Infrastructure

Infrastructure is vital to creating a welcoming visitor experience. Businesses cannot grow and thrive if they can't serve their customers with basic infrastructure. Water and wastewater systems are essential for all types of businesses. The Suisun Valley infrastructure system must be capable of supporting a full range of desired agricultural and tourist uses and while also achieving the following goals:

- Allow for continued irrigation of agricultural crops;
- Support additional uses within ATCs and throughout the Valley;
- Maintain high water quality;
- Provide an effective method to provide water in case of fire; and
- Maintain the rural character of the area.

This section of the Strategic Plan gives business owners, entrepreneurs, and other stakeholders an understanding of the scope of costs associated with certain infrastructure improvements. This information can be used within grant proposals and other methods of fund-seeking to estimate the proposed need.

Costs expressed in this section are estimates based on current (2009) prices typical within the area. Specific project costs will vary depending on site-specific conditions such as location, soil type, and proposed uses.

Improvement Phasing

Water and wastewater infrastructure may be phased in stages, depending on the will of the community. What follows is a description of two choices for water service and two choices for wastewater facilities. The two water service choices described are public water line extensions and individual wells. Unless a majority of owners within the Valley are willing to share in the cost for a public water line extension, the choice will be limited to individual wells. If a majority of owners would pursue a water line extension, this could be done and financed in segments (see Table 2-4). If chosen, the water line extension could be phased as follows:

- Phase 1 would consist of replacing the line along the current Suisun Valley Road corridor from the City of Fairfield point of connection to Morrison Lane.
- Phase 2 would consist of extending this line to Mankas Corner.
- Further phases could add connections to Gomer School, the North Connector, Iwama Market, and back to Rockville Corner, creating a looped system in the end.

Wastewater infrastructure is not sequence-dependent. This report recommends either septic or packaged wastewater systems. These can be developed at any time by the owner or occupant and therefore, no phasing plan has been suggested.

Water

With the addition of the proposed ATC land uses within the Valley, the demand for potable water will be higher. Water demand is separated into demand for potable water used for drinking, washing, and human consumption; and non-potable water used for landscaping, irrigation, and fire suppression. Water demand can be met through a variety of methods including using public water in a water main, on-site wells, and nonpotable water within canals or wells.

This section outlines the existing public water infrastructure in the Suisun Valley, estimated future water demands, and the costs implicit to extending public infrastructure to meet that demand. In addition, this section describes typical well considerations and costs. It is the County's intent to encourage businesses that would benefit from existing and future wells, while also pursuing a public system that further enhances the Valley's ability to promote agricultural tourism activities.

Existing Water Infrastructure

There are several water systems piped throughout the Valley floor. Figure 2-5 shows the major systems present in the Valley. Four agencies have some claim to water, treatment facilities, storage facilities, or conveyance within Suisun Valley: the Suisun Solano Water Authority (SSWA), City of Vallejo, City of Fairfield, and Solano Irrigation District (SID).

SUISUN SOLANO WATER AUTHORITY

SSWA is a joint powers authority (JPA) of Suisun City and SID, which maintains a water pipeline that runs through the middle of the Valley. The SSWA line is a six-inch main of varying materials. Originally installed in the early 1900s to deliver water from Twin Sisters reservoir and Suisun Valley wells to Suisun City, the line has been replaced in short segments over the years. Water in this line now flows to Suisun Valley from SSWA's Gregory Hill tank east of Suisun Valley in Fairfield. As part of the agreement to place the line through the Valley, properties bordering the main were given connections to the pipe. This potable water main is at capacity. No additional connections may be added.

SOLANO IRRIGATION DISTRICT

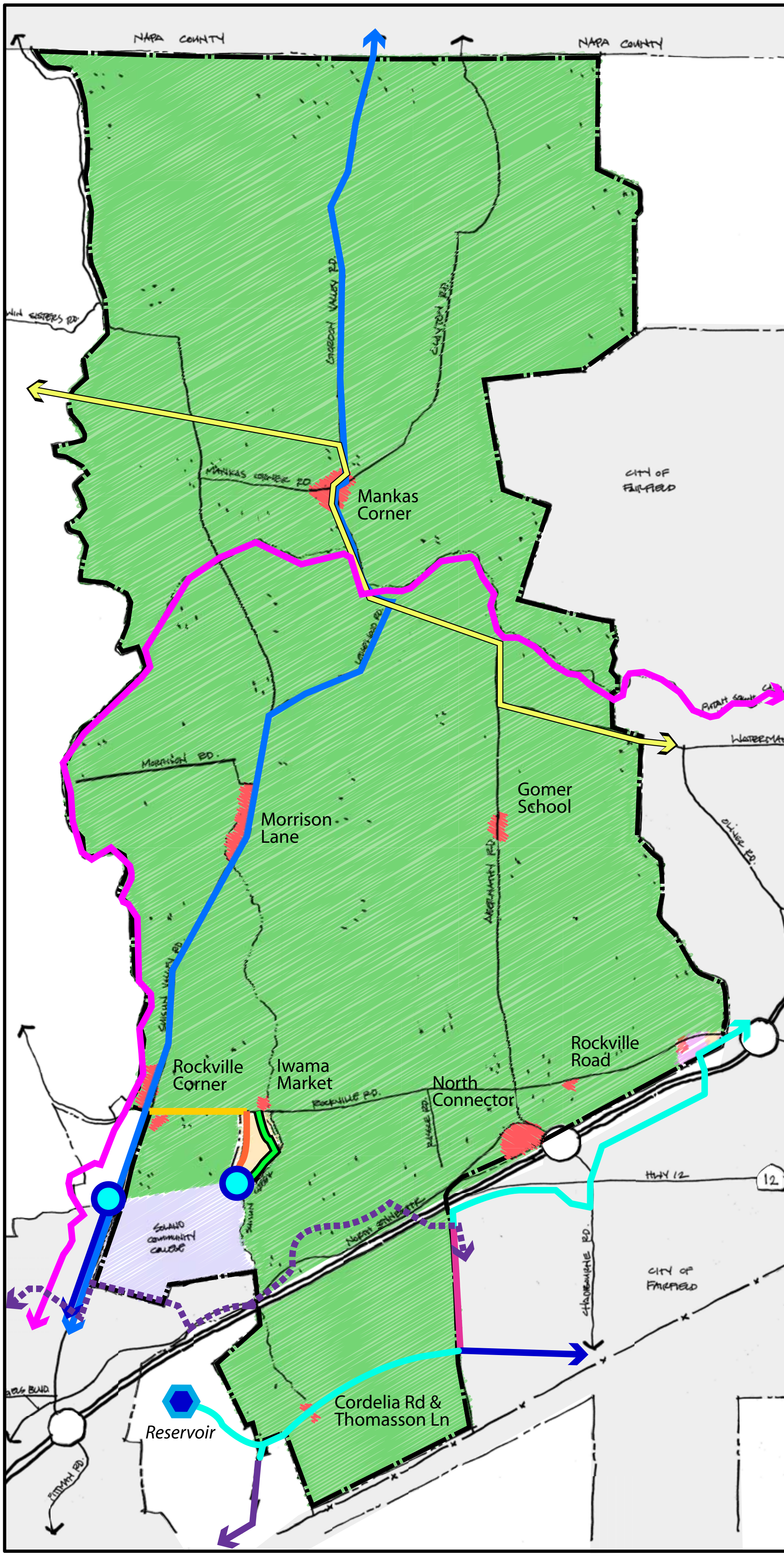
SID is responsible for providing agricultural properties within their district with non-potable water for irrigation. SID uses the Putah South Canal and other facilities to serve farmers with water for crops. Even though it is part of the JPA with Suisun City, SID does not provide potable water to its customers.

CITY OF VALLEJO

The City of Vallejo owns the 24-inch Gordon Valley pipeline. Built in the 1920s, the Gordon Valley pipeline was originally meant to bring water from Lake Curry, located on Suisun Creek in Napa County north of Suisun Valley, to the City of Vallejo. Some properties along the pipeline were allowed free water as part of the right-of-way agreements. Other customers were added later. To meet drinking water regulations, Vallejo added a water treatment plant to the system near Lake Curry. Instead of replacing the Gordon Valley treatment plant in the 1990s,Vallejo chose to close the plant and deliver potable water to Gordon Valley by gravity from the City of Fairfield's Green Valley treatment plant by reversing flow in the Gordon Valley pipeline. Consequently, the capacity of the Gordon Valley pipeline is greater than is needed for the current service. Because of its age, parts of the line are failing and will need to be replaced in coming years if it will continue to be used to transport potable water. Some portions of this main located within the City of Fairfield have already been replaced. In its current condition, is the Gordon Valley Line cannot serve additional users. However, a new pipeline could serve Suisun Valley within the Gordon Valley Line right-of-way.

Two emergency connections are available from the City of Fairfield's water system; one at Suisun Community College, and one next to the Cordelia fire house. These connections have been used in the past when the City of Vallejo has needed to do some work on their system and rely on City of Fairfield water on a temporary basis. The first of these connections is depicted on Figure 2-5 as it is in an ideal location for connections to the Suisun Valley.

The Green Valley treatment plant could serve the Suisun Valley because of its relative height, which permits water to reach the customers in the upper portion of the Valley. During emergencies, the City of Vallejo has augmented the City of Fairfield's system with a pumping station at Mankas Corner. However, the Green Valley treatment plant does not have the additional capacity needed to serve new businesses and other uses proposed within this Strategic Plan.



Suisun Valley Strategic Plan

Figure 2-5

Existing Water Infrastructure

Legend

Potable Water Infrastructure

- Fairfield Connection to Vallejo System
- 36" Fairfield Water Main
- 30" Fairfield Water Main
- Future 30" Fairfield Water Main
- 24" Vallejo Water Main (Gordon Valley Line)
- 24" Fairfield Water Main
- 15/16" Fairfield Water Main
- 8" Vallejo Water Main
- 6" Vallejo Water Main
- 6" SSWA Pipeline
- 6" Fairfield Water Main

Non-Potable Water Infrastructure

- Putah South Canal

Land Use Designations

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

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CITY OF FAIRFIELD

The City of Fairfield has no current water infrastructure that serves the Valley. As stated previously, the City has maintained two emergency connections at the edge of the Valley that have been used by the City of Vallejo. In addition, it uses Vallejo Lakes System water to serve the eastern half of the Willotta Oaks subdivision.

However, the City of Fairfield may be the most feasible partner to provide potable water to additional uses in the Valley. The Waterman water treatment plant has some additional capacity that could be purchased wholesale for the Valley and piped through a new pipeline within the existing Gordon Valley pipeline right-of-way or existing SSWA or Vallejo pipelines.

Future Water Demand

There are currently several types of uses in the Valley that demand water; from agriculture, to residential, to commercial. With the implementation of this Strategic Plan, the County would allow upwards of 500,000 additional square feet of commercial uses, providing that all commercially designated areas were built upon, and depending on the availability of water and wastewater infrastructure to serve new development.

Each type of land use has a different water demand. Residential water demand typically fluctuates between 250 to 500 gallons per day (gpd) per unit. The main factor differentiating the amount of water a unit uses is landscaping. Larger lots generally require more water to maintain the landscaping.

Commercial water demand is typically 2,300 to 2,800 gpd per business. Different types of businesses have different water demands. For instance, restaurants typically have a higher demand than art galleries. Water demand also varies by the number of visitors to a business; the higher the number of visitors the higher the water demand.

Agricultural uses typically have the highest water demand of all uses. The two types of agriculture most common in the Suisun Valley are vine and tree crops. Vine crops typically use 650,000 gallons per acre per year, while tree crops typically use 1,300,000 gallons per acre per year. Unlike commercial or residential uses, agriculture does not require potable water. SID is able to serve agricultural uses under existing water contracts.

Certain assumptions are necessary to estimate the appropriate sizing for future water pipelines within the Suisun Valley, including assumptions regarding the types of land uses most likely to occur within each ATC, as shown below.

These assumptions, listed in Appendix B, were used for estimation purposes only and are not binding for any regulatory purpose. Fire suppression needs were separated from the potable water demand, as water for fire suppression could be served with either potable or nonpotable water.

It is estimated that water use will be greatest in the Rockville Corner, North Connector, and Mankas Corner ATCs.

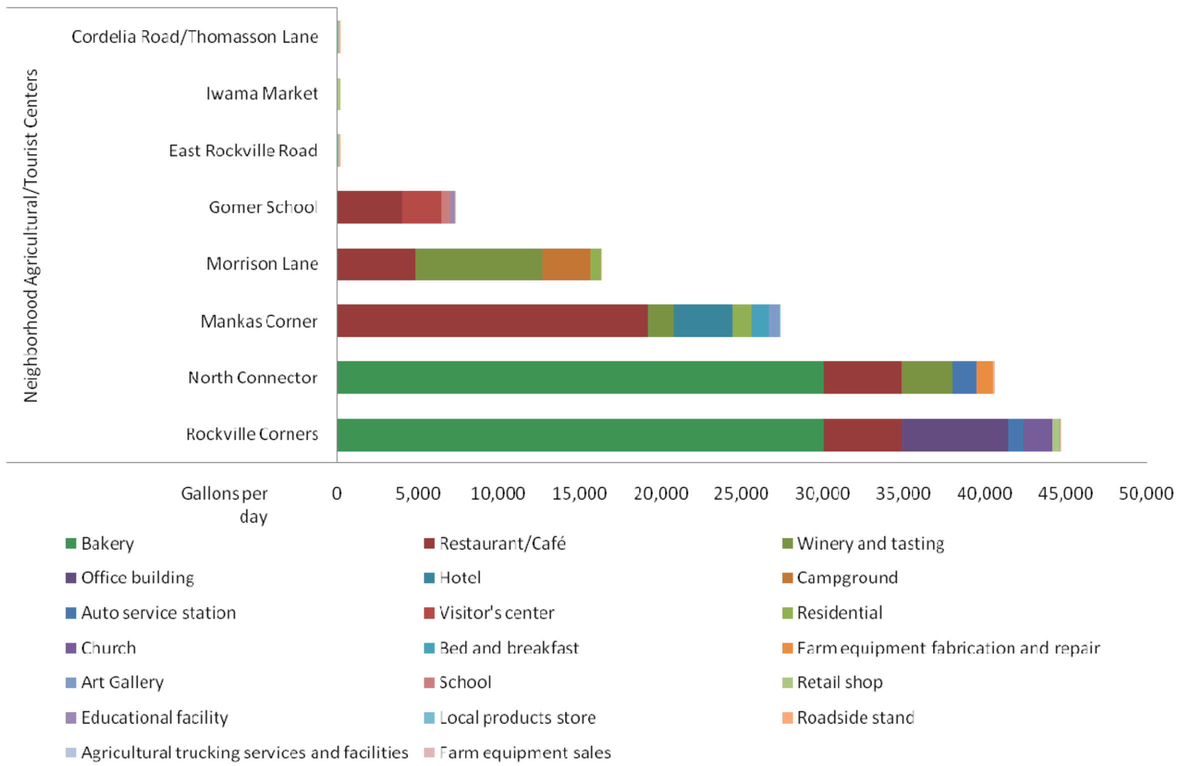
FUTURE WATER SUPPLY

The demand for potable water is relatively small. Estimated demands based on planning level criteria have been developed for each ATC (see Appendix B). The alternatives include:

- Developing wells at each of the demand locations.
- Developing larger wells for several demand locations and piping water from the well(s) as needed.
- Providing a source of potable water from a neighboring water district or municipality and piping potable water to the various demand locations.
- Separating fire protection water supply from potable water supply and developing two separate systems.

Fire Protection System

Fire protection in a rural area can be provided using either potable water or untreated water, allowing different water sources to meet the required demand. These sources may include irrigation water, well water, or potable water.



Estimated water use in each ATC

Fire protection flow and volume requirements are much greater than those for potable water for consumer use. The maximum flow required to meet the demand for potable water is in the range of 10 to 80 gpm, while the fire demand for commercial areas is more than 15 times that flow rate. This demand is generally best met by installing storage facilities and adequately sized pipes to deliver increased fire flows.

The Fire Marshal determines the exact requirements for water flow and duration. There are two fire districts with responsibilities over areas of Suisun Valley: Cordelia Fire District and Suisun Fire District. The fire districts are responsible for directing the development of fire suppression systems for buildings within their respective areas. Figure 2-6 shows the areas for which each fire district is responsible. The Cordelia Fire District is responsible for the area that includes the Rockville Corner, Morrison Lane, Iwama Market, and Cordelia Road and Thomasson Lane ATCs. Suisun Fire District is responsible for the area containing the Mankas Corner, Gomer School, Rockville Road, and North Connector ATCs.

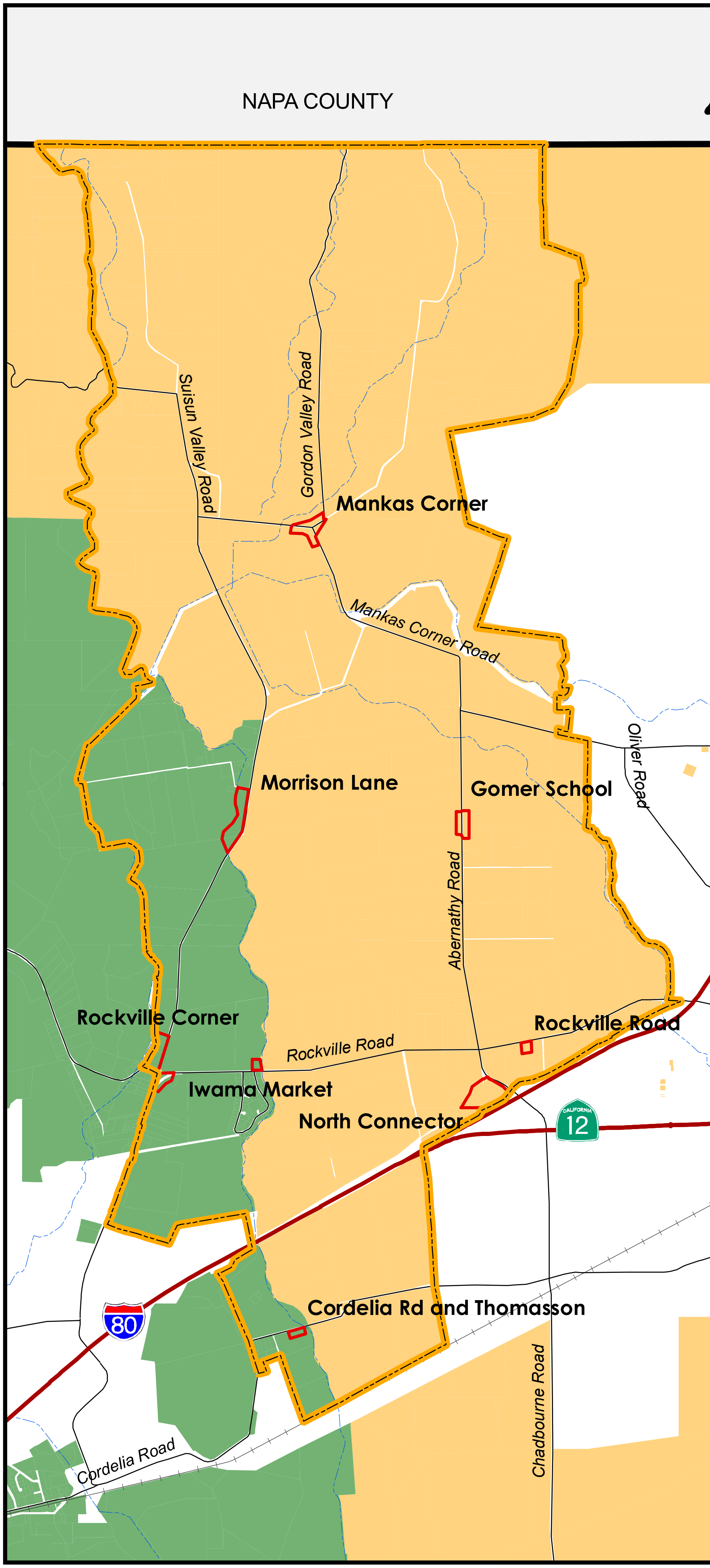
The requirements for fire suppression differ depending on the fire district within which an ATC is located. Fire marshals in Solano County are striving to work toward more consistent requirements. However, as of 2009, the two districts have different requirements, as described below. Based upon information received from the two districts, the Cordelia Fire District has stricter requirements. For this reason, physical and cost assumptions within this document are based on the Cordelia Fire District requirements.

The Suisun Fire District bases their requirements on the fire code, which establishes variable requirements depending on the size and type of the proposed use. On-site water is required in all circumstances, although sprinklers are required only in specific instances.

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

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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

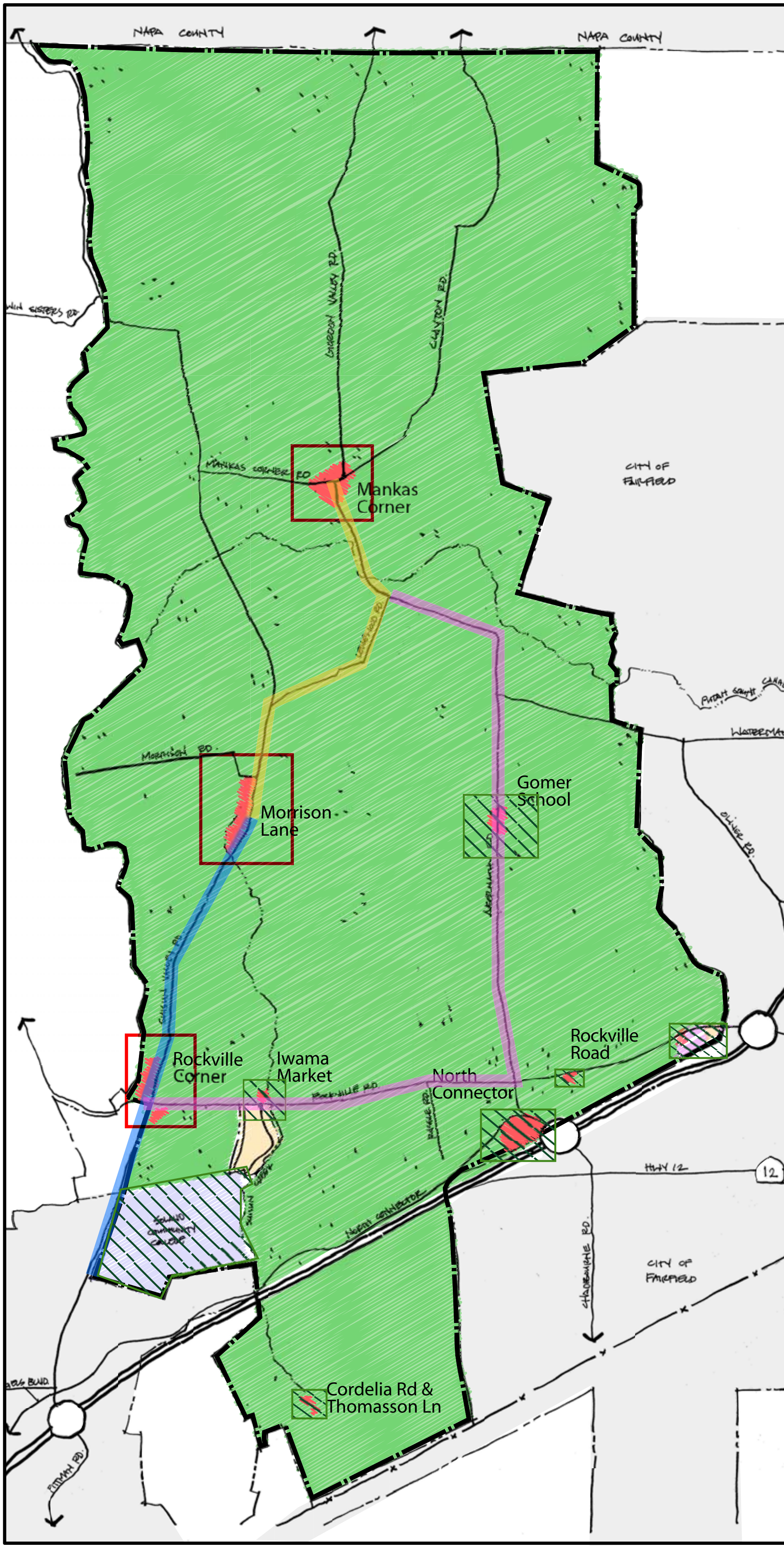
Although groundwater is sometimes unreliable, individual wells may be the simplest method to provide water for some of the ATCs and most agricultural and residential uses throughout the Suisun Valley. Wells are allowed under current County policies and regulations. Well costs depend on the type of soil 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.

[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

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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

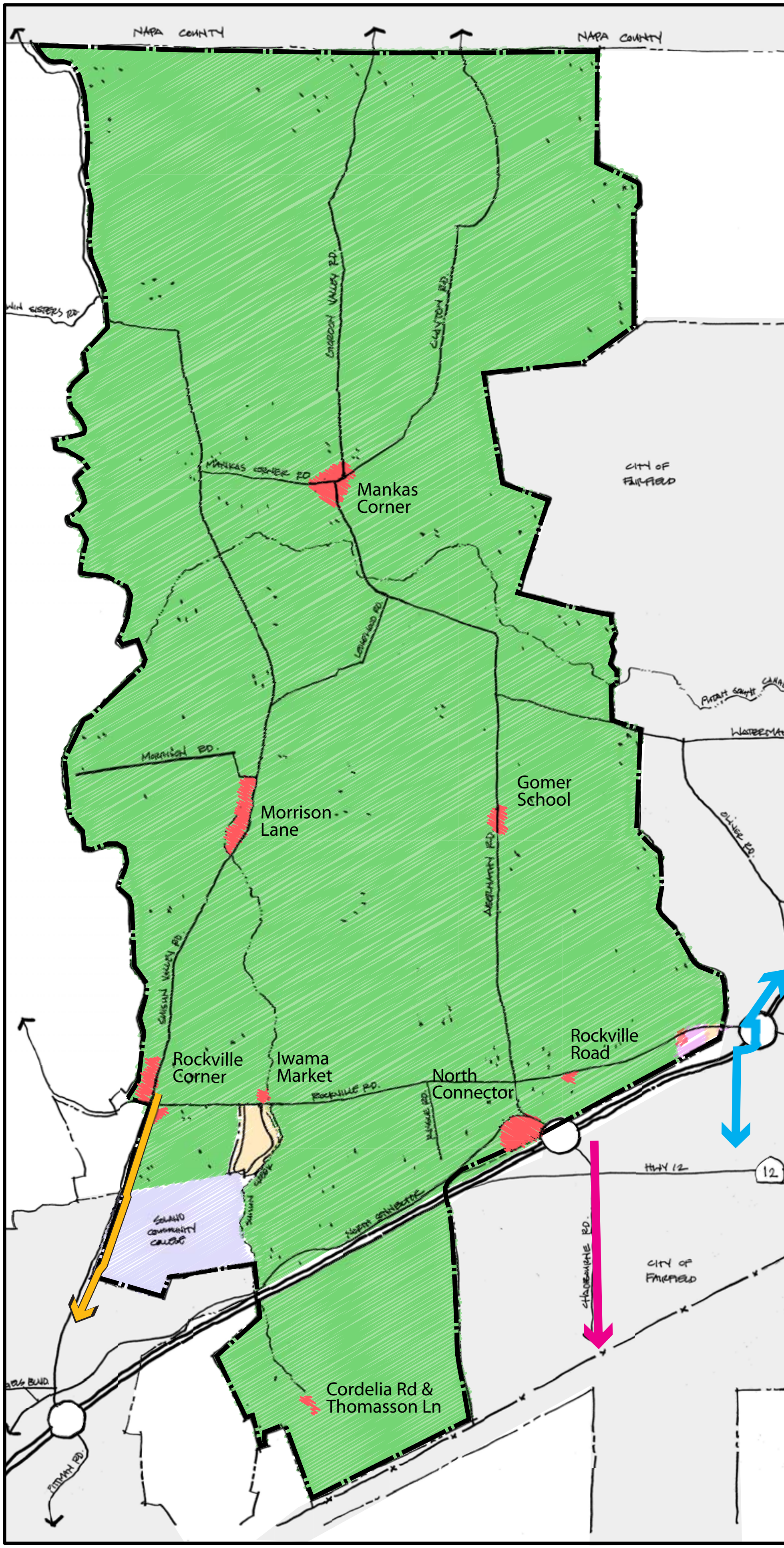
Use	Distance from Well (Feet)
Property lines (un-sewered areas)	25
Septic tanks	100
Leach fields	100
Sewer lines	50
Stream, ditch or drainage canals	25
Sub-surface leaching systems	100
Animal or fowl enclosures	100
Underground storage tanks containing hazardous substances	100

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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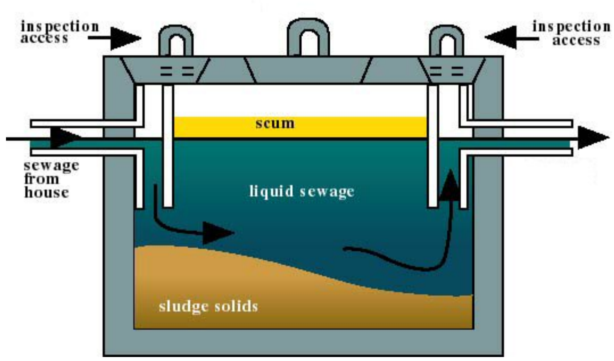
Table 2-7 Typical Wastewater Generation Profile for Suisun Valley ATCs			
Use	**Operation Assumptions**	**Wastewater Use**	**Wastewater Generation**
Café	200 guest visits.	3 gallons per meal per visit * 200 guest visits	600 gallons
Retail spaces	8 employees.	8 employees * 10 gallons per employee	80 gallons
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.