TELL EN-NASBEH’S CONTRIBUTIONS TO UNDERSTANDING IRON AGE ISRAELITE WATER SYSTEMS\(^1\)

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ABSTRACT

Because of the wide exposure of its excavated architectural remains Tell en-Nasbeh has played a significant role in studies involving Iron Age Israelite town and house planning and the nature of the Israelite family. This essay examines a seldom explored aspect of settlement structure and planning: the manipulation of water resources. It shows how Tell en-Nasbeh’s streets and alleys were used to direct water runoff either to cisterns inside of individual houses, or to the

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\(^1\) Most of the data used in this study may be found in the author’s 1993 dissertation, especially pp. 259–89 in Volume I, Section C3 “Drains, Cisterns and Other Water Installations.” Some of the estimates have been slightly revised from that earlier work. Detailed discussions of individual drains may be found in Volume II of the same work in the chapters that cover individual map sections. Metric data, such as lengths, widths, elevations, etc. are derived from the 1:100 site plans archived in the Badè Museum Biblical Archaeology of Pacific School of Religion in Berkeley, CA. Photographs were provided courtesy of the Badè Museum through the kind efforts of Kiersten Neumann (Associate Curator) and the plans were adapted from the 1:100 scale plans in the Museum’s archives. The author thanks the Badè Museum for permission to use these illustrations here.
periphery of the town where a system of drains channeled unwanted water through the offset-inset wall or through the inner-outer gate complex. The study then examines the number and nature of cisterns at Tell en-Naṣbeh. Special attention is paid to the volume and distribution of cisterns in a study area in the south-west corner of the site. Cisterns in that area vary considerably in size, and not every dwelling possesses its own cistern. It is suggested that the existence of cisterns with capacities far beyond the needs of a typical nuclear family in some houses, and the lack of cisterns in adjoining dwellings, may be connected with the role of extended families. Finally, the seldom discussed but important role Israelite girls/women played in transporting water from sources beyond the town walls is briefly explored.

INTRODUCTION

Sunlight, air, land and water are the key ingredients for life on Earth. The land of ancient Israel is abundantly supplied with the first three. It is the fourth resource, water, which has historically been more of a problem, and has become an increasingly pressing issue in the modern world (Zizola and Faris 2011). Unlike Egypt and Mesopotamia, which rely almost entirely on their rivers, the Nile and the Tigris and Euphrates, and systems of canals for water, the inhabitants of the land of Israel have had to rely on a variety of different water sources to meet their needs (Tsuk 1997b; King and Stager 2001: 122–23). These sources include a few small rivers and streams (e.g. the Jordan, Yarkon and Kishon), a large number of springs, rainfall, and a variety of manmade systems such as wells, cisterns and some truly monumental systems (e.g. the large Iron Age systems and the aqueducts of the Roman era). In the central highlands, the core area of Israelite settlement, the location of natural springs often dictated where settlements were constructed. However, since springs were usually located outside of the settlements they served they could be an inconvenient water source; some family member would have to be tasked with drawing water from the spring and bringing it back to the house (Gen. 24:10–15; see below). In addition, because they are dependent on the amount of water in their aquifers for their flow, the volume of water that springs deliver can vary based on the season and whether the year was wet or dry (Tsuk 1997b: 132). Finally, because of the usual lo-
cation of springs outside a settlement’s fortifications, access to such sources could be cut off completely during a time of war.

However, just as too little water was a concern, an overabundance of water at one time, usually in the form of rain, could also cause problems (contra Neufeld 1970: 415). Water flowing swiftly down a sloping street could cut ruts into the surface, making walking more difficult. Conversely, this same flow could lead to unwanted silt accumulation in other locations (McClellan 1984: 64) and such muddy conditions could make walking difficult (Mic. 7:10; Ps. 18:43; 2 Sam. 22:43; Zech. 9:3, 10:5). Water could flow into houses and ruin materials kept on the floor. If the mud plaster used on the walls and roof of a building was not kept in good repair water could damage the structure. For example, quickly flowing water could undercut the base of a wall leading to its subsequent collapse. A factor outside the knowledge of the Israelites was that standing pools of water, and even water kept in cisterns, could foster the spread of diseases by providing homes for mosquitos and microbes found in human and animal waste (Rosen and Greenberg 2002: 287–91; Bradley 1977: 5–15; Carson 1919: 351; International Public Health 1914: 594).

The Israelites of the Iron Age often went to great lengths to construct systems that allowed them to store or access water resources from within their fortified settlements. They were especially adept at creating huge systems at major sites like Hazor, Megiddo, Jerusalem and others, or at important administrative centers like Beer Sheba, which allowed them to access water from adjacent springs, aquifers and wadis. These systems have been studied at great length (e.g. Shiloh 1992; Kaplan 2010; King and Stager 2001: 210–23). Less studied are the ways in which water was procured, stored and otherwise manipulated in smaller, less important settlements, or by individual households. However, those responsible for planning and constructing the walls, roads and open places of a settlement, be they members of the community itself or royal officials, had to take into account such water related factors as they constructed, rebuilt or otherwise modified their settlements. This is not to say that all settlements show evidence of such planning. Some grew in a more agglutinative manner with little, if any, advance planning. Some sites were so small that collecting or removing water was purely a household level issue.
Fig. 10.1. Plan of Tell en-Nasbeh showing areas discussed in this essay. Solid circles are locations of drains. Dashed circles are locations of Cisterns 285 and 231. Polygonal dashed line marks the area examined for water flow along roads and cistern size and distribution. Each grid square is 10 x 10 m.
However, some sites clearly attest to at least some planning, as witnessed by subsurface drains. An understanding of how the Israelites could manipulate water resources requires not only knowledge of the layout of individual houses, but also of adjoining houses, streets, neighborhoods and even the layout of the entire settlement. Such a study in turn requires a site with fairly extensively excavated remains. This makes Tell en-Naṣbeh, approximately two thirds of which was excavated, a prime candidate for such an endeavor.

This study will document the structural remains at Tell en-Naṣbeh devoted to the manipulation of the town’s water resources (Fig. 10.1). In the course of the investigation certain assumptions, estimates, and scenarios will be offered to clarify some of the issues faced by the town’s inhabitants. For example, this study suggests an average daily water consumption of 10 or 15 liters per person (Zorn 1993: 302–03). Similarly, it is assumed that the average size of a nuclear family is about 5 individuals in a single dwelling (Zorn 1994: 32–33; in contrast Schloen suggests a mean household size of 6–7; 2001: 136). The outcomes of scenarios based on such assumptions will differ if another scholar works from a different set of metric assumptions. The point of such exercises, however, is two-fold. First, they help bracket, at least broadly, some of the issues faced by the Israelites themselves. Second, they will encourage others to think more about the amount of effort average Israelites of towns and villages put into dealing with this most important resource. While the systems they created for this purpose were not as monumental as the huge shafts, galleries and tunnel systems found in major Iron Age sites they do reveal a certain level of national, communal, and individual planning. For example, drains that fed out below a building’s walls had to be constructed before those walls. If a drain was to run through or below the settlement’s wall, or below some part of the gate other than its passageway, the drain had to go in first. This was a decision that had to be implemented by the royal engineers who laid out such major fortifications, such as those at Tell en-Naṣbeh. Similarly, the town’s buildings and roads could be laid out so that water did not collect in unwanted areas, but flowed towards outlets or storage installations. This is more a community scale issue. Exactly where a cistern would be located in any given house would be up to its owner. Yet, the engineers, community leaders, and individual homeowners were all dealing with the same resource.
BENEFITS AND PROBLEMS OF WORKING WITH OLD SITES

A significant problem with most excavations of the last few decades is that complete plans of individual Iron Age houses, let alone the neighborhoods in which they were located, are becoming increasingly difficult to come by. This is due to the much slower and more careful excavation and recording techniques in use today. Modern excavations at multi-strata sites with deposits of significant depths are often lucky to excavate a significant part of a single building. Site wide plans, or even plans of neighborhoods, are almost impossible to achieve anymore except at single period sites, or at sites where the latest occupation stratum is the one being studied. Even in these more ideal situations widespread exposures of more than just a few houses are difficult to achieve. While it may be possible to say that a house had a cistern, it is usually not possible to determine how that cistern related to all relevant adjacent spaces. Thus, analysis of how water was manipulated on a site-wide basis is usually impossible in recently excavated sites. However, this is where the old excavations conducted during the period of the British Mandate (and even earlier) can be of great use. These sites (e.g. Megiddo, Tell Beit Mirsim) were often excavated on a vast scale, dwarfing the exposures visible today. While many kinds of detailed information (e.g. animal bones, pollen, micro artifacts) were undoubtedly missed, macro information regarding town plans is available, and this is exactly the information necessary for understanding how water was manipulated. Tell en-Naṣbeh is a perfect candidate for studying the kind of macro social activity that can be garnered from these old reports. The deposits there are relatively shallow and, with the large labor force employed at that time, approximately two thirds of the site was excavated, much of it to bedrock. Because it is a fortified rural town it provides evidence of how water was manipulated outside of the major urban centers excavated on a similarly large scale in the same era (Megiddo, Lachish, Samaria, Gezer).

The problems of working with data from these early excavations (and Tell en-Naṣbeh is no exception) are well known and only a brief summary is required here (Zorn 1999). Elevations on walls, especially along their bases, are usually sparse or non-existent. Floors (especially dirt floors) were often missed, leading to
mixing of artifacts of different periods. Intrusive features, like pits, were often not noticed or recorded. Photographic documentation may be sparse, or even non-existent for certain features, and the features themselves may not have been well cleaned for those photographs. The exact location of even in situ floor assemblages may not be recorded. For these reasons, and others, site stratigraphy may be confused and chronology imprecise.

At Tell en-Naṣbeh there is another significant issue, the longevity of the site. The main Iron Age phase at the site, with its three sub-phases (Strata 3C–3A according to the revised stratigraphy in Zorn 1993: 88–93), likely covers a period from the tenth century through beginning of the sixth century BCE. Over this period it is clear from changes in wall construction techniques (e.g. single stone walls early, double stone walls later) that houses were modified in a variety of ways. For this reason, it is usually impossible to know when one house was modified internally in comparison with its neighbors. Thus the plan of Stratum 3 is something of a chronological pastiche. Nevertheless most house plans are very complete and clear, exhibit a mixing of wall construction techniques, and the buildings usually follow typical three- and four-room plans, cohering with neighboring structures into readily observable architectural or neighborhood blocks. This suggests that the basic plan of the settlement changed relatively little over the centuries. Of course, the plan primarily represents the appearance of the town in its final phase at the beginning of the sixth century.

**WATER MANIPULATION: INTRODUCTION**

There are three basic factors that determine the character of any drainage system: the natural slope of the site; natural or man-made obstacles to water flow; and whether the area through which the water was to flow was also used for human or animal traffic. The most obvious example of a man-made obstacle is a town wall. Drainage in a small, unwalled settlement is a much smaller problem than in a walled town. A wall turns a town into a sort of reservoir which traps and holds in water. Examples of smaller man-made obstacles include architectural terraces, stairways and thresholds. Natural obstacles include high and low points in the bedrock.
Fig. 10.2. Looking north along drain in M18; the drain enters the town wall where the man is standing (Badè Museum of Biblical Archaeology photograph #693).

Fig. 10.3. Schematic plan of drain in M18; 1:500.
The natural slope of the site is of great importance. At a site built on a ridge, like Tell en-Naṣbeh, water will run off on both sides of the ridge. Because of the natural weathering and erosion of the underlying limestone bedrock hill country sites typically have a terraced appearance that falls away from the central high point. A settlement built on a reasonably flat plain will not have either this natural bi-furcation or terracing. Also, a site built on a terraced hilltop is not usually level from one end to the other; there is usually some slope along the hill. Water pouring downslope perpendicular to the crest of the ridge will eventually have to flow parallel to it once it meets a natural or man-made obstacle, such as the town wall, or else collect in a pool. At Tell en-Naṣbeh the slope is downward from south to north.

Site-wide sub-floor drainage did not exist in Iron Age Israel; water had to be channeled above ground most of the time, going underground only when practical or necessary. The only real avenue for extensive aboveground drainage was a town’s road system. However, these same roads had to remain serviceable for human and animal traffic. The water could not be allowed to impede movement by either collecting in extensive pools or too badly eroding the dirt surface of the roads.

SITE WIDE DRAINAGE

Tell en-Naṣbeh follows the classic ring-road structure characteristics of many Israelite hill country sites (Shiloh 1987). Houses along the periphery form a band facing inward onto a road that rings the settlement. Across the road and up slope is another band of houses facing outward and downward. The ring-road at Tell en-Naṣbeh is not continuous around the site; it is interrupted by a block of houses at least at one point on the west (the area east of the drains in AB13 and AD14 in Fig. 10.1), but the underlying principle of a ring-road is clear. In order to facilitate ease of movement through the settlement, the town is crossed by several roads that run perpendicular to the ring-road. The inhabitants of Tell en-Naṣbeh used the ring-road and cross-roads as part of their settlement’s
drainage system. They intended to move water away from where it was not wanted, to places where it was needed, or to remove it from the town into the area beyond the settlement’s wall.

One of the most striking aspects of the layout of Tell en-Naṣbeh is the number and location of drain channels found in the intra-mural area associated with the offset-inset wall and how these features are related to the nearby road system. Eight such drains were identified, extending in a band from about the middle of the western side of the town to its northern end. An analysis of the interplay of these drains and the nearby road system reveals how the engineers who oversaw the construction of Tell en-Naṣbeh’s massive fortifications took into account the pre-existing road system constructed by the town’s inhabitants.

The drain in M18 is constructed in the intramural fill poured up against the town wall (Figs. 10.2–3), is about 7.5 m long by 2.3 m wide, and has walls ranging from ca. 60 to 90 cm thick. An elevation on the floor of the drain where it meets the town wall is 775.98, another on its east wall near its south end is 777.61. The inner channel walls are made of large, rough ashlar blocks set stretcher fashion. These are up to ca. 1.3 m long and 35 cm wide. The external part of the drain walls is composed of smaller cobbles. The floor of the channel may have been stone lined, though this is uncertain due to incomplete documentation. The drain clearly runs up to and into the city wall. Unfortunately the architectural remains in the vicinity of the drain are not especially clear, so how water was fed to the drain from within the town cannot be determined.

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2 See already McClellan 1984: 64–65 for insightful comments about the importance of drainage, in general, in Levantine settlements, and drainage at Tell en-Naṣbeh in particular.
Fig. 10.4. View of larger drain in N15 looking north as the drain begins to pass through the offset-inset wall (Badè Museum of Biblical Archaeology photograph #356).

Fig. 10.5. Schematic plan of drains in N15; 1:500.
In N15 two drains were found (Figs. 10.4–5). The smaller drain is clearly built over Room 213 (shown on McCown 1947: fig. 41) that was part of the casemate-like fortifications of the original Stratum 3C town. The larger drain is also built over an earlier wall (also shown on McCown 1947: fig. 41). Both are built in the fill deposited against the offset-inset wall. The larger drain leads directly into the town wall. The plan shows this more substantial drain to be about 6 m long by 1.5 m wide; top and bottom elevations on the south drain wall are 776.71 and 776.19. Several capstones seem to have been found in situ. The drain walls are fieldstones and it may have had a plastered floor, though this is not certain. The relations of this drain to the architecture to its south are not clear. The smaller drain in N15 is to the southwest of the larger one just described and is not as well preserved. It is about 3.2 m long by 0.6 m wide. Its walls are constructed of narrow stones set lengthwise. The elevation of the channel is about 776.69. It is not clear if the small drain originally fed into its larger neighbor in some way, though this seems doubtful given the locations of the preserved segments, or simply directed water into the intramural zone which then flowed on its own into the larger drain.

Fig. 10.6. Schematic plan of drain in Q13–R14; 1:500.
The drain in Q13–R14 (Fig. 10.6), approximately 20 m long, sits southwest of a small tower. Its remains were not represented on the 1:400 site plan of the 1947 report and it is not mentioned in the text of the publication, but it does appear on fig. 41 (McCown 1947: 181); it is briefly mentioned by McClellan (1984: 65). No photographs were taken of the drain. The construction of the drain is not uniform. Adjacent to the city wall, the walls of the drain channel are three stones thick, about 1 m wide, with an overall width of about 2.3 m; in the intramural area the walls narrow to a single stone in width, about 0.8 m wide, with an overall width of about 1.4 m; they widen to two stones in R14, about 0.8 m wide with an overall width of about 2.4 m, where the channel is alongside the tower. Ten capstones were preserved. The top elevations of the capstones are 776.19 and 775.73, and the lowest point in the channel is 774.90. The drain runs up to the 3B offset-inset wall, but could not be traced through it. Clearly, since the drain runs from inside the ring-road town of Stratum 3 up to the offset-inset wall the drain is contemporary with both. Perhaps the section of drain walls two stones thick belongs to the original 3C town and the drain was later modified and lengthened when the offset-inset wall was added. Water was likely fed into this drain from the presumed ring-road to the east.

Fig. 10.7. Schematic plan of drain in drain in Y12; 1:500.
The next drain along the western side of the town is in Y11–12. The plan of the drain channel is not very clear (Fig. 10.7). The only available photograph (Fig. 10.8) shows a close up view of the drain; there it seems that a later wall is built partially over the south wall of the drain, obscuring its construction. It almost gives the impression that there are two drains, one above the other. The preserved remains of the drain are about 10 m long and 1.5 m wide. The visible drain wall is two stones wide, and the drain had a stone-paved floor. It may be that two capstones survived. An elevation on what may be a capstone is at 776.44; the base of the drain wall is at about 775.60. Both the plan and photograph show the drain crossing the offset-inset wall. The area to the east of the drain was not excavated, so how it related to the town’s layout is unknown.

Fig. 10.8. Looking south at drain in Y12 (Badè Museum of Biblical Archaeology photograph #791b).
To the south and east is what appears to be a drain in AB13 (Fig. 10.9). Unfortunately there is no photograph of this feature. Here there are two narrow stone walls made of small to medium sized fieldstones, with what look like stone paving between them. The top elevation on the south wall is 775.75 and the base elevation of the north wall is 775.18. McClellan also recognized this feature as a possible drain (1984: 59). How water was fed to this possible drain from the town is unclear. To the east is a space designated as Room 388 (McClellan 1984: 59). Like road 541 to the southeast, which clearly does direct water into a drain channel, 388 is paved with stone cobbles and is not part of any adjacent building. Moreover, it aligns with cross-road 644, just as 541 aligns with cross-road 627. However, unlike 541 that clearly opens into the intramural space beyond, 388 seems to be blocked on the southwest by the walls of a casemate room. The plan does not show a passage from 388 to the intramural space. However, it is also clear from the plan that there were two or three stages of construction in this area, so it may be that at some point there was such an opening. Also, unlike 541, none of the adjacent structures seem to be oriented to open on to 388; rather, they seem to open onto the ring-road.
Because of its similarity with 541, and because it does not seem to serve for access to the buildings to either side, it seems quite possible that 388 did funnel water into the intramural area at some point in the town’s history.

The next drain is in AD14 (Fig. 10.10). There is no photograph of this drain. However, it was well enough preserved that the plan shows its channel running completely through the offset-inset wall. Its preserved length is 8.4 m and the width of the channel is ca. 30 cm. The top of its north wall is at 776.28, with a base of 775.53; what seems to be a capstone is at 776.70 and the floor of the channel is at 775.75. The drain walls are ca. 1.0 m wide and composed of small to medium fieldstones three to four stones wide. It is uncertain how far to the northeast the channel extended. The channel is aligned with road 541 to the east. This cobblestone paved road provides drainage for water flowing along ring-road 514 and cross-road 627 and channels it into the intramural area. The drain in AD14 is the obvious destination even though the original site plan shows several later walls in the intramural area.
Fig. 10.11. View to west of drains in AF17 and AG16–17. Most of the capstones have been removed (Badé Museum of Biblical Archaeology photograph #1363).
The final two intramural drains are found in AF17 and AG16–17 (Figs. 10.11–13). The southern, larger drain was about 9.0 m long, 2.5 wide, has walls up to 1 m thick, and the channel is about 60 cm

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3 McClellan (1984: 65, fig. 4) reconstructed a side-road (his road 505) similar to roads 541 and 517 in the long, narrow string of rooms southeast of Ci 358 (a suggestion also made by Badè in his diary; Zorn 1993: 762). His reconstruction of this space as a road leaves out the walls which separate the rooms along this narrow space, but the only explanation offered for these cross walls is that they prevented excessive drainage through this space. While it is possible that McClellan’s road 505 was an alley used to channel water into the intramural area, it is troubling that there is no drain located beyond its southwestern end; such drains are the norm with all other such side-roads. Unfortunately the relation of this string of rooms to the large structure to their southeast is not clear. If this space was a side-road it is unclear if the water flow was directed north to the drain in AD14, or south to the drains in AF17 and AG16–17.
wide. Six capstones were preserved; the easternmost is at 779.04. One elevation on the north wall is at 778.74. The floor of the drain is at 778.39 on the east and 777.92 on the west. It runs up to, but not through the offset-inset wall. The northern, smaller drain has walls 20 to 40 cm thick with a channel about 20 cm wide. Only one capstone was preserved and has an elevation of 778.09. An elevation on the north wall is at 777.95. The floor of the channel on the east is at 777.39 and 777.25 on the west. Photographs also suggest that the northern drain may be a bit lower than its southern neighbor. The plan gives the impression that the two drains converge toward the west, but there is no sign that they actually met. In fact, the southern drain seems to occupy space towards the offset-inset wall that the northern drain might have passed through, at least partially. Since the northern drain is not preserved in the vicinity of the offset-inset wall it seems likely that the northern drain was the original drain, which was eventually replaced by its larger neighbor.

Understanding the relationship of these two drains to the town plan is complicated by several factors. First, on the original site plan only the larger, southern drain is depicted. More important, the town architecture around and east of the drain is muddled on the plan. The rooms presented on the published 1:400 site plan in AF/AG17–18 (generally numbered in the 400–430 range) represent structures both of the Iron Age Stratum 3 town, and walls of the later Stratum 2 (Babylonian–Persian periods). The Stratum 2 walls are especially evident around the drains. The walls of Stratum 3 in this area are actually found on fig. 42 of the site report (McCown 1947: 182). When the Stratum 2 walls are removed from the site plan, and the earlier walls of Stratum 3 from fig. 42 are inserted, a clearer picture of the Iron Age II town in this area emerges (Fig. 10.13; also McClellan 1984: 55, fig. 4). Similar to the situation with road 541 to the north, road 517 fed water from the ring-road 514 and cross-road 563 into the intramural area. As with road 388 and its drain, it is uncertain how water crossed the area of the casemate-like wall to reach the drains. However, the presence of two drains to the west of road 517, and the similarity of the situation here to road 541 and its drain, suggest that some arrangement for drainage through the wall must have existed.
Fig. 10.13. Schematic plan of drain in AF17 and AG16–17; 1:500.

From the above discussion several points regarding the drains along the north and west sides of the town become apparent. The drains are built in the fill piled up against the inner face of the offset-inset wall. The drains are not of uniform construction. Several of the channels demonstrably continue into the offset-inset wall itself, and one can be seen to continue all the way through the wall. It is clear from the drain in Q13–R14, the most completely preserved channel that runs from inside the original casemate-like wall, through the intramural area, and up to the offset-inset wall, that these drains were all probably integrated into the plan of the Stratum 3 ring-road town, even if in most cases their preserved remains preclude definitive assessments (contra McCown 1947: 185, 202). Wherever the excavated adjacent architectural remains are substantial enough to establish their plans, these drains align with spaces in the town that seem to be roads which create breaks in the peripheral band of houses. In at least two cases these feeder roads were paved with cobbles, perhaps as a way to combat erosion, and thus suggesting heavy water flow through these areas. It seems likely that wherever understanding the local architecture is problematic it may be possible to reconstruct similar lanes likewise providing ac-
cess from the interior of the town to the intramural space inside the offset-inset wall (Isserlin 1998: 121, for general comments on drainage patterns in Iron Age towns). Finally, it is clear that those responsible for the construction of the drains in the intramural areas did face some difficulties. The superposition of certain drains (M18, N15) over some of the original casemate-like wall, and the free flow of water along one cobbled alley (AD14), while a similar nearby cobbled alley shows some blockage (AB13) are evidence of these difficulties. The construction of the new town wall, the pouring of a massive leveling fill between the original casemate-like town wall and new solid fortification system, and the need to run drains from inside the original town through the new fill and the new offset-inset wall required modifications to existing structures in some cases. It is not surprising that the integration of the old settlement with its new fortifications raised such problems for those responsible for its construction.

Given these data it seems likely that the drains were constructed at the same time as the city wall. This massive project probably took place in the time of King Asa of Judah who is said to have constructed Mizpah’s walls in the early 9th century (1 Kings 15: 22; contra Finkelstein 2012), and not in the sixth–fifth centuries, as is stated in the original site report (McCown 1947: 185).

**Diverters/Curbs in Roads**

There are clues in the site plan that the slope of a street and door thresholds were not always sufficient to prevent unwanted water from entering adjacent dwellings. In certain locations the town’s inhabitants constructed single stone wide curbs in front of their houses to divert water away from their doors (McClellan 1984: 65; Isserlin 1998: 121; Fig. 10.24 below). These are either C- or L-shaped in form. Two such diverters can be seen on the north side of cross-road 563 (one is labeled Bin 352 on the site plan). Two similar diverters are found along the ring-road. The first is adjacent to Cistern 165, and what may be another is to the west, where it may be protecting what appears to be an oven that was also constructed in the road. The southwestern end of road 563 extends beyond the front wall of the adjacent building, apparently to direct the flow of water from road 563 into the northern part of road 514 instead of into road 517 (McClellan 1984: 65). As will be seen below, some homeowners created ways to capture water from adja-
cent roads to fill their cisterns. These curbs clearly show that other homeowners also strove to keep unwanted water out of their dwellings.

**Gate Drainage System**

In many sites the gate area was very often the site of a drain because the gate was the major natural break in a settlement’s defenses and was also often a low point in the site’s fortifications. That is, the gate was in an area that sloped down, which facilitated drainage. For this reason the construction of a drain in such an area made practical sense. Some examples of sites with gate drainage systems include Megiddo, Gezer, Lachish and Beer Sheba. The gate complex at Tell en-Našbeh provides another example of such a system.

Because of its position on the main north–south road on Judah’s northern border Tell en-Našbeh was especially well protected, with defenses more typical of a major urban center than a rural agricultural town. The entry into the town was defended by an inner-outer gate complex (four-chamber inner gate and two-chamber outer gate), a feature that is paralleled at a number of prominent sites (e.g. Megiddo, Lachish). Because of the local topography on the eastern side of the settlement the gate complex was especially long, almost 90 m from north to south (see Zorn 1997 for a detailed discussion of this gate complex). Four sections of drains were found in the vicinity of this gate system (Fig. 10.14).
Fig. 10.14. Schematic plan showing drain segments in area of inner-outer gate complex; 1:700.
The best preserved and documented drain segment is found just outside the outer gate (R–S24; Fig. 10.15). From just outside the gate’s threshold on the south it follows a slightly curving path for a distance of about 14.5 m to the north. The overall width of the drain is about 50 cm and the interior channel is only slightly more than 20 cm wide. The drain’s walls are constructed of small, mostly rectangular fieldstones laid stretcher fashion. A total of twenty-nine capstones were preserved. An elevation on a capstone at the south end is 773.99. The nearby drain wall is at 773.88 and an elevation on the drain floor here is at 773.64. An elevation on the drain floor not far from its midpoint is 773.45; about one third of the distance to its northern end is a floor elevation at 773.16. On the north the drain ends on the east side of what seems to be a rock-cut installation. This feature is roughly 2.0 m on a side and 1.5 m deep (773.29 to 771.83). There is no photograph of this feature. Possibly the installation is a kind of cistern into which the drain emptied. This would have provided water outside the town for arriving people and animals. However, if there was once a direct connection between the drain and the installation it was not preserved. Unfortunately the floor of the outer gate and the area immediately to the south of the gate inside the town were not excavated down to the
depth of the drain, so the feature’s nature in these areas is unknown.

Two sections of drain are preserved in the space between the inner and outer gates. The section in W24 was uncovered in a test trench dug in 1927. For some unexplained reason many of the architectural remains from this trench, including the drain, were not reproduced on the original 1:400 site plan; they only appear in figure 57 of the site report (McCown 1947: 220). The drain was also not photographed. The walls of the drain are constructed of small fieldstones and are two to three stones wide. The drain’s preserved length is 2.7 m and its overall width is 1.4 m. The drain walls are about 45 cm wide and the channel is 50 cm wide. Two capstones were preserved. An elevation on one capstone is at 775.14 and an elevation on the floor of the drain is at 774.69.

The third section of drain is in Y–Z24, just north of the inner gate (Fig. 10.16). The northern half of the drain runs north to south while the southern part bends to run to the west. The preserved length of the drain is 12 m, with an overall width of 1.2 m. The walls of the drain are about 30 cm thick and constructed of field-
stones one or two stones wide; the channel width is 60 cm wide. The eastern wall of the drain, where it bends to the west, is not preserved. Approximately 18 capstones were preserved along the northern stretch of drain, but none were preserved on its western extension. Elevations on the northern and western walls are at 778.09 and 778.06. No elevations are preserved for the northern half of the drain, but the floor of the southern half sloped down from 777.84 on the west to 777.44.

How this section of drain functioned in conjunction with the other sections of drain found in the gate area is a bit problematic because of its westward bend. The drain is well below all the other walls (Stratum 2) preserved in its vicinity, except for a section of wall in Z23–24 against which the western extension of the drain ends. This fieldstone wall is 8.3 m long, 1.7 m wide on the north and about 2.4 wide on the south; the place where the wall widens is hidden under a later wall. This wall partially overlies a projected continuation of the western wall of the outer gate complex and its southward extension uncovered in W23. The wall in Z23–24 is only about half as wide as the wall in W23, but has similar thicker and thinner sections (an offset-inset?). This wall also lines up well with the western wall of the inner gate. It may be then that the wall in Z23–24 is a narrower continuation of the wall in W23 that connected the two gates. If this is the case perhaps this section of drain collected and drained at least some of the water that accumulated in the space between the two gates. It is also possible that the western extension of the drain was installed in Stratum 2 and was used to drain runoff away from the new buildings constructed to the northwest of the then abandoned inner gate. Finally, a short section of a narrow fieldstone wall was found south of the drain. It appears to be below an adjacent wall of Stratum 2, but there are no elevations on it. This possible section of wall is about the same width as the walls of the drain in Y–Z24 and roughly lines up with the north–south course of the drain and with the space where the opening would have been in the inner gate. It is possible that this fragment represents a southward extension of the drain in Z24.
Finally, a short fragment of a drain channel was found in AB25, just south of the inner four-chamber gate (Fig. 10.17). This drain, like that in W24, was not reproduced on the original 1:400 site plan but does appear in fig. 52A of the report (McCown 1947: 210). Its preserved length is 1.5 m and overall width is 1.3 m. The walls are 35–45 cm thick and the channel is about 45 cm wide. Three or four capstones were preserved. An elevation on the west wall of the drain is at 776.84; what seems to be an elevation on the floor of the channel is at 776.60. Its elevations are one or two meters below those of the adjacent foundations of the four-chamber gate to the north. A systematic error of 1.0 m was made in many of the elevations on the 1:100 plan that documents the drain, including features adjacent to the drain, so the precise depth of the drain below the gate is uncertain; the photograph suggests a depth greater than one meter. The orientation of the drain would lead it through the central opening in the gate. Probably it was part of a larger system that drained a small plaza inside the inner gate. It is unclear wheth-
er it connected with the drain channel north of the four-chamber gate in Y–Z24 described above. The floor of the drain in Z24 is at 777.44 and 777.84, about a meter higher than the drain fragment in AB25; this would make a direct connection unlikely. However, as noted, there was a one meter error in recorded elevations in parts of the inner gate area. The elevations on the plan for the drain were not corrected upwards by that amount; if they were adjusted the drain in AB25 might have connected with that in Z24.

Some general observations on the gate drainage system can now be made. The drain sections in W24, Y–Z24, and AB25 were all constructed in the intramural fill poured up against the offset-inset wall of Stratum 3B. The two sections within the gate complex are below walls of Stratum 2. The drain sections are of various construction techniques, their walls are not of uniform thickness and their channels are not of the same width. The section of drain north of the outer gate is smaller than those within the gate complex. Since the outer gate is the only part of the gate system which continued in use into Stratum 2 it may be that an earlier drain channel, comparable in size to those inside the gate complex, once existed in this area in Stratum 3 and was replaced by a smaller drain in Stratum 2. There is a downward slope from south (776.60) to north (773.16) between the existing drain sections, assuming that the elevations of the drain in AB25 are adjusted by one meter; this is about 3.4 m over 100 m. Even if the drain section north of the inner gate belongs to Stratum 2, the visible drain sections nicely represent a single system that served to drain the area of the inner-outer gate complex of Stratum 3. It is likely that other sections of drain channels still lie hidden in unexcavated areas of the gate complex.

**Intramural Cisterns**

The town’s street system and wall drains were not the only means the inhabitants of Tell en-Naṣbeh had for dealing with excess water. Another method was the use of intramural cisterns. Two such cisterns are known. One is Cistern 285 located in the northeast in AP22 (Fig. 10.18); the other is Cistern 231 in the southeast in AF27 (Fig. 10.19). Both cisterns predate the offset-inset wall. The wall was built part way through the entrance to Cistern 285, while a niche was left in the wall to accommodate Cistern 231 (McCown 1947: 217). There is a niche in the offset-inset wall in V24, just in-
side the outer gate, which has a narrow enclosing wall similar to the wall enclosing the mouth of the Cistern 231, so perhaps this marks the location of a third unexcavated cistern. Herzog (1992: 263) claims that there were six intramural cisterns fed by drain channels, but does not give their number designations, so it is impossible to know which cisterns he intends. None of the drain channels discussed above feeds into a cistern, and neither Cistern 285 nor 231 is fed by a drain.

Fig. 10.18. Cistern 285; 1:500.

Fig. 10.19. Cistern 231; 1:500.

**HOUSEHOLD CISTERNs AT TELL EN-NAṣBEH**

Israel’s Mediterranean climate has two main seasons, a cool wet winter when most of the rain falls (October to April) and a warm dry summer in which there is little to no rain (May to September). Tell en-Naṣbeh is in an area that receives about 50 cm of rainfall per year. Clearly, given the long dry season, it was in the best interests of the community to capture and store as much of this half
meter of rainfall as possible. One of the most important techniques for capturing and storing rainfall for later use was the cistern, a usually rock-cut, sub-surface storage chamber. While cisterns had been used to some extent since the Bronze Age (Miller 1980) their use begins to become more pronounced in the hill country in Iron Age I, and greatly proliferates in Iron Age II (King and Stager 2001: 126; Zertal 1988: 348–50; Faust 2005: 207–08; Tsuk 1997b: 130–31). However, it is incorrect to claim that most Iron Age II houses had cisterns (King and Stager 2001: 126; see Hopkins 1985: 151–52, 265–66; Isserlin 1998: 121), as is clear from the remains at Tell en-Naṣbeh.

Cisterns (ḇôr, bôʾr) are mentioned in twenty-two verses in the Hebrew Bible (Stager and King 2011: 122–23). Several of these passages indicate that the possession of one’s own cistern was very desirable, a sign of the good life (Deut. 6:11; 2 Kings 18:31; Isa. 36:16; Neh. 9:25; Prov. 5:15). The construction of cisterns by kings was occasionally noted (2 Chr. 26:30; Jer. 41:9). However, water

Fig. 10.20. Floral motif in plaster in Cistern 33. Note the stippling in the lower plaster layer used to help bind layers together (Badè Museum of Biblical Archaeology photograph #A70).
from a cistern was seen as inferior to spring water (Jer. 2:11) and was subject to ritual corpse contamination, which water from a spring was not (Lev. 11:36). A cistern might also be used as a hiding place during war (1 Sam. 13:6), as a prison (Jer. 37:16, 38:6–13), and as an impromptu burial site (Jer. 41:7–9).

The original Tell en-Naṣbeh report identified 53 cisterns based on the presence of “water-proofing cement” (McCown 1947: 129). Plaster on the wall of Cistern 33 preserves stippling marks used to key layers of plaster together; it also preserves an impressed floral design (Fig. 10.20; McCown 1947: pl. 44.1–2). Cistern 159 preserved three layers of plaster (McCown 1947: pl. 45.2). However, 53 cisterns is a minimal estimate because such plaster may not have survived in all cisterns, and not all cisterns cut into limestone need such plastering to make them water tight (King and Stager 2001: 126). The main distinction between the two types of rock-cut features identified at Tell en-Naṣbeh, cisterns and silos, is shape (for additional details on Tell en-Naṣbeh cisterns see Zorn 1993: 275–85). Cisterns tend to have narrow circular mouths which can easily be sealed to help prevent large debris, animals, and humans from falling in, and also to reduce evaporation (eight Tell en-Naṣbeh cisterns were found still sealed; e.g. McCown 1947: pl. 95.1). Cisterns also tend to widen out substantially below ground while silos tend to have mouths that are about the same diameter as their shafts (the roofs of some cisterns may have collapsed, making them seem more like silos). On the basis of form, the previous number of identified cisterns has been increased from 53 to 101 site wide. Some number of these may not have been in use simultaneously with others, and some number must certainly have existed in the one third of the site that was not excavated. An estimate of roughly 110 cisterns for the entire site at any moment seems appropriate for Stratum 3 (Zorn 1993: 283). A similar estimation of the total number of dwellings in Stratum 3 amounts to about 200 (Zorn 1993: 116). In other words, it may be suggested that somewhat more than half of all houses had any sort of cistern.
Forty-four of the 53 originally identified cisterns were grouped into two types (Fig. 10.21). The more numerous type (39 examples recorded, 89% of total) is bottle-shaped, that is, below their necks they broaden out in rough trapezoidal forms. Fewer in number (5 rec-
In most cases no obvious channels used to fill the Tell en-Naṣbeh cisterns remain. The best preserved example feeds water from the intersection of roads 514, 627 and 541 into Cistern 363 by way of a stone-lined and covered channel (Fig. 10.22). Drains were also found feeding Cistern 119 (unfortunately there were are no other surrounding architectural remains; McCown 1947: pl. 79.3–4) and Cistern 326, found inside the 4-room house of Stratum 2 inside the outer gate. Cistern mouths were cut into bedrock, but over time, as floor accumulations increased in depth, it seems that the construction of narrow stone walls around them raised the mouths of cisterns. Some examples include Cisterns 176 (McCown 1947: pl. 101.4), 165 in the southern part of the study area (McCown 1947: pl. 44.5), and 363 (Fig. 10.22). Presumably most cisterns were sited at low spots in floors and water simply flowed in from the sur-
rounding space. McClellan (1984:61) noted the large number of cisterns at the lower western end of cross-road 644 where it connect to road 388 (Ci 364a and others around it), and suggested they were so sited in order to capture runoff from that street. There has been much debate over whether three- and four-room houses were completely roofed over or contained an open courtyard (e.g. Stager 1985: 15; Netzer 1992: 195–97; Mazar 1990: 485–86; Holladay 2009: 69–70). It perhaps makes more sense that the mouth of a cistern would be located in a space open to the elements in which water collected, rather than in a roofed over space, especially if there is no evidence that water was fed into the cistern from an adjacent road. Of course, the presence of such a channel providing water from beyond the room in which the cistern was located, such as for Cistern 363, obviates any need for placing it in an open space. Water from such open and public spaces was not, however, of the highest quality (Rosen and Greenberg 2002: 286).

Evidence that cisterns were sited so that they might be filled directly from street runoff does, however, exist. Cistern 363 has already been mentioned. Cistern 380 has two mouths; one is located inside the house, the other, beyond the house wall, is located in the adjacent ring-road 514 (Fig. 10.23). A low wall also cuts across the interior of the cistern, perhaps suggesting that one part of the cistern was a settling basin for street debris. Cistern 380 is thus the clearest example of a cistern constructed to make use of street runoff. However, there are indications that other cisterns made similar use of street runoff, though in a less sophisticated manner. In the study area the mouths of several cisterns were found cut across by house walls that separated the dwelling from an adjacent road (357, 359). Several other cisterns also seem to lie along the projected line of similar front house walls (146, 160, 161, 163; McClellan 1984: 65), though the walls themselves were not preserved. It is possible that the cisterns cut across by walls in this fashion allowed water to flow into them from the street and be drawn from inside the house.
Fig. 10.23. Looking north along ring-road 514. The mouth of Cistern 380 in the road is on the right, while the opening on the left is inside the house (Badé Museum of Biblical Archaeology photograph #1294).
What does the ratio of cisterns to houses say about how water was manipulated at Tell en-Naṣbeh? In the study area there are substantial remains of 31 buildings that seem to be dwellings, mostly of the three- and four-room variety (Fig. 10.24). As indicated by squiggly lines on the 1:100 plans these structures were almost all excavated down to bedrock. A total of 20 cisterns were found in these dwellings. However, four of the dwellings had two cisterns each. Thus, of the 31 dwellings 15 did not possess their own cistern, while 16 had one or two cisterns, a ratio of almost 1:2. The possession of one’s own cistern was a clear desideratum for the biblical authors (who were no doubt upper class and might well have been able to afford the construction of a cistern). In some sites (probably small ones) and in some periods every house may have had one. It is clear, however, that even in the hill country not every house necessarily had one (Isserlin 1998: 125, 139).
If access to, and storage of, water was a significant concern to the ancient Israelites why did every house in the hill country not have a cistern? As shown above, a well-sited cistern could be fed from roof, courtyard and street runoff, obviating the need for carrying water from a spring every day (more on this below). A cistern could also provide a certain amount of water independence. If a large cistern were full at the end of the rainy season its owners knew how much water they had available to last them through the summer. During a siege access to a settlement’s spring might be cut off and a cistern might be its owner’s only source of water. During the summer or a period of drought the flow of local springs might be severely diminished, which would also affect how much water was captured in cisterns, but some could, at least, be captured. However, cisterns do have their own drawbacks. Cisterns also contain debris from human and possibly animal activities in courtyards and streets and so are likely less healthy than water drawn daily from a spring, though springs can also contain varied contaminants (Rosen and Greenberg 2002: 291–92). Also, the hewing of a cistern is not a trivial matter. The construction by hand of a cistern with a capacity of 20 m$^3$ could require the removal of solid limestone weighing 50 tons, and the huge Cistern 159 might have required the removal of over 140 tons of solid rock (Walker 2011). Once hewn a cistern would likely require some maintenance, either in the form of occasional plastering or cleaning. However, how often, if ever, a cistern was cleaned out is not clear. For example, Cisterns 361 and 369 each contained over 100 recorded finds of all types, and Cistern 370 contained 275+ objects, including bones, suggesting that cleaning could be rare in some instances.

However, as is clear from the number of cisterns found at Tell en-Naṣbeh, the town’s inhabitants believed that the hewing of a certain number of cisterns was desirable. That is, the benefits were thought to largely outweigh the disadvantages. Why then do only about half the houses have cisterns? After all, the Stratum 3 settlement existed for over 300 years, so there was a great deal of time in which to undertake the work. The answer may be tied in to the capacity and distribution of the cisterns themselves.
### Table 10.1. Cistern Capacities in Study Area

<table>
<thead>
<tr>
<th>Cistern</th>
<th>Shape</th>
<th>Base</th>
<th>Depth</th>
<th>Volume</th>
<th>Individuals</th>
</tr>
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<tbody>
<tr>
<td>Ci 155</td>
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<td>4.6</td>
<td>3.0</td>
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<tr>
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<tr>
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<td>57.5</td>
<td>32/21/38/26</td>
</tr>
<tr>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
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</tr>
<tr>
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<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
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<td>2.9</td>
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<td>36.6</td>
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<tr>
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<tr>
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<td>-</td>
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<tr>
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<td>1.2</td>
<td>16.4</td>
<td></td>
</tr>
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</table>

Notes:
- **Shape:** B = Bottle; C = Cylinder; ? = Shaped not recorded.
- **Base:** Approximate area of base of cistern in m².
- **Depth:** Depth of cistern based on elevations at bottom and mouth of cistern minus 53 cm for thickness of roof.
- **Volume:** Volume of cistern in m³; multiply Volume by 1000 for number of liters. Bottle shaped cisterns are calculated at 75% of a cylindrical shape and cylinders are calculated as cylinders.
- **Individuals:** Number of people able to be supplied by the cistern in #1/#2/#3/#4 format:
  - #1 = 10 liters per day for 180 days
  - #2 = 15 liters per day for 180 days
  - #3 = 10 liters per day for 150 days
  - #4 = 15 liters per day for 150 days
An attempt to estimate the capacities of these cisterns does, however, face several difficulties. First, information or indications for the shapes of the cisterns is limited. Dotted lines on the 1:100 site plans are usually used to indicate the subsurface extent of each cistern. However, such dotted lines are not always used, especially at the southern end of the site that was excavated in the first two seasons when recording standards were more rudimentary. These dotted lines do provide a rough idea of the maximum internal floor area of each cistern, but not of their exact shapes. Second, only ten cistern sections were published in the 1947 report; drawings of a few others exist on the site’s 1:100 plans. This lack of cistern sections hampers efforts to reconstruct cistern capacities. Finally, bedrock elevations are usually recorded near the mouths of cisterns, usually with another elevation at the base of the cistern. The thickness of the rock roof of the cistern is usually not directly available (only as can be estimated from a few section drawings). For most cisterns it is unclear how much of the total height of the cistern (based on the difference between the elevation at its mouth and the one at its base) is made up by the roof. Even given these caveats it is still possible to offer some tentative estimate of cistern capacities.  

In the study area 21 cisterns likely in use during the time of Stratum 3 were examined (Table 10.1). Of this total, 15 provided data that allowed their internal floor area to be estimated; they also provided elevations near their mouths and at their bases. Section drawings of four cisterns at the northern end of the site (171, 173, 183, and 216) suggest an average roof thickness of 53 cm. The height of each cistern was adjusted downward by this amount. This adjusted height was used to calculate the cylindrical cisterns as cylinders, while the bottle-shaped cisterns were calculated at 75% of a cylinder’s capacity. The average capacity of the 15 measurable cisterns was about 18 m\(^3\) or 18,000 liters. At 10 liters of water per day per person over a five month dry season (150 days) a cistern of this capacity could store enough water for the needs of 12 individuals (for data on 10 liters of water per day per person see Zorn 1993:  

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4 The volumes used here are more conservative estimates than those found in Zorn 1993: 277–81.
At 15 liters per day per person a cistern of this capacity could supply eight individuals over the same period. If the known 53 cisterns had an average capacity of 18 m³ they could have supplied water for between approximately 350 to 640 people, depending on whether 10 or 15 liters per day is used, and whether 180 or 150 days is the time span. According to the same metrics, the estimated 110 total cisterns for the site could have supplied between about 730 and 1300 inhabitants. If the estimated 200 houses on the site contained an average of 5 inhabitants the cisterns could meet this total demand.

The cisterns do, however, vary greatly in capacity. The smallest have a capacity of only one or two cubic meters while the largest has a capacity of around 58 m³ (58,000 liters). This is also reflected in the standard deviation of the measured volumes. The standard deviation of 16 m³ is almost as much as the average capacity of the measured cisterns. Put another way, two thirds of the measured cisterns should lie within a range between 2 m³ and 34 m³. Using the above figures it is possible to suggest that a cistern with a capacity of 9.0 m³ would provide enough stored water for a family of 5 for 6 months at 10 liters per day, or a family of 6 for 5 months. At 15 liters per day the cistern would have to be 12.5 m³ for the same periods and family sizes. Cisterns with a capacity below that amount could not store enough water for a family of that size, and were thus likely meant to supplement other sources of water, or were filled by hand when it was thought necessary. Six of the measurable cisterns (40%; 156, 324, 357, 358, 364b) are below the 9.0 m³ threshold. Four cisterns (27%; 155, 354, 356, 369) fall in the range of 9.0–12.5 m³ figure, and five others (33%; 159, 320, 359, 363, 370) greatly exceed that figure. Cisterns 359, 363 and 370 could provide water for 20–25 individuals at 10 liters per day for 5–6 months, or for 14–18 people at 15 liters per day. Cistern 159 had sufficient capacity for 32–38 people at 10 liters per day for 5–6 months, or 21–26 people at 15 liters per day. In other words, the first three cisterns were sufficient for the needs of 3–5 families of 5 people each, and the largest cistern could supply water for 4–8 families.

Understanding water storage at Tell en-Našbeh is clearly more complicated than simply totaling up the estimated average capacities of the site’s cisterns. Almost half of the dwellings had no cisterns at all; some had cisterns, but not with enough capacity to
support a typical family through to the end of the dry summer months; some had cisterns with capacities greatly beyond the needs of a typical family; only a modest fraction (about 20% in the study area) had cisterns of a size suitable for the demands of a single family. So, while the total capacity of all the cisterns could have supported the town’s likely population, direct access to cistern water was very uneven.

What could account for the hewing of such large cisterns, no trivial matter as shown above, which far exceed the needs of a typical size family in such domestic contexts? One possibility is that these large cisterns were meant to supply the needs of extended families inhabiting nearby houses, rather than only nuclear families.

Much has been written lately about the roles and history of extended and nuclear families in ancient Israel (see Faust 2012 for discussion and recent bibliography). Some posit (though there is disagreement) that before the rise of the monarchies extended families were the norm, but that as society became more urban and socially stratified such larger family groups disappeared and nuclear families were the rule. Some also see a difference between social structures in urban centers (more nuclear families) as compared to rural settings (preservation of extended families). The presence of a handful of cisterns in late Iron Age Tell en-Naṣbeh with a capacity far exceeding the needs of a nuclear family cannot prove that they were used by extended families at that time. They may, in fact, have been hewn much earlier in the life of the stratum. There is, in fact, no way to date when they were hewn. Still, that such large cisterns were hewn at all, at some point in the life span of Stratum 3, indicates that water storage installations of that size were desired and were in use. The possibility that they served extended families should be factored in to future discussions of family structure in ancient Israel.

The block of houses northeast of road 514 containing Cisterns 359 (36.6 m$^3$) and 354 (11.6 m$^3$) may represent evidence of water resources shared by an extended family or families (see the discussions by Brody 2009 and 2011, and by Faust 2012: 111 n. 53 and 163 n. 17 for additional data and debate over the existence of extended families in this block of buildings). Unfortunately, the area further upslope to the east was not excavated, so the number of additional houses and cisterns there is unknown, so the scenario offered here can only be suggestive of possibilities. The two cis-
terns together have a capacity of 48 m$^3$. Depending on the amount of water used per day (10 or 15 liters) and length of the dry season (150 or 180 days) they could hold water for 18–32 individuals. This seems enough to support roughly 4–6 nuclear families. If each dwelling in this block (average total ground floor area, including walls but excluding possible upper floors, being 45 m$^2$; Zorn 1993: 118) were occupied by a nuclear family (though the building northwest of Cistern 359 may have been used for olive pressing) these two cisterns seem capable of supplying their water storage needs. Water might be kept in storage jars (see below), but one is then left to explain the tremendous size of Cistern 359, with its capacity far beyond the needs of a nuclear family. Note also that these buildings all share walls, indicating that this block was constructed at one time as an architectural unit, another possible indication of cooperation and planning across an extended family. In order to facilitate site drainage this block was laid out in conjunction with the architectural units and roads surrounding it, suggestive of community level planning.

As mentioned above, some of the town’s inhabitants may not have had access to sufficient cistern water to meet their needs. Many of these may have had to rely on water drawn from a spring on a daily basis. Even owners of cisterns may have felt the need to “top up” at times. There are four springs within 1.5 km of Tell en-Naṣbeh (Mapping Center of Israel; straight line distances; actual distances navigating the settlement’s streets and fortifications, along with local topography, would have been greater). Unfortunately the amount of water produced by these springs is not known, though hill country springs in general seem to have a flow of 10,000 to 350,000 m$^3$ per year. This flow can drop off considerably during the summer and fall (Tsuk 1997c: 132). Even at the minimum flow, though, these four springs may have provided over 10,000 liters of water per day, which at 10–15 liters of water per person would suffice for around 670–1000 people. Since these springs all lie beyond the walls of the town, water from them had to be carried in. It is thus worthwhile to briefly explore some of the ramifications of the need to supply a family with spring or well water on a daily basis.

One liter of water weighs one kilogram. A family of five might require 50–75 liters of water on average each day. On an average daily basis this same weight in kilograms, along with the weight of
appropriate containers, would need to be brought to a home which did not have access to a cistern. There are two ways that water could be transported: by animal or by human. The most typical beast of burden in ancient Israel was the donkey. A lower end estimate for a donkey’s carrying capacity is about 45 kg (Animal Management 1914: 274). However, donkeys in use in the Old Assyrian trade with Anatolia carried about twice that weight, about 90–100 kg (Veenhof 1972: 45; Lewy 1964: 186), which matches modern usage in Ethiopia (Gebreab et al. 2004: 49). A round trip journey to a spring about 1 km away was estimated to take about 2 hours for a donkey (Zertal 1988: 344). It seems that a single trip by a typical donkey could supply the average needs of a nuclear family. If a family did not have a donkey or other beast of burden the water would have to be carried by a member of the family.

A large cross-cultural study of traditional societies showed that the fetching of water was the third most common task performed by women (after preparing vegetables and cooking, but before tasks involved in cloth production) and was seldom a male task (Murdock and Provost 1973: 207). The same is suggested for Israel based on a variety of sources and parallels. One is the famous story of Rebekah in Gen. 24:10–22, who carries a vessel called a *kad*. There are also reports from early twentieth century researchers documenting the role of women in fetching water (e.g. Grant 1907: 92, also the top illustration on the plate entitled Women’s Work between pages 48–49). This usually took place twice a day, in the morning and evening (Wilson 1906: 128). Fetching water is also the most commonly depicted female activity in classical Greek art (Durand, Frontisi-Ducroux, and Lissargue 1989: 122).

The roles of women in ancient Israel have been the subject of lively study, especially over the last 20 years (for recent bibliography see Ebeling 2010). These have tended to focus on the importance of women in grain processing/distribution, cloth production (e.g. Meyers 2007), and ritual activities, and how these were important mechanisms for creating and maintaining the female social networks which were crucial to a settlement’s well-being (Meyers 2013: 141–46). So far, however, relatively little attention has been paid to the important social role Israelite women and girls played in fetching water for their households. Most often tasks and activities using water are mentioned, but not how the water itself was procured.
Fig. 10.25. Tell en-Nasbeh jars 56 (top), 239 (bottom left) and 387 (bottom right) 1:10 (Wampler 1947: pls. 4, 14, and 24).
Heavy loads can be carried on the back or on the head (Lloyd et al. 2010: 528). Head-loading of bulky and heavy burdens, such as water, seems fairly typical (Lloyd et al. 2010: 529). Studies have shown that people who have been trained from youth to bear loads in such a fashion can carry 70% of their own weight on their heads (Lloyd et al. 2010: 528; Maloy et al. 1986), though the most energy efficient weight was 20% of body weight. Girls in the range of 10 to 12 years were able to carry 20 liter buckets of water in this way (Lloyd et al. 2010: 528). One study suggested that the maximum weight an adult male Indian worker should carry on his head was 30 kg (Datta, Chatterjee, and Roy 1975). Thus, the amount an individual could carry on his/her head is quite substantial, but also quite variable. Much depends on an individual's age, strength, size, tolerance of pain, expertise in bearing such burdens and other factors.

The capacities of two typical small jars from Tell en-Našbeh were calculated (Fig. 10.25). Holemouth jar 387, found in Cistern 363 in the study area, had a capacity of 7.8 liters, while the more sack-shaped jar 239 had a capacity of 22.2 liters. Unfortunately jar 387 itself could not be located, but a jar of the same type, from the same cistern weighed 3.2 kg. Jar 387 full of water weighed about 11 kg. Jar 239 weighed 5.1 kg. Full of water it weighed about 29.3 kg. The weight of the smaller jar and the water it could hold is within the range of around 20 liters that the 10–12 year old girls mentioned above could carry, while the larger jar is almost half again heavier than 20 liters. Wilson noted that Palestinian women normally carried one to two gallons of water (ca. 3.8–7.6 liters) in ce-

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5 It would be useful to study human skeletal remains from Iron Age Israel to identify markers indicative of head-loading. Such markers have been documented in a variety of cultures where head-loading is practiced (Capasso, Kennedy and Wilczak 1999: 14, possibly 31, 33–35, possibly 71; Lovell 1994: 161–62; Echarri and Forriol 2005)

6 Joseph Greene of the Harvard Semitic Museum, where these vessels are currently on display, provided the weights for these two jars. Avshalom Karasik of the Israel Antiquities Authority calculated the volumes of the jars. I thank both these colleagues for their assistance with the metrics for these jars.
ramic jars on their heads, less than the capacity of jar 387. Use of this smaller jar would necessitate 6–10 round trips to a spring. Use of the larger jar would reduce the number of trips to 3–4. Fetching water from a spring each day for a family of five could thus be a significant investment in time for an individual, but was also crucial for the survival of the family.

If any animals had to be watered at the home this would affect how many people a cistern could support, though most likely animals were watered outside the settlement itself. It would also increase the number of daily trips to a spring required to provide for the entire household.

Where was spring water stored in an Israelite house if it did not possess a cistern? Was water kept in storage jars in homes? Such a practice is not mentioned in the biblical text. There are references to jars (kad) used to draw and transport water (Gen. 24:14–46; 1 Kings 18:33; Kelso and Albright 1948: 19; King and Stager 2001: 143–45; Dever 2001: 232–33). There are also references to water kept in containers, but it is not clear from the contexts what type of ceramic containers these were. For example, in 1 Kings 19:6 Elijah is provided with water in a vessel by an angel. In 1 Sam. 26:11–16 David is able to steal a water container from near Saul’s head as he slept. Presumably since Saul was on campaign, and Elijah was on a journey, these were small, easily transportable jars, not massive pithoi. King and Stager (2001: 144) understand this small, portable container (ṣappaḥat) to be a pilgrim flask, which fits the above two contexts well (Kelso and Albright 1948: 30).

The absence of evidence for the use of large water storage jars from the texts does not, however, mean they did not exist; their absence from the texts may only be an artifact of the writers’ interests. In fact, one scholar has argued, on the basis of the relative lack of cisterns in Iron Age I hill country sites, that the ubiquitous collar-rim jars of the period may have been used, at least in part, for water storage (Zertal 1988: 350–51). Thus, water storage in jars may have sufficed for houses that did not possess a cistern.

The ability to store water in jars would obviate the need to rely on cisterns. However, storage of water in jars has several drawbacks when compared with cisterns. First, as noted above, cisterns can be filled by using sloping surfaces and channels. Jars can be used to fill cisterns, but for large cisterns this was likely more of a supplementary procedure because of the great capacity of many
cisterns as compared to the much smaller capacity of the jars used to fill them (to fill the ca. 58,000 liter capacity Cistern 159 by hand with the 7.8 liter capacity jar 387 would require over 7300 trips to a spring). On the other hand, storage jars have to be filled by hand with water brought from a spring. Moreover, cisterns take up very little floor space; only their mouths need to be taken in to consideration. The average capacity of a cistern in the study area was 18,000 liters. At Tell en-Naṣbeh a typical large jar (Fig. 10.25, jar 56 at top) had a capacity of 153 liters, which would likely suffice for a single family for 2–3 days. Each such jar had a diameter of 57 cm. In order to duplicate the storage capacity of an average cistern about 118 jars of this type would be required and would occupy 30–40 m² of floor space. Clearly storing that much water in jars was impractical. Unfortunately it is not possible to know how much water a typical family might keep on hand in storage jars. Was one day’s worth of water considered sufficient? A week’s? A month’s? A household that relied exclusively on storing a few days’ worth of water in jars would be at a great disadvantage during a siege when access to springs was cut off.

**WATER USE AT TELL EN-NAṢBEH: SUMMARY AND CONCLUSION**

It is clear from this discussion that the inhabitants of Tell en-Naṣbeh in Iron Age II Stratum 3 went to some lengths to lay out their dwellings, road system and cisterns both to capture what water they could, and also to channel excess water beyond the settlement’s peripheral band of houses. The 3A settlement’s road system was laid out to make use of the generally downward south to north slope of the bedrock (e.g. ca. 780.70 along the ring-road in AJ21 in the south and ca. 776.50 in Q15 in the north; also McClellan 1984: 65). Water flowed down from the crest of the hill to the ring-road and then north along the ring-road. When possible, street runoff was diverted into cisterns of dwellings that fronted on these streets. Along the northern and western sides of the town the remaining runoff was channeled from the ring-road into side-roads, through the line of casemate-like fortifications. This is evidence of a degree of local civic cooperation and planning.

At the height of the Tell en-Naṣbeh’s expansion in Stratum 3B–C an elaborate drainage system had been developed. With the addition of the massive offset-inset wall and the creation of an in-
tramural zone, drains were added to the existing street drainage system on the northern and western sides of the town to channel water through the intramural zone and out beyond the wall itself. On the eastern side such runoff was directed through a drain in the town gate, or into two known cisterns (see Zorn 1993: 269–75 for drainage systems known at other Iron Age sites published up to that time). This is not to say that the system as it evolved was perfect. For example, there were no doubt always some areas where unwanted water pooled, and a system designed for typical amounts of water could be overwhelmed by a 500 year flood.

Why was such effort expended to direct water away from the southern part of the town? The answer is clear from the nature of the installations found in the southern intramural zone. A total of 61 storage pits (called bins in the 1947 report) were uncovered on the south side of the town, from just south of the inner gate in AC24–25 on the east, to AD15 on the west (Zorn 1993: 251–57). They were constructed in the same fill poured up against the offset-inset wall as the drains to the north and so postdate the construction of the wall. Such bins were used to store grain. Keeping the ground around these bins as dry as possible to minimize loss of food to rot was thus a significant concern. There is only a small area on the west where both drains and bins are found (AF–AG17 and AD15). The fact that the intramural storage system and wall drains seem to be part of a single, purposefully designed system intended to keep the southern bin area as dry as possible, suggests that the town wall and gate system, intramural fill, drains, intramural cisterns, and bins were integrated into a single system at the same time. Presumably the intramural fill was likewise sloped to the north to facilitate drainage away from the bins in the south. This was a tremendous construction project, certainly undertaken under royal direction.

Slightly more than half the town’s dwellings had cisterns. As a whole, these cisterns could provide for the site’s total population. However, not every house had a cistern of sufficient size to meet the needs of a typical family, while some contained cisterns with capacities far in excess of a single family’s needs. This suggests that the largest cisterns may have served the needs of extended families. Conversely, some families may have had to rely on water drawn from springs or wells and transported laboriously to the town,
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probably by a female member of the family, and stored there in jars.

Tell en-Naṣbeh thus provides important evidence of how water manipulation at a small Judean border town evolved over time. However, Tell en-Naṣbeh cannot be used uncritically as a template to explain how other sites manipulated local water resources. Each site must be studied on the basis of its own local setting, including site topography, local hydrology, and even political history. Nevertheless, this study does serve as a valuable example for how local and national planning strategies for water manipulation at a modest Iron Age II hill country site could be integrated, and suggests some social implications that “flow” from the previous observations.

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