
Subject: Napa Silverado Service Area Analysis
Prepared For: North Bay Watershed Association – Integrated Water Resources Committee
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Section 1 Introduction and Purpose

This Technical Memorandum is part of a feasibility study of satellite recycled water treatment prepared as part of a regional water recycling analysis for the North Bay Watershed Association. The general analysis techniques and analyses described in Technical Memorandum #1 “Draft General Process and Distribution System Overview”, dated May 2004, (hereinafter referred to as the General Criteria) are used to identify a range of candidate satellite treatment plant sites and compare the feasibility of these satellite systems to a centralized recycling system. These techniques will be applied to the Silverado Area of Napa.

Section 2 Study Area Characteristics

2.1 Study Area

The study area is the Silverado area of the City of Napa (City), which includes the Silverado Country Club and Resort as well as Silverado Highlands, a community of luxury homes. The Silverado Country Club includes two 18-hole golf courses, tennis courts and a spa as well as guest condominiums and meeting facilities.

2.2 Water Supply

Water service within the City of Napa is provided by the City public works department. The City also provides water to certain unincorporated areas outside of the City boundaries, including the Silverado Highlands Community. There are three sources of water supply¹:

- Lake Hennessey – Lake Hennessey is the City’s primary water supply source between the months of May and October. The reservoir was created by the Conn Dam, built in 1946, and stores approximately 31,000 acre-feet of water. Water from Lake Hennessey is treated at the Hennessey Treatment Plant.
- Milliken Reservoir – The Milliken Dam was built on the Napa River in 1923, creating Milliken Reservoir. Currently, Milliken Reservoir is used as a secondary water supply during the months of March and October. This water supply is treated at the Milliken Water Treatment Plant.
- State Water Project – Napa receives water from the State Water Project through the North Bay Aqueduct. This source is the City’s lead water supply between October and April, and is treated at the Jameson Treatment Plant.

The Silverado Country Club and Resort uses groundwater for its irrigation demands.

¹ Comprehensive Water Service Study: Draft Determinations, LAFCO of Napa County, October 9, 2003.

2.3 Wastewater Treatment and Disposal

Wastewater collection, treatment, and disposal services for the study area are provided by Napa Sanitary District (NSD). NSD operates the Soscol Water Recycling Facility which collects and treats wastewater from the City of Napa as well as unincorporated areas of Napa County.

During the winter months the treated water is discharged into the Napa River. During the summer months discharge in the Napa River is prohibited. Between May 1 and October 31, the water is treated in the plant's tertiary treatment facilities and recycled. The current and future customers for the recycled water include nearby golf courses, parks and business parks.

Section 3 Market Assessment Methodology

3.1 Relationship to Current Recycled Water Supply

This technical memorandum, which focuses specifically on the feasibility of satellite treatment facilities, analyzes recycled water feasibility differently than traditional market assessments. The traditional method for identifying potential recycled water customers is to locate large irrigation or process water customers that are in the vicinity of the central wastewater treatment facility. The analysis for satellite treatment focuses on users located some distance from the central wastewater treatment plant and begins by identifying a distant large water user and then identifying a nearby "sewershed" with adequate flow to serve the user.

The City and NSD have an agreement that recognizes the City as the sole purveyor of water, but defines a portion of the service area in which NSD is allowed to provide recycled water. NSD sells the recycled water to large users close to its Soscol Water Recycling Facility and reimburses the City for loss of revenue from its water customers². It is assumed that the construction of a satellite plant would require an amendment to this agreement that would expand the service area for recycled water delivery.

3.2 Regulatory Context

It is assumed that all of Napa's urban recycled water market, including the Silverado area, will require Title 22 Disinfected Tertiary Recycled Water.

NSD is in San Francisco Bay Regional Water Quality Control Board (Region 2). Region 2 has implemented a General Water Recycling Permit. Public agencies may apply for coverage under the General Permit by filing a Notice of Intent together with an Engineer's Report prepared in accordance with Title 22.

3.3 Water Demand and Sanitary Sewer Flow

The water demand for the Silverado Area was estimated using the land use estimations outlined in the General Criteria as shown in Table 1. The acreages were estimated using parcel maps and spatial land use data from the Napa County Geographic Information Systems Database.

² Agreement Between City of Napa and Napa Sanitation District for Sale of Recycled Water Within City of Napa Water Service Area, dated August 4, 1998.

Table 1 Land Use Based Demand Factors

Land Use	Demand Rate (AF/acre/year)
Vineyards	0.5
Irrigated Agriculture	2.0
Irrigated Pasture	2.5
Golf Courses	3.5
Urban Irrigation	3.0
Commercial/Industrial Process	1.7
Toilet Flushing	1.5 gal/flush

In accordance with the General Criteria, the satellite treatment analysis assumes that a potable water backup supply is available to provide adequate reliability to the user. In addition, and in accordance with the General Criteria, this study assumes that the satellite treatment plant includes a storage tank to manage potential discrepancies between wastewater flow and irrigation demand.

The General Criteria suggested that users located outside a 4-mile distance from the central treatment plant might be cost-effectively served by a satellite water recycling facility. This analysis acknowledges that pipeline can rarely be placed on a straight radial alignment and uses a 2.5 mile radius to approximate a 4 mile distance along an alignment. This initial assumption preliminarily identified the Silverado area as a location in which satellite recycled water production might be more cost effective than centralized production.

The proposed water recycling facilities are sized to provide for the demand of the average day of the peak month of water use. It has been assumed that the peak monthly demand is approximately 18% of the total annual water demand, as shown in Figure 1. To determine the size of the plant, the total annual demand is multiplied by 18% to determine the total demand during the peak month. It is then divided by 30, to determine the average daily demand during the peak month. The plant is sized to provide for this demand.

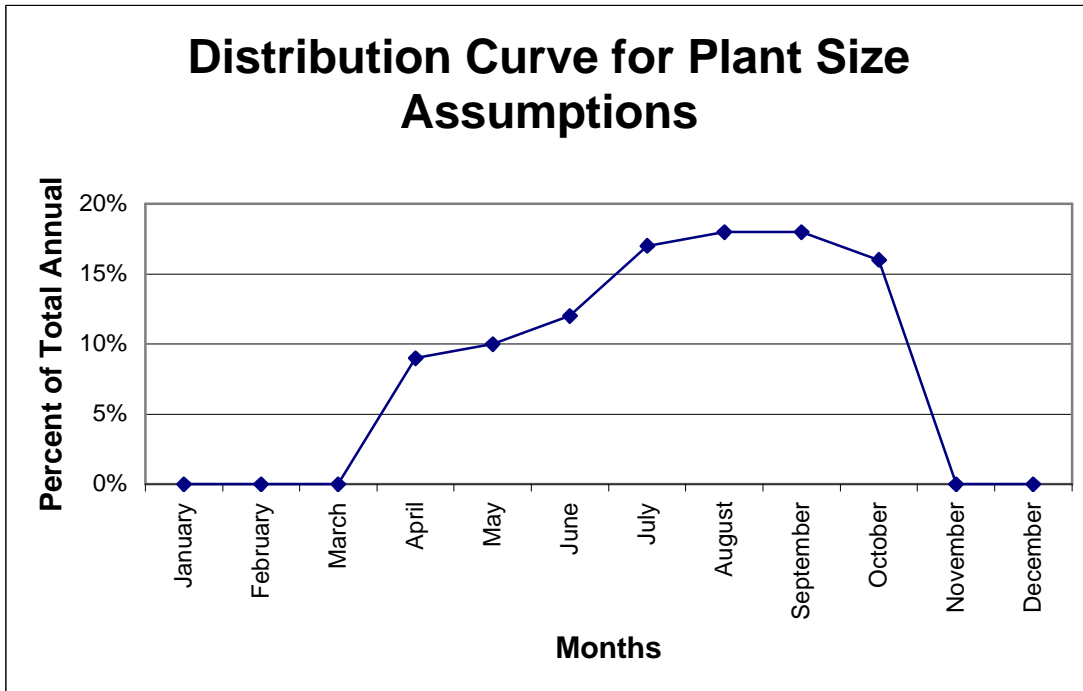


Figure 1 Distribution Curve for Plant Size Assumptions

For satellite treatment plant sizing, the other consideration to be examined is the amount of wastewater available to be treated in the area. NSD provided detailed sewer mapping in AutoCAD format to assist in the analysis of raw wastewater supply for the satellite plant. This mapping was used to locate the best location for the sewer diversion. In addition, the District provided flow data from an inflow and infiltration study done by Geotivity. This data was helpful for estimating the dry weather flow in the sewer at the point of diversion, and by extension, the maximum potential size of the satellite plant.

3.4 Cost Assumptions

The NBWA Satellite Plant analysis includes comparison of the cost of satellite treatment to the cost of treatment at the central plant. Satellite treatment can be a cost effective recycled water alternative at locations miles away from the central plant because of high distribution system costs from the central plant. The costs of satellite and centralized recycled water treatment are also compared to the cost of potable water.

The General Criteria in Technical Memorandum #1 include cost curves for both satellite treatment facilities and central plant upgrades. These curves were used to develop the cost analysis for each alternative evaluated. The cost per acre foot calculation includes capital cost annualized over 30 years at an interest rate of 6% plus the annual O&M cost divided by the annual yield of the plant in acre feet. For more information on cost development, see Technical Memorandum #1.

When looking at recycled water as a water supply, it is useful to compare its cost to the cost of potable water for the current customers. The Silverado Country Club uses well water for so its cost of irrigation water is negligible. For the water users that are City of Napa customers, the cost of water is \$3.23/thousand gallons.

Section 4 Alternatives Analyzed

4.1 Silverado Area

4.1.1 Summary Market Analysis

There are several irrigation water users in the Silverado area, most notably, the Silverado Country Club and Resort. The users were identified using parcel maps and land use information from the Napa County GIS system. They are shown in Figure 2. According to the land use information, the two largest water users in the Silverado Area are the Silverado Country Club golf courses, and the common use areas of the surrounding condominiums. The Silverado Country Club covers approximately 272 acres. Assuming 90% of the area is golf course turf and a land use factor of 3.5 AF/acre/year, the annual water demand of the Country Club golf courses is approximately 860 AF/yr. The condominium common areas cover approximately 111 acres. Assuming 80% of the area is irrigable turf and a land use factor of 3 AF/acre/year, the annual water demand of the common areas is approximately 270 AF/yr.

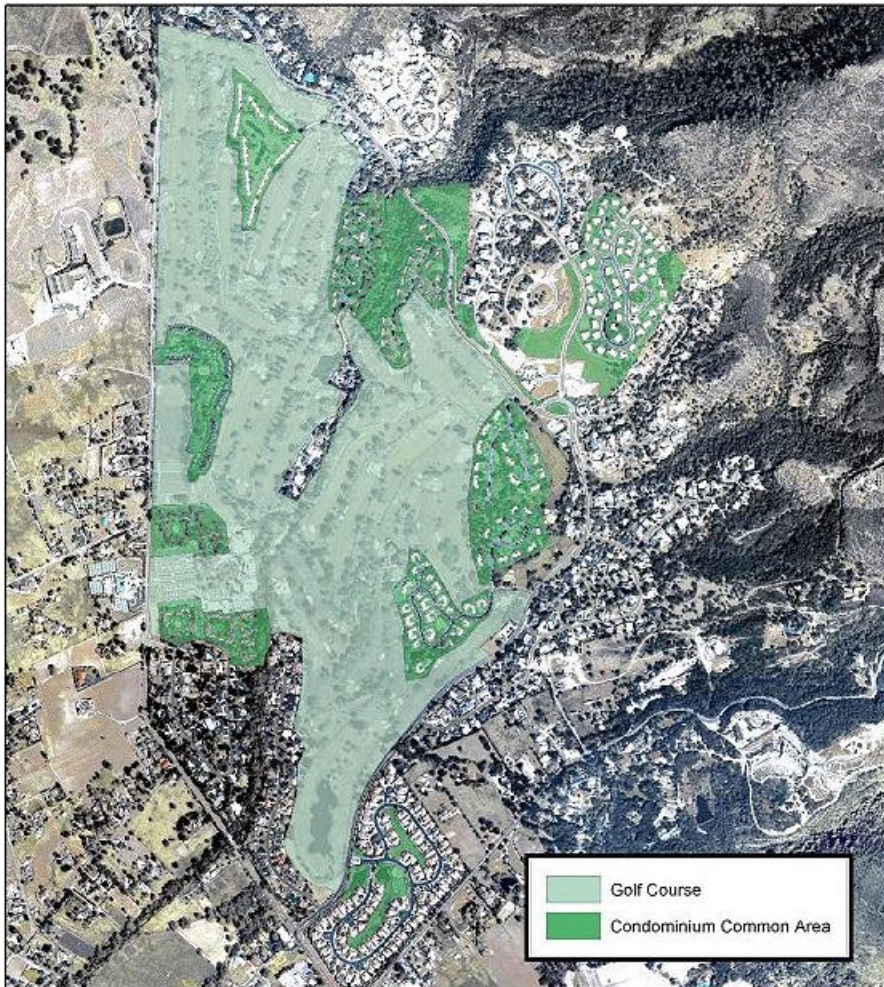


Figure 2 Irrigation Land Use in Silverado Area

4.1.2 Sizing of Treatment Facilities

Based on the estimated irrigation demand curve, the total demand of the golf courses and condominium common areas could be met with a recycled water facility with a capacity of 2.2 mgd. However, there is not enough capacity in the sewer collection system in the Silverado area to meet this

demand. Based on the sewer flow data provided by NSD, the sewer main that carries flow from the Silverado Area has only 150,000 gpd of dry weather flow. Therefore, a satellite plant in the area would be sized based on the raw wastewater available, and it would only serve a fraction of the total demand.

4.1.3 Location of Sanitary Sewer Diversion

The raw wastewater for the satellite treatment plant would be diverted from the sewer main that conveys the collected wastewater from the Silverado Area to the rest of the NSD collection system. This sewer main roughly follows an alignment roughly 300 ft to the east of Milliken Creek. The diversion would be at the location where this sewer main crosses Hedgeside Ave.

The location of sewer diversion is approximately 40,000 ft from the Soscol Treatment Plant.

4.1.4 Cost Comparison

For feasibility analysis, the capital and O&M cost of siting a recycled water satellite plant at Hedgeside Avenue was compared to adding the equivalent capacity and transmission system to the Soscol Treatment Plant. These two costs are also compared to the value of the water saved by replacement with potable water. The costs are shown in Table 2 below.

Table 2 Comparative Cost Analysis for West Novato Area

Alternative	Capital Cost	Annual O&M	Total \$/AF
150,000 gpd Satellite Facility	\$3,940,000	\$46,000	\$4,300
150,000 gpd Upgrade to Soscol RWF	\$7,780,000	\$111,000	\$8,670

The capital cost of the satellite facility corresponds to a \$3.1 million satellite plant plus a \$0.8 million distribution system. The capital cost of central treatment at the recycled water facility is only \$1.5 million for treatment, but is \$6.3 million for distribution due to the distance from the plant. However, it is likely that NSD would not limit itself to 150,000 gpd if providing recycled water produced at the centralized treatment plant. It is expected that the cost per acre foot of providing for all 2.2 mgd of irrigation demand from the Soscol facility would be significantly lower due to economies of scale. Based on extrapolation of the cost curves described in the General Criteria, treatment and distribution to supply the entire demand in the Silverado Country Club Area from the Soscol treatment plant would cost approximately \$1,670 per acre foot.

The City of Napa water customers currently pay \$3.23/thousand gallons for water. This is equivalent to approximately \$1,050/af.

Section 5 Conclusions and Recommendations

A satellite treatment plant on Hedgeside Ave. would only provide for a fraction (7%) of the irrigation demand in the area due to the limited volume of wastewater available in the collection system. The satellite plant would also have a higher unit cost as compared to other sources of water for the area. The cost in \$/AF each alternative is shown in Table 3.

Table 3 Overall Cost Comparison

Water Source	Unit Cost \$/AF
150,000 gpd satellite recycled water plant	\$4,300
150,000 gpd recycled water supply from Soscol	\$8,670
2.2 mgd recycled water supply from Soscol	\$1,670
Potable water provided by City of Napa	\$1,050

Since a satellite treatment plant would be limited in size and have a relatively high unit cost, it is not a feasible water supply alternative for serving the Silverado Country Club area. If other driving forces for satellite treatment emerge in the future, further studies should include the following:

- Verification of water demands and available wastewater flow within the sewershed
- Environmental documentation
- Refinement of costs including land acquisition, engineering studies and design
- Financing plan
- Development of inter-agency agreements for operation and maintenance of the facilities