TECHNICAL MEMORANDUM 1204
LOTT Wastewater Resource Management Plan

March 26, 1999

Robinson & Noble, Inc.
Tacoma, WA

In Association with
Brown and Caldwell

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APPENDIX

ARTESIAN WELL ANALYSIS

As a part of the ongoing evaluation concerning issues that affect wastewater management, LOTT approved an investigation of the flowing artesian wells of the downtown Olympia area. This project, Task 1204, was designed to identify as many wells as possible, quantify the flows from these wells, determine the fate of the water produced, and provide recommendations for management of these wells. As part of the consultant team assisting LOTT with its evaluation, Robinson & Noble, Inc. was designated to complete Task 1204.

The task was broken into two phases: a data collection and field reconnaissance effort, followed by an analysis and recommendations phase. Our initial effort involved the collection and collation of data from LOTT, the City of Olympia, and Thurston County Health Department. In particular, a 1994 survey of the wells conducted by Thurston County Health served as the basis for the current effort. The field survey consisted of three visits by Robinson & Noble personnel, with the assistance of a citizens group, Friends of the Artesians, concerned with the flowing wells of Olympia.

Our survey investigated 36 reported well sites, locating 19 wells (at 18 sites) and three spring sites. Three of the sites investigated have wells that were apparently previously unknown. Figure 1-1 illustrates the locations of the wells and springs covered in this effort. Figure 1-2 is a reproduction of the well location map from the 1994 Artesian Well Survey by Thurston County Environmental Health Department (TCEHD). That effort originally identified 94 well sites or springs based on information collected in the field and from two previous surveys by the City of Olympia (the first a 1939 to 1943 survey as summarized in Fieldbook 17, and the later an undated survey). The figure shows 86 of the 94 sites. The 1994 survey identified 31 wells as field located.

HYDROGEOLOGIC SETTING

The hydrogeology of Thurston County is complex, but can generally be described as a sequence of coarse-grained, water-bearing units (aquifer systems) alternating with fine-grained confining layers. These aquifer systems and their respective confining units were deposited as a result of intermittent glaciation of the Puget Sound region. Typically, the aquifer systems are found in glacial deposits, and the confining layers are formed from material laid down during the interglacial periods. Based on the results of work for Technical Memorandum 1200 (1996), there are eight hydrostratigraphic units identified in the county. Of these, seven units are expected to be present in the study area for this project (see Figure 1-3). From youngest to oldest, these units are:

Recessional/Perched Aquifer System	(Qvr)
Vashon Till Confining Unit	(Qrt)
Advance Outwash Aquifer System	(Qva)
Kitsap Formation Confining Unit	(Qk)
Pre-Kitsap Glacial Aquifer System	(Qpkg)
Clover Park Confining Unit	(Qcp)
Undifferentiated Unconsolidated System	(TQu)

These units are fully described in Technical Memorandum 1200. For this study, insufficient data was available to determine the specific details of the units as they exist beneath the study area. Assumptions of the hydrogeology were made based on our previous work (Task 1200 in particular) and other related regional studies. In order to illustrate the relationship of the hydrostratigraphic units with the downtown area, a conceptual model of the area was created. This is presented graphically as Figure 1-3.

Within the study area, artesian wells tap the Qva Aquifer, Qpkg Aquifer, and aquifer systems of the undifferentiated sediments. This interpretation is based primarily on the reported depths of the wells and the general thicknesses of the hydrostratigraphic units. Because these wells are believed to be completed in three different aquifer systems, well characteristics (flow, water quality, response to recharge, risk of contamination) are variable from well to well. More detailed definitions of the units from which the wells produce water is not available because most of these wells lack geologic logs or other specific construction information.

Based on a 1998 USGS report on the groundwater hydrology of Northern Thurston County (Drost and others, 1998), the general flow directions for the major aquifers tapped by the artesian wells are from east to west or southeast to northwest. Potentiometric maps in the USGS study indicate that the primary recharge areas for the portions of the aquifer systems tapped by the downtown Olympia wells are the upland areas in and around Lacey. Water flowing from the wells initially started as rainfall or lake water in this upland area, infiltrated through the surface sediments, aquifer systems, and confining layers, and flowed westward under the downtown area. Water that is not discharged through the wells or springs will then flow to Budd Inlet or Puget Sound, discharging as springs below sea level or as upward leakage through the marine bottom sediments.

In general, water quality from the wells should be similar to most other ground water in the northern portion of the County, which is quite good. Because the wells tap portions of the aquifer systems which are highly confined and in which the natural flow direction is generally upward, water in these aquifer systems is protected from land use activities in the downtown area.

WELL SURVEY

Field Procedures

During our data collection process, we collected all information available to us for each site and assigned the well a relative priority for our field investigation. The prioritization was based upon reported well location, previously estimated flow, and whether the well was field located during the 1994 survey. A table of the wells from the 1994 survey is attached as an appendix to this report. The wells in this attached table are ranked according to our prioritization. The table includes summaries of information from previous studies (Fieldbook 17 and the undated survey provided by TCEHD). From our prioritized list, 36 well sites were investigated. Of these, 16 sites were verified as still having existing wells, three sites were found to have previously unrecorded wells, three sites contained springs, and wells could not be located at the remaining 15 sites (see Figure 1-1). Two of the three previously unreported wells were identified based on the location of outfalls draining to Capitol Lake, although the wells themselves were not located. All of the fieldwork was accomplished with the assistance of Dr. Jim Ingersoll and Scott McLain of the Friends of the Artesians. Specific details on each of the visited well sites are given below.

Individual Well Summary

Well 6 – Located in the American Legion Building at 219 W. Legion Way. Well is valved and shut off.

We met with Steve Rodriguez who showed us what appears to be a 3-inch well that is currently shut off using an existing valve. The well was originally connected to a reservoir tank and heat exchange system and was presumably used to supply the adjacent boiler with water for the building's steam heat. There appears to be a (overflow?) pipe plumbed into a pipe exiting the SE corner of the building that connects to a stormwater line that outfalls to Capitol Lake.

Well 7 – This well was not located.

According to the 1994 Artesian Well Survey (Thurston County Environmental Health), the "Tideland" well was located, as noted in Fieldbook 17, at 4th & Sylvester. The dock/boardwalk structures for Percival Landing Park cover up any likely location for this well. The well may have been capped/destroyed when the park was built or it could still be present under the boardwalk.

Well 8 – Located along the front wall of Bayview Thriftway at 516 W. 4th. Well is valved and shut off.

We spoke with the store manager who confirmed the existence of the well just outside building near a small rock fountain, but not directly visible. She said the well was valved and shut off and that the well has not flowed in the 10 years she'd been there.

Well 12 – Approximately located at 510 Plum between a Jack-in-the-Box restaurant and a building currently under construction.

We spoke to the construction foreman for the adjacent site regarding the well. He indicated that the well was generally located behind a retaining wall that separates the parking lots of the above two properties and pointed out drainage pipes exiting from the base of the retaining wall. The foreman indicated that water, which he presumed to be from a well, issued from the drainage pipes only during the winter months. This seemed like a reasonable location for the well, given historical information, although the presence of a bed of drain-rock or other permeable material behind the retaining wall seems a more likely source for the winter discharge than an artesian well. The 1994 Artesian Well Survey located this well in a manhole marked "Drain" in the parking lot between the Jack-in-the-Box and the adjacent property and indicated that the well is plumbed to the sewer line. It was not determined whether or not the new construction has covered the well location (the retaining wall is not obvious in the 1994 photo) and the well is now, indeed, behind the retaining wall. Regardless, the well is likely still connected to the sewer line.

Wells 18 and 19 – These wells were not located but are presumed capped/destroyed.

According to the 1994 Artesian Well Survey, these wells are located at the Senior Center at 222 Columbia NW. We spoke with the building manager/engineer who said that he had no knowledge of wells on-site. Since the building is reasonably new, our guess is that the wells were capped/destroyed during construction. This conclusion is consistent with the recollection of an adjacent property owner (Joe Weist) as indicated in the 1994 well survey.

The manager, who used to work for the City of Olympia, gave us information regarding two wells in/around the alley between 5th and 7th between Water and Columbia that were used to "fill" Capitol lake. (These wells could be, or include, Well 28; but they are herein referred to as **Wells A and B**). Apparently, the current construction around Heritage Park uncovered the lines running from these wells, then extended them to the lake. We tried to find these wells, but most of block and alley are paved over (Heritage Bank parking area?) and the construction site was closed to us.

Well 22 – This well is located at the back of a parking lot at 206 Olympia NE. Well is flowing to the sewer system at a rate of 1.0 gpm.

Flow from this 1.5-inch well enters a vertical 4-inch pipe under a rock cairn approximately 1.5 feet from the well that appears to drain to the sewer system. Discharge was measured at roughly 0.7 gpm, but the pipe leaks around the base, making this measurement an underestimate.

Well 23 – This well was not located but presumed capped/destroyed.

According to the 1994 Artesian Well Survey, the well is located at the Transit Center, Block 22, Sylvester's Addition. No wells were apparent on the grounds and employees had no knowledge of a well on site. We were referred to the manager who was not available. The Transit Center was recently renovated, and we presumed the well was capped/destroyed. The 1994 effort talked with the contractor who did the renovation and determined that three 2-inch wells were encountered during demolition of the site, and that all three were capped and buried. Two wells were 11 feet below grade; the remaining one was five feet below grade.

Well 24 – This well was not located.

According to the 1994 Artesian Well Survey, this well was located at the Old Olympia Creamery site, now a parking lot, at 114 N. Water Street. At the property, we found two 4-inch pipes, uncapped, filled with dirt, and generally flush with ground level located in the cement slab running east-west across the property. These are not likely wells, but it was unclear what purpose they served. We also found a 2.5-inch pipe running north-south to a second 2.5-inch pipe with square-top plug with what looked to be a v-shaped intersection of the pipes. This is possibly an old sewer connection or potentially could be the connection for Well 25, which apparently was, at some point, plumbed to serve the creamery. Unfortunately, notes from the 1994 effort are illegible and include an ambiguous photo that could not be related to the site.

Well 25 – This well was not located and is presumed to be valved or capped/destroyed.

According to the 1994 Artesian Well Survey, this well was located at Seagull Books and Crafts (now the Lemon Grass restaurant), at 212 W. 4th. Photos and notes from this effort indicate the 2-inch well is valved and plugged. On our first two visits, the restaurant was closed. According to Rick (a Roto-Rooter employee), who was working on some water problems for the owner of the property, the restaurant has no sump, but it does have some new tile drains that may run water from a well (if it exists) to the stormwater line located in the alley. On our final visit, we spoke with the owner of the restaurant who indicated that her water problems were definitely related to the sewer line. We looked around, but found no indication of a well or plumbing related to the routing of well water to the Old Creamery site next to the restaurant. The well indicated in the 1994 effort was not visible. This well was probably capped/destroyed when the building was renovated.

Well 26 – This well was not located.

Though it was not found by the 1994 Artesian Well Survey, the survey results reported this well was located by a previous survey in Minh's Grocery (now the Santosh Restaurant) at 166 4th Ave. We spoke with the owner of the restaurant and looked around the kitchen and back rooms. No well was found inside or outside of the building. It cannot determine whether it is more likely that this well was capped/destroyed or piped to the storm or sewer system.

Well 27 – This well was not located.

The 1994 well survey indicated that this well had been previously located at Schoenfeld Furniture at 107 4th Ave. SW, but no well was located. We spoke with a salesman with 40+ years experience at the store. He informed us that there had been a water fountain in the corner at one time, but no longer. Well 27 has probably been capped/destroyed or piped to the storm or sewer system below grade.

Well 29 – Possibly located (if this is indeed Well 29) near 721 Columbia SW at the Old Northern Pacific Railroad Depot. Well flows at a rate of 20-50 gpm to Capitol Lake.

We met with Peter Waugh with GA (General Administration) and Andy Stapleton (construction foreman?). They took us to the site that, by location, is likely to be Well 29. This site, located 20 to 30 feet into the heavy underbrush east of the railroad tracks, has what appears to be a very large concrete reservoir and some associated plumbing that may be related to the old pump works. Flow on the order of 20 to 50 gpm issues upward from an opening in the reservoir and flows away in all directions. No actual well is visible at this site. However, we presume this is actually discharge from an artesian well given the temperature of the water (cold—approximately 50°F) and the presence of abundant fine grey sand (something we've seen at several other artesian well sites). Flow from this site would likely end up in Capital Lake. However, as discussed below, no direct route of flow has been positively established.

During the construction of the road to the west of the railroad tracks, the construction crew encountered an 8-inch pipe in the subsurface escorting a large quantity of water to Capital Lake. They exposed the pipe, connected it to some 8-inch corrugated plastic pipe, and ran it to the lake. The flow in this pipe is difficult to estimate, as the flow was only audible, and not visible. The initial thought was that this pipe was escorting water from the concrete reservoir discussed above to Capitol Lake. However, according to Andy Stapleton, the water at the reservoir was injected with dye in order to ascertain where the water flowed to, and the dye was reportedly not seen discharging from this pipe under the road. The construction crew is, therefore, under the impression that these are independent sources of water. It is even possible that this pipe represents another well (or the real Well 29), although we have no evidence to support this supposition.

The 1994 Artesian Well Survey indicates discussions with the occupants of the Economic Development Council of Thurston County building (formerly the Northern Pacific Railroad Depot building) revealed a meter box behind the building containing a valve and old water lines. It was not determined whether or not these were, in fact, related to Well 29. However, the photo in the 1994 study summary reveals a grassy setting completely unlike the heavy underbrush present at the concrete reservoir site a, presumably, short distance away. It is unclear, then, whether these fittings were related to an as yet undiscovered well, the well whose flow is carried by the discharge line under the newly constructed road, or the well at the reservoir site (any of which could be Well 29).

Mr. Waugh and Mr. Stapleton also showed us two pipes that were uncovered during excavation adjacent to the site office, which is just west of the intersection of Water St. and Legion Way. The upper of the two pipes was not flowing when it was uncovered, and it was subsequently capped. The lower of the two pipes was flowing at an estimated 10-30 gpm. A shut-off valve was placed on this pipe to control the water. The construction company intends to extend these pipes to Capital Lake at the completion of the project. It seems likely that these two pipes escort water from the two, unnumbered wells (herein referred to as **Wells A and B**) in the alley between 5th and 7th and Water and Columbia (discussed with Wells 18 and 19) which could include Well 28.

Well 30 – This well was not specifically located during this project, but has historically been located inside Capitol Lake.

Mr. Stapleton (Heritage Park construction foreman?) also informed us that Well 30, located in Capital Lake, is probably flowing again. Mr. Stapleton said that Cliff Ikerd (who controls the water level in Capitol Lake?) indicated that the well, which may have been previously capped off, was damaged at some point and now flows beneath the surface of Capital Lake.

Well 31 – This well was not located.

According to Fieldbook 17, this well used to be in the alley behind the Spar restaurant at 114 East 4th. Similar to the 1994 Artesian Well Survey, we located a 1-inch capped rusted pipe, about one foot long, behind the building, but this appears to be a natural gas line.

Well 32 – This well is located in the basement crawl space in the rear of the Spar restaurant at 114 East 4th Street. Well flows at five to 10 gpm and unused overflow from well is routed to the sewer system.

We spoke several employees who informed us that the owner (Mr. McWain) was not available. The manager took us to the well, which is accessed through the men's restroom. The 2-inch well flows into a small reservoir that then empties into a larger reservoir from which water for the restaurant is withdrawn. An overflow from this second, larger reservoir is plumbed into the sewer line. Flow was not visible, but estimated at between five and 10 gpm.

Well 34 – This well is located in a crawl space in the kitchen of the King Soloman's Reef restaurant at 212 East 4th. Well flows at five to eight gpm and unused overflow from well is routed to the sewer system.

We spoke with a manager and the on-duty cook who indicated the well was in a crawl space in the kitchen under a large metal plate. The 2-inch well flows into a two-chamber reservoir that has a free-fall overflow to a goose-neck fitting which drains to the sewer. Flow was estimated at five to eight gpm.

Well 35 – This well is located on the SW corner of the intersection of 4th and Washington in the US Bank parking lot and is plumbed to a water fountain. Well is valved and shut off.

Well 36 – This well, or collection of wells, is located in the SW corner of the basement of US Bank at 402 S. Capitol. Well flows at 30 to 50 gpm to the sewer system.

We spoke with several bank employees, and on our second visit we were given access to the basement. We found what could be a common collection point for one or more artesian wells. This collection system consists of two or more sump pumps pumping water out of an enclosed concrete collection channel/tunnel that extends along the south wall beneath the basement floor. There is a multitude of pipes inside this enclosed channel that could be wells, but we were unable to make that determination. Water (issuing from a metal disk-like apparatus) was under significant pressure and demonstrated a pulsing/surging discharge. This behavior may suggest that this is a pressure leak from the sump system, however the water appeared to be evenly distributed around the disk. Flow was estimated at 30 to 50 gpm. A drain is located at one end of this collection chamber and we presume that the water is pumped into the sanitary sewer system.

Well 37 – This well is plumbed to a water fountain located in the storeroom at the back of Talcott Jewelers at 420 Capitol Way S. Well is valved and only flows to the water fountain when activated.

We spoke with the store manager who showed us the fountain. The well itself was not visible, but is reported to be 1.5-inch diameter. The manager indicated that this was one of the first artesian wells drilled in the downtown area. He also said the well does not flow of its own accord when the valve is opened, and the fountain operates on a pump. Overflow from this fountain, when it runs, would flow into the sewer system.

Well 39 – This well was not located, but presumed capped off.

The 1994 Artesian Well Survey refers to this well as the Old Capitol well, generally located at 600 S. Washington. Previous surveys located this well outside of the old Capital Building and indicate that it was used to supply a fountain across the street in Sylvester Park, but no pipes were visible at the surface. We contacted Larry Kessel (GA) who also indicated that one, or perhaps two, artesian wells were located in Sylvester Park and were used to run fountains. It appears that this well has, at the very least, been capped off below grade or plumbed to the sewer system (per 1994 Artesian Well Survey).

We also inquired within the old Capital Building, but employees were unaware of any wells in the basement. Larry Kessel verified that no wells are located in the basement.

Well 40 – This well is located in the basement of State of the Arts building at 500 S. Washington. The well is [presumed] flowing and plumbed to the sewer, however the well is not visible and flow could not be estimated.

Maintenance personnel directed us to a sump in the basement. Water was present and the sump

pump float valves were visible, however the well itself was not. Fieldbook 17 estimated the flow at 10 gpm.

Well 41 – This well is located in the basement approximately mid-block of the Donald building, at 209 5th SE, which houses the 5th Avenue Bistro. This well flows at an estimated eight to 10 gpm into the sewer system.

We spoke with Anne Buck (the building owner) who showed us the well. The well reservoir has apparently filled with fine, grey sand and is not currently used. Overflow from system is routed to the sewer system.

Well 44 – This well is located in the NW corner of the basement of the YMCA building at 510 Franklin SE. This well flows at 0.5 to 1.0 gpm to the sewer system.

We spoke with Roger Jones (Associate Executive Director) at the YMCA. He showed us the well in the boiler room in the basement. This appears to be a 2-inch well plumbed to a system that pumps the water up to street level and into the sanitary sewer. We could not estimate the flow, but we contacted the maintenance person (Gary) who indicated that the flow was approximately 0.5 gpm in summer and 1.0 gpm in winter.

Well 46 – This well is found in the Diamond "A" parking lot at the 400 Block of 4th Avenue. A freestanding 2-inch pipe discharges approximately 10 gpm that drains to the stormwater system.

The Diamond "A" parking lot well is a 2-inch well used as a public water supply. Water from this well flows to a near-by storm drain in the parking lot. The discharge was measured at about 10 gpm.

Well 50 – This well was not located. The address reported for this well is one block east of the previously unrecorded well at Carras Cabinets (see **Well C** below) which may represent the actual location for this well.

Well 69 – This well is generally located in an ivy bed in the courtyard of the LOTT facility at 500 N. Adams. Well is plumbed to the stormwater system which discharges to East Bay.

We spoke with several employees who indicated that this is the only remaining artesian well at the LOTT facility. They monitor all the stormwater catch basins and are quite certain no other wells are present on the property. The well flow can be observed in a manhole to the east of the visitor's entrance of the main building on Thurston Avenue. We estimated flow was on the order of 20 to 30 gpm. The LOTT employee said the flow did not vary much over the course of the year, although he had heard that the flow has varied from 20 to 50 gpm. The 1994 Artesian Well Survey stated that this well might be Well 67.

Well 78 – This well was located near the intersection of I-5 and Henderson Boulevard to the west of the City of Olympia shop (immediately west of their trash facilities). This well flows

directly into Moxlie Creek at a rate of 30 to 100 gpm.

This well, located in the center of a pond with a 50 foot radius, appears to be 3-inch in diameter and sticks up approximately three feet above the pond surface with an additional 5-inch to 7-inch head. We could only get within 50 to 75 feet of this well. The flow was visually estimated at 30+ gpm, however, this amount of head from a 3-inch pipe indicates a flow of approximately 100 to 125 gpm. This discrepancy is not critical to our effort, as flow from this well goes directly to Moxlie Creek.

Well 80 – This well is located in the Olympia Fireplace Supply warehouse at 516 4th Ave. E. Well is flowing and plumbed to sewer line, although well is not visible and flow was not estimated.

We met with building owner Dick Castle of Olympic Glass (same block). He showed us a grate inside warehouse where a (reported) ¾-inch pipe in the sub-floor flows into sewer lines. Mr. Castle thinks there may have been a second well on the block, but was unsure.

Site 86 - This is a spring located in a deep ravine 150 feet to the south of 1311 N. Quince, according to the 1994 Artesian Well Survey.

We were unable to locate the headwaters of the spring, as the ravine is steep and choked with blackberries and ivy, but water was observed in the ravine. It appears that this spring ultimately flows directly to the Sound.

Site 87 – This spring is located at the Harbinger Inn at 1136 East Bay Drive.

Water (approximately five to 10 gpm) flows through the Inn's basement and into a drainage that, according to the Inn's owner, drains to the bay at the base of the hill.

Site 91 – This well is located in the back room/office of Bulldog News at 116 4th Avenue E. The well is [presumed] capped, however the well is not clearly identifiable.

Employees directed us to three grates in the center of the back room/office floor. One of the metal plates was removed to reveal a cistern (?) containing approximately three feet of stagnant water. Several 2- to 3-inch capped pipes were visible, however they looked too new to be the original well and may in fact be related to a (non-functioning?) drainage system. Fieldbook 17 estimated flow at 15 gpm from a 2-inch pipe.

Site 94 -- This spring is located at Bigelow Ave NE and N. Quince St.

Flow is less than 0.5 gpm. Water enters a storm grate at the intersection of Bigelow and Quince that ultimately enters the sewer system.

Well 95 – This well was not located.

Previous surveys have located this well at the BPOE 186 building at 318 5th Ave. SW. No wells are apparent at the surface. A drinking fountain is present, although the water tastes chlorinated, indicating the fountain is plumbed to City water. New construction for Heritage Park (between 4th, 5th, Sylvester, and Water) may have capped/destroyed the well or routed flow to a sewer or storm drain.

Well 96 – This well was not located.

We obtained the keys for the eastern Yardbirds shopping center building from the real estate firm across the street. No wells were located in this building. The western building was just condemned, and entry was not advised, particularly since the roof had collapsed over the portion of the building in which the well is purported to be. It seems likely that this well is still present, and the 1994 well survey indicates that the storeowners believe the water flows north to East Bay.

Wells A and B – These wells are approximately located in the alley between Columbia and Water and 5th and Legion Way. See discussion under Wells 18 and 19 and Well 29.

Well C – This well is located inside a workshop at Carras Cabinets, Inc. at 307 E. State (one block west of the reported location for Well 50). The flow was estimated at greater than 10 gpm flowing to the sewer system.

We spoke with the owner of the store who indicated that a fountain used to be located here, but that now the well is plumbed to sewer. The well was not visible, but water could be heard flowing in a 4-inch PVC line that appears to be routed to the sewer system. Flow was not visible, but was estimated at greater than 10 gpm.

Analysis

After the field investigation was completed, a probable fate of the water was determined for each well with identified flow (Figure 1-4). This was accomplished by matching the well location with maps of the City's sewer and stormwater drain systems and then determining the most likely entrance point and resulting route for water produced at that site. Table 1-1 lists all 38 wells or springs, their expected routing and discharge point, and an estimate of flow.

Of the 22 wells and springs located, ten were producing water continuously, and three more had controlled flows to the LOTT system. Two more wells should produce water to the LOTT system but currently had no flow. The total produced by these 15 wells is approximately 117 gpm. Using the estimates from the 1994 survey for the same 15 wells, the production becomes 123 gpm. It should be noted that both of these estimates are more likely high rather than low, since those wells with control features are not in constant use and the remainder were estimated using the highest of the flow values identified. The maximum flow estimate for all the wells listed in Table 1-1, assuming all wells exist but excluding those noted as draining to outfalls other than LOTT, is 288 gpm. If this speculation is expanded to address all 96 wells listed in the 1994 survey, again excluding those not expected to discharge to the LOTT system and also those noted as destroyed, the maximum flow to the LOTT system would be 353 gpm. This represents

508,320 gallons per day or almost 185 million gallons per year. However, it is considered unlikely that this quantity is currently being produced since not all the wells are expected to still exist and since maximum flow estimates were preferentially used in the analysis. It is also likely that the estimated flows have changed over the past 50 years, due to development and changes in groundwater production from the aquifer systems.

Given the nature of the aquifer systems and the hydrology of artesian systems in general, it is reasonable to assume that most if not all, wells are subject to tidal influences. The intensity and timing of the effect will very greatly between wells depending upon the aquifer characteristics, distance to the ultimate natural discharge point, the potentiometric gradient of the aquifer system and the tidal pattern. Therefore, the total flow amounts discussed above are based on estimates that could be lower or higher than average for a given site. Careful measurements of a site would be necessary for two or more tidal cycles in order to identify accurately the tidal influences at that point. For this project, tidal monitoring was not feasible at most locations due to the difficulties in determining flow and general site access. At other locations, monitoring was considered less important due to the fate of the water or limited flow.

Much as with tidal influence, the wells and springs of the downtown area will likely be subject to changes in flow due to seasonal effects. Naturally, the highest water levels in the shallower aquifer systems occur in the winter with periods of greatest precipitation. Deeper systems may have some delay to high water levels due to intervening confining layers that retard recharge flow into the aquifer. Measurements of the seasonal changes in wells were outside the scope of this project.

Table 1-1 Summary of Artesian Wells and Fate of Flow

Well	Name	System well flows into	System outfall	R&N flow estimate (gpm)	FB17 flow estimate (gpm)
6	American Legion	Stormwater	Capitol Lake	0 (Valved)	67.5
7	4th & Sylvester	Not located	N/A	----	30
8	Bayview Thriftway	Stormwater (?)	LOTT	0 (Valved)	20
12	Jack-in-the-Box	Stormwater	LOTT	0	0
18,19	Senior Center	Destroyed (?)	N/A	----	6, 3
22	206 Olympia	Sewer	LOTT	1	1
23	Transit Center	Destroyed (?)	N/A	----	1.5
24	Old Creamery	Not located	N/A	----	10
25	Lemon Grass Restaurant	Not located	N/A	----	17
26	Santosh Restaurant	Not located	N/A	----	3.5
27	Shoenfeld Furniture	Not located	N/A	----	5
28	Water St. between 4th & 5th	(See Wells A,B)	----	----	----
29	Old Northern Pacific Depot	Drainage pipe	Capitol Lake	20-50	80
30	Capitol Lake	Not located	Capitol Lake	----	50
31	Behind the Spar	Not located	N/A	----	15
32	Spar Restaurant	Sewer	LOTT	5 - 10 (Valved)	15
34	King Solomon's Reef Restaurant	Sewer	LOTT	5-8	?
35	Water fountain	Sewer (?)	LOTT	0 (Valved)	----
36	US Bank	Sewer	LOTT	30-50	----
37	Talcott Jewelers	Sewer	LOTT	(1.5—pumped)	3
39	Sylvester Park	Not located	N/A	----	0
40	State of the Arts	Not located	N/A	----	10
41	5th Ave. Bistro	Sewer	LOTT	8-10?	10
44	YMCA/Olympia Building	Sewer	LOTT	1?	20?
46	Diamond "A" Parking Lot	Stormwater	LOTT	10	4
50	Alley between 4th, Jefferson, & Adams	(See Well C)	----	----	1
69	LOTT	Stormwater	East Bay	20-40	60
78	I-5 / Henderson Boulevard	Moxlie Creek	Capitol Lake (?)	30 – 100	----
80	Olympic Fireplace	Sewer	LOTT	5-15	35
86	N. Quince *(spring)*	Drainage system	East Bay	<1	15
87	Harbinger Inn *(spring)*	Drainage system	East Bay	5-10	11
91	Bulldog News	Sewer	LOTT	?	15?
94	Bigelow *(spring)*	Sewer	LOTT	0.5	----
95	Heritage Park	Not located	N/A	----	----
96	Yardbirds	Not located (building condemned)	East Bay (?)	----	----
A,B	Wells A and B	Drainage system	Capitol Lake	0, 10-30	----
C	Carras Cabinets	Sewer	LOTT	>10	----
	Maximum total flow of wells known to be discharging to LOTT			117.0	123.0

MANAGEMENT OPTIONS

The primary goal of Task 1204 was to identify wells draining to the LOTT system and provide recommendations for the management of those wells. Of the wells that were field verified by this effort, 15 are currently producing water or could produce water to the LOTT system. The maximum estimate of the water expected to be produced by these wells is 117 to 123 gpm.

Four options could be exercised by LOTT at each of the located wells. Listed in order of increasing cost and effort, these are:

1) No action
2) Addition of flow control mechanisms
3) Re-direction of flow away from the LOTT system
4) Closure/Abandonment of the well

The decision to take action on specific wells will, presumably, be based on both the estimated discharge of the well (and thereby the potential benefit to the treatment facility) and the economic factors involved in altering the existing structure. Decisions that may be predicated on public opinion are considered beyond the scope of this investigation. Consideration of the level of public use of the water will also prove important. In many cases, the physical access to the well is limited thus limiting the options for a successful alteration of the flow. In other cases, access is sufficient but the water is used as a public source and is considered desirable to the community at large.

The overall costs and estimates of effort for alterations to all of the identified sources is outside the scope of this project. However, there are several sites where it appears that efforts could be successfully made that would serve to assist LOTT in its long-term management of the down-town system. The first decision to be made is whether or not to take action regarding the wells located by this effort. That decision is most likely a compromise between reducing the day-to-day cost of operations by reducing the volume of water needing treatment, the cost of the proposed action, and any potential negative impacts associated with taking the action. If the benefits of controlling the flow of a well are worth considering, the decision to be made, then, is how to control the flow. The 15 wells that were identified by this investigation can be ranked as high priority (Wells 36 and 80), medium priority (Wells 32, 41, 44, 46, 91, and C), and low priority (Wells 8, 12, 22, 34, 35, 37, and 94), based upon their estimated flow. Table 1-2 lists the wells grouped by their priority. Granted, controlling any quantity of excess water needlessly routed to and treated by LOTT represents an incremental benefit. High-priority wells, with average flow rates of 30 to 50 gpm, are designated as such because controlling their flow represents the greatest benefit to LOTT. Medium- and low-priority wells, with flows of 10 to 15 gpm and of less than 10 gpm, respectively, represent proportionately smaller benefits.

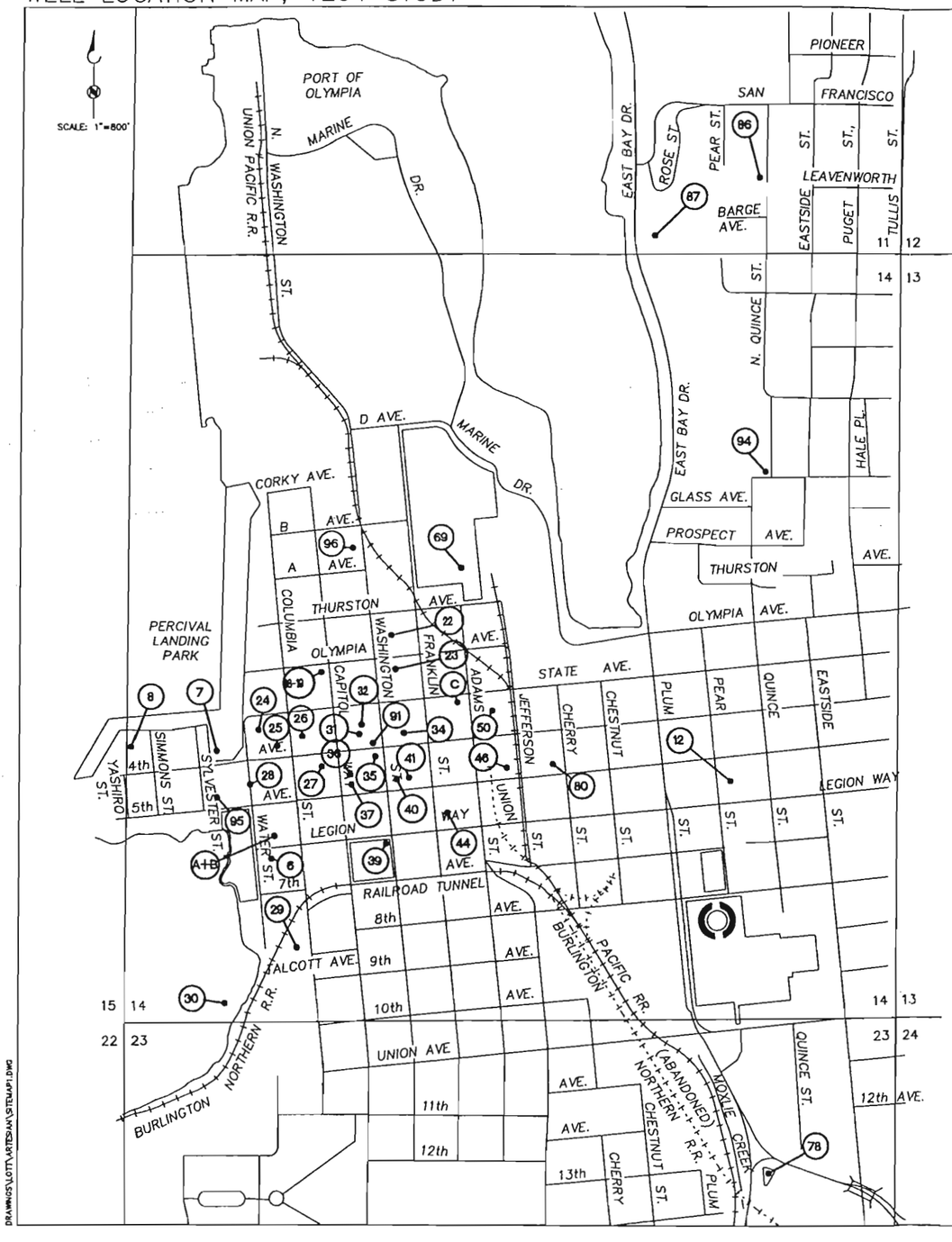
Table 1-2 Prioritization of Wells flowing to LOTT

High		Medium		Low	
Well	Max. gpm	Well	Max. gpm	Well	Max. gpm
36	50	32*	15	8	0*
80	35	41	10	12	0
		44	20	22	1
		46	10	34	8
		91	15	35	0*
		C	10	37	1.5*
				94	0.5
Totals:	85		80		11

* Wells with non-constant flow (being valved or pumped)

After having identified a relative ranking for the wells, a determination must be made, on a well-by-well basis, as to how best to control the flow. If the decision is made to install a valve on a well, the well owner will still have the ability to use the well and, presumably, the discharge would be greatly reduced. However, by controlling the flow, particularly on wells with high artesian head, the potential exists for the pressurized water to break around the existing well casing and discharge to the surface again as a means of pressure relief. If this were to occur, the potential for some degree of property damage would exist. Use of a valve, rather than a cap, in such cases would perhaps allow the controlled relief of pressure that would not otherwise be provided, although the problem may also occur with a valve. In a few cases, it may be possible to design a new outfall for a well such that its discharge remains unchanged, but the water is routed away from the LOTT system. If the decision is made to decommission a well and thereby avoid the possible problem of pressure-relief flow outside the well casing, the pipe would likely be perforated and then pressure-grouted. This method is likely much more expensive than the installation of a flow control device, however it offers a greater degree of certainty that the flow will be successfully shut off.

WELL LOCATION MAP, 1204 STUDY



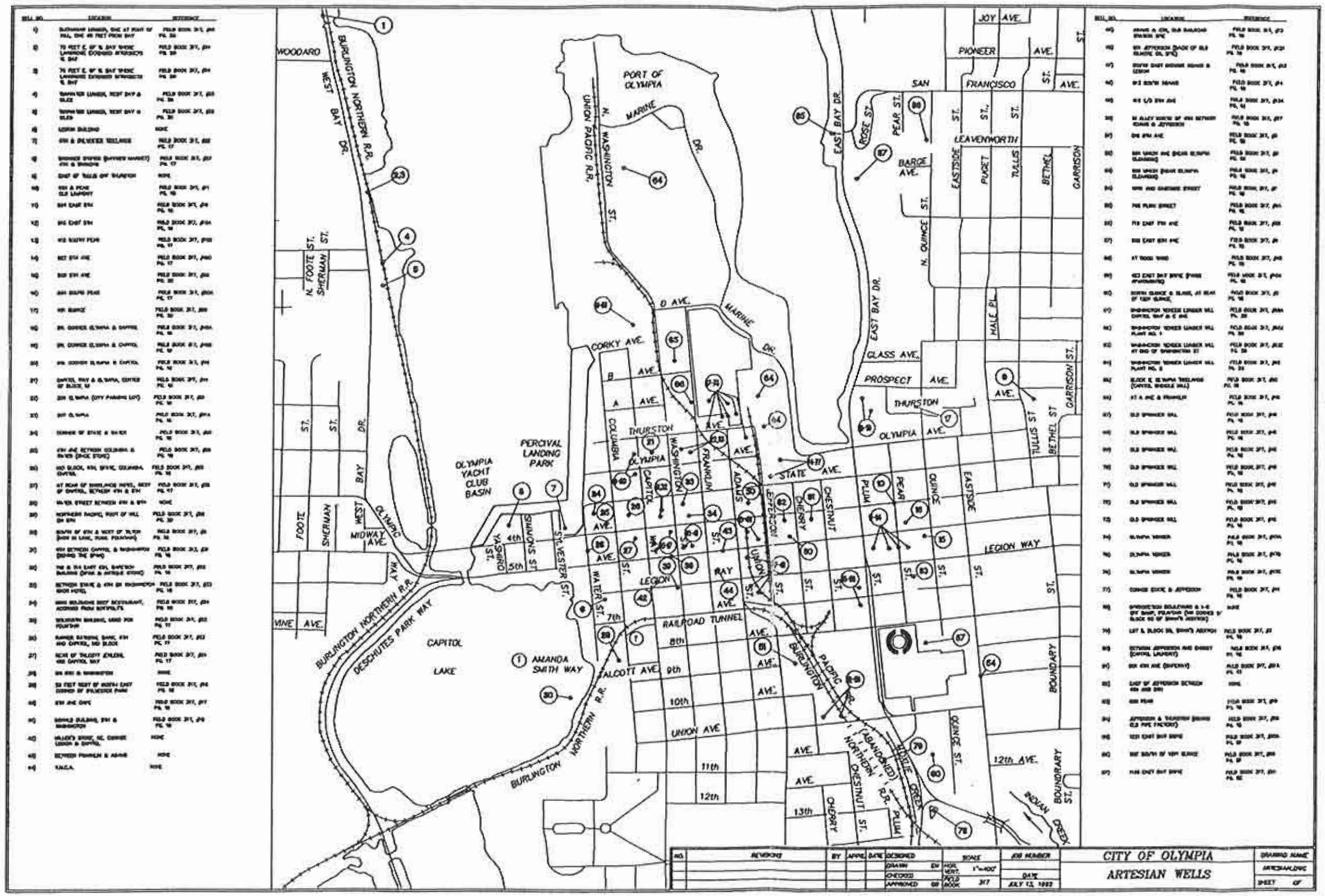
LEGEND:

LOTT Wastewater Resource Management Plan

WELL NO.	LOCATION
6)	AMERICAN LEGION BUILDING
7)	4TH & SYLVESTER TIDELANDS
8)	THRIFTWAY
12)	JACK IN THE BOX, 815 EAST 5TH
18)	SW. CORNER OLYMPIA & CAPITOL
19)	SW. CORNER OLYMPIA & CAPITOL
22)	206 OLYMPIA (CITY PARKING LOT)
23)	207 OLYMPIA
24)	CORNER OF STATE & WATER, OLD CREAMERY
25)	4TH AVE BETWEEN COLUMBIA & WATER, LEMON GRASS RESTAURANT
26)	MID BLOCK, 4TH, STATE, COLUMBIA, CAPITOL, (SANTOSH RESTAURANT)
27)	AT REAR OF SCHOENFELD FURNITURE, WEST OF CAPITOL, BETWEEN 4TH & 5TH
28)	WATER ST. BETWEEN 4TH & 5TH
29)	NORTHERN PACIFIC, FOOT OF HILL ON 8TH
30)	SOUTH OF 9TH & WEST OF TILTON (NOW IN LAKE)
31)	4TH BETWEEN CAPITOL & WASHINGTON (BEHIND THE SPAR)
32)	118 & 114 EAST 4TH, BARETICH BLDG. (SPAR RESTAURANT)
34)	KING SOLOMON'S REEF RESTAURANT
35)	WOOLWORTH BLDG., USED FOR FOUNTAIN
36)	US BANK, 4TH & CAPITOL, MID-BLOCK
37)	REAR OF TALCOTT JEWELERS, 420 CAPITOL WAY
39)	23 FEET WEST OF NORTH EAST CORNER OF SYLVESTER PARK
40)	STATE OF THE ARTS
41)	DONALD BLDG. 5TH & WASHINGTON (5TH AVE. CAFE)
44)	Y.M.C.A
46)	DIAMOND "A" PARKING, 4TH AVE. EAST
50)	IN ALLEY NORTH OF 4TH BETWEEN ADAMS & JEFFERSON
69)	LOTT
78)	INTERSECTION BLVD. & I-5 OFF RAMP FOUNTAIN (NW CORNER OF BLOCK 60 OF SWAN'S ADD.)
80)	BETWEEN JEFFERSON & CHERRY (OLYMPIC FIREPLACE)
86)	150 FT. SOUTH OF 1311 QUINCE
87)	1136 EAST BAY DRIVE (HARBRINGER INN)
91)	BULLDOG NEWS
94)	N. SIDE QUINCE & BIGELOW
95)	HERITAGE PARK
96)	YARDBIRDS
A&B)	MID-BLOCK BETWEEN WATER & COLUMBIA ON LEGION
C)	SO. OF FRANKLIN ON STATE AVE.

BROWN AND CALDWELL
AND ASSOCIATED FIRMS

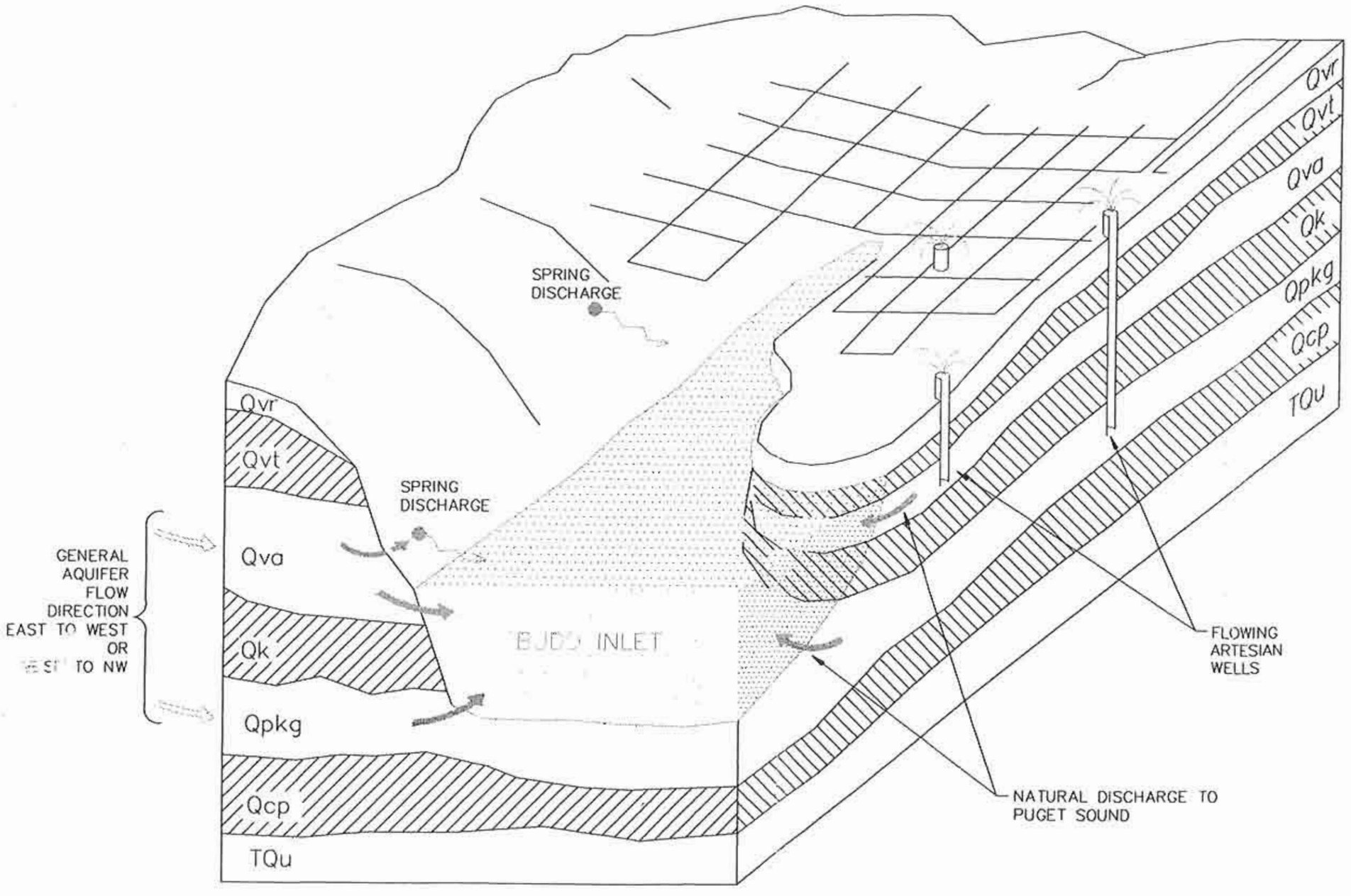
FIGURE 1-1



NOTE:

REPRODUCTION OF 1994 SURVEY WELL LOCATION MAP. REPORTED SCALE IS NOT CORRECT.

LOTT
Wastewater
Resource Management
Plan



HYDROSTRATIGRAPHIC UNIT

Qvr	VASHON RECESSIONAL/ PERCHED AQUIFER SYSTEM
Qvt	VASHON TILL CONFINING UNI
Qva	VASHON ADVANCE OUTWASH AQUIFER SYSTEM
Qk	KITSAP FORMATION CONFININ UNIT
Qpkg	PRE-KITSAP GLACIAL AQUIFE SYSTEM
Qcp	CLOVER PARK CONFINING UNI
TQu	UNDIFFERENTIATED UNCON- SOLIDATED SYSTEM

NOTE:

FOR COMPLETE UNIT DESCRIPTION, SEE TECHNICAL MEMORANDUM 1200.

SCALE: 1"=400'

LOTT PROPERTY BOUNDARY

69

22

94

C

91

34

36

32 (PUMPED)

46

37 (PUMPED)

41

A&B

12 (NO FLOW)

6 (VALVED)

44

LOTT Wastewater Resource Management Plan

LEGEND:

- ARTESIAN WELL (SEE FIGURE 1-1)
- SEWER MAIN
- STORMWATER SYSTEM
- DRAIN TO PUGET SOUND OR CAPITOL LAKE

	LOTT / City of Olympia -- Artesian Well Survey			(Task 1204)							*Robinson & Noble, Inc.*			
											Job 6519C			
		1994 Survey												
Well				**Reported**	**Reported**	**Reported**	***Field Book 17***			***Artesian Well Investigation***	**DOH PWS**			
Number	**Category**	**Site Name/Location**	**Address**	**flow (gpm)**	**size (in)**	**depth (ft)**	**Reference**	**Notes**	**Reference**	**Notes**	**Number**	**Group**		
1	4	Old Buchman Lumber Site	2000 W. Bay Drive	4	2		55, pg 20	(2 wells) Foot of hill & 40' from bay	55	Discharges directly to Budd Inlet				
2	3	Old Panama Shingle Site	1110 W. Bay Drive	15	2		54, pg 20	75' east of W. Bay Drive	54	Discharges directly to Budd Inlet				
3	3	Old Panama Shingle Site	1110 W. Bay Drive	12	2		54, pg 20		54	Discharges directly to Budd Inlet				
4	3	Old Tumwater Lumber Site	902 W. Bay Drive	15	3	110	53, pg 20	This well is pumped @ 40 gpm	53	Possibly discharges to stormwater outfall				
5	3	Old Tumwater Lumber Site	902 W. Bay Drive	10	3	125	53, pg 20		53	Possibly discharges to stormwater outfall				
6	3	American Legion Bldg.	219 W. Legion	67.5	3	496	16, pg 16	Flows to concrete sump	none					
7	3	Tidelands	4th and Sylvester	30	1.25		26, pg 17	Medium tide. Flows into bay	26	Discharges to bay				
8	3	Bayview Thriftway	516 W. 4th	20	2	190	27, pg 17	Flow at medium tide.	27	Brenner Oysters. Foundation in front of Mark & Park? St. Possible sewer connection.				
9	3		E of Tullis, off Thurston				none		none					
10	3	Old Laundry	4th and Pear	1.5	2	75	11, pg 16	no notes	11	No remarks				
11	3	Salvation Army	808 5th SE (was 804 E 5th)	0.8	1	60	19, pg 16	no notes	19	No remarks				
12	2		510 Plum (was 815 E 5th)	0			19A, pg 16	Not flowing	19A	Well not flowing in 1939				
13	3		412 S Pear	0.6	2	75	19B, pg 17	no notes	19B	No remarks				
14	3	Community Youth Services	824 E 5th (was 822 E 5th)	8.1	2		19C, pg 17	no notes	19C	(822 Pear) No remarks				
15	3		909 5th Ave	0		Spring	20, pg 17	Spring 6' deep & piped to sewer. No flow	20	Well not operating. Piped to sewer				
16	3		504 S. Pear	0		Spring	20A, pg 17	Spring 6' deep & piped to sewer. No flow	20A	Well not flowing in 1939. Discharge to sewer.				
17	3		405 Quince	30	2	100	59, pg 20	no notes						
18	4	Senior Center	222 Columbia NW	6	2	155	45A, pg 19	(2 wells: ref 45 and 45A) 2nd well is 196'	45A	Possibly in use by Star Cleaners				
19	4	Senior Center	222 Columbia NW	3	2	210	45B, pg 19	Flows into concrete tank	45B	Possibly in use by Star Cleaners				
20	4	Lasen Electric Service	301 N. Capitol Way	12	3	400	46, pg 19	PUMPED by air jet to concrete tank.	none	(Ref. Nos 45, 45A, 45B, & 46 are all listed as "Agnew Cleaners" in FB 17).				
21	3		Center of Block 12	10	2		44, pg 19	Capitol Way and Olympia	44	Capitol, Water & Olympia. Discharges to sewer				
22	1		206 Olympia NE	1	1.25		51, pg 19		51	Used in garage				
23	4	Transit Center	Block 22, Sylvester's Addn.	1.5	1		51A, pg 19	(207 Olympia Ave.) In rear of lot.	51A	No remarks				
24	3	Old Olympia Creamery Site	114 N. Water	10	2		28, pg 18	Well is pumped, flow given by Mgr.	28	Cor. Of State & Water. Creamery is using water, excess goes to sewer.				
25	3	Seagull Books & Crafts	212 W. 4th	17	2	240	29, pg 18	Piped to creamery.	29	Creamery is using water. Excess discharged to sewer.				
26	3	Minhs Grocery	116 4th Ave W	3.5	2		30, pg 18	"Curley's Place" - at rear	30	Mid-block 4th, State, Columbia, Capitol. Curleys Place using water.				
27	3	Schoenfeld's Furniture	4th & Capitol Way	5			25, pg 17	no notes	25	Under Golburg Furniture				
28	3		Water St. between 4th & 5th				none		none					
29	3	Old Northern Pacific Rail Depot	721 Columbia SW	80	3	180	58, pg 20	Foot of hill at 8th. Q measured by NPRR	58	No information on use or discharge of well				
30	4	Capitol Lake	Capitol Lake	50	3		8, pg 15	Medium tide.	8	Discharge to Capitol Lake (aeration)				
31	3	Behind the Spar Restaurant	114 East 4th	15			31, pg 18	no notes	31	Discharges to storm sewer				
32	1	The Spar Restaurant	114 East 4th	15	2		32, pg 18	Storage under floor	31, 32	Discharges to storm sewer	02788	A		
33	3	Old Knox Hotel	114 or 117 N. Washington	2			33, pg 18	Flows into tank & used by hotel (now gone)	33	No record of well after hotel demolition				
34	1	King Soloman's Reef Rest.	212 East 4th	?			34, pg 18	no notes	34	No remarks	01316	A		
35	1	Fountain	SW corr. of 4th & Washington				22, pg 17	Woolworth Bldg.	22	… used as fountain				
36	2	West 1 Bank	402 S. Capitol				23, pg 17	Could not locate - told well not operating						
37	1	Talcott Jewelers	420 Capitol Way S	3	1.5	117	24, pg 17	One of the oldest wells	24	No remarks	03682	B		
38	3		5th and Washington				none		none					
39	3	Old Capitol Bldg.	600 S. Washington	0			15, pg 16	E. across Wash. NW cor. of block	15	23' west of NE cor. of Sylvester Park. Capped & not in use since 1939.				
40	3	State of the Arts	500 S. Washington	10			17, pg 16	Good well in basement, couldn't measure	17	(5th Ave Café) Located in basement.				
41	2	Chattery Down (Donald Bldg.)	209 5th SE	10			18, pg 16	good well in basement, couldn't measure	18	Piped to 5th Ave Café				
42	3	Old Millers Store	NE cor. Legion & Capitol				none		63? (no)	Causing foundation problem [Ref no. 63 seems to apply to Well 89].				
43	3		5th between Franklin & Adams				none		62	Well discharge to be corrected under Schedule L.(?) [No Ref no 62 in our copies].				
44	2	YMCA	510 Franklin SE	20?			none		64? (no)	Discharge to sanitary sewer [Ref no. 64 seems to apply to Well 87].				
45	3	Olympic Outfitters	510 Franklin SE	6			12, pg 16	[See Well 93].	12	Railroad Station (4th & Adams). Water was pumped to station.				
46	1	Diamond A Parking Lot	4th Avenue E (400 blk)	4	2		12A, pg 16	Flow to Gilmore Oil fountain	12A	No remarks	03684	A		
47	3		SE cor Legion & Adams	100		Spring	13, pg 16	Spring records	13	Sewer seemed dry, didn't indicate discharge to sanitary.				
48	3		613 S. Adams				14, pg 16	2 wells. Covered and Abandoned.	14	Wells covered and abandoned 1939				
49	3		415 1/2 5th Ave E	0.25			13A, pg 16	Appt. house	13A	No remarks				
50	3		In alley, 4th, Jefferson, Adams	1	2		37, pg 18	gpm est.	37	No remarks				
51	3		619 9th Ave.	3			6, pg 15		6	Possibly in use				
52	3		604 Union Ave	13			5, pg 15		5	No remarks				
53	3		609 Union Ave				4, pg 15		4	Well has been abandoned.				
54	3	Old Eastside St. Grocery	1001 Eastside	5	2	135	7, pg 15	800 gallon tank	7	No remarks				
55	3	McDonalds	715 Plum SE	1.2			9A, pg 15	(703 Plum) no notes	9A	No remarks				
56	3	McDonalds	715 Plum SE	0.82			9B, pg 15	(715 E 7th) no notes	9B	No remarks				
57	3	Olympia City Hall Complex	905 E 8th				9, pg 15	Closed under house.	9	Closed under house.				
58	3	Woodyard	Prospect & East Bay Dr.				40, pg 19	Well covered, not operating.						

	LOTT / City of Olympia -- Artesian Well Survey			(Task 1204)							*Robinson & Noble, Inc.*		
											Job 6519C		
		1994 Survey											
Well				**Reported**	**Reported**	**Reported**	***Field Book 17***			***Artesian Well Investigation***	**DOH PWS**		
Number	**Category**	**Site Name/Location**	**Address**	**flow (gpm)**	**size (in)**	**depth (ft)**	**Reference**	**Notes**	**Reference**	**Notes**	**Number**	**Group**	
59	3	Holiday Shores Appts.	422 E. Bay Drive	0.5	2		40A, pg 19	At high tide only, used to be good well.	40A	No remarks			
60	3		1201 Quince	3.5	0.75	135	2, pg 15	At rear of house (Ms. Parker's place).	2	(N. Quince & Glass) Private well.			
61	3	Port of Olympia	Capitol Way & C Ave.	15	3	160	52A, pg 20	All three wells flow into concrete tank.	52A	Water used at plant.			
62	3	Port of Olympia	Capitol Way & C Ave.	15	3	160	52B, pg 20	All water is used.	52B	Water used at plant.			
63	3	Port of Olympia	Capitol Way & C Ave.	30	3	440	52C, pg 20	(See pg. 22)	52C	Water used at plant.			
64	3	Port of Olympia	Foot of N. Washington	15	3	400	52, pg 20		52	Water used at plant.			
65	3	Dept of Wildlife	NE cor. Washington & B	15	3		50, pg 19	PUMPED 25gpm, flow used to be 15gpm	50	Olympia Tidelands. Possibly discharges to sewer			
66	3	(At old water tank)	A Ave and Franklin				49, pg 19	Could not find.	49	Location not confirmed in 1939 survey.			
67	2	LOTT Treatment Facility	500 N. Adams	60	3		48, pg 19	6 wells. Measured 2 wells,	48	Wells probably	(This list implies that EACH well		
68	2	LOTT Treatment Facility	500 N. Adams	60			48, pg 19	estimated flow for the rest	48	discharged to	flows 60 gpm. FB 17 seems to say		
69	2	LOTT Treatment Facility	500 N. Adams	60			48, pg 19	(could not measure).	48	ground water.	60 gpm is total of all six 3-in wells).		
70	2	LOTT Treatment Facility	500 N. Adams	0	4		48, pg 19	2 wells. Not flowing	48	Not flowing in 1939			
71	3	Power Substation	NE cor. Franklin & Thruston				48, pg 19	no notes. May be wrong reference					
72	3	City of Olympia	320 Thurston NE				48, pg 19	number. Ref. No. 48 only accounts for					
73	3	(Olympia Veneer)??	Thurston, Jefferson & Adams				48, pg 19	6 wells (67 - 70).					
74	3	Port of Olympia	NE cor State & Jefferson		4	250	47, pg 19	Flow sufficient for two 500-hp boilers.	47A	Drinking fountain for mill. Well destroyed when mill was torn down.			
75	3	Port of Olympia	NE cor State & Jefferson	30	3	115	47, pg 19	Could not measure. (All in use).	47B	Drinking fountain for mill. Well destroyed when mill was torn down.			
76	3	Port of Olympia	NE cor State & Jefferson	30	3	115	47, pg 19	30 gpm est.	47C	Drinking fountain for mill. Well destroyed when mill was torn down.			
77	3	Port of Olympia	NE cor State & Jefferson	1.5	1.5		41, pg 19	This used to be strong well.	41	No remarks			
78	2		I-5 and Henderson Blvd.				none		none				
79	3		Lot 5, Block 58, Swan's Add.	13	2	140	3, pg 15	Remington's place.					
80	2	Olympia Fireplace Supply	516 4th Ave. E	35	2		38, pg 18	could not measure (?)	38	Near Capitol Chev. Probably discharging to sanitary sewer.			
81	3	Safeway	609 4th Ave. E	0.33			21A, pg 17	Well under pavement (parking).					
82	3		Alley by 412 Jefferson SE				none						
83	3	Soda Works	606 E. Pear	2.6			10, pg 16	(Now 905 E. 7th).	10				
84	4	Port of Olympia	E side of Jefferson & Thruston				39, pg 18	Old pipe factory. Could not find well.	none				
85	4		1221 E. Bay Drive	3.5	2	30	65A, pg 51		none				
86	2		105 ft. S. of 1311 Quince	15		Spring	65, pg 51	Spring at head of canyon. In present condition not safe for use. Est flow.					
87	2	Harbinger Inn	1136 East Bay Drive	11		Spring	64, pg 52	Riddle Sanatorium. (Two springs, one in use). Serves 4 families & sanatorium. (Each springs = 5.5 gpm)					
88	3	Cascade Pole Site	N. of Marine Drive				none		none				
89	?	Old brewery site	E. Bay Dr. & Oak Ave.	37.5			63, pg 52	Measured pipe near sidewalk. Used by boathouses.		[See Well 42 note].			
90	1	Wa. DOT	318 State St.	0	1.5		42 & 43, pg 19		43	Well does not flow. Different well drilled since 1939 survey.			
91	2	Bulldog News (closed)	116 4th Ave E	15?	2		32?, pg 18	Baretich Bldg. Storage under floor		Same catch basin as for 31 (Well 32)			
92	3	Bettman Block	Cor 4th & Adams	10	2		36, pg 18	Cannot measure (gpm from plumber).					
93	3	Eastside Club	410 4th Ave. E.	6			12?, pg 16	[See Well 45].	12	Railroad Station (4th & Adams). Water was pumped to station.			
94	2		N. side Qunice & Bigelow				none		none				
95	3	BPOE 186	318 5th Ave. SW				none		none	(USGS WSB 10, pg 221)			
96	2	Yardbirds Shopping Center	506 Capitol Way N.				none		none	(USGS WSB 10, pg 97)			

Well Category number assigned according to reported flow and ranking from 1994 survey as below.

1994 Survey by Thurston Co. Environmental Health

1 Wells providing water to the public

2 Free flowing wells and springs

3 Existing wells that are either capped off or free flowing - Unable to locate or confirm

4 Existing wells that are not free flowing