eastern and western wall abruptly broken off to create a more unified westward view of the Via della Foce.

The tabernae in III, i, 14 all gained a row of back rooms which projected into courtyard 42, and a doorway connecting room 20 of III, i, 14 was blocked up. A basin was installed against this blocked doorway (feature 101), and although it is poorly preserved, the taberna-shape of III, i, 14 points to a continued economic/industrial usage into this period. Likely in connection with this growth of the tabernae, new water features were added in the bar in III, i, 10.[360] Supporting this idea of a prospering row of tabernae

[360] The bar gained a new counter (feature 113) and water basin (feature 80).

comes from the courtyard fountain in the northeast corner of the western part of the insula, which received a second superimposed basin (feature 111) in this period.[361] What is clear is that more water, or at least more consistent water was required here, at an important movement point into and out of the western part of the insula. While the total number of drainage features decreases only slightly in this period (from 51 to 49 features), the number of downshafts is an interesting aspect to explore. While debate continues over the exact function or contents of these downshafts, what is clear is that their creation in this period can act as a proxy to indicate new or changing layouts of upper floor structures. In his study of insula V, ii, Boersma used the location and number of these downshafts to calculate the number of apartments, inhabitants, and upper floors of individual buildings.[362] A similar operation can be suggested for some parts of insula III, i, especially in the northwestern part of the insula, in buildings III, i, 10 and III, i, 14 (Figure 3.96).

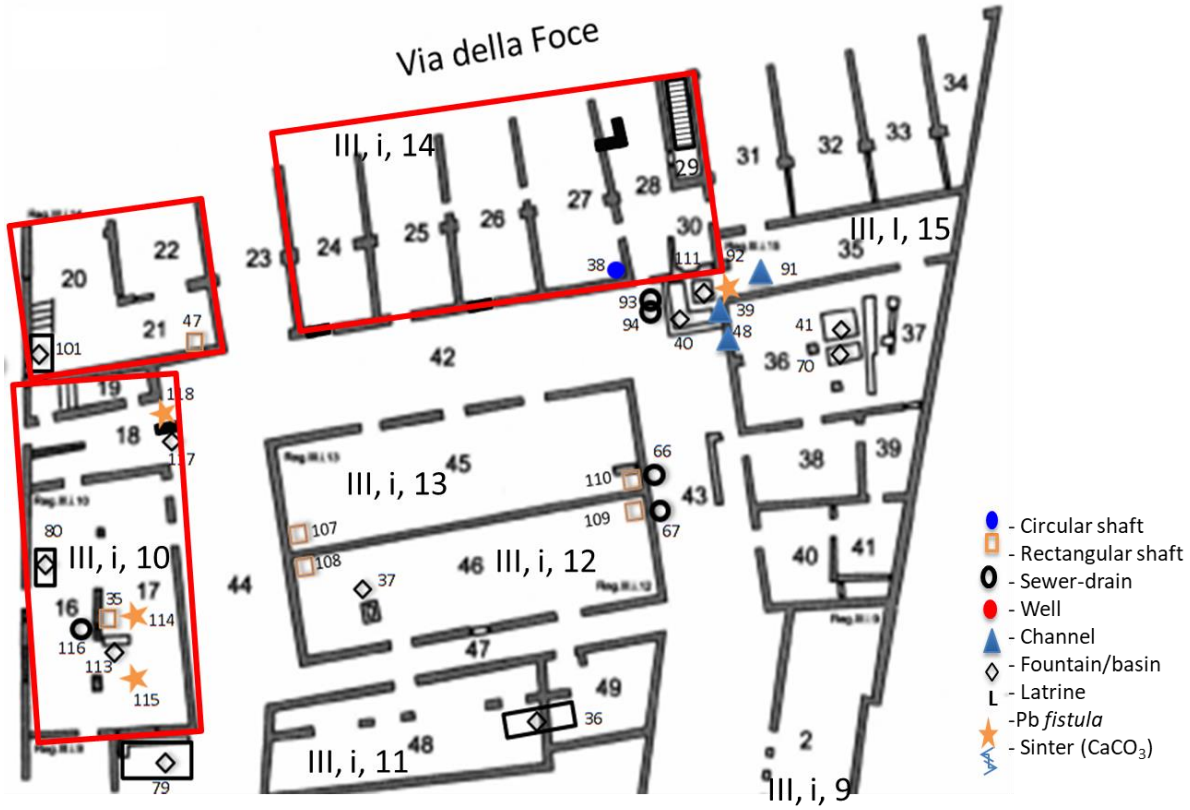

Figure 3.96: Water features in buildings III, i, 9-15 (after Rose 2005, App.1, 177.). Red boxes indicate new upper floor apartment divisions on the basis of downshaft evidence.

In the bar (III, i, 10), the new counter (feature 113) was built directly against one of several *opus vittatum* piers. Within one of these piers was a rectangular downshaft. Although the conjunction of a bar with a downshaft is irregular, it matches the wider pattern of opportunistic construction in Ostia. The Trajanic sewer line was located directly on the western side of the brick pier, and it continued to collect spills from the bar while now incorporating upper floor waste material. The contemporary staircase added in room 19 must have meant that a new apartment was added above rooms 16-19, with its own dedicated downshaft, and access to fresh aqueduct flowing water with the contemporary fountain (feature 117).

[361] See above Fig. 4.9 for these superimposed basins.

[362] Boersma 1985, 221; see Chapter 5.1 in the present study for a detailed discussion of the evidence from insula V, ii.

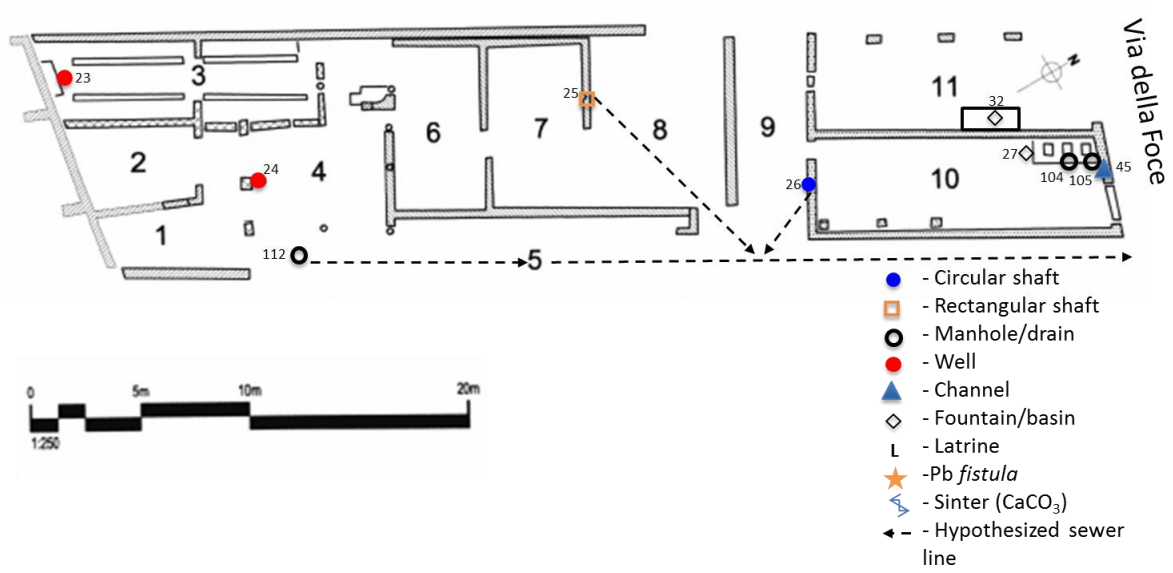

Figure 3.97: The Mitreo degli Pareti Dipinti (III, i, 6) with dashed lines indicating the probable path of sewers in the building (after Rose 2005, App. 1, 174).

The same constellation of features is present in building III, i, 14. As mentioned above, in this period the majority of the tabernae fronting the Via della Foce gained an extra room on their south side. With the backwards projecting of the new tabernae rooms in building III, i, 14, it appears that as below, so above: new superstructures were also created above the rooms fronting the Via della Foce. Newly installed staircase-downshaft combinations permit us to sketch out at least two upper floor apartments. One was created above rooms 20-22, and another was created above rooms 24-30.[363] The presence of these new downshafts in turn can be used to identify where underground sewer lines are likely to lie. A similar phenomenon is present in III, i, 6 (Figure 3.97). Two downshafts were newly installed in rooms closer to the Via della Foce (features 25, 26). Their position suggests that both of them directed material towards the narrow hallway 5, under which the Augustan sewer (feature 112) is thought to have run.

Another example of downshafts reflecting changing upper-floor situations comes from the Domus Tigriniani (III, i, 4), where a downshaft was blocked up related to the expansion of the domus into the Vicolo degli Tigriniani (Figure 3.98). This downshaft was part of the earlier Trajanic tabernae fronting this small street, and was no longer necessary with the reconstruction of the upper floor in connection with the insertion of the nymphaeum and related structures in the late 4th-early 5th century.

[363] In the apartment above rooms 20-22, the downshaft is in room 21 (feature 47), and for the apartment above rooms 24-30, the downshaft is in room 27 (feature 38).

Figure 3.98: Blocked up downshaft in building the Domus Tigriniani (III, i, 4).

3.2.4.2: Culture

In terms of *ex novo* construction there certainly is a reduction from the 2nd and 3rd century period, but economic activities and patterns of movement persist into this final stage of the city's life. The period is characterized by a reduction of movement across the city at all levels, with major roads of the city blocked (e.g. Semita dei Cippi), and many doorways closed. Although the blocking of doors in itself is nothing new for Ostia, the fact that in this period only one side of the blockage of many walls is finished, may indicate a change in the direction or focus of visibility.[364]

New luxurious private structures like the Domus Tigriniani take advantage of previously existing public ones. Yet, in other cases, the initial structures continue to dictate the terms of urban development (III, i, 10).[365] Economically speaking, the contemporary creation of more publically oriented tabernae and upper floor apartments promoted the creation of new drainage features. When comparing the public-private split of water features in the insula, it has maintained the same values as the previous period. The new and existing water features are predominantly public, which continues to run opposite to the wider urban trend of increased private investment of water features in Ostia (Table 3.23).

[364] Recalling Meiggs 1973, 3, "*It is tempting to draw social and economic inferences from such observations as the blocking of a door, the changes in the size of flats, the encroachment of houses on shops; but only when examples are numerous enough to suggest a general tendency are such changes valuable to the historian*."

[365] Dig. XXXIX, 2, 7 on the potential profits of re-selling the collapsed or abandoned building material from a neighboring structure.

		Roman Water Footprint # 4 (300-600 AD)
Private Oriented-insula	Total # of Features	20
Public Oriented-insula	Total # of Features	69
Private Oriented-Ostia	Total # of Features	63
Public Oriented-Ostia	Total # of Features	36

Table 3.23: Private and Public water features in insula III, i and in contemporary Ostia between AD 300-600.

The 3rd century version of the public Terme della Basilica Cristiana (III, i, 3) continues into this period, and it resembles many other 3rd and 4th century bath buildings in Ostia, with fewer and smaller basins.[366] A wider example of the use of water for increasingly diverse purposes in Ostia comes from the theater, which gains a curious new water system in this period. The central entrance into the theater and the tabernae on either side of it were converted into water channels and cisterns for flooding the shallow orchestra floor (Figure 3.99).[367]

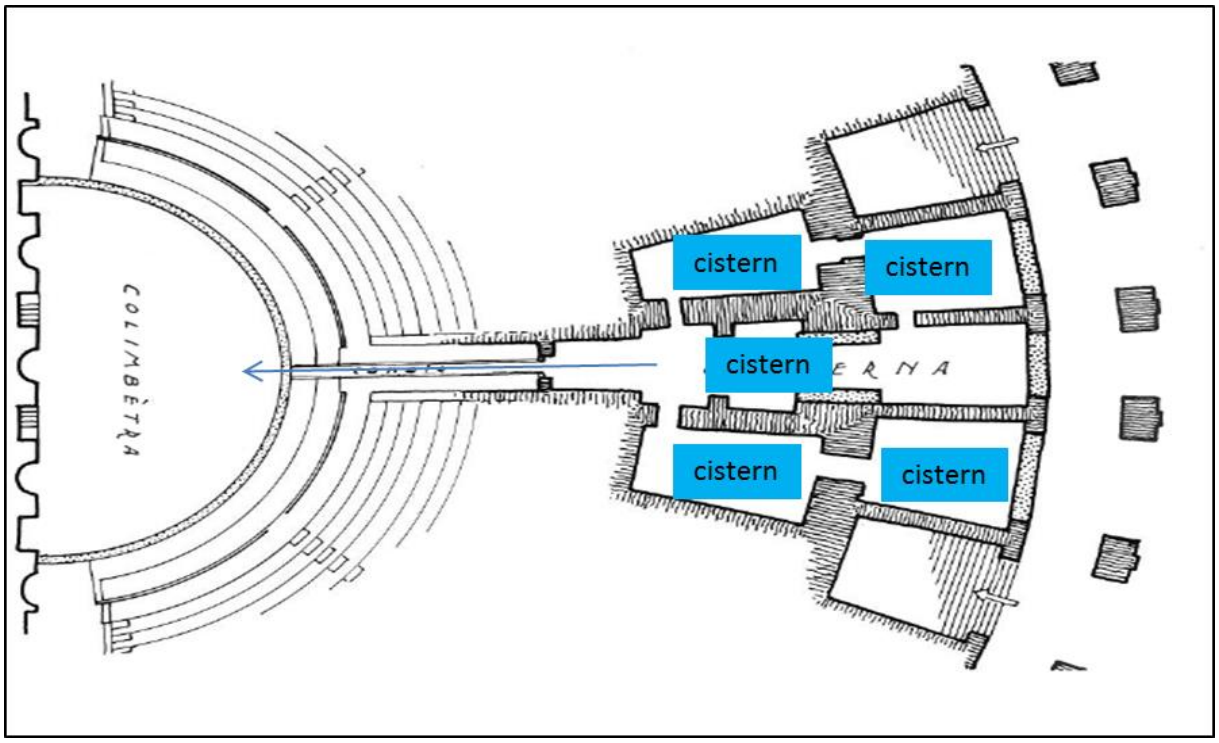

Figure 3.99: Late Antique modifications to the theater at Ostia, whereby the main entrance and flanking rooms were turned into cisterns to flood the floor of the theater (Traversari 1960, 42, fig. 17).

3.2.4.3: Nature

In this period we see an increase in the number of flooding events, compared to the previous period, with six floods recorded in Rome during this period.[368] The Tiber river continued to silt up and further reduce the accessibility of Ostia to the sea. As a result of repeated levelling and construction phases, the ground level of Ostia reaches increasingly higher levels, compared to its early Imperial levels. This certainly would have influenced the impact, or at least the distribution of minor floods on urban

[366] Gering 2013, 277 for the Terme Piccole on the Via della Foce; Turci 2014 for the Terme Musiciolus.
[367] Traversari 1960, 43 for a short study of this change to the theater in Ostia. Water would flow down the central hallway through a sluice gate and fill the ca. 1 m high enclosed space around the orchestra.
[368] Aldret 2007, 242 for a list of these floods in Rome.

buildings. Areas without Severan or Late Antique buildings, such as the Campo della Magna Mater (IV, i) or the area around the Tempio di Ercole (I, xv, 5) would have been noticeably more effected by flood waters. While there is clear evidence of continued investment in new or rebuilt structures, many were abandoned. Although at a reduced level in comparison to the previous period, the amount of faunal evidence remains high into this period.[369] There is a common reduction in skeletal size of cattle, pigs, and domestic fowl in this period, perhaps providing some rural substantiation to the archaeological evidence of the more inward facing nature of the city. The number of bath buildings declines only slightly from the previous period, although many of the 14 existing baths are smaller than before, and do not survive long into the 5th century.

3.2.4.4: Conclusion

Late Antique Ostia has seen a surge of dedicated research in the past several decades, moving beyond the decline and fall idea of Meiggs, and questioning the conception of Ostia as a Potemkin village behind wealthy domus complexes.[370] It is no doubt that from the 4th to 6th centuries the urban fabric of Ostia changed dramatically, especially in terms of accessibility and visibility. Across the city, the most noticeable *ex novo* hydraulic structures are built inside Late Antique domus, with large nymphaea and their expansion across earlier structures. Insula III, i also follows this trend in the Domus Tigriniani (III, i, 4), however the picture becomes much more nuanced when we look beyond the marble panelled nymphaeum. A Roman hydraulic simile may be helpful here. Arches are the most visible part of an aqueduct line, but they often represent only a small fraction of the entire length of the supply channel. In the same way, Late Antique water features are usually viewed as exceptional and isolated creations, but the system is much more complicated when we include underground or previously existing sections of the water system.

In the eastern section of the insula, the main hydraulic change comes with the end of the Terme della Basilica Cristiana (III, i, 3) in the late 4th or early 5th century. The tabernae wrapping around the baths (III, i, 5 and 7) become disconnected by the expansion of the Domus Tigriniani (III, i, 4), but perhaps used forms of *opus vittatum* along the Via della Foce to create a "modern" façade. The western half of the insula (III, i, 9-15) mostly retained its Trajanic shape, although again in this set of buildings, 4th century expansion along the street front (III, i, 14) came with new water systems of supply, usage, and drainage. In fact, the two halves of the insula remained architecturally and hydraulically disconnected from each other throughout their history, with only a small staircase installed at a later point to connect them. Even this late staircase may be more to give access to the multi-seater latrine rather than a sign of new movement patterns between the eastern and western side of the insula. The insula presents itself as resolutely public in this period, with a change coming only towards the end of the insula's life, with the Domus Tigriniani taking advantage of likely already abandoned space. Water features in this period can be characterized as opportunistic, keying into established systems, especially in terms of drainage. The hydraulic system as a whole is complex and diverse, and we see a similar mixing of activities as in the rest of the city. The insula participates in the hydraulic activity of the city until the end of the aqueduct functioning in the late 5th or 6th century.[371] As in Roman Water Footprint #3, the combination of new building projects with abandoned structures forms a more nuanced context of the urban situation into which water features were added.

[369] Gering 2013, 265; Lavan 2012, 677, 688 identified a similarly thick layer of Late Antique fill across many of the structures in his excavations (e.g. South Portico of the Forum); he interpreted as dump material; MacKinnon 2014, 194 for the material from the late 2nd to early 4th century.
[370] Meiggs 1973, where his Chapter 5 is entitled "The Decline of Ostia", spanning the 3rd to 16th century.
[371] Bukowiecki *et al.* 2008, 190 for 4th-5th century repairs on the supra-mural aqueduct line.

3.3: III, i Diachronic Analysis

III, i Roman Water Footprint # 1-4						
Indicator	Sub-Indicator	Data	Roman Water Footprint #1 (4th century BC- 50 AD)	Roman Water Footprint #2 (50-200 AD)	Roman Water Footprint #3 (200- 300 AD)	Roman Water Footprint #4 (300- 600 AD)
Infrastructure	Supply Systems	Rain Water	0	0	0	0
		Ground Water	3	4	2	2
		Aqueduct	0	7	14	15
		Total # of Supply Features	3	11	16	17
	Usage Systems	Number of Leisure Water Features	0	5	8	9
		Number of Industrial/Economic Water Features	0	3	10	8
		Number of Domestic Water Features	0	1	4	6
		Total # of Usage Features	0	9	22	23
	Drainage Systems	Sewer	1	22	26	22
		Downshaft	0	11	12	14
		Drains	0	6	13	13
		Total # of Drainage Features	1	39	51	49
	System Resilience	Number of Types of Supply	1	2	2	2
		Number of Types of Usage	0	3	3	3
		Number of Types of Drainage	1	3	3	3
		Total System Complexity	2	8	8	8
		Total # of Features	4	59	89	89
Culture	Private Oriented-insula	Total # of Features	4	20	20	20
	Public Oriented-insula	Total # of Features	0	39	69	69
	Private Oriented-Ostia	Total # of Features	36	122	101	63
	Public Oriented-Ostia	Total # of Features	17	72	49	36
Nature	External	Tiber River Floods	21	6	2	6
	Internal	Urban Garbage	1	3	4	3
		Urban Health (# of Baths)	3	21	16	14

Table 3.24: Complete Roman Water Footprint for insula III, i.

Insula III, i has a more complex history than previous research has brought to light. While the insula has much in common with the wider trends of Ostia's urban development, it expressed this in its own individual way. The data in the following charts comes from the Roman Water Footprint (RWF) table directly above (Table 3.24). Using ground water or rain water was never a part of this insula's strategy for water supply, although a handful of Republican wells survived until the end of the insula's life. As soon as it was available, the insula was heavily dependent on aqueduct supplied water (Figure 3.100).

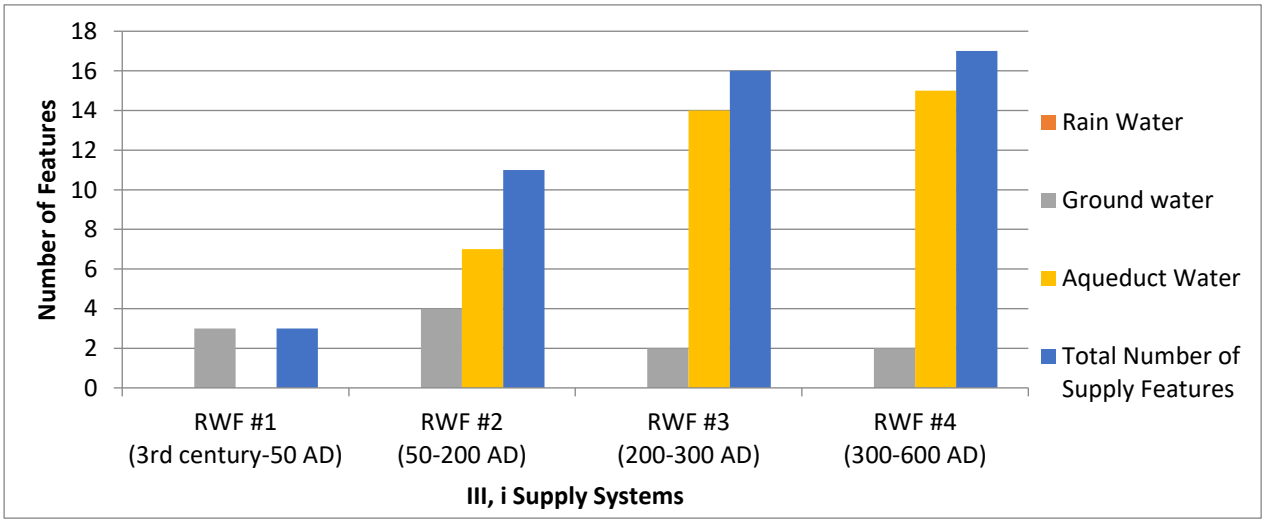

Figure 3.100: Supply Features in III, i for each Roman Water Footprint.

While there is no evidence of usage in RWF #1, the peak of Usage evidence comes from RWF #3, similar to the other categories of infrastructure for III, i. This period is dominated by Industrial/Economic water features, but also has a high number of leisure water features (Figure 3.101). The number of domestic features increases continually over time. The total number of usage features only marginally increases from RWF #3 into #4.

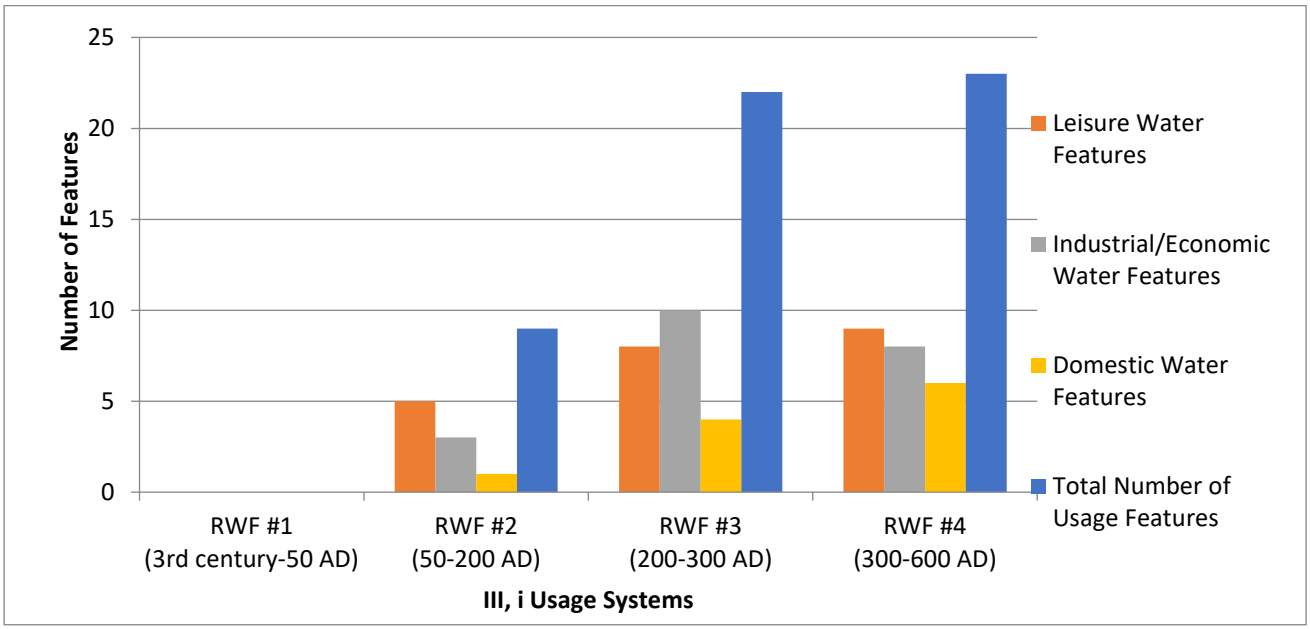

Figure 3.101: Usage Features in III, i for each Roman Water Footprint.

The most surprising result comes from the high number of drainage features preserved in the insula (Figure 3.102). Many of the drainage systems from RWF #2 persist into RWF #4, however the highest number of drainage features comes in RWF #3. This has provided a window into the practical functioning of the buildings, but more importantly, how different building take part in these drainage systems. From plotting the temporal and spatial distribution of the downshafts, it has been possible to reconstruct some of the division and creation of new upper floor spaces, especially in the RWF #4 period.

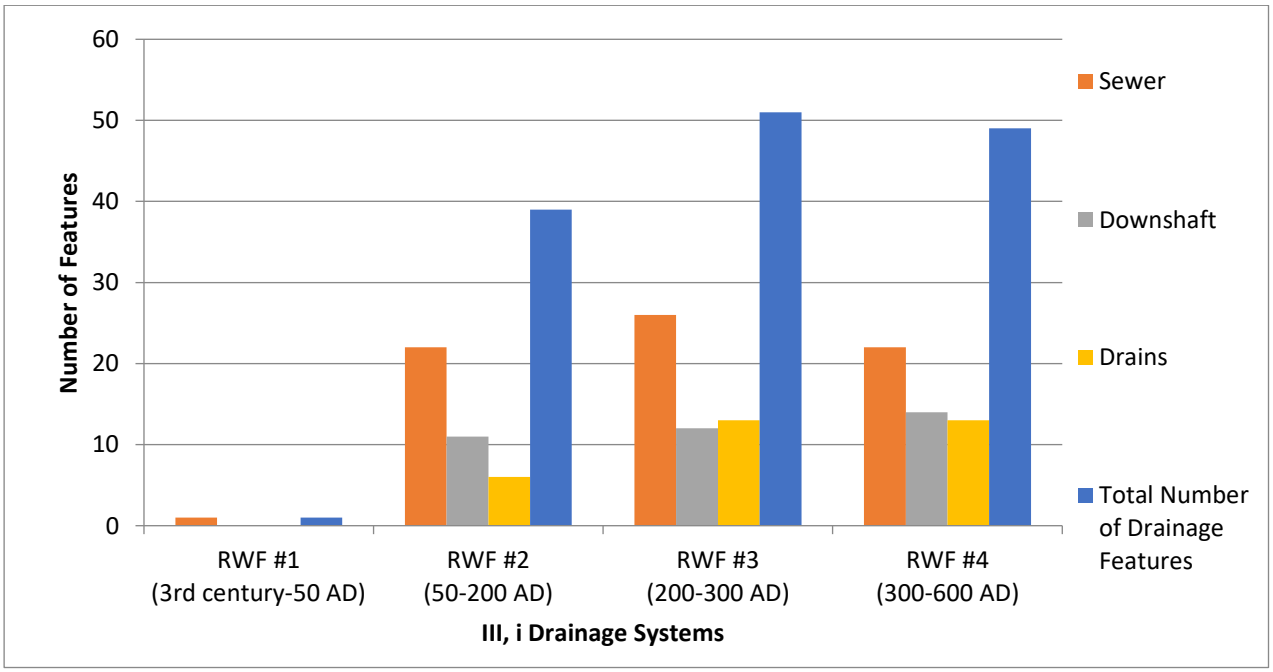

Figure 3.102: Drainage Features in III, i for each Roman Water Footprint.

The pace of the insula's infrastructure development is already set in RWF #2. In all aspects of the Infrastructure category we see a peak in RWF #3, which pertains to the Severan period (Figure 3.103). One would expect more water features in the insula at the same time as the 2nd century boom period of Ostia, but it is in the (post)Severan period that there is a large jump in the size of the infrastructure system. This surprising trend largely continues into the later period for all parts of the system (Supply, Usage, Drainage). This is most true for the drainage systems, many of which continue to function from the 1st or 2nd century well into the 4th century, such as the Trajanic sewer for the latrine in III, i, 9 (feature 33), or the sewer under the Vicolo degli Tigriniani (feature 100).

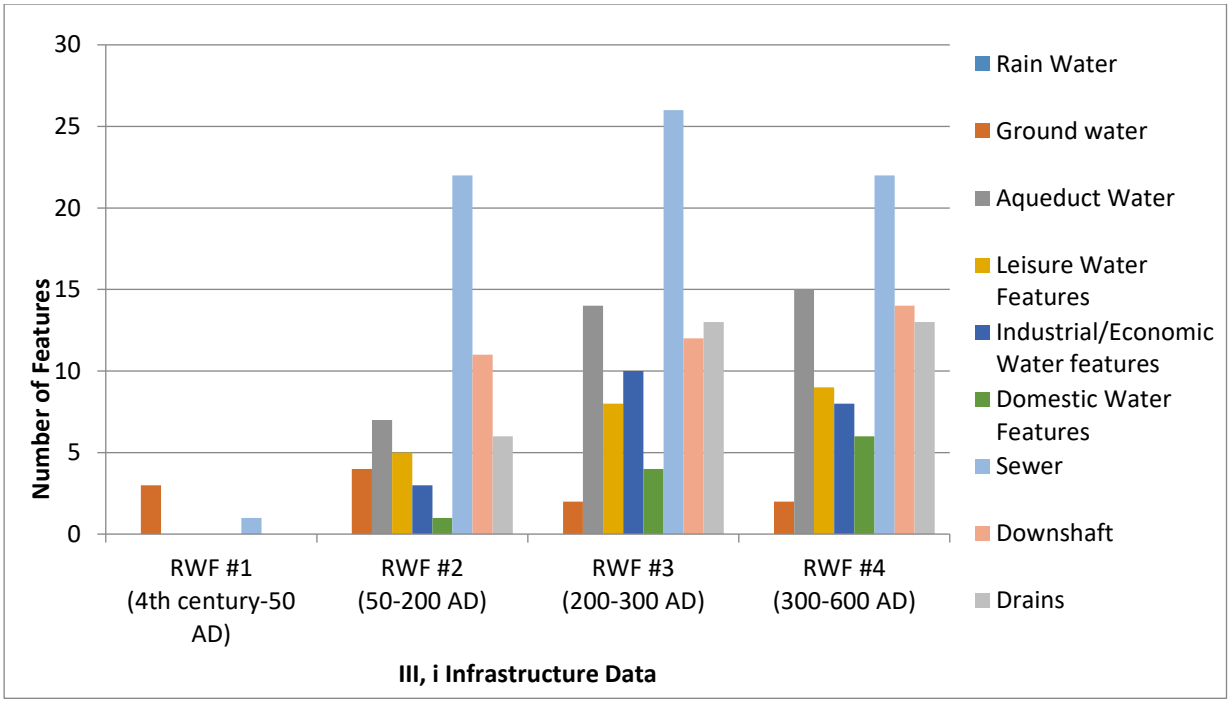

Figure 3.103: Infrastructure Data for insula III, i, with data from Table 4.8 above.

By aggregating the individual parts of the hydraulic system (Figure 3.104). This suggests a much higher degree of continuity of the hydraulic system in insula III, i than has been previously interpreted. At least hydraulically speaking, the 3rd century and the shift to the Late Antique period, does not show the symptoms of a wide-spread crisis. The same can be said for the Late Antique period (RWF #4). Yet for both of these periods (RWF #3 and #4), the most important factor to keep in mind is the distribution of the water features. While the total number of water features seems high, these water features are concentrated in fewer and fewer buildings, such as in the Domus Tigriniani (III, i, 4) and in the street-fronting tabernae of buildings III, i, 10 and 14.

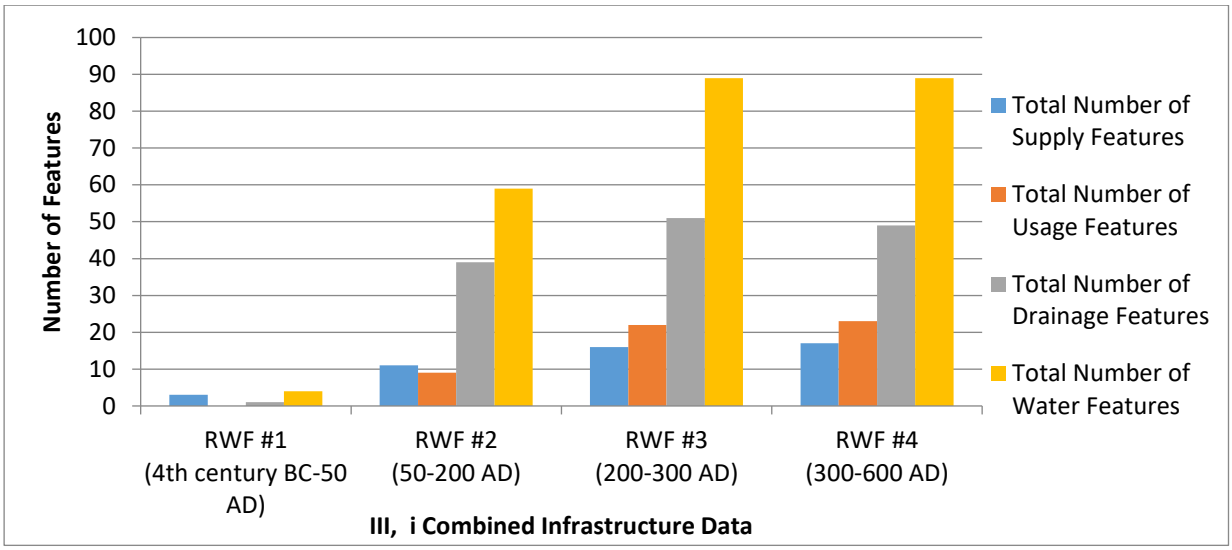

Figure 3.104: Combined Infrastructure data for insula III, i.

The degree of complexity in the insula remained stable from RWF #2 into RWF #4, although the distribution of this complexity shifted through time (Figure 3.105). The development of the Domus Tigriniani and the road-side structures of III, i, 10 and 14 resulted in many more water features added in RWF #4. While the number of water features in the insula is the lowest compared to the other case studies in this project, it has provided valuable new insights into the history and connectivity between minimally published buildings.[372]

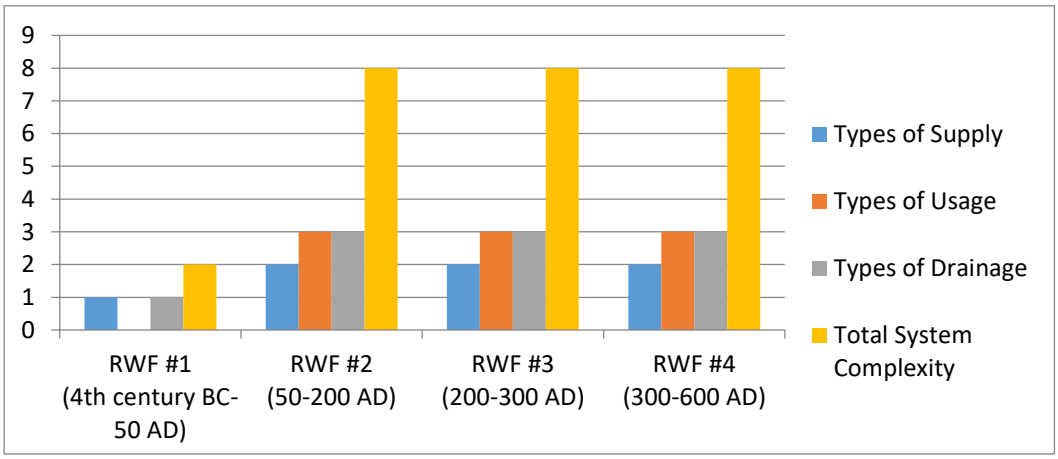

Figure 3.105: System Resilience Indicators for insula III, i.

Throughout its history, the buildings of the insula retained an east-west grouping of structures. Regarding the diachronic relationship between private and public water features, in RWF #3 , there are more than three times more private than public features in insula III, i (Figure 3.106). In all phases, this runs contra to the wider urban trend of Ostian water features, which tended more toward the private than the public. This stronger presence of public buildings, especially tabernae, is likely the result of the insula's position at an important cross-road of Ostia, where the main *decumanus maximus* branches into two different roads; the insula's rows of tabernae would have had maximum visibility along these two axes. Despite the diverse functions of the buildings of the insula, they are predominantly economic, and the success of these businesses reduced the chance that they would be transformed into alternative uses.

[372] See Chapter 6 *infra* for a comparison of larger trends between the three case studies.

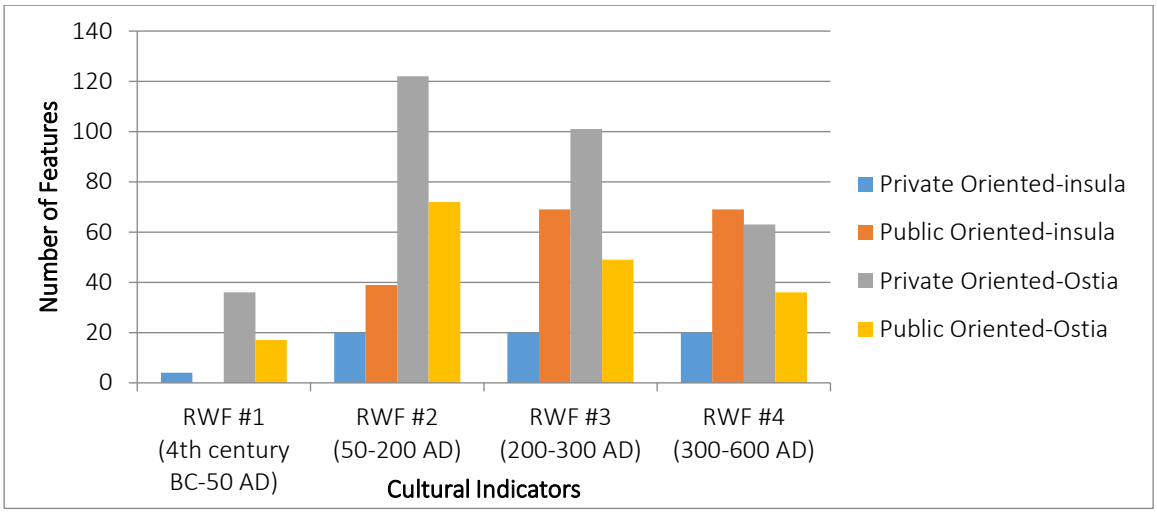

Figure 3.106: Cultural Indicators in III, i for each Roman Water Footprint period.

In its connection with the surrounding environment, we can imagine that the low number of wells in this insula would have pushed early residents of the insula towards the river for access to water, regardless of the increasingly polluted nature of the river (Figure 3.107). It is unknown whether the insula suffered from the effects of the river's flooding, but the disparate ground levels across the insula surely made even a small amount of water a difficult issue to manage for some of the buildings. Faunal evidence from the Tempio dei Fabri Navales supports the archaeological evidence of collapsed or at least abandoned structures within the western part of the insula in the 3rd century, which accords well with the late 4th – early 5th century period of new building in the area (e.g. the tabernae in III, i, 14).

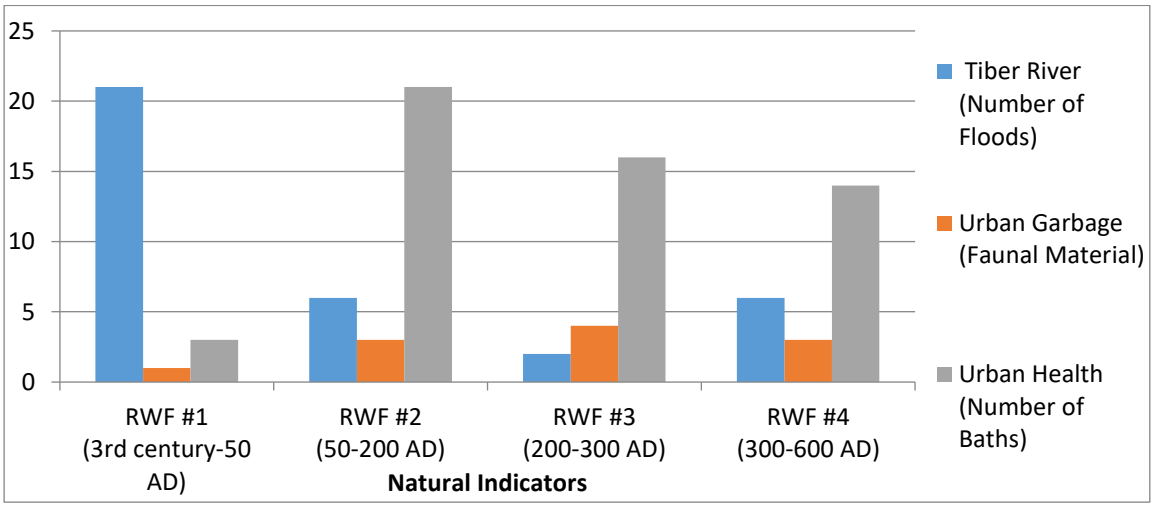

Figure 3.107: Natural Indicators in III, i and Ostia for each Roman Water Footprint period.

3.4: insula III, i Conclusion

By applying the Roman Water Footprint to all buildings in this city block, new hydraulic relationships have become visible between different buildings, as well as between the two halves of insula III, i, reflecting its unique position at the most important crossroads of the entire city. More widely speaking, investigating the hydraulic histories of the 15 buildings of this insula has stressed the spatial and hydraulic integration of buildings of different functions together. This is most true in the Domus Tigriniani (III, i, 4); the scholarly spotlight on this structure for more than 70 years has overshadowed the dynamic history of buildings around this domus. This is not to say that the domus is unimportant to our understanding of the Late Antique situation in the insula. Rather, a closer examination of the Vicolo degli Tigriniani and its connection to the tabernae III, i, 5 and III, i, 7 revealed a thriving economic area that likely survived the expansion of the domus, albeit on a reduced scale. The same can be said for the

interaction of the domus with their eponymous baths, the Terme della Basilica Cristiana (III, i, 3). The hydraulic results of this study present a much more nuanced history of the bath building, namely that we can expand the definition of the bath building to encompass buildings III, i, 1 and III, i, 2. In its connection to the Domus Tigriniani, large sections of the bath building were already out of use at the time of the domus' expansion in the late 4th and early 5th century, a fact largely obscured by Calza's rendering of the phasing of the structure in his early work on the domus.

CH 4: CASE STUDY OF INSULA IV, ii

4.0: Introduction to insula IV, ii

Insula IV, ii was excavated during the Fascist period (1938-1942), and attracted previous scholarly attention for the lighthouse-mosaic in the Terme del Faro (IV, ii, 1) (Figure 4.108).[373] A recent socio-spatial study of the insula by Stöger (2011) offered a detailed look at the structural phasing and integration of the *insula* into the larger city in terms of movement. This novel combination of contemporary architectural methods (space syntax) with Roman urban evidence provided a wealth of data for this study. Several of the inscribed lead *fistulae* from the Terme del Faro have attracted interest for their mention of Matidia, the niece of emperor Trajan, as well as suggesting a partial identification of the ownership record of this bath building.[374]

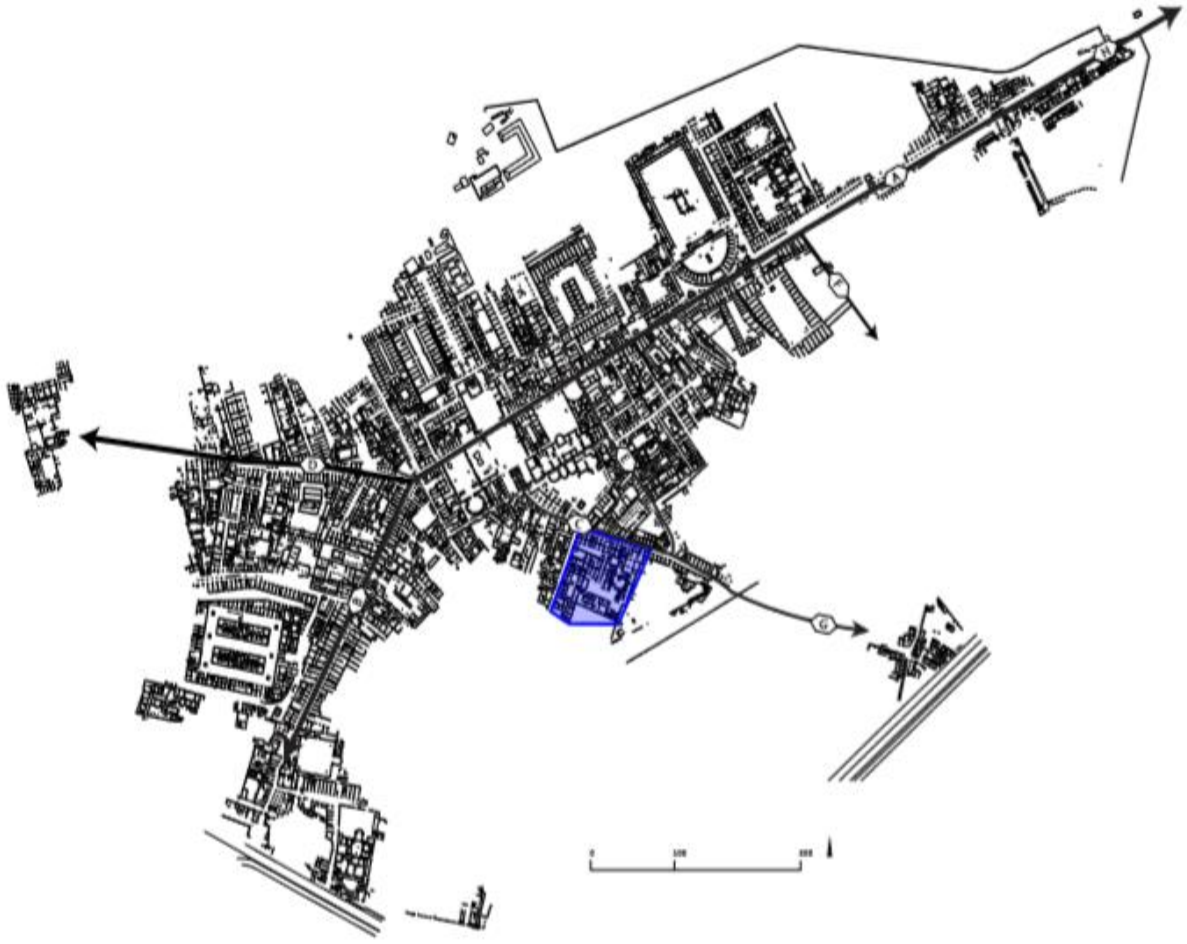

Figure 4.108: Location of insula IV, ii within Ostia.

[373] While the insula is oriented NE-SW, for ease of description, all descriptions for this insula take the *cardo maximus* as north.

[374] Geremia-Nucci 2000; see below section on Terme del Faro (IV, ii, 1).

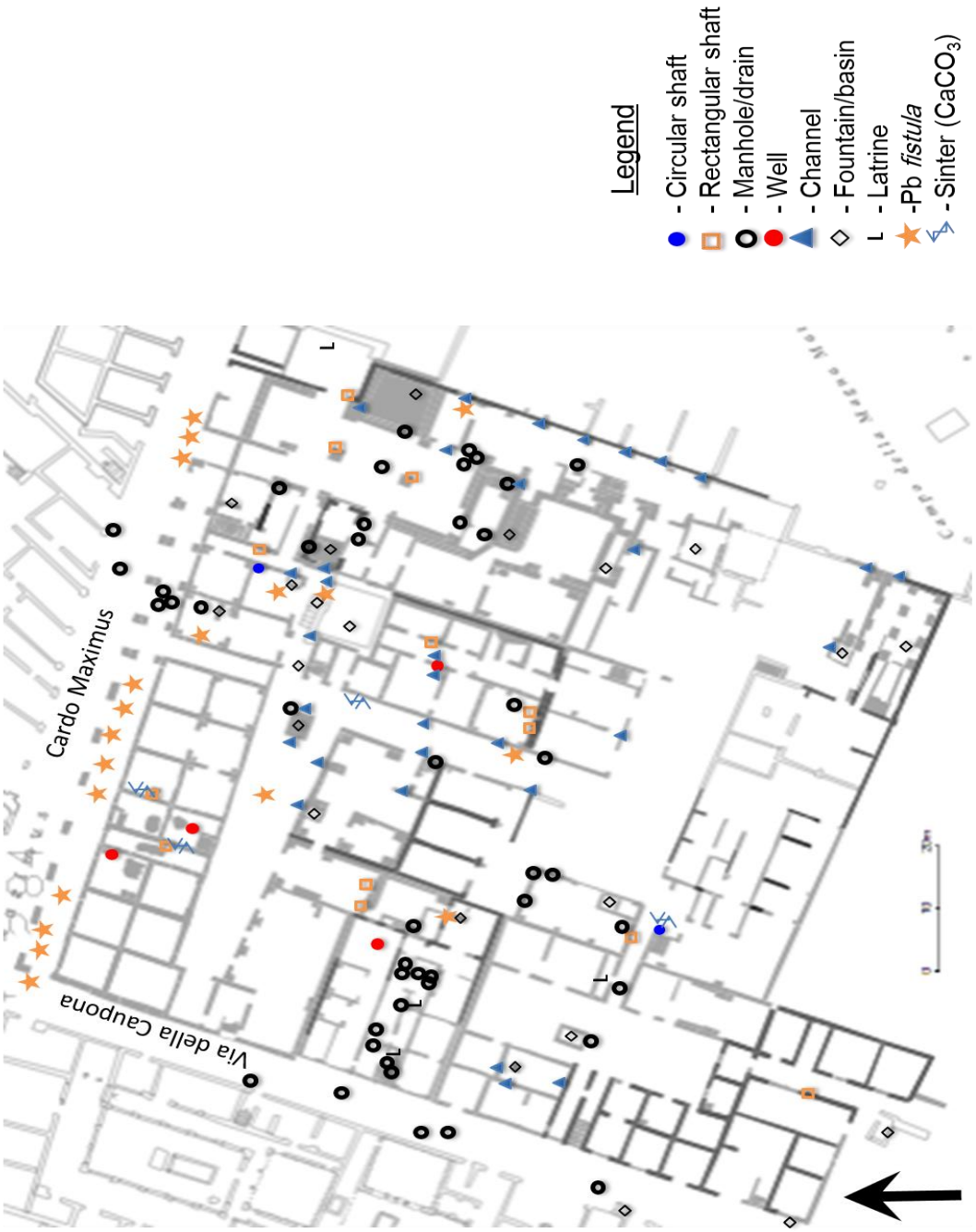

Figure 4.109: All identified hydraulic features in insula IV, ii (after Stöger 2011, 158, Fig. 5.112)

This *insula* has fourteen buildings of diverse usage, such as economic, religious, hygienic, social, industrial, and domestic functions (Figure 4.109). The insula is situated in the southern part of the intra-mural section of the city, where the southern stretch of the *cardo maximus* exits Ostia through the Republican city walls at the Porta Laurentina.[375] Like the Via Ostiensis that heads east to Rome, the southern Via Laurentina was also bounded on both sides by funerary monuments, and acted as a conduit for traffic arriving into Ostia from the city's nearby agricultural Pianabella area. Insula IV, ii lies directly west of a major fork in the *cardo maximus*, where the road splits into the Semita dei Cippi, one of the few roads for which we have the ancient name.[376] The insula rests on the edge of the unexcavated section of the city, which makes it difficult to integrate the preserved buildings to its neighborhood. The

[375] Meiggs 1973, 64; Zevi 1996, 69 for the creation of these walls.
[376] Giornale di Scavi (GdSc) 26, 88 (19-3-1940) for the discovery of the inscription.

city block lies directly west of the Campo della Magna Mater (IV, i), which retained its Republican ground level, surviving the numerous large-scale raising of the wider city level. Directly across the *cardo maximus* from insula IV, ii was one of the largest mills-bakeries in Ostia (I, xiii, 4), with eleven *in situ* grain mills.[377] Directly north-west of the insula's portico (IV, ii, 2-3) was one of the largest thermal structures in the city, the Forum baths (Terme del Foro, I, xii, 6).[378] To the west of the insula was a city block occupied by several elaborate Late Antique domus structures (Domus delle Colonne, IV, iii, 1; Domus dei Pesci, IV, iii, 3; Domus IV, iii, 5). This urban situation places insula IV, ii in a heavily trafficked area that witnessed dynamic architectural changes throughout the history of the city. From the documentary and photographic archives at Ostia from this initial period, excavation around insula IV, ii proceeded inwards from the *cardo maximus* to the south, with the soil originally resting ca. 4 m above the current height of the walls (Figure 4.110).

Figure 4.110: The original height of the soil during excavations in 1940 (SBAO B.2912) at left, compared with the current state of the insula at right. Looking south down hallway 20 of the Caseggiato dell'Ercole (IV, ii, 2-3).

4.1: Methodology

Following the examination of previously published material, as well as archival photographs, primary investigation of the extant remains was carried out by the author. This entailed the systematic search for and documentation of all preserved hydraulic features within the insula. While many of the large features (e.g. bath basins) were described by previous studies, numerous undocumented water features were identified in the course of the current study. These vary from patches of calcium carbonate ($CaCO_3$) on walls, to a large (98, 000 liter) cistern, to single drains, and fragments of lead pipes (*fistulae*). As with

[377] Bakker 1999 for a comprehensive look at this structure and wider subject in Ostia.
[378] Cicerchia & Marinucci 1992 for a study of the Forum baths.

the other *insulae* described in this thesis, arbitrary numbers have been given to each water feature that pertain only to this block.[379] For clarity and ease of identification, a chart and accompanying map are provided for each building to aid the reader in locating individual water features. Water features are described following the pre-established numerical order of the rooms in each building. After the spatial description of all the water features of a given building, the features are organized into temporal phases to present the hydraulic biography of each building in this city block. In the conclusion section of each building, the known water features are arranged into four temporal phases. This section is to be read together with section 4.2, in which the hydraulic infrastructure is integrated into the Roman Water Footprint methodology. This results in a contextualized picture of water in the *insula* in a single time period and how this changed over time. As the insula lies at a roughly NE-SW orientation, for clarity of description in this study, the *cardo maximus* is taken as north, and the Via della Caupona del Pavone lies to the west.

4.1.1: Water Features of insula IV, ii

The discussion of each of the 14 buildings of *insula* IV, ii follows the structure:

History of Excavation and Restoration

Location in insula

Phasing and Comments

Water Features Chart

Description of Water Features

Infrastructure Chronology

Conclusion

[379] See Appendix 3 for a master list of water features.

IV, ii, 1: Terme del Faro

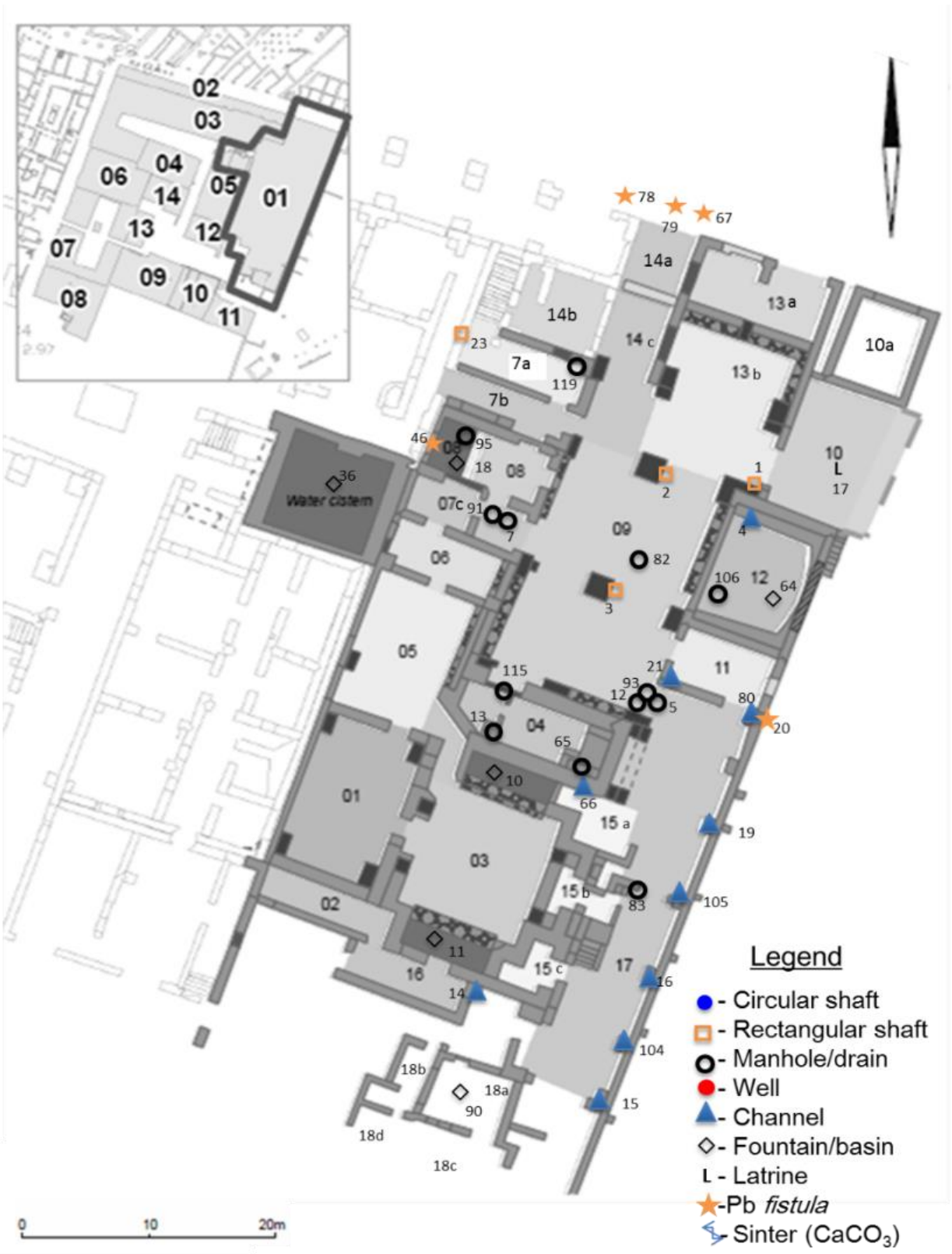

Figure 4.111: Identified water features in the Terme del Faro (after Stöger 2011, 79, Fig. 5.16).

Location in insula

The bath building is entered directly from the *cardo maximus* and lies directly west of the Campo della Magna Mater, to which it was connected in a later period by a staircase (Figure 4.111).[380] The southern section of the building is connected to the southern courtyard of the entire *insula*. The baths are bounded to the west by the Caseggiato dell'Ercole (IV, ii, 2-3) and building IV, ii, 5.

History of Excavation and Restoration

The initial excavation of this building dates to 1940, when excavation moved past the brick pilasters of the Portico dell'Ercole. Calza describes the statues uncovered here, and is surprised that this area wasn't excavated by Visconti, commenting on the large sections of fallen vaulting.[381] The mosaics were restored between 1956-1961, which revealed metal screws to close water taps, as well as 23 bronze coins cemented into the floor of the service corridors.[382] A targeted trench of the hypocaust system in rooms 1 and 5 was carried out by Fausto Zevi in 1964.[383] Onomastic research conducted by Roberta Geremia-Nucci in 2000 produced a sequence of ownership of the bath building based on inscribed lead pipes found in and around the baths.[384]

Phasing and Comments

Before the creation of the mid-sized bath building in AD 138-192, there are fragmentary traces of earlier structures, notably *tabernae* in rooms 14b and 13b, the latter of which housed the later eponymous bath mosaic.[385] The foundations of these early walls (ca. 1.0 m below the current floor level),[386] indicate a date contemporary with the construction of the Campo della Magna Mater, although this does not imply any connection to the cult's activities. The average current floor level in the bath building is ca. 1.50-1.80 m higher than the Campo ground level.[387] In general, the underlying terrain of the building slopes down to the south from the *cardo maximus*.[388] The south wall of taberna 14b has an *opus reticulatum* wall that also included some tufo quoining; the *opus reticulatum* and brick wall of taberna 13a presented a street front that was later incorporated into the Portico dell'Ercole (IV, ii, 2). In the Trajanic period, the west wall of room 13a was modified, which decreased the size of a religious niche present there.[389] The first clear use of the structure as a bath building in the mid-2nd century AD comes from *fistulae* evidence as well as brick stamps.[390] The extent of the bath building at this period is unclear, but may have constituted only the southern rooms 1, 3, 4, and 5. The service areas on the eastern and southern side of the bath also date to this period, as does the *opus reticulatum* retaining wall separating the bath from the Campo to the east.[391] The Severan period (AD 193-235) witnessed the largest structural change to this building, with a new hypocaust system built ca. 85 cm higher than the previous

[380] Calza & Nash 1959, Pl. 133 with an enlivened version of Piranesi's Campo Vaccino.
[381] GdSc 26, 84 (8-3-1940); GdSc 28, 143 (5-7-1940) for the initial excavation.
[382] GdSc 32 (covering 1956-61), (17-10- 1958); GdSc 33, 105 (13-7-1964).
[383] GdSc 33, 107 (15-7-1964).
[384] Geremia-Nucci 2000.
[385] SBAO R4260 (inv.14903 no.9) for the taberna; in SO 1, 127 these structures are dated by Becatti to Trajan, but by Bloch to the second half of the 2nd century (p.226).
[386] Stöger 2011, 76, note 31.
[387] Stöger 2011, 72.
[388] Although this might be the result of overzealous excavation methods during the 1938-1942 period.
[389] Bakker 1994, 229, Pl. 40.
[390] Geremia-Nucci 2000, 386 mentions Cornificia, either the daughter or sister of Marcus Aurelius; Barbieri 1953, 158, no. 5 (CORNIFICIAE IIX= *Cornificia*); GdSc 33, 105 (13-7-1964).
[391] Rieger 2004, 125 for a Trajanic date of this wall contemporary with the wider ground level raising of Ostia in the early 2nd century AD; Stöger 2011, 76-78 prefers a date closer to the bath's first phase (AD 150-160).

one (Figure 4.112), the creation of the eponymous lighthouse mosaic in the *apodyterium* (room 13b), and a Europa and Zeus-bull fresco in *frigidarium* 8.[392]

The baths were further embellished at this point with sculptures of a Capitoline Venus and a Farnese style "weary" Hercules, as well as other aquatically themed mosaics, which today unfortunately lean stacked against each other in room 3, spilling tesserae into the tall grass. Zevi's attribution of this period more precisely to Caracalla aligns well with the epigraphic evidence: an inscribed lead pipe from the early 3rd century.[393]

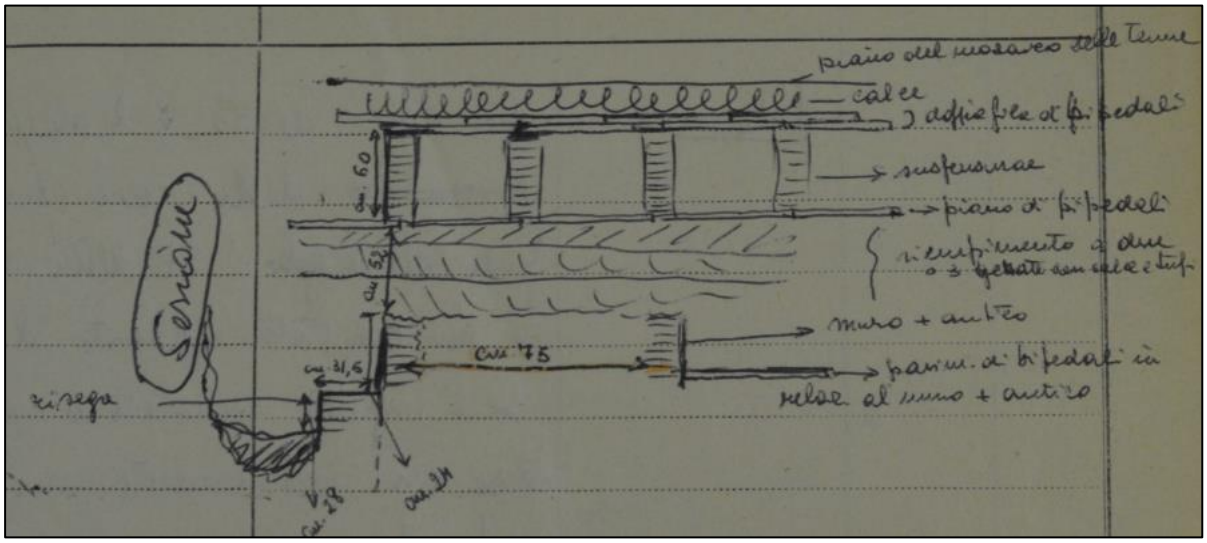

Figure 4.112: Zevi's original sketch showing the original level of the hypocaust, followed by a fill layer, with the 3rd century *suspensurae* on top (GdSc 33, 107 (13-7-1964)).

A multi-seater latrine (room 10) also dates from this Severan period.[394] The last quarter of the 3rd century CE saw a re-construction of taberna 13a, perhaps connected with a change of ownership, as recorded by another inscribed lead fistula.[395] The bath continued to function at least until the 5th century AD, based on the final piece of inscribed water pipe, dating to ca. 450 AD. Coins dating to the 5th century AD were uncovered in the service hallway of the baths, indicating the long usage of this bath building. Evidence for later continuity of the structure comes from the blockage of the wall between room 5 and 6 with rough tufa and stone cobbles; these walls were removed in the modern period.

Water Features Chart

The following hydraulic features are located in the Terme del Faro (IV, ii, 1) (Table 4.25).

[392] Clarke 1979, 93, 97 sees room 01 as "late draftsmanly" and later in date than the Pharos mosaic; Meiggs 1973, 433 compares the fresco to the Venus in the Baths of the Seven Sages (III, x, 2); SO IV, 172-176, 342-44, Pl. CXLVIII, no. 323.

[393] Geremia Nucci 2000, 395 for a discussion on L. Didius Marinus, expanding Barbieri 1953, 155, no. 6β: (DIDI MARINI.E.VE=*Didi Marini e(gregii) v(iri) e[t…]*); Zevi's 1964 sounding dated this closer to Caracalla in comparison with the themes and style of the frescoes.

[394] Jansen 2002, 178, note 240 identifies this latrine.

[395] Geremia Nucci 2000; Stöger 2011, 78.

IV, ii, 1 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
3	basin	caldarium, N side of room	10	3
3	basin	caldarium, S side of room	11	3
4	ceramic pipe	S wall of room, E part	65	4
4	drain	half cappucina shape, S wall of room, W part	13	3
4	sewer	N wall of room, N part	115	3
7a	sewer	NE corner	119	2
7c	manhole cover	within E part of floor	7	2
7c	sewer	within E part of floor	91	2
8	basin	frigidarium, W side of room	18	2
8	drain	within N part of floor	95	2
9	rectangular downshaft	E face of central pier	3	2
9	manhole cover	within floor of SE corner	5	2
9	sewer	NW drain	93	2
9	sewer	W drain	12	3
9	sewer	runs in NW-SE direction	82	2
10	latrine	entire room	17	3
11	channel	SW corner of room	21	3
12	fistula outlet(?)	N wall of room, W part	4	3
12	basin	frigidarium, entire room	64	3
12	drain	W wall of room, S part, at floor level	106	3
13b	rectangular downshaft	SE corner of room	1	3
13b	rectangular downshaft	E face of S pier	2	2
15a	channel(?)	N wall of room	66	4
15b	drain	N wall of room, E part	83	3
16	channel	half cappuccina shape, within pier on N wall of room	14	3
17	2 fistulae	pier 1	20	3
17	channel	pier 1	80	3
17	channel	pier 3	19	3
17	channel	pier 4	105	3
17	channel	pier 5	16	3
17	channel	pier 6	104	3
17	channel	pier 7	15	3
18	fountain/castellum?	entire room	90	3
Cardo Maximus	fistula	CORNIFICIAE IIX	67	2
Cardo Maximus	fistula	SCIPIONIS ORFITIS	78	3
Cardo Maximus	fistula	VALERI. FALTONI.ADELFI.VC. ET IN…ET ANICIAE ITALICAE	79	4

Table 4.25: Identified water features in building IV, ii, 1.

Description of Water Features

The excavation of numerous lead *fistulae* (features 67, 78, 79) in the *cardo maximus* around the entrance to the bath building have provided invaluable epigraphic data concerning the ownership

history of this bath building.[396] Although individual pipes cannot be associated directly with specific bath basins, they prove a continuity of aqueduct-fed water. In the caldarium of the baths (room 3), there are two rectangular pools on the north and south wall of the room (features 10 and 11 respectively). Although the water supply and drainage of feature 11 is unclear, a half-cappuccina channel (feature 14) in the service room 16, appears to be connected to the basin's water supply. This type of feature is usually part of drainage systems, but its height of more than 1.5 m above the current ground level makes this unlikely. The channel passes through the center of a pier that lies next to numerous openings through the west wall of *praefurnium* 15c. Given the concentration of water supply features in the eastern section of the building, feature 14 likely held a pressurized water pipe that entered through the upper back wall of basin 11.[397] The water supply to the northern caldarium basin (feature 10) is also unknown, however the drainage system is visible on the north side of the basin itself.[398]

Directly north of the caldarium basin (feature 10), is an L shaped drain (feature 13) that runs along the south wall of room 4 before turning 90° to the north. The L-shaped section has a half-cappucina shape, and its drainage function is proved by feature 115, a rectangular channel on the north wall of room 4 that extends slightly under the floor of room 9 of the bath building. The roof of drainage channel 115 is made by two roughly cut blocks of travertine.[399] In the southeastern corner of room 4 is a partially preserved *in situ* ceramic channel (feature 65) that descends from west to east on a roughly 45° angle. This is made from two *imbrices* placed together, and acted as a drain from an upper floor. Its drainage function is corroborated by a heavily damaged channel (feature 66), which is dug ca. 1.72 m into the other side of the same wall, in service area 15a. The presence of an upper floor here is substantiated in this part of the building by the staircase in the service room 15c.

In the northeastern corner of room 7a is a cappucina sewer (feature 119) section. The sewer could be identified continuing to the south for ca. 1.30 m before turning to the east, under the floor of room 14c. Built into the floor of room 7c is a square manhole cover (feature 7), which has 3 almond shaped openings. This covers a rectangular drain (feature 91), which runs in an E-W orientation parallel to the walls of room 7c. This drain likely was responsible for removing water from the floor, as the *frigidarium* directly to the north has its own drain. The marble clad *frigidarium* (feature 18) in room 8 contains a colorful fresco of Europa sitting astride a Zeus-bull and is entered by walking down several reconsolidated marble steps.[400] A short piece of lead *fistula* (feature 46) is present in the west wall of this cold pool and connects with an aedicula-style niche,[401] pointing to a possible supply source from the large cistern discussed below in building V, ii, 5. A small circular drain (feature 95) is visible at the north end of the frigidarium's floor. As the initial excavation photos show very few walls preserved above ca. 2.0 m, a modern creation date may apply to the water features in this *frigidarium*. In the bath's main room (room 9), rectangular downshafts (features 2, 3) were built into the east side of the two central brick piers. These are central pillars of the bath, immediately visible upon entering, and would have accentuated the highly decorated large *frigidarium* (feature 64).[402] A third rectangular vertical channel (feature 1) is present on the north side of this *frigidarium*, but instead of running the entire vertical length of the surviving wall, the vertical shaft turn 90° ca. 1.20 m from the ground. Instead of conducting water downwards, this channel likely held the pool's supply pipe; this interpretation is supported by the impression of a *fistulae* pipe (feature 4) on the internal north wall of the pool. The

[396] Geremia Nucci 2000, 400 for a discussion on Valerius Faltonius Adelfius and his wife Anicia Italica, expanding Barbieri 1953, 170, no. 32α (VALERI. FALTONI.ADELFI.VC. ET IN= *Valeri Faltoni Adelfi v(iri) c(larissimi) et in(lustris)*); See section IV, ii, 2-3 below for additional *fistulae* evidence.

[397] SBAO A1848 (inv.1848) for feature 14; SBAO B3645 (inv.6134) for a view on the number of holes in the west wall of room 15c.

[398] SBAO B3652, D1310 for a trial sondage in room 3.

[399] SBAO B3651 (inv.6140), B3653 (inv.6142) for the two travertine support stones of feature 115.

[400] Calza & Nash 1959, Pl. 89 for this room.

[401] See below, section IV, ii, 2-3, feature 47.

[402] Stöger 2011, 82 for a visibility analysis of this frigidarium.

southwest corner of the pool has a drain (feature 106) below the lowest step that proceeds ca. 4.00 m into room 9 at a NE-SW angle. During the excavation of the marine-lighthouse mosaic in room 13b, a sewer was identified running at a roughly NW-SE angle across room 9 (feature 82).[403] Directly where the public and functional sections of the bath meet (between rooms 9 and 17), there is a circular travertine cover stone (feature 5). This lies directly above the intersection of two drainage channels (feature 93 and 95). Interestingly, a glimpse inside this channel revealed that the two channels are not linear or perpendicular, but rather, they radiate from under the drain at a roughly 45^0 angle (Figure 4.113).

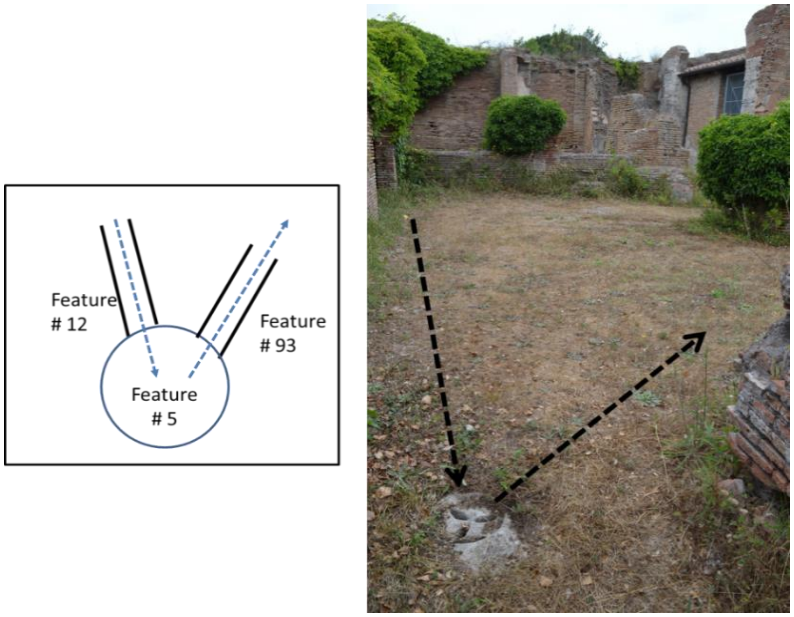

Figure 4.113: Plan of the orientation of the drains 12 and 93 in relation to the manhole cover (feature 5). The dashed lines indicate the direction of flow through drains 12 and 93.

A multi-seater latrine was installed in room 10 in the Severan period, contemporary with the larger development of the northern area of the bath. Multi-seater latrines are known in conjunction with several other bath buildings at Ostia, and a nearby parallel comes from the southwest corner of the Terme del Foro (I, xii, 6). The latrine in the present case likely drained into the sewer running under the *cardo maximus* (feature 114). Although described as a latrine by previous research, the present study could not find any trace of the architectural or hydraulic features associated with multi-seater latrines.[404] On the east side of the building is the long rectangular service corridor (room 17), punctuated by three *praefurnia* (rooms 15a, 15b, 15c), which warmed the *caldaria* and hypocaust floors of room 3. On the east side of room 15b, there is an east-west projecting wall of *opus latericium*; at ground level is a half cappucina drain (feature 83) piercing the bottom of this wall. The eastern wall of room 17 divides the baths and the Campo della Magna Mater. The six preserved brick piers running along the internal face of this wall all contain a horizontal rectangular channel (features 15, 104, 16, 105, 19, 80) that runs at ground level. The internal dimensions of these channels differ, yet they all have a similar large *bipedalis* as their roof. Based on the two contiguous *fistulae* preserved in the north-most pier (feature 20), these pipes must have extended the entire length of the service corridor. It is interesting to note here that the southern wall of room 11 contains many irregularly placed rectangular openings, including one in the southwest corner (feature 21). Together with the supply pipes immediately south of this wall, it is possible that this room acted as a kind of distribution space for various water features.[405] The

[403] GdSc 29, 14 (18-12-1941): *"Nel ripulire una fogna che* ***traversa obliquemente la sala centrale*** *adiacente a quella con mosaic marino nelle Terme del Faro, si trovano mescolati con la terra di riempiemento alcuni frammenti di iscrizioni..."*, emphasis added.

[404] Jansen 2002, 178, note 240 includes this latrine in a list of other multi-seater latrines in baths.

[405] Gorgato 1998, 109-112 suggests this, although this room appears heavily rebuilt.

structure designated by the author as room 18 (feature 90) is puzzling given its present isolation and poor state of preservation. It is here proposed that this structure in fact was a small *castellum*-fountain structure, given the similarity of its ground plan to the nymphaeum III, vi, 4 near the Case a Giardino.[406] The structure is heavily overgrown, yet possesses an interesting combination of building techniques, including *opus latericium* and *opus quasi-incertum*, as well as an *opus spicatum* paved space to the south east (room 18c; Figure 4.114, see also Figure 4.111 above).

Figure 4.114: Feature 90 directly south of the Terme del Faro (IV, ii, 1) (SBAO B3714).

Infrastructure Chronology

Roman Water Footprint #1 (4th century B.C.- AD 50)

No known water features.

Roman Water Footprint #2 (AD 50-200)

The archaeological traces of the building's first water system can be securely dated from epigraphic evidence to the mid-2nd century AD.[407] This *fistula* pipe (feature 67) supplied the early bathing complex, focusing on the hot room 3 (features 10, 11) and the service room 4 (features 13, 115).[408] The cold room 8 (features 18, 95) also was likely fed at this time; this arrangement changed in the Severan period with the addition of the Europa fresco and supply by means of a lead pipe (feature 46). Given the *opus reticulatum* within the lowest level of several walls in feature 90 (especially in room 18a), this feature also dates to this period, perhaps as a storage room for the bath building. Room 9 is where the majority of the drainage features converge. The central drain line is likely feature 82, which begins at the cappucina drain (feature 95). The downshaft in the southern pier (feature 3) emptied into this drain as it heads at a roughly NW angle through room 9. It is also possible that the drain 91 from room 7c drains into sewer 82 as it heads toward the street. Upon entering the bath's corridor toward the *cardo maximus*, downshaft 2 and drain 119 are placed so as to empty into the main sewer. From this point, the sewer would continue into the main *cardo* sewer (feature 114).

Roman Water Footprint #3 (AD 200-300)

In the Terme del Faro, the epigraphic evidence from this period points to a complete re-building of the hypocaust system (in rooms 1, 3, 5 and 6), as well as the insertion of a multi-seater latrine (feature 17),

[406] RS II, 218 for the nymphaeum at III, vi, 4.
[407] Geremia-Nucci 2000, 389.
[408] SBAO B3654 (inv. 6143), C 2149 (inv.8693), C2153 (inv.8699) for this room.

the two *caldaria* (features 10, 11), and the *frigidarium* (feature 64).[409] In connection with *fridarium* 64, drain 106 was installed and connected to the existing drainage system from the previous period. Additionally, the drains leading out of room 4 (features 13 and 115) were created to connect with the previously created sewer line (feature 82), where it begins at feature 5. This accounts for the otherwise strange combination of sewer directions here (

Figure 4.115).[410] A supply line (features 1, 4) fed *frigidarium* 64, perhaps connected to the lead pipe naming a Servius Scipio Orfitus (feature 78).[411] In connection with the insertion of the large cistern in IV, ii, 5, a door that previously connected the bath to the central *insula* courtyard was blocked up.[412] In this period the Europa *frigidarium* (feature 18) was redecorated, with the drain (feature 95) and supply (features 46, 47) rebuilt.[413] The brick piers added on the inner face of the wall dividing the *insula* from the Campo della Magna Mater date to this period as well, as the piers are not integrated into the wall but built against it. The rectangular channels(features 15, 16, 19, 80, 104, 105) that pierce these piers and the contiguous lead pipes (feature 20) date to the period of the large Severan overhaul of the bath building. Their length is the interesting factor, as it expands the reach of the pressurized water system to the south of the insula, where there are very few water features. This could imply that piped water came not (only) from the *cardo maximus*, but also from the supra-mural water line already in existence since the Hadrianic period.[414]

It is here postulated that feature 90 was at this moment transformed into a localized *castellum divisorium*/nymphaeum with a connection to the larger urban network. Given the vicinity of the Republican wall and the similarities to the nymphaeum in III, vi, 4 mentioned above, this feature acted both as a small cistern for the baths and for the southern part of the insula. The *opus spicatum* floor (18c) would indicate a high degree of foot traffic, which would be difficult to account for given the liminal placement of this structure.[415] A localized pressure system could also account for the variable heights of some of the supply channels in the bath building.

[409] GdSc 33, 107 (13-7-1964).
[410] Stöger 2011, 167 also identifies this space as significant to movement patterns in the baths.
[411] Barbieri 1953, #28α; GdSc 26, 78 (20-2-1940); Geremia Nucci 2000, 386.
[412] SBAO D1318 (inv. 10243) for a window at the top of the west wall of room 7c; see section IV, ii, 5 below.
[413] Clarke 1979, 51-52, describes the lighthouse mosaic as having an asymmetrical juxtaposition of figural elements that contrasts strongly with 2nd and early 3rd century mosaics given their lack of directional cues.
[414] Bruun 2002, 170 records *fistulae* (# A2a) discovered in front of the temple of Magna Mater dating to the Hadrianic period: (…*sub. cur. proc. patri(moni)*), C.I.L. XV, 7739α; Bukowiecki *et al.* 2008, 158 for the Hadrianic date of this supra-mural line.
[415] Stöger 2011, 184, fig. 6.17 shows that this is the least spatially connected part of the entire insula.

Figure 4.115: Dashed lines indicate reconstructed drainage lines in the 3rd century (after Stöger 2011, 79, Fig. 5.16).

Roman Water Footprint # 4 (AD 300-600)

In the final period of the bath's life, epigraphic evidence dating to ca. 420 AD testifies to the continued vitality of this bath building.[416] In terms of drainage, we have the insertion of a drainage pipe composed of two clam-shelled *imbrices* (feature 65) roughly hewn into the south wall of room 4, as well as a rectangular hole (feature 66) cut into the other side of the same wall (15a).[417] Together with the half-cappuccina drain (feature 83) these three drainage features may point to a higher ground level in this part of the bath building in this time period. As mentioned above, the bath underwent several

[416] The lead pipe (feature 79); Barbieri 1953,# 32α; Bruun 1991, 288; Geremia Nucci 2000, 400 for Valerius Faltonius Adelfius and his wife Anicia Italica; AE 1954.180; GdSc 26, 78 (20-2-1940).
[417] See SBAO D1296 (inv.10220) for restoration of this wall.

architectural transformations in this period, with walls closing off rooms (rooms 1, 4, 6, 7c) (Figure 4.116), and stairways connecting the bath to the Campo della Magna Mater (rooms 10, 11).[418]

Figure 4.116: Late Antique doorway blocking *in situ* in 1964 at left (GdSc 33), and wall removed for accessibility seen in 2015 (by author).

Conclusion

Although many of the bath building's water systems appear isolated from the rest of the insula, a systemic view reveals its connection to the wider insula, and to the larger urban networks of supply and drainage. The bath's total renovation in the Severan period follows a wider contemporary trend in Ostia, in which many bath buildings were renovated or built *ex novo*. Its modifications in the Late Antique period also match the broader trend in Ostia of subdividing internal spaces.[419] Especially the blocking up of walls to the heated rooms suggests an end, or at least a reduction, of the thermal capabilities of the building in its final phase.

[418] SBAO D1310 (inv.10226) shows no wall originally between feature 10 and room 15a.
[419] See section 4.2 for a discussion of wider trends in construction in Late Antique Ostia.

IV, ii, 2 and 3: Portico e Caseggiato dell'Ercole

Figure 4.117: Identified water features in IV, ii, 2-3 (after Stöger 2011, 93, Fig. 5.35).

Location in insula

The Portico and Caseggiato dell'Ercole are located on the north side of insula IV, ii and present a ca. 65.00 m face onto the *cardo maximus* (Figure 4.117). A row of square rooms are accessible from the street through the brick-piered portico, and only the rooms in the eastern section (rooms 5, 6, 8-19) are connected to back rooms of equal dimension. However, all of the southern facing rooms open onto a broad trapezoidal courtyard. Evidence for the use of several of these rooms as *tabernae* is known for rooms 3, 5, 8, and 21. The northwest corner of the portico lies ca. 10.00 m across the street from the southern entrance to the Terme del Foro (I, xii, 6) courtyard, and at the place where the *cardo* changes direction; this suggests a prime location for the shops. The caseggiato also includes three rooms to the south that likely had an industrial function (28, 29, 30), and a courtyard entrance with an *opus latericium*

wall niche.[420] These three southern rooms are to the north of building IV, ii, 6, and to the west of building IV, ii, 4. A stretch of sidewalk frames the western face of the Caseggiato along the Via del Caupona, extending only the length of the Caseggiato and not including the portico on the *cardo maximus*, or the subsequent buildings to the south. The originality of this and other sidewalks has been seriously called into question by recent research.[421]

History of Excavation and Restoration

The building was excavated between December 1939 and July 1940 and immediately underwent consolidation and restoration. This applies especially to the piers along the *cardo maximus*, some of which are precariously unstable at the time of writing, necessitating the closure of the entire insula to the public. At the same time as the initial excavation-restoration, several walls from the last period of the insula's life were torn down to create a more harmonious *mise-en-scène*.[422] A relief of Heracles holding a club and wearing a lion skin was found among the rubble of the portico and was used to name the entire caseggiato-portico complex. The portico and caseggiato are studied together given their interconnectivity and contemporary building phases.

Phasing and Comments

Offering a frontal view onto the *cardo maximus* and close to the Porta Laurentina, evidence of an earlier domus from the Republican period is attested in the western half of the caseggiato, around rooms 17/18 and 21.[423] Evidence of this earlier domus also comes from two wells, which survived the raising of the ground level in this part of the city in the early 2nd century, and were incorporated into the later Caseggiato and Portico dell'Ercole. Based on brick stamps the major building phase of this structure dates to AD 160-170, when the *opus latericium* structure was built against both the *opus reticulatum* of the Caupona del Pavone, and the *taberna* of the earliest phase of the Terme del Faro (IV, ii, 1, room 13).[424] The portico was built in alignment with the existing *taberna*, forming a cohesive visual face of the insula; this was contemporary with the creation of the portico along the western side of the Terme del Foro, monumentalizing the street into a unified view of multi-story porticoes. Supporting brick piers were placed in the corners of several rooms of the caseggiato. The western rooms of the caseggiato (rooms 21-26), lacking these piers, seem to have been added slightly after AD 170; the brick piers in front of these rooms are off-center in comparison with those to the east and are likely also from the same later phase.[425] Additionally, the eastern wall of hallway 20 has a massive relieving arch of red-painted *bipedales* with white-painted mortar to support the dual staircases at the end of the original group of structures.[426] The caseggiato has evidence for at least one upper floor, indicated by staircases spread throughout the caseggiato (rooms 2, 17/18, 19, 21, and 28). The large room 30 originally was divided by more walls, as indicated on Calza's plan,[427] yet these are not preserved. The once vibrant wall paintings in taberna 8 date from the mid-3rd century.[428] Two late walls of *opus vittatum* were recorded in the courtyard by archival photographs, and plans from the initial excavation. One of these walls continues the eastern wall of IV, ii, 04 at least as far as incorporating the courtyard fountain (feature 68).[429] The second of these walls continues the line of the Caseggiato dell'Ercole's hallway 1 to the south to the stairs of the cistern (IV, ii, 05, room 14 below). These walls indicate a later division of the open space of this courtyard, and of the entire insula.

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[420] Bakker 1994, 230, dates this niche to the period of Marcus Aurelius.
[421] Stöger 2011, 96 for the sidewalk; Claire Weiss, pers. comm. doubts the originality of these sidewalks.
[422] Bakker 1994, 90.
[423] Stöger 2011, 96.
[424] SO 1, 226 for Bloch's reading of the brick stamps.
[425] Stöger 2011, 100 for these piers.
[426] Meiggs 1973, 240.
[427] SO I, plan sec. 13.
[428] SBAO B2949, R4260 (no.9) for the taberna in a 1986 snowfall.
[429] Rinaldi 2012, 76; SBAO B3036; See below IV, ii, 5 for these archival photographs.

Water Features Chart

The following hydraulic features are located in buildings IV, ii, 2-3, (Table 4.26).

IV, ii, 2-3 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
3	basin	within bar counter	88	2
6	fountain basin	SE corner of room	24	3
6	Pb fistula	NE corner of basin #24	75	3
6	channel	E wall	130	3
7	rectangular downshaft	E wall of hallway	23	2
7	circular downshaft	W wall-continues upwards	22	2
8	bar basin	within bar counter	94	2
8	Pb fistula	leads to the W	142	3
8	sewer	N of bar counter	117	2
8	manhole	floor drain directly N of rm 08	25	2
8	sewer	E-W sewer branch	92	2
8	sewer	N-S sewer branch	127	2
14	rectangular downshaft	W wall-N face of pier	26	4
17/18	well	center of room	27	1
20	rectangular downshaft	E side hallway	28	2
21	well	between rm 20 and 21	29	1
Cardo Maximus at portico	Pb fistula	OFI(cina).IVLI.MARCIHNI	83	3
Cardo Maximus at portico	Pb fistula	M AVRELIVS PRIMVS FEC	133	2?
Cardo Maximus at portico	Pb fistula	EX OFF A METILI T(hreptionis)	134	2?
Cardo Maximus at portico	Pb fistula	M AVRELIVS PRIMVS FEC	135	2?
Cardo Maximus at portico	Pb fistula	SCIPIONIS ORFITI	136	3
Cardo Maximus at portico	Pb fistula	EX OFF A METILI THPEPTIONIS	137	2?
Cardo Maximus at portico	Pb fistula	VQ. FAV	138	2
Cardo Maximus at portico	Pb fistula	M.AVRELIS PRIMUS FEC	139	2?
Cardo Maximus at portico	Pb fistula	SCIPIONIS ORFITI	140	3
Cardo Maximus at portico	Pb fistula	EX OFF AMETILI THPEPTIONIS with 10 pointed star	141	2?

Table 4.26: Identified water features in the Portico e Caseggiato dell'Ercole (IV, ii, 2-3).

Description of Water Features

In the easternmost taberna of the caseggiato (room 3), is a bar counter with its ground level basin (feature 88) that projects out into the room (Figure 4.118).[430] Continuing into the southeast part of the

[430] Hermansen 1982, 162 (no. 26) for the bar counter.

building, in the southeast corner of room 6 there is a fountain basin (feature 24) with a lead *fistula* fragment in situ (feature 75).[431]

Figure 4.118: Bar counter with its projecting floor level basin, feature 88, (Stöger 2011, 88, Fig. 5.29).

The pipe fragment is likely the product of modern restoration to the basin, but the supply channel for the fountain is original (feature 130). This channel passes from hallway 7 through the east wall of room 6 into the basin, and was likely supplied by the large cistern (feature 36). Hallway 7 also has vertical channels recessed into its western and eastern walls that are roughly across from each other. The semi-circular downshaft (feature 22) on the western face of this wall (feature 22) continues the entire height of the wall. This vertical downshaft continued into the upper floor of the building, and is visible on the landing at the top of the staircase of room 2. Compared with other combinations of downshafts and staircases in Ostia, this is evidence for a drop-toilet on an upper floor.[432] On the eastern wall of hallway 7 is a rectangular channel (feature 23) built as part of the wall. Unlike a typical downshaft, it does not continue up the entire height of the wall, but at a height of ca. 1.50 m from the floor turns 90^0 horizontally into the neighboring room 7a of IV, ii, 1.[433] This elbow joint makes it unlikely that feature 23 was part of a drainage system, and should instead be interpreted as part of a pressurized supply system using an inverted siphon.

The bar counter in room 8 was built directly against the east wall of this room, facing the *cardo maximus*. Underneath the marble covered barrel vault of the bar is a water basin (feature 94). It was supplied by a lead pipe (feature 142) that entered from the doorway between rooms 1 and 8 (Figure 4.119).[434]

[431] For this fountain see: RS II, 132 (sch.123); SBAO D1188 (inv. 10113), filed in the Ostia archives under IV, ii, 04.
[432] Hobson 2009, 71 for drop-toilets.
[433] The same orientation as the downshaft (feature 1) in IV, ii, 1.
[434] Hermansen 1982, 163.

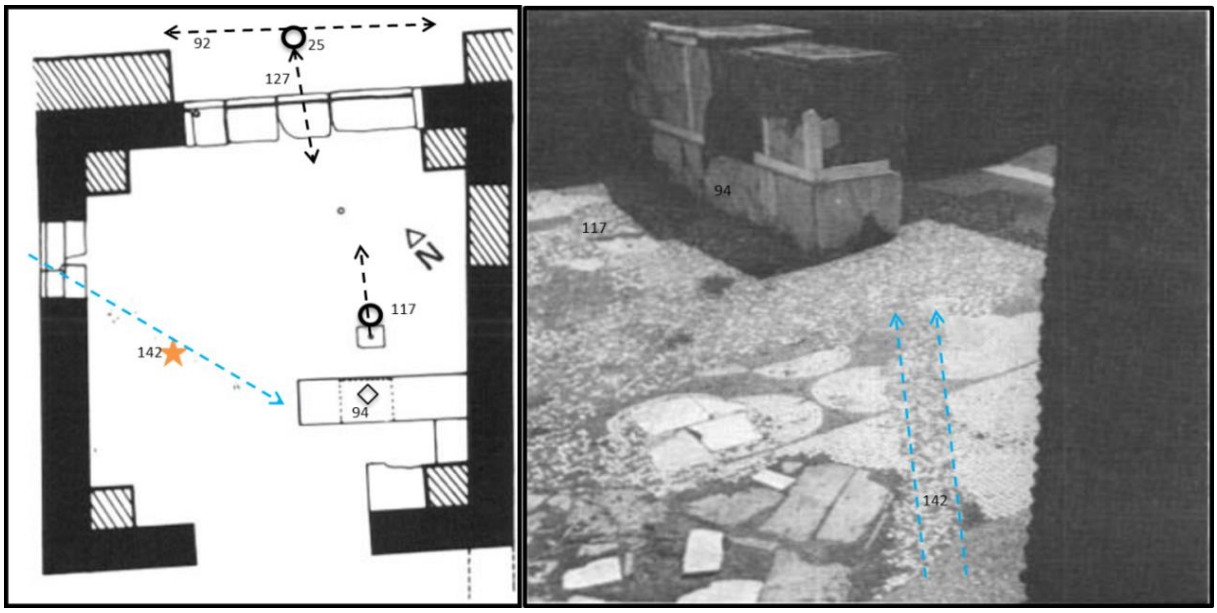

Figure 4.119: Hydraulic features in connection with the bar counter in room 8, with the line of the lead supply pipe indicated on the right picture by dashed lines (Hermansen 1982, 164, Fig. 101; 165, Fig. 100).

The disrupted tesserae of the mosaic in room 8 indicate that the pipe was inserted after its creation, and that the pipe entered from room 1. The water from the bar basin drained out through a sewer line directly in front of the bar counter (feature 117), which sloped downwards towards the north. Directly in front of the threshold of taberna 8 and within the floor of the portico is a square marble manhole cover (feature 25) with 3 almond shaped holes. The position of the manhole cover only two meters from the street would suggest a direct exit into the city's main *cardo* sewer (feature 114). However, internal inspection of the drain revealed that it was built in a T shape, with one branch (feature 92) running parallel to the portico (in an E-W direction), and the perpendicular line (feature 127) leading south into the taberna in room 8. From the trajectory and type of sewer (cappucina) we can infer that drain 92 is a major line that continues under the portico in both directions before emptying into the central sewer. In contrast, the flat-roofed *opus latericium* section that connects to the taberna (feature 127) is similar to other smaller secondary drains observed in other buildings of the insula.

A rectangular downshaft (feature 26) is present in room 14, which faces onto the *cardo* (Figure 4.120, Figure 4.121, Figure 4.122). However, in this case, the vertical rectangular channel is not built into a wall, but rather is situated in the north face of an oddly placed pier on the western side of the room. Unlike other later piers identified in this insula, which are placed against corners or load-bearing piers, this pier is keyed into the middle of the length of the wall, and the channel is roughly cut into the western wall of room 14.[435] This poses a puzzling sequence of construction, whereby an existing rectangular downshaft within the west wall of room 14 acted as a grafting site for the later brick pier 26. Given the consistently thick coating of calcium carbonate ($CaCO_3$), and the shape of the brick pier, this structure is here interpreted as a water distribution tower of the type known from Pompeii and Herculaneum.[436] The rectangular shaft would then have held vertically placed lead pipes bringing water to a (now-lost) basin on top of the tower. This system of using pressurized water (inverted siphons) was not previously known at Ostia, and based on the bricks used, must date to the late 3rd or early 4th century AD.[437]

[435] For an expanded discussion on inverted siphons and urban water towers, as well as the dating of this feature, see Locicero 2017.

[436] Camardo *et al.* 2006 for the two water towers known in Herculaneum; Olsson 2015 for the water towers in Pompeii;.

[437] Heres 1982, 123, Fig. 32.4 for similar masonry style in the piers along the *decumanus* dated to AD 350.

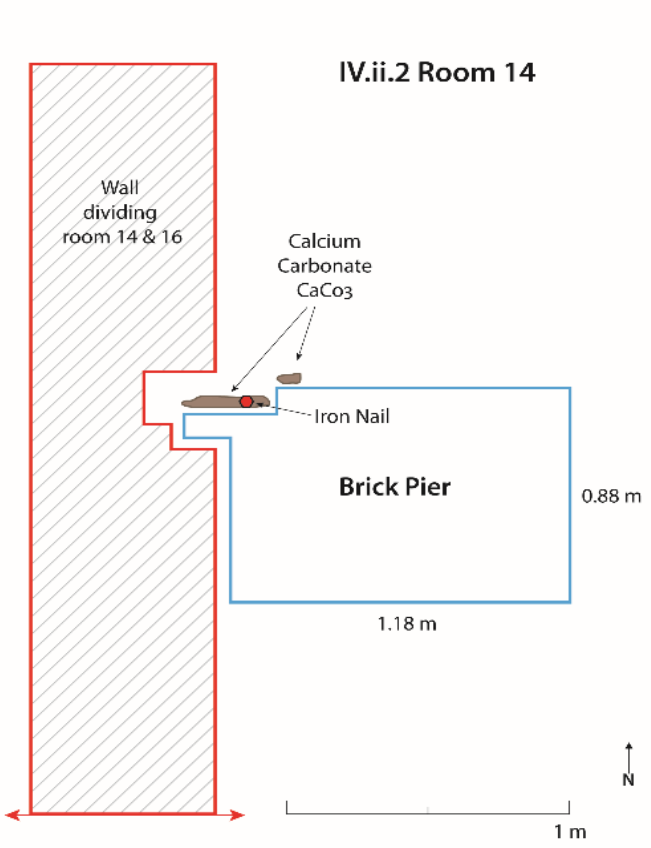

Figure 4.120: Schematic ground plan of feature 26.

Figure 4.121: Archival photograph of feature 26 viewed from the north when it was excavated in December 1940 (SBAO B2916).

Figure 4.122: The water tower (feature 26) viewed from the north in 2016, with the white coating of calcium carbonate visible on its inner lip.

There are two wells in the caseggiato (room 17/18 and 21), which are surviving elements from the earlier Republican *domus* here. The well in room 17/18 (feature 27) has a fluted marble well-head and its stubborn persistence through the early 2nd century ground raising of the area is the reason for its location in the center of a small stair room.[438] The second well (feature 29), is also in a strange position in the eastern part of the caseggiato, namely in the middle of a wall separating a taberna from a hallway (room 20). Given the unusual internal dimensions of the well, it appears that the original position of the well would place it directly within hallway 20, and that its shaft was built up at a roughly 45° angle towards the west (Figure 4.123).[439] This would have allowed access to the well water both from within the taberna and from the hallway of the caseggiato.

[438] RS I, 45 (sch. 32) for the well.

[439] Hermansen 1982, 165-166 (no. 28); RS I, 45 (sch. 31); The opening of the well extends 30 cm into hallway 20.

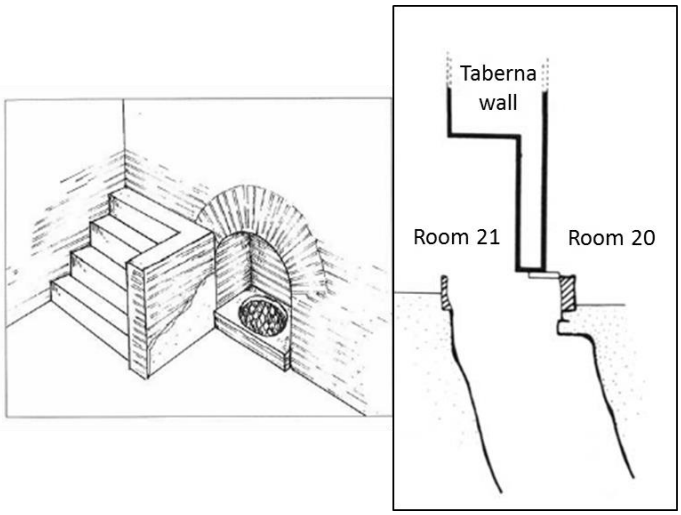

Figure 4.123: Reconstruction of feature 29 viewed within room 21 (RS I, 45, Fig. 52). Cross section of feature 29, with room 21 on the left and room 20 on the right (Hermansen 1982, 166, Fig. 105).

The eastern face of hallway 20 contains a rectangular downshaft (feature 28) that exists for the entire preserved height of the wall and is coated with sinter to a varying thickness.[440] The placement of a downshaft within a hallway seems uncharacteristic for this architectural feature, however, its corroborates the structural sequence of the caseggiato: this wall was originally built as the external wall of the building unit (rooms 1-20). Slightly later, rooms 21-26 were added onto the western side of the caseggiato. More than a dozen sections of lead pipes were found in the vicinity of the portico and the *cardo maximus* in 1940 (features 83, 133-141) with little precise indication of their original location.[441] Several prominent *plumbarii* (lead pipe manufacturers) from Ostia are represented in this group, namely the Aurelii and the Iulii, who predominantly date to the 2nd and 3rd centuries AD.[442]

Infrastructure Chronology

Roman Water Footprint # 1 (4th century B.C.- AD 50)

From the earliest period of the insula's history are two wells (features 27, 29). The stubborn survival of these through multiple ground level changes attests to their continued importance for the insula's inhabitants.

Roman Water Footprint #2 (AD 50-200)

With the creation of the Portico and Caseggiato dell'Ercole comes the creation of several water features, as well as the main architectural structure of the wider *insula*. The two bar counters were added slightly later (features 88, 94), taking advantage of thirsty travelers arriving through the Porta Laurentina. In the latter, a sewer line (feature 117) was also created to drain water out of the bar and into the sewer line (features 127 and 92) running under the portico. Downshaft 22 certainly continued into the ground, and likely proceeded toward the *cardo maximus*, where it either emptied into the main sewer, or into the branch of drain 92. The sharp right angle turn taken through a wall by feature 23 suggests a supply function (with pressurized pipes), and may be related to the Terme del Faro or the original changing room (*apodyterium*) of the baths (IV, ii, 1, room 7a).

Feature 28 acted as a drain from the upper floors of the caseggiato, however, the uniform coating of sinter ($CaCO_3$) makes this interpretation more problematic, as this formation is associated with the karstic (limestone) source of the long-distance aqueduct lines, and not from the sand-percolated ground

[440] SBAO B2912.
[441] The three lead pipes discussed above in IV, ii, 1 (features 67, 78, 79) were also found in this context.
[442] Bruun 1991, 309 for a list of several prominent *plumbarii* families in Ostia.

water of the city.[443] Should we imagine that the aqueduct-fed water from the courtyard fountain (feature 68) was physically transported upstairs and drained through upper floor kitchen-toilet structures? The majority of the lead pipes found around the portico date to this period (features 133,[444] 134,[445] 135,[446] 137,[447] 138,[448] and 139[449]). Although some of the pipes were connected to each other, this does not imply a unified system, or that they were even connected to water features within insula IV, ii.

Roman Water Footprint # 3 (AD 200-300)

As described below in section IV, ii, 5, this period witnessed the insertion of the large cistern less than 3.00 m to the south of the rooms of the caseggiato. While its technical details will be explained more thoroughly below, it suffices here to say that several *in situ* lead pipes and channels are preserved in the northern wall of this cistern. As the fountain (feature 24) is fed by a channel (feature 130) in the south part of hallway 1, it can be deduced that the creation of this fountain is directly linked to the cistern.[450] Also in this time period, the water supply to the taberna in room 8 changed: a lead pipe line (feature 142) was installed that entered from hallway 1.

Roman Water Footprint # 4 (AD 300-600)

The water tower dates to the late 3rd or early 4th century based on the quality and style of its *opus latericium*. The vertical channel of the tower (feature 26) was built against an existing downshaft within the west wall of room 16. However, the calcium carbonate that coats the channel of the tower is completely absent from the downshaft. This means that the downshaft continued to function after the tower was built, and the calcium carbonate was blocked from forming on the inner face of the downshaft because it was protected by a section of wood.[451]

Conclusion

The water features in the Portico e Caseggiato dell'Ercole present a very stable hydraulic history over time, where new elements were added to earlier systems. Buildings IV, ii, 2-3 manage to look both outward, with their bars, and inward, by means of the later water tower. This water tower offers strong support for the continuity of hydraulic investment in the later period of the city's life, and implies the connectivity of the Portico with other buildings in *insula* IV, ii, or perhaps to a neighboring *insula*.

[443] Meiggs 1973, 249, "No rooms yet found in *insulae* are heated, and upper floors could have no running water…"; Dig. I, 15, 3.4 states that tenants in the upper floors of apartment buildings were required to keep water in case of fire: *"praeterea ut aquam unusquisque inquilinus in cenaculo habeat, iubetur admonere (praefectus vigilium)"*.

[444] Barbieri 1953, #28β; GdSc 26, 78 (20-2-1940).
[445] Barbieri 1953, 182; C.I.L. XV, 7739β (=XIV, 1997); GdSc 26, 84 (8-3-1940).
[446] Barbieri 1953, #28β; GdSc 26, 90 (27-3-1940).
[447] GdSc 26, 98 (8-4-1940).
[448] Barbieri 1953, #48; GdSc 26, 98 (8-4-1940).
[449] Barbieri 1953, #28β; GdSc 26, 98 (8-4-1940).
[450] RS II, 132 (sch. 123) dates this to the late 2nd century AD.
[451] Such coverings are inferred from the frequent pairs of nails preserved around other downshafts in insula IV, ii and in other parts of Ostia (e.g. Chapter 3.1: III, i, 1, feature 4).

IV, ii, 4

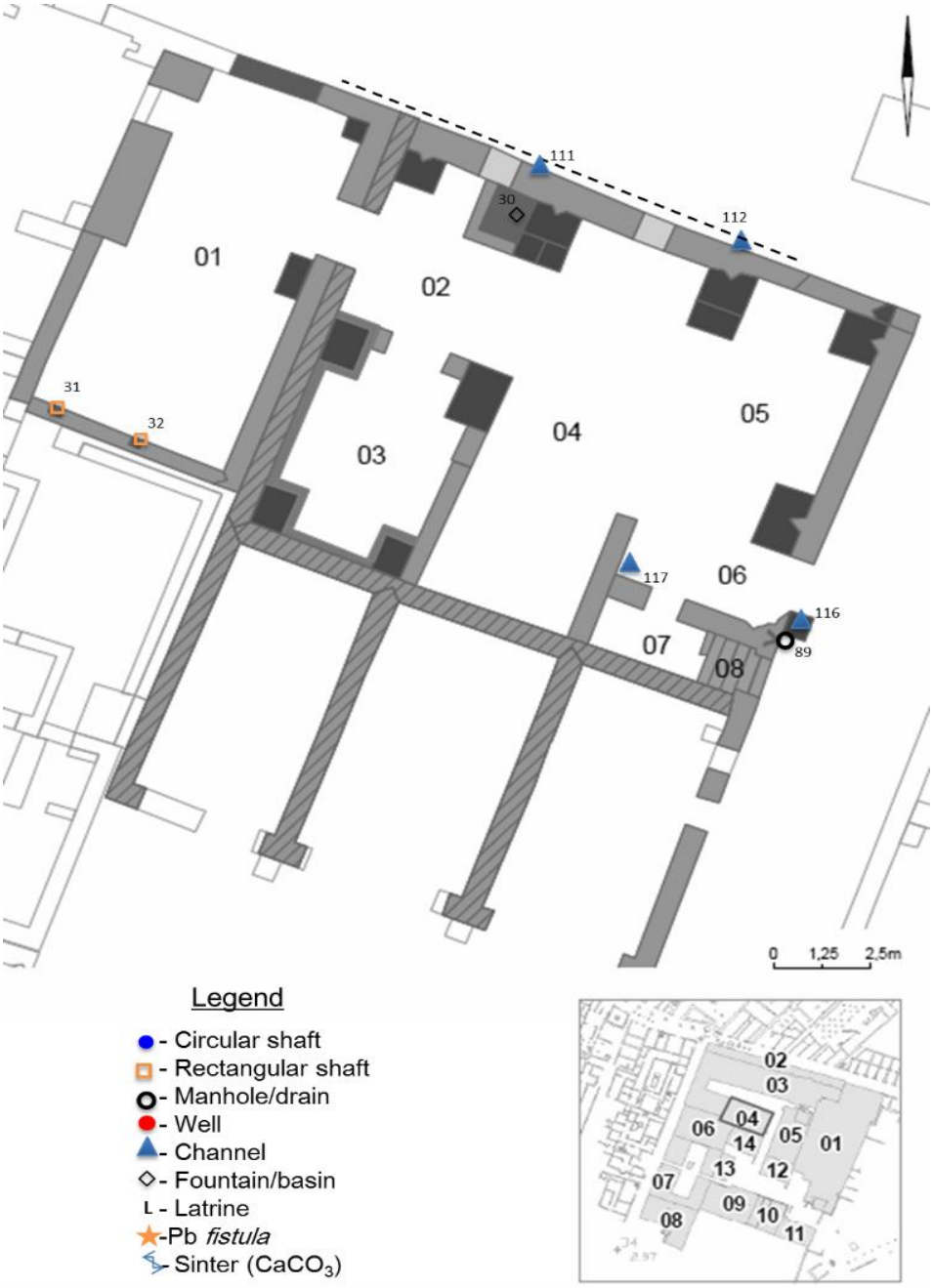

Figure 4.124: Identified water features in IV, ii, 4 (after Stöger 2011, 107, fig. 5.52).

Location in insula

Building IV, ii, 04 is located within the northern courtyard of the *insula* (Figure 4.124). Its current entrance is on the eastern side, and opens onto the corridor connecting the northern and southern courtyards of the *insula*. Three windows open onto the originally basalt-paved northern courtyard. The building is buttressed by numerous large piers in the corners of almost every room; these are much larger and thicker than in other parts of the *insula*. The internal space is divided into four roughly rectangular areas, with a small stairway room (room 7) squeezed underneath a later stairway (room 8). Room 1 originally was open to the industrial space 30 of IV, ii, 2-3, as well as onto the northern courtyard

of the *insula* but this was later sealed up. A doorway was also later sealed between room 4 and IV, ii, 14, room 2.[452]

History of Excavation and Restoration

This building is located in the heart of the *insula*, and is interpreted as being for industrial purposes, based on the layout of its rooms.[453] Although not explicitly mentioned in the initial excavation reports, it is likely that this structure was also excavated in 1940 together with the other buildings of this *insula*. Also, like other structures in the *insula*, this building underwent consolidation work in the 1960s.[454]

Phasing and Comments

Based on brick stamps, the building IV, ii, 4 dates to the late Hadrianic or early Antonine period and shares a wall with the *tabernae* of IV, ii, 14.[455] The building initially had a wide doorway on the north side of room 1, which opened onto the northern courtyard of the insula. The construction of industrial space in this part of the *insula* has parallels with IV, ii, 5, 6, and 14. Large brick support piers were later installed in many other buildings in the block in the late 2nd century AD, yet in this structure several of the brick piers had *additional* piers added onto them.

Just as the northern courtyard of the insula, this building also originally sported a robust basalt floor. As mentioned in the previous section, walls visible only in the initial excavation photographs show later walls of *opus vittatum* present in the courtyard. These extended the eastern wall of IV, ii, 04 in a northern direction as far as, and including the courtyard fountain (feature 68). Together with the parallel wall of the same date, it appears that this connecting corridor acted to partially restrict the interconnectivity of the insula. Similar divisions of the internal layout of *insulae* from the 3rd and 4th centuries are known from other *insulae* at Ostia.[456]

Water Features Chart

The following hydraulic features are located in building IV, ii, 4 (Table 4.27).

IV, ii, 4 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
1	rectangular downshaft	S wall- W shaft	31	2
1	rectangular downshaft	S wall- E shaft	32	2
2	fountain basin	basin in NE corner of room 2	30	3
2	channel	external N wall of room 2	111	3
1-2-4-5	fistula channel(?)	runs along almost entire N external face of IV, ii, 4	112	2
6	channel	runs parallel to E side of IV, ii, 4; through later pier at doorway	116	3
6	drain	S of entrance to IV, ii, 4; on external SE corner at ground level	89	3

Table 4.27: Identified water features in building IV, ii, 4.

[452] See section on IV, ii, 14 below.
[453] Stöger 2011, 108, although she admits the limited evidence for this attribution.
[454] GdSc 32, 127 (6-7-1960).
[455] Stöger 2011, 106.
[456] Gering 2004 gives an overview of this subject.

Description of Water Features

Along the internal side of the northern wall of the building is a large fountain basin (feature 30), built against the corner formed by the double piers that subdivide this space (Figure 4.125).

Figure 4.125: North facing view showing basin 30 against the north wall of room 2 before consolidation (RS II, 136, sch. 125).

This basin was fed by a channel in the north wall of room 2 (feature 111). This channel is formed by a *bipedalis* brick extending over a rectangular space through the north wall of room 2. While the lead pipe itself is now lost, there is a narrow channel (feature 112) cut into the *opus latericium* wall where it meets the northern courtyard floor. While at first view this may seem like the effect of vegetation eroding the bricks, this is an intentional channel that has been covered in three places by angular brick fragments (Figure 4.126). At ground level the brick course has been replaced by an L shaped section tile, perhaps a reused section of hypocaust *tubulus*, or a section of roof tile *imbrex*. This channel runs for a length of ca. 17.50 m, from the northeast corner of the building until the blocked doorway in room 1. Although not technically a covered channel, the pipe would have been protected from the activities in the courtyard by the overhanging lip of the inserted L-shaped fragments.

Figure 4.126: View looking east at feature 112, from the northern courtyard of insula IV, ii.

Along the southern wall of room 1 are two parallel rectangular downshafts (features 31, 32). The eastern one of these shafts (feature 32) is less structurally coherent than its neighbor, and the bottom 0.50 m of its shaft was filled with rubble. These downshafts were not built as part of the *opus latericium* wall, but are of the tile-backed variety, and are composed of vertically placed *bipedales* set against the external wall of room 7 of the Caupona del Pavone (IV, ii, 6).

Three hydraulic features are clustered around the entrance to IV, ii, 4, hallway 6. Immediately south of the entrance is one of several brick piers in this hallway. Between the pier and the outer wall of this building is a small channel (feature 116), that is within the foundation of the pier placed below its bonding course (Figure 4.127). Where the channel emerges on the south side of the pier, it is covered by two bricks, which appear to protect it. Continuing along the outer face of the building, there is a partially blocked *cappucina* drain connected with room 6 of the building (feature 89).[457] There is evidence of bubbled sinter on the inner face of these *bipedales*, and the channel certainly continues much deeper into the ground that is currently visible.

Figure 4.127: View looking west at the eastern side of room 8 of building IV, ii, 4. The cappucina drain 89 and the southern end of channel 116 are indicated by the dashed circles. The black dashed line indicates the transition between the foundation and the upper courses of the wall.

Infrastructure Chronology

Roman Water Footprint # 1 (4th century B.C.- AD 50)

No preserved water features date from this period.

[457] SBAO B3705 (inv. 6194) shows this cappucina as well.

Roman Water Footprint # 2 (AD 50-200)

The two downshafts (features 31, 32) are from the earliest period of the building's use, when it was built against IV, ii, 6. They imply drainage from an upper floor, perhaps of rainwater. These downshafts likely drained downwards to the north, and were blocked at the same time as the north and west doorways of room 1. The long channel running along the exterior north face of the building (feature 112) dates to this period, as it does not continue across the wall closing off room 01.

Roman Water Footprint #3 (AD 200-300)

The basin (feature 30) is dated to this period based on its insertion against the substantial pillars added in the late 2nd or early 3rd century. This dating is supported also by the discovery of a lead *fistula* pipe, which ran the entire length of the northern courtyard of the insula, and is dated epigraphically to the late 3rd century AD.[458] The channel feeding the basin (feature 111) also dates to this period. During this period comes the first evidence of a supply and drainage system running down the central corridor of the insula, which will be synthetically treated in the subsequent section (4.2) as it involves four contemporary buildings. The drains and channels (features 89, 116, 117) are contemporary with the addition of the supporting piers in the courtyard. These piers in turn coincided with a change in elevation in at least this section of the insula, based on not only the height of the features today, but on their position securely within the foundation course of the piers. Given the calcium carbonate evidence within the *cappucina* drain (feature 89), it must have carried a pressurized pipe into the channel of feature 117.

Roman Water Footprint # 4 (AD 300-600)

No preserved water features date from this period.

Conclusion

Building IV, ii, 4 preserves evidence of its connection to the adjacent buildings of the insula, which increases in the Severan period (Roman Water Footprint #3). The rising ground level across the insula in this period caused the building to become more closed off, with only one opening onto the central corridor of the insula. The two tile-backed downshafts indicate an upper floor, but their destruction also suggests that the spatial arrangement of this upper floor apartment changed dramatically.

[458] See below section IV, ii, 5 (feature 76).

IV, ii, 5: Caseggiato

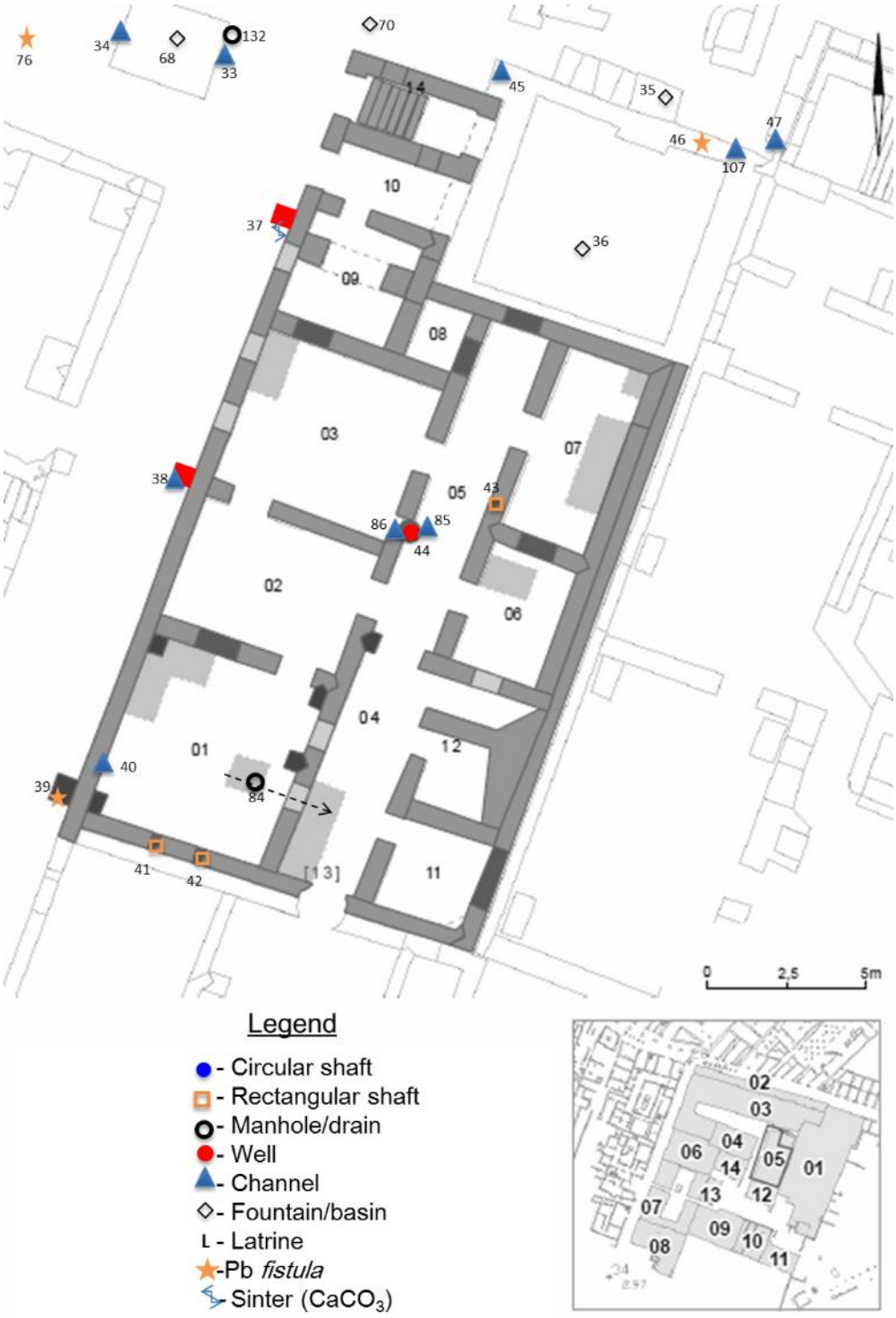

Figure 4.128: Identified water features in IV, ii, 5 (after Stöger 2011, 109, Fig. 5.55).

Location in insula

This building lies in the central core of the insula, and its eastern side is contiguous to the Terme del Faro (Figure 4.128). It is bounded on the south by building IV, ii, 12, and on the west by the central corridor that connects the two internal courtyards of the insula. The northern edge of the building is bounded by the large cistern (feature 36).

History of Excavation and Restoration

Like the other buildings of the *insula*, IV, ii, 05 was excavated in the 1938-42 period by Calza, and also underwent restoration in the 1960s. Several targeted excavation trenches occurred in 1994 and 1995 directed by Pellegrino, Falzone, and Olivanti, with the well-preserved wall paintings subsequently studied.[459]

Phasing and Comments

The main construction phase for this building is dated by an *in situ* brick stamp between AD 123-155, although it incorporates sections of Hadrianic reticulate.[460] The layout of the structure appears residential, with especially rooms 6 and 7 resembling *medianum* apartments, implying light entered only from corridor 5.[461] The building is divided into two parts by a central hallway (room 4, 5). The original entrance to this building was from the north, through hallway 5. At a moment in the later 2nd century, rooms 11 and 12 were inserted into the small courtyard (room 4), respecting the original layout and window in room 6. A strange architectural feature is present against the east wall of room 12, and resembles a broad triangular pier with a small dividing wall extending from its apex. This feature is far too large to act as a lateral support, and may be evidence of a changing arrangement of upper floor apartments.

In the Severan period a large cistern was created that blocked the northern entrance to the building, and a doorway leading into room 7c of the Terme del Faro (IV, ii, 1). A similar obstruction can be observed at the southern extent of the eastern wall (room 11), which would have led into the *caldarium* of the baths. As mentioned above, the Severan period is the most dramatic building phase for the bath building, when all its currently visible technological and artistic accoutrements were added. This would reinforce the interconnectivity of the baths with building IV, ii, 5 in the Severan period, when the orientation and entrance changed outwards, toward the *cardo*. A noticeable architectural feature of this eastern wall of IV, ii, 5 is the doubling of its walls, possibly linked to the late 1st century AD construction laws requiring walls to separate bath buildings from neighboring structures due to the heat.[462] The rooms on the opposite side of this eastern wall were all heated by large *praefurnia*, partially explored in the 1960s.[463] The southern extent of IV, ii, 5 exits into building IV, ii, 12, which will be discussed in greater detail below. However, the nature of the connection between these two structures is unclear, as the opening between them is very roughly preserved (Figure 4.129). Perhaps the staircase in the southeast corner of this building was used to access the upper floors of IV, ii, 5.

Additionally, building IV, ii, 5 seems to have been connected with the final architectural phase of buildings IV, ii, 4 and 14; it seems no coincidence that the corridor dividing these buildings has 3 sets of piers with their counterpart across the corridor. A coin of Gordian III (AD 238-44) was found, which points to the building's continued use into the later 3rd century CE.[464]

[459] GdSc 32, 125 (26-4-1960); GdSc 74 (1994-1995); Liedke 1995, 15 dates the wall paintings in room 6 to the Pre-Severan period.
[460] Stöger 2011, 112 for the brick stamp
[461] DeLaine 2004, 151.
[462] *Dig*. VIII, ii, 13.
[463] See Miliaresis 2013 for a recent study on heat transfer using computational fluid dynamics within the Forum baths of Ostia; baths were likely always kept at a minimum level of heat, since fully igniting a hypocaust system every day uses exponentially more fuel; See also Oetelaar *et al.* 2014, and the above discussion of building IV, ii, 1 for the *praefurnia*.
[464] Stöger 2011, 111, note 133.

Figure 4.129: View looking north at the current passageway between buildings IV, ii, 12 and building IV, ii, 5.

Water Features Chart

The following hydraulic features are located in building IV, ii, 5 (Table 4.28).

IV, ii, 5 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
1	fistula	external W face of W wall; S face of pier 3	39	3
1	drain	cappuccina shape, W wall near SW corner	40	3
1	rectangular downshaft	S wall, W shaft	41	2
1	rectangular downshaft	S wall, E shaft	42	2
1	sewer	E part of room	84	2
2	drain	cappuccina shape, external W face of W wall; S face of pier 2	38	3
3	ceramic pipe	bottom of well 44- E side	85	1
3	ceramic pipe	bottom of well 44- W side	86	1
5	rectangular downshaft	E wall	43	2
5	well	between rooms 3 and 5	44	1
9b	sinter	external W wall of room 9b; S face pier 1	37	3
15	channel	external NW corner	45	3
15	fistula	external N face	46	3
15	fountain niche(?)	semicircular niche where IV, ii, 5 (room 15) meets IV, ii, 1 (room 8)	47	2
15	basin	external N face at top of staircase	35	3
15	channel	external N face of cistern	107	3
15	cistern	cistern inserted into courtyard	36	3
16	channel	E face of courtyard fountain	33	2
16	channel	courtyard fountain- W side exit point of pipe	34	2
16	fountain	E part of N courtyard	68	2
16	drain	drain in internal bottom NE corner	132	2
16	basin	N of staircase 14	70	4
31	fistula	runs E-W length of internal courtyard	76	3

Table 4.28: Identified water features in building IV, ii, 5.

Description of Water Features

This building offers an exciting diversity of water features that may hold the key to understanding the larger distribution of water in the insula and perhaps the larger southern intra-mural area of Ostia. The corridor running along the western side of the building presents several interesting water features. Firstly, at the southernmost extent of the building, there is a brick pier added against the wall with a lead *fistula* pipe (feature 39) at ground level. The pipe is visible on the south side of the pier, yet it turns 90^0 into the southwest corner of room 1. The direction of water flow is unclear, as lead pipes are also known in drainage systems in Ostia.[465] Continuing north along this corridor, one encounters a second brick pier along the eastern wall with a cappucina drain (feature 38) at the bottom, although in this case the channel continues through the entire length of the pier. As mentioned above, these three piers (except the northern one) have an identical pier across the corridor, which are dealt with in their various building sections.[466]

The northernmost pier in this corridor does not have a channel, but it does offer some tantalizing clues regarding the larger provisioning of water in this building. A wide patch of calcium carbonate (feature 37) is present directly south of this brick pier, on the external wall of room 9b. The sinter patch ranges up to ca. 1.10 m away from the pier, stretching to the current ground level, and over a rectangular construction, perhaps where a pipe turned horizontally to the south (Figure 4.130).

Figure 4.130: West wall of IV, ii, 5, room 09 with calcium carbonate concentration (feature 37). Cylinders indicate possible location of now-lost vertical pipes .

[465] Jansen 2002, 171, note 196 for lead pipes in drainage capacities.
[466] IV, ii, 4 and IV, ii,14.

Returning to the southeast part of the building, a cappucina drain was roughly installed into the space under a relieving arch in the west wall of room 1 (feature 40). Also in room 1, we find a parallel set of rectangular tile-backed downshafts (features 41, 42), that run the entire extant height of the wall and are similar to the ones described above in IV, ii, 4 (features 31, 32).[467] Feature 41 is heavily damaged, and it's tile backing is poorly preserved, revealing the northern face of building V, ii, 12. The 1994-1995 excavations uncovered a small section of a sewer line (feature 84) in room 1 that runs into the central hallway of the building. Ceramic material found within this cappucina drain dates its purposeful filling to the 3rd century AD. [468]

Continuing inside the building, we move into its long central hallway to a well (feature 44). The position of this well was respected by the east wall of room 3, which arches over the well.[469] The well wall is made of *opus reticulatum* and the well-head is a roughly pitted piece of travertine. However, the designation of this feature might equally act as a small cistern given its two internal ceramic pipes (feature 85 and 86). These circular pipes are set into the *opus reticulatum* walls of the well at a NNE-SSW orientation and at different heights. They likely channeled rainwater from the roof of an earlier structure into the well.[470] On the eastern side of the hallway is a rectangular downshaft (feature 43), which provides further proof of at least one upper floor. It is unclear whether this downshaft was connected to the nearby well 44, as the bottom of the downshaft is heavily eroded.

On the eastern edge of the northern courtyard is a rectangular fountain (feature 68). The fountain is one of the "bauletto" type known across Ostia, which can be generally described as barrel vaulted, rectangular, (mostly) aqueduct fed, and offering a rectangular opening on one side to allow for bucket access.[471] This action is attested by rope-wear marks on the travertine blocks used in several of these fountains.[472] Alternatively, overflowing water (if present), could exit in one or more streams to be filled in containers, proved both by remaining exit holes in the lateral side of these fountains, as well as convex basins cut into travertine gutters along their long side.[473] This fountain follows the general trend, with a small rectangular shaft (feature 33) on the eastern side with the remains of a circular channel for a lead *fistula* to enter ca. 0.88 m from the ground level. While the *fistula* itself is now lost, it implies a localized pressure system. Within the lower north east corner of the fountain is a small drain (feature 132) that emptied into the courtyard. The western face of the fountain has an overflow spout (feature 34). While the roof of this fountain is largely restored, its internal walls retained the original coating of waterproof mortar, especially in the corners. The barrel-vaulted ceiling was rebuilt at the time of excavation using several anepigraphic bricks (Figure 4.131).[474] Due to similarities to the masonry of the Portico e Caseggiato dell'Ercole (IV, ii, 2-3), the fountain is dated to AD 160-70. Although this fountain (est. capacity ca. 5500 l) was certainly fed by a pipe on its eastern face, a stretch of six lead *fistulae* pipes (feature 76) was found to the west which ran the entire length of the courtyard toward the Via della Caupona.[475]

[467] SBAO B6253 (no. 16, 18), with a west facing view showing both downshafts.
[468] GdSc 74: see section D, locus 30 for the fill composition.
[469] SBAO B3702 (inv. 6191) also shows feature 43.
[470] Similar combinations of pipes and wells are noted in Chapter 5, for insula V, ii (e.g. V, ii, 2; V, ii, 5; V, ii, 13).
[471] RS II, 134, (sch.124) for this particular bauletto fountain
[472] E.g. the fountain in the Via della Fontana (RS II, 65-68, sch. 57).
[473] See especially the fountains of Case a Giardino: Jansen 2002, 172; Paschetto 1912, 252; RS II, 214.
[474] Shapes made by impressed dots: swastika, trident, upside-down T; these were not recoded in greater detail as they were certainly purposely placed there by the restorers as a wink to future archaeologists.
[475] For these pipes see: Barbieri 1953, 173 #38 (EX. OFICI. IVLIES.AQVILINES (=*ex ofici(na) Iulies Aquilines*)); C.I.L. XV, 7758 (=AE 1977, 164); GdSc 26, 78 (20-2-1940); RS II, 134.

Figure 4.131: Original and current state of the bauletto fountain viewed from the west (SBAO B3036).

Thanks to an examination of the archival photographs of the entire northern courtyard from the initial excavation period, two walls of *opus vittatum* were identified in connection to this fountain. The first was mentioned above in the discussion of IV, ii, 4; this wall extended northward from the east wall of IV, ii, 4 and included the east wall of the fountain, restricting access to the central corridor of the *insula*. The second extended southward from the west wall of hallway 1 from IV, ii, 3, and likely closed off this narrow corridor; this obstructed access to the baths from the larger courtyard (Figure 4.132,Figure 4.133). Built against this latter wall was a small semi-circular basin (feature 70) that was removed together with the *opus vittatum* wall.

Figure 4.132: Archival photo showing the two walls of *opus vittatum* outlined in black, the bauletto fountain 68, and the basin 70 outlined in red (SBAO B3036).

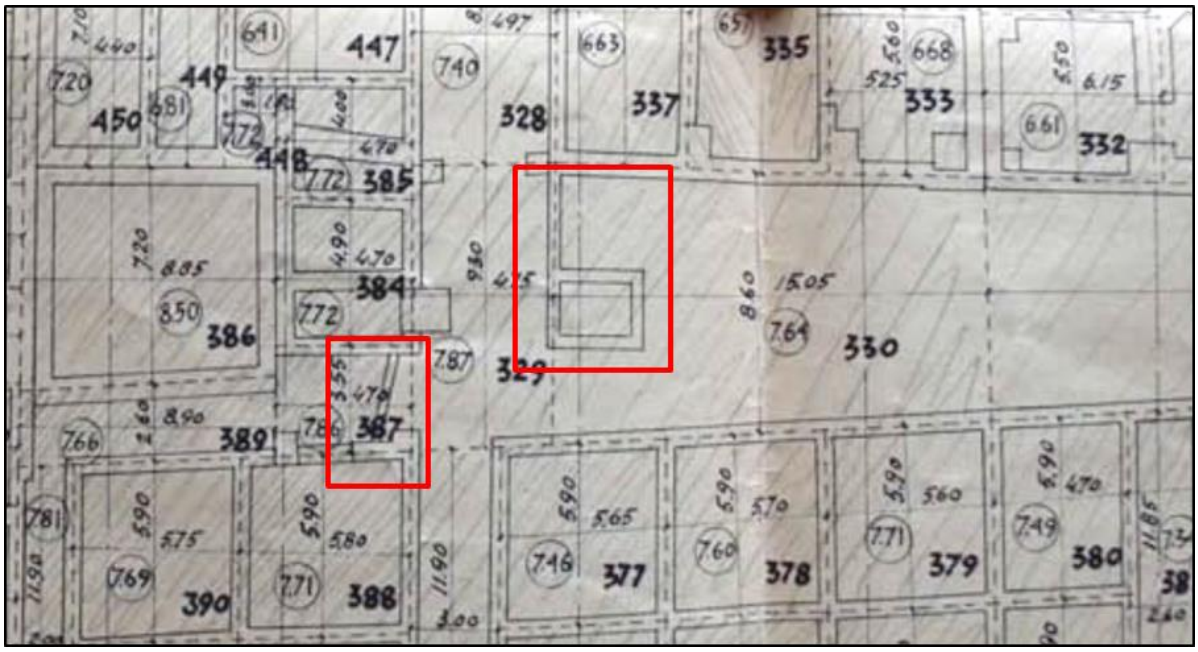

Figure 4.133: Plan drawn of the northern courtyard of insula IV, ii with *opus vittatum* walls outlined in red. North is at the bottom of the image (after Rinaldi 2012, 76, Fig. 7).

The largest concentration of water features for the entire *insula* exists around this next feature. The large cistern (feature 36) was inserted in the Severan period and blocked earlier doorways to both IV, ii, 5 and the Terme del Faro (IV, ii, 1).[476] At ca. 6.00 x 7.00 m the cistern could hold roughly 98, 000 litersof water, and was certainly connected to the water needs of the adjacent Terme del Faro.[477] The cistern is today entered from a modern breakage in its western wall, through room 10 of building 5. This breakage is comparable with the hole broken through the south side of the Porta Romana *castellum*, done to remove large lead pipes. In the case of the cistern in IV, ii, 5 this breakage may indicate that there were large lead pipes previously exiting the western wall of the cistern (Figure 4.134).

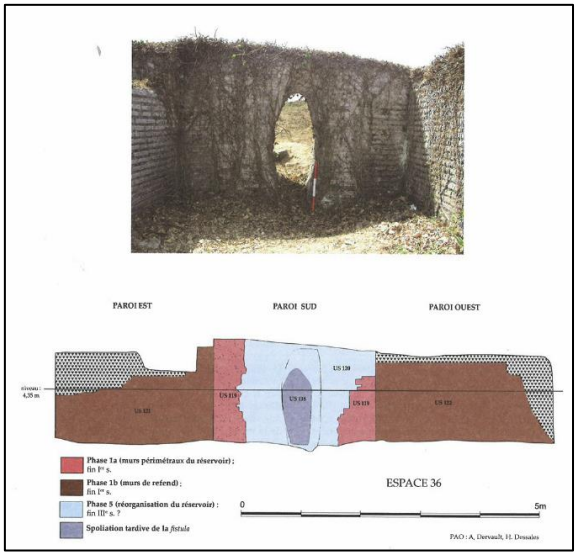

Figure 4.134: Ovoid breakage through the south wall of the Porta Romana *castellum* (Bukowiecki *et al*. 2008, 23, Fig. 5).

[476] RS I, 171 for this cistern.

[477] Volumetric calculation of basins at Ostia are based on the average surviving height (ca. 2.00 m) of waterproof *opus signinum* residue.

Due to the outward pressure of such a volume of water, the walls of the cistern are almost double the thickness of the other walls in the *insula*. The insertion of the cistern wall is clearest at the north end of IV, ii, 5, where the southern face of the cistern is visible through an ovoid breakage of one of the original entrances to the building; the external east wall of the cistern is visible through a rectangular "window" of the baths (IV, ii, 1, room 7c). Interestingly, when viewed from above, these walls are not directly contiguous, but rather are separated by a gap that varies from ca. 0.50- 0.85 m (Figure 4.135).

Figure 4.135: View looking south at doubling of walls between the cistern (right side) and the Terme del Faro (left side). The gap lies between these two walls.

Based on the fill material uncovered during excavation, the cistern was covered by a barrel vault, and could only be accessed via a staircase on the external side of the north wall. At the top of six stairs is a small rectangular basin pierced by circular holes on each of its four sides, evidence of its use as a distribution box (feature 35).[478] Private access staircases are known in connection with other cisterns (e.g. Terme di Nettuno II, iv, 2, room 16), and offered restricted access to the water distribution. While this distribution basin is heavily restored, the presence of the four channels are verified in archival photos. It is unclear from where the water arrived to fill this basin, but this small basin certainly redistributed water to other supply systems.

Progressing into the narrow hallway along the external north face of the cistern, a number of irregularly placed rectangular channels exit the northern face of the cistern. At about 50 cm above the current ground level there is an in situ lead *fistula* (feature 46) that exits the wall at a NW-SE direction. It is set into a rough matrix of mortar and brick fragments. Slightly to the east there is a channel (feature 107) at the same level of the *fistula*, which may indicate a drain. However if this were the case, then it would render the lead pipe (feature 46) at a great risk of clogging from particulate (Figure 4.136).[479] In the corner formed by the northeastern external corner of the cistern and the external western wall of the bath's *frigidarium* (IV, ii, 1, room 8), there is an arched recess at ground level (feature 47).[480] Inside this niche is a fragment of the lead fistula that exits the west wall of the bath's Europa *frigidarium* (feature 46). The insertion of the cistern partially blocked the accessibility of the niche, but it appears that the niche remained accessible.

[478] Cf. RS I, 158 (sch. 30); SBAO B3038 shows the external north face of the cistern and the relationship to the staircase; B3039 (inv. 5528) shows a close-up of the basin with circular holes exiting the eastern and southern side.
[479] Bukowiecki *et al.* 2008, 130 describes pipes at bottom of structure 12 of the Porta Romana castellum, with a similar possible problem.
[480] See above discussion on the Terme del Faro (IV, ii, 1).

Figure 4.136: Looking south at the north wall of the cistern in building IV, ii, 5. The lead *fistula* (feature 46) is visible at right, and the channel (feature 107) at left.

Infrastructure Chronology

Roman Water Footprint #1 (4th century B.C.- AD 50)

The well (feature 44) is a stubborn reminder of the Republican past of building IV, ii, 5. The orientation of the internal ceramic pipes argues for an earlier rain-fed supply system. Several Claudian coins and amphorae fragments attest to the longevity of the building before its transformation.[481]

Roman Water Footprint #2 (AD 50-200)

With the initial construction of the building came the insertion of the three downshafts (features 41, 42, 43). The question of drainage is raised by these three downshafts: where did the water go? For feature 43, it is likely that it acted as a drain for roof water, and in that case was connected to the earlier system of the well (feature 44). However, the story seems different for features 41 and 42. Perhaps these also drained roof water, but instead of into a cistern, they funneled the water out through feature 84. The section of sewer (feature 84) dates from this period given its stratigraphic relationship below the 3rd century mosaic, and above a late 1st century fill layer.[482] The central courtyard fountain (feature 68) also dates to this period. While this fountain basin is the only contemporary pressurized water feature, the line supplying it remains unclear. The fountain was created centuries before the later cistern: based on contemporary dates and vicinity (ca. 3.00 m), it is hypothesized that this fountain was fed by a branch of the lead pipe that ran along the north side of building IV, ii, 4 (feature 112 above).

[481] GdSc 74, locus A.55 for Dressel 2/4; local B.53 for Dressel 6a sherds and two coins of Claudius.
[482] GdSc 74, locus B.19.

Roman Water Footprint # 3 (AD 200-300)

In the Severan period, the large cistern was created, and while it was certainly not as large as the *castella aquae* at Porta Romana, Porta Marina (IV, viii, 2) or under the Terme di Nettuno (II, iv, 2), it is on the larger end when compared to the estimated capacities of other cisterns in the city.[483] While this water reserve helped to supply the Terme del Faro, we also have concrete evidence for another lead pipe line feeding this bath from the *cardo* at this time period (feature 78), so there would be a significant amount of water left over. The two channels and the lead *fistula* on the north face (82, 107, 46) also point to a substantial amount of water exiting the cistern in this direction. One of these likely supplied the contemporary fountain in room 4 of IV, ii, 2-3 (feature 46), while another fed the *frigidarium* of the Terme del Faro (IV, ii, 1, room 8) through the curved niche (feature 47). Building upon this idea of surplus water, comes the evidence from the small rectangular structure at the top of the stairs (feature 35), which acted as a distribution box for water in several different directions. If we accept even the position of this box as original, we can then assume pressurized water could be pushed up to this height (ca. 3.00 m from current ground level), well above any of the other water features in the *insula*.[484] Features 45 and 37 are also likely connected to the wider distribution of water from the large cistern. The *fistula* pipe (feature 76) that runs through the length of the northern courtyard dates from the 3rd century, and instead of supplying the courtyard fountain (feature 68), more likely was connected to another structure. The brick piers in the insula's central hallway date from this period, as do the channels passing through the bottom of the piers (features 38, 39). As mentioned in the discussion of the preceding building, these features, now exposed, belong to a period when the internal level of the courtyard was higher, therefore placing them securely underground. The roughly built drain (feature 40) in the west wall of room 01 of IV, ii, 5 is difficult to date, as it exists at roughly the same depth as the sewer in the same room (feature 84). Additionally, the fill material (2 nearly complete amphorae laid on their side) of feature 84 indicate a conscious destruction of this system in the 3rd century.

Roman Water Footprint # 4 (AD 300-600)

The archival photo described above (SBAO B3036, Figure 4.132) shows that even though the internal arrangement of the insula was split into an eastern and western section, a new smaller basin (feature 70) was created for those passing down the central corridor. This also proves the late continuity of the courtyard fountain well into this period.

Conclusion

Building IV, ii, 5 always had a hydraulic and spatial connection to its neighboring buildings, especially the Terme del Faro. The *medianium*-style rooms survived the insertion of the large cistern to the north, yet the central sewer system of the building did not. This system turned out into the central corridor of the insula and was part of a larger insula-wide sewer project of the 3rd century. However, the water supply system of the well and downshaft in the northern part of the building remained functional throughout these changes.

[483] RS I, 103-140 for all the non-thermal cisterns in Ostia and their estimated volumes.
[484] SBAO B3036 and B3037 for a before and after look at this internal courtyard.

IV, ii, 6: Caupona del Pavone

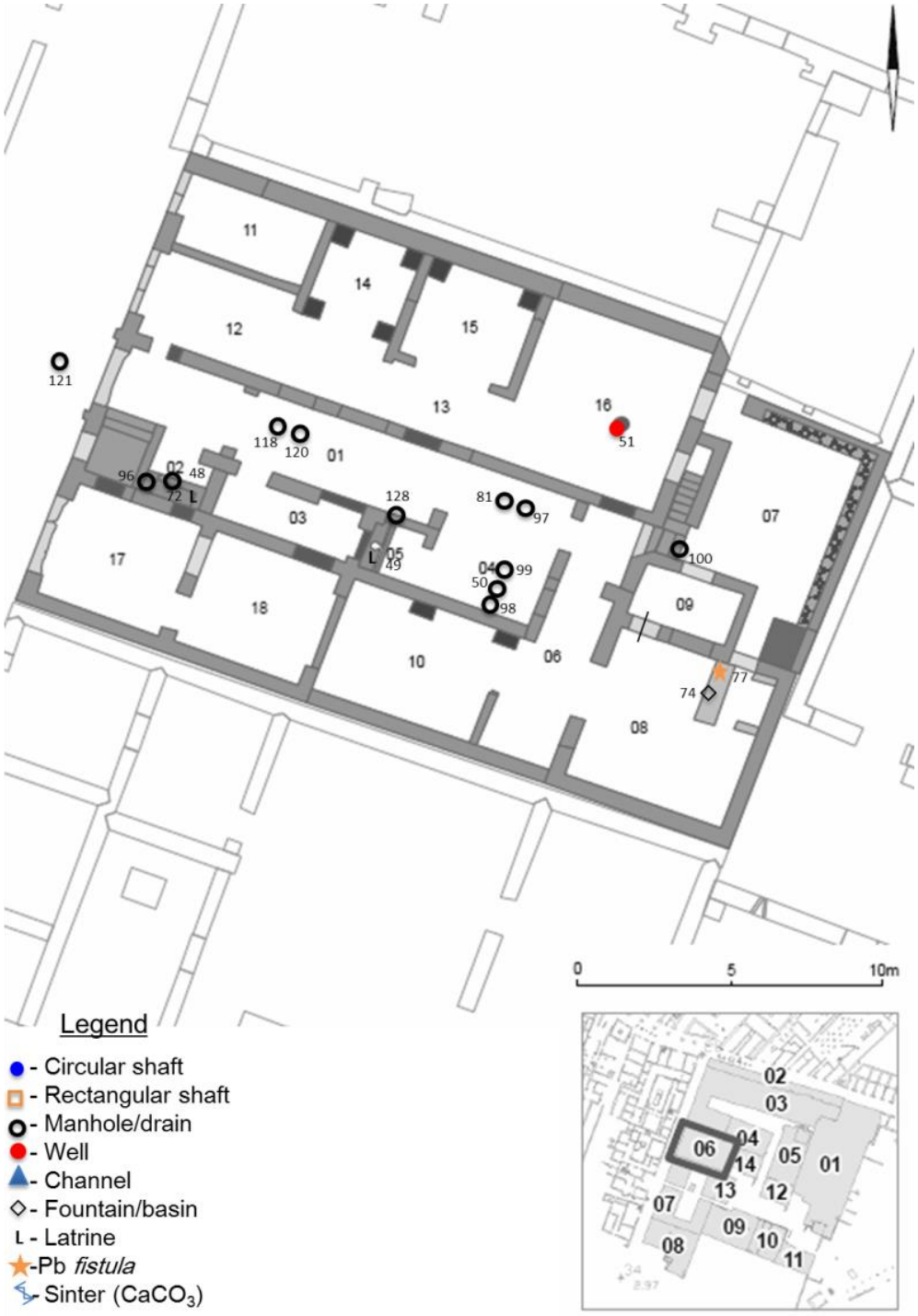

Figure 4.137: Identified water features in IV, ii, 6: the Caupona del Pavone (after Stöger 2011, 116, fig. 5.61).

Location in insula/in relation to other bldgs.

This building is located on the western side of the insula, with four doorways which all open onto the Via della Caupona, a side-street of the *cardo* (Figure 4.137). Building IV, ii, 6 lies between building IV, ii, 03 to the north, and the rooms of IV, ii, 07 to the south. The eastern side of the building is bounded by the rooms and courtyard of IV, ii, 14 and IV, ii, 4. The building has no connection with the inner spaces of the insula, and its four wide doors on the street make it resolutely outward-facing.

History of Excavation and Restoration

This building was excavated in July 1940 and restored shortly thereafter by I. Gismondi. Restoration applied especially to the internal rooms and their high number of preserved wall paintings.[485] The walls and their paintings survive to around 2.20 m, especially in the rooms farthest from the street. Restorations continued sporadically in the 1960s.

Phasing and Comments

The majority of the building's core is Hadrianic in date, and it was likely a luxurious private house. The floor level was also changed in this period, as is visible under the well head in courtyard 16, where an earlier *opus spicatum* floor was covered by the later black mosaic tesserae. In the Severan period (AD 193-235) the southern half of the building was adorned by the luxurious wall paintings that are visible but rapidly fading today. Based on stylistic and technical comparisons with similar motifs, these paintings of semi-nude youths floating on a blood-orange colored background, vegetal motifs, and simple red bands on white backgrounds can be dated closer to AD 200-220 (Figure 4.138).[486]

Figure 4.138: North wall of room 9 in 1970 at left (Gasparri 1970, Tav. X), and in 2015 at right (by author).

To this Severan phase can be attributed the insertion of the geometric mosaics and supporting brick piers in several rooms (10, 14, 15), as well as the closure of several doors on the north half of the building with variations of *opus vittatum*.[487] The only trace of previous structures comes from a well in room 16, with the original depth accessible down a staircase in room 7. Given its depth, it is likely from the earliest period of the insula's history, and can be dated to the late Republican or early Augustan period.[488] Some late examples of *opus reticulatum* are known in the northeastern part of the building in this period, placed between *opus vittatum mixtum* piers and intersected by a band of brick.[489] In a 3rd phase, the

[485] Gasparri 1970, 5-7 for a full description of the excavation.
[486] Gasparri 1970, 12-14, 32, 33.25. This section on phasing draws upon Gasparri's close reading of the masonry and decoration.
[487] Becatti 1961, 176-7, n. 324-6.
[488] RS I, 46 (sch. 33) for this well and access room.
[489] Van Dalen 1991, 263.

richly decorated room 8 had its lower wall band decorated with a design of false *giallo antico* marble with red veins. The final phase of this part of the structure saw its dramatic change from a domestic space to an inn (*caupona*) of some kind. This is when the bar counter with its mounted marble steps was inserted into room 8 (Figure 4.139), and the building assumed the function that now to defines it. To this period can also be dated the decorations from room 11, 14, 17, and 18.[490]

Figure 4.139: View looking south at the bar counter and stepped shelves of room 08 in IV, ii, 6.

As for the final phase of the building's life, we are only informed by a large pile of tesserae that were found in room 3 as unused spolia.[491] In general, it is difficult to precisely define the exact functions and differentiations between *popina, stabulum, caupona,* but the number and size of the rooms, the side street location of the bar, and the high degree of painted decoration, point to a relatively higher class of clientele visiting and staying here.[492] The stairs immediately next to the central entrance point to additional rooms accessible on upper floors.

Water Features Chart

The following hydraulic features are located in building IV, ii, 6 (Table 4.29).

[490] Gasparri 1970, 27 for a revival of Pompeian 1st Style wall painting in the 3rd century.
[491] Becatti 1961 (=SO IV), 156 for this description.
[492] Hermansen 1982, 191-195 for an overview of the terminology.

IV, ii, 6 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
1	manhole	hallway across from doorway into room 3	118	2
1	sewer	hallway across from doorway into room 3	120	2
2	latrine	directly S of main entrance	48	4
2	drain	W side of latrine	96	4
2	drain	N side latrine	72	4
4	drain cover	SE floor drain	50	3
4	sewer	N from cover 50	99	3
4	sewer	S from cover 50	98	3
4	drain cover	NW floor drain	81	2
4	sewer	under features 81-96	97	2
5	latrine	W part of room 4; single seater	49	3
5	drain	NE corner of latrine 49	128	3
7	drain	under lowest courtyard step	100	2
8	basin	within bar counter	74	3
8	fistula	feeds small basin within bar counter	77	3
16	well	in center of room	51	1

Table 4.29: Identified water features in building IV, ii, 6.

Description of Water Features

Entering the third doorway from the north along the Via della Caupona, a shallow rectangular basin is placed on the floor of the first small room on the right hand side. Given the drain (feature 96) sloping down toward the street, this has been generally interpreted as a latrine (feature 48), although the low walls running around its 3 external sides could also make it a simple industrial drain.[493] An additional wide drain pierces the northern side of the latrine (feature 72), implying that it also served to drain excess water from hallway 1.

Proceeding down the *opus spicatum* hallway (room 1) is a marble fragment mostly covered by vegetation. This fragment (feature 118) is directly across from the doorway into room 3 and is likely a modern safety feature to cover the 1.40 m deep shaft above a sewer line.[494] This sewer line is built with latericium walls, although the typical bipedales leaning against each other (cappucina) are absent. West of the shaft the sewer (feature 120) continues under the length of the hallway and into the sewer line under the Via della Caupona (feature 121). To the east, this sewer continues to connect with drains 97 and 100 (

Figure 4.140).

[493] RS II, 136 (sch. 126a) identify this as a 3rd-4th century fountain basin; SBAO Colore 511, 116. The latrine is almost completely restored with modern concrete.

[494] It is labeled as a water feature, since there must have been some kind of drain cover here *in antiquo*.

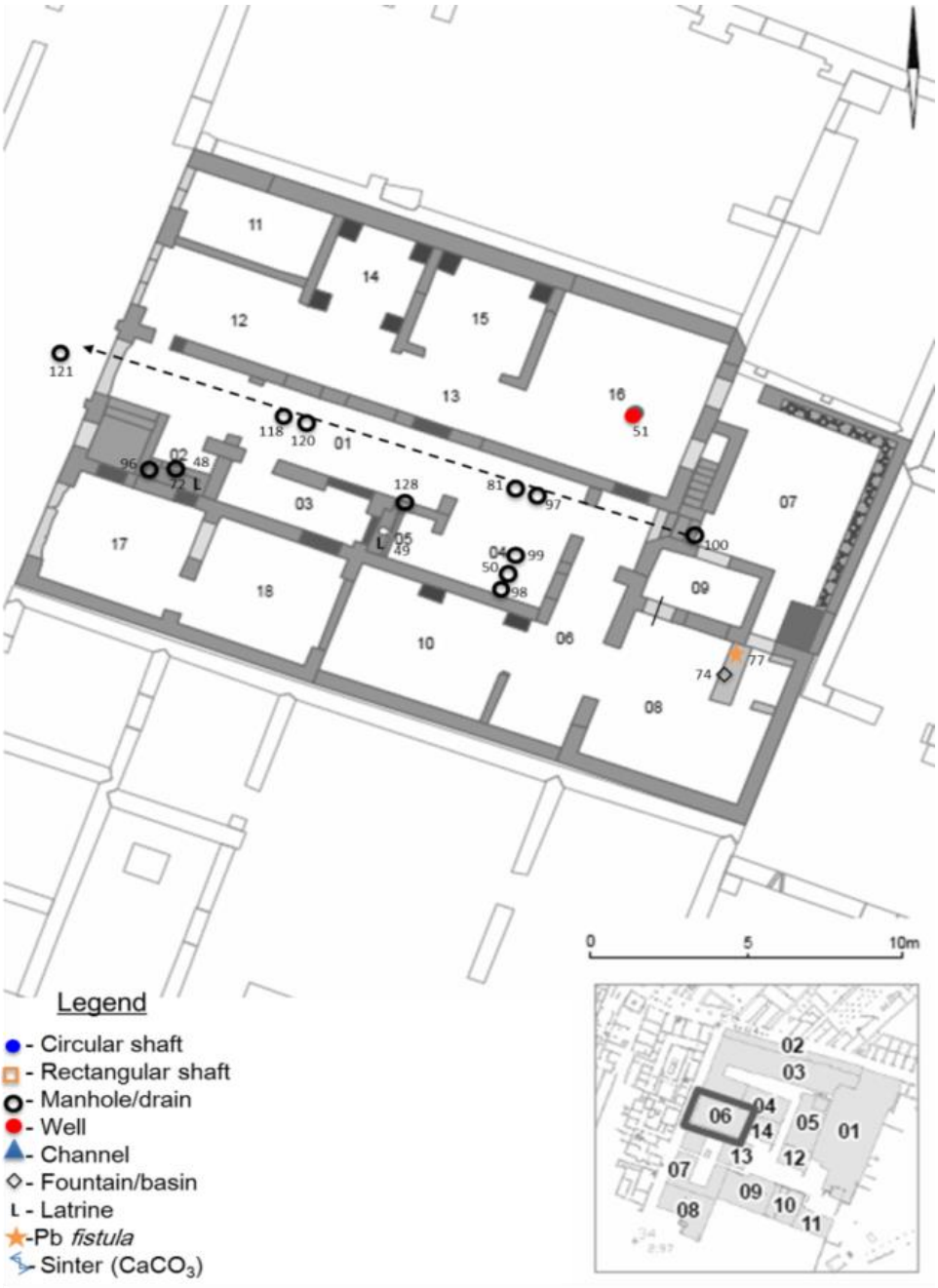

Figure 4.140: Total length of sewer 100 indicated in black dotted line (after Stöger 2011, 116, Fig. 5.61).

At the eastern end of this hallway is room 4, which has two drains in the floor. Given the sloping of the floor here, it is assumed that this room was exposed to the sky. Both of these drains are simple holes in square travertine blocks (features 50, 81), and are only 0.40 m apart.[495] The northern drain (feature 97) connects with and is similar to feature 120 in the same hallway, although east of the manhole the bipedales roofing is preserved. The southern drain (feature 99) is much more modest in its preserved size, but also has a cappucina-style roof like feature 97. This drain runs perpendicular (north) to feature 97, and is connected to a smaller secondary drain, feature 98, which comes from the south and has a single flat *bipedalis* roof. A rough repair of the floor *in antiquo* is indicated by irregularly shaped pieces of marble placed directly into the surrounding white mosaic tesserae (Figure 4.141).

[495] SBAO B1077 (inv. 3566) shows these drains.

Figure 4.141: Looking north at drain cover 50 in IV, ii, 6 with *in antiquo* repair visible on the right side of the image. Channels 99 and 98 are indicated by the dashed line.

Within the small space attached to this internal courtyard is a single-seater latrine (feature 49) with a modern keyhole seat (Figure 4.142). It has a drain (feature 128) that initially slopes down to the north. However, as no trace of this drain is visible within the sewer line running down hallway 1 (feature 120), drain 128 must turn 90° and drain towards the street.

Figure 4.142: View looking west at latrine 49 in room 5 of IV, ii, 6.

Entering into the caupona proper, we see the black and white geometric mosaics and the fading wall paintings. In the east corner of room 08 is a bar counter with a small stepped marble countertop against the back wall of the room, covering the earlier wall paintings.[496] Like many other bar counters in Ostia,

[496] Hermansen 1982, 167-169; Similar to the stepped bar in other such establishments in Ostia (e.g. Caseggiato del Termopolio (I, ii, 5)).

this one has a barrel vaulted opening with a square basin (feature 74) at roughly knee height. This basin would have been filled with running water from a lead *fistula* pipe (feature 77). Unique in Ostia, the underside of this arch was decorated with green and red fish painted on a white background, visible to a customer only when standing immediately in front of the counter. Regardless of what had already been consumed at the taberna, the rippling water in the basin would appear to contain moving fish (Figure 4.143). A short graffito is carved into the back of the bar, perhaps by a bored bar tender.[497]

Figure 4.143: The fish decorating the underside bar counter: view in 1970 at left (Gasparri 1970 Tav. VII), view in 2015 at right (by author).

Continuing into the back courtyard of the *caupona* (room 7), one descends several steps almost a meter down into a rectangular space with a bench on its north and east sides. A narrow rectangular drain (feature 100) is set into the final step of these stairs. This is the final feature in the long sewer (ca. 20 m) that runs down almost the entire length of the caupona. There is a small niche in the south-east corner of this courtyard that was partially blocked by the insertion of room 9. The aedicula niche preserves the building's eponymous fresco of a peacock with several objects surrounding it (Figure 4.144).[498]

[497] See Appendix 2 for this.

[498] Bakker 1994, 91 dates the *aedicula* to the Severan or first half of the 3rd century.

Figure 4.144: Remains of the eponymous peacock fresco in IV, ii, 6 in 2015.

The courtyard holds the last surprise of the building with a subterranean well accessible down seven stairs. The well (feature 51) retained its Republican-Augustan shape, surviving several changes to the ground level, and reaching a height of ca. 2.80 m for its shaft. The well was threby accessible both from this subterranean access point, as well as from room 16 of the *caupona* from a pepperino well-head (Figure 4.145,Figure 4.146).[499]

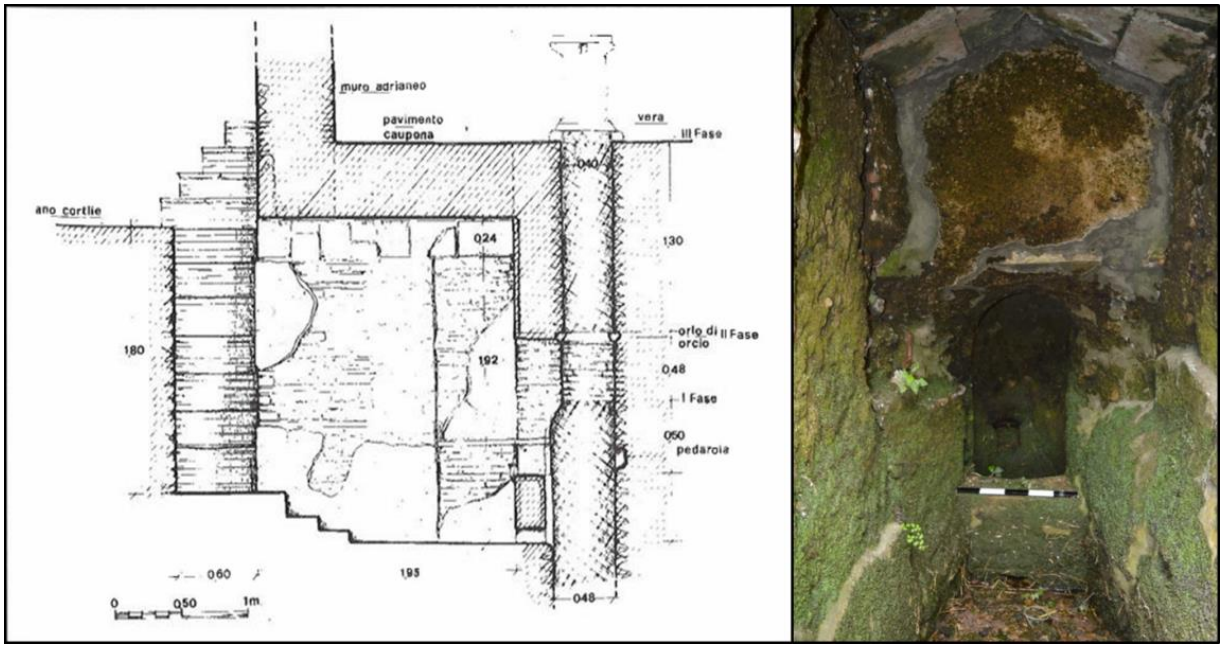

Figure 4.145: Looking west at the small access room for well 51 on the right, cross section of the well and its access room at left (RS I, 47, Fig. 56b).

[499] Becatti 1961, 9; Kieburg 2014, 176; RS I, 46 (sch. 33).

Figure 4.146: View looking up the shaft of well 51 in the Caupona del Pavone.

Infrastructure Chronology

Roman Water Footprint # 1 (4th century B.C.- AD 50)

The well (feature 51) clearly played an important role throughout the entire history of the building. As the building is closed off from the rest of *insula* IV, ii, this well would have acted as the main water source for close to 200 years.

Roman Water Footprint # 2 (AD 50-200)

As mentioned above, the majority of the structure dates from the Hadrianic period, when we can identify a raise in the ground level in this area. Taking advantage of this raising, the sewer line was installed running the length of the ca. 20 m long hallway 1 (features 100, 97, 120). This ca. 0.50 x 1.00 m sewer is the most substantial in the entire insula and has a clear connection to the larger urban sewer network running under the Via della Caupona, which was unknown previous to this research. The walls of this sewer are of a similar *latericium* as the wall dividing room 1 from rooms 12 and 13. Its size is comparable to the sewer branch running underneath the *cardo maximus* (feature 114), which points to its high quality and the expense of its construction.[500]

Roman Water Footprint # 3 (AD 200-300)

The drain in the southeast part of room 4 (feature 99) can be dated to this period. This is based on the adjacent large tesserae placed to direct water towards the drain. Perhaps the northern drain cover (feature 81) was often blocked by courtyard detritus and required an extra adduction point. Little more can be said about the direction of drain 98, which extends southward from feature 50 into the covered rooms of the building. In the later part of this period (late 3rd century CE) the building assumed its role as a *caupona*, and it subsequently gained architectural features typical to the increased movement of people. The bar counter was installed in the room furthest from the road together with its rippling fish basin (feature 74) fed by a lead *fistula* pipe (feature 77). Returning to the courtyard (room 4), a small *opus vittatum* wall was installed that reduced the size of this space, but offered the perfect nook for a single-seater latrine (feature 49) which drained not into the hallway sewer, but made its own linear way

[500] Meiggs 1973, 374, note 3, dates this building as Hadrianic around a Trajanic core.

under the street to the west (feature 128). A single seat latrine meant a touch of luxury as is known from other contemporary wealthy homes around Ostia.[501]

Roman Water Footprint #4 (AD 300-600)

The final evidence for water flow in this building comes from the latrine/basin next to the main entrance (feature 48), which simply was affixed to the existing drainage system created by the earlier latrine (feature 49).

Conclusion

Building IV, ii, 6 was always outward facing, both spatially and hydraulically. It relied only on ground water when it was a private domus, and added an aqueduct-fed feature only when it became a public caupona, requiring more water. The large sewer line within the building also attests to this inward facing attitude, as the building never connected to the sewer network created between nearly all other buildings of the insula in the 3rd century.

[501] See Chapter 5 for examples from the Domus del Protiro (V, ii, 4-5), and the Domus della Fortuna Annonaria (V, ii, 8).

IV, ii, 7

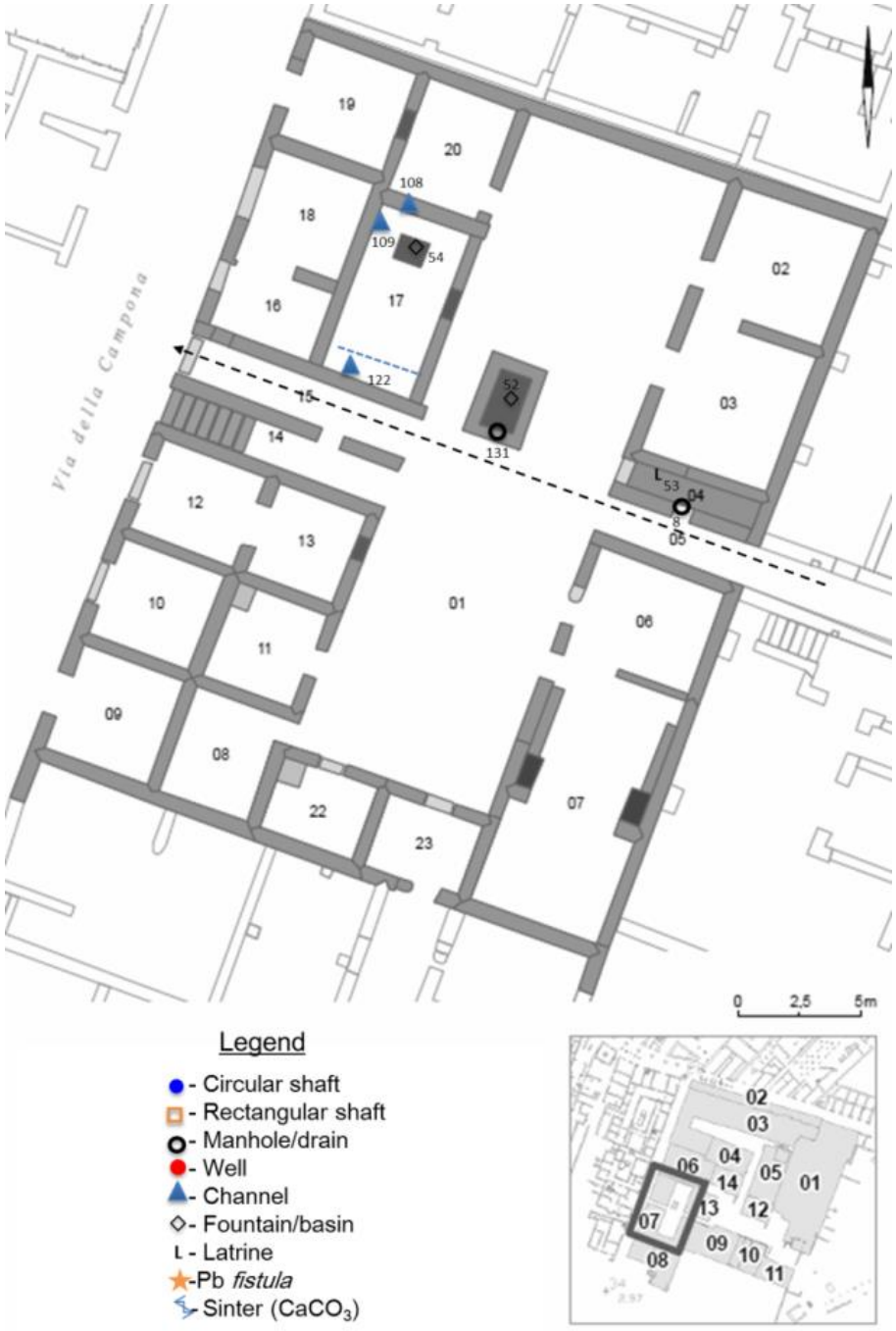

Figure 4.147: Identified water features in IV, ii, 7 (after Stöger 2011, 124, Fig. 5.68).

Location in insula

The building is located in the southwest section of the insula and is accessible both from the Via della Caupona and from the internal southern courtyard of the insula (Figure 4.147). It lies directly south from the Caupona (IV, ii, 6), and presents six open *tabernae*-like rooms onto the Via della Caupona. Building IV, ii, 7 lies directly north of building IV, ii, 8.

History of Excavation and Restoration

Calza likely excavated this building also in 1940, although exact descriptions of it are lacking. The building was restored in the 1960s, when coins ranging from Nerva to Gallienus were found.[502]

Phasing and Comments

The current layout of the building has a ring of rooms opening onto a central courtyard and a rectangular fountain in the center. A central hallway allowed movement from the Via della Caupona into the center of *insula* IV, ii and divided the building into a northern and southern half. A single staircase south of the building's main entrance hallway (room 14) provides evidence for at least one upper floor. The south and southwest sections of the building date from the Hadrianic period; the north and northeast sections were built in a slightly later phase against the existing walls of IV, ii, 6.[503] In this late Hadrianic-early Antonine phase, partition walls were added between rooms 19-20, 1-17, and 1-13. These are thought to be the latest walls in Ostia to have reticulate facings of high quality.[504] In the mid-3rd century CE there was more building activity here.[505] It is interesting here to mention that the building lacks brick piers supporting its walls like nearly every other building in the *insula*. In room 2 and 3 a large amount of marble revetment was found at the moment of excavation, evidence of later spoliation processes.[506]

Water Features Chart

The following hydraulic features are located in building IV, ii, 7 (Table 4.30).

IV, ii, 7 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
1	fountain	in building courtyard	52	3
1	drain	S wall of fountain 52	131	3
4	latrine	N side of corridor 4	53	2
5	sewer	runs E-W through room 5	8	2
17	basin?	along entire S length of room	122	4
17	fountain (?)	N half of room; L shape	54	3
17	channel	W wall; NW corner	108	3
17	channel	W wall; NW corner	109	3

Table 4.30: Identified water features in building IV, ii, 7.

Description of Water Features

All of the water features are located in its northern half of the building. Starting in the main courtyard, there is a rectangular fountain (feature 52).[507] The fountain basin is quite thick and large, and it is unclear whether it was roofed. Its location north of the main hallway acknowledges a high degree of movement in this area (Figure 4.148).[508] A circular ceramic drain (feature 131) is present at ground level on its

[502] GdSc 32, 119-120 (22-2-1960); Stöger 2011, 125.
[503] Stöger 2011, 129; Van Dalen 1991, 265-269.
[504] Van Dalen 1991, 276 for the study of late usage of *opus reticulatum*.
[505] A coin of Gallienus (AD 253-268) was found here.
[506] Stöger 2011, 128; Spolia material was also found nearby in room 3 of IV, ii, 06.
[507] RS II, 137 (sch. 127) for this basin.
[508] Stöger 2011, 193, Fig. 6.22 for fountains respecting central corridors of movement and lines of sight in the insula.

southern face, although this is only visible in the original excavation records. A rectangular latrine (feature 53) was placed on the eastern side of the building, within room 4 (Figure 4.149). This latrine opened onto the corridor connecting the internal courtyard of the insula to the Via della Caupona. From archival photographs, the latrine drains can be identified as emptying into the larger sewer line (feature 8), which runs in an east-west direction under hallway 5. This sewer continues westward toward the Via della Caupona.[509]

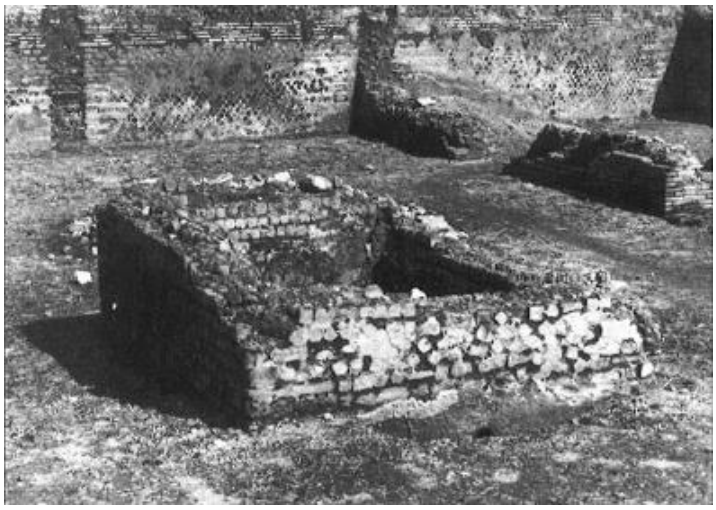

Figure 4.148: View looking north at feature 52 and its drain 131 in the foreground (SBAO D1168).

Figure 4.149: Looking east at the latrine 53, with its drain indicated by the dashed white line (SBAO B3707).

The final cluster of water features visible in the building is in room 17 (Figure 4.150). The strangest is a feature (feature 54) that is shaped like a single-seater reclining sofa, or an upright L shape (Figure

[509] GdSc 32, 124 (10-4-1960); Merletto 2000, 301 for a typology of Roman latrines. According to Merletto, this narrow rectangular format is the most common shape for latrines across the Roman world.

4.151,Figure 4.152). It is composed of an odd agglomeration of different types of bricks and tufa stones, and sits on a low foundation of bricks. The north wall is completely flat, except for an apparent entry point for water that is covered by a very thick *bessalis* brick (Figure 4.153). This feature is identified tentatively as a fountain due to the presence of several holes for water supply on its northern and western faces. Water flowed downward and out through its southern face, although there is evidence that an additional water exit hole was blocked by roughly filling in the space under two leaning *bipedales*.

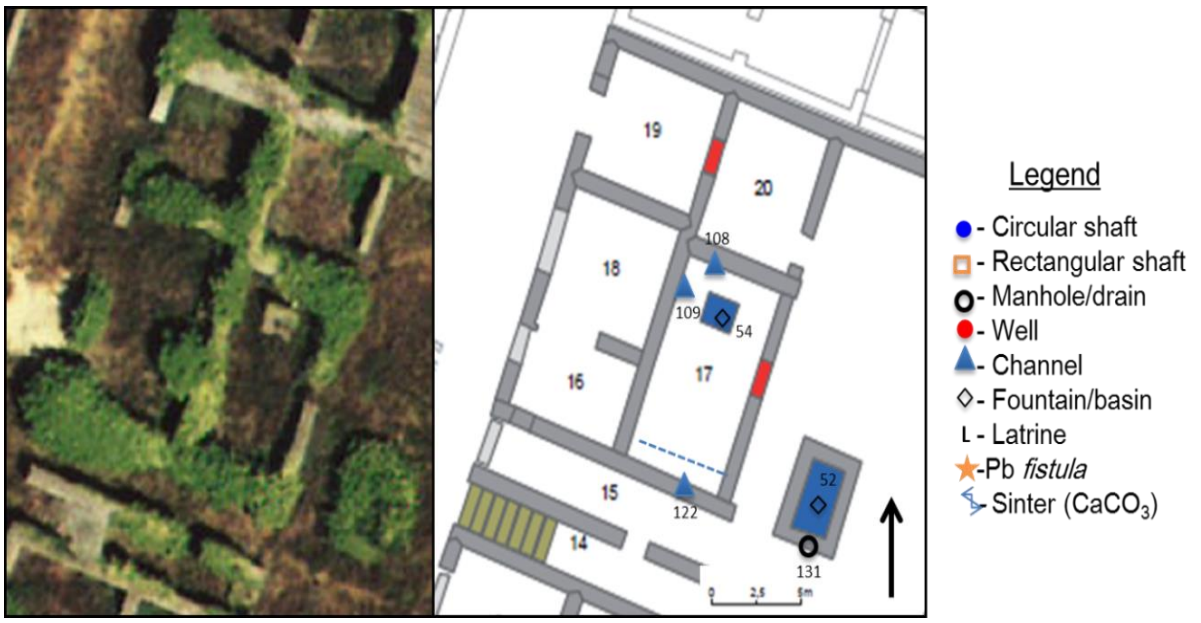

Figure 4.150: View of the northwest corner of IV, ii, 7 from above at left (Mannucci 1995, Pl. 44), and with identified water features on right (Stöger 2011, 124, Fig. 5.68).

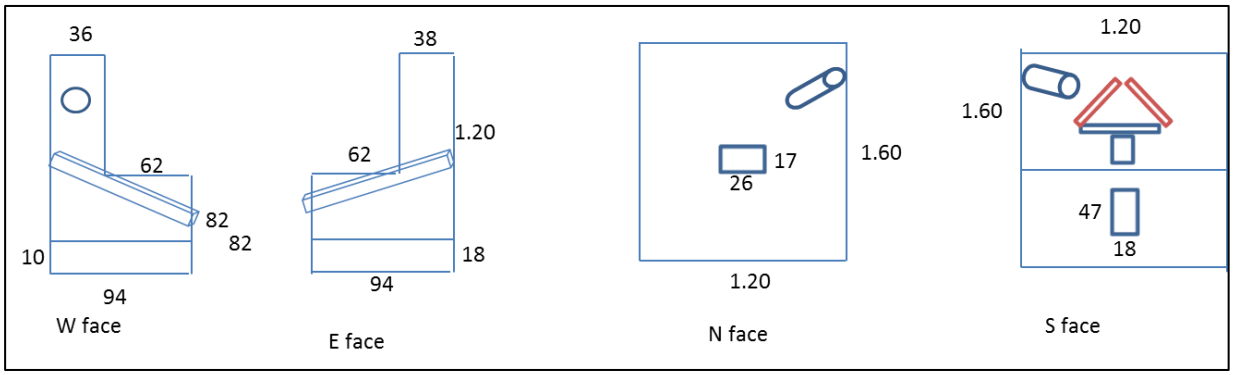

Figure 4.151: Schematic measurements of feature 54 in building IV, ii, 7.

Figure 4.152: West face of the feature 54, showing its L shape, and possible supply line made of two *imbrices*.

Figure 4.153: View of the north face of the feature 52, with the thick *bessalis* brick covering a possible supply feature.

Evidence for the blocking up of water channels is also present in the northwest corner of this room, where two channels (features 108, 109) were closed by a rough mixture of brick and mortar pieces, fragments of ceramics, and burned glass (Figure 4.154). These channels are at the same height as the supply channel on the west face of the fountain, although the relationship between these features is unclear. Also in room 17 is a curious feature located on the southern wall. This has been interpreted as a bench, however it appears more like a basin with an internal partition, similar to feature 58 in the neighboring building IV, ii, 13. The basin (feature 122) is very roughly built and contains some stamped 1960s reconsolidation bricks in its northern wall. It may have had a drain in the south into hallway 15, although this is where the doorway into the room was closed at a later point with a very rough reticulate wall.

Figure 4.154: View of feature 109, a possible closed channel in the northwest corner of room 17.

Infrastructure Chronology

Roman Water Footprint #1 (4th century B.C.- AD 50)

No preserved water features date from this period.

Roman Water Footprint # 2 (AD 50-200)

The latrine (feature 53) and its sewer (feature 8) are the only water features that date from this period. The sewer drained to the south for a short distance before turning 90° to the west and leading out to the Via della Caupona.

Roman Water Footprint #3 (AD 200-300)

The rectangular courtyard fountain (feature 52) was built in this period out of tufo cobbles, and attached itself to the existing drainage line via a drain(feature 131). The relatively late date for the central courtyard fountain could be explained by the blocking up of room 23 and the access into IV, ii, 8. If the irregular structure (feature 56) to the south of IV, ii, 8 is interpreted as an earlier fountain (see next section, IV, ii, 8), then the insertion of room 23 would represent an obstruction or reduction in access to this water source in the 3rd century. Also in this period we see the creation of the fountain like structure (feature 54) and its associated channels (features 108, 109). How the pipe on its western face (made by 2 imbrices) was fed, or where the water eventually flowed remains unclear given the extreme density of vegetation in this room. Perhaps the wall closing the east side of room 17 also dates to this period, restricting access to this water feature. A threshold ca. 0.30 m above the current ground level indicates a difference in the 3rd century ground level here. It is unclear how far into this period the sewer

(feature 8) of latrine 53 functioned; a coin of Maximius Thrax (AD 235-238) was discovered in the fill of the sewer in 1960, offering a *terminus ante quem* of its disuse.[510]

Roman Water Footprint # 4 (AD 300-600)

From this final period of the building's life, we have the evidence from room 17, which lost one of its entrances with the creation of basin 122. The lack of waterproof *opus signinum* and the normal thickness of the walls make it unlikely that the entire room was flooded.[511] Given the height of the threshold (ca. +0.30 m above ground level) on the eastern side of room 17, perhaps basin 122 was sunk into the ground.

Conclusion

Although little is known of the water systems of this building, its multi-seater latrine and large courtyard basin indicate that the many different activities were occurring within its rooms. The position of these two water features also indicate that building 8 was deeply connected with other buildings of the insula, and that they were intentionally placed to take advantage of the flow of people from the street into the southern part of the insula. The unusual water features in room 17 may indicate some kind of specialized industrial or economic activity.

IV, ii, 08

Figure 4.155: Identified water features in IV, ii, 08 (after Stöger 2011, 131, Fig. 5.76).

[510] GdSc 32, 124 (10-4-1960) for the coin.

[511] The room's dimensions are ca. 4.00 x 7.50 m. Given the average *opus signinum* height in Ostia of ca. 2.00m that equals 60m^3 (=60,000 l). The large Severan cistern (IV, ii, 5, feature 36) has a capacity of 98,000 l, however it has substantially thicker walls and *opus signinum* coating.

Location in insula

The building is located on the limit of the site's excavated area, in the southwest corner of the insula, where the Via della Caupona runs into the area now used for modern agricultural activities (Figure 4.155). Building IV, ii, 8 delimits the western side of a large open space directly south of insula IV, ii that is currently more than 1.00 m lower than the ground levels of the buildings in this part of the insula (Figure 4.156). Building IV, ii, 8 was originally connected to IV, ii, 7 to the north through hallway 12. Structurally, the building is very outward facing and has very few internally connected rooms. It is divided into an eastern and western section by hallway 12; the western section has doorways opening onto the Via della Caupona and a small square to the south, while the eastern section is made up of four small rectangular rooms. Unlike the western half, these four rooms continue the architectural line of the southeastern corner of IV, ii, 8. The two doors fronting the Via della Caupona are separated by a small staircase, offering access to upper floors.

Figure 4.156: View of the external east face of building IV, ii, 8 where it intersects with the south wall of building IV, ii, 9.

History of Excavation and Restoration

As with IV, ii, 7, little is known of the initial excavation of this structure, although it is safe to assume Calza also excavated this building in 1940. The 1960 restoration unearthed a small *giallo antico* marble head from this building.[512]

Phasing and Comments

Based on the identified brick stamps and the quality of the *opus reticulatum*, the building dates to the Hadrianic period.[513] At a somewhat later stage, supporting pillars were added along the four sides of room 07 in *opus vittatum*, while two projecting masonry arms were added to the south of room 11.

[512] GdSc 32, 125 (29-4-1960) for this discovery
[513] Stöger 2011, 131.

Water Features Chart

The following hydraulic features are located in building IV, ii, 8 (Table 4.31).

IV, ii, 8 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
4	basin	external SW wall of room 4	73	3
12	rectangular downshaft	W side central corridor	55	2
13	basin?	Rectangular structure S of room 6	56	3

Table 4.31: Identified water features in building IV, ii, 8.

Description of Water Features

This building has three water features. Built against the street side of room 4 is a now-lost rectangular basin (feature 73), which was recorded by Calza during the initial excavation. The second feature (feature 55) is a rectangular downshaft on the west side of hallway 12, and although it exists for the entire length of the preserved wall, appears to have been heavily restored during the 1960s. More interestingly for local water usage is feature 56, an irregular rectangular basin that seems added onto an existing support structure. Together with the suppFigure 4.157ort walls added onto the south side of room 11, this continues the hallway of room 12 (Figure 4.157).

Figure 4.157: Aerial view of IV, ii, 8, with feature 56 indicated by the dashed lines (after Mannucci 1995, Pl. 43, 44).

Infrastructure Chronology

Roman Water Footprint # 1 (4th century B.C.- AD 50)

No preserved water features date from this period.

Roman Water Footprint #2 (AD 50-200)

The rectangular downshaft (feature 55) dates to this period of Hadrianic construction, and its position on the external wall of a complex of buildings suggests its function was to drain rain water. No sinter was discovered inside the recess.

Roman Water Footprint #3 (AD 200-300)

The irregular rectangular basin (feature 56) in the south of the building can be dated contemporary with the *opus latericium* support arms added on the south of room 11. The creation of this freestanding basin coincides with the blocking of the hallway between this building and IV, ii, 8, and may represent an independent source for water supply. As there are no additional structures to the west, this may substantiate its identification as a small courtyard fountain, since it would be directly accessible from the Via della Caupona. Feature 73 is tentatively dated to this period, since it is the period when structures of all kinds began to encroach upon the street space.[514] A targeted geophysics project carried out in 2015 highlighted the potential for future non-invasive research in this areaFigure 4.158 of Ostia, and for further integrating insula IV, ii into the wider urban fabric of the city (Figure 4.158).[515]

Figure 4.158: Preliminary geophysics results, with building IV.ii.8 in the black box (after Sonnemann *et al.* 2015, 11, Fig. 3).

[514] Gering 2013, 262 for examples of this process.
[515] Sonnemann *et al.* 2015.

Roman Water Footprint # 4 (AD 300-600)

No preserved water features date from this period.

Conclusion

Building V, ii, 8 appears to have been mostly disconnected from the other buildings of the insula, although it shared a hallway with building IV, ii, 7. Although its basins (features 56, 73) suggest that it was responsible for its own water supply, the preliminary results of the geophysics indicate that there are many more unexcavated structures near this building: its modern liminal situation cannot be extrapolated for antiquity.

IV, ii, 09 and IV, ii, 13

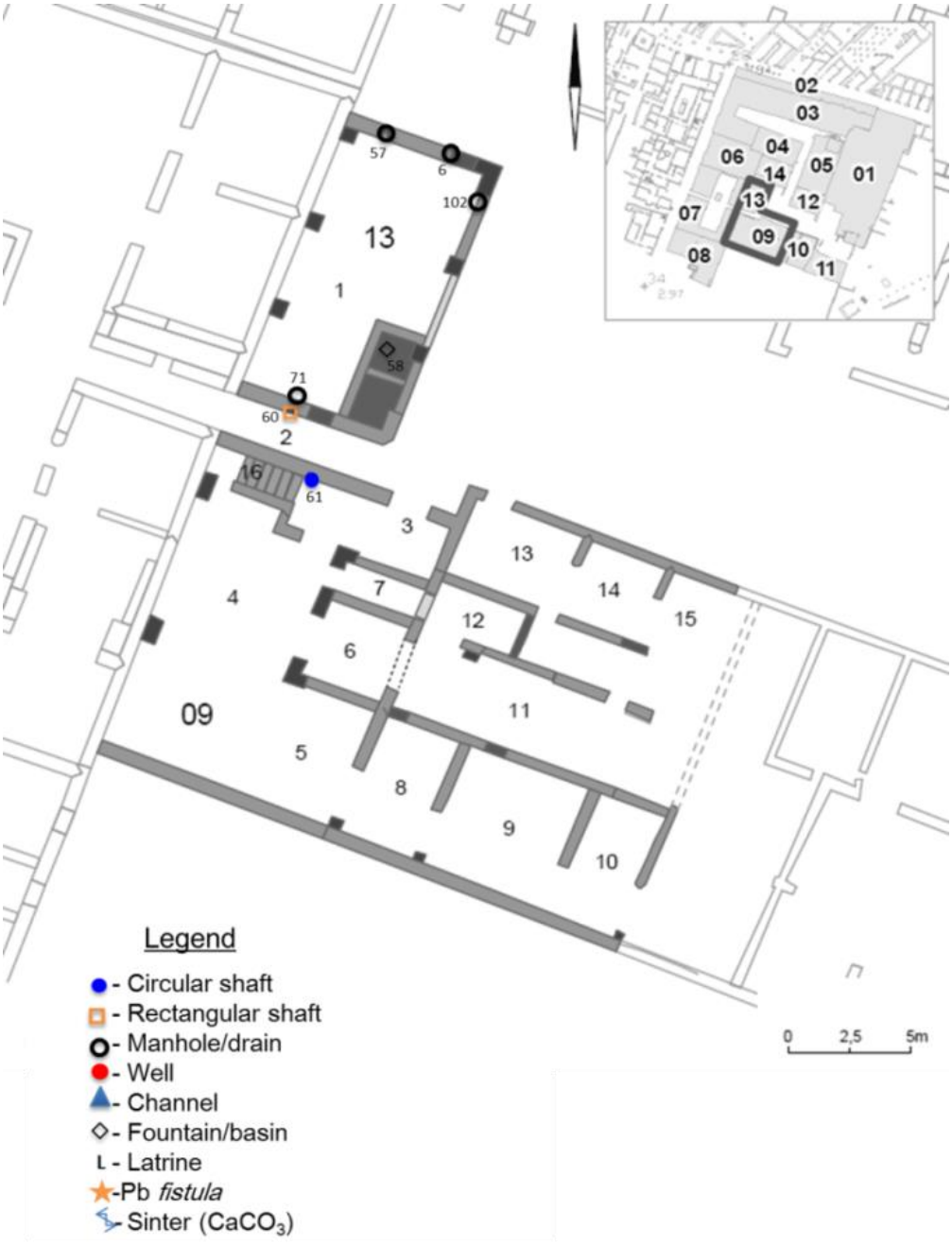

Figure 4.159: Identified water features in IV, ii, 9 and 13 (after Stöger 2011, 134, Fig. 5.80).

Location in insula

These two buildings form an L shape on the internal side of the large southern courtyard of *insula* IV, ii (Figure 4.159). The buildings are directly to the east of the IV, ii, 7. They also lie along the southern border of the insula, with their backs bordered by the large dividing wall of Antonine *latericium*. The ground level within IV, ii, 9 is ca. 1.00 m higher than the current ground level south of this wall.

History of Excavation and Restoration

These two buildings are studied together because of their intertwined building history. The buildings underwent restoration in the 1960s, as indicated by modern brickstamps.

Phasing and Comments

The eastern section of IV, ii, 9 dates from the Trajanic period with its *opus reticulatum* and tufo quoining.[516] In the mid-2nd century CE the western section was completely rebuilt against IV, ii, 7. The rooms 8-9-10 possibly acted as a *medianum* style apartment, similar to the eastern rooms (rooms 6, 7) in IV, ii, 5.[517] At a later point in the 3rd century supporting piers were added in the western section (rooms 1, 4), as well as along the southern wall (rooms 8, 9, 10). In this period doorways were closed up in rooms 1, 8, 9, and 12. However, the doorway closed in the south wall of room 1 appears modern, given the presence of modern bricks *below* the travertine threshold. In room 1 the threshold on the eastern side of the room is ca. 0.40 m above the current ground level, and the piers placed around the room have ca. 0.40 m of rough block and brick foundation visible before a bonding course and subsequent levels of brick courses. Together, this implies a higher ground level, otherwise there would need to be two small steps on either side of the travertine threshold to access the room. Room 1 is divided from the rest of the rooms by a hallway (room 2), which continues the eastern hallway of IV, ii, 7. Building IV, ii, 9 has a central internal courtyard (room 4), which is accessed in the south by a hallway that runs parallel to the south wall of the building. The northern rooms of the building are accessed from the southern courtyard of the insula through room 13. The building is heavily overgrown and mostly inaccessible.

Water Features Chart

The following hydraulic features are located in buildings IV, ii, 9 and 13 (Table 4.32).

IV, ii, 9, 13 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
1	drain	N wall; E corner	6	3
1	drain	cappucinna shape through N wall	57	3
1	drain	half cappuccina shape, E wall NE corner	102	3
1	fountain basin	double basin in SE corner	58	4
2	drain	N side corridor 2; open to room 1	71	4
2	rectangular downshaft	N side corridor 2	60	2
3	circular downshaft	NW corner; E of stairs 16	61	2

Table 4.32: Identified water features in building IV, ii, 9, 13.

[516] Stöger 2011, 133-136, Figs. 5.81, 5.82 dates this section of the southern wall to the Antonine period; *Contra* Van Dalen 1991, 264, who dates the *latericium* in the east wall of room 13 between 200-235 AD.
[517] DeLaine 2004, 151; see above for building IV, ii, 5.

Description of Water Features

The majority of the water features are in room 1. The first (feature 57) is on the northern wall of room 1 and is a cappucina-style drain. This channel is at the current ground level and passes through the entire thickness of the wall into the small open space between this building and IV, ii, 14 (Figure 4.160). While the *bipedales* are securely in the foundation level, it is unclear how deep into the ground the channel continues. Continuing to the east along the same wall, a rectangular drain was installed together with the blockage of a doorway here (feature 6).

Figure 4.160: External north wall of room 1, with feature 6 on the left, and feature 57 on the right.

On the east wall of the same room is another drain (feature 102), although this one is the half-cappucina shape and has much less of its opening visible above ground (Figure 4.161).[518] This drain also lies within the foundation course and goes through the entire thickness of the wall, and the single angled *bipedalis* continues into the ground for an unknown depth. The feature is located directly south of the join between two walls; on the internal face of this joint is a low rectangular construction similar to the one encountered in connection with the sinter spread in IV, ii, 5 (feature 37). Perhaps as in the case of feature 37, this low construction indicates where a vertical pipe was bound to the corner and turned at a sharp angle into a lower drain.

In the southeast corner of room 1 is a large double basin made of irregular brick masonry (Figure 4.162). This fountain basin (feature 58) was built against the existing southern and eastern wall of the room, and is also partially attached to the southern extent of the room's travertine threshold.[519] The basin/fountain was originally a single internal basin but was divided at a later point by a narrow wall of similar masonry to the basin.

[518] Behind the shed created for a planned archaeo-park for children to excavate a spoil heap in the same courtyard.
[519] RS II, 138 (sch. 128); SBAO B3697 (inv. 6186) for a pre-restoration view, C1775 (inv.8297). The latter is to be found in the SBAO archives filed under building IV, ii, 6.

Figure 4.161: Visible features of drain 102 in the northwest corner of room 1 at left. At right, a similar half-cappucina in the Terme del Faro (IV, ii, 1).

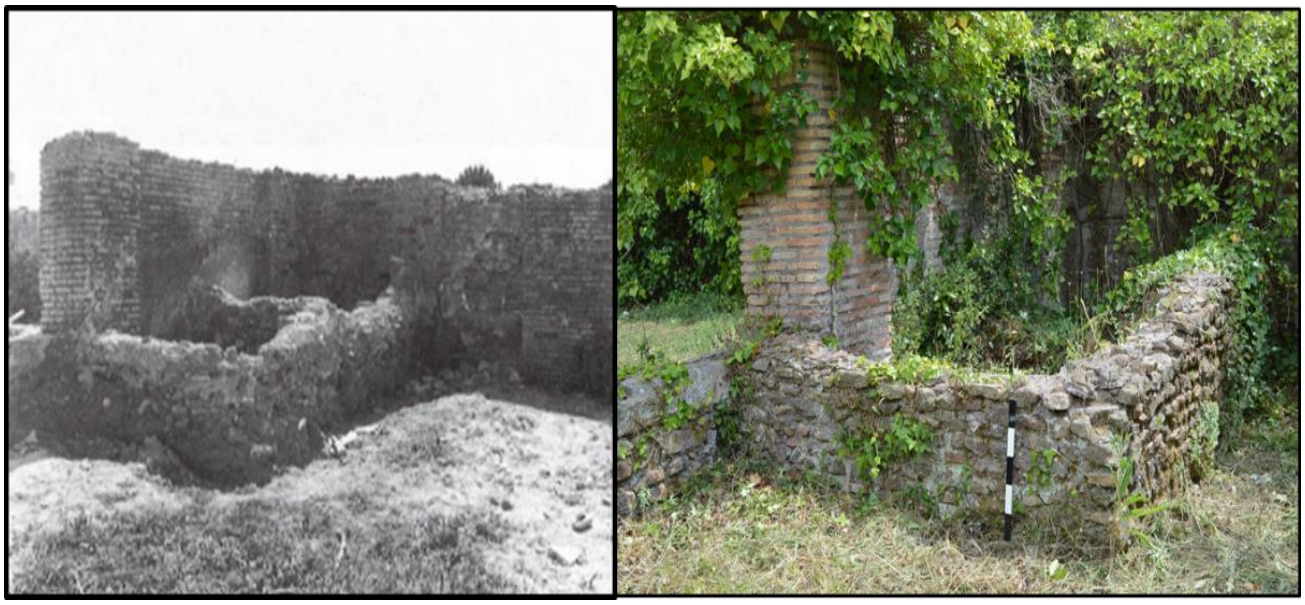

Figure 4.162: Southeast view of basin during initial excavation (SBAO C1775-1776), and in 2016 (by author).

On the external face of the south wall of room 1 is a rectangular downshaft preserved for the entire height of the wall, although the upper section is restored. This downshaft (feature 60) has a rectangular opening through the wall into room 1. This rectangular opening is feature 71, which is a small drain created to take advantage of the drainage connection established by feature 60 (Figure 4.163).

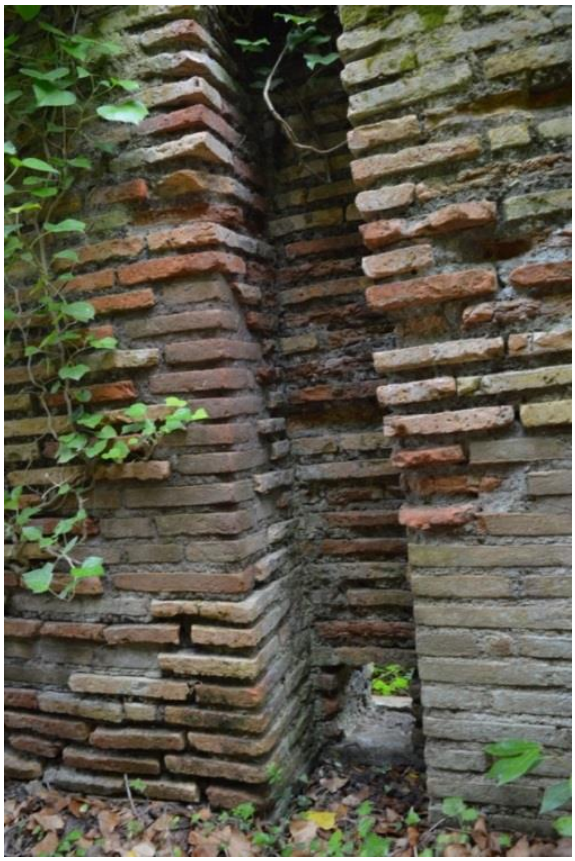

Figure 4.163: Downshaft feature 60 with drain 71 at bottom.

The final water feature is a semi-circular downshaft (feature 61), located on the inner face of the north wall of room 3 in IV, ii, 13. It is heavily damaged at its lower extent, and the eroding bricks make its dimensions unclear, yet there are significantly thick layers of sinter (calcium carbonate) covering the entire inner surface (Figure 4.164).

Figure 4.164: View looking down the inner face of feature 61 with the thick and irregular coating of sinter.

Infrastructure Chronology

Roman Water Footprint # 1(4th century B.C.- AD 50)

No preserved water features date from this period.

Roman Water Footprint # 2 (AD 50-200)

The two downshafts (features 60, 61) date to the Antonine period, when the entire western section of the building was heavily rebuilt. It is at this point that the downshafts could easily have been connected to the drainage system installed in the latrine of IV, ii, 7 (feature 53).

Roman Water Footprint # 3 (AD 200-300)

The drainage channels in the room 1 (features 6, 57, 102) point to a later date in the 3rd century. Together with the raised threshold on the eastern side of the room and the clear difference between the foundation and brick wall courses visible in the room, these water features demonstrate the later substructures of this building.[520] Given the levels of the bonding course in the central hallway of the insula and similar drainage discussed above (e.g. features 39, 40, 89, 101), we can hypothesize the modern under-excavating of the later floor level in this building as well.

Roman Water Footprint # 4 (AD 300-600)

The double basin (feature 58) dates to this period, as it covers the blocking layer on the south and east side of room 1. Given the height of the travertine threshold in this room and the extreme roughness of the external walls of this basin, it is likely that it was a basin sunk into the floor of this room. The basin drained out through feature 71, which was roughly broken through the bottom section of downshaft 60.

Conclusion

The hydraulic evidence from buildings IV, ii, 9 and 13 matches the contemporary events of the insula, which may be another factor in helping to identify which buildings worked together, or were owned by the same person. Upper floors were present above both buildings, and the difference in shape of the two downshafts indicates a division of upper floor drainage systems, with the rectangular downshaft removing rain water and the circular one removing waste from an upper-floor toilet. These buildings were intimately connected to all the activities of the insula, with the same evidence for higher ground levels and shared sewer networks as its neighboring buildings.

[520] Van Dalen 1991, 264 gives a date of AD 200-235 for this eastern wall.

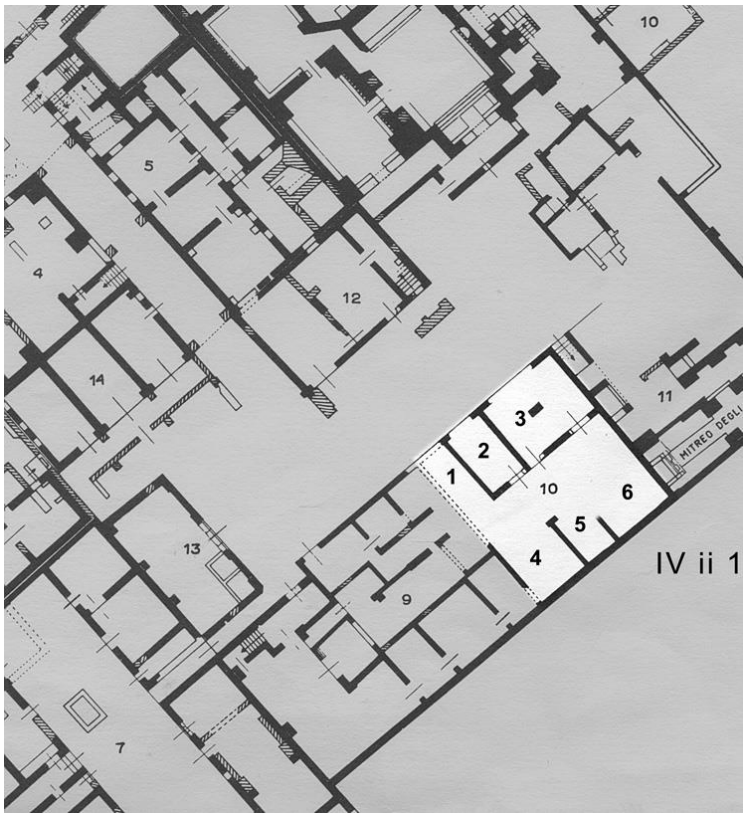

Figure 4.165: Plan of building IV, ii, 10 (SO 1, Pl. 13)

Location in insula

The building is made up of a northern and southern group of rooms divided in half by a small courtyard, although its internal wall divisions and connection to IV, ii, 9 are unclear (Figure 4.165). This building also has as its back the Trajanic wall, which divides the insula from the open area to the south. A large (+ 3.00 m) breakage is present in this retaining wall.[521] On the external northeast corner of the building is a later staircase, proving the existence of upper floors.

History of Excavation and Restoration

This building was initially excavated together with the neighboring Mitreo degli Animali (IV, ii, 11) and was one of the earliest buildings excavated in this area of the city.[522] This was based on the earlier interpretation that this structure must be connected with the temple of the Magna Mater and the *mithraeum*. However, following the floor level of the mithraeum caused the excavators to undercut the floor of IV, ii, 10 by ca. 0.60 m.

Phasing and Comments

The floor level in this building is also ca. 1.00 m above the open area to the south. The northern rooms (rooms 1, 2, 3) open onto a small inner courtyard, and perhaps also onto the southern courtyard of the

[521] Stöger 2011, 132, fig. 5.77 (=SBAO inv. 1171) shows the substantial breakage in the south wall of room 4.
[522] Stöger 2011, 139; it was excavated between 1864-1869 by P.E. Visconti during the period of papal excavation but disrupted by the Risorgimento.

insula. In the center of room 3 is a freestanding brick pillar that is likely connected to the staircase that was added onto the external northeast corner of the building.[523]

Water Features Chart

The following hydraulic features are located in building IV, ii, 10 (Table 4.33).

IV, ii, 10 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
No known water features	x	x	x	x

Table 4.33: Identified water features in building IV, ii, 10.

Description of Water Features

No water features have been discovered in this building.

Infrastructure Chronology

No water features have been discovered in this building.

Conclusion

With a complete lack of identified water features, the inhabitants of IV, ii, 10 must have completely relied upon the neighboring buildings for their water needs. The contemporary addition of a staircase and brick pier indicates that a new apartment was added above the rooms of building IV, ii, 10 in a later period.

[523] Stöger 2011, 137 (=SBAO inv. 1782) is incorrectly labeled in Ostia's photo archives, given the inconsistency between the view and a structural plan.

IV, ii, 11: Mitreo degli Animali

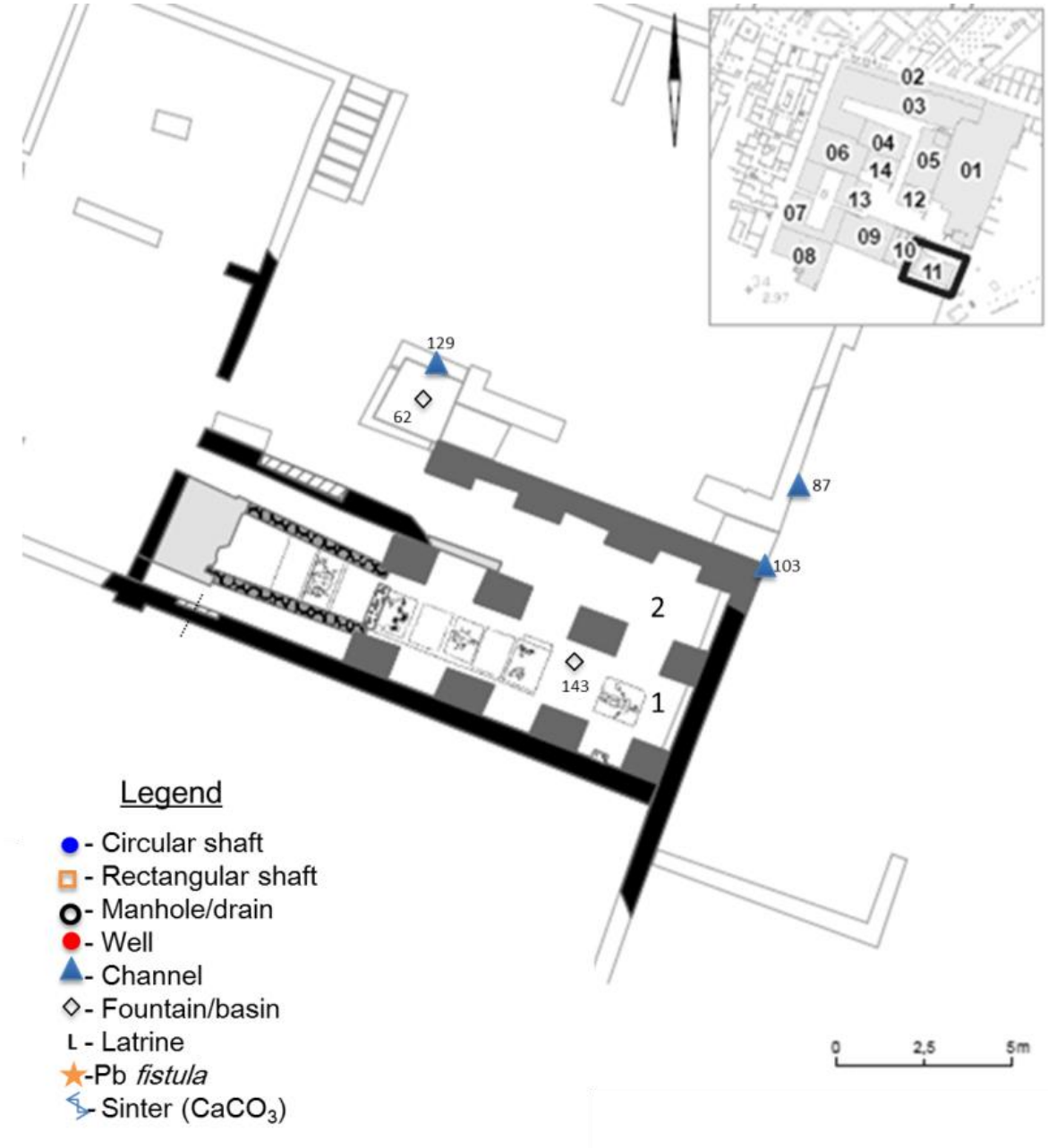

Figure 4.166: Identified water features in IV, ii, 11 (after Stöger 2011, 140, Fig. 5.90).

Location in insula

The mithraeum is located in the southeast corner of the insula (Figure 4.166). The north side of the building is accessed via a small hallway that opens onto the southernmost section of the insula's courtyard, and places the mithraeum at a considerable distance from all known streets.[524] It is bordered to the west by IV, ii, 10, and to the north by the small southeast courtyard of the *insula*, only a short distance (ca. 9.00 m) south of the hypothesized water feature 90 of the Terme del Faro (IV, ii, 1).

[524] Stöger 2011, 159 for the mithraeum as one of the most segregated rooms compared to the streets surrounding insula IV, ii.

History of Excavation Restoration

The Mitreo degli Animal (IV, ii, 11) was excavated in the 1890's by Vaglieri, as it was believed to be the *metroon* of the nearby Magna Mater temple. P.E. Visconti excavated this mithraeum together with the Campo della Magna Mater, Porta Laurentina, and a small stretch of the Via Laurentina. Some brief further work, especially on the mosaics and altar were carried out by Finelli in 1908.[525] Excavation and restoration continued under Calza, who followed Visconti's idea that the building was connected to the temple of Magna Mater since they were both "Eastern" cults, although this connection has now been disproven.[526] The majority of the mithraeum was part of the excavation carried out between 1938-42.[527]

Phasing and Comments

A fragmentary basin was identified underneath the mosaic floor when it was investigated by Finelli, and little additional detail about this phase was recorded. The mithraeum dates to AD 160, and was thought to be the earliest mithraeum in Ostia.[528] However, this view has been challenged most recently by White, who shifts its first phase as a mithraeum into the Severan period (AD 198), and sees the creation of the Mitreo degli Animali as part of a the second wave of Mithraism in Ostia.[529]

Like other mithraea in Ostia, it has a linear series of rectangular images, which refer to the mithraic grades. The modern and ancient literature on the cult of Mithras is enormous, with diverse architectural and artistic trends across the Roman world.[530] In terms of this mystery cult in Ostia, 17 mithraea have been found inserted into a wide variety of contexts, including bath and guild buildings, and grain storage structures.[531] The integration of well-preserved mithraea within the city is unparalleled in the Roman world and thus makes Ostia ideal for the study of this important mystery cult. Actual and ceremonial wells and water sources are often located in mithraea, recalling the hypogean birth of Mithras and his related miracles.[532]

The mithraeum was installed against existing Trajanic *opus reticulatum* walls, with rectangular brick piers added along the north and south side of the figural mosaics. The building has a narrow hallway (room 2) directly parallel to the line of mosaics, but a blocked door in the southwest corner of room 1 (directly south of the altar) points to an earlier entrance to the building from the south.[533] This door is also evidence of the +1.00 m ground level raise associated with the installation of the mithraeum. In the 3rd century a rectangular altar was added against the western wall. As in other mithraea in Ostia, the building would have been covered, likely with few windows and longitudinal benches along either side of the mosaics. Perhaps the staircase on the eastern face of IV, ii, 10 gave access also to an upper floor above room 1.

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[525] GdSc 1, 52 (16-4-1908); GdSc 1, 55 (12-5-1908), where it is called *"il metroon"*, with the mosaics already in a poor state: *"…musaico rinvenuto in una stato orribile di conservazione di piu di quanto fu descritto nell'ultimo giornale…"*; Paschetto 1912, 374 calls it *"il Sacrario sotteraneo"* and includes it in his itinerary (pp. 261).

[526] Rieger 2004, 252-257; Rinaldi 2012, 124 for Magna Mater restorations.

[527] GdSc 26, 66 (21-1-1940).

[528] Paschetto 1912, 375: *"Se è un mitreo, esso è il più antico fra quelli ostiensi".*

[529] Clarke 1979, 90 had already proposed this shift in chronology based on stylistic grounds; White 2012, 446-451, whose dating revolves around epigraphic dedications of M. C(a)erellius Hieronymus (C.I.L. XIV, 70, 4313). He proposed (pp. 462) instead the Mitreo degli Pareti Dipinti (III, i, 6) to be the oldest mithraeum in Ostia.

[530] See the selection made by Meyer 1987, but especially Porph. *De antr. Nymph.* 6-7 and the role of water in the "Mithras liturgy" (P.G.M. IV, 475-834). For secondary sources see Beck 2006, Becatti 1954, and Vermaseren 1956.

[531] Mitreo delle Terme del Mitra (I, xvii, 2), Mitreo di Fructosus (I, x, 4), and Mitre delle Sette Porte (IV, v, 13) respectively.

[532] Part of the Mithras mythology is a Moses-like myth where Mithras shoots an arrow at a rock and a spring gushes forth.

[533] Stöger 2011, 142.

Water Features Chart

The following hydraulic features are located in building IV, ii, 5 (Table 4.34).

IV, ii, 11 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
1	basin	entire area covered by mithraic mosaic	143	1
2	rectangular niche	external E wall of courtyard pier	103	2
	fountain basin	N of mithraeum	62	3
	ceramic pipe	internal N wall of basin 62	129	3
	fistula channel (?)	external E wall, N of courtyard pier	87	2

Table 4.34: Identified water features in building IV, ii, 11.

Description of Water Features

A rectangular basin (feature 143) was created in the area now covered by the eponymous mosaics (Figure 4.167).[534]

Figure 4.167: View looking west at the mithraeum in 2016.

[534] GdSc 1, 52 (16th-30th April, 1908): *"… forse stato notata* ***una vaschetta*** *con cordone in cocciopesto, la quale se estente per tutta la lunghezza del metroon, ma non conserva sempre la medesima altezza, della quale resta il pavimento, il cordone, e pochi resti della stabilitura delle pareti, stabilitura sempre in cocciopesto. Questa vasca piu tardi fu distrutta e cacciata* ***sotto il pavimento in musaica*** *con le figure indicate. Non ho ancora capito se detta vasca era un bagno sacro del tempio di Cibele che gli sta vicinio o un deposito di acqua di una cosa privata prima che vi fosse stati costruito il metroon piu su nominato."*; emphasis added by author.

Attached to the northern wall of hallway 2 is a low rectangular basin (feature 62). It was roughly added against the existing wall of brick piers, although various plans omit this basin altogether.[535] It is now preserved as a shallow sunken basin of brick walls within the current ground level, and was fed by a ceramic pipe in the north wall of the basin (feature 129).

On the external face of the wall dividing the mithraeum (and *insula*) from the Campo della Magna Mater are two hydraulic features (features 87, 103). These are not architecturally connected to the mithraeum but will be treated here given their spatial vicinity. The reticulate wall on the eastern side of the building is connected in its northeast corner to a line of brick piers that form hallway 2. Directly north of this brick pier is a small section of wall that acts as a barrier between the mithraeum and the wall that extends along the same orientation as the east wall of the mithraeum. This wall forms part of the original eastern limit of the insula, and over which the Terme del Faro (see IV, ii, 1 above) expanded to form its service corridor in the Trajanic period. Directly where this wall meets the small section of masonry dividing it from the mithraeum, is a channel with hydraulic mortar inside (Figure 4.168). This channel (feature 87) contains the semi-circular impression of a small (6 cm) lead pipe that is only visible from the external face of the wall. Feature 87 does not pass through into the internal side of the wall, but there is a half-dome shaped cutout in this internal face.

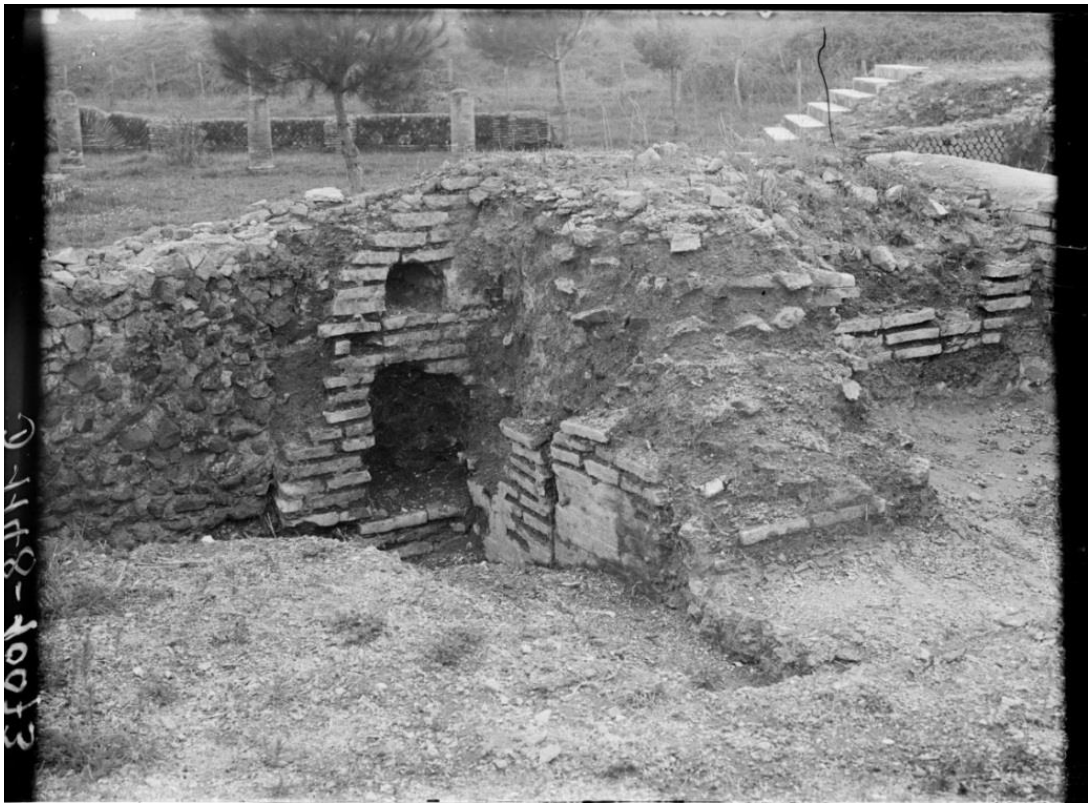


Figure 4.168: View looking east at the internal face of feature 87, with the portico and temple of Magna Mater in the background (SBAO D1148).

Directly north of the brick piers forming hallway 2 is a rectangular recess (feature 103) cut into a small wall section built to connect the mithraeum with the original dividing wall of the insula. The identification of this feature as hydraulic remains tentative, however, its clearly defined shape and vicinity to the two previous features make its hydraulic definition likely.

[535] SO I, map 13 shows only the northern wall of the basin; SBAO B3706 shows this basin.

Infrastructure Chronology

Roman Water Footprint # 1 (4th century B.C.- AD 50)

No preserved water features date from this period.

Roman Water Footprint #2 (AD 50-200)

While the *fistula* pipe impression (feature 87) post-dates the creation of the eastern retaining wall of the insula, little additional archaeological information is preserved. The basin 143 dates to this period, and was completely destroyed by the ground raising connected with the creation of the mithraeum in AD 198.

Roman Water Footprint #3 (AD 200-300)

The courtyard basin (feature 62) and its ceramic adduction pipe (feature 129) date to this period, given their addition against the brick piers of the late 2nd century AD. However, it is unclear whether the basin was connected to the mithraeum, the southeast courtyard of the *insula*, or both. What is clear is that there is a water supply feature in this section of the insula, which perhaps is evidence for a connection to the wider urban supply system. Features 87 and 88 could then form a direct link between the water system circulating along the Republican walls and the water feature (feature 90) directly south of IV, ii, 1, (ca. 9.00 m from here).[536]

Roman Water Footprint #4 (AD 300-600)

No preserved water features date from this period.

Conclusion

In a manner similar to the other early mithraeum known at Ostia, (e.g. the Mitreo delle Pareti Dipinti (III, i, 6), and the Mitreo degli Caseggiato di Diana (I, iii, 3-4), this mithraeum was installed in a previously domestic structure. The basin discovered underneath the mosaic (feature 143) perhaps was originally the shallow *impluvium* of a domestic nature. The installation of the mithraeum is the decisive moment of this structure's life, with the subsequent water features likely connected to the worship of Mithras.

[536] See IV, ii, 1 above for description of this feature.

IV, ii, 12

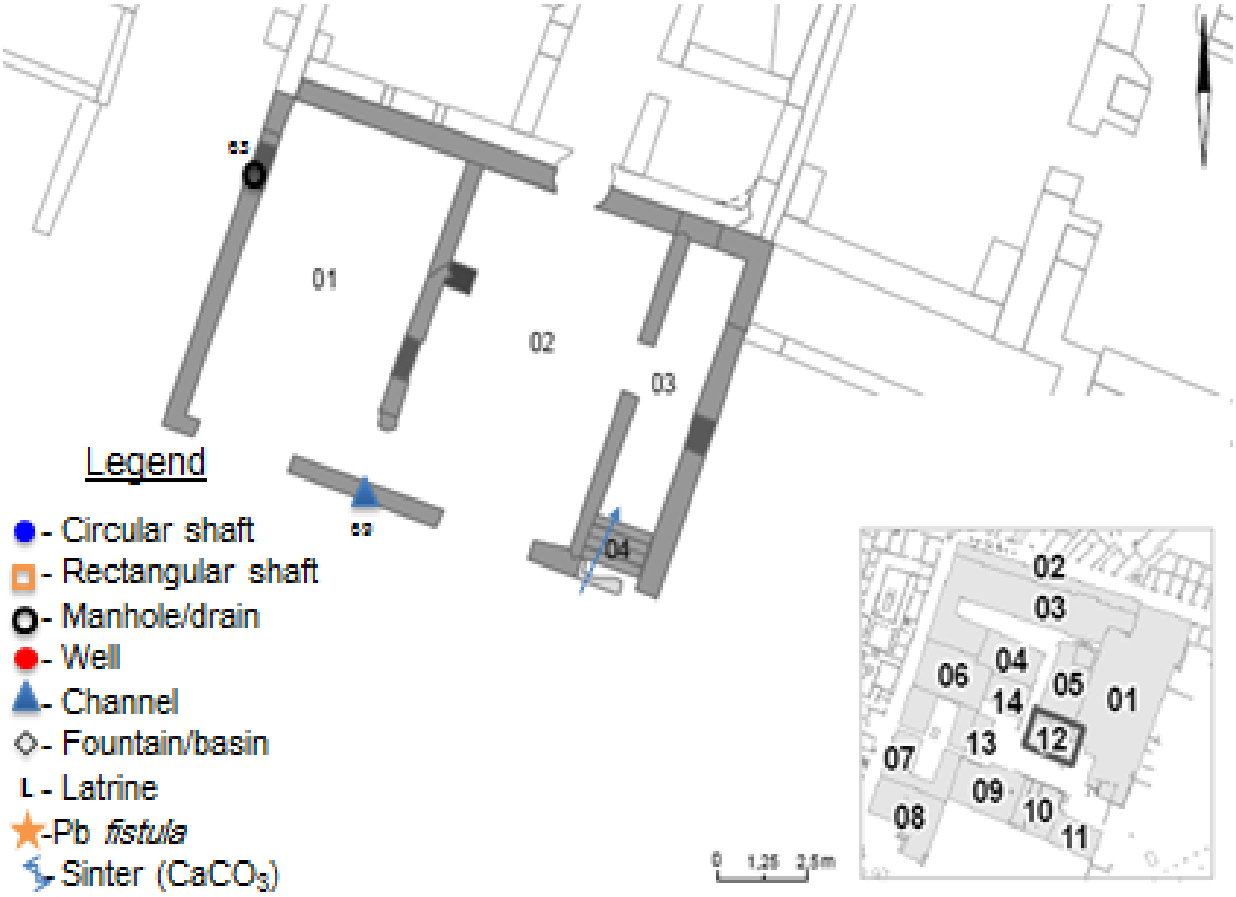


Figure 4.169: Identified water features in V, ii, 12 (after Stöger 2011, 147, Fig. 5.100).

Location in insula

The building is located in the southern part of the insula, and is placed directly to the south of IV, ii, 5 (Figure 4.169). Its western side has a door that originally opened onto the insula's central corridor, but was later blocked. On its eastern side the building shares a wall with the service area of the Terme del Faro (IV, ii, 1).

History of Excavation and Restoration

As with the other buildings of the *insula*, IV, ii, 12 was excavated in 1940, although it received no direct mention by the excavators.

Phasing and Comments

The earliest structural evidence comes from the Hadrianic reticulate of the north wall. The building's current form dates from the Severan period, and is contemporary with large structural changes made to IV, ii, 1 and IV, ii, 5.[537] The wall dividing room 1 and 2 is of *latericium* and rough tufa blocks, and was built against the early reticulate wall. Slightly later, the brick pier in room 2 was added, and doorways were closed in rooms 1, 2, and 3 with a neat *opus vittatum*. The building seems to respect the structural layout of IV, ii, 5, yet it is unclear how and when these two buildings were connected: the passageway

[537] Stöger 2011, 148.

connecting these two buildings may be ancient or modern.[538] The staircase on the southeast corner of the building (room 4) indicates an upper floor; together with the staircase in IV, ii, 5, room 14, these likely both gave access to the upper floor apartments of IV, ii, 5. One is drawn to the connection of the three buildings IV, ii, 1, 5, and 12, all of which meet in the northeast corner of the IV, ii, 12. These buildings are discussed in greater detail above (IV, ii, 1 and 5). Stöger saw this relationship as indicative of a shared ownership of these three properties.[539] Additionally, the large rectangular rooms are separated from the southern courtyard by an east-west section of wall that frames the southern edge of the building. This wall seems to respect the corridor connecting IV, ii, 5 and 12 and may support the antiquity of this connection.

Water Features Chart

The following hydraulic features are located in building IV, ii, 12 (Table 4.35).

IV, ii, 12 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
1	drain	cappuccina shape, under blocked up door	63	3
1	drain?	external S face of E-W wall	69	3

Table 4.35: Identified water features in building IV, ii, 12.

Description of Water Features

On the western side of the building is a cappucina drain with only one *bipedalis* brick remaining (feature 63). This forms a quite large opening (0.37 x 0.33 m) between IV, ii, 12 and the connecting corridor of the *insula* (Figure 4.170). It is securely built into a very roughly composed foundation level, and the wall above it is in the *latericium* of the Severan period. Immediately south of this feature in the same wall, a doorway connecting room 1 to the insula's central hallway was closed by an *opus vittatum* wall. The second water feature in this building is on the external face of the wall blocking access to rooms 1 and 2. Feature 69 is an irregular channel broken through this wall, although it was later blocked on its internal (northern) face. Its function is unclear, as are its dimensions; any supporting *bipedales* or stones are absent. It is preserved only as a large circular hole at the current ground level.

[538] See IV, ii, 5 above for a discussion of the *medianum* layout. The relationship between building 5 and 12 is not dealt with in the GdSc 74 excavation and report on IV, ii, 5.
[539] Stöger 2011, 149.

Figure 4.170: View looking east at the cappucina drain (feature 63) going through the west wall of room 1 in IV, ii, 12. The dotted line indicates the line between the foundation and superstructure.

Infrastructure Chronology

Roman Water Footprint #1 (4th century B.C.- AD 50)

No preserved water features date from this period.

Roman Water Footprint #2 (AD 50-200)

No preserved water features date from this period.

Roman Water Footprint #3 (AD 200-300)

Feature 63 can be dated to the Severan period, when dividing walls of *opus latericium* were added against the earlier (Hadrianic) reticulate wall. Based on the height of the *opus vittatum* masonry closing the door directly south of this channel, it can be inferred that the apex of this channel was under the contemporary floor level. Based on the *opus latericium* similarity to the wall of feature 63, feature 69 also is dated to this Severan period and possibly acted as a drain.

Roman Water Footprint #4 (AD 300-600)

No preserved water features date from this period.

Conclusion

While little remains of the exact personality of building IV, ii , 12, much can be observed from its connection to building IV, ii, 5. Once the large cistern was added in the Severan period, the main entrance into building IV, ii, 5 would have had to been through building IV, ii 12. This also applies to it

supper floor apartments. The water features in this building are related in space and time to the other hydraulic activities undertaken in the 3rd century within the central hallway.

IV, ii, 14:"*tabernae*"

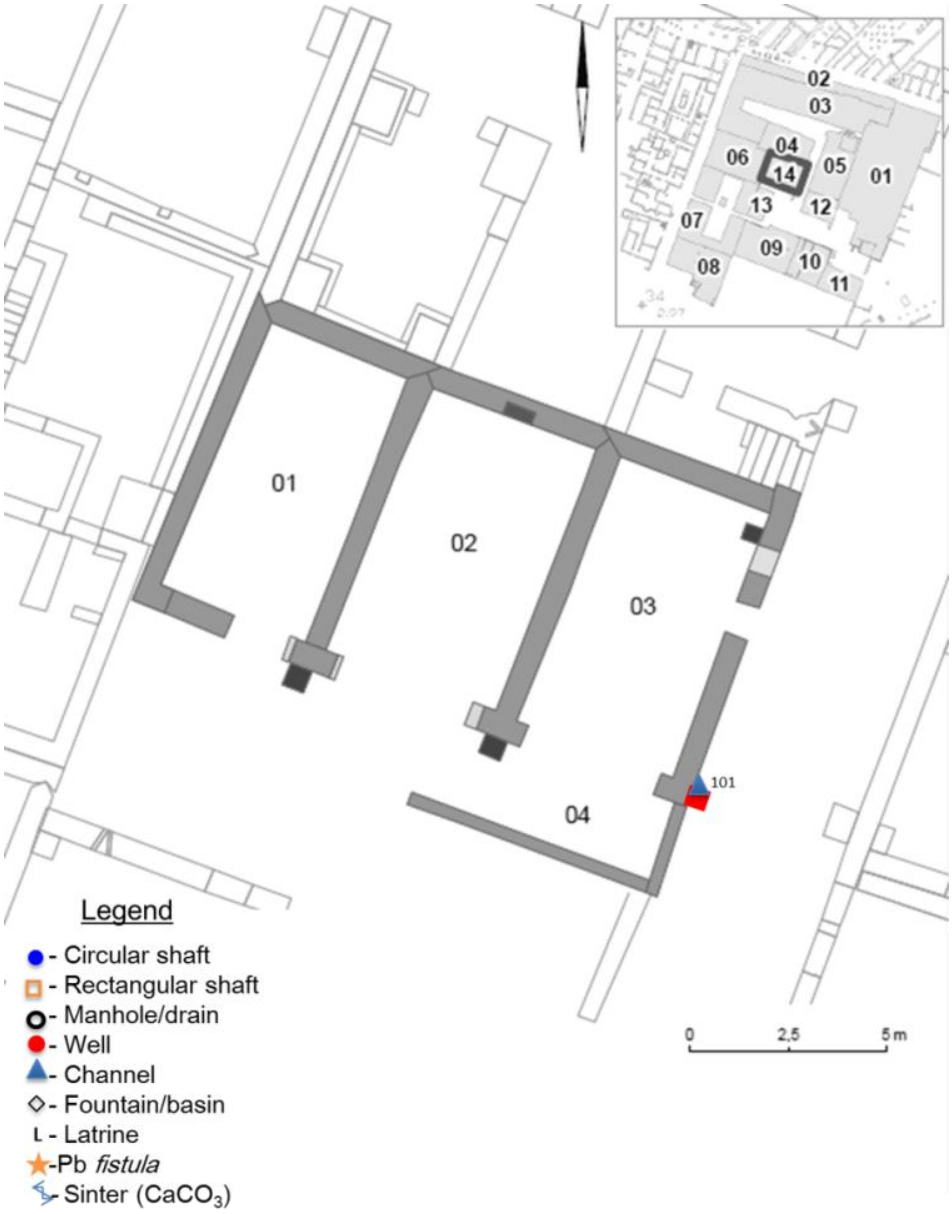


Figure 4.171: Identified water features in IV, ii, 14 (after Stöger 2011, 152, Fig. 5.108).

Location in insula

This building is composed of 3 rectangular rooms in the center of the insula (Figure 4.171). The building lies directly south of and shares a wall with IV, ii, 4. The western wall is against the eastern wall of the Caupona del Pavone (IV, ii, 6); three splayed windows pierce this wall. The building had a small enclosure in its southeastern corner, although a mirroring western section is known from Calza's 1953 plan. The building opens onto the central corridor of the insula, and onto a small courtyard facing the north wall of IV, ii, 13.

History of Excavation and Restoration

This building likely also was excavated in the 1940 period of excavation although no separate mention of it is made in the excavation reports. Brick stamps give evidence for isolated conservation work in the 1960s.

Phasing and Comments

The building was first constructed in the Hadrianic period based on the north wall's reticulate facing and its *opus latericium* quoining. The eastern wall (room 3) was reconstructed in the Antonine period in *opus latericium*, including a window and doorway connecting the building directly to the insula's central corridor. This is likely connected with the creation of this corridor and coeval structural phase of IV, ii, 5.[540] Based on the height of the putlog holes in the wall, the original depth of the floor can be estimated at ca. 1.00 m lower than its current level. Even with this raising, the rooms today lie ca. 0.50 m below the level of the central hallway. Wall paintings in several rooms, now mounted on plaster boards, are dated to the Severan period (Figure 4.172).[541] At a later point, a crude passageway was smashed through the reticulate walls dividing the three rooms, perhaps focusing attention on the central corridor of the insula.

Figure 4.172: Severan wall painting on the eastern wall of room 1 in 2017.

Water Features Chart

The following hydraulic features are located in building IV, ii, 14 (Table 4.36).

IV, ii, 14 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
3	fistula channel	external E face; through brick pier	101	3

Table 4.36: Identified water features in building IV, ii, 14.

[540] Stöger 2011, 154.
[541] Liedke 2003, 105 for the paintings.

Description of Water Features

This building possesses one water feature on the external side of its eastern wall (room 3). Feature 101 is the preserved imprint of a lead *fistula* pipe that ran vertically along the corner formed by the eastern wall of the building and the brick pier. The hydraulic mortar imprint runs ca. 0.84 m vertically from the current ground level up the wall before stopping suddenly. At ground level, the semi-circular imprint turns 90^0 and runs horizontally through the entire length of the pier, parallel to the eastern wall of the building. This feature likely pre-dates the insertion of the pier, as the *latericium* in the internal face of the pier respects the irregular line of the fistula imprint (Figure 4.173).

Figure 4.173: View looking south at the pier on the east side of IV, ii, 14. Preserved indentation of lead pipe outlined in dashed lines.

Infrastructure Chronology

Roman Water Footprint #1 (4^{th} century B.C.- AD 50)

No preserved water features date from this period.

Roman Water Footprint #2 (AD 50-200)

No preserved water features date from this period.

Roman Water Footprint #3 (AD 200-300)

Feature 101 shows a marked similarity to other water features running through piers from the same time period and nearby, namely features 37, 38, and 39.

Roman Water Footprint #4 (AD 300-600)

No preserved water features date from this period.

Conclusion

The one preserved water feature from this building informs us that a pressurized water line was present against the eastern wall before the insertion of the brick piers. As this line was part of the wider network running through the central corridor of the insula, it indicates that both a sewer and supply network were present here. This pipe also hydraulically binds building IV, ii, 14 to its neighboring building 4 and 5.

4.1.2: Data Conclusion

Insula IV, ii retained much of its initial architectural shape in the late 2nd century, although major renovations occurred in the Severan period. Yet, in terms of its hydraulic systems the insula changed dramatically over its life. From mostly individual water systems, there is a distinct change in the degree of hydraulic connectivity between buildings after the Severan period. Some buildings, like the Mitreo degli Animali (IV , ii, 11) and the Caupona del Pavone (IV, ii, 6) remained unconnected to these wider changes. Many water features were so as to maximize their accessibility, while at the same time not obstructing the flow of movement through the city block. However, the creation of dividing walls in the 4th century caused more of an east-west split of the insula. With the identification and chronological phasing of the hydraulic systems of each building now presented, the following section will place water features of the same chronological period in context with each other to identify wider trends of supply, usage, and drainage within the insula as a whole.

4.2: The Roman Water Footprints of insula IV, ii

4.2.0 Introduction

In the previous section, the individual hydraulic features of all buildings in insula IV, ii were identified and placed within the hydraulic history of individual buildings. This section turns from the spatial to the temporal. Water features from all buildings that date to the same time period will be examined together, to present an overview of the block´s hydraulic landscape throughout the stages of its life.[542] The infrastructure data is then inserted into the Roman Water Footprint framework, as outlined in Chapter 2. The Roman Water Footprint combines the archaeological traces of water with contemporary evidence for how water was used in public and private oriented spaces, and in the local environment of Ostia. Juxtaposing these three types of evidence produces a holistic view of water in the *insula*, and how the relationship between these three types of data changed over different periods of its life. In the final part of this chapter, trends in the wider hydraulic biography of the insula will be discussed.

[542] For more specific chronologies or technical details of individual water features or individual buildings, see the preceding section, 4.1.

4.2.1: IV, ii-Roman Water Footprint 1 (4th century B.C. – AD 50)

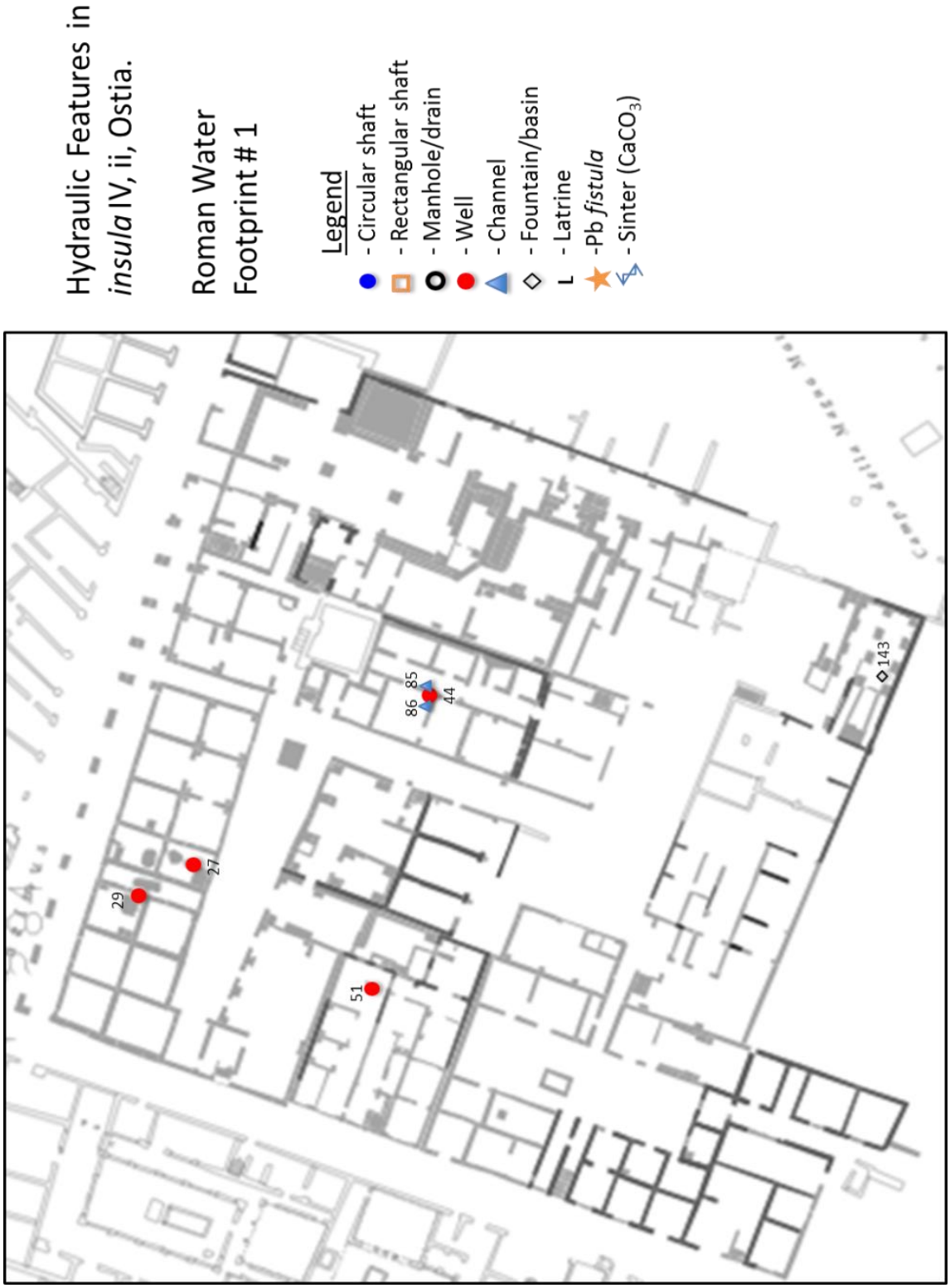


Figure 4.174: Water features identified in insula IV, ii between the 4th century B.C. and AD 50 (plan after Stöger 2011, 158, Fig. 5.112).

IV, ii Roman Water Footprint # 1 (4th century B.C.- AD 50)			
Indicator	Sub-Indicator	Data	Quantity
Infrastructure	Supply Systems	Rain Water	2
		Ground Water	4
		Aqueduct	0
		Total # of Supply Features	6
	Usage Systems	Number of Leisure Water Features	0
		Number of Industrial/Economic Water Features	0
		Number of Domestic Water Features	1
		Total # of Usage Features	1
	Drainage Systems	Sewer	0
		Downshaft	0
		Drains	0
		Total # of Drainage Features	0
	System Resilience	Number of Types of Supply	2
		Number of Types of Usage	1
		Number of Types of Drainage	0
		Total System Complexity	3
		Total # of Features	7
Culture	Private Oriented-insula	Total # of Features	7
	Public Oriented-insula	Total # of Features	0
	Private Oriented-Ostia	Total # of Features	36
	Public Oriented-Ostia	Total # of Features	17
Nature	External	Tiber River Floods	21
	Internal	Urban Garbage	1
		Urban Health (# of Baths)	3

Table 4.37: Roman Water Footprint #1 from insula IV, ii.

4.2.1.1: Infrastructure

Evidence for the water system in this earliest period of the insula's life is relatively simple compared to the complexity of the later periods (Figure 4.174). Starting with supply there are four wells (features 27, 29, 44, and 51) spread out across the insula (Table 4.37). Each of these exhibits a great deal of resilience, surviving numerous ground level changes and altering the position and layout of later buildings. The Caupona del Pavone is resolutely separated from the rest of the insula, implying that this well would have acted as the main water source in the domus for close to two hundred years until it was turned into a Caupona and the swimming-fish bar counter was inserted. Built into the walls of the well in IV, ii, 5 (feature 44), were two ceramic pipes that substantiate a system of rain water collection. This is the only example of this provision strategy in this insula. In terms of drainage, although the sewer line running underneath the *cardo maximus* (feature 114) is broadly dated to the Trajanic period, it may be contemporary with the building of the Republican walls and the Porta Laurentina.[543]

In terms of system resilience of the insula in this period, the total resilience of the water features in the insula is very low (3/9). This means that the supply, usage, and drainage of water in the insula is very rigid and can only be put to very specific uses, and is in a precarious position if one of the supply systems fails. The low figure also is a result of the minor traces of hydraulic evidence found for this period.

[543] Bukowiecki *et al.* 2008, 92 excavated a section of sewer line running under the Republican city wall near the Porta Romana *castellum*.

4.2.1.2: Culture

This earliest period of the city's water usage is fragmentary at best, with three wells found within the forum area.[544] We can expect several other open-air water features in connection with Republican and early Augustan domus houses, such as *impluvia* or storage cisterns.[545] While at least some sections of the city's sewer line date to the late Republican period, there is little top-down urban investment in water features in this period beyond the handful of wells and short traces of sewers in the forum. The insula has more private than public water features in this period, matching the general trend across Ostia. We can imagine the wells in the forum acting as focal points for movement and social action in Republican Ostia, especially before the Ciceronian walls. The majority of the population would likely depend on public wells. The *cippi* of Caninius record the space between the river and the *decumanus maximus* as public space that could be used by all to manage their daily water needs.[546] A private domestic well would surely have been an object of prestige, and merited the elaborate marble well-heads that in some cases remained visible for hundreds of years. (Table 4.38).

insula IV, ii		Roman Water Footprint # 1 (4th century B.C-AD 50)
Private Oriented-insula	Total # of Features	7
Public Oriented-insula	Total # of Features	0
Private Oriented-Ostia	Total # of Features	36
Public Oriented-Ostia	Total # of Features	17

Table 4.38 Private and Public water features in insula IV, ii and in contemporary Ostia in Roman Water Footprint #1 (4th century B.C.- AD 50).

The city is perched between the river and on the sea, and had a 4th century B.C. river port that had already silted up by the 1st century B.C.[547] In terms of bathing structures, only fragmentary evidence survives from the Republican period, although in general in this time period they are small and may have been seen as decadent or immoral.[548] From a religious point of view, we have contemporary evidence of the veneration of water deities in Rome and the impact of these on patterns of ritual movement and urban toponyms, with the worship of father Tiber as the most important. While there is little evidence for his worship at Ostia, we should certainly view him as a key figure, especially based on the particular vulnerability of Ostia to frequent river flooding.[549]

4.2.1.3: Nature

At the beginning of this period of Ostia's life the Tiber is the least filled with debris coming downstream from Rome, yet this changes with the urban growth in the Augustan period. There are no natural springs within the urban area of Ostia, and thus we assume its blossoming population from its foundation until the creation of the aqueduct sustained itself with water from the river and from rain collection. Additionally, we cannot exclude the use of marsh water from the nearby *Stagno Ostiense* for a wide

[544] RS I, 21-23 for these wells; SO 1, 73 for the earliest forum situation at Ostia.
[545] Meiggs 1987, 192-195 discusses the economic situation in Republican Ostia and mentions that wealthy *duovirate* families likely owned central atrium-style homes in the late Republican and early Imperial period.
[546] C.I.L. XIV, 4702, 4703; For nearby examples in Rome: Frontinus *De Aq.* 1.4 *"For four hundred and forty-one years from the foundation of the City, the Romans were satisfied with the use of such waters as they drew from the Tiber, from wells, or from springs."*
[547] Goiran *et al.* 2014; Hadler *et al.* 2015, 86 both offer a view of the Tiber during the early period of Ostia's life.
[548] Bruun 2016 for changing categories of what was considered "luxuria" in the Roman world; Medri & Di Cola 2013, 101 for Republican bath at Ostia known only epigraphically.
[549] Edlund 2006 for water in Roman Republican religion; Rieger 2004, 243-249 for attributing the temple in the center of the Piazza della Corporazioni to Pater Tiber.

variety of purposes, such as agriculture, salt harvesting, and small scale industrial purposes.[550] The marshes likely also acted as a baseline source for local foods, such as certain species of birds and plants. The highest number of recorded floods in the history of the city dates to this period, and we can imagine that while not as dramatic at Rome, it is undeniable that flooding was a real concern at Ostia, exacerbated locally by the inland marshes. The city is at its earliest and lowest levels, with minimal relief above the river plain. The after-effects of flooding on a low-lying area can be just as catastrophic as the flood event itself, which perhaps contributed to the minimal amount of preserved material from this period across the city.[551] These after-effects include structural damage, latent disease, and loss of biodegradable items. In terms of internal urban health, this low number of bath buildings would equal a low degree of bacterial interaction, although many other cultural practices could equally accomplish this. The amount of internal garbage begins at its lowest and starts to increase rapidly toward the end of this period.[552]

4.2.1.4: Conclusion

When considering the hydraulic aspect of insula IV, ii in its earliest period, the meagre evidence preserved accords well with the wider trend of privately focused water features. Access to water would be easier for wealthier people who could install wells within their home, while the remaining majority of the population must go either to the center of the *castrum* to public wells or to the river bank for their water. This is not to say that domus dwellers did not also use water from the river, just that they had an added degree of complexity available within their immediate surrounding for their needs. By incorporating rain water collection, *insula* IV, ii begins to diversify its collection strategy, which may also add to its social prestige.

[550] Giraudi 2011 gives a detailed look at the formation of these marshes.
[551] Aldrete 2007, 129-158 for the after effects of a flood and pp. 242 for recorded flooding of the Tiber river.
[552] MacKinnon 2014, 187-189 for faunal evidence in Ostia.

4.2.2: IV, ii-Roman Water Footprint 2 (AD 50-200)

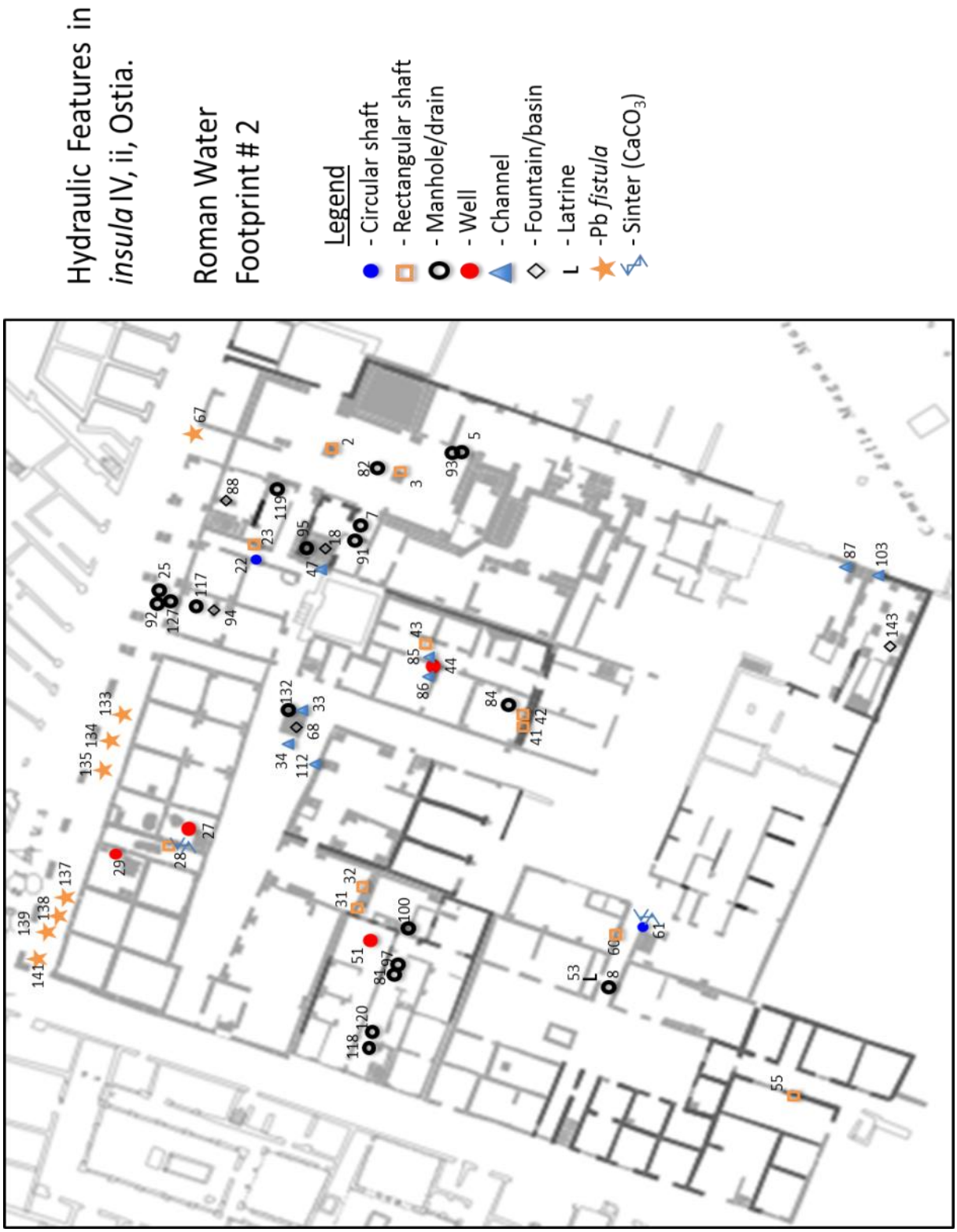


Figure 4.175: Water features identified in insula IV, ii between 50-200 AD (plan after Stöger 2011, 158, Fig. 5.112).

IV, ii Roman Water Footprint # 2 (AD 50-200)			
Indicator	Sub-Indicator	Data	Quantity
Infrastructure	Supply Systems	Rain Water	2
		Ground Water	4
		Aqueduct	11
		Total # of Supply Features	17
	Usage Systems	Number of Leisure Water Features	5
		Number of Industrial/Economic Water Features	2
		Number of Domestic Water Features	1
		Total # of Usage Features	8
	Drainage Systems	Sewer	16
		Downshaft	13
		Drains	4
		Total # of Drainage Features	33
	System Resilience	Number of Types of Supply	3
		Number of Types of Usage	3
		Number of Types of Drainage	3
		Total System Complexity	9
		Total # of Features	58
Culture	Private Oriented-insula	Total # of Features	35
	Public Oriented-insula	Total # of Features	23
	Private Oriented-Ostia	Total # of Features	122
	Public Oriented-Ostia	Total # of Features	72
Nature	External	Tiber River Floods	6
	Internal	Urban Garbage	3
		Urban Health (# of Baths)	21

Table 4.39: Roman Water Footprint # 2 from insula IV, ii.

4.2.2.1: Infrastructure

The first phase of the Terme del Faro (IV, ii, 1) dates to this phase, when it was supplied with aqueduct water by means of an epigraphic lead pipe (feature 67) (Figure 4.175). Based on the position and orientation of the ceramic pipes in the well (feature 85) in IV, ii, 5, the newly installed downshaft 43 was likely be connected to this earlier system of rain collection (Table 4.39).

Evidence of aqueduct supply in this period is present mostly in buildings in the northern section of the insula. The majority of this evidence comes from the area around the Portico dell'Ercole (IV, ii, 3), where numerous epigraphic fistulae were found. As mentioned in section 4.1, several of the same names were found stamped onto pipes in the neighboring Molino (I, xiii, 4) and in the Semita dei Cippi, implying perhaps a neighborhood's favourite lead-pipe maker (*plumbarius*), or some kind of social relationship connecting the inhabitants of this part of the city. The central courtyard fountain (feature 68) also dates to this period, offering a centralized location foraqueduct water for the inhabitants of the *insula*. It is hypothesized here that a branch of the lead pipe (feature 112) fed this fountain, entering through channel 33. This courtyard "bauletto" fountain will continue to be a central fixture of the insula's water supply into the Late Antique period. The presence of pressurized water supply comes from two Z-shaped channels found in the Terme del Faro.[553] In both cases a vertical channel set within a wall takes a sharp

[553] Room 7a (feature 23) and room 13b (feature 1).

90° turn and passes through the wall itself. While only one of these (feature 1) is known in direct connection with a bath basin, it is hypothesized that the same can be said for the other vertical channel, perhaps in connection with the Terme del Faro's contemporary *apodyterium*.[554] Rain water collection is identified by a downshaft (feature 43) in building IV, ii, 5, where it was created directly opposite a well that had several ceramic pipes built into its wall.

Usage of water in this period is mostly related to the bath building, but is also present in the tabernae fronting the *cardo maximus*. Domestic evidence for usage comes from building IV, ii, 5, as well as for the basin identified underneath the Mitreo degli Animali (feature 143). The complexity of the usage features expands from 1 to 3 types.

Several small sewer lines were installed to support individual or groups of buildings across the insula. A sewer line (feature 82) was created within the Terme del Faro, capturing waste from bath basins and downshafts. Together with the creation of the Caseggiato and Portico dell'Ercole came a smaller sewer line running parallel to the street front. A section of the sewer is preserved for several meters along the eastern section of the Portico, collecting the waste from the taberna in room 8 of IV, ii, 3 (feature 117), as well as the drain of the courtyard fountain (feature 132). The short stretch of sewer identified in IV, ii, 5 (feature 84), also headed toward this sewer in the portico, continuing in a northward direction under the space of the later cistern, and through hallway 5 of IV, ii, 2. A relatively large sewer system was also installed at this time in the Caupona del Pavone (IV, ii, 6: features 97, 100, 120), taking advantage of the raising of the ground level. This domestic sewer connects to the larger urban sewer network running under the Via della Caupona (feature 121). Also taking advantage of a major construction phase and a favourable location in a hallway is the sewer servicing the latrine in IV, ii, 7 (feature 8). This line ran in a linear (east –west) direction towards the Via della Caupona.

The downshafts in this period offer a dynamic mixture of locations and functions. While one of these was mentioned above in connection with rain collection, several downshafts directed rain water to secondary sewer lines, not collecting the water for any subsequent purposes. This is the case for the twin downshafts in several buildings.[555] The downshafts in IV, ii, 4 likely drained to the north towards the *cardo*, passing through the Portico dell'Ercole (IV, ii, 2, room 20). While the two downshafts of IV, ii, 9, 13 (features 60, 61) were connected to the latrine sewer of IV, ii, 7 (feature 8), it is their location and different shape which are of interest here (Figure 4.176). These two downshafts are directly across a narrow hallway from each other and probably had a shared upper floor spaces. The rectangular shaft is too shallow to have held a large vertical ceramic pipe and likely was reserved for rain water drainage, while the semi-circular downshaft could easily hold a vertical drainage pipe for upper-floor latrines. In the extreme southwest of the insula comes a similar rectangular downshaft (feature 55) that was also likely for drainage purposes. The drain could have led out towards the sewer under the Via della Caupona, using the hallway and skirting the southern rooms of IV, ii, 8. To further complicate the evidence from the downshafts is the variable presence of calcium carbonate (i.e. sinter) they contain. Although this material is only present in some downshafts (features 28, 61), they must indicate a large or at least consistent flow of aqueduct water on upper floors.

In terms of system resilience, the insula reaches a level of 9/9, meaning that there is a maximum level of diversity in all aspects of the insula's water system (supply, usage, and drainage). This comes from an expanding number uses to which water is put in this period, and the need to create enough infrastructure to support this diversity of uses within neighboring buildings.

[554] In room 7a of the baths; Similar Z-shaped channels are known in larger nymphaea, such as the one discussed in Chapter 5 within the Domus del Protiro (V, ii, 4-5, features 37, 38).

[555] Rain downshafts in the Terme del Faro (IV, ii, 1: features 2, 3); IV, ii, 4 (features 31, 32) and in IV, ii, 5 (features 41, 42)

Figure 4.176: Different shaped downshafts in insula IV, ii indicate a division of upper floor waste removal. At right is the semi-circular downshaft in building IV, ii, 9 (feature 61), and at left is the rectangular downshaft from building IV, ii, 13 (feature 60).

4.2.2.2: Culture

This period witnessed the introduction of aqueduct lines from the Malafede hills, first leading to the large cistern now under the *palaestra* of the Terme di Nettuno (II, iv, 2), and the second to the large *castellum aquae* directly south of the Porta Romana.[556] These were revolutionary to the hydraulic landscape of Ostia, and heralded a period of widespread bath and public fountain creation, as well as transforming the possibilities for water distribution and display throughout the city. This was contemporary with a large jump from mostly private hydraulic infrastructure to a combination of public and private systems (Table 4.40). Together with public urban systems like the street sewers there is a much larger increase in private structures. Private buildings like a domus invested in complex internal supply and drainage structures, such as the Caupona del Pavone (IV, ii, 6).

The buildings of the insula mirror the general urban trend of an increasing overall number of water features, as well as the proportion of private to public features (Tab. 6.4). This diversity reflects the wider situation across Ostia with the dramatic spread of multi-story *insulae* across the city.

[556] Bukowiecki 2008, 57 for this initial aqueduct line.

insula IV, ii		Roman Water Footprint # 2 (AD 50-200)
Private Oriented-insula	Total # of Features	35
Public Oriented-insula	Total # of Features	23
Private Oriented-Ostia	Total # of Features	122
Public Oriented-Ostia	Total # of Features	72

Table 4.40: Private and Public water features in insula IV. ii and in contemporary Ostia between AD 50-200.

4.2.2.3: Nature

On a larger ecological level, water was brought in from a separate hydraulic basin in the Malafede hills, as local supply was insufficient. However, this is not a case of urban centers depriving rural communities of water, and it is likely that rural communities benefitted from these lines as well.[557] In terms of the Tiber river, this period saw fewer floods compared to the previous Roman Water Footprint period (4th century B.C.- AD 50).[558] The river was certainly more polluted in this period, and not simply by modern standards. Contemporary authors describe the negative impact of Rome's pollution on local fish populations, which we can imagine as a direct result of the increase in urban manufacturing industries such as leather processing, and fulling.[559] However, as discussed above, the increased pollution likely had little effect on the acquisition of water for certain applications. Additionally, the expansion of Portus reduced the strength of the Tiber flowing by Ostia as a result of the digging of the *fossa Traiana*.[560] This action increased the rate of delta progradation near Ostia, ensuring its departure from the stage of large-vessel trade. The amount of internal urban garbage jumps exponentially from the previous period, tied in with the boom in population, production, and building. The highest number of functioning bath buildings also exist in this period (21 baths), surely facilitating the spread of water-borne parasites at an equally exponential rate.

4.2.2.4: Conclusion

This period witnessed one of most massive changes to the total urban landscape of Ostia. With widespread socio-economic change, came a parallel increase in the complexity and diversity of the hydraulic infrastructure in the insula. The majority of these systems encompass, or at least pass through the space of other buildings, especially in terms of sewer lines. There is a definite clustering of water features in the north (IV, ii, 1, 2, 3, 4, 5), central (IV, ii, 6), and southern (IV, ii, 7-14) parts of the insula. The presence of existing sewer lines dictated the location of later structures. There is also a clear subdivision in types of downshafts, and it is possible to use these features to sketch out the position and diversity of upper floor structures. While the number of floods decreases in this period, the overall health of the city must surely have decreased with the incredible surge in proportion to the city's growth. Many more people coming from a wide range of places mixed with large-scale building projects, and all of it washed into the high number of bath basins would have potentially promoted the spread of water-borne diseases.

[557] Wilson 1999 for an overview of rural aqueduct usage.
[558] Aldrete 2007, 242 for floods recorded in this period.
[559] MacKinnon 2014, 191 for the surprising lack of fish bones in the osteological assemblages throughout Ostian history.
[560] Keay *et al.* 2014b for the canal system at Portus.

4.2.3: IV, ii Roman Water Footprint 3 (AD 200-300)

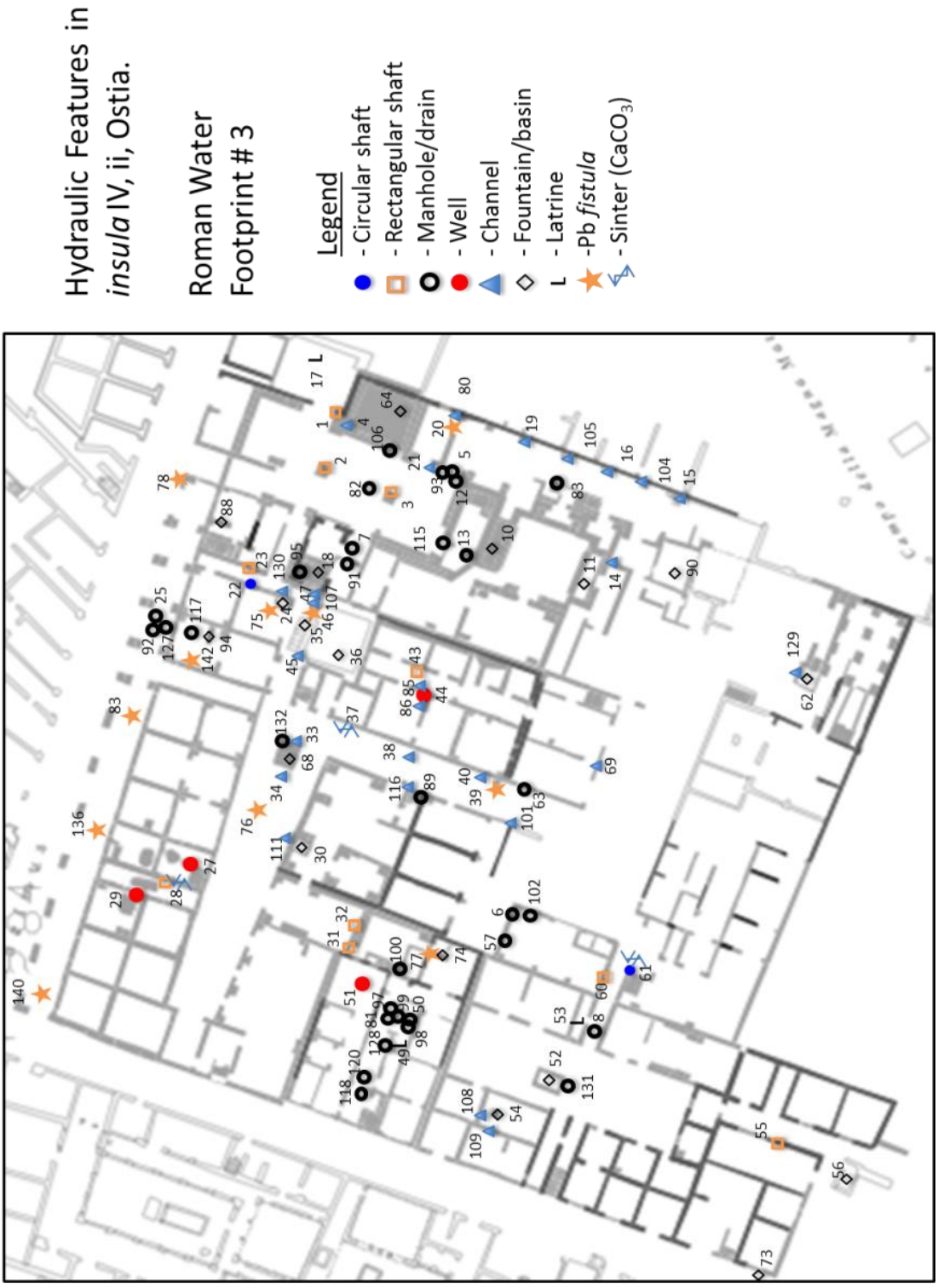


Figure 4.177: Water features identified in insula IV, ii between 200-300 AD (after Stöger 2011, 158, Fig. 5.112).

IV, ii Roman Water Footprint # 3 (AD 200-300)			
Indicator	Sub-Indicator	Data	Quantity
Infrastructure	Supply Systems	Rain Water	3
		Ground Water	4
		Aqueduct	27
		Total # of Supply Features	34
	Usage Systems	Number of Leisure Water Features	15
		Number of Industrial/Economic Water Features	5
		Number of Domestic Water Features	1
		Total # of Usage Features	21
	Drainage Systems	Sewer	25
		Downshaft	10
		Drains	17
		Total # of Drainage Features	52
	System Resilience	Number of Types of Supply	3
		Number of Types of Usage	3
		Number of Types of Drainage	3
		Total System Complexity	9
		Total # of Features	107
Culture	Private Oriented-insula	Total # of Features	46
	Public Oriented-insula	Total # of Features	61
	Private Oriented-Ostia	Total # of Features	101
	Public Oriented-Ostia	Total # of Features	49
Nature	External	Tiber River Floods	2
	Internal	Urban Garbage	4
		Urban Health (# of Baths)	16

Table 4.41: Roman Water Footprint #3 from insula IV, ii.

4.2.3.1: Infrastructure

Infrastructure expands in all areas in this period (Figure 4.177). The total number of supply features doubles in this period when compared to the previous phase (from 17 to 34 features); the majority of this growth comes from aqueduct-supplied features (Table 4.41). These are clustered in the Terme del Faro (IV, ii, 1), which received a large-scale reconstruction in this period, and perhaps a new owner (Figure 4.178).[561] The line of brick piers added along the eastern side of the building contained at least two lines of lead supply pipes; in addition to the lead pipe known from the area of the *cardo*, these features suggest a secondary supply system. This secondary system would be represented by the newly installed *castellum divisorium*-nymphaeum (feature 90) in the southern part of the baths, and be connected to the supra-mural aqueduct line of the city. Rain water and ground water continue to be used into this period as well, ensuring a diverse supply system in the insula.

Other than the activity in the baths, the largest change in this period comes from the insertion of a large cistern (feature 36) against the north face of IV, ii, 5. Aqueduct water first reached a small distribution box on the northern wall of the cistern and was split through four different channels (Figure 4.179). Water from the cistern directly supplied the baths (IV, ii, 1) and basin 24 in the Caseggiato dell'Ercole (IV, ii, 2).

[561] See section 4.1 (IV, ii, 1) for the *fistula* pipe naming Scipio Orfitus (feature 78).

Figure 4.178: Two details of the Severan fresco added in the Terme del Faro, showing Europa astride Zeus at right, and maritime attendants at left.

Figure 4.179: Looking south at the flight of stairs leading to the top of the cistern, with the distribution basin indicated by dashed lines.

An elevated channel (feature 45) within the cistern probably acted as an additional off-take, leading water from the northwest corner of the cistern, before turning south and heading along the external western side of building IV, ii, 5. Based on the sinter evidence, water would then turn 90° towards the ground, perhaps leaking from the pressure and causing the formation of irregularly spread sinter (feature 37). Such pressure breaks are a well-known symptom of *fistulae*. Throughout the insula, large basins are installed in this period (features 30, 52, 54, 56, 73), and although a new connection to the

aqueduct is known for only one of these basins (feature 76) , the others were also likely supplied in this way. Also in this period, the domus in IV, ii, 6 was converted into the Caupona del Pavone, and gained a new bar basin with its optical illusion fish.

With the renovation of the bath building (IV, ii, 1), new sewer lines were created and attached to pre-existing ones. Geophysical prospection within the central room carried out in the summer of 2015 has indicated the approximate path of these drains (Figure 4.180).[562] The ground penetrating radar was carried out using a 250 MHz transmitter with an approximate depth of 30-50 cm, and identified the outline of the large rectangular drain (feature 115) in the south part of the room, as well as the central drain (feature 82). While additional geophysical work would further define these channels, these initial results do prove the potential for further geophysical prospection within thermal structures.

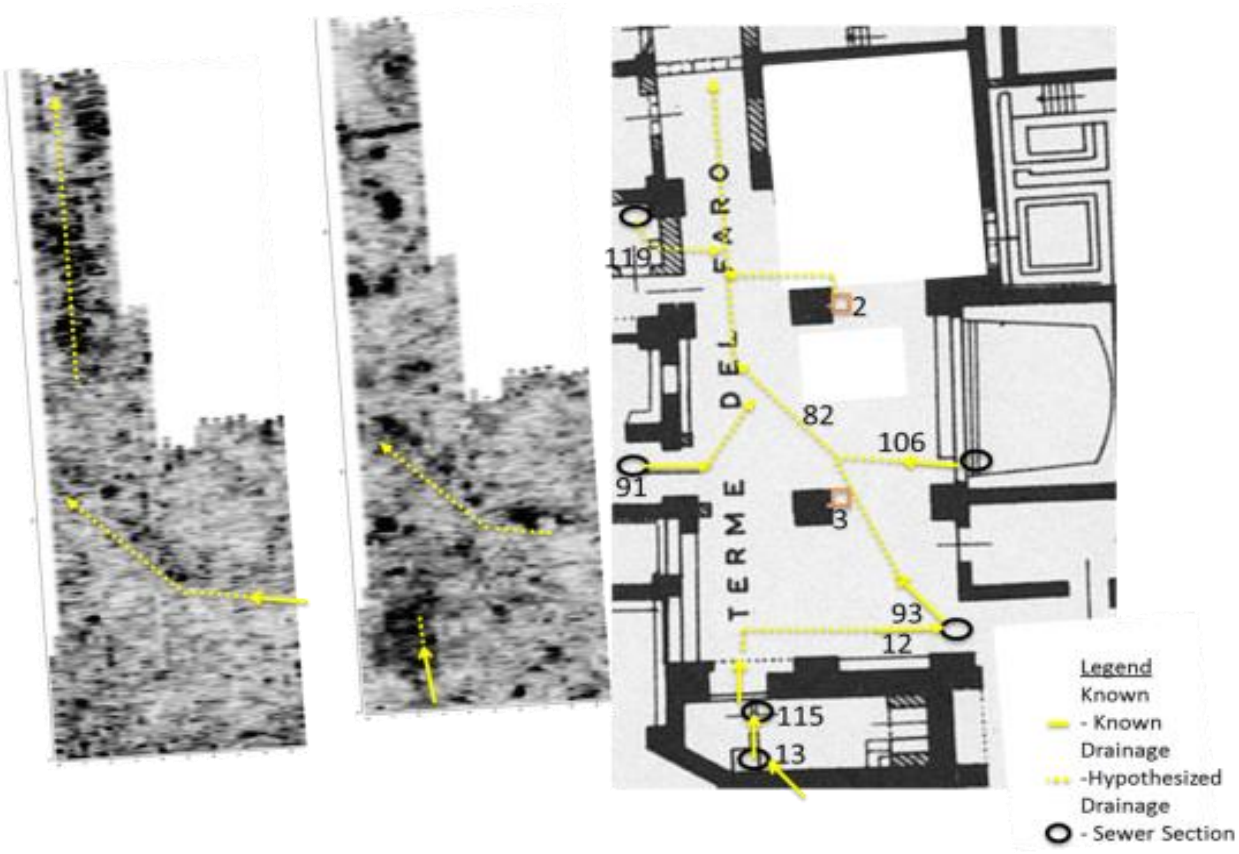


Figure 4.180: Two depth slices of the ground penetrating radar study of the Terme del Faro (IV, ii, 1), with identified and hypothesized sewer features indicated by solid and dashed lines respectively.

Fill material recovered from the sewer line running from IV, ii, 5 toward the *cardo* (feature 84) dated its destruction in the 3rd century, and is connected with the insertion of the large cistern.[563] However, the sewer was only destroyed under the cistern: water from building 5 was now directed out into the central corridor of the insula. The northern extension of the sewer that ran through the Caseggiato dell'Ercole (IV, ii, 3) continued to function. In this period, the ground level within the rest of the insula was raised to a level higher than at present: the exact height difference is estimated to have been ca. 50 cm above the current ground level. This is substantiated not only by the current position of many drainage features, but also from the height of the bonding course within brick piers that were added at this time.

[562] Conducted by T. Sonneman with the support of H. Stöger and assisted by bachelor students from Leiden University and TU Delft.

[563] See section 4.1 for a description of the 1994-1995 excavation carried out in building IV, ii, 5.

While only secondary channels and isolated sewer sections remain, they are all roughly contemporary and must have been part of a centralized supply and drainage system. This was composed of three main sections (Figure 4.181).

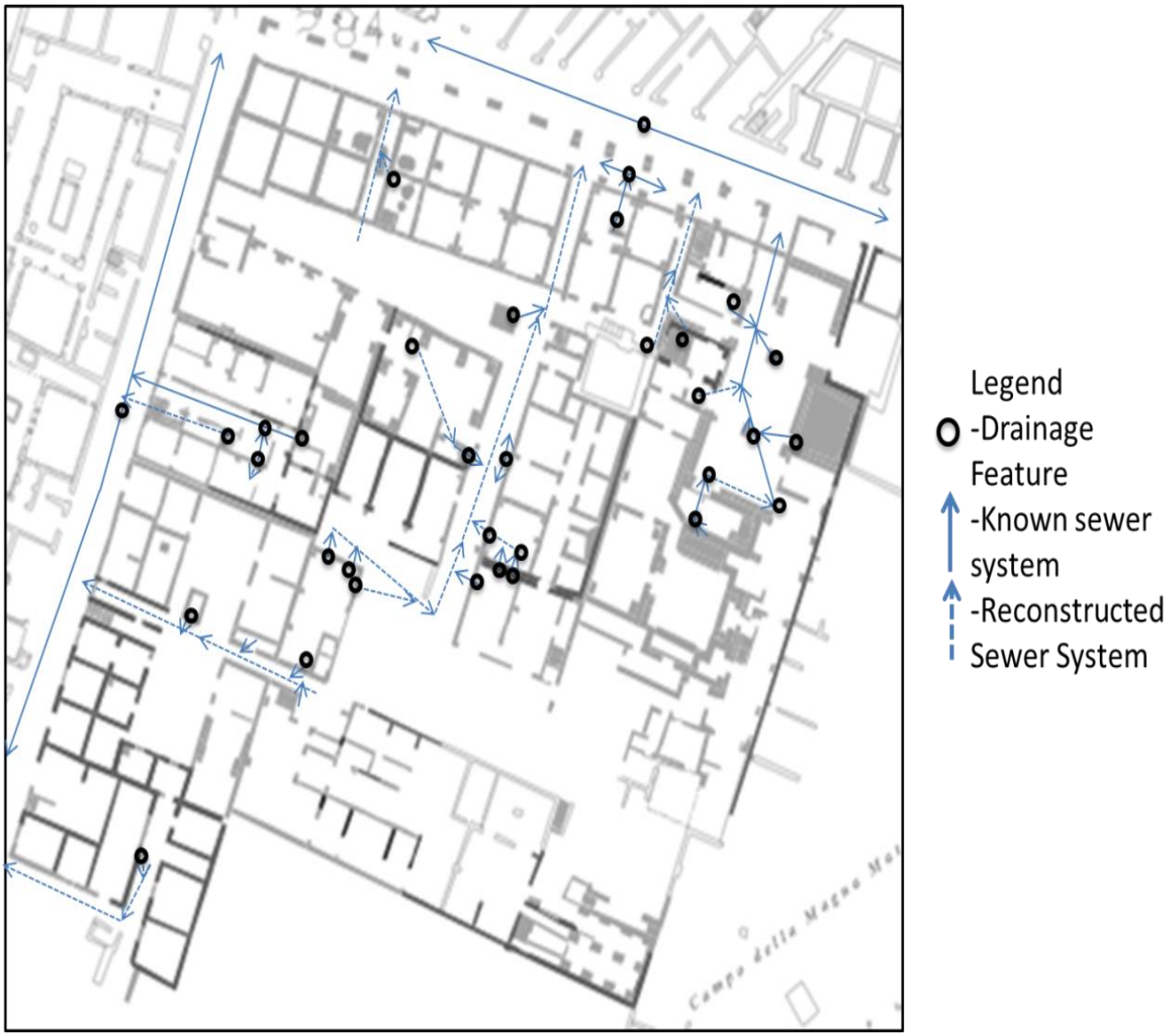


Figure 4.181: Reconstructed drainage and sewer systems in insula IV, ii in RWF #3 (after Stöger 2011, 158, Fig. 5.112).

The first runs down the central corridor of the insula, connecting the features of building 4, 5, 12, and 14.[564] This sewer would have connected to the 2nd century sewer line already in place to drain the courtyard bauletto fountain. The second section is made up of the features in the north part of IV, ii, 13, and likely connected to the first section.[565] The third section comprises features from buildings 7, 9, and 13.[566] In addition to these more integrated drainage systems, existing lines continued to be used and modified in the Caupona (IV, ii, 6) and building IV, ii, 8.[567]. Also in the Caupona, a new latrine was installed (feature 49) that connected directly to the sewer under the Via della Caupona del Pavone. The multi-

[564] IV, ii, 4: features 89, 116; IV, ii, 5: features 37, 38, 39, 40; IV, ii, 12: feature 63; IV, ii, 14: feature 101.
[565] IV, ii, 13: features 6, 57, 102.
[566] IV, ii, 7: features 8, 131; IV, ii, 9, 13: features 60, 61.
[567] IV, ii, 6: features 98, 99, 50; IV, ii, 8: feature 56.

seater latrine in the Terme del Faro was also installed in this period (feature 17); similar latrines are common in bath buildings, such as in the Terme del Foro (I, xii, 6), and Terme di Nettuno (II, iv, 2).[568]

The hydraulic system of the insula remains at its maximum level for all parts of the hydraulic system (9/9). This means that there are many different types of contemporary supply sources, and that water is being used in many different ways. The drainage systems are also composed of different drainage types, with water draining from upper apartments, ground level basins, and through larger sewer networks. A maximum level of resilience also means that the entire hydraulic system is flexible, and can react and adapt if one part of the system breaks down.

4.2.3.2: Culture

This period is characterized by a much more water being used in spaces with a public orientation than in inward facing private spaces (Table 4.42). This trend is opposite to the previous Roman Water Footprint #2 phase (AD 50-200). Most of this public water usage comes from the new phase of the Terme del Faro (IV, ii, 1), and the transformation of the Caupona del Pavone (IV, ii, 6) from a domestic into an outward facing building. This runs against the wider trends in the city, which has more evidence of private investment in this period. Accepting the Severan chronology proposed for the Mitreo degli Animali (IV, ii, 11), it suggests that the mithraeum was created almost in the same year as the renovations to the bath building, which could suggest a much wider program of building involving the entire eastern section of the city block.[569]

insula IV, ii		Roman Water Footprint #3 (AD 200-300)
Private Oriented-insula	Total # of Features	46
Public Oriented-insula	Total # of Features	61
Private Oriented-Ostia	Total # of Features	101
Public Oriented-Ostia	Total # of Features	49

Table 4.42: Private and Public water features in insula IV, ii and in contemporary Ostia between AD 200-300.

4.2.3.3: Nature

In this period, the Tiber had a very low number of recorded flooding episodes, with only two floods known.[570] The highest number of preserved urban landfills date to this period, which is connected with the wider ground raising for new building projects.[571] This high amount of waste is indicated by the peak in faunal material identified for the 3rd century. The number of bath buildings in the city decreases from the previous Roman Water Footprint period, from 21 to 16 functioning thermal establishments. Evidence from recent wide-scale Late Antique surveys of Ostia have shown that there were numerous collapsed and abandoned buildings in Ostia in this period, which would have been excellent places for the accumulation of vermin and bacteria.[572] When taken together with the maximum amount of preserved internal faunal evidence, the evidence of a high number of functioning bath buildings point to the least healthy period in the city's history. Accumulated disease from the city would have been sloughed off into the pools of the 3rd century bath buildings.

[568] Jansen 2002, 178, note 240 identifies this as a latrine.
[569] White 2012, 446-451 for this dating.
[570] Aldrete 2007, 242 for the flood evidence.
[571] MacKinnon 2014, 192-194.
[572] Lavan 2012, 677 for this survey.

4.2.3.4: Conclusion

Numerous buildings were connected with the water supply from the cistern. Also in terms of drainage, almost the entire insula becomes connected in three large sewer systems that all drain outwards towards the main streets. The raising of the ground level offered the opportunity for collaboration between different structures, but equally took advantage of existing systems. Similar now-lost, or "floating" ground levels are beginning to be identified across Ostia.[573] This connection implies more than a hydraulic opportunism, but suggests a deeper social connection between the owners of these structures, or perhaps an action taken by only one owner of several structures. It also adds a new understanding to the modern and ancient history of the insula. The excavation practices and agendas of 1938-42 campaigns excavated into the more southern areas of the insula following the ground level of the Portico dell'Ercole, and must have removed the drainage and supply systems here. This is not to besmirch these earlier projects, but rather to contextualize their activities, and to use similarly placed water features as proxies for reconstructing now-lost urban systems.

[573] Gering 2013, 258, Fig. 3 for this now-lost ground level in the Caseggiato del Sole (V, vi, 1).

4.2.4: IV, ii Roman Water Footprint 4 (AD 300-600)

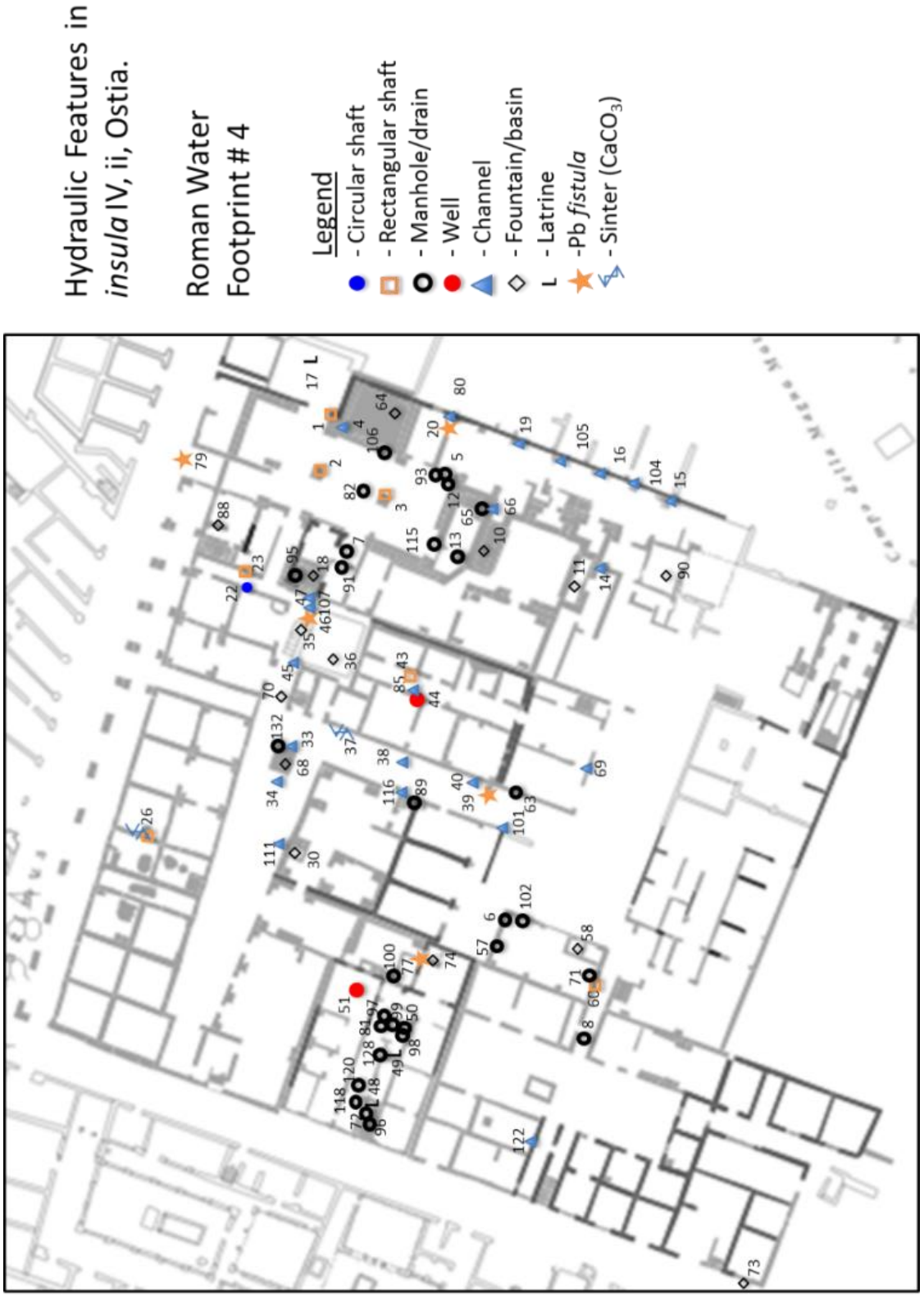


Figure 4.182: Water features identified in insula IV, ii between AD 300-600 (after Stöger 2011, 158, Fig. 5.112).

IV, ii Roman Water Footprint # 4 (AD 300-600)			
Indicator	Sub-Indicator	Data	Quantity
Infrastructure	Supply Systems	Rain Water	2
		Ground Water	2
		Aqueduct	20
		Total # of Supply Features	24
	Usage Systems	Number of Leisure Water Features	12
		Number of Industrial/Economic Water Features	3
		Number of Domestic Water Features	2
		Total # of Usage Features	17
	Drainage Systems	Sewer	20
		Downshaft	7
		Drains	17
		Total # of Drainage Features	44
	System Resilience	Number of Types of Supply	3
		Number of Types of Usage	3
		Number of Types of Drainage	3
		Total System Complexity	9
		Total # of Features	85
Culture	Private Oriented-insula	Total # of Features	40
	Public Oriented-insula	Total # of Features	45
	Private Oriented-Ostia	Total # of Features	63
	Public Oriented-Ostia	Total # of Features	36
Nature	External	Tiber River Floods	6
	Internal	Urban Garbage	3
		Urban Health (# of Baths)	14

Table 4.43: Roman Water Footprint #4 from insula IV, ii.

4.2.4.1: Infrastructure

In the overall number of supply features there is a slight decline from the previous Roman Water Footprint period (Table 4.43). This pertains mostly to aqueduct based sources, as ground water and rain water supply systems remain largely stable (Figure 4.182). The baths (IV, ii, 1) continue to function, as attested by an epigraphic lead pipe (feature 79). At some point later in the 5th century, several walls in the baths were blocked up with rough *opus mixtum* walls; as these walls blocked off access to the *caldaria*, it remains unclear to what degree the baths still functioned. Based on the late type of *opus latericium*, the water tower in IV, ii, 2 also dates to this period. Its characteristic rectangular shaft and coating of calcium carbonate represent a much later *comparandum* than the more famous examples at Pompeii and Herculaneum.[574] All of the features supplied by the aqueduct can no longer function with the demise of this system, out of use at some point in the 6th century CE.[575] The wells from the 1st century in buildings, 2, 5, and 6 continue to function into this period.[576] Together with the separate aqueduct lines feeding different fountains and cisterns, this implies a flexibility of water supply needs in this insula.

The total number of usage features declines slightly in this period, compared to the previous Roman Water Footprint period (AD 200-300), but the majority of water features from the previous period continue. As in the bath building, several stretches of walls were added throughout the insula. The most

[574] Locicero 2017 for further literature and computational fluid dynamic modeling of this water system.
[575] Bukowiecki *et al*. 2008, 190 for 4th-5th century repairs on the supra-mural aqueduct line.
[576] IV, ii, 2: features 27, 29; IV, ii, 5: feature 44; IV, ii, 6: feature 51.

important of these for the present discussion are the ones dividing the insula into an eastern and western half. These walls continued the line of hallway 1 in the Caseggiato dell'Ercole (IV, ii, 3), and reduced access to the central courtyard fountain (feature 68). A new fountain basin was added (feature 70) against one of these *opus vittatum* walls. This implies that both fountains are working at the same time, but perhaps were accessible only to different halves of the insula. Further evidence for the closure of doorways comes from the double chambered basins in buildings IV, ii, 7, and 9. Both of these are built in connection with a blocked doorway, and their extremely rough exterior indicates that these basins were originally sunk into the ground. The height of these basins and their associated thresholds supports the theory of a higher ground level in this period. The identification of these basins as related to industrial processes comes from their robust size and depth.

The sewage system outlined in the previous phase continues to function, although it is not possible to identify continuity in all of the secondary sewers or downshafts. The basins described in the previous section connect to these lines. New drainage features are installed in the bath building indicating newly added upper floor drainage needs. In the Capuona del Pavone, a new latrine was installed next to the main entrance (feature 48). The latrine drains directly out to the Via della Caupona del Pavone, under the building's staircase (Figure 4.183). This line had already been created with the previously installed latrine in room 5 of the same building, continuing the hydraulic isolation of this building from the rest of the insula.

The overall hydraulic system maintains its resilience of 9/9, the maximum achievable level. This is interesting to observe, given that the total number of features declines compared to Roman Water Footprint #3, from 107 to 85 features in Roman Water Footprint #4.

Figure 4.183: Latrine installed in the Caupona del Pavone (IV, ii, 6).

4.2.4.2: Culture

Across Ostia in this period there are many examples of the re-division of space within *insulae*. At the beginning of this period, the available evidence indicates a small but robust burst in hydraulic features across Ostia. This entails the insertion of large nymphaea into Late Antique domus structures or in public spaces, as well as the creation of *ex novo* bathing structures. Together with this hydraulic investment, many buildings across the city are known to be abandoned or in a ruinous state. While it is difficult to identify structural continuity in several buildings of insula IV, ii, the closure of walls and sections of the

insula off from each other point to new divisions of space. This has implications for access to water features as well as highlighting changing needs within the insula.

The gap between publicly and privately oriented water features shrinks to its smallest margin in the entire history of the insula, although there are still slightly more public water features functioning at this time (Table 4.44). This runs against the wider urban trend of Ostia, in which private water features are nearly double the number of public features.[577]

insula IV, ii		Roman Water Footprint # 4 (AD 300-600)
Private Oriented-insula	Total # of Features	40
Public Oriented-insula	Total # of Features	45
Private Oriented-Ostia	Total # of Features	63
Public Oriented-Ostia	Total # of Features	36

Table 4.44: Private and Public water features in insula IV, ii and in contemporary Ostia between AD 300-600.

4.2.4.3: Nature

This period experienced the same amount of flooding events as in Roman Water Footprint #2 (AD 50-200), with 6 floods. This is higher than the two floods known from the previous Roman Water Footprint #3 period, with 2 floods. In this period of the city's life, the number of abandoned buildings increases. These could be used as *ad hoc* garbage dumps, or places for less regularly organized economic practices, or even as shelter for squatting populations. Evidence for internal faunal depositions is still high in this period, with only a slight decrease from the previous period.[578] A similar trend is present in the number of bath buildings, with 14 bath buildings known at least for the beginning of this period.

4.2.4.4: Conclusion

In this period we see a similar trend across the insula in all areas of its infrastructure (supply, usage, drainage). The existing infrastructure decreases, but only slightly in all aspects of the system. The structure of the hydraulic system changes very little, which is comparable to the minimal structural change observed in the broader insula at this time. The same hydraulic opportunism as in previous phases is present here as well. However, the insula remains largely a product of the initial 2nd century phase of creation. In this final phase of the insula's life, both the hydraulic infrastructure and the architectural composition of the insula do not match the wider urban trend of Ostia; no large *ex novo* buildings were created in the insula in this final period of its life.

4.3: Diachronic Analysis

The indicators of the Roman Water Footprint will now be discussed diachronically, to highlight larger trends over the complete life of the insula. This will highlight what features make insula IV, ii unique. The data in the subsequent charts comes from the Roman Water Footprint table directly below (Table 4.45).

[577] Lavan 2012, 689.

[578] MacKinnon 2014, 194-195 for the Late Antique faunal evidence across Ostia.

IV, ii Roman Water Footprint # 1-4						
Indicator	Sub-Indicator	Data	Roman Water Footprint #1 (4th century B.C.- AD 50)	Roman Water Footprint #2 (AD 50-200)	Roman Water Footprint #3 (AD 200-300)	Roman Water Footprint #4 (AD 300-600)
Infrastructure	Supply Systems	Rain Water	2	2	3	2
		Ground Water	4	4	4	2
		Aqueduct	0	11	27	20
		Total # of Supply Features	6	17	34	24
	Usage Systems	Number of Leisure Water Features	0	5	15	12
		Number of Industrial/Economic Water Features	0	2	5	3
		Number of Domestic Water Features	1	1	1	2
		Total # of Usage Features	1	8	21	17
	Drainage Systems	Sewer	0	16	25	20
		Downshaft	0	13	10	7
		Drains	0	4	17	17
		Total # of Drainage Features	0	33	52	44
	System Resilience	Number of Types of Supply	2	3	3	3
		Number of Types of Usage	1	3	3	3
		Number of Types of Drainage	0	3	3	3
		Total System Complexity	3	9	9	9
		Total # of Features	7	58	107	85
Culture	Private Oriented-insula	Total # of Features	7	35	46	40
	Public Oriented-insula	Total # of Features	0	23	61	45
	Private Oriented-Ostia	Total # of Features	36	122	101	63
	Public Oriented-Ostia	Total # of Features	17	72	49	36
Nature	External	Tiber River Floods	21	6	2	6
	Internal	Urban Garbage	1	3	4	3
		Urban Health (# of Baths)	3	21	16	14

Table 4.45: Complete Roman Water Footprint for insula IV, ii.

Similar to the conclusions reached by Stöger in her spatial analysis of IV, ii, the buildings of the insula are hydraulically integrated together and should be seen as a unit, rather than as a sum of discrete parts. This is true not only in terms of the sewer lines, but also in terms of supply (Figure 4.184). The large cistern (feature 36) and the water distribution tower (feature 26) indicate not only that buildings of ostensibly different functions were connected and shared water, but allow us to sketch out the insula's connection to the wider urban systems of Ostia. At the same time as this increased connectivity, several buildings do not connect to the wider system of the insula, such as the Caupona del Pavone (IV, ii, 6). Despite its functional change from a private domus to an outward facing inn, the successive owners of the building did not want to connect spatially, socially, or hydraulically with the rest of the insula.

Ground water acquisition via wells act as a constant baseline in the hydraulic story of insula IV, ii. The four wells (features 27, 29, 44, 51) each persisted into later periods of time, causing sometimes awkward architectural negotiations. This offers an important piece to the discussion on ancient sustainability introduced in Chapter 2, and helps us to look beyond the idea of volumetric "needs" towards other sources of water supply. This is especially clear when we compare the nigh number of aqueduct features present in each Roman Water Footprint. If there are multiple sources of aqueduct supplied water throughout the insula, why go to the trouble of incorporating an older well into your building? The answer must lie in a division of water sources for different uses and preferences.

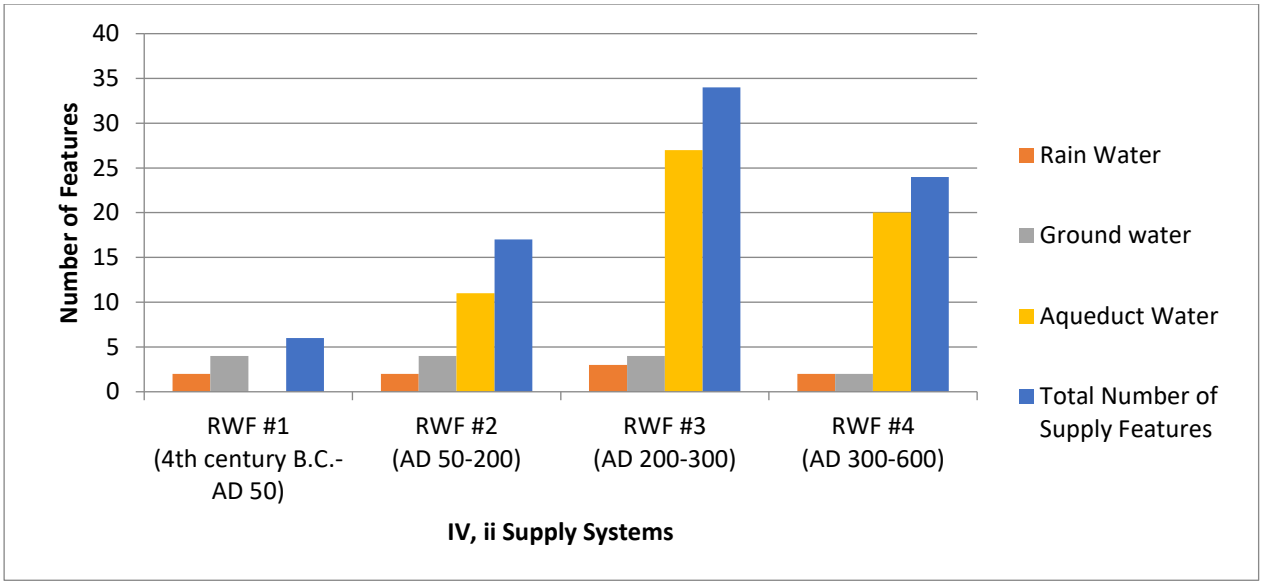


Figure 4.184: Supply Features in IV, ii for each Roman Water Footprint.

The Usage trends in the insula fluctuate over time, however leisure features remain dominant from Roman Water Footprint #2 to #4 (Figure 4.185). Industrial/Economic features have their peak in Roman Water Footprint #3, with the bars in the Caseggiato dell'Ercole (IV, ii, 2), and in the Terme del Faro (IV, ii, 1). Domestic water usage is very low in comparison and remains almost unchanged over the entire history of insula IV, ii.

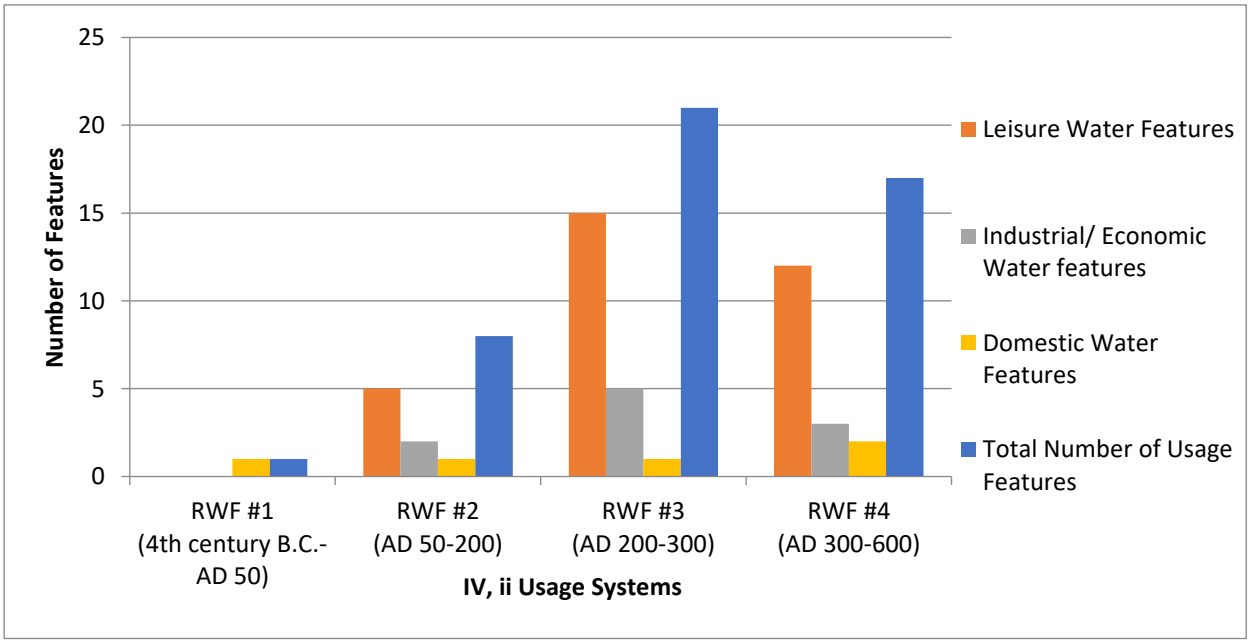


Figure 4.185: Usage Features in IV, ii for each Roman Water Footprint.

Drainage features have their highest distribution in Roman Water Footprint #3 as a result of three main sewer lines installed to connect nearly all the buildings of the insula (Figure 4.186). The presence of this insula-wide drainage system suggests that a single property owner, or a group of owners worked together and mutually benefitted from this system. The number of downshafts decrease over time, but the number of drains stays stable from Roman Water Footprint #3 into #4.

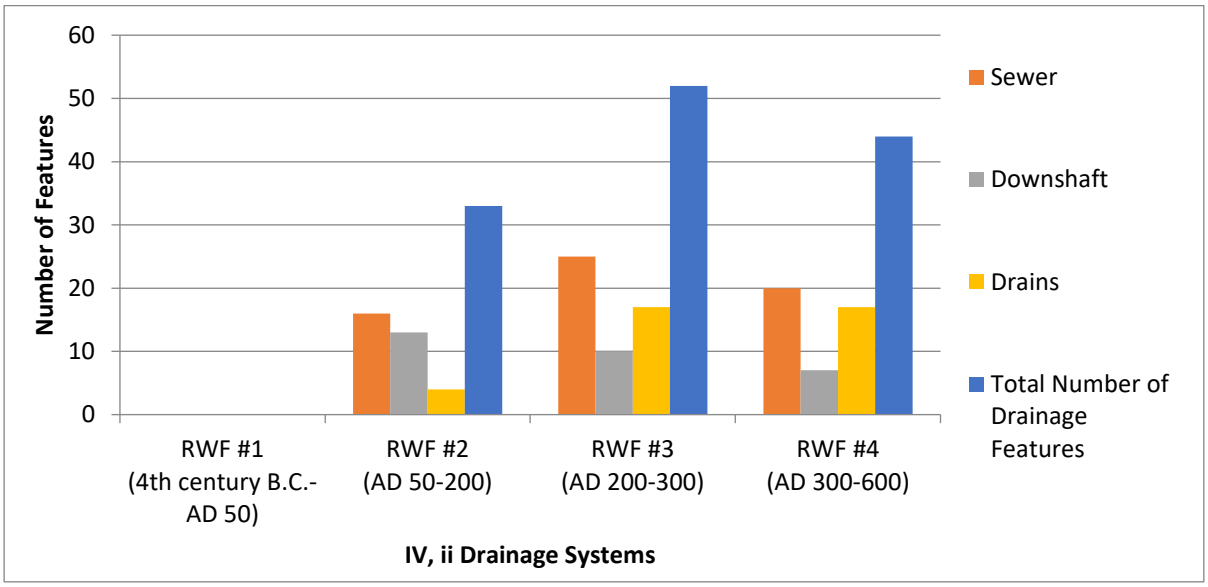


Figure 4.186: Drainage Features in IV, ii for each Roman Water Footprint.

Although Roman Water Footprint #3 has the highest number of water features, the degree of complexity remains stable at 9/9 from Roman Water Footprint #2 into #4 (Figure 4.187). The architectural skeleton of the insula is created in Roman Water Footprint #2, yet #3 is the most dynamic time in the entire history of the insula. Once created, the hydraulic systems maintains its sustainability into the Late Antique period, adapting to changes in individual buildings, or even a group of buildings.

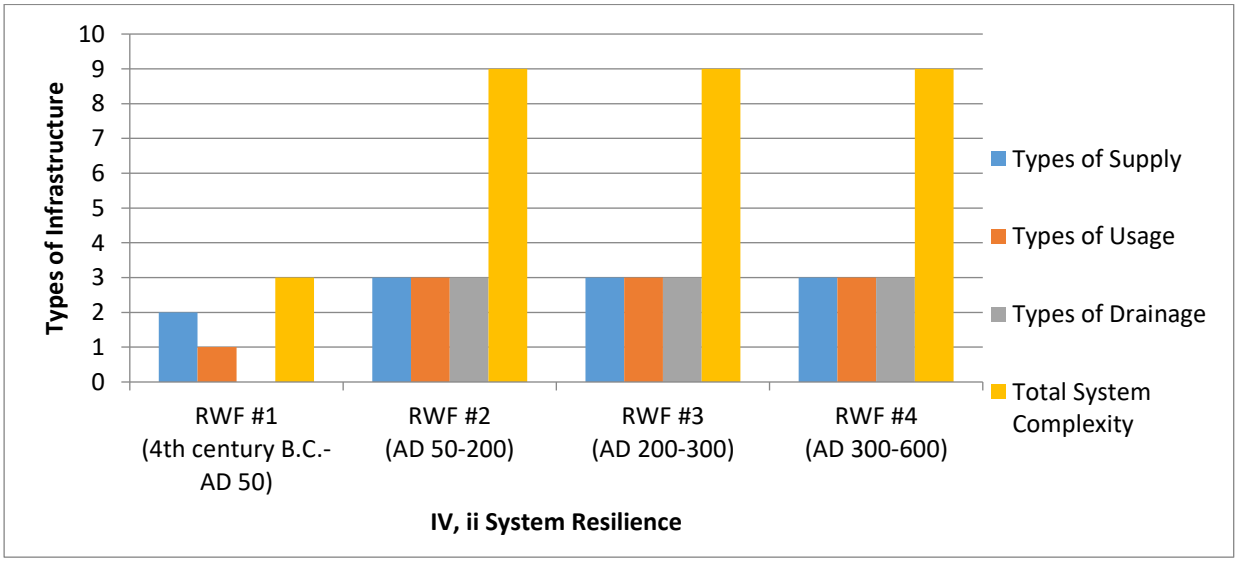


Figure 4.187: System Resilience of IV, ii for each Roman Water Footprint.

Breaking down the infrastructure system to its individual components, some diachronic strengths and weaknesses are visible (Figure 4.188). While the number of water features in many different categories increases from RWF #2 to RWF #3, aqueduct supply features and sewer features are present in the highest number in every period. We can also observe the only gradual decline from RWF #3 into #4, indicating that the insula's water system remained relatively stable into the Late Antique period.

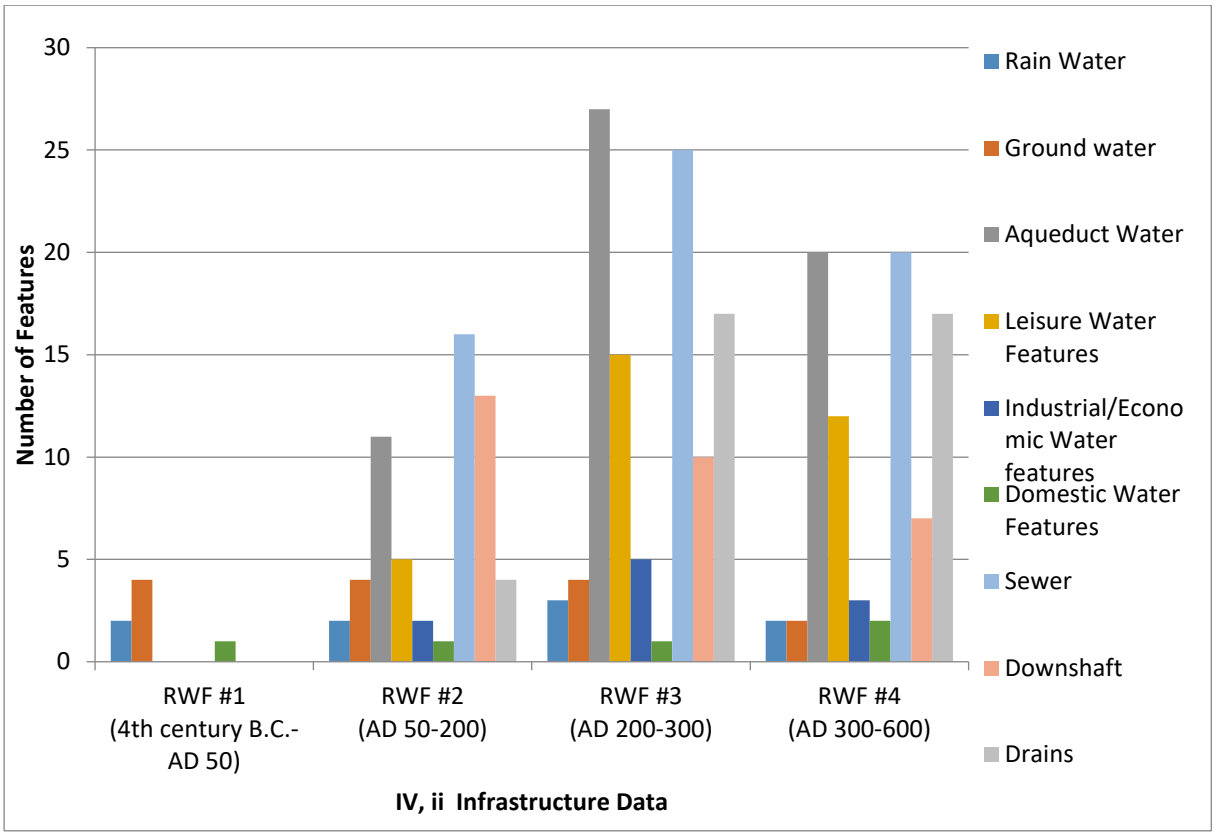


Figure 4.188: Infrastructure Data for insula IV, ii.

Insula IV, ii saw a sharp increase in the number of functioning water features between Roman Water Footprint #1 and #2. This growth continued between periods #2 and #3, although in this case we see roughly double the number of water features (Figure 4.189). While the total number of water features shows a distinct peak and drop, the proportional relationship between the three categories of infrastructure remain stable from Roman Water Footprint #2 to #4. Drainage features are always most plentiful, with fewer supply features, and with the fewest number of usage features. This hydraulic stability matches the architectural stability of the insula, which mostly retained its late 2nd century shape.

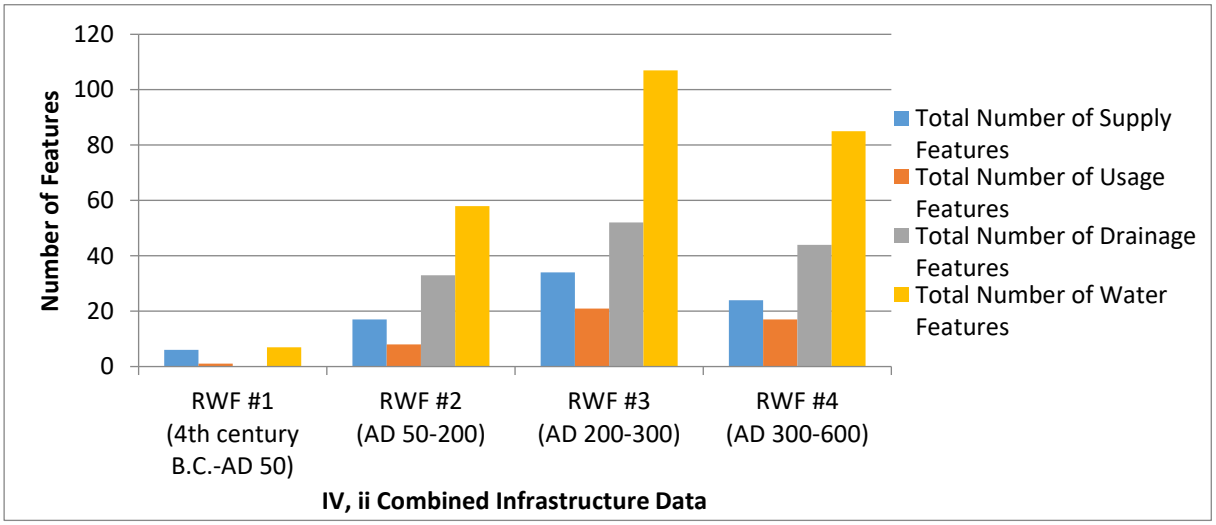


Figure 4.189: Combined Infrastructure data from insula IV, ii.

In Roman Water Footprint #3, the ratio of private to public water features inverts, with more public features continuing throughout the remaining life of the insula (Figure 4.190). The main cause for this

change comes from the large-scale rebuilding of the bath building (IV, ii, 1), but equally important is the creation of the three main branches of the underground sewer system.

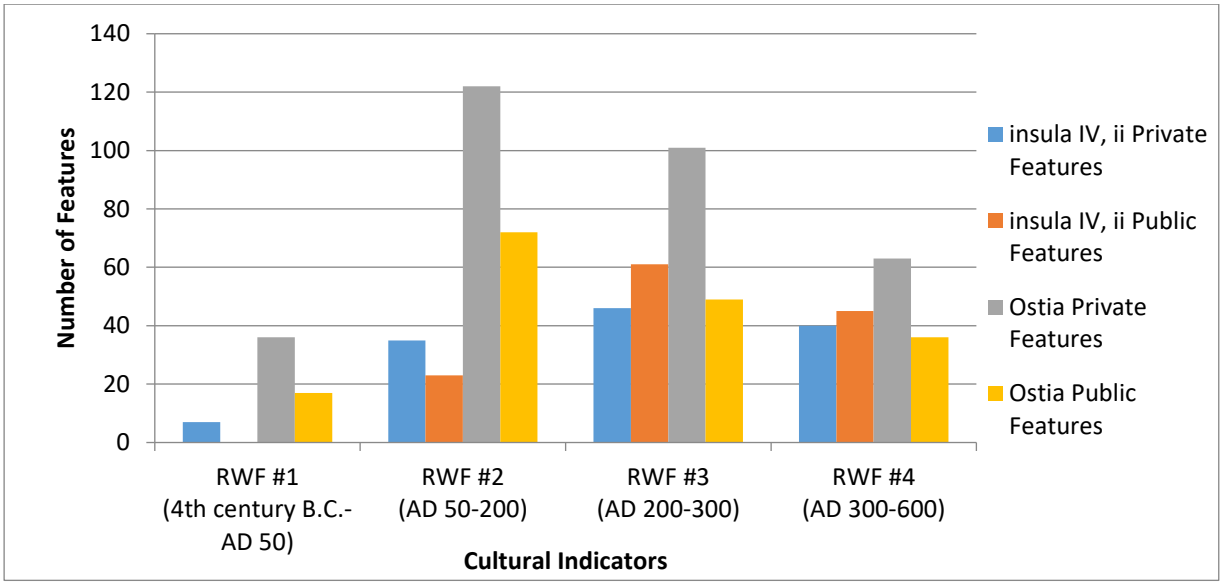


Figure 4.190: Cultural Indicators in IV, ii for each Roman Water Footprint period.

While the insula appears quite removed from the riverside activity, it in fact lies only ca. 400 m from the Tiber river, and with the low relief of Ostia, would certainly have experienced some issues in cases of flooding (Figure 4.191). This may have been exacerbated by the neighbouring Campo della Magna Mater (IV, i): its much lower Republican level and encircling brick walls would have made it a perfect structure for retaining flood water and debris. Having this water resting directly against the wall between the Campo and the insula would cause damage to the hypocaust systems of the bath building, which may provide a reason for the bath building's eastward expansion. The distance from the Tiber may have meant at least a decrease in smell from the downstream material from Rome. There is no evidence of internal waste dumps, or abandoned structures in insula IV, ii, yet this may just be a result of the excavation practices of the past rather than the true situation.

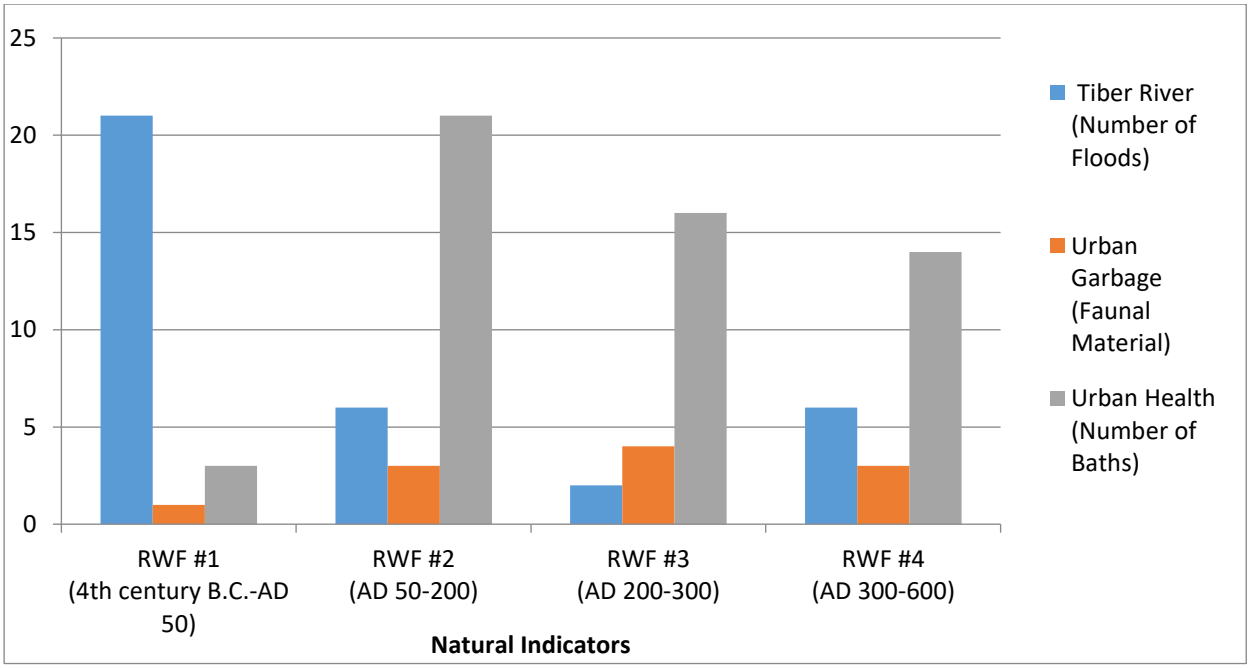


Figure 4.191: Natural Indicators in IV, ii and Ostia for each Roman Water Footprint period.

4.4: Insula IV, ii Conclusion

Many questions remain not only about the infrastructure of the insula, but its wider connection to Ostia. In terms of infrastructure, it appears as though the southern part of the insula was connected to the supra-mural water aqueduct of the city, but little trace of the city's Republican wall or any connection remains. Equally, it is unclear exactly how the 3rd century supply and drainage system connected to the earlier systems, and in turn, how the drainage systems of the Portico dell'Ercole connected to the sewer underneath the *cardo maximus*. Yet, the integration of almost every building in this period adds a new dimension to our understanding of the insula's history, and, as mentioned above, may act as a new proxy for reconstructing 3rd century community history of the insula. Topographically, the disparity in ground levels within the insula can now be seen as a result of 20th century excavation techniques, but this does little to help us interpret the ca. 1.50- 2.00 m height discrepancy between the southern buildings of the insula and the area directly south of it. Despite these caveats, adding a hydraulic level onto the existing archaeological and spatial data provides a new perspective on the history of insula IV, ii and its relationship to the wider city.

Chapter 5: Insula V, ii

5.0: Introduction

This chapter deals with insula V, ii, perhaps the best studied insula in the Roman world (Figure 5.192).[579] Insula V, ii is located in the south-eastern part of Ostia, and is bordered by the Semita dei Cippi to the west, the Via della Domus della Fortuna Annonaria to the north, and the Via della Domus del Pozzo to the east. The block consists of 14 structures, several of which preserve a chronology stretching from the Augustan to the Late Antique period.

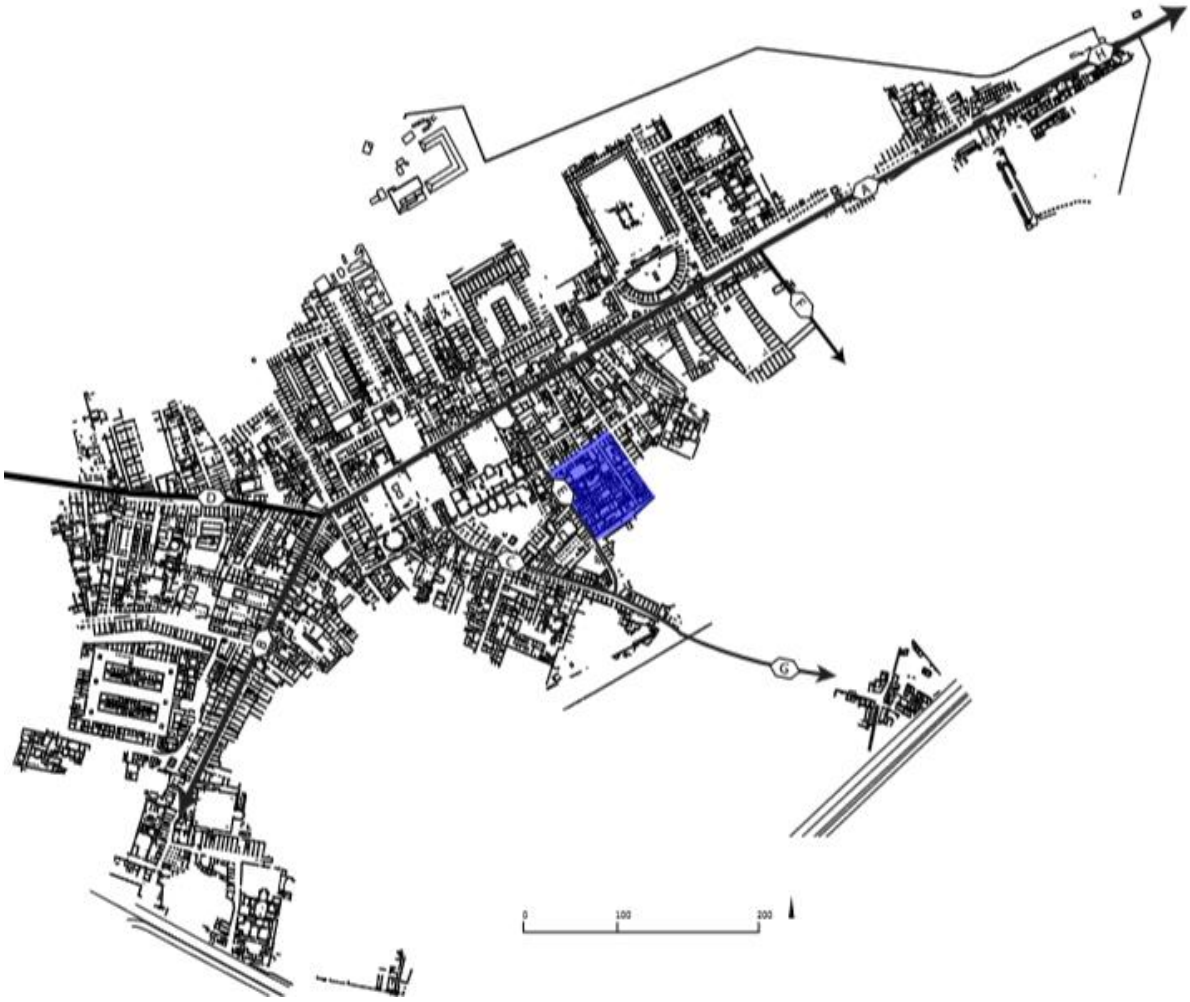


Figure 5.192: Location of insula V, ii in Ostia.

The entire block was first excavated by Guido Calza in his 1938-1942 campaigns, when excavation started on the area formed between the Via del Sabazeo, the *decumanus*, the Via dei Molini (=Semita dei Cippi), and the Via Ostiense (Figure 5.193).[580] Special attention was given to the wealth of mosaics and marble sculpture discovered in the buildings along the eastern side of the insula.

[579] Boersma 1985.

[580] GdSc 25, 2 (3-10-1938): *"In seguito al lavori dell'Esposizioni Universale, sulla zona Ostiense, il Duce ordina il proseguimento degli scavi di Ostia, affinche la zona del mare e la cittá antica riacquistano il loro splendore. La grande opera di scavo é diretta scientificamente dall'Il Archeologo Prof. Guido Calza, a tecnicamente dall'Arch. Con. Italo Gismondi."* Emphasis added.

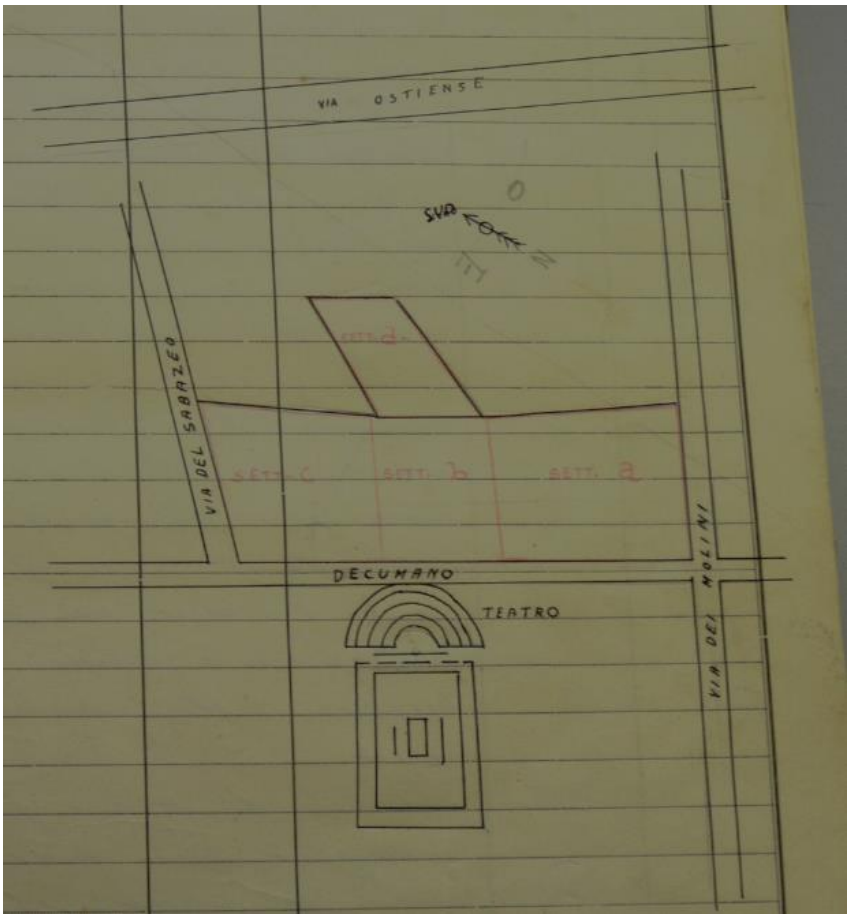


Figure 5.193: Schematic plan of the excavation plan in 1938. Insula V, ii is located in "Sett. a" along the Via dei Molini (=Semita dei Cippi). North is at the bottom of the image (GdSc 25, 2 (3-10-1938)).

The block received sporadic restoration throughout the 1960s, yet it was not until the 1980s that attention was focused on the buildings again. Johannes Boersma and his team researched the block as a whole between 1973 and 1976, culminating in his publication, *Amoenissima Civitas* in 1985 (Figure 5.194).[581] Starting from an initial goal to systematically investigate the Domus del Protiro (V, ii, 4-5), the team placed the building in its urban context by applying an equally detailed eye to the other buildings of insula V, ii. Through targeted sondages, archival research, and a detailed examination of the construction techniques, Boersma's work created an impressive amount of data. However, the rich data sets were not extrapolated into a larger discussion of the insula, and the room-by-room, wall-by-wall approach makes the raw data difficult to read through.

[581] Boersma 1985.

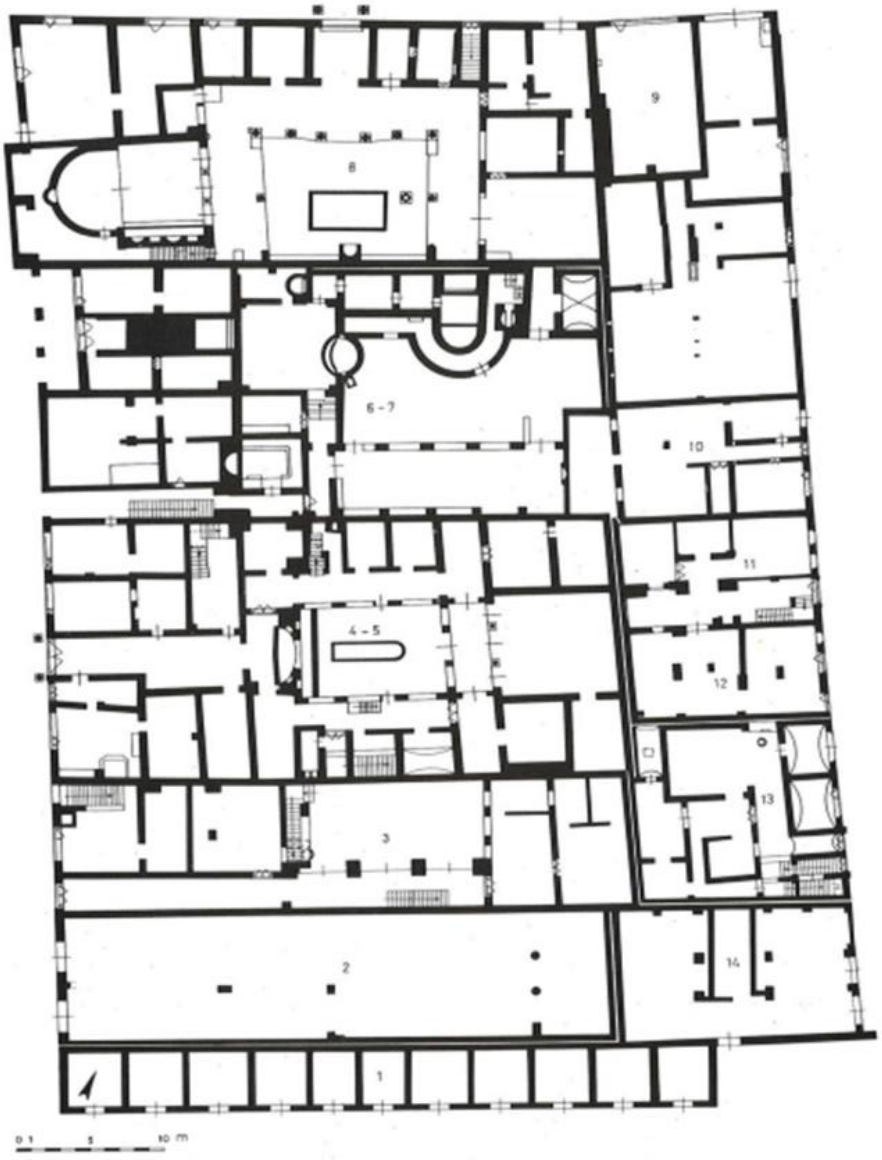


Figure 5.194: Insula V, ii from its final stage, with its 14 buildings (Boersma 1985, 218, Fig. 204).

Additional excavation and research of the eastern and southern sections of the city block continued in the 1980s through the work Roberto Petriaggi. His work involved some targeted sondages in buildings 1, 9, 10, and 14.[582] Additionally, he fully excavated and reconsolidated building V, ii, 2.[583] The present author seeks to incorporate the important work of Petriaggi with the findings of Boersma's study. It is safe to say that insula V, ii has been studied to a level of detail rarely given to such a complex of Roman urban buildings. This is the reason that the city block was chosen as a case study by the present study. Several of its largest *nymphaea* and bath buildings have received attention from previous studies, such as in the catalogue of Ricciardi and Scrinari.[584] However, beyond these, the complex network of water features have received little attention. Through a systematic study of the visible structures, as well as from the valuable photographic archives, the present study identified more than 180 different water features in insula V, ii. These range in time from the Republican to the Late Antique period, and in complexity from small patches of calcium carbonate (sinter), to large sewer systems that snake their way under multiple buildings. The author is indebted to these earlier works, and it is hoped that the

[582] GdSc 54, covers the period from 20-XII-1982 to 18-I-1988. See individual buildings below for details.
[583] Petriaggi 1984, 1987.
[584] RS I & II.

identification and contextualization of the water features add a new layer onto our understanding of insula V, ii and the wider network of water systems in Ostia.

5.1: Methodology

As with the other city blocks described in this study, arbitrary numbers have been given to each water feature that pertain only to this block.[585] For clarity and ease of identification, a chart and accompanying map are provided for each building to aid the reader in locating individual water features. Water features are described following the pre-established numerical order of the rooms in each building. After the description of all the water features of a given building, the features are organized into temporal phases to present the hydraulic history of each building in insula V, ii. In this overall history, the known water features are arranged into the chronological phases of the Roman Water Footprint methodology outlined in Chapter 2. This section is to be read together with section 5.2, in which the hydraulic infrastructure is integrated into the Roman Water Footprint methodology to give a contextualized picture of water in the insula in a single time period and how this changed over time.

5.1.1: Water Features of insula V, ii

The discussion of each building is in the following order:

History of Excavation and Restoration

Location in insula

Phasing and Comments

Water Features Chart

Description of Water Features

Infrastructure Chronology

Conclusion

V, ii, 1

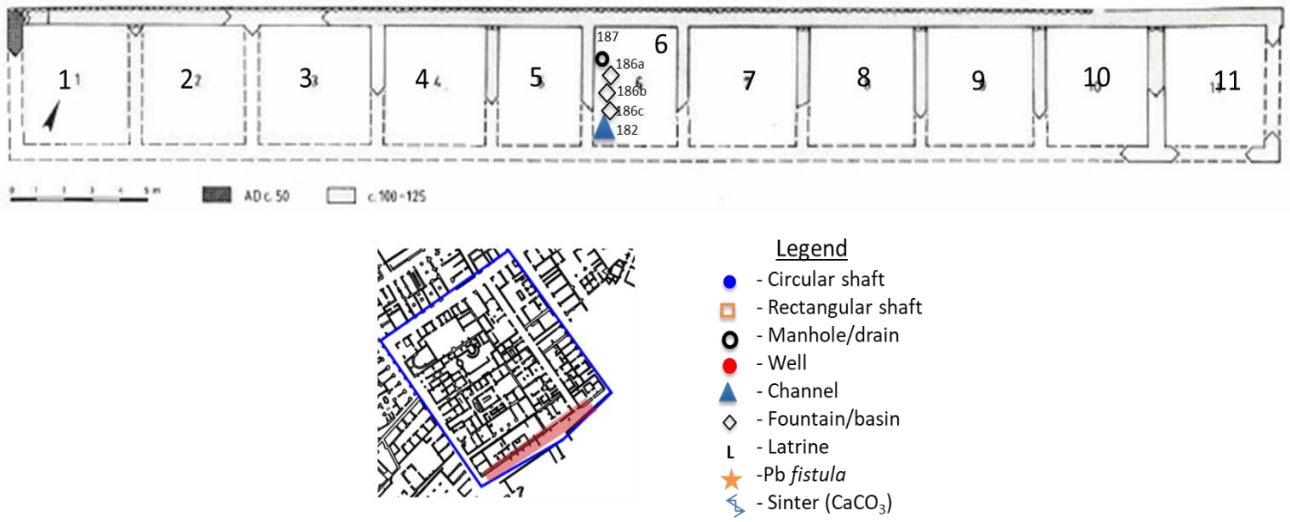


Figure 5.195: Identified water features in V, ii, 1 (after Boersma 1985, 25, Fig. 23).

[585] See Appendix 3 for a master list of water features.

Location in insula

The building runs nearly the entire southern flank of the insula, with its western face running parallel to the Semita dei Cippi (Figure 5.195). From the partial remains, the row of eleven rectangular rooms all face the small unnamed street that divides insula V, i from V, ii. For ease and standardization of description, the present author proposes this street be named the Vicolo dei Cippi, given that the actual *cippi* was discovered only several meters away from building 1. The building's eastern section partially forms the southern wall of V, ii, 14.

History of Excavation and Restoration

The building was excavated by Calza in 1938-1942,[586] but received little study until Boersma's investigation. Extensive restoration took place in 1960, as the majority of the walls were barely preserved above the foundation.[587] Two small trenches in rooms 6, 8, and 9 were excavated by Petriaggi between 1985-1988.[588] Petriaggi reported finding an unusually high amount of ceramic and mortar fragments, as well as pieces of unidentified animal bone. Given the location of this building near the limit of the site's excavation, he suggested the building acted as a kind of dump for building waste during Calza's excavation. However, a similar composition of material was reported by the French team excavating the similarly arranged taberna on the western side of the Porta Romana *castellum*; building V, ii, 1 may in fact have been a peripheral dumping ground for garbage *in antiquo*.[589]

Phasing and Comments

The west wall of the building is one of the few early traces of construction in the entire block, with a tufo wall dating to ca. AD 50; the remaining walls date to the Trajanic period (AD 100-125).[590] Little of the structure has been excavated, but the eleven rooms appear to all open on to the Vicolo dei Cippi, without any interconnecting doorways. The building was built against building V, ii, 2.

Water Features Chart

The following hydraulic features are located in the building V, ii, 1 (Table 5.46).

V, ii, 1 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
6	fountain	against W wall of room 6	186a	2
6	fountain	against W wall of room 6	186b	2
6	fountain	against W wall of room 6	186b	2
6	supply source(?)	supplied 186c from the SW	182	2
6	drain	NW corner of basin 186	187	2

Table 5.46: Identified water features in building V, ii, 1.

Description of Water Features

Five water features are known from this building, and all were partially revealed by the excavations of Petriaggi in 1987. A final plan is given in a publication of the same year, but description of the features

[586] GdSc 25, 2 (3-10-1938) for the initial excavation of this city block.
[587] GdSc 32, 129 (3-6-1960) for some later work, especially in V, ii, 3.
[588] For Petriaggi's daily excavation notes, see GdSc #54, 97 (entry from 3-VII-1985); the entries dealing with V, ii, 1 span 3-7-1985 to 30-4-1987.
[589] Bukowiecki *et al.* 2008, 227-234 for the *castellum* evidence; Mackinnon 2014 for a much-needed summary of known archaeozoological evidence from Ostia.
[590] Boersma 1985, 106, 195.

comes only from the daily excavation notes (Figure 5.196).[591] The excavators described 3 interlocking rectangular basins, two of which were built against the *opus reticulatum* west wall of room 6 (186 a and 186 b).

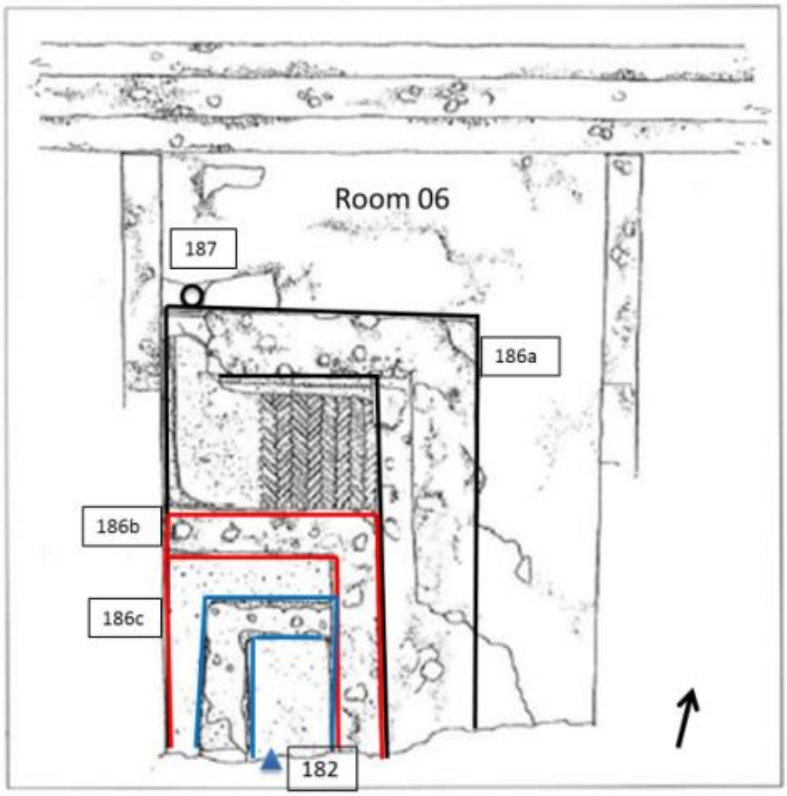


Figure 5.196: Basins in room 6 (after RS II, 166, Fig. 295).

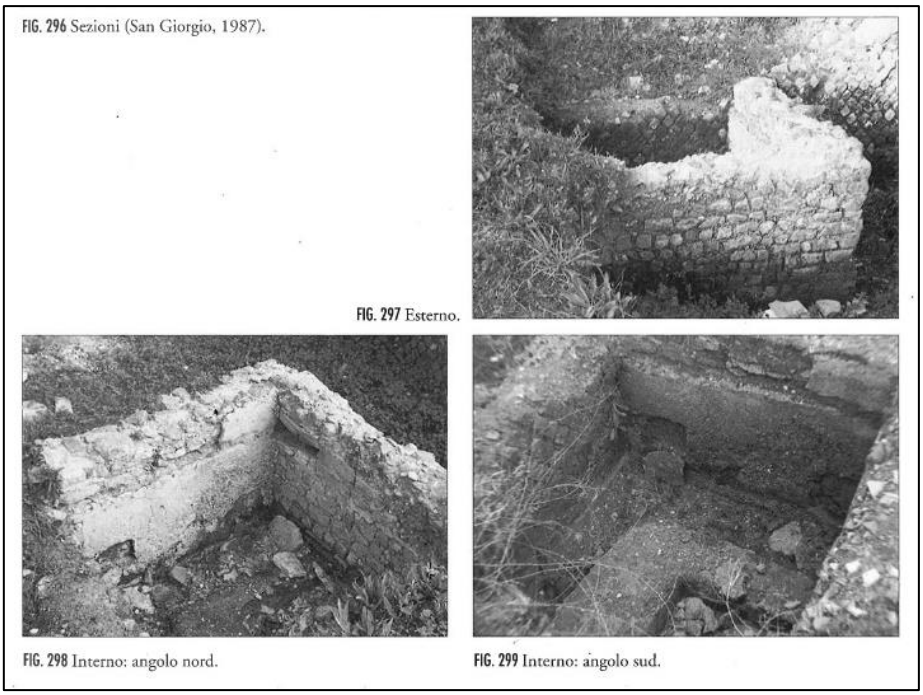


Figure 5.197: Water features in room 06 during excavation (RS II, 166, Figs. 297-299).

[591] GdSc 54, 27, (8-7-1985) for this excavation; Petriaggi 1987, 194, fig. 2.

Based on the location of the hydraulic mortar, 186 b was built first surrounded by an *opus spicatum* floor. Then at a later point this basin no longer functioned and was split into two other basins, features 186 a and 186 c (Figure 5.197). These two later basins were both built using existing walls of 186b. Feature 186 a was drained by feature 187. The waste water exited the north wall of the basin in its northwest corner.[592] Petriaggi interpreted the basin as the remains of a "bauletto", or barrel vaulted fountain given the large number of tiles discovered within the basin. The excavators report that there was also evidence of water supply (feature 182) in the final phase of the fountain (186c) in the southwest corner.[593]

Infrastructure Chronology

Roman Water Footprint #1 (4th century B.C.- AD 50)

No water features known.

Roman Water Footprint #2 (AD 50-200)

The basins here likely date to the early decades of the 2nd century, sometime after the Trajanic walls of the tabernae were built. The creation of basins 186 a and c likely occurred around the middle of the 2nd century, although a more precise date remains elusive. The building likely also experienced some damage from the fire recorded in neighboring V, ii, 2, and the basins were out of use when the ground level of the surrounding area was raised in the later 2nd century.

Roman Water Footprint #3 (AD 200-300)

No water features known.

Roman Water Footprint #4 (AD 300-600)

No water features known.

Conclusion

As the sondage made by Petriaggi was restricted in size, the southern edge of the basins and the northern part of room 6 were left unexcavated. If the interpretation of the excavator is correct, a bauletto fountain (feature 186b) was built sometime after the AD 100-125 date given for the west wall of room 6. The supply pipe to the fountain is missing, but as these fountains are often supplied by the aqueduct line, we can hypothesize that one came from the Semita dei Cippi and under the Vicolo dei Cippi. The evidence of some form of water supply in the northeast corner of the fountain (186a) would seem to confirm this. As these fountains are usually on the outside of structures or in courtyards to ensure ease of access, the position of this bauletto fountain is unusual, even for Ostian standards.[594] Additionally, this interpretation is difficult to accept given the presence of hydraulic mortar on the external north wall of basin 186b. The depth of the *opus spicatum* floor (ca. 90 cm below current ground level) may help to interpret this basin, as dating to *before* the construction of this row of tabernae in the Trajanic period. The same combination of roughly built basin and *opus spicatum* floor is known at a similar height in the neighboring room in building V, ii, 2 (see below).[595] To further this mystery, the location of drain 187 suggests an outflow into the internal northwest corner of a small room. Even though no sewer line is known under the Vicolo dei Cippi, the narrowness of the room would necessitate some kind of hook shaped sewer line leading out of the room to the south. Otherwise, this flat tile-

[592] GdSc #54, 112, entry from 28-4-1987. Because of the presence of Dutch students on the excavation, basins 186b and 186c are respectively called *"vasca maggiore olandese"*, and *"vasca minore olandese"*.
[593] GdSc #54, 105, entry from 11-07-1985.
[594] For *bauletto* fountains is Ostia, see RS II, 23, 27, 34, 43, 52, 60, 65, 69, 98, 104, 114, 119, 126, 134, 137, 179.
[595] The street level in front of V, ii, 2 is +3.10m a.s.l., and the *opus spicatum* floor of room 7 of building V, ii, 2 lies at ca. +2.30 m a.s.l.

covered drain would then conduct water against the north wall of the building inside a rather small room.[596]

V, ii, 2

Figure 5.198: Plan of V, ii, 2 as seen by Boersma in the early 1980s (Boersma 1985, 26, fig. 25).

Location in insula

Building V, ii, 2 is located in the southwestern section of the insula (Figure 5.198). It is a long rectangular building (39 x 10 m)**,** with two doorways opening onto the Semita dei Cippi on its western face. It is bounded to the north by V, ii, 3, to the east by V, ii, 14, and the south by V, ii, 1.

History of Excavation and Restoration

The building was initially excavated by Calza in 1939 down to the level of the Semita dei Cippi, with some minor restoration of the upper walls of the building done in the 1960s.[597] The building was described by Boersma, however, Petriaggi excavated the building down to its earliest layers between 6-12-1984 to 27-06-1985, and again between 11-1-1988 to 18-1-1988 (Figure 5.199).[598] Restoration occurred contemporary with Petriaggi's excavation, as is visible from modern brick stamps on several of the lower walls. In an effort to conserve the structure, now more than two meters below the level of the Semita dei Cippi, Petriaggi constructed a large wooden roof to cover the structure, as well as installing a metal walkway through the center of the excavated structure. The large black and white geometric mosaic at the eastern end was also transferred onto a suspended floor to preserve it and the underlying earlier mosaic (Figure 5.200). Despite these precautions, the building has lain partially exposed to the elements since 1988, and the forces of nature and tourism have virtually destroyed the early 1st century AD mosaics and fragile walls of the building. Many of the walls described by Petriaggi are no longer visible or lie in piles, while the mosaics are almost completely chipped away by plants and rainfall.

[596] Boersma 1985, 377, the room measures 3.90 x 3.14 m.
[597] Boersma 1985, 379.
[598] GdSc #54, 12-96, 119-122.

Figure 5.199: Structures uncovered by Petriaggi's excavations of V, ii, 2, with identified water features (after Petriaggi 1987, 194, Fig. 2).

Figure 5.200: Laying the modern sub-floor in 1985 for the black and white geometric mosaic in the eastern part of building V, ii, 2 (Mannucci & Petriaggi 1995, 240, Fig. 3).

Phasing and Comments

The building is laid out with a series of rooms grouped together on the north and south side of a central hallways: a large sewer runs directly underneath this hallway. At the far eastern end, a single large room is divided from the others by two large tufa columns. Building V, ii, 2 has a complex structural history that begins in the late 1st century B.C. As the building was only briefly described by Petriaggi in the context of his wider work on the south and east side of the insula, more detail on its phasing and layout are introduced here. This is also to integrate Petriaggi's and Boersma's dating sequences. The absence of a final publication of this building means that several phases can only be relatively placed within the building´s wider chronology. The numbering of the rooms is my own, as the numerous *opus craticium* walls mentioned by Petriaggi are no longer visible.[599]

Phase 1: This phase is dated to the late 1st century B.C. or early 1st century AD, based on the style and depth of the high-quality marble well head, which was installed in a building with *opus reticulatum* walls. This original building had a beaten earth floor that was discovered ca. 40 cm below the lowest mosaic in room 9 (ca. +1.30 m a.s.l.). The two roughly circular tufo columns were also installed in this period.[600]

Phase 2: An all-white mosaic in miniature tesserae (*opus vermiculatum*) was installed in room 9. In the neighboring room 8, the geometric border of a white marble *opus sectile* floor is preserved at roughly the same height as the mosaic in room 9. A line of rectangular travertine bases was created parallel to the north wall of the building that ran almost half of the building's length. This perhaps suggests an earlier covered portico in this building. A line of *opus latericium* bricks were discovered running through rooms 10 and 14, of only several courses high. Given that these are on a different orientation than the main hallway in phase 3, they can also be assigned to phase 2.

Phase 3: In the Flavian period, the ground level of the entire building was raised (ca. 30 cm).[601] Taking advantage of this, a sewer network was installed running along the north and central parts of the building (see below). A new black and white mosaic was installed in room 9, and the mosaics in rooms 4 (black-and-white geometric), 5 (*opus sectile*) (Figure 5.201, Figure 5.202), and 6 (black and white geometric) were installed. If all of the mosaics sitting at the same height are contemporary, then the *opus sectile* mosaic in room 5 could suggest an earlier date for this phase. A similar pattern of

[599] Vitr. *De arch*. II, 8, 20 dislikes these wattle-and-daub walls for their flammability.
[600] Petriaggi 1987, 198; Tomassini 2016, 6 for numerous *opus craticum* walls in a contemporary domus under the Domus delle Taberne Finestrate (IV, v, 18).
[601] Petriaggi 1987, 198.

interlocking hexagons is known at Rome from the Domus Aurea, dating between 64-68 AD (Figure 5.203).[602] Room 9 also received red and yellow wall paintings. Brick piers were installed to divide the rooms along the south side from each other and from the central hallway 13, as were marble thresholds all at approximately the same height (ca. +1.98 m a.s.l.). Room 7 was created, and likely had an industrial function based on the *opus spicatum* floor. Petriaggi dated this phase to the late-Flavian/early-Trajanic period based on epigraphic and numismatic evidence within the fill layer of the ground raising.[603] This period saw the creation of building 1 directly along the southern face of building 2, closing the doorway in room 5 and directing the building's access toward the Semita dei Cippi.

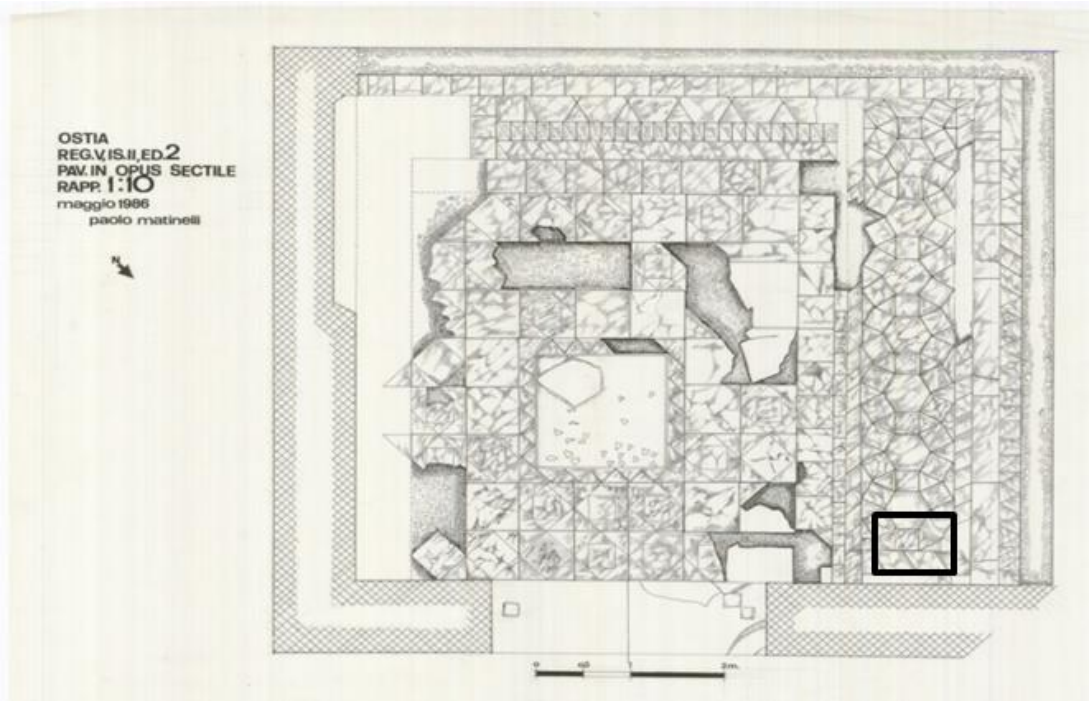


Figure 5.201: *Opus sectile* mosaic found in room 5, with preserved section indicated by the box (Archivio Disegno 8498).

Figure 5.202: Section of the *opus sectile* mosaic in room 5 as preserved in 2016.

[602] Manzione 1992, 21 identified a polychrome mosaic in the Trajanic phase of the Domus del Tigriniani (see Chapter 3: III, i, 4, the "Basilica Cristiana"); Meyboom & Moormann 2013, 150 for the Domus Aurea mosaic; a similar hexagonal black and white mosaic is known at Ostia from the Hadrianic Insula delle Muse (SO 4, Tav. XXXIV, Fig. 265).

[603] Petriaggi 1987, 200, although this implies a very rapid succession of phases in the early 2nd century.

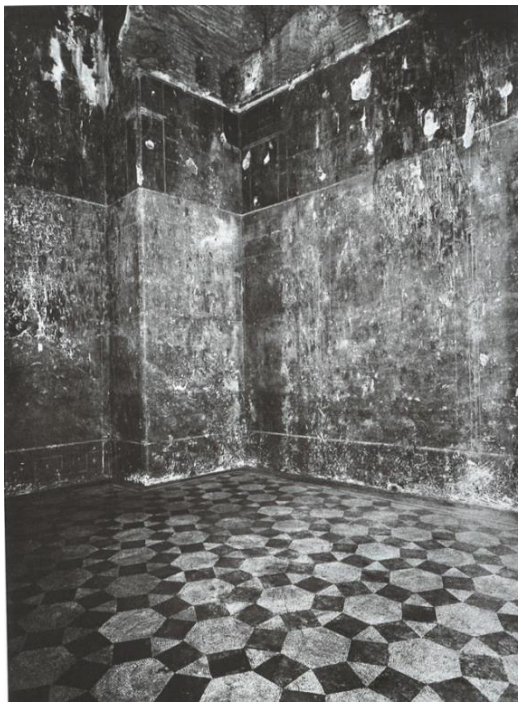


Figure 5.203: Interlocking hexagonal mosaic from room 116 of the Domus Aurea, Rome (Meyboom & Moormann 2013, 150, Fig. 116.1).

Phase 4: Little remains from this phase beyond some rough additions. These included the insertion of the large basin above the *opus spicatum* floor of room 7, as well as several dividing walls in wattle-and-daub (*opus craticum*). Throughout the entire building there are clear traces of a fire that destroyed the previous phases, most noticeable today in the wall paintings in room 9, whose violent orange and yellow color resulted from fire-induced oxidization.[604]

Phase 5: This phase is dated by Petriaggi to ca. 130-140 AD, later than Boersma's Trajanic date.[605] The ground level was raised by nearly 1.50 m across the entire building, with the fill layer made up of a large quantity of burnt ceramics and fragments of painted wall plaster.[606] Two rectangular rooms with floors of *opus spicatum* were built opening directly onto the Semita dei Cippi. No openings are preserved between rooms 1 and 2, or between these rooms and the area to the east (i.e. over the previous rooms). The walls are difficult to discuss further as only their foundation level is visible, they are present for only about 20 cm above the current ground level, and are covered by a layer of modern concrete. The wall dividing the two tabernae from each other was purposefully laid off-center, respecting the underlying central sewer of the building. Perhaps the space to the east of these two rooms remained empty after the ground level was raised. These two small taberna-shaped rooms did not last for long, and new walls were built above the north, east, and south walls in the subsequent phase.

Phase 6: The ground level was raised again slightly, obscuring traces of the twin tabernae, and the building assumed the open rectangular shape described by Boersma. The foundation level of these new walls is clearly visible in the north wall. The tufa columns from the earliest level of the building continued to poke up through the surface into this last phase, as did the top of two brick piers from phase 2. Boersma interpreted the structure in this phase as a mostly open-air industrial structure with the only a large covered space on the east side of the building.

[604] GdSc #54, 18 (14-XII-84).

[605] Petriaggi 1987, 200; Boersma 1985, 110 dates the building's perimeter walls to AD 100-125.

[606] Tomassini 2016, 6 reports an equally high quantity of painted plaster fragments in the fill layer underneath the early Augustan domus found below the Domus delle Taberne Finestrate (IV, v, 18).

Phase 7: Evidence for the repair of the north wall can be dated by its *opus vittatum* to the second half of the 4th century.[607] Boersma suggested that the building continued to function in its open-air form well into the 4th century.

Water Features Chart

The following hydraulic features are located in the building V, ii, 2 (Table 5.47).

V, ii, 2 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
6	well	W side of room 6	159	1
6	ceramic pipe	internal E wall of well	160	1
6	ceramic pipe	internal W wall of well	161	1
7	basin	rectangular basin	156	2
7	drain	NW corner of drain 156	157	2
7	drain	NW corner of room7	158	2
10	sewer	parallel to N wall of buidling	155	2
11	latrine channel(?)	against E wall of room 11	162	2
11	basin(?)	NE corner of room 11	163	2
12	drain channel	center of room 12	124	2
12	drain channel(?)	center of room 12	164	2
13	sewer	main building sewer	154	2
Semita dei Cippi	sewer	sewer under Semita dei Cippi	116	2

Table 5.47: Identified water features in building V, ii, 2.

Description of Water Features

The first water feature identified in building V, ii, 2 comes from one of the earliest phases of the building's life (Table 5.58, Figure 5.204). A white marble well head decorates a circular well (feature 159) of *opus reticulatum*.[608] The external walls of the well-head are partially covered by the later walls of rooms 6 and 7, but if the well-head was completely visible when first built, it would indicate the height of the floor level from phase 1 (+1.46 m a.s.l.).[609] Two circular ceramic pipes run horizontally through the east and west walls of the well (features 160 and 161 respectively). The ceramic pipes have different diameters and enter the well at different heights. These pipes can be dated to the same period as the well itself. A large rectangular basin (feature 156) lies ca. 1.50 m to the east of the marble well head. This basin was built above an earlier *opus spicatum* floor in room 7, as well as against earlier brick piers of the same room. It re-used a marble threshold block on the north side, and the upper walls are roughly broken away. Its floor is thickly coated in hydraulic mortar and slopes steeply down towards a drain (feature 157) in the northwest corner (Figure 5.205). This broken piece of ceramic pipe drained the water from the basin directly into the northwest corner of room 7.

[607] Boermsa 1985, 27, 110.
[608] RS I, 55 (sch. 43) for the well.
[609] Petriaggi 1984 dates the well to 50-100 AD.

Figure 5.204: Looking east at well 159 and later walls built against its marble well-head.

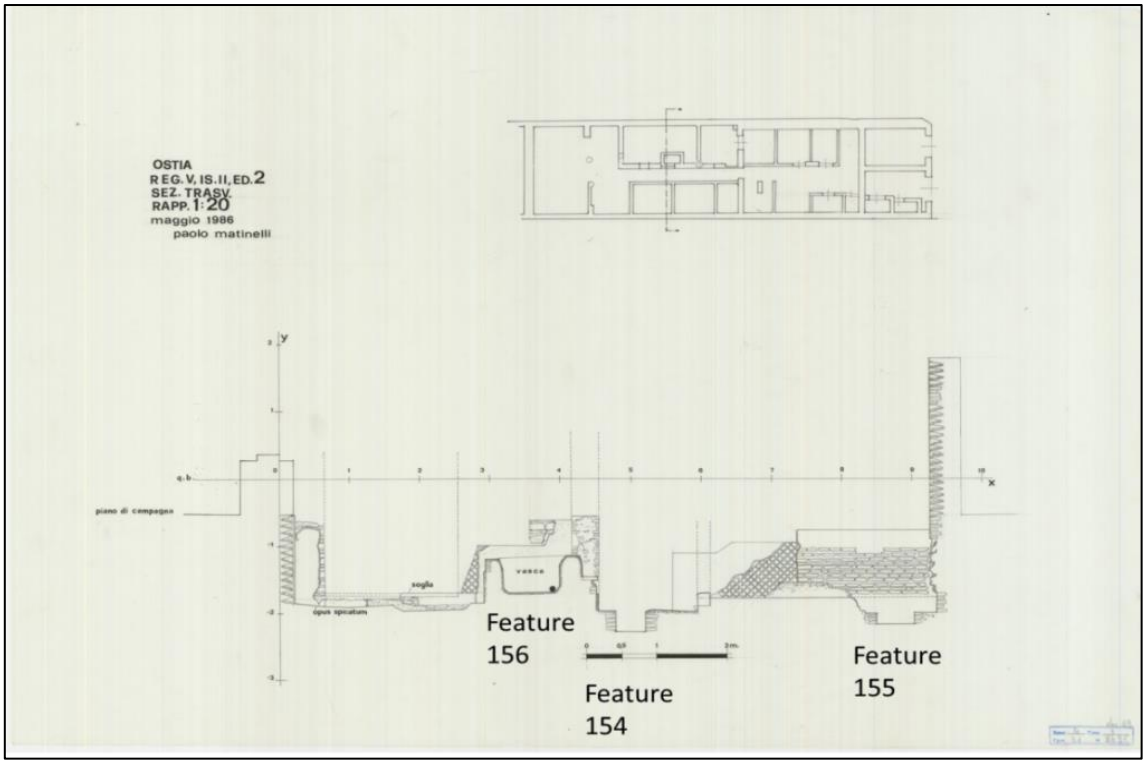


Figure 5.205: Cross section of V, ii, 2 showing features 154, 155, 156 (Archivio Disegni 8491).

Directly in this northwest corner of room 7 is a very roughly constructed drain (feature 158) that respects the line of the marble well head. It conducted the run-off water from basin 156 to the main sewer (feature 154) of the building. Running parallel to the north wall of the building is a stretch of sewer line (feature 155). This sewer channel begins abruptly in a roughly rectangular section and slopes down from the east to the west for ca. 11.00 m before curving to the south (Figure 5.206). Sewer 155 does not connect with the main sewer of the building (feature 154). The side walls of feature 155 are of brick and the floor is made of *bipedales*. The roofing of the sewer is not preserved, but likely was covered by a single horizontal *bipedalis*; this is based on the roofing of secondary drainage channels known in other parts of Ostia.[610] The very thick mortar on the sewer channel's walls and upper shoulders support this interpretation.

Figure 5.206: Sewer 155, with main section of sewer visible against the north wall of the building at left. At right the origin of the sewer with its *bipedales* floor.

Room 11 presents a confusing mixture of partially-preserved drains, but at least one feature has been identified as a single-seater latrine (feature 162).[611] Between and below brick piers is an L-shaped drain that has a clearly sloping connection to the main sewer. The latrine drain respects the roughly built wall that forms the west side of room 11. No evidence of water supply is found here. An interpretation of this drain as a latrine is strengthened by the shallow rectangular basin (feature 163), which lies directly to the north of the latrine drain. This basin was built against existing walls to the north, east, and south. A single flat brick lies at the southwestern side of the basin. This can be interpreted as a drain as it empties directly into the northwestern wall of feature 162, helping to flush any waste out to the building's central sewer.

Two very poorly preserved drainage channels are present in the center of room 12 (features 124, 164).[612] Drain 164 lies to the west of a rubble foundation of a travertine block. Although little remains of the channel, the connection to the main sewer 154 is clear, strengthening its identification. A similar drainage channel (feature 124) is located directly to the east of the same rubble pier, but it is only known from excavation photos, and was not visible to the present study after 30 years of exposure.

The final water feature is perhaps the most sensational. An L-shaped sewer channel (feature 154) is preserved running about 1/3 of the building's total length. Like sewer 155 it has brick walls with a floor

[610] Comparison from within the insula, cf. V, ii, 4-5, feature 55 (below).
[611] Petriaggi 1987, 200 for the latrine.
[612] Petriaggi 1987, 197.

of *bipedales*. The channel runs for a minimum visible length of 32.00 m, with a drop of 0.92 m.[613] It begins with a rectangular pit in the northeast corner of room 10 with an irregularly placed roof *tegula* as its floor (Figure 5.207). The contents of this sewer ran into a larger one under the Semita dei Cippi (feature 116).

Where the rectangular *bipedalis* narrows to form the sewer channel, there is a narrow rectangular cutting through the east wall of the pit which is evidence of a simple sluice gate (Figure 5.207). Such sluice gates are known from one of the sewer lines of the Terme del Mitra (I, v, 17), to control the flow or amount of water.[614] The sewer channel itself slopes down from north to south, then curves 90° towards the west, sloping consistently towards the Semita dei Cippi. At this change in direction, the south wall appears to be eroded away by water, implying a very dynamic and consistently high volume of water. This interpretation is supported by the fragmentarily preserved sluice gate, which would release a concentrated burst of water when opened. A brick stamp was discovered where the channel changes direction.[615] The sewer had a flat roof where it ran within the building, but this changed to a cappucina roof at the western end of the channel when it passes under room 1. The depth of the sewer channel here is ca. 2.00 m below the current street level.[616] Given the remaining ca. 3.50 m underneath room 1, the drain should continue sloping downwards towards the Semita dei Cippi at least another 30 cm (to ca. +0.84 m a.s.l.).

Figure 5.207: A pair of rectangular grooves would contain a vertical panel of metal which could be raised or lowered to adjust water flow. Example from the Terme del Mitra at left, and from V, ii, 2 at right, with grooves outlined in white.

Infrastructure Chronology

Roman Water Footprint #1 (4th century B.C.- AD 50)

In this period, well 159 was installed together with its two supply pipes 160 and 161. This implies rain collection at this point of the building's life, likely from the contemporary roof.

[613] Grewe 2014, 86 for discussion about slopes in aqueduct channels. The slope of this sewer is extremely low at 0.03%.

[614] Similar sluice gates are known in connection with dividing aqueduct water in the *castellum divisiorium* of Nimes and Pompeii.

[615] Petriaggi 1987, 200; see App. 2 for the brick stamp.

[616] The level of the Semita dei Cippi directly west of building 2 is ca. +3.10 m a.s.l. (Boersma 1985, 381), and the bottom of the sewer is ca. +1.14 m a.s.l.

Roman Water Footprint #2 (AD 50-200)

All remaining water features date to this period, namely to Phase 3 described above (late Flavian-early Trajanic), before the ground level of the building was raised to its current height. While some features date slightly earlier (e.g. feature 155) or later (e.g. feature 163) within this phase, all fall between the creation of the main sewer 154 and the building's destruction by fire and abandonment.

Roman Water Footprint #3 (AD 200-300)

The main sewer line (feature 154) continued to function in this period.

Roman Water Footprint #4 (AD 300-600)

The main sewer line continued to function in this period. A tile-backed rectangular downshaft (feature 60) was built into the south wall of room 8 in the adjacent building V, ii, 3.[617] The *opus vittatum* wall dates to the 4th century, and consciously positioned its exit point directly above the beginning point of sewer 154. It is possible that this downshaft drained rain water off of the multi-story building 3, and into sewer 154, proving its continued functioning after the ground level of the entire area was raised to its current height (Figure 5.208, Figure 5.209).

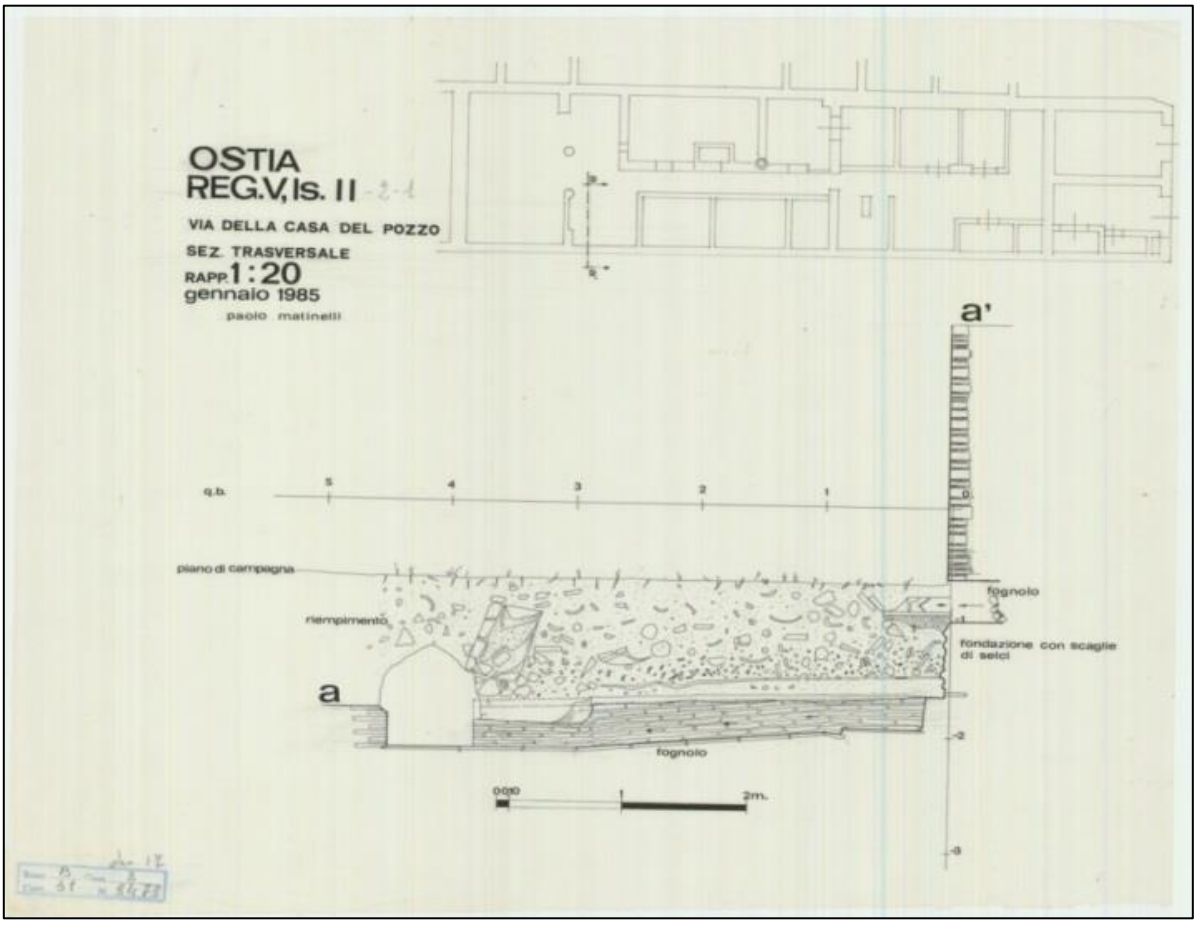


Figure 5.208: Beginning section of feature 154 and its connection to the sewer in V, ii, 3 (feature 60) (Archivio Disegni 8478).

[617] See subsequent building for details.

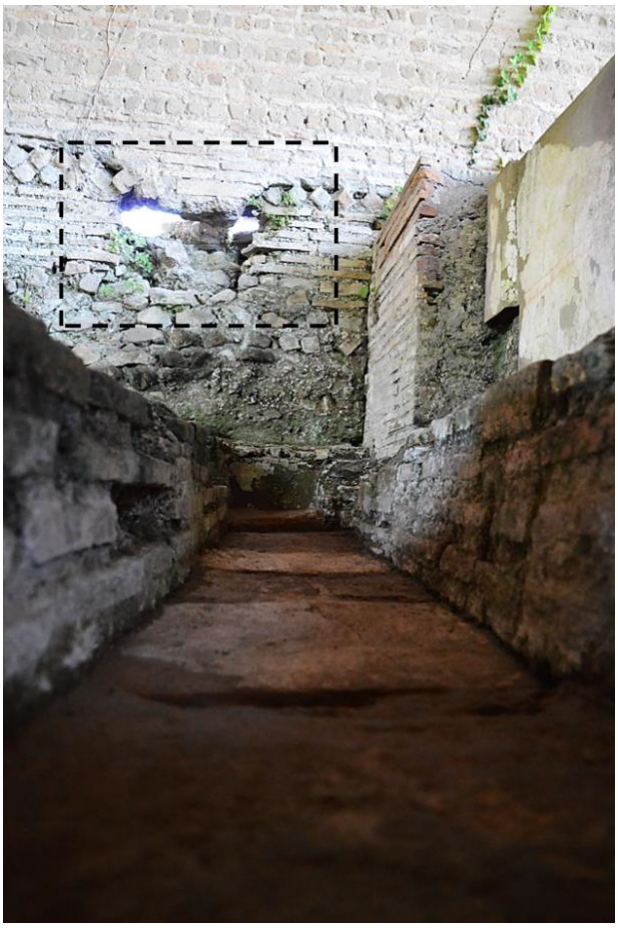


Figure 5.209: View looking north within the sewer channel 154 with the lower end of downshaft 60 indicated in the black box.

Conclusion

The presence of ceramic pipes in well-walls is known at other wells in the block, and hints at a rainwater collecting function.[618] This points to a varying combination of water supply strategies from the earliest period of the building's life.[619] The single seater latrine is identified based on its thin supporting walls and the dedicated sewer directly underneath it. A similar situation is known from the latrines in the Domus del Protiro (V, ii, 4-5, features 4 and 32), where narrow brick piers support a single keyhole latrine seat. While there is no evidence of pressurized water supply, the combination of drains could infer that this latrine was flushed either by water thrown from a sitting bucket and/or by the draining of neighboring basin 163. The large size of the basin, and the *opus spicatum* floor in room 7 argue for an industrial function for this room. The mid- 1st century date for this large basin comes from its construction against early 1st century brick piers. The combination of the basin (and its drain) with the drain in room 7 (feature 158) ties these features together chronologically. As this drainage system terminates in the main drain of the building (feature 154), we can say that the latter was functioning until the fire which destroyed the entire building.[620] This depth of the central sewer in building V, ii, 2 will be discussed in section 5.2 given its implications for the wider history of the urban drainage network of Ostia. Generally speaking, the abundance of drainage features built against the north side of building V, ii, 2 is puzzling. Neither Boersma's description of the upper levels nor Petriaggi's excavation notes reveal any kind of process that would have required the concentration of five drainage features.

[618] V, ii, 4-5, feature 21; V, ii, 13, features 112, 133.

[619] See Chapter 1, for a discussion on the fluctuating groundwater levels identified elsewhere in the insula (the well in V, ii, 4-5, feature 21; Boersma 1985, 374)

[620] GdSc 54, 18 (12-12-1984) for the presence of ash and burned ceramics.

V, ii, 3: Caseggiato

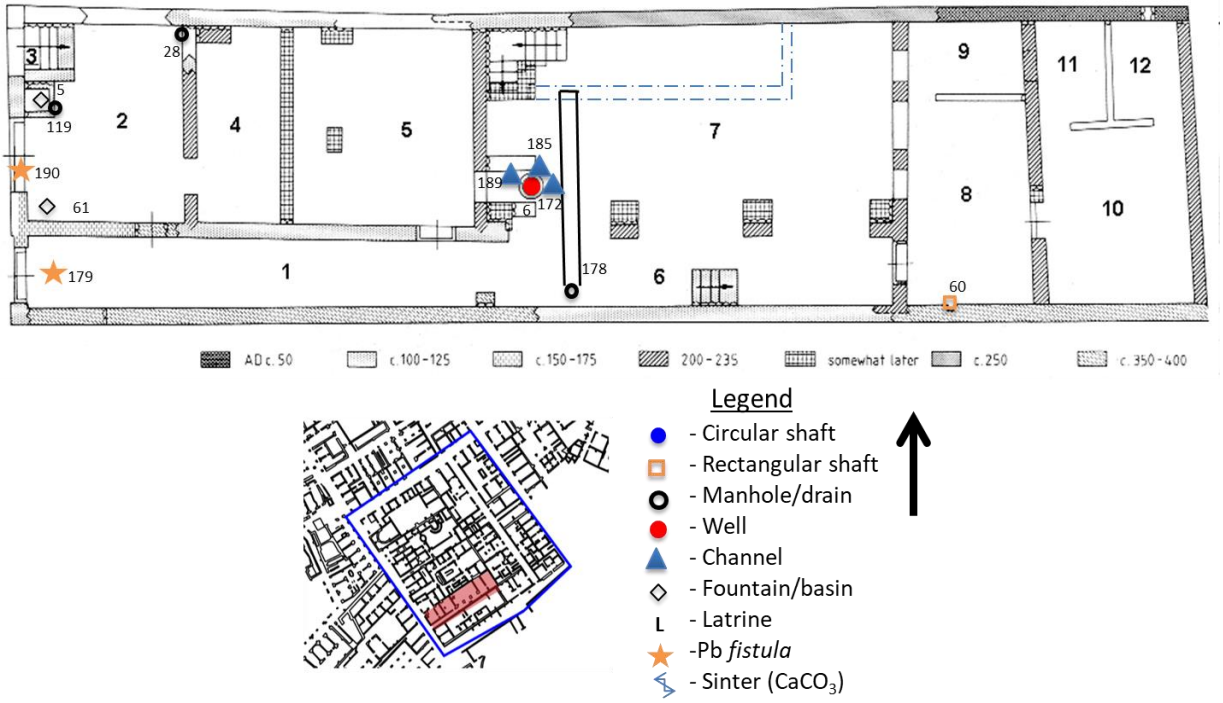


Figure 5.210: Identified water features in V, ii, 3 (after Boersma 1985, 28, fig. 27).

Location in insula

Building 3 is located in the southeast part of insula V, ii (Figure 5.210). It opens to the Semita dei Cippi in the west, and is bounded by the Domus del Protiro (V, ii, 4-5) to the north, building V, ii, 13 to the east, and building V, ii, 2 to the south.

History of Excavation and Restoration

Although not directly mentioned in the excavation records, this building was excavated by Calza during the 1938 excavation of insula V, ii. The building received some repairs in the 1960s and 1974.[621] A trench in the Semita dei Cippi in front of the building was excavated in 1970 by the Italian energy and water company ACEA.[622] A small sondage was carried out by Petriaggi in the 1980s in room 7, uncovering an L shaped wall below the surface, as well as a sewer line (feature 178). Restoration was also done in 1984 and 1985, dateable from modern brickstamps.

Phasing and Comments

Building 3 has twelve rooms and is rectangular (ca. 41 x 10 m). Modern excavation has removed the latest floor levels across the entire building, visible from the diverse heights of several architectural features. These are in room 6 and 7, such as the bonding course within *opus vittatum* piers on the south side of room 7 and the threshold between room 6 and 8.[623] The earliest structural evidence from the building comes from fragmentary walls dating to the first half of the 1st century B.C. A section of *opus reticulatum* wall along the north wall of the building dates from the mid-1st century C.E.[624] The ground

[621] GdSc 32, 129 (3-6-1960) for an epigraphic find here.
[622] This information comes from a note in the Ostia Photographic Archives, from photo SBAO R894.6. The reason for this trench is unknown, as no modern electrical or drainage features are known near this building.
[623] Boersma 1985, 383; the threshold lies at +3.87 m a.s.l. compared to the level of the Semita dei Cippi in front of room 1 at +3.09 m a.s.l.
[624] Boersma 1985, 34 for this wall.

level within the entire building was raised by ca. 60 cm in the Trajanic period, yet the building assumed its current shape in the Severan period. This is when the ground level was again raised ca. 40 cm, and the piers in courtyard 7 were added, together with many of the dividing walls within the building.[625] Although Boersma states that the rooms furthest from the street were raised and those fronting the street kept the Trajanic floor heights, this cannot be sustained given the similar heights of the Severan thresholds and drainage features preserved throughout the building. Rather, the preferences of 20th century excavation must be at work here; excavation preferred to make a more visually consistent space matching the street level. The final structural phase dates to the later 4th century, when 2/3 of the southern wall was rebuilt in *opus vittatum*.[626] Perhaps we can also assign the *opus vittatum* walls identified on the north side of room 7 to this final period as well.

Water Features Chart

The following hydraulic features are located in the building V, ii, 3 (Table 5.48).

V, ii, 3 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
1	fistula	unknown position in floor of corridor 1	179	2
2	basin	rectangular shape; W wall of room 2; S of stairs	5	3
2	drain	lower E wall of basin 5	119	3
2	sewer	under NW pier of room 4	28	3
2	circular basin	SW corner of room 2	61	2
2	fistula	threshold of room 2 and Semita dei Cippi	190	3
7	well	SW part of courtyard 7	6	2
7	ceramic pipe	internal N wall of well	185	2
7	ceramic pipe	internal E wall of well	172	2
7	ceramic pipe	internal W wall of well	189	2
7	sewer	W side of rooms 6 and 7	178	3
8	rectangular downshaft	S wall of room 8	60	4

Table 5.48: Identified water features in building V, ii, 3.

Description of Water Features

The first water feature of this building is a lead *fistula* pipe (feature 179) found in hallway 1, the narrow entrance corridor of the building. It is known only from an unpublished and undocumented excavation in 1970. While the location of the photo is described only as "within corridor 1", these photos documented an incredibly well-preserved epigraphic stamp on the pipe.[627] The stamp carries only the name MESSIAE↓PAEDIAE (Figure 5.211). The name is otherwise unknown from Ostia and as such gives little help with identifying a date of insertion.[628] It is unclear to where this pipe directed water, as the fountain basins in the building are close enough to the street to be supplied by a simple branching.

[625] Boersma 1985, 31, 113, 119.
[626] Boersma 1985, 35, 116; more specifically, *opus vittatum* A and B.
[627] SBAO R893.10 (inv. 11472), R894.6 (inv. 11473).
[628] Barbieri 1953, #15 has AECLESIAE written from right to left, roughly dated to the 4th or 5th century and from an unknown location; Bruun 1991, 425f; Bruun 2002, 161; see Appendix 2 for further discussion on this *fistula*.

Figure 5.211: Archival photo showing *fistula* (feature 179) uncovered in V, ii, 3 (SBAO R894.6).

In room 2 there are several water features. A second lead pipe was discovered in 1950, located under the threshold into room 2 from the Semita dei Cippi (feature 190).[629] It carried two inscriptions that are also known from other buildings in this study: SCIPIONIS ORFITI, and M AURELIUS PRIMUS FEC. A roughly circular basin (feature 61) was located in the southwest corner of room 2. It is no longer visible, but was briefly mentioned by Boersma, with little supporting information, other than that it was sunk into the floor.[630] Better preserved is the rectangular basin (feature 5) along the western wall of room 2, inserted between the northern entrance to the building and a staircase.[631] This basin was heavily reconstructed in 1985, and the rough rubble composition of its lower courses seems to suggest a much later date.[632] This is supported by the drain (feature 119) in the lower east wall of the basin, resting ca. 20 cm above the current ground level.[633] Feature 28 is a sewer line that runs roughly at the current ground level of room 2, and continues sloping upwards under the Severan *opus vittatum* pier of room 4. The sewer is the cappuccina type, with two obliquely set *bipedales* resting on low walls of brick (Figure 5.212). Above the bipedales is a tightly packed brick relieving arch, and the sewer itself is built against the north wall of room 2. As the wall between building 3 and the Domus del Protiro is lost here, the extension of this sewer is now lost.

[629] See Ch. 5, IV, ii, I for discussion of these inscriptions; GdSc 29, 98 (Nov. 1950): *"Sulla Semita dei Cippi in procede ai restauro della domus tarda con il protiro marmoreo* (=Domus del Portiro) *delle piccolo terme adiacenti, a dell'abside* (=Terme di Filosofo)*…adiacente a Sud, a del magazzino sul lato ovest. Nel ingresso all'edificio adiacente a sud a quest'ultimo magazzino parallelamente a una fogna tarda superficiale* (= feature 28) *che a stato demolite, si trova* ***una gran fistula*** *e m.7 a lunghezza circa."* Emphasis added.

[630] Boersma 1985, 113, 382.

[631] Boersma 1985, 29, 113, 382.

[632] RS II, 169 (sch. 157) fort his rectangular fountain.

[633] Boersma 1985, 382 measured the floor at +3.07 m a.s.l

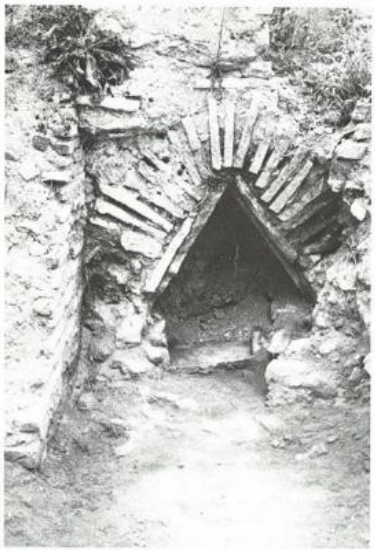


Figure 5.212: Looking east at the cappucina sewer in room 2 of V, ii, 3 (feature 28) (Boersma 1985, 81, Fig. 102).

Continuing down corridor 1 we come to a portico and courtyard (rooms 6 and 7). Along the west wall of room 7 is a well (feature 6).[634] The brick well itself is only partially visible, but the travertine well-head that sits above it is completely above the current ground level. The roughly circular well head preserves iron fittings on the internal northeast wall and the external west wall: these do not pass through the sides of the well-head. The well accessed the stratum of ground water, and perhaps the iron fittings are the remnants of some kind of lifting device.[635] A ceramic supply pipe (feature 185) was uncovered by early excavations, which supplied this well from the north with rain water (Figure 5.213).[636] Two additional ceramic pipes were uncovered within the walls of this well: they lie at the same depth from the top of the well-head, and enter through the east (feature 172), and west (feature 189) walls of the well.

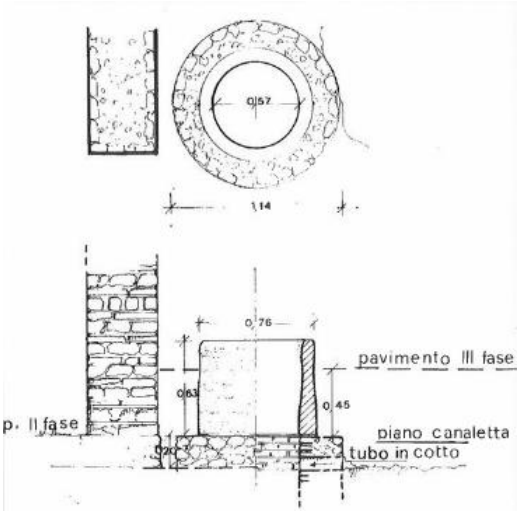


Figure 5.213: Plan and cross section of well in V, ii, 3 (feature 185) (RS I, 56, Fig. 79).

[634] Boersma 1985, 114, 115, 384.
[635] Camardo *et al.* 2006, 184 describes the evidence for two winches preserved in Herculaneum for lifting ground water.
[636] RS I, 56 (sch. 44).

A sewer line of ca. 5.50 m is known only from archival photos in rooms 6 and 7.[637] The sewer (feature 178) was revealed during an excavation in the 1980s by Petriaggi, who also uncovered several fragments of walls parallel to the north wall of room 7 (Figure 5.214). The beginning of the sewer is composed of three slightly overlapping *bipedales* that rest on top of this *opus vittatum* wall and slope downwards from north to south. The brick walls and bipedales floor of the channel confirm its identification as a sewer line, however, its terminal section abruptly ends in a roughly defined pit close to the south wall of room 6 (Figure 5.215).

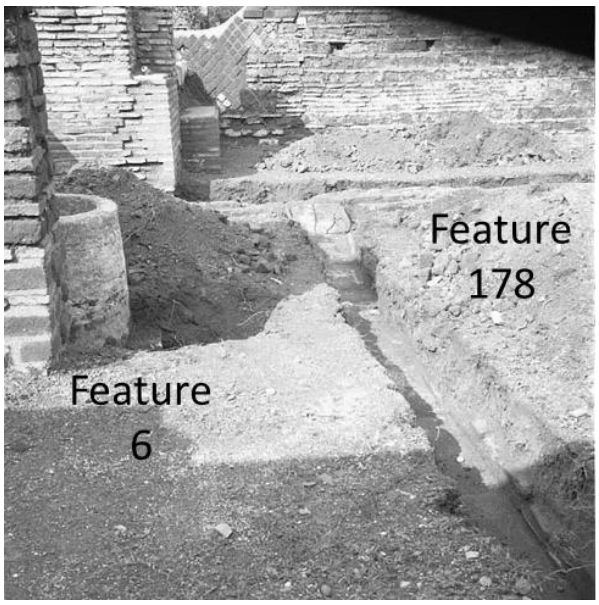


Figure 5.214: View looking north in room 7 at well 6 and sewer 178 (SBAO R4265.2).

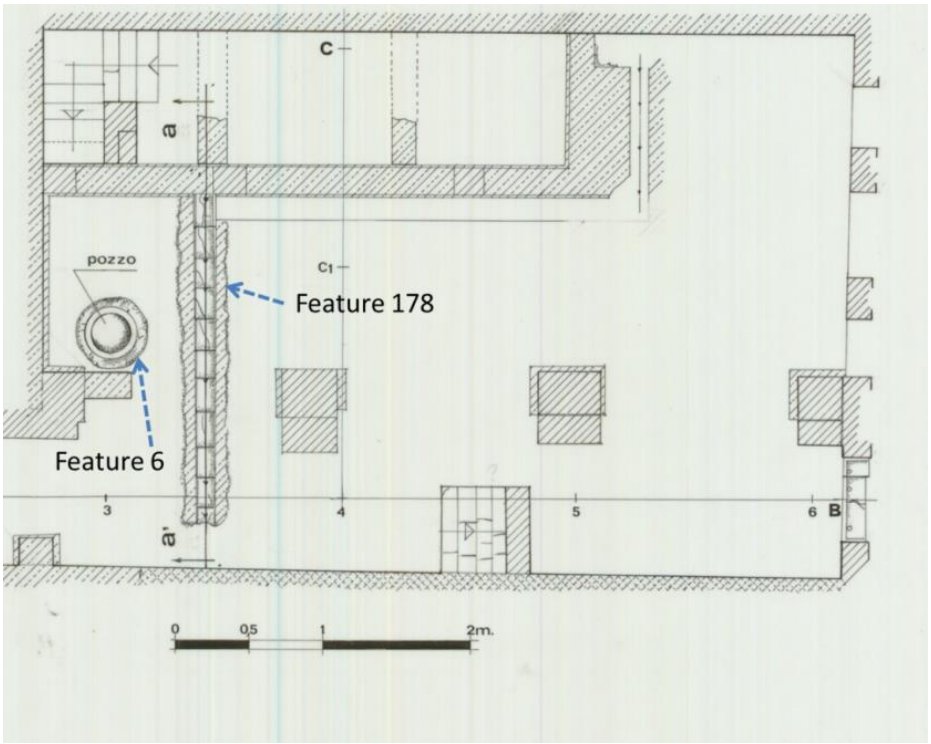


Figure 5.215: Plan showing the orientation and location of features 6 and 178, with north at the top of the photo (Archivio Disegni 8471, April 1968 by P. Matinelli).

[637] SBAO R4625 (inv. 14908). Dimensions estimated by author from archival photo.

The final water feature of building 3 is located in the south wall of room 8. This is a tile-backed rectangular downshaft (feature 60).[638] The point where this downshaft meets the current ground level is severely eroded.

Infrastructure Chronology

Roman Water Footprint #1 (4th century B.C.- AD 50)

No known water features.

Roman Water Footprint #2 (AD 50-200)

As in building 2, the well (feature 6) from an earlier period (Trajanic) survived several phases of ground raising, and persisted into the final stages of the building's life. Less clear is the continuity of the well's supply pipes (features 172, 185, and 189), which directed rainwater into this well.

Roman Water Footprint #3 (AD 200-300)

The majority of the water features date to when the ground level was between +3.65-3.91 m a.s.l.[639] The two sewer lines (features 28 and 178) could not discharge their waste at ground level and must have been covered when the ground level was raised in the Severan period. This is supported by the height of the cappucina drain of feature 28. The street-side basin (feature 5) is dated by Boersma to the Trajanic period together with the staircase, but its original supply and drainage are not preserved.[640] Boersma states that water draining from this basin simply emptied onto the open floor of room 2.[641] Instead, I would argue that the basin and its drain 119 date to this Severan period or later, when the ground level of the building was higher than at present. Both the origin and continued path of this sewer is unclear: there are no preserved water features in building 3 which could have drained into this sewer line, and it is unlikely that the sewer continued under the room's staircase. The rough rubble foundation level implies it was built into a now-lost floor level of a later period. This basin likely drained to the contemporary sewer 28: the minimal difference in height between these features is too close to be accidental. Additional support comes from the *opus vittatum* piers in room 7. The height of the bonding course of these piers all range around the +3.91 m a.s.l. range, as does the threshold into room 8 (+ 3.79 m a.s.l.). Although the origin and end point of the sewer are unclear, we can safely place them into this period when the ground level was higher than at present. The lead pipe entering room 2 (feature 190) can be dated to this period based on the secure identification of *Servius Scipio Orfitus*.[642]

Roman Water Footprint #4 (AD 300-600)

In this period, the southern wall of room 8 was rebuilt in *opus vittatum*, and the rectangular downshaft (feature 60) was built at this time, likely for rain drainage.

Conclusion

The lead supply pipe in room 1 (feature 179) that comes from Semita dei Cippi may be contemporary with the earliest known lead pipe (AD 175-200) found in the bakery I, xiii, 4 almost directly across the street.[643] The pipe in the bakery also comes from the direction of the Semita dei Cippi. The sewers

[638] See Appendix 1 for description of hydraulic terminology used in this work. Boersma 1985, 116, 117, 385. The south wall of room 8 was partially restored in 1984 to support the protective roof built over neighboring building V, ii, 2.
[639] Compared to the current ground level that fluctuates between +3.07-3.42 m a.s.l.
[640] Boersma 1985, 29 for the Trajanic date of basin 5, which was heavily restored.
[641] Boersma 1985, 113.
[642] See Chapter 4, section IV, ii, 1 and IV, ii, 2-3 for full discussion of the evidence.
[643] Bakker 1999, 73 for the lead pipe in the bakery. The first basin in the bakery dates to. AD 175-200.

(feature 28, 178) of the Severan period both are connected with neighboring buildings, and hint at a more interconnected drainage system in insula V, ii.

V, ii, 4-5: Domus del Protiro (House of the Porch)

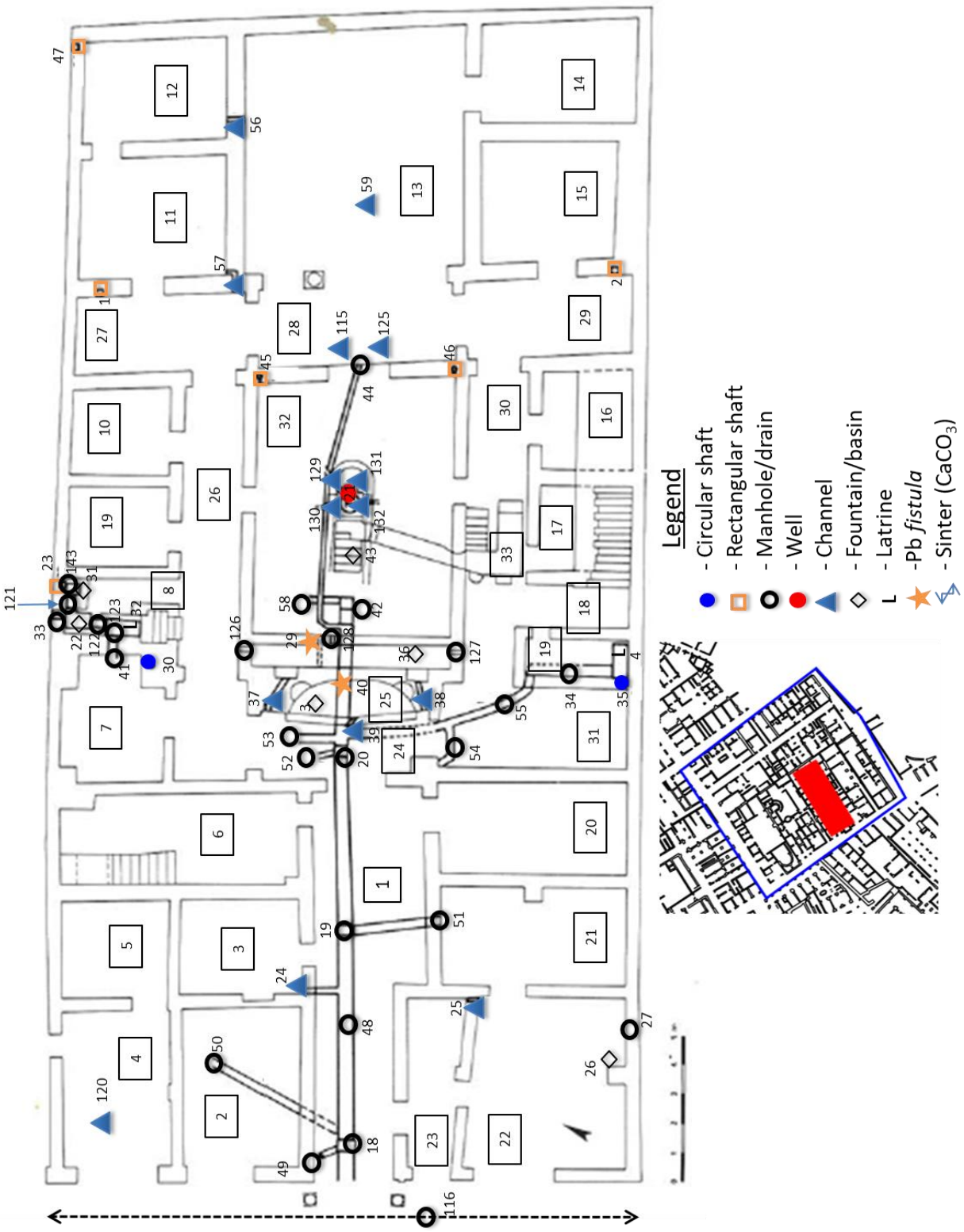


Figure 5.216: Identified water features and room numbers (in boxes) in the Domus del Protiro (after Boersma 1985, 96, Fig. 112).

Location in insula

The Domus del Protiro is located in the west-central part of the insula, and is bordered by the Terme del Filosofo (V, ii, 6-7) to the north, buildings V, ii, 11 and 12 to the east, and V, ii, 3 to the south (Figure 5.216). It has five doorways that open onto the Semita dei Cippi, and one opening onto the Terme del Filosofo (V, ii, 6-7)

History of Excavation and Restoration

The building was excavated in the winter of 1950s by Gismondi. Sporadic excavation and reconsolidation occurred in 1974 and 1975.[644] Boersma excavated several targeted trenches within the house, revealing its early structural history, sculptures of several divinities, and many of the drainage features discussed below.[645] The floor of room 13 was restored in 1991.

Phasing and Comments

The study of this building was the initial aim of Boersma's team, and a wealth of information emerged through the detailed study of its masonry, as well as through targeted sondages to reach earlier levels of the building's history. Likely because of this, the Domus del Protiro has the most number of identified water features of any building in insula V, ii, with evidence for several interlocking systems of supply, distribution, and drainage. As the structural chronology is complex, a summary will be given here so that the hydraulic developments in the building may be more clear.

The earliest evidence from this building comes from the Claudian period, with three sections of travertine channels identified in the eastern part of the building. After this, three major building phases occurred in the Trajanic, mid-3rd century, and late 3rd century respectively. Modifications continued in the 4th century, namely with the creation of both basins of the *nymphaeum*. The building continued to function into the 5th century, when a new inscription was added in the tympanum above the main entrance, indicating a change of ownership.[646] The majority of the building's current form dates to the mid-3rd century phase, resembling other Late Antique domus of the 3rd and 4th centuries in Ostia in its axiality, elaborate nymphaeum, frontal tabernae, and separated upper floor apartments.[647]

[644] Boersma 1985, 241-245; GdSc 29, 96 (Nov. 1950) for restorations here.
[645] Boersma 1985, 280-281 (Apollo; inv. 2179), 284-287 (Diana; inv. 2177), 287-288 (Venus; inv. 1122), 289-290 (Genius; inv. 413), 290-291 (unidentified female heads; inv. 357).
[646] Becatti 1949, 21, 53 n.11; Boersma 1985, 74, 293; Meiggs 1973, 552; Stöger 2007 for a diachronic overview of monumental doorways in Ostia.
[647] Boersma 1985, 192 gives as other examples: House of the Columns, House of the Fish, House of the Round Temple.

Water Features Chart

The following hydraulic features are located in the Domus del Protiro (Table 5.49).

V, ii, 4-5 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
1	drain cover	directly E of central threshold; near N wall	18	3
1	sewer	NW corner of hallway	49	3
1	drain cover	SE of room 3 threshold; near N wall	19	3
1	sewer	central sewer of building; runs from courtyard 32 to Semita dei Cippi	48	3
2	sewer	secondary sewer branch	50	3
3	ceramic pipe	drains from SW corner of room 3 into room 1	24	3
4	channel	surface find	120	surface find
7	circular downshaft	runs vertically through SE pier in room 7	30	3
7	drain	E wall at ground level	41	2
8	basin	rectangular basin in NE corner	31	4
8	latrine	SW corner; drains down towards the N	32	3
8	sewer	Passes through N wall in NW corner of room	33	(2?) 3
8	pit?	Continuity of latrine 32	22	3
8	rectangular downshaft	NE corner	23	2
8	sewer	runs E-W against N wall of room 8	121	2
8	sewer	below central pier on W wall	122	3
8	sewer	directly S of central pier on W wall	123	2
8	drain	drains basin 23 to sewer 121	143	4
12	rectangular downshaft	external N wall	47	2
12	channel	in S wall; ground level of filled in doorway btwn room 12 and 13	56	3
13	drain	center of room	59	1
19	latrine	single seat latrine against S wall	4	3
19	sewer	SW corner of latrine; runs along W wall	34	3
19	circular downshaft	circular ceramic pipe inside SW pier	35	3
21	sewer	N wall of room 21	51	3
22	channel	NE corner of room going through N wall	25	2
22	basin	SE wall of rm 22; drains S through feature 27	26	4
22	drain	drains basin 26; exits room 22	27	4
24	drain cover	center of room; recycled funeral inscription	20	4
24	channel	N brick pier of nymphaeum; vertical up apsidal niche; turns 90 degrees and goes horizontally through pier into E face of nymphaeum	37	3
24	channel	S brick pier of nymphaeum; vertical up apsidal niche; turns 90 degrees and goes horizontally through pier into E face of nymphaeum	38	3

V, ii, 4-5 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
24	sewer	N side of room 24	52	3
24	sewer	N side of room 24	53	3
25	basin	W side of nymphaeum 36	3	4
25	drain	W wall of feature 3	39	4
25	lead pipe	E wall of basin 3	40	4
27	channel	SE corner of room; L shape connecting to room 11 at ground level	57	2
27	rectangular downshaft	N section of E wall	1	3
28	gutter	W side of room 28; cut out of tufa block	115	1
28	gutter	W side of room 28; cut out of tufa block	125	1
29	rectangular downshaft	S section of E wall	2	3
31	sewer	NW corner room 31	54	3
31	sewer	central area of room 31; slopes down from S to N	55	3
32	fistula	E wall of basin 36	29	4
32	nymphaeum	W side of room 32; E basin is feature 36; W basin is feature 3	36	4
32	drain cover	W side of room 32	42	3
32	fountain	center of room 32; covers room 33	43	3
32	sewer	begins W side of room 28; crosses under floor of room 32 to sewer 48	44	3
32	rectangular downshaft	NE corner of room 32; inside NE pier	45	2
32	rectangular downshaft	SE corner of room 32; inside SE pier	46	2
32	sewer	W side of room 32	58	3
32	drain	N wall of basin 36; two superimposed horizontal drains	126	4
32	drain	S wall of basin 36; drains down into room 30	127	4
32	drain	E wall of basin 36; drains down from W to E	128	4
33	well	Underneath courtyard 32 fountain; has 4 ceramic pipes set into wall	21	1
33	ceramic pipe	circular pipe passing through NE well wall	129	1
33	ceramic pipe	circular pipe passing through NW well wall	130	1
33	ceramic pipe	circular pipe passing through S well wall	131	1
33	ceramic pipe	circular pipe passing through SW well wall	132	1

Table 5.49: Identified water features in the Domus del Protiro (V, ii, 4-5).

Description of Water Features

Upon crossing the central threshold, a line of three drain covers are visible (features 18, 19, 20), with a further drain cover present in room 32 (feature 42). These all rest above the central sewer of the building, feature 48, and two of them are re-used inscribed plaques.[648] This main sewer line is ca. 18 m long, and nine secondary sewer lines drain into it (features 49, 50, 24, 51, 52, 53, 55, 58, 44). It slopes down from east to west (+1.84-1.71 m a.s.l.), and empties into the sewer which runs under the Semita dei Cippi (feature 116). While almost all of the channels have a flat roof of horizontally placed *bipedales*, sections covered by a threshold use the cappucina roofing method for extra support.[649] The drain set into the floor in the northwest corner of room 3 (feature 24) differs from these other drains in that it is composed of an angled circular ceramic pipe. Two of these secondary drains will be described in more

[648] Boersma 1985, 471, they were replaced with concrete cast copies in 1973-74.

[649] As in the case of feature 55 where it exits room 31.

detail as they connect other water lines to the main sewer; the remaining seven lines can only be traced for a meter or so away from the main sewer, and seem to end in the middle of rooms. Sewer 55 drains the waste and water that accumulated in room 19. A single-seater latrine (feature 4) was built against the south wall of the room, and its sewer (feature 34) sloped down to the north before entering into sewer 55.[650] In the southwest corner of the same room is a brick pier that contains a circular downshaft (feature 35); this downshaft empties into the latrine's sewer. A small sewer branch (feature 54) connects the latrine's sewer with sewer 55. The second major sewer line is feature 44. This begins at the threshold between rooms 28 and 32, crossing the latter before emptying into the central sewer (feature 48). Two sections of tufa gutters were discovered flanking the north and south side of the entrance to feature 44 (features 115, 125).[651] These lie ca. 60 cm below the current ground level (a+2.04 m a.s.l.),[652] and were likely connected to another fragment of tufa gutter (feature 59) identified in room 13 (Figure 5.217).[653]

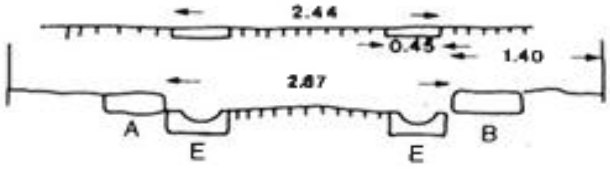


Figure 5.217: Cross section of the western side of portico 28, with tufa gutters 115 and 125 indicated by the letter "E"(Boersma 1985, 241, Fig. 210).

When courtyard 32 was excavated by Boersma's team, a sewer line (feature 44) was identified. It was built on top of an earlier *opus spicatum* floor, and altered its course to respect the line of fountain 43 (Figure 5.218). While sewer 44 serviced the marble portico floor of room 28, any rain water that accumulated in the central courtyard 32 would drain through the drain cover 42. A small secondary sewer line (feature 58) also drained into this drain cover (feature 42). Additionally, the 5 cm diameter hole in this slab also had to remove the rain water brought down by features 45 and 46. Both of these are descending ceramic pipes that make an abrupt 90° turn and direct their water across horizontal travertine gutters. Although these gutters enter courtyard 32 at different heights, the size of these gutters make it clear that these were specifically used for directing rain water from the roof of the Domus del Protiro.[654]

[650] Boersma 1985, 293 for the inscription on the re-used funerary stone.
[651] Boersma 1985, 141, 250, Fig. 208, 210. The gutters come from excavation trench 6-C.
[652] Boersma 1985, 364 gives the current height of room 28 as between 2.63-2.72 m a.s.l.
[653] Boersma 1985, 98; SO 1, 120 dates these gutters to the period between Augustus and Trajan.
[654] Feature 45 lies at the current, reconstructed ground level of courtyard 32, and feature 46 is ca. 8 cm above the floor.

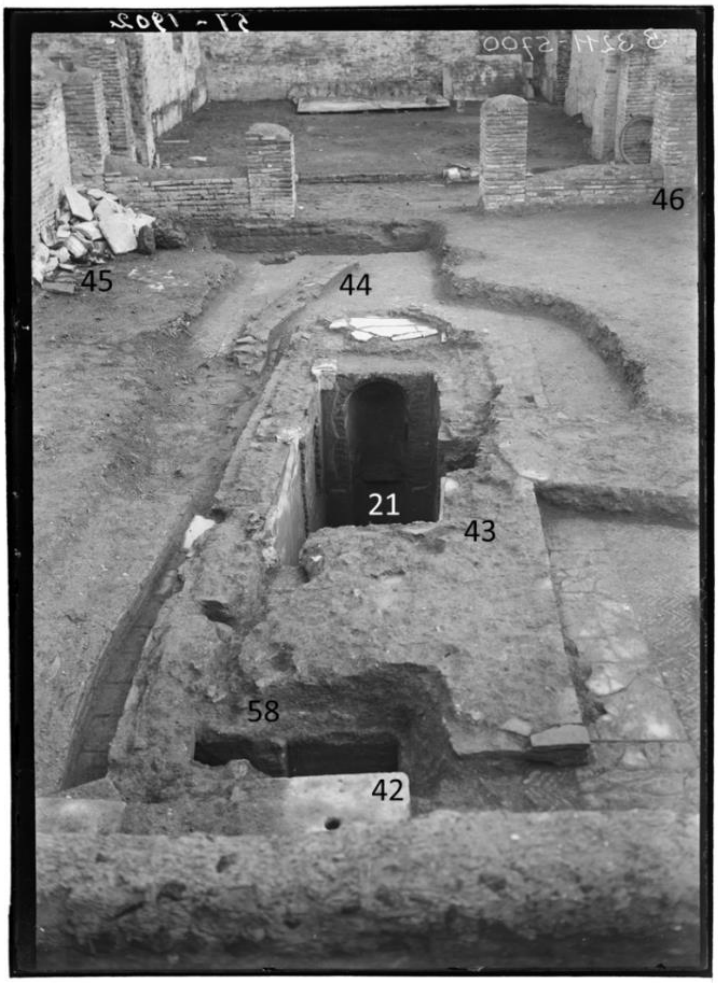


Figure 5.218: View looking east across courtyard 32 showing its water features and the underground room 33 (SBAO B3211).

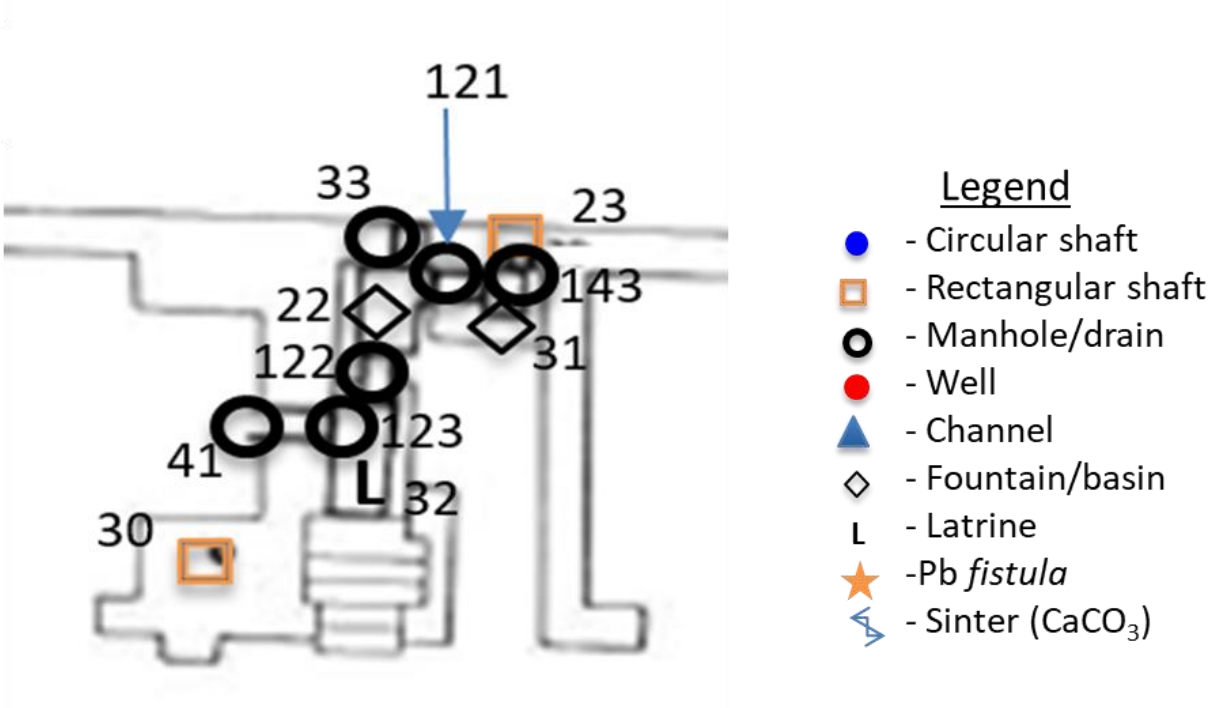


Figure 5.219: Identified water features in room 8 (after Boersma 1985, 95, Fig. 112).

Room 8 has a concentration of hydraulic features (Figure 5.219). It contains the second latrine of the house, and the preserved fragments of a keyhole seat show it was also a single-seater. In the southwest corner of the room is a rectangular pit (feature 32) with narrow brick piers on its north and south side. This is the latrine proper, and was built against the back face of the staircase. Its contents appear to have continued under a brick pier, through a narrow channel (feature 122), and into a second collecting pit (feature 22). This second pit (feature 22) is too wide to be a another latrine, and was covered with flat bricks, some of which are preserved in its south corner. From here, waste material would exit the building through a sewer (feature 33).

A small half-cappucina sewer (feature 123) goes through the west wall of room 8 and empties into the bottom of latrine 32. Directly on the other side of this wall is room 7, which contains a circular downshaft (feature 30), which emptied its contents into sewer 32.[655] This downshaft is a vertically descending ceramic pipe that is built within a brick pier (dated to 250 AD) in the southwest corner of room 7.[656] A mosaic was installed in room 7 after the piers were added, with the room sloping down towards the east. This was done on purpose, since a drain (feature 41) is present in the east wall of room 7. While this drain is only very roughly preserved, it is not visible in room 8, and perhaps turned 90° vertically downwards to enter into the sewer line 123 from above. In the northeast corner of room 8 is a rectangular downshaft (feature 23), that was filled in with bricks in the 4th century, and was covered by a rectangular basin (feature 31). This basin is formed by a roughly L-shaped wall that was added into the northeast corner of the room (Figure 5.220). In the lower northeast corner of the basin is a small drain (feature 143), made of a small circular ceramic pipe that was roughly broken in half. This drain empties into a half-cappuccina sewer (feature 121) that slopes down from east to west, and was built against the north wall of room 8; this drain conducts waste into the larger sewer 33. Sewer 33 collects the waste from all of the secondary channels in room 8, and drains the contents out to the north, into the Terme del Filosofo (V, ii, 6-7).

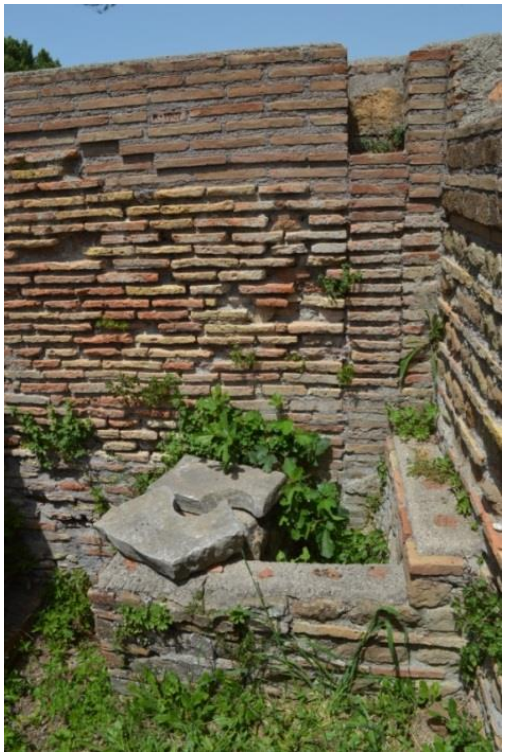


Figure 5.220: Northeast corner of room 8 with downshaft 23 and basin 31.

[655] Boersma 1985, 376.

[656] This pier and the pipe were restored in 1987, and there appears to be plaster or mortar on the inner face of the pipe.

The easternmost section of the house (rooms 11-15, 27-29) contains several dispersed water features. In the northeast corner of room 27 is a rectangular downshaft (feature 1), which has an identical twin in the southeastern corner of room 29 (feature 2). Both of these downshafts were blocked up at a later period. Another rectangular downshaft is located on the external northeastern face of room 12 (feature 47), but this one was *not* blocked by later masonry. Rooms 11 and 12 each had a single drainage channel to remove liquids from their mosaic floors.[657] Room 11 is drained by feature 57, an L shaped channel in the southwest corner of the room that transports its contents into hallway 27. Room 12 is accessed by climbing several stairs, and has a square drainage channel (feature 56) in its southern wall. This drain was built into blocking material of the door between rooms 12 and 13, and empties ca. 30 cm above the current floor level of room 13.[658] The nymphaeum is aligned with the central axis of the entire house, and is visible from the main entrance. In the mid-3rd century, two brick piers were built, forming the north and south part of the two-faced nymphaeum (Figure 5.221).

Figure 5.221: Looking west into courtyard 32 and the eastern basin (feature 36) of the nymphaeum.

While these piers support the marble façade of the eastern side of the nymphaeum, they also each have a vertical channel running up their western face (features 37 and 38). The roughly gouged out channels turn 90° and continue horizontally through the brick piers to emerge above the eastern basin. These would have contained lead pressure pipes that exited two rectangular niches constructed in the eastern face of the nymphaeum to supply two separate basins on the eastern side.[659] In the early 4th century, the two separate basins were destroyed and a single eastern basin (feature 36) was created along the entire face of the courtyard. The western wall of basin 36 is composed of a wall that closed the space between the mid-3rd century brick piers (Figure 5.222). This wall contains an obliquely sloping channel that was clearly cut through earlier bricks. Within the space gouged out by this channel are two oxidized pieces of metal that may be the trace of some kind of additional water supply (feature 40). A small fragment of lead pipe (feature 29) was reported by Boersma preserved in this eastern wall of the

[657] Compare the heights of Room 12 (avg. height, +3.24 m a.s.l.) with Room 13 (+2.82 m a.s.l.).
[658] This floor level dates to a 1991 restoration.
[659] Boersma 1985, 358 with the brick piers called “north and south lateral structures”.

fountain basin (feature 36), perhaps as an overflow feature.[660] The eastern basin 36 drained out through drain 128 into courtyard 32. This eastern basin had three additional drains, two in the north wall (feature 126), and one in the south wall (feature 127). While the southern drain appears to have emptied into corridor 30, the continuation of the drains on the north side are blocked by modern restoration work.

Figure 5.222: Looking north at the eastern basin of the nymphaeum (feature 36). The dashed lines indicate the wall added between the mid-3rd century brick piers.

In the 4th century, the western basin (feature 3) was built by adhering an obliquely angled wall against two brick piers (Figure 5.223). A drain (feature 39) for this western basin channeled water directly towards the drain cover of feature 20. A brickstamp was identified set into the thick hydraulic mortar in the northwestern part of basin 3.[661]

[660] Boersma 1985, 355: *"Remains of lead pipe projecting from the wall at junction of connecting wall and north lateral structure. Presumably forming one with lead pipe through east wall of east basin."*

[661] See Appendix 1 for this brick stamp, which appears to have been intentionally placed here by modern restoration work given its uncharacteristically prominent position.

Figure 5.223: Western basin (feature 3) of the nymphaeum.

Before ending our description with the handful of water features from the front part of the building, we will discuss the features identified in room 33, which is an underground room accessible from a staircase in room 30. After passing through a small vestibule, a cramped hallway leads under the southern part of courtyard 32 to emerge at a peculiarly shaped room with a well sunk into the floor (Figure 5.224).

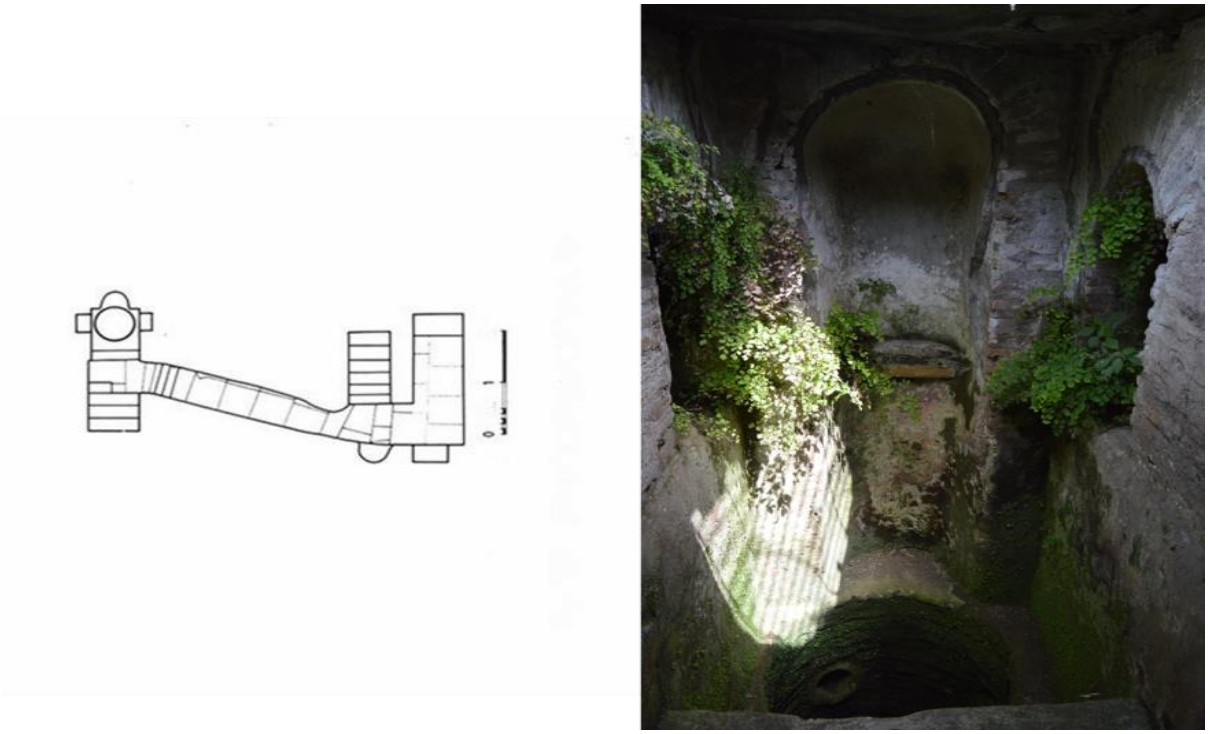


Figure 5.224: Well 21 located in the underground room 33. Plan of this room at left (Boersma 1985, 373, Fig. 538), and photo looking into the well's *aedicula* at right.

This well (feature 21) dates from the earliest period of the house's use; even when the level of the courtyard was raised by more than a meter, a descending set of stairs was added to ensure its accessibility.[662] Although the staircase itself was covered by a horseshoe-shaped fountain (feature 43) at a still later phase, the staircase and passageway to the south ensured that the well remained a hidden but essential part of the house's functioning. The three walls that rise above the well (i.e. under courtyard 32) are built in a grotto-like shape: the eastern wall has a semicircular niche, and the northern and southern walls have rectangular niches. Set within the *opus latericium* courses of the well's wall are four circular ceramic pipes (features 129, 130, 131, 132). The pipes are all of a similar size (15-20 cm external diameter) yet they were placed at different heights (Figure 5.225).[663]

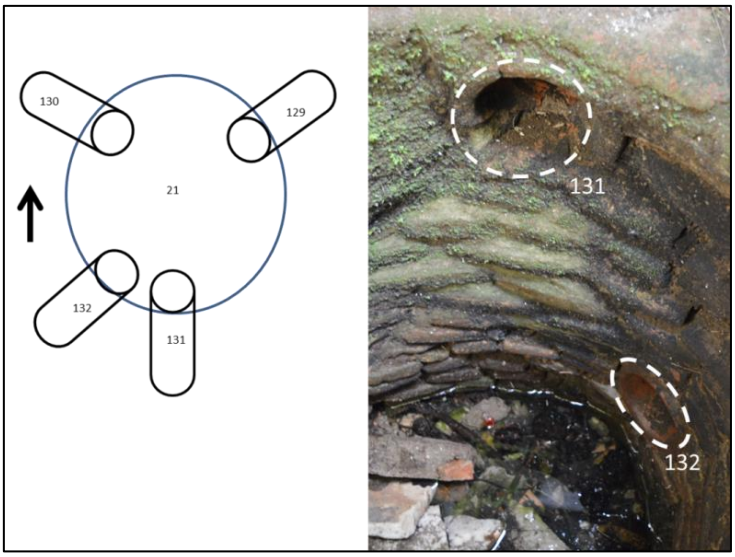


Figure 5.225: Schematic plan of well 21 with location and orientation of ceramic pipes 129, 130, 131, and 132 at left. Internal view of pipes 131 and 132 set into the wall of the well at right.

The final group of water features come from the street facing rooms of the house, which were likely tabernae. In room 4, a section of stone channel was found on the surface. While it was not found *in situ*, its triangular shape and internal semicircular profile resembles channels found in situ in the latrine of the Terme del Filosofo directly next door, as well as another surface find from the same building (feature 175). Moving finally to room 22, an oddly oblong shaped fountain basin (feature 26) was built in the southeast corner of the room.[664] Only visible from Boersma's excavation plans, the basin used the pier of the south wall and the wall itself for its back wall (Figure 5.226). Its awkward shape and position are likely a result of fitting the basin to an earlier drain (feature 27). Another drain is present in the northeast corner of room 22, passing between room 22 and 23; this half-cappuccina drain (feature 25) is at ground level, although the direction of flow is unclear.

[662] RS I, 57 (sch. 45) describe the well.
[663] Feature 129: +0.43m a.s.l.; feature 130: +0.07 m a.s.l.; feature 131: +0.69 m a.s.l.; feature 132: +0.13 m a.s.l.
[664] Boersma 1985, 80, Fig. 101; 350, Fig. 467.

Figure 5.226: Domus del Protiro. Looking south in room 22 at the remains of basin 26 and drain 27 (Boersma 1985, 81, Fig. 101 at left; photo at right by author).

Infrastructure Chronology

Roman Water Footprint #1 (4th century B.C.- AD 50)

The main well with its 4 internal ceramic pipes (features 21, 129, 130, 131, 132) date to this period, indicating rain water collection.[665] The three fragments of tufa gutters (features 59, 115, 125) also date to the Claudian period, and indicate that there was some kind of open-air flowing of water. Given the depth of these channels and their similarity to latrine sponge-gutters, these were likely used to direct rain water into drains.

Roman Water Footprint #2 (AD 50-200)

Several water features date to the Trajanic phase of the building's life, when the entire building was raised to its current level. The well continued to function, and was reached by a dedicated staircase, which perhaps acted as the axial anchor for the wider architectural layout of the building. An additional rain drain was installed in room 8 (feature 23). This emptied into drain 121, running parallel to the north wall of room 8, which perhaps emptied into an earlier form of drain 33. Another two drains were located in the west wall of room 8. Feature 123 lies at the current bottom of the latrine, and is securely integrated within the Trajanic *opus testaceum* wall, its location perhaps foreshadowing the placement of the later latrine. On the other side of the same wall (i.e. the east wall of room 7) is a drain at floor level (feature 41); this drain is also securely integrated into the same Trajanic wall. Given the difference in height (ca. 80 cm), this drain cannot be connected to feature 123 in room 8 and must be from an earlier system. Two rain drains were installed within the eastern walls of courtyard 32, features 45 and 46.[666] The remaining two water features from this period are also drains, however these were built into the walls between rooms with no identified water features or supply systems. Drain 57 in room 11, and drain 25 in room 22 are both built at ground level and seem to conduct liquids between the rooms.

Roman Water Footprint #3 (AD 200-300)

With the 3rd century many new walls were created in the house, and several rain drains. Downshafts 1 and 2 were part of a brief AD 200-235 phase, when rooms 11-15 were built as a unit. Together with downshaft 47 (see below V, ii, 10), these were located on external walls. Features 1 and 2 were blocked up with *opus vittatum* shortly after, during the major AD 250 building phase, although downshaft 47 continued to function.[667] Also in this AD 250 phase, a doorway between rooms 12 and 13 was blocked up in *opus testaceum*, but in this case, a channel (feature 56) was added within the blocking up of the wall between rooms 12 and 13. With the raising of the ground level, the sewer network was installed,

[665] Boersma 1985, 98, 241, 374 note that five complete amphorae were found in this well.
[666] Boersma 1985, 13, 94, 376. The location and material of these might reflect the position of the earlier Claudian travertine gutters located nearby (features 115, 125).
[667] Boersma 1985, 13, 376; specifically *opus vittatum A*.

and many secondary drains connected to the house's central drain, feature 48.[668] In the AD 250 building phase also came the creation of the two brick piers forming the western edge of the courtyard. Within each of these was a channel for a lead supply pipe (features 37 and 38), although at this point there must have been two separate basins with the space between them still open.[669] In courtyard 32 the horse-shoe shaped fountain basin 43 was created above the Claudian well, covering the access staircase. The service room 33 was created to preserve access to the well. In room 8 a latrine was added under a staircase, perhaps connecting to the earlier drains 33 and 123. This latrine used drains 22 and 122 to direct waste out of the building. Perhaps in a desire not to be dependent on one single-seater latrine for the entire ground floor, a second single-seater latrine (feature 4) was installed in room 19, also in connection with a vertically descending ceramic pipe. Again in connection with a staircase, this latrine had its own sewer line (feature 34) which connected to the central system of the house, serving the southern side of the building. These vertically descending ceramic pipes (features 30, 35) are here interpreted as evidence of upper floor drop toilets.[670]

Roman Water Footprint #4 (AD 300-600)

If the sewer system was the star of the previous phase, in this one the nymphaeum steals the show. In the early 4th century (AD 300-320) the eastern basin of the nymphaeum (feature 36) was created, closing off the space between the earlier brick piers, and was installed over the 3rd century *opus spicatum* floor of courtyard 32. The brick piers gained an elaborate marble veneer, and a third lead pipe (feature 40) was added, although it is unclear whether this continued through the eastern wall of the basin (feature 29) to supply the courtyard fountain (feature 43). This eastern basin drained outwards (feature 128) towards a marble drain cover (feature 42), and perhaps also out of the roughly broken "drains" in the north and south walls of the basin (features 126, 127). Towards the end of the 4th or early 5th century, a bow-shaped wall was added on the western face of the nymphaeum, forming a second basin (feature 3).[671] This basin drained out through feature 39 and into the recycled drainage lid (feature 20). Also from the late 4th or early 5th century, a glass bowl was uncovered by Boersma in connection with the latrine (feature 34) in room 19.[672] In the latrine room 8, a low basin (feature 31) was added in the northeastern corner of the room. This basin blocked the downshaft 23, and took advantage of the earlier drain (feature 121), contributing to the flushing of the sewer (feature 33). An additional basin (feature 26) was added in room 22 against a now-lost *opus vittatum* wall. From numismatic evidence, this basin and its accompanying drain (feature 27) date to ca. 320 AD.[673]

Conclusion

The striking takeaway from this building is the sheer internal complexity and diversity of its water systems. While discussion of the relationship of this building with its neighbors will follow in the subsequent section, we can already identify reactive and interactive systems here. This is true even from examining just the evidence from the courtyard in its final phase: 3 water supply systems (lead pipes, rain, ground water), diverse usages (display, drinking), and multiple overlapping drainage lines. As in other buildings, later drainage systems tend to connect with earlier ones, joining separate drainage systems for rain, toilets, and fountain overflow.

[668] Boersma 1985, 374ff; secondary connecting drains are features 18, 19, 24, 42, 44, 49, 51, 52, 53, 54, 55, and 58.
[669] Boersma 1985, 85.
[670] Trusler & Hobson 2017 for upper floor toilets in Pompeii, building on the work of Jansen 2002.
[671] Boersma 1985, 86, 102.
[672] Boersma 1985, 102, 232.
[673] Boersma 1985, 80, 460.

V, ii, 6-7:Terme del Filosofo (Philosopher Baths)

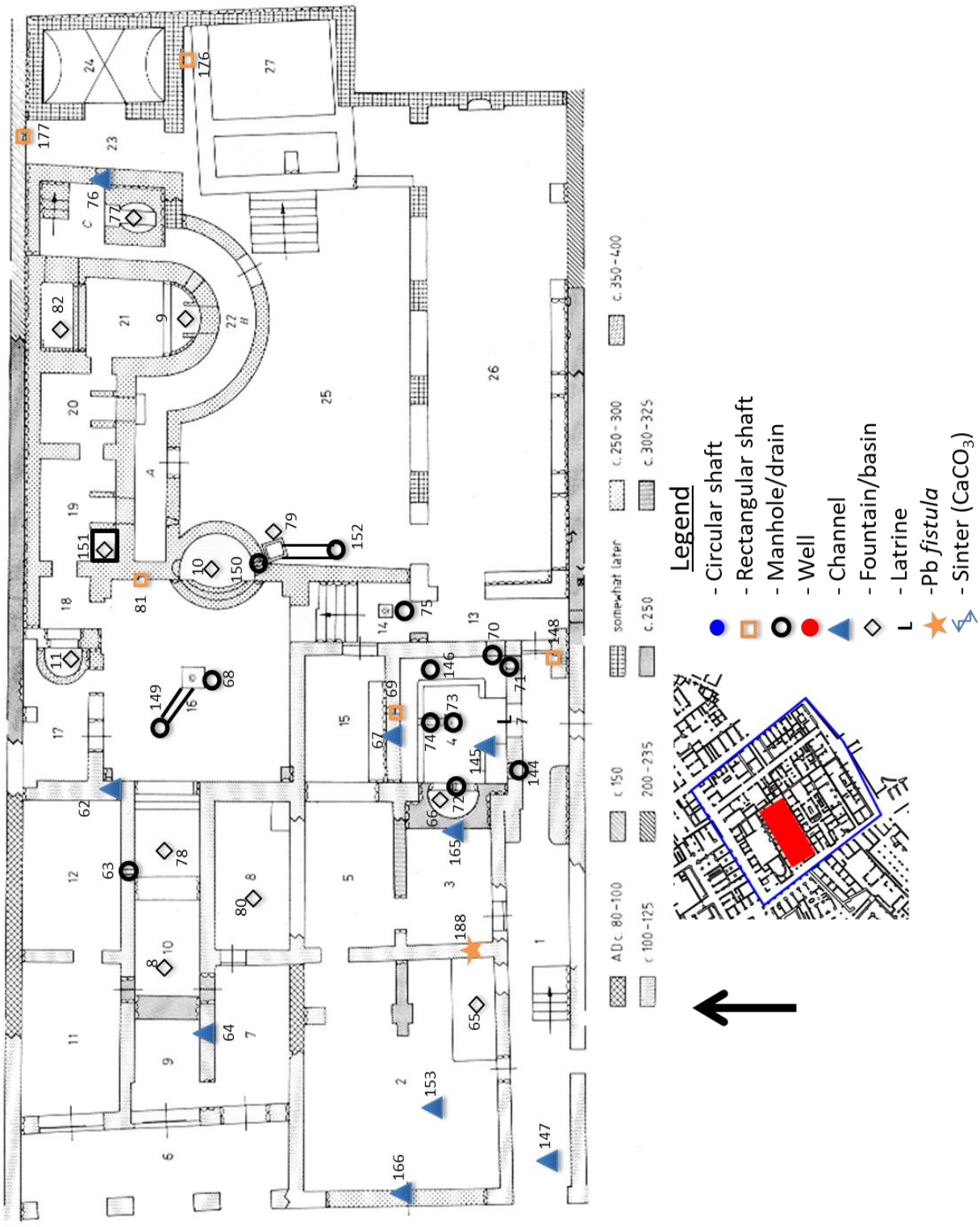


Figure 5.227: Identified water features in the Terme del Filosofo (after Boersma 1985, 36, Fig. 36).

Location in insula

The Philosopher Baths are located in the northern-central part of insula V, ii (Figure 5.227). They are bordered to the north by the Domus della Fortuna Annonaria (V, ii, 8), to the east by buildings V, ii, 9 and V, ii, 10, and to the south by the Domus del Protiro (V, ii, 4-5). The western face of the building opens into three rooms and a portico (rooms 2, 6, 7, 9, 11), and a fourth entrance in its southwest corner. This long hallway 1 leads from the Semita dei Cippi past the entrance to a series of rooms and a multi-seater latrine, as well as into the bath building proper.

History of Excavation and Restoration

The Terme del Filosofo were excavated in 1939 by Calza, as part of his southward excavation along the Semita dei Cippi.[674] They were restored in 1950 and in 1987.[675]

Phasing and Comments

Although there are some fragmentary walls preserved from the 1st century AD, the Philosopher Baths have two main phases. The western half of the building mostly preserves the Trajanic period, and the bath proper was installed in the eastern half of the building in the second quarter of the 3rd century.[676] After the Trajanic period, a small temple was built in the eastern area of the building, although it lasted only about 15 years before being torn down.[677] In the Severan period the ground level in the eastern section was raised by ca. 1.0 m and the rooms of a small but luxurious bathing complex were installed against existing structures.[678] The construction of elevated rooms was a similar solution taken by other contemporary bath buildings in Ostia, and provides an example of different contemporary heights *in antiquo* between neighboring buildings.[679] It also has important implications for the drainage of the bath features. The ca. 18 X 40 m building received its modern name from a bust of a 3rd century philosopher found during the excavations, usually interpreted as Plotinus.[680] In addition to the 3rd century evidence, there are some isolated traces of walls from the late 1st century AD, and later 4th century (e.g. the south wall of room 5).

[674] GdSc 25, 48 (30-1-1939).
[675] GdSc 29, 96 (Nov. 1950).
[676] Boersma 1985, 44, 126.
[677] Boersma 1985, 43, 407; the temple dates to the reign of Alexander Severus.
[678] Boersma 1985, 127.
[679] Terme Bizantine (IV, iv, 8), Terme dei Cisiarii (II, ii, 3).
[680] GdSc 29, 98 (17-11-1950) for the discovery of the Plotinus bust.

Water Features Chart

The following hydraulic features are located in the Terme del Filosofo (Table 5.50).

V, ii, 6-7 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
1	marble channel	surface find	147	surface find
1	rectangular downshaft	SE corner room 1	148	2
2	basin	rectangular basin	65	2
2	channel	E wall of room 2; supplies basin 65	188	2
2	marble channel	surface find	153	surface find
2	channel	rectangular channel passing through W wall of room 2	166	3
3	channel	E wall; horizontal rectangular channel through wall	165	3
4	latrine	multi-seater latrine	7	2
4	basin	W wall of room 3; semicircular shape	66	3
4	channel	goes horizonal through N wall of room 4	67	2
4	rectanguar downshaft	N wall of room 4	69	2
4	sewer	SE corner of room 4; set within latrine drain 146	70	3
4	sewer	in SE corner of S wall; set within latrine drain 146	71	2
4	drain	E wall of basin 66	72	3
4	drain cover	center of room 4; above feature 74	73	3
4	drain	drains feature 74 to main latrine drain 146	74	3
4	sewer	empties into SW corner of main latrine drain 146	144	2
4	travertine gutters	set into floor around perimeter of latrine floor	145	3
4	main latrine sewer	Around N-E-S walls of latrine	146	2
7	channel (drain?)	N wall; goes through into room 9	64	2
8	cistern(?)	possible cistern-unexcavated	80	unexcavated
10	reservoir(?)	possible reservoir-unexcavated	8	unexcavated
12	drain	SE corner of room; goes through W wall of room 16	62	3?
12	drain	S wall; drain for feature 78	63	3
14	drain cover	S of staircase	75	3
16	basin	frigidarium basin; oval shape	10	3
16	drain cover	center of room 16; square with single central recessed hole	68	3
16	basin	frigidarium basin; rectangular shape	78	3
16	semi-circular downshaft	E wall of room 16/ directly N of basin 10	81	3
16	sewer	cappuccina sewer under feature 68	149	3
16	drain	SE corner of basin 10; circular ceramic pipe	150	3
18	basin	W wall of room; apsidal shape	11	3
19	basin(?)	SW corner at floor level; rectangular shape	151	3
21	basin	caldarium; rectangular shape; along entire N wall of room 21	82	3
21	basin	caldarium; semi-circular shape; S part of room 21	9	3
22C	drain	E wall directly N of 77; at floor level	76	3
22C	water boiler	E part of corridor; SE corner of room 22c	77	3
23	semi-circular downshaft(?)	N wall internal face	177	3?
25	basin/fountain(?)	W wall of room; S of frigidarium 10	79	3
25	sewer branch	S of curved wall of basin 10	152	3
27	semi-circular downshaft(?)	N wall of room; internal face	176	3?

Table 5.50: Identified water features in building V, ii, 6-7.

Description of Water Features

Given the high number of water features in this building (41), the water features will be discussed in three groups: those in the western section (rooms 2, 3, 5, 7, 8, 10); those of the latrine (room 4); those of the baths proper (rooms 12-27). The interconnectivity of these features will be discussed in the building's conclusion below. Accessible from hallway 1, is the large rectangular room 2. In the southeastern corner of the room is a large poorly preserved basin (feature 65) that was built against the existing walls of the room.[681] The corner of the room is currently used as a spoil heap for marble fragments and only the lowest course of the basin is currently visible. Within this spoil heap is a fragment of a marble channel (feature 153) with an internal channel that is also triangular in section. While this feature is out of context, it is remarkably similar not only to the sponge-gutters in the neighboring latrine (features 145 a-h), but also to another stretch of channel (feature 147) resting on the surface in room 1. The latter feature has a recessed tongue and groove cutting, indicating that it was meant to connect with another channel (Figure 5.228).

Figure 5.228- Terme del Filosofo, section of marble channel (feature 147) found on surface.

Returning to the large basin in room 2, a clear indication of its water supply is in the east wall of room 2. A roughly square channel (feature 188) cut through the wall is the perfect height for a (now-lost) *fistula* pipe to supply water into the basin. The basin likely drained out into the sewer in the neighboring hallway 1. The western wall of room 2 contains a small rectangular channel (feature 166) that connects the room with the Semita dei Cippi. This rectangular channel was constructed at the same time as the western wall, which closed off room 2 from the street. A thick *bessalis* brick acts as a roof for this channel, and it is perhaps no coincidence that the top of this channel lies *below* the level of a travertine threshold block preserved in the northwestern corner of the room. This may suggest that feature 166 was originally located underground.

In the east wall of room 3 there is a horizontal channel (feature 165), which is now blocked up with *opus signinum* or mortar. Given its position and height, this held the supply fistula for basin 66 in the latrine. Directly adjacent to channel 165, there are a line of bricks within the lower north and east walls of room 3 that are uniformly gouged out. Additionally, the *opus spicatum* floor of the neighboring room 5 is ca. 25 cm higher than the current floor level in room. This missing ground level in room 3 together with the gouged out space support the interpretation that a small lead pipe exiting room 5 was meant to rest within this gouged out space and to supply basin 66 in the latrine.

[681] Boersma 1985, 124,125,391 for the basin.

A channel of indeterminate function is present in the north wall of room 7. This channel (feature 64) is internally coated with sinter, and appears to be a drain of some kind, as it only has a short horizontal stretch before sloping downwards at a 45° angle.[682] The last two features (features 8 and 80) have been described by previous scholars as "reservoirs",[683] and are essentially rooms left unexcavated by 1939 excavations, perhaps as they were not directly visible from the street.[684] The walls separating room 10 from its neighboring rooms (rooms 7, 9, 11) were erected in the 3rd century, turning the western part of room 10 into a dead space when the *frigidarium* of the bath was installed. In any case, no trace of supply, distribution, or drainage are known, and they cannot be identified as hydraulic features with certainty. The latrine (feature 7), contains several networks of supply, distribution, and drainage features Figure 5.229). The room is rectangular, with a semi-circular niche on the west side (feature 66) made of *opus vittatum*, which contained as a fountain basin. This basin was drained by a short stretch of ceramic pipe as a drain (feature 72) at floor level, and may also have directed water to the sponge-gutters.[685] The presence of continually flowing aqueduct water is attested in this room from the typical bubble formation of calcium carbonate layers within the travertine sponge-gutters (features 145 a-h) encircling the room. These have been re-laid in the modern period into a bedding of concrete (Figure 5.230); as there are no right-angle (i.e. corner) pieces it is unlikely that the gutters lie in their original position. Also, while the majority of these gutters are triangular in profile, one in the southwest corner is rectangular, and is void of any calcium carbonate.[686] Water or other liquids present on the surface of the latrine floor would drain into the center of the room through a drainage plaque (feature 73). This plaque lies above drain 74, which is a roughly L-shaped drain with a roof that changes from flat to cappuccina shaped. The effluence from drain 74 would enter into the central latrine drain 146, which encircled the north, east, and south side of the latrine. Drain 146 is ca. 1.00 m deeper than the floor of the latrine and is located directly underneath the keyhole-shaped seats of the latrine. Hydraulic mortar in the corners would have helped the waste to drain more smoothly towards the exit.[687]

Four additional drains emptied into the main latrine drain (feature 146). On the north wall of the latrine, directly across from the entrance, is a rectangular downshaft (feature 69). It is of the tile-backed variety of downshaft, and the southern face of the south wall of room 15 is clearly visible here.[688] The position of this downshaft indicates that it drained liquids from an upper floor, but the position of this downshaft is no accident. Passing through the wall towards room 15 is a horizontal drain (feature 67). This channel slopes down from north to south and emerges into the latrine drain directly below the downshaft. In the lower southern part of the east wall of the main latrine drain is, a well-preserved cappucina sewer (feature 70).

[682] Boersma 1985, 122, 395.

[683] Boersma 1985, 42, 122.

[684] GdSc 25, 52 (30-1-1939), refers either to feature 8 or 80: "*Piu a sinistra* (to room 16) *si é un ambiente con alta pavimentazione che potrebbe essere* ***una cisterna***." Emphasis added.

[685] Boersma 1985, 125, 392; Merletto 2000, 302 for a typology of latrine designs across the Roman world. The latrine in the Terme del Filosofo is of the peristyle type.

[686] This modern reinstallation is why the surface finds of the marble sponge-gutters (features 147, 153) have been included in this study.

[687] Boersma 1985, 392: the channel slopes down from the northwest (+1.87 m a.s.l.) to the southwest (+1.49 m a.s.l.); Lehar 2016 rebuilt a section of latrine channel to test how water actually flushes away material on a low gradient and with right angles.

[688] Instead of built into the masonry of the wall, this type of downshaft is constructed by closing off the space between two sections of a wall, usually with *bipedales*.

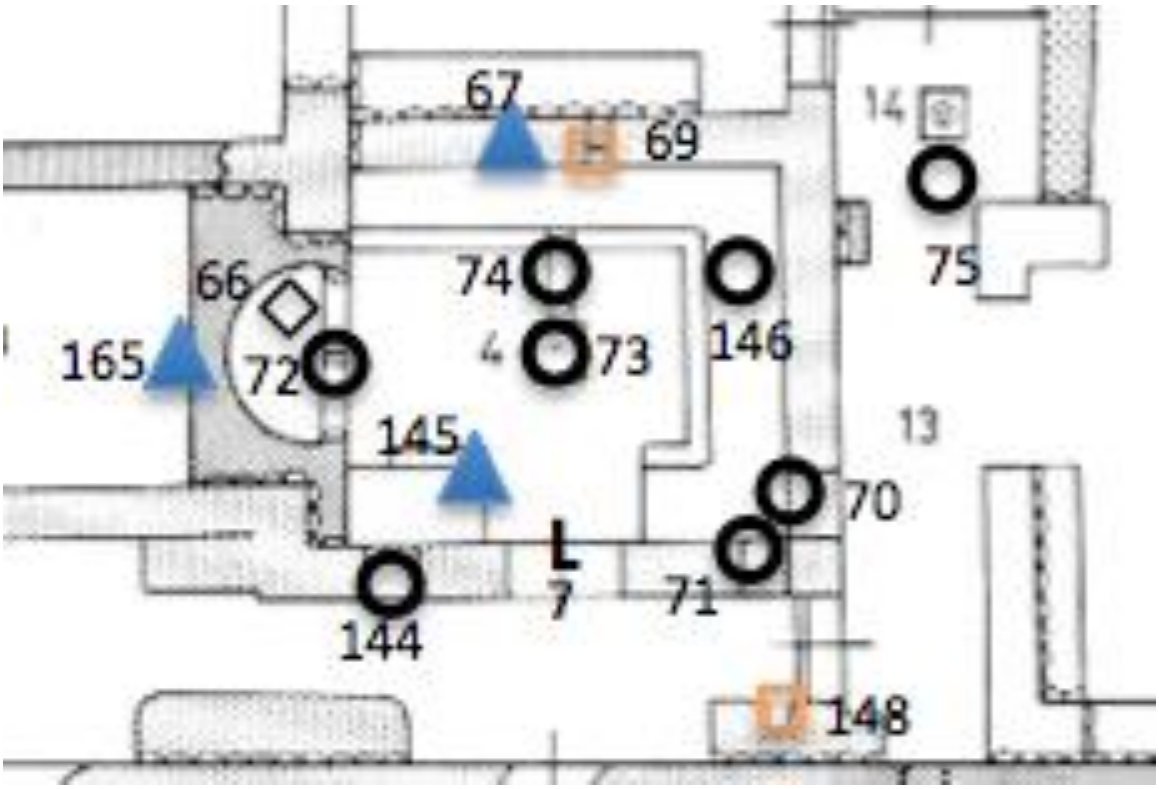


Figure 5.229: Identified water features in latrine 4 (after Boersma 1985, 36, Fig. 36).

Figure 5.230: The northeast corner of the sponge gutter, with traces of accumulated calcium carbonate within the lowest part of the gutter.

The obliquely placed *bipedales* continue to the east for ca. 1.50 m before curving to the north (Figure 5.231). A brick stamp preserving the hobnails of a shoeprint are preserved within this channel.[689]

Figure 5.231: Looking east at the cappucina sewer 70, in room 4 of the Terme del Filosofo (V, ii, 6-7).

In the lower eastern section of the latrine's south wall is feature 71. This is a flat-roofed sewer that continues towards the south. A partially preserved brick stamp was discovered on the inner surface of the sewer's roof.[690] Due to a large volume of *in situ* sediment, the subsequent direction of the sewer is unknown; based on its vicinity, it is likely that it received the waste deposited by downshaft 148 in room 1. This downshaft is formed by the space between two piers, and is large enough to have held a circular ceramic pipe.[691] The final sewer feature of this latrine is the sewer that leads all of the latrine's combined waste out towards the Semita dei Cippi. This sewer (feature 144) begins in the southwest corner of the main latrine drain. This is an estimated 14 m cappucina sewer that runs south for ca. 0.70 m before curving to the west and sloping down towards the Semita dei Cippi.[692]

Climbing several stairs, we enter the bath building proper, coming to the wide square room of room 16, with its flanking cold pools on the east and west sides. Frigidarium 10 is on the east side of room 16. It is roughly apsidal in shape and is entered by descending two heavily eroded steps.[693] The thick coating of bubbled calcium carbonate in the *frigidarium's* drain indicates a clear connection to the aqueduct line. The drain of the bath (feature 150) is composed of a roughly broken circular ceramic pipe in the southern wall of the basin. This exits the external wall of the basin ca. 40 cm above the current floor

[689] See Appendix 2 for this and other brick stamps recovered from this sewer.
[690] See Appendix 2 for the brick stamp.
[691] The opening is 31 x 36 cm, although the upper part of the pier was restored in the modern period.
[692] Boersma 1985, 211, 392; See Appendix 2 for brick stamps found here.
[693] Boersma 1985, 45, 127, 399.

level of courtyard 25.[694] A roughly oxhide-ingot shaped basin (feature 79) lies on the surface of the courtyard directly south of the *frigidarium's* drain (Figure 5.232).[695] The oxhide-ingot shaped basin (feature 79) has a drain in its lower northeast corner, and a circular opening in its upper southeast side indicating it was likely supplied by a lead pipe with a small diameter.

Figure 5.232: Basin 79 placed against the outside face of *frigidarium* basin 10, with drain 150 visible on the lower right side (Terme del Filosofo, room 25).

Dug into the floor of the courtyard directly below basin 79 is a sewer line (feature 152). This sewer line is composed of brick walls and has a flat roof, and slopes down to the south. It runs parallel to the western wall of courtyard 25 for at least 1.70 m, and likely drains into feature 75 in the adjacent room 14; this interpretation is bolstered by the relieving arch built into the west wall of room 25.[696]

Returning inside room 16 of the bath building, a marble slab with a circular hole (feature 68) lies in the center of the floor. The floor, which was reconstructed in the 1980s or 1990s, slopes down toward this central slab. The slab itself lies above a square shaft that begins a cappucina sewer line (feature 149). This sewer drained any liquids that were present on the floor of room 16; the sewer runs for at least 2.00 m in a northwest direction, with its bottom lying at +2.51 m a.s.l.[697] A second surface drain (feature 62) is present in the northwest corner of room 16, although this drain is roughly broken through the wall of room 16, and drained into the southeast corner of room 12 (Figure 5.233).[698] On the western side of room 16 is another *frigidarium*, feature 78. This rectangular basin is entered by descending two marble steps, and was drained by feature 63. As with the previous *frigidarium*, there is no evidence of water supply, but the bubbled sinter in feature 63 proves the presence of aqueduct water.

[694] Boersma 1985, 406:The height of exit point of drain is + 3.15 m a.s.l., with the preserved fragment of the mosaic floor of courtyard 25 at +2.76 m a.s.l.

[695] Boersma 1985, 127, 406; i.e. one side is straight, while the other three are inwardly concaved. A similar shape is known from the central fountain of the Sede degli Augustali (V, vii, 2): see RS II, 177 (sch. 166). This basin may not have come from this spot originally.

[696] The irregular surface of the courtyard may indicate additional sewer lines not detected by initial excavation.

[697] Orientation and depth observed using the extendable mirror and tape measure described in Chapter 1.

[698] At the current ground level there is an amorphous agglomeration of unidentified material. Compare this to the accumulation of sinter described in Chapter 4 in IV, ii, 5, feature 37.

Figure 5.233: Terme del Filosofo. Drains visible in room 12: feature 62 at left, and feature 63 at right.

On the eastern wall of room 16, slightly north of basin 10, is a semicircular downshaft (feature 81).[699] This is very irregularly cut into the wall, with its semi-circular cross-section visible only where it reaches the floor. The internal face of this downshaft is roughly filled with a mortar conglomerate; as the floor of room 16 and the upper section of its eastern wall was restored in 1987, it is very fragmented. Continuing further into the baths, a small basin was installed in the western wall of room 18.[700] This basin (feature 11) is a single person plunge bath, and severely reduced the space of room 17. There is no remaining evidence for supply or drainage. Although rooms 19 and 20 preserve their *praefurnia* holes accessible from the service corridor 22, there are no *tepidaria* basins *per se*. The southwest corner of room 19 contains a loose agglomeration of concrete, tufo, and brick fragments (feature 151). As there is no evidence of water supply or drainage here, it is unclear if this is in fact a water feature, but the presence of a *praefurnium* directly adjacent to this mass could suggests its identification as a *laconicum*, or dry-heat room (Figure 5.234).[701] The preserved thickness of the walls and marble paneling support this interpretation.

Figure 5.234: Terme del Filosofo. Looking south into the southeast corner of room 19 with feature 151 outlined in dashed line.

[699] Boersma 1985, 127, 398.
[700] Boersma 1985, 45, 127, 401.
[701] Poccardi 2006, 76-80 for the history of this word and its usage in Roman baths; a room of similar function is known directly across the street in the Terme del Faro (I, xii, 6, room 16), where it is called a *sudatorium*.

In the furthest part of the bath is room 21 with its two hot basins.[702] The rectangular *caldarium* (feature 82) on the northern side of this room is very poorly preserved, with its *suspensurae* and floor largely absent. A substantial wall was built on its southern face to completely block access to the pool. The semi-circular caldarium on the south side of room 21 (feature 9) is not as poorly preserved, and some traces of its heating tubuli remain.[703] A service corridor, room 22, runs as an outline around the *praefurnia* to allow service access to the hot baths. In the eastern most section of room 22 is the likely substructure of a water heater (feature 77).[704] The dense composition of this substructure and its narrow horseshoe shaped *praefurnium* suggest that it supported a metal tank for boiling water (Figure 5.235).[705]

Figure 5.235: Terme del Filosofo. Water boiler in 1985 at left (Boersma 1985, 129, Fig. 135), and at right 2017 (by author).

Given the small size of the hot pools, this boiler (*miliarium*) could have been filled by bucket and likely had small pipes directing the water to the adjacent hot pools (features 9 and 82).[706] When the water boiler was built, it partially blocked a cappucina sewer section (feature 76) in the eastern wall of room 22. The sewer's *bipedales* pass through room 22 into room 23, and extend below the current ground level. The relieving arch above the sewer section continues into the ground immediately west of the *bipedales*, implying that there was an earlier sewer line here before the insertion of the water heater. This would have drained one or more of the *caldaria*.

The final two water features extend for the entire vertical height of the north wall of room 23 (feature 177), and of room 27 (feature 176). These "grooves" were irregularly hacked out of the brick walls and are more pronounced towards the bottom both in depth and width, yet they taper off and become shallower as they extend upwards (Figure 5.236). They are identified here as water features for their

[702] GdSc 25, 50 (30-1-1939) for these *caldaria*.
[703] Boersma 1985, 45, 402.
[704] Boersma 1985, 128 (Fig. 135), 404.
[705] The 2 x 2 m base is composed of *spolia* material (e.g. blocks of travertine column bases, tiles and bricks), and was heavily rebuilt in 1987.
[706] De Haan 2010, 69-73 for a good overview of water-tank heating; Hurard *et al.* 2016, 1567 for a water tank in Roman Gaul; see Chapter 3 for another *miliarum* in the Terme della Basilica Cristiana (III, i, 3).

similarity to downshafts. They are very similar in shape and orientation to the four grooves described in relation to building V, ii, 9 (see below).[707]

Figure 5.236: Terme del Filosofo (V, ii, 6-7). View looking north at features 176 (right) and 177 (left).

Infrastructure Chronology

Roman Water Footprint #1 (4th century B.C.- AD 50)

No known water features.

Roman Water Footprint #2 (AD 50-200)

In this period, only the western section of the later building is present. In room 2 the large basin was installed at the end of the 2nd century against a wall of *opus vittatum B*, supplied by the lead pipe in channel 188.[708] The north, east, and south walls of latrine 7 originally date to this period.[709] The internal drains of the latrine also date to this period (features 67, 69, 71, 144, 146) although, as discussed above, it is not clear from where some of the drains originated, as the baths would not be created for another 150 years. The downshaft at the east end of room 1 (feature 148) also dates to this period, and emptied into the latrine channel through feature 71. The final water feature come from the channel in the north wall of room 7 (feature 64).

Roman Water Footprint #3 (AD 200-300)

The majority of the water features in this period are connected with the insertion of the bathing complex ca. 250 AD. The wide doorway of room 2 was blocked up in this period, and drain 166 was created within

[707] See below for features 17, 101, 102, 103.
[708] Boersma 1985, 124, 391.
[709] Boersma 1985, 124.

that blocking, perhaps to provide a new drain for basin 65. As mentioned above, this drain lies below the level of the travertine threshold incorporated into the wall, strengthening its identification as an underground drain *in antiquo*. A bonding course of *bipedales* runs across the wall at the same height as the travertine threshold, perhaps indicating a now-lost floor level. Although the shape of the latrine in room 4 in its previous period is unknown, it received a new basin on its western side (feature 66), which was supplied by feature 165, and drained out through drain 72. Part of the rebuilding entailed a new floor and surface drainage system (features 73, 74, 145). To conduct water from at least the hot basins, the large drain 70 was created at this time.

Moving to the bath proper, the majority of the systems are connected with drainage, but there is also evidence of supply. While it is remains an argument *ad silentium*, it is possible that features 8 and 80 were cisterns, and received pressurized aqueduct water at a higher level than the bath basins. Upon entering the central bath hall (room 16), a *frigidarium* basin lies on the eastern side. The drained water of this basin can be followed through the following features: 10-150-79(?)-152-75 (Figure 5.237). The expelled water ends in the latrine's main channel (feature 146), helping to flush out this channel.

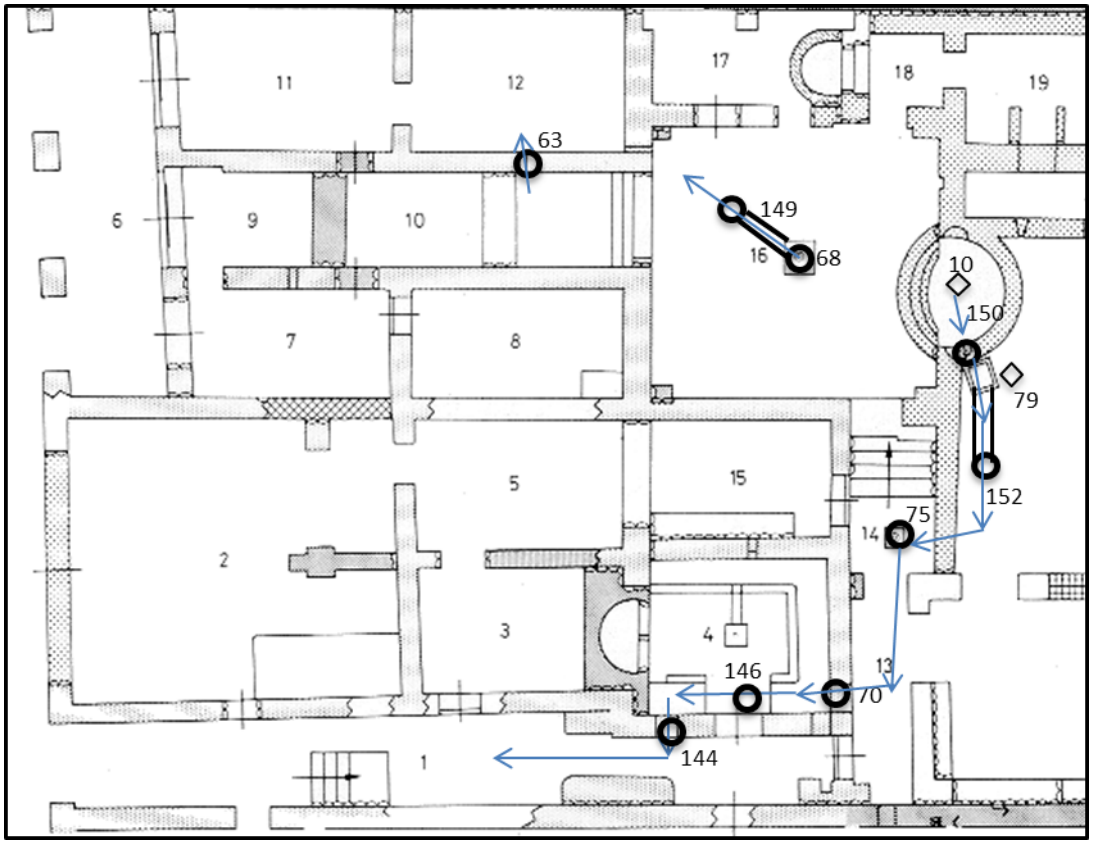


Figure 5.237: Reconstructed drainage systems of the Terme del Filosofo (after Boersma 1985, 36, Fig. 36).

On the western side of room 16 is the second *frigidarium*, basin 78. Like its eastern neighbor, this basin was also supplied by aqueduct water, but its drainage line is known only through feature 63. Given the position of this drain it was most certainly underground and drained directly to the Semita dei Cippi. The drain cover in room 16 (feature 68) dates to this period, as does its large sewer (feature 149), which was created together with the baths. The direction and depth of this sewer argue for its emergence in the east wall of room 12, and its absence cannot be rectified.[710] Basin 11 also dates to this period,

[710] Boersma 1985, 121, 122, 236, 396, 399 on draining out across the floor of rooms 11 and 12 to street. As the bottom of the sewer is at + 2.51m a.s.l., and the current ground level of room 12 is +2.91 m a.s.l., the 50 cm tall sewer (=+3.01 m a.s.l.) should be visible in room 12.

although both its supply and drainage are unknown. Upper floor drainage passed vertically through room 16 in downshaft 81. Given their vicinity and the lack of evidence in any other direction, both basin 11 and feature 81 also likely connected with drain 149.

In the heated rooms, the possible basin (feature 151) in room 19 dates to this period, although it is poorly preserved. The twin caldaria in room 21 (features 9 and 82) were supplied with hot water from the water tank (feature 77), and it is likely that the resulting water drained out through feature 76. In another scenario, the used water from the *caldaria* could continue under courtyard 25 to connect with sewer 152. Given that the basins had hypocaust heating, it's unclear exactly *why* the water boiler was needed, especially given the discrepancy in their volumes.[711] Little can be said about the function of the irregular downshafts (features 176, 177), other than that they were roughly cut into ca. 250 AD walls.

Roman Water Footprint #4 (AD 300-600)

No new water features were added in this period, and the bath is thought to have functioned into the 5th century. At an unknown point in this period, the caldarium basin 82 was resolutely blocked up, leaving only the semicircular *caldarium* (feature 9) for the bathers.

Conclusion

In terms of supply, the bath building was supplied by flowing aqueduct water. The minimal capacity of the water boiler in this bath building may shed light on the wider discussion in Roman hydraulic studies about how often bath basins were emptied. Perhaps the water boiler acted just to add a burst of extra hot water to the basins, and was not a main supply source. The complexity of the drainage system is an interesting conclusion of this building, as later systems take advantage of existing systems. The latrine becomes a hub in the 3rd century for the drainage of bath basins as well as upper floor drainage. Rain drainage is present in multiple parts of the building. As with other buildings in insula V, ii, we have evidence for fragments of Late Antique drainage systems removed in the modern period. These "floating sewers" (features 62, 63, 64, 149, 166), and their associated ground levels suggest a still vibrant Late Antique hydraulic landscape in insula V, ii.

[711] Boersma 1985, 45, 128, 404: the combined volume of the hot pools is 2.27 m^3 (=2270 liters), with the water heater reconstructed as having a capacity of only 520 liters.

V, ii, 8: Domus della Fortuna Annonaria

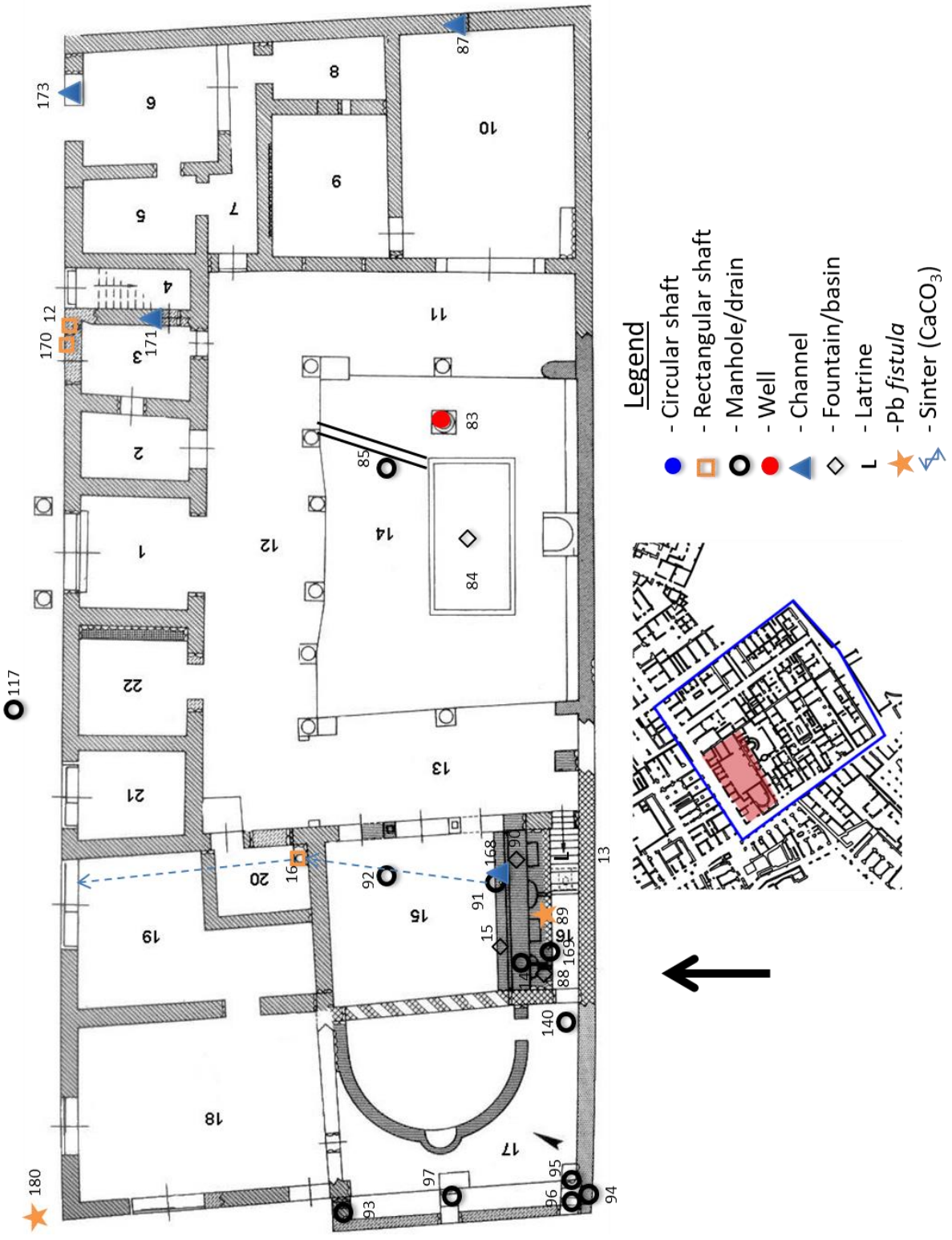


Figure 5.238: Identified water features in the Domus della Fortuna Annonaria (after Boersma 1985, 158, Fig. 155).

Location in insula

This large private house, typical of the Late Antique domus shape known at Ostia, occupies nearly the entire northern face of the insula, along an eponymous street, the Via della Fortuna Annonaria (Figure 5.238). Its western face runs along the Semita dei Cippi, its southern side borders the Terme del Filosofo (V, ii, 6-7), and its eastern side borders part of V, ii, 9. Nearly all of the northern rooms open onto the Via della Fortuna Annonaria.

History of Excavation and Restoration

The building was first excavated in 1939, and received a fair amount of attention in the Giornale di Scavi for the high concentration of sculpture and epigraphic fragments found here.[712] The upper sections of the apse and nymphaeum in room 15 were rebuilt during its initial excavation. The building has undergone extensive restoration, involving a re-laying of the mosaics in room 9, as well as the re-erection of the columns and nymphaeum of room 15. A modern flowerbed was planted to indicate where the central courtyard's *impluvium* basin was located.

Phasing and Comments

The earliest evidence from this building comes from the circular well (feature 83) in the eastern section of the courtyard, dated stylistically from its well-head to the early Augustan period. The majority of the north and eastern sections of the building date to the Antonine period, identifiable from the almost uniform yellow bricks.[713] The black and white mosaic with mythological scenes in room 9 dates to ca. 210 AD.[714]

The 4th century saw many changes to the building, with the addition of walls in rooms 3,[715] 6, 17, and 18. The most dramatic change in the early 4th century is the insertion of a semi-circular apse in the western section of room 15 and its accompanying nymphaeum.[716] The final structural change comes in the 5th or 6th century with the insertion of a "bench" of rough masonry along the eastern side of room 22.

[712] GdSc 25, 54 (30-1-1939), saw the area of the domus as the lowest within the unexcavated area, and the reason for the concentration of objects here. The building is known as Edificio 12 in the GdSc

[713] Boersma 1985, 47: the building measures ca. 40 x 18 m.

[714] Boersma 1985, 148.

[715] Bakker 1994, 236, Pl. 14 for this as a niche for domestic religion.

[716] Boersma 1985, 54 for the apse which is dated to the period of Constantine (AD 306-337); Brenk & Pensabene 1998-99, 287 for further examples of this *"apsidomania"* that was a common architectural addition in this period (e.g. Domus dei Augustali, Schola di Traiano, Terme del Mitra) with one added on the north side of the neighboring Terme del Foro at the same time (Cicerchia & Marinucci 1992, 137).

Water Features Chart

The following hydraulic features are located in the Domus del Fortuna Annonaria (Table 5.51).

V, ii, 8 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
3	circular downshaft	NE corner of room; within N wall; vertical ceramic pipe	12	4
3	circular downshaft(?)	N wall; vertical circular hole	170	4
3	channel	E wall of room; horizontal channel	171	4
6	channel	NE corner of room; W-most pier	173	4
10	channel	E wall of room at floor level	87	2
14	well	E side of courtyard	83	1
14	basin	center of courtyard; rectangular shape	84	1?
14	sewer	NE side of basin 84	85	1?
15	basin	lower rectangular basin of nymphaeum	15	4
15	drain	drains basin 90; in S wall of basin 90	14	4
15	nymphaeum	upper rectangular basin of nymphaeum; drains both into features 15 and 169	90	4
15	drain	in floor of basin 15	91	4
15	sewer	branch of sewer draining nymphaeum	92	4
15	drain	leads from basin 90 into basin 15	168	4
16	latrine	E side of room 16; single seater	13	4
16	basin	rectangular basin; supplied by drain of the nymphaeum (feature 14)	88	4
16	fistula line	N wall of room 16; semi-circular channel cut into wall; runs from W-E and ends in latrine	89	4
16	sewer	sewer of latrine; slopes down from E to W	140	4
16	drain	S wall of basin 88	169	4
17	sewer	runs horizontally N-S through the NW pier of room 17	93	4
17	sewer	runs horizontally N-S through the SW corner of room 17; covered by a relieving arch; covers features 95, 96	94	4
17	sewer	runs horizontally N-S through the SW corner of room 17; E drain under 94	95	4
17	sewer	runs horizontally N-S through the SW corner of room 17; W drain under 94	96	4
17	sewer	runs horizontally N-S though central pier on W wall of room 17	97	4
18	fistula	external NW corner of room 18	180	2?
20	circular downshaft	SE corner of room with vertical ceramic pipe; inside pier	16	4
Via della Fortuna Annonaria	sewer	runs under street	117	1?

Table 5.51: Identified water features in building V, ii, 8.

Description of Water Features

In one of the taberna (room 3) opening onto the Via della Fortuna Annonaria, there are three water features. In the awkwardly angled masonry that forms the northeastern corner of room 3 there is a circular downshaft (feature 12), with a vertically placed circular ceramic pipe *in situ* (Figure 5.239). This would have acted as a drainage shaft from the upper floor, together with the much less clear feature 170. The latter remains only as a circular hole left in the concrete cap added during modern consolidation work, and it is unclear whether it is in fact the "echo" of a now-lost drainage feature. Passing through the east wall of room 3 is a poorly preserved drain (feature 171), roofed by a large tufo block. The other face of this drain lies below the floor level of room 4, and it is not possible to access it.

Room 6 is located in the northeastern most part of the building, and it has a blocked up channel (feature 173) passing through one of its brick piers (Figure 5.240). While the south face of this channel appears clearly shaped, its northern face is filled in with a mixture of concrete and brick fragments (Figure 5.240). This channel could have held a lead fistula pipe leading into the house. In the southeastern section of the building is room 10, which had a floor of *opus sectile*, and a small channel (feature 87) that went through the east wall of the room. This channel appears to be a flat-roofed drain, and leads into room 6 in the neighboring building V, ii, 9. Turning to the wide central courtyard of the house, there is evidence for a large rectangular pool (feature 84) in the center (Figure 5.241).[717] This is an *impluvium* style pool, that drained out towards the northeast, in a small flat roofed drain (feature 85). This drain passed under a now-removed brick pier and perhaps continued its length out through room 3.[718]

Figure 5.239: Domus della Fortuna Annonaria: northeast corner of room 3 with the ceramic pipe of the circular downshaft (feature 12) visible in the lower left.

[717] RS II, 169 (sch. 158); GdSc 25, 54 (30-1-1939) for the types of marble found here (e.g. Porta Santa, Cipollino, Africano, Verde Antico, and Rosso Antico)

[718] The brick pier was originally against the 2nd pier from the right but was removed after Fig. 7.50 was taken.

Figure 5.240: Domus della Fortuna Annonaria. View looking south at the blocked-up channel (feature 173) in room 6.

Figure 5.241: View looking east across the courtyard of the Domus della Fortuna Annonaria showing the location of features 83, 84, and 85 (SBAO B2834).

Also on the eastern side of the wide courtyard is a well with a marble well-head decorated with garlands and *bucrania* (feature 83).[719] It rests on a low platform of travertine, which raises the well-head above the *opus reticulatum* walls of the well (Figure 5.242).

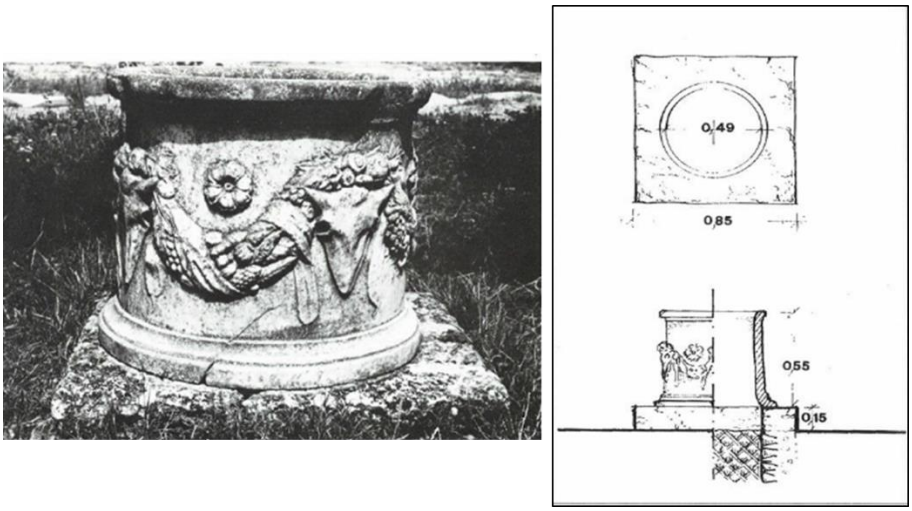


Figure 5.242: Domus della Fortuna Annonaria. Well 83 (at left, Boersma 1985, 141, fig. 143; at right RS I, 58, Fig. 83).

Along the southern wall of room 15 is an elaborate nymphaeum with an upper and lower rectangular basin (Figure 5.243). This nymphaeum was heavily restored but it is still possible to reconstruct its hydraulic functioning.[720] Alternating rectangular and semi-circular niches offer space for four statues. Water would have entered via the lead pipe (feature 89), exiting below the semicircular niches into the larger rectangular basin (feature 90). This larger basin has thickly coated corners of *opus signinum*, and was most recently restored in 1987.[721] Water in basin 90 could flow through a small drain (feature 168) into the shallow lower basin attached to its north face (feature 15). Basin 15 lies ca. 15 cm below the level of the marble floor, and drained out through a small hole (feature 91). Boersma hypothesized that the water from drain 91 continued under the floor of room 15 through a drain (feature 92), towards the Via della Fortuna Annonaria.[722] A second drain in basin 90 (feature 14), conducted water into a small basin (feature 88) in room 16.

In room 16 is an example of a private, single-seater latrine.[723] This latrine (feature 13) is accessed by walking down a sloping *opus sectile* hallway, which reused earlier inscriptions in the floor. A small basin (feature 88) was built into the northern wall of room 16, and was supplied by a drain (feature 14) that conducted water from the main basin of the nymphaeum (feature 90). This small basin itself had a drain (feature 169), which emptied water onto the room's floor and sloped down to the east, providing water to flush out the contents of the latrine. Along the entire north wall of the room is an irregular yet consistent cut out section of the wall (feature 89). Its western limit begins roughly at floor level at the intersection between rooms 16 and 17, then after sloping upwards at a roughly 45° angle, it runs horizontally across the entire face of room 16 (Figure 5.244). This groove held the lead pipe supplying the nymphaeum.

[719] RS I, 58 (sch. 46) for the well head.
[720] Boersma 1985, 150, 421; RS II, 234 (sch. 27).
[721] Although at time of writing, the 1987 restoration has collapsed; GdSc 25, 56 (30-1-1939), 76 (30-2-1939) for sculptural and epigraphic finds within this rectangular basin.
[722] Boersma 1985, 424.
[723] GdSc 25, 58 (30-2-1939) for the discovery of this *"gabineto personale"*.

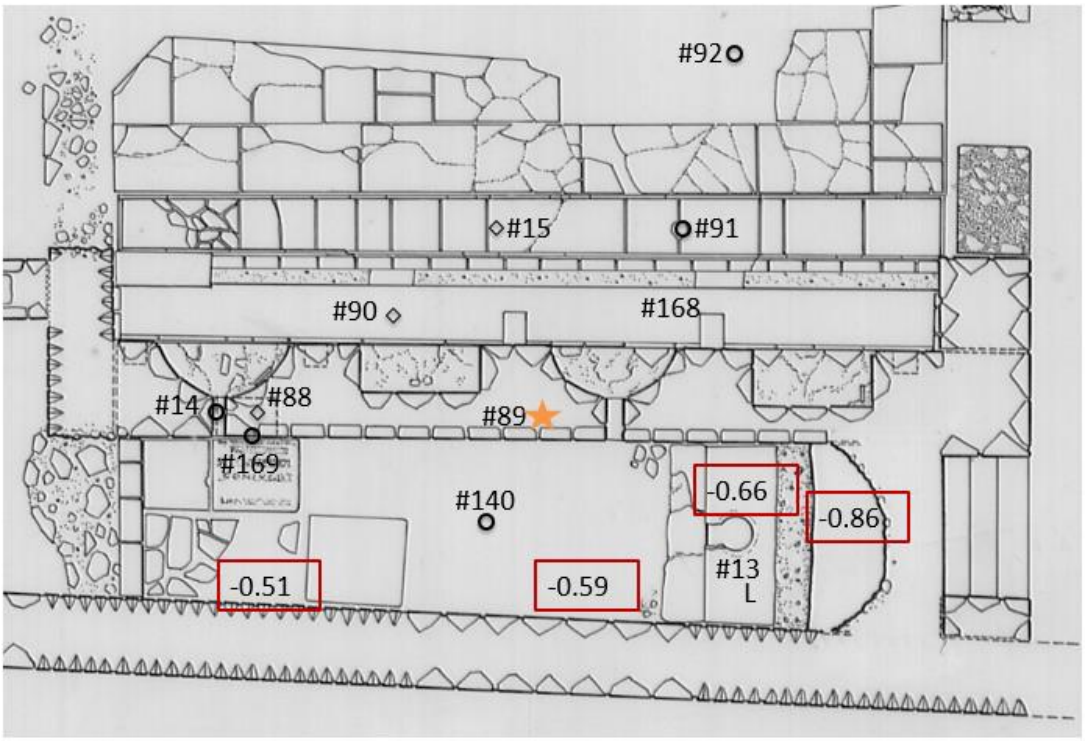


Figure 5.243: Plan of the nymphaeum in the Domus della Fortuna Annonaria with its water features. The private latrine in room 16 is visible in the lower part of the image, with floor heights in meters below sea level in red boxes (after Archivio Disegni 8539; floor heights come from Boersma 1985, 423).

Figure 5.244: Domus della Fortuna Annonaria, room 16. View while sitting on the latrine seat, looking west at the small basin (feature 88), and lead pipe channel (feature 89) visible to the right.

The keyhole shaped seat of the latrine is placed over a rectangular drain which presumably drained out towards the Semita dei Cippi (feature 140).[724] However, no such sewer drain is known from previous research: if we suppose a standard cappucina drain to be present underneath the lowest part of the latrine seat, this would add ca. 80 cm of depth to the sewer line here (Figure 5.245).[725] The latrine was installed at the same time as the walls blocking off room 17 from the Semita dei Cippi.

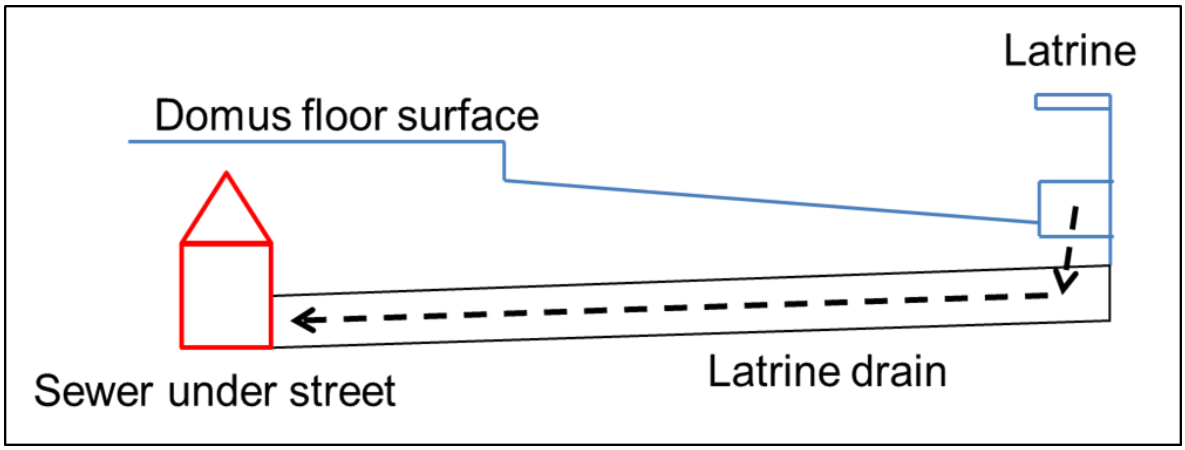


Figure 5.245: Schematic cross section of the latrine room 16. The black dashed line indicates the possible flow of water and waste from the latrine.

Along the western wall of room 17 are a line of three brick piers that were originally set in line with the western wall of the entire insula.[726] At a later point an additional set of piers was added on to the existing ones, however these later brick piers projected out into the Semita dei Cippi (Figure 5.246). Passing through the bottom of each of these secondary piers are cappucina drains.

Figure 5.246: Domus della Fortuna Annonaria. View looking north along the Semita dei Cippi at the western wall that projects from room 17.

[724] Boersma 1994, 39.
[725] Compared to the heights of complete cappucina drains preserved elsewhere in insula V, ii, such as feature 144 in the Terme del Filosofo (V, ii, 6-7).
[726] Boersma 1985, 150, 410 dates this to the fourth quarter of the 2nd century.

The drain in the northern pier (feature 93) and in the middle pier (feature 97) are composed of a cappucina drain that pass through the brick pier; these drains were clearly built at the same time as the piers within which they are located. The drain passing through the southern pier is composed of two secondary drains, features 95 and 96 (Figure 5.247, Figure 5.248). These are both covered by a large brick relieving arch (feature 94) supported on the street side by a rectangular travertine block. As this is the only section of this sewer with two drains (i.e. features 95, 96), it supports the hypothesized direction of flow from south to north, and implies that two different drains merged into a larger one at this point.

Figure 5.247: Domus della Fortuna Annonaria. View looking north at drain 95 (right) and drain 96 (left).

Figure 5.248: View looking north showing the southern face of room 17 of the Domus della Fortuna Annonaria. The height of the travertine thresholds of the tabernae on the eastern side of the Forum baths match the height of the drains in the Domus della Fortuna Annonaria.

Directly beyond the external northwestern corner of room 18 a curving lead pipe (feature 180) was discovered buried in the intersection between the Semita dei Cippi and the Via della Fortuna Annonaria. This anepigraphic *fistula* was only recorded in archival photographs and while both the date of its modern excavation and any information about its date remain unclear, the curving pipe does respect the orientation of room 18.[727] In a small room (room 20) that opens off of the northwestern corner of the courtyard, there is evidence for a circular downshaft (feature 16). This vertical ceramic pipe was

[727] SBAO R 894.1, R 894.2, R 894.8; Schioler 1971, 94 identified several hand written labels on 10 pipes stored under the Capitolium. These pipes were said to originate from a 1966 excavation at the corner of the Via della Fortuna Annonaria and Semita dei Cippi, and from the nearby Terme del Filosofo, and may refer to same pipes in the archival photos.

roughly added into the southeastern corner of this room, and acted as a drain from the upper floors of this building.

Infrastructure Chronology

Roman Water Footprint #1 (4th century B.C.- AD 50)

The well (feature 83) and the courtyard basin (feature 84) date to this pre- or early Augustan period. Although the irregularly laid out colonnade dates to the Flavian period, the basin is here dated contemporary to the well; this is based on the height of its drain (feature 85), which lies below the level of the colonnade.[728] The sewer under the Via della Fortuna Annonaria (feature 117) is also dated contemporary to (or earlier than) the creation of the basin, since the low relief of the city in this period argues against street drainage.

Roman Water Footprint #2 (AD 50-200)

The drain through the eastern wall of room 10 (feature 87) dates to this period, as it is securely built into the lower courses of the Antonine wall. The *fistula* pipe (feature 180) on the external northwestern corner of room 18 takes its *terminus post quem* from the Antonine walls of the room, but may be later.

Roman Water Footprint #3 (AD 200-300)

No known water features.

Roman Water Footprint #4 (AD 300-600)

The nymphaeum and the latrine date to this period. Interesting here is the connection between these two prestige water features via drain 14. Also in this time period we see the insertion of drainage features related to upper floors (features 12, 170), which connected to the earlier drainage line (feature 85). In room 20, feature 16 can be added to this list: Boersma dates it as "post-Antonine", but as it respects the line of the door blocked after AD 350, it must be earlier, and so around the early 4th century.[729] To this period can be added the drain in room 3 (feature 171), and the blockage of the channel in room 6 (feature 173).

In terms of the drainage features of room 17, a brief excursus on its dating is presented, as it has a wider impact on the hydraulic history of insula V, ii. Boersma's dating sequence is as follows:

#1) The south wall of room 17 with its relieving arch dates to Trajanic period (AD 96-102).

#2) In the Antonine period, three brick piers were built along the same orientation as the western side of the building, lining up with the street piers of the Terme del Filsofo (room 6).

#3) Shortly thereafter (ca. 175 AD) three piers were attached onto the western (i.e. street) side of the earlier piers, extending into the street ca. 1 m and containing features 93, 94, 95, 96, and 97.[730]

#4) Around AD 350, these double piers were connected by a rough wall of *opus vittatum B* resting on a course of tufa blocks.[731]

I agree with Boersma's phase #2 that the original line of piers along the western side of the room dates to the Antonine period, but not his phase #1, since the relieving arch is only necessary to protect a drain, yet the drain didn't exist yet. Also, his placing of the additional piers (phase #3) extending out into the street with their open drains at the bottom seems untenable. These double piers would be unstable, given that the piers are all pierced by drains at their bases; if all the piers have cross sections of sewers,

[728] Becatti 1949, 23; Boersma 1985, 141, 419.
[729] Boersma 1985, 57
[730] Boersma 1985, 151.
[731] Boersma 1985, 56-57 for these piers.

then it follows that a sewer line is running through all three piers. Boersma's phase #4 pertains to the wall forming the western extent of room 17, which connected the three latest piers. This chronology also cannot be maintained, as the foundation level of this wall (a mix of concrete and tufo blocks) is clearly visible in the southern section. The line of tufo blocks present in this blocking wall lies at the same height as preserved 4th century thresholds and wall intersections (foundation-bonding course) around the building.

A revised sequence for this part of the building is proposed here (Figure 5.249). The first phase (#1) comes with the Antonine creation of the first piers along the western side of the domus. In phase #2 the second set of brick piers were added onto the earlier ones and had a covered sewer line running through their bases. This phase should be moved from Boersma's AD 175 into the 4th century, connecting it with the creation of the large apse in room 15, and the raising of the contemporary street level in the Semita dei Cippi. When inserted into existing spaces, 4th century apses are usually unconcerned with a finished exterior masonry surface, as is the case here.[732] In a final phase #3, the walls blocking off the space between the piers were added. Both the conspicuousness of the newly installed latrine, and the fact that the apse backed onto the Semita dei Cippi would warrant the erection of a wall to block these features from the street. This phase #3 should be dated soon after the secondary piers, also in the 4th century. In this way, the sewer channel would still pass through the internal area of the house, but would be contained in an underground channel set into the now unused space in room 17.

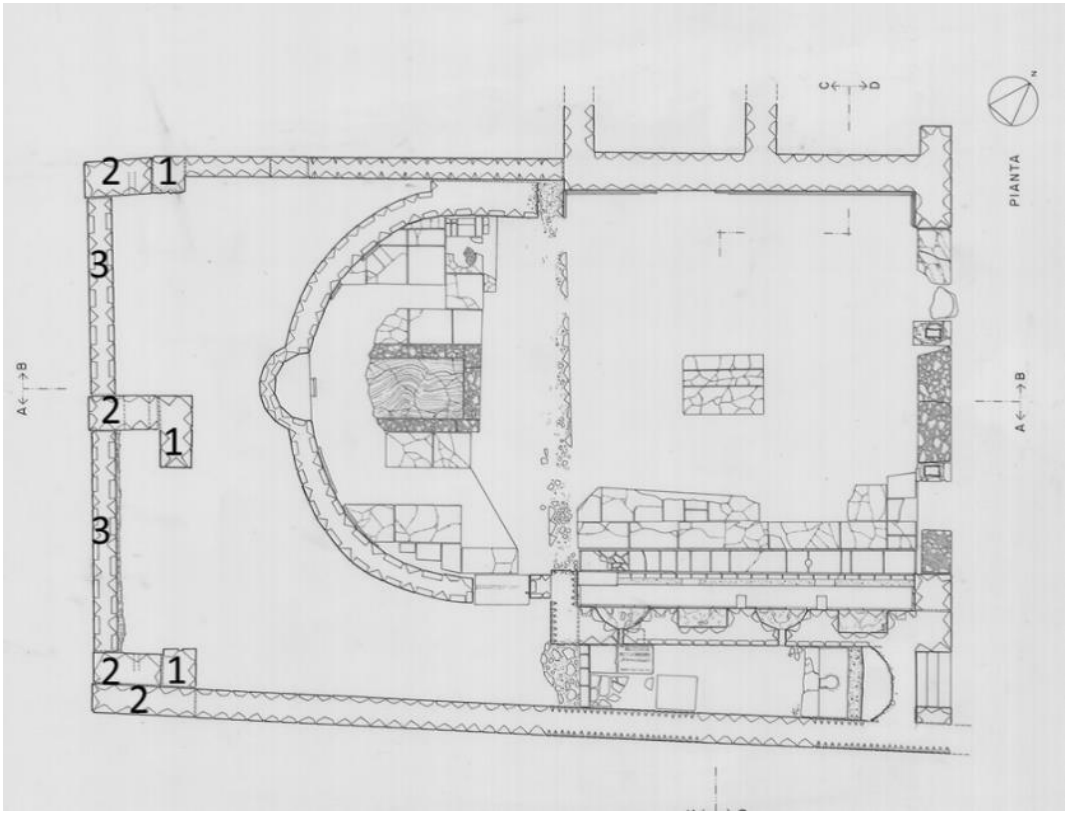


Figure 5.249: Revised sequence of construction for room 17 in the Domus della Fortuna Annonaria.

Conclusion

The domus does not have the same degree of hydraulic complexity as the previous two large buildings in this insula, and many of the structures deal with drainage from upper floor levels. The early 4th century is truly the hydraulic apex of this building, with the installation of the nymphaeum and the latrine. As

[732] See Chapter 3, III, i, 4, feature 18, yet this apse dates to the late 4th, early 5th century.

discussed above, Boersma's interpretation of the sewer fragments on the west side of room 17 (in the Antonine period) can no longer be substantiated, and provides important information about the wider urban situation of Ostia in the 4th century. The 4th century Semita dei Cippi certainly was not as busy as it had previously been. Taken together with the structural histories of the Forum baths and the Semita dei Cippi itself, these features indicate that a sewer line sloped down from south to the north along the Semita dei Cippi. At this time, the ground level was ca. 50-75 cm higher than at present and covered these drainage features. Directly across the street from these drains are a row of tabernae on the eastern side of the Forum baths (I, xii, 7); the robust travertine support piers for 4th to early 5th century tabernae lie at roughly the same height as the hypothesized ground level required to cover the sewer drains in room 17.[733] Previous researchers did identify these as drainage features, but took the modern ground level to have been the same for subsequent periods of the insula's life. This would suggest that the wealthy residents of the Domus della Fortuna Annonaria wanted to channel an open sewer section through their house.[734] The fact that these drains are at the current ground level must be seen as the result of 20th century excavation in this area.[735]

V, ii, 9: Caseggiato

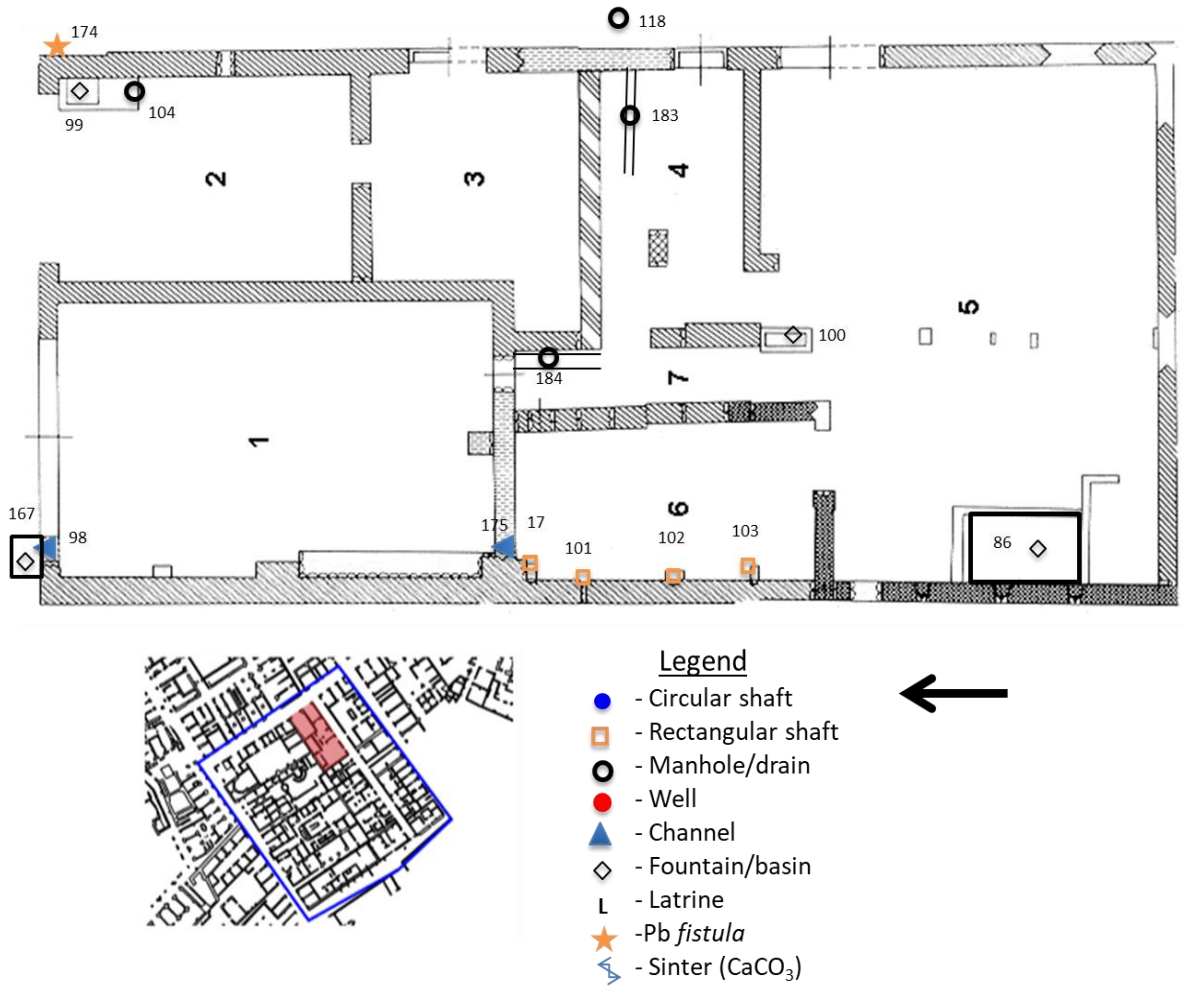


Figure 5.250: Identified water features in V, ii, 9 (after Boersma 1985, 58, Fig. 64).

[733] Cicerchia & Marinucci 1992, 20: their third phase of the bath buildings in the 4th to early 5th century included the addition of the *tabernae* (I, xii, 7) on its eastern side. The bottom of the travertine piers all hover ca. 50 cm above the current ground level.
[734] Boersma 1985, 150.
[735] Weiss, personal comment about the dramatic modifications to the streets of Ostia in the 20th century.

Location in insula

Building V, ii, 9 is located in the northeastern corner of the insula, and opens onto the Via della Fortuna Annonaria on its northern side with two doorways, and onto the Via della Casa del Pozzo on its eastern side via four doorways (Figure 5.250). It is bounded to the south by V, ii, 10, and to the west by the Domus della Fortuna Annonaria (V, ii, 8) and the Terme del Filosofo (V, ii, 6-7).

History of Excavation and Restoration

The building was originally excavated by Calza in his 1939-1941 excavations, with the resulting floors undercut in many rooms.[736] Some walls were restored in 1982, namely the west wall of room 1 and the northwest wall of room 7. The building was re-examined and re-excavated in some sections by Petriaggi in 1983 and 1984.[737]

Phasing and Comments

The earliest phases of this building date to the late 1st century B.C. or early 1st century AD, and comes from the western wall of room 5.[738] A doorway functioned here until the first half of the 1st century AD, when the ground level of the wider area was raised and three windows were installed in the same wall. The building's shared wall with the Domus della Fortuna Annonaria dates to the Antonine period. In the 3rd century these windows were blocked, perhaps as part of the short-lived temple installed in the courtyard of the later Terme del Filosofo.[739] The building has a subtly complex building history, especially in the 3rd century.[740] The lack of any preserved staircase implies this building had no upper floors. A doorway between rooms 1 and 7 was blocked up at a later stage (Figure 5.251). The height of the doorway's threshold from the current ground level argues not only for the presence of a functioning ground level at a later period, but an ever *later* period when the rooms were still in use and the doorway was roughly blocked. These later interventions are roughly dated to the 5th or 6th century, although this remains provisional in light of the small but growing *comparanda* of Late Antique building techniques in Ostia.

Figure 5.251: Late door blockage, seen from the south side of room 1 on left, and from the north side of room 7 on the right.

[736] GdSc 29, 12 (26-11-1941) lists epigraphic finds from the first southward exploration of the Via della Domus del Pozzo.
[737] GdSc 54, 1-8 (20-12-1982) for the excavation of building 9.
[738] Boersma 1985, 58, 465.
[739] Petriaggi 1984, 202, with the west wall of room 6 labeled "A".
[740] Meiggs 1973, 548 tied the building's history in with that of the Domus della Fortuna Annonaria.

Water Features Chart

The following hydraulic features are located in building V, ii, 9 (Table 5.52).

V, ii, 9 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
1	channel	NW corner of room 1	98	4?
1	basin	external NW wall of room 1	167	4?
1	ceramic pipe	SW corner of room 1	175	2
2	basin	NE corner of room 2	99	4?
2	drain	SE corner of basin 99	104	4?
2	fistula channel	external NE corner of V, ii, 9	174	4?
4	drain	N side of room 4 and 7/crosses W-E	183	2?
5	basin	N side; S of travertine piers	100	3
5	basin	W side of room 5	86	2
6	rectangular downshaft(?)	NW corner of room 6	17	2?
6	rectangular downshaft(?)	2nd from N in W wall	101	2?
6	rectangular downshaft(?)	3rd from N in W wall	102	2?
6	rectangular downshaft(?)	4th from N in W wall	103	2?
7	drain	NE corner; along E side of room	184	2
Via della Casa del	sewer	under street	118	2?

Table 5.52: Identified water features in building V, ii, 9.

Description of Water Features

On the external wall of room 1, evidence for a street-side fountain basin (feature 167) comes only from early plans.[741] While no trace of the basin itself survives, the channel for a supply line (feature 98) goes through the Antonine wall of room 1.[742] The supply line to this basin likely originated from the street under the nearby threshold. The connection between this now-lost basin and the channel emerging from the brick pier next to it remains unclear (Figure 5.252).[743]

In the southwest corner of room 1 is a roughly inserted channel ca. 1.50 m above the current ground level. A sherd of a circular ceramic pipe was broken and inserted into the bottom of this channel together with a coating of mortar to bind it to the bottom of the channel. The channel itself passes through the south wall of room 1, and is perhaps connected to the functioning of the four vertical "niches" running along the west wall of room 6. However, the restoration work on the neighboring west wall of room 1 makes its identification as a water feature at all unclear.

[741] SBAO B1713, plan drawn by L. Giammiti.
[742] Boersma 1985, 161, 427.
[743] See previous section, V, ii, 8, room 6, feature 173.

Figure 5.252: View looking south at the external northern wall of room 1 with feature 167 directly to the right of the scale. The pier to the right is part of building V, ii, 8 and contains feature 173.

In the internal northeastern corner of room 2 is a much better preserved fountain basin (feature 99).[744] This basin was roughly built of brick and tufo fragments against the existing eastern wall of room 2 and has a modern concrete cap on its top (Figure 5.253, Figure 5.254). The basin was supplied by a lead pipe, whose channel is preserved on the external wall of the room, and slopes upward at a roughly 45° angle (Figure 5.255).[745] The drain for basin 99 (feature 104) is located in its southeastern corner, and presumably exited the building through the east wall of room 2 into the sewer under the Via della Casa del Pozzo.

Figure 5.253: View looking north at basin 99, with its drain (feature 104) visible in the lower right of the picture.

[744] RS II, 171 (sch. 160) for the basin.

[745] See RS II, 117 (sch. 108) for a similar supply pipe as feature 174 in the Casa delle Ierodule (III, ix, 6). Perhaps an underground pipe similar to feature 180 (described above in V, ii, 8) also existed underneath the intersection between the Via della Fortuna Annonaria and the Via della Casa del Pozzo.

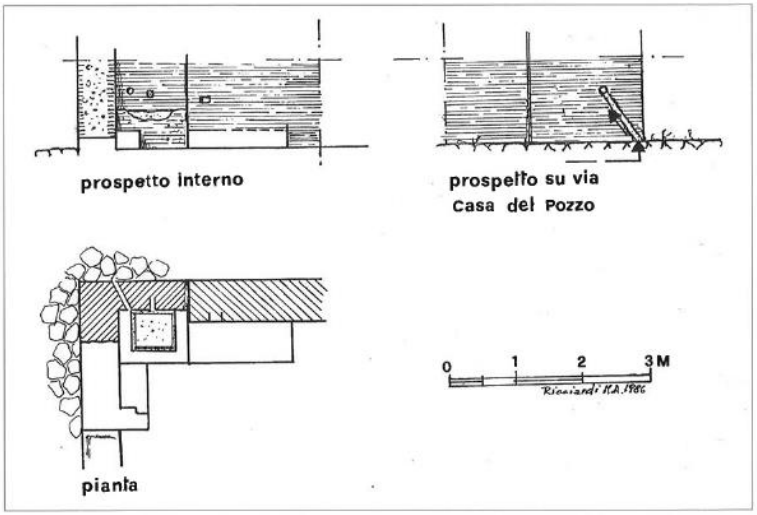


Figure 5.254: Schematic plans of features 99 and 174 (from RS II, 171, Fig. 308).

Figure 5.255: View looking west at fistula channel (feature 174) on the external northeast side of room 2.

Traces of a drainage channel (feature 183) were found within room 4, less than a meter south of the wall between rooms 3 and 4. This drain is not described in the excavation notes, but appears to slope downwards from west to east under a late doorway (Figure 5.256).[746] A similar small section of drainage channel (feature 184) was also identified, although in room 7. Excavation of the drain was not recorded, although the plan suggests that it slopes down from north to south. Given the spatial vicinity, feature 184 likely connected to 183 and drained out towards the Via della Casa del Pozzo. A little known sewer line should therefore also run under this street, and be contemporary with (or earlier than) these early drainage systems.

[746] GdSc 54, 1-8 (20-XII-1982) for the latest excavation of this building.

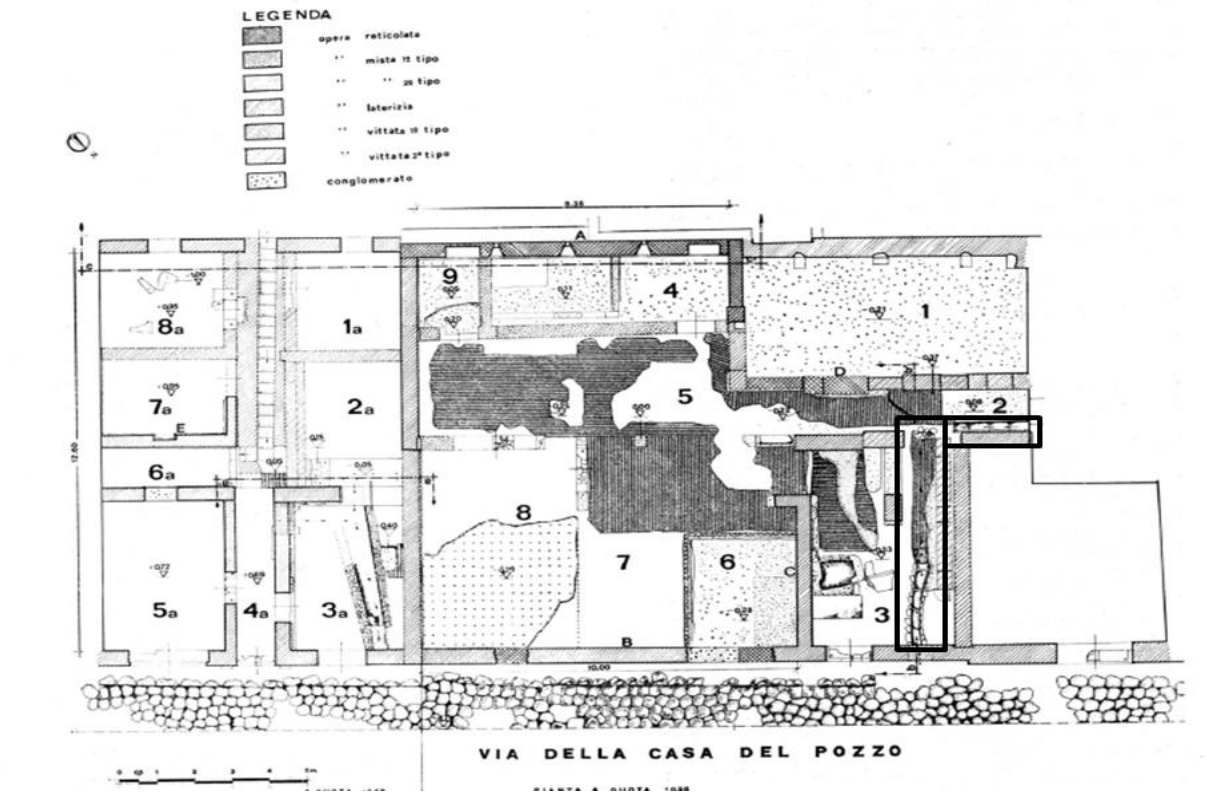


Figure 5.256: Plan of the 1983 excavation by Petriaggi of buildings V, ii, 9 and 10. Features 183 and 184 are visible in rooms 3 and 2 respectively in boxes (Petriaggi 1984, 200, Fig. 2).

Moving into room 5, a poorly preserved fountain basin (feature 100) was built against a brick pier in the northern part of the room. This shallow rectangular basin was made of tufa and brick fragments covered in plaster, and is identified mostly from traces of *opus signinum* on the southern face of the brick pier.[747] Turning to the southwest side of room 5, there is the remains of a rectangular basin (feature 86). From the brief description given by Petriaggi,[748] it remains unclear whether feature 86 is a basin or not, although it was described as one by Gismondi and Ricciardi & Scrinari based on a preserved coating of beaten earth with mortar and rubble.[749] Ricciardi & Scrinari say that it was likely supplied by rain water in the first instance, and then later connected to the cistern of the neighboring Terme del Filosofo.[750]

Along the western wall of room 6 are four vertical "niches", all of which are irregular semi-circular sections cut out of the wall (Figure 5.257). Petriaggi discovered rectangular travertine blocks underneath each niche.[751] In general all of the niches become more deeply cut into the wall as they extend towards the top of the walls, and their identification as downshafts, or as water features at all remains tentative. If they did contain vertically descending ceramic pipes, these would noticeably protrude beyond the face of the wall. Their interpretation as related to drainage comes from the position of feature 102, which is directly opposite to a drain described in the previous section.[752]

[747] Boersma 1985, 62, 430; RS II, 170 (sch. 159b).
[748] GdSc 1988, 5-8 for V, ii, 9, although the focus of the excavation is on room 5.
[749] Petriaggi 1984, 200.
[750] RS II, 170 (sch. 159a), although no evidence exists that the neighboring space in the Terme del Filosofo was used as a cistern.
[751] Boersma 1985, 59, 163, 431; Petriaggi 1984, 201, the travertine blocks are compared by the present author to those discovered running in a north-south alignment through room 5.
[752] Domus della Fortuna Annonaria room 10, feature 87.

Figure 5.257: View looking west at the western wall of room 6, showing from right to left, features 17, 101, 102, and 103.

Infrastructure Chronology

Roman Water Footprint #1 (4th century B.C.- AD 50)

No known water features.

Roman Water Footprint #2 (AD 50-200)

The vertical drains in room 6 are dated to this period (features 17, 101, 102, 103), however they cannot be dated any more precisely than "post-Antonine", or after the creation of the west wall of room 6. A similar reason is given for assigning the ceramic pipe in the north wall of room 6 (feature 175) to this period.[753] If these are in fact water features, they represent a very fragmented system in this period. The drains 183 and 184 date to this period based on the floors under which they were placed.[754] It is unclear to what they were connected, but the presence of a blocked doorway between rooms 1 and 7 would suggest some kind of water usage within room 1. The sewer under the Via della Casa del Pozzo (feature 118) should also be dated to this period, although as it is unexplored, it may be earlier. The rectangular basin in the southwest corner of room 5 is also dated to this period, although little more can be said about its supply or drainage.

Roman Water Footprint #3 (AD 200-300)

The basin in the north side of room 5 (feature 100) dates to this period as it was built directly against piers dating to the early 3rd century.[755]

Roman Water Footprint #4 (AD 300-600)

The basin 167 and its supply pipe 98 are dated to this period, given the contemporary blockage of the channel directly adjacent to this room in the Domus della Fortuna Annonaria in the early 4th century (feature 173). The basin in room 2 is also dated to this period, but in this case, its depth is the reason

[753] Boersma 1985, 58 dates this wall to 190-200 AD.
[754] Petriaggi 1984, 201 for these drains.
[755] Boersma 1985, 62: the piers are a combination of *opus testaceum* and *opus vittatum B*.

for its dating. Its remains are quite rough and appear to have been sunken into the now-lost ground level.

Conclusion

The water systems of the building are very fragmented in time and space, yet they support the mostly industrial identification by Boersma and Petriaggi. The early 20th century undercutting of ca. 70 cm likely removed evidence of the continuation of these systems.

V, ii, 10: Caseggiato

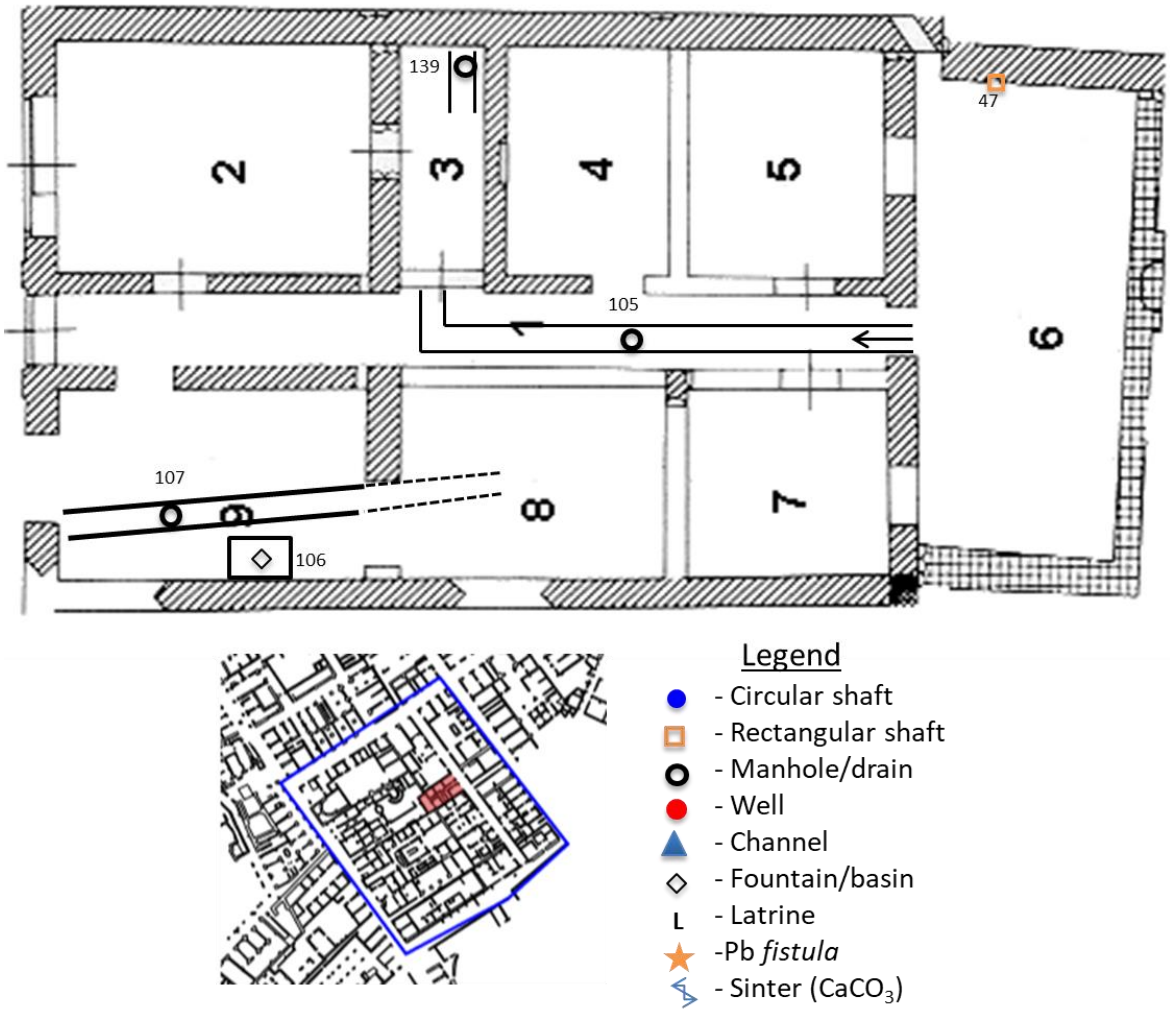


Figure 5.258: Identified water features in V, ii, 10 (after Boersma 1985, 62, Fig. 69).

Location in insula

The building is located on the eastern side of the insula, with three doorways opening directly onto the Via della Casa del Pozzo (Figure 5.258). The rectangular building (ca. 9 x 17 m) is bounded to the north by V, ii, 9, to the west by the Terme del Filosofo (V, ii, 6-7), and to the south by V, ii, 11. The westernmost room of the building, room 6, projects into the internal courtyard of the Terme del Filosofo, and interrupts the regular east and west division of space within the insula.

History of Excavation and Restoration

This building was excavated in the 1939-1940 excavation period of Calza, and was re-examined both by Boersma and by Petriaggi in the early 1980s. The latter excavated sections of this building together with neighboring V, ii, 9.

Phasing and Comments

Petriaggi identified some Claudian *opus reticulatum* under the north walls of building 10, yet the current shape of the building's construction dates to the early Severan period.[756] The lack of stairs precludes any upper floors in this building. Preserved wall painting within a niche in room 4, and fragments of mosaic in room 5 date to the second half of the 3rd century. Between the early and mid-3rd century, room 6 was added, projecting into the neighboring Terme del Filosofo.

Water Features Chart

The following hydraulic features are located in building V, ii, 10 (Table 5.53):

V, ii, 10 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
1	sewer	beings at threshold of room 6; runs E then turns S into room 3	105	3
3	sewer	SW part of room3; against W wall	139	3
9	basin	central section of N wall	106	3
9	sewer	runs W-E across room 9	107	3

Table 5.53: Identified water features in building V, ii, 10.

Description of Water Features

The most striking water feature from this building is a long sewer that runs down hallway 1 before turning into room 3 (Figure 5.259). This sewer (feature 105) slopes down from west to east, and appears to continue descending into room 3.[757] In the southwestern corner of room 3, a flat-roofed sewer channel (feature 139) is preserved, which runs for at least 0.75 m along the west wall of room 3, and is likely a continuation of this large drain. The question of what this drain serviced, or where it leads remains unclear. This is made more puzzling by the complete lack of substantial water features in room 6 of building V, ii, 10, as well as the absence of any evidence for the sewer in the neighboring building V, ii, 11 (room 4).

In one of the tabernae flanking the entrance to the building, room 9, there is evidence for a section of an additional sewer line, as well as a small water basin (Figure 5.260). The water basin (feature 106) is quite small, but is preserved thanks to its coating of *opus signinum*, which was laid onto an existing floor of *opus spicatum*.[758] It was built against the north wall of room 9. Underneath the same *opus spicatum* floor was discovered traces of a cappucina sewer (feature 107). As is visible from the archival photos below, this drain passed under the threshold between rooms 8 and 9, and was protected by a brick relieving arch. This sewer lies about 1.25 m lower than the sewer line running down the central hallway of the building (feature 105). Given the vicinity to the street, sewer 107 likely sloped downwards from west to east towards the street.

[756] SO 1, 153, 238 dated the building to the first decades of the 3rd century; Boersma 1985, 170; Petriaggi 1984, 204.
[757] Boersma 1985, 465.
[758] Petriaggi 1984, 203.

Figure 5.259: View looking west down hallway 1 at sewer channel 105, after restoration in 1982 (Boersma 1985, 465, Fig. 606).

Figure 5.260: View looking west at room 9, with features 106 and 107 outlined, seen at left during excavation (SBAO R3484, 34), and at right in 2016.

Infrastructure Chronology

Roman Water Footprint #1 (4th century B.C.- AD 50)

No known water features.

Roman Water Footprint #2 (AD 50-200)

No known water features.

Roman Water Footprint #3 (AD 200-300)

The sewer line running down room 1 and into room 3 (features 105, 139) was installed after the initial creation of the building, when the wall between room 3 and 4 was created. The combination of sewer and low basin in room 9 are also dated to this period.

Roman Water Footprint #4 (AD 300-600)

No known water features.

Conclusion

The presence of mosaic flooring and a religious niche inside would indicate a more domestic nature of this building. Yet, the presence of two sewer lines in this building supports its interpretation as a quasi-industrial complex. Drainage systems of this size are usually connected with larger water features, or are the continuation of a larger system, neither of which are preserved in this building.

V, ii, 11: Caseggiato

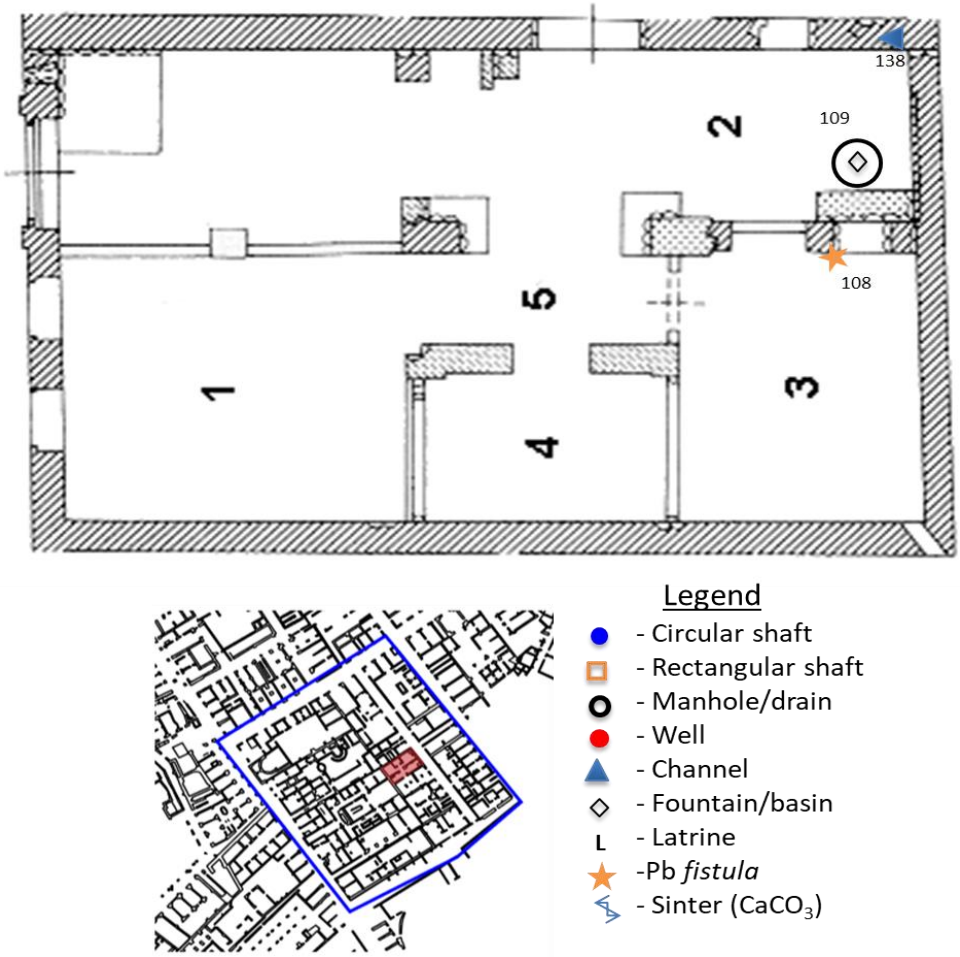


Figure 5.261: Identified water features in V, ii, 11 (after Boersma 1985, 65, Fig. 73).

Location in insula

Building 11 is located on the east side of the insula, and has one wide opening onto the Via della Casa del Pozzo (Figure 5.261). An additional doorway connects the building to V, ii, 12 directly to the south. The building is bounded on the north by V, ii, 10, and to the west by the Domus del Protiro (V, ii, 4-5).

History of Excavation and Restoration

Lacking any direct mention, the building is assumed to have been excavated following the 1941 expansion of the Via della Domus del Pozzo, the building underwent later restoration.[759]

Phasing and Comments

The first phase of the building dates to the Severan period, with several piers added in the second half of the 3rd century (between rooms 2 and 3). A narrow shelf or bench was built into the west wall of room 2, although its function remains unclear. A large staircase in the southeast corner indicates the presence of an upper floor in this building. Several patches of painted wall plaster are preserved under the two reconstructed windows that open onto the Via della Casa del Pozzo (Figure 5.262), helping to date this phase of the structure to the 3rd century. On the northern jamb of the main entrance, a graffito was carved (Figure 5.263).[760]

Figure 5.262: Preserved wall painting in the northeast corner of room 1, as seen in 2016.

Figure 5.263: Preserved graffito at the entrance to the building V, ii, 11.

[759] The nature of the concrete capping of the building's wall appear similar to those applied in the 1960s in neighboring buildings.

[760] See Appendix 2 for more information on this inscription.

Water Features Chart

The following hydraulic features are located building V, ii, 11 (Table 5.54):

V, ii, 11 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
2	basin	W part of room 2; against N pier	109	3
2	drain	SW corner of room 2	138	3?
3	channel (?)	S wall; below filled in window	108	3

Table 5.54: Identified water features in building V, ii, 11.

Description of Water Features

There are three water features identified in this building, and they all cluster in the southwestern part of the building. In the northwestern part of room 2, a brick pier was built against an earlier wall of *opus vittatum*. Against this brick pier, a basin/well (feature 109) was roughly constructed from tufa blocks. This water feature was heavily restored in 1982, and it is not possible to ascertain its internal functioning (Figure 5.264).[761]

Figure 5.264: View looking west at feature 109 in V, ii, 11.

In the southwest corner of room 2 there is a channel (feature 138) that passes through the southern wall and into room 4 of V, ii, 12 (Figure 5.265). This channel is very roughly built, but the orientation of the brick and tufa fragments in the wall proves the intentional construction of this channel.

[761] Boersma 439, 467.

Figure 5.265: View looking south at feature 138 in V, ii, 11.

The final water feature is a poorly defined channel (feature 108) that appears to have held a lead *fistula* pipe. In the southwestern corner of room 3 is an *opus vittatum* wall that included a central core of *opus reticulatum*. Perhaps the presence of a supply pipe was the reason for this irregular combination of masonry techniques. Supporting evidence for the presence of a lead pipe comes from a channel that passes through the entire thickness of the wall, which is respected by the *opus vittatum* quoining (Figure 5.266). Additionally, at the threshold of room 2 and 3, one of the bricks on the corner has a clear semicircular section cut out of the mortar, which could have held an upward curving lead pipe, similar to the one described above in V, ii, 9 (feature 174) (Figure 5.267). Following this interpretation, an earlier water supply system would have passed through the south wall of room 3, but ceased once the brick wall was added to the north side of room 2.[762]

Figure 5.266: View looking south at feature 108 in V, ii, 11.

[762] Several brick piers were added to other walls of building V, ii, 11 at the same time.

Figure 5.267: View looking south at the semicircular space cut out of the mortar in the doorway between room 2 and 3 of building V, ii, 11.

Infrastructure Chronology

Roman Water Footprint #1 (4th century B.C.- AD 50)

No known water features.

Roman Water Footprint #2 (AD 50-200)

No known water features.

Roman Water Footprint #3 (AD 200-300)

All of the preserved water features in the building date to this phase. Feature 108 seems to be the earliest as it was part of the first Severan period wall of room 2. The basin/well in room 2 dates after the 260 AD addition of the extra piers in the building, as it respects the later wall. Feature 138 is difficult to date, but it is a water feature passing between buildings 11 and 12.

Roman Water Footprint #4 (AD 300-600)

No known water features.

Conclusion

Despite being clustered together, the water features in this building are not connected to each other. It is possible that feature 138 dates to a later period, although this cannot be currently determined.

V, ii, 12: Caseggiato

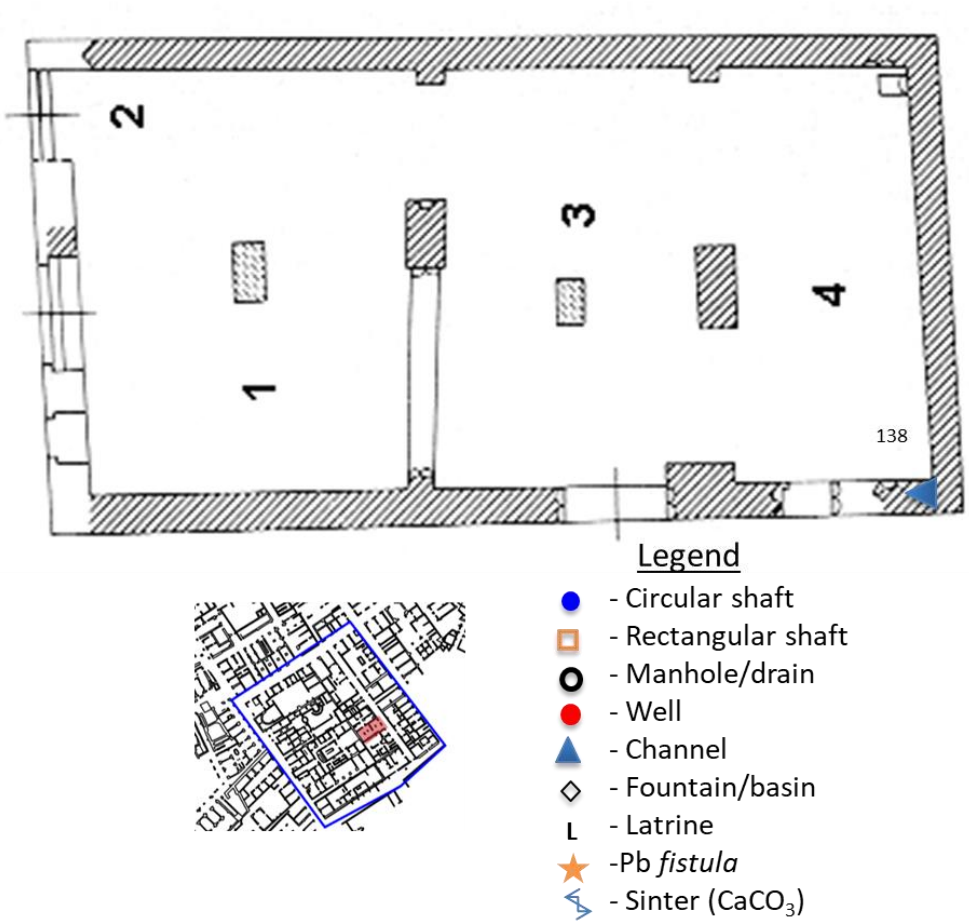


Figure 5.268: Plan of V, ii, 12 (after Boersma 1985, 67, fig. 77).

Location in insula

Building 12 is located along the eastern side of insula V, ii, with two openings onto the Via della Casa del Pozzo (Figure 5.268). The building is connected internally to V, ii, 11 to the north, and is bounded to the west by the Domus del Protiro (V, ii, 4-5), and to the south by V, ii, 13.

History of Excavation and Restoration

This building was likely excavated by Calza as part of the excavation of the neighboring buildings. Restoration in 1982 are attested by modern brick stamps.

Phasing and Comments

Although there are traces of an earlier *opus reticulatum* underneath, the building's current form dates to the Severan period.[763] However, it incorporated large tufo blocks from the city's original castrum wall on its street side, as well as within its southern wall. These tufa blocks are very visible, especially in contrast with the brick piers built against them (Figure 5.269). In the second quarter of the 4th century, two *opus vittatum* piers were installed in the middle of the courtyard. Contemporary with these piers, a doorway was opened up to connect buildings 11 and 12.

[763] Boersma 1985, 180. Perhaps this *opus reticulatum* can also be dated to the Claudian period, like the reticulate walls in building 10; Meiggs 1973, 545 dated the building to the 2nd century.

Figure 5.269: View looking west at the large tufa blocks framing the entrance to V, ii, 12, with the entrance to V, ii, 11 visible to the north.

Water Features Chart

No water features were identified within this building.

Description of Water Features

No water features are present in this building, other than the southern opening of channel 138 described above within V, ii, 11 (Figure 5.268).

Infrastructure Chronology

No water features known.

Conclusion

Beyond its late connection to V, ii, 11, little is known about the hydraulic function(s) of this building. It must have relied on its neighboring buildings for its water needs, or from public sources.

V, ii, 13: Caseggiato

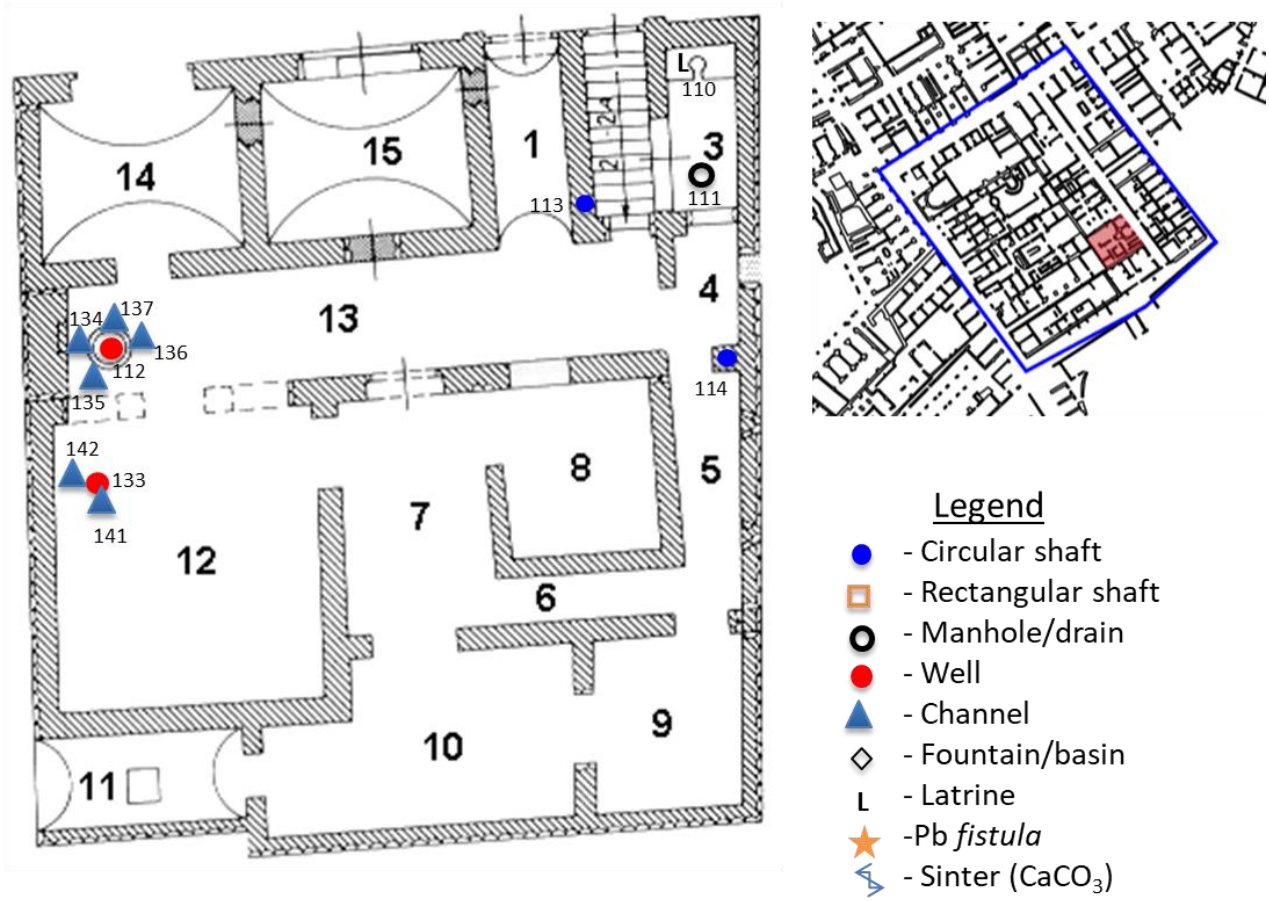


Figure 5.270: Identified water features in V, ii, 13 (after Boersma 1985, 69, Fig. 80).

Location in insula

This building is located in the southeast part of the insula and has three major openings onto the Via della Casa del Pozzo (Figure 5.270). To the north it is bounded by V, ii, 12, to the west by the Domus del Protiro (V, ii, 4-5) and V, ii, 3. To the south it is neighbored by V, ii, 14.

History of Excavation and Restoration

Again in this case we lack specific information on the building's initial excavation, but it was likely excavated under Calza. The building underwent restorations in in 1984 during the contemporary excavation and restoration of the eastern side of insula V, ii by Petriaggi.

Phasing and Comments

The building is Severan, although there is a single fragment of Trajanic *opus testaceum* preserved in the south wall of room 4. Despite having several types of walls (e.g. *opus mixtum*, *opus vittatum A*) the building is resolutely Severan. Building 13 presents an interesting combination of barrel vaulted tabernae, an internal *medianium*-style apartment, and a private latrine.[764] Slightly later in the 3rd century, the building underwent some minor modifications, with two doors in room 15 blocked, the eastern walls of room 12 removed, and the addition of a staircase over the latrine in room 3. In the 4th century, a low masonry bench was added at the north end of room 13, directly north of well 112.

[764] Boersma 1985, 200.

Water Features Chart

The following hydraulic features are located in the Domus del Protiro (Table 5.55):

V, ii, 13 Room #	Feature	Description/Position	Feature #	Roman Water Footprint Phase
2	circular downshaft	N wall of room under staircase	113	3
3	latrine	W part of room	110	3
3	sewer	runs W-E across room	111	3
4	circular downshaft	SW corner of room; inside pier	114	3
12	well	NE part of room 12	133	2
12	ceramic pipe	internal SW wall of well 133	141	2
12	ceramic pipe	internal NW wall of well 133	142	2
13	well	N wall room 13	112	2
13	ceramic pipe	internal N wall of well 112	134	2
13	ceramic pipe	internal NW wall of well 112	135	2
13	ceramic pipe	internal S wall of well 112	136	2
13	ceramic pipe	internal E wall of well 112	137	2

Table 5.55: Identified water features in building V, ii, 13.

Description of Water Features

The first water feature in this building is located under stairway 2. This is a circular downshaft (feature 113) that is visible behind a pile of marble fragments stored here by modern excavators. The internal circular ceramic pipe is coated with an even level of calcium carbonate (sinter) along its entire preserved length (Figure 5.271). Although the upper section of this pipe sequence and the staircase itself was heavily restored, the presence of a circular downshaft together with a staircase is known from many other buildings discussed in this work.[765] Continuing into the building, in the neighboring room 3 there is a single-seater latrine (feature 110). Evidence for this comes from the characteristic wall cut outs in the northeast and southeast corners of room 3 for a single keyhole seat.[766] Similar to the latrine in the Domus della Fortuna Annonaria (V, ii, 8) discussed above, this latrine was also located underneath a staircase.[767] Evidence for a sewer channel (feature 111) was discovered under the floor here in a west-east direction; It is likely that waste from this latrine emptied out into the Via della Casa del Pozzo. An additional drainage feature is located within a brick pier only a few meters south of the entrance to room 3. This is another circular downshaft (feature 114), which also has a thick coating of calcium carbonate on its inner surface (Figure 5.272). Whatever waste was moving through this pipe would connect to the sewer that ran under the floor of room 4, through the latrine (feature 111), passing under latrine 110 and finally into the Via della Casa del Pozzo.

[765] Boersma 1985, 187, 447 for this feature; See for other examples, Chapter 4, feature 22 (in IV, ii, 2-3), and feature 61 (in IV, ii, 9, 13).

[766] Boersma 1985, 186 for the latrine seat;In insula V, ii, see the above discussion for latrines in V, ii, 4-5 (features 4 and 32), and in V, ii, 8 (feature 13).

[767] Boersma 1985, 182 for this staircase, although in this case the staircase was added *after* the latrine.

Figure 5.271: View looking up feature 113, with its ca. 5 cm thick coating of calcium carbonate visible on the internal surface of the ceramic pipe.

The other concentration of water features comes from the northern part of the building. In the northeastern floor of room 12 is the opening for a large well-cistern (feature 133). Its internal shape roughly resembles a pineapple, expanding from an internal diameter of 60 cm to ca. 1.00 m and back to 60 cm: it extends at least 3.80 m below the current ground level (Figure 5.273).[768] Within the internal tufa walls of this well-cistern are two circular ceramic pipes: feature 141 in the southwestern wall, and feature 142 in the northwestern wall. These pipes indicate that rain water was channeled into this cistern from two other sources, likely from a roof drain.

Figure 5.272: Views of feature 114 with its thick coating of calcium carbonate.

[768] Boersma 1985, 453 does not mention this feature but gives the absolute floor height of this room at +3.61 m a.s.l., making this feature extend at least 20 cm *below* sea level.

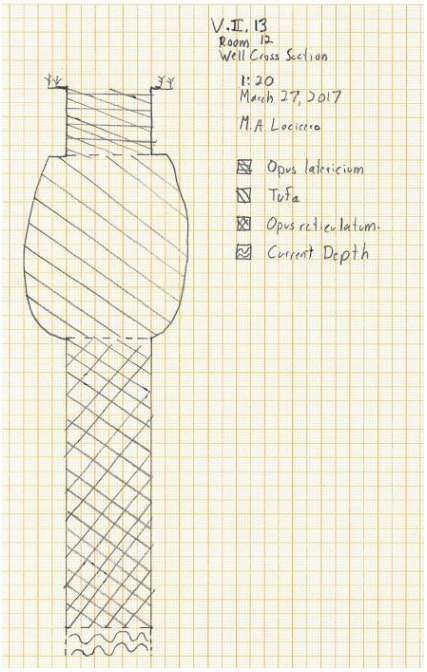


Figure 5.273: Schematic cross section of well 133.

Figure 5.274: View looking east at features 133 (circled in white) and the well head of feature 112 in the background.

The location of feature 133 is even more surprising given the much more clearly constructed well (feature 112), directly to the east in room 13 (Figure 5.274). This well has a plain marble well head that rests upon a circular wall of *opus latericium*, and has a current depth of ca. 1.90 m below the current ground level.[769] Within the brick walls of this well are four circular ceramic pipes all entering the well at different heights and directions (features 134, 135, 136, 137).

[769] Boersma 1985, 454 gives the height of the black and white mosaics in the north of this room at +3.41 m a.s.l.; with an observable depth of 1.90 m, the current absolute depth of the well is +1.50 m a.s.l.

Infrastructure Chronology

Roman Water Footprint #1 (4th century B.C.- AD 50)

No known water features.

Roman Water Footprint #2 (AD 50-200)

Although there is little other structural evidence in building 13 from this period, both of the wells (features 112, 133) are dated to this period. The *opus reticulatum* walls and rough marble well-head are very similar to other Trajanic wells discussed in this chapter.

Roman Water Footprint #3 (AD 200-300)

The remaining water features date to this period, when the majority of the structure as it remains today was created. The latrine (feature 110) was created, and the material descending downshaft 114 entered into the short stretch of sewer (feature 111), under the floor of rooms 3 and 4. An additional downshaft (feature 113) was created to drain waste from an upper floor.

Roman Water Footprint #4 (AD 300-600)

No known water features.

Conclusion

As with the previous well discussed in this building, the combination of wells and ceramic pipes testify to a much larger system of rain water supply. With two wells, building 13 would have been supplied with a significant amount of water both from ground water reserves and via rain collection.

The presence of two downshafts indicates the division of the upper floor into (at least) two apartments, supported by the double staircases in rooms 2 and 3. The thick coating of sinter within both of these pipes is interesting, as this material only forms from the constant flowing of undiluted aqueduct water over a long period of time. This would infer that such water was present on the upper floor of this building. This is puzzling as no aqueduct-fed water features are known in this building, and water from the wells would leave no such calcium carbonate coating.

V, ii, 14: Caseggiato

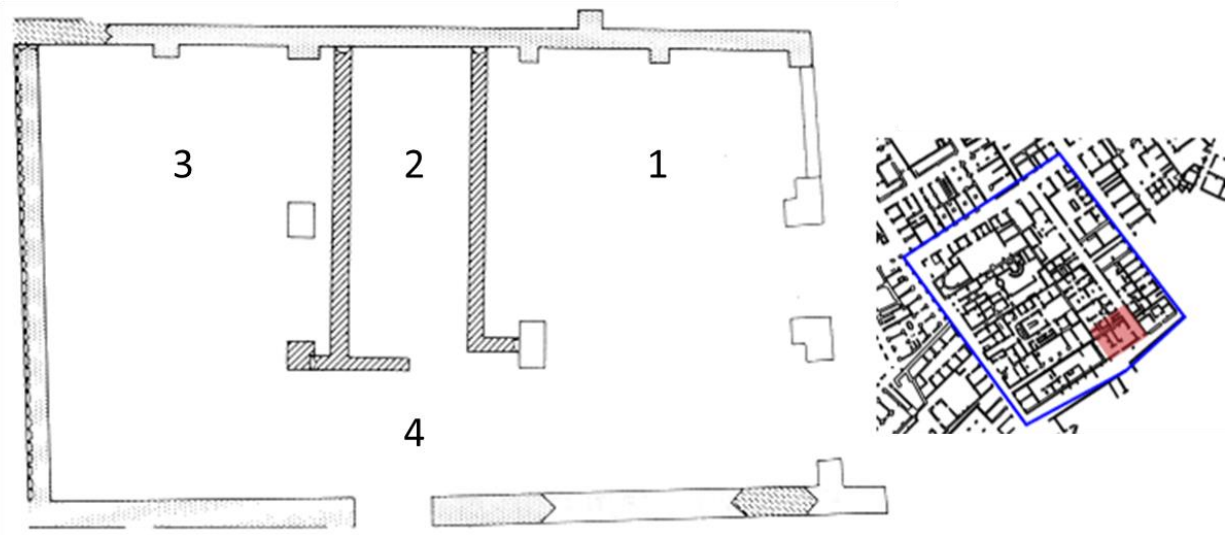


Figure 5.275: No water features were identified in V, ii, 14 (after Boersma 1985, 70, Fig. 84).

Location in insula

Building 14 is located in the southeastern part of the insula, and has two doorways opening onto the Via della Casa del Pozzo (Figure 5.275). It is bordered to the north by V, ii, 13, to the west by V, ii, 2, and its southwest corner is blocked by two tabernae of V, ii, 1. The building also lies on the southern limit of the excavated area of the city.

History of Excavation and Restoration

This building was first excavated by Calza, but some targeted sondages occurred in 1984 by Petriaggi.[770] Some restoration of its mosaics took place in 1995.[771] In this last intervention, the black and white mosaics were lifted and re-laid on a bed of modern concrete.

Phasing and Comments

Four mosaics were uncovered within the building, three geometric and one of *opus spicatum*. The mosaic identified in the easternmost room has no parallel at Ostia (Figure 5.276), and under the floor a *sestertius* of Faustina Augusta was identified and dated to ca. 164 AD on stylistic grounds.[772] All of the mosaics are dated to the mid-3rd century AD. This coincides with the closing off of the southern extension of the Via della Casa del Pozzo by means of a marble threshold.[773]

Figure 5.276: View looking south at room 1 of V, ii, 14 with its unique mosaic in the foreground and the end of the Via della Casa del Pozzo in 2015.

Water Features Chart

No known water features.

[770] GdSc 54, 9-12 (31-X to 8-XI-1984).
[771] Mannucci & Petriaggi 1995, 236
[772] Petriaggi 1987, 194, who compares the mosaic to SO 4 #132 (p.83), #325 (p.176).
[773] GdSc 1988, 10-11, with this particular trench excavated on Nov. 2, 1984.

Description of Water Features

No water features were identified in this building.

Infrastructure Chronology

No known water features.

Conclusion

As no water features were identified in this building, it is unclear how it was integrated to the rest of the insula. Its 250 AD mosaics coincide with a period of widespread rebuilding in many, if not all, of the other buildings in the insula. The fact that closure of the southern end of the Via della Domus del Pozzo is contemporary with these newly added mosaics suggests a much closer connection to neighboring buildings.

5.1.2: Data Conclusion

This detailed investigation into the hydraulic systems in insula V, ii brought many new aspects to light for each of the buildings investigated. Many previously unpublished elements of the city block's water system emerged from a detailed study of the archival photographs and excavation records. This is especially true for building V, ii, 2, in which a host of new water features from the 1st century AD were revealed, offering precious information for building up a more diachronic look at the sewer system of Ostia in subsequent centuries. Even well-studied buildings still offered some new aspects, such as the Domus del Protiro (V, ii, 4-5), in which the desire to keep different types of water supply in the same building was demonstrated in its courtyard, with rain, ground water, and aqueduct water all being used in the 4th century. This clearly reflects a desire not to create the most simple systems, but rather that different types of water were valued for different reasons or uses. While a great deal of previous research has been done on insula V, ii, the present study was able to add a new level of analysis to our understanding of insula V, ii. Wider trends in water supply, usage, and drainage in insula V, ii will be treated in the subsequent section.

5.2: Roman Water Footprints of insula V, ii

5.2.0: Introduction

In section 5.1, the individual hydraulic features of the buildings of insula V, ii were identified and placed within the history of each building. This section combines the individual histories of the buildings into a unified whole, then applies a chronological lens to the data. In this way, water features from across the insula that date to the same time period will be examined together. This approach offers an examination of water in insula V, ii both at a chronological and spatial scale, moving up from a micro-scale (individual building) to a meso-scale (entire insula) of investigation.[774] In addition to a different scale of investigation, this section inserts the archaeological evidence of water systems in insula V, ii into the Roman Water Footprint framework outlined in Chapter 2. For each of the four major time periods of systemic change to the hydraulic system of Ostia, the infrastructure data are confronted with the presence of water in publicly or privately oriented buildings, and with wider environmental data. Combining these three fields of inquiry will produce a contextualized view of water in the insula at different periods of its life, and quantitatively tracks changes to this dynamic relationship over time. The chapter concludes by reviewing the hydraulic biography of the insula.

[774] For more specific chronologies or technical details of individual water features or individual buildings, the reader is invited to consult the preceding section.

5.2.1: V, ii Roman Water Footprint #1 (4th century B.C. – AD 50)

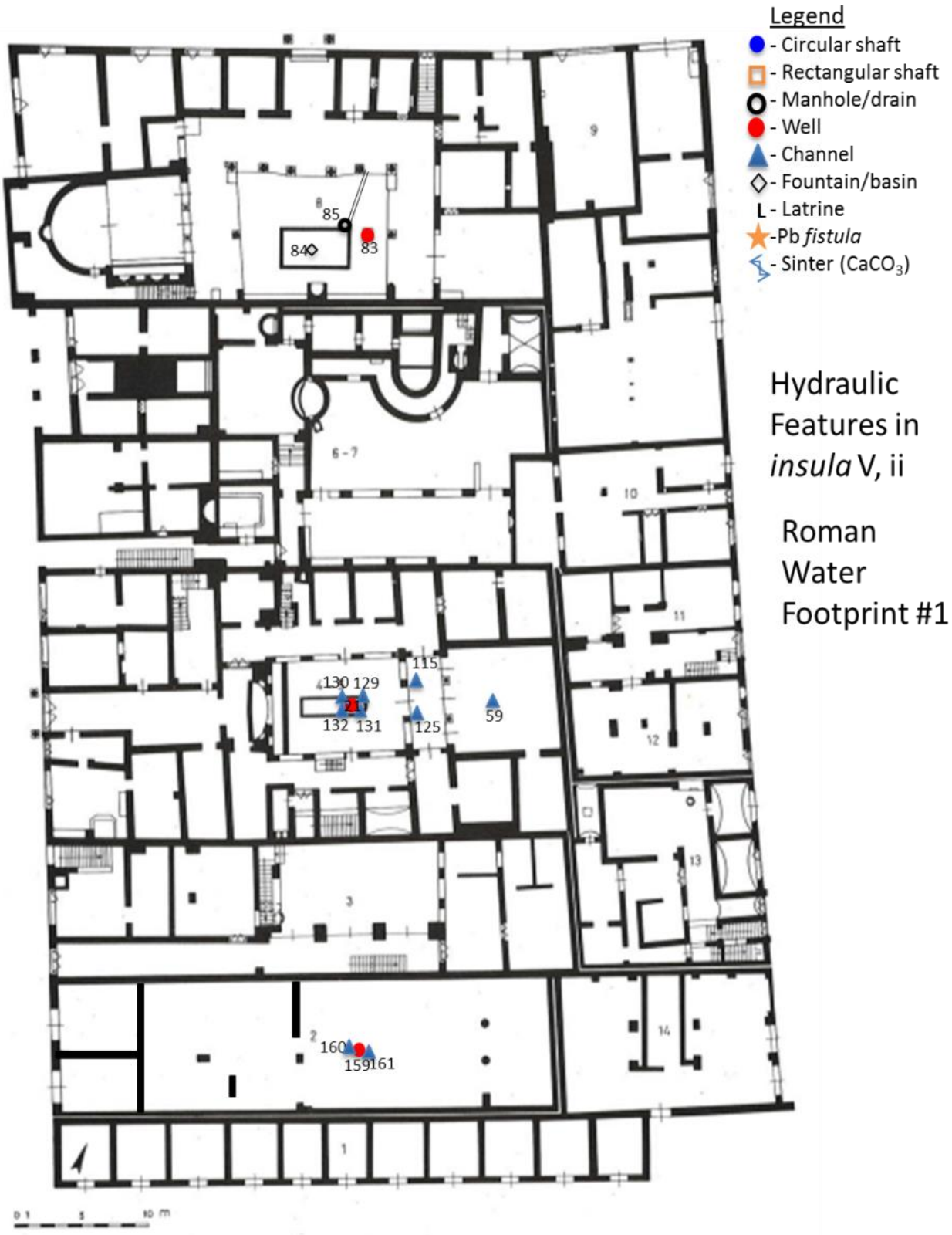


Figure 5.277: Water features identified in insula V, ii between the 4th century B.C. and AD 50 (after Boersma 1985, 218, Fig. 204).

V, ii Roman Water Footprint # 1 (4th century B.C.- AD 50)			
Indicator	Sub-Indicator	Data	Quantity
Infrastructure	Supply Systems	Rain Water	6
		Ground Water	3
		Aqueduct	0
		Total # of Supply Features	9
	Usage Systems	Number of Leisure Water Features	0
		Number of Industrial/Economic Water Features	0
		Number of Domestic Water Features	1
		Total # of Usage Features	1
	Drainage Systems	Sewer	0
		Downshaft	0
		Drains	4
		Total # of Drainage Features	4
	System Resilience	Number of Types of Supply	2
		Number of Types of Usage	1
		Number of Types of Drainage	1
		Total System Complexity	4
		Total # of Features	14
Culture	Private Oriented-insula	Total # of Features	14
	Public Oriented-insula	Total # of Features	0
	Private Oriented-Ostia	Total # of Features	36
	Public Oriented-Ostia	Total # of Features	17
Nature	External	Tiber River Floods	21
	Internal	Urban Garbage	1
		Urban Health (# of Baths)	3

Table 5.56: Roman Water Footprint #1 from insula V, ii.

5.2.1.1: Infrastructure

From the earliest period of the insula's life there is evidence for water supply from three wells (Figure 5.277). Two of these wells have ca. 20 cm ceramic pipes built horizontally into their side walls.[775] These pipes are here interpreted as the preserved fragments of a wider system of rain water collection; these were likely connected to vertical downshafts to channel rain water from rooftops. Recent geomorphological studies have found that the level of the ground water is known to fluctuate seasonally and annually, and these pipes perhaps indicate a desire to ensure an adequate water supply throughout the hot Italian summers.[776] Wells are then a central node in a wider network, attesting to a diversity of water acquisition already in the earliest period of the insula's life, before the creation of the wider urban aqueduct. The survival of these three wells into much later periods confirms their central importance.

Little is known of water usage in this period, with the wide basin in the Domus della Fortuna Annonaria as the only example (Table 5.56).[777] Together with the well mentioned above (feature 83), in the same building, this can be interpreted as a domestic context already in this early period. In connection with these early water features in the Domus della Fortuna Annonaria, a short stretch of sewer line is also preserved here. This sewer heads in a roughly northeast direction before turning towards the Via della Fortuna Annonaria, implying that an urban sewer network already existed in this early period. The other

[775] Four ceramic pipes in well 21 (features 129-132), and two in well 159 (features 160, 161).
[776] See Chapter 1 for the detailed environmental context of Ostia.
[777] V, ii, 8: feature 84.

drainage features of the block are three sections of tufa gutters identified from the eastern part of the Domus del Protiro (V, ii, 4-5: features 59, 115, 125), that perhaps were part of a Claudian period courtyard or narrow industrial building. The system has a very low resilience (4/9), meaning that the identified system is not very complex. This score comes as a result of the predominantly water supply features found. However, already at this early stage, there is a diversity of water acquisition approaches being used in the insula. In this pre-aqueduct period, a diversity of supply systems would ensure more consistent water throughout the year. Where known, these water supply features are present in domestic structures, suggesting this hydraulic resilience would have made these houses more self-sustainable, and likely had social consequences as well.

5.2.1.2: Culture

While the urban composition of Ostia is very fragmentarily known in this period, the survival of a few Republican and early imperial domus hint at what these structure may have looked like. In the majority of cases they had their own internal water supply, usually with a well and an *impluvium*.[778] The evidence from insula V, ii matches this trend, with its marble decorated wells suggesting the existence of domus-style houses with porticoes. The city is undergoing large changes in this period, expanding outwards from the castrum, and the subsequent construction of the Ciceronian city walls. In terms of public and private water features, the water features of the insula match the wider trend in Ostia, with mostly domestically oriented structures and fewer industrial structures.

5.2.1.3: Nature

The insula's spatial importance comes from its location on the busy Semita dei Cippi, which connects the Tiber river to the southern areas of the city. The ca. 300 m distance between the river bank and the insula could easily be overcome in cases of flooding, which were most numerous in this period.[779] Even if the flood waters would not reach so far inland, the presence of a wider sewer network would transport water into buildings further away from the river. Other than the few wells in private houses and in the forum, the river is likely the main water source in this period. There are few bath buildings known from this period (n=3), and they are very poorly preserved.[780] Together with the minimal degree of faunal evidence, few larger conclusions can be drawn about the natural environment of the city at this time, beyond its close connection to the river.

5.2.1.4: Conclusion

In this period there is evidence in insula V, ii for a diversity of water collection strategies. This is a product of social and hydraulic factors; decorated wells and/or *impluvia* are part of the hydraulic trappings of a domus, but the added value of rain-fed pipes would ensure water in cases of fluctuating ground water levels. In the case of the Domus della Fortuna Annonaria, the ability to fill the large basin by hand with water extracted from the well would certainly have had social implications. Not only would people with such systems be one of the few in the city with drinkable water during the hot Italian summer, but to have a large pool full of water certainly would be a statement of power. If decorated wells, especially those that survive into later periods, are a hallmark of Republican or early imperial domus houses, perhaps a re-examination of these features can be used as a proxy to map out the contemporary domus landscape of Ostia.[781] The presence of an early sewer line in V, ii suggests its connection to a wider network. While this represents a touch of luxurious infrastructure, local flooding would have turned this luxury into a curse by transporting unwanted material back through the system and into sewer-provisioned buildings.

[778] Like in the Domus Fulminata (III, vii, 3-5), see Van der Meer 2005, 93.
[779] Aldrete 2007, 242 collects evidence for 21 floods in this period (4th century B.C.- AD 50).
[780] Like the baths under the Via dei Vigili, of which only mosaics remain.
[781] RS I, 21-66 lists 57 known wells, many of which have a first phase in the Republican or Augustan period.

5.2.2: V, ii Roman Water Footprint #2 (AD 50-200)

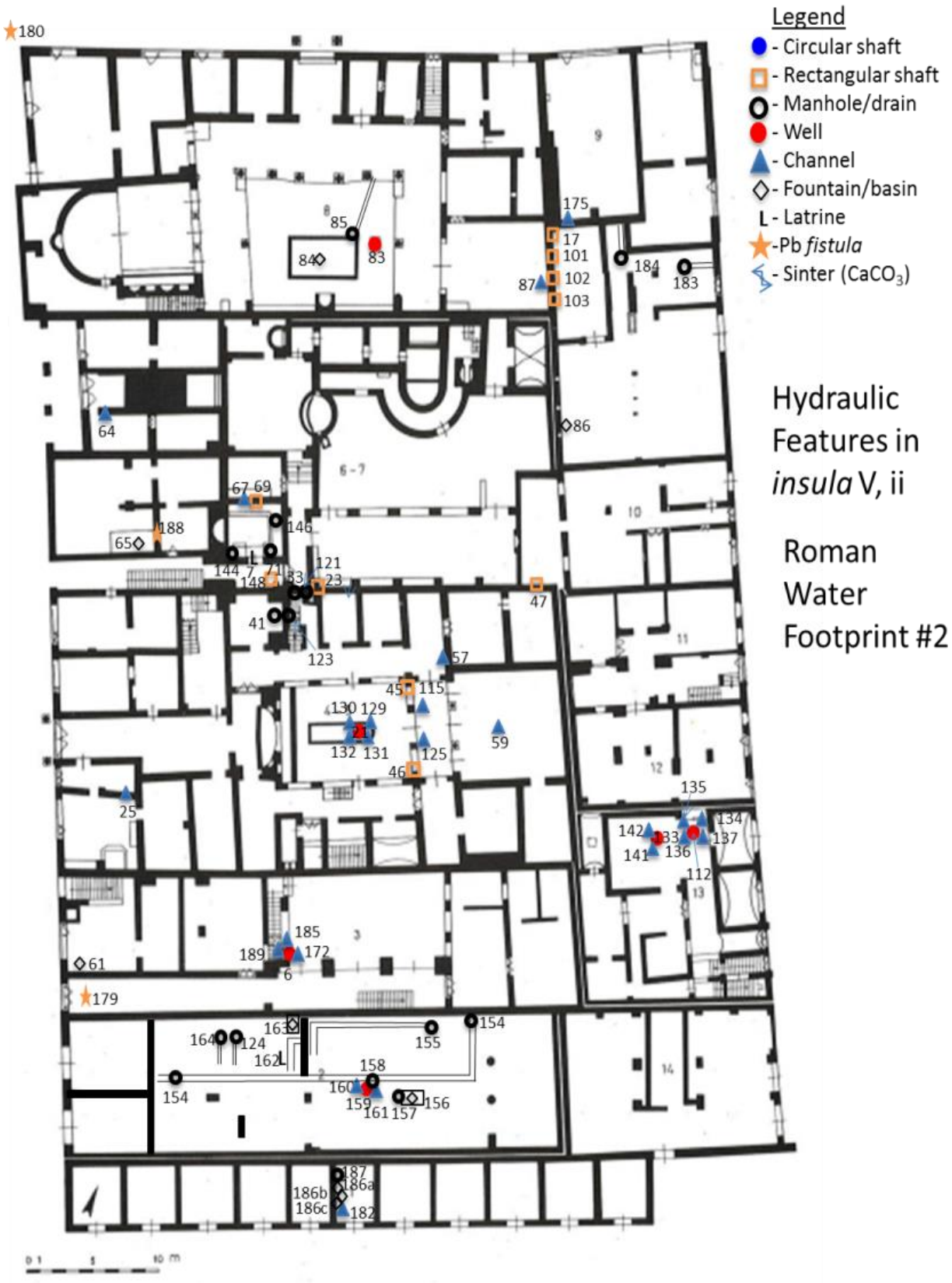


Figure 5.278: Water features identified in insula V, ii between AD 50-200 (after Boersma 1985, 218, Fig. 204).

5.2.2.1: Infrastructure

The total number of supply features more than triple into this period when compared to the previous Roman Water Footprint #1 period, from 9 to 28 identified features: aqueduct water, well water, and rain water are now being used together (Table 5.57). New wells were created in V, ii, 3 and V, ii, 13.[782] A number of horizontal ceramic pipes were identified in each of these new wells, indicating a clear concern for capturing rain water and using it together with ground water.[783] Together with the previously created and still functioning rain water collection systems described above, this period has the highest number of active supply features in the entire history of the insula (Figure 5.278).

V, ii Roman Water Footprint # 2 (AD 50-200)			
Indicator	Sub-Indicator	Data	Quantity
Infrastructure	Supply Systems	Rain Water	17
		Ground Water	6
		Aqueduct	5
		Total # of Supply Features	28
	Usage Systems	Number of Leisure Water Features	2
		Number of Industrial/Economic Water Features	10
		Number of Domestic Water Features	1
		Total # of Usage Features	13
	Drainage Systems	Sewer	10
		Downshaft	8
		Drains	13
		Total # of Drainage Features	31
	System Resilience	Number of Types of Supply	3
		Number of Types of Usage	3
		Number of Types of Drainage	3
		Total System Complexity	9
		Total # of Features	72
Culture	Private Oriented-insula	Total # of Features	42
	Public Oriented-insula	Total # of Features	30
	Private Oriented-Ostia	Total # of Features	122
	Public Oriented-Ostia	Total # of Features	72
Nature	External	Tiber River Floods	6
	Internal	Urban Garbage	3
		Urban Health (# of Baths)	21

Table 5.57: Roman Water Footprint # 2 from insula V, ii.

Despite the increased reach of aqueduct supplied water, evidence for this type of water is sparse and scattered in this period. Several features supplied water to basins described in the subsequent section, and must have come from lead pipes originating under the Semita dei Cippi.

[782] Features 6 in V, ii, 3, and features 112, 133 in V, ii, 13.

[783] Feature 6 has 3 internal pipes (features 172, 185, 189), feature 112 has 4 internal pipes (features 134-137), and feature 133 has 2 internal pipes (features 141, 142).

Basins of varying sizes are installed across the insula in this period, yet the direct connection to aqueduct supply lines are only known in some cases.[784] The robust walls of these basins and their placement against earlier walls suggests their function was related to various industrial processes. The insula now has evidence for more diverse types of water usage, with domestic and industrial water features. Mixed domestic/industrial water usage is a well-known phenomenon of Roman urbanism, however, in V, ii there is not enough remaining evidence to hypothesize the exact nature of these activities.[785] The complexity and number of drainage features expands dramatically in this period. Many of these are a result of the widespread Trajanic ground raising and new construction phases in most buildings of the insula. This included several multi-level buildings, many of which preserve evidence for a clear division of upper floor drainage through different types of downshafts. As described in Chapter 2, downshafts that are more related to domestic drainage are often located in connection with staircases, while those incorporated into the external wall of a building can be tentatively associated with rain water drainage.[786]

A high density of drainage features was created at this time connecting the Domus del Protiro and the Terme del Filosofo. A multi-seater latrine was installed in the baths, although the baths themselves wouldn't be created for another 150 years. This latrine was designed to collect waste from an upper floor downshaft and from a neighboring room, but it also collected material from the neighboring Domus del Protiro. All of the waste collected by the drainage features in room 8 of the domus entered into the multi-seater latrine of the baths. Many drainage channels were created in V, ii, 2 in this period, yet the function of nearly all of the sewer lines remains unclear. Their number and size point to some kind of industrial activity, but this interpretation is complicated by the location of contemporary rooms decorated with mosaics directly across a narrow hallway. Two isolated sections of a sewer line are also known in V, ii, 9 (features 83, 84), and like V, ii, 2, it is unclear where they originated from. Very little is known about the wider sewer network of the city, but the information from V, ii, 2 may shed light on this issue. The sewers of Ostia lie ca. 50 cm underneath the basalt paving stones, and are roughly 0.50 m wide x 1.00 m tall.[787] Absolute heights are known for the streets around insula V, ii and several of the channels identified by Boersma.[788] Given the known dimensions of the streets of Ostia and the average size of the street sewers, the bottom of the sewer channel underneath the Semita dei Cippi would lie at a depth of ca. +1.47m a.s.l..[789] However, the recorded channel bottom of the sewer channel in building 2 lies at +1.14 m a.s.l., making it ca. 34 cm *below* the sewer bottom in the Semita dei Cippi. This would imply that waste from the Semita dei Cippi sewer could flow *into* the sewer in building V, ii, 2. As both of these systems are contemporary, this situation could not occur. To resolve this discrepancy in height, therefore, the sewer system must have gone through multiple phases of raising, like the road itself. An initial system was created under the 1st century AD level of the Semita dei Cippi, hypothesized here to be the same height as floor level of the mosaics in V, ii, 2 (ca. + 1.98 m a.s.l.). The sewers from building V, ii, 2 drained into this system (Figure 5.279).

[784] Newly installed basins: V, ii, 1 (features 186a-c); V, ii, 2 (feature 156, 16); V, ii, 3 (feature 61); V, ii, 6-7 (feature 65); V, ii, 9 (feature 86).
[785] Flohr 2011 gives an overview of *fullonicae* in atrium houses of Pompeii.
[786] The function of the four irregular "niches" gouged out of the west wall of room 6 in V, ii, 9 (features 17, 101-103) remains difficult to explain.
[787] See chapter 4, IV, ii, 2 feature 100 in the Caupona del Pavone; Grewe 2015, 239 for sewer construction in general; SO 1, 66 Fig. 18 gives a cross section of the Via Ostiensis, with the maximum thickness of the first bedding of road support measuring ca. 1 m.
[788] Boersma 1985, 378-458 for heights of all floors and walls in insula V, ii: Boersma's 0 point equals +2.81 m a.s.l.
[789] This is the depth given by Boersma of the latrine channel in the Terme del Filosofo (feature 144).

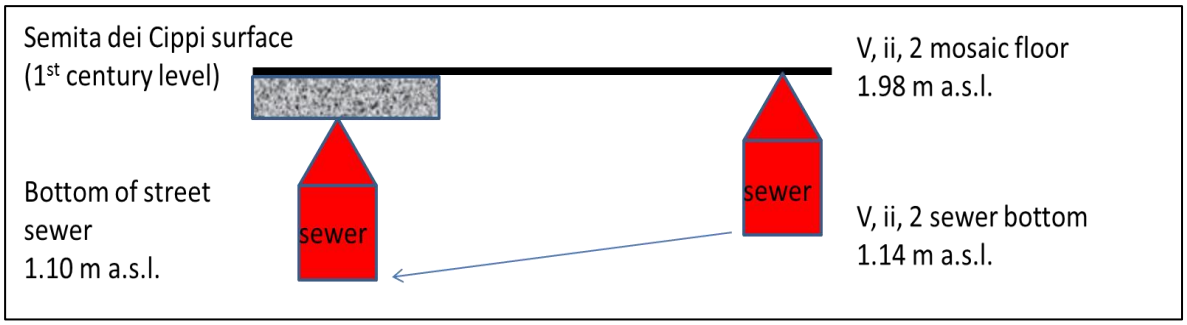


Figure 5.279: Street and sewer system of insula V, ii in the 1st century.

With the Trajanic raising of the ground level of the Semita dei Cippi (to +3.11 m a.s.l.) a new sewer line was required (Figure 5.280). It is here hypothesized that the Trajanic sewer system was built directly above the 1st century sewer line, adding new courses of bricks to create a Trajanic channel of ca. 1.50 m in height (ca. +1.10-2.61 m a.s.l.).

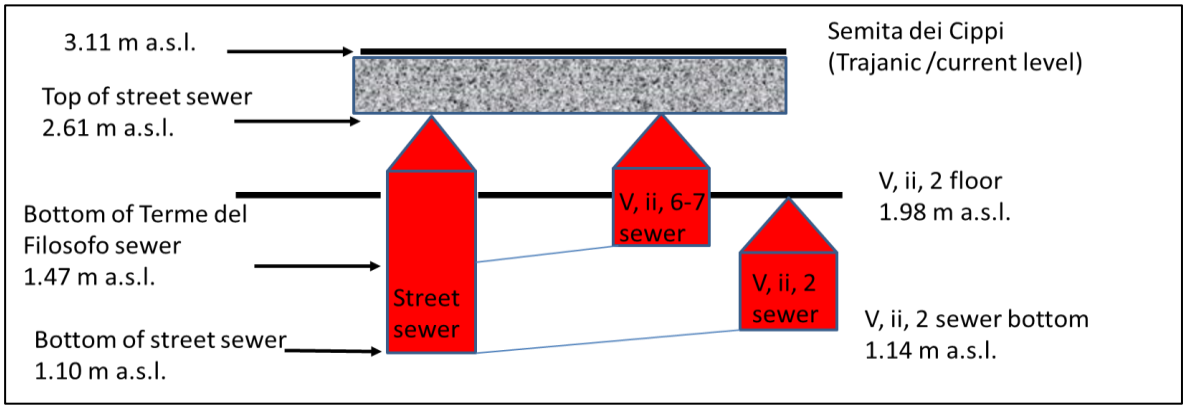


Figure 5.280: Street and sewer system of insula V, ii in the Trajanic period (heights taken from Boersma 1985, 378-458).

The total number of water features in the insula increases when compared to the previous Roman Water Footprint (4th century B.C.- AD 50) from 14 to 72. This is largely a result of the concentration of drainage features created within the Domus del Protiro and V, ii, 6-7, and from the 17 functioning rain water acquisition systems. Together with the increase in the number of water features comes an accompanying increase in overall system complexity.[790] System complexity reaches its maximum level (9/9), meaning that there is a maximum level of diversity within the system, with highest number of different types of supply (3/3), usage (3/3), and drainage (3/3). Considering that system resilience in the previous Roman Water Footprint period (4th century B.C.- AD 50) was much lower (4/9), the water systems in the insula can now react to a diversity of uses. In terms of water supply, it also means that the insula can sustain itself if one of the water supply sources, like the aqueduct, fails.

5.2.2.2: Culture

The difference between privately and publically oriented water investment in this period is at its narrowest margin in the history of the insula, with 42 private features and 30 public water features functioning. This is similar to the larger trend within Ostia, although in V, ii the difference between the values is not as large as compared to the wider city.[791] This interaction is most clear with the drainage systems present within the Domus del Protiro and the Terme del Filosofo, which is supported by the contemporary connection of spaces between these buildings. In each building there are two sets of

[790] See Chapter 2 for a more robust definition of system resilience.
[791] Based on available data (RS I, II), Ostia in this period has 122 private water features and 72 public water features.

doors that face each other, implying an easier flow of movement, especially in relation to the multi-seater latrine. Taken together, the hydraulic and archaeological evidence indicate a composite unit of publicly and privately oriented spaces that suggests a single owner for both of these buildings, or perhaps two owners working together. This is the period of greatest urban expansion in Ostia, when two aqueduct lines were introduced to the city, and there is a great mixing of buildings of different functions.

5.2.2.3: Nature

The six recorded floods in this period are more than three times less than in the previous Roman Water Fooptrint #1 period, although the ground raising in many parts of the city in the 2nd century may stem from a desire to reduce the effects of flooding.[792] The rise of multi-story *insulae* both in Ostia and Rome reflects the increasing urban density of these cities, and would certainly have made the Tiber noticeably dirtier than in the previous period. This perhaps accounts for the absence of fish bones from the osteological record of the city.[793] The amount of identified urban waste increases dramatically compared to the previous period, although, as mentioned in Chapter 2, this is unevenly spread between construction fill and in peripheral areas of the city.[794] The number of functioning bath buildings is highest in this period, with 21 identified bath buildings. When integrated with the other natural factors outlined in this period, this implies an increasingly fecund environment for water-borne parasites.[795]

5.2.2.4: Conclusion

The multi-seater latrine and connected sewer lines may have been a health risk for the inhabitants of the Domus del Protiro and Terme del Filosofo in terms of communicable diseases. The raising of the street level in this period by ca. 1.5 m offered new opportunities for construction across the insula, and it appears as though this was also the case for the main sewer line under the Semita dei Cippi. This increase in the height of the sewer channel may be a reflection of the technical awareness of the need to increase the volumetric carrying capacity of the sewer by making a channel that was several times taller than previously. So the initial sewer system did not function in the same way for the rest of its life, but rather "grew up", or was made taller in this Roman Water Footprint period (AD 50-200).

Although the incorporation of several wells into later structures attests to their continued usage, it is unclear whether the internal ceramic pipe systems of rain collection continued to function into later periods. The insula displays a characteristically Ostian mix of buildings of different functions, having its street fronts lined with tabernae to take advantage of the increased traffic in this period along the Semita dei Cippi. By using all available types of water, the insula could react to its changing water needs throughout the year.

[792] Aldrete 2007, 242 for the flooding data.
[793] MacKinnon 2014, 191.
[794] MacKinnon 2014, 189-192.
[795] Mitchell 2015, 6: *"This suggests that the Roman habit of washing at the public baths does not seem to have decreased their risk of contracting ectoparasites, compared with Vikings and medieval people who did not use public baths in the same way."*

5.2.3: V, ii Roman Water Footprint #3 (AD 200-300)

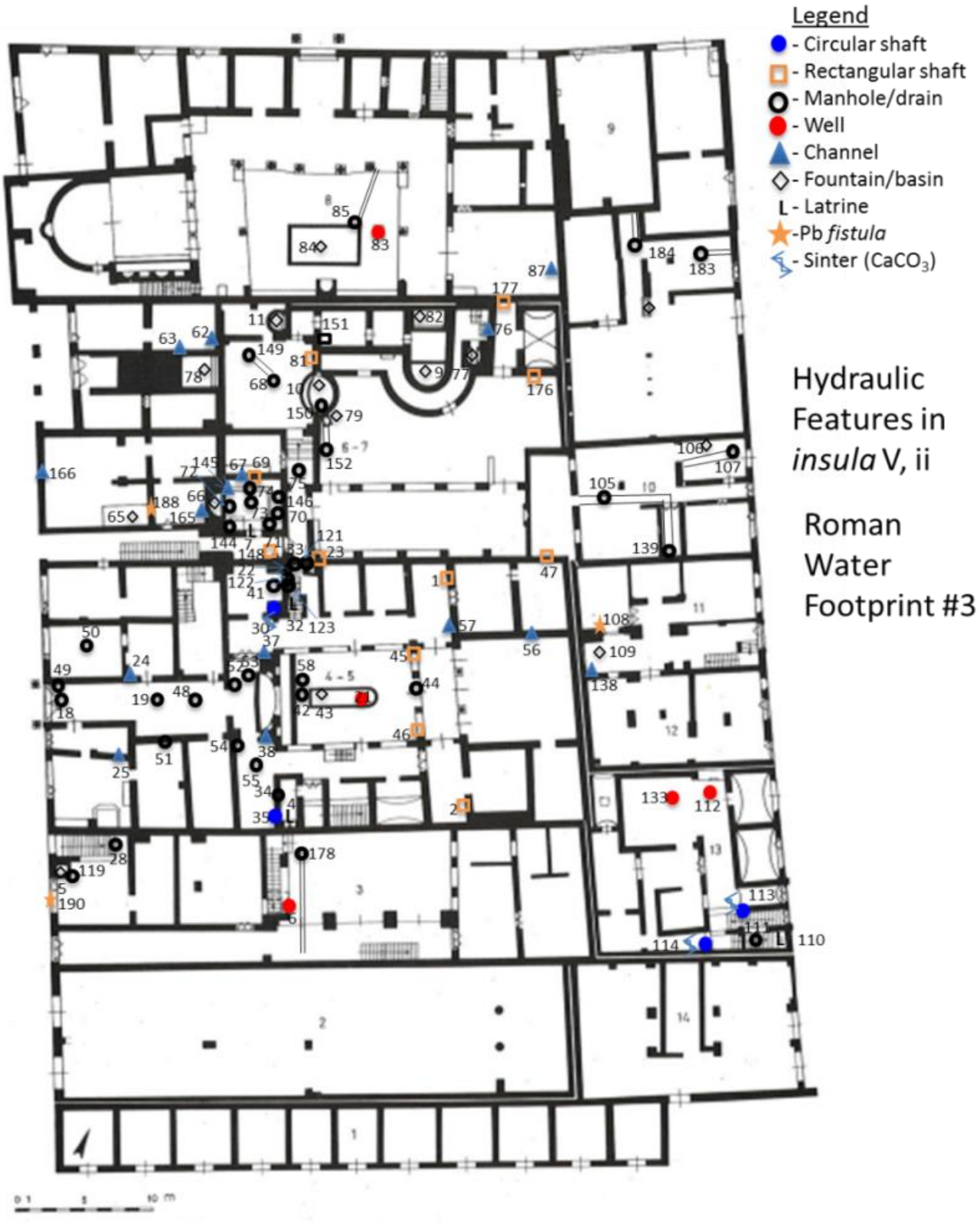


Figure 5.281: Water features identified in insula V, ii between AD 200-300 (after Boersma 1985, 218, Fig. 204).

5.2.3.1: Infrastructure

Wells across the insula continued to function in this period (Figure 5.281).[796] There was a significant drop in the number of rain water supply features in this period, from 17 features in the previous Roman Water Footprint period (#2, AD 50-200) to 2 in this period (Table 5.58). This doesn't necessarily indicate a radical decrease in the number of these features, but results from the inability to date the functional duration of the rain water pipes. Some of the pipes may have in fact continued to function into this period, surviving the Severan ground raising present in several buildings of the insula.

V, ii Roman Water Footprint # 3 (AD 200-300)			
Indicator	Sub-Indicator	Data	Quantity
Infrastructure	Supply Systems	Rain Water	2
		Ground Water	5
		Aqueduct	6
		Total # of Supply Features	13
	Usage Systems	Number of Leisure Water Features	10
		Number of Industrial/Economic Water Features	3
		Number of Domestic Water Features	7
		Total # of Usage Features	20
	Drainage Systems	Sewer	30
		Downshaft	13
		Drains	24
		Total # of Drainage Features	67
	System Resilience	Number of Types of Supply	3
		Number of Types of Usage	3
		Number of Types of Drainage	3
		Total System Complexity	9
		Total # of Features	100
Culture	Private Oriented-insula	Total # of Features	58
	Public Oriented-insula	Total # of Features	42
	Private Oriented-Ostia	Total # of Features	101
	Public Oriented-Ostia	Total # of Features	49
Nature	External	Tiber River Floods	2
	Internal	Urban Garbage	4
		Urban Health (# of Baths)	16

Table 5.58: Roman Water Footprint #3 from insula V, ii.

The use of pressurized water increases only slightly in this period compared to the Roman Water Footprint # 2 (AD 50-200), from 5 to 6 identified aqueduct supply features. An early version of the nymphaeum was created in the Domus del Protiro, which was supplied by pressurized aqueduct

[796] Wells in V, ii, 3 (feature 6); V, ii, 8 (feature 83); V, ii, 13 (features 112, 136).

water.[797] The Terme del Filosofo bath complex (V, ii, 6-7) was created in this period, supplied exclusively by aqueduct water. The Trajanic multi-seater latrine was incorporated into the bath complex, and was embellished with a new fountain on its western side. Evidence of new aqueduct investment also comes from a fragment of lead fistula pipe uncovered near the entrance to building V, ii, 3, dated epigraphically to the 3rd century.[798] Half of the functioning usage features in this period are related to the operations of the baths, with the remainder spread around domestic contexts. A horseshoe shaped fountain basin was installed in the Domus del Protiro, covering but not destroying the well underneath. Basins were added in several buildings of the insula at this time, with a variety of shapes and functions.[799] The large *impluvium* basin in V, ii, 8 (feature 84) continued to function in this period, together with its drain out to the Via della Fortuna Annonaria. The large rectangular basin in the bath complex continued to function, but access to it was reduced in this period; the industrial/economic function of this street-facing taberna continued even after access to the street was blocked.[800]

In this Roman Water Footprint period (AD 200-300), the sewer system becomes increasingly complex and present in almost every building of the insula (Figure 5.282). All of the sewers within individual buildings empty into the major sewer lines present under the streets surrounding the insula. Several of the building sewer lines are shared by multiple buildings, while others are isolated and only drain one building. A sewer in building V, ii, 3 appears to head directly through its southern wall into the neighboring building V, ii, 2.[801] As no trace of this sewer line is visible within building V, ii, 2, the sewer in building V, ii, 3 likely exited toward the Semita dei Cippi.[802] The same false positive comes from the new sewer line added in building V, ii, 10, which appears to continue into building V, ii, 11, yet no trace of the sewer is present in the latter building.[803] The sewer in V, ii, 9 was also created in this period, and was isolated from any other system, draining into the sewer under the Via della Domus del Pozzo.[804] The tripling of sewer features in comparison to the previous period (from 10 to 30 sewer features) is largely a result of the creation of the sewer network within the Domus del Protiro, together with its accompanying latrines and downshafts. In the Trajanic period, a door existed the Domus del Protiro, which was directly aligned with the latrine in the bath building. The blocking up of this wall in the Severan period would have motivated the inhabitants of the Domus del Protiro to create their own latrine. As the space above rooms 7-10 has been reconstructed as a separated group of apartments, this latrine may have been especially for the residents in this section of the Domus del Protiro's northern side.[805] Supporting this interpretation is the contemporary insertion of a vertical ceramic pipe next to the single-seater latrine. Connection of some kind still remained between the two neighbors, as the waste gathered in the private latrine of the domus was conducted into the multi-seater latrine of the baths.[806]

[797] V, ii, 4-5, features 37, 38.
[798] The lead fistula is feature 179 in building V, ii, 3.
[799] Square basin in V, ii, 3 (feature 5); rectangular basin in V, ii, 9 (feature 100); rectangular basin in V, ii, 10 (feature 106); circular basin in V, ii, 11 (feature 109).
[800] The basin (feature 65) is in room 2 of the Terme del Filosofo (V, ii, 6-7).
[801] The sewer (feature 178) is present in the central part of building V, ii, 3.
[802] An additional section of unconnected sewer line (feature 28) was created in the western part of building V, ii, 3.
[803] Also like the previous "false positive" sewer connection between building V, ii, 2 and 3, building V, ii, 10 has a second small and isolated sewer line (feature 107).
[804] The two sections of sewer line are features 183 and 184.
[805] Boersma 1985, 93 for proposed upper floor arrangements in the Domus del Protiro.
[806] Boersma 1985, 236 collects examples of laws (servitudes) dealing with construction and drainage laws that may have influenced construction in insula V, ii.

Figure 5.282: Known and reconstructed parts of the sewer system in insula V, ii in Roman Water Footprint #3, AD 200-300 (after Boersma 1985, 218, Fig. 204).

A combination of latrine, downshafts, and sewers was created in building V, ii, 13. While the creation of two downshafts so close to each other in itself is not unusual, the southern downshaft's (feature 114) creation together with an ascending staircase suggests a different role for this downshaft (Figure 5.283). The downshaft and stair combination here point to a connection between building 13 and 14, and may help to explain the complete absence of water features in V, ii, 14. In this period, a new connection was made between building V, ii, 13 and 14, not on the ground level, but on the first floor. Drainage of water

features on the upper floor of building V, ii, 14 exited through building V, ii, 13; drainage from water features on the upper floor of building V, ii, 13 also exited into the same system.

Figure 5.283: Building V, ii, 13 and 14, with drainage features identified: arrows indicate sewer lines and blue dots indicate circular vertical downshafts (after Boersma 1985, 218, Fig. 204).

The water systems of the insula maintain their level of complexity (9/9) from the previous phase, Roman Water Footprint #2. The buildings of the insula continue to use water in a variety of ways, and there are many different types of supply and drainage systems functioning at the same time. The total number of water features increased from Roman Water Footprint #2, from 72 to 100 features in this period.

5.2.3.2: Culture

Despite the increase in the overall number of features in this period compared to the previous one (72 to 100 features), the difference between the amount of privately over publicly oriented water increases only slightly (Table 5.59).

insula V, ii		RWF # 2	RWF # 3
Private Oriented insula	Total # of features	42	58
Public Oriented insula	Total # of features	30	42

Table 5.59: Public and Private water features in insula V, ii in RWF Roman Water Footprint #2 (AD 50-200), and Roman Water Footprint #3 (AD 200-300).

This is largely a result of the 250 AD construction phase of the Domus del Protiro (V, ii, 4-5) and the Terme del Filosofo (V, ii, 6-7). However, just as in the previous phase, this difference is minor compared to the wider trend in Ostia, in which there are roughly double the number of private water features than public (Table 5.60). The insula reflects the changing nature of the city in this period, and its relationship to an equally changing Rome of the 3rd century. The Domus del Protiro offers an early example of the domus shape that will come to dominate the layout of the insula as well as the wider urban landscape of Ostia in the subsequent Late Antique centuries.

insula V, ii		RWF # 2	RWF # 3
Private Oriented-Ostia	Total # of features	122	101
Public Oriented-Ostia	Total # of features	72	49

Table 5.60: Public and private investment in Ostia in Roman Water Footprint #2 (AD 50-200), and Roman Water Footprint #3 (AD 200-300).

5.2.3.3: Nature

The number of flooding events is lowest in the city's history, although the severity of any single flood's effect would vary substantially.[807] Perhaps the ground raisings of the 2nd and mid-3rd century helped to mitigate the effects of flooding, at least in certain parts of the city. The number of bath buildings decreases slightly from the previous period, from 21 to 16 functioning bath buildings. Regarding the amount of faunal evidence, this period preserves the maximum amount of faunal evidence in the history of the city, with large depositions pointing to a combination of urban garbage dumps and large construction projects.[808] Combining these internal and external environmental aspects points to Roman Water Footprint #3 as the period with the highest risk of transferable diseases in this period, and the most unhealthy period to live in Ostia.

5.2.3.4: Conclusion

The diversity of supply systems in the insula is most evident in the Domus del Protiro, where aqueduct water, ground water, and rain water were concentrated into a single room, each with their own separate system. Perhaps this ability to withstand seasonal fluctuations in water availability would have added to the social prestige of the household.

The complexity of the insula's hydraulic system in this period maintains its maximum level, with more attention given to its drainage systems. In several cases, traces of this sewer system indicate a higher ground level across the insula in this period. While this allows waste to drain more easily away from more rooms, it also invites smell and parasites into many more rooms. An extensive sewer network within a single building would also be seriously affected from any flooding of the sewer system.

The existing structural division of the insula into northern, eastern, and western sections continues into this period, and is reinforced by the irregularly distributed raising of the ground level within and around the insula. Insula V, ii retains its internal subdivisions, and in the case of the Domus del Protiro and the Terme del Filosofo, become even more separated from each other. Architectural relationships between the buildings are mirrored in their hydraulic systems, especially in the sewer systems.

Together with the vertically descending downshafts, these systems offer valuable information about the changing configuration of upper floor apartments in the Severan period; central here is the fact that the drainage systems in the insula continued to connect to the earlier system. The hydraulic connections between the Domus del Protiro and the Terme del Filosofo, and between buildings V, ii, 13 and 14 offer some new insights into their structural histories. The changing interconnectivity of sewer systems between these two sets of buildings must imply changes in ownership, or at least a change to the previous hydraulic *status quo*.

[807] Aldrete 2007, 242 records only 2 floods at Rome between AD 200-300.
[808] MacKinnon 2014, 192-194.

5.2.4: V, ii Roman Water Footprint #4 (AD 300-600)

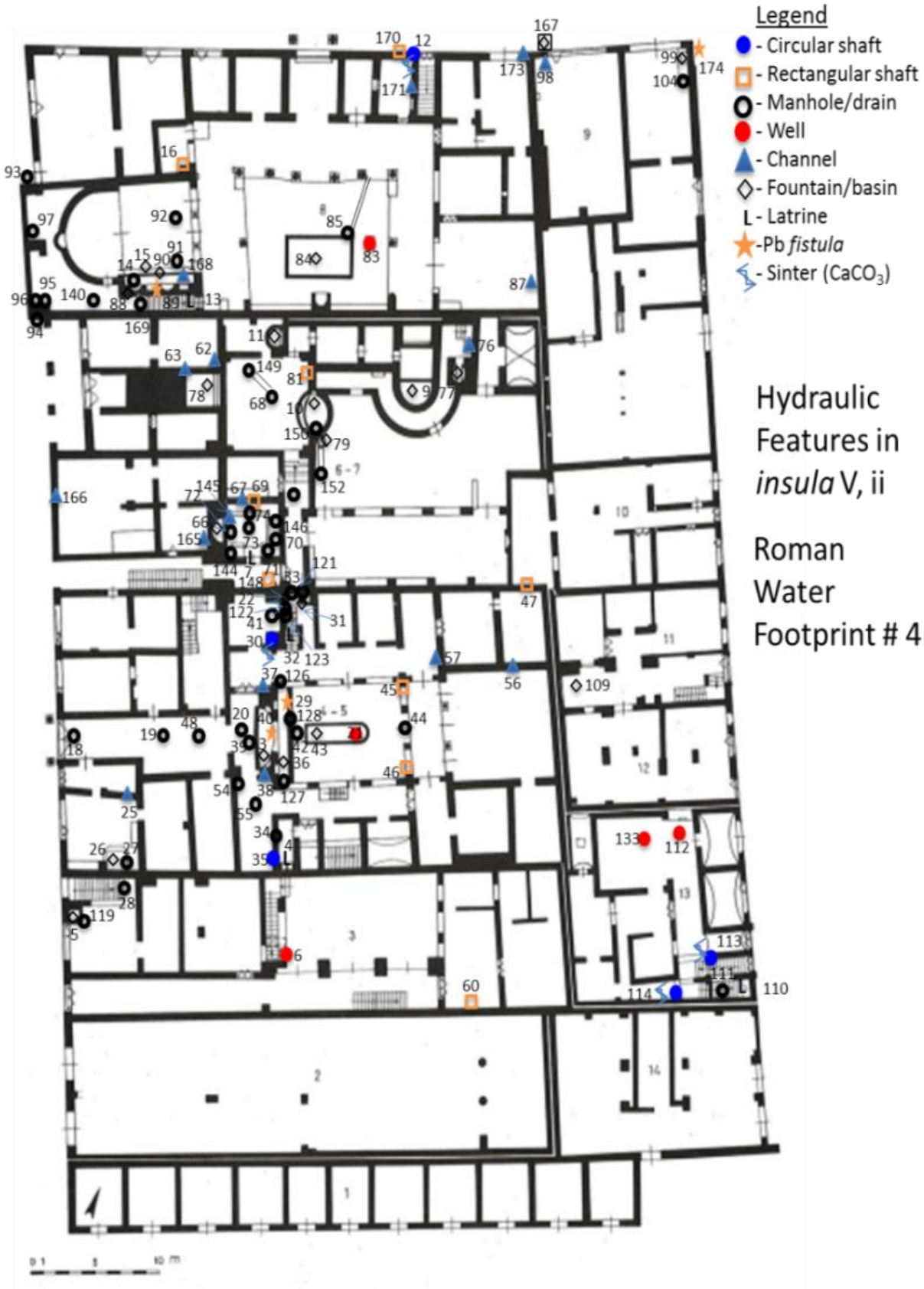


Figure 5.284: Water features identified in insula V, ii between AD 300-600 (after Boersma 1985, 218, Fig. 204).

5.2.4.1: Infrastructure

The total number of supply features increases only slightly in this period compared to Roman Water Footprint period #3, from 13 to 15 (Figure 5.284). Nearly all of the wells from Roman Water Footprint #2 were integrated into the buildings in this period, surviving additional ground raising events. Yet, it is unknown whether their internal rain water systems are still working. As no associated downshafts or supply channels for these horizontal ceramic pipes are known at present, the diversity and complexity of the supply system must remain a minimum estimate (Table 5.61). What is known is that new aqueduct-supplied features were created across the insula, with important ramifications for domestic and industrial usage. This is most evident in the creation of aqueduct-supplied nymphaea in the Domus della Fortuna Annonaria and the Domus del Protiro. The system maintains its diversity, with ground water, rain water, and aqueduct water all used in this period.

V, ii Roman Water Footprint # 4 (AD 300-600)			
Indicator	Sub-Indicator	Data	Quantity
Infrastructure	Supply Systems	Rain Water	2
		Ground Water	5
		Aqueduct	8
		Total # of Supply Features	15
	Usage Systems	Number of Leisure Water Features	9
		Number of Industrial/Economic Water Features	3
		Number of Domestic Water Features	13
		Total # of Usage Features	25
	Drainage Systems	Sewer	25
		Downshaft	11
		Drains	36
		Total # of Drainage Features	73
	System Resilience	Number of Types of Supply	3
		Number of Types of Usage	3
		Number of Types of Drainage	3
		Total System Complexity	9
		Total # of Features	113
Culture	Private Oriented-insula	Total # of Features	74
	Public Oriented-insula	Total # of Features	39
	Private Oriented-Ostia	Total # of Features	63
	Public Oriented-Ostia	Total # of Features	36
Nature	External	Tiber River Floods	6
	Internal	Urban Garbage	3
		Urban Health (# of Baths)	14

Table 5.61: Roman Water Footprint #4 from insula V, ii.

Domestic usage features increase, thanks to the *nymphaea* added in the Domus del Protiro and the Domus della Fortuna Annonaria. These highly decorated water features were created contemporary with wider building phases, focusing visual and/or spatial attention on the marble-clad and statue filled fountains. Private domestic usage of water is common across Ostia, and is a primary characteristic of the Late Antique domus. The placement of small square basins into or adjacent to the street is known

across the insula.[809] The modern under-excavation of building V, ii, 9 was discussed above in connection with its roadside basin (feature 99), and the door-filling between rooms 1 and 7.[810] Taken together, these observations support the assumption that supply and drainage systems were present here *in antiquo*. This indicates that diverse types of activities can be reconstructed within this building. The addition of a basin in the Domus del Protiro (feature 31) shows that the drainage system between the domus and the baths is still working. While one of the hot basins (*caldarium*) was destroyed in the bath building, the remaining basins continued into this period.[811]

Many of the sewer lines from the previous period continue to work in this period, with some even gaining additional secondary sewer lines. New downshafts were added in several rooms of the Domus del Protiro, and in the Domus della Fortuna Annonaria.[812] The location of these suggests that earlier drains were still functioning into this Roman Water Footprint period, and that the newly installed downshafts took advantage of earlier systems. In the Domus della Fortuna Annonaria, the downshafts in room 3 coincide with the blocking up of that room from the street, and more importantly, with the creation of a staircase in the neighboring room 4. Together with an additional downshaft added in the northern part of this domus, these new downshafts indicate a distinct change to the division of upper floor space in this period.[813]

This hydraulic opportunism continued in the connecting of sewer systems between several buildings. The Domus del Protiro appears to split its drainage needs between its neighbors to the north and south (Figure 5.285). The private latrine on the north of domus connected to the sewer system of multi-seater latrine of the bath building to the north. However, in the southwest of the domus, when an apsidal fountain basin was added (in room 22), its drainage did not connect to the central system of the domus, but rather flowed out through a newly installed sewer section in building V, ii, 3 to the south.

The most important aspect of drainage and the hydraulic system of the insula in general comes from an analysis of contemporary sewer systems across the insula. This issue was touched upon in the discussion of the channels on the western side of the Domus della Fortuna Annonaria.[814] Hydraulic evidence in this domus indicated that the Late Antique ground level was ca. 50 cm above the current street level, and that a now-lost sewer system was present between this Late Antique ground level and the current street level. However, the contemporary installation of the single-seater latrine in this domus indicates that there was also a functioning sewer line ca. 1.00 *below* the current street level. Although superimposed sewer lines are otherwise unknown in Roman hydraulic engineering, two (or three) level aqueduct channels are well-known (Figure 5.286).[815] In aqueducts, these stacked channels kept waters of different qualities separate from each other, and can maintain different degrees of water pressure at each level.

[809] Features 26, 31, 99, 109, 167.
[810] See Chapter 5 for building V, ii, 9.
[811] See Chapter 5 for the Terme del Filosofo (V, ii, 6-7), feature 82
[812] Downshafts in room 3 (Features 12 and 170) connected to a drain from the 1st century AD that came from the courtyard's impluvium (feature 84). A partially buried relieving arch in the south wall of room 3 lies directly in line with this drain, supporting the proposed continuation of this drain.
[813] The downshaft in room 20 is feature 16.
[814] See Chapter 5, building V, ii, 8 (Domus della Fortuna Annonaria) for a revised chronology of these sewers.
[815] A. Koloski-Ostrow, pers. comm.; Superimposed water channels was already part of toolkit of the Athenian aqueduct constructed by Peisistratus (see Tölle-Kastenbein 1994).

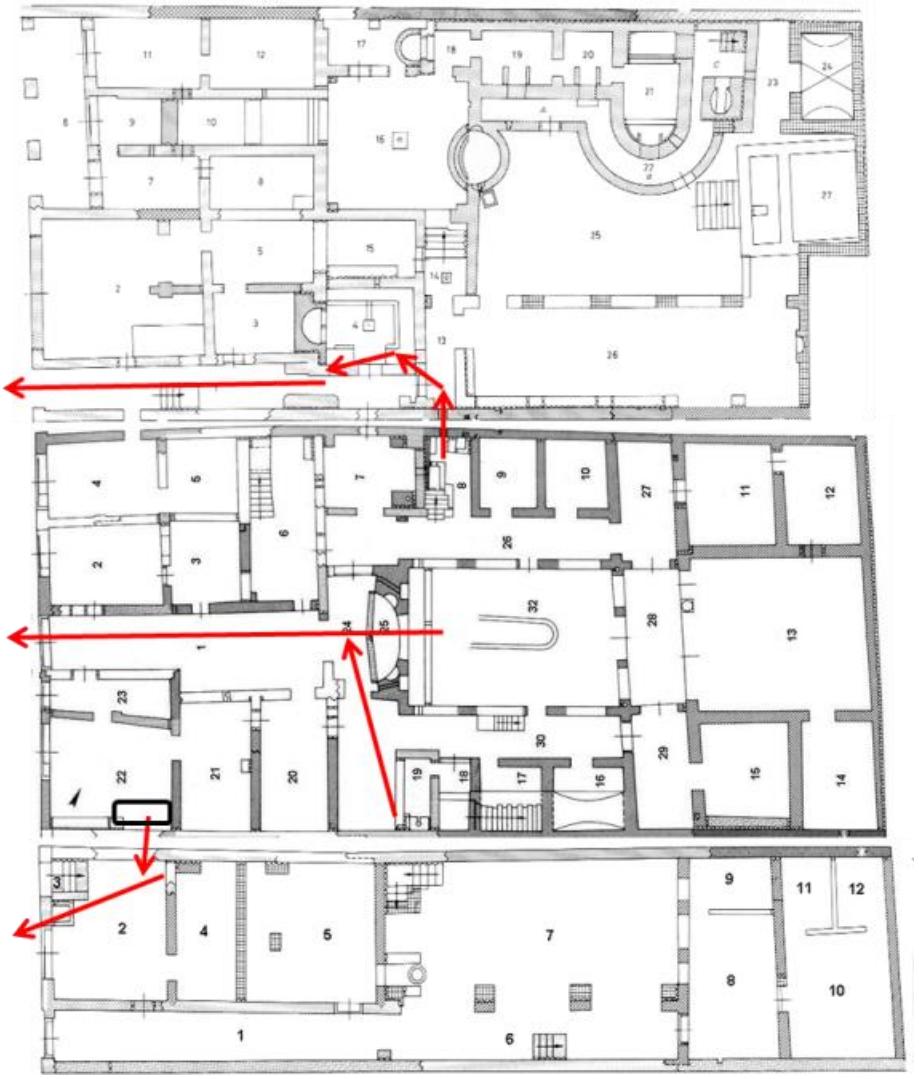


Figure 5.285: Main drainage lines of the Terme del Filosofo, the Domus del Protiro, and building V, ii, 3 indicated by arrows (after Boersma 1985, Figs. 27, 36, 112).

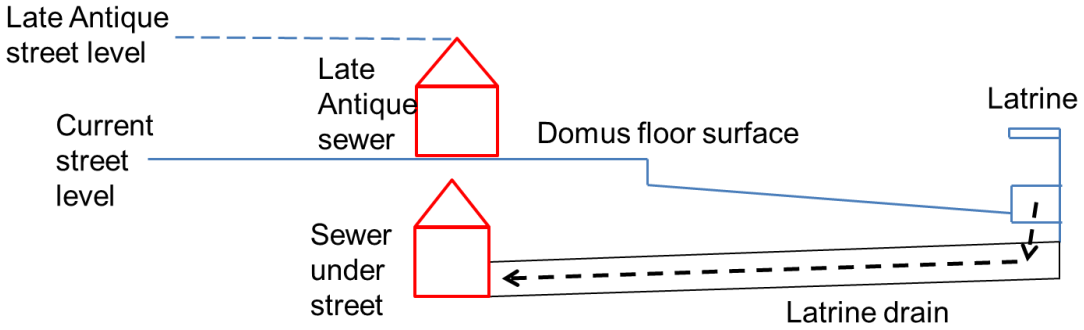


Figure 5.286: Schematic of sewers identified in in the Domus della Fortuna Annonaria (V, ii, 8).

Additional support for this two-level sewer system comes from the sewer line identified in V, ii, 2, and its connection with its neighboring building (V, ii, 3). Contemporary with the insertion of a staircase in building V, ii, 3, a downshaft was also created here in the Late Antique period. This newly created downshaft descended exactly where the sewer line in V, ii, 2 begins (Figure 5.287). The otherwise curious position of this downshaft suggests that this 4th century downshaft was placed here to connect with the 1st century sewer in the neighboring building V, ii, 2; the sewer in V, ii, 2 must still be working,

despite the ground level of that building being raised by ca. 2.00 m. This may be another example of a changing social or economic relationship between two different properties.

Figure 5.287: Tile-backed downshaft added in building V, ii, 3 at left, with the breakage through the wall visible at the bottom. At right, the same breakage seen from the other side of the wall, in building V, ii, 2, directly above its 1st century AD sewer line.

The greatest number of contemporary functioning water features was present only in this final stage of the insula's life, with 113 known water features, although the difficulties of identifying the duration of many water features suggest that this number should be seen as a minimum. The complexity and resilience of the insula's hydraulic system is unchanged from Roman Water Footprint #3 (9/9). This is largely a result of the rebuilding phases in many buildings of the insula, continuing 3rd century energy into the 4th and 5th centuries. The insula's system is very resilient, and this may be reflected in the increasing interaction between multiple buildings in this final period.

5.2.4.2: Culture

The 4th to the 6th centuries saw important social, urban, and economic changes for Ostia. A tetrarchic mint was briefly opened in Ostia, and a Christian basilica was built in the southeastern part of the city by the emperor Constantine.[816] Small bath buildings were created, with some earlier ones continuing through contractions in their size.[817] The number of larger domus buildings increase across the city, with the majority installing elaborate private nymphaea. Together with this larger architectural trend, many small scale interventions occured, with doors, streets, and sometimes entire buildings blocked off.

[816] Bauer & Heinzelmann 1999 for the Basilica; Drost 2014 identified four *officinae* minting coins in Ostia between AD 308-313.
[817] David *et al.* 2014 for a Late Antique bath in insula IV, ix.

Especially in the early 5th century, the Semita dei Cippi is a key example of this, with its junction at the *decumanus* blocked by a large exedra.[818] Across the city, the gap between privately and publicly oriented water features reduces. Within insula V, ii the exact opposite occurs: more private water features are functioning in this period. Also, the gap between private and public water features in the insula more than doubles compared to the previous Roman Water Footprint period (Table 5.62).

insula V, ii		RWF # 3	RWF # 4
Private Oriented insula	Total # of features	58	74
Public Oriented insula	Total # of features	42	39
Private Oriented-Ostia	Total # of features	101	63
Public Oriented-Ostia	Total # of features	49	36

Table 5.62: Private and Public water in insula V, ii and Ostia in Roman Water Footprint #3 (AD 200-300) and Roman Water Footprint #4 (AD 300-600).

5.2.4.3: Nature

The number of floods increases in this period to the same level as Roman Water Footprint #2 (AD 50-200), with 6 floods known in this period.[819] The ground level was at its highest in the city's ancient life, which provided some structures the opportunity to install their own drainage system. Perhaps these individual actions reflect the desire to be less affected by flooding.[820]

The new marble-clad domus' of this period share the city with many abandoned and ruinous structures. The amount of faunal material in the city remains high, although it slightly decreases compared to Roman Water Footprint #3 (AD 200-300).[821] The number of functioning bath buildings (14) is still nearly as high as in the 3rd century, attesting to a sustained level of communal water interaction.

5.2.4.4: Conclusion

Despite a mix of different types of structures within the insula, the buildings along the Semita dei Cippi receive much more attention. However, many of these "typical" Late Antique changes appear to have already occurred in the mid-3rd century. Although the Domus della Fortuna Annonaria blocked off access to street fronts and installed luxury water features (e.g. private latrine and nymphaeum), similar changes had occurred in the neighboring Terme del Filosofo and Domus del Protiro already in the previous century. Evidence of buildings sharing sewer systems or further hydraulic fragmentation may point to changing patterns of ownership. The division of the Domus del Protiro's drainage between its neighbors to the north and south may indicate that there was a single owner for all three properties in this period. When we add the evidence that building V, ii, 2 and V, ii, 3 were also connected by their drainage systems, we can hypothesize that, at least in terms of hydraulic infrastructure, nearly the entire western side of the insula (buildings V, ii, 2-7) was connected. As the newly installed downshafts indicate a need for increased drainage on upper floors, this could indicate that all that glitters was not in fact gold for the owners of the Domus della Fortuna Annonaria. While the domus did gain more decoration and hydraulic amenities, the need for increased drainage could suggest the creation of more, smaller apartments on the upper floor than had previously existed. In this scenario, we posit that there would

[818] Gering 2013, 266 for the chronology of the exedra.
[819] Aldrete 2007, 242 for flooding details.
[820] Gering 2013, 272 for a peak of intramural rubble dumping in the 4th century.
[821] MacKinnon 2014, 194-195 for the faunal evidence.

be fewer tenants that could afford larger upper floor apartments, and more tenants of lower economic means. Just because the domus is richly decorated in this period does not mean the same situation is occurring on the upper floors: in fact, it may point in exactly the opposite direction. The same conclusion can be drawn from the changing relationship between buildings V, ii, 2 and V, ii, 3 in terms of the new downshafts and stairs added there.

Although in a fragmentary state, the sewer system of the insula preserves evidence for an superimposed sewer system, which is otherwise unparalleled in Roman archaeology. These 4th century sewers can be imagined as "floating" above the current street level of the Semita dei Cippi.[822] The reason for this system is unknown, but perhaps some sections of the sewer system, even within one stretch of street were blocked, or it may suggest private hydraulic investment in a public space. Sewers are the responsibility of the urban administration, but the sewer on the external side of the Domus della Fortuna Annonaria may indicate a partial breakdown of, or a neglectful attitude from the urban administration in the Late Antique period.

When taken together with the additional evidence of higher ground levels and under-excavated floors, the Late Antique fabric of Ostia begins to appear more substantial. The city certainly experienced a reduction in population and activity from the 2nd century, but new investment continued to occur, especially within the large domus. Taking advantage of a quieter Semita dei Cippi, these domus expanded into the streets.[823] More surprising than the *ex novo* features installed is the high degree of continuity from sometimes much older periods, with new water flowing through old channels.

[822] GdSc 29, 98 (Nov. 1950): "*Nel ingresso all'edificio adiacente a sud a quest'ultimo magazzino* (=V, ii, 3) *parallelamente* ***a una fogna tarda superficiale che a stato demolite****, si trova una gran fistula e m.7 a lunghezza circa con la marca…"*, emphasis added.

[823] Baldini-Lippolis 2007 gives an overview of private encroachment on public space in the Late Antique period.

5.3: Diachronic Analysis

The indicators of the Roman Water Footprint will now be discussed diachronically, to highlight larger trends over the complete life of the insula. This will identify what features in the history of insula V, ii make it unique. All data in the subsequent charts come from the Roman Water Footprint table directly below (Table 5.63).

V, ii Roman Water Footprint # 1-4						
Indicator	Sub-Indicator	Data	Roman Water Footprint #1 (4th century B.C.- AD 50)	Roman Water Footprint #2 (AD 50-200)	Roman Water Footprint #3 (AD 200-300)	Roman Water Footprint #4 (AD 300-600)
Infrastructure	Supply Systems	Rain Water	6	17	2	2
		Ground Water	3	6	5	5
		Aqueduct	0	5	6	8
		Total # of Supply Features	9	28	13	15
	Usage Systems	Number of Leisure Water Features	0	2	10	9
		Number of Industrial/Economic Water Features	0	10	3	3
		Number of Domestic Water Features	1	1	7	13
		Total # of Usage Features	1	13	20	25
	Drainage Systems	Sewer	0	10	30	25
		Downshaft	0	8	13	11
		Drains	4	13	24	36
		Total # of Drainage Features	4	31	67	73
	System Resilience	Number of Types of Supply	2	3	3	3
		Number of Types of Usage	1	3	3	3
		Number of Types of Drainage	1	3	3	3
		Total System Complexity	4	9	9	9
		Total # of Features	14	72	100	113
Culture	Private Oriented-insula	Total # of Features	14	42	58	74
	Public Oriented-insula	Total # of Features	0	30	42	39
	Private Oriented-Ostia	Total # of Features	36	122	101	63
	Public Oriented-Ostia	Total # of Features	17	72	49	36
Nature	External	Tiber River Floods	21	6	2	6
	Internal	Urban Garbage	1	3	4	3
		Urban Health (# of Baths)	3	21	16	14

Table 5.63: Complete Roman Water Footprint for insula V, ii.

The highest number of supply features is present in RWF #2 (AD 50-200). The high degree of diversity in the supply system, especially in terms of rain water collection, point to an advanced awareness of the seasonal fluctuations of different sources of water (Figure 5.288). This is best exemplified in courtyard 32 of the Domus del Protiro (V, ii, 4-5), where a complex network of supply, usage, and drainage features work together: even considering only water supply, a *nymphaeum*, fountain basin, well, and rain water are all functioning at the same time. In spite of the availability of local ground water, wells such as these may have been just as prestigious as elaborate *nymphaea*. Prestige in this case may be defined not just by the amount of marble paneling, but equally by the system's flexibility: an elaborate nymphaeum may lose some of its value if there is not enough water for it to function.

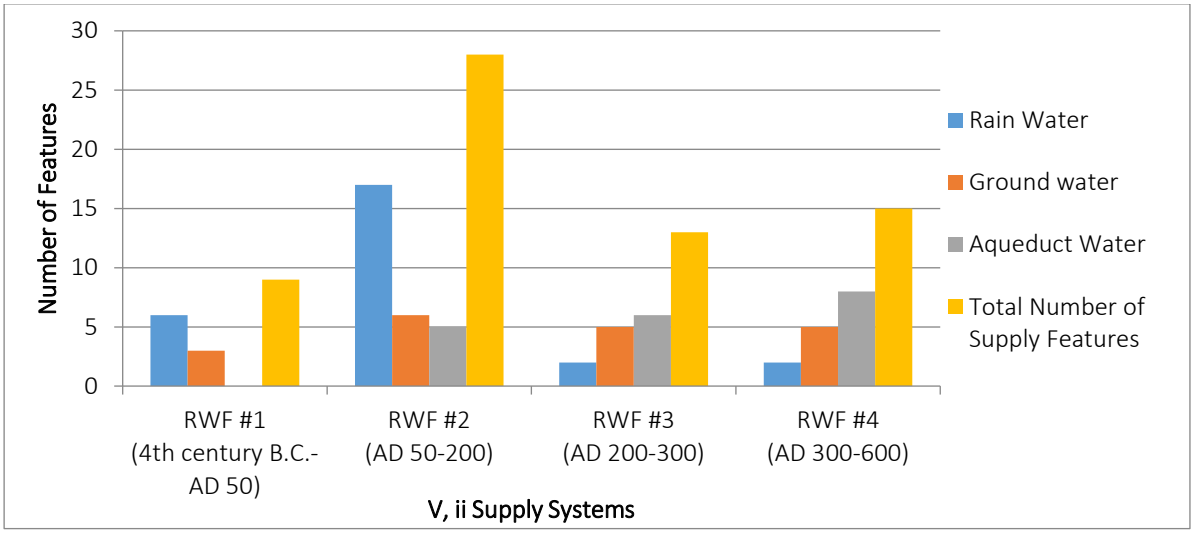


Figure 5.288: Supply Features in V, ii for each Roman Water Footprint.

There is little evidence in RWF # 1 for types of usage, but a diversity of water usage is present by RWF #2 (Figure 5.289). Although Industrial/Economic features are much more present in RWF #, this situation does not lat. This situation changes in RWF #3 when Leisure and Domestic water usage both increase dramatically, and Industrial/Economic usage drops to a third of its previous value. The highest number of usage features is present in RWF #4, when many of the domestic structures created or substantially modified in RWF #3 receive further modifications.

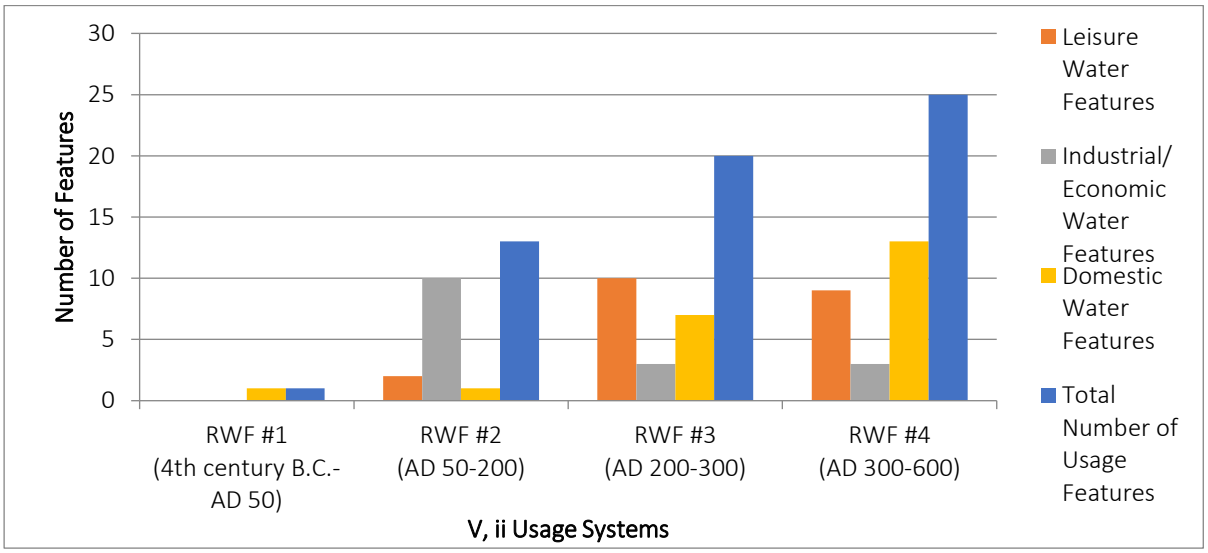


Figure 5.289: Usage Features in V, ii for each Roman Water Footprint.

The sewer system over time appears to have had multiple phases within the insula (Figure 5.290). There is evidence of 4th century drains connecting to 1st century ones, but there is also evidence of new sewer lines built above these early lines.[824] This hydraulic opportunism provokes some challenging questions about the Late Antique cityscape around the insula in terms of changing ground levels, and subsequent conclusions about a possible superimposed sewer line (Figure 5.291). Despite being "*la vittima sacrificale della strategia di lavoro dell'E42*", a growing body of evidence permits an initial reconstruction of the hydraulic infrastructure of the insula in its final stage.[825]

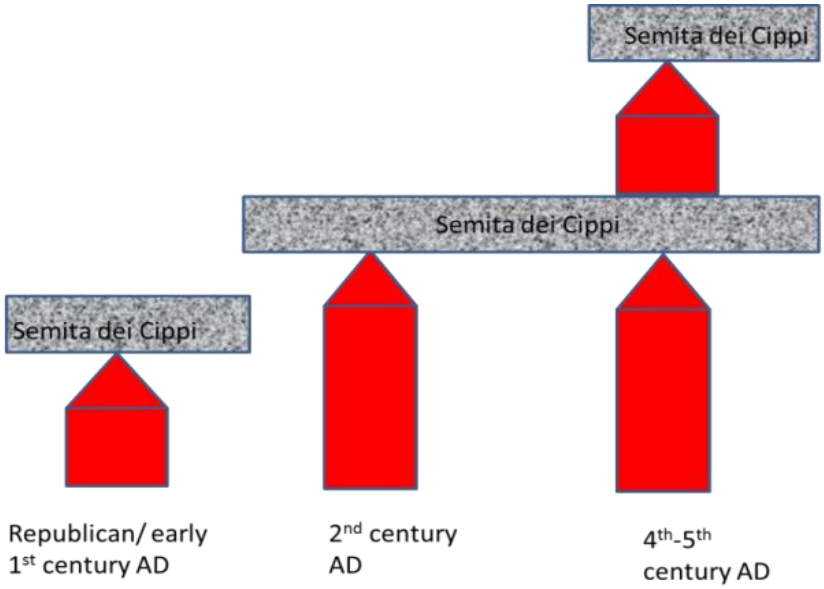


Figure 5.290: Development of sewer systems based on the evidence from insula V, ii.

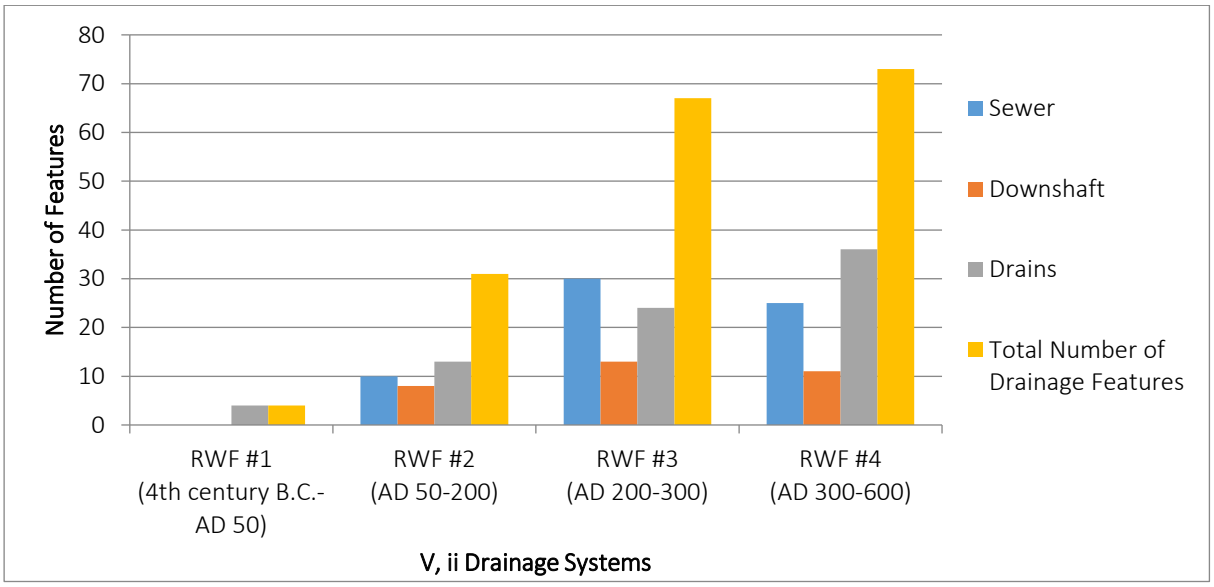


Figure 5.291: Drainage Features in V, ii for each Roman Water Footprint.

Looking at the System Resilience of insula V, ii, it is clear that once the system reached its maximum level of complexity (9/9) in RWF #2, this level was maintained throughout the remainder of the insula's life (Figure 5.292). This stability of infrastructure is intriguing, especially when recalling the dynamic

[824] Such as in V, ii, 8 (features 93-97), or in V, ii, 10 (feature 107).
[825] David *et al.* 2014.

character of the Supply, Usage, and Drainage systems in the preceding graphs. The shift from RWF #2 to RWF #3 is not reflected in this graph, implying that the system was flexible enough to adapt to dramatic changes over time.

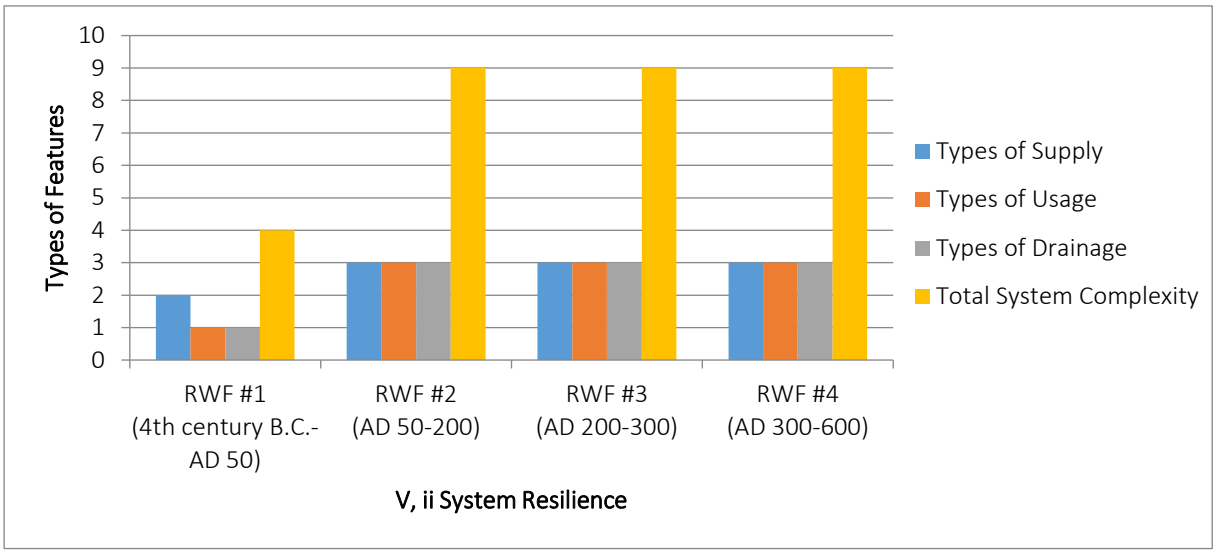


Figure 5.292: V, ii System Resilience for each Roman Water Footprint.

A closer investigation of the parts of the insula's hydraulic infrastructure expands upon the smaller trends identified in the preceding graphs (Figure 5.293). This pertains especially to the general stability and increase of the entire system into the final RWF #4 period. Many of the hallmarks of Late Antique water usage can already be detected in the 3rd century, suggesting a much longer temporal trend in attitudes toward water usage in insula V, ii. The industrial/economic appearance of the insula changes toward the more domestic and leisure-focused character of the insula in RWF #3 and #4.

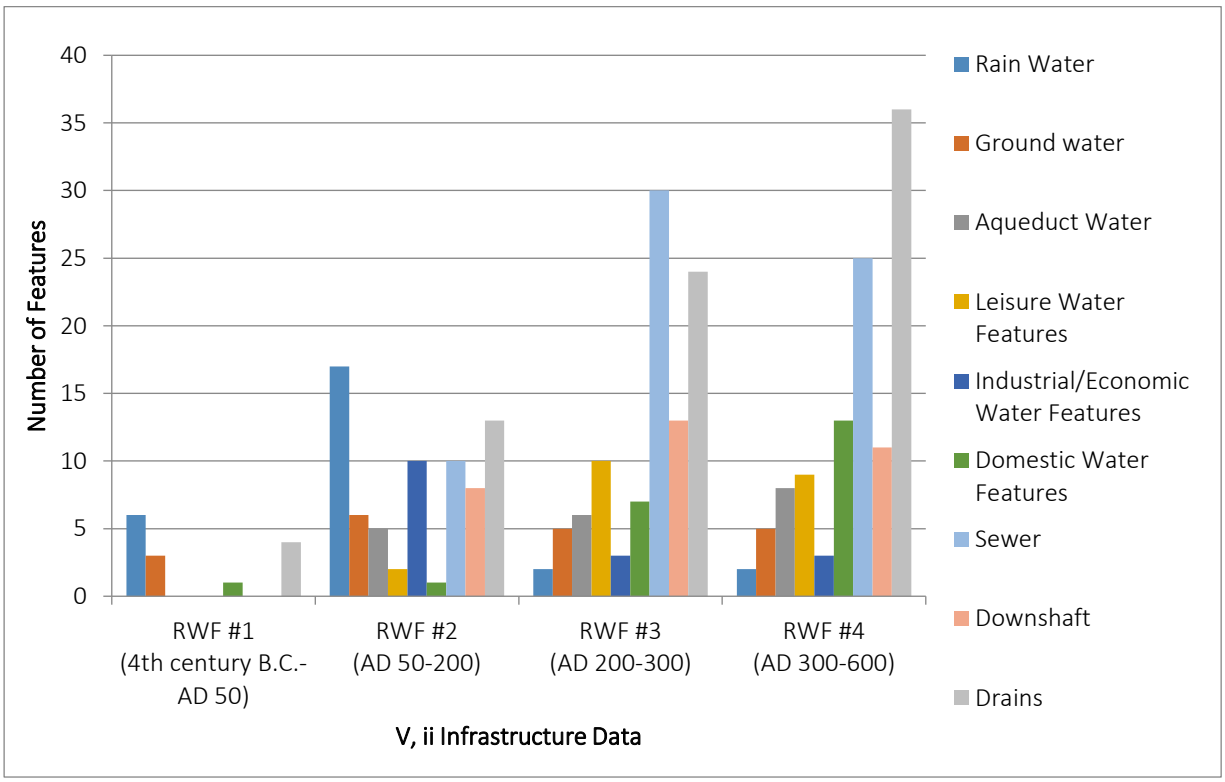


Figure 5.293: Infrastructure Data for insula V, ii.

Although the maximum number of Supply features comes in RWF #2 as a result of the many rain water collection features, this is in sharp contrast with the Usage and Drainage Indicators, which reach their maximum number of features only in RWF #4 (Figure 5.294). This suggests that the same water supply sources were sufficient to be applied in an increasing number of ways. Combining the infrastructure data in this way highlights the similarities between RWF #1 and #2, which could not be identified in the previous chart. The insula's life can thus be assigned two central hydraulic phases: RWF #1 and #2, and RWF #3 and #4.

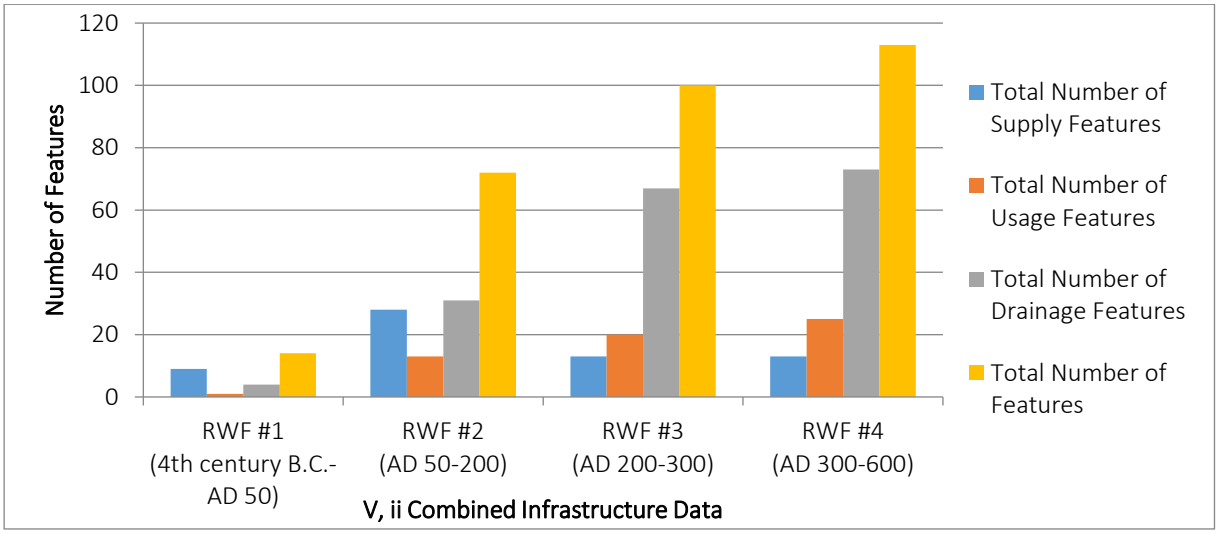


Figure 5.294: Combined Infrastructure data from insula V, ii.

Privately oriented water features are more numerous than publicly oriented features in every time period of the insula's life, increasing steadily until they reach their peak in RWF #4 (Figure 5.295). This results from the increasing number of private homes created in the insula, and a decrease in number of publicly oriented tabernae. Together with an increase in the number of both private and public features over time, the difference between these values also grows over time. Although this growing dominance of private over public water follows the wider trend in Ostia, the number of features for Ostia is generally decreasing over time.[826]

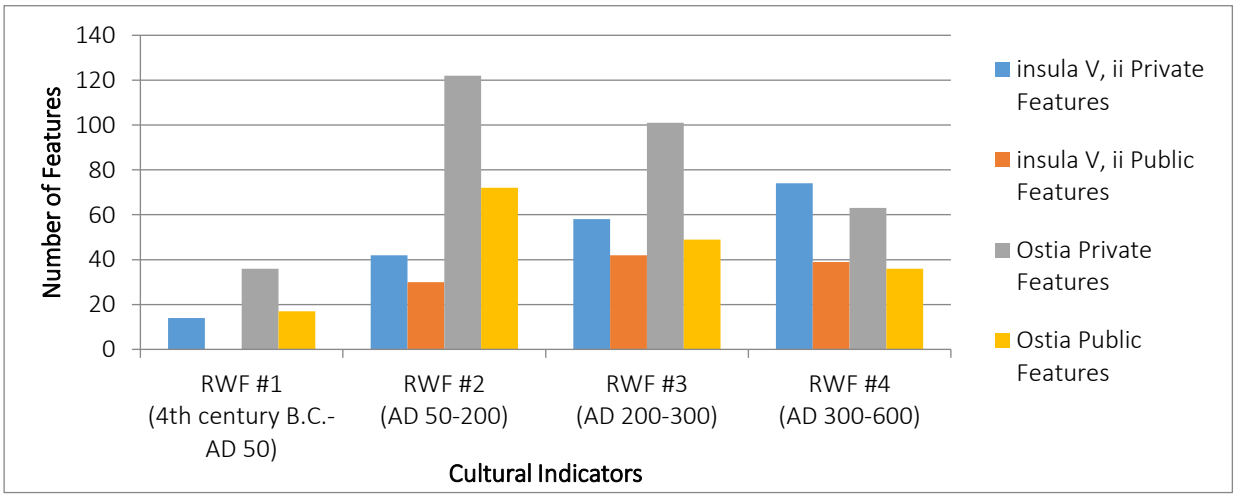


Figure 5.295: Cultural Indicators in V, ii for each Roman Water Footprint period.

[826] As discussed in Chapter 2, this may equally be a result of how Ricciardi & Scrinari prioritized their data.

With this high level of internal hydraulic connections, this insula may have been much less dependent on water from the river, even for industrial/economic uses. As mentioned above, the ca. 300 m distance from the river to the insula is not too far to travel, but it seems unlikely in this case. However, the continually rising ground level of the streets around the buildings of the insula would make structures even more at risk of flood damage (Figure 5.296). Even minor flooding of the streets would flow into buildings located 0.50-1.00 m below the ground level.[827]

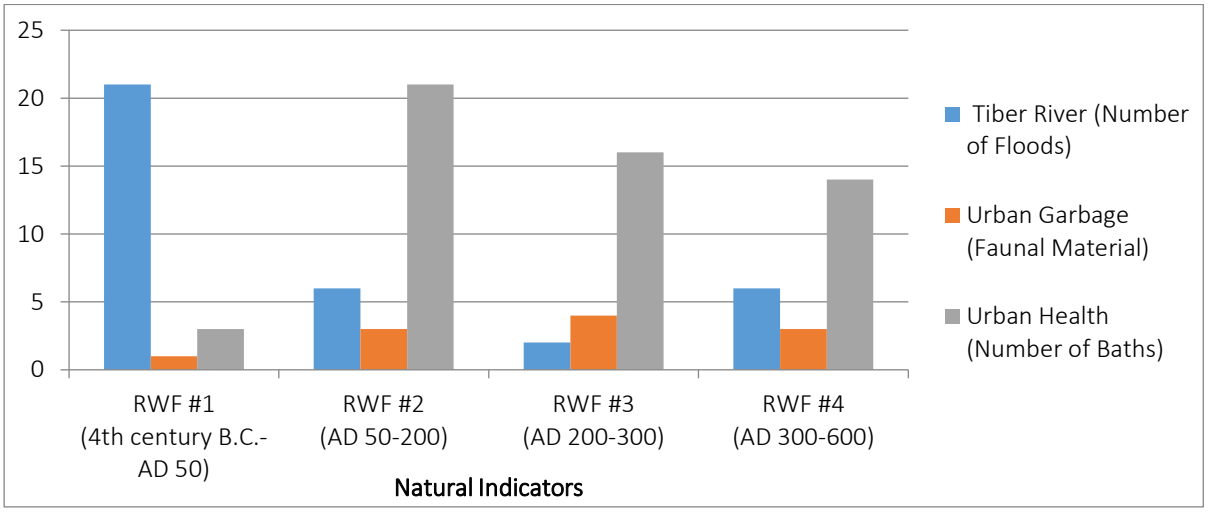


Figure 5.296: Natural Indicators in V, ii and Ostia for each Roman Water Footprint period.

5.4: insula V, ii Conclusion

As discussed in section 5.1, the fact that insula V, ii has not been more studied is mostly a result of the dense presentation of Boersma's *Amoenissima Civitas*. The precise details on the composition and measurements of every wall and floor level can be difficult reading, even for specialists of Roman construction and architecture. However, the value of Boersma's work for this study cannot be overstressed. It forms a chronological resolution rarely available for single buildings, let alone an entire city block. This temporal data proved invaluable in connecting local infrastructure elements to the wider context of insula V, ii and Ostia itself. New techniques for interpreting and visualizing the data from V, ii are currently underway, and point towards more integration of architectural data with a host of other data sets (Figure 5.297).

Insula V, ii appears to have had a mostly disconnected history for the first several centuries of its existence, yet this began to change in the 3rd and 4th centuries. Neighboring buildings become increasingly connected hydraulically, usually in terms of drainage systems. This is the case especially in RWF #3 (AD 200-300), where downshafts and sewer lines indicate hydraulic relationships between nearly all of the buildings in the insula. Evidence from the sewer systems in insula V, ii have provided many new benchmarks for understanding the spatial and chronological development of the wider urban sewer network. Not only were 1st century sewers built upon by later sewers, but a second superimposed sewer line was installed in the 4th century. This sewer line was sandwiched between the present Trajanic street level and a now-lost Late Antique ground level.

The examples of hydraulic opportunism within the insula are surely no coincidence, and when taken together with contemporary moments of building modification, point to dynamic social connections between buildings and through time. Lacking written evidence for such (inter)connections, issues of

[827] The Domus della Fortuna Annonaria already lies several robust steps below the current (Trajanic) ground level. Adding a further 50 cm of street height would intensify this situation, offering a point for flood water to accumulate.

ownership or mutual cooperation are surely at work here. While spatial or architectural approaches are useful to identify past social relationships, hydraulic evidence can be an equally powerful tool to highlight this aspect of urban life in Ostia.

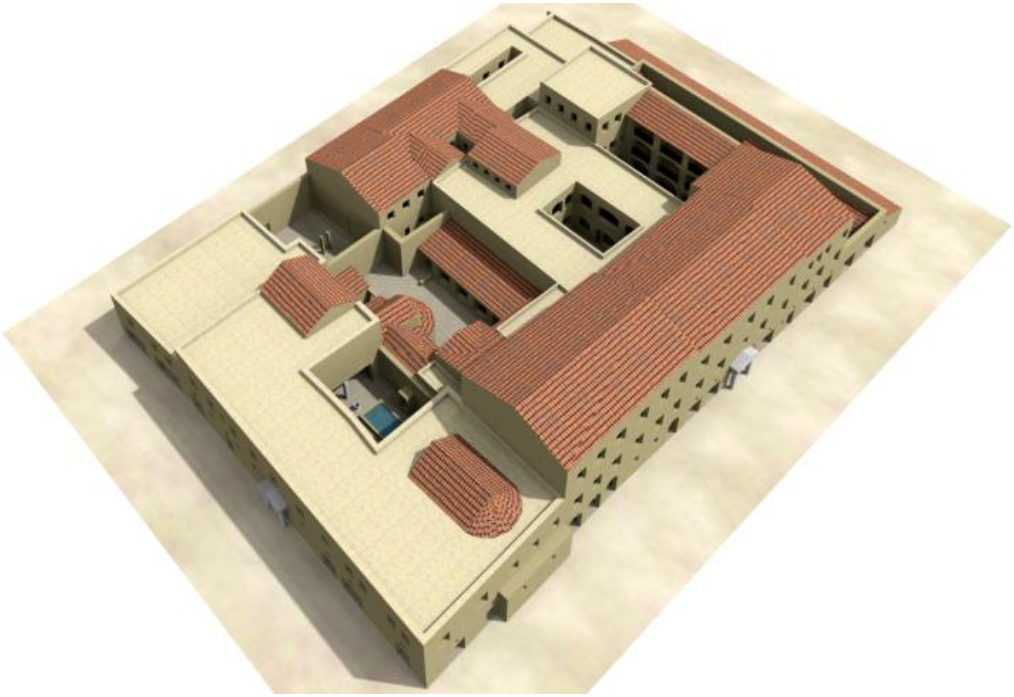


Figure 5.297: 3D model of insula V, ii in its final AD 400 phase (image by A. Jansen).

Chapter 6: Diachronic Discussion

6.0: Introduction

Detailed information on the distribution and chronology of the hydraulic systems of individual buildings in each *insula* were presented into Chapters 3, 4, and 5. Together with each of these data chapters came a section (3.1, 4.1, 5.1) that aggregated this data chronologically, presenting the total hydraulic biography of each insula over its entire life. These latter sections applied the Roman Water Footprint method to integrate the hydraulic systems of each insula into the wider environmental and cultural landscape of Ostia in each time period. In this chapter, the contextualized understanding of each insula is compared to the other case studies from a chronological perspective. In this way, similarities and differences between the insulae can be identified in each time period. This also acts as a final litmus test to determine how representative the data from any one insula is when compared with the available evidence for the wider city.

6.1: Roman Water Footprint #1 (4th century BC- 50 AD) in insulae III, i; IV, ii; V, ii

The earliest evidence for hydraulic infrastructure is lowest in this period (4th century B.C.- AD 50) across all insulae (Table 6.64). Although this may be a result of the minimal Republican structures excavated in the case studies and the wider city, it may equally indicate a real evidence of absence.

In terms of water supply, insula V, ii has the most number of features, excelling especially in terms of rain water collection (Figure 6.298). This is in stark relief to insula III, i, which has no evidence for rain harvesting in this phase or throughout its entire history. As this period is defined as the pre-aqueduct phase, no aqueduct supply systems are therefore present. This makes the presence of wells no surprise, yet one would expect there to be *more* wells present. This low number of wells must then imply that water was obtained at wells in the forum, or acquired from the Tiber river. The number of water usage features is very low, with only two known water usage features identified across all three insulae. Known usage features are all located within domestic contexts. A similar situation is present for the drainage systems, with only five identified features. Other than a handful of scattered drains in V, ii there are minimal traces of these features in any of the case studies. When comparing the total hydraulic infrastructure of all three insulae in this time period, very few parts of the system are identifiable (Figure 6.299). What is clear, however, is that the hydraulic systems are only present in domestic circumstances (IV, ii and V, ii), and that in these domestic buildings there is a desire to use both rain and ground water resources. The fragmented drainage system present in blocks III, i and V, ii paint the same picture of individual actions resulting from small-scale, mostly domestic concerns.

Roman Water Footprint # 1 (4th century BC- AD 50)					
Indicator	Sub-Indicator	Data	III, i	IV, ii	V, ii
Infrastructure	Supply Systems	Rain Water	0	2	6
		Ground Water	3	4	3
		Aqueduct	0	0	0
		Total # of Supply Features	3	6	9
	Usage Systems	Number of Leisure Water Features	0	0	0
		Number of Industrial/Economic Water Features	0	0	0
		Number of Domestic Water Features	0	1	1
		Total # of Usage Features	0	1	1
	Drainage Systems	Sewer	1	0	0
		Downshaft	0	0	0
		Drains	0	0	4
		Total # of Drainage Features	1	0	4
	System Resilience	Number of Types of Supply	1	2	2
		Number of Types of Usage	0	1	1
		Number of Types of Drainage	1	0	1
		Total System Complexity	2	3	4
		Total # of Features	4	7	14
Culture	Private Oriented-insula	Total # of Features	4	7	14
	Public Oriented-insula	Total # of Features	0	0	0
	Private Oriented-Ostia	Total # of Features	36	36	36
	Public Oriented-Ostia	Total # of Features	17	17	17
Nature	External	Tiber River Floods	21	21	21
	Internal	Urban Garbage	1	1	1
		Urban Health (# of Baths)	3	3	3

Table 6.64: Roman Water Footprint # 1, with data from insulae III, i, IV, ii, V, ii.

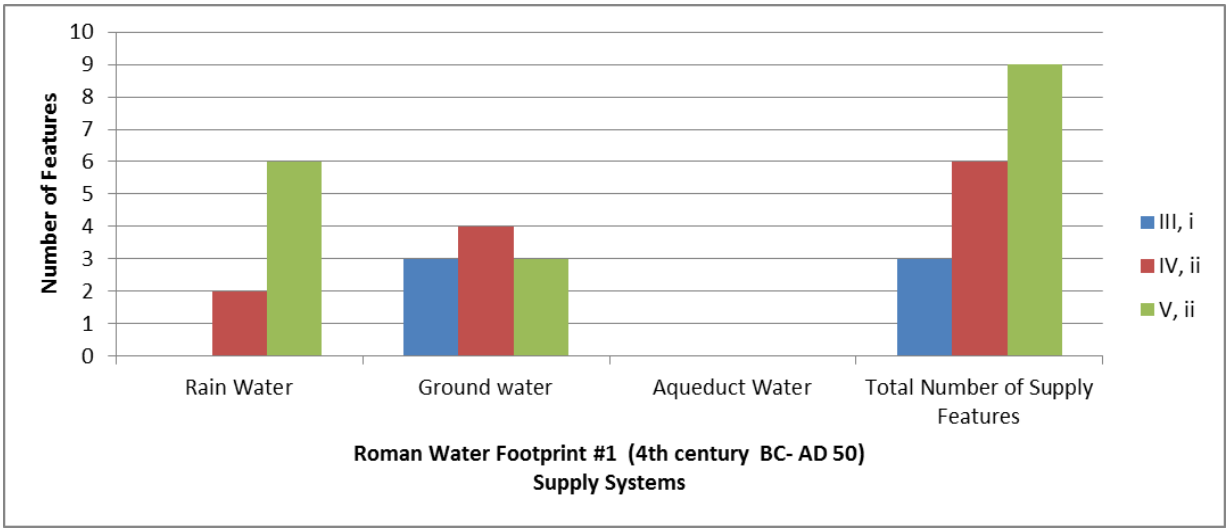


Figure 6.298: Supply systems of insulae III, i, IV, ii, and V, ii in Roman Water Footprint #1 (4th century B.C.- AD 50).

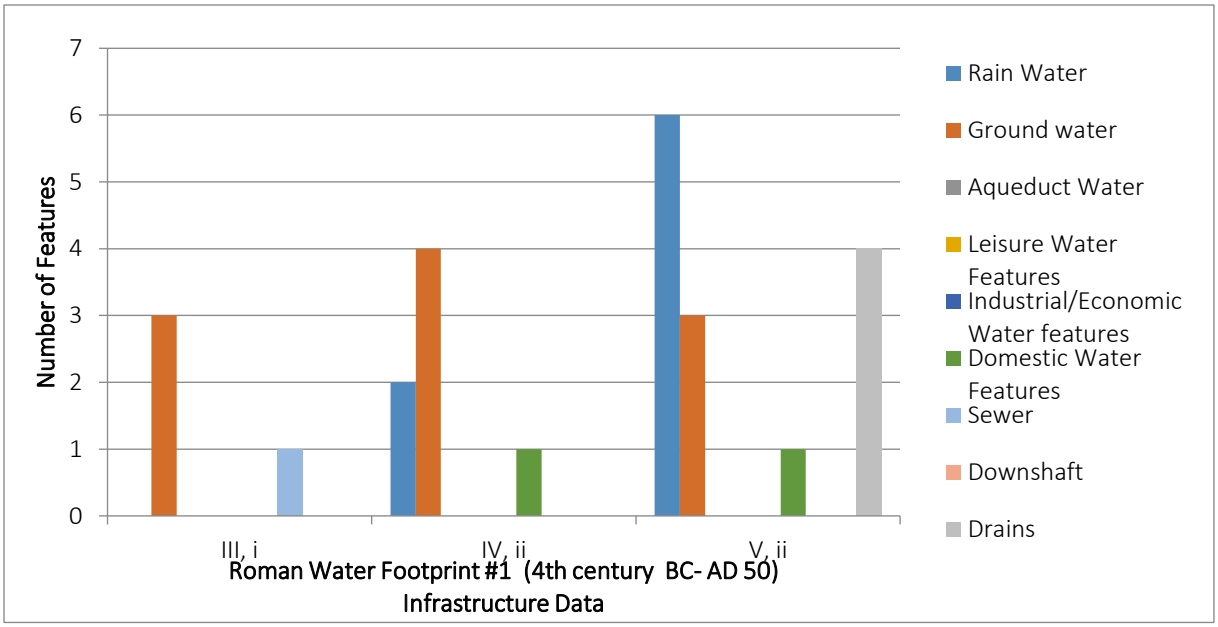


Figure 6.299: Infrastructure Data for insulae III, i, IV, ii, and V, ii in Roman Water Footprint #1 (4th century B.C.- AD 50).

By condensing the infrastructure data in the previous chart, a more clear picture emerges of the difference between the three insulae in this period (Figure 6.300). Insula V, ii has the highest number of water features compared to the other two insulae, yet all three city blocks have many more water features relating to supply than to usage or drainage. This suggests that there was a focus just on obtaining water in this early period, with less emphasis given to constructing lasting water features for using or draining that water.

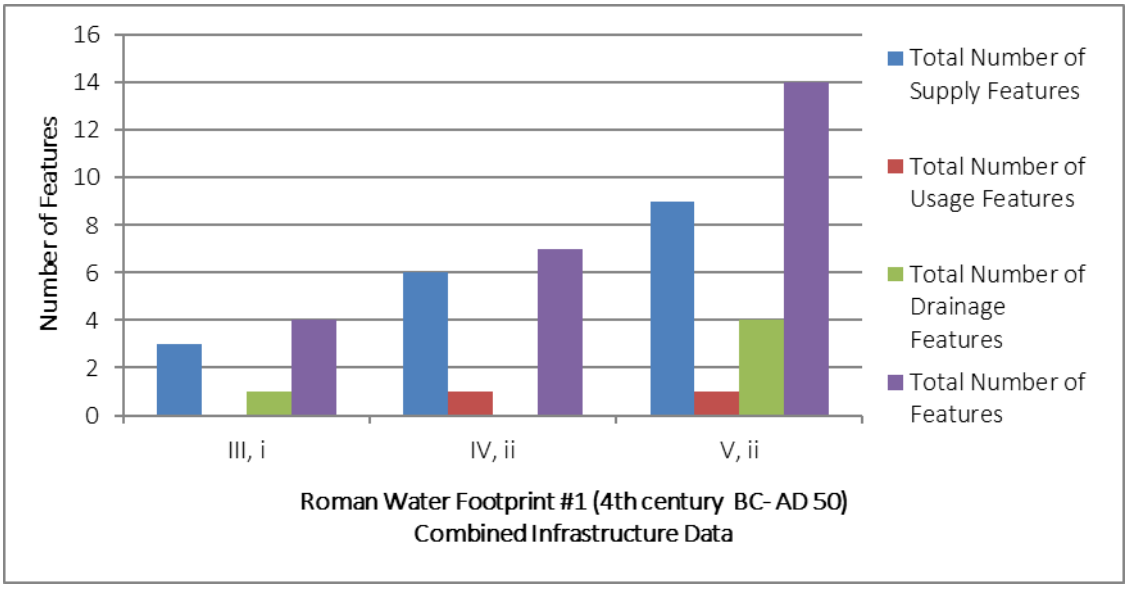


Figure 6.300: Combined Infrastructure data for insulae III, i, IV, ii, and V, ii Roman Water Footprint #1 (4th century B.C.- AD 50).

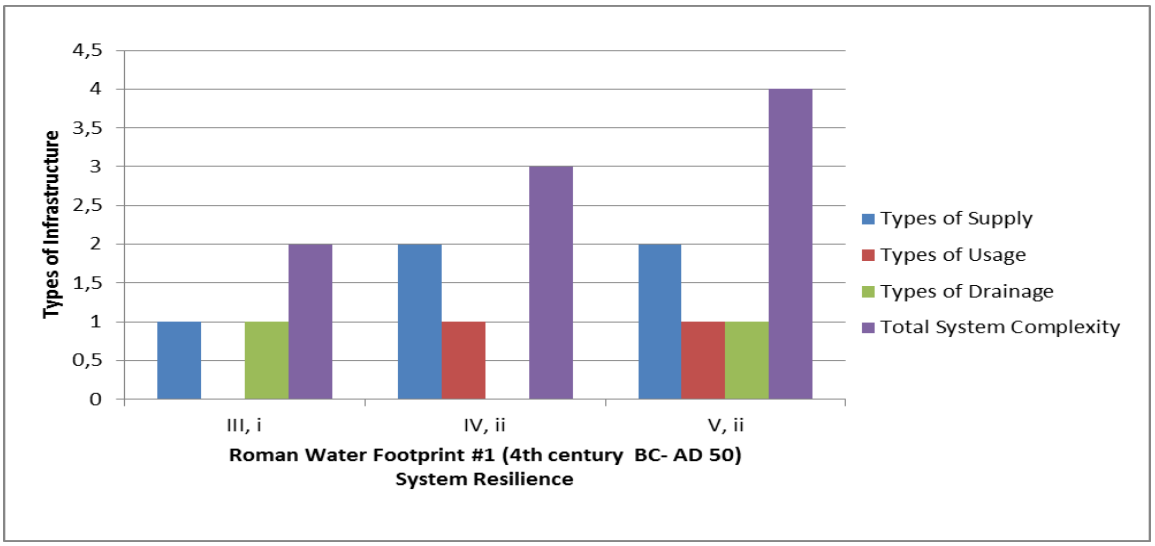


Figure 6.301: System resilience compared between insulae III, i, IV, ii, and V, ii in Roman Water Footprint #1 (4th century B.C.- AD 50).

Although insula V, ii has the highest degree of overall system complexity, this is still low, scoring 4/9 (Figure 6.301). Despite the wider knowledge about capturing rain water, this was not done equally in the three insulae. This low degree of system complexity in all of the insulae makes them likely vulnerable to seasonal and annual variations in ground water and rain water availability. The role of wells is especially important here, since marble-decorated wells from this early period often doubled as individual cisterns: numerous ceramic pipes set within these wells directed rain water into the well, coming from upper floor downshafts. Differences in water supply would be even more pronounced between those living in domus buildings and the remainder of the population, who would need to look to alternative sources of water for drinking and other activities. Despite the easily accessible ground water level, there are few known wells across Ostia in this period, suggesting that the creation of wells was either not as easy, or as widely practiced as would seem doable. In the time before the creation of the first aqueduct, perhaps the possession of multiple sources of water within a wealthier domus also carried social prestige, in the form of water resilience and security. Buildings that are more resilient are also more sustainable and can operate independently of external hydraulic systems.

As outlined in Chapter 2, every water feature is labelled either as Public or Private, based on the identifiable orientation of the room in which it is present, and as far as the evidence permits. In a situation where tabernae were built as part of a domus: the water features in the tabernae would be designated Public, and the water features within the domus would be designated Private. The author acknowledges the on-going debate between these two labels, especially regarding the social permeability of Roman houses.

However, it is hoped that such an approach is valuable to researchers interested in diverse aspects of Roman cities and water usage.[828] When examining the difference between private and public water usage, a similar trend emerges for both the three studied insulae and for Ostia

Figure 6.302). While the number of water features is low in the three insulae, the majority of evidence lies in the private domain. Only in insula V, ii is there evidence for a handful of public water features. The lack of architectural evidence for the earliest periods of Ostia's life may also be a result of the high frequency of flooding, which is the highest in the city's entire history. The 21 known floods for Rome in this period include mytho-historical floods.[829] Yet, based on the frequency of floods from better documented periods, this number is likely within an acceptable range. The low ground level of Ostia in

[828] The contributions in Tuori & Nisson (ed.) 2015 provide an update on this debate; see Dessales 2011 and Flohr 2011 for the interaction between industrial and domestic activities in domus houses of Pompeii.
[829] Aldrete 2007, 242 for floods in Rome in this period.

this period, coupled with a very high water table and the presence of neighboring marshes, would certainly exacerbate even minor flooding from the Tiber. While these floods may not have been disaster-level events, frequent flooding would have much larger effects on the early structures and health of the people in early Ostia.

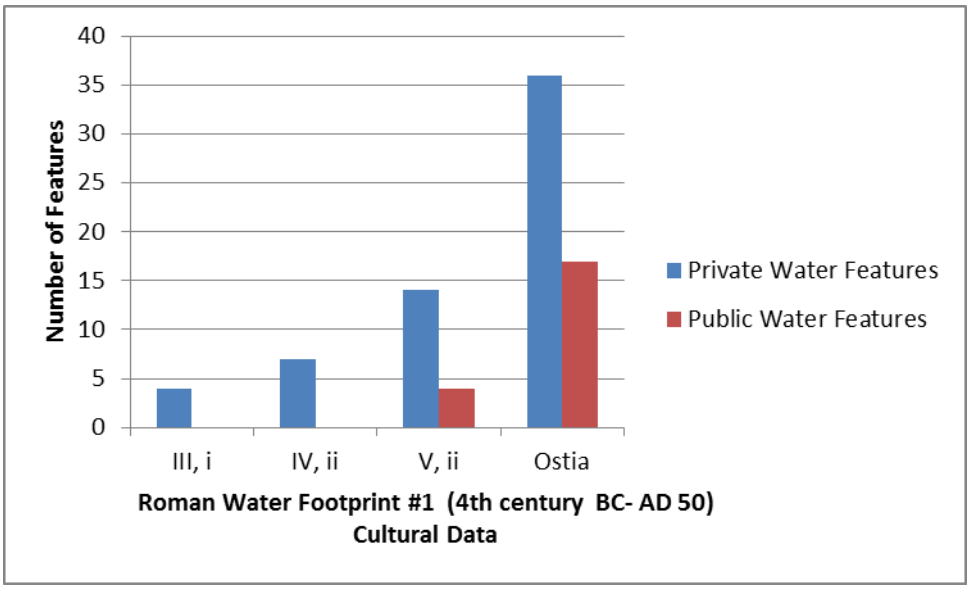


Figure 6.302: Cultural Indicator Data for insulae III, i, IV, ii, and V, ii in Roman Water Footprint #1 (4th century B.C.- AD 50).

Urban health across the city is difficult to assess given the few sewer systems known for this period, and the minimal evidence of accumulated faunal remains.[830] The three bath buildings known to exist from this period are the fewest in the city's history, and their small size suggests that not all people could be accommodated by them.[831] Subsequently, this means that fewer people would be at risk of swapping and contracting water-borne diseases in early Ostia.

6.2: Roman Water Footprint #2 (50-200 AD) in insulae III, i; IV, ii; V, ii

All hydraulic systems in the three insulae increase exponentially in this period when compared to the previous Roman Water Footprint phase (4th century B.C.- AD 50) (Table 6.65). The introduction of the urban aqueduct lines provide new opportunities especially for supply and usage systems. Lead pipes were installed in all insulae for the local distribution of aqueduct water (Figure 6.303). Together with this type of water comes the first development of sinter, or calcium carbonate, upon some walls and pipes in the city. The presence of this material acts as a helpful proxy in detecting where aqueduct based water flowed. Across the three insulae studied in this thesis there is evidence for inverted siphons pressurizing water well above the ground level. The identification of calcium carbonate within vertical downshafts implies the presence of flowing aqueduct water on at least the first floor of a building. If this is not the case, the only way continually flowing water would run down these channels is if people (i.e. slaves) repeatedly carried massive amounts of aqueduct water from courtyard fountains to upper floors for domestic usage.

[830] MacKinnon 2014, 187-189 for faunal evidence in Ostia

[831] Medri & Di Cola 2013, 101 for a concise chart of known baths in Ostia. Although little is known of these baths, they were likely small to medium in size, certainly not as large as the later Terme di Nettuno (II, iv, 2) or Terme di Faro (I, xii, 6).

Roman Water Footprint # 2 (AD 50-200)					
Indicator	Sub-Indicator	Data	III, i	IV, ii	V, ii
Infrastructure	Supply Systems	Rain Water	0	2	17
		Ground Water	4	4	6
		Aqueduct	7	11	5
		Total # of Supply Features	11	17	28
	Usage Systems	Number of Leisure Water Features	5	5	2
		Number of Industrial/Economic Water Features	3	2	10
		Number of Domestic Water Features	1	1	1
		Total # of Usage Features	9	8	13
	Drainage Systems	Sewer	22	16	10
		Downshaft	11	13	8
		Drains	6	4	13
		Total # of Drainage Features	39	33	31
	System Resilience	Number of Types of Supply	2	3	3
		Number of Types of Usage	3	3	3
		Number of Types of Drainage	3	3	3
		Total System Complexity	8	9	9
		Total # of Features	59	58	72
Culture	Private Oriented-insula	Total # of Features	20	35	42
	Public Oriented-insula	Total # of Features	39	23	30
	Private Oriented-Ostia	Total # of Features	122	122	122
	Public Oriented-Ostia	Total # of Features	72	72	72
Nature	External	Tiber River Floods	6	6	6
	Internal	Urban Garbage	3	3	3
		Urban Health (# of Baths)	21	21	21

Table 6.65: Roman Water Footprint # 2 in insulae III, i, IV, ii, V, ii.

This solution does not seem tenable, and forces us to reconsider our understanding of urban water distribution. While we do lack the vertically running lead pipes, the accumulation of calcium carbonate acts as a direct proxy to identify where aqueduct water once ran. In this period, rain water collection jumps dramatically in insula V, ii, but remains otherwise unchanged in blocks III, i, and IV, ii. This preference in water collection strategies may explain the paucity of aqueduct features in insula V, ii in comparison with the other two insulae. Ground water systems are present at roughly the same concentration in all of the insulae in this period. As with Supply, the highest number of Usage features in this period are present in insula V, ii (Figure 6.304). This insula also has the highest number of industrial/economic features, which is part of a wider trend across all three insulae that show an increase in industrial/economic, and leisure features, and a decline in domestic water features. This matches what is known of Ostia in this AD 50-200 period, when numerous *collegia* and tabernae were created across the city, expanding the number of businesses and places of production.[832]

[832] Hermansen 1982, 55-88 remains fundamental to the study of *collegia* and tabernae in Ostia; see Heinzelmann 2002 for an updated position on the "bauboom" of 2nd century Ostia.

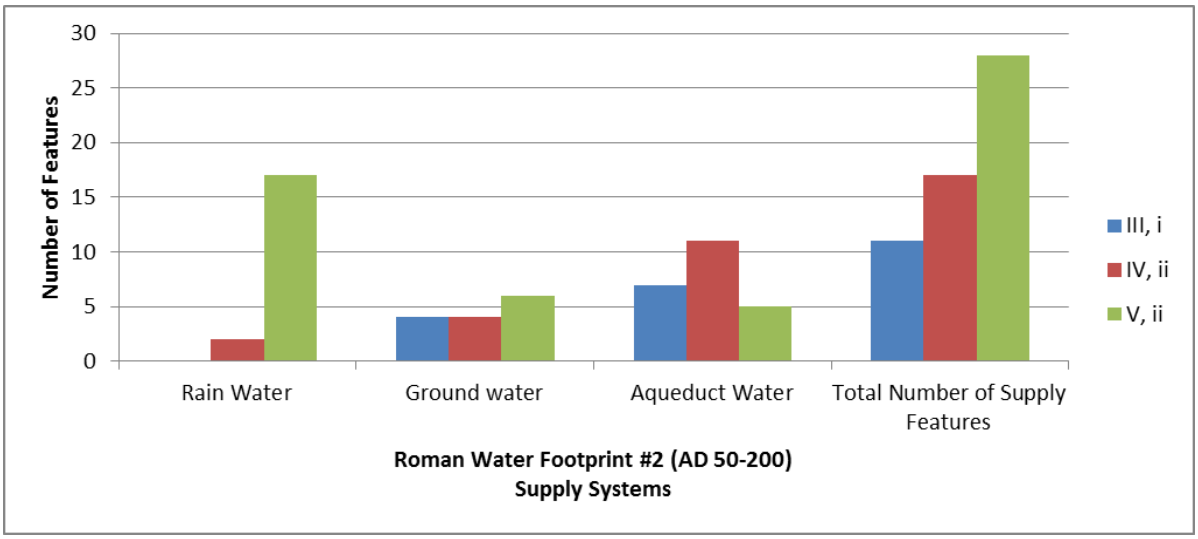


Figure 6.303: Supply systems of insulae III, i, IV, ii, and V, ii in Roman Water Footprint #2 (AD 50-200).

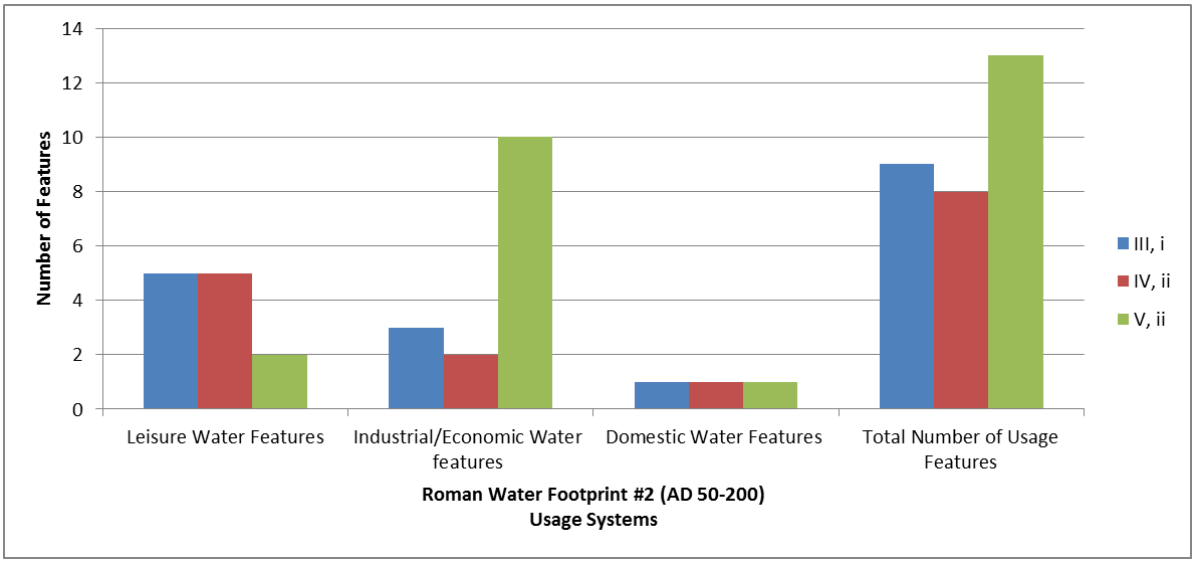


Figure 6.304: Usage systems of insulae III, i, IV, ii, and V, ii in Roman Water Footprint # 2 (AD 50-200).

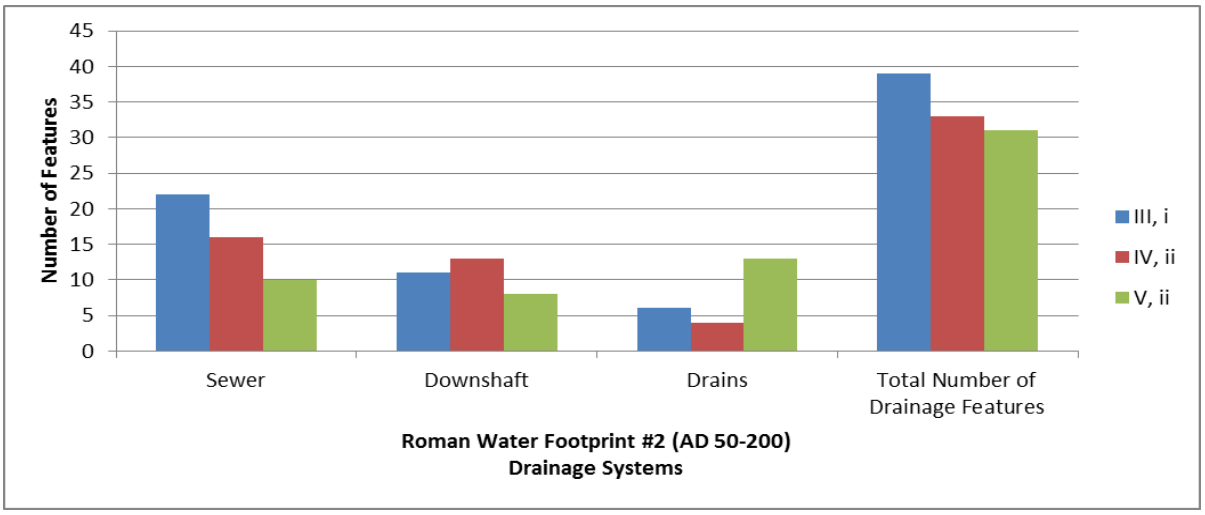


Figure 6.305: Drainage systems of insulae III, i, IV, ii, and V, ii in Roman Water Footprint # 2 (AD 50-200).

The number of drainage features increases in all three insulae, resulting from the diffusion of smaller sewer sections and different types of downshafts (Figure 6.305). These sewer lines are contemporary with wider 1st century sewers known under the major streets of Ostia, such as the one under the Via della Foce or the *cardo maximus*.[833] Major sections of sewer lines are often roofed in the cappucina style, in which two obliquely leaning *bipedales* cover a rectangular channel. Many of these major lines are fed by smaller secondary sewer lines, which often have a flat roof made of a horizontal roof tile or single *bipedalis*. Together with drains from individual basins and downshafts directing different types of water toward the sewer, the city gains a hierarchy of drainage infrastructure. Several of these major and minor sewers were unknown before the current research project, but can now be identified with certainty. Insula III, i has the most number of drainage features, due in large part to the Trajanic phase of the Terme della Basilica Cristiana (III, i, 3). However, the number of drainage features is roughly equivalent in all of the insulae. As the city is at is maximum population, issues of local, neighbourhood, and urban drainage are crucial, especially given the city's low-lying position next to the sea and Tiber river.[834]

By comparing the hydraulic systems of all three insulae against each other, it is evident that insulae III, i and IV, ii are more similar to each other than compared with insula V, ii in certain aspects (Figure 6.306). This is most clear in the Rain Water category, which in insula V, ii is much higher than in insula IV, ii, and this category is not present at all in insula III, i. Equally, insulae III, i and IV, ii have similar quantities and proportions of water features. Condensing the infrastructure data from Fig. 6.9 brings the relationship between all three insulae into better relief (Figure 6.307). Insula V, ii has the highest overall number of water features (n=72), and there is a close correlation between III, i and IV, ii in how many water features are present in this period. But amongst all three insulae there is a similar trend of system hierarchy: all insulae have less Usage features than Supply features, and all have many more Drainage features than Supply or Usage. So while the insulae differ in their specific number and composition of water features, they all present a similar relationship between different parts of the hydraulic system. The creation of these drainage features indicates that all parts of the hydraulic system were valued and that while not as visually appealing as marble-clad fountains and pools, were vital to the successful habitation of a city.[835] Despite being invisible for the most part, these Drainage features are an important part of the entire functioning of the system.

[833] For the sewer under the Via della Foce see Chapter 3 (III, i, 14, feature 73); for the sewer under the *cardo maximus* see Chapter 4 (IV, ii, 1, feature 114).

[834] Meiggs 1973, 78 estimates 50,000 inhabitants at the death of Antoninus Pius.

[835] Pliny the Elder (XXXVI, 24, 104-106) is rightly amazed at the sewer systems of Rome, calling it a hanging city (*urbe pensilis*) since it is underpinned by the network of drains and sewers.

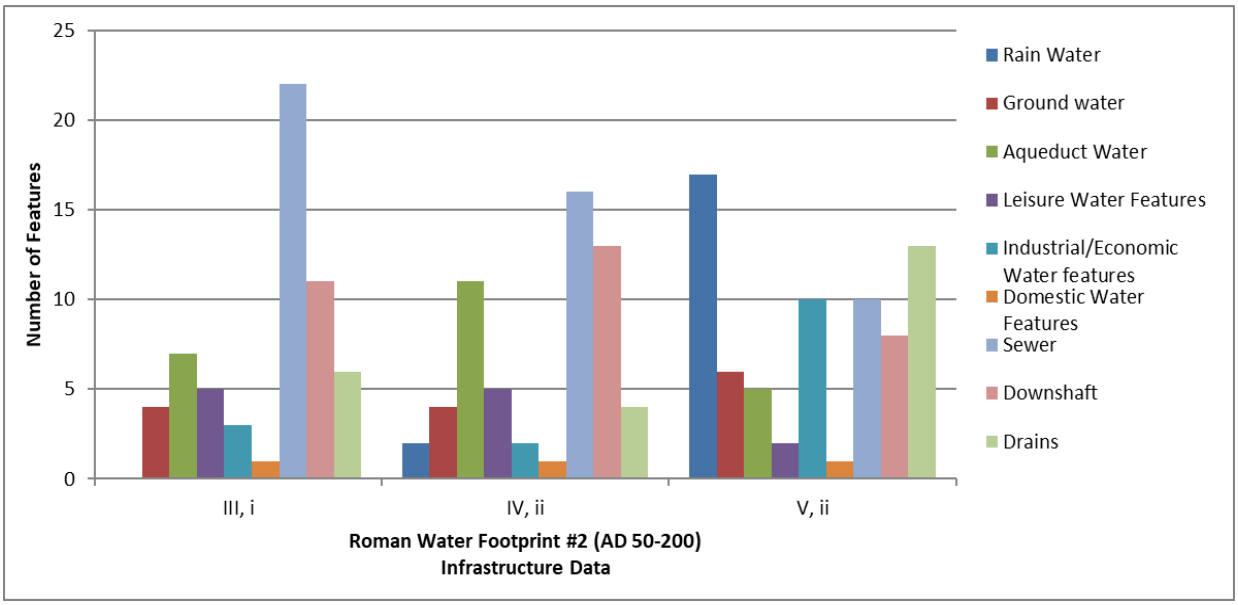


Figure 6.306: Combined Infrastructure data comparing insulae III, i, IV, ii, and V, ii in Roman Water Footprint #2 (AD 50-200).

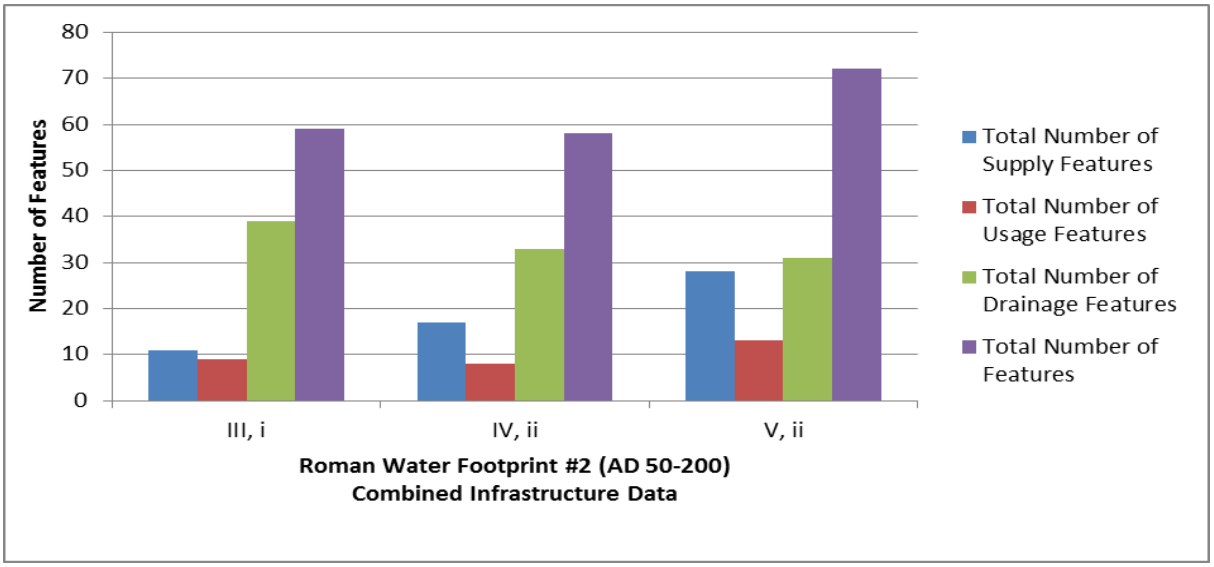


Figure 6.307: Combined Infrastructure data for insulae III, i, IV, ii, and V, ii in Roman Water Footprint #2 (AD 50-200).

When the system's resilience in this period is graphed, the diversity of the system reaches values that will be maintained throughout the subsequent Roman Water Footprint phases #3 and #4 (Figure 6.308). In all three categories of Infrastructure (Supply, Usage, Drainage), the system reaches its maximum level of diversity; only insula III, i does not reach maximum system diversity as it does not possess rain water collection systems. This means that in all three categories, the systems are highly diversified. In terms of infrastructure, this means that all of the *insulae* are relying on a mix of systems at all levels of hydraulic system, and can flexibly react to seasonal variations, or those caused by maintenance concerns. This diversity of supply, usage, and drainage in the three insulae accords well with the wider historical narrative of Ostia in the first and second centuries: a busy and growing city with a mixture of hydraulic activities and needs.

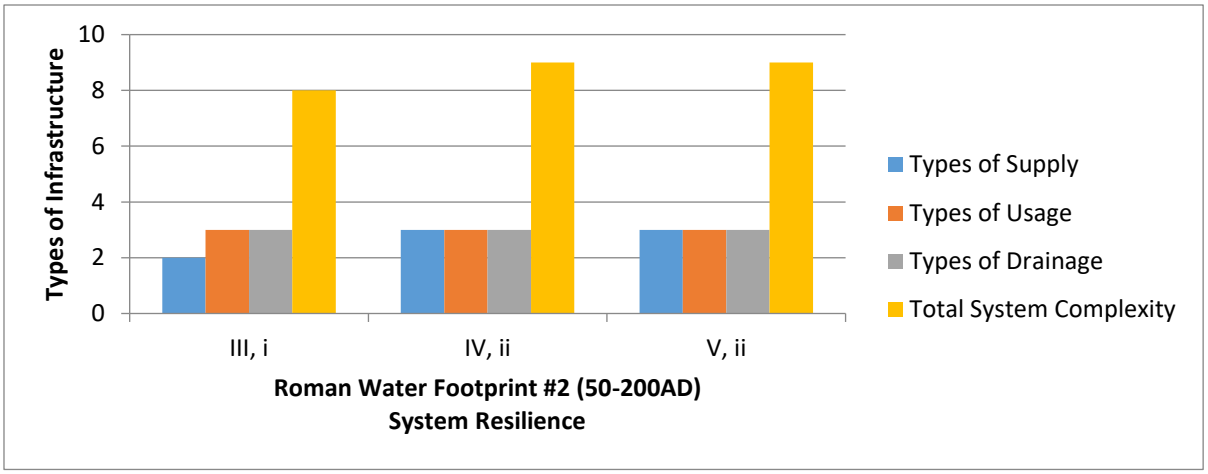


Figure 6.308: System Resilience for insulae III, i, IV, ii, and V, ii in Roman Water Footprint #2 (AD 50-200).

The relationship between the insulae and the city changes when examining the presence of water in publicly and privately oriented spaces (Fig. 6.309). Ostia's wider trend has more private than public water features in this period, similar to the preceding period. Only insula III, i has more public than private water features, with the opposite trend in the other two insulae. This is a result of insula III, i having many more tabernae and entire buildings dedicated to public usage.

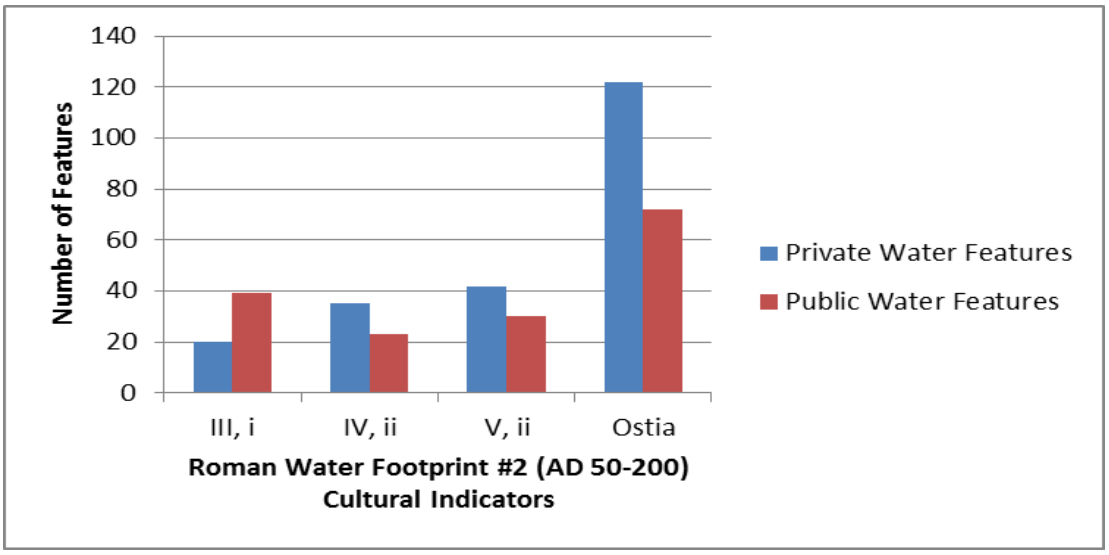


Figure 6.309: Cultural Indicators of insulae III, i, IV, ii, and V, ii in Roman Water Footprint #2 (AD 50-200).

Environmentally speaking, there are fewer floods in this period than previously, with only six recorded flood events.[836] The widespread raising of many parts of the city in the 2nd century, must have reduced the impact, or at least the reach of flood waters. Yet, the insertion of sewer lines under many more streets and within nearly every building implies a host of post-flooding problems in almost all parts of the city, such as blockage by flood debris.[837] This is the boom period in Ostia's urban history, and even a relatively minor flood of 1 or 2 meters would have had a visible impact on the city's functioning. The presence of several internal garbage dumps across the city in this period would have increased the negative health impact of any floods.[838] This period also witnessed the maximum number of functioning bath buildings, with 21 known operational baths. Well-distributed across the city, the number and

[836] Aldrete 2007, 142-143 for floods recorded in this time period in Rome.
[837] Aldrete 2007, 144-158 elaborates on the delayed effects of floods, such as the rapid spread of disease and parasites resulting from standing water full of sewage waste, street garbage, and polluted upstream water.
[838] MacKinnon 2014, 189-192 for the faunal evidence from Ostia.

diversity of these baths made them available to the entire population of Ostia. Although the city's role as a harbour for Rome began to change with the creation and development of Portus, Ostia still remained a multicultural city, with people and goods arriving from across the Roman Empire. Given these factors, the waters of the bath buildings would have acted as excellent vectors for the transmission of a variety of water-borne diseases. While there are certainly many other ways for this to happen, the role of baths in this process cannot be overstated.

6.3: Roman Water Footprint #3 (AD 200-300) in insulae III, i; IV, ii; V, ii

The 3rd century continued to witness a great deal of hydraulic activity in the three case studies and in the wider city (Tab. 6.66). This change is largely a result of the doubling of aqueduct features in III, i and IV, ii (Figure 6.310), certainly reflecting the creation of a new aqueduct line in the Severan period. Insula IV, ii has the highest number of supply features in this period (34 features), as a result of the overhaul of the Terme del Faro (IV, ii, 1), and the cistern built in IV, ii, 5. As in the previous period, lead pipes with the same name were found in IV, ii and in V, ii, perhaps attesting to a favourite pipe maker (*plumbarius*) in this southern neighborhood of the city.[839] The number of supply features drops sharply in V, ii (from 28 to 13 features), but, as described in Chapter 5.2, this is a result of the inability to date the chronological duration of the rainwater supply systems. The presence of functioning ground water continues, although the overall number decreases slightly in comparison with the previous period.

Roman Water Footprint # 3 (AD 200-300)					
Indicator	Sub-Indicator	Data	III, i	IV, ii	V, ii
Infrastructure	Supply Systems	Rain Water	0	3	2
		Ground Water	2	4	5
		Aqueduct	14	27	6
		Total # of Supply Features	16	34	13
	Usage Systems	Number of Leisure Water Features	8	15	10
		Number of Industrial/Economic Water Features	10	5	3
		Number of Domestic Water Features	4	1	7
		Total # of Usage Features	22	21	20
	Drainage Systems	Sewer	26	25	30
		Downshaft	12	10	13
		Drains	13	17	24
		Total # of Drainage Features	51	52	67
	System Resilience	Number of Types of Supply	2	3	3
		Number of Types of Usage	3	3	3
		Number of Types of Drainage	3	3	3
		Total System Complexity	8	9	9
		Total # of Features	89	107	100
Culture	Private Oriented-insula	Total # of Features	20	46	58
	Public Oriented-insula	Total # of Features	69	61	42
	Private Oriented-Ostia	Total # of Features	101	101	101
	Public Oriented-Ostia	Total # of Features	49	49	49
Nature	External	Tiber River Floods	2	2	2
	Internal	Urban Garbage	4	4	4
		Urban Health (# of Baths)	16	16	16

Table 6.66: Roman Water Footprint # 3 in insulae III, i, IV, ii, V, ii.

[839] See for detailed information on these pipes, Chapter 4: IV, ii, 1 (feature 78); Chapter 5: V, ii, 3 (feature 190).

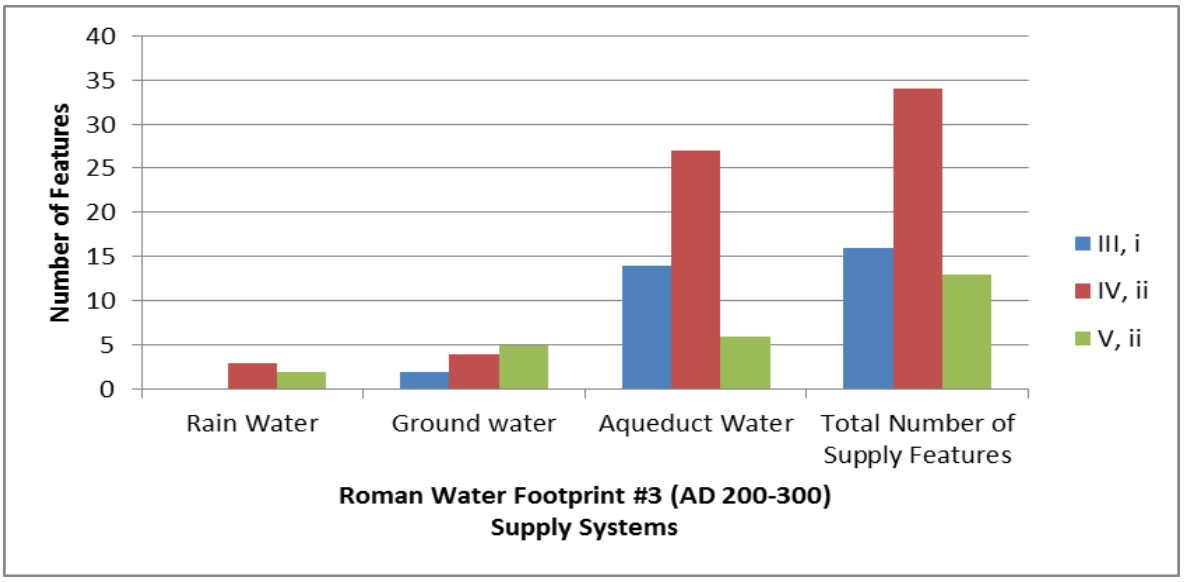


Figure 6.310: Supply systems of insulae III, i, IV, ii, and V, ii in Roman Water Footprint #3 (AD 200-300).

Usage increases across all the insulae, with more than double the values in III, i and IV, ii when compared to Roman Water Footprint #2 (AD 50-200) (Figure 6.311).[840] Insula V, ii also shows growth in the number of usage features, but in leisure and domestic water features, connected with the AD 250 building phase of the Domus del Protiro (V, ii, 4-5) and the Terme del Filosofo (V, ii, 6-7). In this period, insula III, i leads in the number of Economic/Industrial features, as well as in the total number of Usage features.[841]

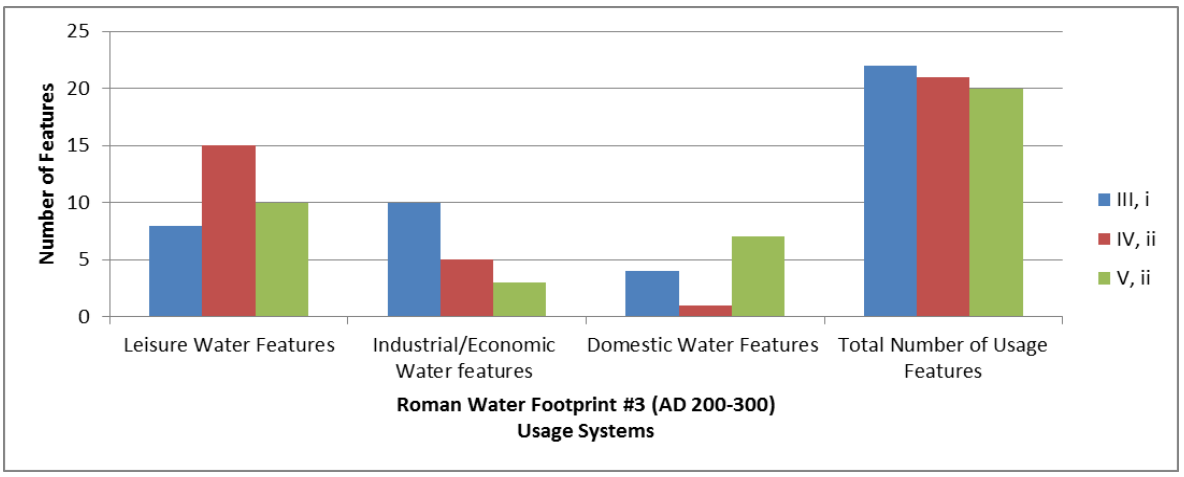


Figure 6.311: Usage systems of insulae III, i, IV, ii, and V, ii in Roman Water Footprint #3 (AD 200-300).

All types of drainage increase in this period in every insula (Fig. 6. 312). This is partially a result of the widespread rise in urban ground levels in Ostia. Networks of sewer systems were created *ex novo* in IV, ii and V, ii in connection with the Severan rebuilding of the Terme del Faro (IV, ii, 1) and the Terme del Filosofo (V, ii, 6-7).[842]

Fewer sewer lines were created in III, i, but the number of sewer lines is roughly the same in all insulae. While the total length of these systems is no longer present, supporting evidence for these "floating sewers" is found in many parts of the insulae or wider city.[843] Support for the higher ground level comes from the height of the bonding course in brick support piers or walls, and in thresholds that now lie ca.

[840] In insula III, i, there is an increase from 9 to 22 features, and in insula IV, ii from 8 to 12 Usage features.
[841] This is mainly represented by the creation of large, often double-chambered basins.
[842] See Chapter 4.2, Roman Water Footprint #3 for IV, ii, and Chapter 5.2, RWF #3 for V, ii.
[843] See Chapter 4.2 for these "floating sewers" in insula IV, ii, and Chapter 5.1 for their presence in insula V, ii.

40 cm above the current ground level.[844] The insertion of several new downshafts in all of the insulae may appear innocuous enough, but they give an early indication of wider changes to come in the subsequent Late Antique period.

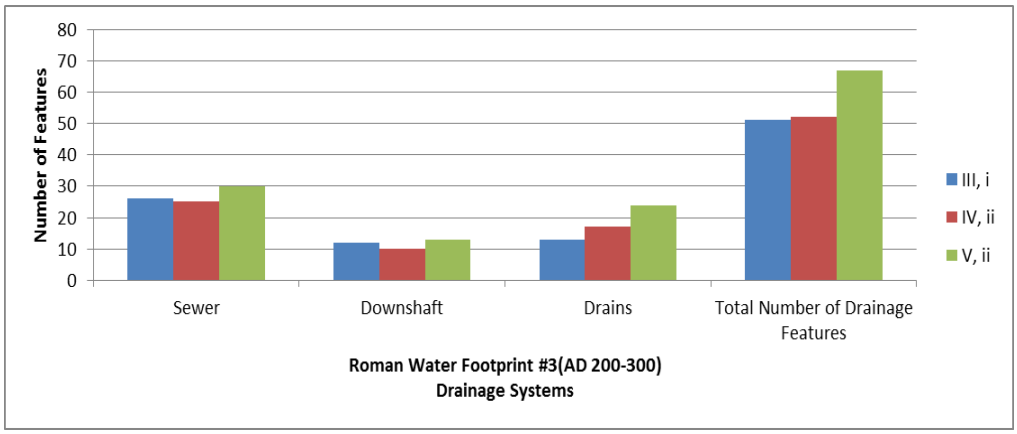


Figure 6.312: Drainage systems of insulae III, i, IV, ii, and V, ii in Roman Water Footprint #3 (AD 200-300).

New downshafts mean that upper floors are being reconfigured in new ways to drain waste from upper floors, suggesting an increased subdividision of upper floor space into smaller apartments. The evidence for this phenomenon is much more present in the subsequent Roman Water Footprint phase (#4), and will be explored in greater detail in the following section. Looking at the complete hydraulic infrastructure of each insula in this period (Roman Water Footprint #3), they each have a unique combination of different elements (Figure 6.313). Whereas insula III, i and IV, ii had similar hydraulic profiles in RWF #2 (AD 50-200), and V, ii was the outlier, now all three differ in the number and type of water features present. The only element they do share is in the number and distribution of Drainage elements: in all three insulae, the proportional number of Sewers, Downshafts, and Drains is similar. As the other parts of the hydraulic system in each insula is widely different, this suggests that the same type of Drainage system can handle a diversity of activities.

When aggregating this data into the larger infrastructure categories of Supply, Usage, and Drainage, a similar trend emerges as from the previous Roman Water Footprint #2 period (AD 50-200) (Figure 6.314). There is the same proportional increase of number of features in different parts of the system: fewest supply, then more usage, then most drainage. Only IV, ii doesn't follow this trend, which may be a result of the supply features in its bath building (Terme del Faro: IV, ii, 1). The total number of water features increases in all of the investigated insulae, with 107 more features than in the previous period.[845] Roman Water Footprint #3 contains the maximum number of water features in insula III, i (89 features), and in IV, ii (107 features). The insulae maintain their degree of system complexity from the previous RWF #3 period (Figure 6.315). At first glance, this would suggest that nothing has changed from the previous period, however, this graph should be taken together with the other ones in this Roman Water Footprint #3 section. It is then possible to see that although the number of types of each class of infrastructure remained stable, there were clear changes to the number of water features in each category of infrastructure. The spatial distribution of the water features is an important point to raise here, since this micro-scale (i.e. single building) issue is not reflected in these aggregated graphs. Within every insula, although the quantitative number of water features increases, the distribution of these water features becomes concentrated and localized in individual buildings, or several buildings. This trend continues into the subsequent Late Antique period, but begins in the early 3rd century.

[844] Gering 2013, 258 gives numerous examples of this phenomenon in 3rd century Ostia.
[845] Total number of water features in all three *insulae*: 189 in Roman Water Footprint #2, and 296 in Roman Water Footprint #3.

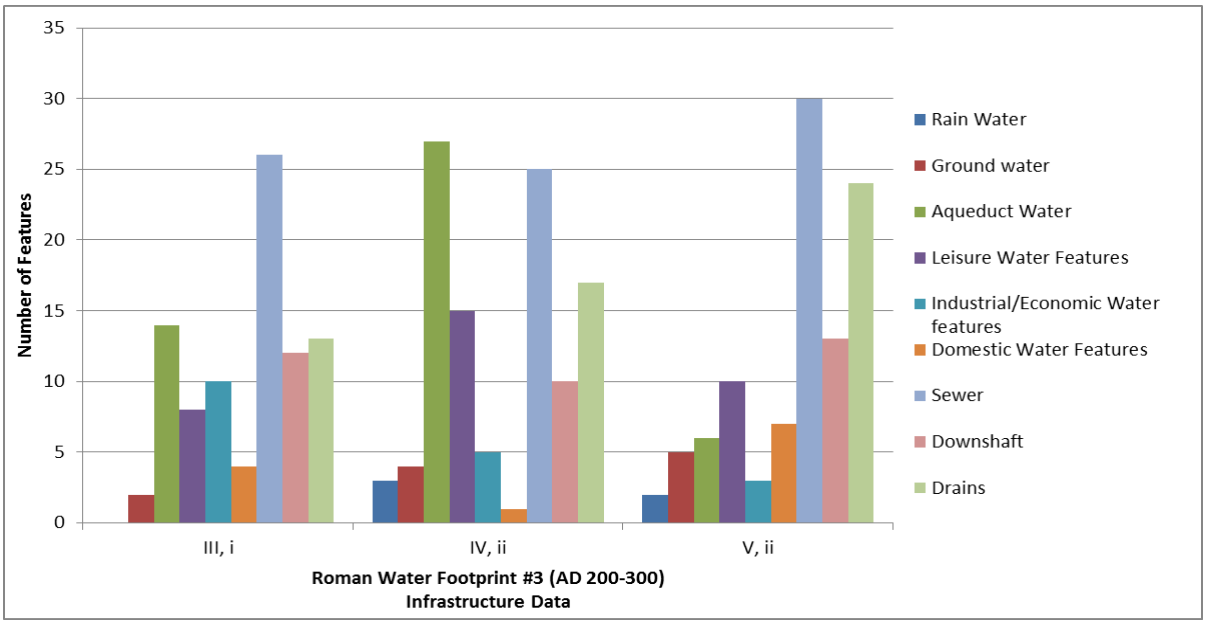


Figure 6.313: Combined Infrastructure data comparing insulae III, i, IV, ii, and V, ii in Roman Water Footprint #3 (AD 200-300).

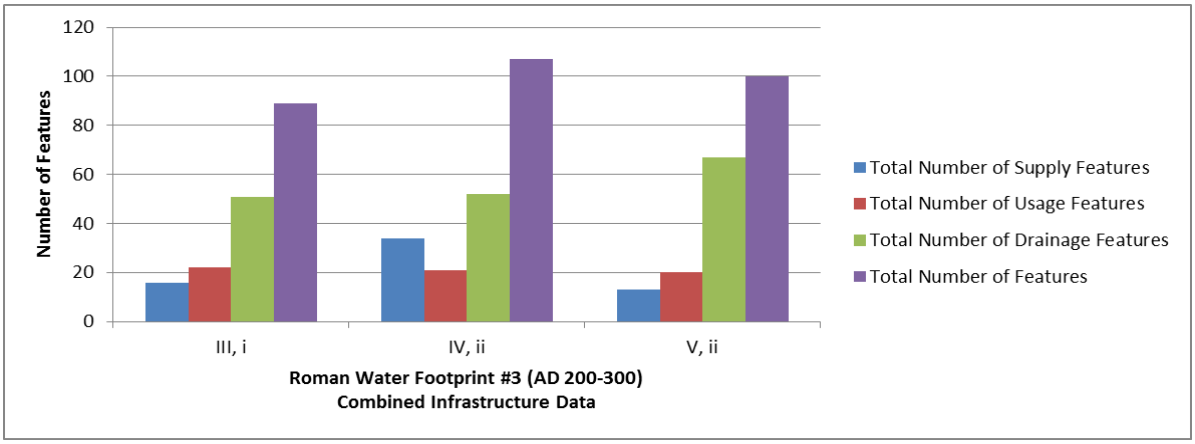


Figure 6.314: Combined Infrastructure data for insulae III,i, IV, ii, and V, ii in Roman Water Footprint #3 (AD 200-300).

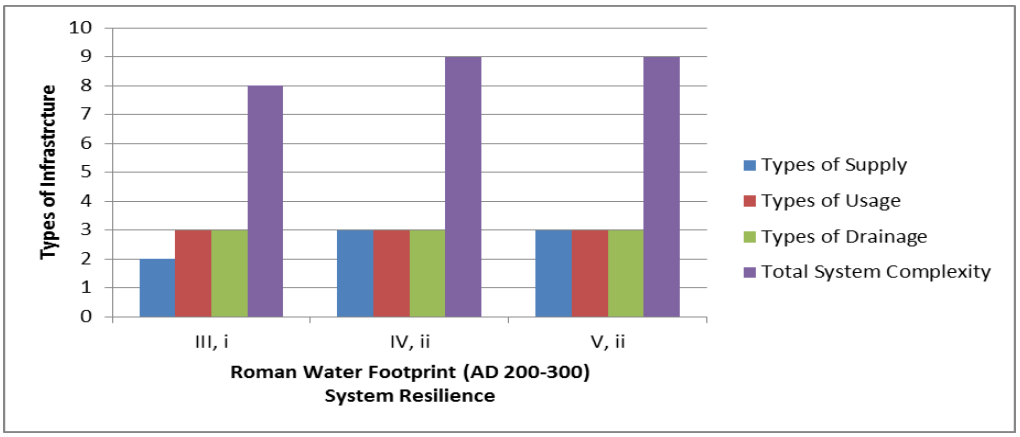


Figure 6.315: System Resilience of insulae III, i, IV, ii, and V, ii in Roman Water Footprint #3 (AD 200-300).

The number and relationship between publicly and privately oriented water features continues to change in this period. In Ostia, the wider trend shows double the number of private features compared to public ones (Figure 6.316). On an insula level, all three insulae reach their maximum values of private and public water features in this period. Insula III, i continues its previous trend of having more public than private features, but insula IV, ii flips its previous ratio, to also have more public than private features. Insula V, ii maintains its previous division, with more private than public.

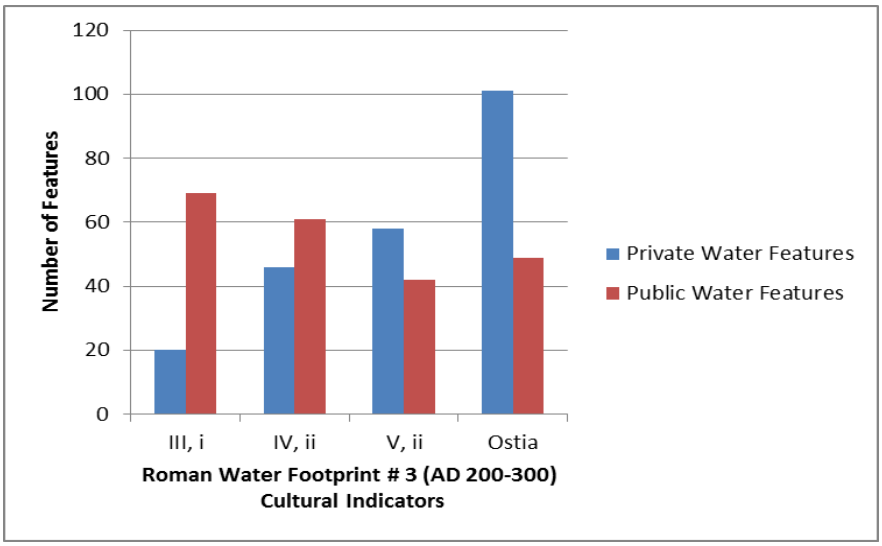


Figure 6.316: Cultural Indicators of insulae III, i, IV, ii, and V, ii in Roman Water Footprint #3 (AD 200-300).

The wider landscape of the city was changing in dynamic ways in the 3rd century, caused by a combination of uneven abandonment, a possible earthquake, and conscious levelling projects. Although this period experienced the fewest number of floods in the city's history, with only two recorded flood events, it also contains the highest amount of preserved osteological material.[846] This material comes from various points across the city and is primarily related to urban garbage dumps or larger ground-levelling projects. The osteological evidence fits well with the picture produced by the changing distribution of water features throughout all the insulae. The 3rd century is a turbulent time, but one of growth when many buildings take advantage of abandoned or destroyed property to expand or be completely rebuilt. The increase in water features in every insula in this period does not necessarily imply increased prosperity, rather that many *ex novo* systems were required, both in terms of supply and drainage. So, this suggests that earlier (e.g. Trajanic sewers) systems were not continuing to work, and while some buildings in each insula were renovated, others took advantage of derelict or collapsed properties to create new structures, such as the buildings along the east side of insula V, ii.[847] The 16 functioning bath buildings in this time period attest to their continued cultural importance, although the general decrease in the size of the bath buildings and basins reflects changing cultural attitudes of bathing. If the city has its maximum number of abandoned buildings and internal garbage piles, and the majority of the bath basins are small, then any person heading to the baths has likely come into contact with the maximum amount of urban waste. Taken together, this suggests that the 3rd century, especially the later part of it, would have been the unhealthiest period in the life of the city, when it would have been the easiest to catch water-borne diseases.

[846] Aldrete 2007, 242-243 for flooding data; MacKinnon 2014, 192-194 for faunal analyses.
[847] Buildings V, ii, 9-13; Gering 2013 suggested that 3rd century Ostia would be much more ruinous than Late Antique Ostia.

6.4: Roman Water Footprint 4 (AD 300-600) in insulae III, i; IV, ii; V, ii

The final several centuries of the city's life continued to offer a great diversity in hydraulic infrastructure, which reflects the wider changing dynamic of Ostia (Table 6.67).

Roman Water Footprint # 4 (AD 300-600)					
Indicator	Sub-Indicator	Data	III, i	IV, ii	V, ii
Infrastructure	Supply Systems	Rain Water	0	2	2
		Ground Water	2	2	5
		Aqueduct	15	20	8
		Total # of Supply Features	17	24	15
	Usage Systems	Number of Leisure Water Features	9	12	9
		Number of Industrial/Economic Water Features	8	3	3
		Number of Domestic Water Features	6	2	13
		Total # of Usage Features	23	17	25
	Drainage Systems	Sewer	22	20	25
		Downshaft	14	7	11
		Drains	13	17	36
		Total # of Drainage Features	49	44	73
	System Resilience	Number of Types of Supply	2	3	3
		Number of Types of Usage	3	3	3
		Number of Types of Drainage	3	3	3
		Total System Complexity	8	9	9
		Total # of Features	89	85	113
Culture	Private Oriented-insula	Total # of Features	20	40	74
	Public Oriented-insula	Total # of Features	69	45	39
	Private Oriented-Ostia	Total # of Features	63	63	63
	Public Oriented-Ostia	Total # of Features	36	36	36
Nature	External	Tiber River Floods	6	6	6
	Internal	Urban Garbage	3	3	3
		Urban Health (# of Baths)	14	14	14

Table 6.67: Roman Water Footprint # 4 in insulae III, i, IV, ii, V, ii.

Wells continued to be incorporated into Late Antique building projects, suggesting their continued operation from the Republican or early Imperial period (Figure 6.317). Their conscious preservation may reflect some kind of hydraulic prestige, whereby it was valuable, or at least desirable, to possess a diversity of water supply types, and further, to juxtapose Republican wells with cutting-edge fashionable domestic nymphaea. All three insulae continue to use a mix of rain and ground water, although the number of these features decreases compared to the previous Roman Water Footprint period (#3: AD 200-300). The marble-clad nymphaea and associated fountains constructed in insulae III, i (Domus Tigriniani, III, i, 4), and insula V, ii (Domus della Fortuna Annonaria, V, ii, 8; Domus del Protiro, V, ii, 4) often receive the bulk of research attention, but hydraulically speaking, they do not entail the creation of substantially more aqueduct supply features.

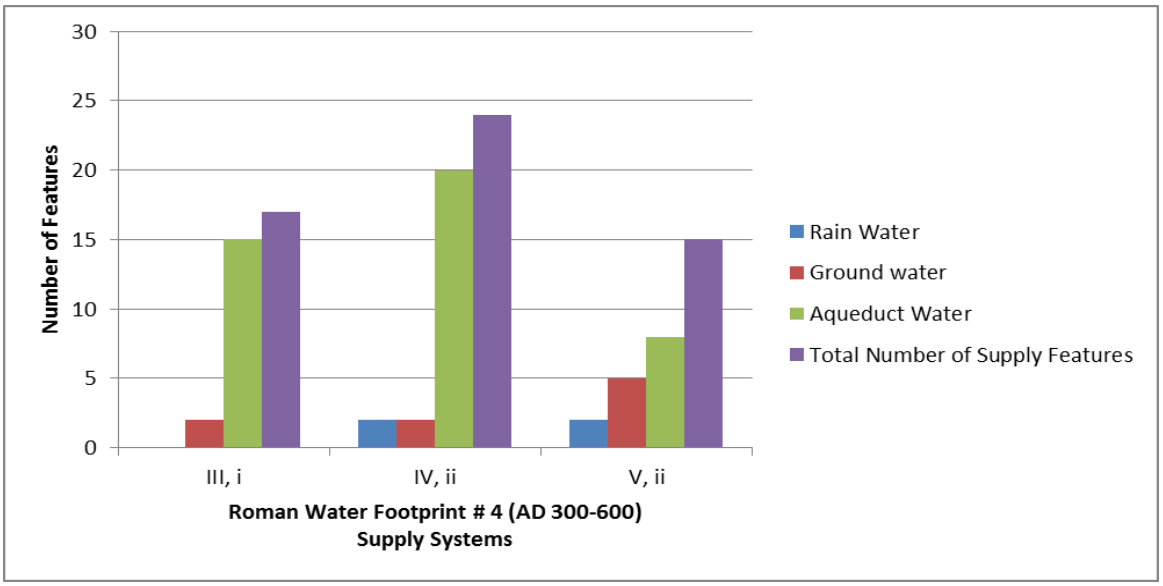


Figure 6.317: Supply systems of insulae III, i, IV, ii, and V, ii in Roman Water Footprint #4 (AD 300-600).

The aqueduct line continues to function into the 5th century, as indicated by a stamped *fistula* excavated near insula IV, ii.[848] Distribution of pressurized water is also known from the water tower identified in the Caseggiato dell'Ercole (IV, ii, 3).[849] The creation of a stand-alone pressure tower may also be a response to changing ground levels known across the city at this time, and the need to pressurize water to different places than before.

Water usage in this period differs between each of the three insulae (Figure 6.318). Insula III, i maintains its Industrial/Economic lead, but becomes more diversified with the insertion of several water features as part of the expansion of the Domus Tigriniani. While all the city blocks have different kinds of activities, in insula III, i, each of these activities have roughly the same number of Usage features.[850] The other two insulae favour other types of water usage: insula IV, ii has more Leisure features (in its bath building), and V, ii has more Domestic features (in V, ii, 6 and 8). The creation of Late Antique domus buildings in insulae III, i and V, ii are responsible for the majority of water features in this period. The drainage systems from the three insulae indicate that new hydraulic activities are occurring across the city (Figure 6.319). The higher ground level within the city blocks is known already from the Severan period, especially in insula IV, ii.[851]

However, by examining the sewer systems in and around insula V, ii, it also became clear that the ground level was higher than the current street level by ca. 50 cm.[852] Yet, there are also examples in all three insulae of Late Antique water features emptying into Trajanic or earlier sewer lines. Taken together, this suggests that the sewer system was not functioning to the same degree across all parts of the city.

[848] See Chapter 4.1, Terme del Faro (IV, ii, 1).
[849] See Chapter 4.1, Caseggiato e Portico dell'Ercole (IV, ii, 2-3) for this tower.
[850] Total usage features in III, i: 23 features; insula IV, ii: 17 features; insula V, ii: 25 features.
[851] SO 1, 162 already identified this during excavation: *"Lo scavo ha attestato estesi e spessi scarichi di cocciame, detriti di anfore, tegolozza su bari quartieri della città; e i pozzi molto tardi che rimangono…hanno l'imboccatura a un livello molto più alto del selciato del II secolo d. C., provando* ***un forte rialzamento stradale negli ultimi tempi****."* Emphasis added.
[852] See Chapter 5.1, Domus della Fortuna Annonaria (V, ii, 8), and Chapter 5.2, Roman Water Footprint #4 for supporting details; Gering 2013, 276 for similar kinds of drains exiting the Terme Piccole (I, xix, 5), well-above the current Via della Foce street level.

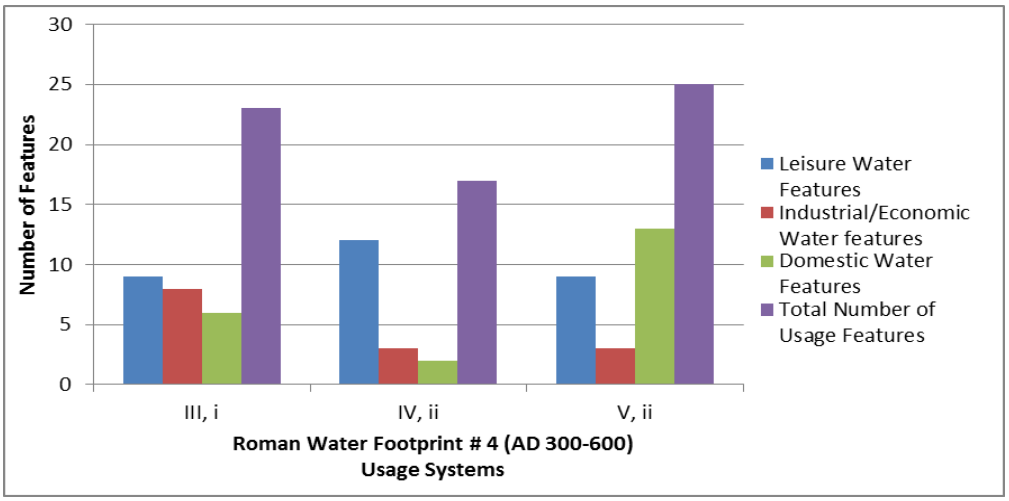


Figure 6.318: Usage systems of insulae III, i, IV, ii, and V, ii in Roman Water Footprint #4 (AD 300-600).

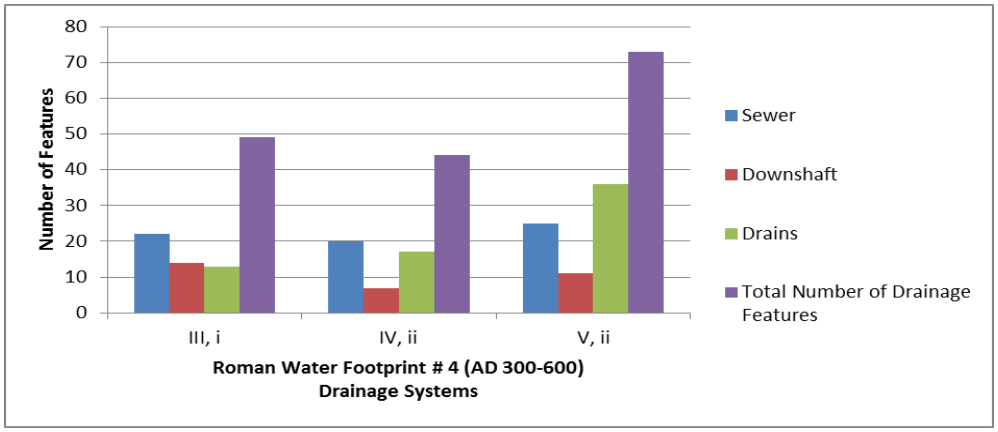


Figure 6.319:Drainage systems of insulae III, i, IV, ii, and V, ii in Roman Water Footprint #4 (AD 300-600).

Additionally, it means that in some parts of the city, there were superimposed sewer lines, with 3rd or 4th century sewer lines running above the Trajanic sewers known under the present street level of the city. The previous interpretation that the initial sewers in Ostia simply survived repeated ground-level raisings requires reinterpretation, as does our understanding of how these superimposed lines interacted with each other. These insula-specific sewer lines also indicate a degree of autonomy of each insula, or at least a kind of communal or neighbourhood discussion as to their placement, direction, and construction.[853] While these local sewer networks differ in each insula in their degree of interconnectivity, their presence indicates that drainage systems can provide new perspectives regarding urban social interaction, property ownership, and urban topography than has been fully appreciated.

Another example of individual actions reflecting wider changes comes from the downshafts in the three insulae studied.[854] As intimated in the previous section, the creation of downshafts on internal walls, either within hollow brick piers, or by simply covered in concrete in the corner of a room indicate a greater need for drainage on upper floors. As these downshafts are often of the circular kind, and placed within, rather than on the outside of buildings, they are here interpreted as belonging to domestic waste or upper floor toilets. While their contents can be debated, their presence cannot be, and their frequent connection with newly installed staircases indicates that there are more and smaller apartments being created on first or second floors. These downshafts may offer us a picture of Ostia with a class of people

[853] Stöger 2015 uses space syntax to identify possible neighborhoods in Ostia and also identified individual architectural choices that would have fostered neighborhoods.
[854] In III, i, 10, 14; IV, ii, 1; V, ii, 8, 13, 14.

that cannot afford to live in the large domus houses, but also cannot afford to rent out the larger apartments created in the past. This could suggest that there is a shrinking or absent middle class in Ostia, with only upper and lower class people inhabiting the city.

Taking this one step further, it could also mean that the upper class is not as wealthy as it used to be, and needed to create more apartments to maintain the same amount of rent. Whatever the case may be, these downshafts point to active choices being made regarding the removal of waste and water from buildings in Ostia in the Late Antique period. Other downshafts were resolutely blocked up in this period in the three insulae, suggesting that they were no longer needed. Perhaps the same issue is at work here as for the newly created downshafts, and that in some parts of the city blocks, there are no more tenants at all on upper floors, and as a result, they no longer require vertical drainage downshafts.[855] By comparing the total hydraulic systems of the three insulae, some more specific trends can be drawn out (Figure 6.320). Generally speaking, the systems of three insulae are increasingly different from each other, which results from the stronger role of the wealthy domus houses, especially in insula III, i and V, ii. This continues the trend from the previous period (RWF #3: AD 200-300), in which the domus house controls more area of the city block, and receives much more hydraulic attention than other buildings. Aqueduct supply features and sewer features are at high levels in this period, with the highest number of drains (36 features) known in insula V, ii. This is more than the combined number of drains in the other two insulae, and is connected to the increased number of water features created in the two large domus houses in this insula. When the Infrastructure data is distilled, the role of the domus houses becomes clear (Figure 6.321). With the creation of the elaborate domestic water features, the hydraulic system still maintains its hierarchy of features, with an increasing number of supply, usage, and drainage features, as in III, i and V, ii. No such single elaborate building is present in insula IV, ii, and it maintains its hydraulic diversity. In quantitative terms, only in this period does insula V, ii reach its maximum number of water features (113 features).

The degree of system resilience remains at the same level as the preceding period for all three insulae (Figure 6.322). This means that the system is complex, diversified, and flexible in all aspects. While the hydraulic systems are increasingly localized in fewer buildings in each insula, these continue to sustain themselves in a diversity of ways, especially in the domus buildings in insula V, ii (Domus del Protiro, Domus della Fortuna Annonaria). In terms of water in public and private spaces, each insula presents this relationship in a different way (Figure 6.323). The distribution between water in public and private spaces in insula V, ii mirrors the wider trend at Ostia, reflecting the boom of Late Antique luxury houses built across the city in this period. However, the other two insulae run directly opposite to this trend, especially insula III, i, which continues to display its resolutely outward facing public personality. While the respective values remain the same in this insula as in the previous RWF #3 period (20 private and 69 public water features), this continuity itself is the important point: despite its luxury domus, the rest of the city block continues to maintain its publicly oriented buildings, like the row of tabernae along the Via della Foce.[856] Much of the private investment comes from the creation of the private sewer and drainage systems outlined above in Figure 6.319.

[855] Downshafts blocked up in III, i, 4; IV, ii, 4; and V, ii, 4-5.

[856] See
Figure 6.316 above for the Public-Private Water Usage in Roman Water Footprint #3; see Chapter 3.2 for detailed information on the role of tabernae in insula III, i, 4.

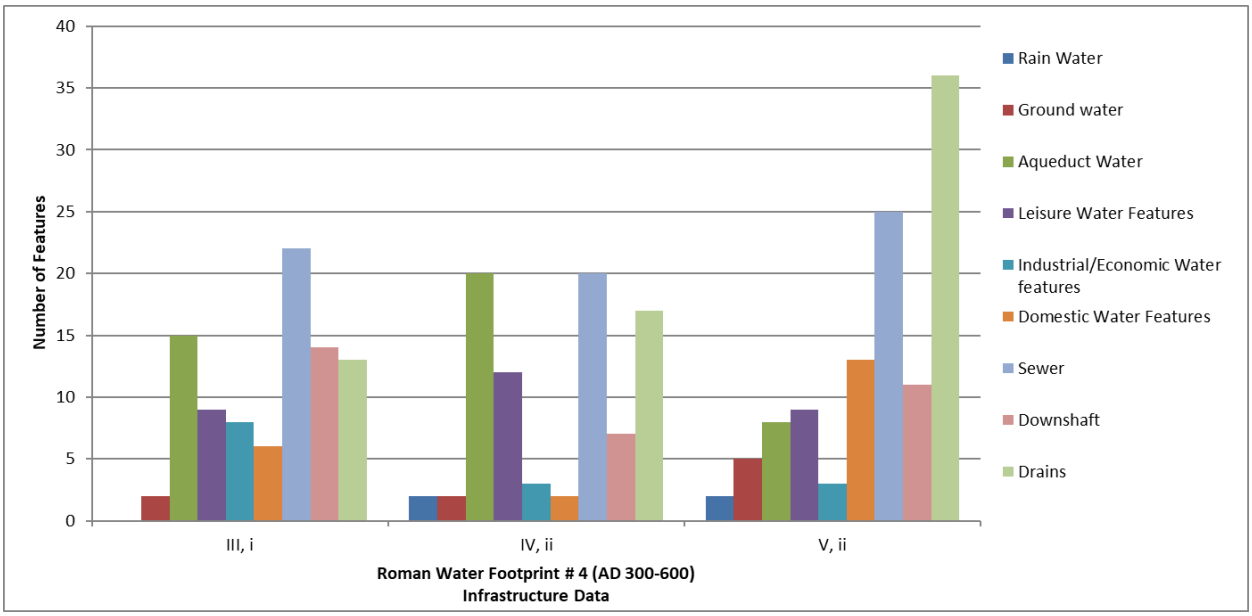


Figure 6.320: Infrastructure data comparing insulae III, i, IV, ii, and V, ii in Roman Water Footprint #4 (AD 300-600).

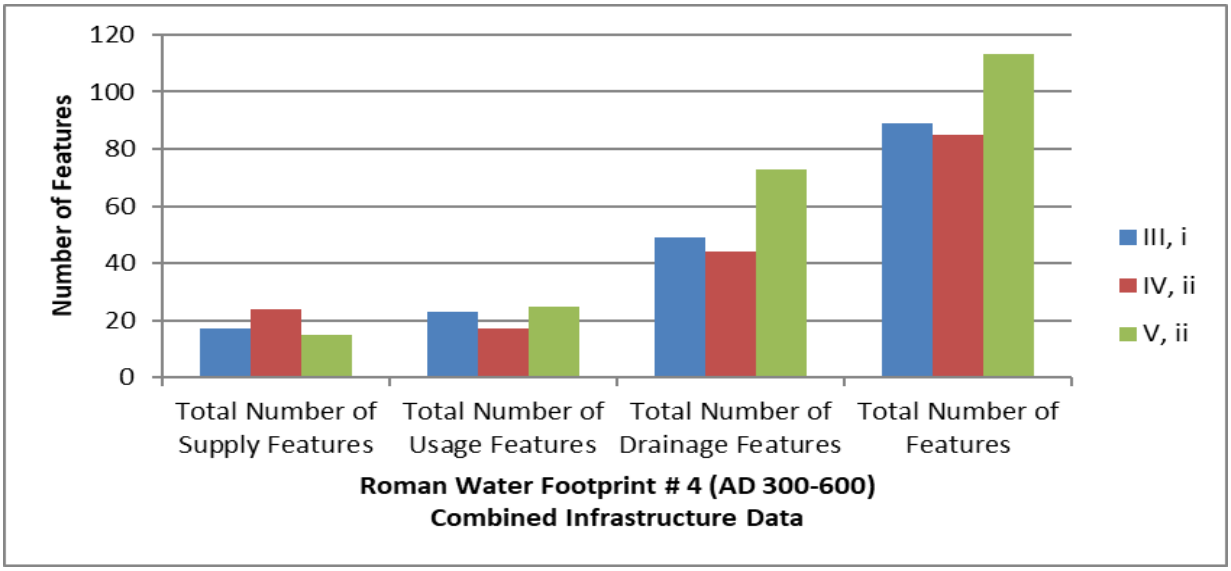


Figure 6.321: Combined Infrastructure data for insulae III, i, IV, ii, and V, ii in Roman Water Footprint #4 (AD 300-600).

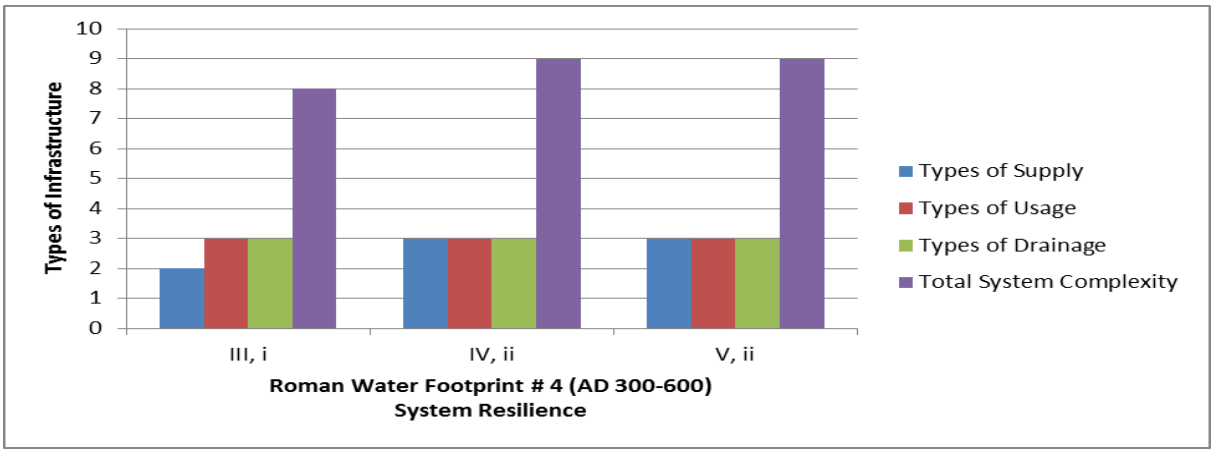


Figure 6.322: System Resilience of insulae III, i, IV, ii, and V, ii in Roman Water Footprint #4 (AD 300-600).

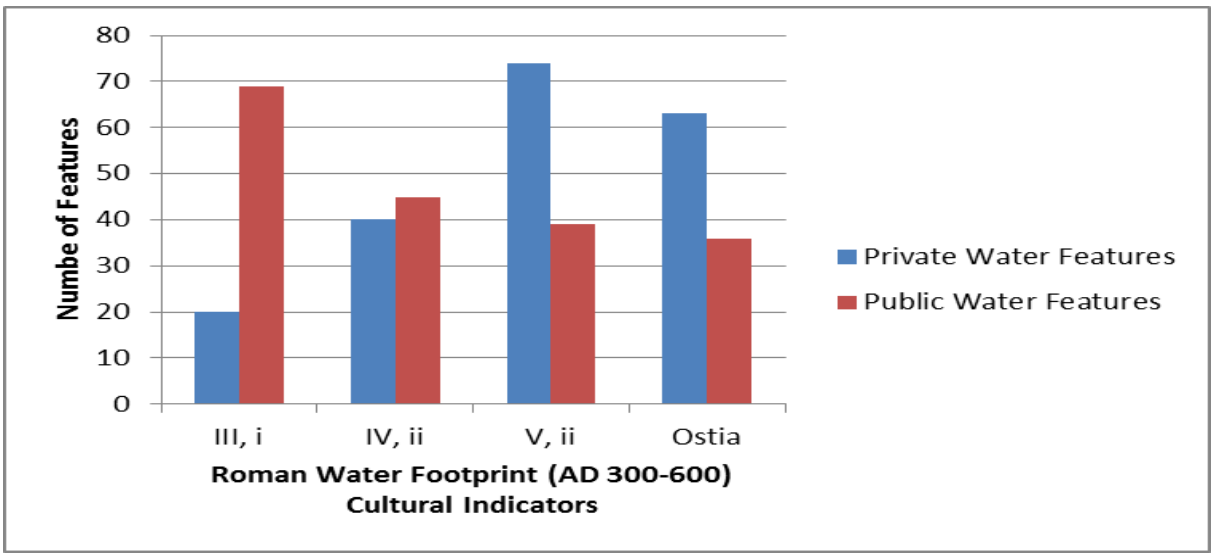


Figure 6.323: Cultural Indicators of insulae III, i, IV, ii, and V, ii in Roman Water Footprint #4 (AD 300-600).

During these Late Antique centuries six recorded floods occurred.[857] This is the same number as occurred during the Roman Water Footprint #2 period (AD 50-200), but the impact on the city must have been reduced given the rise in street levels that had occurred since the 1st century AD. Although the magnitude of these (or any) floods in Ostia remains a question for further research, the impact of rising flood waters on sewer systems is well attested in Rome. Perhaps it was one or several of these floods that caused the destruction and blockage of earlier sewer systems, forcing the residents of the city to create their own.

Changes to the wider urban fabric were evident also in the design of bath buildings in this period. While 14 thermal complexes are known to be functioning, at least in the early part of this period, communal bathing continued into the 5th century, and perhaps in some rare cases continued after the collapse of the aqueduct in the 6th century. Several bath buildings had relied on norias or water wheels to supplement or even completely supply them with water already for centuries.[858] Bath buildings, just like what can be gleaned from upper floor apartments, also experienced more subdividing, with smaller hot

[857] Aldrete 2007, 243 for the flooding evidence in the 4th-7th centuries.
[858] Such as the Terme del Mitra (I, xvii, 2) and the Terme dei Cisiarii (II, ii, 3).

and cold basins created. An example of this comes from insula V, ii, where one of the hot pools in the Terme del Filosofo (V, ii, 6-7) was completely blocked up and removed in this Late Antique phase.[859]

Hydraulically speaking, it was not the collapse of the aqueduct line that "caused" the abandonment or reduction of population in Ostia. Early Imperial wells and rain water systems continued to be used, and new wells were even dug into the formerly-busy *decumanus* and Semita dei Cippi. While there is certainly much more to explore regarding the Late Antique landscape of Ostia, the other aspects of the city's decay must be equally borne in mind. Larger socio-political forces made the city less desirable a place to live in the 5th and 6th centuries, and its increasing move towards privately owned buildings could not maintain its urban functioning.

[859] See Chapter 5.1 for the Terme del Filosofo more detailed history.

6.5 Total Hydraulic Histories of insulae III, i; IV, ii; V, ii

The following charts outline the major hydraulic trends in all three of the insulae studied in this work (Figure 6.324, Figure 6.325, Figure 6.326).

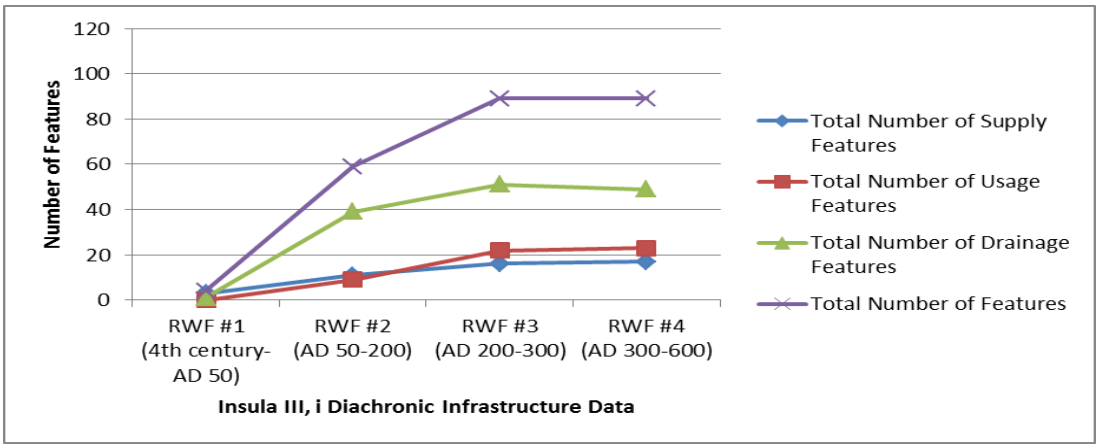


Figure 6.324: Combined infrastructure data for the entire history of insula III, i.

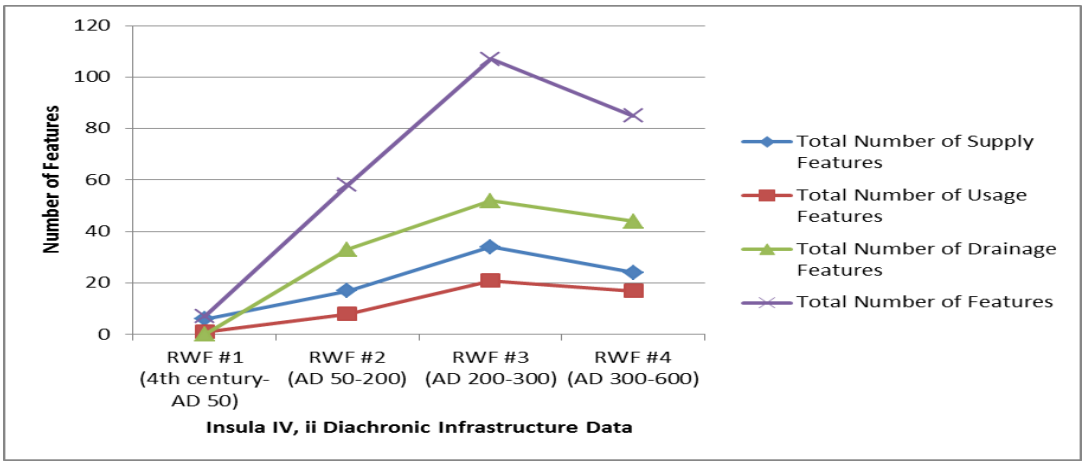


Figure 6.325: Combined infrastructure data for the entire history of insula IV, ii.

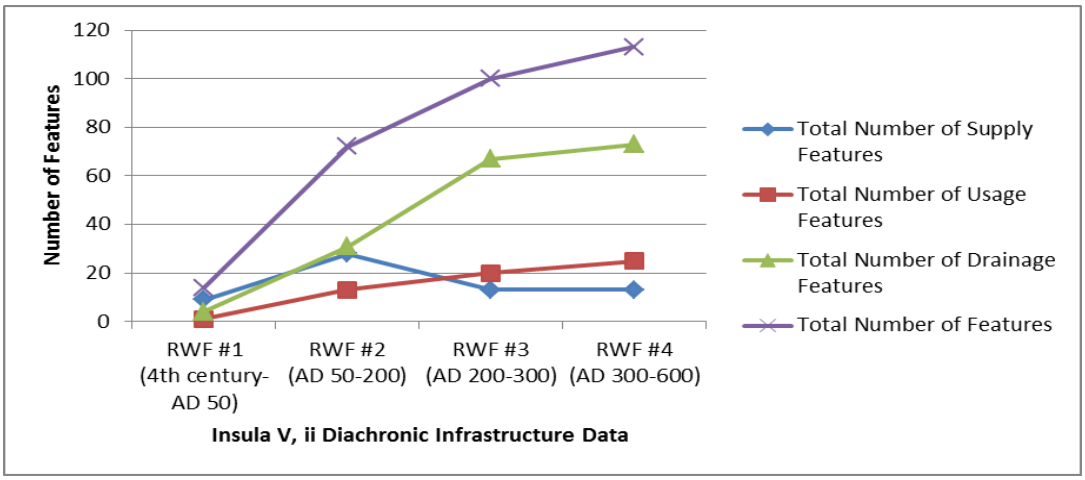


Figure 6.326: Combined infrastructure data for the entire history of insula V, ii.

By placing all three hydraulic biographies of the insulae next to each other, larger similarities and differences can be identified. The metaphor of a biography may be useful here: three children growing up in the same household will have much in common, but many crucial and intrinsic differences will distinguish them from each other. Right from the beginning (RWF #1: 4th century B.C.-AD 50), the blocks have different characters, especially in terms of what types of water supply resources they utilize. This is a direct reaction to the type of buildings created in each insula in the formative Republican and early Imperial period. Some of the city blocks maintain this diversity and self-sustainability throughout the rest of their existence (e.g. IV, ii, and V, ii), while others never choose to take advantage of other types of hydraulic systems (III, i). Just like a young child, the initial stage of Ostia's life is the one most replete with hydraulic incidents, namely with the highest number of flooding throughout its history. The repeated interaction with flood waters caused many sewer lines to be created across the city. Lacking the topography of Rome, these sewer lines directed drainage water in all directions away from the city centre: into the river harbor, out to the Mediterranean, and under an eastern city gate.[860] Perhaps this multi-directionality of drainage systems assisted flood waters to drain out in all possible directions of the otherwise flat and bumpy topography of Ostia. The city could then be seen to have discrete "catchment-basins" like rivers in a landscape, with different neighborhoods or city blocks channelling their waste water out in different directions.[861]

In all three city blocks the creation of the aqueduct lines in Roman Water Footprint #2 (AD 50-200) offered a wealth of hydraulic opportunities, and there is a clear growth in all aspects of the hydraulic system when compared to the previous period. This is the high Imperial period of Ostia, with massive urban investment especially during the Trajanic and Hadrianic periods. This is the city we are most familiar with, with a declining harbour function, but much prosperity as a result of Ostia's relationship with Portus. In all of the insulae, but especially insula IV, ii, the structural layout of the buildings in this period provided a framework to later development.

However, it is the transition from the Roman Water Footprint period #2 to #3 (AD 200-300) that appears to be much more hydraulically significant. Like teenagers developing into adults, the three city blocks continue to grow and develop while maintaining some deep structural similarities. The available hydraulic evidence supports the contention that the Severans, and more widely, 3rd century hydraulic systems, left a dramatic impression on Ostia. In all three insulae there is the structural relationship already elucidated in the previous sections, that of hydraulic hierarchies. The number of water features increases like a pyramid, with supply features at the top with the fewest number of features, then increasing to have more features dealing with the usage of the gathered waters. At the bottom of the pyramid comes the drainage features, most numerous. Only insula IV, ii goes against this model, but even then the number of supply and usage features is at no point dramatically divergent. While the top of this pyramid (Supply features), are most well studied, these rely heavily on the subsequent levels of hydraulic systems, most importantly the drainage systems.

Taking the metaphor to its final stage, the final phase of hydraulic life in the insulae is far from linear. Ostia is a very different city than its 2nd century heyday; the surrounding variables are all so different that comparing the two becomes increasingly anachronistic. Each insula reacts differently to the change from Roman Water Footprint # 3 into # 4 (AD 300-600). Insula III, i stays largely stable, maintaining its 2nd century character. Although it does gain a prestigious domus, this merely maintains the hydraulic situation of the insula, rather than dramatically changing it. Insula IV, ii witnesses a slight decline into Roman Water Footprint #4 in all its hydraulic categories. Its bath building, with its Severan rebuilding, continues to be the main novelty of this insula, with numerous smaller patches added to the various buildings, but with no dramatic changes. Insula V, ii thrives in its old age with its major investment in

[860] Bukowiecki 2008 *et al.* 92 for a sewer exiting the city gate directly south of the Porta Romana *castellum*; David *et al.* 2013 for the sewer draining *"direttamente in mare"* from the Terme del Sileno (IV, ix, 7); Heinzelmann-Martin 2002, 8 for the sewer emptying into the river harbor.

[861] Poehler 2012 modeled this idea for Pompeii, but in terms of rainwater drainage on the city streets.

250 AD bearing rich fruit in its later years. The creation of two luxury domus buildings and a bath building in the previous period allow this mercurial city block to continually invest in itself into its later years, when it gains its highest number of total water features.

Chapter 7: Conclusion

Through a combination of systematic survey, archival research, and a reconsideration of existing research, this study traced the individual water histories of nearly 45 buildings in three city blocks of Ostia (III, i; IV, ii; V, ii) from the Republican to the Late Antique period. Aggregating this archaeological and hydraulic evidence at different chronological and spatial scales resulted in a holistic understanding of the hydraulic infrastructure of each building, but more importantly, it explored how neighboring buildings worked together or in isolation from each other. Through an extensive review of existing literature, this study presented an updated *status quaestionis* about many different aspects of water in Ostia, building upon the work of previous scholars. This study carried out extensive and systematic fieldwork within the three insulae selected, recording the current state of each building, as well as identifying a great number of unpublished water features. In total, nearly 450 water features were identified by this study. Yet, an investigation into the photographic archives and the primary excavation notes provided the present study with a great deal of information regarding the hydraulic systems of the researched insulae. From these archival sources also emerged a greater appreciation for the impact earlier excavations had on the present state of Ostia's urban environment.

Regarding the urban hydraulic system of Ostia, one of the main outcomes of this study involves the chronology and distribution of the sewer system.[862] This has been especially true for the 3rd century and the Late Antique period, for which new evidence has been produced by the present study to attest to the modest yet vibrant hydraulic activity happening in the city. Especially from insulae IV, ii and V, ii, the evidence has allowed us to propose an initial chronology of Ostia's sewer system and how it adapted over time to increased ground levels and to accommodate greater capacities of waste. In insula IV, ii, this study identified how a diversified sewer network was created in the 3rd century that linked nearly every building in the insula together. For insula V, ii the identification of two superimposed contemporary sewer systems provides a new dimension to appreciating the technical limits of Roman construction. Such a double sewer system has not been identified elsewhere in the Greco-Roman world. By establishing the chronology and distribution of parts of Ostia's sewer network, this study has taken some initial steps toward understanding how the city reacted over time to flood events, ground level raising, and the changing role of private citizens in constructing and maintaining these sewer systems.

While this study was concerned with the specific relationship of Ostia with water, broader conclusions have been developed that are more widely applicable to Roman water research. One aspect this study stressed was the role of proxy data sets for the study of Roman water, namely sinter (calcium carbonate, $CaCO_3$), and downshafts. Thick depositions of sinter have been studied in connection with aqueduct lines across the Roman empire. This study demonstrated that even small 10 x 10 cm patches of this material within an urban environment can act as clear footprints for following the path of aqueduct water. The absence of preserved lead pipes make the future incorporation of this material crucial to urban water studies looking to understand urban water distribution.

Vertical downshafts have been well-studied at Pompeii in connection to the presence or absence of upper-floor toilets, but these features have much more to reveal.[863] While they can be used to identify upper floor toilets, this study showed that these downshafts were often functionally divided between toilet drainage and rain drainage. This demonstrated that the resulting material from each of these different systems was put to subsequent uses. Specifically, by identifying the common occurrence of these rain drains within wells, this study could track the diverse methods by which Ostians acquired their water. It was the combination of sinter within downshafts that led the present author to conclude that there must have been an abundance of constantly flowing aqueduct water on upper floors in Ostia. Sinter only forms from flowing aqueduct water over extended periods of time, and the idea of slaves carrying thousands of litres of aqueduct water up several flights of stairs does not seem likely. Therefore,

[862] Jansen 2002 is the only researcher to have begun this line of enquiry.

[863] Most recently by Trusler & Hobson 2017, who identified 286 wide-bore downpipes in Pompeii.

the presence of sinter 4 or 5 meters above the ground and far from any bath buildings must be an indication that pressurized water existed above the ground floor. Support for this interpretation comes from this study's identification of a water tower of the type known at Pompeii and Herculaneum. These towers have never been found in an urban context later than the 1st century AD. The water tower identified in insula IV, ii was dated to the late 3rd or 4th century and proves that a similar network existed at Ostia, ensuring pressurized aqueduct water travelled around the otherwise flat city at a constant pressure.

More than identifying the hydraulic histories of three city blocks in Ostia, it was the integration of this archaeological evidence with other data sources that proved to be the most enriching. The present study acted as an initial methodological bridge to connect Roman and 21st century ways of conceptualizing, managing, and using water resources in urban environments. It was inspired by current and on-going developments in sustainable resource management that attempt to integrate the three central factors of water sustainability: infrastructure, culture, and nature. The Roman Water Footprint method was created by this study as a way to apply the dizzying interconnectivity of modern water to the archaeological and historical evidence of water usage in Roman cities. Its successful application to the case-studies in this work attest to its further applicability at various scales of inquiry.

This study showed how the creation and usage of water systems is a product of the dynamic interaction of water technology, cultural values about waters, and environmental factors. More important than identifying what this "water culture" looked like in different phases of the city's life, was being able to diachronically track changes to its internal composition. Issues of definition remain to be further explored in subsequent studies, especially in integrating qualitative and quantitative data sets. This was most clear in the System Resilience section of the Roman Water Footprint, which sought to identify how many different types of each system were present (e.g. types of supply, of usage, and of drainage). The more types of each system that were present would equate to a higher degree of system resilience, or hydraulic sustainability. Identifying different types of water supply (rain water, ground water, aqueduct water) did show how combinations of these different types changed over time. However, when moving from the level of the individual building to the wider city block, this diversity was obscured. Combining the evidence of system resilience from all buildings in a city block offered a uniform picture of hydraulic sustainability, yet this did not necessarily reflect the reality: one hydraulically dominant building (e.g. domus) could overshadow the water systems in an insula. As it was developed for the lacunose data sets of Roman archaeology, the Roman Water Footprint method is meant to be a flexible matrix, into which different types of data can be juxtaposed, as long as they fall under the three main categories of infrastructure, culture, and nature. The aim of this study was not to frame Ostia as the "ideal city" for studying Roman water systems, or to create a method that can only function for Ostia and other archaeological *rarae aves*. Its aim was to construct an open matrix for placing water systems in their wider social and environmental context and to track how these three factors relate to each other in different time periods.

Zooming out to the theoretical framework of this work, an outcome of this study was to show that Roman water should be seen as a socially constructed "object", just like any other from the Roman world. The way in which (modern or ancient) cities or individuals deals with water is complex, but this study showed how changes to this complexity can be measured over time. The main result was that there is no 1:1 correlation between how complex a society's technology is and how it uses water. It is the local, small-scale choices which often have larger and long-term impacts on relationships with water. For non-water specialists of the ancient world, it is hoped that this work highlights the possible flexibility of how ancient cities and ancient populations dealt with water. The point here is not to detract from the excellent specialist research on aqueducts, fountains, or bath buildings. Rather, the aim of this study is to place large-scale water features in their wider social and technological context, and to use the wealth of previous research into Roman cities and water usage to shift our focus from "how" to "why".

As mentioned above in connection with Ostia, the role of sewer systems in Roman urban studies has only begun to be explored.[864] Incredible new sources of data are contained within these often well-preserved contexts, and although their subterranean and culturally liminal position has led to their minimal study, this may just be what has ensured their excellent preservation. Roman water studies can be conceived of as an iceberg, with supply features such as aqueducts and fountains the most well studied, largely as a result of many of them visible for many centuries. These research agendas may equally be one result of our modern obsession with the supply of ever-increasing amounts of water in our homes and cities. While a wealth of information has been gained regarding the architectural, art-historical, and hydraulic functioning of these features, what lies beneath the surface has an equal amount of information to provide us about Romans and their cities. By integrating sewer and drainage systems into subsequent research agendas, and by taking a systems approach to Roman water systems, future research will be able to fill in tesserae currently missing in the mosaic of these ancient systems.

Roman water management is often defined by its technical precision in large construction projects. But by applying the Roman Water Footprint to Ostia, this study demonstrated that on an urban level, a city is not just an amalgamation of systems directing water from point A to point B following the most efficient gradient. Messy, overlapping, and personal hydraulic choices dynamically interact within larger social and environmental frameworks. Through the comparison outlined in the preceding chapter between the different insulae, it is clear that while each block is certainly connected to the wider city, they each have different ways of expressing this dialogue. Some are very flexible and constantly renewing their system and architectural layout in step with dynamic social changes, while others remain more rigid and add new features onto old systems.

Future Directions

By taking a thematic perspective, this study used water to add an important new dimension to the rich socio-historical evidence from Ostia. As a result, the present work shed light on how buildings of different functions interacted with each other, by taking over a neighboring building, or working together to create mutually beneficial hydraulic systems. This interaction between socio-historical forces and water systems can be explored further, with the expansion of the data set on Ostian water systems. In this way, greater spatial and diachronic trends across Ostia will become visible. The continued development of the Roman Water Footprint method will now make it possible to compare the hydraulic biographies of wider parts of Ostia to each other, and then to the entire city as a whole. Large yet discrete data sets on different aspects of water already exist for Ostia, and with the Roman Water Footprint method it is now possible to aggregate these data sets together to create the hydraulic biography of an entire Roman city throughout its life.

With much to consider for future approaches to researching Roman cities, several aspects of modern water usage have become more clear as a result of this study. Surely the most important take-away from this study has been the sheer flexibility of Roman water systems, long-represented in primary literary sources but lacking a more pronounced archaeological definition. To see a 3rd century house using rain water, ground water, and aqueduct water all in one room, and with separated systems for each of these types of water, immediately confronts the modern researcher with an uncomfortable comparison. How many of our homes or buildings have such systems? Does this mean that the Romans used water more sustainably than we do? In light of the evidence raised by this study, it is clear that the same types of relationships or entanglements bind modern and ancient people to water. However, while the Romans can be accused of having overflowing fountain water running through the streets, their cultural values of using different types of water for different activities seems quite opposite to our habit of using the same type of water to flush toilets, to bathe, and to drink.

[864] Koloski-Ostrow 2015 offers a good recent handbook on this subject.

To put it another way, Roman cities were filled with a polyphony of waters, in which the different types of waters were combined together to form dynamic hydraulic assemblages and put to diverse uses. Our modern approach to urban water usage was to replace this polyphony of waters with a soloist, to prefer to have one type of water for all purposes. It is clear that this tactic puts a great deal of pressure on the soloist; this course of action is decidedly un-sustainable at local and global scales.[865] Perhaps by placing modern and ancient perceptions regarding water in dialogue with each other we can become more aware of our contemporary hydraulic habits and values, and subsequently more open to changing them. By looking more closely at the diversity of the trail of liquid footprints leading from the past to the present, perhaps we can propose new directions for this trail to take in the future.

[865] Watts 2018: At time of writing, Cape Town, South Africa, will be the first modern city to experience "Day Zero" in April 2018, when the city administration will turn off all water supply to 1 million homes.

Appendix 1: Definition of Hydraulic Terms

The terminology used to describe Roman hydraulic features is a delicate issue, complicated not only by modern nuances of functional/spatial/temporal labels utilized by modern multi-lingual scholarship (e.g. German, French, Italian, English), but equally, by the relative equivalency of any of these terms to those utilized by Frontinus and other Roman authors. Words such as “reservoir”, “tank”, “cistern”, “castellum”, “basin”, “channel/canal”, all come with similar temporal and linguistic baggage. An additional complication comes from the fact that several different types of features can be used in a single system, so a single sewer line might be composed of flat-roofed channels, half-cappucina sections, and cappucina channels. The way in which this study uses some hydraulic terms is given for a measure of clarity, or at least consistency.

Cappucina

A cappucina is a type of channel and can be either for supply or drainage purposes, although they are most commonly found as part of a sewer network (Fig. 1). For supply, they can occasionally act as a protective place to lay lead pipes. The cappucina is formed by a floor of *bipedales* and parallel walls of brick, which can vary in height. Where this brick course ends, two large *bipedales* are placed at roughly a 45° angle, lying obliquely against each other, forming a triangular shape that increases the height of the overall channel. In order to protect the *bipedales* leaning against each other, a relieving arch is often built above the cappucina.

Figure 327: A cappucina channel used as part of a sewer system, as seen in the Terme del Filosofo (V, ii, 6-7) in Ostia.

Half-cappucina

A half-cappucina is a variation of a cappucina, however instead of two obliquely placed *bipedales*, there is only one. These can also be used for supply or drainage, and are known in both contexts in the Terme del Faro (IV, ii, 1). This type of channel is often employed when a channel is added against an existing wall or pier (Fig. 2).

Figure 328: Half-cappucina used as a drainage feature in the Terme del Faro (IV, ii, 1)

Castellum

This is one of the most diversely used word in Roman hydraulic studies.[866] In this study the term only refers to the monumental masonry structure in the eastern part of Ostia, the Porta Romana *castellum*. This structure collected the water from the aqueduct and diverted it through various secondary channels to distribute water across the city.

Channel

This word is used to identify a conduit of indeterminate function, and applies to a broad range of water features. It does not necessarily carry a "supply" connotation, and can equally be used to describe a "sewer channel" or " aqueduct channel .

Cistern

A cistern indicates a masonry structure that receives water, from any kind of source (e.g. rain water, aqueduct water). These vary in size from 1 x 2 m to structures capable of holding 100, 000 liters of water. Cisterns can also act as localized distribution points.

Drain

A drain is the point through which water leaves a basin. Drains are most often made of a section of circular ceramic pipe, but can also be a short section of lead pipe. Drains are used to remove water from a basin, either directly into a sewer, or into a smaller secondary sewer.

Downshaft (tile back)

This is a type of downshaft found in 2nd and 4th century contexts. They are created when a length of wall is built against an earlier wall (Fig. 3). When this later wall is constructed, space is consciously left between two separate sections of wall. To "bridge" or cover this space, large *bipedales* or roof-tiles are used to act as a backing. This tile-backing ensures that liquid waste descending the downshaft does not come into direct contact with the interface between the older and more recent walls. Tile-backed downshafts are always associated with rectangular downshafts.

[866] Bukowiecki *et al.* 2008, 11-18 and Peleg 2006 for an expanded definition of a castellum and its various subtypes.

Figure 329: An example of a tile-backed downshaft in building IV, ii, 4.

Downshaft (rectangular)

Downshafts come in several different types, but in all cases are meant to transfer liquid material by means of a vertically descending channel (Fig. 4). The rectangular variety are built at the same time as the wall in which they are situated. Their dimensions vary, and in some cases can be ca. 20 cm deep from the surface of the wall. For these larger rectangular downshafts, some, but not all of them originally contained an internal line of vertically placed ceramic pipes. Indications of whether these pipes were present or not can sometimes be found from examining where the downshaft meets the floor surface, as the floor often retains the (semi)circular outline of these pipes. The frequent presence of oxidized nails on the surface of the wall on either side of the downshaft's channel indicate that the downshafts were covered *in antiquo*, perhaps by slats of wood that could be removed for maintenance. Rectangular downshafts can be found either on the external wall of a building, or within internal rooms of the building. This diversity of location suggests that Roman drainage systems, at least in some cases, were divided into rain drainage and internal drainage.

Figure 330: Example of a rectangular downshaft in the Caseggiato dell'Ercole (IV, ii, 3).

Downshaft (circular)

This type of downshaft is most famously known from Pompeii and Herculaneum, where they preserve evidence of upper-floor toilets.[867] They are composed of vertically arranged circular ceramic pipes that are set within rectangular downshafts. The 15-20 cm diameter of many of these pipes suggests that they transported a variety of types of waste from upper floor apartments into sewers. Circular downshafts are most often found in connection with staircases, supporting their interpretation as draining the waste from single-seater but communally used toilets (Fig. 5). Even with the pipes lost or removed by previous excavation, the identification of downshafts as the circular variety can be attested by circular outlines in the building's floor. If these are not present, their semi-circular imprint can sometimes be found in accumulations of sinter within the downshaft. When found in combination with other types of downshafts, they indicate a division of drainage strategies.

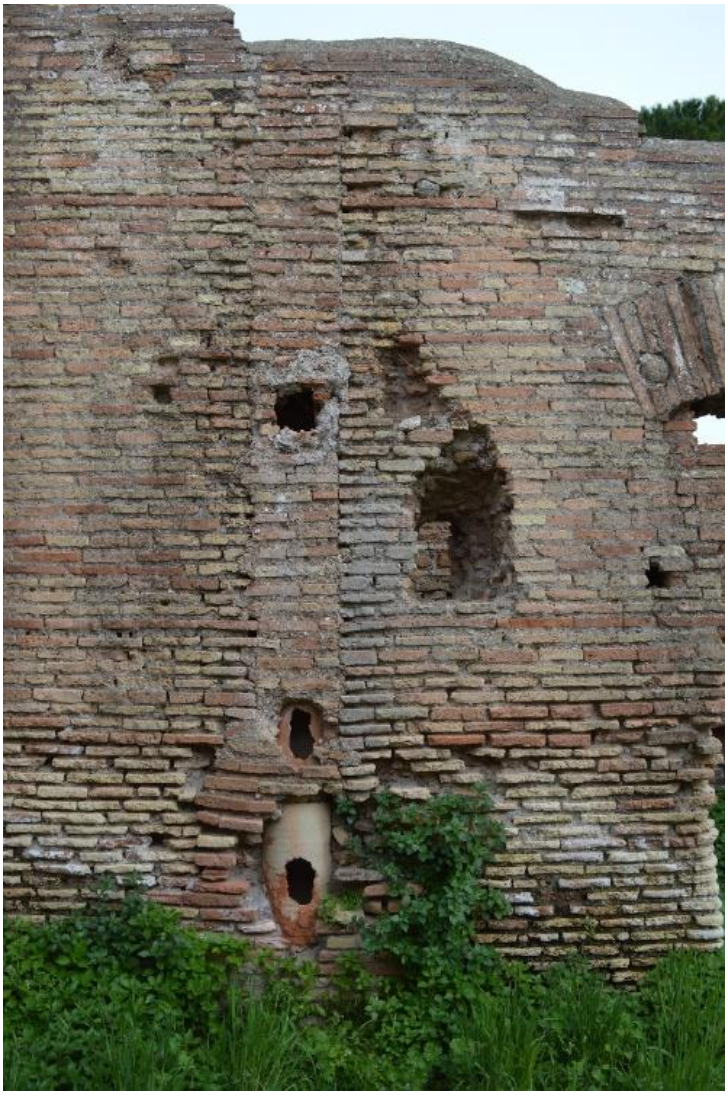


Figure 331: Circular downshaft of pipe from Caseggiato del Mosaico del Porto (I, xiv, 2) in Ostia.

Fistulae

Lead pipes are called *fistulae*, and are an essential part of Roman hydraulic distribution networks. These can range in size from 6-30 cm in diameter, though most often they are around 10 cm in diameter. Fistulae can occur singly, or in groups (Fig. 6). The great majority of *fistulae* were removed in the Late

[867] Trusler & Hobson 2017 for a detailed look at these features.

Antique period, and in the modern period, when their value was not yet appreciated. They can carry epigraphic stamps that offer a wealth of information on their creation, ownership, and chronology.[868]

Figure 332: A pair of lead pipes of different diameters preserved in the Terme del Faro (IV, ii, 1).

Basin

A basin is the receptacle into which water is deposited. Basins are installed against existing walls, and may have internal divisions to split water into smaller sub-basins (Fig. 7). They often have quite thick walls, and when of a larger size (e.g. 1 x 3 m), they can be related to an industrial function.

Figure 333: Double chambered basin present in IV, ii, 13.

Fountain

A fountain is composed of several different water features. It is supplied by pressurized water that falls into a basin, before exiting the basin by means of a drain. Fountains are present in a wide variety of shapes and sizes, and when they are lavishly decorated, can then be defined as a nymphaeum.

Sewer

A sewer is an underground structure that removes waste from a building or group of buildings. It is most commonly found underneath urban streets, but is also known from individual buildings, or groups of buildings. The role of a sewer is to collect waste that is either directly deposited into the sewer, or by means of secondary smaller sewers. This waste is transferred beyond the limits of a building, or of an

[868] Bruun 1991 remains the standard work on *fistulae*.

entire city, by means of a sloped channel. Sewers vary in size, but are largest when underneath a street, in order to transport a much larger volume of waste. Roman sewers collected all kinds of waste, including corpses, industrial waste, or the contents of a latrine. Not all Roman cities, or even the entire area of a city necessarily possessed a sewer network.

Sinter

Sinter is the German term for the accumulation of calcium carbonate ($CaCO_3$). This material is most commonly known in the Roman world in connection with aqueducts. Many Roman aqueducts originated in karstic, or limestone-based sources, and this means that water has flowed across limestone before it enters the aqueduct channel. However, the water has picked up calcium from flowing over the limestone, and when the water interacts with oxygen, either through turbulence or by slowing down, the water deposits the minute quantities of calcium it is carrying. This material builds up over time, and if not removed, can seriously obstruct the flow of water through an aqueduct channel or through lead pipes.[869] Sinter is often a direct proxy for aqueduct water, as it carries high concentrations of dissolved calcium. This material is also known in rectangular downshafts, which either held a vertically ascending lead pipe, or a vertically descending pipe filled with aqueduct water (Fig. 8).

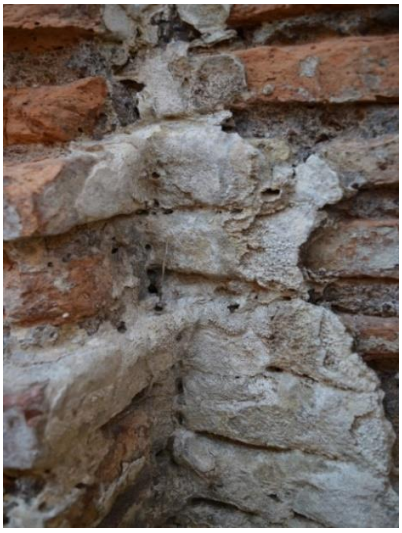


Figure 334: Sinter accumulated on a rectangular downshaft in III, i, 1.

[869] Sürmelihindi *et al.* 2013 offer a comprehensive geochemical analysis of this material in Roman aqueducts.

Appendix 2: Epigraphic Evidence

Several pieces of epigraphic evidence were uncovered by this study in all of the investigated city blocks. Several of these inscriptions represent examples of otherwise known inscriptions in Ostia, although they were not recorded in their individual contexts by previous research. Others are here presented for the first time. For more information on the context of each inscription, the reader is invited to return to the relevant chapters within this work.[870]

Epigraphic Evidence from insula III, i

#1

Find Location: III, i, 8, room 20, south wall.

Visible Letters: …N V ↓ V I I I I

Description: Crescent shaped stamp with two nested circles (Fig. 1). The text is written facing inwards, and perhaps contains a figure in the centre. There is some trace of writing within the second nested circle. The IIII may be a consular dating indicator, as known from Bloch 1967, #129, which has SERVIANO III ET VARO COS.

Notes: The brick stamp was heavily coated in mortar, obscuring the text. This brick stamp was found in 2016 when a section of wall in building III, i, 8 had recently collapsed, exposing many fragments of brick. As building III, i, 8 was created in ca. 125 AD, the stamp can only be dated after this.

Additional References: Arrows on Ostian brick stamps are also known from Bloch 1967, #37, #242, #341, #380. See Chapter 3.1 for the wider context of building III, i, 8.

Figure 335: Brick stamp identified in III, i, 8.

[870] Chapter 3.1 for insula III, i; Chapter 4.1 for insula IV, ii; Chapter 5.1 for insula V, ii.

#2

Find Location: III, i, 8, room 20, south wall.

Visible Letters: N/A.

Description: The brick preserves the front left(?) paw imprint of a dog (Fig. 2).

Notes: The dog's footprint is not very deeply impressed into the brick. This brick stamp was found in 2016 when a section of wall in building III, i, 8 had recently collapsed, exposing many fragments of brick. Although animal prints in bricks are a well-known occurrence, no systematic recording of these features has yet been carried out. As building III, i, 8 was created in ca. 125 AD, the stamp can only be dated after this.

Additional References: See Chapter 3.1 for the wider context of building III, i, 8.

Figure 336: Canine footprint identified in III, i, 8.

#3

Find Location: Terme della Basilica Cristiana (III, i, 3), room 8, under the staircase.

Visible Letters: …ICINA

Description: Only a small section of the stamp is preserved (Fig. 3). It has a circular shape, and appears to have an additional internal ring of text.

Notes: This brick stamp was re-laid in the modern period when the staircase was repaired. As the only visible word is (offi)cina, literally "workshop", this could apply to several different brick workshops in Ostia. Large-scale modifications to this part of the bath building dates to the late 3rd or early 4th century, providing a *terminus post quem* for this stamp.

Additional References: Bloch 1967, #403, #420, #421. See Chapter 3.1 for the wider context of the Terme della Basilica Cristiana (III, i, 3).

Figure 337: Brick stamp from the Terme della Basilica Cristiana (III, i, 3).

Epigraphic Evidence from insula IV, ii

#4

Find Location: Caupona del Pavone (IV, ii, 6), on back side of bar counter in room 8.

Visible Letters: V I C

Description: Letters are unattached, and are carved unevenly into the plaster on the back of the stepped bar counter (Fig. 4).

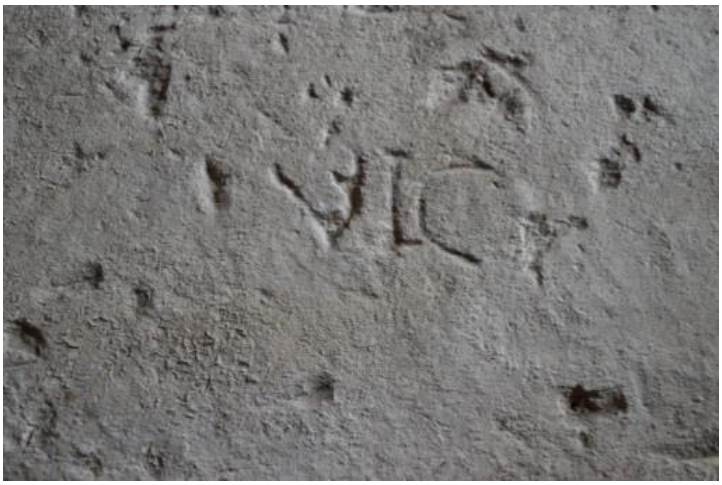


Figure 338 inscribed graffito on inner bar counter of Caupona del Pavone (IV, ii, 6)

Notes: This likely stands for *Victor* or a variation thereof. There are many examples of people named Victor or Victorinus in Ostia (e.g. C.I.L. XIV (1), 4569). This graffito can be dated after the installation of the bar counter, ca. 250 AD, and likely refers to the owner of the newly established *caupona*.

Additional References: Gasparri 1970, 22.

Epigraphic Evidence from insula V, ii

#5

Find Location: Within the long hallway (room 1) of building V, ii, 3.

Visible Letters: MESSIAE↓PAEDIAE

Description: The letters are clearly stamped into the lead pipe, with two words separated by a downward pointing arrow (Fig. 5). Its dimensions are unknown as this comes from an archival photograph.

Figure 339- lead pipe found in connection with V, ii, 3.

Notes: The pipe was identified from archival photographs housed in Ostia's Archivio Fotografico (R893.10 and R894.6). It is one of three pipes discovered in 1970 by an excavation of the Italian water and electricity company ACEA, and is the only pipe discovered in this excavation to carry an inscription. The inscription is otherwise unique. While "Messia" is an irregular but attested *nomen* (C.I.L. X, 7655), several examples of a Messia are known from Ostia and Isola Sacra.[871] The use of a single arrow or anchor are otherwise unknown on *fistulae*, although arrows are possible elements of brick stamps.[872] Combinations of arrows on lead pipes are known at Ostia, where several arrows are overlapped to create a star-like shape.[873] Paedia may be a transcription error of the *plumbarius* (i.e. Paedia=Pedia), and may refer to Pedia, an attested *cognomen* (C.I.L. VI (1), 5069), which is otherwise unknown at Ostia. If interpreted as a name, Messia Paedia can be added to the small list of female names known on lead pipes; she may have been the owner of building III, i, 3.[874]

[871] C.I.L. XIV, 1346 records a *Messia Gaia*, dated between AD 171-300.; Thylander 1951-1952, #180 for a *Messia Candida* on Isola Sacra dated between AD 138-180; Other examples of *Messia* (C.I.L. V (1), 4529, from Brescia) or *Messianus* (C.I.L. X (1), 6239, from the Republican period) are known across Italy.

[872] See Brick Stamp #1, above.

[873] Barbieri 1953, 154, Fig 2.5 for his #5 (CORNIFICIAE IIX). On the back side of this pipe, Barbieri recorded 5 overlapping arrows that form a 10-pointed star.

[874] Bruun 1991, 289, 344 for women named on lead pipes in different roles.

Inscriptions on *fistulae* are most often names in the genitive or dative, followed by a verb, like "fecit". An alternative reading could interpret the inscription as a statement or sentence.[875] Grammatically speaking, *messiae* could equally be the Latinized form of the Greek New Testament use of Messiah (Messias, -ae).[876] A Christian tombstone is known at Rome with "Messiae Chreste" written on it.[877] Following this line of argument, Paediae can also be seen as the Latinized form of the Greek word for learning, or knowledge (παιδεία). Putting them together, one interpretation of the pipe would be: "for the learning of the Messiah". A similar grammatical combination using a form of *paideia*, is known from the Old Testament Hebrews XII.5: "My son, do not make light of the Lord's discipline".[878] While this may seem unusual, another Latinized Greek pipe is known at Ostia, with the word "AECLESIAE" (for the church) stamped onto it.[879] Building V, ii, 3 went through several structural phases over its life, with the current ground level likely dates to the Trajanic period. The entire ground level of the building was raised another 40 cm above this level in the Severan period, and it is to this period that this *fistula* is dated.

Additional References: See Chapter 5.1 for the wider context of building V, ii, 3.

#6

Find Location: Domus del Protiro (V, ii, 4-5), within the western basin of the nymphaeum.

Visible Letters: C. $\widehat{\text{AL}}$B

Description: The letters all sit within a rectangular box, with only the left section of the inscription preserved. The letters A, L, and B are ligatured together (Fig. 6).

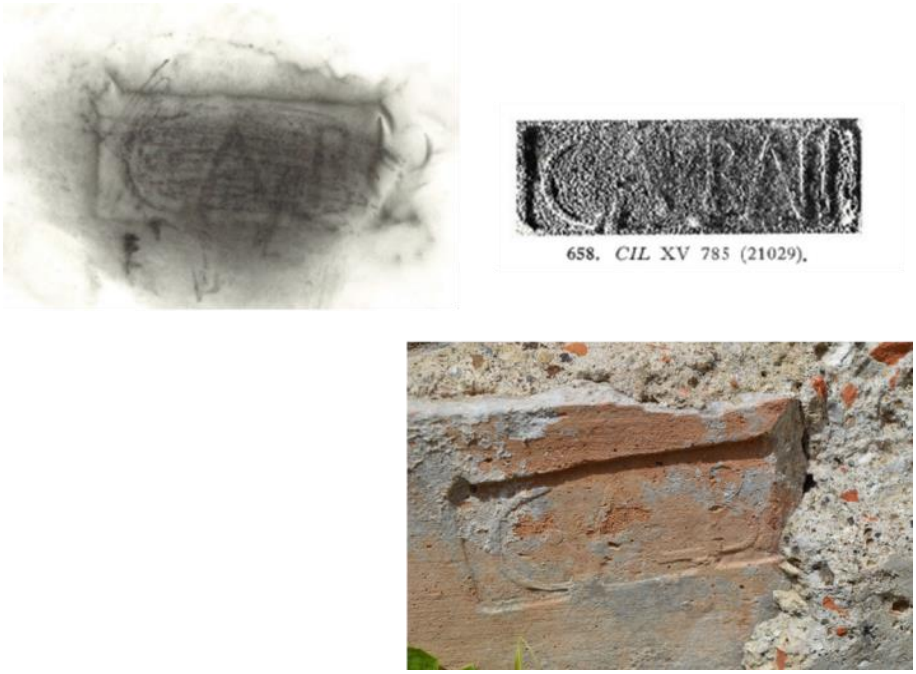


Figure 340 : Brick stamp identified in the nymphaeum of the Domus del Protiro (V, ii, 4-5).

[875] D. Jansen provided a great deal of assistance with the grammatical aspects of this alternative argument.
[876] "*messiae*" would then be dative or genitive singular.
[877] Notizie degli Scavi 1916, p. 108, nr. 125.
[878] *Υἱέ μου, μὴ ὀλιγώρει* ***παιδείας*** *κυρίου*, emphasis added. In both the Old Testament and present example, both the word for Jesus (*κυρίου*) and for *messiae* are written in the genitive, and depend on *παιδείας/ paediae.*
[879] Barbieri 1953, 162, #15, dated by Barbieri on orthographic grounds to the late 4th or early 5th century. This is another example of the ioticization resulting from the transformation of a Greek word (*ἐκκλησία*) into Latin.

Notes: The brick stamp is currently plastered into the western basin of the domus' nymphaeum, and was placed there by modern restorers. C. Albani is known from other brick stamps at Ostia, coming from the *figlinae Albanianae*.[880] The basin in which the brick stamp is placed dates to the 4th century, and it likely just recycled an earlier brick.

Additional References: Boersma 1985, 358 for the nymphaeum.

#7

Find Location: Within the eastern sewer line of the Terme del Filosofo (V, ii, 6-7), ca. 1.5 m within the sewer, on the south side of the sewer.

Visible Letters: N/A

Description: The shoe print is composed of a grouping of hob-nail indentations, and seem to be a left foot (Fig. 7). An examination of the footprint shows that it was evenly pressed into the wet tile, without the characteristic pressure on the heel or toe normally resulting from someone walking or running across the tile.[881] The sole has a blunt and rounded shape, with nails located around the outside of the sole and with two parallel lines of nails running down the center.

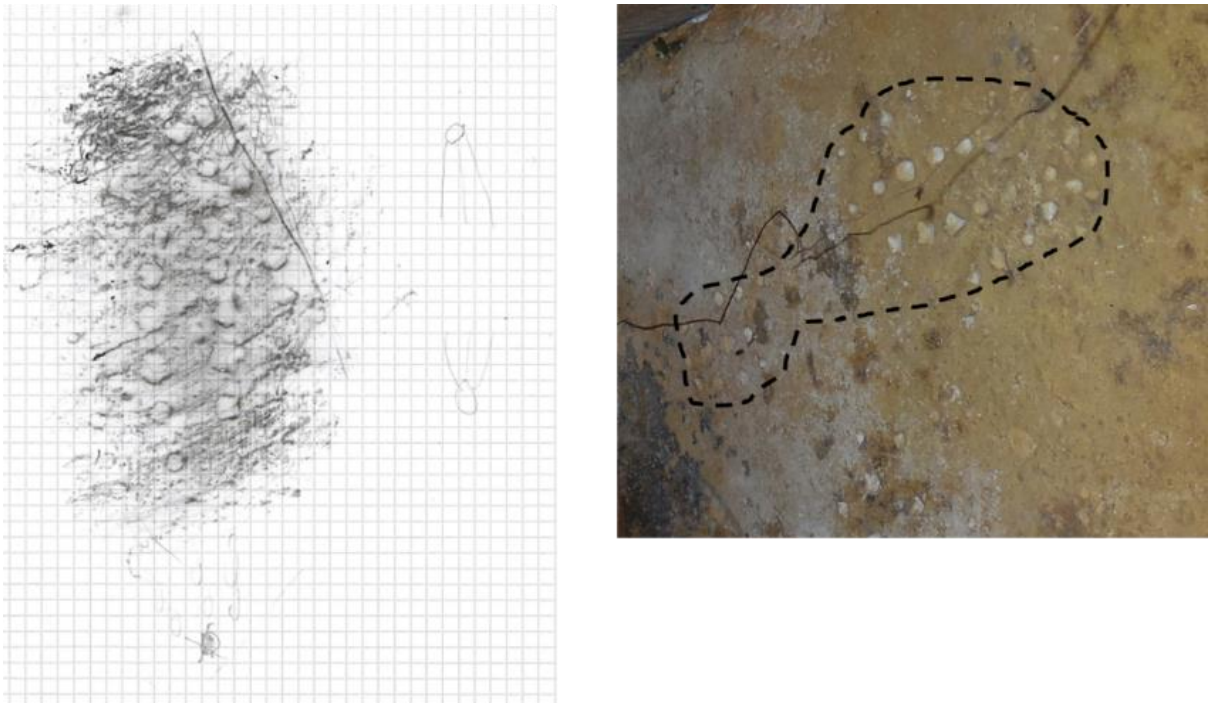


Figure 341: Shoe print found within the sewer of the Terme del Filosofo (V, ii, 6-7).

Notes: Footprints of animals or people are well-attested "accidents" of the brick-making process and are found around the Roman world. However, the fact that the shoeprint appears clearly impressed onto the tile, and its location so deep within a sewer may imply a conscious placement. Roman toilets are known to have been culturally liminal places, in which dangers were certainly lurking. The figural painting of Fortuna within a dozen communal toilets in Pompeii and Ostia is perhaps unsurprising given the intense smell and semi-darkness of these structures.[882] Feet are well-known iconographic

[880] Steinby 1978, #658 for C.I.L. XV, 785 is the closest parallel, with the full inscription reading C. ALBANI; C.I.L. XV, 1871; Bloch 1967, #3 gives a circular brick stamp from the *figlinae Albanianae*.
[881] Carol Van Driel-Murray assisted the author with interpreting this brick stamp.
[882] Jansen 1993 and Koloski Ostrow 2015, 113 for the role of Fortuna in protecting toilets in Ostia and Pompeii.

statements in the Roman world, known as *plantae pedum*.[883] Perhaps the footprint identified within the Terme del Filosofo's sewer was consciously placed there, to act as an apotropaic symbol to drive away evil forces from the latrine. The latrine was rebuilt in the Severan period, which matches the dating of the shoe print. Similar nail arrangements are known from early 3rd century contexts in the northern Roman provinces.[884]

Additional References: Van Driel-Murray 2016. See Chapter 5.1 in the present study for a full discussion of the phasing of the latrine.

#8

Find Location: Within the southeastern wall of the communal latrine in the Terme del Filosofo (V, ii, 6-7). A sewer line with a flat roof joins the latrine from the south, and the brick stamp is located upon this flat, broken tile.

Visible Letters: M(arci) F R V C T I S E(F?) X(ti)

Description: The brick stamp is formed of a single crescent, with no writing or symbols in its center. One-third of the brick stamp is missing as a result of the brick being broken to fit into its current position. The stamp is very deeply pressed into the tile, especially at the horns of the crescent.

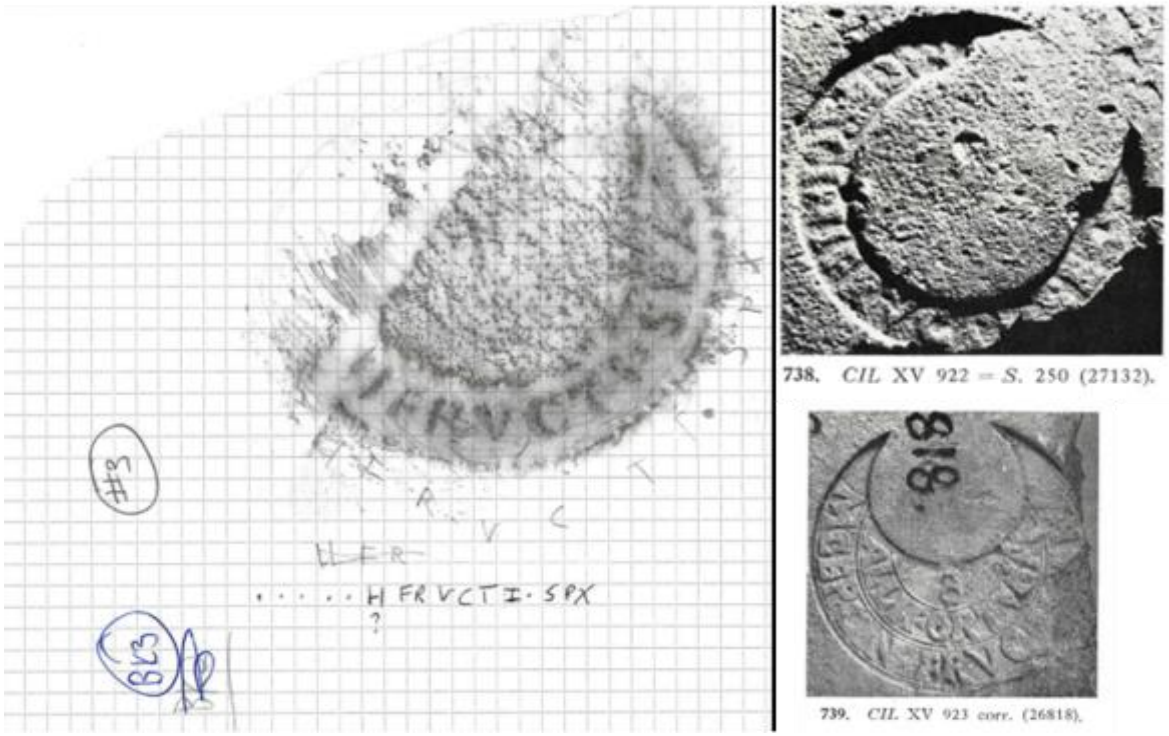


Figure 342: Brick stamp found within the latrine of Terme del Filosofo (V, ii, 6-7). Charcoal rubbing at left, with comparanda at left from Steinby 1978, #738 and #739.

Notes: The stamp refers to Marcus Cercinus Fructus Sextus. Parallels for this stamp come from C.I.L. XV, 922 (=Steinby 1978, #738), and from C.I.L. XV, 923 (=Steinby 1978, #739). The same error of writing

[883] In Ostia a notable example of this phenomenon comes from the Mitreo della Planta Pedis (III, xvii, 2), in which feet are placed in the mithraeum's floor mosaic.
[884] Van Driel-Murray 2016, 145, Fig. 6.11 (right) for a similar-looking shoe print from the Dutch Rhine.

SFX instead of SEX is known in C.I.L. XV, 754b (= Steinby 1978, #640). This stamp was used by Boersma to date the first phase of the sewer line to the Trajanic period.[885]

Additional References: N/A.

#9

Find Location: Western sewer in the latrine of the Terme del Filosofo (V, ii, 6-7). Within the large cappucina opening of this sewer, this brick stamp is found on the southern tile.

Visible Letters: CND …T. C L E M E N T I.

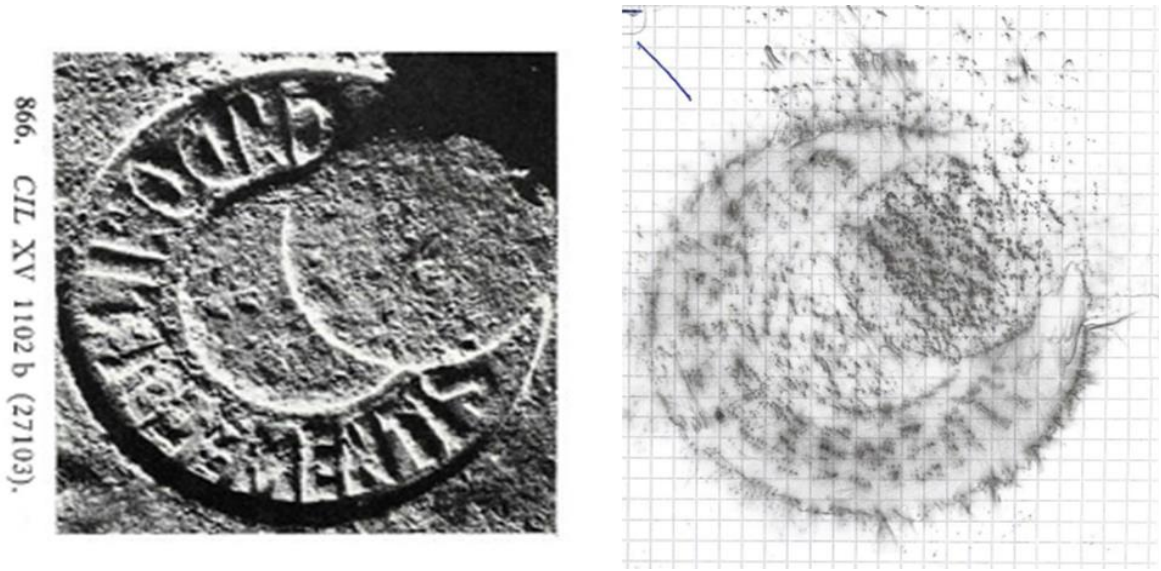


Figure 343: Brick stamp identified within the latrine of the Terme del Filosofo (V, ii, 6-7). Charcoal rubbing at right, and example at left from Steinby 1978, # 866.

Description: The brick stamp consists of a crescent filled with the text of the brick stamp, which can be reconstructed as reading: CN(aeus) DOMITI CLEME(ntis).[886] The horns of the crescent are deeply impressed into the tile, and a remaining coating of mortar obscured several letters of the inscription. There is a single nested field within the crescent, however no figure was identified in this field.

Notes: Other examples with the same text are known to have a palm branch on either side of the text, or with the central field containing a helmet, shield, and spears.[887]

Additional References: See Chapter 5.1 in the present study for a full discussion of the phasing of the latrine.

#10

Find Location: Western sewer in the latrine of the Terme del Filosofo (V, ii, 6-7). Within the large cappucina opening of this sewer, this brick stamp is found on the northern tile.

Visible Letters: M. C E R C …..C T I .. S E X..

[885] Boersma 1985, 134, although it is unclear whether he refers to this brick stamp, or to the preceding two stamps.
[886] Bloch 1967, # 286 (= C.I.L. XV (1), 1102b), #502 for the better preserved example.
[887] Boersma 1985, 392 identified this brick stamp as having the head of Minerva on it, but this was not identified by the present study; Steinby 1978, #866 for the palm branches and Bloch 1967, #67 for the example with arms.

Description: A single crescent contains the text, and there are no nested fields within the center (Fig. 10). Instead, there is a standing human figure, whose feet face the opening of the crescent. The right arm of this figure is extended and possibly holding an object, while the figure's left arm is bent across its stomach and holds something circular (*patera*?). The figure's face looks to the right. The brick stamp was encrusted with a coating of mortar or plaster, and more detail could not be ascertained.

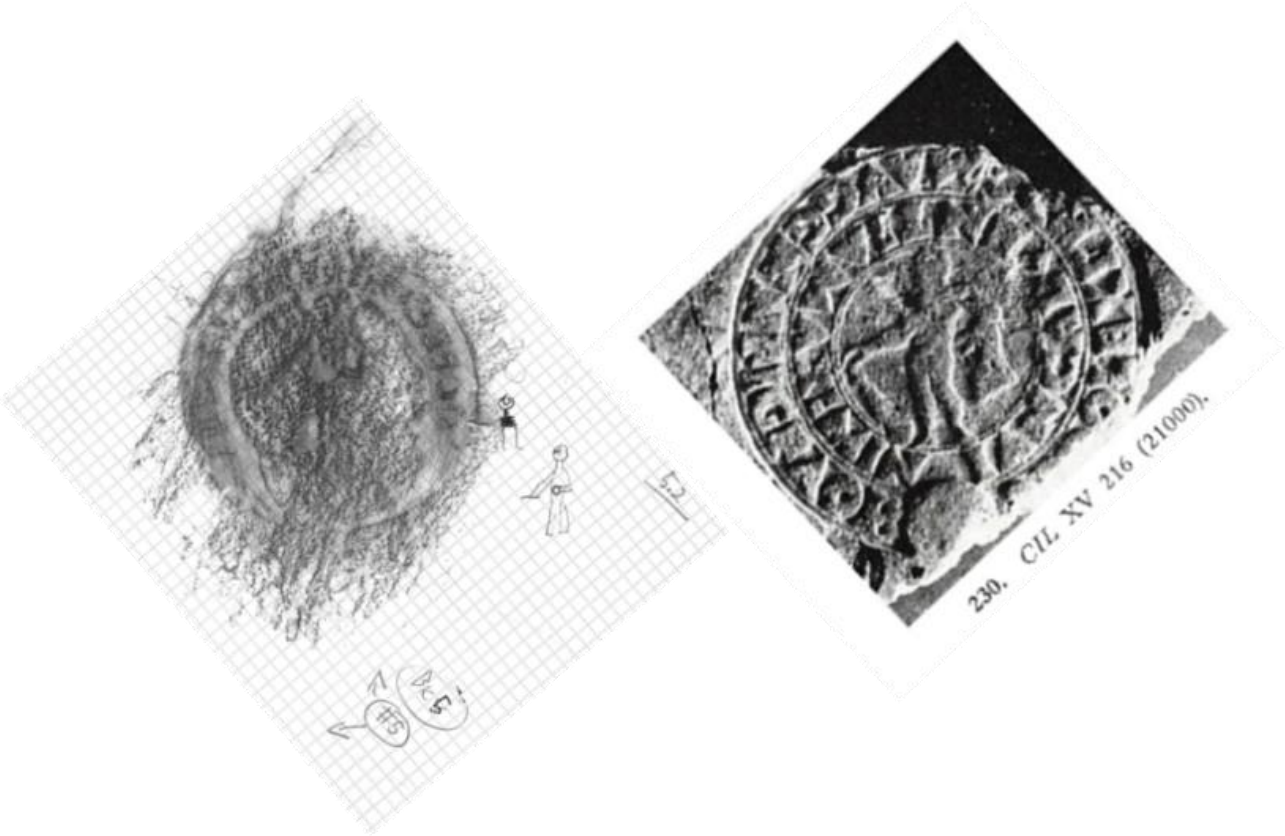


Figure 344: Brick stamp with standing figure from the latrine of the Terme del Filosofo (V, ii, 6-7). Charcoal rubbing at left, and example with standing Hercules at right (Steinby 1978, #230).

Notes: Like the stamp described above, this stamp names Marcus Cercinus Fructus Sextus.[888] The figure in the centre is here interpreted as Hercules, whose right arm holds his club. His lion skin is draped over his left arm, hanging down. While both the text and the figure are identifiable, they are not known in this combination together. None of the recorded brick stamps with M. Cercinus also have a standing Hercules, and vice versa.[889]

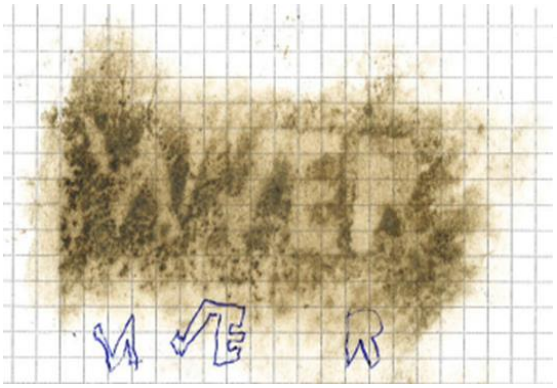
Additional References: See Chapter 5.1 in the present study for a full discussion of the phasing of the latrine.

#11

Find Location: Within the sewer channel of building V, ii, 2.

Visible Letters: M VER

[888] *Comparanda* naming M. Cercinus Fructus Sextus are: C.I.L. XV, 922 (=Steinby 1978, #738), and from C.I.L. XV, 923 (=Steinby 1978, #739).
[889] Standing Hercules known from C.I.L. XV, 214 (=Steinby 1978, #229), and C.I.L. XV, 685 (=Steinby 1978, #584); in the latter example, the exact same pose is held by Mercury instead of Hercules.



1213. *CIL* XV 2210 (21704, 27950).

Figure 345: Brick stamp identified as part of the sewer channel in building V, ii, 2.

Description: The stamp preserves only the beginning of the more full inscription known elsewhere. The V and E are ligatured together. The stamp was recorded by the excavator and can now be found on the shoulder of the long sewer that runs the length of building V, ii, 2.

Notes: The brick stamp was dated by the excavator to the late late Flavian or Trajanic period.[890] The stamp has clear parallels, and names M(arcus) Ver(us) Sax(..) Po(…).[891] His work is connected with that of Claudius Gobatus Volusianus, who was active during the Trajanic period.[892] A dating at the earlier end is proposed by the present study, as the building within which the stamp was found was substantially modified in the Trajanic period.

Additional References: Bloch 1936, Vol. 1, 206 (#66).

#12

Find Location: Inscribed into northern door jamb of entrance into building V, ii, 11.

Visible Letters: H E R M O C

Description: The letters are all carved roughly but legibly at a prominent height, that is immediately visible when entering the central doorway of building V, ii, 11 (Fig. 12).

Notes: Several examples from Rome and Naples attest to the Greek name *Hermocrates* and Hermogenes. However, in Ostia there are many example only of Hermogenes, especially from the Porta Romana necropolis (e.g. C.I.L. XIV (1) 4643). Several of these funerary plaques refer to a Fabius Hermogenes, and are dated from the mid-to late 2nd century.[893] Meiggs identifies this person as the son of L. Fabius Spurius Eutyches, president of the Fabri Tignuarii.[894] Additional evidence of this name comes from dedications identified in the Terme del Faro (I, xii, 6), naming perhaps other members of this family: M. Aurelius Hermogenius,[895] P. Annius Hermogenianus,[896] and [---]s Hermogenes Fabian[us].[897] Another Aurelius Hermogenes is known from a graffito on the Caserma dei Vigili (II, v, 1).[898]

[890] Petriaggi 1987, 200, note 16.
[891] Steinby 1978, # 1213 (=C.I.L. XV, 2210).
[892] For Claudius Gobathus see: C.I.L. XV (1), 251(=Steinby 1978, #742, I-V), 252 (=Steinby 1978, #743).
[893] C.I.L. XIV (1) 4642, 4643 (101-150 AD),
[894] Meiggs 1973, 181, 211, 561: the funerary plaque of L. Fabius is dated ca. AD 138-150; C.I.L. XIV, 160 names a Quintus Turranius Hermogenes as part of the *fabri tignuarii* from AD 220-240, perhaps carrying on the family's position in the guild.
[895] C.I.L. XIV (1), 5340; Cebeillac-Gervasoni 2010, pp. 237-238, nr. 69.2 dates this to AD 250-260.
[896] C.I.L. XIV (1), 5357, where he is listed as the *patronus* on the album of an unnamed corporation, dated to AD 262.
[897] C.I.L. XIV (1), 5361, where he is listed as part of an album, perhaps of the Augustales.
[898] C.I.L. XIV (1), 4523, Notizie degli Scavi 1912, 101.

Figure 346: Graffito inscribed in building V, ii, 11.

As building V, ii, 11 dates to the Severan period, with some small interventions in the later 3rd century, we can exclude the early 2nd century contenders identified above. The identity of the inscriber is difficult to pinpoint, but it may be the Aurelius Hermogenes who also carved his name into the Caserma dei Vigili. With the high number of Hermogenes' known in Ostia, Boersma's reading of this inscription as Hermae can now be updated, and place it securely in the 3rd century.[899]

Additional References: C.I.L. VI (1), 7193 for Hermocratia; for Hermogenes recorded in Ostia, see C.I.L. XIV (1): 160, 170, 353, 547, 1105, 4287, 4523, 4643, 5340, 5357, 5361, and AE 1985, 205; Meiggs 1973, 561 (=C.I.L. XIV (1), 4642).

[899] Boersma 1985, 483, fig. 588.

Appendix 3: Identified Water Features in *insulae* III, i; IV, ii; V, ii with Roman Water Footprint Data

Information in the following charts follows this legend.

		Type	
		RW	*Rain Water*
Indicators		**G**	*Ground Water*
S	*Supply*	**A**	*Aqueduct*
U	*Usage*	**L**	*Leisure*
D	*Drainage*	**I/E**	*Industrial/ Economic*
		DOM	*Domestic*
		SW	*Sewer*
		DO	*Downshaft*
		DR	*Drain*

Insula III, i

III, i, 1 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private/Public
5	rectangular downshaft	1	2	x	**2**	**3**	**4**	D	DO	PRV
7	channel	2	**2**	x	**2**	**3**	**4**	D	DO	PRV
9	drain	3	2	x	**2**	**3**	**4**	D	DO	PRV
10	sewer	84	2	x	**2**	**3**	x	D	SW	PRV
10	sewer	85	2	x	**2**	**3**	x	D	SW	PRV
11	marble gutter fragments	89	3	x	x	**3**	**4**	D	SW	PRV
11	sewer	81	2	x	**2**	**3**	x	D	SW	PBL
12	sewer	82	3	x	x	**3**	**4**	D	SW	PRV
13	rectangular tubuli	4	2	x	**2**	**3**	x	D	DO	PRV
14	rectangular downshaft	44	x	x	x	x	x	x	x	x
14	water boiler	83	2	x	**2**	**3**	x	D	SW	PRV
18	rectangular downshaft (?)	5	2	x	**2**	**3**	x	D	DO	PRV
III, i, 2 Room #	**Feature**	**Feature #**	**Initial Water Footprint Phase**	**RWF #1 (4th century B.C.-50 AD)**	**RWF # 2 (AD 50-200)**	**RWF #3 (AD 200-300)**	**RWF #4 (AD 300-600)**	**Indicator**	**Type**	**Private/Public**
1	sewer	87	2	x	**2**	**3**	**4**	D	SW	PBL
3	channel	6	4	x	x	x	**4**	D	DR	PBL
4	drain	7	2?	x	**2**	**3**	**4**	D	SW	PBL
4	basin/latrine	90	4	x	x	x	**4**	D	SW	PBL

III, i, 3 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private/Public
4	fountain	8	3	x	x	3	4	S	A	PBL
4	channel	103	3	x	x	3	4	S	A	PBL
4	drain	9	3	x	x	3	4	U	L	PBL
4	drain	10	3	x	x	3	4	D	DR	PBL
4	drain	96	3	x	x	3	4	D	DR	PBL
5	marble gutter fragments	65	x	x	x	x	x	x	x	x
6	pool	11	3	x	x	3	4	U	L	PBL
6	drain	97	3	x	x	3	4	D	DR	PBL
7	rectangular tubuli	12	3	x	x	3	4	U	L	PBL
7	rectangular downshaft	13	3	x	x	3	4	D	DO	PBL
8	water boiler	69	3	x	x	3	4	U	L	PBL
8	drain	49	2	x	2	3	x	D	DR	PBL
8	sewer	50	2	x	2	3	x	S	A	PBL
8	drain	54	3	x	x	3	4	D	DR	PBL
9	cistern	68	2	x	2	3	4	U	L	PBL
10	manhole shaft	42	2	x	2	3	4	D	SW	PBL
10	sewer	43	2	x	2	3	4	D	SW	PBL
10	channel	55	2	x	2	3	4	S	A	PBL
11	Pb fistula	59	2	x	2	3	4	S	A	PBL
11	sewer	22	2	x	2	3	4	D	SW	PBL
12	cistern	98	2	x	2	3	4	U	L	PBL
12	drain	64	2	x	2	3	4	D	DR	PBL
13	downshafts(?)	99	2?	x	2	x	x	D	DR	PBL
14	basin	14	4?	x	x	x	4	U	L	PBL
14a	sewer	88	2	x	2	3	4	D	SW	PBL
15	Pb fistula	60	2	x	2	3	4	S	A	PBL
15	channel	61	2	x	2	3	4	S	A	PBL
15	Pb fistula	62	3	x	x	3	x	S	A	PBL
15	channel	63	3	x	x	3	x	S	A	PBL
15	sewer	86	2	x	2	3	4	D	SW	PBL
16	double tubuli	15	2?	x	2	x	x	U	L	PBL
17	drain	51	2	x	2	3	4	D	DR	PBL
17	sewer	52	2	x	2	3	4	D	SW	PBL
17	basin	53	2	x	2	3	4	D	DR	PBL
17	ceramic pipe	75	3	x	x	3	4	D	DR	PBL
18	cistern	56	2	x	2	3	4	U	L	PBL
18a	channel	57	2	x	2	3	4	S	A	PBL
18b	drain	58	2	x	2	3	4	D	DR	PBL
III, i, 4 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private/Public
1	rectangular downshaft	16	2	x	**2**	**3**	**4**	D	DO	PBL
3	basin	17	4	x	x	x	**4**	U	DOM	PRV
3	nymphaeum	18	4	x	x	x	**4**	U	DOM	PRV
3	channel	19	4	x	x	x	**4**	S	A	PRV
3	channels	102	4	x	x	x	**4**	S	A	PRV
3	rectangular downshaft	20	2	x	**2**	**3**	x	D	DO	PBL
3	sewer	100	2	x	**2**	**3**	**4**	D	SW	PBL
11	well	21	1	**1**	**2**	**3**	**4**	S	G	PRV
III, i, 5 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private/Public
7	well	77	1	**1**	**2**	x	x	S	G	PRV
22	basin	31	3?	x	x	**3**	x	U	I/E	PBL
24	basin	76	3?	x	x	**3**	x	U	I/E	PBL

III, i, 6 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private/Public
3	well/pit	23	2	x	**2**	x	x	S	G	PRV
4	well	24	1	**1**	**2**	**3**	**4**	S	G	PRV
5	sewer	112	1	**1**	**2**	**3**	**4**	D	SW	PRV
7	rectangular downshaft	25	4?	x	x	x	**4**	D	DO	PRV
9	semi-circular downshaft	26	4?	x	x	x	**4**	D	DO	PBL
10	basin	27	3?	x	x	**3**	**4**	U	I/E	PBL
10	ceramic pipe	104	3?	x	x	**3**	**4**	D	DR	PBL
10	ceramic pipe	105	3?	x	x	**3**	**4**	D	DR	PBL
10	drain	45	3?	x	x	**3**	**4**	S	A	PBL
11	basin?	32	3?	x	x	**3**	**4**	U	I/E	PBL
III, i, 7 Room #	Feature	Feature #	Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private/Public
7	basin	28	2	x	**2**	**3**	**4**	U	I/E	PBL
22	basin	29	3	x	x	**3**	**4**	U	I/E	PBL
24	basin	30	3	x	x	**3**	**4**	U	I/E	PBL
III, i, 8 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private/Public
19	basin	78	3	x	x	**3**	x	U	I/E	PBL
III, i, 9 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private/Public
5	drain	33	2	x	**2**	**3**	**4**	D	SW	PBL
5	latrine	34	2	x	**2**	**3**	**4**	D	SW	PBL
5	channel	106	2	x	**2**	**3**	**4**	D	SW	PBL
5	basin	46	2	x	**2**	**3**	**4**	U	L	PBL
15	double basin	79	3	x	x	**3**	x	U	DOM	PBL
III, i, 10 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private/Public
16	basin?	80	4	x	x	x	**4**	U	I/E	PBL
16	sewer	116	2	x	**2**	**3**	**4**	D	SW	PBL
17	rectangular downshaft (?)	35	4	x	x	x	**4**	D	DO	PBL
17	basin	113	4	x	x	x	**4**	U	I/E	PBL
17	Pb fistula	114	2	x	**2**	**3**	**4**	S	A	PBL
17	Pb fistula	115	2	x	**2**	**3**	**4**	S	A	PBL
18	fountain	117	4?	x	x	x	**4**	U	DOM	PBL
18	Pb fistula	118	4?	x	x	x	**4**	S	A	PBL
III, i, 11 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private/Public
49	cistern	36	3	x	x	**3**	x	U	DOM	PBL
III, i, 12-13 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private/Public
45	sewer	66	2	x	**2**	**3**	**4**	D	SW	PRV
45	downshaft(?)	107	2	x	**2**	**3**	**4**	D	DO	PRV
45	downshaft(?)	110	2	x	**2**	**3**	**4**	D	DO	PRV
46	basin	37	2	x	**2**	**3**	**4**	U	DOM	PRV
46	cappucina sewer	67	2	x	**2**	**3**	**4**	D	SW	PRV
46	downshaft(?)	108	2	x	**2**	**3**	**4**	D	DO	PRV
46	downshaft(?)	109	2	x	**2**	**3**	**4**	D	DO	PRV

III, i, 14 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private/Public
20	basin	101	4	x	x	x	**4**	U	I/E	PBL
21	rectangular downshaft	47	4	x	x	x	**4**	D	DO	PBL
27	semi-circular downshaft	38	4	x	x	x	**4**	D	DO	PBL
Via della Calcara	sewer	95	2	x	**2**	**3**	**4**	D	SW	PBL
Via della Foce	sewer	73	2	x	**2**	**3**	**4**	D	SW	PBL
III, i, 15 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private/Public
35	Pb fistula	92	4	x	x	x	**4**	S	A	PBL
35	channel	91	4	x	x	x	**4**	S	A	PBL
35	fountain lower basin	40	3	x	x	**3**	**4**	U	DOM	PBL
35	fountain upper basin	111	4	x	x	x	**4**	U	DOM	PBL
35	drain	93	3	x	x	**3**	**4**	D	DR	PBL
35	sewer	94	3	x	x	**3**	**4**	D	SW	PBL
36	channel	39	3	x	x	**3**	x	S	A	PBL
36	channel	48	3	x	x	**3**	x	S	A	PBL
36	basin	70	2	x	**2**	**3**	x	U	I/E	PBL
36	basin	41	2	x	**2**	**3**	x	U	I/E	PBL

Insula IV, ii

Information in the following charts follows this legend.

		Type	
		RW	*Rain Water*
Indicators		**G**	*Ground Water*
S	*Supply*	**A**	*Aqueduct*
U	*Usage*	**L**	*Leisure*
D	*Drainage*	**I/E**	*Industrial/ Economic*
		DOM	*Domestic*
		SW	*Sewer*
		DO	*Downshaft*
		DR	*Drain*

IV, ii, 1 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private/ Public
3	basin	10	3	x	x	3	4	U	L	PBL
3	basin	11	3	x	x	3	4	U	L	PBL
4	ceramic pipe	65	4	x	x	x	4	D	DR	PBL
4	drain	13	3	x	x	3	4	D	SW	PBL
4	sewer	115	3	x	x	3	4	D	SW	PBL
7a	sewer	119	2	x	2	x	x	D	SW	PBL
7c	manhole cover	7	2	x	2	3	4	D	SW	PBL
7c	sewer	91	2	x	2	3	4	D	SW	PBL
8	basin	18	2	x	2	3	4	U	L	PBL
8	drain	95	2	x	2	3	4	D	DR	PBL
9	rectangular downshaft	3	2	x	2	3	4	D	DO	PBL
9	manhole cover	5	2	x	2	3	4	D	SW	PBL
9	sewer	93	2	x	2	3	4	D	SW	PBL
9	sewer	12	3	x	x	3	4	D	SW	PBL
9	sewer	82	2	x	2	3	4	D	SW	PBL
10	latrine	17	3	x	x	3	4	U	L	PBL
11	channel	21	3	x	x	3	x	D	DR	PBL
12	fistula outlet(?)	4	3	x	x	3	4	S	A	PBL
12	basin	64	3	x	x	3	4	U	L	PBL
12	drain	106	3	x	x	3	4	D	DR	PBL
13b	rectangular downshaft	1	3	x	x	3	4	S	A	PBL
13b	rectangular downshaft	2	2	x	2	3	4	D	DO	PBL
15a	channel(?)	66	4	x	x	x	4	D	DR	PBL
15b	drain	83	3	x	x	3	x	D	SW	PBL
16	channel	14	3	x	x	3	4	S	A	PBL
17	2 fistulae	20	3	x	x	3	4	S	A	PBL
17	channel	80	3	x	x	3	4	S	A	PBL
17	channel	19	3	x	x	3	4	S	A	PBL
17	channel	105	3	x	x	3	4	S	A	PBL
17	channel	16	3	x	x	3	4	S	A	PBL
17	channel	104	3	x	x	3	4	S	A	PBL
17	channel	15	3	x	x	3	4	S	A	PBL
18	fountain/castellum?	90	3	x	x	3	4	U	L	PBL
Cardo Maximus	fistula	67	2	x	2	x	x	S	A	PRV
Cardo Maximus	fistula	78	3	x	x	3	x	S	A	PRV
Cardo Maximus	fistula	79	4	x	x	x	4	S	A	PRV

IV, ii, 2-3 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private/ Public
3	basin	88	2	x	2	3	4	U	I/E	PBL
6	fountain basin	24	3	x	x	3	x	U	I/E	PBL
6	Pb fistula	75	3	x	x	3	x	D	DR	PBL
6	channel	130	3	x	x	3	x	S	A	PBL
7	rectangular downshaft	23	2	x	2	3	4	D	DO	PRV
7	circular downshaft	22	2	x	2	3	4	D	DO	PRV
8	basin	94	2	x	2	3	x	U	I/E	PBL
8	Pb fistula	142	3	x	x	3	x	S	A	PBL
8	sewer	117	2	x	2	3	x	D	SW	PBL
8	manhole	25	2	x	2	3	x	D	SW	PBL
8	sewer	92	2	x	2	3	x	D	SW	PBL
8	sewer	127	2	x	2	3	x	D	SW	PBL
14	rectangular downshaft	26	4	x	x	x	4	S	A	PBL
17/18	well	27	1	1	2	3	x	S	G	PRV
20	rectangular downshaft	28	2	x	2	3	x	S	G	PRV
21	well	29	1	1	2	3	x	S	G	PRV
Cardo Maximus at portico	fistula	83	3	x	x	3	x	S	A	PRV
Cardo Maximus at portico	fistula	133	2?	x	2	x	x	S	A	PRV
Cardo Maximus at portico	fistula	134	2?	x	2	x	x	S	A	PRV
Cardo Maximus at portico	fistula	135	2?	x	2	x	x	S	A	PRV
Cardo Maximus at portico	fistula	136	3	x	x	3	x	S	A	PRV
Cardo Maximus at portico	fistula	137	2?	x	2	x	x	S	A	PRV
Cardo Maximus at portico	fistula	138	2	x	2	x	x	S	A	PRV
Cardo Maximus at portico	fistula	139	2?	x	2	x	x	S	A	PRV
Cardo Maximus at portico	fistula	140	3	x	x	3	x	S	A	PRV
Cardo Maximus at portico	fistula	141	2?	x	2	x	x	S	A	PRV

IV, ii, 4 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private/ Public
1	rectangular downshaft	31	2	x	2	3	x	D	DO	PRV
1	rectangular downshaft	32	2	x	2	3	x	D	DO	PRV
2	fountain basin	30	3	x	x	3	4	U	I/E	PRV
2	channel	111	3	x	x	3	4	S	A	PRV
1-2-4-5	fistula channel(?)	112	2	x	2	x	x	D	SW	PRV
6	channel	116	3	x	x	3	4	S	A	PRV
6	drain	89	3	x	x	3	4	D	SW	PRV
IV, ii, 5 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private/ Public
1	fistula	39	3	x	x	3	4	S	A	PRV
1	drain	40	3	x	x	3	4	D	SW	PRV
1	rectangular downshaft	41	2	x	2	x	x	D	DO	PRV
1	rectangular downshaft	42	2	x	2	x	x	D	DO	PRV
1	sewer	84	2	x	2	x	x	D	SW	PRV
2	drain	38	4	x	x	3	4	D	SW	PBL
3	ceramic pipe	85	1	1	2	3	4	S	RW	PRV
3	ceramic pipe	86	1	1	2	3	x	S	RW	PRV
5	rectangular downshaft	43	2	x	2	3	4	D	DO	PRV
5	well	44	1	1	2	3	4	S	G	PRV
9b	sinter	37	4	x	x	3	4	S	A	PRV
15	channel	45	3	x	x	3	4	D	DR	PBL
15	fistula	46	3	x	x	3	4	D	DR	PBL
15	fountain niche(?)	47	2	x	2	3	4	U	L	PBL
15	basin	35	3	x	x	3	4	S	A	PBL
15	channel	107	3	x	x	3	4	D	DR	PBL
15	cistern	36	3	x	x	3	4	U	L	PBL
16	channel	33	2	x	2	3	4	S	A	PBL
16	channel	34	2	x	2	3	4	D	DR	PBL
16	fountain	68	2	x	2	3	4	U	L	PBL
16	drain	132	2	x	2	3	4	D	DR	PBL
16	basin	70	4	x	x	x	4	S	RW	PBL
31	fistula	76	3	x	x	3	x	S	A	PBL
IV, ii, 6 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private/ Public
1	manhole	118	2	x	2	3	4	D	SW	PRV
1	sewer	120	2	x	2	3	4	D	SW	PRV
2	latrine	48	4	x	x	x	4	U	DOM	PRV
2	drain	96	4	x	x	x	4	D	DR	PRV
2	drain	72	4	x	x	x	4	D	DR	PRV
4	drain cover	50	3	x	x	3	4	D	DR	PRV
4	sewer	99	3	x	x	3	4	D	SW	PRV
4	sewer	98	3	x	x	3	4	D	SW	PRV
4	drain cover	81	2	x	2	3	4	D	DR	PRV
4	sewer	97	2	x	2	3	4	D	SW	PRV
5	latrine	49	3	x	x	3	4	U	L	PRV
5	drain	128	3	x	x	3	4	D	DR	PRV
7	drain	100	2	x	2	3	4	D	SW	PRV
8	basin	74	3	x	x	3	4	U	L	PRV
8	fistula	77	3	x	x	3	4	S	A	PRV
16	well	51	1	1	2	3	4	S	G	PRV

IV, ii, 7 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private/ Public
1	fountain	52	3	x	x	3	x	U	I/E	PBL
1	drain	131	3	x	x	3	x	D	DR	PBL
4	latrine	53	2	x	2	3	x	U	L	PRV
5	sewer	8	2	x	2	3	4	D	SW	PRV
17	basin?	122	4	x	x	x	4	U	DOM	PRV
17	fountain (?)	54	3	x	x	3	x	U	L	PBL
17	channel	108	3	x	x	3	x	S	A	PBL
17	channel	109	3	x	x	3	x	S	A	PBL
IV, ii, 8 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private/ Public
4	basin	73	3	x	x	3	4	U	L	PBL
12	rectangular downshaft	55	2	x	2	3	x	D	DO	PRV
13	basin?	56	3	x	x	3	x	U	DOM	PBL
IV, ii, 9, 13 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private/ Public
1	drain	6	3	x	x	3	4	D	DR	PRV
1	drain	57	3	x	x	3	4	D	SW	PRV
1	drain	102	3	x	x	3	4	D	DR	PRV
1	fountain basin	58	4	x	x	x	4	U	I/E	PRV
2	drain	71	3	x	x	x	4	D	DR	PRV
2	rectangular downshaft	60	2	x	2	3	4	D	DO	PRV
3	circular downshaft	61	2	x	2	3	x	D	DO	PRV
IV, ii, 10 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private/ Public
No known water features	x	x	x	x	x	x	x	x	x	x
IV, ii, 11 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private/ Public
1	basin	143	1	1	2	x	x	U	DOM	PRV
2	rectangular niche	103	2	x	2	x	x	U	L	PBL
	fountain basin	62	3	x	x	3	x	U	L	PBL
	ceramic pipe	129	3	x	x	3	x	S	RW	PBL
	fistula channel (?)	87	2	x	2	x	x	S	A	PBL
IV, ii, 12 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private/ Public
1	drain	63	3	x	x	3	4	D	SW	PRV
1	drain?	69	3	x	x	3	4	D	DR	PRV
IV, ii, 14 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private/ Public
3	fistula channel	101	3	x	x	3	4	S	A	PRV

Insula V, ii

Information in the following charts follows this legend.

		Type	
		RW	*Rain Water*
Indicators		**G**	*Ground Water*
S	*Supply*	**A**	*Aqueduct*
U	*Usage*	**L**	*Leisure*
D	*Drainage*	**I/E**	*Industrial/ Economic*
		DOM	*Domestic*
		SW	*Sewer*
		DO	*Downshaft*
		DR	*Drain*

V, ii, 1 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private /Public
6	fountain	186a	2	x	**2**	x	x	U	I/E	PBL
6	fountain	186b	2	x	**2**	x	x	U	I/E	PBL
6	fountain	186c	2	x	**2**	x	x	U	I/E	PBL
6	supply source(?)	182	2	x	**2**	x	x	S	A	PBL
6	drain	187	2	x	**2**	x	x	D	DR	PBL
V, ii, 2 Room #	**Feature**	**Feature #**	**Initial Water Footprint Phase**	**RWF #1 (4th century B.C.-50 AD)**	**RWF # 2 (AD 50-200)**	**RWF #3 (AD 200-300)**	**RWF #4 (AD 300-600)**	**Indicator**	**Type**	**Private /Public**
6	well	159	1	**1**	**2**	x	x	S	G	PRV
6	ceramic pipe	160	1	**1**	**2**	x	x	S	RW	PRV
6	ceramic pipe	161	1	**1**	**2**	x	x	S	RW	PRV
7	basin	156	2	x	**2**	x	x	U	I/E	PRV
7	drain	157	2	x	**2**	x	x	D	DR	PRV
7	drain	158	2	x	**2**	x	x	D	DR	PRV
10	sewer	155	2	x	**2**	x	x	D	SW	PBL
11	latrine channel(?)	162	2	x	**2**	x	x	U	L	PBL
11	basin(?)	163	2	x	**2**	x	x	U	I/E	PBL
12	drain channel	124	2	x	**2**	x	x	U	I/E	PBL
12	drain channel(?)	164	2	x	**2**	x	x	U	I/E	PBL
13	sewer	154	2	x	**2**	x	x	D	SW	PRV

V, ii, 3 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private /Public
1	fistula	179	2	x	**2**	x	x	S	A	PBL
2	basin	5	3	x	x	**3**	**4**	U	I/E	PBL
2	drain	119	3	x	x	**3**	**4**	D	DR	PBL
2	sewer	28	3	x	x	**3**	**4**	D	SW	PRV
2	circular basin	61	2	x	**2**	x	x	U	I/E	PBL
2	fistula	190	3	x	x	**3**	x	S	A	PBL
7	well	6	2	x	**2**	**3**	**4**	S	G	PRV
7	ceramic pipe	185	2	x	**2**	x	x	S	RW	PRV
7	ceramic pipe	172	2	x	**2**	x	x	S	RW	PRV
7	ceramic pipe	189	2	x	**2**	x	x	S	RW	PRV
7	sewer	178	3	x	x	**3**	x	D	SW	PRV
8	rectangular downshaft	60	4	x	x	x	**4**	D	DO	PRV

V, ii, 4-5 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private /Public
1	drain cover	18	3	x	x	**3**	**4**	D	DR	PRV
1	sewer	49	3	x	x	**3**	x	D	SW	PRV
1	drain cover	19	3	x	x	**3**	**4**	D	DR	PRV
1	sewer	48	3	x	x	**3**	**4**	D	SW	PRV
2	sewer	50	3	x	x	**3**	x	D	SW	PRV
3	ceramic pipe	24	3	x	x	**3**	x	D	DR	PRV
4	channel	120	surface find	x	x	x	x	x	x	x
7	circular downshaft	30	3	x	x	**3**	**4**	D	DO	PRV
7	drain	41	2	x	**2**	**3**	**4**	D	DR	PRV
8	basin	31	4	x	x	x	**4**	U	DOM	PRV
8	latrine	32	3	x	x	**3**	**4**	U	DOM	PRV
8	sewer	33	2	x	**2**	**3**	**4**	D	SW	PRV
8	pit?	22	3	x	x	**3**	**4**	D	SW	PRV
8	rectangular downshaft	23	2	x	**2**	**3**	x	D	DO	PRV
8	sewer	121	2	x	**2**	**3**	**4**	D	SW	PRV
8	sewer	122	3	x	x	**3**	**4**	D	SW	PRV
8	sewer	123	2	x	**2**	**3**	**4**	D	SW	PRV
8	drain	143	4	x	x	x	**4**	D	SW	PRV
12	rectangular downshaft	47	2	x	**2**	**3**	**4**	D	DO	PRV
12	channel	56	3	x	x	**3**	**4**	D	DR	PRV
13	drain	59	1	**1**	**2**	x	x	D	DR	PRV
19	latrine	4	3	x	x	**3**	**4**	U	DOM	PRV
19	sewer	34	3	x	x	**3**	**4**	D	SW	PRV
19	circular downshaft	35	3	x	x	**3**	**4**	D	DO	PRV
21	sewer	51	3	x	x	**3**	x	D	SW	PRV
22	channel	25	2	x	**2**	**3**	**4**	D	DR	PRV
22	basin	26	4	x	x	x	**4**	U	I/E	PBL
22	drain	27	4	x	x	x	**4**	D	DR	PBL
24	drain cover	20	4	x	x	x	**4**	D	DR	PRV
24	channel	37	3	x	x	**3**	**4**	S	A	PRV
24	channel	38	3	x	x	**3**	**4**	S	A	PRV
24	sewer	52	3	x	x	**3**	x	D	SW	PRV
24	sewer	53	3	x	x	**3**	x	D	SW	PRV
25	basin	3	4	x	x	x	**4**	U	DOM	PRV
25	drain	39	4	x	x	x	**4**	D	DR	PRV
25	lead pipe	40	4	x	x	x	**4**	S	A	PRV
27	channel	57	2	x	**2**	**3**	**4**	D	DR	PRV
27	rectangular downshaft	1	3	x	x	**3**	x	D	DO	PRV
28	gutter	115	1	**1**	**2**	x	x	D	DR	PRV
28	gutter	125	1	**1**	**2**	x	x	D	DR	PRV
29	rectangular downshaft	2	3	x	x	**3**	x	D	DO	PRV
31	sewer	54	3	x	x	**3**	**4**	D	SW	PRV
31	sewer	55	3	x	x	**3**	**4**	D	SW	PRV
32	fistula	29	4	x	x	x	**4**	D	DR	PRV
32	nymphaeum	36	4	x	x	x	**4**	U	DOM	PRV
32	drain cover	42	3	x	x	**3**	**4**	D	DR	PRV
32	fountain	43	3	x	x	**3**	**4**	U	DOM	PRV
32	sewer	44	3	x	x	**3**	**4**	D	SW	PRV
32	rectangular downshaft	45	2	x	**2**	**3**	**4**	S	RW	PRV
32	rectangular downshaft	46	2	x	**2**	**3**	**4**	S	RW	PRV
32	sewer	58	3	x	x	**3**	x	D	SW	PRV
32	drain	126	4	x	x	x	**4**	D	DR	PRV
32	drain	127	4	x	x	x	**4**	D	DR	PRV
32	drain	128	4	x	x	x	**4**	D	DR	PRV
33	well	21	2	**1**	**2**	**3**	**4**	S	G	PRV
33	ceramic pipe	129	1	**1**	**2**	x	x	S	RW	PRV
33	ceramic pipe	130	1	**1**	**2**	x	x	S	RW	PRV
33	ceramic pipe	131	1	**1**	**2**	x	x	S	RW	PRV
33	ceramic pipe	132	1	**1**	**2**	x	x	S	RW	PRV

V, ii, 6-7 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private /Public
1	marble channel	147	surface find	x	x	x	x	x	x	x
1	rectangular downshaft	148	2	x	2	3	4	D	DO	PBL
2	basin	65	2	x	2	3	x	U	I/E	PBL
2	channel	188	2	x	2	3	x	S	A	PBL
2	marble channel	153	surface find	x	x	x	x	x	x	x
2	channel	166	3	x	x	3	4	D	DR	PBL
3	channel	165	3	x	x	3	4	S	A	PBL
4	latrine	7	2	x	2	3	4	U	L	PBL
4	basin	66	3	x	x	3	4	U	L	PBL
4	channel	67	2	x	2	3	4	D	DR	PBL
4	rectanguar downshaft	69	2	x	2	3	4	D	DO	PBL
4	sewer	70	2	x	x	3	4	D	SW	PBL
4	sewer	71	2	x	2	3	4	D	SW	PBL
4	drain	72	3	x	x	3	4	D	DR	PBL
4	drain cover	73	3	x	x	3	4	D	DR	PBL
4	drain	74	3	x	x	3	4	D	DR	PBL
4	sewer	144	2	x	2	3	4	D	SW	PBL
4	travertine gutters	145	3	x	x	3	4	D	DR	PBL
4	main latrine sewer	146	2	x	2	3	4	D	SW	PBL
7	channel (drain?)	64	2	x	2	x	x	D	DR	PBL
8	cistern(?)	80	unexcavated	x	x	x	x	x	x	x
10	reservoir(?)	8	unexcavated	x	x	x	x	x	x	x
12	drain	62	3?	x	x	3	4	D	DR	PBL
12	drain	63	3	x	x	3	4	D	DR	PBL
14	drain cover	75	3	x	x	3	4	D	DR	PBL
16	basin	10	3	x	x	3	4	U	L	PBL
16	drain cover	68	3	x	x	3	4	D	DR	PBL
16	basin	78	3	x	x	3	4	U	L	PBL
16	semi-circular downshaft	81	3	x	x	3	4	D	DO	PBL
16	sewer	149	3	x	x	3	4	D	SW	PBL
16	drain	150	3	x	x	3	4	D	DR	PBL
18	basin	11	3	x	x	3	4	U	L	PBL
19	basin(?)	151	3	x	x	3	x	U	L	PBL
21	basin	82	3	x	x	3	x	U	L	PBL
21	basin	9	3	x	x	3	4	U	L	PBL
22C	drain	76	3	x	x	3	4	D	DR	PBL
22C	water boiler	77	3	x	x	3	4	U	L	PBL
23	semi-circular downshaft(?)	177	3?	x	x	3	x	D	DO	PBL
25	basin/fountain(?)	79	3	x	x	3	4	U	L	PBL
25	sewer branch	152	3	x	x	3	4	D	SW	PBL
27	semi-circular downshaft(?)	176	3?	x	x	3	x	D	DO	PBL

V, ii, 8 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private /Public
3	circular downshaft	12	4	x	x	x	**4**	D	DO	PRV
3	circular downshaft(?)	170	4	x	x	x	**4**	D	DO	PRV
3	channel	171	4	x	x	x	**4**	D	DR	PRV
6	channel	173	4	x	x	x	**4**	S	A	PRV
10	channel	87	2	x	**2**	**3**	**4**	D	DR	PRV
14	well	83	1	**1**	**2**	**3**	**4**	S	G	PRV
14	basin	84	1?	**1**	**2**	**3**	**4**	U	DOM	PRV
14	sewer	85	1?	**1**	**2**	**3**	**4**	D	DR	PRV
15	basin	15	4	x	x	x	**4**	U	DOM	PRV
15	drain	14	4	x	x	x	**4**	D	DR	PRV
15	nymphaeum	90	4	x	x	x	**4**	U	DOM	PRV
15	drain	91	4	x	x	x	**4**	D	DR	PRV
15	sewer	92	4	x	x	x	**4**	D	SW	PRV
15	drain	168	4	x	x	x	**4**	D	DR	PRV
16	latrine	13	4	x	x	x	**4**	U	DOM	PRV
16	basin	88	4	x	x	x	**4**	U	DOM	PRV
16	fistula line	89	4	x	x	x	**4**	S	A	PRV
16	sewer	140	4	x	x	x	**4**	D	SW	PRV
16	drain	169	4	x	x	x	**4**	D	DR	PRV
17	sewer	93	4	x	x	x	**4**	D	SW	PRV
17	sewer	94	4	x	x	x	**4**	D	SW	PRV
17	sewer	95	4	x	x	x	**4**	D	SW	PRV
17	sewer	96	4	x	x	x	**4**	D	SW	PRV
17	sewer	97	4	x	x	x	**4**	D	SW	PRV
18	fistula	180	2?	x	**2**	x	x	S	A	PRV
20	circular downshaft	16	4	x	x	x	**4**	D	DO	PRV
V, ii, 9 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private /Public
1	channel	98	4?	x	x	x	**4**	S	A	PBL
1	basin	167	4?	x	x	x	**4**	U	L	PBL
1	ceramic pipe	175	2	x	**2**	x	x	S	A	PBL
2	basin	99	4?	x	x	x	**4**	U	I/E	PBL
2	drain	104	4?	x	x	x	**4**	D	DR	PBL
2	fistula channel	174	4?	x	x	x	**4**	S	A	PBL
4	drain	183	2?	x	**2**	**3**	x	D	SW	PBL
5	basin	100	3	x	x	**3**	x	U	I/E	PBL
5	basin	86	2	x	**2**	x	x	U	I/E	PBL
6	rectangular downshaft(?)	17	2?	x	**2**	x	x	D	DO	PBL
6	rectangular downshaft(?)	101	2?	x	**2**	x	x	D	DO	PBL
6	rectangular downshaft(?)	102	2?	x	**2**	x	x	D	DO	PBL
6	rectangular downshaft(?)	103	2?	x	**2**	x	x	D	DO	PBL
7	drain	184	2	x	**2**	**3**	x	D	SW	PBL
V, ii, 10 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private /Public
1	sewer	105	3	x	x	**3**	x	D	SW	PRV
3	sewer	139	3	x	x	**3**	x	D	SW	PRV
9	basin	106	3	x	x	**3**	x	U	DOM	PRV
9	sewer	107	3	x	x	**3**	x	D	SW	PRV

V, ii, 11 Room #	Feature	Feature #	Initial Water Footprint Phase	RWF #1 (4th century B.C.-50 AD)	RWF # 2 (AD 50-200)	RWF #3 (AD 200-300)	RWF #4 (AD 300-600)	Indicator	Type	Private /Public
2	basin	109	3	x	x	**3**	**4**	U	DOM	PRV
2	drain	138	3?	x	x	**3**	x	D	DR	PRV
3	channel (?)	108	3	x	x	**3**	x	S	A	PRV
V, ii, 12 Room #	**Feature**	**Feature #**	**Initial Water Footprint Phase**	**RWF #1 (4th century B.C.-50 AD)**	**RWF # 2 (AD 50-200)**	**RWF #3 (AD 200-300)**	**RWF #4 (AD 300-600)**	**Indicator**	**Type**	**Private /Public**
No known water features	x	x	x	x	x	x	x	x	x	x
V, ii, 13 Room #	**Feature**	**Feature #**	**Initial Water Footprint Phase**	**RWF #1 (4th century B.C.-50 AD)**	**RWF # 2 (AD 50-200)**	**RWF #3 (AD 200-300)**	**RWF #4 (AD 300-600)**	**Indicator**	**Type**	**Private /Public**
2	circular downshaft	113	3	x	x	**3**	**4**	D	DO	PRV
3	latrine	110	3	x	x	**3**	**4**	U	DOM	PRV
3	sewer	111	3	x	x	**3**	**4**	D	SW	PRV
4	circular downshaft	114	3	x	x	**3**	**4**	D	DO	PRV
12	well	133	2	x	**2**	**3**	**4**	S	G	PRV
12	ceramic pipe	141	2	x	**2**	x	x	S	RW	PRV
12	ceramic pipe	142	2	x	**2**	x	x	S	RW	PRV
13	well	112	2	x	**2**	**3**	**4**	S	G	PRV
13	ceramic pipe	134	2	x	**2**	x	x	S	RW	PRV
13	ceramic pipe	135	2	x	**2**	x	x	S	RW	PRV
13	ceramic pipe	136	2	x	**2**	x	x	S	RW	PRV
13	ceramic pipe	137	2	x	**2**	x	x	S	RW	PRV
V, ii, 14 Room #	**Feature**	**Feature #**	**Initial Water Footprint Phase**	**RWF #1 (4th century B.C.-50 AD)**	**RWF # 2 (AD 50-200)**	**RWF #3 (AD 200-300)**	**RWF #4 (AD 300-600)**	**Indicator**	**Type**	**Private /Public**
No known water features	x	x	x	x	x	x	x	x	x	x

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Abbreviations

MEFRA: *Mélanges de l'École Française de Rome. Antiquité.*

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Nederlandse Samenvatting

De huidige studie, Liquid Footprints: Water, Urbanism and Sustainability in Roman Ostia, onderzoekt de rol van water in de oude Romeinse stad Ostia. Ostia ligt ca. 20 km ten westen van Rome, gescheiden door Rome door een keten van kwelders in het binnenland. In de oudheid lag Ostia op het kruispunt van de rivier de Tiber en de Middellandse Zee en trad het verscheidene eeuwen op als een van de havensteden van Rome. Deze stad bestond bijna 1000 jaar, van de late 4de tot het begin van de 3e eeuw voor Christus. tot de 6e-7e eeuw na Christus. Na bijna 150 jaar archeologisch, epigrafisch en geofysisch werk is een schat aan gegevens verzameld over de relatie van Ostia met Rome en de bredere mediterrane wereld, evenals over het specifieke karakter van Ostia. De stad was in de oudheid verdeeld in vijf regio's en er is een ongelooflijke diversiteit aan gebouwen, van religieuze gebouwen tot flatgebouwen met meerdere verdiepingen, bars, graanopslagplaatsen, badgebouwen en privéwoningen.

Met zo'n diversiteit aan gebouwen en vereisten, een stad met een geschatte bevolking van ongeveer. 40-50, 000 zou een grote hoeveelheid water nodig hebben gehad. Deze studie onderzoekt hoe water werd gewonnen, gebruikt en afgevoerd in Ostia, en hoe deze systemen in de loop van de tijd veranderden. Om een hoge resolutie te bereiken, werden drie stadsblokken (insulae) geselecteerd als case-studies: III, i; IV, ii; en V, ii. Voor elk van deze stadsblokken voerde de auteur systematisch veldwerk uit van de staande overblijfselen en relevante archiefbronnen om alle sporen van watervoorziening, gebruik en drainage te identificeren. Dit creëerde gedetailleerde hydraulische biografieën voor individuele gebouwen, evenals hele stadsblokken: de ontwikkeling, diversificatie en wijziging van de watersystemen van de blokken zou gedurende hun hele leven in kaart kunnen worden gebracht.

Om deze hydraulische systemen in een context te plaatsen, ontwikkelde de huidige studie echter een nieuwe methodologie, de Romeinse water-voetafdruk. De methode is geïnspireerd op de manieren van de 21e eeuw om te begrijpen hoe en waarom water wordt gebruikt in moderne steden. Deze moderne inzichten hebben aangetoond dat duurzaam watergebruik niet alleen gebaseerd is op geavanceerde hydraulische technologie, maar ook op omgevingsfactoren en een sterke culturele factor. Dit laatste is in feite het belangrijkste, omdat het ons vertelt waarom we water gebruiken zoals wij. De Romeinse watervoetafdruk nam deze drie pijlers van duurzaam watergebruik (technologie, milieu en cultuur) en veranderde ze om gegevens uit een oude Romeinse stad te verwerken. Door gebruik te maken van de Romeinse watervoetafdruk heeft dit onderzoek de archeologische gegevens over het watergebruik in Ostia met paleo-milieugegevens en Romeinse culturele gebruiken voor het gebruik van water verwerkt. Op deze manier kunnen de watersystemen worden gecontextualiseerd in hun bredere milieu- en culturele omgeving. Bovendien kunnen wijzigingen in de hydraulische context van Ostia in de loop van de tijd worden gemodelleerd.

De resultaten van het onderzoek geven aan dat het Romeinse watergebruik veel diverser en flexibeler was dan tot nu toe werd aangenomen. Meerdere soorten water werden gebruikt binnen individuele gebouwen, elk met hun eigen toegewijde fysieke systemen. Ook in termen van drainage ontwikkelde deze studie een eerste chronologie voor de ontwikkeling en distributie van het rioolstelsel van Ostia. Het belangrijkste resultaat van de Roman Water Footprint-methode gaf aan dat het hydraulisch systeem in de loop van de tijd veranderde samen met veranderende sociaal-culturele waarden en eisen van Ostia. Door Romeinse watersystemen in dialoog te brengen met de gecontextualiseerde methodologie die wordt gebruikt in modern duurzaam wateronderzoek, vormt deze studie een eerste brug tussen moderne en oude benaderingen van water en stedenbouw.

English Summary

The present study, *Liquid Footprints: Water, Urbanism, and Sustainability in Roman Ostia*, explores the role of water in the ancient Roman city of Ostia. Ostia lies ca. 20 km west of Rome, separated by Rome by a chain of inland salt-marshes. In antiquity, Ostia was situated at the intersection of the Tiber River and the Mediterranean Sea, and acted as one of the harbour cities of Rome for several centuries. This city existed for nearly 1000 years, from the late 4th-early 3rd century B.C. until the 6th-7th century AD. After nearly 150 years of archaeological, epigraphic, and geophysical work , a wealth of data has been collected about Ostia's relationship with Rome and the wider Mediterranean world, as well as about Ostia's specific character. The city was divided into five regions in antiquity, and there is an incredible diversity of structures here, from religious buildings to multi-floor apartment buildings, grain storehouses, private homes, bath buildings, and bars.

With such a diversity of buildings and requirements, a city with an estimated population of ca. 40-50, 000 would have needed a large quantity of water. This study investigates how water was acquired, used, and drained away in Ostia, and how these systems changed over time. To achieve a high level of resolution, three city blocks (insulae), were selected as case studies: III, i; IV, ii; and V, ii. For each of these city blocks, the author carried out systematic fieldwork of the standing remains and relevant archival sources to identify any and all traces of water supply, usage, and drainage. This created a detailed hydraulic biographies for individual buildings, as well as entire city blocks: the development, diversification, and alteration of the blocks' water systems could be mapped out over their entire life.

However, to contextualize these hydraulic systems, the present study developed a new methodology, the Roman Water Footprint. The method was inspired by 21st century ways of understanding how and why water is used in modern cities. These modern insights have indicated that sustainable water usage is based not only on advanced hydraulic technology, but also includes environmental factors, and a strong cultural factor. The latter is in fact the most important, as it tells us *why* we use water as we do. The Roman Water Footprint took these three pillars of sustainable water usage (technology, environment, and culture), and modified them to handle data from an ancient Roman city. By using the Roman Water Footprint, this study incorporated the archaeological evidence of water usage in Ostia with paleo-environmental data, and with Roman cultural practices of using water. In this way, the water systems could be contextualized into their broader environmental and cultural milieu. Additionally, changes to the hydraulic context of Ostia could be modelled over time.

The results of the study indicate that Roman water usage was much more diverse and flexible than has been previously appreciated. Multiple types of water were used within individual buildings, each with their own dedicated physical systems. Also in terms of drainage, this study developed an initial chronology for the development and distribution of the sewer system of Ostia. The main outcome of the Roman Water Footprint methodology indicated that the hydraulic system changed over time together with changing socio-cultural values and requirements of Ostia.

By placing Roman water systems into dialogue with the contextualized methodology used in modern sustainable water research, this study forms an initial bridge between modern and ancient approaches to water and urbanism.

Curriculum Vitae

Mark Anthony Locicero was born in Toronto, Canada on March 4th, 1987. From 1999-2005 he attended St. Michael's College School, in Toronto. From 2005-2009, Mark completed a Bachelor's degree with Honours from Queen's University in Canada, from the Department of Classical Studies. Subsequently, from 2009-2011, he completed a Master's degree in Roman and Greek Archaeology from the University of British Columbia, in Vancouver, Canada. Mark officially began his doctoral research at Leiden University in September 2013, "Liquid Footprints: Water, Urbanism and Sustainability in Roman Ostia". Throughout his academic career, Mark has participated in several fieldwork projects (Jordan, Sicily, Serbia), and has been involved with teaching classes at the Bachelor and Master level. He has helped to organize two specialist conferences on water in antiquity, and has presented his doctoral research before several international conferences.

Propositions

1. Researching urban environments from a city block (insula) level offers a new perspective on the role of water in the urban history of Ostia.

2. The Roman Water Footprint method developed by my doctoral research can be used to study the water systems of cities around the Roman empire, to quantitatively identify changing Roman water practices.

3. The sewer system of Ostia gained a second, superimposed level in the 4th century that functioned at the same time as the sewer system from the 2nd century (see Chapter 5).

4. The people living in each building and city block studied in this thesis made active choices in how many kinds of water it had: being water-resilient created a visible level of prestige.

5. Studying underground drainage systems reveals much more about urban water usage than large and decorated water features, like fountains.

6. This thesis demonstrated that Roman sustainability is a research field that can be explored through the use of contemporary resource management methods (see Chapter 2).

7. Combining a study of physical water systems with environmental and cultural data gives a more nuanced and contextualized perspective to our understanding of Roman water systems.

8. Investigating Roman water systems and usage with modern perspectives highlights the interconnectivity between ancient cultural habits, environmental constraints, and physical water systems.

9. Urban survey of standing archaeological structures can identify many aspects of Roman water usage, without the need for costly excavation.