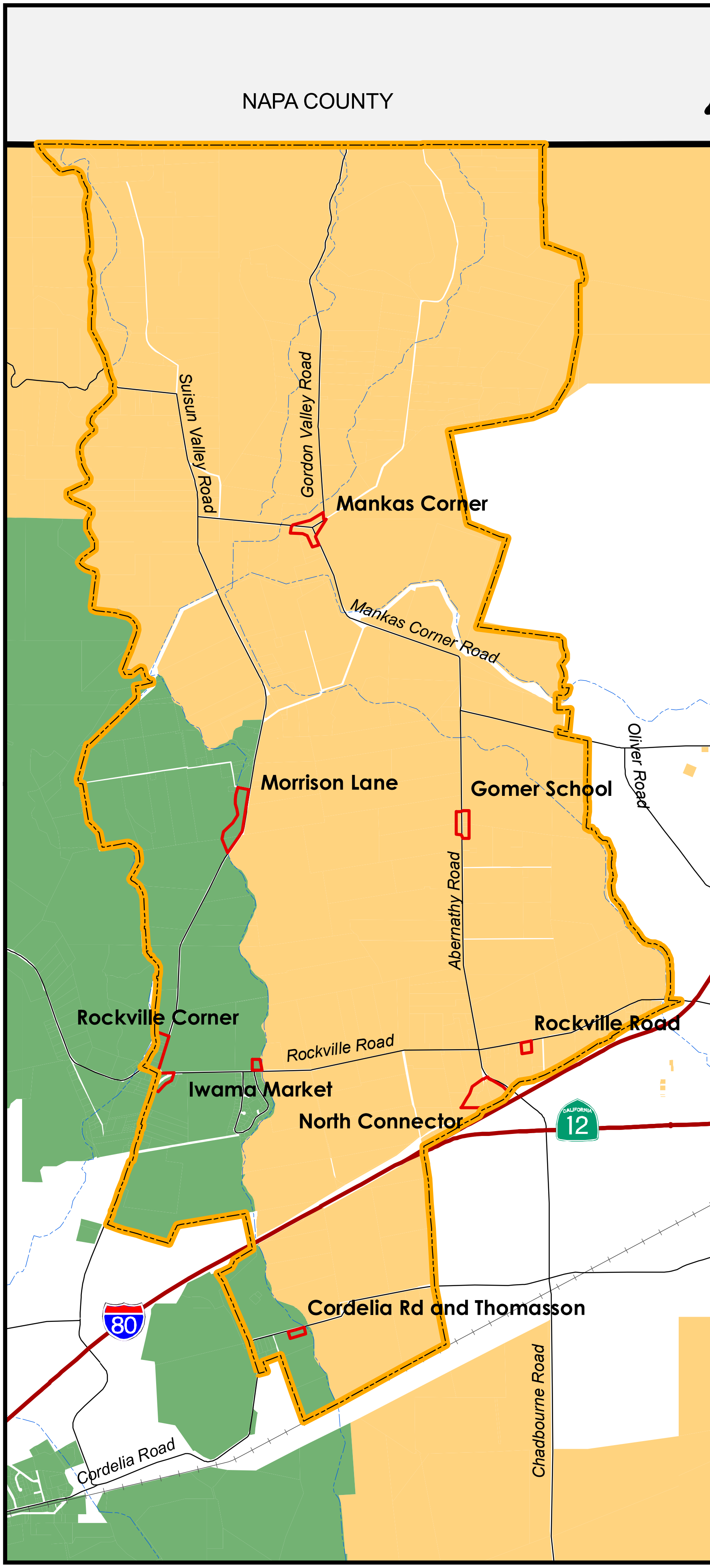
Suisun Valley Strategic Plan

Figure 2-6

Fire Districts



Legend

- Suisun Valley Strategic Plan Area
- Agricultural Tourist Centers

Fire Districts

- Cordelia Fire District
- Suisun Fire District

N

0 0.25 0.5 1 Miles

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Conversely, the Cordelia Fire District has a mandatory sprinkler requirement. Every new building in their district must have sprinklers. Commercial development must provide enough water to achieve 1,250 gallons per minute (gpm) for two hours at 20 pounds per square inch (psi) residual pressure. This can be accomplished through on-site storage capable of containing at least 150,000 gallons of water. The requirements for residential use include two sprinkler heads capable of supporting 17 gpm for 10 minutes. This could be accomplished with 5,000 gallons of on-site storage. It is possible that the required water storage could be shared among several adjacent properties through agreements. This report assumes that businesses and residences in each ATC can and will share the water storage tanks.

Combining the potable water and fire suppression systems would require a significant increase in the potable water distribution system, and is not recommended. Assuming the fire protection system is separate from the potable water system, disinfection of the entire fire supply would not be necessary. A 150,000 gallon storage tank should be adequate to provide fire protection for each grouping of businesses and residences within an ATC. This water supply could be provided from the most convenient source, and a circulation pump within the storage tank could be installed to maintain water quality. The required storage capacity to accommodate the fire demand could also be provided using a smaller tank located at each developed area.

Public Water System

One method to serve the Suisun Valley with water is to extend or replace existing water pipelines, as discussed in the following section. Costs associated with such extension or replacement are based the premise that new pipes would be placed within the City of Vallejo's Gordon Valley Line right-of-way, relying on wholesale potable water from the City of Fairfield, and assistance with potable water resale and non-potable water supply from SID. The most important aspect of this approach is the need for close coordination and cooperation among these agencies. It is essential that Solano County work with the cities and SID to enable a potable water supply and infrastructure for the Suisun Valley.

Table 2-4 identifies the potential costs of extending a potable water pipeline along the Suisun Valley "loop" consisting of Suisun Valley Road, Mankas Corner Road, Abernathy Road, and Rockville Road. These improvements would be phased over time to supply priority destinations with water first. For example: Phase 1 would consist of replacing the line along the current Suisun Valley Road corridor from City of Fairfield point of connection to Morrison Lane. Phase 2 would consist of extending this line to Mankas Corner. Further phases would add connections to Gomer School, the North Connector, Iwama Market, and back to Rockville Corner, creating a looped system in the end. Other alternatives could also be created as needed to supply priority destinations with municipal potable water via a looped system. This would enable the construction of a larger system on a funds-available basis.

Well Water

Although groundwater is sometimes unreliable, individual wells may be the simplest method to provide water for some of the ATCs and most agricultural and residential uses throughout the Suisun Valley. Wells are allowed under current County policies and regulations. Well costs depend on the type of soil and distance to the water table at the well location. According to a local well driller[1], a typical well in the Suisun Valley would cost between $20,000 and $45,000. Exact cost depends on the depth of the well and the size of the casing. These costs include an initial drilling investigation, but do not include system piping. Each well, with reservoir, in the Suisun Valley is estimated to cost at least $180,000 plus the cost of a pumping, treatment, and distribution system. These wells could possibly be shared with neighbors.

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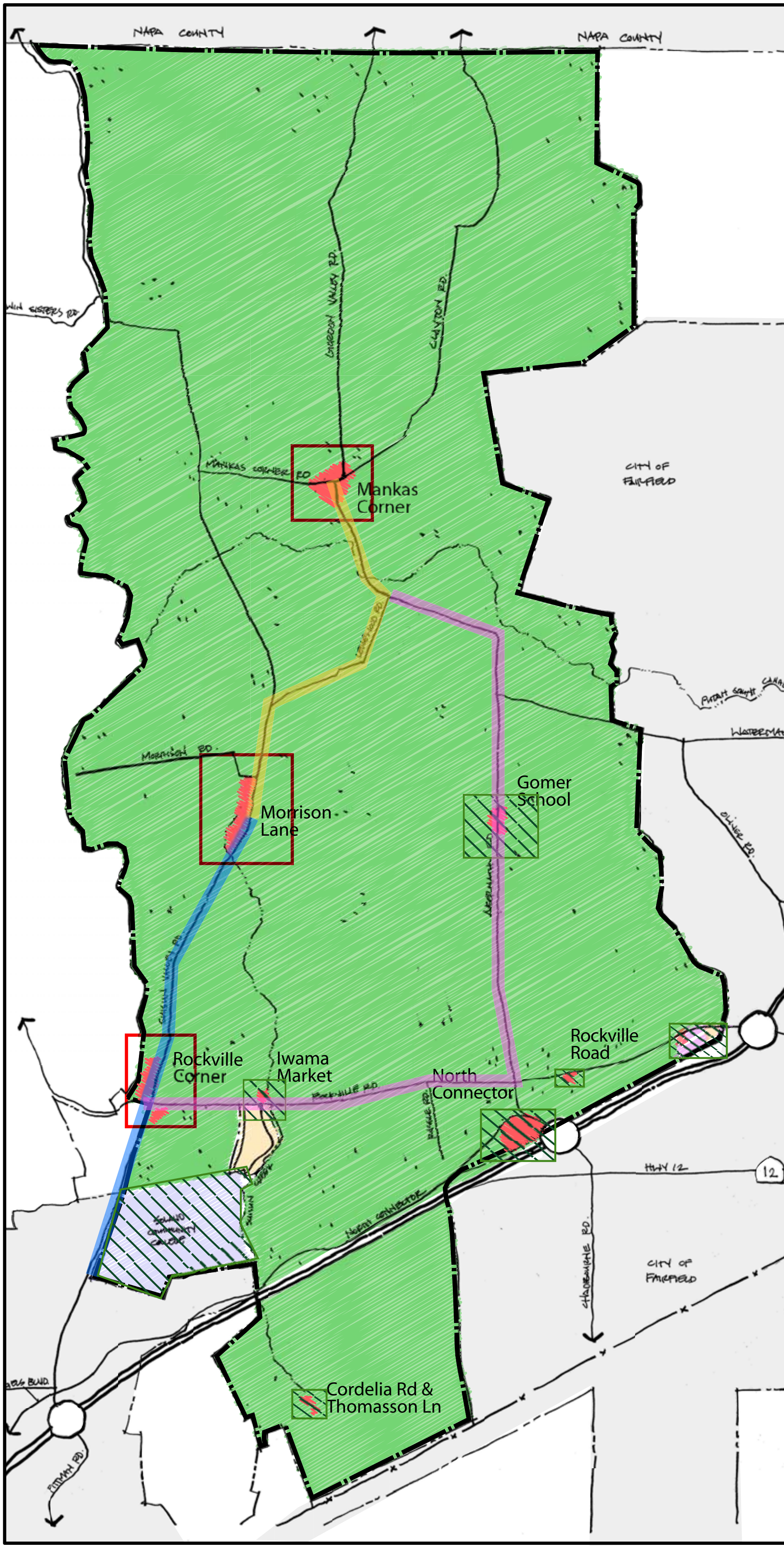
[1] Huckfeldt, Don. Contractor and owner. Huckfeldt Well Drilling. Napa, CA. August 6, 2009—Telephone conversation with Elizabeth Boyd of EDAW regarding typical costs of wells within Suisun Valley.

Table 2-4
Water Infrastructure Costs

Tool	Size	Typical Unit Cost*	Locations/ Centers Served	Number of Units	Total Cost
Water Pipeline	8-inch diameter	$63 per linear foot	Fairfield Connection Valve to Rockville Corner	2,700 feet	$170,200
Water Pipeline	6-inch diameter	$45 per linear foot	Rockville Corner to Morrison Lane	8,500 feet	$382,500
Storage Tank/ Reservoir	150,000 gallon reservoir	$0.60 to $1.00 per gallon	Rockville Corner ATC, Morrison Lane ATC	Two tanks	$300,000
Total Phase 1 Cost					**$833,700**
Water Pipeline	6-inch diameter	$45 per linear foot	Morrison Lane to Mankas Corner	10,000 feet	$450,000
Storage Tank/ Reservoir	150,000 gallon reservoir	$0.60 to $1.00 per gallon	Mankas Corner ATC	One tank	$150,000
Total Phase 2 Cost					**$600,000**
Water Pipeline	4-inch diameter	$40 per linear foot	Mankas Corner to Gomer School	10,800 feet	$432,000
Water Pipeline	4-inch diameter	$40 per linear foot	Gomer School to existing line near Iwama Market	10,400 feet	$416,000
Storage Tank/ Reservoir	150,000 gallon reservoir	$0.60 to $1.00 per gallon	Unknown	Additional tank	$150,000
Total Additional Phase Cost					**$998,000**
Total Pipeline Cost					**$1,850,600**

* Source: AECOM Water 2009, estimated based on bids for nearby projects



Suisun Valley Strategic Plan

Figure 2-7

Potable Water Infrastructure Phases

Legend

- Phase I
- Phase 2
- Additional Phases
- Primary Focus Service Areas
- Additional Service Areas

Land Use Designations

- Agriculture
- Traditional Community - Residential
- Neighborhood Commercial
- Service Commercial
- Public/Quasi-Public
- Neighborhood Agricultural/Tourist Center

0 900' 1800' NORTH

SOLANO 1850 COUNTY

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Table 2-5 shows the estimated depth a well would need to be drilled in various locations in the Suisun Valley. Based on existing well performance, a well in the Morrison Lane ATC could be drilled to a shallow depth (250 feet) while producing a steady flow of water (100 gpm). Like a public water system, wells would also need to be united with a storage tank to serve fire flow.

Table 2-5
Typical Well Depths and Output Levels for Suisun Valley

ATC Location	Typical Well Depth	Typical Well Output*
Mankas Corner ATC	400 feet	10 gpm
Gomer School ATC	250 feet	40 gpm*
Morrison Lane ATC	250 feet	100 gpm
Iwama Market ATC	350 feet*	40 gpm*
Rockville Corner ATC	350 feet	40 gpm
North Connector ATC	300 feet	200 gpm
Cordelia Road/ Thomasson Lane ATC	400 feet	60-70 gpm
Rockville Road ATC	300 feet	200 gpm
Average Well	***300 feet***	***50 gpm***
Average Cost per Well	**$30,000**	

Note: Average cost includes drilling, permitting, casing, and containment. It does not include pumping, storage, treatment, or distribution costs.
* Data on existing wells was not available in this area and this number was estimated conservatively.
Source: Huckfeldt, pers. comm. 2009

Some additional considerations for wells include proper siting and groundwater protection. Wells must be located away from potential sources of contamination. Table 2-6 shows the minimum distances at which a well could be placed near certain uses.

Table 2-6
Well Siting Criteria

Use	Distance from Well (Feet)
Property lines (un-sewered areas)	25
Septic tanks	100
Leach fields	100
Sewer lines	50
Stream, ditch or drainage canals	25
Sub-surface leaching systems	100
Animal or fowl enclosures	100
Underground storage tanks containing hazardous substances	100

Source: AECOM Water 2009

WASTEWATER

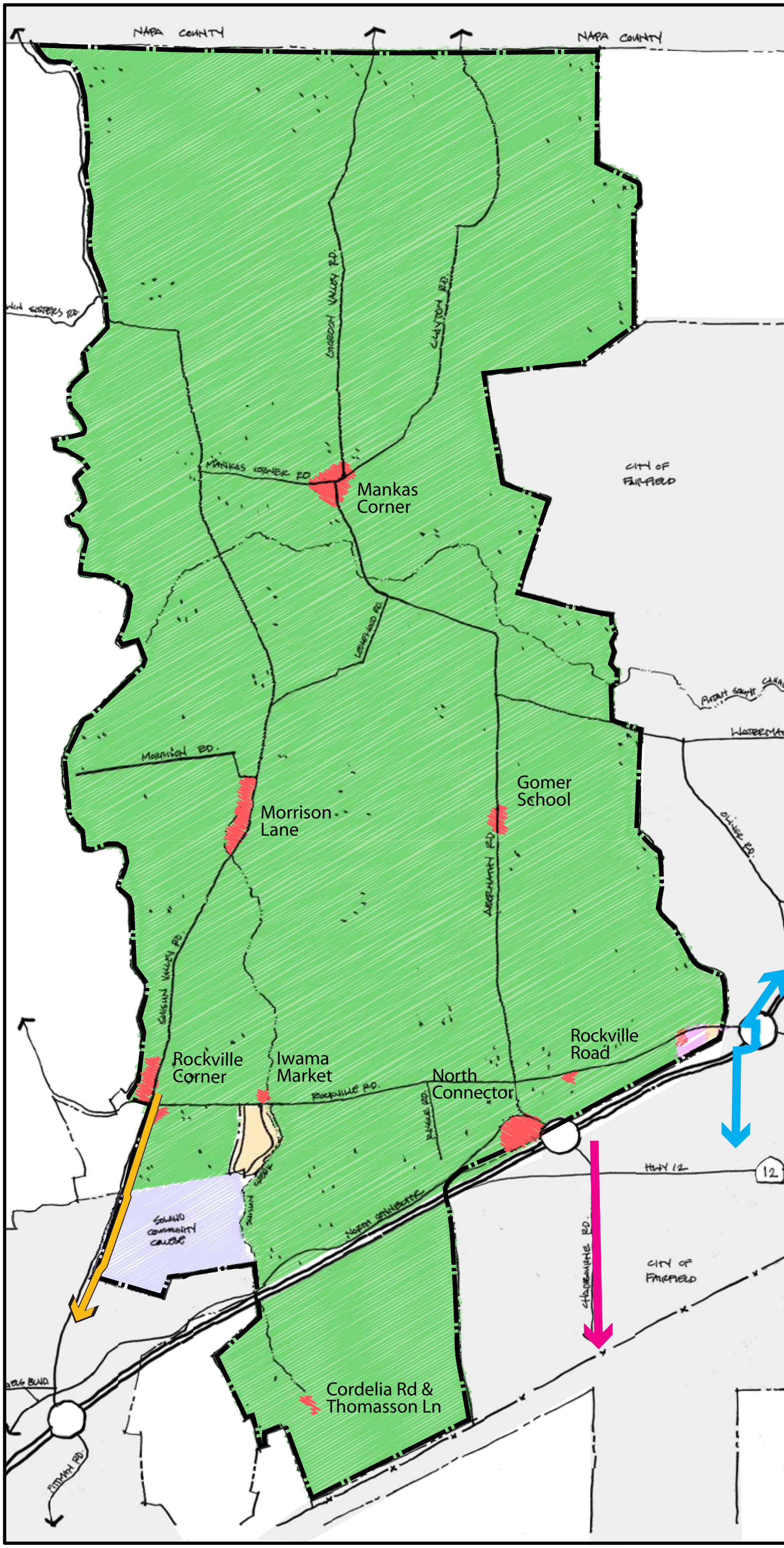
Existing wastewater infrastructure within Suisun Valley is mainly septic. Public sewer service was extended to Rockville Corners in the 1970s when septic systems began to fail and public health became a concern. Figure 2-8 shows the three existing sewer lines that extend to the Valley's border at Rockville Corner, near the North Connector, and near the intersection of Travis Street and I-80. Although it is possible to extend these lines, it is impractical to do so given the proposed scale of future tourist-serving development in the Suisun Valley.

The County recommends that businesses and residents handle wastewater treatment locally through septic or packaged wastewater treatment systems. Table 2-7 shows some typical uses permitted within Suisun Valley ATCs that if grouped together would generate approximately 1,500 gallons of wastewater per day. The following section describes wastewater systems capable of handling these uses.

Suisun Valley Strategic Plan

Figure 2-8

Existing Wastewater Infrastructure



Legend

- 8” Fairfield Sewer Line
- 10” Fairfield Sewer Line
- 18” Fairfield-Suisun Sewer District Sewer Line

Land Use Designations

- Agriculture
- Traditional Community - Residential
- Neighborhood Commercial
- Service Commercial
- Public/Quasi-Public
- Neighborhood Agricultural/Tourist Center

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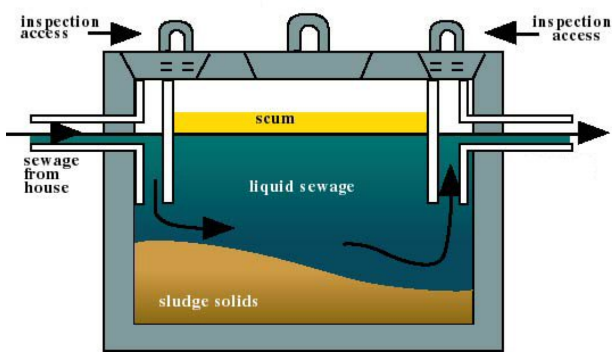
Table 2-7 Typical Wastewater Generation Profile for Suisun Valley ATCs			
Use	**Operation Assumptions**	**Wastewater Use**	**Wastewater Generation**
Café	200 guest visits.	3 gallons per meal per visit * 200 guest visits	600 gallons
Retail spaces	8 employees.	8 employees * 10 gallons per employee	80 gallons
Bed and Breakfast	10 guests	50 gallons per guest * 10 guests	500 gallons
Art gallery	50 visits	5 gallons per visit * 50 visits	250 gallons
Total			**1,430 gallons**
Source: Based on information from *Wastewater Engineering: Treatment, Disposal and Reuse* by Metcalf & Eddy			

Either a septic or packaged treatment system would be subject to State and County Environmental Health regulations. The County would also need to work with property owners to establish improvement districts to enable businesses and residences to share the capacity of these systems.

Septic and Leach Field System

A typical septic and leach field system to serve 1,500 gallons per day of wastewater costs approximately $27,000 and requires at least 1,800 square feet of space. A 4-inch or 6-inch polyvinyl chloride (PVC) pipe collects wastewater from each facility and routes it to a septic tank via gravity flow. A typical tank usually contains one or two compartments for separation of both floating debris and sedimentation. The outlet then routes the pretreated water to a leach field. The leach field consists of a header pipe or diverting box to multiple perforated pipes wrapped in fabric and laid in a 24-inch-wide washed gravel bed or to a series of infiltrator chambers in gravel.

The land area required to support a septic system varies by the size of the tank and leach field required, as shown in Table 2-8.



Typical Section of a Septic Tank

Much of the soil within Suisun Valley is fine sandy loam, clay loam, or silty clay loam. Assuming percolation of 2.5 gallons per square foot over 24 hours, a 24-inch wide trench, and 1,500 gpd flows, a septic system serving the typical Suisun Valley ATC would require 3,200 gallons of storage in multiple tanks and approximately 600 square feet of leach field absorption area. A 3,200 gallon tank installed would cost approximately $15,000. Collection pipes would cost approximately $40-50 per foot installed (for 4- to 6-inch pipes). Thus, the leach field system to accommodate the 1,500 gallons would cost approximately $12,000 installed.

Table 2-8
Typical Land Area Requirements for Septic Tanks and Leach Fields

Septic Tank Sizing

Average Flows (gpd)	Minimum Tank Capacity (gallons)	Approximate Tank Size (length x width x depth in feet)
0-500	900	4 x 8 x 4
501-700	1,200	4 x 10 x 5
701-900	1,500	5 x 12 x 5
901-1,240	1,900	6 x 12 x 5
1,241-2,500	3,200	multiple tanks

Leach Field Sizing

Type of Soil	Typical Absorption Capacity (gallons/sf, 24-hour period)
Clay with small amount of sand or gravel	1.0 - 1.5
Clay with small amount of sand or gravel	1.5 – 2.0
Sandy loam/clay	2.5
Fine sand	4.0
Coarse sand or gravel	5.0

Source: The Engineering Toolbox. 2005. Septic Systems. http://www.engineeringtoolbox.com/septic-systems-d_1113.html. Accessed August 26, 2009.

Packaged Sewer Treatment Plants

A typical packaged sewer treatment plant (packaged plant) to serve 1,500 gallons per day of wastewater would cost between $50,000 to 100,000 and require at least 1,500 square feet of space. Different approaches exist regarding on-site package treatment, varying on numerous factors such as level of treatment and volume. A packaged treatment plant consists of construction, assembly, connection, and installation modules designed for on-site wastewater treatment serving a limited area with a minimum design flow of 1,500 gpd. Packaged plants are typically supplied by a manufacturer and designed to achieve a minimum of secondary treatment. With appropriate agreements, several businesses could use a single plant, thereby achieving economies of scale. The cost of pipes to connect each business to the plant is typically between $40-50 per foot installed for 4- to 6-inch pipes. There are two main types of packaged plants; Membrane Bioreactor Systems and Sequencing Batch Reactor Systems.

SEQUENCING BATCH REACTOR SYSTEMS

Sequencing batch reactors (SBRs) are industrial processing tanks used to treat wastewater in batches. Oxygen is bubbled through the wastewater, making the wastewater suitable for discharge into sewers or for use on land.

An SBR installation consists of at least two identically equipped tanks with a common inlet, which can be switched between them. The tanks have a “flow through” system, with raw wastewater (influent) coming in at one end and treated water (effluent) flowing out the other. There are five stages to treatment: *fill, react, settle, draw and idle*.

Oxygen is added to the system to encourage the growth of aerobic bacteria, which consume the nutrients in the waste. Nitrogen is converted from a reduced ammonia form to oxidized nitrite and nitrate forms, a process known as nitrification.

The settling stage is usually the same length in time as the aeration stage. During this stage, the sludge formed by the bacteria is allowed to settle to the bottom of the tank. The aerobic bacteria continue to multiply until the dissolved oxygen is all but used up. Conditions in the tank, especially near the bottom are now more suitable for anaerobic bacteria to flourish. Many of these, and some of the bacteria, which would prefer an oxygen environment, now start to use oxidized nitrogen instead of oxygen gas and convert the nitrogen to a gaseous state, as nitrogen oxides or, ideally, di-nitrogen gas. This is known as de-nitrification.

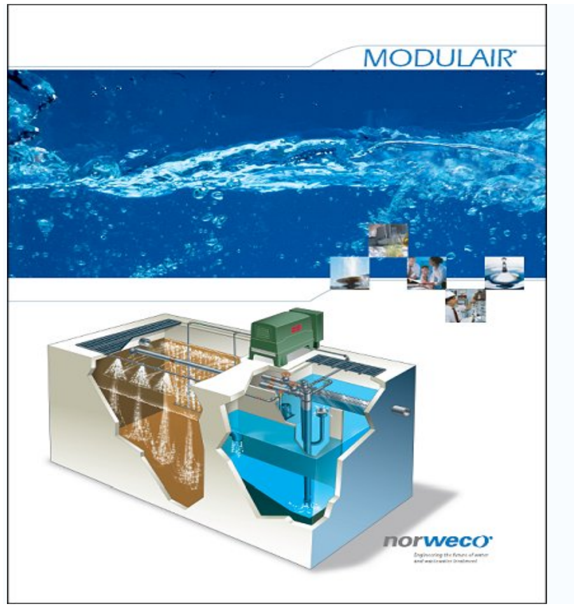
As the bacteria multiply and die, the sludge within the tank increases over time and a waste activated sludge pump removes some of the sludge during the settle stage to a digester for further treatment. The quantity or "age" of sludge within the tank is closely monitored, as this can have a marked effect on the treatment process. The sludge is allowed to settle until clear water is on the top 20-30 percent of the tank contents.

The decanting stage most commonly involves the slow lowering of a scoop or "trough" into the basin. This has a piped connection to a lagoon where the final effluent is stored for disposal to a wetland, tree growing lot, ocean outfall, or to be further treated for use on parks, golf courses, and similar uses requiring water for landscaping.

MEMBRANE BIOREACTOR SYSTEMS

Membrane Bioreactor Systems (MBRs) use membranes to separate the liquids from the solids. One of the key benefits of an MBR system is that it overcomes limitations associated other types of packaged systems related to how the sludge settles in the tank. The MBR system is able to remove biodegradable materials at a higher loading rate, meaning more sewage can be treated effectively to a higher level.

The cost of building and operating a MBR is usually higher than conventional wastewater treatment but the high quality effluent make them particularly useful for situations where water reuse is desired.



A typical MBR packaged sewer treatment plant consists of an MBR skid, influent wet well, and a sludge storage tank. The approximate size of the MBR skid would be 15 feet tall, 15 feet wide, and 35 feet long. A cast-in-place wet well would be installed underneath the skid to an approximate depth of 12 to 15 feet. The skid, influent wet well, and the sludge storage tank could be installed in a covered area of approximately 1,500 square feet. There should be a concrete slab-on-grade for all of the facilities. This area should be enclosed with fencing, a wall, or shed consistent with the character within the Valley. Whichever enclosure is chosen, truck access must be provided for sludge removal. The MBR system would also require a means of effluent disposal, which could include seepage pits or leach fields. The owner would either need to allocate space for a leach field, or would need to install seepage pits, which are essentially perforated precast manholes. The space needed for a leach field is shown in Table 2-8 and depends on the flow of effluent and the percolation of the soil. If the water is treated to an acceptable level, per Solano County Environmental Health regulations, then the treated water could be discharged to grade, in an irrigation ditch, or could be reused on-site in a drip irrigation system. The use of packaged plants is regulated by County Environmental Health who likely requires non-aerial applications such as drip and bubbler type irrigation. The septic tank alone (pretreatment only) does not treat water to this level. If treated water is used for irrigation, a storage tank and pump would be required.

The estimated cost for each packaged system is approximately $50,000 installed for an SBR system and $100,000 installed for an MBR system. The difference would be that an MBR system is able to produce a higher quality effluent. Maintenance costs would be in addition to these.

COMPARISON BETWEEN SEPTIC AND PACKAGED TREATMENT

Table 2-9 compares the benefits and impacts of using conventional septic systems or packaged treatment plants within the Suisun Valley. Septic systems are least costly to install and operate but depend on the quality of the soil in order to work effectively. MBRs and SBRs both use less space, do not rely on the soil for treatment, and effluent can be used for irrigation. They are much more expensive than septic systems and require skilled maintenance.

The main decision points for choosing a system include the cost and expected amount of influent; packaged systems need at least 1,500 gpd and septic systems cannot be expanded once they are completed. If stakeholders are looking for a flexible solution that can accommodate a large number of users with water reuse opportunities, a packaged plant may be most appropriate. If there is very little influent to be treated and if there is little expectation that there would need to be future expansion then a septic system would be a better choice.

Table 2-9
Benefits and Impacts of Wastewater Systems

	Septic	Packaged
Benefits	▸ Less expensive to install and operate.	▸ Treated wastewater can be reused for irrigation, lowering potable water demand. ▸ SBR and MBRs require a smaller footprint than a septic tank and leach field system. ▸ Easily expandable.
Impacts	▸ Potential contamination of water sources from systems leaching over time. ▸ If soil percolation is poor, systems may not operate well. ▸ Sized for maximum load, thereby requiring large septic tank volume. ▸ Not easily expandable.	▸ More expensive to install and operate than a septic system. ▸ Requires skilled maintenance.