Andrew Wilson

The *castra* of Frontinus

Frontinus' treatise on Rome's aqueducts contains a detailed breakdown of water distribution for each aqueduct line, listing quantities of water distributed in the emperor's name (*in nomine Caesaris*) and for private and public uses. The figures for public use are further broken down into distribution to *castra*, public buildings (*opera publica*), display fountains (*munera*), and public fountains (*lacus*). This is potentially one of the most important parts of his work for understanding how Rome's distribution network functioned, yet it is also one of the most frustrating, as several of the key terms are unclear. First, the figures given for individual lines do not match the totals, as there has evidently been corruption of some of the figures in the manuscript tradition. Secondly, it remains uncertain whether the unit of measurement employed, the *quinaria*, has any real validity as a unit to measure the flow of water[1]. Frontinus seems to have understood it as a unit of cross-sectional area; but this is inadaquate for measuring water distribution as one needs to know the rate of flow through the aperture of a given section – which in the case of pipes is determined by the head of pressure, which is unlikely to have been uniform at all offtakes. Thirdly, it is not clear on what principles water was distributed *in nomine Caesaris* – does this refer to distribution to the emperor's properties (and those of the imperial family), or to other public or military destinations, or also to private individuals to whom the emperor had granted privileges? Fourthly, what does Frontinus mean by the 18 *castra* which are listed as a category of distribution under *opera publica*?

The most recent commentator on Frontinus, Rodgers, is unsure: 'It is not clear what F. means by *castra.* The numbers alone indicate more than the *castra praetoria*, which was in F.'s day the barracks for the *cohortes urbanae* (*RE Suppl.* 10, 1026) as well as for the praetorian guard, and might in any case have received its water *nomine Caesaris*[2].' Following Evans[3], he suggests that *castra* could have been used for the *stationes* of the *cohortes vigilum* – but does not remark (a) that there is no evidence that these were ever called *castra* rather than *stationes*, and (b) that there were only 7 of them (one for every two regions of the city), which would leave us 10 *castra* short of Frontinus's total. There were also 14 *excubitoria* for the *vigiles* but if we wanted to include these (minor) buildings under the heading of *castra* we would now have too many entities (21 as against Frontinus' 18). The *Castra Misenatium*, *Castra Peregrina* and *Castra Ravennatium* are only attested, epigraphically or archaeologically, well after Frontinus[4].

Rodgers continues: 'Similar terminology might have been in use for *collegia* who provided public services (cf. *TLL* 3, 561.11); *castra* is thus used in the *Notitia regionum* for

[1] See Bruun *Appendix C* in Rodgers 2004, 342-346 for the most recent and balanced discussion.
[2] Rodgers 2004, 245-246.
[3] Evans 1994, 10.
[4] *LTUR* I (1993), *ad voces.*

lecticarii, *silicarii* and the like, but their 'military' organisation (cf. *RE* 12, 1093) may have postdated F[5].' Indeed, the use of *castra* for the seats of these guilds is not attested before the fourth century AD, and moreover, one would expect such guilds to pay for their water use[6].

One could try to proceed in another manner. Frontinus, and other writers, such as Vitruvius, use the term *castellum*, which originally meant a small fort, in the sense of a water distribution tank (sometimes *castellum divisorium*). *Castellum* is of course the diminutive of *castrum* or *castra*, and one could argue that Frontinus should be using *castra* to mean some larger entity than a distribution *castellum* – for which the obvious candidate would be a large reservoir or storage cistern (as distinct from a settling tank, which is a *piscina limaria*).

Bruun's not dissimilar suggestion was that *castra* here meant 'some sort of fountain, cistern or *castellum* … it cannot be regarded as implausible that another category of "public water posts" or of "local cisterns" was intended by *castra*[7]'. Evans rejected this argument on the grounds that *castra* in such a sense should be downstream of a *castellum* and would necessary be smaller than *castella*, and therefore the diminutive-master relationship should operate the other way around: 'Even more problematic is the use of the term to indicate a "local cistern," if *castra* were supplied through *castella*: we would expect the diminutive form to indicate the smaller reservoir or tank, not the larger one within the distribution net[8].' However, this misunderstands the physical realities of Rome's enormously complex distribution system. *Castella* were not necessarily large structures; they need to be little more than junction boxes, or tanks from which a number of pipes branched off. The stone distribution tank at Porta Viminalis is very small[9], while outside Rome, the two best known distribution *castella*, at Pompeii and Nîmes each held only a few cubic metres of water[10]. Reservoir cisterns would be substantially larger, with capacities of several hundred or thousand cubic metres. Secondly, a reservoir cistern might well be upstream of several *castella*, which acted as local distribution nodes at points along the branch governed by the reservoir cistern. If we understand *castra* as reservoir cisterns, there is no problem with the size relationship between them and distribution structures implied in the *castra/castellum* linguistic relationship.

Indeed, the use of the military term *castellum* as a water distribution tank is otherwise unmotivated unless it is the diminutive of a larger water-related structure which was called *castra*. There is no other readily understandable reason to call a distribution tank a *castellum*; it does not look or act in any way like a fort. This begs the question, though, of why *castra* was used to mean a water reservoir? It might come either from the massiveness of the structure, or possibly from some loose sense of a parallel between storing water and housing troops – perhaps, especially, the use of *castra* for an overnight marching camp suggested a metaphorical transference to the overnight storage function of a reservoir. If *castra* were used in this way, the formation of a diminutive, *castellum*, for a smaller water-related structure would then be unsurprising.

By the time Frontinus wrote, in the reign of Trajan, the technology and use of storage reservoirs was well developed. Their function was probably to accumulate reserves of water overnight, when demand was generally less, that could be distributed the following day. In

5 Rodgers 2004, 245-246, again following Evans 1994, 10.
6 Bruun 1991 254-256.
7 Bruun 1991, 253.
8 Evans 1994, 10-11 n. 44.
9 Lanciani 1880, Tav. VI.2; Ashby 1935, 151.
10 Cf. Ohlig 2001 for the Pompeii *castellum*.

this way the demand placed by installations such as public baths could be mitigated[11]. The largest reservoirs might also accommodate some seasonal fluctuation in supply. The large terminal reservoir known as the *Piscina Mirabilis* on the Bay of Naples is Augustan, and the vast cisterns at La Malga in Carthage are now thought to be either Augustan or Claudian[12]. At Rome there is a considerable amount of evidence for the use of storage reservoirs on branches of the network, associated especially with large public baths and imperial palaces, and while the bulk of the evidence post-dates Frontinus, some belongs to the first century AD. The first-century examples include a Caligulan cistern below the so-called Domus Tiberiana on the NW corner of the Palatine[13], and the Neronian cistern on the Palatine beneath the audience chamber of Domitian's Domus Flavia. Lanciani considered the cistern on the Palatine under S. Bonaventura (one chamber of which served as refectory for the monks) to be probably Flavian. He calls it a *piscina pensile*, presumably meaning that the water-reservoirs were supported on vaulted substructures, and refers to a a large lead pipe on which was found a *chiave di metallo corintio di peso fine a libbre novanta*[14] – a bronze stopcock weighing 90 pounds – suggesting that the cistern acted as a storage or regulation reservoir whose outlet could be controlled and implying an outlet pipe of correspondingly large size. A parallel might be drawn with the stopcock found in the tap chamber of the Bordj Djedid cisterns at Carthage[15].

More detail is available for a series of reservoir cisterns which postdate Frontinus, and while they cannot be used as direct evidence for the widespread use of reservoir cisterns in Rome at the time Frontinus wrote, they suggest that by Bruun's "local cisterns" we should be thinking in terms not of small structures, but of sizeable reservoirs on local branches of the network. The *Arcus Caelimontani* branch of the *Aqua Claudia* supplied two reservoir cisterns on the Caelian at the place called Aquaeductium, near the substructures of the Temple of Divus Claudius. The recent study by Tucci demonstrates a Severan date for one of these, and shows that the other is pre-Severan, perhaps Trajanic or first-century AD[16]. Large cisterns in the Via S. Nicola da Tolentino, with a capacity of c. 1,965 m^3 were originally considered by Lugli to be in Hadrianic brickwork, although he includes them in a list of Trajanic buildings dated AD 110-112; no detailed evidence is given for either supposition[17].

In 1873-1875 three aqueduct channels were seen heading towards the site of the Ministry of Finance, and Lanciani connected these, plausibly, with three large reservoir cisterns found during construction works for the Ministry. These he therefore identified as the terminal cisterns of the Marcia, Tepula and Julia, but considered them to be of the second century A.D. as the whole water supply arrangements of that area appeared to have undergone modification since the original construction of the lines[18]. These cisterns in fact governed only some branches of the aqueducts, as pipes also diverged upsteam of this point near the Porta Viminalis, for instance from the small circular distribution *castellum* in that area.

Lanciani also records that large cisterns on the south side of Via Principe Eugenio, between Piazza Vittorio Emmanuele and Porta Maggiore were destroyed in the summer

11 Wilson 1998, 89-91; 2001.
12 Hans Vanderleest, pers. comm.
13 Van Deman 1924.
14 Lanciani 1880, 160.
15 Wilson, 1998, 83-84.
16 Tucci 2006.
17 Lugli 1940, III, 33-37; 1957, 603. Capacity is estimated from dimensions of 4 chambers 38.55 m long x 4.32 m wide and 2.95 m high to the spring of the vault. The structure was on two levels, but the lower one served only as substructures, not filled with water.
18 Lanciani 1880, 95 and tav. VI fig. 1a.

of 1879; their brickstamps indicate a mid second-century date[19]. Approximate dimensions from the plan in *FUR* f. 31 suggest dimensions of 18.4 by 15.3 m, giving a footprint of c. 280 m^3, which might equate to a capacity of *c.* 840-980 m^3 given a water depth of 3-3.5 m. Lanciani in *FUR* f. 24 shows a *piscina a. 1597 a Sisto V destructo* near the E. end of Piazza Vittorio Emanuele. Dimensions from the plan appear to be *c.* 24 by 8 m, giving a footprint of 192 m^2, which might imply a storage capacity of 400-700 m^3, depending on water depth.

Enormous reservoir cisterns were associated with the imperial thermae of the second and third centuries: The Sette Sale, feeding the Baths of Trajan, had a capacity of c. 7,000 m^3, and the capacity of the cisterns for Baths of Caracalla is estimated at *c.* 10,000-11,500 m^3 [20]. Pirro Ligorio's measurements for the Botte dei Termini[21], which supplied the Baths of Diocletian, suggest perhaps 6600 m^3 – while Ligorio is notoriously unreliable, these figures are not out of line with those for the other reservoirs which fed imperial *thermae*.

Frontinus' delivery figures for different structures on different aqueduct lines may give some insight into the character of the various categories he lists (Table 1)[22]. The major discrepancy between Frontinus' figures for totals and those obtained by adding up the figures for individual aqueduct lines occurs with *castra* – 37 *quinariae* (Frontinus' total is too low). The figures for *lacus* are fairly consistent; they get from 2.04 to 2.45 *quinaria* on average each. *Munera* (ornamental display fountains) get between 2.0 and 22.33 *quinaria* each – most received *c.* 4 times the average lacus, though some were considerably more lavish. The greatest range comes with *opera publica* and the *castra*. Distribution to *opera publica* varied from the low figures of 2.33 for the Tepula and 2.73 for the Marcia, to the exceptionally high figure of 86.25 for the Virgo. This latter figure is undoubtedly influenced by the Virgo's supply of a few large public works – the Baths of Agrippa, the Euripus and probably the Baths of Nero[23]; the category of *opera publica* probably included imperial *thermae* (but not privately operated smaller neighbourhood baths). Interestingly, the Virgo supplied no *castra*. Average figures for the distribution to *castra* on different lines vary from 4 to 50 *quinaria*, and this considerable variation may also provide a subsidiary argument against seeing them as supplying the *stationes* and *excubitoria* of the *vigiles*. Such variation might, however, be consistent with supplying reservoir cisterns of different sizes.

In sum, while the manner in which Frontinus and his staff calculated their water distribution figures may never become fully clear to us, Bruun's suggestion that by *castra* Frontinus meant some kind of specialised feature on the water distribution network remains attractive, and the best candidate for such a feature would be reservoir cisterns on local branches of the network. In the present state of our knowledge, a specialised use of the word *castra* to mean reservoir cisterns makes at least as much sense as trying to find enough separate barracks or "camps" for military or other associations to make up Frontinus' total of 18.

[19] Lanciani 1880, 174; tav. VIII fig 6a.
[20] Manderscheid - Garbrecht 1994 (12,500 m^3); Lombardi - Corazza 1995 (10,000 m^3).
[21] Quoted in Lanciani 1880, 96-97.
[22] Frontinus, *De Aquis* 78-86; usefully summarised in Bruun 1991, 102-103.
[23] Evans 1994, 109.

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Aqueduct	*Number of castella*	*Number of castra*	*Delivery to castra* (quinariae)	*Average to castra* (quinariae)	*Number of opera publica*	*Delivery to opera publica* (quinariae)	*Average to opera publica* (quinariae)	*Number of munera*	*Delivery to munera* (quinariae)	*Average to munera*	*Number of lacus*	*Delivery to lacus* (quinariae)	*Average to lacus* (quinariae)
Appia	20	1	4	4.00	14	123	8.79	1	2	2.00	92	226	2.46
Anio Vetus	35	1	50	50.00	19	196	10.32	9	88	9.78	94	218	2.32
Marcia	51	4	42.5	10.63	15	41	2.73	12	104	8.67	113	256	2.27
Tepula	14	1	12	12.00	3	7	2.33	0	0	0.00	13	32	2.46
Iulia	17	2	69	34.50	11	181	16.45	3	67	22.33	28	65	2.32
Virgo	18	0	0	0.00	16	1380	86.25	2	26	13.00	25	51	2.04
Claudia and Anio Novus	92	9	149	16.56	18	374	20.78	12	107	8.92	226	485	2.15
Calculated Total	**247**	**18**	**326.5**	**18.14**	**96**	**2302**	**23.98**	**39**	**394**	**10.1**	**591**	**1333**	**2.26**
Frontinus' Total in *Aq.* 78	**247**	**200 (!)**	**279**		**95**	**2301**		**39**	**386**		**591**	**1335**	

Table 1: Numbers of water elements and deliveries to them in *quinaria*, by aqueduct line, according to Frontinus' figures (de *Aquis* 78-86). The Alsietina is omitted because all its water was distributed *extra urbem*.