TOWN OF WINDSOR

Water Master Plan

2019 UPDATE



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TOWN OF WINDSOR WATER MASTER PLAN UPDATE

Final Report 2019



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Town of Windsor

October 2019

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LIST OF ABBREVIATIONS AND ACRONYMS

AC	Asbestos Cement
ADD	Average Day Demand
ADWF	Average Dry Weather Flow
AF	Acre-feet
AFY	Acre-feet per year
APN	Assessor's Parcel Number
AWWA	American Water Works Association
C Factor	Hazen Williams Roughness Coefficient
CIP	Capital Improvement Program
DHS	California Department of Health Services
DI	Ductile Iron
DU	Dwelling Unit
EPS	Extended Period Simulation
Fps	Feet per second
Ft	Feet
GCM	General Circulation Model
gpd	gallons per day
gpm	gallons per minute
ISO	Insurance Service Office
MCL	Maximum Contaminant Level
MDD	Maximum Day Demand
MG	Million Gallons
mgd	million gallons per day
Mg/L	Milligrams per liter
NFPA	National Fire Protection Association
ppb	Parts per billion
Psi	Pounds per square inch
PVC	Polyvinyl Chloride
Restructured Agreement	2006 Restructured Agreement for Water Supply between SCWA and its retail contractors
RRWF	Russian River Well Field
SCADA	Supervisory Control and Data Acquisition
SCWA	Sonoma County Water Agency
Town	Town of Windsor and Windsor Water District
UGB	Urban Growth Boundary
UWMP	Urban Water Management Plan

EXECUTIVE SUMMARY

The Water Master Plan Update (WMP), is a renewal of the 2011 Water Master Plan (RMC Water & Environment 2011). The previous master plan defined the water distribution system improvements based on the 2010 General Plan and utilized water production data from 2006. Since that time the Town has adopted its 2040 General Plan and its demands have decreased by about 20 percent, the decrease due largely to the implementation of several water conservation efforts in response to the recent drought as well as improved water efficiency standards.

The goal of this WMP update is to establish a Capital Improvement Program (CIP), building off the CIP developed as part of the 2011 WMP, for the Town of Windsor (Town) by analyzing the water distribution system, supply, and storage under current and projected build out water demands and identifying deficiencies and operational improvements using current information. Ultimately, the goal for this work is to ensure the Town's water distribution system is operated efficiently and can deliver a sufficient quantity of water reliably in anticipation of planned development.

INTRODUCTION

The Windsor Water District (WWD) water service area includes all areas within the limits of the Town. The WWD also serves the Shiloh and Mayacama area in the eastern hills, the Airport area south of the town, along with several additional customers through outside service agreements. For purposes of this WMP, the Town of Windsor and WWD are jointly referred to as "Town", since the Town Council also serve in the role of Board of Directors for WWD. The Town's distribution system is comprised of approximately 136.6 miles of predominantly polyvinyl chloride (PVC) pipes, with pipe diameters that range from 4 to 18 inches. The Town owns and operates four storage tanks in the primary pressure zone (Zone 1), 12 storage tanks in smaller (and higher elevation) pressure zones, 5 river wells, and 5 off-river wells – four of which are currently inactive. The water system storage capacity is approximately 5.5 million gallons (MG). An overview of the Town's potable water system is provided in Figure ES-1.

SUPPLY AND DEMAND

A supply and demand assessment was conducted to evaluate the Town's existing supply portfolio and storage capacity as well as project future demands and to identify shortfalls and hydraulic deficiencies.

WATER SUPPLIES

The Town's potable water supply comes from, and the majority of demands are met by, two sources: surface water diverted at the Russian River Well Field (RRWF) and surface water (Russian River) delivered via Sonoma County Water Agency's (SCWA) Santa Rosa Aqueduct. A summary of the Town's existing water supplies is presented in Table ES-1. The Town also has a recycled water system that supplies irrigation water to a number of vineyards and agricultural uses, as well as for urban uses within the Town, but those supplies and demands were not considered as part of this WMP.

Figure ES-1: Supply Sources and System Overview

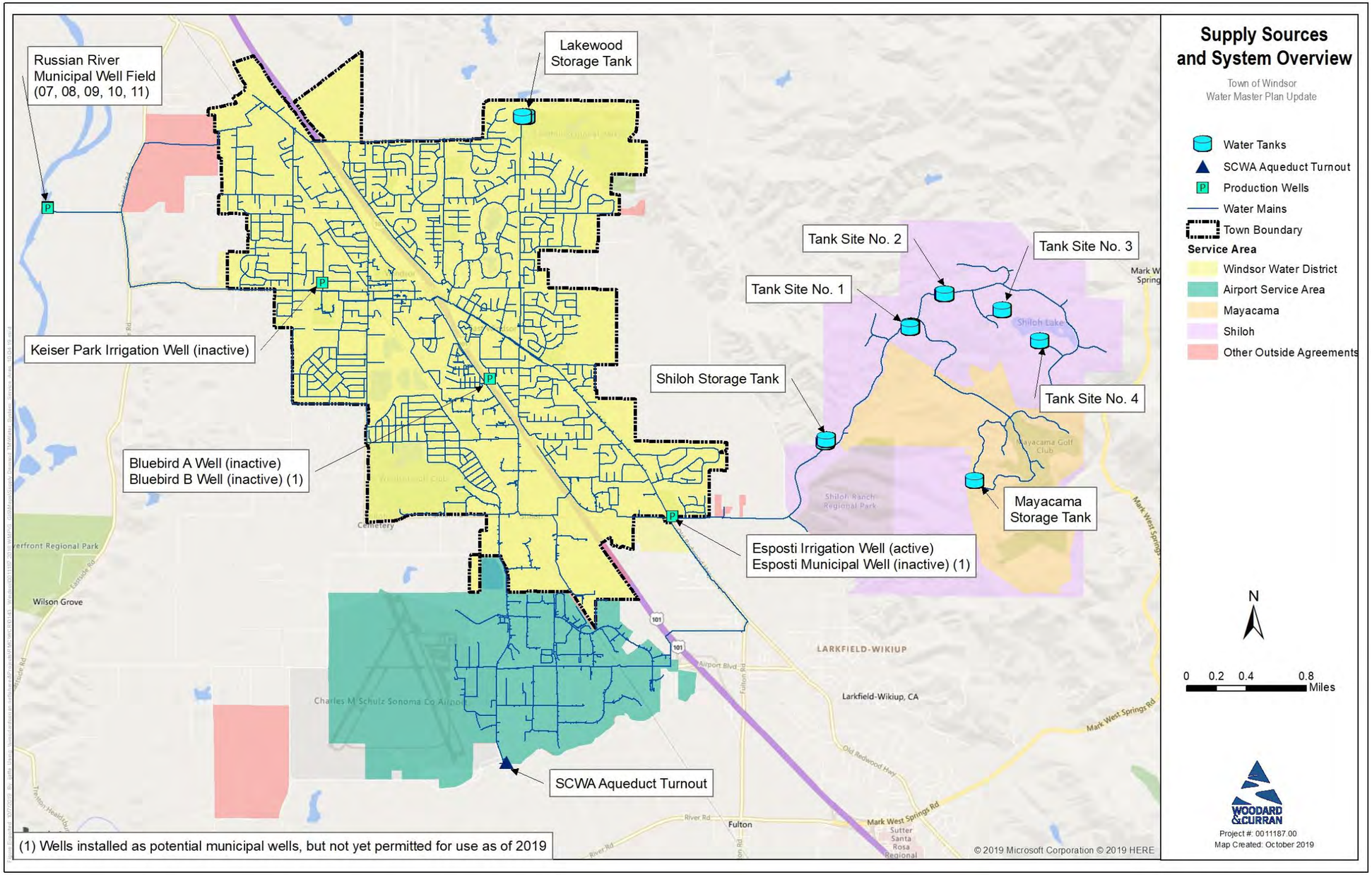


Table ES-1:Summary of Current Windsor Potable Water Supplies

Supply Source	Capacity	
	Max Capacity (MGD)	Annual Contract/Right (AFY)
Russian River Well Field[1]	7.4 (instantaneous) / 7.2 (monthly average)	4,725
Off-river Wells[2]	n/a	n/a
Purchased SCWA Water[3]	2.4 (instantaneous) / 1.5 (monthly average)	900
Total	9.8 (instantaneous) / 8.7 (monthly average)	5,625

Note:

1. Based on information presented in the 2011 WMP, the annual contracted amount is set by the Restructured Agreement with SCWA and a *Memorandum of Understanding Regarding Water Transmission System Capacity Allocation during Temporary Impairment* (SCWA, October 2006).
2. There are currently no active potable off-river production wells.
3. 900 AFY is the maximum volume that the Town is contracted to purchase from SCWA as set by the Restructured Agreement. There is no daily or instantaneous capacity restriction, though the average daily rate for any month cannot exceed 1.5 MGD. Historical maximum instantaneous supply rate is approximately 1,700 gpm (2.4 mgd).

EXISTING AND FUTURE DEMANDS

The Town's existing demands were estimated based on billing records from 2012 – 2017. Ultimately, 2017 billing data were used to establish existing potable water demands, which were determined to be 3,374 AFY. Using the 2017 billing data, a per capita water use factor was developed (109 gpcd). For the projected demand calculation, it was assumed that there would be a post-drought demand rebound of 10 percent (increasing the demand factor calculated from the 2017 demands by 10 percent to 120 gpcd). The projected future demands for the Town were estimated to be 5,500 AFY.

Table ES-2: Existing and Future Demands

Scenario	Existing Demands	Future Demands[1]
Population	27,517	40,917
Annual	3,374 AFY	5,500 AFY
Monthly	4.5 mgd	7.4 mgd
Peak Hour	9.0 mgd	14.7 mgd

Notes:

1. Future demands presented in this table were calculated based on population projection at 2040.

SUPPLY VERSUS DEMAND

The Town currently has an annual supply of 5,625 AFY with peaking capabilities of 8.7 mgd and 9.8 mgd, monthly average and instantaneous, respectively. The Town's existing demands are 3,374 AFY with peak demands of 4.5 mgd and 9.0 mgd, max month and peak hour, respectively. As summarized in Table ES-3, the Town has sufficient supply to meet existing demands.

Table ES-3:Existing Supply versus Existing Demand

Scenario	Supply[1]	Demand	Sufficient Supply
Annual	5,625 AFY	3,374 AFY	Yes
Monthly	8.7 mgd	4.5 mgd	Yes
Peak Hour	9.8 mgd	9.0 mgd	Yes

Notes:
1. Includes existing RRWF supply and SCWA aqueduct water.

In addition to the existing supplies, it is assumed that the ongoing assessment of the Esposti Municipal Well will lead to a new supply source. Additionally, the Town plans to develop a North Windsor supply well as a second off-river supply source. These two wells are expected to be developed within the next five years. For the purposes of this study, the capacity of the Esposti Municipal Well and North Windsor Well are each estimated at 350 AFY annually with a peak capacity of 400 gpm (0.6 mgd). The addition of these wells increases the Town's supplies to 6,325 AFY annually, 9.3 mgd in max month and 11.0 mgd instantaneously. The Town's 2040 demands are projected to be 5,500 AFY annually with a max month demand of 7.4 mgd and peak hour demand of 14.7 mgd. As summarized in Table ES-4, the Town's projected peak hour demand is higher than the available instantaneous supply; however, the system has sufficient storage to make up for the difference between peak supply and demand.

Table ES-4:Future Supply versus Future Demand

Scenario	Supply[1]	Demand	Sufficient Supply
Annual	6,325 AFY	5,500 AFY	Yes
Monthly	9.3 mgd	7.4 mgd	Yes
Peak Hour	11.0 mgd	14.7 mgd	Yes (difference between peak demand and supply will be made up through use of storage)

Notes:
1. Includes existing RRWF supply, SCWA aqueduct water and future off-river groundwater supply.

HYDRAULIC MODEL AND CAPACITY ASSESSMENT

The Town's water distribution system was modeled using InfoWater, Suite 12.4, Update #5. The previous hydraulic model was updated to include all pipes constructed and adjustments to system controls implemented since the last model update. System demands were updated based on the 2017 billing data, which were linked to parcels and then loaded to the nearest model junction. Fire flows were assigned to model junctions located near an existing fire hydrant based on the land use associated with the parcels adjacent to the hydrant (residential or commercial/industrial).

For this WMP, four model scenarios under existing and future demands were created for the purposes of system evaluation. The scenarios are summarized in Table ES-5.

Table ES-5:Model Scenarios

Model Scenario	Existing Demands (mgd)	Future Demands[1] (mgd)	Purpose
Average Day	3.0	4.6	Review delivery pressure, pipe velocities, and potential water quality issues
Maximum Day	5.1	7.8	Review delivery pressure and pipe velocity/headloss
Maximum Day plus Fire Flow[2]	5.1	7.8	Review fire flow capacity/availability
Peak Hour	9.0	13.7	Review delivery pressure and pipe velocity/headloss

Notes:

1. Future demands are based on known developments and general plan land uses and may not precisely match demands calculated based on population (population-based demand projections are generally more conservative).
2. Fire flow evaluation includes an additional fire flow of either 1,500 gpm or 3,000 gpm depending on the location.

EXISTING AND PROJECTED DEFICIENCIES

The hydraulic model was used to evaluate the performance of the distribution system based on the Town's system performance and design criteria under both existing and projected demand scenarios. Storage was evaluated by comparing available storage to the supply required during a peak hour occurrence, or a minimum of average day demand during other emergency situations. Based on this assessment, six existing deficiencies in the distribution system piping were identified, all related to fire flow delivery pressures. No additional distribution piping deficiencies were identified under future demand conditions. No existing or future storage deficiencies were identified.

CAPITAL IMPROVEMENT PROGRAM (CIP)

Based on the results of the capacity assessment, six pipeline projects were developed to address the existing system deficiencies. Further, building on the results of the 2011 WMP, six more pipeline projects were developed to increase system reliability. An additional eight projects were requested by the Town for inclusion in the CIP. A summary of these projects, including the cost and phasing, is included in Table ES-6.

CONCLUSION

With the analysis complete, the system assessed, and the modest number of projects recommended, we find the Water System well-planned, well-managed, and poised for excellent ongoing service to the Town residents and customers into the future.

Table ES-6:CIP Project Phasing Summary

Project No.	Project Location	Project Type	Project Description	Recommended Facilities:		Estimated 2018 Construction Cost	Estimated 2018 Total Capital Cost[1]	CIP Year	Phase	Notes
				Length (ft.)	Size (in.)					
WM-1	Gumview Rd.	Deficiency	Remove existing 6-inch pipe on Gumview Rd. (from Sunray Pl to dead end) and install 12-inch pipe	620	12	$360,000	$640,000	FY 24-25	Phase 2	
			Remove existing 6-inch pipe from Gumview Rd. south to dead end, and install 8-inch pipe	560	8					
WM-2	Turnberry Ct.	Deficiency	Remove existing 8-inch pipe on Turnberry Ct. and install 12-inch pipe along Turnberry Ct. Install new 12-inch pipe from end of Turnberry Ct. cul-de-sac to pipe south of Lakewood Tanks.	970	12	$310,000	$540,000	FY 21-22	Phase 1	
WM-3	Savannah Way/Lockwood Dr. and Merner Dr.	Deficiency	Install three new 8-inch pipes: 1. From dead end on Lockwood Dr. to dead end on Savannah Way; 2. On Merner Dr. (from Moll Dr. going east); 3. On Merner Dr. (from Lockwood Dr. going west)	670	8	$160,000	$290,000	FY 23-24	Phase 1	
WM-4	N. Laughlin Rd.	Deficiency	Install new 8-inch pipe east of North Laughlin Rd.	310	8	$75,000	$130,000	FY 25-26 through FY 29-30	Phase 2 & 3	
WM-5	Skylane Blvd. and Aviation Blvd.	Deficiency	Install new 8-inch pipe east of Skylane Blvd and North of Aviation Blvd.	240	8	$57,000	$100,000	FY 25-26 through FY 29-30	Phase 2 & 3	
WM-6	Century Ct.	Deficiency	Remove existing 10-inch and 8-inch pipes on Century Ct. and install 12-inch pipe.	1,000	12	$360,000	$640,000	FY 22-23	Phase 1	
WM-7	Emmerson St. (Pleasant Ave. to Old Redwood Hwy)	Reliability	Install new 12-inch pipe on Emmerson St. south of Pleasant Ave., connecting to Old Redwood Hwy.	1,700	12	$550,000	$980,000	FY 30-31 through FY 35-36	Phase 3	
WM-8	Jensen Ln. to Pleasant Ave.	Reliability	Install new 12-inch pipe on Jensen Ln. going east and then south to Pleasant Ave.	5,400	12	$1,500,000	$2,700,000	FY 30-31 through FY 35-36	Phase 3	
WM-9	Vinecrest Rd./Jensen Ln.	Reliability	Install new 12-inch pipe starting from Vinecrest Rd. going south to Jensen Ln.	2,700	12	$1,300,000	$2,300,000	FY 30-31 through FY 35-36	Phase 3	
	Prince George Way and Buckeye Dr.	Reliability	Install two new 8-inch pipes connecting the new 12-inch pipe to existing pipes on Prince George Way and Buckeye Dr.	2,400	8					
WM-10	Russian River Well Field	Reliability	Install new 18-inch pipe going east from Russian River Well Field along Fontana Rd. to Eastside Rd.	2,400	18	$900,000	$1,600,000	FY 23-24	Phase 1	
WM-11	Gumview Rd. to Windsor River Rd.	Reliability	Install new 12-inch pipe from dead end on Gumview Dr. going south to Windsor River Rd.	4,000	12	$1,100,000	$1,900,000	FY 25-26 through FY 29-30	Phase 2 & 3	
WM-12	Windsor River Road and Windsor Road	Reliability	The Existing 6-inch pipe across the railroad at the Windsor River Road and Windsor Road intersection is being upsized to 12-inch as part of an intersection reconstruction project. The upsizing provides redundancy for the existing 12-inch pipeline across the railroad tracks. However, the new 12-inch will connect to a 6-inch pipe on the west side of the intersection. WM-12 would connect that upsize to the 16-inch main on Wall Street.	360	12	$140,000	$240,000	FY 25-26 through FY 29-30	Phase 2 & 3	

Table ES-6 (continued)

Project No.	Project Location	Project Type	Project Description	Recommended Facilities:		Estimated 2018 Construction Cost	Estimated 2018 Total Capital Cost[1]	CIP Year	Phase	Notes
				Length (ft.)	Size (in.)					
W-1	Esposti Well Water Treatment	Supply	Design and construct wellhead treatment for the existing Esposti Municipal Well. The project includes evaluation of treatment options, environmental issues and location, as required. This project is identified in the Water Master Plan Update as Project W-2 and has been refined since 2017. This project will be phased with the North Windsor water supply well as recommended in the Esposti Well Feasibility Study.	n/a	n/a		$2,550,000	FY 21-22 & FY 22-23	Phase 1	Costs provided by Town (adjusted from 2011 WMP)
W-2	North Windsor Supply Well	Supply	The Project is consistent with General Plan Public Facilities and Services Policy PFS-1.1 - The Town shall maintain the Capital Improvement Programming (CIP) to ensure the implementation of the General Plan and the adequate and timely provision of public facility and municipal utility improvement, and Policy PFS-2.2 - The Town shall maintain the Urban Water Management Plan to adequately estimate projected water demands and supplies over the planning horizon for average and drought year conditions; and shall implement water supply projects to provide a reliable supply during all water conditions.	n/a	n/a	$1,200,000	$1,800,000	FY 23-24 & FY 24-25	Phase 1 & 2	
W-3	Replacement/New Well at Russian River Well	Supply	Construct a new well at the Russian River Well Field site. This project was identified in the 2011 Water Master Plan Update and includes design and feasibility evaluation in FY 23-24 with well construction thereafter to meet operational and future growth demands.	n/a	n/a	$600,000	$860,000	FY 23-24 & FY 24-25	Phase 1 & 2	
T-1	Shiloh Tank Site #2 Enclosures	Other	The booster pumps located at the Shiloh 2 tank site are housed in a wooden box which requires maintenance staff to crawl into the box to perform inspection/maintenance. This project will replace the box with a small building and fence enclosure to keep the pumps secure and weather tight and allow for easier access for maintenance personnel.	n/a	n/a		$96,400	FY 20-21	Phase 1	Costs provided by Town
T-2	Shiloh Tank Sites #1 and #2 Stationary Generators	Other	Purchase, design and construction of two 125 kW fixed set generators at Shiloh Tank Sites #1 and #2 to include site preparation, pad and enclosures, fuel storage equal to 36 hours maximum generator output, and purchase and installation of automatic switchgear.	n/a	n/a		$400,000	FY 21-22	Phase 1	Costs provided by Town
S-1	Wild Oak Water Service Replacements	Other	The water services in the area of Wild Oak Drive are over 40 years old and due for replacement. The replacement of these services is planned just prior to resurfacing of the streets (pavement overlay) such that future replacement would not deface the newly paved street surface.	n/a	n/a		$953,000	FY 23-24	Phase 1	Costs provided by Town
I-1	Town-wide Advanced Metering Infrastructure (AMI)	Other	This project is completion of the Advanced Metering Infrastructure (AMI) system and includes the installation of collectors and transmitters in the field equipped with GPS antennas and cellular WAN. Also included in the project is software, implementation and staff training for the AMI system.	n/a	n/a		$225,000	FY 19-20	Phase 1	Costs provided by Town
I-2	Meter Flow Testing Improvements at Russian River Well Field	Other	Design and construction of well-field pipeline improvements for flow meter testing at the Russian River Well Field.	n/a	n/a		$350,000	FY 23-24 & FY 24-25	Phase 1	Costs provided by Town
Total						$8,612,000	$19,294,400			

1. INTRODUCTION

This Water Master Plan Update (WMP) is an update of the 2011 Water Master Plan (RMC Water & Environment, 2011). The goal of this WMP update is to establish a Capital Improvement Program (CIP), building off the CIP developed as part of the 2011 WMP, for the Town of Windsor (Town) by analyzing the water distribution system, supply, and storage under current and projected build out water demands and identifying deficiencies and operational improvements using current information. Ultimately, the goal for this work is to ensure the Town's water distribution system is operated efficiently and can deliver a sufficient quantity of water reliably in anticipation of planned demand.

The Town of Windsor was incorporated 1992 and is located in central Sonoma County approximately seven miles northwest of the City of Santa Rosa. The Town is bordered by the Russian River to the west, with Highway 101 running through the center of Town. The Town's water system primarily serves all areas within the Town of Windsor and two large service areas outside of the Town: the Airport Service Area (to the south) and the Shiloh/Mayacama Service Area (to the east). There are also a few minor areas with outside service area agreements. A map of the Town setting, including the jurisdictional and service area boundaries, is included in Figure 1-1.

The Town's distribution system is comprised of approximately 136.6 miles of predominantly polyvinyl chloride (PVC) pipes, with pipe diameters that range from 4 to 18 inches (described in detail in Chapter 5). The majority of the Town's system has been installed within the last 25 years and is reportedly in good condition. The Town owns and operates four storage tanks in the primary pressure zone (with a total capacity of 5 MG), 12 storage tanks in smaller (and higher elevation) pressure zones (with a total capacity of 0.45 MG), 5 river wells, and 5 off-river wells – four of which are currently inactive. The Town also has a recycled water system that supplies irrigation water to a number of vineyards and agricultural uses, as well as for urban uses within the Town. A study looking at potential expansion of the recycled water system was completed in May 2013[1]. This WMP evaluates only the potable water supplies and demands, although expansion of recycled water could be an alternative to address water supply deficiencies.

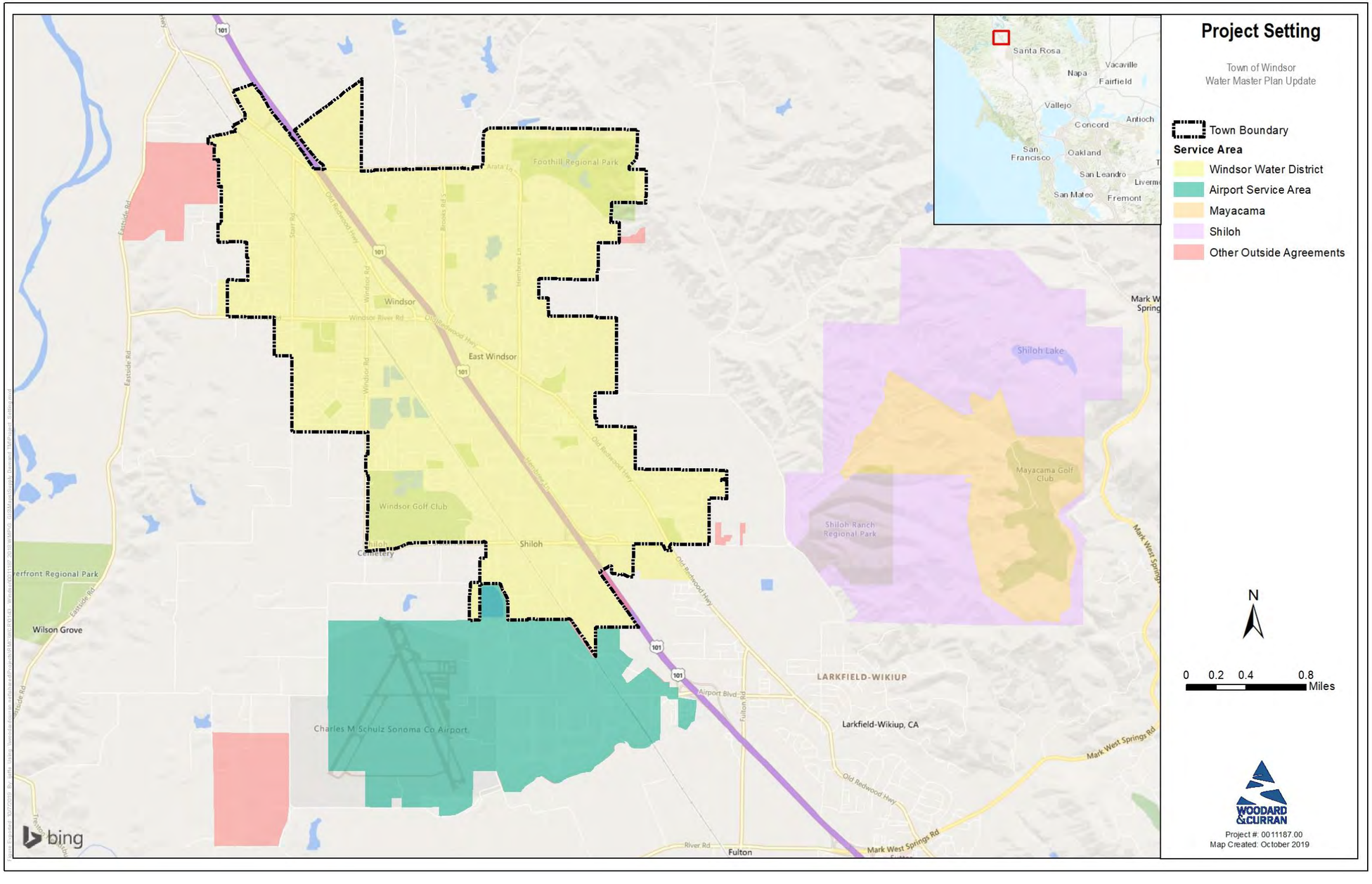
The Airport Service Area includes approximately 810 acres within the Airport Area Specific Plan boundary, plus additional acreage comprising the operational properties and businesses associated with the Sonoma County Airport. The Airport Service Area distribution system includes approximately 10.5 miles of mainly PVC pipeline with pipe diameters ranging from 6 to 12 inches. In the southern portion of the Airport Service Area, the 12-inch water main that runs along Laughlin Road connects to the Sonoma County Water Agency's (SCWA) 36-inch diameter Santa Rosa Aqueduct line (Brown and Caldwell, 2007).

The Shiloh/Mayacama Service Area covers approximately 1,900 acres and includes approximately 9.4 miles of mainly PVC pipeline with pipe diameters ranging from 6 to 12 inches. At the time of the this WMP effort, the Town was determining the ownership of and responsibilities for the facilities in the Mayacama/Shiloh service area. While the demands for this area were considered as part of the review of the Town's distribution system, an analysis of the hydraulic capacity of the facilities in the service area was not conducted in this planning effort

As part of the work to complete this document, Woodard & Curran utilized information from a variety of sources to build as complete a planning picture as possible. These sources are included in the References section at the end of the document.

[1] West Yost Associates, *Urban Recycled Water Facilities Planning Study Prepared for Town of Windsor*, May 2013.

Figure 1-1: Town of Windsor Water Master Plan Project Area



2. EXISTING WATER SUPPLIES

The Town's potable water supply comes from, and the majority of demands are met by, two sources: surface water diverted at the Russian River Well Field (RRWF) and surface water (Russian River) delivered via SCWA's Santa Rosa Aqueduct. The Town also has several off-river wells that are currently not in service due to water quality issues. A summary of the Town's existing water supplies is presented in Table 2-1 with additional information on each source presented in the following sections.

Table 2-1: Summary of Current Windsor Potable Water Supplies

Supply Source	Capacity	
	Max Capacity (MGD)[1]	Annual Contract/Right (AFY)
Russian River Well Field	7.4 (instantaneous) / 7.2 (monthly average)	4,725[2]
Off-river Wells[3]	n/a	n/a
Purchased SCWA Water[4]	2.4 (instantaneous) / 1.5 (monthly average)	900
Total	9.8 (instantaneous) / 8.7 (monthly average)	5,625

Note:

1. The instantaneous capacity is the capacity the Town is capable of providing with its existing infrastructure. The monthly average capacity is based on the annual contract or water right (which should not be exceeded over the course of a single month).
2. Based on information presented in the 2011 WMP, the annual contracted amount is set by the Restructured Agreement with SCWA and a *Memorandum of Understanding Regarding Water Transmission System Capacity Allocation during Temporary Impairment* (SCWA, October 2006).
3. There are currently no active potable off-river production wells.
4. 900 AFY is the maximum volume that the Town is contracted to purchase from SCWA. There is no daily or instantaneous capacity restriction, though the average daily rate for any month cannot exceed 1.5 MGD. Historical maximum instantaneous supply is approximately 1,700 gpm (2.4 mgd).[1] The instantaneous system capacity will be reviewed as part of a later project task.

2.1 Well Sources

The Town currently owns ten wells; five of these wells comprise the Town's RRWF (wells 07, 08, 09, 10 & 11), and five are off-river groundwater wells, as shown in Figure 2-1. The RRWF, located approximately 300 feet from the Russian River, diverts surface water from the shallow alluvium beneath the river, with the river serving as the conveyance system for surface water impoundments at Lakes Mendocino and Sonoma. The Town's surface water diversion is by agreement with SCWA under their water rights. A summary of the RRWF well data is shown in Table 2-2. The Town's off-river groundwater wells consist of Bluebird A & B, Esposti Irrigation Well, Esposti Municipal Well, and Keiser Park (irrigation only). Except for Esposti Irrigation Well, which provides raw water for irrigation of Esposti Park, the Town's off-river wells are currently inactive as shown in Table 2-3. Esposti Municipal Well is planned for use as a future municipal well, while some of the remaining wells may be turned into monitoring wells in the future. A summary of the status of the Town's off-river supply wells is included in Appendix A (Town of Windsor 2019).

[1] Kennedy/Jenks Consultants, *Storage-Needs Analysis for Main Distribution Zone,* February 2014

Table 2-2: Russian River Well Field Data

Well[1]	Well Diameter (in.)	Well Depth (ft.)	Status	Capacity		
				gpm	MGD	AFY
River Well 07	16	91	Online	1,285	1.9	2,073
River Well 08	16	102	Online	1,285	1.9	2,073
River Well 09	18	88	Online	1,300	1.9	2,097
River Well 10	16	100	Online	1,300	1.9	2,097
River Well 11	16	100	Online	1,300	1.9	2,097
River Total				**6,470**	**9.3**	**10,436**
River Firm Capacity[2,3]				**5,170**	**7.4**	**8,339**

Note:
1. Well capacities are based on information presented in the Town's 2015 UWMP.
2. Firm capacity assumes one well is out of service.
3. Total capacity at RRWF assumes use of all five wells 24 hours/day, 7 days per week, 365 days per year

Table 2-3: Existing and Proposed Off-river wells, Uses and Estimated Capacity

Well Name	Status	Use	Constraints	Flow (GPM)	Estimated Sustainable Yield (AFY)
Esposti Irrigation Well[1]	Active	City Park Irrigation	Non-potable water quality	200	unknown
Esposti Municipal Well[2]	Monitoring well only, no well pump	Not in use Future municipal well - wellhead treatment required (2022-23 CIP)	Non-potable water quality, high treatment cost	Average: 400 Instantaneous: 800	350
Bluebird Well A[3]	Inactive	Not in use	Non-potable water quality	400	unknown
Bluebird Well B[4]	Monitoring well only, no well pump	Not in use	Non-potable water quality	270	220
Kaiser Park[5]	Inactive Irrigation well	Not in use	Non-potable water quality	300	unknown
North Windsor (Formerly Hiram Lewis Park)[6]	Future well (2024-25 CIP) Arsenic study completed (Appendix B)	Proposed future municipal well	Water quality monitoring and site selection pending	Average: 400 Instantaneous: 800	350

Note:
1. Source: 2005 UWMP– Table 2-2 (Brown & Caldwell 2007). Unknown sustainable yield, no pumping test completed.
2. Source: Esposti Supply Well Redevelopment Treatment Feasibility Study (GHD, 2017). 350 AF = 6.5 months x 7 days x 24 hours x 60 minutes
3. Source: 2005 UWMP– Table 2-2 (Brown & Caldwell 2007). Unknown sustainable yield, no pumping test completed.
4. Source: 2011 Water Master Plan – Table 7-1 (RMC, 2011)
5. Source: 2011 Water Master Plan – Table 3-1 (RMC, 2011). Unknown sustainable yield, no pumping test completed.
6. Source: Estimated based on data from existing off-river well. 350 AF = 6.5 months x 7 days x 24 hours x 60 minutes

2.1.1 Esposti Well and Windsor Groundwater Arsenic Study

The Esposti Municipal Well was redeveloped in 2016 with a potential sustained pumping rate of 400 gpm. Naturally occurring arsenic is present in groundwater beneath the Town and, in some areas and at some depths including near the Esposti Municipal Well site, arsenic concentrations exceed the State's Primary Maximum Contaminant Level (MCL) prior to treatment. In conjunction with the WMP effort, Woodard & Curran conducted a water quality study to document arsenic concentrations in groundwater beneath the Town. Information was obtained from public and private sources, as feasible, and used to identify areas for siting future off-river water supply wells where arsenic concentrations may be below the MCL.

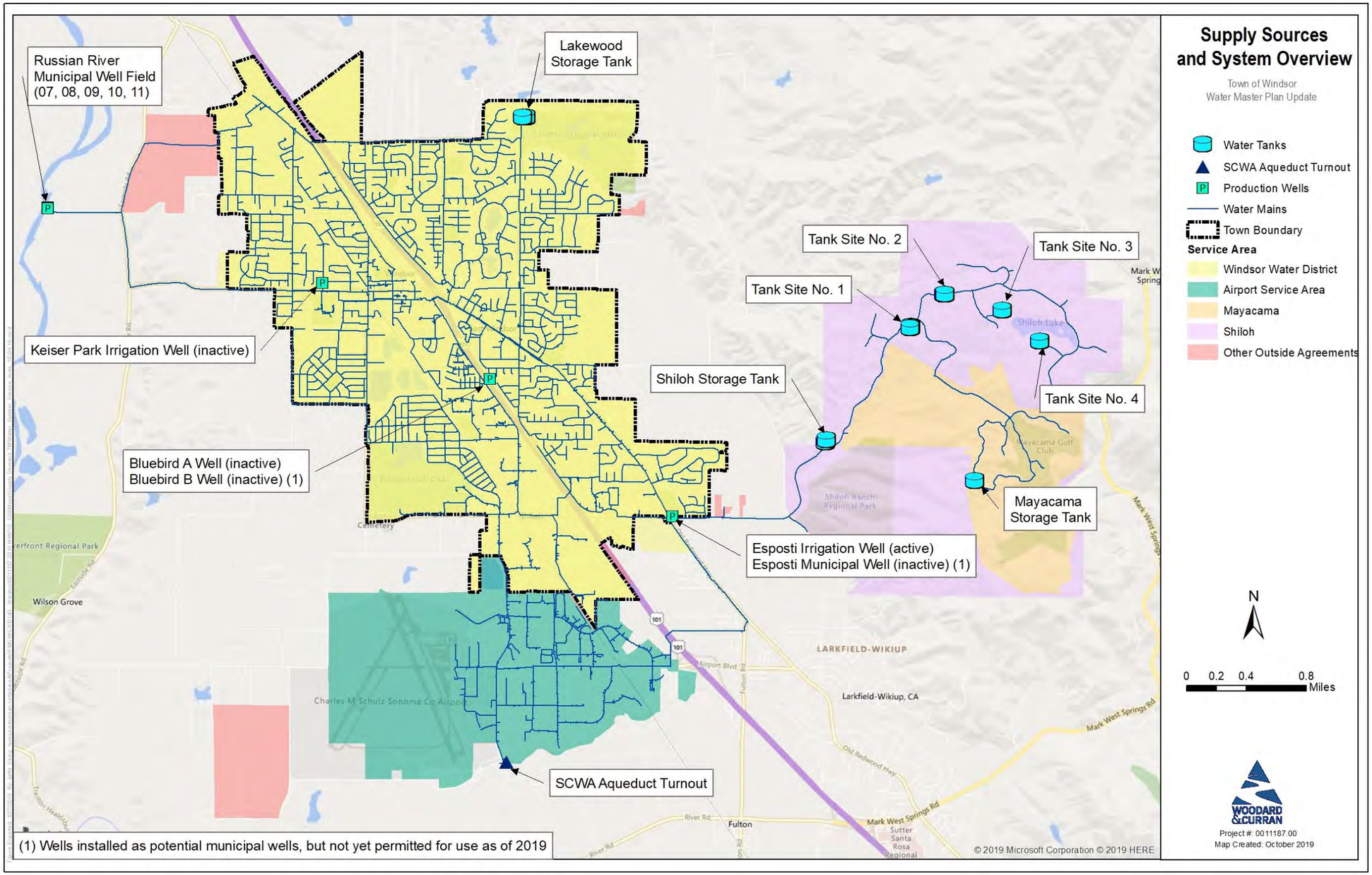
Lower concentrations of arsenic were found to correlate with wells constructed in alluvial materials. The alluvium, consisting of a wide mixture of materials ranging in size from clay to sand to rocks and boulders, ranges in thickness from a few feet along the edges of the valley to at least 600 feet in the valley center where Highway 101 passes through Town. Thicker sections of alluvium support higher well production rates. Research conducted in the area by the United States Geological Survey (USGS) indicates that lower arsenic concentrations correlate with cooler groundwater which is generally at shallower depths. Deeper water-bearing formations beneath the alluvium, including the Glen Ellen, the Wilson Grove, and the Petaluma Formation have variable but typically lower yields, higher temperatures, and higher arsenic concentrations.

The results of the study indicate that the northern part of Town, closest to the middle of the basin where alluvial deposits are thickest and groundwater temperatures are lower, is the most favorable location for a new off-river water supply well. The full results of the groundwater analysis are included in Appendix B. The required treatment for arsenic removal to levels below the MCL for drinking water is costly and for this reason, further development of the Esposti Municipal Well for municipal potable use is currently on hold to allow further investigation of a new well at the north of Town that would not require arsenic treatment and would be a less costly option.

2.2 Purchases from SCWA

In addition to the Town's well sources, the Town is also supplied by the Sonoma County Water Agency's (SCWA) Santa Rosa Aqueduct. The Town can purchase up to 900 AFY of water from SCWA which is delivered directly into the distribution system from the aqueduct connection. There is no restriction on the maximum water purchase for any single day, although the average daily rate for any single month cannot exceed 1.5 mgd. The maximum recorded supply from the Santa Rosa Aqueduct is 2.4 mgd on June 14, 2012. The aqueduct connection is indicated on Figure 2-1.

Figure 2-1: Supply Sources and System Overview



3. EXISTING AND PROJECTED WATER DEMANDS

The Town's current and future water demand estimates are required to analyze the water supplies to identify shortfalls and to analyze the water distribution system to identify potential hydraulic deficiencies. The methodology for developing demands involves identifying both existing and future land uses within the Town, geocoding water consumption data to estimate and distribute existing water usage spatially within the system, and using the combination of water consumption data and land use data to develop appropriate water demand factors for use in projecting future demands.

Future demand projections were developed using two approaches: a population-based approach for use in evaluating overall water supply needs and rate of growth, and a land use-based approach for use in spatially allocating demands in the hydraulic model. The reason for the two approaches is that each demand projection serves a specific purpose. The population-based demand projection is needed for water supply planning for average conditions (such as what is needed for urban water management and drought contingency planning). The land use-based approach is needed for infrastructure and system capacity planning which considers the distribution of peak demands.

Water production data is then used to develop appropriate peaking factors and diurnal patterns, as well as to estimate system losses (unaccounted-for-water).

3.1 Land Uses

The land use categorization is used as the basis for development of demand factors which are used to spatially allocate demands associated with future development within the hydraulic model.

3.1.1 Existing Land Use within the Town

Existing land uses were identified for all parcels corresponding to general plan land use categories for the purpose of estimating appropriate water use factors. Parcels within the Town were assigned to one of 19 General Plan land use categories (or vacant) based on their existing land use. The 19 General Plan ("PRF_ALT" in the Town's General Plan GIS file) and 134 assessor land use categories ("UseCodeDes" in the Sonoma County GIS file) were mapped to the six generic water demand categories identified in the Town's billing data (Commercial, Industrial, Irrigation, Multi-Family Residential, Single Family Residential and Other).

Where a parcel's generic demand category based on the assessor data and General Plan data matched, the General Plan land use category was assigned to that parcel as the existing land use type. For the majority of the Town's parcels, the existing land use is similar to that identified in the General Plan. In those cases where the generic categories did not match (the existing land use does not match what was anticipated by the General Plan), a manual review was conducted to map the assessor land use category to a General Plan land use category so that the parcel could be properly assigned an existing land use category.

The process used to assign existing land use categories is illustrated in Appendix C. Tables recording the mapping from existing land use categories (tax assessor categories) to the six generic use categories and from the General Plan land use categories to the six generic use categories are included in Appendix C. A summary of the existing land use within the Town is provided in Table 3-1 and shown in Figure 3-1.

Table 3-1: Summary of Existing Land Use within the Town

Land Use Category		Dwelling Units (DU)	Area (acres)	Average DU/acre
RR	Rural Res	8	91	0.1
ER	Estate Res	712	359	2.0
VLDR	Very Low-Density Res	5,376	1,046	5.1
LDR	Low Density Res	1,558	296	5.3
MHP	Mobile Home Park	84	69	1.2
MDR	Med Dens Res	646[1]	72	9.0
HDR	High Density Res	469[1]	11	42.6
BMU	Boulevard Mixed Use	13[1]	45	0.3
NC	Neighborhood Center/Mixed	0	4	0.0
TC	Town Center Mixed Use	30[1]	11	2.7
GC	Gateway Commercial	N/A	43	N/A
RC	Retail Commercial	N/A	153	N/A
SC	Service Commercial	N/A	14	N/A
GB	General Business	N/A	16	N/A
LI	Light Industrial	N/A	81	N/A
HI	Heavy Industrial	N/A	163	N/A
PQ	Public/Quasi Public	N/A	176	N/A
PR	Park and Rec	N/A	313	N/A
OS	Open Space	N/A	439	N/A
	Total	8,896	3,401	N/A

Note:

1. When the assessor data didn't indicate the number of units on multi-unit property, dwelling units are estimated based on the midpoint of the provided range.

3.1.2 Future Land Use

The Town of Windsor is approximately 94 percent developed (217 of 3,403 acres vacant within Town Limits). The primary development within the Town is anticipated to be the development of currently vacant in-Town parcels and the development on opportunity sites within the Airport Area Specific Plan, an area around the Sonoma Marin Area Rail Transit station that is served by the Windsor Water District and identified by Sonoma County for redevelopment. As shown in Table 3-2 (the summary of the future land use expected for currently vacant parcels), the Town is anticipating the development of more high-density housing resulting in a total increase in dwelling units within the Town of about 2,000 (greater than 20 percent increase from the existing count).

There are also a limited number of parcels outside the Town with annexation plans underway, including the North of Arata Lane Area (a portion of which was recently annexed into the Town), the area east of Jensen Lane and several parcels south of Shiloh Road. The proposed Lytton Rancheria residential development project, a portion of which falls within the Town's Urban Growth Boundary (UGB), is another area that may be served water by the Town in the future. Water demand projections in the WMP are based on land use assumptions within the UGB in the adopted 2040 General Plan. A summary of the future land use expected for current vacant parcels is included in Table 3-2.

The Town provided a list of specific developments and potential annexations; this data is presented in Appendix D and identified in Figure 3-2. Figure 3-2 also indicates the general plan land use of currently vacant parcels.

Table 3-2: Future Land Use for Currently Vacant Parcels

Land Use Category		Dwelling Units[1]	Area (acres)
RR	Rural Res	0	0
ER	Estate Res	19	7
VLDR	Very Low-Density Res	65	11
LDR	Low Density Res	89	12
MHP	Mobile Home Park	36	2
MDR	Med Dens Res	175	13
HDR	High Density Res	837	44
BMU	Boulevard Mixed Use	300	17
NC	Neighborhood Center/Mixed	86	7
TC	Town Center Mixed Use	396	29
GC	Gateway Commercial	N/A	4
RC	Retail Commercial	N/A	8
SC	Service Commercial	N/A	10
GB	General Business	N/A	0
LI	Light Industrial	N/A	34
HI	Heavy Industrial	N/A	13
PQ	Public/Quasi Public	N/A	0
PR	Park and Rec	N/A	0
OS	Open Space	N/A	7
	Total	2,003	217

Note:

1. Vacant parcels were assigned their General Plan land use category and associated DU/acre factor (assumed to be 80 percent of the maximum DU/acre allowable for a given land use category, summarized in Table 3-7).

3.1.3 Airport Service Area

The Airport Service Area includes both the Sonoma County Airport and associated development, as well as the developed lands within the County of Sonoma's Airport Area Specific Plan. These combined areas are made up of existing residential, commercial, and industrial development. The Airport Area is outside of the Town boundary but is served by the Town per an agree with the County of Sonoma. Significant new development, including residential, commercial and industrial use, is expected in the Airport Area Specific Plan as a result of a current update to this plan. Details of the projected growth in the Airport Area Specific Plan are included in the *Airport Specific Plan Water Demands Estimates* memo (M Group 2019) and the *Airport Area Specific Plan Water Supply Assessment Request* (County of Sonoma 2019). For the purposes of this WMP, the demand factors presented in the memo and the land use presented in the *Assessment Request* were assumed for incorporating growth in the Airport Area Specific Plan. The *Demands Estimates* memo and the *Water Supply Assessment Request* are included in Appendix E.

3.1.4 Mayacama and Shiloh Service Area

The Town has an agreement in place to serve three pressure zones outside of the Town boundary in the Mayacama and Shiloh subdivisions located in the hills east of the Town. These areas consist of primarily residential land use with 11 commercial accounts. The demands are included in the Town's billing data. Limited growth and intensification are expected in these areas as the final vacant parcels are developed which will add approximately 20 new accounts.

3.1.5 **Existing Customers Outside Town's Service Area**

In addition to customers in the service areas noted above, the Town also provides water distribution service to seven customers located on Slusser Road and Mark West Station Road. These customers are supplied water from SCWA-owned distribution pipes. The Town is charged for the water delivered by SCWA, and the Town, acting as the retailer, bills the customers in turn. Billing data for these customers were provided and used to allocate demands in the model but were subtracted out for supply and demand comparisons. No additional customers outside the service area are anticipated at this time.

3.2 Existing Water Demands

Water billing data for 2012 through 2017 was provided by the Town for analysis of the existing water system demands. The Town has 8,266 active potable water meters and 533 active recycled water meters. Of the potable water meters, roughly 7,213 are associated with residential users (single family and multi-family meters, including both indoor and outdoor demands), 706 are associated with non-residential indoor water use, 276 are associated with non-residential irrigation and 71 are non-residential mixed use (irrigation and indoor uses). Recycled water use was not considered as part of this evaluation as recycled water customers are served from a separate hydraulic system. The potable water meter records were geolocated in ArcGIS and assigned to parcels where possible:

a. The initial geolocation process was based on service address and parcel APN. Using the initial matching method, 92 percent of the accounts were matched, accounting for 82 percent of the system demand.

b. A second geolocation step was used to locate the remaining accounts based on addresses, but they were not linked to parcels. These demands were not used for demand factor development because they could not be linked to land use designations. This step was completed so that the demands could be more accurately distributed in the model.

c. A manual review was conducted of the Town's 40 largest customers to ensure that they had been properly geolocated and assigned to appropriate parcels.

The Town's annual water use has recently begun to increase after hitting a low of around 2,850 AFY in 2015 due to demand reductions related to the drought. Demands have rebounded to roughly 85 percent of pre-drought conditions (2012 demands) as of 2017. For the purposes of this evaluation, the 2017 demands were used as the starting point for the analysis because the demand records include all existing developments. A discussion of how the existing demands were used is included in the following sections. A summary of the Town's demands over the last six years, broken out by residential, non-residential indoor and irrigation use (excluding recycled water use), is shown in Figure 3-3. Demands for each service area are summarized in Table 3-3.

Note that future demands from existing users are expected to increase modestly due to continued rebound from drought-related conservation. A 10 percent increase in demand across all customers is assumed for estimating future water demands of existing customers, which would coincide with an overall per capita use of 120 gallons per capita per day (or around seven percent below the SBx7-7 requirement of 130 gpcd).

Figure 3-1: Town of Windsor Existing Land Use

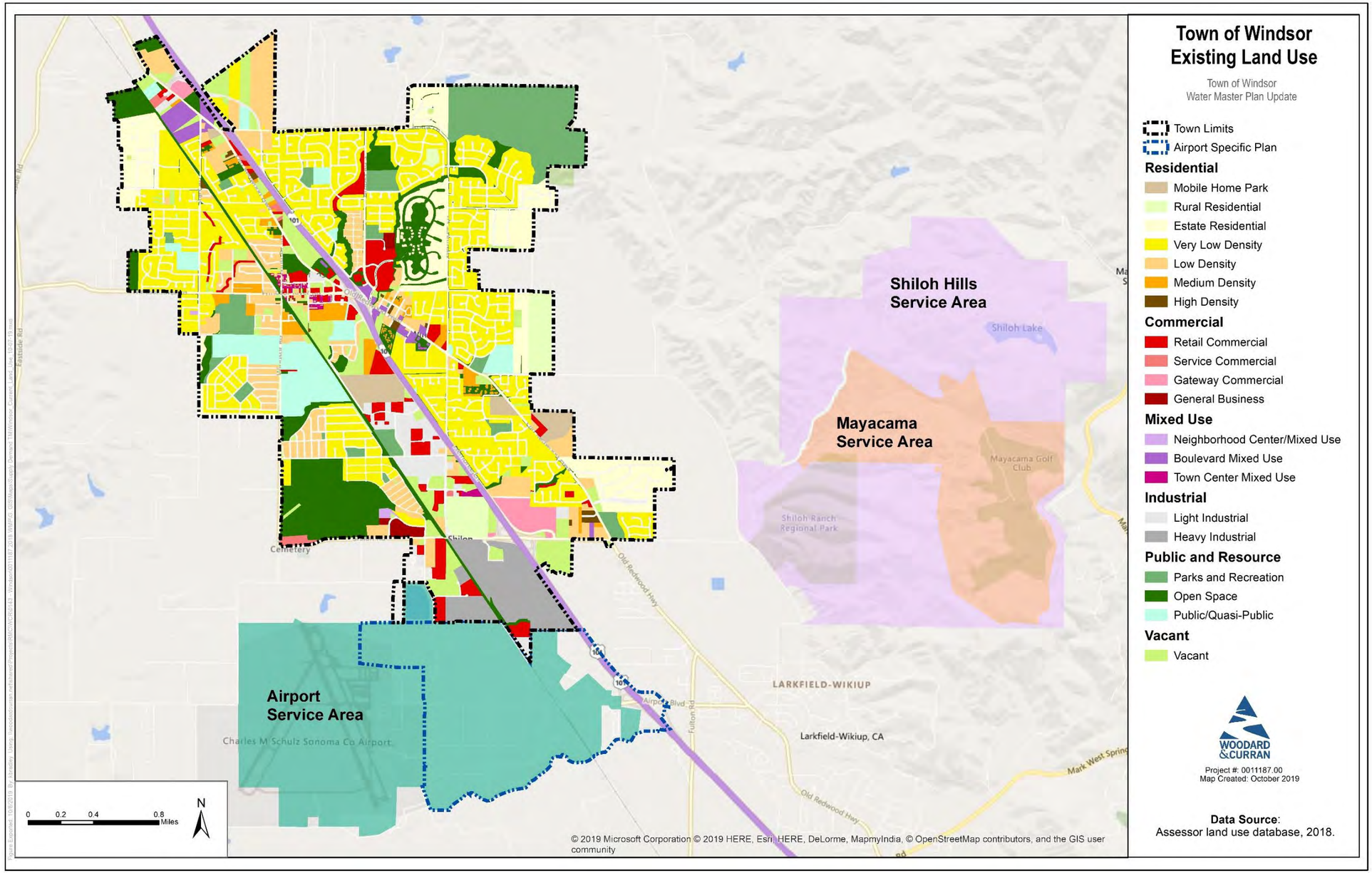


Figure 3-2: Future Development within the Town and Anticipated Annexations

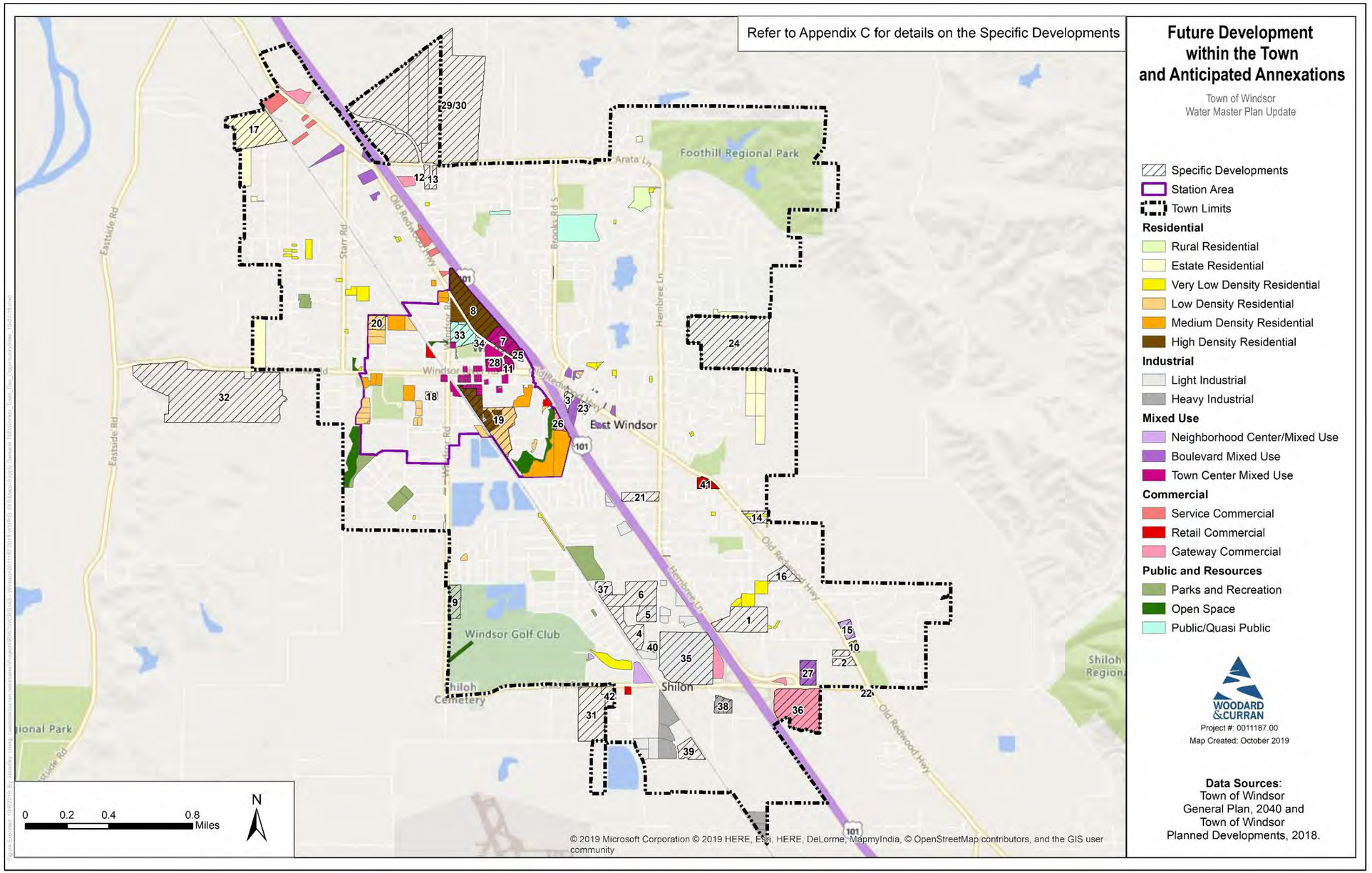
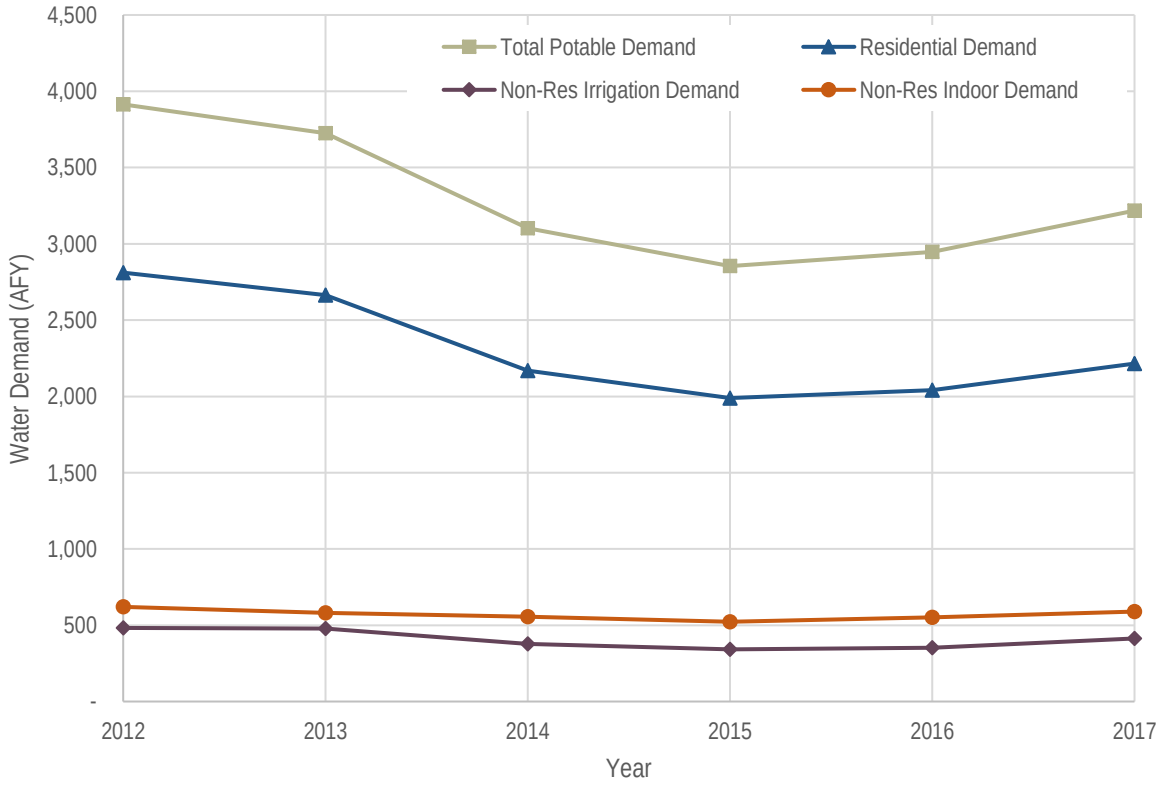


Figure 3-3: Historical Potable Water System Demand



Note: Residential use includes both indoor and outdoor demands.

Table 3-3: Potable Water System Demands by Service Area (AFY)

Service Area	2012	2013	2014	2015	2016	2017
Town[1]	3,379	3,201	2,637	2,421	2,500	2,726
Airport	405	387	341	326	337	373
Shiloh/Mayacama	95	105	97	82	83	90
Total	3,879	3,692	3,075	2,829	2,920	3,189

Note:

1. The seven Outside Area Customers are included in the Town service area for this summary as their separated demand is negligible.

3.2.1 Top 20 Water Users

Based on billing records, the Town's 20 largest water use accounts were identified. Accounting for larger water users separately from other potable water demands is valuable because the water demands from these larger potable water use customers are unique and a change in one, or a handful of them, can dramatically affect water system performance. Actual potable water demands for the top 20 large water use accounts in 2017 were obtained from meter records and are presented in Table 3-4.

Table 3-4: Top 20 Potable Water Customers

No.	Land Use	Indoor ADD (gpd)	Irrigation ADD (gpd)	Total Potable ADD (gpd)
1	Mobile Home Park	32,502	-	32,502
2	Commercial	26,085	-	26,085
3	Multi-family Residential	21,015	-	21,015
4	Institutional	1,770	18,337	20,106
5	Winery	19,612	-	19,612
6	Commercial/Industrial	16,317	1,029	17,346
7	Mobile Home Park	12,528	-	12,528
8	Institutional	1,274	11,153	12,427
9	Hotel	8,182	2,489	10,671
10	Multi-family Residential	9,105	1,476	10,580
11	Multi-family Residential	5,179	4,380	9,560
12	Industrial	8,869	238	9,107
13	Commercial/Industrial	7,179	1,755-	8,934
14	Industrial	8,387	-	8,387
15	Institutional	769	7,553	8,322
16	Hotel	6,811	1,366	8,177
17	Commercial	4,326	3,004	7,330
18	Multi-family Residential	4,852	2,398	7,250
19	Hotel	6,755	471	7,227
20	Institutional	6,902	-	6,902[1]
	Total	208,419	55,649	264,066

Note:

1. This is a mixed-use meter which serves both indoor and irrigation demands. For the purposes of this summary table, the proportion of indoor and irrigation demands has not been estimated.

3.2.2 Unaccounted-for Water

Unaccounted-for water is the difference between the water produced into the system and the authorized water consumption from the Town's system. Unaccounted-for water includes both actual water losses, such as from system leaks, and apparent water loss, including customer metering inaccuracies and unauthorized water theft. The Town's unaccounted-for water has remained very consistent over the last few years, ranging from four to six percent with an average of 5.4 percent from 2015 to 2017, which is good compared to industry standards. An unaccounted-for water factor of 5.5 percent will be applied to projected water demands. A summary of the unaccounted-for water numbers is presented in Table 3-5.

Table 3-5: Unaccounted-For Water

Year	Water Production (AFY)	Authorized Consumption (AFY)	Difference (AFY)	Difference (%)
2015	3,024	2,831	194	6.4%
2016	3,053	2,922	131	4.3%
2017	3,374	3,189	186	5.5%
Average	3,151	2,981	170	5.4%

3.3 Demand Factors

Demand factors were developed for both the population-based demand projection and the land-use based projection. The methodology and resulting demand factors for both processes are described in the following sections.

3.3.1 Population Based Demand Factors

Demand factors for a population-based demand projection should consider all relevant legislation to ensure that projections are in line with the Town meeting all water use requirements. A summary of the regulations considered for the population-based estimate is included below:

- Water Conservation Act (2009) – The Water Conservation Act of 2009, also known as 20x2020, established the requirement that water purveyors reduce their water demands (indoor, outdoor, residential and non-residential) per capita by 20 percent by 2020. Senate Bill X7-7 (SBx7-7) set the terms of this requirement and the methodologies to be used to document compliance (at the interim and final checks in the 2015 and 2020 UWMPs, respectively). Per the Town's 2015 UWMP, its 2020 target is 130 gallons per capita per day (gpcd).

- Senate Bill 606 and Assembly Bill 1668 (2018) – These two bills did not finalize any new water use standards but did direct DWR to develop recommendations on water loss standards (by July 2020), indoor residential usage (by January 2021) and outdoor residential water usage (by October 2021). The legislation sets default efficiency standards for indoor residential use at 55 gpcd through 2025, 52.5 gpcd until 2030 and 50 gpcd after January 1, 2030.

Based on a review of the regulations and anticipated water use requirements, a set of assumptions were made to develop water use factors for the population-based estimate which would comply with the regulations:

2. Because the Town has been proactive in implementing conservation programs, especially during the drought, it was assumed that the Town's water usage was not likely to rebound from the current per capita use of 109 gpcd to the full 130 gpcd. Instead, as noted previously, it was assumed that the Town's total per capita use would be 120 gpcd, which would fall at about seven percent below its SBx7-7 requirement (an increase of about 10 percent from the 2017 per capita water usage).
3. The indoor residential water usage was assumed to fall in line with the default efficiency standards set in SB 606. Based on the Town's record of water conservation and current water usage, it is reasonable to assume that the Town will meet all of the water use regulations.

A summary of the factors used to calculate the projected water use is included in Table 3-6.

Table 3-6: Regulation-Based Demand Factors for Population-Based Demand Estimate

Demand Factor	Regulation	Target	Current Factor	Factor for Projections
Per Capita Water Use (indoor, outdoor, residential and non-residential)	20x2020 / SBx7-7	130 gpcd	109 gpcd	120 gpcd
Indoor Residential Water Use	SB 606 and AB 1668	55 gpcd (through 2025) 52.5 gpcd (through 2029) 50 gpcd (starting in 2030)	n/a	55 gpcd (through 2025) 52.5 gpcd (through 2029) 50 gpcd (starting in 2030)

3.3.2 Land Use-Based Demand Factor Development

Land use-based demand factors were developed to estimate water demands for future developments for use in the distribution system model. In anticipation of the water use regulations related to indoor and outdoor water use targets (described in the previous section) separate indoor and irrigation demand factors were developed for the land use-base demand projection when possible to facilitate future changes to the individual demand components and to maintain consistency with the Town's landscape water budgeting approach (requirements for water efficient landscaping) for development applications.

The Town's metering system includes separate irrigation meters for the majority of non-residential customers (some non-residential customers are served by mixed-use meters), allowing for the development of indoor demand factors for non-residential customers. The Town's methodology for assigning irrigation water budgets to proposed developments was applied to create irrigation demand factors for non-residential uses.

Since residential customers generally have only a single meter measuring both irrigation and indoor usage, a single, combined demand factor was developed for each residential land use type.

The development of these demand factors is detailed below:

1. Once the water meter records were geolocated and assigned to parcels the billing and land use data was processed to develop demand factors.

    a. A combined residential demand factor was estimated for residential customers while separate demands for indoor and irrigation demands for non-residential customers were estimated. Non-residential mixed-use and recycled water meters were excluded.

    b. Demands, acreages and dwelling units (DUs) were summed for the associated land use type.

        i. Residential demand factors (gpd/DU) were calculated by dividing the total demand for a given residential land use type (increased by 10 percent to account for the post-drought use rebound described in the previous section) by the number of DUs associated with that land use. The number of DUs for each parcel was based on land use code descriptions from the Sonoma County parcel shapefile (tax assessor data). Multi-family residential parcels generally did not include the number of units in the assessor data; therefore, the average density from the parcel's general plan category was used. As noted previously, the residential demand factors incorporate both indoor and outdoor usage.

ii. Non-residential indoor demand factors (gpd/acre) were calculated by dividing the total indoor demand for a given land use type (increased by 10 percent to account for the post-drought use rebound described in the previous section) by the total acreage for that land use. Because of the small sample size for the three commercial land use types (Gateway Commercial, Retail Commercial and Service Commercial) and the similarity in development on those land uses, the demand factors for these land use categories were averaged and a single commercial demand factor was used for all three categories.

iii. Non-residential irrigation demand factors (gpd/acre) were calculated by applying the Town's methodology for calculating the Maximum Applied Water Allowance (MAWA) for irrigation for development applications. This method accounts for the annual net reference evapotranspiration for the Town (36 inches) and the landscaped acreage of the development. A factor to calculate the landscaped acreage based on the parcel size was developed for each land use type based on the factors used by the County when developing demands for the Airport Area Specific Plan. The landscaped acreage (assumed to be 20 percent of the parcel acreage) was multiplied by the irrigation demand factor from the MAWA calculation (assuming "regular" landscaping per the MAWA methodology) to determine the projected irrigation demand.

2. Additional demand factors were developed for high water use specific developments (breweries and wineries) as well as for special development types (hotels).

    a. Based on a review of typical water use for the beverage industry (Beverage Industry Environmental Roundtable, *Beverage Industry Continues to Drive Improvements in Water and Energy Use*, 2016), it was assumed that the water to beer/wine ratio would be 5:1 (gallons of water used to gallons of beer/wine produced). For the Russian River Brewery, a factor of 3:1 was applied to account for confirmed installation of water conserving technologies.
    b. Based on a review of existing billing data for the hotels currently served by the Town, a demand factor of 70 gpd/room was developed. This demand factor accounts for all indoor water use at the hotel and is applied based on information available in development applications.

A summary of the demand factors is presented in Table 3-7.

Table 3-7: Land Use-Based Demand Factors

General Plan Land Use Category		General (UWMP) Land Use Categories	Future DU Factor and DU Range from the General Plan (DU/acre)[1]	Residential Demand Factor (gpd/EDU)[2]	Indoor Demand Factor (gpd/acre)[3]	Landscaped Area Factor (acre/acre)[4]	Irrigation Demand Factor (gpd/acre)[5]
RR	Rural Res	SFR	0.16 (0.0 – 0.2)	1,220			
ER	Estate Res	SFR	2.4 (0.2 – 3.0)	390			
VLDR	Very Low-Density Res	SFR	4.8 (3.0 – 6.0)	250			
LDR	Low Density Res	SFR	6.4 (5.0 – 8.0)	170			
MHP	Mobile Home Park	SFR	9.6 (6.0 – 12.10)	160			
MDR	Med Dens Res	MFR	12.8 (8.0 – 16.0)	110			
HDR	High Density Res	MFR	25.6 (16.0 – 32.0)	110			
BMU	Boulevard Mixed Use	Mixed Use	12.8 (8.0 – 16.0)		600	0.2	1,200
NC	Neighborhood Center/Mixed	Mixed Use	12.8 (8.0 – 16.0)		720	0.2	1,200
TC	Town Center Mixed Use	Mixed Use	25.6 (16.0 – 32.0)		660	0.2	1,200
RC	Retail Commercial	Commercial	12.8 (8.0 – 16.0)		500	0.2	1,200
GC	Gateway Commercial	Commercial	0 (n/a)		420	0.2	1,200
SC	Service Commercial	Commercial	0 (n/a)		420	0.2	1,200
GB	General Business	Commercial	0 (n/a)		420	0.2	1,200
LI	Light Industrial	Industrial	0 (n/a)		150	0.2	1,200
HI	Heavy Industrial	Industrial	0 (n/a)		270	0.2	1,200
PQ	Public/Quasi Public	Institutional	0 (n/a)		190	0.2	1,200
PR	Park and Rec	Institutional	0 (n/a)		0	0	N/A
OS	Open Space	Irrigation	0 (n/a)		0	0	N/A

Note:

1. DU/acre factor calculated based on 80 percent of the maximum range consistent with the 2040 General Plan.
2. The residential demand factor was calculated based on existing demands (increased by 10 percent for drought rebound) and includes both indoor and irrigation demands.
3. The indoor demand factor was calculated based on existing demands (increased by 10 percent for drought rebound).
4. The landscaped area factor is the approximate percentage of the parcel that will be landscaped. These factors were developed based on factors used by the County for projecting demands in the Airport Area Specific Plan.
5. The irrigation demand factor is based on the Town's MAWA calculation and assumed that the area would include "regular" landscape and the net evapotranspiration was equal to 36 inches. The total calculation is as follows: 0.45 [conversion factor for regular landscaping] * 36 inches * 0.62 [conversion from inches to gal/SF/year] * Landscaped Area

3.4 Water Demand Projections Including Future Customers

Potable water demand projections were developed for the Town's service area. Projected water demands were calculated using both a population-based estimate and a land use-based estimate. The population-based projection was used to establish the future Town-wide demands through 2040 while the land use-based projection was used to provide a spatial allocation of future demands for use in the hydraulic model.

These demand projections assume that existing demands will increase in the future slightly to account for a post-drought usage rebound (discussed below) but will not change otherwise. Demand increases within the Town's service area will be based on development of currently vacant parcels and redevelopment/densification of currently developed parcels. Demands are also anticipated to increase due to the development or connection of outside areas or annexation. A breakdown of the projected water demand estimates is presented in the following sections.

3.4.1 Population Based Projection

An initial future demand estimate was conducted based on the current population (from the Department of Finance) and an assumed growth rate of 1.5 percent based on the Growth Control Ordinance (discussed in the 2040 General Plan). This estimate also accounts for anticipated changes in the population due to annexation or out-of-Town connections. A population-based estimate was used in conjunction with a review of relevant state legislation and anticipated regulations to ensure compliance with water use guidelines as described in Section 3.3.1. The population-based demand estimate was calculated using the demand factors described previously (see Table 3-6), along with projected population based on 2017 population data and an assumed growth rate of 1.5 percent (based on the Town's Growth Control Ordinance). The demands could be further broken down based on the indoor residential water use factors, assumed water loss factor, and the current split between non-residential indoor water use and total irrigation demand as summarized in Table 3-8 and Figure 3-4. As indicted by Table 3-8, the total demand within the Town is estimated at 5,500 AFY in 2040.

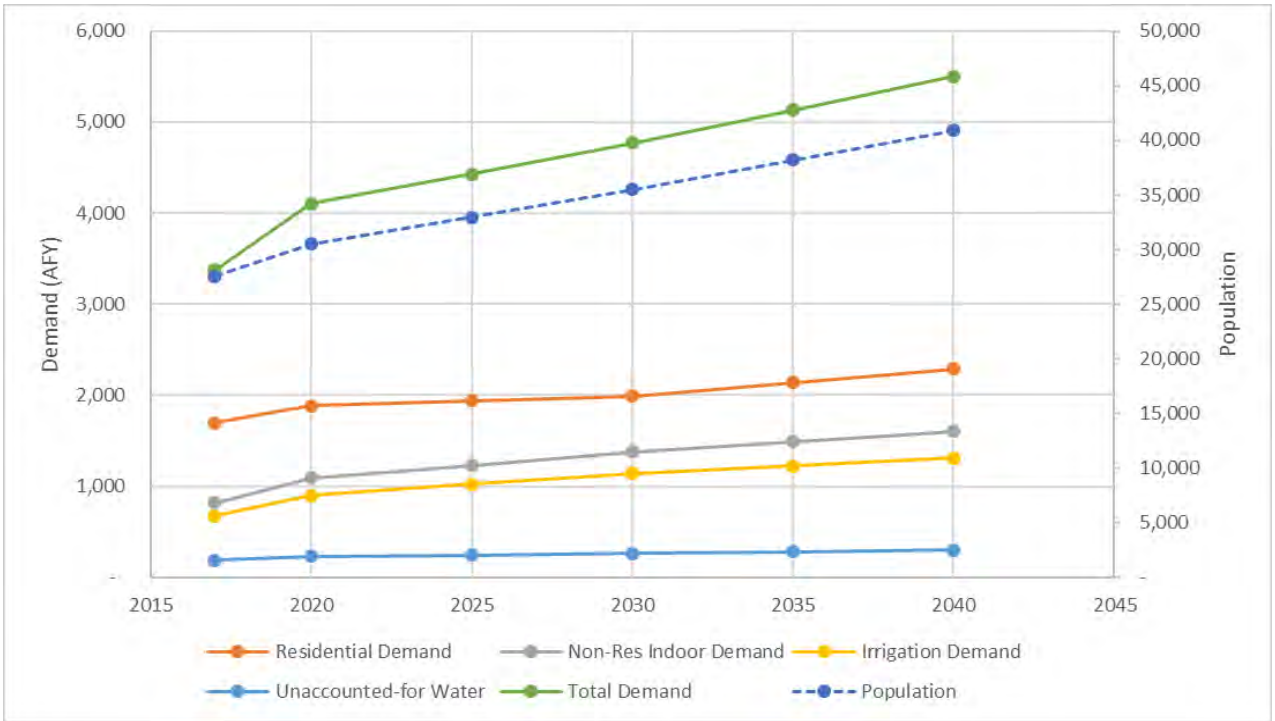
Table 3-8: Population-Based Demand Projections

Year	2017	2020	2025	2030	2035	2040
Town Population[1]	26,934	28,160	30,340	32,680	35,210	37,930
Airport Area Specific Plan Population[2]	583	2,324	2,613	2,800	2,987	2,987
Town Service Area Population	27,517	30,484	32,953	35,480	38,197	40,917
Water Demand (AFY)						
Residential Demand[3]	1,697[7]	1,880	1,940	1,990	2,140	2,290
Non-Residential Indoor Demand[4]	615	1,090	1,230	1,380	1,490	1,600
Irrigation Demand[4]	876[7]	900	1,020	1,140	1,220	1,310
Unaccounted-for Water[5]	186	230	240	260	280	300
Total Demand (AFY)[6]	3,374	4,100	4,430	4,770	5,130	5,500

Notes:

1. 2017 population served was provided by the Town, based on Department of Finance data and a growth rate of 1.5 percent (based on the Town's Growth Control Ordinance). This includes the population in the Shiloh/Mayacama Service Area. Further, it is assumed that the population projection already accounts for growth in the North of Arata Annexation area.
2. A separate growth rate for the Airport Area Specific Plan was provided by Sonoma County based on the planned phasing of development in the area. Population projections for the area were based on the planned residential unit construction and a person per unit factor of 2.5.
3. Based on the default efficiency standards established in SB 606 and AB 1668 listed in Table 3-6.
4. Irrigation demand projections assume that the residential irrigation demand will be set based on the standards listed in Table 3-6 and non-residential irrigation demand is equal to 40 percent of the total non-residential based on the existing split between non-residential indoor and irrigation use.
5. The unaccounted-for water factor used was 5.5 percent.
6. Total demand was based on the per capita water use factor of 120 gpcd.
7. The 2017 residential demands include residential irrigation as there is no way to filter out residential irrigation usage from the billing data unless a parcel has a separate irrigation meter. It was therefore assumed that the indoor residential usage was equal to 55 gpcd and that all residential demand above that allowance could be attributed to irrigation.

Figure 3-4: Population-Based Demand Projections



3.4.2 Land Use Based Projection (Spatial Demand Allocation)

Land use-based demand projections were developed using the land use-based demand factors for non-residential water use and residential water use (presented in Table 3-7), the Town's methodology for approving new development irrigation demands, and a database of anticipated land use for currently vacant land based on data from the Town's General Plan GIS data.

Residential and non-residential water use projections were calculated based on available proposed development information and the acreage and general plan land use categories for currently vacant parcels. Information from the specific development plans (residential unit counts and/or acreage) was extracted and applied to the appropriate parcels. Vacant parcels were assigned their General Plan land use category and associated DU/acre factor (assumed to be 80 percent of the maximum DU/acre allowable for a given land use category, summarized in Table 3-7). Demands for specific developments with high water use (breweries and wineries) were calculated first using the available development information and the special demand factors described in Section 3.3.2. Demand factors (gpd/DU or gpd/acre, presented in Table 3-7) were then applied to those parcels which did not already have a demand assigned.

Irrigation demand projections were calculated based on the Town's methodology for calculating the Maximum Applied Water Allowance (MAWA) for irrigation for development applications. This method accounts for the annual net reference evapotranspiration for the Town (36 inches) and the landscaped acreage of the development. A factor to calculate the landscaped acreage based on the parcel size was developed for each land use type (summarized in Table 3-7). The landscaped acreage was multiplied by the irrigation demand factor from the MAWA calculation (assuming "regular" landscaping) to determine the projected irrigation demand.

The land use-based projections were added to the existing demands (increased by 10 percent for drought rebound) and the demands from the Airport Area Specific Plan (discussed in the next section) to determine the total projected demand. A summary of the land use-based projected demands is presented in Table 3-9.

3.4.3 Airport Area Specific Plan

As discussed in Section 3.1.3, there is significant development expected as a result of the update to the County of Sonoma's Airport Area Specific Plan. Per direction from the County, the future demands for the Airport Area Specific Plan were calculated based on the land use-based demand factors presented in the *Airport Area Specific Plan Water Demand Estimates* memo (M Group 2019) and the planned land use included in the *Airport Area Specific Plan Water Supply Assessment Request* (County of Sonoma 2019). Using these references, the future demands in the area are projected to reach 858 AFY (over 100 percent growth from the existing demands in the area). Additional information regarding the Airport Area Specific Plan development and the projected demands can be found in Appendix E. In addition to the new development in the Airport Area Specific Plan, the update to the plan will include adding a parcel with 69 existing mobile homes that are expected to be connected to the Town's potable water system. This will add an additional demand of 30 AFY.

Table 3-9: Land Use-Based Demand Projections

Service Area	Existing Demand (AFY)	Future Demand (AFY)[2]
Town[1]	2,743	3,874
Airport Specific Plan Area	355	858
Shiloh Hills/Mayacama	90	108
Unaccounted-for Water	186	278
Total	3,374	5,118

Notes:
1. All outside area agreements not listed specifically in this table have been incorporated into projections for the Town service area
2. The future demand year for the land use-based demand projections is 2040 (consistent with the General Plan).

3.5 Peaking Factors

Water system facilities are generally sized to meet peak demand periods. The peaking conditions of most concern for facility sizing are typically maximum monthly demand, maximum day demand with fire flow, and peak hour demand. Peak water use is typically expressed as a ratio, or a peaking factor, dividing the peak water use by the average daily water use. These peaking factors are then used to calculate maximum month, maximum day and peak hour water use conditions for future conditions.

3.5.1 Maximum Month

Based on the Town's billing data for the past six years, the peak potable water use typically occurs in July or August (occasionally falling in June), which corresponds with high temperatures and minimal rainfall. The maximum month demand (MMD) in 2017 occurred in July, with a peaking factor of 1.43 (to the average day demand). It is recommended that a maximum month peaking factor of 1.5 be used for planning purposes to be slightly more conservative than the recently recorded peak.

3.5.1.1 Maximum Day

The maximum day demand (MDD) in 2017 occurred on July 17, with a peaking factor of 1.53 (to the average day demand). The 2011 Water Master Plan identified a maximum day demand peaking factor of 1.9 which has served the Town well. Due to conservation efforts implemented by the Town it is not surprising that the maximum day demand factor has been reduced. For this master plan it is recommended that a peaking factor of 1.7 be used for planning purposes to account for some post drought rebound. This peaking factor should be revisited again in two to five years to revisit the impact of the Town's conservation efforts on the max day demand.

3.5.2 Peak Hour

The peak hour demand (PHD) is often estimated using the hourly metering data for the distribution system. The PHD peaking factor is defined as the ratio of PHD to ADD. Based on hourly supply data from 2017, it was determined that the PHD peaking factor was 3.0. When compared to the peak hour peaking factor in the 2011 WMP (2.9) it is not surprising that the PHD peaking factor has increased slightly due to the reduction in the Town's ADD resulting from recent conservation efforts. While conservation efforts typically result in significant impacts to the ADD and MDD, the magnitude of the impact on the peak hour demand is often not as great which results in a larger or unchanged PHD peaking factor. For this WMP, it is recommended that a peaking factor of 3.0 be used for planning purposes.

3.5.3 Peak Factor Summary

A summary of the peaking factors to be used for the Water Master Plan are presented in Table 3-10.

Table 3-10: Summary of Peaking Factors

Peaking Factor	Factor (compared to ADD)
Maximum Month Demand (MMD)	1.5
Maximum Day Demand (MDD)	1.7
Peak Hour Demand (PHD)	3.0

3.5.4 Diurnal Demand Patterns

Diurnal demand patterns represent the time-varying water demands for given areas or land use categories. The factors are applied at each time step in order to provide a realistic picture of time-varying demands. Diurnal demand patterns

were developed as part of the 2011 WMP for residential, industrial and other non-residential users. For this demand evaluation, those demand patterns were reviewed and updated as necessary and an additional demand pattern was created for irrigation demands. These demand patterns will be used in the hydraulic model as part of the potable water system capacity evaluation.

A systemwide average day demand diurnal pattern was developed based on hourly tank level information and production data from wells or aqueducts for 2017. The systemwide demand pattern was then used to develop separate curves for residential, industrial, non-residential and irrigation customers based on the proportion of the Town's demand attributed to each demand category. A similar procedure was used to develop patterns for the maximum month using data from July 2017. Separate curves were developed for average day and maximum month conditions to better capture the changes in diurnal peaking seen throughout the year (the maximum month diurnal curve has higher peaking factors). A summary of the diurnal demand patterns for average day and maximum month demand conditions are presented in Figure 3-5. The separate demand patterns for average day and maximum month conditions are presented in Table 3-11.

Figure 3-5: Systemwide Diurnal Demand Pattern

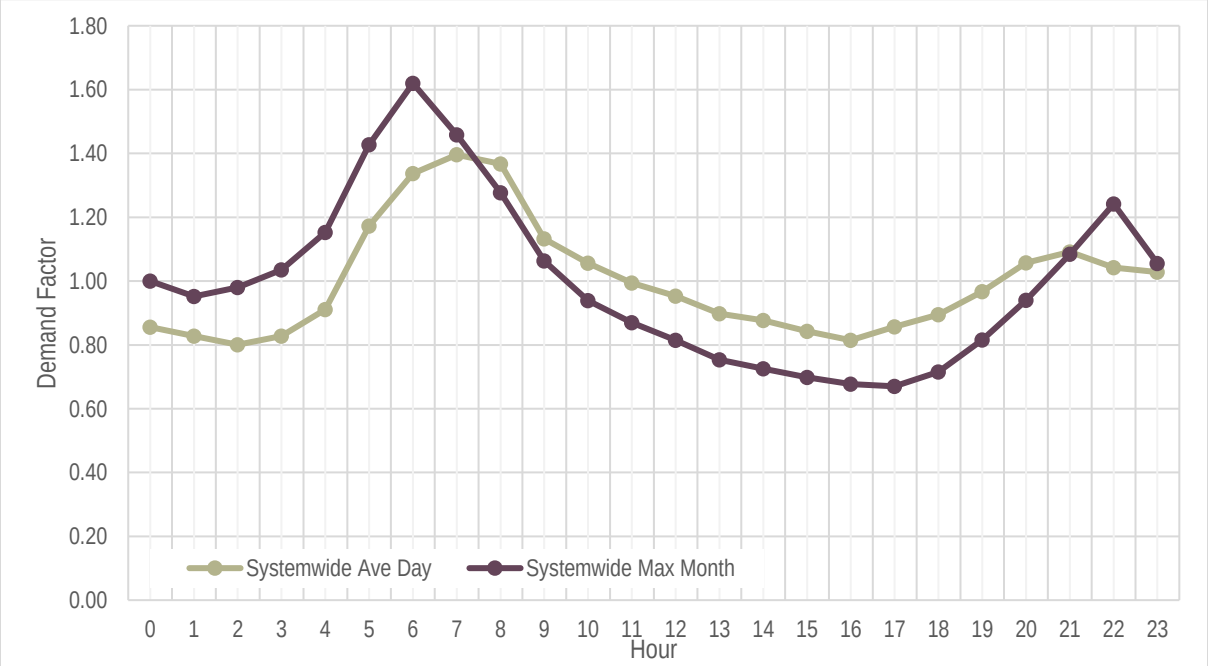


Table 3-11: Diurnal Demand Patterns

Hour	Irrigation		Residential		Non-Residential (Commercial)		Industrial		Systemwide	
	Ave. Day	Max. Month	Ave. Day	Max. Month	Ave. Day	Max. Month	Ave. Day	Max. Month	Ave. Day	Max. Month
0	3	3	0.61	0.82	0.5	0.5	1	1	0.86	1.00
1	3	3	0.57	0.75	0.5	0.5	1	1	0.83	0.95
2	3	3	0.53	0.79	0.5	0.5	1	1	0.80	0.98
3	3	3	0.57	0.87	0.5	0.5	1	1	0.83	1.03
4	3	3	0.69	1.04	0.5	0.5	1	1	0.91	1.15
5	3	3	1.07	1.44	0.5	0.5	1	1	1.17	1.43
6	0	0	1.75	2.16	0.6	0.6	1	1	1.34	1.62
7	0	0	1.73	1.82	1.0	1.0	1	1	1.40	1.46
8	0	0	1.53	1.40	1.6	1.6	1	1	1.37	1.28
9	0	0	1.19	1.09	1.6	1.6	1	1	1.13	1.06
10	0	0	1.08	0.91	1.6	1.6	1	1	1.06	0.94
11	0	0	0.99	0.81	1.6	1.6	1	1	0.99	0.87
12	0	0	0.93	0.73	1.6	1.6	1	1	0.95	0.81
13	0	0	0.85	0.64	1.6	1.6	1	1	0.90	0.75
14	0	0	0.82	0.60	1.6	1.6	1	1	0.88	0.73
15	0	0	0.77	0.56	1.6	1.6	1	1	0.84	0.70
16	0	0	0.73	0.53	1.6	1.6	1	1	0.81	0.68
17	0	0	0.79	0.52	1.6	1.6	1	1	0.86	0.67
18	0	0	1.03	0.77	0.9	0.9	1	1	0.89	0.72
19	0	0	1.24	1.02	0.5	0.5	1	1	0.97	0.82
20	0	0	1.37	1.20	0.5	0.5	1	1	1.06	0.94
21	0	0	1.42	1.41	0.5	0.5	1	1	1.09	1.08
22	3	3	0.88	1.17	0.5	0.5	1	1	1.04	1.24
23	3	3	0.86	0.90	0.5	0.5	1	1	1.03	1.06

3.5.5 Airport Area Specific Plan

Peaking factors for the Airport Area Specific Plan were assumed to be consistent with those used throughout the rest of the Town. As development progresses in the Airport Area, additional peaking factors and/or diurnal curves may be developed to account for the large industrial users in the area.

3.6 Projected Demand Summary

The population-based and land use-based projections use different approaches for estimating future demands and are not expected to result in the same projected demands. In the Town's case, the land use-based projection is somewhat less than the population-based projection for 2040. This is likely due to more conservative water use assumptions applied to the population-based projections. If the Town's existing per capita water use of 109 gpcd was applied to the project population, then the projected potable water demand would be very similar to (in fact slightly less than) the land use-based approach.

For the purposes of this planning effort, to be conservative, the population-based demands were used as the basis of estimating the Town's storage and water supply needs. The land-use based demands are used only for assessing distribution system capacity and fire flow sufficiency. A summary of the projected 2040 demands and the peak demands by water service area is included in Table 3-12.

Table 3-12: Projected 2040 Demand Summary (based on population)

Service Area	Projected Demand (AFY)	Projected Max Month Demand (mgd)	Projected Max Day Demand (mgd)	Projected Peak Hour Demand (mgd)
Town[1]	4,520	6.05	6.86	12.11
Airport Area Specific Plan	872	1.17	1.32	2.34
Shiloh/ Mayacama	108	0.14	0.16	0.29
Total	5,500	7.37	8.35	14.73

Notes:

1. All outside area agreements not listed specifically in this table have been incorporated into the Town service area

4. SUPPLY AND DEMAND COMPARISON

4.1 Existing Supply versus Demand

As discussed in Section 2, the Town currently has an annual supply of 5,625 AFY with peaking capabilities of 8.7 mgd and 9.8 mgd, monthly average and instantaneous, respectively. The Town's existing demands are 3,374 AFY with peak demands of 4.5 mgd and 9.0 mgd, max month and peak hour, respectively. As summarized in Table 4-1, the Town has sufficient supply to meet existing demands.

Table 4-1: Existing Supply versus Existing Demand

Scenario	Supply	Demand	Sufficient Supply
Annual	5,625 AFY	3,374 AFY	Yes
Monthly	8.7 mgd	4.5 mgd	Yes
Peak Hour	9.8 mgd	9.0 mgd	Yes

4.2 Future Supply versus Demand

In addition to the existing supplies, it is assumed that the ongoing assessment of the Esposti Municipal Well will lead to a new supply source. Additionally, the Town is planning to develop a new North Windsor Supply Well which will also serve as a new supply source. The order of implementation of the two new supply wells will be determined based on the results of additional field studies but it is expected that one well will be online within the next five years and the second will be online within the next ten years. For the purposes of this study the capacity of the Esposti Well and North Windsor Supply Well is estimated at 350 AFY each with a sustainable capacity of 400 gpm (0.6 mgd). The addition of these wells increases the Town's supplies to 6,325 AFY annually, 9.3 mgd in max month and 11.0 mgd instantaneously. The Town's 2040 demands are projected to be 5,500 AFY annually with a max month demand of 7.4 mgd and peak hour demand of 14.7 mgd. As summarized in Table 4-2, the Town's projected peak hour demand is slightly higher than the available instantaneous supply; however the system has sufficient storage to make up for the difference between peak supply and demand.

Table 4-2: Future Supply versus Future Demand

Scenario	Supply	Demand	Sufficient Supply
Annual	6,325 AFY	5,500 AFY	Yes
Monthly	9.3 mgd	7.4 mgd	Yes
Peak Hour	11.0 mgd	14.7 mgd	Yes (difference between demand and supply will be made up through use of storage)

4.3 Climate Change Impacts on Future Demands

For this Study, General Circulation Model (GCM) forecasts of temperature and precipitation were reviewed to determine the likely trend in Town water demands. GCM data was extracted from the *Cal Adapt* database published by UC Berkeley's Geospatial Innovation Facility for the three selected models, warm and wet CNRM-CM5 (RCP 4.5), warm and dry MIROC5 (RCP 4.5) and hot and dry MIROC5 (RCP 8.5), for the spatial extent covering the Town's service

area. The Localized Constructed Analogs downscaling method[1] was used to convert data from the GCM output to data specific to the selected region covering the Town. As shown in Figure 4-1, the average maximum temperature is expected to increase by 4 to 6 degrees Fahrenheit. As increased temperature typically correlates with increased water demands it is reasonable to assume that the Town's demands may increase as a results of climate change.

To determine the impact of climate change on water demand, the relationship between demand and climate factors, such as temperature and precipitation, should be understood. Due to the Town's early and effective implementation of conservation programs prior to and during the recent (2013-2017) drought, it is difficult to directly estimate a relationship between water demand and climate factors. Instead, a sensitivity analysis was conducted for this study to compare climate-related demands to the Town's water supply.

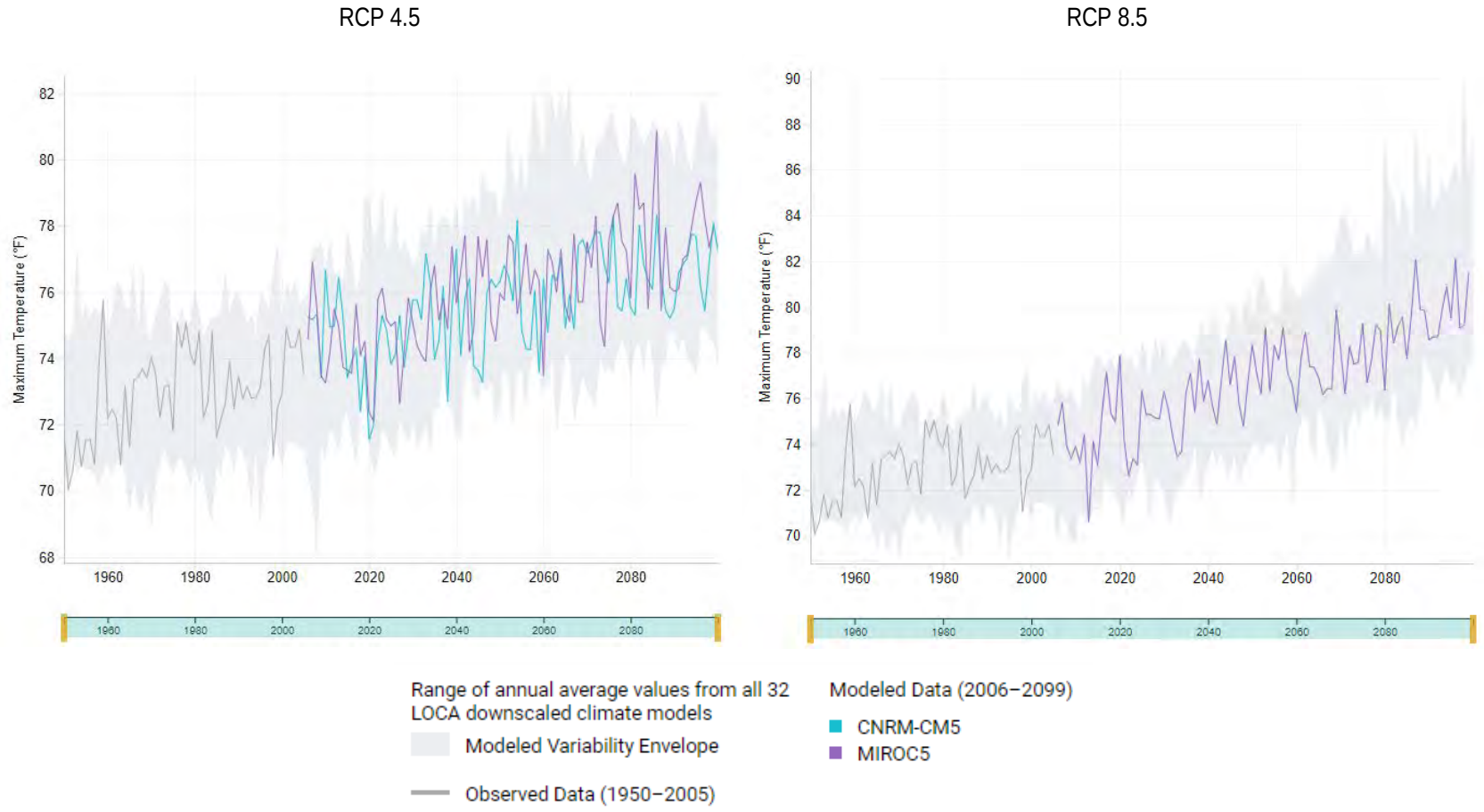
With indoor demands in California likely to be limited by the passage of AB 1668 and SB 606, climate change is most likely to impact irrigation demands. An assessment was conducted to determine the potential impact on the Town's supply availability. As shown in Table 4-3, the Town has adequate supply to meet demands even if irrigation demands increase by 20 percent. Given the Town's successful conservation efforts to date it is reasonable to expect that the Town's climate change-related demand changes will be limited, and the Town's supply will remain adequate for future conditions.

Table 4-3: Supply versus Demand with Climate Change-Related Irrigation Demand Increases

% Change in Irrigation Demands	Future Irrigation Demand (AFY)	Future Total Demand (AFY)	Future Supply (AFY)	Excess Supply (AFY)
0%	1,310	5,500	6,325	825
5%	1,376	5,566	6,325	759
10%	1,441	5,631	6,325	694
15%	1,507	5,697	6,325	628
20%	1,572	5,762	6,325	563

[1] http://loca.ucsd.edu/what-is-loca/

Figure 4-1: Predicted Maximum Temperature for the Town of Windsor



Source: cal-adapt.org

5. HYDRAULIC MODEL UPDATE

The Town's hydraulic model was previously developed for the 2011 Water Master Plan. The model was updated as part of this WMP to evaluate the Town's water system for both existing and future conditions. This section summarizes the hydraulic model update.

5.1 2011 Water Master Plan Model

The 2011 Water Master Plan model was used as the basis for the current model update. The model was developed using H2OMap Water GIS Suite 8.0, Update #4 (H2OMap Water). The model was constructed using GIS data provided by the Town supplemented with pump, valve, tank, and well information.

The model was calibrated based on fire hydrant flow tests conducted by Town staff (in accordance with Chapter 6 of the American Water Works Association's (AWWA) Manual M17 (*Installation, Field Testing, and Maintenance of Fire Hydrants*). Model calibration was used to refine system controls, minor losses and Hazen-Williams roughness coefficients (C-factors). C-factors were developed based on pipe material and approximate pipe age. Pipe material was included in the Town's GIS for most of the pipes however the specific pipe installation dates were not available. Though specific pipe ages were not available; it was assumed that the Town's distribution system is in fair to good condition based on the age of the system. The model input values for pipe C-factors are summarized in Table 5-1.

Table 5-1: Pipe Materials and C-factors (Inherited from 2011 WMP)

Pipe Material	C-factor
Polyvinyl Chloride (PVC)[1]	140
Asbestos Cement (AC)	120
Ductile Iron (DI)	110

Note:
1. Pipes with unknown material were assumed to be PVC.

5.2 Model Updates

Due to limited changes in the Town's water system, it was assumed that the calibration was still adequate and no updates to the roughness coefficients, minor losses, or controls were necessary. The only changes to the model prior to its use for the system evaluation was the addition of recently constructed pipelines and updates to the demand estimates.

The Town's hydraulic model was updated to InfoWater, Suite 12.4, Update #5. InfoWater is an industry-standard, stand-alone, GIS-based modeling program produced by Innovyze, Inc., based on the same EPANET engine that the original model used.

5.2.1 Model Network Updates

Once converted to InfoWater, the hydraulic model was updated to include all pipes constructed and adjustments to system controls implemented since the last model update. The Town provided updated distribution system GIS data and operator notes and SCADA data related to changed controls. Using the GIS capabilities of InfoWater, the old model was compared to the updated GIS data to identify pipes installed and abandoned since the last model update. New pipes were added to create the new existing system model network. A breakdown of the pipes included in the updated existing model network is presented in Table 5-2.

Based on discussions with Town staff and a review of system SCADA data, the settings at the Santa Rosa Aqueduct turnout were adjusted to better replicate current operations. For the updated model, the input pressure from the aqueduct was set to 96 psi, and is activated during evening hours and during the fire flow simulations. The aqueduct connection was not included for peak hour demand simulations as the Town does not typically draw from the aqueduct during the peaks (instead relying on system storage). Typically, the aqueduct connection is used at night when demands are lower to fill storage tanks in the system. A plot of the SCADA data for the pressure downstream of the aqueduct connection (from 2017) is included in Appendix F.

Table 5-2: Existing System Pipe Materials and C-Factors

Pipe Material[1]	C-factor	Modeled Length	
		(ft)	(mi)
Polyvinyl Chloride (PVC)[2]	140	573,682	109
Asbestos Cement (AC)	120	63,025	12
Ductile Iron (DI)	110	11,480	2

Note:
1. Pipe material based on information included in the 2011 WMP and record drawing information for pipes added to the model as part of this model and WMP update.
2. Pipes with unknown material (about 420 feet) were assumed to be PVC.

5.2.2 Demand Allocation

Existing and projected demands for the Town were developed using water billing data, future land use and demand factors, as described in Section 3. Existing and future demands were linked to parcels. Parcels, and their associated water demands, were assigned to the nearest model junction using the GIS Spatial Join function. InfoWater allows demands to be entered in up to 10 categories in order to apply different diurnal patterns or track demand types. For the model update, demands were loaded into eight categories in order to track existing and future (incremental) demands and apply various diurnal patterns.

5.2.3 Fire Flows

Fire flows were assigned to model junctions located near an existing fire hydrant (based on the Town's fire hydrant GIS data). The fire flow assigned to the junction was based on the land use associated with the parcels adjacent to the hydrant (residential or commercial/industrial). If any of the adjacent parcels were non-residential, the commercial/industrial fire flow requirement of 3,000 gpm was assigned. For all residentially located hydrants, a fire flow of 1,500 gpm was used.

5.3 Modeled Scenarios

For this WMP, four model scenarios under existing and future demands were created for the purposes of system evaluation. The scenarios are summarized in Table 5-3.

Table 5-3: Model Scenarios

Model Scenario	Existing Demands (mgd)	Future Demands[1] (mgd)	Purpose
Average Day	3.0	4.6	Review delivery pressure, pipe velocities, and potential water quality issues
Maximum Day	5.1	7.8	Review delivery pressure and pipe velocity/headloss
Maximum Day plus Fire Flow[2]	5.1	7.8	Review fire flow capacity/availability
Peak Hour	9.0	13.7	Review delivery pressure and pipe velocity/headloss

Notes:

1. Future demands are based on known developments and general plan land uses, and may not match demands calculated based on population.
2. Fire flow evaluation includes an additional fire flow of either 1,500 gpm or 3,000 gpm depending on the location.

6. PERFORMANCE AND DESIGN CRITERIA

The operational performance and design criteria for the following are described in this section:

- Fire Flow Requirements
- Water Supply Capacity
- Pumping Facility Capacity
- Water Storage Facilities
- Total System Supply Availability
- Water Pipeline Sizing

These operational and design criteria are generally consistent with the criteria presented in the *Town of Windsor Water Master Plan Update* (September 2011) and are summarized in the following sections. These performance and design criteria reflect typical industry standards for water system design under the demand conditions of average day, maximum day, maximum day plus fire flow, and peak hour. A summary table of performance and design criteria is provided in Appendix G.

Water quality criteria and non-revenue water (water loss) criteria were not considered as part of this planning effort.

6.1 Fire Flow Requirements

Minimum fire flows are assumed to be concurrent with a maximum day demand scenario and must meet a minimum residual pressure of 20 pounds per square inch (psi) measured at the fire demand node (or hydrant) for evaluation of both current and future system operation. These fire flow requirements are listed in Table 6-1 for both residential and commercial/industrial land use.

Table 6-1: Minimum Fire flows

Land Use	Fire Flow (gpm)	Duration
Residential	1,500	2 hours
Commercial/Industrial	3,000	3 hours

6.2 Water Supply Capacity Requirements

Typically, a water system supply capacity is determined to be adequate based on the ability to provide sufficient water to meet peak demand periods such as a maximum day demand plus fire flow, or a peak hour demand with the largest pump or nearest well to the fire location out of service to ensure reliability of the water system to provide adequate flow under all conditions.

6.2.1 Maximum Day plus Fire Flow

According to typical industry standards, the Town's water supply system should have the capability of meeting a system demand scenario equivalent to the occurrence of a maximum day demand plus fire flow. For the WMP analysis, it has been assumed that the largest well at the RRWF is out of service during a maximum day plus fire flow scenario.

6.2.2 Peak Hour Demand

Peak hour demand should be met from a combination of all available supply sources in the system including: RRWF, the SCWA aqueduct, storage tanks, and other wells, with the largest well out of service.

6.3 Pumping Facility Capacity

Water system pumping capacity is considered to be sufficient if the capacity of the pumps can meet both maximum day demand plus fire flow, as well as peak hour demand with the largest pump out of service. To ensure the water system can meet these performance criteria, the RRWF, all pumping facilities at the Shiloh/Mayacama Tank sites, and all new wells should be equipped with on-site, back-up power generators or adapters to allow interconnections to a portable generator, which could be used during an extended power outage.

6.4 Santa Rosa Aqueduct Capacity

Capacity of the Santa Rosa Aqueduct connection is summarized in Table 6-2. For evaluation of adequacy of distribution system supply, storage, and hydraulic conditions, it is assumed that the Santa Rosa Aqueduct will be operational under maximum day plus fire and peak hour scenarios.

6.5 Water Storage Facilities

Total water storage requirements are based on the following components:

- Operational storage
- Fire storage
- Emergency storage

The system storage should be capable of meeting supply required during a peak hour occurrence, or a minimum of average day demand during other emergency situations. The storage requirements for each component are discussed in the following sections and summarized in Table 6-2. It should be noted that the Town's storage criteria was updated after the 2011 WMP as part of 2014 storage assessment.

Table 6-2: Typical System Storage Requirements

Storage Criteria	Criteria
Operational	(Peak Hour Demand – Instantaneous Supply Capacity) x 4 hours
Fire Storage[1]	Fire Flow Requirement x Flow Duration (3,000 gpm x 3 hours = 0.54 MG)
Emergency Storage	(1.0 x Average Day Demand) – Santa Rosa Aqueduct Daily Capacity (1.5 MGD)

Note:
1. Based on maximum fire flow requirement for the pressure zone (all pressure zones include a commercial/industrial user).

Table 6-3: Santa Rosa Aqueduct Capacity

Source	Historical Maximum Instantaneous Capacity[1]		Maximum Daily Supply Capacity[2]		Annual Contract/Right (AFY)
	(mgd)	(gpm)	(mgd)	(gpm)	
Santa Rosa Aqueduct	2.4	1,700	1.5	1,000	900

Notes:

1. Maximum hourly production recorded on historical peak demand day (June 14, 2012) based on data from the Town's SCADA system.
2. The Restructured Agreement for Water Supply from the Sonoma County Water Agency limits the Town's withdrawal of water from the Santa Rosa Aqueduct to an average daily rate during any month of up to 1.5 MGD.

6.5.1 Operational Storage

Water demands vary diurnally over a 24-hour period with higher demands occurring in the early morning hours when residents are preparing to leave for work or school. Water demands decrease to an average demand as the day progresses and eventually increase again in the early evening as residents return home.

Typically, wells are operated at a constant rate over a 24-hour period and are supplemented during higher daily demands by flow from storage tanks or interties to other water systems. Storage tanks are filled during lower demand periods. The storage volume used to meet daily peak demands is defined as the operational storage. The 2011 Water Master Plan used criteria based on a typical standard of 25% of the total volume used on the maximum day. For this Master Plan, to recognize the reliability of the Town's water sources, the Town has elected to use a revised minimum operational storage volume. The requirement is defined according to the following equation:

Operational Storage = (Peak Hour Demand – Russian River Well Field Capacity – Santa Rosa Aqueduct Capacity – Potable Well Capacity) x 4 hours

6.5.2 Fire Storage

Fire flow requirements are established by the Insurance Service Office, Inc. (ISO) and National Fire Protection Association (NFPA) provided in the Uniform Fire Codes (UFC). These requirements are based on building type (residential, commercial, etc.), building size in square feet, and type of construction (wood, steel, etc.).

The recommended fire flows were provided in Table 6-1. Based on these fire flows, an adequate fire flow volume for the largest potential fire (industrial/commercial) is required to be stored in the storage tanks for each pressure zone. The fire storage requirement for each pressure zone is 0.54 MG (3,000 gpm x 3 hours).

6.5.3 Emergency Storage

Emergency storage is required by regulatory agencies to ensure water supply during facility failures such as a major transmission break or natural emergency such as flooding that may affect the ability of the main water supply source to provide sufficient capacity. The American Water Works Association (AWWA) has published guidelines for treated water emergency storage requirements in Manual M32. Based on the AWWA guidelines and requirements published for similar agencies that own water distribution systems, the minimum emergency storage volume for each pressure zone is typically equivalent to the average day demand.

For this WMP, the Town has elected to adjust the emergency storage requirement to assume that just the Town's largest water supply (the RR Well Field) is out of service. Under this scenario the Town would still have an average daily source capacity of up to 1.5 mgd (from the SCWA aqueduct) and potentially more if a new potable well is constructed. Thus, the existing emergency storage requirement was changed to the average day demand minus 1.5 MG.

6.6 Total System Supply

The Town's total distribution system water supply shall be determined by the following:

- Pumping capacity at the RRWF, and
- SCWA Aqueduct,

The total water supply shall be capable of meeting maximum day demand. The total water supply necessary to meet these criteria will change over time as the Town experiences growth.

6.7 Potable Water Distribution System

Adequate system pressure is a basic indicator of acceptable water distribution system performance. The recommended performance standards for the Town's potable water system pressures are summarized in Table 6-4.

Table 6-4: Potable Water System Pressure Criteria

Condition	Delivery Pressure Range (psi)[1]	System Pressure Range (psi)[2]
Average Day	35 – 90	0 – 120
Maximum Day	35 – 90	0 – 120
Maximum Day plus Fire Flow	Minimum 20 at hydrant	0 – 120
Peak Hour	Minimum 35	0 – 120

Notes:
1. Allowable pressure range at customer connections.
2. Allowable pressure range at any point within the distribution system. A pressure near zero psi should only be observed at storage tank sites.

The transmission pipelines in the Town's water system generally range between 12 and 18-inches in diameter with distribution pipelines ranging between 4- and 8-inch in diameter. Future pipelines shall be designed based on the velocity and headloss criteria presented in Table 6-5. Pipelines should also be sized in order to meet the pressure criteria presented in Table 6-4.

Table 6-5: Water Pipeline Sizing Criteria

Condition	Maximum Velocity (fps)	Maximum Headloss (ft/1,000ft of pipeline)
Average Day	10	5
Maximum Day	10	5
Maximum Day plus Fire Flow	10	10
Peak Hour	10	7

This assessment did not include an evaluation of water age, water quality issues or complaints, or pipe break history.

7. MODEL RESULTS AND SYSTEM EVALUATION

The system evaluation included both a review of the Town's storage and an assessment of the distribution system based on the performance and design criteria summarized in Section 6. Storage deficiencies were identified by comparing available storage to the supply required during a peak hour and maximum day plus fire flow scenario. Supply deficiencies were identified by evaluating the available supply in comparison to the supply required to meet a maximum day demand. The hydraulic model was used to identify distribution system capacity deficiencies. Piping deficiencies were identified for existing and future scenarios based on evaluation of pipe headlosses, node pressures, and pipe velocities in relation to the performance criteria.

The results of the storage evaluation and hydraulic analysis, presented in the following sections, were used to develop projects for the Capital Improvement Program (CIP).

The Town maintains and operates the Mayacama/Shiloh service area and is researching ownership of the facilities and responsibilities for system upgrades. At this time, a review of the Mayacama/Shiloh service area was not conducted as part of this evaluation but may be conducted separately, as appropriate.

7.1 Existing System Evaluation

A summary of the current water distribution system and any storage, supply, and piping deficiencies identified during the model analysis is summarized below.

7.1.1 Existing Storage Capacity Assessment

Currently, the Town owns and operates 16 storage tanks with a capacity of 5.4 million gallons (MG) as shown in Table 7-1.

Table 7-1: Existing Storage Tanks

Tank Location	Zone	No. of Tanks	Tank Capacity (gallons per tank)	Total Capacity (gallons)	Elevation (feet)
Lakewood Hills No. 1	1	1	1,000,000	1,000,000	309
Lakewood Hills No.2	1	1	2,000,000	2,000,000	209
Shiloh MG Tank Site	1	2	1,000,000	2,000,000	288
ZONE 1 TOTAL		4	N/A	5,000,000	N/A
Shiloh Tank Site No.1[1]	2	4	10,500	42,000	534
Shiloh Tank Site No. 2[1]	3	3	10,500	31,500	796
Shiloh Tank Site No. 3[1]	4	3	10,500	31,500	984
Shiloh Tank Site No. 4[1]	4	1	100,000	100,000	984
Mayacama[1]	3A	1	240,000	240,000	690
ZONE 2 TOTAL		12	N/A	445,000	N/A
TOTAL		16	N/A	5,445,000[2]	N/A

Note:

1. This tank is located in the Mayacama/Shiloh area, which was not evaluated as part of the fire flow analysis. Thus, this existing storage was not considered for evaluation against the Town's storage criteria.
2. This is the total storage in the Town. This number is not used for evaluating the Town's storage criteria as that evaluation is conducted on a zone by zone basis.

The current storage requirements based on the performance and design criteria are summarized in Table 7-2.

Table 7-2: Current Storage Needs

	Ave Day (MGD)	Max Day Demand (MGD)	Peak Hour (MGD)	Operational Storage Required (MG)	Emergency Storage Required (MG)	Fire Storage Required (MG)	Total Storage Required (MG)	Existing Storage (MG)	Sufficient Storage?
Existing System	3.31[1]	5.63[1]	9.93[1]	0.02[2]	1.81[3]	0.54[4]	2.38	5.00[5]	Yes

Notes:

1. The demands used to evaluate the current storage needs include the assumed 10 percent demand increase over the 2017 demands to account for the post-drought rebound.
2. *(Peak Hour Demand – RRWF Capacity – Santa Rosa Aqueduct Capacity – Potable Well Capacity) x 4 hours = (9.93 mgd – 7.4 mgd – 2.4 mgd – 0 mgd) x 4 hours / 24 hrs/day* = 0.02 MG
3. (1.0 x Average Day Demand) – Santa Rosa Aqueduct Daily Capacity = 3.31 mgd - 1.5 MGD = 1.81 MG
4. Fire Flow Requirement x Flow Duration = 3,000 gpm x 3 hours x 60 min/hr = 0.54 MG
5. This number includes storage in Zone 1 only; storage for the Mayacama/Shiloh area was not included in this analysis.

Under existing conditions the Town has two supply sources; the RRWF and the SCWA Aqueduct. Based on the capacities of those two sources (7.4 mgd and 2.4 mgd, respectively) the Town has sufficient instantaneous capacity to meet peak hour demands (9.93 mgd) so minimal (0.02 MG) operational storage is required. The emergency storage requirement is calculated assuming the RRWF is out of service, so the average day demand (3.31 mgd accounting for the post-drought rebound) is served by the average aqueduct capacity (1.50 mgd) which leaves 1.81 MG of storage required. Finally, the fire storage requirement (0.54 mgd) is based on the maximum fire flow required for the area (industrial and commercial fire flow requirements are 3,000 gpm for 3 hours). Based on the storage requirements as shown in Table 7-2 for existing conditions, the Town meets its storage requirements (exceeding the minimum total required storage of 2.38 MG). The addition of planned groundwater wells would further increase the reliability of the existing supply and further reduce the emergency storage requirement.

7.1.2 Water Distribution System Performance Evaluation

The purpose of the water distribution system performance evaluation is to identify necessary improvements to support the Town's existing potable water demands while meeting the Town's recommended potable water system performance and design criteria.

The following scenarios were evaluated to assess the distribution system performance under existing potable water demand conditions:

- Peak Hour Demand (PHD) Scenario: In this scenario, node pressures, pipe velocities, and pipe headlosses were evaluated during a peak hour demand condition.
- Max Day Demand plus Fire Flow (Fire Flow): In this scenario, hydrant pressures, pipe velocities, and pipe headlosses were evaluated during a maximum day demand condition with the addition of fire flow demand. Fire flow demands were applied throughout the Town at hydrant locations.

The existing water distribution system is expected to deliver peak hour flows and maximum day demand plus fire flow within the acceptable pressure, velocity, and headloss ranges as identified Section 6.7.

7.1.2.1 Peak Hour Demand Scenario

A steady-state hydraulic evaluation was conducted using the hydraulic model to evaluate system performance under an existing peak hour demand condition.

The PHD evaluation results indicate that the existing water distribution system can meet the Town's minimum pressure criterion of 35 psi at all service connections except on Turnberry Court, near the Lakewood Storage Tank, where the delivery pressure is predicted to be around 30 psi (identified in Figure 7-1).

Results from the velocity simulation indicate that all pipes in the existing water distribution system were able to maintain a velocity below 10 fps, which meets the Town's requirement.

7.1.2.2 Fire Flow Scenario

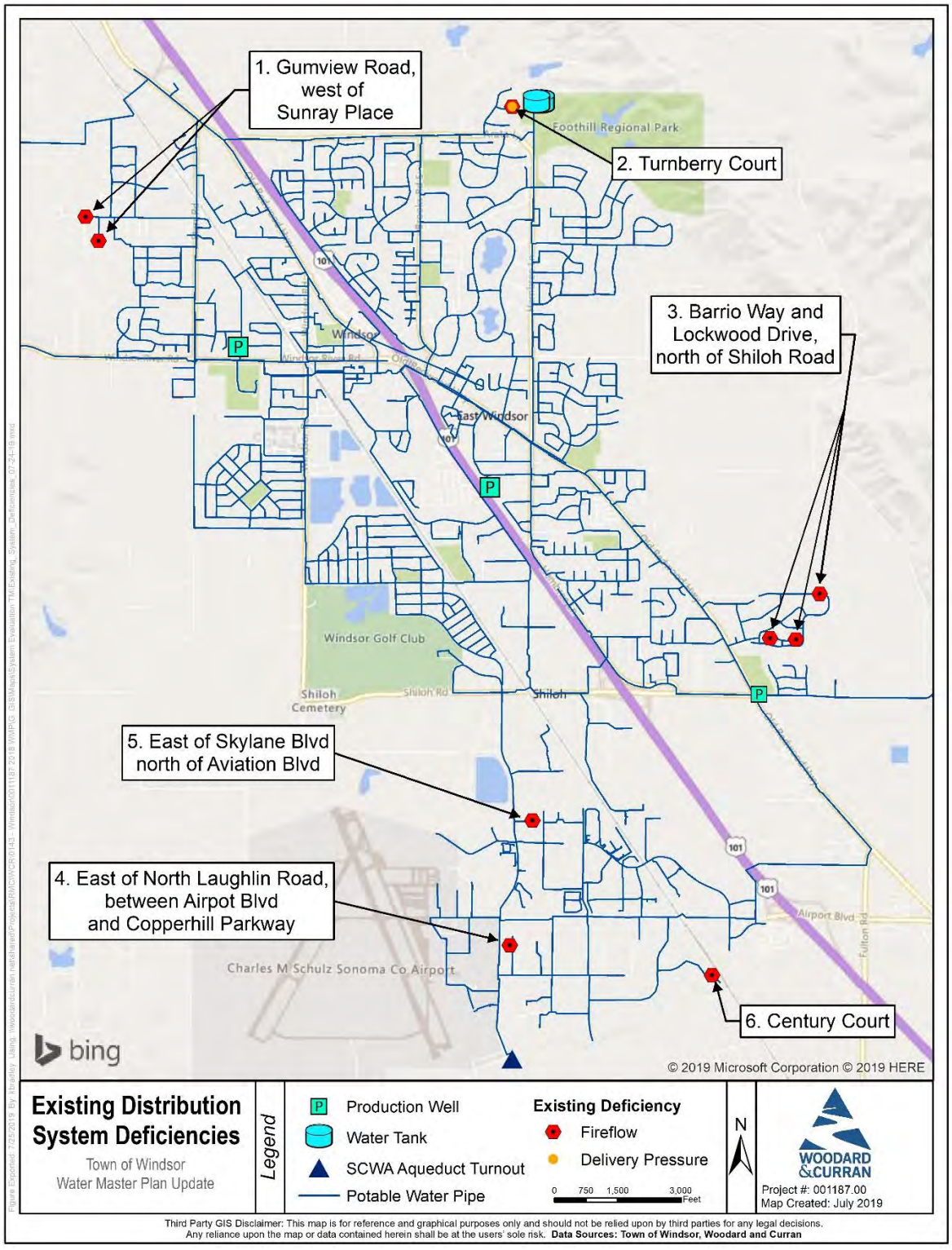
The Fire Flow evaluation was completed using InfoWater's fire flow simulation tool. A steady-state hydraulic evaluation was used to determine if modeled nodes representing hydrant locations could meet a residual pressure of 20 psi under max day demand conditions with the addition of the required fire flow demand.

The results of the Fire Flow evaluation indicate that the existing water distribution system can meet the residual pressure requirement of 20 psi under max day demand and fire flow conditions in all areas except the following (identified in Figure 7-1):

1. On Gumview Road, west of Sunray Place
2. On Turnberry Court, near Lakewood Storage Tank
3. On Barrio Way and Lockwood Drive, north of Shiloh Road
4. East of North Laughlin Road, between Airport Boulevard and Copperhill Parkway
5. East of Skylane Boulevard and north of Aviation Boulevard
6. On Century Court, on the east side of the Airport Area

Pipe velocity was also evaluated, and the results indicate that there are no areas in which velocities are above the maximum 10 fps criterion except in some cases where the minimum residual pressure requirement for fire flows was also not met.

Figure 7-1: Existing Distribution System Deficiencies



7.2 Future Water Distribution System

An overview of the future water distribution system and any storage, supply, and piping deficiencies identified during the model analysis is provided below.

7.2.1 Storage

The anticipated storage requirements over the planning horizon to 2040 are shown in Table 7-3. These values assume that the fire flow requirement will not change and the Town will add two additional groundwater wells with a capacity of 1.15 mgd each (based on the assumed supply from the Esposti Municipal Well). For the purposes of this analysis, it was assumed that the Town will add one of the Esposti Municipal or North Windsor groundwater wells by 2023 (5-year) and the other by 2025 (10-year) as new supply sources. These new supplies increase the Town's instantaneous capacity to 10.95 mgd and 12.10 mgd for the 5- and 10-year assessments, respectively.

Table 7-3: Projected Future Storage Needs

Planning Horizon (Year)	Ave Day (MGD)	Max Day Demand (MGD)	Peak Hour (MGD)	Operational Storage Required (MG) [1]	Emergency Storage Required (MG) [2]	Fire Storage Required (MG) [3]	Total Storage Required (MG)	Existing Storage (MG)[4]	Sufficient Storage?
5-year (2023)	4.02	6.83	12.05	0.28	2.52	0.54	3.34	5.00	Yes
10-year (2028)	4.33	7.35	12.98	0.43	2.83	0.54	3.80	5.00	Yes
Future (2040)	4.91	8.34	14.73	0.73	3.41	0.54	4.58	5.00	Yes

Notes:

1. *(Peak Hour Demand – RRWF Capacity – Santa Rosa Aqueduct Capacity – Potable Well Capacity) x 4 hours / 24 hr/day = (PHD - 7.4 mgd – 2.4 mgd – 1.15 mgd) x 4 hours / 24 hrs/day*
2. (1.0 x Average Day Demand) – Santa Rosa Aqueduct Daily Capacity
3. Fire Flow Requirement x Flow Duration = 3,000 gpm x 3 hours x 60 min/hr
4. This number includes storage in Zone 1 only; storage for the Mayacama/Shiloh area was not included in this analysis.

Based on the storage requirements and projected demands, the Town has adequate storage to meet its future storage needs. Should the Town add an additional groundwater well, the added supply diversity capacity and diversity will provide reliability to the Town's supply in support of the existing storage capacity.

7.2.2 Future Water Distribution Performance Evaluation

The future water distribution system piping was evaluated based on the headlosses, node pressures, and velocities as described in the existing system evaluation. Model scenarios for future conditions assumed that capacity improvement projects developed to address existing system deficiencies were implemented and are part of the future existing system. As with the existing system evaluation, four demand scenarios were developed for the future system evaluation based on the projected demands discussed in Section 3.

Generally, the model results for the performance and design criteria were within an acceptable range of the recommended values. In the peak hour scenario, pipeline velocities and headloss were below the performance criteria maximum and delivery pressure was met throughout the system. There were no deficiencies identified related to the future fire flow scenario.

8. RECOMMENDED IMPROVEMENTS AND CIP PHASING

This section presents the recommended improvements to address system deficiencies identified during the system evaluation for both the existing and future water distribution system.

8.1 Capacity Improvements

As described in Section 7, the distribution system was assessed, using the performance and design criteria summarized in Section 6, to identify distribution and storage deficiencies for existing and future conditions. The results of the system evaluation indicate the need for capacity improvement projects related to fire flow availability. The approaches for providing system capacity relief include the following:

- Upsizing or replacing existing capacity-deficient pipes with larger pipes
- Installing new pipes in parallel to existing pipes to increase capacity
- Installing new pipes to create additional looping in the system to eliminate dead ends, thus reducing headloss and increasing redundancy

Table 8-1 provides a summary of the projects developed to address capacity deficiencies identified during the system evaluation. The proposed capacity improvement projects are shown in Figure 8-1, with individual project maps included in Appendix H.

Table 8-1: Capacity Improvement Projects Summary

Project No.	Project Location	Project Description	Recommended Facilities:	
			Length (ft.)	Size (in.)
WM-1	Gumview Rd.	Remove existing 6-inch pipe on Gumview Rd. (from Sunray Pl to dead end) and install 12-inch pipe	620	12
		Remove existing 6-inch pipe from Gumview Rd. south to dead end, and install 8-inch pipe	560	8
WM-2	Turnberry Ct.	Remove existing 8-inch pipe on Turnberry Ct. and install 12-inch pipe along Turnberry Ct. Install new 12-inch pipe from end of Turnberry Ct. cul-de-sac to pipe south of Lakewood Tanks.	970	12
WM-3	Savannah Way/Lockwood Dr. and Merner Dr.	Install three new 8-inch pipes: 1. From dead end on Lockwood Dr. to dead end on Savannah Way; 2. On Merner Dr. (from Moll Dr. going east); 3. On Merner Dr. (from Lockwood Dr. going west)	670	8
WM-4	N. Laughlin Rd.	Install new 8-inch pipe east of North Laughlin Rd.	310	8
WM-5	Skylane Blvd. and Aviation Blvd.	Install new 8-inch pipe east of Skylane Blvd and North of Aviation Blvd.	240	8
WM-6	Century Ct.	Remove existing 10-inch and 8-inch pipes on Century Ct. and install 12-inch pipe.	1,000	12

8.2 Reliability Improvements

In addition to identifying six capacity improvement projects, a preliminary assessment was conducted to identify reliability projects. This effort built off the reliability and redundancy projects developed in the 2011 Water Master Plan. The purpose of these projects is to increase system redundancy to eliminate reliance on critical structures and to prepare for system expansion as the Town continues to develop. The approaches for providing system reliability include the following:

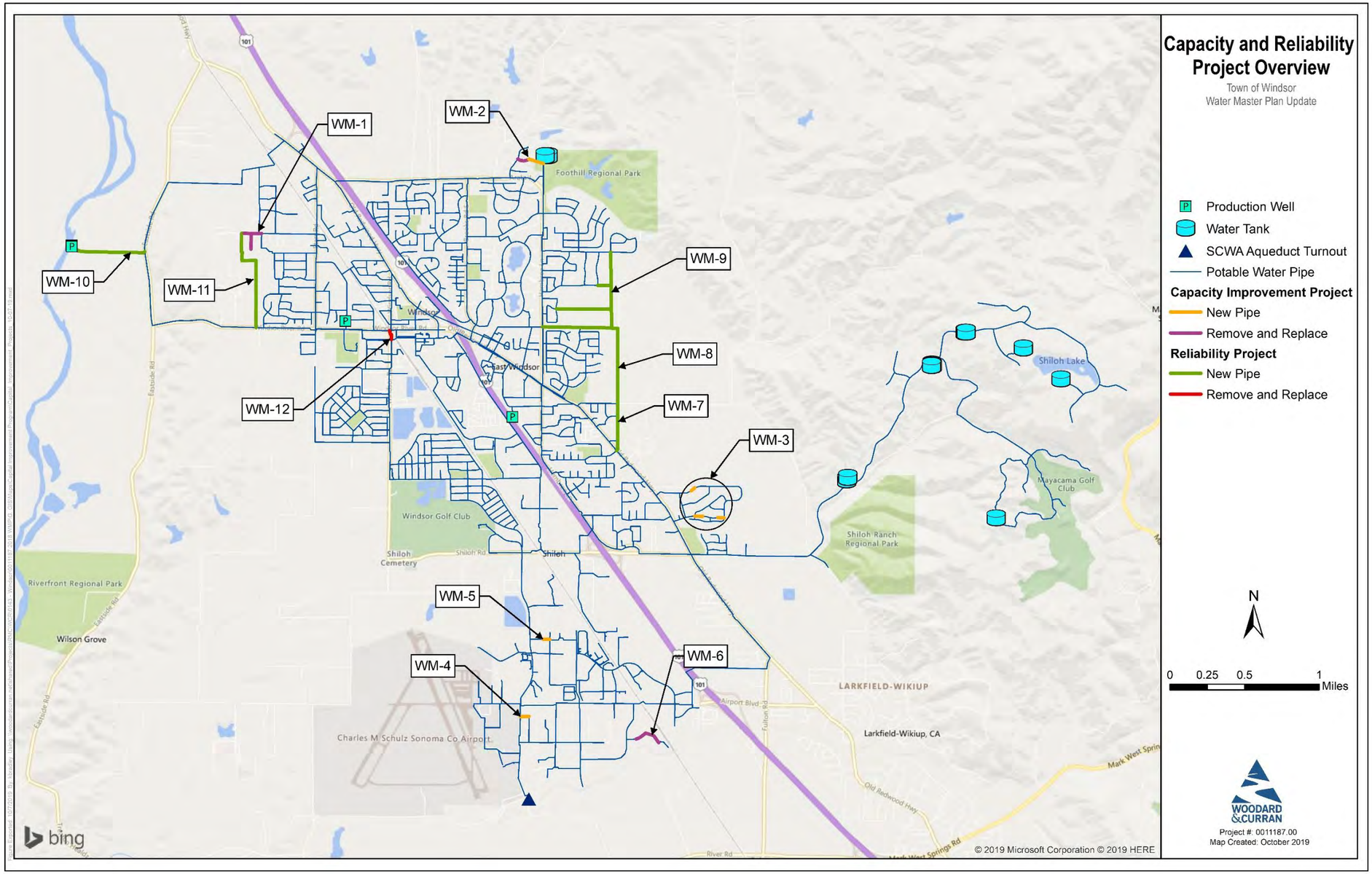
- Upsizing existing pipes with larger pipes
- Installing new pipes in parallel to existing pipes to increase capacity and redundancy
- Installing new pipes to create additional looping in the system to eliminate dead ends, thus increasing redundancy

Table 8-2 provides a summary of the reliability projects with an overview of the projects included in Figure 8-1 and individual project maps included in Appendix H.

Table 8-2: Reliability Projects Summary

Project No.	Project Location	Project Description	Recommended Facilities:	
			Quantity (ft.)	Size (in.)
WM-7	Emmerson St. (Pleasant Ave. to Old Redwood Hwy)	Install new 12-inch pipe on Emmerson St. south of Pleasant Ave., connecting to Old Redwood Hwy.	1,700	12
WM-8	Jensen Ln. to Pleasant Ave.	Install new 12-inch pipe on Jensen Ln. going east and then south to Pleasant Ave.	5,400	12
WM-9	Vinecrest Rd./Jensen Ln.	Install new 12-inch pipe starting from Vinecrest Rd. going south to Jensen Ln.	2,700	12
	Prince George Way and Buckeye Dr.	Install two new 8-inch pipes connecting the new 12-inch pipe to existing pipes on Prince George Way and Buckeye Dr.	2,400	8
WM-10	Russian River Well Field	Install new 18-inch pipe going east from Russian River Well Field along Fontana Rd. to Eastside Rd.	2,400	18
WM-11	Gumview Rd. to Windsor River Rd.	Install new 12-inch pipe from dead end on Gumview Dr. going south to Windsor River Rd.	4,000	12
WM-12	Windsor River Road and Windsor Road	The Existing 6-inch pipe across the railroad at the Windsor River Road and Windsor Road intersection is being upsized to 12-inch as part of an intersection reconstruction project. The upsizing provides redundancy for the existing 12-inch pipeline across the railroad tracks. However, the new 12-inch will connect to a 6-inch pipe on the west side of the intersection. WM-12 would connect that upsize to the 16-inch main on Wall Street.	360	12

Figure 8-1: Capacity and Reliability Project Overview



8.3 Additional Capital Improvement Projects

In addition to those capacity and reliability projects identified during the system evaluation, Town staff identified and developed an additional eight projects. Of these eight projects, three were developed as part of the 2011 WMP and are related to new or replacement wells. These projects, Esposti Well Water Treatment, North Windsor Supply Well and Russian River Well Replacement, were identified as a means to replace groundwater pumped from Bluebird Well A and Esposti well and to enhance the Town's supply reliability. Though the Town's projected demands have decreased since the 2011 WMP due to increased conservation efforts, these projects are still important for diversification of the Town's supply portfolio, which currently relies heavily on Russian River sources, and to anticipate replacement of an aging well at the RRWF. It should be noted that the Esposti Municipal Well has already been developed but does not meet potable water quality standards; the proposed capital improvement project would provide the necessary treatment and pump to use the well for potable supply. As discussed in Appendix A, as part of the Town's approved 2019-23 approved 5-year CIP, the Town will move forward with investigation of the North Windsor Well to determine if a new well could be installed without also implementing arsenic treatment. Based on those investigations, the Town will either install a new North Windsor Well or implement arsenic treatment at the existing Esposti Municipal Well by 2025. It is expected that the second off-river well project would be implemented by 2030 for further supply diversification.

The remaining projects address system maintenance needs, improvements for emergency response, enhancements to customer meter reading infrastructure, and regulatory requirements for volumetric flow testing of source meters.

A summary of the eight additional improvement projects is included in Table 8-3.

Table 8-3: Additional Improvement Projects Summary

Project No.	Project Name	Project Description
W-1	Esposti Well Water Treatment	Design and construct wellhead treatment for the existing Esposti Municipal Well. The project includes evaluation of treatment options, environmental issues and location, as required. This project is identified in the Water Master Plan Update as Project W-2 and has been refined since 2017. This project will be phased with the North Windsor water supply well as recommended in the Esposti Well Feasibility Study.
W-2	North Windsor Supply Well	The Project is consistent with General Plan Public Facilities and Services Policy PFS-1.1 - The Town shall maintain the Capital Improvement Programming (CIP) to ensure the implementation of the General Plan and the adequate and timely provision of public facility and municipal utility improvement, and Policy PFS-2.2 - The Town shall maintain the Urban Water Management Plan to adequately estimate projected water demands and supplies over the planning horizon for average and drought year conditions; and shall implement water supply projects to provide a reliable supply during all water conditions.
W-3	Replacement/New Well at Russian River Well	Construct a new well at the Russian River Well Field site. This project was identified in the 2011 Water Master Plan Update and includes design and feasibility evaluation in FY 23-24 with well construction thereafter to meet operational and future growth demands.
T-1	Shiloh Tank Site #2 Enclosures	The booster pumps located at the Shiloh 2 tank site are housed in a wooden box which requires maintenance staff to crawl into the box to perform inspection/maintenance. This project will replace the box with a small building and fence enclosure to keep the pumps secure and weather tight, and allow for easier access for maintenance personnel.
T-2	Shiloh Tank Sites #1 and #2 Stationary Generators	Purchase, design and construction of two 125 kW fixed set generators at Shiloh Tank Sites #1 and #2 to include site preparation, pad and enclosures, fuel storage equal to 36 hours maximum generator output, and purchase and installation of automatic switchgear.
S-1	Wild Oak Water Service Replacements	The water services in the area of Wild Oak Drive are over 40 years old and due for replacement. The replacement of these services is planned just prior to resurfacing of the streets (pavement overlay) such that future replacement would not deface the newly paved street surface.
I-1	Town-wide Advanced Metering Infrastructure (AMI)	Complete the final phase of automated meter-reading program. This project is completion of the Advanced Metering Infrastructure (AMI) system and includes the installation of collectors and transmitters in the field equipped with GPS antennas and cellular WAN. Also included in the project is software, implementation and staff training for the AMI system.
I-2	Meter Flow Testing Improvements at Russian River Well Field	Design and construction of well-field pipeline improvements for flow meter testing at the Russian River Well Field.

8.4 Project Costs

This section presents the estimated costs of the recommended capacity and reliability improvements.

8.4.1 Cost Estimating Approach

Planning-level cost estimates for the recommended capacity and reliability improvements were prepared using the cost factors described below and summarized in Table 8-4. Cost estimates were prepared at a Class 4 level (-30% to +50%) per AACE International guidelines. The process for developing the project costs is presented in Table 8-5. Costs for additional improvement projects were provided by the Town.

Construction Costs

The construction costs include baseline pipe construction unit costs for open-cut trench pipe installation, potholing, and, in some cases, pipe removal.

Pipeline Costs

Raw pipe unit costs were based on 2019 RS Means data and were then loaded to include the following assumptions:

- Open cut installation
- Excavation and backfill
- 8-foot pipe cover
- Standard re-paving (6-inch added to trench plug)
- Allowance for isolation and other valves/appurtenances
- Limited dewatering needs

As appropriate, a cost to remove existing pipe was added to the projects.

Potholing

Potholing is the practice of digging a test hole to expose underground utilities in order to avoid damaging existing facilities during construction. The need for, and cost associated with, potholing increases in more urban areas.

Table 8-4: Project Unit Costs

Item	Description	Type	Cost[1]	Unit
Sitework (Open Cut Pipelines)	Pipe Installation	8-inch PVC DR-18	$146.98	$/LF
		12-inch PVC DR-18	$211.27	$/LF
		18-inch HDPE DR-21	$280.96	$/LF
	Pipe Removal	6-inch	$17.27	$/LF
		8-inch	$28.78	$/LF
		10-inch	$28.78	$/LF
	Potholing	Rural: 1 pothole per 100 feet at $1,200 per pothole	$1,200	$/100 feet of pipe
		Light Urban: 3 potholes per 100 feet at $1,200 per pothole	$3,600	$/100 feet of pipe
		Heavy Urban: 5 potholes per 100 feet at $1,200 per pothole	$6,000	$/100 feet of pipe
General Requirements	Traffic Control	Rural	2% x Sitework Cost	$/LS
		Light Urban	4% x Sitework Cost	$/LS
		Heavy Urban	7% x Sitework Cost	$/LS
Allowances and Contingency	Construction Allowances	Mobilization/Demobilization	10% of pipeline costs	Allowance
		Contractor Overhead and Profit	10% of raw construction subtotal	Allowance
		Sales Tax	8.125% of raw construction subtotal	Allowance
	Other Allowances and Contingency	Contingency	30% of construction cost	Allowance
		Environmental Documentation & Permits	5% of construction cost with contingency	Allowance
		Design Cost	15% of construction cost with contingency	Allowance
		Project Administration and Construction Management Cost	15% of construction cost with contingency	Allowance

Note:

1. Unit costs are from RSMeans 2018.

Table 8-5: Project Cost Development Process

Item	Description	Total Cost
Sitework	Pipe Installation	Unit Cost (based on pipe size) x Quantity
	Potholing	Unit Cost (based on land use) x Quantity
	Pipe Removal (if necessary)	Unit Cost (based on pipe size) x Quantity
General Requirements	Mobilization	Sitework Subtotal x 10% (10% of Division 2)
	Traffic Control	Based on land use
Estimated Total Construction Cost	Raw Construction Subtotal	Sitework Subtotal + General Requirements Subtotal
	Contractor Overhead and Profit	Raw Construction Subtotal x 10%
	Sales Tax	Raw Construction Subtotal x 8.125%
Estimated Construction Cost with Contingency	Estimated Total Construction Cost with Contingency	Estimated Construction Cost + Contingency (30% x Estimated Construction Cost)
Estimated Total Capital Cost	Environmental Documentation & Permits	Estimated Total Construction Cost with Contingency x 5%
	Design Cost	Estimated Total Construction Cost with Contingency x 15%
	Project Administration and Construction Management Cost	Estimated Total Construction Cost with Contingency x 15%

Other Construction Cost Factors

In addition to baseline pipe construction cost, pipe removal cost, potholing cost, and cost of traffic control, the raw construction cost includes allowances for the following items:

- Mobilization/demobilization of the construction team/site
- Contractor overhead and profit
- Sales tax

Finally, a 30 percent contingency was applied to account for unforeseen costs associated with construction. This contingency factor is considered appropriate for master planning. During design, detailed geotechnical and utility surveys will be completed and reflected in the final plans and specifications for the project. Therefore, the design-level construction cost estimate will typically include a lower percentage for contingencies.

Estimated Capital Improvement Costs

In addition to the construction costs, the total capital improvement costs for the projects includes the following:

- Environmental documentation and permitting (5%)
- Design (15%)
- Project administration and construction management cost (15%)

8.4.2 Project Cost Summary

The estimated costs for the recommended capacity and reliability improvement projects are summarized in Table 8-6; detailed cost estimates are provided in Appendix H. Costs for the additional capital improvements projects are based

on the Town's 2019-2024 Appropriations Plan for Water (dated March 11, 2019) and are included in Appendix I. The total estimated capital cost of the projects identified is approximately $19.3 million. Of this total, about $2.3 million is for capacity improvements to address existing capacity deficiencies, $9.7 million is for reliability and redundancy to eliminate reliance on critical structures and to prepare for system expansion as the Town continues to develop, and $7.2 million of additional improvements.

8.5 Recommended CIP Phasing

In an effort to plan for adequate funding of the proposed CIP, the recommended projects were phased over a 20-year planning horizon beginning in fiscal year (FY) 2019/2020. The projects were phased based on the hydraulic modeling results described in Section 7. Three planning phases were identified for the recommended projects as discussed below and shown in Table 8-7. The projects in each phase have been listed in the order of priority based on the operational performance and design criteria. Maps illustrating the phasing for the projects are included in Figure 8-2 through Figure 8-4.

Phase 1 projects include projects that are recommended to be built between the current year and FY 23-24. Phase 1 projects include: W-1, WM-2, WM-3, WM-6, WM-10, S-1, T-1, T-2, I-1 and I-2. Phase 1 also includes the planning/design phases for projects W-2 and W-3. Project W-1 will increase the Town's supply to support continued growth and project WM-10 serves as redundancy for the main transmission line from the RRWF. The other projects address existing deficiencies or necessary system updates/maintenance.

Phase 2 projects include projects that are recommended to be built between FY 24-25 and FY 28-29. Phase 2 projects include: W-2, W-3, WM-1 and half of WM-4, WM-5, WM-11, and WM-12. Projects W-2 and W-3 will increase the Town's water supply reliability and help to meet the peak hour demands as the Town continues to develop. Project WM-1 addresses a pressure deficiency and can be completed in conjunction with WM-11 which will support development on the western edge of the Town and increase system redundancy. Finally, projects WM-4, WM-5, WM-11, and WM-12 will be started in Phase 2 and completed in Phase 3.

Phase 3 projects include projects that are recommended to be built between FY 29-30 and FY 38-39. Phase 3 projects include: the second half of projects WM-4, WM-5, WM-11, and WM-12 and projects WM-7, WM-8 and WM-9. These projects were developed to support continued growth in the Town and increase system redundancy.

Table 8-6: Estimated Project Costs

Project No.	Project Location	Estimated Construction Cost[8]	Estimated Total Capital Cost[9]
Capacity Improvement Projects			
WM-1	Gumview Rd.	$360,000	$640,000
WM-2[1,2]	Turnberry Ct.	$310,000	$540,000
WM-3	Savannah Way/Lockwood Dr. and Merner Dr.	$160,000	$290,000
WM-4[3]	N. Laughlin Rd.	$75,000	$130,000
WM-5[3]	Skylane Blvd. and Aviation Blvd.	$57,000	$100,000
WM-6	Century Ct.	$360,000	$640,000
	Subtotal – Capacity Projects	$1,322,000	$2,340,000
Reliability Improvement Projects			
WM-7[1,4]	Emmerson St. (Pleasant Ave. to Old Redwood Hwy)	$550,000	$980,000
WM-8[1,4]	Jensen Ln. to Pleasant Ave.	$1,500,000	$2,700,000
WM-9[1,4]	Vinecrest Rd./Jensen Ln., Prince George Way, and Buckeye Dr.	$1,300,000	$2,300,000
WM-10	Russian River Well Field	$900,000	$1,600,000
WM-11[1,5]	Gumview Rd. to Windsor River Rd.	$1,100,000	$1,900,000
WM-12	Windsor River Rd/Windsor Rd Intersection	$140,000	$240,000
	Subtotal – Reliability Projects	$5,490,000	$9,720,000
Additional Capital Improvement Projects			
W-1[6]	Esposti Well Head and Treatment Systems		$2,550,000
W-2[7]	North Windsor Supply Well	$1,200,000	$1,800,000
W-3[7]	Replacement/New Well at RRWF	$600,000	$860,000
T-1[6]	Shiloh Tank Site #2 Enclosures		$96,400
T-2[6]	Shiloh Tank Sites #1 and #2 Stationary Generators		$400,000
S-1[6]	Wild Oak Water Service Replacements		$953,000
I-1[6]	Town-wide Advanced Metering Infrastructure		$225,000
I-2[6]	Meter Flow Testing Improvements at RRWF		$350,000
	Subtotal – Additional Improvement Projects	$1,800,000	$7,234,400
	Total	$8,612,000	$19,294,400

Notes:

1. This project includes easement acquisition, costs of which are not included here.
2. The final easement may impact the layout and length of the new 12" pipeline.
3. This project will be completed as part of proposed development on the adjacent vacant property.
4. Projects WM-7, WM-8 and WM-9 will tie together to form a new loop on the eastern part of the Town.
5. WM-11 project could also be tied into project WM-1.
6. Cost provided by Town (adjusted from 2011 WMP)
7. These projects used adjusted contingency and allowance factors due to additional details being made available for the cost of installing wells for the Town.
8. The estimated construction cost does not include contingency.
9. The Estimated Total Capital Cost is fully loaded (includes planning, design, contingency, etc)

Table 8-7: CIP Project Phasing Summary

Project No.	Project Location	CIP Year	Phase	Estimated Total Capital Cost	Phase 1					Phase 2		Phase 3
					FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	FY 24-25	FY 25-26 through FY 28-29	FY 29-30 through FY 38-39
Capacity Improvement Projects												
WM-1	Gumview Rd.	FY 24-25	Phase 2	$640,000						$640,000		
WM-2	Turnberry Ct.	FY 21-22	Phase 1	$540,000			$540,000					
WM-3	Savannah Way/Lockwood Dr. and Merner Dr.	FY 23-24	Phase 1	$290,000					$290,000			
WM-4	N. Laughlin Rd.	FY 25-26 through FY 29-30	Phase 2 & 3	$130,000							$130,000	
WM-5	Skylane Blvd. and Aviation Blvd.	FY 25-26 through FY 29-30	Phase 2 & 3	$100,000							$100,000	
WM-6	Century Ct.	FY 22-23	Phase 1	$640,000				$640,000				
		Subtotal – Capacity Projects		**$2,340,000**	**$0**	**$0**	**$540,000**	**$640,000**	**$290,000**	**$640,000**	**$230,000**	**$230,000**
Reliability Improvement Projects												
WM-7	Emmerson St. (Pleasant Ave. to Old Redwood Hwy)	FY 30-31 through FY 35-36	Phase 3	$980,000								$980,000
WM-8	Jensen Ln. to Pleasant Ave.	FY 30-31 through FY 35-36	Phase 3	$2,700,000								$2,700,000
WM-9	Vinecrest Rd./Jensen Ln., Prince George Way, and Buckeye Dr.	FY 30-31 through FY 35-36	Phase 3	$2,300,000								$2,300,000
WM-10	Russian River Well Field	FY 23-24	Phase 1	$1,600,000					$1,600,000			
WM-11	Gumview Rd. to Windsor River Rd.	FY 25-26 through FY 29-30	Phase 2 & 3	$1,900,000							$1,520,000	$380,000
WM-12	Windsor River Rd/Windsor Rd Intersection	FY 25-26 through FY 29-30	Phase 2 & 3	$240,000							$192,000	$48,000
		Subtotal – Reliability Projects		**$9,720,000**	**$0**	**$0**	**$0**	**$0**	**$1,600,000**	**$0**	**$1,712,000**	**$6,408,000**
Additional Capital Improvement Projects												
W-1[1]	Esposti Well Head and Treatment Systems	FY 21-22 & FY 22-23	Phase 1	$2,550,000			$500,000	$2,050,000				
W-2[1]	North Windsor Supply Well	FY 23-24 & FY 24-25	Phase 1 & 2	$1,800,000					$775,000	$1,025,000		
W-3	Replacement/New Well at RRWF	FY 23-24 & FY 24-25	Phase 1 & 2	$860,000					$500,000	$360,000		
T-1	Shiloh Tank Site #2 Enclosures	FY 23-24	Phase 1	$96,000		$96,400						
T-2	Shiloh Tank Sites #1 and #2 Generators	FY 21-22	Phase 1	$400,000			$400,000					
S-1	Wild Oak Water Service Replacements	FY 20-21	Phase 1	$953,000					$953,000			
I-1	Town-wide Advanced Metering Infrastructure	FY 19-20	Phase 1	$225,000	$225,000							
I-2	Meter Flow Testing Improvements at RRWF	FY 23-24 & FY 24-25	Phase 1	$350,000	$50,000	$300,000						
		Subtotal – Additional Improvement Projects		**$7,234,400**	**$275,000**	**$396,400**	**$900,000**	**$2,050,000**	**$2,228,000**	**$1,385,000**	**$0**	**$0**
	Total			**$19,294,400**	**$275,000**	**$396,400**	**$1,440,000**	**$2,690,000**	**$4,118,000**	**$2,025,000**	**$1,942,000**	**$6,408,000**

Note:

1. The order of completion for projects W-1 and W-2 are dependent on water quality test boring results for the North Windsor Supply Well. If water quality test results indicate lower overall costs for development of a municipal well at the North Windsor site as compared to the Esposti site, then W-2 would start in FY 21-22, and W-1 would be delayed until FY 23-24, reversing the currently proposed order.

Figure 8-2: Phase 1 CIP Projects

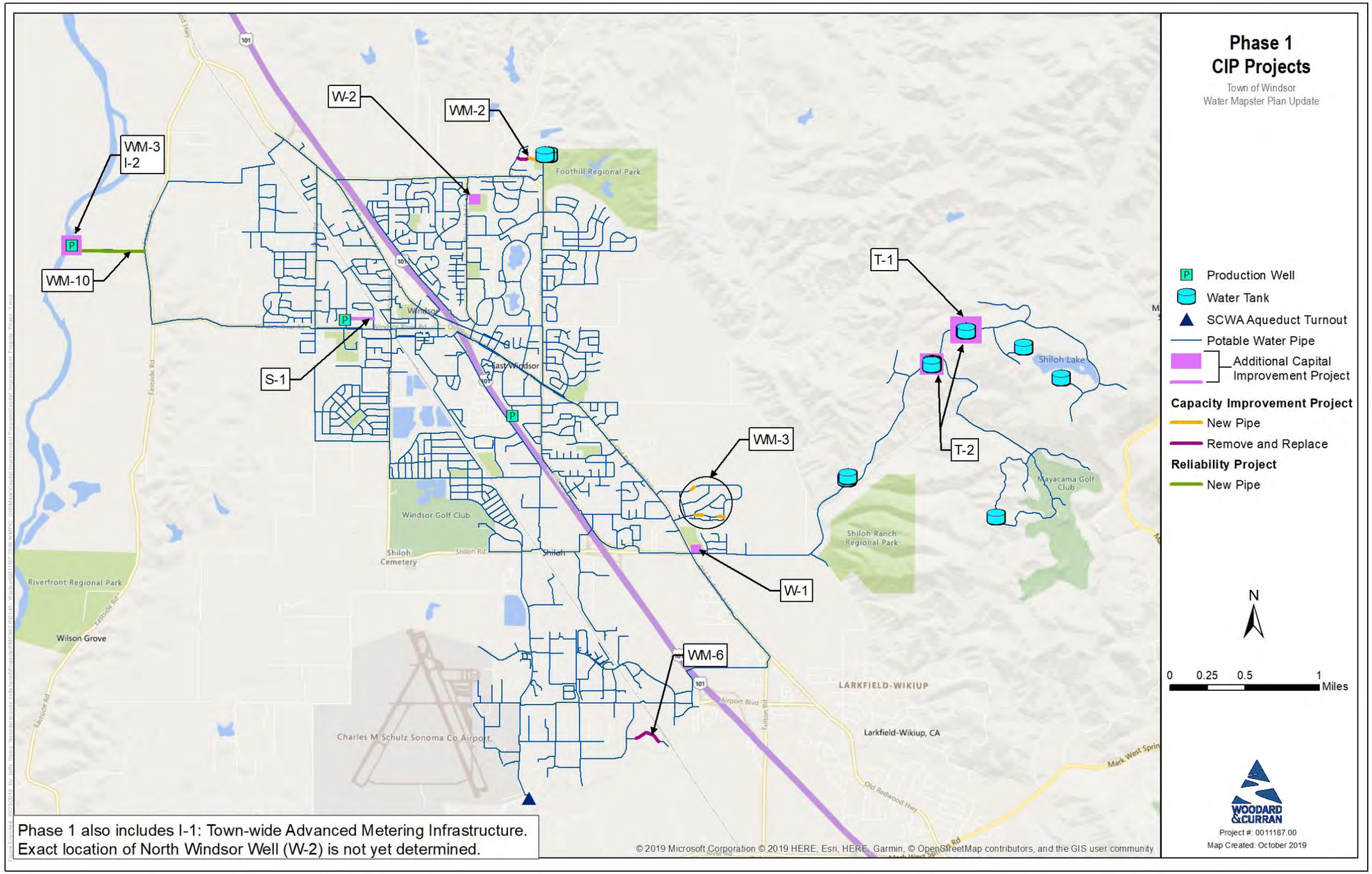


Figure 8-3: Phase 2 CIP Projects

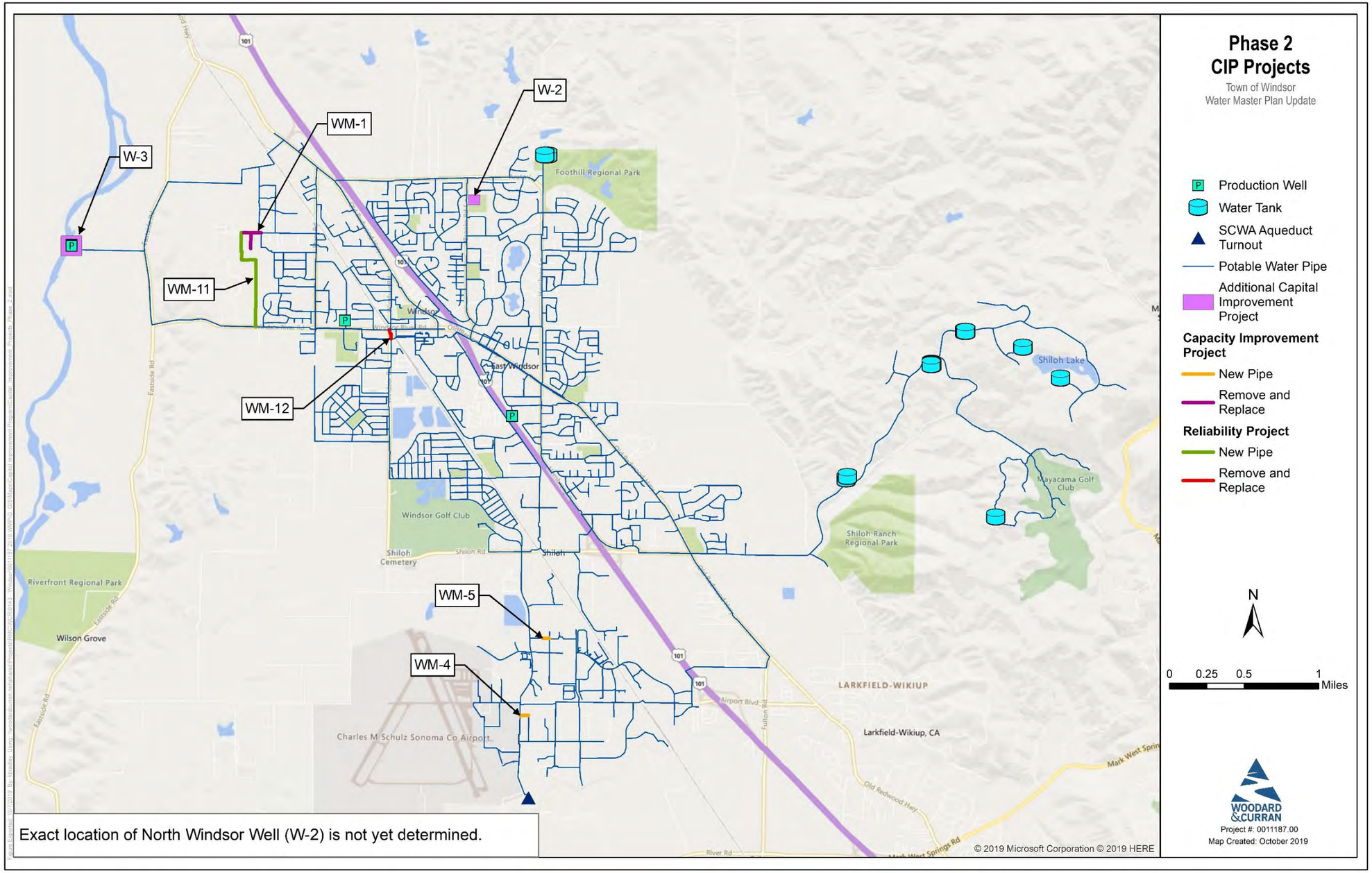
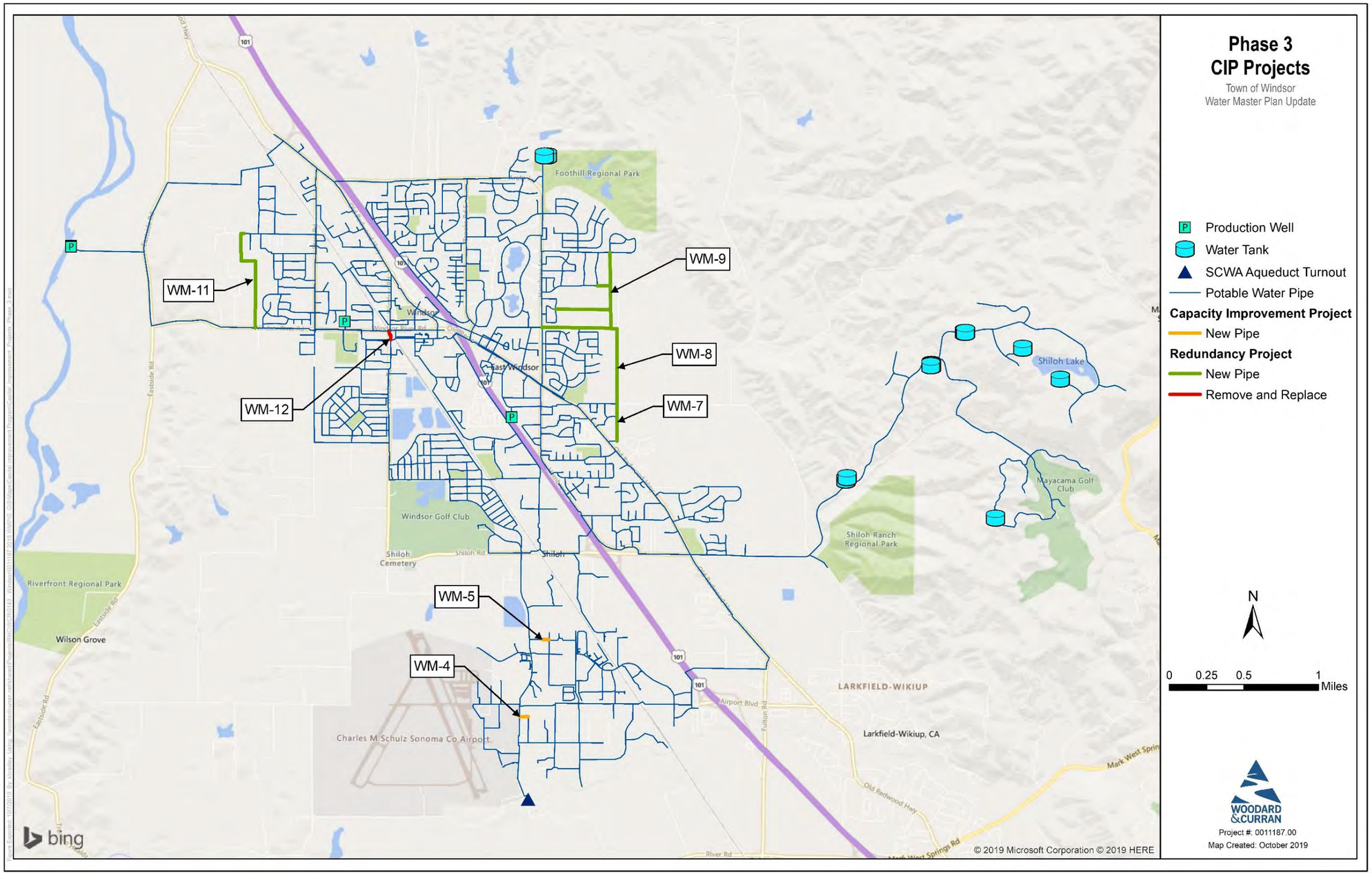


Figure 8-4: Phase 3 CIP Projects



9. CONCLUSION

With the analysis complete, the system assessed, and the modest number of projects recommended, we find the Water System well-planned, well-managed, and poised for excellent ongoing service to the Town residents and customers into the future.

Below are recommended future studies to further improve the maintenance and performance of the Town's water system.

9.1 Additional Recommendations

In addition to the recommended CIP projects, the projects and programs list below should be implemented to enhance the existing and future water system and provide the Town with an improved understanding of customer water use. Recommended future studies include but are not limited to the following:

9.1.1 Review/assess the Mayacama/Shiloh service area

At the time of this WMP effort, the Town was determining the ownership of and responsibilities for the facilities in the Mayacama/Shiloh service area. Pending the results of that investigation, an analysis of the service area is recommended as a supplement to the system evaluation conducted as part of this WMP. Based on the findings of the hydraulic model, there may be vulnerabilities in this area pertaining to both storage and conveyance of fire flows in this area.

9.1.2 Water age and quality evaluation

Based on the results of the preliminary water age model simulation (under average day demand conditions), there are potential water age hot spots in the Mayacama/Shiloh service area. Increased water age may be linked to decreased water quality. As part of the Mayacama/Shiloh service area assessment the water age concerns could be further evaluated and addresses as needed.

9.1.3 Water Audit

Perform a top-down water audit for the entire water system utilizing AWWA methodology and the latest version of AWWA's audit software. This approach provides a valuable understanding of a system's revenue and losses by completing an in-depth data analysis to calculate and determine losses and their cost to the system. The top-down approach will also provide key standard financial and operational performance indicators.

9.1.4 GIS database review and update

The Town's GIS database is missing significant amounts of data (e.g. pipe material, installation year), includes some pipes that are not owned by the Town, and is inaccurate in some places. A thorough update of the database is needed to extract information from the Town's record drawings. The data extraction should include pipe age and material, ownership information, and a reference to the Town's source record drawings. It is recommended that the database also include fields to indicate the year of any rehabilitation work done and the type of rehabilitation.

9.1.5 Evaluation of Distribution System Rehabilitation/Replacement Funding Needs

The Town currently does not have a systematic approach to estimating rehabilitation/replacement funding needs. When the Town's GIS system is fully up to date with pipe age and material data, the Town should consider using this data to estimate future system rehabilitation/replacement needs based on system age as well as maintenance and break history records.

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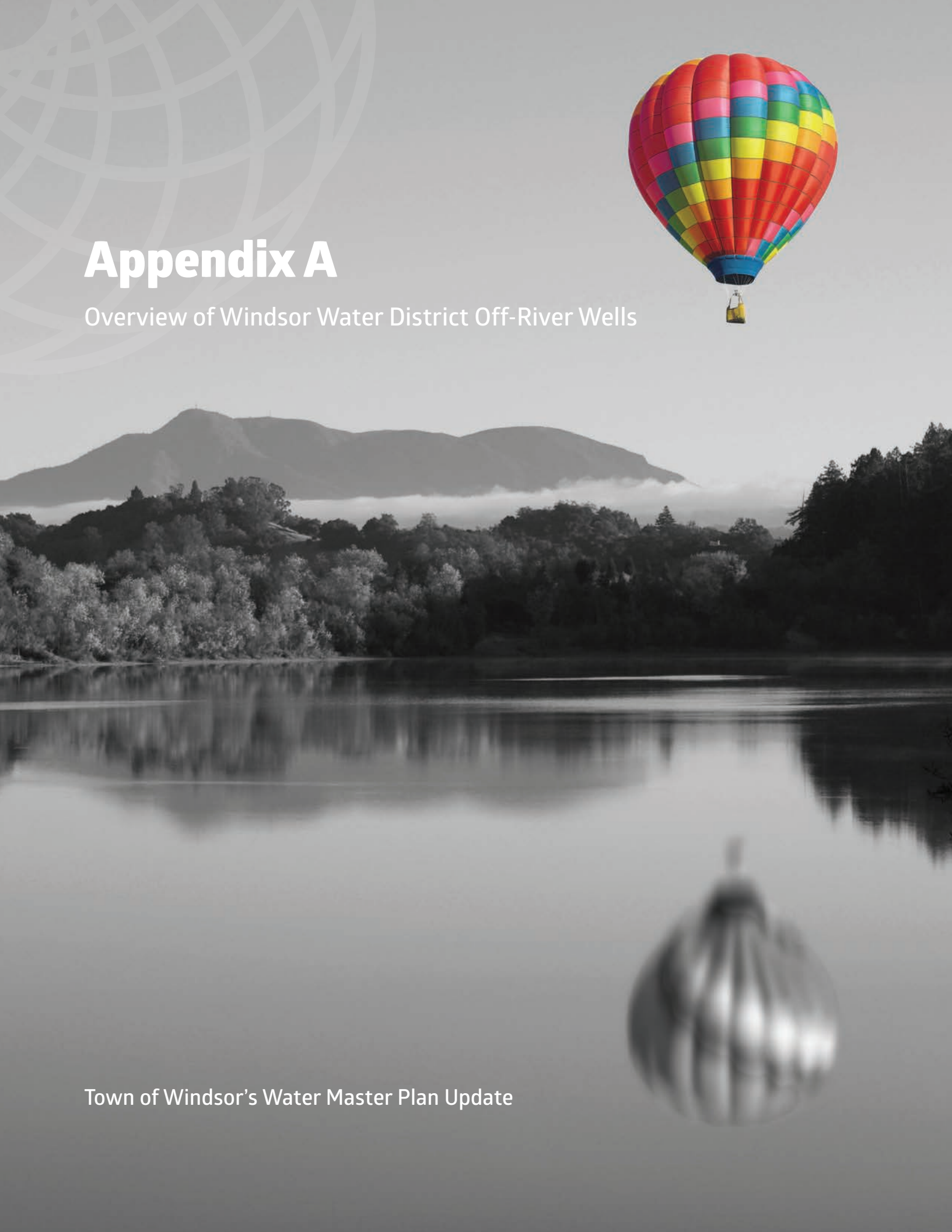
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Appendix A

Overview of Windsor Water District Off-River Wells

Town of Windsor's Water Master Plan Update

APPENDIX A: OVERVIEW OF WINDSOR WATER DISTRICT OFF-RIVER WELLS

Overview of Windsor Water District Off-River Wells

Prepared by: Town of Windsor
September 2019

A short summary is provided on the history of off-river wells to provide context and to inform the current Capital Improvement Program (CIP).

Prior to 2001, the Town had been pumping potable water from several off-river wells, including but not limited to the Esposti irrigation, Bluebird (A) municipal and Keiser irrigation wells. The Bluebird well was the only one being used for potable production into the drinking water system. Although the other two met potable water quality criteria at that time, they were only being utilized for park irrigation, while serving as potential emergency drinking water supplies should they be needed.

In 2001, the U.S. Environmental Protection Agency adopted a lower standard for arsenic in drinking water (reducing the limit from 50 mg/L to 10 mg/L). As detailed in the 2011 WMP, by 2010, the Town no longer relied on these three wells for potable water supply but continued to use the Esposti and Keiser wells for irrigation of nearby parks. The 2011 WMP indicates that the off-river wells were being used at an average annual volume of 130 AF between 2001 and 2006.

In 2010, the Town installed two replacement wells, Esposti Municipal Well and Bluebird Well B. The wells were drilled deeper in an attempt to find a zone of lower arsenic in the groundwater, but these efforts were not successful.

In 2011, the WMP and associated Program Environmental Impact Report (EIR) were completed, and four wells were recommended to move forward to maximize system reliability and provide additional supplies:

- Esposti Municipal Well, installed in 2010 (270 gpm; 1,000 gpm instantaneous flow; 646 AFY capacity)
- Bluebird Well B, installed in 2010 (270 gpm; 646 AFY capacity)
- Hiram Lewis Park Well, now referred to as the North Windsor Well (assumed 270 gpm)
- A replacement well at the Russian River Well Field (assumed 1,300 gpm)

The 2011 WMP and EIR also recommended that long-term water supply development for Managed Aquifer Recharge (MAR) be considered and planned for the long-term as the local hydrogeologic conditions indicated that the aquifer appears to be suitable for use as a short-term water supply only. It was recommended that the Town pursue grants to explore additional well locations for MAR. Since that time, potable water demands have decreased, so the Town has not moved forward with MAR exploration but has maintained the short-term well replacement projects and continues to investigate options for developing off-river municipal wells.

The future water supply projects recommended in the 2015 Urban Water Management Plan (UWMP) included the following:

- Install well-head arsenic treatment on the Esposti Municipal Well. The analysis indicated a need for the project in 2020 to address single dry year droughts. It was estimated that the project would increase water supply in the range of 325 to 850 AFY.
- Install a North Windsor Well between 2020 and 2030 as needed to address single dry year drought demands. The project was estimated to provide an additional 325 to 850 AFY of potable water.

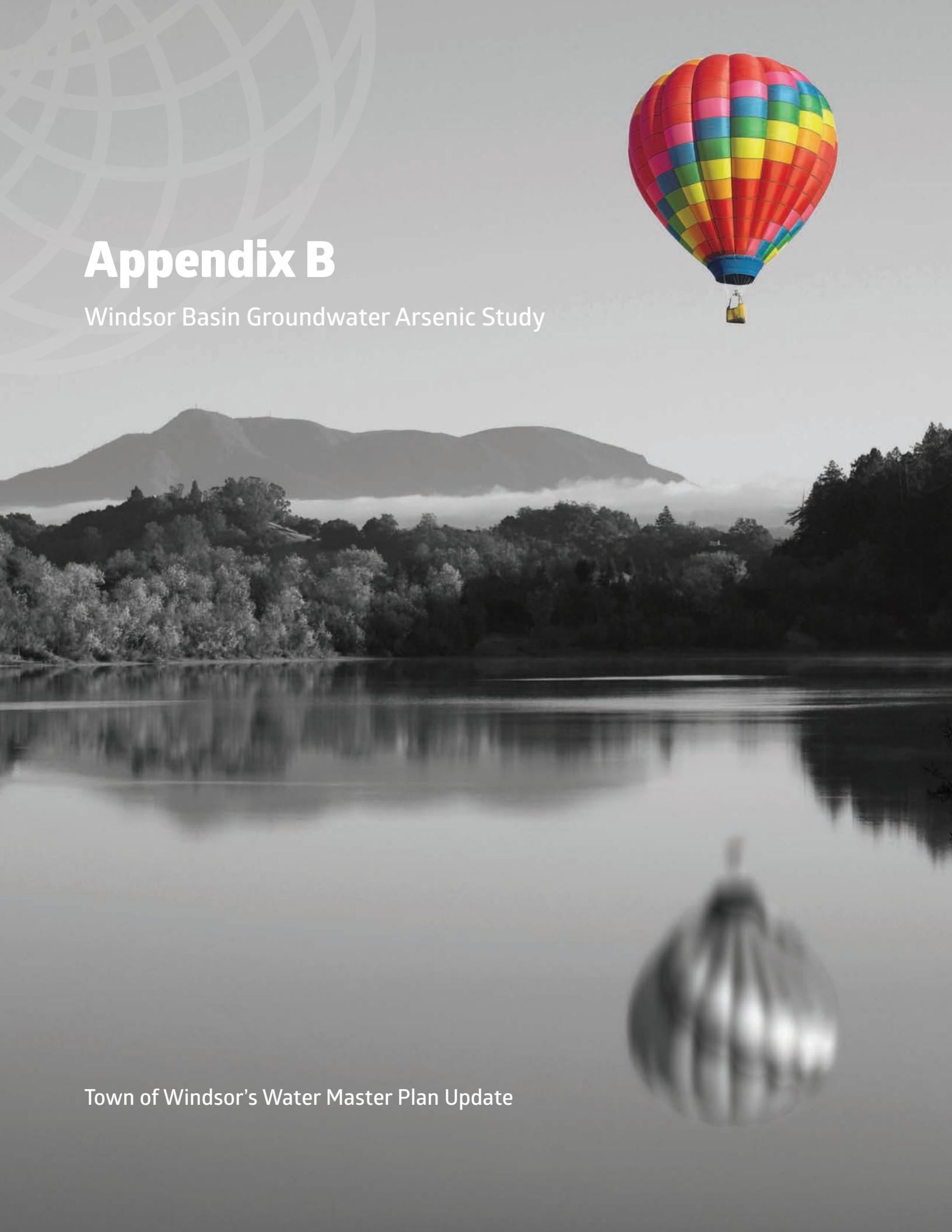
In FY 2016-17, the Esposti Municipal Well was redeveloped and retested, but arsenic levels remained above the MCL and the well was not put into use. The sustainable yield was calculated at 400 gpm (or 325 AFY sustainably pumped for 6 months annually) with an instantaneous, peak day demand flow of 800 gpm that could be produced for short term emergency conditions.

The Town's adopted 2019-2023 Five-Year Capital Improvement Program includes three well projects to expand off-river well production, provide emergency water supply, and replace aging infrastructure. These projects are carried forward in this WMP report as follows:

1. First, investigate the North Windsor Well area to see if a new well can be installed with iron and manganese treatment, but no arsenic treatment. If successful, the assumed production would be 400 gpm, with a sustainable yield of 350 AFY (run daily for 6 months) by 2025.

2. If the North Windsor well requires arsenic treatment, then the Town would first initiate a well improvement project, including necessary arsenic treatment, at the existing Esposti Municipal Well for potable supply in FY 2024-25. For water planning purposes a sustainable yield of 400 gpm (or 350 AFY sustainably pumped for 6 months annually) was assumed, with an instantaneous, peak day demand flow of 800 gpm that could be produced for short-term emergency conditions.

3. The CIP also assumes that one of the Russian River wells will need to be replaced by FY 2024-25 (1,300 gpm).



Appendix B

Windsor Basin Groundwater Arsenic Study

Town of Windsor's Water Master Plan Update

APPENDIX B: WINDSOR BASIN GROUNDWATER ARSENIC STUDY

COMMITMENT & INTEGRITY
DRIVE RESULTS

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Walnut Creek, California 94596
www.woodardcurran.com

TECHNICAL MEMORANDUM

PREPARED BY: Lauren Salberg, GIT and Kevin Almestad, GIT

REVIEWED BY: Jim Strandberg, PG, CHG and Dave Richardson, PE

DATE: October 16, 2019

RE: Windsor Basin Groundwater Arsenic Study

As part of the Water Master Plan Update 2019 (WMP Update), the Town of Windsor (Town) requested Woodard & Curran to conduct a literature review and document existing information on the presence of naturally occurring arsenic in groundwater beneath the Town. The last two wells the Town drilled in 2010 (Esposti Municipal and Bluebird B), both contained naturally occurring arsenic at levels that exceed the federal and state Primary Maximum Contaminant Level (MCL). A well development and treatment feasibility study conducted for the Esposti Municipal Well identified high costs associated with treating arsenic in groundwater, therefore the results of this study will be used for the siting of future off-river water supply well locations that may have low arsenic. The results of the study are documented in this Technical Memorandum (TM) and will be incorporated into the WMP Update. This TM is organized into the following sections:

1.0 Introduction

2.0 Sources of Information

3.0 Regional and Local Hydrogeology

4.0 Water Well Locations and Depths

5.0 Geochemistry and Arsenic Groundwater Quality Data

6.0 Conclusions and Recommendations

7.0 References

1.0 Introduction

Naturally occurring arsenic is present in raw groundwater in the Santa Rosa Plain Groundwater Basin beneath the Town and, in some areas and at some well screen depths, arsenic concentrations exceed the federal and state Primary Maximum Contaminant Level (MCL) of 10 micrograms per liter (ug/L) for drinking water. As part of the WMP Update, the Town requested Woodard & Curran to conduct a literature review to more fully understand and document existing information on the presence of naturally occurring arsenic in groundwater beneath the Windsor area. The study included communications with public and private entities to confirm known sources of information and to obtain additional information not readily available.

2.0 Sources of Information

In addition to information provided by the Town, Woodard & Curran obtained information from the following sources:

- United States Geological Survey (USGS);
- California Department of Water Resources (DWR);
- California State Water Resources Control Board (State Water Board);
- North Coast Regional Water Quality Control Board;
- Sonoma County Department of Health Services, Environmental Health and Safety;
- Sonoma County Water Agency (now known as Sonoma Water);
- Santa Rosa Plain Basin Advisory Panel;
- Santa Rosa Plain Groundwater Sustainability Agency;
- Consultant reports (BESST, GHD, RMC, and Winzler & Kelly); and
- Local private contractors (Alpha Analytical, Analytical Sciences, Weeks Drilling and Pump Company, and Clear Heart Drilling).

Online data sources included:

- California Statewide Groundwater Elevation Monitoring (CASGEM);
- DWR Well Completion Reports;
- Groundwater Ambient Monitoring and Assessment (GAMA) Program (including the Priority Basin Project, GAMA PBP);
- GeoTracker GAMA (including USGS Groundwater Quality Monitoring);
- Water Quality Portal (NWIS and STORET);
- SGMA Data Viewer;
- SGMA Basin Prioritization Dashboard;
- Santa Rosa Plain Groundwater Sustainability Agency Website; and
- Sonoma State University Tap Water Database.

3.0 Regional and Local Hydrogeology

3.1 Regional Geology and Hydrogeology

The Town lies within the northern portion of the Santa Rosa Plain sub-basin (DWR number 1-55.01) of the Santa Rosa Valley Groundwater Basin (DWR, 2003). The Santa Rosa Valley Groundwater Basin is one of a series of northwest-southeast trending structural depressions in the southern part of the North Coast Hydrologic Region. The Santa Rosa Plain sub-basin consists of five groundwater storage units, including the Windsor Basin shown on Figure 1 (USGS, 2013a). The Windsor Basin is bounded to the west by the Sebastopol Fault, by the Healdsburg fault zone and Mayacmas Mountains foothills to the east, and by the Trenton Ridge Fault to the south. The Trenton Ridge Fault trends in a northwest-southeast direction under the Santa Rosa Valley between the Rodgers Creek Fault to the east and the Sebastopol Fault to the west.

The main water-bearing units in the Santa Rosa Valley Groundwater Basin are young alluvial sediments of Quaternary age, older alluvial sediments of Tertiary age, sedimentary deposits including the Glen Ellen, Wilson Grove, and Petaluma formations of late Tertiary age, and Tertiary-age Sonoma

Volcanics. These Tertiary-age sedimentary and volcanic formations are underlain by basement rocks (bedrock), including the Franciscan Complex, which yield little to no groundwater. A west-to-east cross-section through the Windsor Basin from a three-dimensional lithologic model developed by the USGS (2013a) shows a higher percentage of coarser grained materials within 500 feet of ground surface compared to finer grained materials at greater depths (Figure 2). The Santa Rosa Plain Basin reportedly extends to a depth of 4,500 feet beneath the Town (USGS, 2013a).

A conceptual diagram of the geology and groundwater flow system in the Windsor Basin shows the Wilson Grove Formation is primarily located west of the Sebastopol Fault and the Sonoma Volcanics are primarily located east of the Rodgers Creek Fault (and Healdsburg fault zone, Figure 3). These geologic units underly the uplands surrounding the Santa Rosa Valley and interfinger with the basin-fill deposits and have limited lateral hydraulic communication and little influence on groundwater production rates and groundwater quality in the Windsor Basin beneath the Town. The structural trough beneath the Windsor Basin, represented by the greatest thickness of the Petaluma Formation, is skewed towards the eastern side of the valley closer to the Healdsburg and Rodgers Creek faults (i.e., Healdsburg fault zone).

3.2 Local Geology and Hydrogeology

The surficial geology of the Windsor Basin consists of Quaternary-age alluvium and the Tertiary-age sedimentary Glen Ellen Formation (Figure 4). The heterogeneous alluvial materials, ranging in size from clay-sized particles to sands and boulders, vary in thickness from a few feet along the edges of the valley to at least 600 feet in the valley center where Highway 101 passes through Town. Thicker deposits of alluvium support higher well production rates. The saturated alluvium has limited hydraulic communication with the underlying Glen Ellen Formation. Although heterogeneous, these materials comprise a continuous body of saturated material across the Windsor Basin.

Groundwater is recharged primarily from subsurface inflow, infiltration of precipitation, and seepage from streambeds. Discharge is primarily through water production wells and to a lesser extent from subsurface outflow and evapotranspiration from plants. Groundwater generally flows from the highlands on the east and west sides of the Windsor Basin towards the valley floor. The Healdsburg fault zone on the east edge and the Sebastopol Fault on west edge of the basin may influence local horizontal and vertical groundwater flow directions. Well production rates are highly variable in the alluvium and sedimentary formations with the Glen Ellen and Wilson Grove formations being the most permeable (USGS, 2013a). Hydrogeologic characteristics of these formations throughout the Santa Rosa Plain provided by the USGS (2013a) are summarized below:

- Glen Ellen Formation: Thickness is variable with a typical range of hundreds of feet but can be up to 3,000 feet. The substantial amount of clay-sized material, degree of compaction, and cementation limit the permeability of the formation. Well production is highly variable. Specific capacities are less than 10 gpm/foot. Specific yield values range from 3 to 7 percent. Hydraulic conductivity ranges from 13 to 23 feet/day.

- Wilson Grove Formation: Most of the consistently productive wells are constructed in the upper part of this formation with relatively clean sands and low degree of cementation. Specific capacities are reportedly 5 to 6 gpm/foot. Moderate to high storativity results in specific yield in the range of 10 to 20 percent, higher than any other rocks or sediments in the area. Hydraulic conductivity ranges from 2 to 65 feet/day.

4.0 Water Well Locations and Depths

The primary source for well locations shown on Figure 5 was the Town's GIS database. The Town's GIS database consultant, GTG, provided the location and depth of 1,765 wells for this study. Well locations and total depth were also obtained from public sources, including DWR and USGS online databases, and referenced literature. Many of the well locations available from these public sources are duplicative with information provided by GTG. Those that are thought to be different are also shown on Figure 5.

The primary sources for well construction details, specifically well screen intervals, were the DWR Well Completion Reports. According to the USGS (2010), most public supply wells in the Santa Rosa Plain Basin are drilled to depths of 200 to 500 feet.

The Esposti Municipal Well was constructed with screen intervals in the range of 380 to 655 feet below ground surface (ft bgs). According to GHD (2017), the aquifer production characteristics are consistent with descriptions of the Glen Ellen Formation. The Bluebird B Well was constructed with a screen interval from 695 to 745 ft bgs. Based on the similar depth, it is assumed the well is also constructed in the Glen Ellen Formation.

Wells located near the northern Town limit are shown on Figure 6. The wells are located near Arata Lane and in the vicinity of the vacant Manchester property owned by the Town. The Assessor's Parcel Number for this property is 066-310-029. Information provided by the Town for 45 wells is summarized in Table 1. Thirty of the wells are relatively shallow with depths ranging from about 70 to 230 feet and reported production rates of 5 to 50 gallons per minute (gpm). Fifteen deeper wells ranging from about 350 to 800 feet have reported production rates ranging from 30 to 440 gpm. It is noteworthy that wells completed from 500 to 800 feet have reported production rates greater than 200 gpm.

Table 1: Windsor Wells near Arata Lane

Well ID	Depth (bgs)	Well Use Type	Production Rate (GPM)	Temperature
1[a]	804	Irrigation	440	Cool
2	703	Irrigation	703	--
3[b]	690	Irrigation	200	--
4	637	Domestic	200	--
5	585	Irrigation	100	83°F
6	490	Public	200	--
7	500	Public	200	--
8	470	Domestic	300	--
9	400	Other	100	--
10	390	Irrigation	50	Cool
11	381	Domestic	40	Cool
12	380	Irrigation	100	--
13	380	Domestic	90	--
14	352	Unknown	38	Cool
15	349	Domestic	30	--
16	227	Domestic	30	--
17	218	Domestic	50	Cool
18	216	Domestic	35	--
19	196	Domestic	45	--
20	190	Domestic	35	--
21	180	Domestic	20	--
22	178	Domestic	38	--

23	170	Domestic	35	Cool
24	164	Domestic	35	--
25	157	Domestic	20	--
26	152	Domestic	5	--
27	149	Domestic	--	--
28	143	Domestic	45	--
29	142	Domestic	30	--
30A	142	Domestic	35	--
30B	136	Domestic	--	--
31A	131	Domestic	6	--
31B	124	Domestic	24	--
32	129	Domestic	30	--
33	124	Domestic	15	--
34	123	Domestic	20	Cool
35	123	Domestic	18	--
36	120	Domestic	35	--
37	120	Domestic	20	--
38	112	Domestic	10	--
39A	107	Domestic	14	--
39B	89	Domestic	10	Cool
40	90	Domestic	12	--
41	68	Domestic	5	Cool
42	145	Domestic	30	--

bgs = Below ground surface
GPM = Gallons per minute
°F = Degrees Fahrenheit
[a] = Well is screened from 65 feet bgs to 805 feet bgs at various intervals.
[b] = Well is screened from 90-110 feet bgs and 160-200 feet bgs.

5.0 Geochemistry and Arsenic Groundwater Quality Data

The USGS (2010 and 2013a) has researched the presence of naturally occurring arsenic in groundwater basins in the Sonoma and Napa valleys. Arsenic is a tasteless, odorless, semi-metallic trace element which can be present in surface and groundwater from natural and anthropogenic sources (USGS, 2013a). A natural source of arsenic in groundwater is from the dissolution of arsenic-rich minerals including apatite and arsenian pyrite (USGS, 2010). USGS (2010) found that elevated arsenic concentrations in groundwater in the Santa Rosa Plain are primarily caused by the release of arsenic during dissolution of iron or manganese oxides under iron or manganese-reducing (anoxic) conditions.

The USGS (2013a) reports that arsenic in the natural environment is most commonly associated with sulfide and with ferromanganese-oxide minerals, particularly in areas characterized by geothermal water or high evaporation rates. Results of a USGS study (2013a) found that about 30 percent of the wells sampled for arsenic in the Windsor Basin and Wilson Grove storage unit had concentrations above the MCL for drinking water of 10 ug/L.

As part of the GAMA PBP in the North San Francisco Bay study unit, data from 44 wells in Sonoma, Napa, and Marin counties were used to identify the primary constituents associated with deep hydrothermal fluids (Forrest, et al., 2013). Arsenic is an element often used to determine whether hydrothermal mixing is occurring due to upwelling along fractures and faults. Elevated concentrations of arsenic may also be affected by water-rock interaction, including groundwater pumped from fine-grained deposits interbedded with coarser-grained deposits. These studies have identified a positive correlation of increasing arsenic concentrations with increasing water temperature. Elevated arsenic concentrations were also found to

have a positive correlation with reducing conditions (dissolved oxygen concentrations less than 1 milligram per liter) and/or high pH (greater than 7.8).

Lower concentrations of arsenic were found to correlate with wells constructed in alluvial materials. Research conducted in the area by the USGS indicates that lower arsenic concentrations correlate with cooler groundwater which is generally at shallower depths. Deeper water-bearing formations beneath the shallow alluvium, including the Glen Ellen, Wilson Grove, and Petaluma formations have variable but typically higher temperatures and higher arsenic concentrations. Water quality data from the USGS (2013a) is summarized in Table 2.

Concentrations of arsenic in groundwater samples collected from wells in the Windsor Basin were obtained from the referenced studies and DWR (water data for 2000 to 2012 provided by the Town), GAMA, and NWIS. Average arsenic concentrations and the number of measurements from 2000 to 2018 for wells in the Windsor Basin are shown on Figure 7. The average concentration of arsenic exceeds 10 ug/L in roughly one-half of the wells with the number of measurements ranging from one or two to over 40.

Groundwater temperature data are not available for most wells in the Windsor Basin. Most numerical data are available from GAMA and NWIS. Relative temperature information (e.g., cool) for wells located near the northern Town limit are provided in Table 1. Arsenic and temperature data were identified for only four wells, including the Town's Esposti Irrigation Well (Figure 8).

Plots of arsenic concentrations, depth, and/or temperature are shown on Figure 9. Arsenic concentrations with depth are shown for three Town wells, Esposti Irrigation Well, Esposti Municipal Well, and Bluebird A Well. The limited dataset suggests that arsenic concentrations may slightly increase with depth in the Glen Ellen Formation at these wells. A plot of temperature with depth could only be prepared for the Esposti Irrigation Well (GHD, 2017). This dataset is inconclusive. A plot of arsenic concentrations with temperature could also only be prepared for the Esposti Irrigation Well (GHD, 2017). This dataset appears to support the correlation of increasing arsenic concentrations with increasing water temperature.

Table 21: Arsenic Water Quality Data (USGS, 2013a)

Number of wells in shallow aquifer	Number of wells in deep aquifer	Total number of wells	Parameter units MCL, SMCL, or NL	Constituent: Specific conductance (µS/cm) [1]900	Chloride (mg/L) [1]250	Total dissolved solids computed (mg/L) [1]500	Nitrate as N (mg/L) [2]10	Arsenic (µg/L) [3]10	Boron (µg/L) [4]1,000	Iron (µg/L) [5]300	Manganese (µg/L) [5]50
Windsor groundwater storage unit											
7	—	—	Number of samples	7	7	7	5	1	6	2	2
7	—	—	Maximum	590	98.0	534	4.8	1.9	620	420	1,000
7	—	—	Minimum	339	8.0	267	0.2	1.9	<10	42	150
7	—	—	Median	477	39.0	396	0.9	1.9	100	231	575
—	9	—	Number of samples	6	9	9	2	5	8	5	7
—	9	—	Maximum	2,700	480.0	1,804	0.3	20.0	2,100	1,200	1,545
—	9	—	Minimum	206	10.5	161	0.1	6.0	100	50	230
—	9	—	Median	331	13.0	337	0.2	9.0	184	280	726
—	—	29	Number of samples	26	29	29	15	7	24	15	16
—	—	29	Maximum	2,700	480.0	1,804	17.6	20.0	2,100	1,200	1,545
—	—	29	Minimum	206	7.0	161	0.02	1.9	40	10	20
—	—	29	Median	377	26.0	321	0.5	6.0	106	320	675
—	—	29	Wells above regulatory level	1	1	3	1	2	2	8	15

6.0 Conclusions and Recommendations

6.1 Conclusions

Information gathered and compiled for this study revealed the presence of roughly 2,000 wells within and near the Town limit. The total depth of most wells is known but well construction details, specifically, depth of the screen interval(s), are limited to wells with DWR Well Completion Reports filed by the driller at the time of construction. This dataset has not been thoroughly reviewed to date. While it is reasonable to assume the well screen interval extends to the total depth of the well, the presence of shallow and deep screen intervals in deep wells is largely unknown. This current uncertainty creates a challenge to the characterization of groundwater quality in the Windsor Basin and the lateral and vertical distribution of arsenic concentrations above the MCL.

The study also found that arsenic concentrations are available for a limited number of wells. The lack of arsenic concentrations for more wells and lack of well construction details in deep wells limits the development of a more complete understanding of the potential correlation of arsenic concentrations with temperature, depth, and lithology (i.e., alluvium and the Glen Ellen, Wilson Grove, and Petaluma formations). Groundwater monitoring also indicates that arsenic concentrations can vary from the time of well drilling, well development, and pumping production - further complicating efforts to locate wells in low arsenic areas.

Research conducted in the area by the USGS indicates that lower arsenic concentrations correlate with cooler groundwater which generally occurs at shallower depths for wells constructed in alluvial materials. The alluvium, consisting of clay- to boulder-size materials, ranges in thickness from a few feet along the edges of the valley to at least 600 feet in the valley center where Highway 101 passes through Town. Thicker sections of alluvium support higher well production rates. Deeper water-bearing formations beneath the alluvium, including the Glen Ellen, Wilson Grove, and Petaluma, have variable but typically lower yields, higher temperatures, and higher arsenic concentrations. Data from some wells thought to be constructed in the upper part of the Wilson Grove Formation, however, are some of the most consistently productive wells.

The currently available arsenic concentrations shown on Figure 7 exceed the MCL throughout most of the Town vicinity. However, the available data also indicate an exception in the north to northwestern portion of Town. Arsenic results are available for only one well in this area, but the average arsenic concentration based on 11 to 40 sampling events from 2000 to 2018 is lower than the MCL. This area, which includes the Manchester property and Arata Lane, is near Highway 101 where the axis of the valley and thickness of alluvium would be greater. A second area that may be promising is the southwestern portion of Town near Pool Creek. This area, however, has been identified based only on the absence of arsenic concentrations. Therefore, the results of the Windsor Basin Groundwater Arsenic Study indicate that the northern part of Town closest to the middle of the basin where alluvial deposits are thickest and groundwater temperatures are lower, is the most favorable location for a new off-river water supply well.

6.2 Recommendations

Woodard & Curran recommends further evaluation of the northern part of Town with the objective of identifying the location of a test well site. This evaluation would be conducted in accordance with a Water Quality Study Plan or similar document. The plan would describe the approach, scope, cost, and duration of the evaluation. Additional information to be collected would include available well construction details, lithologic logs to identify the lithology in the well screen intervals, and information on well operation, including pump depth, production rates, dynamic water levels, as possible.

Based on this information, a subset of wells would be ranked for the collection of additional well-specific data and water quality monitoring. Prior to requesting site/well access, a plan or standard operating procedure would be prepared for activities that may include measuring groundwater temperature and other field water quality parameters, collecting groundwater samples for laboratory analysis of arsenic concentration, and possibly some form of well capacity testing. Data analysis would include evaluating potential correlations of arsenic concentrations with location, lithology, depth, and temperature. The recommendation of the study would be the identification of a site(s) for drilling a test well, possibly the Manchester property.

7.0 References

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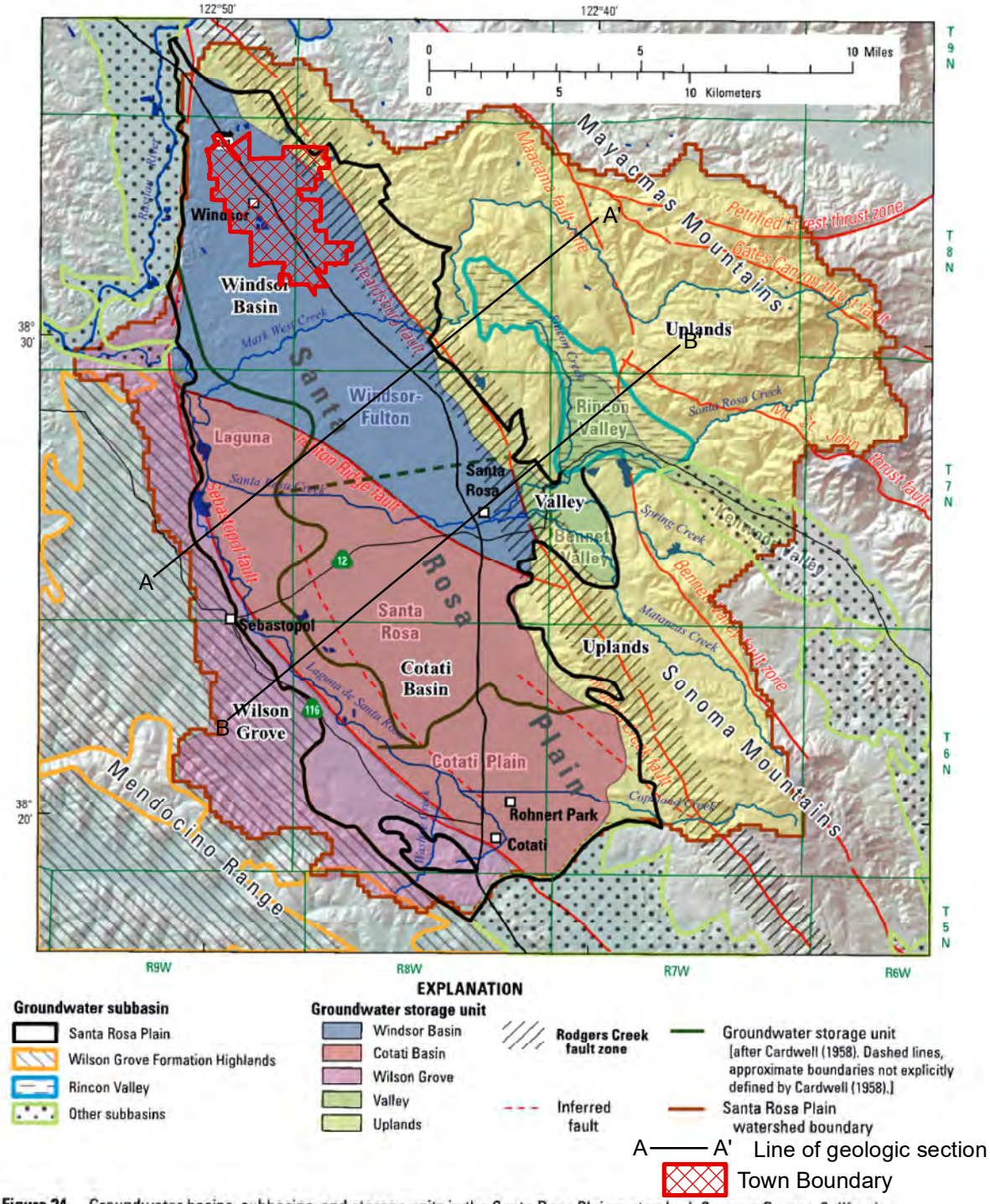


Figure 24. Groundwater basins, subbasins, and storage units in the Santa Rosa Plain watershed, Sonoma County, California.

Groundwater Basins and Subbasins	Source: USGS, 2013a. Modified by Woodard & Curran	Figure 1 WOODARD &CURRAN Project #: 0011187

Figure Exported: 10/16/2019 By: ijaffe Using: \\woodardcurran.net\shared\Projects\RMC\WCR\0143 - Windsor\0011187 2018 WMPG_GIS\Maps\Water Quality TM\Windsor_Figure_1_lj.mxd

Lithologic Cross Sections

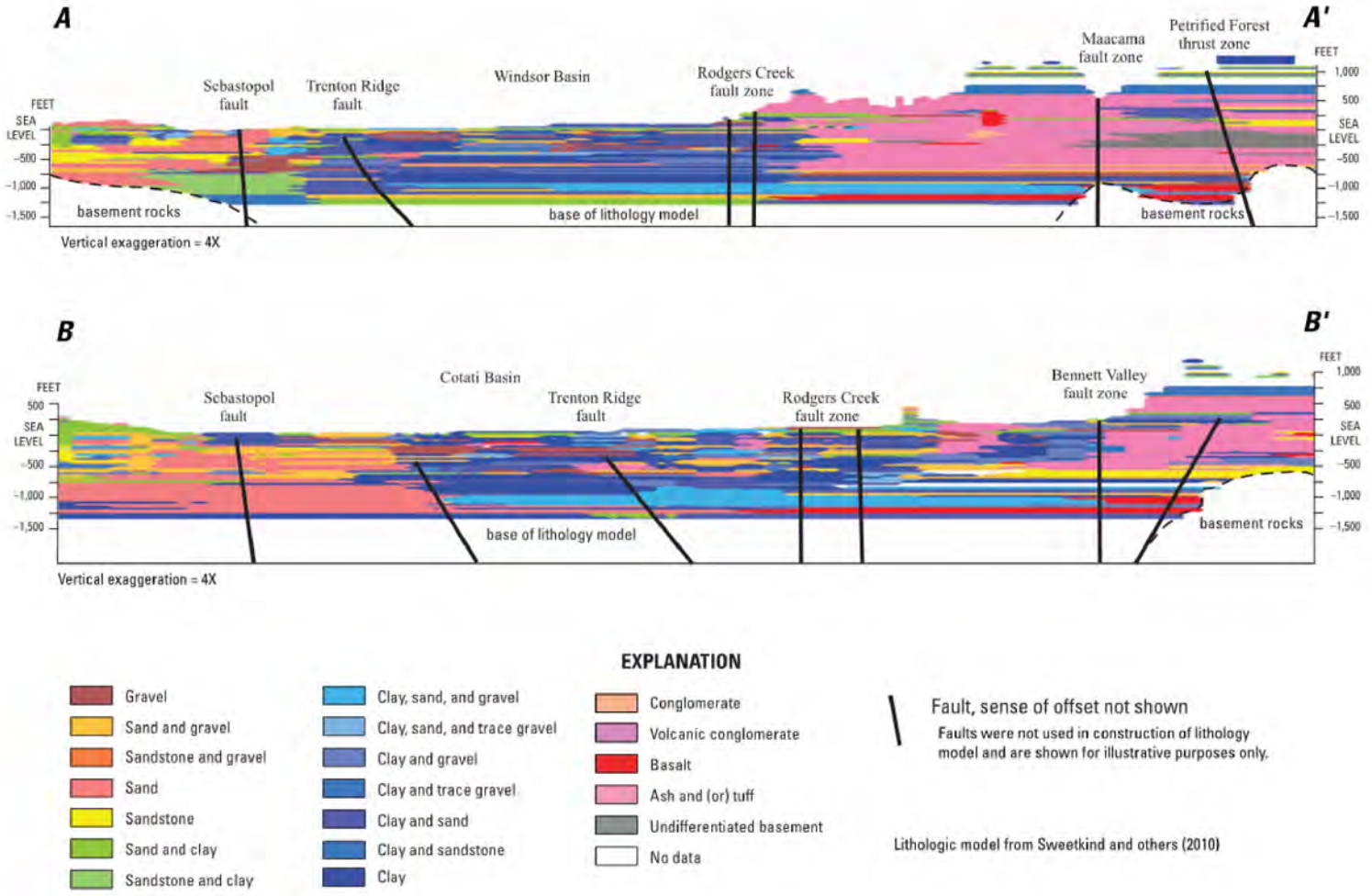


Figure 25. Vertical sections from three-dimensional lithologic model of the Santa Rosa Plain watershed, Sonoma County, California.

Source: USGS, 2013a

Figure 2

WOODARD &CURRAN

Project #: 1234567

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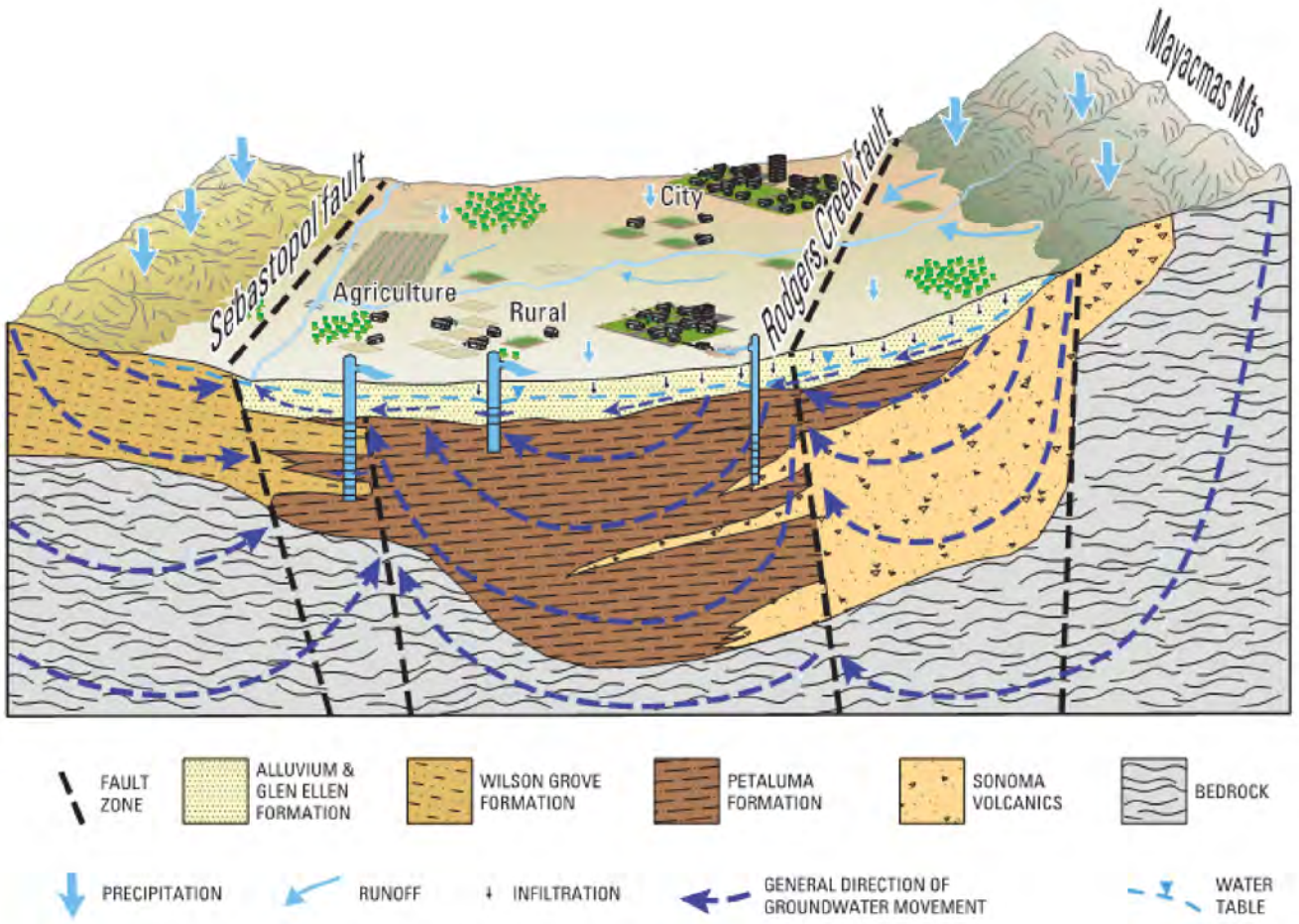


Figure 23. Conceptual diagram of the groundwater system, Santa Rosa Plain watershed, Sonoma County, California.

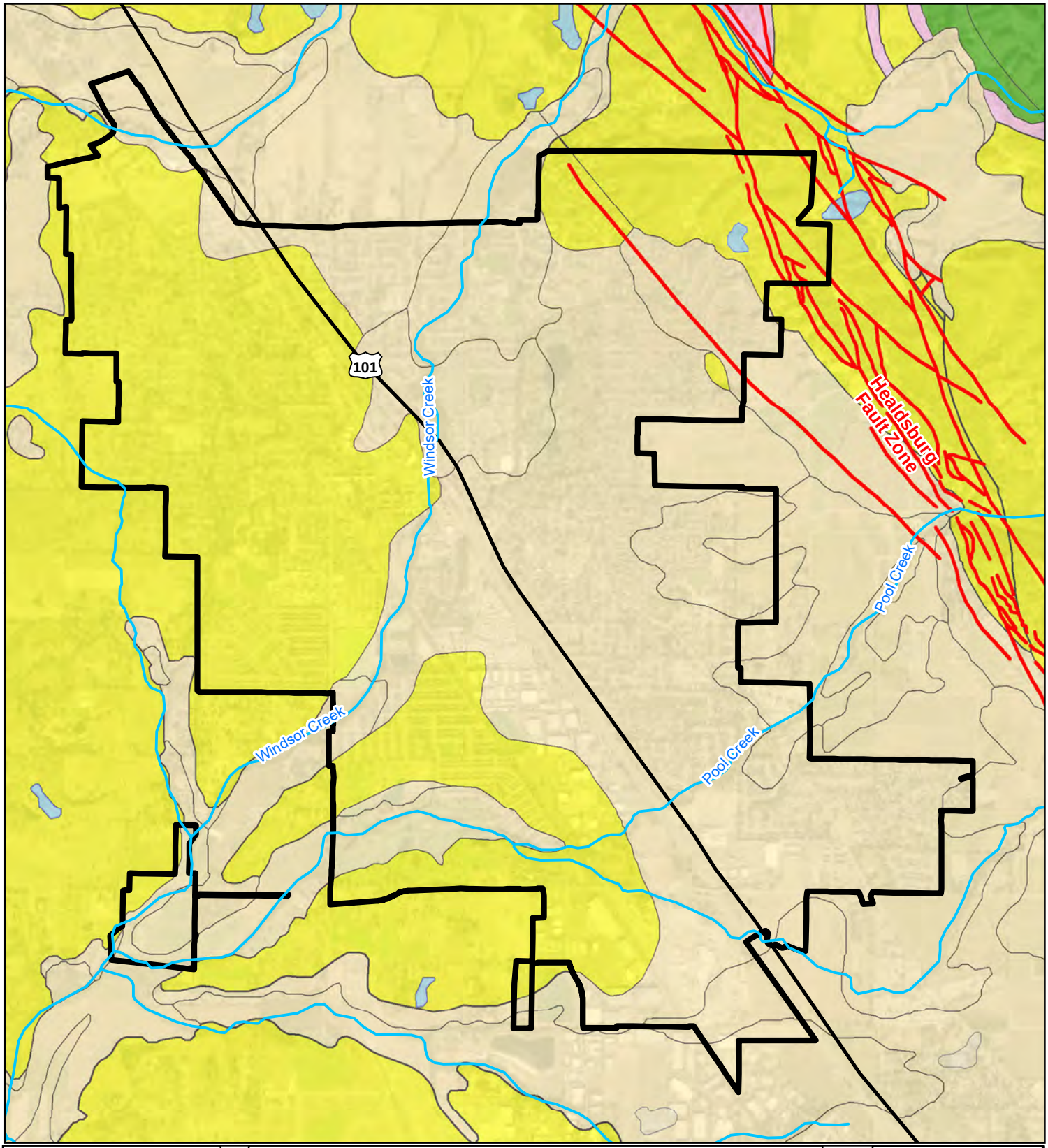
Conceptual Groundwater System Diagram

Source: USGS, 2013a

Figure 3

WOODARD &CURRAN

Project #: 1234567



Geologic Map of the Windsor Basin

Legend

- Town of Windsor
- Creeks
- Highway 101
- Fault Trace

Geologic Units

- Quaternary Deposits
- Glenn Ellen Formation
- Sonoma Volcanics
- Great Valley Sequence
- Water

0 1,500 3,000 Feet

N

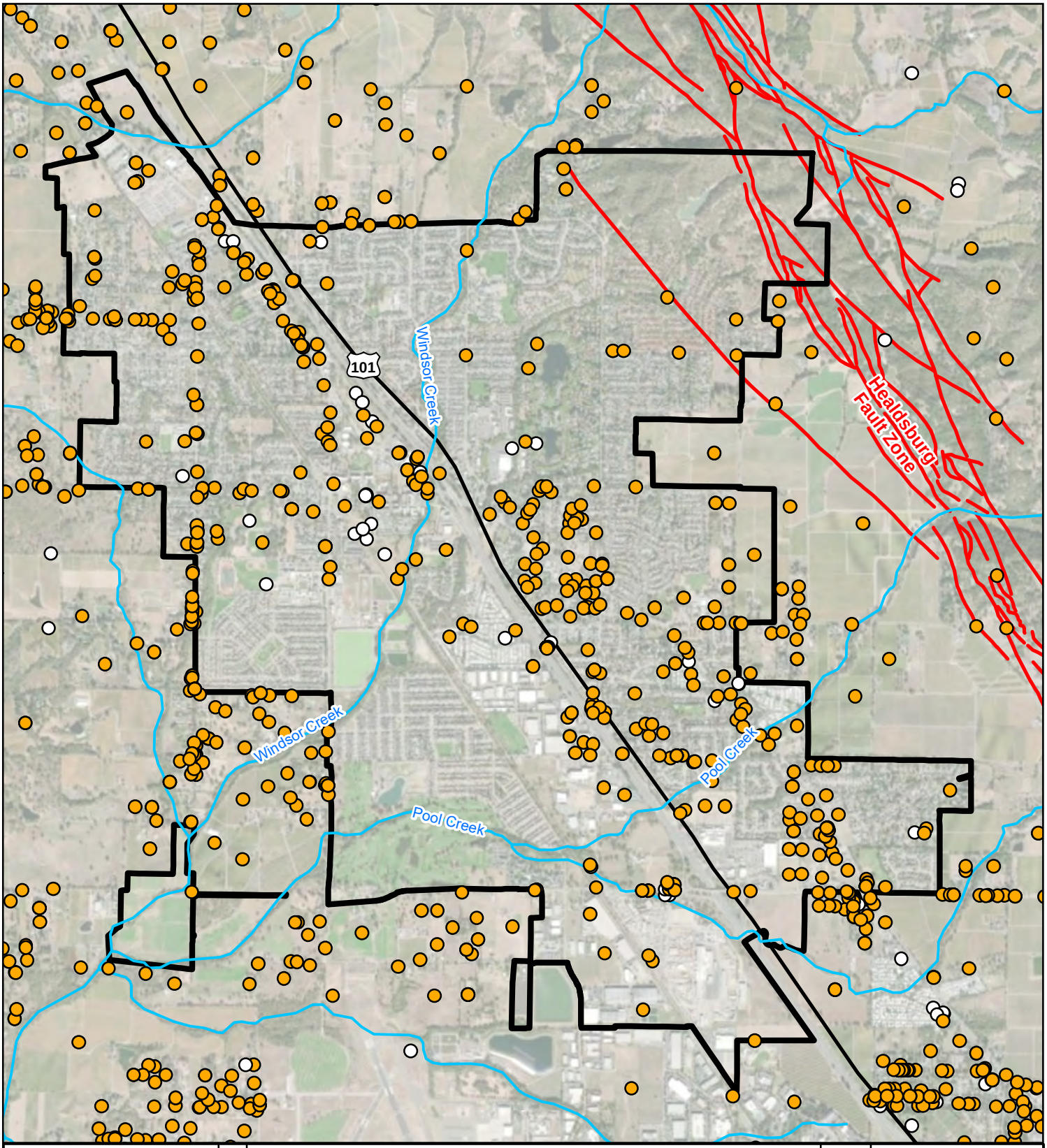
Figure 4

WOODARD &CURRAN

Project #: 0011187
Map Created: Aug. 2019

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Any reliance upon the map or data contained herein shall be at the users' sole risk. **Data Sources: USGS Open-File Report 97-744, USGS Scientific Investigations Map 3410.**



Town of Windsor Wells

2000 - 2018

Legend

- Town of Windsor
- Highway 101
- Creeks
- Fault Trace

All Known Windsor Wells

- Known Depth
- Unknown Depth

Note: Dots may represent multiple wells.

0 1,500 3,000 Feet

N

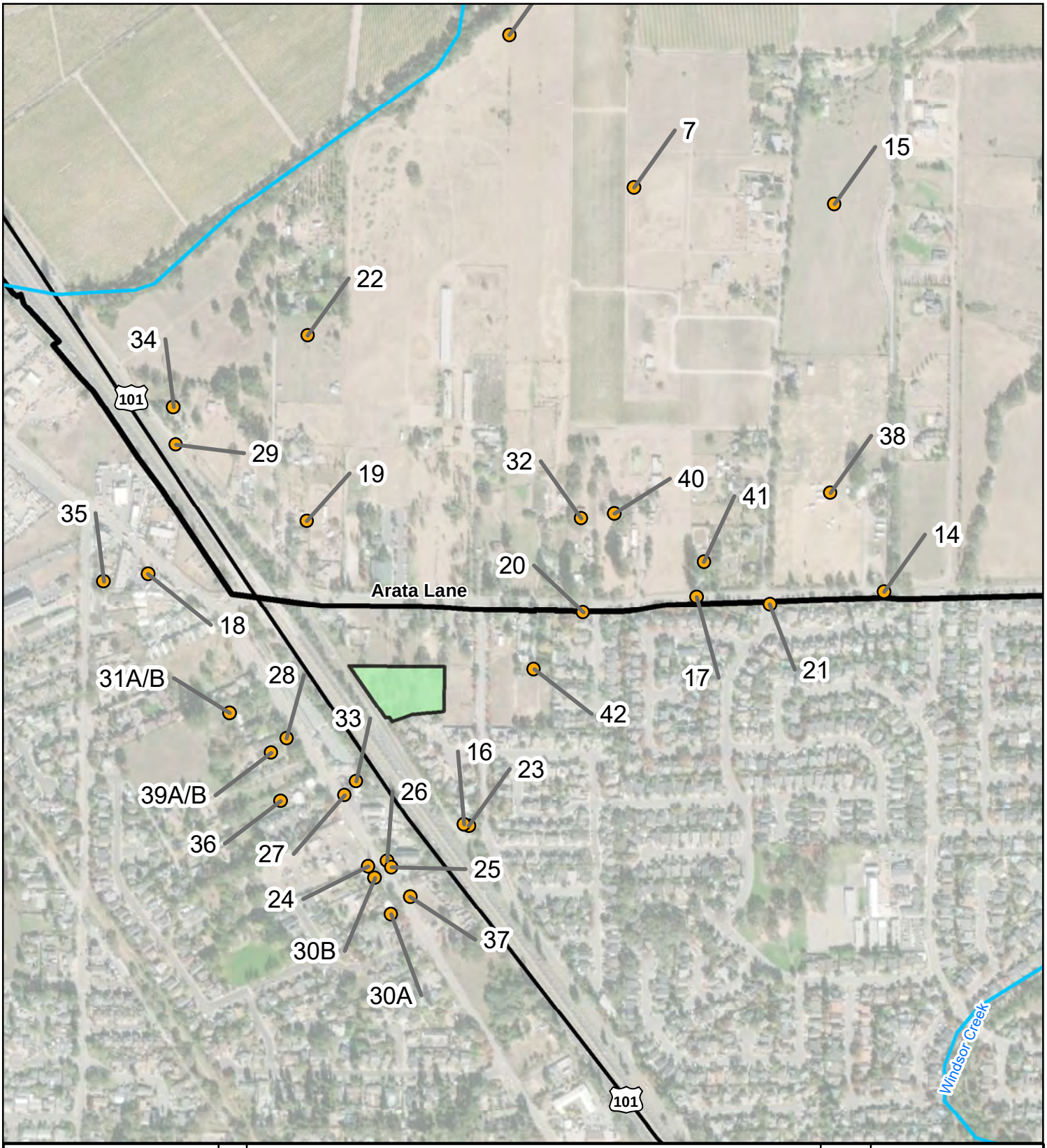
Figure 5

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Any reliance upon the map or data contained herein shall be at the users' sole risk. **Data Sources: DWR, GAMA, NWIS, WQP, USGS Scientific Investigations Map 3410.**



Windsor Wells near Arata Lane

2000 - 2018

Legend

- Well Location
- Town of Windsor
- Manchester Property
- Highway 101
- Creeks

Notes:
1) Well label numbers correspond to the Well IDs in Table 1.
2) Not all wells referenced in Table 1 are shown.
3) Well locations are approximate based on figures provided by the Town of Windsor.

0 375 750 Feet

N

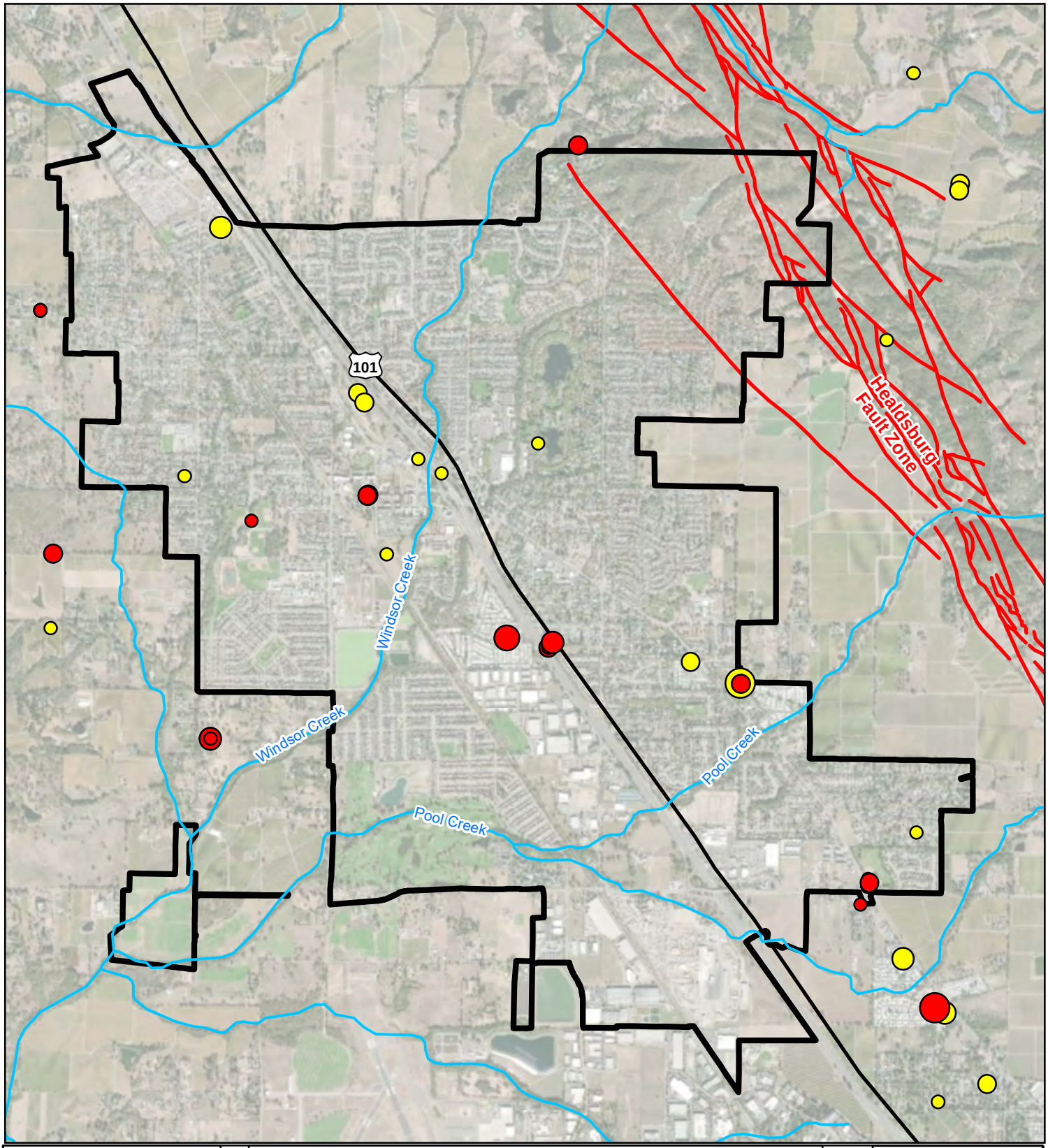
Figure 6

WOODARD &CURRAN

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Average Arsenic Concentrations & Number of Measurements

2000 - 2018

Legend

- Town of Windsor
- Highway 101
- Creeks
- Fault Trace

No. of Measurements

- 1 - 2
- 3 - 5
- 6 - 10
- 11 - 40
- 40+

Avg. Arsenic 2000-2018

- < 10 ug/L
- > 10 ug/L

0 1,500 3,000 Feet

N

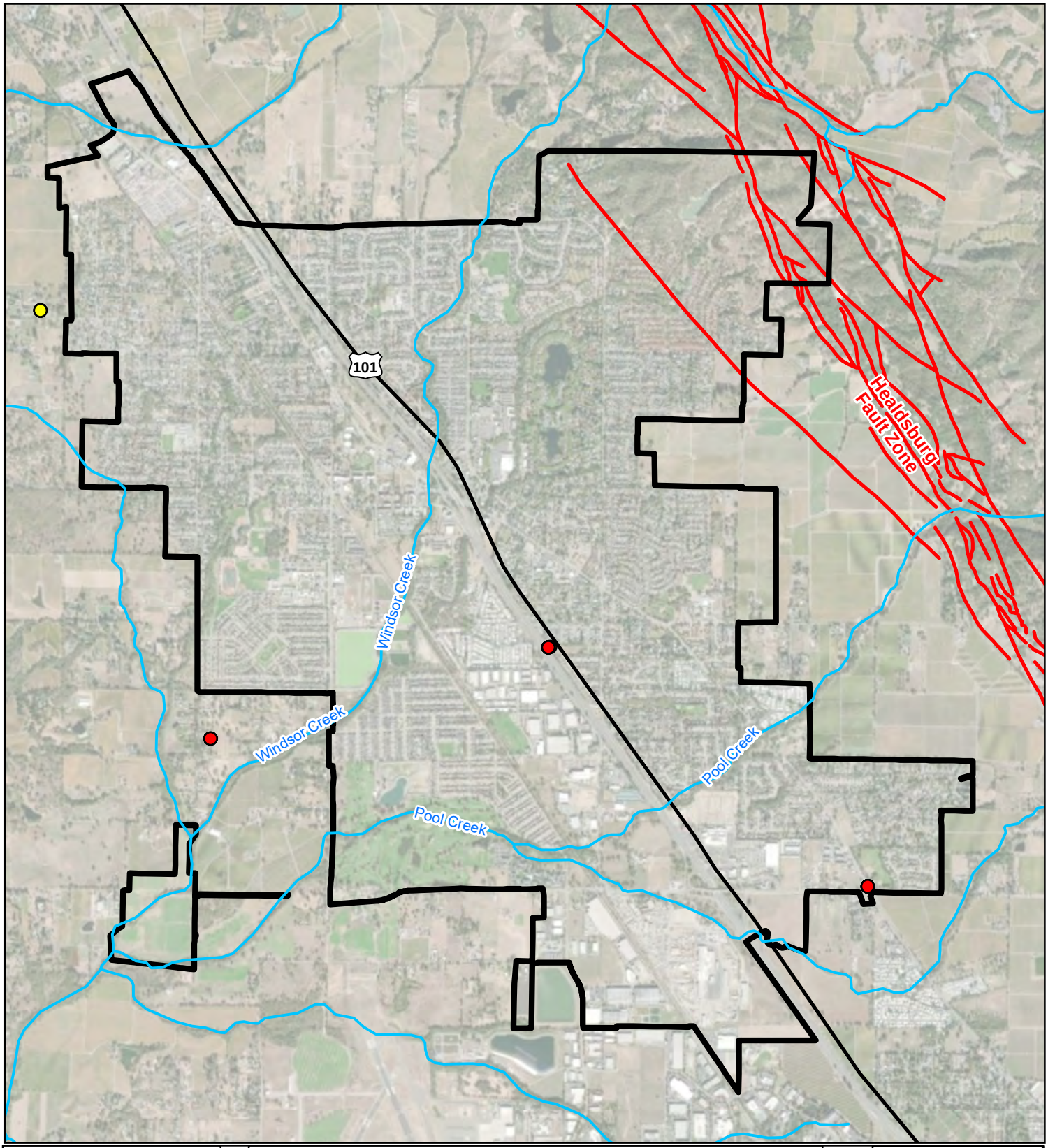
Figure 7

WOODARD &CURRAN

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Any reliance upon the map or data contained herein shall be at the users' sole risk. **Data Sources: DWR, GAMA, NWIS, WQP, USGS Scientific Investigations Map 3410.**



Wells with Arsenic & Temperature Data

2000 - 2018

Legend

- Town of Windsor
- Highway 101
- Creeks
- Fault Trace

Avg. Arsenic 2000-2018

- < 10 ug/L
- > 10 ug/L

0 1,500 3,000 Feet

N

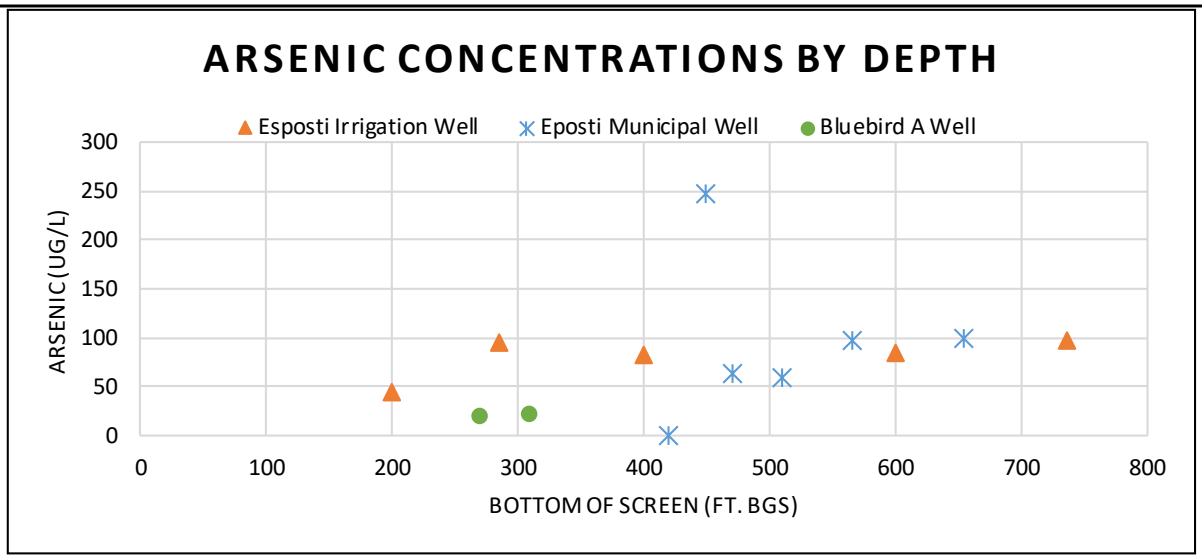
Figure 8

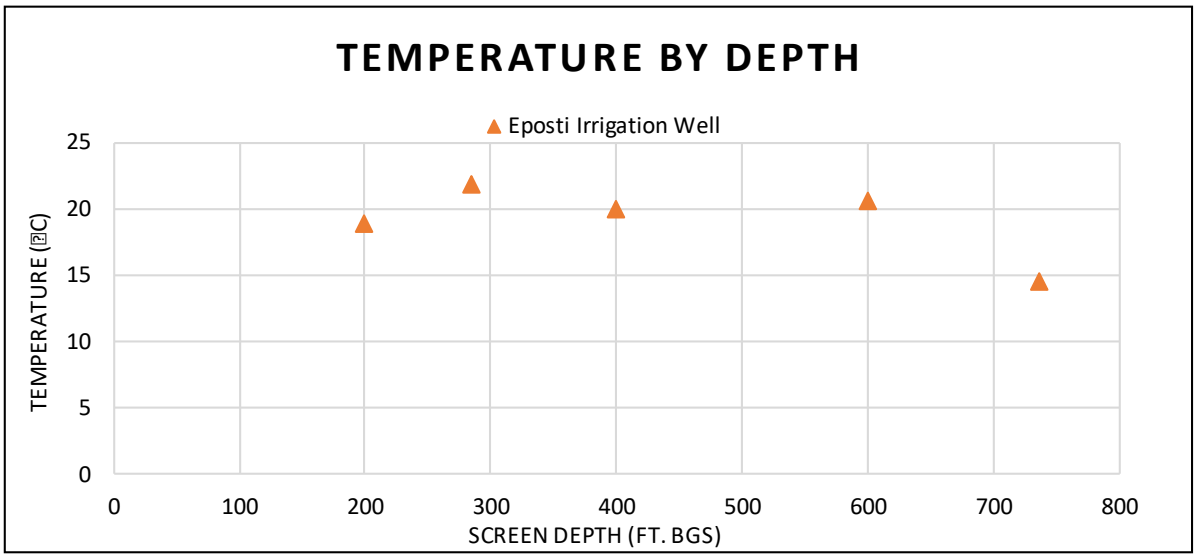
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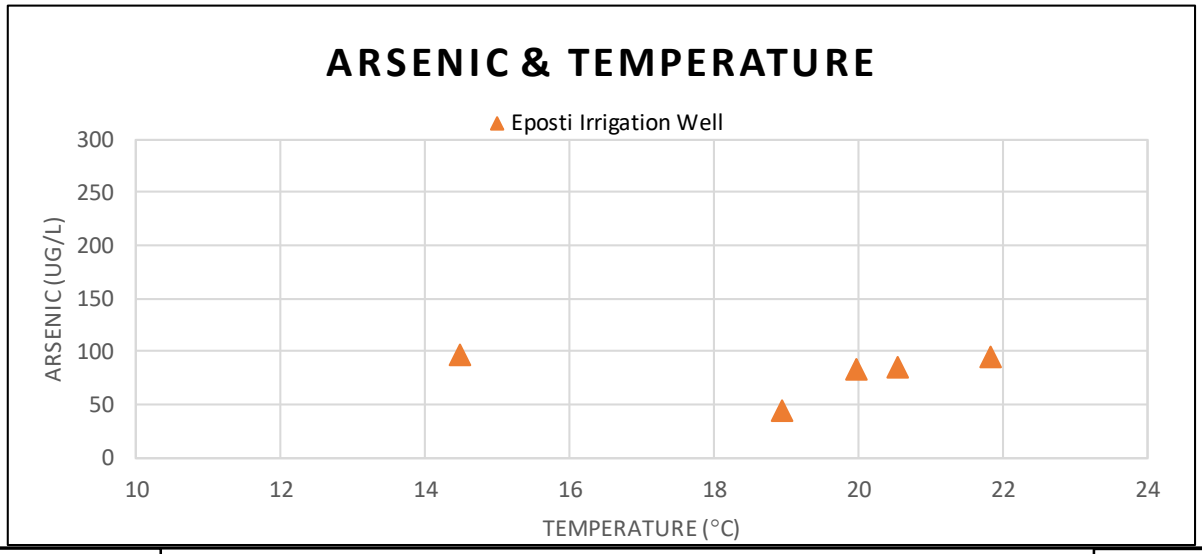
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Any reliance upon the map or data contained herein shall be at the users' sole risk. **Data Sources: DWR, GAMA, NWIS, WQP, USGS Scientific Investigations Map 3410.**







Arsenic Concentration by Depth and Temperature

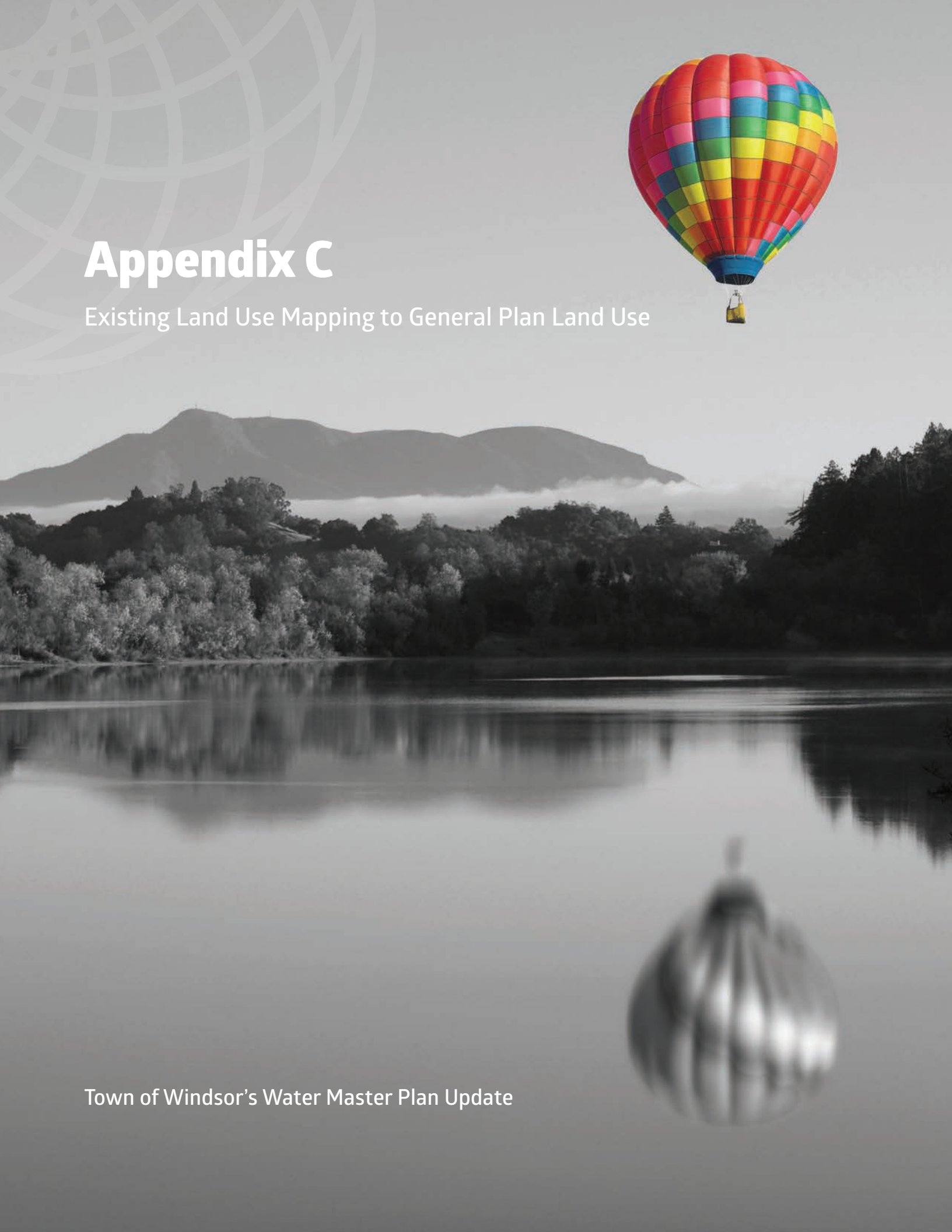
Sources:
RMC, 2009a; RMC 2009b; BESST, 2017b.

Figure 9

WOODARD &CURRAN

Project #: 0011187
Graphs Created: Aug. 2019

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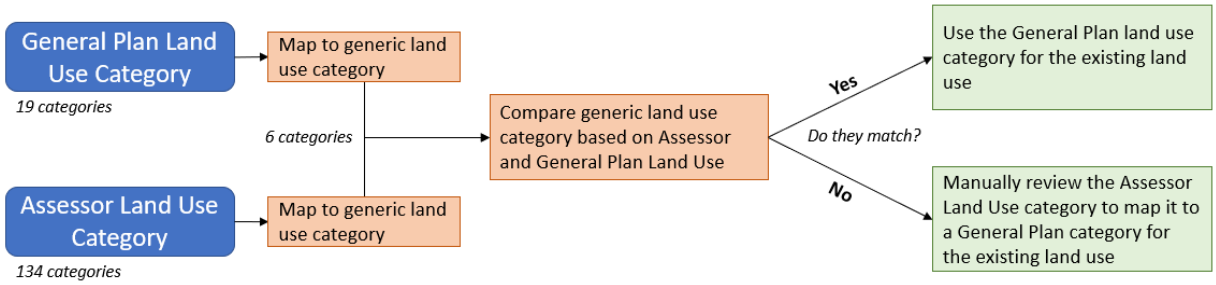
Appendix C

Existing Land Use Mapping to General Plan Land Use

Town of Windsor's Water Master Plan Update

APPENDIX C: EXISTING LAND USE MAPPING TO GENERAL PLAN LAND USE

Existing Land Use Designation Process



Mapping General Plan Land Use Categories to Generic Use Categories

General Plan Land Use Category	Generic Land Use Category
Rural Res	Single Family Residential
Estate Res	Single Family Residential
Very Low-Density Res	Single Family Residential
Low Density Res	Single Family Residential
Mobile Home Park	Single Family Residential
Med Dens Res	Multi-Family Residential
High Density Res	Multi-Family Residential
Boulevard Mixed Use	Commercial
Neighborhood Center/Mixed	Commercial
Town Center Mixed Use	Commercial
Retail Commercial	Commercial
Gateway Commercial	Commercial
Service Commercial	Commercial
General Business	Commercial
Light Industrial	Industrial
Heavy Industrial	Industrial
Public/Quasi Public	Other
Park and Rec	Irrigation
Open Space	Irrigation

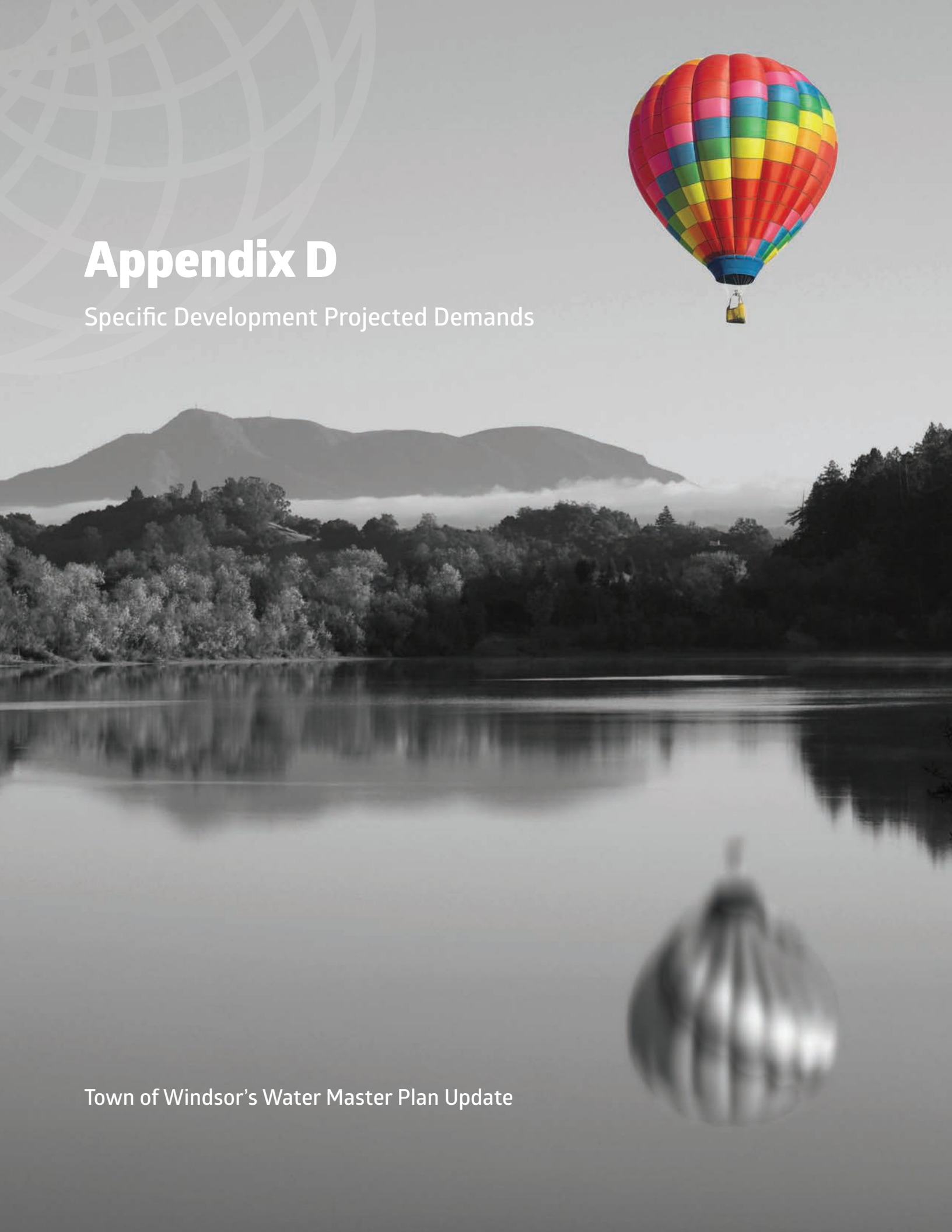
Mapping Tax Assessor Land Use Categories to Generic Use Categories

Assessor Use Code Description	Generic Land Use Category
11-20 Res Unit/2+ Structures	Multi-Family Residential
21-40 Units	Multi-Family Residential
3 Units/2+ Structures	Multi-Family Residential
4 Units/2+ Structures	Multi-Family Residential
4-100 Units	Multi-Family Residential
5-10 Res Units/2+ Structures	Multi-Family Residential
Attached Unit	Single Family Residential
Auto and Truck Repair and Maintenance	Commercial
Auto Sales with Service Center	Commercial
Bank	Commercial
Bowling Alley	Commercial
Bulk Plant	Commercial
Cemetery	Commercial
City Park/Other Rec Facility	Commercial
Club/Lodge Hall	Commercial
Com'l Common Area/Not in CTR	Commercial
Com'l Use/No Other Category	Commercial
Common Area w/Roads & Streets	Single Family Residential
Common Area With Structures	Single Family Residential
Common Area Without Structures	Single Family Residential
Condominium Unit	Single Family Residential
County Flood Control/Wtr Agcy	Commercial
County Park/Other Rec Facility	Commercial
Dance Hall	Commercial
Dental Offices	Commercial
Detached Unit in PUD	Single Family Residential
Duet	Single Family Residential
Enforceably Restricted Dwelling	Single Family Residential
Fast-Food Restaurant	Commercial
Fire District	Commercial
Full Service Station	Commercial
Grocery Store	Commercial
Home for Handicapped (Physical, Mental, Etc.)	Commercial
Hotel With Restaurant	Commercial
Indiv PCL Within Community CTR	Commercial
Indiv PCL/Neighborhood Shop CTR	Commercial
Industrial Common Area	Industrial
Industr'l in No Other Category	Industrial

Assessor Use Code Description	Generic Land Use Category
Irr Vineyd/Premium W/Res	Irrigation
Irrigated Pasture w/Residence	Irrigation
Irrigated Vineyard	Irrigation
Light Manufacturing & Industrial	Industrial
Light Manufacturing & Warehousing	Industrial
Lot w/Misc Res Improvements	Single Family Residential
Manufactured Home on Urban Lot	Single Family Residential
Manufactured Home Park	Commercial
Medical Dental Complex	Commercial
Medical Offices	Commercial
Mini-Warehouse	Commercial
Misc County Property	Commercial
Misc Multiple Use/None Dominate	Commercial
Miscellaneous City Property	Commercial
Miscellaneous District	Other
Miscellaneous State Property	Commercial
Mixture w/Residence or Manufactured Home	Irrigation
Mortuary/Funeral Home	Commercial
Motel/Long Term Occupancy	Commercial
Motel/Over 50 Units	Commercial
Multi-Offices/Residential Units	Commercial
Multiple Combo/Stores & Office	Commercial
Multiple Stores in 1 Structure	Commercial
Multiple Story Store	Commercial
Municipal Utility Property	Other
Neighborhood Shopping Center	Commercial
Non-Irr Vineyard/Varietals w/Res	Irrigation
Non-Irrigated Orchard W/Res	Irrigation
Office Condominium Unit	Commercial
One Duplex (One Structure)	Single Family Residential
One Store & One Office	Commercial
One Story Office Building	Commercial
Other Sales: Trailers, MBH, RV	Commercial
Parking Lot/No Fee	Commercial
Pasture	Irrigation
Private Road	Single Family Residential
Prof'l Off Condo Unit/Non-Ind	Commercial
Raw Subdivision Land	Single Family Residential
Religious Building	Commercial

Assessor Use Code Description	Generic Land Use Category
Rest Home	Commercial
Restaurant	Commercial
Retail Lumber Yard	Commercial
Right-of-Way	Single Family Residential
Rural Res SFD w/Granny Unit	Single Family Residential
Rural Res W/Misc Res Imp	Single Family Residential
Rural Res/2 or more Res	Single Family Residential
Rural Res/Manufactured Home	Single Family Residential
Rural Res/Secondary Use	Single Family Residential
Rural Res/Single Res	Single Family Residential
Rural Res/Vacant Home Site	Single Family Residential
SBE-Valued Utility	Commercial
School District Property	Other
Self Service Car Wash	Commercial
Service Station/Mini-Mart	Commercial
SFD Converted to Res Care Fac	Multi-Family Residential
SFD Non-Conforming Use	Single Family Residential
SFD Secondary Use	Single Family Residential
SFD W/Granny Unit	Single Family Residential
Single Family Dwelling	Single Family Residential
Single Fourplex	Multi-Family Residential
Single Live/Work Unit	Single Family Residential
Single Story Store	Commercial
Single Triplex 3 Units/1 Struc	Multi-Family Residential
Special School	Other
Specialty Lumber Products	Industrial
Specialty Shop (Tires, Brakes)	Commercial
Store w/Res Unit or Units	Commercial
Supermarket	Commercial
Taxable Manufactured Home/Rented Site	Single Family Residential
Trailer Park	Commercial
Two SFD on Single Parcel	Single Family Residential
Two Story Office Building	Commercial
Undefined Commercial Use	Commercial
Undefined Industrial Shell	Industrial
Undev Industrial Lnd/No Util	Industrial
Used Car Lot	Commercial
Vacant City Land	Vacant
Vacant Commercial Land W/Util	Vacant

Assessor Use Code Description	Generic Land Use Category
Vacant Commercial Land/Undeveloped	Vacant
Vacant County Land	Vacant
Vacant Industrial Land/W Util	Vacant
Vacant Land With Problems	Vacant
Vacant Lot Zoned for 2 Units	Vacant
Vacant Lot, May Not Be Buildable	Vacant
Vacant Lot, Totally Unusable	Vacant
Vacant Lots Zoned Apartments	Vacant
Vacant Res Lot Undevel W/Util	Vacant
Vacant Residential Lot/Undevel	Vacant
Veterinary Hospitals	Commercial
Warehousing Condominium	Commercial
Warehousing Yard	Commercial
Warehousing/Active	Commercial
Warehousing/Inactive	Commercial
Wasteland	Irrigation
Winery	Industrial



Appendix D

Specific Development Projected Demands

Town of Windsor's Water Master Plan Update

APPENDIX D: SPECIFIC DEVELOPMENT PROJECTED DEMANDS

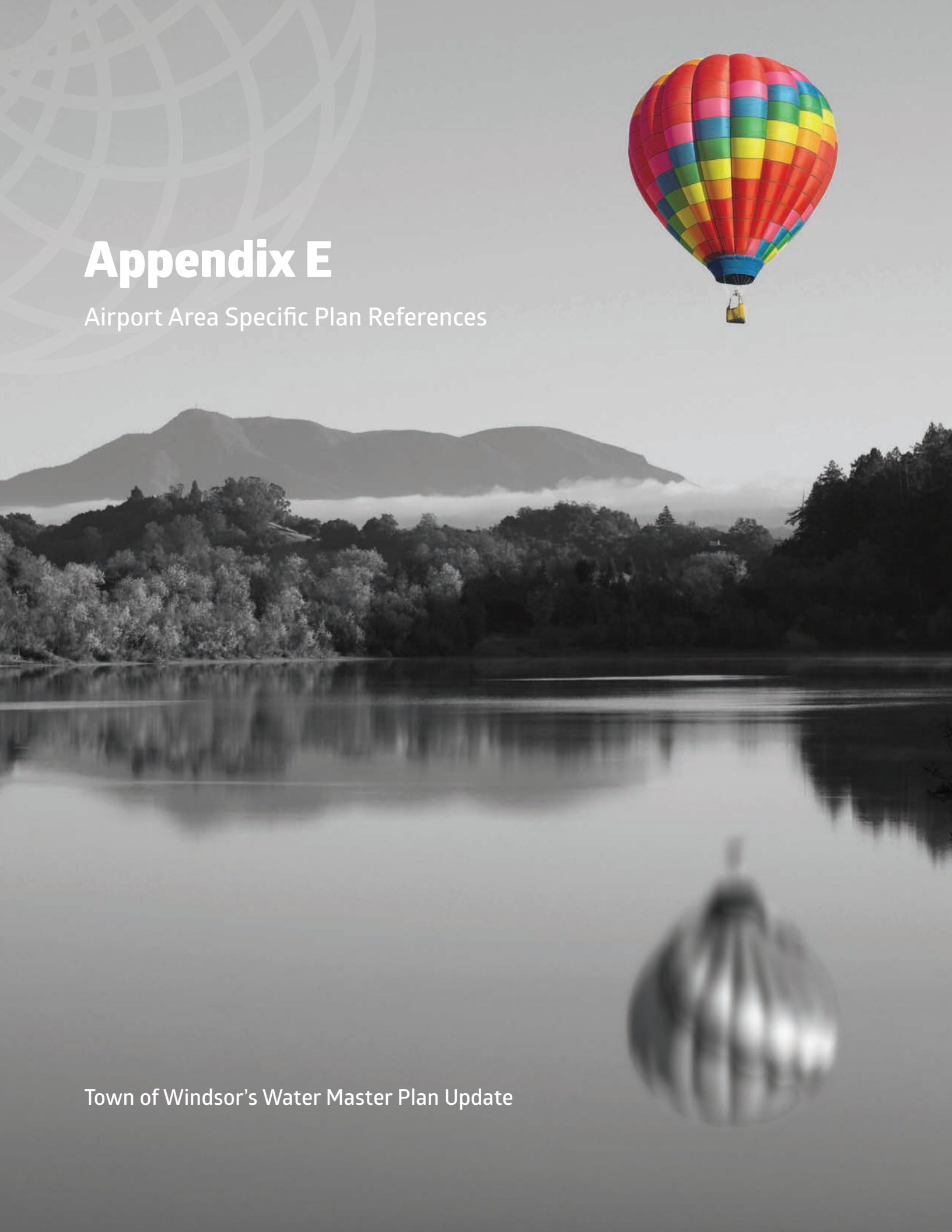
Specific Development Projected Demand Summary

No.	Development Name	Residential Land Use	Non-Residential Land Use	Residential Units (DUs)	Residential Area (Acres)	Non-Residential Area (Acre)	Estimated Average Demand (gpd)[1]
1	Victoria Oaks	LDR	N/A	87	17.0	0.0	14,790
2	Esposti Park Place (Built)	HDR	N/A	36	3.8	0.0	3,600
3	Holiday Inn (Built)	N/A	BMU	20	0.0	1.5	7,647[2]
4	Grand Cru Winery (Built)	N/A	LI	0	0.0	8.6	13,713[3]
5	Encore Events	N/A	LI	0	0.0	4.4	1,671
6	Russian River Brewery (Built)	N/A	LI	0	0.0	14.8	24,256[4]
7	Bell Village Commercial (Built)	N/A	RC	0	0.0	6.7	4,836
8	Vintage Oaks on the Town Green	HDR	N/A	387	18.4	0.0	38,700[5]
9	Overlook	VLDR	N/A	12	5.8	0.0	2,880
10	Windsor Live/Live	MDR	N/A	24	1.2	0.0	2,640
11	Richardson Street Mixed-Use	HDR	TC	30	0.3	0.6	3,598
12	280 Arata Ln	LDR	N/A	7	1.8	0.0	1,190
13	330 Arata Lane	LDR	N/A	6	2.0	0.0	1,020
14	6500 Old Redwood Highway	VLDR	N/A	8	1.8	0.0	1,920
15	The Oaks	LDR	N/A	31	2.9	0.0	5,271
16	Creekwalk	VLDR	N/A	24	4.5	0.0	5,760
17	Draper Estates	ER	N/A	5	23.4	0.0	1,900
18	Duncan Village	LDR	N/A	16	1.4	0.0	2,720
19	Mill Creek Apartments	HDR	N/A	360	20.4	0.0	36,000
20	Windsor Veteran Village	HDR	N/A	60	6.0	0.0	6,000
21	Hembree Lane Subdivision	MDR	N/A	25	5.3	0.0	2,750
22	Sky	HDR	N/A	20	0.8	0.0	2,000
23	Heritage Park	HDR	N/A	31	1.6	0.0	3,100
24	Jensen Lane Annexation and Subdivision	LDR	N/A	250	59.0	0.0	42,500
25	Chevron Remodel	N/A	RC	0	0.0	1.4	1,015
26	Wine Country RV Park	MHP	N/A	36	2.1	0.0	5,040
27	REVEL	HDR	BMU	159	4.9	1.0	17,913

No.	Development Name	Residential Land Use	Non-Residential Land Use	Residential Units (DUs)	Residential Area (Acres)	Non-Residential Area (Acre)	Estimated Average Demand (gpd)[1]
28	Town Green Hotel	N/A	TC	49	0.0	1.9	9,837
29	North of Arata Annexation	LDR	GC	850	146.2	0.0	144,500
30	North Annexation School	N/A	PQ	0	0.0	25.1	10,548
31	Carnation/ATP	N/A	LI	0	0.0	20.0	7,595
32	Lytton	LDR	N/A	*Not considered for the WMP.*			
33	Civic Center Block A	N/A	TC	177	0.0	6.9	15,658[6]
34	Town Hall Expansion	N/A	PQ	0	0.0	1.3	532
35	Micro-Vu	N/A	OS	0	0.0	20.0	0
36	Vicini	N/A	TC	282	9.0	2.0	27,137[7]
37	Winery	N/A	LI	0	0.0	3.3	117,287[8]
38	Mini-Storage	N/A	LI	0	0.0	0.0	4
39	Den Beste Warehouse	N/A	LI	0	0.0	0.8	304
40	LaFort	N/A	LI	0	0.0	1.1	402
41	The Artisan	HDR	N/A	64	2.7	0.0	6,400
42	Shiloh Road Mixed Use	HDR	RC	33	0.0	1.71	4,040
			Total	3,264	441	123	598,674

Note:

1. Demands estimated based on the land use-based projection methods detailed in Section 3.3.2.
2. Demand estimate for the Holiday Inn based on 104 rooms and a per room demand factor (70 gpd/room) as discussed in Section 3.3.2.
3. The demand for the Grand Cru Winery was estimated based on the development estimate of a 25,000 cases per year production facility and a 5:1 water to wine ratio as discussed in Section 3.3.2.
4. The demand for the Russian River Brewery was estimated based on the development estimate of a 60,000 barrel per year production facility and a 3:1 water to beer ratio as discussed in Section 3.3.2.
5. Demand estimate for Town Green Hotel based on 134 rooms and a per room demand factor (70 gpd/room) as discussed in Section 3.3.2.
6. Demand estimate for Civic Center Block A based on 200 rooms and a per room demand factor (70 gpd/room) as discussed in Section 3.3.2.
7. Demand estimate for Vicini based on 350 rooms and a per room demand factor (70 gpd/room) as discussed in Section 3.3.2. The number of hotel rooms used as the estimate is meant to capture potential other demands on the parcel as well.
8. The demand for the Winery was estimated based on the development estimate of a 250,000 cases per year production facility and a 5:1 water to wine ratio as discussed in Section 3.3.2.



Appendix E

Airport Area Specific Plan References

Town of Windsor's Water Master Plan Update

APPENDIX E: AIRPORT AREA SPECIFIC PLAN REFERENCES

permit SONOMA

County of Sonoma
Permit & Resource Management Department

6/19/2019 SENT VIA EMAIL

Ken MacNab
Windsor Water District General Manager
8400 Windsor Road
Town of Windsor, CA

Toni Bertolero
Windsor Water District Engineer
8400 Windsor Road
Town of Windsor, CA

Re: **Subject:** **Airport Area Specific Plan, Water Supply Assessment Request**
File No.: SPA19-0001
Location: County of Sonoma, Windsor Water District Service Area

Mr. MacNab,

The County of Sonoma is in the process of updating the 1984 Airport Industrial Area Specific Plan and programmatic Environmental Impact Report. The updated Sonoma County Airport Area Specific Plan will build upon the foundation set by the existing plan to support a predominantly industrial land use framework; the updated plan has also identified opportunities for residential and commercial development in predefined areas consistent with the goals of the 1984 plan and the county's current goal of addressing the regional housing crisis. The updated plan includes urban design standards and guidelines as well as circulation improvements to support the anticipated buildout of the approximately 810 acre project area. Consistent with State law, the updated Specific Plan will identify the infrastructure improvements that are necessary to support buildout and outline a viable financing and implementation strategy. The programmatic EIR will address the environmental impacts associated with anticipated buildout.

The County is requesting a Water Supply Assessment from the Town of Windsor Water District, service provider of the Plan Area. The requested Water Supply Assessment is requested consistent with SB 610 to ensure that water supply is sufficient for 20 year projections of existing and planned uses, including water conservation measures and corresponding infrastructure improvements.

Project Description
The Specific Plan will include a comprehensive set of goals, objectives, policies, and implementation measures including an infrastructure funding plan. To reflect changes in the availability of transit in the Plan Area, many of the changes in the Specific Plan are within a ½-mile of the new SMART station, including the Airport/Aviation Boulevard intersection. With the inclusion of the Workforce Housing (WH) Affordable Housing (AH) Combining Districts, the project will streamline opportunities for housing on select parcels including limited industrial and commercial parcels east of the train tracks and approximately 40 acres of limited industrial land north of Airport Boulevard between Brickway and

Skylane Boulevards. Land use designations in the area surrounding the SMART station will be amended to recognize existing commercial uses and achieve a mixed-use development pattern with a tighter street grid east of the railroad tracks.

The Specific Plan will retain the industrial land use designations and zoning that currently apply with the exception of parcels being designated to match existing uses and parcels being partially converted to a limited industrial use. In total, approximately 16 acres of land is proposed for conversion from General Industrial (GI) to Limited Industrial (LI). The Specific Plan expands and consolidates commercial areas into a single General Commercial (GC) designation to allow more flexibility for commercial activity and to recognize commercial, service, and retail activities already occurring in the area. The proposed General Commercial area spans slightly over 15 acres and overlaps with 11 acres of opportunity sites identified in the Market Study for the Plan Area.

The Specific Plan proposes to adjust the southeastern boundary of the Urban Service Area (USA) along Mark West Creek to include additional parcels, which will help provide water, wastewater, and other services to the existing mobile home residences (Stonegate Mobile Home Park) and support potential residential development on an undeveloped parcel located west of the mobile home park.

The proposed Specific Plan identifies suitable sites where the Affordable Housing (AH) and Workforce Housing (WH) Combining Districts are appropriate and feasible. The Affordable Housing and Workforce Housing Districts provide the flexibility to develop housing without otherwise changing allowed uses or modifying the base zoning district of the site. The 8.4-acre undeveloped Land Intensive Agriculture (LIA) lot adjacent to Stonegate Mobile Home Park in the southeast of the planning area is proposed to be adjusted to the Urban Residential (UR) General Plan land use designation (and R3 zoning designation). The Urban Residential (UR) designation would enable high-density housing on the parcel consistent with other nearby residential uses and densities including the Mobile Home Park and Vineyard Creek Apartments. The base Urban Residential (UR) designation would allow a residential density of up to 22 units per acre, however, future development may utilize the Affordable Housing (AH) Combining District on this site to achieve a density of up to 24 units per acre. See Table 1.1-1, below, for an overview of the Specific Plan Buildout.

Table 1.1-1 Specific Plan Buildout Overview

Land Use Category	Plan Acres	Potential New Development	
Residential (du)	82.9	896 du	
Light Industrial (sf)	244	1,032,355 sf	
Heavy Industrial (sf)	120	554,602 sf	
Retail (sf)	3.4	15,202 sf	
Office (sf)	87.5	282,939 sf	
Lodging Accommodations	8	200 rooms	
Institutional (sf)	66	0	
Agricultural/Conservation	41	--	
Open Space	17	--	
ROWs, Parking, Creeks	140.2	--	
Total	810 acres	896 du	1,586,957 sf industrial
		282,939 sf commercial	200 rooms
Notes: du = dwelling units, sf = square feet			

Buildout Projection

From a baseline of 2020 we expect approximately 70 percent of all residential development to be built in the first five years and the remainder to be implemented in steady increments across the remaining time as shown in the table below. We also expect all of the hotel/lodging to be developed in the first 5 years. The projected development in other land use categories is expected to have even growth over the 20 year projection.

Land Use	2020-2025	2025-2030	2030-2035	2035-2040
Residential (units)	630	116	75	75
Lodging (rooms)	200	-	-	-
Industrial (sf)	396,740	396,739	396,739	396,739
Retail and Service (sf)	70,734	70,733	70,734	70,733

Please contact Project Planner, Cecily Condon at (707) 565-1958, Cecily.Condon@sonoma-county.org with further correspondence.

Sincerely,

Milan Nevajda
Deputy Director, Planning
Permit Sonoma

WATER DEMAND ESTIMATES

AIRPORT AREA SPECIFIC PLAN

Sonoma County

PREPARED BY:

MAY 18, 2018
REVISED DECEMBER 17, 2018
REVISED JANUARY 31, 2019
REVISED FEBRUARY 13, 2019
REVISED JUNE 12, 2019

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WATER DEMAND ESTIMATES METHODOLOGY

This report provides the assumptions and methodology used to estimate the existing and projected water demands of the Airport Area Specific Plan, to which Windsor Water District (henceforth, the "District") is the water purveyor.

Existing water demand is generated by established uses within the Specific Plan area including residential, commercial (automotive, retail, office, and medical), institutional, irrigation and industrial uses, all of which are presumed to be accounted for in the Town of Windsor's 2015 Urban Water Management Plan (UWMP).[1]

Tables A-1 through A-8 in **Appendix A** quantify the difference between the existing water demand within the planning area (Tables A-1 and A-2) and the water demand under two scenarios; at buildout of the existing Specific Plan (i.e. the business-as-usual (BAU) scenario[2] in Tables A-3 through A-5) and the water demand with buildout of the proposed update (i.e. the Preferred Alternative) to the Specific Plan (Tables A-6 through A-8).

Using the highest reported water year, 2012 for the period between 2010 and 2017 (**Appendix F**), the estimated water demand generated by established uses within the plan area is 368 AF/Y. The total projected annual water demand at full buildout of the "***BAU scenario,***" is projected to be 780 AF/Y. Implementation of the proposed "***Preferred Alternative***" for the Specific Plan is projected to generate a total annual water demand of 875 AF/Y. Thus, the BAU scenario and Preferred Alternative scenarios are projected to increase water demand relative to existing demands (2012) by 412 AF/Y and 507 AF/Y, respectively.

The methodology, techniques, and assumptions that were utilized in quantifying water demand estimates for all land uses described in the Preferred and BAU Alternatives in the Specific Plan area are set forth below.

EXISTING WATER DEMAND

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1 Final 2015 Urban Water Management Plan Town of Windsor Water District, prepared by GHD, June 2016.

2 The BAU Alternative does not include integration of APNs 059-240-067 and 059-230-060 into the plan area. These properties are currently located beyond the Urban Service Area and beyond the Windsor Water District Service Area. No new residential development is anticipated within the BAU Alternative. The Preferred Alternative anticipates that these parcels will be integrated into the plan area; APN 059-240-067 is a vacant site that is anticipated to be zoned for R3 residential, and APN 059-230-060 is anticipated to be zoned R1 to more accurately reflect the existing use as Stonegate Mobile Home Park.

The Airport Area Specific Plan includes existing uses that currently generate water demand. Existing development in the planning area, derived from the County Assessor record, that is served by the District includes the following (weighted average floor area ratios (FAR) for each use is provided in parentheses):

- 952,274 square feet of commercial, retail, and office uses (FAR: 0.43): [3]
- 80,900 square feet of medical facility uses (FAR: 0.5)
- 52,498 square foot of hotel use (90 rooms) (FAR: 0.65)
- 2,732,704 square feet of industrial uses (FAR: 0.34)
- 80,000 square feet of institutional uses (schools) (FAR: 0.13), and
- 249,590 square feet of residential uses (232 units at Vineyard Creek Apartments) (FAR: 0.70)

Existing development in the planning area that is served by groundwater includes the following:

- 41.16 acres of Agricultural and Conservation Land, which is not currently irrigated with potable water.
- 15.29 acres for the Stonegate Mobile Home Park (69 mobile homes)

Existing non-water demanding uses include the following:

- 25.23 acres of Mark West Creek
- 17.16 acres of Open Space and Conservation
- 170.3 acres of Vacant undeveloped lands

[3] This total does not include the American Ag Credit office building, constructed in 2016-2017 with a total of 133,357 square feet. Water demand associated with this facility is captured in future projections.

This report is based on water demand data provided by the District for the period 2010-2017, selecting the year 2012 as the maximum water year based on the highest annual water demand occurrence; development that was completed between 2017 and the publication of this report is minor with the exception of the American AgCredit Facility at 133,357 square feet. This development is not captured in the existing water demand calculation but is accounted for in the projected built out scenarios; it is estimated to generate a water demand of 11.81 acre-feet/year, equivalent to 3% of the overall current development demand for water.[4] Other development projects that were under construction, have been approved or granted entitlements within the Specific Plan area (like the AgCredit Facility) are captured in the projected buildout scenarios.

To identify the existing water use demands currently generated in the planning area, existing demand usage between 2010 and 2017 was queried by the Windsor Water Department.[5] The data provides annual water use totals for the 8-year period between 2010 and 2017 for the Airport Service Area across broad land use categories (Industrial, Commercial, Multi-Family (i.e. the Vineyard Creek Apartments), Hotel, Institutional, and Irrigation associated with all uses). The annual yearly water demand over this 8-year period was reviewed to identify a maximum annual water demand for the existing uses within the Specific Plan area.[6]

Using County Assessor records for each property within the Specific Plan Area, existing uses were converted into broad land use categories that could be correlated to the land use categories that define water use in the District. The following describes how uses in the assessing record were categorized for analysis purposes:

SONOMA COUNTY ASSESSOR RECORD	ASSIGNED CATEGORY	2012 WATER DEMAND (ACRE-FEET/YEAR)

[4] The 133,357 sf American AgCredit Office facility is not captured in the existing development totals and therefore its water use is not accounted for in the water demand factors, since it became operation in 2017 and the water demand factors are derived from active operations for the maximum water year between 2010-2017, which was 2012 for the commercial sector. Using the water demand factor for Office based on empirical data, the water demand generated by the AgCredit Facility is estimated to be 11.81 acre-feet per year.

[5] Personal correspondence with Paul Piazza, Environmental program manager, Town of Windsor, September 2018.

[6] An average figure was also considered but the maximum year 2012 was selected to more accurately represent actual maximum year water demands based on historic trends.

Warehouse	Heavy Industrial	14.95 AF/Y
Industrial_Auto		
Distribution		
Light Mfg/Warehouse	Light Industrial	44.01 AF/Y
Light Mfg/Industrial		
Industrial		
Comm_AutoService	Commercial/Office	73.31 AF/Y
Commercial_Spa		
Office		
Commercial		
Retail	Retail & Services	11.05 AF/Y
RetailCenter		
Retail_Cinema		
Office_Medical	Medical Office	7.17 AF/Y
Hotel_Motel	Hotel	8.33 AF/Y
RR [1]	Residential	29.92 AF/Y
Mobile_Home [2]		
Two-Family [3]		
Multi_Family [4]		
Vacant: Wastewater [5]	Institutional	42.14 AF/Y
School		
Open Space	Vacant	N/A
Vacant		
Vacant_NoUtil		
Agriculture	Agriculture	N/A
Open_Reserved	Open Space	N/A
Indoor Water Demand (Annual)		230.88 AF/Y
Water Use: Fire and Hydrant Testing		1.26 AF/Y
Water Use: Irrigation (Industrial uses)		135.99 AF/Y
Total Water Demand (Annual)		368.13 AF/Y

Notes:

1. *Refers to APN 059-340-031 – Lot on Airport west of Westwind Blvd. (in Plains Conservation Area)*
2. *Refers to APN 059-230-060 – Stonegate Mobile Home Park*
3. *Refers to APN 059-240-002 – Lot west of Regional Pkwy on Airport*
4. *Refers to APN 059-230-080 – Vineyard Creek Apartments*
5. *Refers to APNs 059-271-002 and -003, which span the Airport Larkfield Wikiup Sanitation Zone Treatment Facility.*

Therefore, the total existing water demand generated by established uses within the Airport Area Specific Plan is estimated to be 368.13 acre-feet per year comprised of 232

AF/Y for indoor water use and 136 AF/Y for outdoor irrigation of landscaping (**Appendix A**, **Table A-1 and A-2**).

WATER DEMAND FACTORS

Water demand factors are derived from empirical water use end data provided by the District using maximum water year 2012, as the overall highest water demanding year for the period between 2010 and 2017. The District queried end use water rates for each of the following Water Fee Descriptions:

- Commercial Industrial
- Hotel
- Industrial Airport
- Institutional Airport
- Multi-Family (Vineyard Creek)
- Irrigation Industrial

The existing building floor area square footages for established uses were divided by the average actual end use demands based on water year 2012. The year 2012 was selected because it represents the overall maximum water year for the period between 2010 and 2017. The water demand factors, presented in acre-feet of water per square foot of floor area, per dwelling unit, or per hotel room are set forth in Table A-1.

The water demand factor for ***Retail & Services, Office*** and ***Medical Office*** is based on year 2012 (maximum water year) end use water demand for the Commercial Industrial category from 2010-2017. It assumes that the existing square footage of 952,274 is comprised of 6% Retail & Service and 94% Office (not including the 133,357 square-foot AgCredit Facility), and 80,900 square feet of medical office (Sonoma County Animal Services (Vet Clinic) and Santa Rosa VA Clinic) for a total area of 1,033,174 square feet, which generates a combined water demand of 91.52 acre-feet per year (AF/Y). Thus, based on existing square footage, Retail & Services, Office and Medical Office yield a water demand factor of 0.0886 Acre-Feet per 1,000 Square Feet per Year (AF/1,000 SF/Y).

The water demand factor for the ***Hotel*** category is based on the end use water demand for the Hotel category. The hotel is currently comprised of 52,498 square feet (90 rooms) and based on empirical 2012 data, generates a maximum water demand of 8.33 AF/Y. Thus, hotel uses yield a water demand factor of 0.0926 AF/Room/Y.

The water demand factor for ***Industrial*** uses includes both heavy and light industrial users; it is based on the maximum year end use water demand (year 2012), from 2010-2017, for the Industrial Airport water use category. It assumes that the existing industrial square footage of 2,732,704 is comprised of 694,190 square feet of heavy industrial uses and 2,038,514 square feet of light industrial uses based on existing uses recorded in the Sonoma County Assessor's record parcel data, current to June 2017. The industrial airport end use water demand for the maximum year on record, is 58.97 AF/Y. Thus, industrial uses yield an average water demand factor of 0.0216 AF/1,000 SF/Y.

The water demand factor for ***Institutional*** uses is based on year 2012 for end use water demand for the Institutional Airport category from 2010-2017. Institutional use is comprised of 80,000 square feet and generates an annual average water demand of 42.14 AF/Y. Thus, institutional uses yield a water demand factor of 0.00053 AF/SF/Y.

The water demand factor for ***Residential*** uses is based on the year 2012 (maximum water year) for end use water demand for the Multi-Family category from 2010-2017. Vineyard Creek Apartments contain 232 multi-family dwelling units and generate an average water demand of 29.92 AF/Y. Thus, residential uses yield a water demand factor of 0.1290 AF/Dwelling Unit/Y.

Landscape Water Demand Methodology

The projected landscape water demand was calculated using an estimated landscape coverage area for all land uses. All future development within the Airport Area Specific Plan will be subject to the Sonoma County Water Efficient Landscape Ordinance (Section 7D3 of the Sonoma County Code), which was adopted on December 15, 2009 and went into effect on January 15, 2010, and the Model Water Efficiency Landscape Ordinance. The Ordinance sets forth a Maximum Applied Water Allowance (MAWA) to establish site-specific water budgets. The allowance considers local precipitation records and evapotranspiration[7] rates.

[7] The transfer of water from vegetation to the atmosphere through evaporation from the soil and transpiration from plants.

Applying an estimated landscape area factor to the total acreages designated for each land use provides the average landscape area for each land use component,[8] which excludes impervious surfaces. The total estimated acreage that was presumed to require irrigation for landscaping was then multiplied by the MAWA demand factor to estimate the total water budget. Under the existing condition all land uses other than industrial were presumed to contain irrigated landscaping on 20% of the acreage. The industrial land uses were presumed to contain irrigated landscaping on 15% of the acreage.

The water demand factors for landscaping areas are from the MAWA. The MAWA for commercial and residential each consider a standard landscape area and a special landscape area. The calculated MAWA formulas are as follows:

Commercial (Industrial and Institutional)

Standard Landscape Area MAWA = (ETo (36 Inches) x ETo Adjustment Factor (0.45) x 0.623 (gallons/inches per square feet)/7.48 = 1.34 acre-feet/acre/year

Special Landscape Area MAWA= (ETo (36 Inches) x ETo Adjustment Factor (0.45+0.55) x 0.623 (gallons/inches per square feet)/7.48= 2.98 acre-feet/acre/year

Residential

Standard Landscape Area MAWA = (ETo (36 Inches) x ETo Adjustment Factor (0.55) x 0.623 (gallons/inches per square feet)/7.48= 1.64 acre-feet/acre/year)

Special Landscape Area MAWA = (ETo (36 Inches) x ETo Adjustment Factor (0.55+0.45) x 0.623 (gallons/inches per square feet)/7.48= 2.98 acre-feet/acre/year)
The annual net reference evapotranspiration (ETo) rate for the area was sourced from Windsor's WELO MAWA Calculator (12.01.2015). Evapotranspiration accounts for water loss from plants, and varies depending on location, wind exposure, shading and other factors. The net average annual ETo for the Windsor water service area is 36.0 inches.

The ET adjustment factor is applied to capture the relative water demand of various types of plantings. For residential, standard landscaping areas the ET adjustment factor is 0.55 and for special landscaping areas the ET adjustment factor is an additional 0.45. For

[8] The estimated landscape area is based on a review of existing uses, the approximate area reserved for landscaping, and current Floor Area Ratios to estimate the area likely to be irrigated.

commercial, standard landscaping areas the ET adjustment factor is 0.45 and for special landscaping areas the ET adjustment factor is an additional 0.55. For all land uses other than institutional it is estimated that 15% of the irrigated landscaping will be standard and 5% will be special area landscaping. For institutional it is estimated that 12% of the irrigated landscaping will be standard and 3% will be special area landscaping.

A factor of 0.623 is applied to convert the units from inches per square foot to gallons per square foot. A factor of 7.48 is applied to convert square feet to acres and gallons to acre-feet.

The total irrigation area per acre (or per 43,560 square feet) is then multiplied by the MAWA factor to estimate the maximum water allowance for each land use.

FUTURE WATER DEMAND: BAU SCENARIO

The Business As Usual (BAU) scenario (**Appendix C**) provides a water demand projection for the Specific Plan area assuming no changes are made to the current land use regulations in the area, and that market conditions continue to drive development within the current regulatory framework. Future water demand projections for the BAU scenario (and Preferred Alternative to the Specific Plan) rely on water demand factors by land use category, which are based on empirical data of water use in the Specific Plan area for water year 2012, which is the overall highest water demand year during the period 2010-2017 as described above under the Water Demand Factors discussion.

The underlying assumptions built into the BAU scenario include:

- Water demand at buildout of the Specific Plan will be generated by irrigation of outdoor landscaped areas and indoor water use.

- The Specific Plan continues to build out with land uses that are consistent with the current land uses in the plan area (i.e. land uses that are compatible with the current zoning designations, and no new residential is proposed beyond what exists already, for example at the Vineyard Creek Apartments);

- Two properties in the southeast portion of the plan area that are currently out of the District's service area (APNs 059-230-060 and 059-240-067) remain outside of the district;

- Water demand factors are derived from empirical data based on actual end use consumption for the year 2012, which is the overall highest water demanding year from 2010 through 2017;

- Water demand factors for Cannabis, as an emerging industry with a relatively higher water use relative to traditional industrial uses, have been applied to 18% of the projected new industrial development (8% of total at buildout) under the BAU scenario. Cannabis water demand applies a factor of 0.186 acre-feet per 1,000 square foot for indoor production. [9]

- Water demand factors for breweries, as an industry with a higher water use relative to traditional industrial uses, have been applied assuming that 120,000 barrels of beer are produced annually at buildout of the BAU scenario. Brewery water demand applies a factor based on production as follows:

  barrels/year x 31.5 gallons of beer/barrel x 7 gallons of water/1 gallon of beer [10]

- Water demand factors for wineries, as an industry with a higher water use relative to traditional industrial uses, have been assuming that 80,000 barrels of wine (60

[9] Santa Clara Valley Water District Crop Irrigation Water Use Update, prepared for the Santa Clara Valley Water District, February 27, 2014; and Mills 2011.

[10] Water and Wastewater: Treatment/Volume Reduction Manual, prepared by Brewers Association.

gallons per barrel) are produced annually at buildout of the BAU scenario. Winery water demand uses a production based factor as follows:

barrels/year x 60 gallons of wine/barrel x 6 gallons of water/1 gallon of wine [11]

- Projected water demand at buildout under the BAU Scenario is based on per square foot, per unit, or per room water demand factors;

- Projected potable water demand at buildout under the BAU Scenario does not include any efficiencies in water demand that may be achieved in new and existing development through retrofits and more stringent water efficiency standard that may be adopted under future plumbing code updates;

- Projected outdoor irrigation demands apply current MAWA factors and do not assume any greater water-use efficiency beyond current requirements;

- New development in the Specific Plan achieves the following intensities (Floor Area Ratios) based on existing FAR for these uses in the specific plan area for more recent construction patterns:
    - Heavy Industrial Uses: 0.30
    - Light Industrial and Business Park Uses: 0.35
    - Commercial and Office Uses: 0.45
    - Hotel: 0.65
    - Retail: 0.50
    - Medical Offices: 0.50
    - Institutional Uses: 0.13

- Development in the Specific Plan area is based on the LEG Market Study prepared for the Specific Plan update, which identified the square feet of development that is likely given defined market conditions in the Airport area.

Land Use Type	LEG's Projected Demand in Sq. Ft.	BAU Scenario New Sq. Ft.	BAU as a Percent of LEG's Demand
Industrial	1,446,120	2,223,696	154%*

[11] Water into Wine in California: Economic Perspectives, prepared UC Davis Department of Agricultural and Resources Economics, September 26, 2016.

Commercial	552,365	415,109	75%
Retail	27,000	8,165	30%
Hotel	185 rooms	197 rooms	106%
"Industrial" Includes industrial uses in both the heavy and light industrial business park categories. "Commercial" includes office, services, medical office, and other commercial uses.			
** Higher than expected industrial demand is projected due to the constraints on commercial development resulting from water use, and high demand for industrial land as a result of cannabis and related activities.*			

- Redevelopment occurs on "opportunity sites" (**Appendix E**), which includes some removal of existing water users and replacement with new water users on existing, developed sites.

Net Water Demand: BAU Scenario

As shown in **Appendix A,** Table A-5, the combined gross (projected) water demand for the BAU scenario is estimated to be 780 acre-feet per year at buildout. This compares to an existing water demand of 368 acre-feet per year. As such, the net change in water demand generated by the BAU scenario is approximately 412 additional acre-feet per year at buildout, comprised of 339 AF/Y (82%) for potable indoor demand and 72 AF/Y (18%) for outdoor uses. The Gross Future demand under the BAU scenario is comprised of 571 AF/Y (73%) for potable indoor demand and 208 AF/Y (27%) for outdoor demand.

FUTURE WATER DEMAND: PREFERRED ALTERNATIVE

The ***Preferred Alternative*** is a proposed update to the Specific Plan that reflects a planning process involving stakeholder engagement, community outreach, market analysis, and an evaluation of the future needs and opportunities in the area. The Preferred Alternative to the Specific Plan maintains the industrial character of the area, but also includes residential and mixed-use land use potential on strategic sites that could enhance the area, and take advantage of the employment opportunities in businesses operating within the Specific Plan. The Preferred Alternative could ultimately support the following:

- 1,464,672 square feet of Commercial land use (Comprised of 5% Retail & Service, 88% Office, and 7% Medical Office)
- 224,172 square feet of Hotel (257 Rooms)
- 4,319,661 square feet of Industrial (80% Typical Water User, 8% Cannabis, 4% Brewery and 8% Winery)
- 80,000 square feet of Institutional

- 1,193 Residential Units (Comprised of 955 Apartments, 169 Micro Units, and 69 Mobile Homes)

The total buildout potential in the Preferred Alternative accommodates 8,162,018 square feet of development within the 719-acre planning area. This development will generate a new water demand from indoor and outdoor landscaping uses. The following assumptions are built into the Preferred Alternative (**Appendix D**):

- The Preferred Alternative provides for increased residential and mixed-use development on select sites within the Plan Area to address the County's acute housing crisis, while continuing to accommodate industrial and commercial activities.

- Two properties in the southeast portion of the plan area that are currently out of the District's service area (APNs 059-230-060 and 059-240-067) are assumed to be incorporated into the District. Therefore, the District would service water to the existing Stonegate Mobile Home Park (currently on well water), and anticipated residential development on the adjacent vacant parcel with a projected buildout density of 22 units per acre.

- Water demand factors for Cannabis, as an emerging industry with a relatively higher water use relative to traditional industrial uses, have been applied to 22% of the projected new industrial development (8% of total at buildout) under the Preferred scenario. Cannabis water demand applies a factor of 0.186 acre-feet per 1,000 square foot for indoor production. [12]

- Water demand factors for breweries, as an industry with a higher water use relative to traditional industrial uses, have been applied assuming that 120,000 barrels of beer are produced annually at buildout of the Preferred scenario. Brewery water demand applies a factor based on production as follows:

[12] Santa Clara Valley Water District Crop Irrigation Water Use Update, prepared for the Santa Clara Valley Water District, February 27, 2014; and Mills 2011. Note that the water use factor was scaled up from square foot of growing area to square foot of building area, which likely overstates water consumption, because some parts of the building will not be used for growing.

barrels/year x 31.5 gallons of beer/barrel x 7 gallons of water/1 gallon of beer [13]

- Water demand factors for wineries, as an industry with a higher water use relative to traditional industrial uses, assume that 2 million cases (80,000 barrels) of wine (60 gallons per barrel) are produced annually at buildout of the Preferred scenario. Winery water demand applies a factor based on production as follows:

barrels/year x 60 gallons of wine/barrel x 6 gallons of water/1 gallon of wine [14]

- Micro-Units and Mobile Homes are presumed to use 30% less water relative to traditional apartments.

- Projected potable water demand at buildout under the Preferred Scenario does not include any efficiencies in water demand that may be achieved in new and existing development through retrofits and more stringent water efficiency standard that may be adopted under future plumbing code updates;

- Projected outdoor irrigation demands apply current MAWA factors and do not assume any greater water-use efficiency beyond current requirements;

- Non-residential development in the Specific Plan achieves intensities (Floor Area Ratios) like those anticipated in the Preferred scenario, and residential densities across a variety of residential typologies as described below:

    - Residential in mixed-use development: 22 units/acre
    - Residential in apartment-style development: 22 units/acre

        - This would include workforce housing that includes a 15% share of "micro" units and 85% share as apartments similar to those currently developed at Vineyard Creek Apartments.

- Development in the Preferred Alternative achieves the following in terms of capturing the projected market demand based on the market opportunities identified by LEG:

[13] Water and Wastewater: Treatment/Volume Reduction Manual, prepared by Brewers Association.

[14] Water into Wine in California: Economic Perspectives, prepared UC Davis Department of Agricultural and Resources Economics, September 26, 2016.

Land Use Type	LEG's Projected Demand in Sq. Ft.	Preferred Alternative New Sq. Ft.	Preferred Alternative as a Percent of LEG's Projected Demand
Industrial	1,446,120	1,543,624	107%
Commercial	552,365	399,191	72%
Retail*	27,000	40,864	151%
Hotel	185 rooms	197 rooms	106%
Apartments	808	779	86%

"Industrial" Includes industrial uses in both the heavy and light industrial business park categories. "Commercial" includes office, services, medical office, and other commercial uses.
** Additional retail demand is expected due to increased residential development.*

- Redevelopment occurs on "opportunity sites" (**Appendix E**) resulting in removal of existing water users and replacement with new water users on existing sites.

- Water demand factors are derived from empirical data based on actual end use consumption of the maximum year between 2010 through 2017.

- Projected water demand at buildout of the Preferred Alternative is based on per square foot or per unit water demand factors.

Potable Water Demand Projection: Preferred Scenario Detail

Water demand factors for industrial users at buildout recognize that, "industrial business park" uses span a wide range of industrial activities, which can have a range of water needs. As a result, the industrial category, for water demand purposes, includes a Typical Water User category (with water demand consistent with empirical data for water use in the industrial land use category inclusive of heavy and light industry). In order to estimate water demand from higher using industrial activities cannabis, breweries and wineries are presented individually.

Appendix A, Table A-6 presents the projected potable water demand associated with development of the Preferred Alternative. The water demand factors for industrial uses are derived from year 2012 empirical data for industrial activities in the Specific Plan area, which is the highest year demand for the period from 2010 through 2017 as described above. The water demand factor of 0.000186 AF/SF/Y for cannabis is sourced from the Santa Clara Valley Water District Crop Irrigation Water Use Update as cited above. For comparison purposes Sonoma County Water Agency identified a water demand factor of

0.000139 AF/SF/Y[15] for cannabis. The more conservative factor from the Santa Clara Valley Water District is applied.

The water demand factor of 0.000677 AF/barrel/Y for breweries is sourced from the Brewers Association as cited above. Under the Preferred Alternative it is presumed that up to 120,000 barrels of beer (31.5 gallons per barrel) would be produced at buildout.

The water demand factor of 0.001105 AF/barrel/Y for wineries is sourced from UC Davis' Department of Agricultural and Economics as cited above. Under the Preferred Alternative it is presumed that up to 2 million cases (80,000 barrels) of wine (60 gallons per barrel) would be produced at buildout.

Water demand factors for residential uses are based on a per unit water demand factor of 0.1290 AF/Unit/Y, which is the empirical water demand for the maximum water year (2012) between 2010 and 2017 for residential uses (i.e. water use at the Vineyard Creek Apartments) in the Specific Plan area.

Micro-units and mobile home water demand factors presume a 30% reduction relative to the per unit residential water factor due to anticipated smaller household sizes. A 30% reduction is set forth given the smaller unit size and corresponding smaller household population size.

Appendix A, Table A-7 presents the projected landscaping water demand associated with development of the Preferred Alternative. Each land use is presumed to contain 20% area coverage in irrigated landscaping, with the exception of institutional, which is presumed to contain 15% irrigated landscaping. The projected mix of standard and special area landscaping is presented in Table A-7. As set forth therein, a total of 219.01 acre-feet per year would be required for irrigation of landscaping at buildout of the Preferred Alternative for the Airport Area Specific Plan.

NET WATER DEMAND

A majority of the Airport Area Specific Plan is comprised of existing development that presently generates potable and irrigation water demand. This water demand is factored into and accounted for in Windsor's 2015 UWMP. In order to quantify the additional water

[15] Demand factor assumes 1.16 gallons per day, a 220-day growing period, 111 plants per 1,000 SF, 1.6 growing periods per year, and a water use of 45,323.52 gallons per 1,000 SF per year. Personal communication with Carrie Pollard, Water Use Efficiency Manager, Sonoma County Water Agency.

demand that will be generated in the planning area, the aforementioned methodology was utilized.

As shown in **Appendix A** Table A-8, the combined gross (projected) water demand for the Preferred Alternative is estimated to be 871.79 acre-feet per year at buildout. This compares to an existing water demand of 368 acre-feet per year. As such, the net water demand generated by the Preferred Alternative is approximately 504 acre-feet per year at buildout. The total net water demand is comprised of 421 AF/Y (84%) for potable indoor demand and 83 AF/Y (16%) for outdoor uses.

COMPARISON: BAU, PREFERRED ALTERNATIVE, AND DISTRICT ALLOCATION

According to the District, the total volume of water allocated to the Specific Plan Area is 404 acre-feet per year at buildout in 2040 (per a memo dated January 12, 2018). The memo states that the "model estimate" for 2015 yields a total 356 AF/Y, comprised of 192 AF/Y for potable (residential/commercial and industrial) and 164 AF/Y for irrigation. The projected water use in 2040 of 404 AF/Y is comprised of 209 AF/Y for potable demands and 196 AF/Y for Irrigation.

Compared to the District's identified allocation of 404 AF/Y, both the BAU scenario and Preferred Alternative project a water deficit. The following table summarizes the District's water allocation to the Specific Plan Area and compares the allocation to the BAU and Preferred Alternative water demand projections.

Water Demand	Existing Demand	District's Allocation	BAU Scenario	Preferred Alternative
Indoor Water use	232 (63%)	209 (52%)	571 (73%)	653 (75%)
Irrigation Use	136 (37%)	196 (48%)	208 (27%)	219 (25%)
Total Demand	368	404	780	872
Compared to District's Allocation:				
Indoor Water use			+362 (+173%)	+444 (+212%)
Irrigation Use			+12 (+6%)	+23 (+12%)
Total Water Demand			+375 (+93%)	+468 (+115%)

The projected demand in the BAU scenario (780 AF/Y) results in a deficit of 375 AF/Y. The revised land use profile shown in the Preferred Alternative results in a projected water

demand of 872 AF/Y), an increase over the BAU scenario's water deficit of 92 AF/Y.[16] There is a water deficit of 468 AF/Y between the District's identified allocation and the Preferred Alternative.

In both the BAU and Preferred Alternative, the projected irrigation demand is slightly below the District's allocation (208 and 219 AF/Y versus 196 AF/Y). The BAU scenario indoor water demand is 173% higher than the District's projection (571 AF/Y versus 209 AF/Y), and the Preferred Alternative indoor water demand is 212% higher than the District's allocation (447 AF/Y versus 209 AF/Y).

The projected indoor water demand for the Preferred Alternative is 653 AF/Y, 404 AF/Y of which could be served by the District's allocation, leaving a deficit of 249 AF/Y for potable water and a deficient of 219 AF/Y for irrigation uses.

Water Service Agreement[17]

Water supplies are delivered to the "Airport Industrial Area" pursuant to the Water Services Agreement between Sonoma County and Town of Windsor Water Division.

Sonoma County entered into a Water Services Agreement with the District in 1985, following approval of the Sonoma County Airport Industrial Area Specific Plan (October 30, 1984). The Agreement specifies the terms and conditions under which water services and infrastructure will be provided to the Airport Industrial Area. The Agreement was first amended on March 1, 1988 to include the land within the Sonoma County Airport. A second amendment to the Agreement was executed on June 4, 1996 that spelled out specific abandonment and notification procedures. No other Amendments to the Agreement have since occurred.

The District provides water supplies to all municipal water users within the Specific Plan Area, including Commercial and Residential uses, which were not initially anticipated by the 1985 agreement.

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16 The water demand generated by incorporating two lots not currently included in the District's service area (APNs 059-240-067 and 059-230-060) result in a water demand of 26.75 AF/Y; 5.92 AF/Y is associated with the existing Mobile Home park that would be serviced by the district in the Preferred Alternative, and an additional 20.83 AF/Y is associated with a 185-unit development on the adjacent vacant parcel (resulting from 18.13 AF/Y for indoor use and 2.7 AF/Y for outdoor irrigation).

17 Presuming the 2015 Urban Water Management Plan captures the Specific Plan allocation in its projection of future water demand and analysis of normal, single, and multiple-dry years.

Addressing the Deficit

A few opportunities exist to address water needs in the Specific Plan area. One solution is to offset water demand for suitable uses (mainly irrigation) with recycled water. The SCWA has tertiary treated recycled water supplies that, with the installation of infrastructure, could be made available to the Specific Plan area and used to offset irrigation demand and potentially a portion of the potable water demand (e.g. flushing of toilets). Alternatively, if recycled water supplies are not available, onsite grey water facilities could be explored for specific developments within the Specific Plan area to meet a portion of non-potable demands (such as toilet flushing water). If all future irrigation demands in the BAU Alternative were met with recycled water, the 404 AF/Y allocation of potable supplies would be deficient by 168 AF/Y to meet projected water demand under the BAU Scenario. If all future irrigation demands in the Preferred Alternative were met with recycled water, the 404 AF/Y allocation of potable supplies would be deficient by 249 AF/Y to meet projected water demand under the Preferred Alternative. Alternatively, new water sources (such as well water) or an increased allocation from SCWA may be considered.

APPENDICES

Appendix A – Existing Water Demand vs. Buildout Scenarios (BAU and Preferred Alternative)
Appendix B – Existing Development in the Specific Plan Area
Appendix C – Business-as-Usual Scenario
Appendix D – Preferred Alternative
Appendix E – Opportunity Sites
Appendix F – 2010-2017 Airport Area Water Use Totals

Appendix A: Existing Water Demand

Table A-1 Water Demand, *Existing Development*	Total Acreage (acres)	Building Floor Area (square feet)	Water Demand Factors (AF/SF/Y)	Average Actual Demand (AF/Y)[1]
Agriculture/Open Space[2]	58.32	N/A		N/A
Retail & Services[3]	14.69	124,707	0.000089	11.05
Office[3]	76.70	827,567	0.000089	73.31
Medical Office[3]	4.42	80,900	0.000089	7.17
Hotel[4] (90 rooms)	1.81	52,498	0.092607	8.33
Industrial Heavy[5]	80.43	694,190	0.000022	14.95
Industrial Light[5]	193.58	2,038,514	0.000022	44.01
Institutional[6]	66.06	80,000	0.000527	42.14
Vineyard Creek Apartments (232)[7]	15.29	249,590	0.1290	29.92
Micro-Units[8]	-	N/A	N/A	N/A
Mobile Home[9]	10.35	163,412	N/A	N/A
Creeks[10]	25.28	N/A	N/A	N/A
Misc[11]	171.79	N/A	N/A	1.12
Right of Way[12]	-	N/A	N/A	N/A
Irrigation[13]	N/A	N/A	N/A	135.99
Totals	718.73	4,311,378		
			Existing Water Demand Total	**368.13**

Source: SC-Airport-SP_Analysis_04.26.2018 provides acreage and square footages.
1 Maximum Actual Demands are derived from end use data provided by Windsor Water District for Airport Area Water Use Totals 2010-2017. Year 2012, as the overall highest water demand year was selected. Airport Enterprise uses are outside of the Specific Plan area and are not included in totals.
2 Acreage reflects approximately 44 acres of agricultural/conservation lands and 19 acres of open space/conservation lands.
3 Demand factor is derived from average actual 2012 year water demand for commercial industrial water fee description. Represents combined average of existing uses from Retail & Service, Retail, Office, and Medical Office end use water demands. Office precludes the AgCredit Building comprised of 133,357 sf.
4 Hotel Demand factor is based on 90 rooms and is derived from year 2012 per water fee description. Applies maximum water year 2012 to determine per room factor of 0.0926 AF/Room/Year
5 Industrial Demand factor is derived from year 2012, which reflects the maximum water use year between 2010-2017 for industrial per water fee description and is applied to both heavy and light users under existing conditions.
6 Institutional includes schools and government facilities. Demand factor is derived from actual demand for year 2012 for institutional uses per water fee description, which yields a demand factor of 0.000527 AF/SF/Year
7 Apartments includes the existing Vineyard Creek Apartments comprised of 232 multi-family units that are individually metered. Personal communication with Dani Robinson, Vineyard Creek Apartments, February 25, 2017. Applies maximum water year 2012 to determine per unit factor of 0.1290 AF/Unit/Year
8 Micro-Units do not currently exist within the Specific Plan area. Acreage identifies vacant land that could support micro units.
9 Stonegate Mobile Home Park is currently served by an onsite Groundwater well and is not connected to municipal supplies.
10 Creeks within the Specific Plan area do not generate a municipal water demand.
11 Misc acreage includes currently vacant land that do not generate water demand. Actual miscellaneous water demand are generated by fire line and hydrant testing and are derived from the 2012 year demand for fire line services industrial and hydrant water uses per water fee description.
12 Roadways do not generate a water demand.
13 Irrigation is derived from the 2012 water year per Windsor Water District Airport Area Water Use Totals (Years 2010-2017). Also see Table A-2 for assumed breakout of irrigation by land use.

Table A-2 Landscape Water Demand, *Existing Development*	Acres[1]	% Irrigated[2]	Irrigated Landscaped Acres	MAWA (AF/AC/Y)[3]	Total Demand (AF/Y)
Agricultural and Open Space					
Non-Irrigated Open Space		0%	0.0	0.00	0.0
Subtotal	**58.32**				**0.0**
Creeks					
Non-Irrigated		0%	0.0	0.00	0.0
Subtotal	**25.28**				**0.0**
Commercial Retail					
Standard Landscaping		15%	14.4	1.34	19.3
Special Area		5%	4.8	2.98	14.3
Subtotal	**95.81**				**33.5**
Hotel					
Standard Landscaping		16%	0.3	1.34	0.4
Special Area		4%	0.1	2.98	0.2
Subtotal	**1.81**				**0.6**
Industrial					
Standard Landscaping		10%	27.4	1.34	36.7
Special Area		5%	13.7	2.98	40.8
Subtotal	**274.01**				**77.5**
Institutional					
Standard Landscaping		11%	7.3	1.34	9.7
Special Area		4%	2.6	2.98	7.9
Subtotal	**66.06**				**17.6**
Residential					
Standard Landscaping		12%	1.8	1.64	3.01
Special Area		8%	1.2	2.98	3.65
Subtotal	**15.29**				**6.70**
Rights of Way					
Standard Landscaping		0%	0.0	1.64	0.0
Special Area		0%	0.0	2.98	**0.0**
Subtotal	**0.00**				
Misc.					0.0
Water Demand Landscaping		0%	0.0	0.0	0.0
Subtotal	**182.14**				**0.0**
Total	**718.73**				
			Landscape Water Demand Total		**135.9**

1 Based on the 2012 water year for Irrigation uses within the SMART Station Area Specific Plan.
2 Estimated landscape coverage that is irrigated with municipal water supplies.
3 Maximum Applied Water Allowance (MAWA). MAWA = ETo(36 inches) x ETo Adjustment Factor (Commercial = 0.45; Residential = 0.55; Special Landscape Area = 0.55/0.45) x 0.62 (gal/inches/sf) x 7.48 ac/ac.ft)
MAWA Commercial Standard 1.34 ac-ft/ac/yr; Special 2.98 ac-ft/ac/yr
Residential Standard 1.64 ac-ft/ac/yr; Special 2.98 ac-ft/ac/yr

Table A-3 Water Demand, BAU Scenario	Building Floor Area (square feet)	Total Rooms/ Units/ Barrels	Water Demand Factors (AC-FT/SF/Y)[1]	Projected Demand (AF/Y)[2]
Agriculture/Open Space	N/A	-	-	-
Retail & Services	72,623		0.000089	6.43
Offices	1,421,265		0.000089	125.90
Medical Offices	95,917		0.000089	8.50
Hotel (257 Rooms)	224,172	257	0.092607	23.80
Industrial (Cannabis)[3]	396,512		0.000186	73.73
Industrial (Brewery)[4]	155,300	120,000	0.000677	81.20
Industrial (Winery)[5]	349,500	80,000	0.001105	88.38
Industrial (Heavy/Light)[6]	4,055,088		0.000022	87.55
Institutional	80,000		0.000527	42.14
Apartments[7]	249,590	232	0.1290	29.92
Micro-Units	-	-	-	-
Mobile Home	158,102	-	-	-
Creek	N/A	N/A	N/A	
Right of Way	N/A			
Misc Losses[8]	N/A	-		3.77
Irrigation[9]	N/A	N/A	N/A	208.38
Totals	7,258,070			
			BAU Water Demand Total	**779.71**

1 Water Demand Factors are derived from Existing Actual Demands Provided By Windsor Water District Airport Area Water Use Totals 2010-2017.
2 Projected Demand multiplies the building floor area by the existing water demand factor to project the future water demand.
3 The water demand generated by greenhouse cultivated cannabis applies a water demand factor of 0.186 acre-feet per year per industry standards.
4 The water demand generated by breweries is derived as follows. Based on the benchmark (Russian River facility approximately 113,500 sf inclusive of pub and restaurant) it is estimated that two approximately 77,650 square foot brewery facilities would be developed with an annual production of 60,000 barrels per year each. A barrel of beer contains 31.5 gallons. The industry standard water demand factor of 7 gallons of water required to produce 1 gallon of beer is applied and converted to acre-feet.
5 The water demand generated by wineries is derived as follows. Assumes that on average 2,000,000 cases per year of wine are produced (or 80,000 barrels). Wine barrels contain an estimated 60 gallons per barrel. The industry standard water demand factor of 6 gallons of water required to produce 1 gallon of wine and converted to acre-feet.
6 The existing water demand factor for Industrial uses is applied under the BAU scenario, presuming that heavy and light industry continues to reflect the types of industry historically present.
7 Residential water demand factors are derived from the per unit factor of 0.1290 Acre-feet per unit based on existing demand generated by Vineyard Creek Apartments.
8 Misc Losses captures fire line and hydrant testing, presumed to be 3 times greater than existing at buildout.
9 See Table A-4 for projected Irrigation water demands by land use at buildout.

Table A-4 Landscape Water Demand, BAU Scenario	Acres[1]	% Irrigated[2]	Irrigated Landscaped Acres	MAWA (AC-FT/AC/Y)[3]	Total Max Demand (AF/Y)
Agricultural And Open Space					
Non-Irrigated Open Space		0%	0.0	0.00	0.0
Subtotal	**58.32**				**0.0**
Creeks					
Non-Irrigated		0%	0.0	0.00	0.0
Subtotal	**25.28**				**0.0**
Commercial Retail					
Standard Landscaping		15%	15.9	1.34	21.4
Special Area		5%	5.3	2.98	15.8
Subtotal	**106.23**				**37.2**
Hotel					
Standard Landscaping		15%	1.2	1.34	1.6
Special Area		5%	0.4	2.98	1.2
Subtotal	**7.87**				**2.8**
Industrial					
Standard Landscaping		15%	60.7	1.34	81.3
Special Area		5%	20.2	2.98	60.3
Subtotal	**404.69**				**141.6**
Institutional					
Standard Landscaping		12%	7.9	1.34	10.6
Special Area		3%	2.0	2.98	5.9
Subtotal	**66.06**				**16.5**
Residential					
Standard Landscaping		15%	3.9	1.64	6.4
Special Area		5%	1.3	2.98	3.9
Subtotal	**26.03**				**10.3**
Rights of Way					
Non-Irrigated		0%	0.0	0.00	0.0
Subtotal	**0.00**				**0.0**
Misc					
Standard Landscaping		0%	0.0	0.00	0.0
Subtotal	**24.25**				**0.0**
Total	**718.73**				
				Landscape Water Demand Total	**208.4**

1 Based on the Existing land uses within the SMART Station Area Specific Plan.
2 Estimated landscape coverage that is irrigated.
3 Maximum Applied Water Allowance (MAWA). MAWA = ETo(36 inches) x ETo Adjustment Factor (Commercial = 0.45; Residential = 0.55; Special Landscape Area = 0.45/0.55) x 0.623 (gal / inches per sf) x 7.48 ac/acre-feet)

MAWA	Commercial	Standard	1.34	ac-ft/ac/yr
		Special	2.98	ac-ft/ac/yr
	Residential	Standard	1.64	ac-ft/ac/yr
		Special	2.98	ac-ft/ac/yr

Table A-5: Net Water Demand Projections, *BAU Scenario*				
	Gross Future Demand (AF/Y)	**Existing Demand (AF/Y)**	**Net Water Demand (AF/Y)**	**Net Daily Demand (mgd)**
Potable	571	232	339	0.30
Irrigation	208	136	72	0.06
Total	**780**	**368**	**412**	**0.37**

Table A-6 Preferred Alternative Water Demand	Building Floor Area (sq. ft.)	Total Rooms/ Units/ Barrels	Water Demand Factors (AC-FT/SF/Y)[1]	Projected Demand (AF/Y)[2]
Agriculture/Open Space	N/A	-	-	-
Retail & Services	79,660		0.000089	7.06
Offices	1,289,095		0.000089	114.25
Medical Offices	95,917		0.000089	8.50
Hotel (257 Rooms)	224,172	257	0.094111	23.80
Industrial (Cannabis)[3]	345,573		0.000186	64.26
Industrial (Brewery)[4]	155,300	120,000	0.000677	81.20
Industrial (Winery)[5]	349,500	80,000	0.001105	88.38
Industrial (Heavy/Light)[6]	3,469,288		0.000022	74.73
Institutional	80,000		0.000613	42.16
Apartments[7]	-	955	0.1290	123.17
Micro-Units[7]	-	169	0.0903	15.26
Mobile Home[7]	-	69	0.0903	6.23
Creek	N/A	N/A	N/A	
Right of Way	N/A			
Misc Losses[8]	N/A	-		3.77
Irrigation[9]	N/A	N/A	N/A	219.01
Totals	6,088,505			
			Preferred Alt. Water Demand Total	**871.79**

Source: SC-Airport-SP_Analysis_03.18.2019 provides acreage and square footages.
1 Water Demand Factors are derived from Existing Actual Demands provided by Windsor Water District Airport Area Water Use Totals 2010-2017.
2 Projected Demand multiplies the floor area by the existing demand factor to project the future water demand.
3 Water demand from greenhouse cultivated cannabis applies a factor of 0.186 acre-ft/yr per industry standards.
4 The water demand generated by breweries is derived as follows. Based on the benchmark (Russian River facility approximately 113,500 sf inclusive of pub and restaurant) it is estimated that two approximately 77,650 square foot brewery facilities would be developed with an annual production of 80,000 barrels per year each. A barrel of beer contains 31.5 gallons. The industry standard water demand factor of 7 gal. water required to produce 1 gal. beer is applied and converted to acre-feet.
5 The water demand generated by wineries is derived as follows. Assumes that on average 2,000,000 cases per year of wine are produced (or 80,000 barrels). Wine barrels contain an estimated 60 gallons per barrel. The industry standard water demand factor of 6 gallons of water required to produce 1 gallon of wine and converted to acre-feet.
6 The existing water demand factor for Industrial uses is applied under the BAU scenario presuming that heavy and light industry continues to reflect the types of industry historically present.
7 Residential water demand factors are derived from the per unit factor of 0.1290 Acre-feet per unit based on existing demand generated by Vineyard Creek Apartments. Micro-Units and Apartments are presumed to generate a water demand that is 30% less than vineyard creek. Water demand factor is AC-FT/Unit/Y.
8 Misc. Losses captures fire line and hydrant testing, presumed to be 3 times greater than existing at buildout.
9 See Table A-4 for projected Irrigation water demands by land use at buildout.

Table A-7 Landscape Water Demand	Acres[1]	% Irrigated[2]	Irrigated Landscaped Acres	MAWA (AC-FT/AC/Y)[3]	Total Max Demand (AF/Y)
Agricultural And Open Space					
Non-Irrigated Open Space		0%	0.0	0.00	0.0
Subtotal	**41.16**				**0.0**
Creeks					
Non-Irrigated		0%	0.0	0.00	0.0
Subtotal	**17.43**				**0.0**
Commercial Retail					
Standard Landscaping		15%	24.3	1.34	32.5
Special Area		5%	8.1	2.98	24.1
Subtotal	**161.87**				**56.7**
Hotel					
Standard Landscaping		15%	1.2	1.34	1.6
Special Area		5%	0.4	2.98	1.2
Subtotal	**7.87**				**2.8**
Industrial					
Standard Landscaping		15%	54.5	1.34	73.1
Special Area		5%	18.2	2.98	54.2
Subtotal	**363.48**				**127.2**
Institutional					
Standard Landscaping		12%	0.8	1.34	1.1
Special Area		3%	0.2	2.98	0.6
Subtotal	**6.82**				**1.7**
Residential					
Standard Landscaping		15%	11.6	1.64	19.1
Special Area		5%	3.9	2.98	11.6
Subtotal	**77.66**				**30.7**
Rights of Way					
Non-Irrigated		0%	0.0	0.00	0.0
Subtotal	**0.00**				**0.0**
Misc					
Standard Landscaping		0%	0.0	0.00	0.0
Subtotal	**42.71**				**0.0**
Total	**719.00**				
				Landscape Water Demand Total	**219.01**

1 Based on the Existing land uses within the SMART Station Area Specific Plan.
2 Estimated landscape coverage that is irrigated.
3 Maximum Applied Water Allowance (MAWA). MAWA = ETo(36 inches) x ETo Adjustment Factor (Commercial = 0.45; Residential = 0.55; Special Landscape Area = 0.45/0.55) x 0.623 (gal / inches per sf) x 7.48 ac/acre-feet)

MAWA	Commercial	Standard	1.34	ac-ft/ac/yr
		Special	2.98	ac-ft/ac/yr
	Residential	Standard	1.64	ac-ft/ac/yr
		Special	2.98	ac-ft/ac/yr

Table A-8: Net Water Demand Projections: *Preferred Alternative*				
	Gross Future Demand (AF/Y)	**Existing Demand (AF/Y)**	**Net Water Demand (AF/Y)**	**Net Daily Demand (mgd)**
Potable	653	232	421	0.38
Irrigation	219	136	83	0.07
Total	**872**	**368**	**504**	**0.45**

Appendix B: Existing Development in the Specific Plan Area

Use Code in Tabulation	Use Description	Acres Existing	Existing Built (sf)
Heavy_Industrial	**Warehouse, Industrial Auto, Distribution**	80.43	694,190
Industrial	**Light Manuf, Light Warehouse, Industrial**	193.58	2,038,514
C-MU	**Auto Serv., Retail, Services, Offices**	81.51	1,021,173
	Retail and Services:	4.81	60,249
	Office:	76.70	960,924
Agriculture	**Agricultural/Conservation**	41.16	-
Hotel	**Hotel or Motel**	1.81	52,498
Workforce	**Multi-Unit Workforce Residential**		-
R3	**Multi-Unit Residential**	10.35	249,590
R1	**Mobile Homes AND Single Family**	15.29	163,412
Retail	**Retail**	9.88	64,458
Office_Med	**Medical Facility**	4.42	80,900
Institutional	**School or County Institutions/Utilities**	66.06	80,000
Parking	**Parking Lots**	1.49	-
OS	**Open Space/Conservation**	17.16	-
	ROW	**Excluded**	
	Creeks	25.28	
	Vacant	170.30	
	Total	718.73	4,444,735

Appendix C: Business-as-Usual Scenario

General Use Type	Specific Typology	% of Total	Sq. Ft	Units/Rooms
Residential	TOTAL Residential	100%	249,590	228
	Apartments - Typical[1]	100%	249,590	228
	Workforce Housing - Micro[2]	0%	0	0
	Mobile Home	0%	0	0
Industrial	TOTAL Industrial	100%	4,956,400	
	Cannabis	5%	396,512	
	Winery	7%	349,500	
	Brewery	3%	155,300	
	Typical Water-User[3]	84%	4,055,088	
Commercial	TOTAL Commercial	100%	1,589,805	
	Retail and Services	5%	72,623	
	Offices	89%	1,421,265	
	Medical Offices	6%	95,917	
Accommodations	Hotels	100%	224,172	257
Institutional	School	100%	80,000	

Source: M-Group, 2018

1 - Water use associated with the "apartment" category includes water use for all multi-unit residential structures, including townhomes, duplexes, apartments, and units in mixed-use developments

2 - Water use associated with the "Workforce Housing - Micro" category refers to the 15% of units required in a proposed residential development under the County's Workforce Housing Combining District provisions

3 -The industrial category specifically considers cannabis cultivation operations, winery production facilities, and breweries, as these uses are allowed in the Specific Plan and generate relatively higher water demands relative to light/heavy industrial uses. The share associated with these water use category is derived from existing permit applications for these business types and projections of future development over the next 20 years, as follows:
Cannabis Cultivation - Current permits total 62,420 sq. ft. of existing industrial space converted to indoor cannabis cultivation, project to occupy 18% of the new industrial market over the next 20 years, or approximately 396,512 sq. ft. (8% of total industrial at buildout)
Wineries Production - Current active permits includes three wineries totaling 233,000 sq. ft., or 78,000 sq. ft. per facility, projected to increase by 50% over the next 20 years = 349,500 sq. ft. Assumes 3 wineries currently produce an average of 50,000 cases per year.
Breweries - No current active breweries in the plan area, two breweries projected over the next 20 years of an average size equal to the average winery facility = 155,300 sq. ft.
Future projected industrial square footage totals 4,956,400, heavy water-users are projected to account for approximately 901,312 sq. ft., or 18% of industrial square footage.

Appendix D: Preferred Alternative

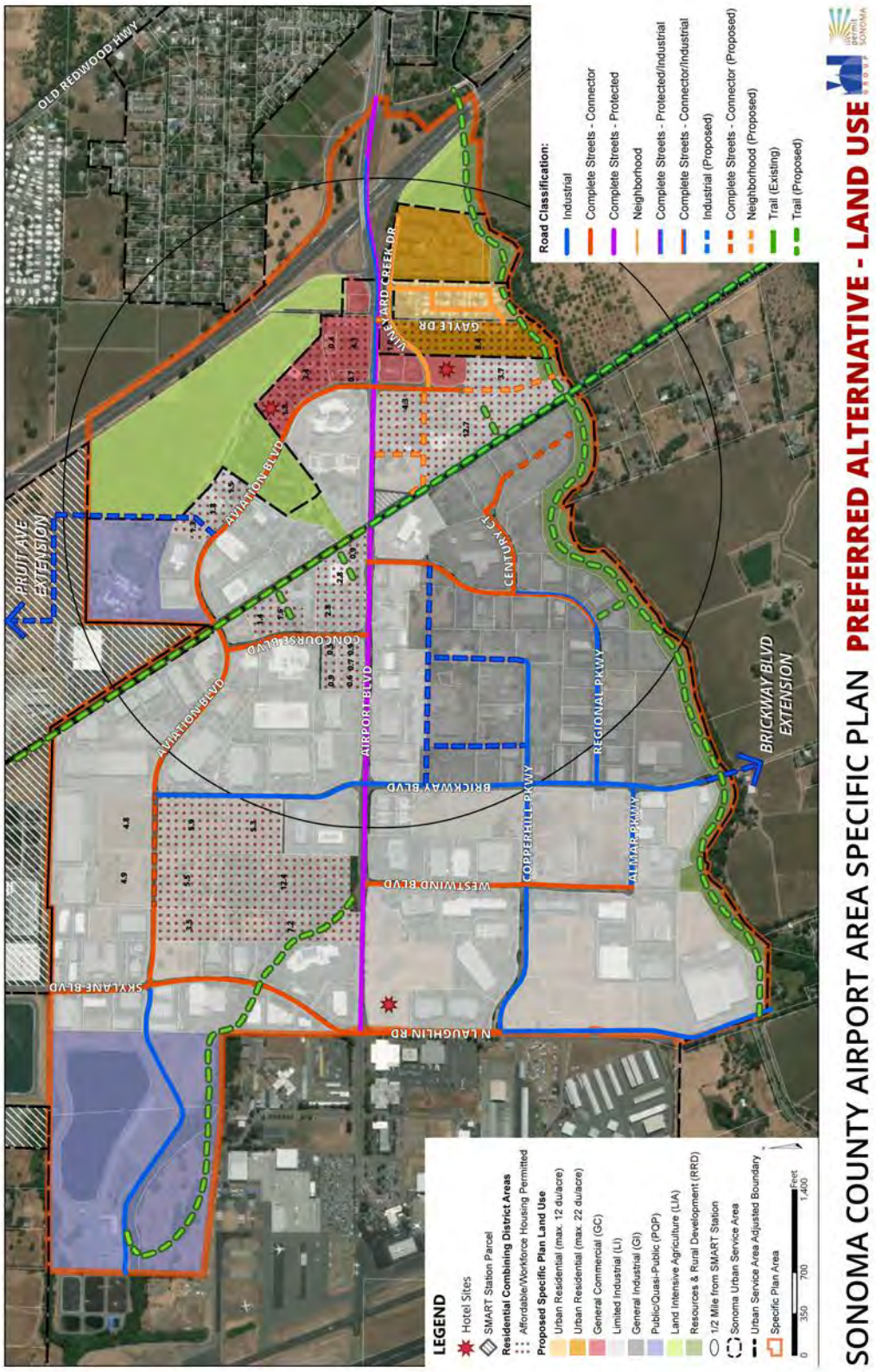
General Use Type	Specific Typology	% of Total	Sq. Ft	Units/Rooms
Residential	TOTAL Residential	100%	2,073,513	1193
	Apartments - Typical[1]	78%	1,621,487	955
	Workforce Housing - Micro[2]	14%	286,145	169
	Mobile Home	8%	175,451	69
Industrial	TOTAL Industrial	100%	4,319,661	
	Cannabis	8%	345,573	
	Winery	8%	349,500	
	Brewery	4%	155,300	
	Typical Water-User[3]	80%	3,469,288	
Commercial	TOTAL Commercial	100%	1,464,672	
	Retail and Services	5%	79,660	
	Offices	88%	1,289,095	
	Medical Offices	7%	95,917	
Accommodations	Hotels	100%	224,172	257
Institutional	School	100%	80,000	

Source: M-Group, 2019

1 - Water use associated with the "apartment" category includes water use for all multi-unit residential structures, including townhomes, duplexes, apartments, and units in mixed-use developments

2 - Water use associated with the "Workforce Housing - Micro" category refers to the 15% of units required in a proposed residential development under the County's Workforce Housing Combining District provisions

3 - Water use associated with the industrial category refers to cannabis cultivation operations, winery production facilities, and breweries. The share associated with this water use category is derived from existing permit applications for these business types and projections of future development over the next 20 years, as follows:
Cannabis Cultivation - Current permits total 62,420 sq. ft. of existing industrial space converted to indoor cannabis cultivation, projected to occupy 8% of industrial.
Wineries Production - Current active permits includes three wineries totaling 233,000 sq. ft., or 78,000 sq. ft. per facility, projected to increase by 50% over the next 20 years = 349,500 sq. ft.
Breweries - No current active breweries in the plan area, two breweries projected over the next 20 years of an average size equal to the average winery facility = 155,300 sq. ft.
Future projected industrial square footage totals 4,319,661, heavy water-users are projected to account for approximately 20% of industrial square footage.


SONOMA COUNTY AIRPORT AREA SPECIFIC PLAN PREFERRED ALTERNATIVE - LAND USE
OLD REDWOOD HWY
PRUITT AVE EXTENSION
AVIATION BLVD
CONCOURSE BLVD
AIRPORT BLVD
CENTURY CT
REGIONAL PKWY
BRICKWAY BLVD
BRICKWAY BLVD EXTENSION
COPPERHILL PKWY
WESTWIND BLVD
SKYLANE BLVD
N LAUGHLIN RD
GAYLE DR
VINEYARD CREEK DR
Road Classification:
Industrial
Complete Streets - Connector
Complete Streets - Protected
Neighborhood
Complete Streets - Protected/Industrial
Complete Streets - Connector/Industrial
Industrial (Proposed)
Complete Streets - Connector (Proposed)
Neighborhood (Proposed)
Trail (Existing)
Trail (Proposed)
LEGEND
Hotel Sites
SMART Station Parcel
Residential Combining District Areas
Affordable/Workforce Housing Permitted
Proposed Specific Plan Land Use
Urban Residential (max. 12 du/acre)
Urban Residential (max. 22 du/acre)
General Commercial (GC)
Limited Industrial (LI)
General Industrial (GI)
Public/Quasi-Public (PQP)
Land Intensive Agriculture (LIA)
Resources & Rural Development (RRD)
1/2 Mile from SMART Station
Sonoma Urban Service Area
Urban Service Area Adjusted Boundary
Specific Plan Area
0 350 700 1,400 Feet

Appendix E: List of Opportunity Sites by APN

PROPERTY APN	PROPERTY APN
059-240-074	059-240-018
059-240-075	059-240-019
059-350-071	059-240-052
059-350-072	059-250-003
059-350-073	059-250-031
059-240-008	059-240-073
059-271-108	059-370-022
059-340-035	059-210-041
059-340-011	059-240-034
059-340-012	059-240-054
059-240-078	059-240-063
059-210-016	059-271-006
059-210-049	059-240-053
059-210-055	059-240-061
059-210-056	059-240-062
059-240-069	059-250-030
059-250-051	059-250-044
059-250-052	059-230-061
059-250-053	059-240-066
059-271-004	059-350-024
059-271-045	059-350-074
059-271-073	059-350-076
059-271-090	059-350-103
059-340-032	059-350-104
059-350-101	059-240-002
059-370-016	059-230-062
059-370-017	059-350-025
059-370-023	059-350-026
059-370-024	059-350-105
059-370-026	059-360-001
059-370-027	059-360-002
059-370-028	059-360-003
059-370-029	059-360-004
059-340-031	059-360-005
059-240-009	059-370-025


SONOMA COUNTY AIRPORT AREA SPECIFIC PLAN OPPORTUNITY SITES
URBAN SERVICE AREA
Preferred Alternative assumes adjustment to the USA to incorporate APNs 059-240-067 and 059-230-060
APN 059-240-067
Not currently in service area BAU Scenario does not include this property in the "Plan Area"
HIGHWAY 101
VINEYARD CREEK DR
AVIATION BLVD
CENTURY CT
CONCOURSE BLVD
AIRPORT BLVD
REGIONAL PKWY
BRICKWAY BLVD
COPPERHILL PKWY
ALMAR PKWY
WESTWIND BLVD
SKYLANE BLVD
N LAUGHLIN RD
WINDSOR
LEGEND
Sonoma Urban Service Area
Specific Plan Area
Opportunity Sites

Appendix F: 2010-2017 Airport Area Water Use Totals

Acct Type	Water Fee Description	2010 Totals	2011 Totals	2012 totals	2013 Totals	2014 Totals	2015 Totals	2016 Totals	2017 Totals
Fire/Hydrant Water									
flsape Total	Fire Line Service Enterprise	-	1,000	4,488	3,023	5,920	691	256	1,473
flsapi Total	Fire Line Service Industrial	364,000	254,000	409,115	269,189	69,944	55,014	159,740	107,258
hydapi Total	Hydrant Water	-	-	25,223	1,394	1,887	5,523	4,369	1,826
	Subtotal	**364,000**	**255,000**	**438,826**	**273,606**	**77,751**	**61,228**	**164,365**	**110,557**
Demand									
comape Total	Airport Enterprise (Sonoma County Airport)	5,702,000	5,641,000	6,935,181	6,518,508	5,173,871	5,018,674	5,327,007	6,697,463
comapi Total	Commercial Industrial	24,967,000	25,432,000	29,820,364	27,291,619	24,930,062	22,487,983	27,320,564	30,150,712
hotlap Total	Hotel	2,063,000	2,322,000	2,715,849	2,758,475	2,731,386	2,497,781	2,734,267	2,486,055
indapi Total	Industrial Airport	16,990,000	19,017,000	19,215,955	18,341,850	17,115,609	15,110,417	16,034,441	15,476,826
instap Total	Institutional Airport	14,489,000	11,735,000	13,730,267	14,512,523	12,125,698	11,807,715	15,985,603	15,664,249
irrape Total	Irrigation Enterprise	1,108,000	1,023,000	1,489,654	1,213,738	957,922	728,822	472,382	1,260,589
irrapi Total	Irrigation Industrial	49,540,257	37,408,001	44,312,965	43,031,427	35,064,679	31,980,021	33,032,131	40,296,278
mulair Total	Multi Family (Vineyard Creek Apt)	9,658,000	9,149,000	9,750,397	9,649,112	9,492,075	7,859,932	8,004,502	7,667,295
	Subtotal	**124,517,257**	**111,727,001**	**127,970,632**	**123,317,252**	**107,591,302**	**97,491,345**	**108,910,897**	**108,910,897**
Grand Total	Yearly Totals in Gallons	**124,881,257**	**111,982,001**	**128,409,458**	**123,590,858**	**107,669,053**	**97,552,573**	**109,075,262**	**119,810,024**
Grand Total AF	**Yearly Totals in Acre Feet**	**383**	**344**	**394**	**379**	**330**	**299**	**335**	**368**

Airport Area Specific Plan Demand Projections

October 2019

Woodard & Curran

Proposed Airport Area Specific Plan Development by Land Use Category

Land Use Categories	Plan Acres[1]	Existing[2]		Potential New Development[1]		Potential Total Development	
Residential	82.9	292 du		896 du		1,128 du	
Industrial (Cannabis)	364	-		345,573 sf		345,573 sf	
Industrial (Brewery)		-		155,300 sf		155,300 sf	
Industrial (Winery)		-		349,500 sf		349,500 sf	
Industrial (Heavy/Light)		2,732,704 sf		736,564 sf		6,201,972 sf	
Retail	3.4	124,707 sf		15,202 sf		139,909 sf	
Office	87.5	827,567 sf		282,939 sf		1,110,506 sf	
Medical Office		80,900 sf		-		80,900 sf	
Lodging Accommodations	8	90 rooms		200 rooms		290 rooms	
Institutional	66	80,000 sf		-		80,000 sf	
Agricultural/Open Space	41	-		-		-	
Creeks	17	-		-		-	
Miscellaneous	140.2	-		-		-	
Total	810 acres	292 du	90 rooms	896 du	200 rooms	1,128 du	290 rooms
		80,000 sf institutional	2,732,704 sf industrial	0 sf institutional	1,586,937 sf industrial	80,000 sf institutional	4,319,641 sf industrial
		1,368,755 sf retail/office		298,141 sf retail/office		1,666,896 sf retail/office	

Acronyms: du = dwelling units; sf = square feet.

Notes:

1. Source: Data from *Airport Area Specific Plan Water Supply Assessment Request* (County of Sonoma 2019)
2. Source: Data from *Airport Specific Plan Water Demands Estimate* memo (M Group 2019).

Airport Area Specific Plan Water Demand Projection by Land Use

Land Use	Building Floor Area (SF)	Total Rooms/ Units	Water Demand Factors (AFY/SF)[3]	Projected Demand (AFY)
Agricultural/Open Space	N/A	N/A	N/A	N/A
Retail & Services	139,909		0.000089	12.5
Office	1,110,506		0.000089	98.8
Medical Offices	80,900		0.000089	7.2
Hotel	52,498	290	0.094111	27.3
Industrial (Cannabis)	345,573		0.000186	64.3
Industrial (Brewery)	155,300		0.000677	81.2
Industrial (Winery)	349,500		0.001105	88.4
Industrial (Heavy/Light)	3,469,268		0.000022	76.3
Institutional	80,000		0.000613	49.0
Apartment	-	935	0.129[2]	120.6
Micro-Units	-	124	0.0903[2]	11.2
Mobile Home	-	69	0.0903[2]	6.2
Creek	N/A	N/A	N/A	N/A
Right of Way	N/A	N/A	N/A	N/A
Miscellaneous	N/A	N/A	N/A	3.8
Irrigation	N/A	N/A	N/A	211.3
Total	5,783,454			858.1

Notes:

1. Basis of demand factors are described in the *Airport Specific Plan Water Demands Estimate* memo (M Group 2019).
2. The unit for the residential water demand factor is AFY per dwelling unit, not per square foot.

Projected Irrigation Demands for the Airport Area Specific Plan

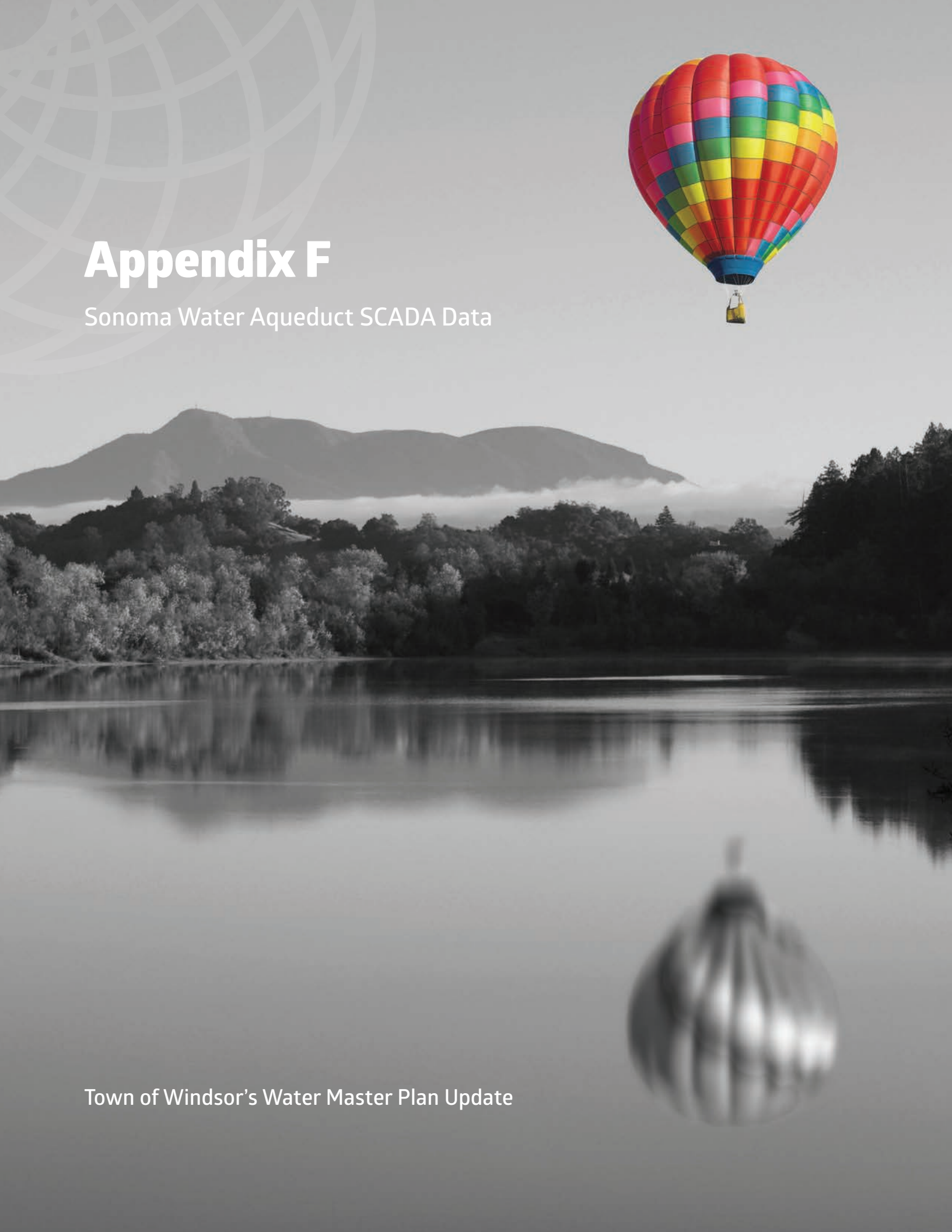
Land Use	Acres	% Irrigated	Irrigated Acreage	MAWA (AFY/acre)	Total Demand (AFY)
Agricultural and Open Space	58				0.0
Non-Irrigated		0%	0.0	0.0	0.0
Creeks	140.2				0.0
Non-Irrigated		0%	0.0	0.0	0.0
Commercial Retail	90.9				31.8
Standard Landscaping		15%	13.6	1.34	18.3
Special Area		5%	4.5	2.98	13.5
Hotel	8				2.8
Standard Landscaping		15%	1.2	1.34	1.6
Special Area		5%	0.4	2.98	1.2
Industrial	364				127.4
Standard Landscaping		15%	54.6	1.34	73.2
Special Area		5%	18.2	2.98	54.2
Institutional	66				16.5
Standard Landscaping		12%	7.9	1.34	10.6
Special Area		3%	2.0	2.98	5.9
Residential	82.9				32.7
Standard Landscaping		15%	12.4	1.64	20.4
Special Area		5%	4.1	2.98	12.4
Rights of Way	0				0.0
Non-Irrigated		0%	0.0	0	0.0

Land Use	Acres	% Irrigated	Irrigated Acreage	MAWA (AFY/acre)	Total Demand (AFY)
Special Area					0.0
Mis.	0				0.0
Standard Landscaping		0%	0.0	0	0.0
Special Area			0.00	2.98	0.0
Total	810			24.88	211.3

Notes:

1. Estimated landscape coverage that is irrigated.
2. Maximum Applied Water Allowance (MAWA):
   MAWA = ETo (36 inches) x ETo Adjustment Factor (Commercial = 0.45; Residential = 0.55; Special Landscape Area = 0.45/0.55) x 0.623 (gallons / inches / square feet) x 7.48 (acres / acre-feet)

Commercial MAWA	Standard	1.34 AFY/acre
	Special	2.98 AFY/acre
Residential MAWA	Standard	1.64 AFY/acre
	Special	2.98 AFY/acre



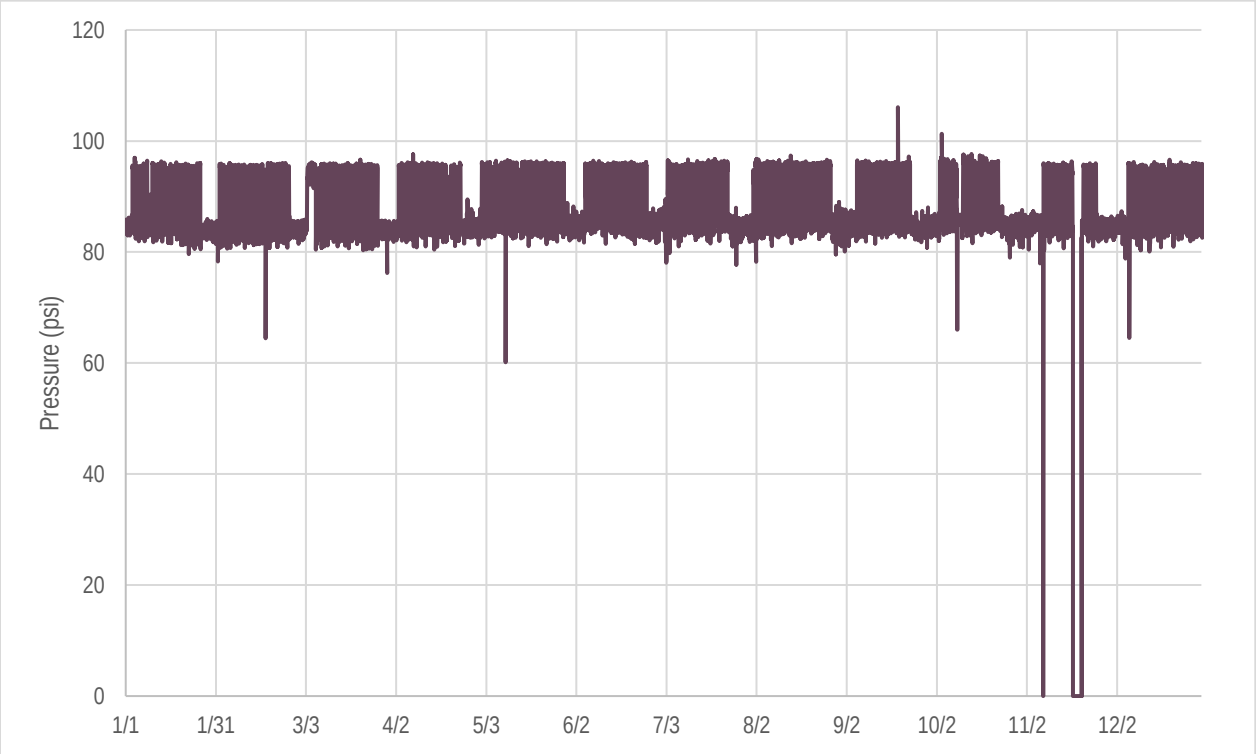
Appendix F

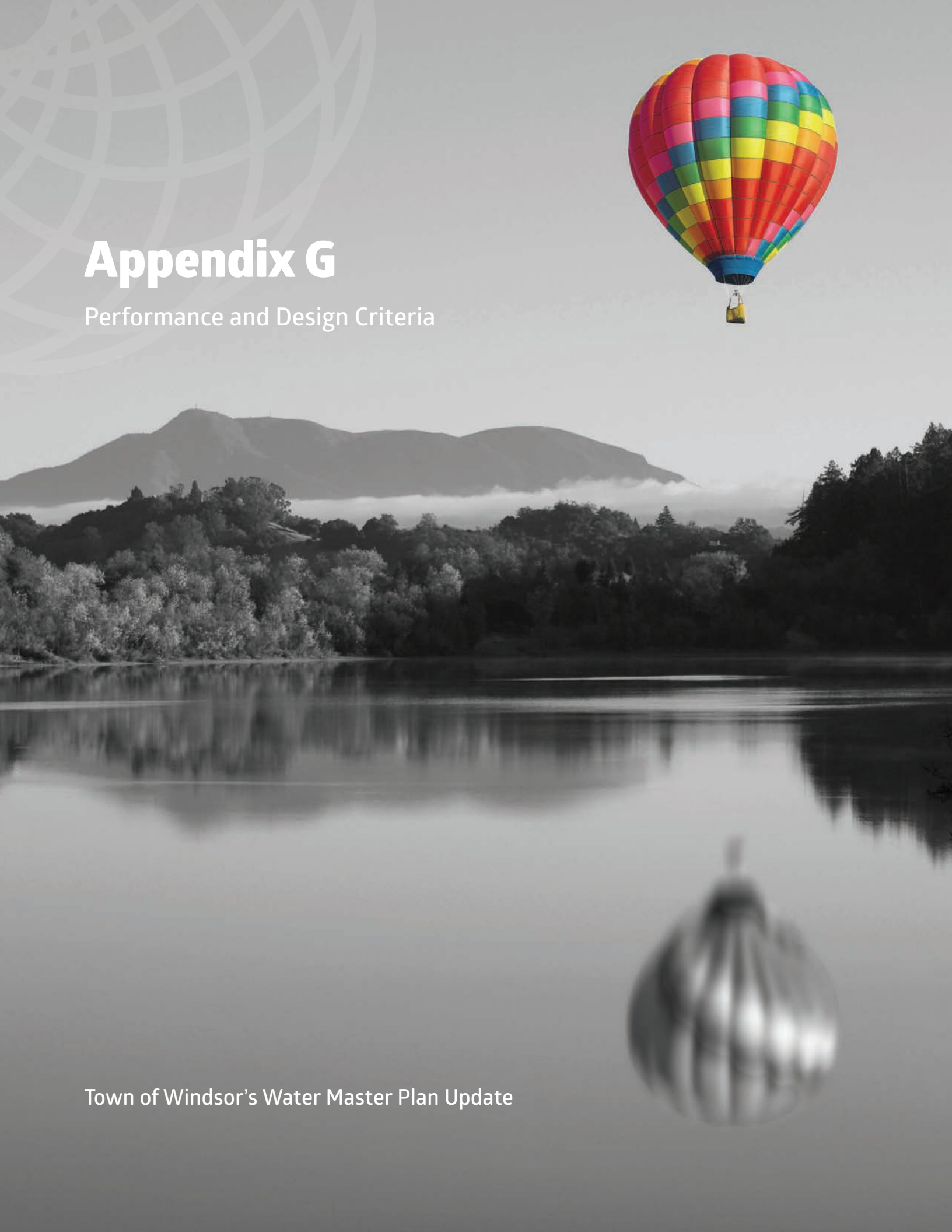
Sonoma Water Aqueduct SCADA Data

Town of Windsor's Water Master Plan Update

APPENDIX F: SCWA AQUEDUCT SCADA DATA

SCADA Recorded Pressure Downstream of SCWA Aqueduct Connection (2017)





Appendix G

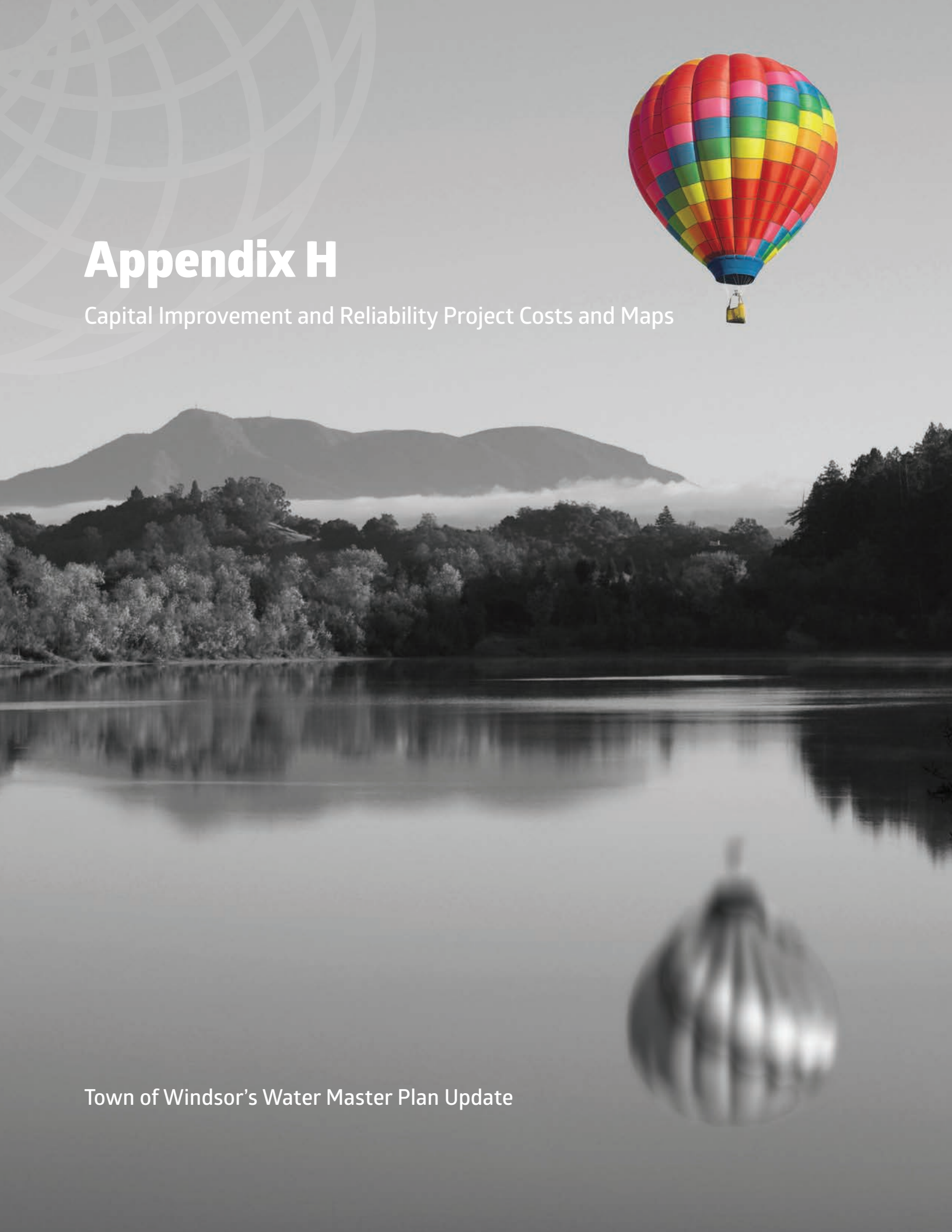
Performance and Design Criteria

Town of Windsor's Water Master Plan Update

APPENDIX G: PERFORMANCE AND DESIGN CRITERIA

Town of Windsor - 2018 Water Master Plan
Design and Performance Criteria

Description	Design/Performance Criteria
Pipe Design	
Materials	6-inch and 12-inch water mains shall be Polyvinyl Chloride (PVC) C900, minimum PC 150 or Ductile iron pipe ANSI/AWWA C151, Class 50, minimum. 14, 16 or 18-inch diameter water mains shall be Ductile iron pipe or PVC C905, PC 165 psi or as shown on plans and specifications. Asbestos cement pipe shall not be used under any circumstances Ductile iron pipe must be polyethylene encased and cathodic protection shall approved by the Town Engineer. Where the normal main line static pressure exceeds 150 psi, Ductile iron pipe or Class 200 PVC must be used.
Minimum Size	For residential/commercial installations, public and private mains shall be 8" minimum. 6" minimum suitable where fire hydrants are not
Pipe wall thickness	Designed based on pipe material, pressure requirements, and external loading
Design Pressure - Maximum	120 psi measured at a fire hydrant 90 psi measured at a faucet
Design Pressure - Minimum	20 psi measured at a fire hydrant 90 psi measured at a faucet
Maximum Velocity	10 feet per second
Headloss	Average Day Demand: Maximum 5 ft/1000 ft Maximum Day Demand: Maximum 5 ft/1000 ft Maximum Day Demand Plus Fire Flow: Maximum 10 ft/1000 ft Peak Hour Demand: Maximum 7 feet/1000 feet, deviation with approval by Town Engineer
Ground Cover	The minimum cover for all water main construction, under any circumstances, is 30" Where cover exceeds 8 feet, special permission from the Town Engineer is required. Where cover is less than 30 inches, minimum Pressure Class 150 Ductile iron pipe is required, pipe thickness to be designed based on pipe material, pressure requirements, and external loading
Vertical Alignment	Water main should be installed above wastewater or storm line with a clearance of 12 inches
Horizontal Alignment	Minimum horizontal separation from existing gas, electrical, and telephone lines shall be 3 feet between pipes. Minimum clear horizontal separation from a metallic pipeline with an induced current shall be 5 feet. Minimum clear horizontal separation from a storm drain shall be 5 feet.
Connection to an Existing Main	For connecting 2-inch diameter pipes and smaller, use a hot tap. Cut-in tee must be used if additional valves are required on the existing main. If the new lateral is larger than existing main, the tee shall be the size of the new lateral and reduced to the size of the existing main. Size-on-size taps are allowed up to 8-inch in accordance with the approved standards. 12-inch size-on-size taps are allowed only under emergency situtations and with the specific approval of the Town Engineer.
Allowable Joint Deflections (allowable radius)	Up to 12-inch diameter and per pipe manufacturer's requirements
Water Meters	Maintain a minimum 5' separation from the sewer lateral Residential: 1 meter per lot
Fire Requirements	
Residential Areas	1,500 gallons per minute for a duration of 2 hours with a 20 psi residual pressure
Commercial Areas	3,000 gallons per minute for a duration of 3 hours with a 20 psi residual pressure
Industrial Areas	3,000 gallons per minute for a duration of 3 hours with a 20 psi residual pressure
Storage	3,000 gpm for a duration of 3 hours
Hydrant Spacing - Residential	Space fire hydrants every 500', or as approved by the Fire Chief. No building may be more than 250' from the nearest hydrant or as approved by the Fire Chief Approximately one fire hydrant is needed for every two acres in a residential development
Hydrant Spacing - Commercial and Industrial	General hydrant spacing shall be every 300' or as approved by the Fire Chief No building may be more than 150' from the nearest hydrant or as approved by the Fire Chief
System Operating Requirements	
Operational Storage	[PHD – RR Well Field Capacity – SR Aqueduct Capacity (2.4 mgd) – Future Potable Well Capacity] x 4 hours OR 0.25 x Max Day Demand
Emergency Reserve Storage	(1 x Average Day Demand) - SR Aqueduct Daily Capacity (1.5 mgd) OR Average Day Demand
Fire Suppression Storage	See above (Fire Requirements)
Pressure Reducing Valves	Requred where service pressure is above the system operating pressure, places where the water will be moved from a zone of higher pressure to a lower pressure zone
Pump Operation	Pumps to be capable of delivering maximum day demand with the largest pump out of service, pumps to be capable of delivering all demand scenarios with a minimum of 1 stand by pump
Backflow Prevention	Required for irrigation services
System Operating Pressure	Average Day Demand: 35-90 psi Maximum Day Demand: Minimum 35 psi Maximum Day Demand Plus Fire Flow: Minimum 20 psi Peak Hour Demand: Minimum 35 psi

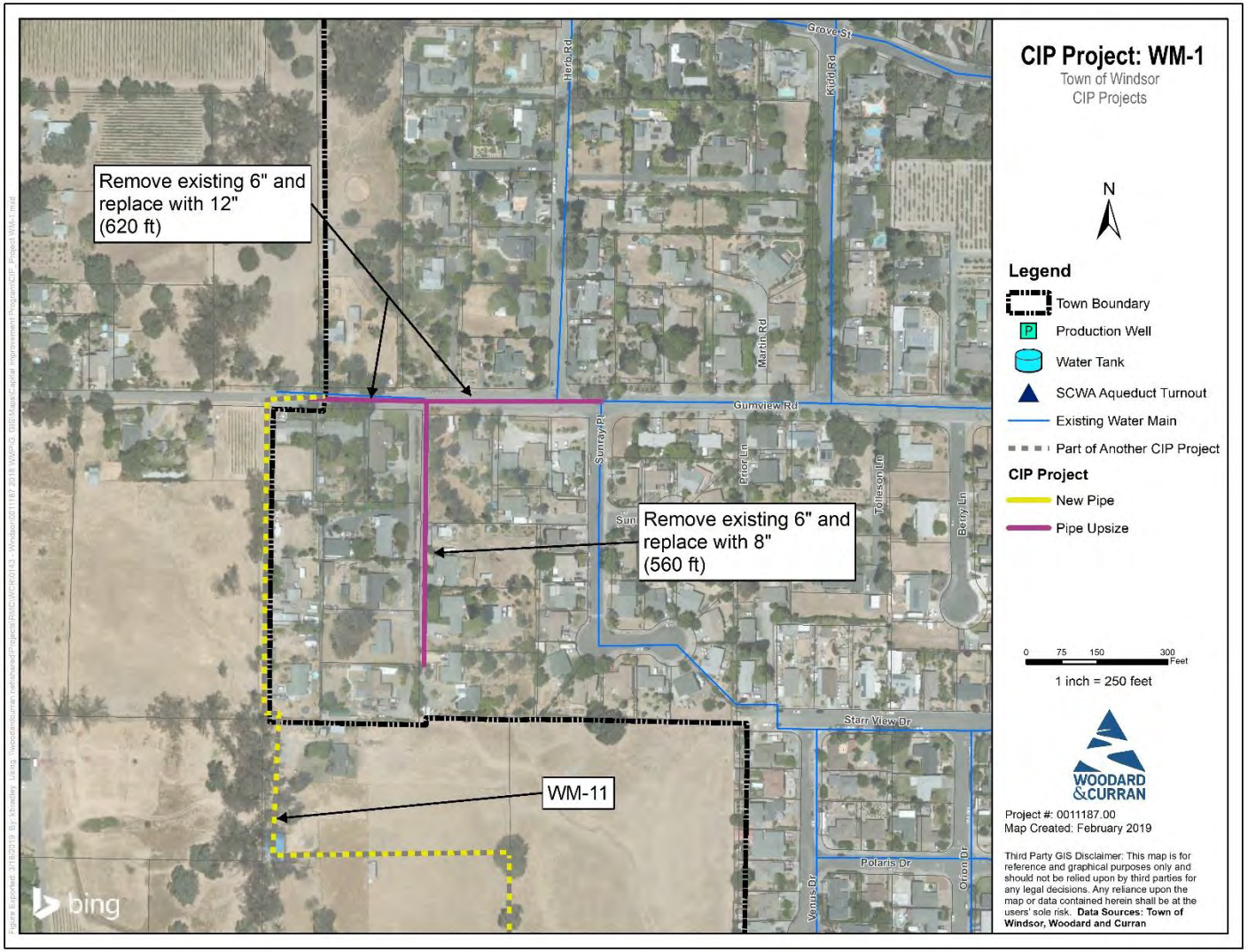


Appendix H

Capital Improvement and Reliability Project Costs and Maps

Town of Windsor's Water Master Plan Update

APPENDIX H: CAPITAL IMPROVEMENT AND RELIABILITY PROJECT COSTS AND MAPS


Remove existing 6" and replace with 12" (620 ft)
Remove existing 6" and replace with 8" (560 ft)
WM-11
Grove St
Herb Rd
Kidd Rd
Martin Rd
Gunview Rd
Sunray Pl
Prior Ln
Tolleson Ln
Berry Ln
Starr View Dr
Polaris Dr
Orion Dr
Venus Dr
bing
CIP Project: WM-1
Town of Windsor
CIP Projects
N
Legend
Town Boundary
Production Well
Water Tank
SCWA Aqueduct Turnout
Existing Water Main
Part of Another CIP Project
CIP Project
New Pipe
Pipe Upsize
0 75 150 300 Feet
1 inch = 250 feet
WOODARD &CURRAN
Project #: 0011187.00
Map Created: February 2019
Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions. Any reliance upon the map or data contained herein shall be at the users' sole risk. Data Sources: Town of Windsor, Woodard and Curran

Project: WM-1: Gumview Rd

Aspect: Distribution System Capacity Project

Date: 2/4/2019
Project Number: 0011187.00
Prepared By: I Jaffe
Checked By: R Little
Check Date: 2/7/2019

Notes: *This project could also be tied into project WM-11. The pipe segment along Gumview could be sized between 8" and 12". For this cost estimate a 12" pipe has been assumed.*

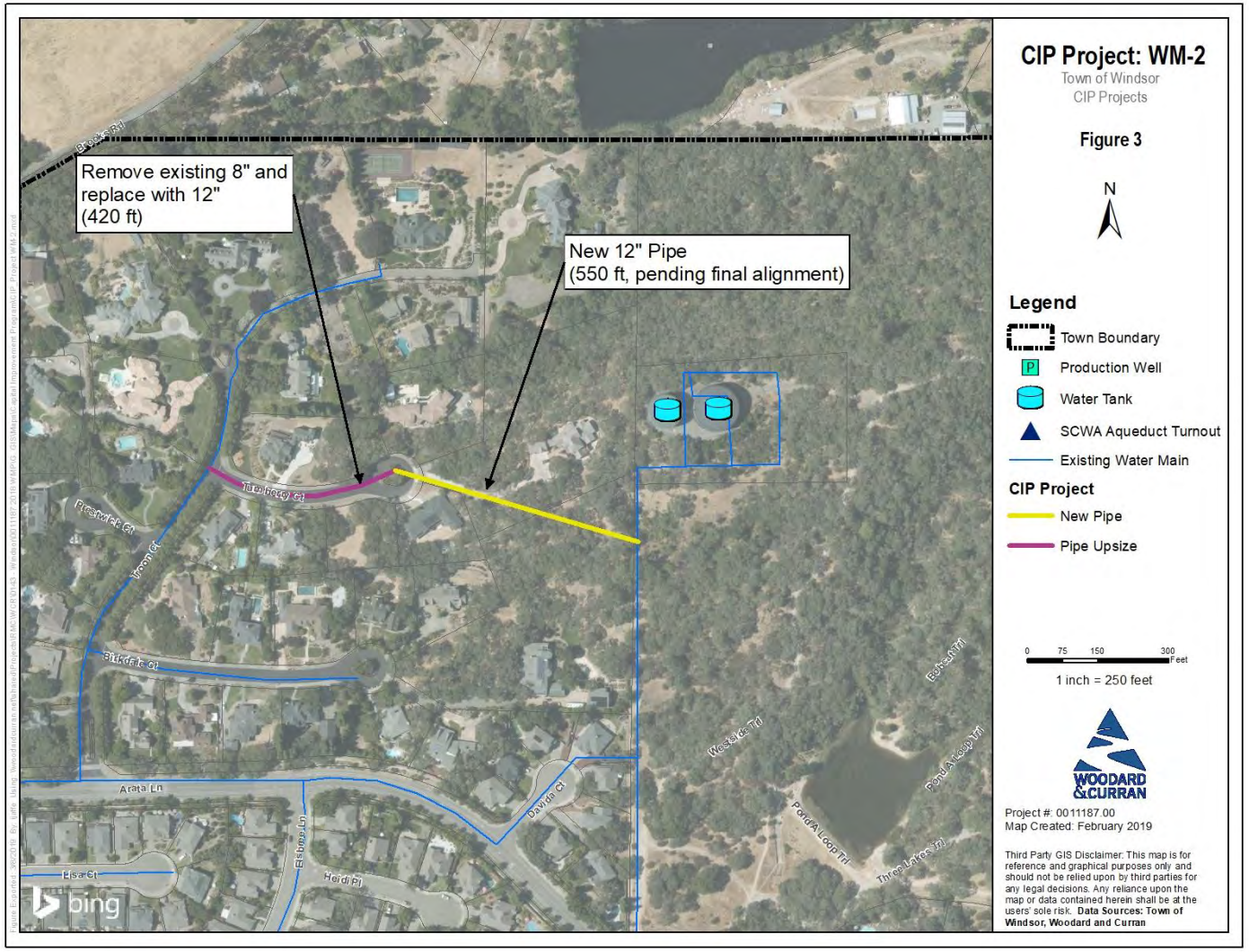
Estimate Type: Concept Level

Process Cost Summary by Division

Spec. Division			Subtotal	Notes
1 - General Requirements			$ 40,000	
2 - Sitework			$ 277,000	
	Raw Construction Subtotal		**$ 317,000**	
	Contractor Overhead & Profit	10%	$ 32,000	
	Sales Tax	8.125%	$ 13,000	Assumes this applies to 50% of Raw Constr. Cost
	Estimated Total Construction Cost		**$ 360,000**	
	Estimating Contingency	30%	$ 110,000	
	Estimated Construction Cost with Contingency		**$ 470,000**	
	Environmental Documentation & Permits	5%	$ 24,000	
	Design Cost	15%	$ 71,000	
	Project Administration and Construction Management Cost	15%	$ 71,000	
	Estimated Total Capital Cost		**$ 640,000**	

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
1 - General Requirements							**$ 40,000**	
	Mobilization	10%		1	LS	$27,687	$ 28,000	10% of Division 2
	Traffic Control	4%		1	LS	$11,075	$ 12,000	Light Urban

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 276,872**	
	Open Cut Pipelines							
	12-inch PVC DR-18 Pipe	12	inch	620	LF	$211	$ 130,984	Length of pipe along Gumview Road (from Sunray Pl to the dead end)
	Potholing			6	EA	$3,600	$ 21,600	Light urban: 3 potholes per 100 feet @ $1,200 per pothole
	Removal of existing pipe	6	inch	620	LF	$17	$ 10,707	
	8-inch PVC DR-18 Pipe	8	Inch	560	LF	$147	$ 82,310	Length of pipe from Gumview Road south to the dead end
	Potholing			6	EA	$3,600	$ 21,600	Light urban: 3 potholes per 100 feet @ $1,200 per pothole
	Removal of existing pipe	6	inch	560	LF	$17	$ 9,671	


Remove existing 8" and replace with 12" (420 ft)
New 12" Pipe (550 ft, pending final alignment)
Brooks Rd
Turpin Hill Ct
Prestwick Ct
Broom Ct
Burkdale Ct
Arata Ln
Elsa Ct
Elsbeth Ln
Heidi Pl
Davida Ct
Bobcat Trl
Westside Trl
Pond A Loop Trl
Three Lakes Trl
bing
CIP Project: WM-2
Town of Windsor
CIP Projects
Figure 3
N
Legend
Town Boundary
Production Well
Water Tank
SCWA Aqueduct Turnout
Existing Water Main
CIP Project
New Pipe
Pipe Upsize
0 75 150 300 Feet
1 inch = 250 feet
WOODARD &CURRAN
Project #: 0011187.00
Map Created: February 2019
Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions. Any reliance upon the map or data contained herein shall be at the users' sole risk. Data Sources: Town of Windsor, Woodard and Curran

Project: WM-2: Turnberry Ct

Aspect: Distribution System Capacity Project

Date: 2/4/2019
Project Number: 0011187.00
Prepared By: K. Bradley
Checked By: R Little
Check Date: 2/7/2019

Notes: *This project includes easement acquisition, costs of which are not included here. The final easement may impact the layout and length of the new 12" pipeline.*

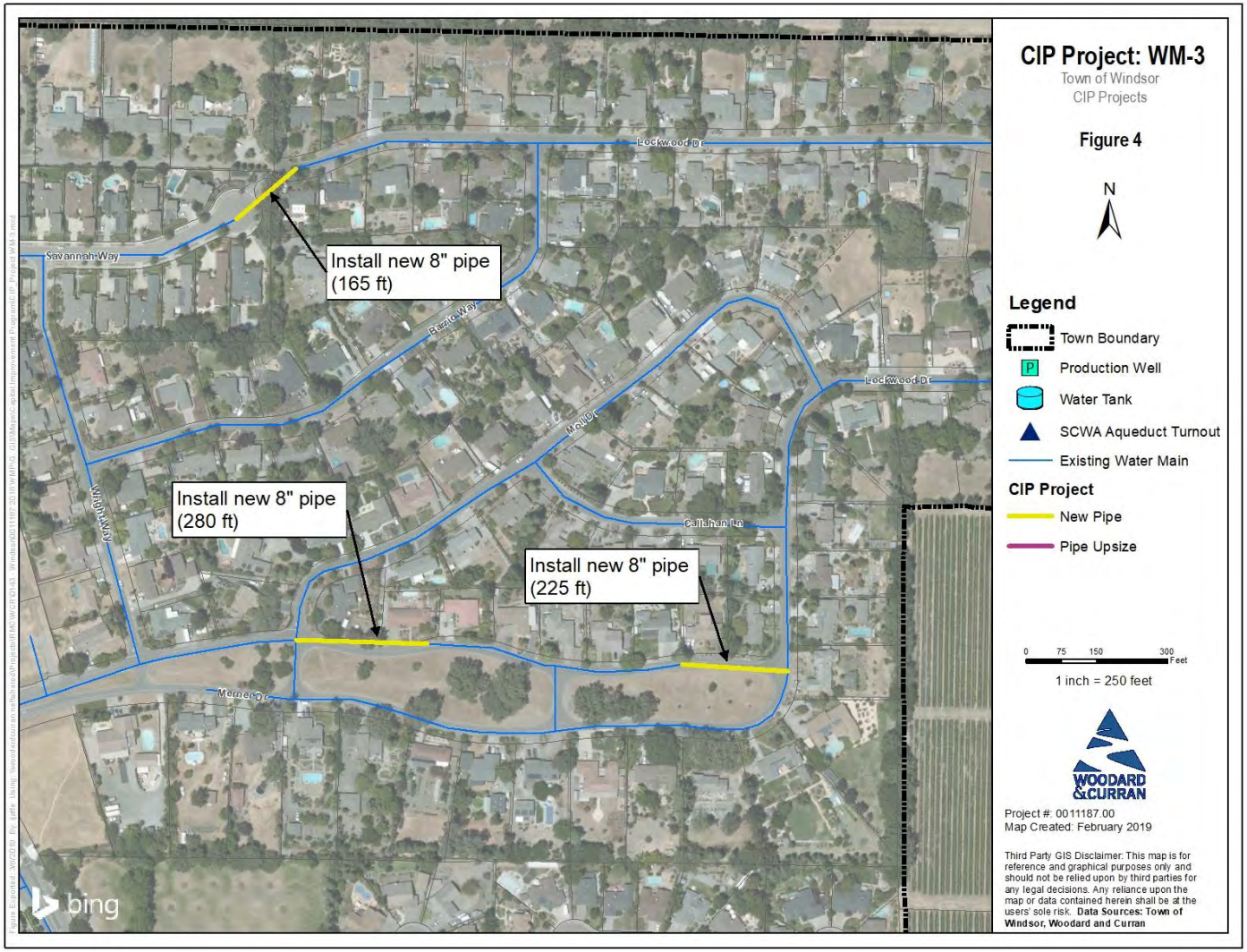
Estimate Type: Concept Level

Process Cost Summary by Division

Spec. Division			Subtotal	Notes
1 - General Requirements			$ 29,000	
2 - Sitework			$ 239,000	
	Raw Construction Subtotal		**$ 268,000**	
	Contractor Overhead & Profit	10%	$ 27,000	
	Sales Tax	8.125%	$ 11,000	Assumes this applies to 50% of Raw Constr. Cost
	Estimated Total Construction Cost		**$ 310,000**	
	Estimating Contingency	30%	$ 93,000	
	Estimated Construction Cost with Contingency		**$ 400,000**	
	Environmental Documentation & Permits	5%	$ 20,000	
	Design Cost	15%	$ 60,000	
	Project Administration and Construction Management Cost	15%	$ 60,000	
	Estimated Total Capital Cost		**$ 540,000**	

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
1 - General Requirements							**$ 29,000**	
	Mobilization	10%		1	LS	$23,862	$ 24,000	10% of Division 2
	Traffic Control	2%		1	LS	$4,772	$ 5,000	Rural

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 238,616**	
	Open Cut Pipelines							
	12-inch PVC DR-18 Pipe	12	inch	420	LF	$211	$ 88,731	Length of pipe along Turnberry Ct (from Troon Ct to the end of cul-de-sac)
	Potholing			4	EA	$3,600	$ 14,400	Light urban: 3 potholes per 100 feet @ $1,200 per pothole
	Removal of existing pipe	8	inch	420	LF	$29	$ 12,089	
	12-inch PVC DR-18 Pipe	12	Inch	550	LF	$211	$ 116,196	Length of pipe from end of Turnberry Ct cul-de-sac to pipe south of Lakewood Tanks. (Easement required)
	Potholing			6	EA	$1,200	$ 7,200	Rural: 1 pothole per 100 feet @ $1,200 per pothole


Install new 8" pipe
(165 ft)
Install new 8" pipe
(280 ft)
Install new 8" pipe
(225 ft)
Lockwood Dr
Savannah Way
Beale Way
Mellor
Callahan Ln
Wright Way
Merner Dr
bing
CIP Project: WM-3
Town of Windsor
CIP Projects
Figure 4
N
Legend
Town Boundary
Production Well
Water Tank
SCWA Aqueduct Turnout
Existing Water Main
CIP Project
New Pipe
Pipe Upsize
0 75 150 300
Feet
1 inch = 250 feet
WOODARD &CURRAN
Project #: 0011187.00
Map Created: February 2019
Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions. Any reliance upon the map or data contained herein shall be at the users' sole risk. Data Sources: Town of Windsor, Woodard and Curran

Project: WM-3: Savannah Way/Lockwood Dr and Merner Dr

Aspect: Distribution System Capacity Project

Date: 2/4/2019
Project Number: 0011187.00
Prepared By: K. Bradley
Checked By: R Little
Check Date: 2/7/2019

Notes: *This project consists of 3 new pipes: 2 on Merner Dr and 1 connecting between Savanna Way and Lockwood Dr.*

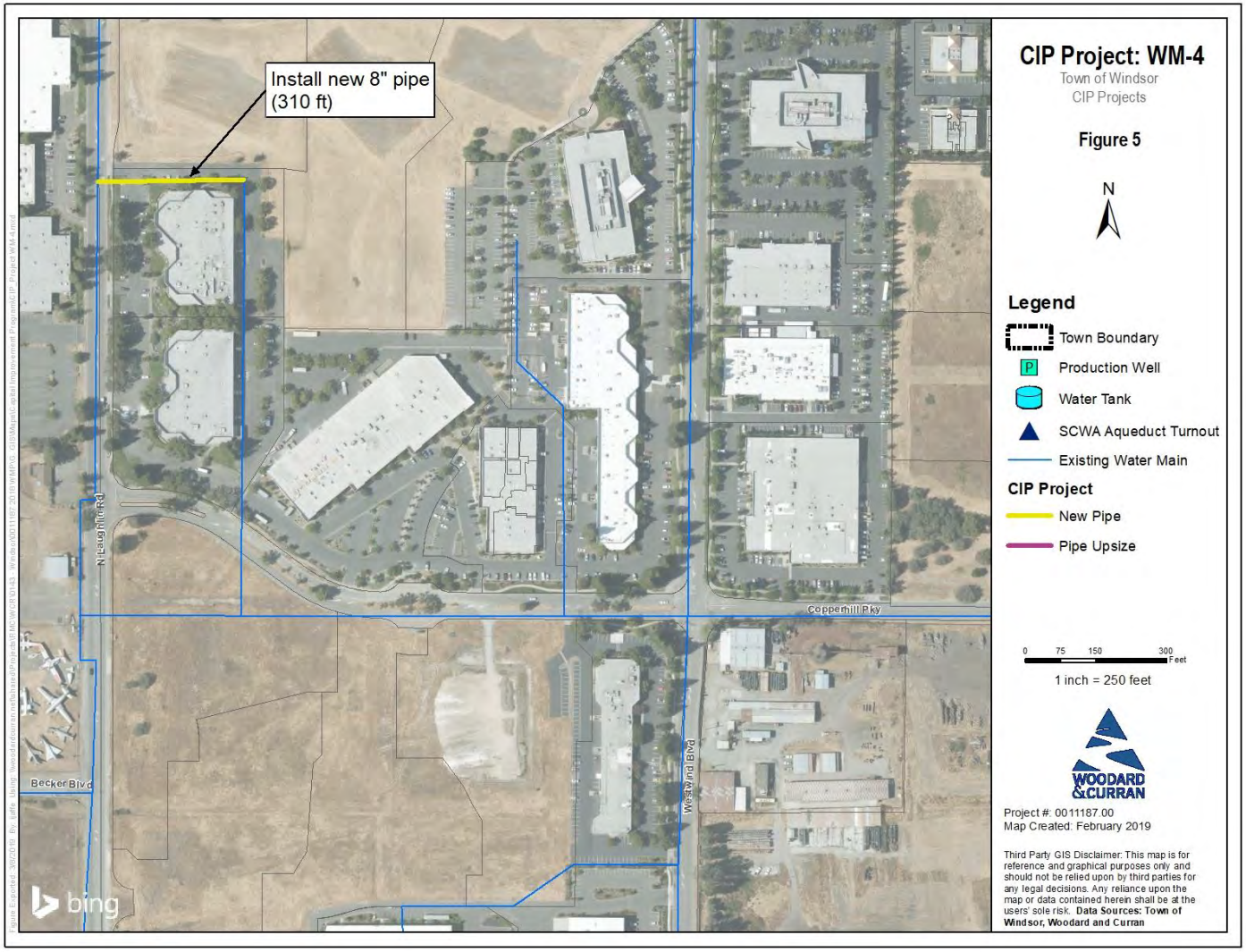
Estimate Type: Concept Level

Process Cost Summary by Division

Spec. Division			Subtotal	Notes
1 - General Requirements			$ 18,000	
2 - Sitework			$ 124,000	
	Raw Construction Subtotal		**$ 142,000**	
	Contractor Overhead & Profit	10%	$ 14,000	
	Sales Tax	8.125%	$ 5,800	Assumes this applies to 50% of Raw Constr. Cost
	Estimated Total Construction Cost		**$ 160,000**	
	Estimating Contingency	30%	$ 48,000	
	Estimated Construction Cost with Contingency		**$ 210,000**	
	Environmental Documentation & Permits	5%	$ 11,000	
	Design Cost	15%	$ 32,000	
	Project Administration and Construction Management Cost	15%	$ 32,000	
	Estimated Total Capital Cost		**$ 290,000**	

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
1 - General Requirements							**$ 18,000**	
	Mobilization	10%		1	LS	$12,368	$ 13,000	10% of Division 2
	Traffic Control	4%		1	LS	$4,947	$ 5,000	Light Urban

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 123,678**	
	Open Cut Pipelines							
	8-inch PVC DR-18 Pipe	8	inch	165	LF	$147	$ 24,252	Length of pipe from dead end on Lockwood Dr to dead end on Savannah Way
	Potholing			2	EA	$3,600	$ 7,200	Light urban: 3 potholes per 100 feet @ $1,200 per pothole
	8-inch PVC DR-18 Pipe	8	inch	280	LF	$147	$ 41,155	Length of pipe on Merner Drive (from Moll Dr going east)
	Potholing			3	EA	$3,600	$ 10,800	Light urban: 3 potholes per 100 feet @ $1,200 per pothole
	8-inch PVC DR-18 Pipe	8	inch	225	LF	$147	$ 33,071	Length of pipe on Merner Dr (from Lockwood Dr going west)
	Potholing			2	EA	$3,600	$ 7,200	Light urban: 3 potholes per 100 feet @ $1,200 per pothole


Install new 8" pipe
(310 ft)
N Naughton Rd
Copperhill Pky
Becker Blvd
Westwind Blvd
bing
CIP Project: WM-4
Town of Windsor
CIP Projects
Figure 5
N
Legend
Town Boundary
Production Well
Water Tank
SCWA Aqueduct Turnout
Existing Water Main
CIP Project
New Pipe
Pipe Upsize
0 75 150 300
Feet
1 inch = 250 feet
WOODARD &CURRAN
Project #: 0011187.00
Map Created: February 2019
Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions. Any reliance upon the map or data contained herein shall be at the users' sole risk. Data Sources: Town of Windsor, Woodard and Curran

Project: WM-4: N Laughlin Rd

Aspect: Distribution System Capacity Project

Date: 2/8/2019
Project Number: 0011187.00
Prepared By: K. Bradley
Checked By: R Little
Check Date: 2/7/2019

Notes: *This project will be completed as part of proposed development on the vacant property to the north and east.*

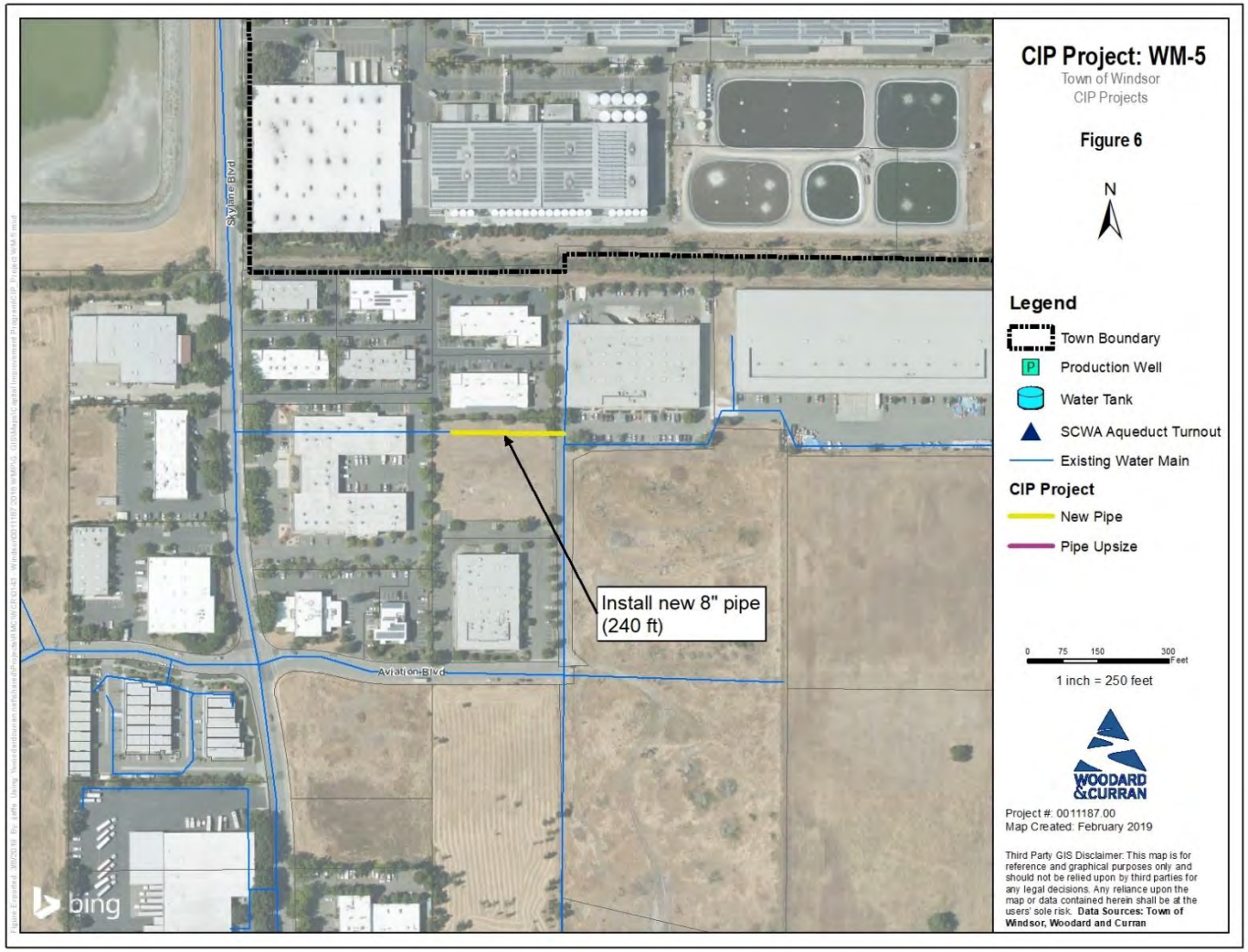
Estimate Type: Concept Level

Process Cost Summary by Division

Spec. Division			Subtotal	Notes
1 - General Requirements			$ 9,000	
2 - Sitework			$ 57,000	
	Raw Construction Subtotal		**$ 66,000**	
	Contractor Overhead & Profit	10%	$ 6,600	
	Sales Tax	8.125%	$ 2,700	Assumes this applies to 50% of Raw Constr. Cost
	Estimated Total Construction Cost		**$ 75,000**	
	Estimating Contingency	30%	$ 23,000	
	Estimated Construction Cost with Contingency		**$ 98,000**	
	Environmental Documentation & Permits	5%	$ 4,900	
	Design Cost	15%	$ 15,000	
	Project Administration and Construction Management Cost	15%	$ 15,000	
	Estimated Total Capital Cost		**$ 130,000**	

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
1 - General Requirements							**$ 9,000**	
	Mobilization	10%		1	LS	$5,636	$ 6,000	10% of Division 2
	Traffic Control	4%		1	LS	$2,255	$ 3,000	Light Urban

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 56,364**	
	Open Cut Pipelines							
	8-inch PVC DR-18 Pipe	8	inch	310	LF	$147	$ 45,564	Length of pipe east of N Laughlin Rd
	Potholing			3	EA	$3,600	$ 10,800	Light urban: 3 potholes per 100 feet @ $1,200 per pothole


Skylane Blvd
Aviation Blvd
Install new 8" pipe
(240 ft)
bing
CIP Project: WM-5
Town of Windsor
CIP Projects
Figure 6
N
Legend
Town Boundary
Production Well
Water Tank
SCWA Aqueduct Turnout
Existing Water Main
CIP Project
New Pipe
Pipe Upsize
0 75 150 300 Feet
1 inch = 250 feet
WOODARD &CURRAN
Project #: 0011187.00
Map Created: February 2019
Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions. Any reliance upon the map or data contained herein shall be at the users' sole risk. Data Sources: Town of Windsor, Woodard and Curran

Project: WM-5: Skylane Blvd and Aviation Blvd

Aspect: Distribution System Capacity Project

Date: 2/8/2019
Project Number: 0011187.00
Prepared By: K. Bradley
Checked By: R Little
Check Date: 2/7/2019

Notes: *This project will be completed as part of proposed development on the vacant property.*

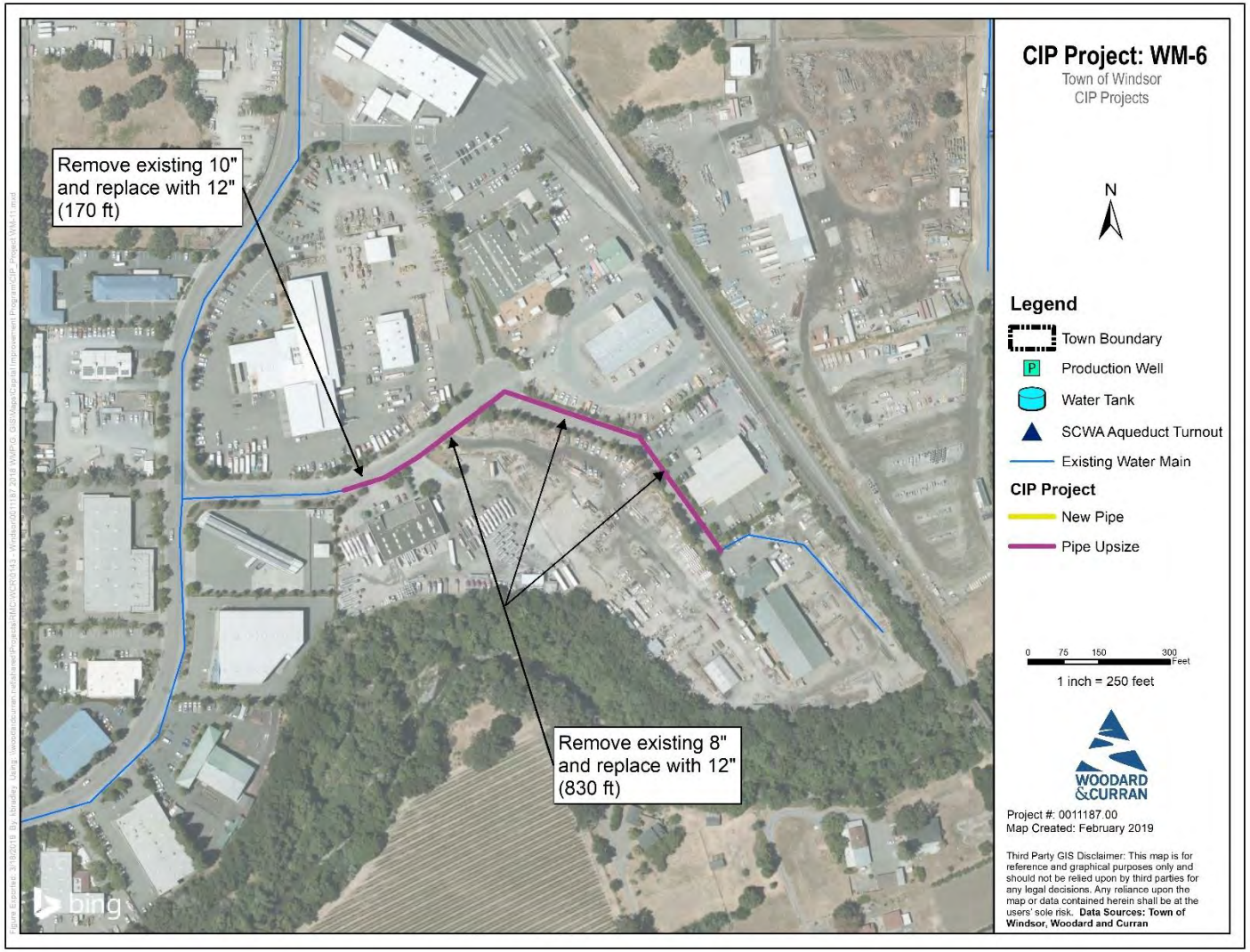
Estimate Type: Concept Level

Process Cost Summary by Division

Spec. Division	Subtotal	Notes
1 - General Requirements	$ 7,000	
2 - Sitework	$ 43,000	
Raw Construction Subtotal	**$ 50,000**	
Contractor Overhead & Profit 10%	$ 5,000	
Sales Tax 8.125%	$ 2,000	Assumes this applies to 50% of Raw Constr. Cost
Estimated Total Construction Cost	**$ 57,000**	
Estimating Contingency 30%	$ 17,000	
Estimated Construction Cost with Contingency	**$ 74,000**	
Environmental Documentation & Permits 5%	$ 3,700	
Design Cost 15%	$ 11,000	
Project Administration and Construction Management Cost 15%	$ 11,000	
Estimated Total Capital Cost	**$ 100,000**	

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
1 - General Requirements							**$ 7,000**	
Mobilization		10%		1	LS	$4,248	$ 5,000	10% of Division 2
Traffic Control		4%		1	LS	$1,699	$ 2,000	Light Urban

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 42,476**	
Open Cut Pipelines								
	8-inch PVC DR-18 Pipe	8	inch	240	LF	$147	$ 35,276	Length of pipe east of Skylane Blvd and North of Aviation Blvd.
	Potholing			2	EA	$3,600	$ 7,200	Light urban: 3 potholes per 100 feet @ $1,200 per pothole


Remove existing 10" and replace with 12" (170 ft)
Remove existing 8" and replace with 12" (830 ft)
CIP Project: WM-6
Town of Windsor
CIP Projects
N
Legend
Town Boundary
Production Well
Water Tank
SCWA Aqueduct Turnout
Existing Water Main
CIP Project
New Pipe
Pipe Upsize
0 75 150 300 Feet
1 inch = 250 feet
WOODARD &CURRAN
Project #: 0011187.00
Map Created: February 2019
Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions. Any reliance upon the map or data contained herein shall be at the users' sole risk. Data Sources: Town of Windsor, Woodard and Curran
bing

Project: WM-6: Century Ct

Aspect: Distribution System Capacity Project

Date: 2/11/2019
Project Number: 0011187.00
Prepared By: I Jaffe
Checked By: R Little
Check Date: 2/11/2019

Notes: *This project extends to the end of the Town-owned pipe. The pipe continues as a private fire line to the southeastern corner of the property.*

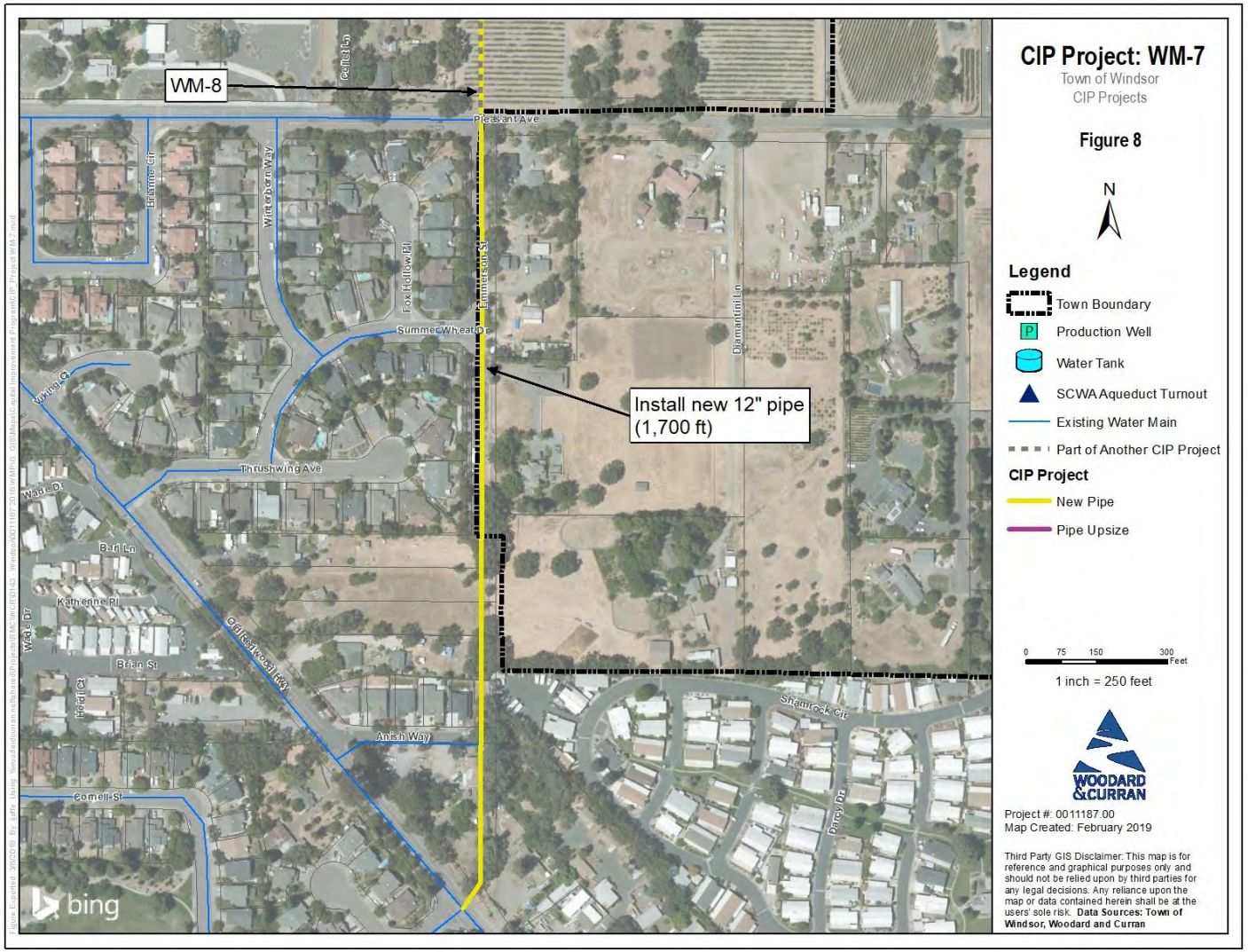
Estimate Type: Concept Level

Process Cost Summary by Division

Spec. Division			Subtotal	Notes
1 - General Requirements			$ 34,000	
2 - Sitework			$ 277,000	
	Raw Construction Subtotal		**$ 311,000**	
	Contractor Overhead & Profit	10%	$ 31,000	
	Sales Tax	8.125%	$ 13,000	Assumes this applies to 50% of Raw Constr. Cost
	Estimated Total Construction Cost		**$ 360,000**	
	Estimating Contingency	30%	$ 110,000	
	Estimated Construction Cost with Contingency		**$ 470,000**	
	Environmental Documentation & Permits	5%	$ 24,000	
	Design Cost	15%	$ 71,000	
	Project Administration and Construction Management Cost	15%	$ 71,000	
	Estimated Total Capital Cost		**$ 640,000**	

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
1 - General Requirements							**$ 34,000**	
	Mobilization	10%		1	LS	$27,605	$ 28,000	10% of Division 2
	Traffic Control	2%		1	LS	$5,521	$ 6,000	Rural

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 276,047**	
	Open Cut Pipelines							
	12-inch PVC DR-18 Pipe	12	inch	170	LF	$211	$ 35,915	Pipe from middle of Century Ct to the parcel to the south of the cul de sac
	Potholing			2	EA	$3,600	$ 7,200	Light urban: 3 potholes per 100 feet @ $1,200 per pothole
	Removal of existing pipe	10	inch	170	LF	$29	$ 4,893	
	12-inch PVC DR-18 Pipe	12	inch	830	LF	$211	$ 175,350	Segment of pipe in middle of Century Ct
	Potholing			8	EA	$3,600	$ 28,800	Light urban: 3 potholes per 100 feet @ $1,200 per pothole
	Removal of existing pipe	8	inch	830	LF	$29	$ 23,889	


WM-8
Pleasant Ave
Install new 12" pipe
(1,700 ft)
Thrushwing Ave
Summer Wheat Dr
Fox Hollow Pl
Timbers Dr
Diamantini Ln
Shamrock Cir
Daisy Dr
Orchard Wood Way
Brian St
Comell St
Anise Way
Katherine Pl
Barl Ln
Ward Dr
Hoerl Ct
Brianne Cir
Winterberry Way
Gerlach Ln
bing
CIP Project: WM-7
Town of Windsor
CIP Projects
Figure 8
N
Legend
Town Boundary
Production Well
Water Tank
SCWA Aqueduct Turnout
Existing Water Main
Part of Another CIP Project
CIP Project
New Pipe
Pipe Upsize
0 75 150 300 Feet
1 inch = 250 feet
WOODARD &CURRAN
Project #: 0011187.00
Map Created: February 2019
Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions. Any reliance upon the map or data contained herein shall be at the users' sole risk. Data Sources: Town of Windsor, Woodard and Curran

Project: WM-7: Emmerson St (Pleasant Ave to Old Redwood Hwy)

Aspect: Distribution System Reliability Project

Date: 2/6/2019
Project Number: 0011187.00
Prepared By: K. Bradley
Checked By: R Little
Check Date: 2/7/2019

Notes: *This project will tie into projects WM-8 and WM-9. This project will require an easement. The cost of the easement is not included in this estimate.*

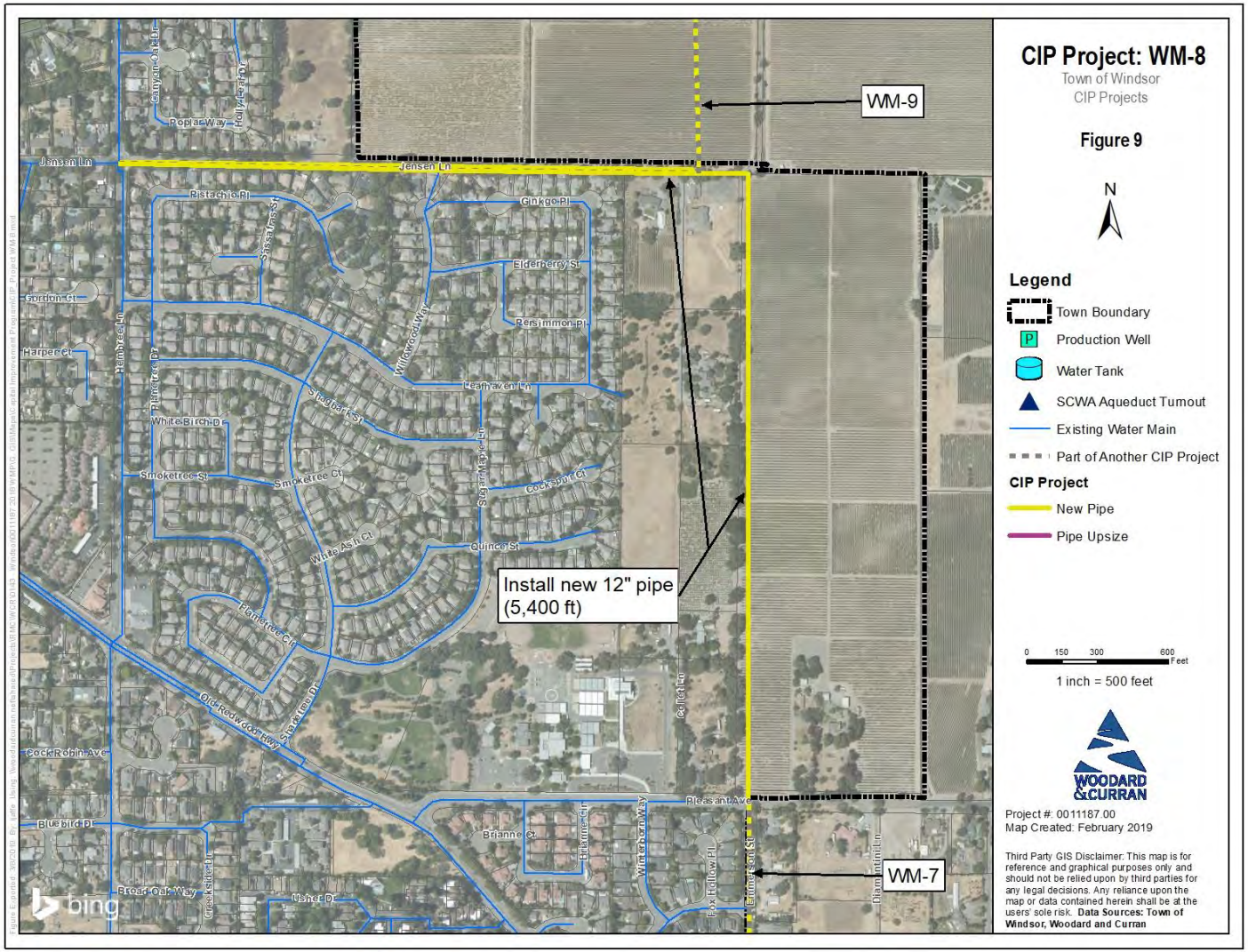
Estimate Type: Concept Level

Process Cost Summary by Division

Spec. Division			Subtotal	Notes
1 - General Requirements			$ 60,000	
2 - Sitework			$ 421,000	
	Raw Construction Subtotal		**$ 481,000**	
	Contractor Overhead & Profit	10%	$ 48,000	
	Sales Tax	8.125%	$ 20,000	Assumes this applies to 50% of Raw Constr. Cost
	Estimated Total Construction Cost		**$ 550,000**	
	Estimating Contingency	30%	$ 170,000	
	Estimated Construction Cost with Contingency		**$ 720,000**	
	Environmental Documentation & Permits	5%	$ 36,000	
	Design Cost	15%	$ 110,000	
	Project Administration and Construction Management Cost	15%	$ 110,000	
	Estimated Total Capital Cost		**$ 980,000**	

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
1 - General Requirements							**$ 60,000**	
	Mobilization	10%		1	LS	$42,035	$ 43,000	10% of Division 2
	Traffic Control	4%		1	LS	$16,814	$ 17,000	Light Urban

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 420,351**	
	Open Cut Pipelines							
	12-inch PVC DR-18 Pipe	12	inch	1,700	LF	$211	$ 359,151	Length of pipe on Emmerson St south of Pleasant Ave, connecting to Old Redwood Hwy
	Potholing			17	EA	$3,600	$ 61,200	Light urban: 3 potholes per 100 feet @ $1,200 per pothole


CIP Project: WM-8
Town of Windsor
CIP Projects
Figure 9
N
WM-9
WM-7
Install new 12" pipe
(5,400 ft)
Legend
Town Boundary
Production Well
Water Tank
SCWA Aqueduct Tumout
Existing Water Main
Part of Another CIP Project
CIP Project
New Pipe
Pipe Upsize
0 150 300 600 Feet
1 inch = 500 feet
WOODARD &CURRAN
Project #: 0011187.00
Map Created: February 2019
Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions. Any reliance upon the map or data contained herein shall be at the users' sole risk. Data Sources: Town of Windsor, Woodard and Curran
Jensen Ln
Poplar Way
Holly Leaf Dr
Canyon Oak Ln
Pistachio Pl
Sassafras St
Ginkgo Pl
Elderberry St
Persimmon Pl
Willowood Way
Gordon Ct
Harper Ct
Hemlock Ln
Planetree Dr
Leafhaven Ln
Shagbark St
White Birch Dr
Sugar Maple Ln
Smoketree St
Smoketree Ct
Cockspur Ct
White Ash Ct
Quince St
Feverfew Ct
Old Redwood Hwy
Shelford Dr
Center Ln
Rock Robin Ave
Bluebird Dr
Pleasant Ave
Brianne Ct
Brianne Cir
Wild Horse Way
Fox Hollow Pl
Diamond St
Diamond Ln
Crane Feeder Dr
Broad Oak Way
Usher Dr
bing

Project: WM-8: Jensen Ln to Pleasant Ave

Aspect: Distribution System Reliability Project

Date: 2/8/2019
Project Number: 0011187.00
Prepared By: K. Bradley
Checked By: R Little
Check Date: 2/7/2019

Notes: *This project will tie into projects WM-7 and WM-9. This project will require an easement. The cost of the easement is not included in this estimate.*

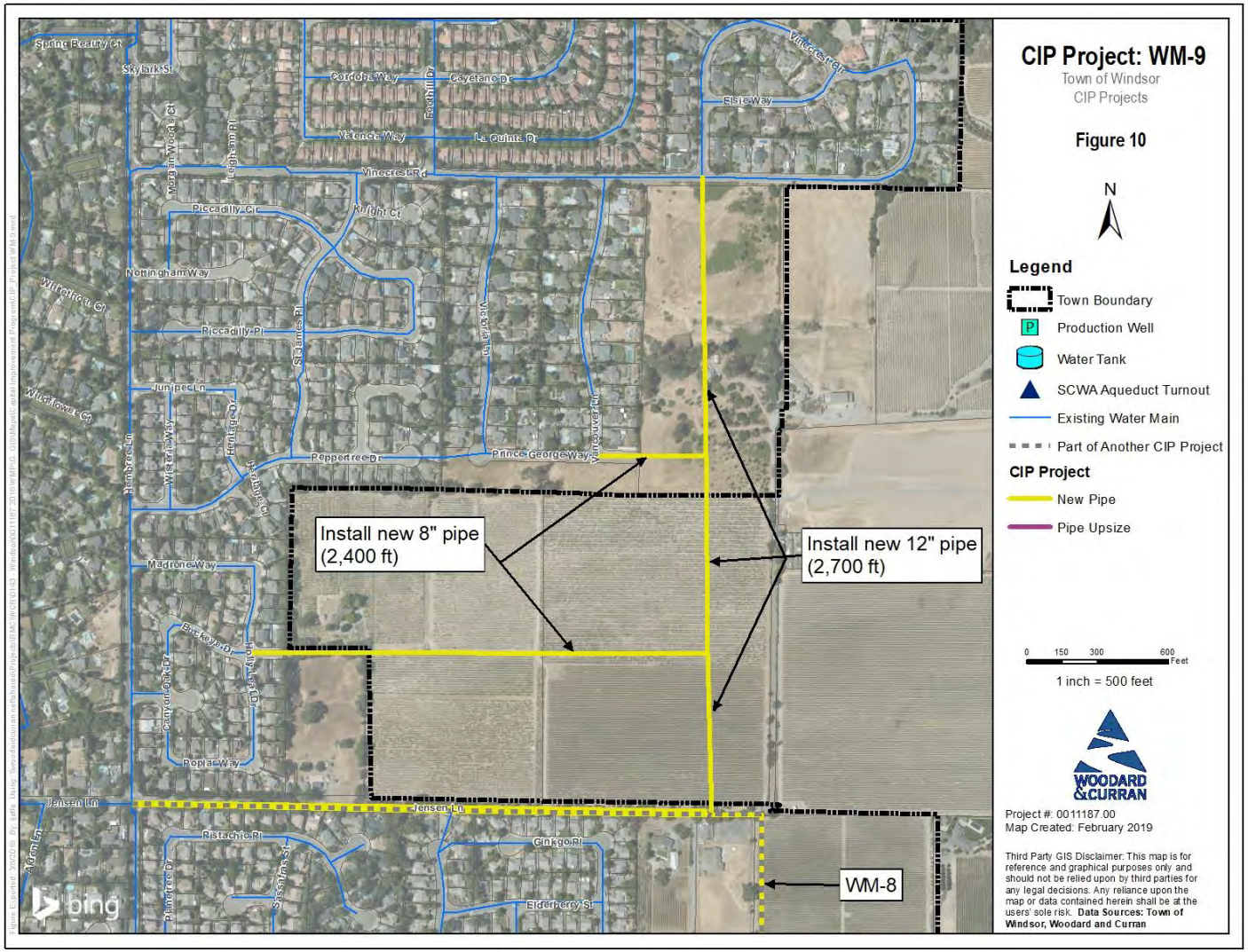
Estimate Type: Concept Level

Process Cost Summary by Division

Spec. Division			Subtotal	Notes
1 - General Requirements			$ 146,000	
2 - Sitework			$ 1,206,000	
	Raw Construction Subtotal		**$ 1,352,000**	
	Contractor Overhead & Profit	10%	$ 140,000	
	Sales Tax	8.125%	$ 55,000	Assumes this applies to 50% of Raw Constr. Cost
	Estimated Total Construction Cost		**$ 1,500,000**	
	Estimating Contingency	30%	$ 450,000	
	Estimated Construction Cost with Contingency		**$ 2,000,000**	
	Environmental Documentation & Permits	5%	$ 100,000	
	Design Cost	15%	$ 300,000	
	Project Administration and Construction Management Cost	15%	$ 300,000	
	Estimated Total Capital Cost		**$ 2,700,000**	

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
1 - General Requirements							**$ 146,000**	
	Mobilization	10%		1	LS	$120,563	$ 121,000	10% of Division 2
	Traffic Control	2%		1	LS	$24,113	$ 25,000	Rural

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 1,205,633**	
	Open Cut Pipelines							
	12-inch PVC DR-18 Pipe	12	inch	5,400	LF	$211	$ 1,140,833	Length of pipe from Jensen Ln going east and then south to Pleasant Ave
	Potholing			54	EA	$1,200	$ 64,800	Rural: 1 pothole per 100 feet @ $1,200 per pothole


CIP Project: WM-9
Town of Windsor
CIP Projects
Figure 10
N
Legend
Town Boundary
Production Well
Water Tank
SCWA Aqueduct Turnout
Existing Water Main
Part of Another CIP Project
CIP Project
New Pipe
Pipe Upsize
Install new 8" pipe (2,400 ft)
Install new 12" pipe (2,700 ft)
WM-8
0 150 300 600 Feet
1 inch = 500 feet
WOODARD &CURRAN
Project #: 0011187.00
Map Created: February 2019
Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions. Any reliance upon the map or data contained herein shall be at the users' sole risk. Data Sources: Town of Windsor, Woodard and Curran
bing
Spring Beauty Ct
Skylark St
Cordoba Way
Cayetano Dr
Foothill Dr
Elsie Way
Vinecrest Cir
Valencia Way
La Quinta Dr
Vinecrest Rd
Piccadilly Cir
Knight Ct
Nottingham Way
Piccadilly Pl
St James Pl
Victoria Ln
Juniper Ln
Heritage Dr
Peppertree Dr
Prince George Way
Vancouver Pl
Madrone Way
Poplar Way
Jensen Ln
Ginkgo Pl
Elderberry St
Ristachio Pl
Sycamore St
Planetree Dr

Project: WM-9: Vinecrest Rd/Jensen Ln, Prince George Way, and Buckeye Dr

Aspect: Distribution System Reliability Project

Date: 2/6/2019
Project Number: 0011187.00
Prepared By: K. Bradley
Checked By: R Little
Check Date: 2/7/2019

Notes: *This project will tie into projects WM-7 and WM-8. This project will require an easement. The cost of the easement is not included in this estimate.*

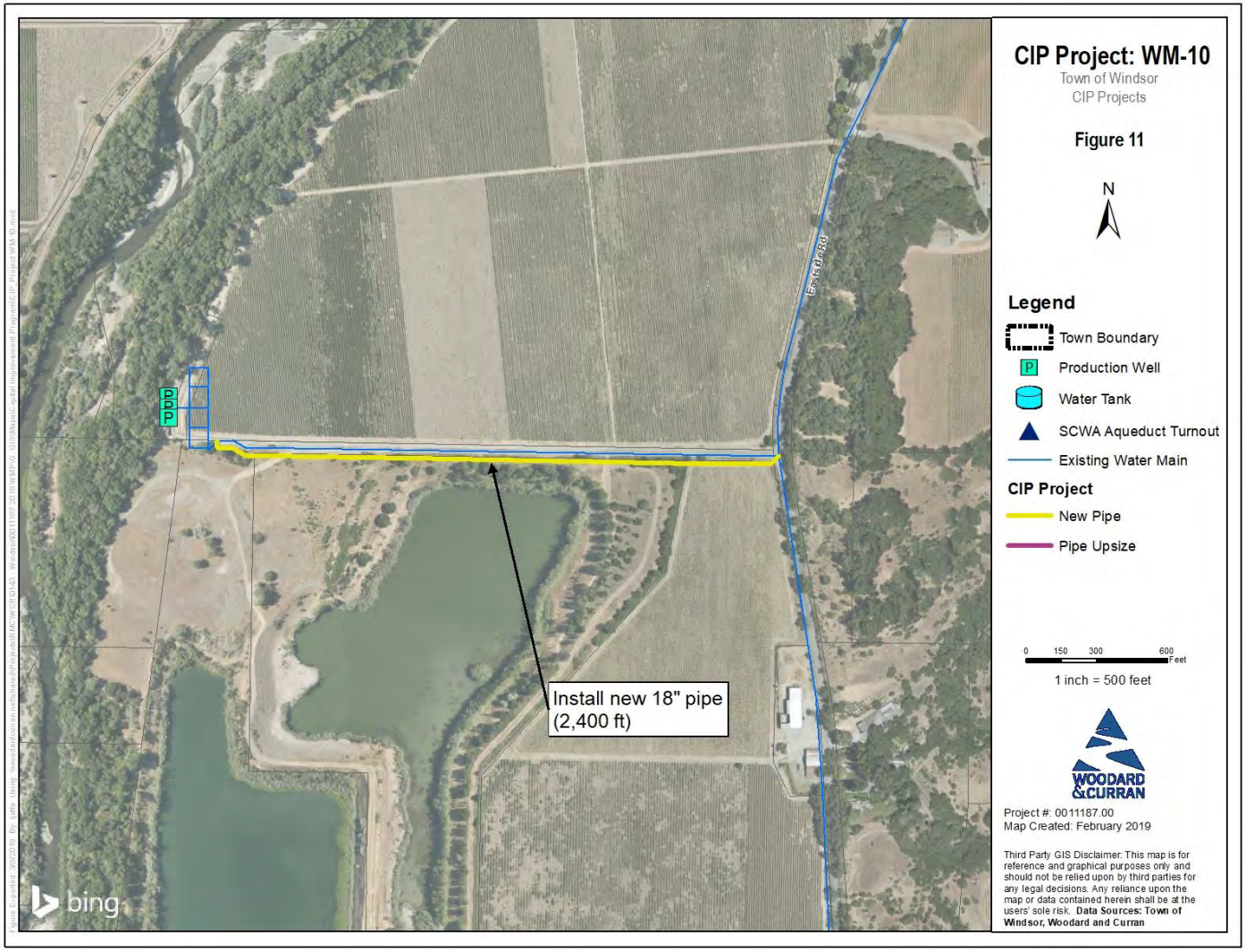
Estimate Type: Concept Level

Process Cost Summary by Division

Spec. Division			Subtotal	Notes
1 - General Requirements			$ 119,000	
2 - Sitework			$ 985,000	
	Raw Construction Subtotal		**$ 1,104,000**	
	Contractor Overhead & Profit	10%	$ 110,000	
	Sales Tax	8.125%	$ 45,000	Assumes this applies to 50% of Raw Constr. Cost
	Estimated Total Construction Cost		**$ 1,300,000**	
	Estimating Contingency	30%	$ 390,000	
	Estimated Construction Cost with Contingency		**$ 1,700,000**	
	Environmental Documentation & Permits	5%	$ 85,000	
	Design Cost	15%	$ 260,000	
	Project Administration and Construction Management Cost	15%	$ 260,000	
	Estimated Total Capital Cost		**$ 2,300,000**	

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
1 - General Requirements							**$ 119,000**	
Mobilization		10%		1	LS	$98,437	$ 99,000	10% of Division 2
Traffic Control		2%		1	LS	$19,687	$ 20,000	Rural

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 984,372**	
Open Cut Pipelines								
	12-inch PVC DR-18 Pipe	12	inch	2,700	LF	$211	$ 570,416	Length of pipe from Vinecrest Rd south to Jensen Ln
	Potholing			27	EA	$1,200	$ 32,400	Rural: 1 pothole per 100 feet @ $1,200 per pothole
	8-inch PVC DR-18 Pipe	8	inch	2,400	LF	$147	$ 352,756	2 pipes connecting to the 12" main, one to Prince George Way and one to Buckeye Dr
	Potholing			24	EA	$1,200	$ 28,800	Rural: 1 pothole per 100 feet @ $1,200 per pothole


Install new 18" pipe
(2,400 ft)
bing
CIP Project: WM-10
Town of Windsor
CIP Projects
Figure 11
N
Legend
Town Boundary
Production Well
Water Tank
SCWA Aqueduct Turnout
Existing Water Main
CIP Project
New Pipe
Pipe Upsize
0 150 300 600 Feet
1 inch = 500 feet
WOODARD &CURRAN
Project #: 0011187.00
Map Created: February 2019
Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions. Any reliance upon the map or data contained herein shall be at the users' sole risk. Data Sources: Town of Windsor, Woodard and Curran

Project: WM-10: Russian River Well Field

Aspect: Distribution System Reliability Project

Date: 2/11/2019
Project Number: 0011187.00
Prepared By: K. Bradley
Checked By: R Little
Check Date:

Notes: *This is a parallel pipe to the existing 18" supply line coming from the Russian River Well Field.*

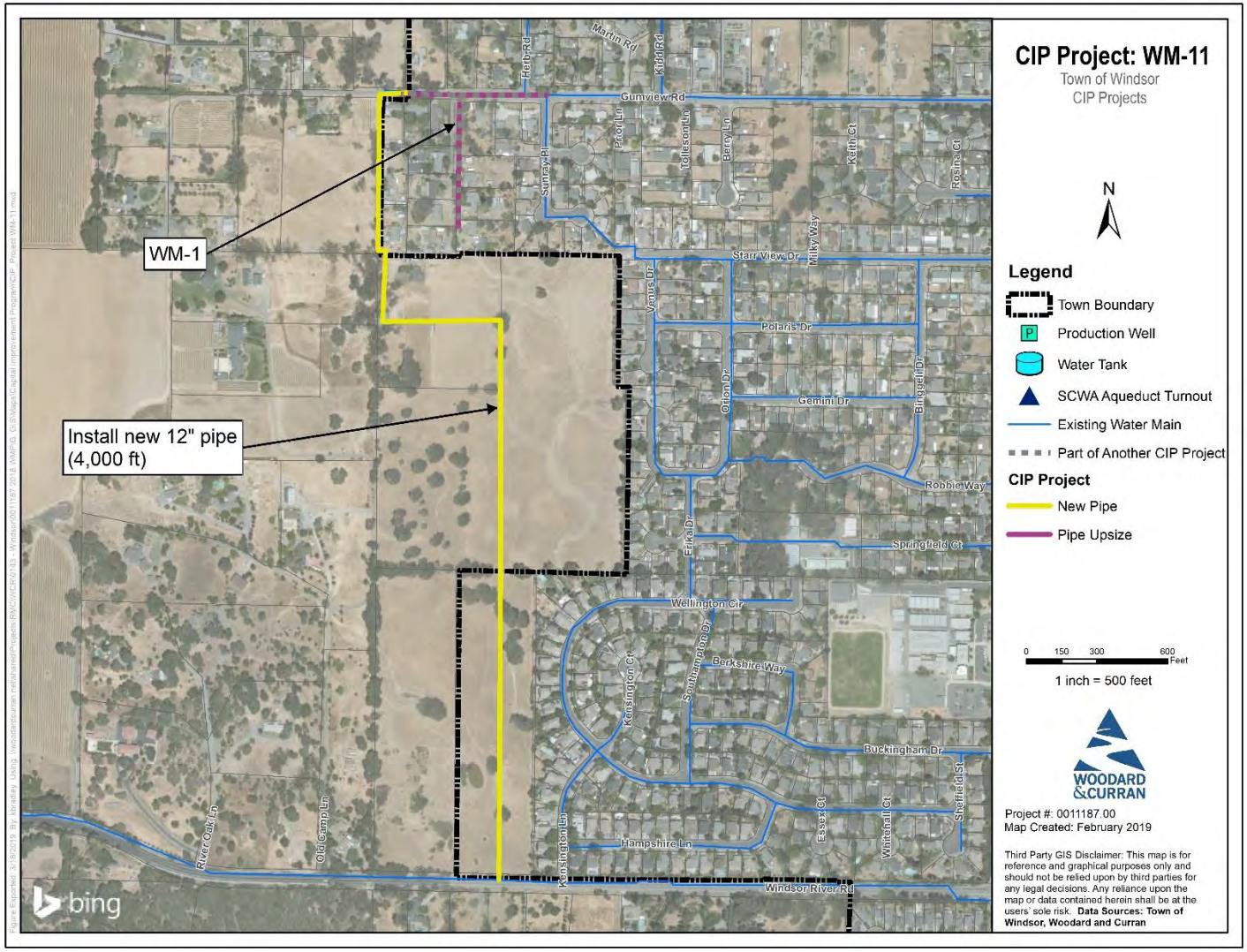
Estimate Type: Concept Level

Process Cost Summary by Division

Spec. Division			Subtotal	Notes
1 - General Requirements			$ 86,000	
2 - Sitework			$ 704,000	
	Raw Construction Subtotal		**$ 790,000**	
	Contractor Overhead & Profit	10%	$ 79,000	
	Sales Tax	8.125%	$ 32,000	Assumes this applies to 50% of Raw Constr. Cost
	Estimated Total Construction Cost		**$ 900,000**	
	Estimating Contingency	30%	$ 270,000	
	Estimated Construction Cost with Contingency		**$ 1,200,000**	
	Environmental Documentation & Permits	5%	$ 60,000	
	Design Cost	15%	$ 180,000	
	Project Administration and Construction Management Cost	15%	$ 180,000	
	Estimated Total Capital Cost		**$ 1,600,000**	

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
1 - General Requirements							**$ 86,000**	
Mobilization		10%		1	LS	$70,311	$ 71,000	10% of Division 2
Traffic Control		2%		1	LS	$14,062	$ 15,000	Rural

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 703,113**	
Open Cut Pipelines								
	18-inch HDPE DR-21 Pipe	18	inch	2,400	LF	$281	$ 674,313	Length of pipe going east from Russian River Well Field on Fontana Rd.
	Potholing			24	EA	$1,200	$ 28,800	Rural: 1 pothole per 100 feet @ $1,200 per pothole


WM-1
Install new 12" pipe
(4,000 ft)
CIP Project: WM-11
Town of Windsor
CIP Projects
N
Legend
Town Boundary
Production Well
Water Tank
SCWA Aqueduct Turnout
Existing Water Main
Part of Another CIP Project
CIP Project
New Pipe
Pipe Upsize
0 150 300 600 Feet
1 inch = 500 feet
WOODARD &CURRAN
Project #: 0011187.00
Map Created: February 2019
Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions. Any reliance upon the map or data contained herein shall be at the users' sole risk. Data Sources: Town of Windsor, Woodard and Curran
Gunview Rd
Starr View Dr
Polaris Dr
Gemini Dr
Robbie Way
Springfield Ct
Wellington Cir
Berkshire Way
Buckingham Dr
Hampshire Ln
Windsor River Rd
Martin Rd
Kidd Rd
Herb Rd
Sunray Pl
Prior Ln
Tolleson Ln
Barry Ln
Keith Ct
Rosina Ct
Milky Way
Venus Dr
Orion Dr
Bluegell Dr
Erika Dr
Kensington Ct
Southampton Dr
Kensington Ln
Essex Ct
Whitehall Ct
Sheffield St
River Oak Ln
Old Camp Ln
bing

Project: WM-11: Gumview Rd to Windsor River Rd

Aspect: Distribution System Reliability Project

Date: 2/6/2019
Project Number: 0011187.00
Prepared By: K. Bradley
Checked By: R Little
Check Date: 2/7/2019

Notes: *This project could also be tied into project WM-1. This project will require an easement. The cost of the easement is not included in this estimate.*

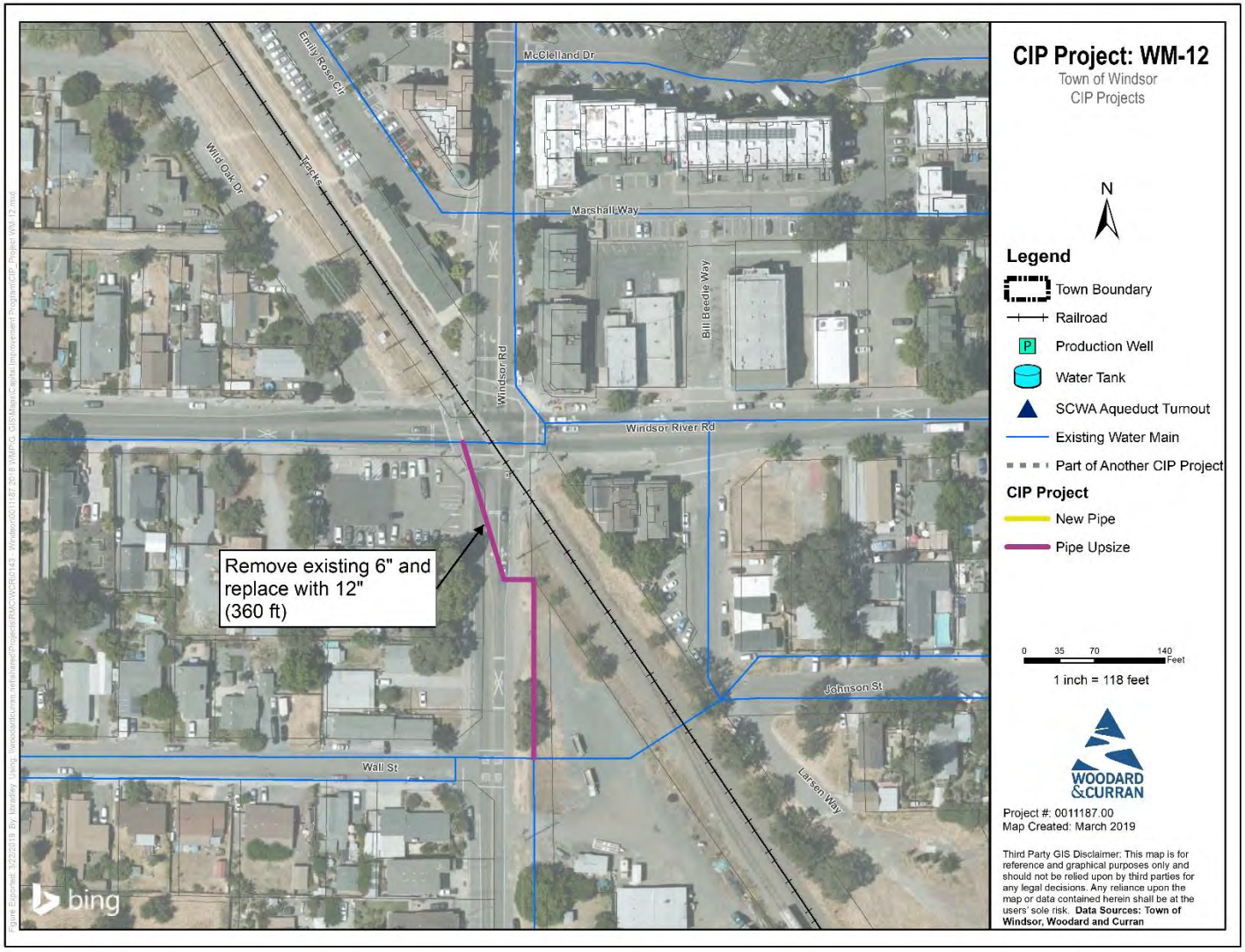
Estimate Type: Concept Level

Process Cost Summary by Division

Spec. Division			Subtotal	Notes
1 - General Requirements			$ 108,000	
2 - Sitework			$ 894,000	
	Raw Construction Subtotal		**$ 1,002,000**	
	Contractor Overhead & Profit	10%	$ 100,000	
	Sales Tax	8.125%	$ 41,000	Assumes this applies to 50% of Raw Constr. Cost
	Estimated Total Construction Cost		**$ 1,100,000**	
	Estimating Contingency	30%	$ 330,000	
	Estimated Construction Cost with Contingency		**$ 1,400,000**	
	Environmental Documentation & Permits	5%	$ 70,000	
	Design Cost	15%	$ 210,000	
	Project Administration and Construction Management Cost	15%	$ 210,000	
	Estimated Total Capital Cost		**$ 1,900,000**	

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
1 - General Requirements							**$ 108,000**	
	Mobilization	10%		1	LS	$89,306	$ 90,000	10% of Division 2
	Traffic Control	2%		1	LS	$17,861	$ 18,000	Rural

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 893,061**	
	Open Cut Pipelines							
	12-inch PVC DR-18 Pipe	12	inch	4,000	LF	$211	$ 845,061	Length of pipe from dead end on Gumview Dr going south to Windsor River Rd
	Potholing			40	EA	$1,200	$ 48,000	Rural: 1 pothole per 100 feet @ $1,200 per pothole


Remove existing 6" and replace with 12" (360 ft)
McClelland Dr
Emily Rose Cir
Wild Oak Dr
Tracks
Marshall Way
Bill Beedie Way
Windsor Rd
Windsor River Rd
Johnson St
Wall St
Larsen Way
bing
CIP Project: WM-12
Town of Windsor
CIP Projects
N
Legend
Town Boundary
Railroad
Production Well
Water Tank
SCWA Aqueduct Turnout
Existing Water Main
Part of Another CIP Project
CIP Project
New Pipe
Pipe Upsize
0 35 70 140 Feet
1 inch = 118 feet
WOODARD &CURRAN
Project #: 0011187.00
Map Created: March 2019
Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions. Any reliance upon the map or data contained herein shall be at the users' sole risk. Data Sources: Town of Windsor, Woodard and Curran

Project: WM-12: Windsor River Rd and Windsor Rd

Aspect: Distribution System Reliability Project

Date: 3/22/2019
Project Number: 0011187.00
Prepared By: K. Bradley
Checked By:
Check Date:

Notes: *This pipe will connect to a new 12-inch pipe that is replacing an existing 6-inch pipe across the railroad at the Windsor River Road and Windsor Road intersection as part of an intersection reconstruction project. This project will connect the new 12-inch pipe to the 16-inch main on Wall Street.*

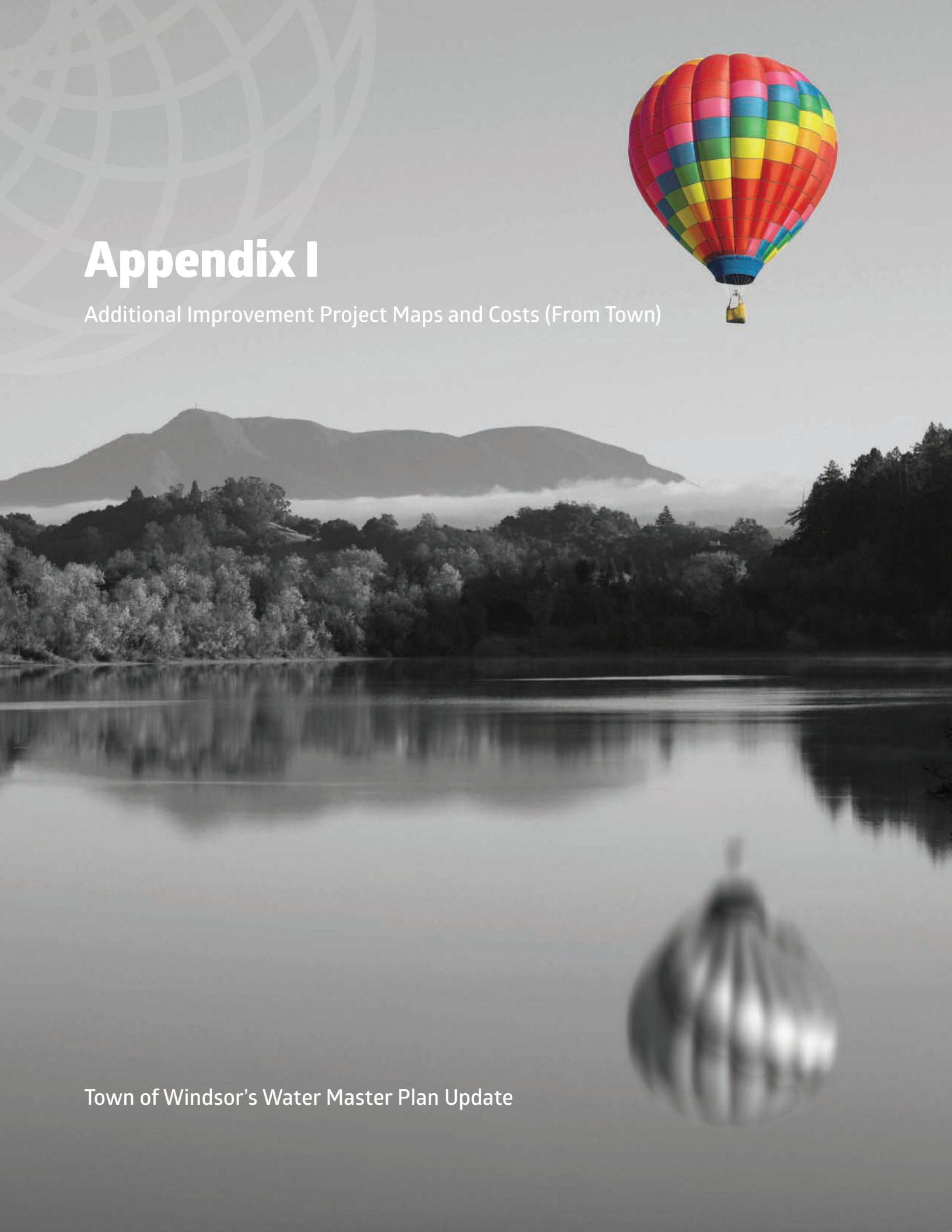
Estimate Type: Concept Level

Process Cost Summary by Division

Spec. Division			Subtotal	Notes
1 - General Requirements			$ 19,000	
2 - Sitework			$ 107,000	
	Raw Construction Subtotal		**$ 126,000**	
	Contractor Overhead & Profit	10%	$ 13,000	
	Sales Tax	8.125%	$ 5,100	Assumes this applies to 50% of Raw Constr. Cost
	Estimated Total Construction Cost		**$ 140,000**	
	Estimating Contingency	30%	$ 42,000	
	Estimated Construction Cost with Contingency		**$ 180,000**	
	Environmental Documentation & Permits	5%	$ 9,000	
	Design Cost	15%	$ 27,000	
	Project Administration and Construction Management Cost	15%	$ 27,000	
	Estimated Total Capital Cost		**$ 240,000**	

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
1 - General Requirements							**$ 19,000**	
	Mobilization	10%		1	LS	$10,627	$ 11,000	10% of Division 2
	Traffic Control	7%		1	LS	$7,439	$ 8,000	Heavy Urban

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
2 - Sitework							**$ 106,272**	
	Open Cut Pipelines							
	12-inch PVC DR-18 Pipe	12	inch	360	LF	$211	$ 76,056	Length on pipe Windsor Rd from intersection of Windsor Rd and Windsor River Rd south to Wall St.
	Potholing			4	EA	$6,000	$ 24,000	Heavy Urban: 5 potholes per 100 feet @ $1,200 per pothole
	Removal of existing pipe	6	inch	360	LF	$ 17	$ 6,217	

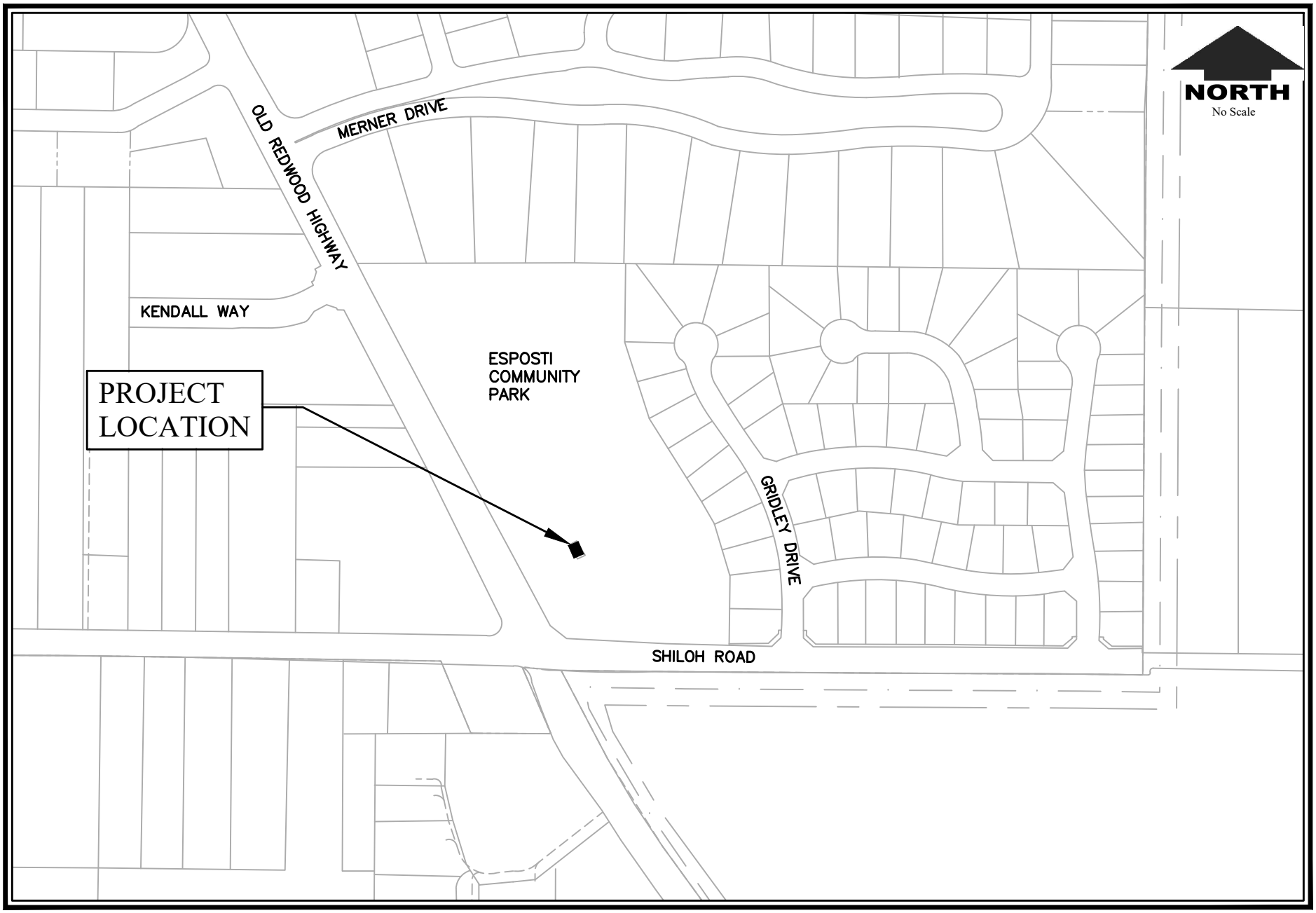


Appendix I

Additional Improvement Project Maps and Costs (From Town)

Town of Windsor's Water Master Plan Update

APPENDIX I: ADDITIONAL IMPROVEMENT PROJECT MAPS AND COSTS (FROM TOWN)



Esposti Well Water Treatment

TOWN OF WINDSOR

Town of Windsor
Five Year Capital Improvement Program
Project Detail Form

Project Name:
Esposti Park New Supply Well

Project No: 1310

Project Description:
Design and construct wellhead treatment for the existing Esposti Park potable well. The project includes evaluation of treatment options, environmental issues and location, as required. This project is identified in the Water Master Plan Update as Project W-2 and has been refined since 2017. This project will be phased with the North Windsor water supply well as recommended in the Esposti Well Feasibility Study.

Department:
Public Works - Engineering

Priority:

	Mandate
X	**Necessary**
	Desirable

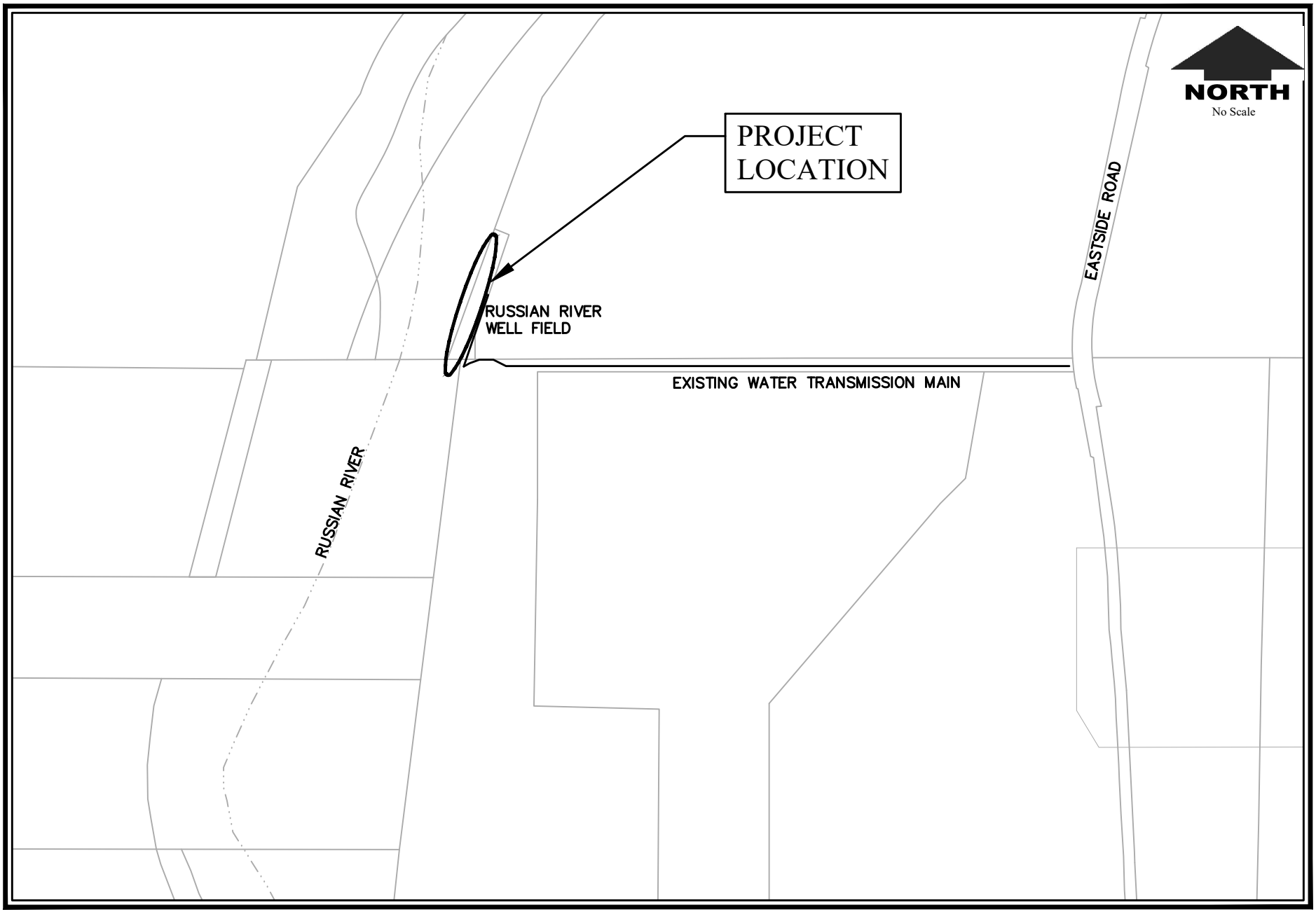
Justification:
Wellhead treatment for the existing Esposti Park Well would allow existing groundwater thatis currently used for irrigation to meet potable water standards. Wellhead treatment could generate about 350 AFY of water to enhance the Town's water supply to meet current demands in periods of drought and/or emergency and to meet increase maximum day demand as the Town's demand increases over time. It is estimated that the well would be expected to provide 400 gallons per minute (gpm), or 0.5 MGD. Treatment facilities for arsenic and manganese were assumed in the costs for this project and will be evaluated with other options before moving forward with construction. Costs assume the well will be located on Town-owned property and no land purchase costs are included.

Appropriations beyond the 5 year program period are needed to complete project:

YES ( )
NO (X)

General Plan Consistency:
The Project is consistent with General Plan Public Facilities and Servies Policy PFS-2.2 - The Town shall maintain the Urban Water Management Plan to adequately estimate projecte water demands and supplies over the planning horizon for average and drought year conditions; and shall implement water supply projects to provide a reliable supply during all water conditions.

	Item	Budget FY 18-19	Est Expend FY 18-19	FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	Total
Project Costs:	Design/Environmental	-	-	-	-	500,000	-	-	$ 500,000
	Construction	1,754,350	-	-	-	-	1,720,000	-	$ 1,720,000
	Construction Engineering	150,000	-	-	-	-	98,000	-	$ 98,000
	Project Management/Admin.	32,000	-	-	-	-	232,000	-	$ 232,000
	Contingency	-	-	-	-	-	-	-	$ -
	Total	$ 1,936,350	$ -	$ -	$ -	$ 500,000	$ 2,050,000	$ -	$ 2,550,000
Funding Sources:	Water Capital Fund	1,936,350	-	-	-	500,000	2,050,000	-	$ 2,550,000
		-							
	Total	$ 1,936,350	$ -	$ -	$ -	$ 500,000	$ 2,050,000	$ -	$ 2,550,000
Estimated O & M									



Replacement/New Russian River Well

TOWN OF WINDSOR

Project: W-2: New North Town Well

Aspect: Potable Supply Project

Date: 6/19/2019
Project Number: 0011187.00
Prepared By: I Jaffe
Checked By: J Strandberg
Check Date: 6/27/2019

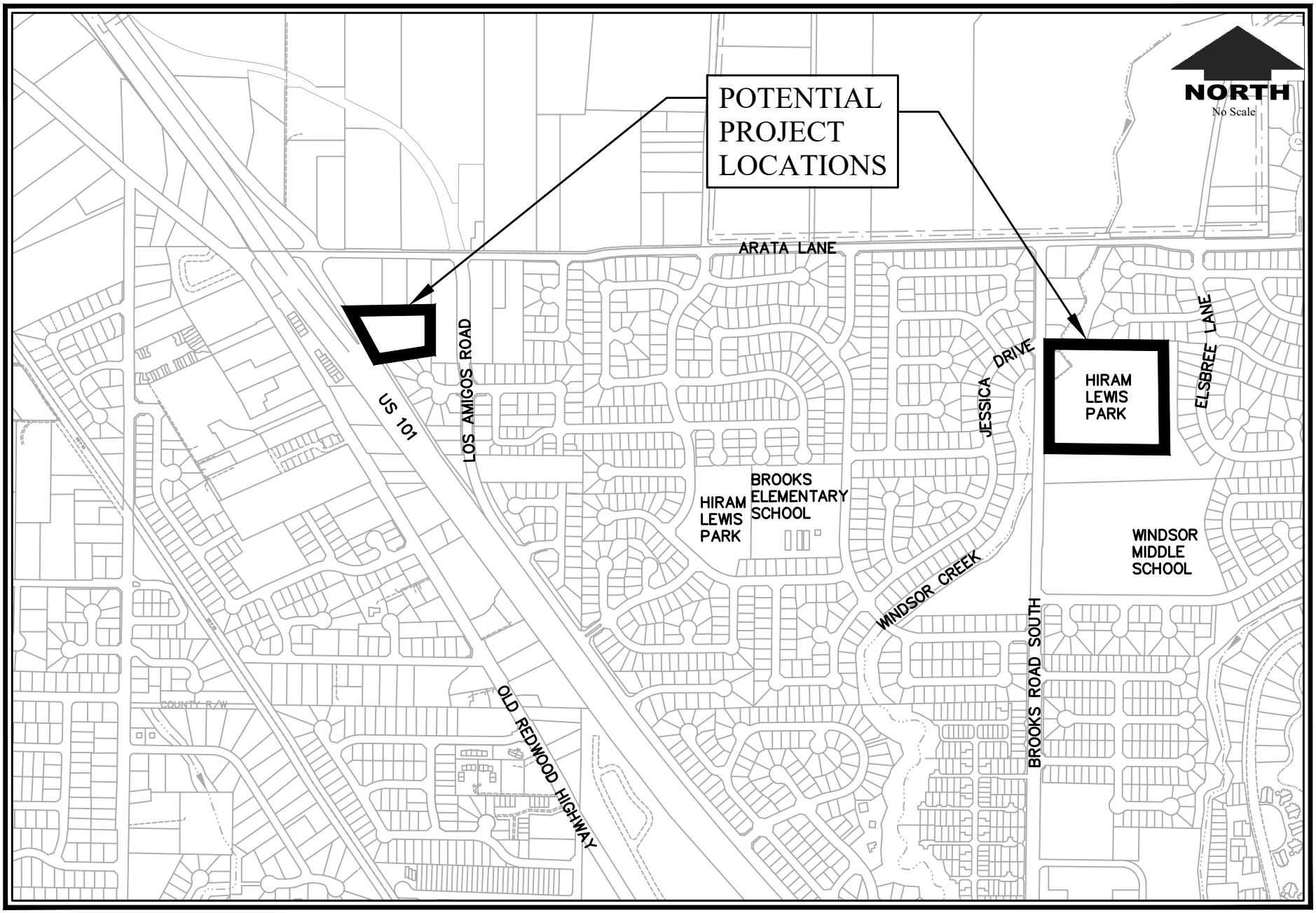
Notes: *Project costs assume well depth, casing diameter, casing and screen material and pump. Project costs assumes approximate well depth and casing diameter. Iron and Manganese treatment (in addition to chlorination) is included in the costs.*

Estimate Type: Concept Level

Process Cost Summary by Division

Spec. Division	Subtotal	Notes
1 - General Requirements	$ 55,000	
2 - Sitework	$ 175,000	
3 - Concrete	$ -	
10 - Specialties	$ -	
11 - Equipment	$ 437,000	
15 - Mechanical	$ -	
16 - Electrical	$ 370,000	
Raw Construction Subtotal	**$ 1,037,000**	
Contractor Overhead & Profit 10%	$ 80,000	Overhead/profit already included in unit cost for well
Sales Tax 8.125%	$ 42,000	Assumes this applies to 50% of Raw Constr. Cost
Estimated Total Construction Cost	**$ 1,200,000**	
Estimating Contingency 15%	$ 180,000	
Estimated Construction Cost with Contingency	**$ 1,400,000**	
Environmental Documentation & Permits 5%	$ 70,000	
Design Cost 10%	$ 140,000	
Project Administration and Construction Management Cost 10%	$ 140,000	
Estimated Total Capital Cost	**$ 1,800,000**	

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
1 - General Requirements							**$ 55,000**	
	Mobilization	10%		1	LS	$54,410	$ 55,000	10% of Division 2 and 16
Item	**Description**	**Size**	**Units**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**	**Notes**
2 - Sitework							**$ 174,100**	
	Sitework							
	Earthwork			1	LS	$20,000	$ 20,000	
	Aesthetic fencing - Wood Post			200	LF	$40	$ 8,000	
	Landscaping/Park Mitigation Allowance			1	LS	$10,000	$ 10,000	
	Piping and Appurtenances							
	Ductile Iron Pipe, Coated	12 inch		200	LF	$180	$ 36,000	
	Misc. Butterfly Valves, Etc.	12 inch		9	EA	$2,400	$ 21,600	
	Swing Check Valve	12 inch		1	EA	$5,800	$ 5,800	
	Air Vacuum Valve	12 inch		1	EA	$6,200	$ 6,200	
	Air Vacuum Relief Valve	10 inch		1	EA	$6,200	$ 6,200	
	Surge Anticipator Valve	12 inch		1	EA	$12,500	$ 12,500	
	Pressure Transducer	12 inch		2	EA	$1,500	$ 3,000	
	Desander	10 inch		1	EA	$12,600	$ 12,600	
	Flow Meter	12 inch		2	EA	$6,100	$ 12,200	
	Misc. Gauges, Valves, Etc. Allowance			1	LS	$20,000	$ 20,000	
Item	**Description**	**Size**	**Units**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**	**Notes**
11 - Equipment							**$ 437,000**	
	Well Drilling, Construction, Development and Testing							
	Well Construction and Testing			1	LS	$275,000	$ 275,000	Assumed well depth is 500 feet, reverse rotary drilling method, casing OD is 10.75-inch, 200 feet of blank casing (ASTM A606 Type 4 high strength low alloy carbon steel with 0.25-inch wall thickness), 300 feet of 304L stainless steel continuous wire wrap screen (0.04-inch slot opening), 304L dielectric coupling (Roscoe Moss Co.)
	Submersible Pump			1	EA	$75,000	$ 75,000	VFD pump
	Pad Structure for Pump or Vault/Manhole			1	LS	$10,000	$ 10,000	
	Water Level Monitor and Temp Logger			1	EA	$2,000	$ 2,000	
	Treatment Facilities							
	Chlorine Equipment (valve, controls, etc)			1	LS	$25,000	$ 25,000	
	Wellhead Treatment - Iron & Manganese			1	LS	$50,000	$ 50,000	
Item	**Description**	**Size**	**Units**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**	**Notes**
16 - Electrical							**$ 370,000**	
	Electric Service, Transformer, Demolition, etc			1	LS	$230,000	$ 230,000	
	Electrical and Control			1	LS	$140,000	$ 140,000	



North Windsor Supply Well

TOWN OF WINDSOR

Project: W-3: Replacement / New Well at RRWF

Aspect: Potable Supply Project

Date: 6/19/2019
Project Number: 0011187.00
Prepared By: I Jaffe
Checked By: J Strandberg
Check Date: 6/27/2019

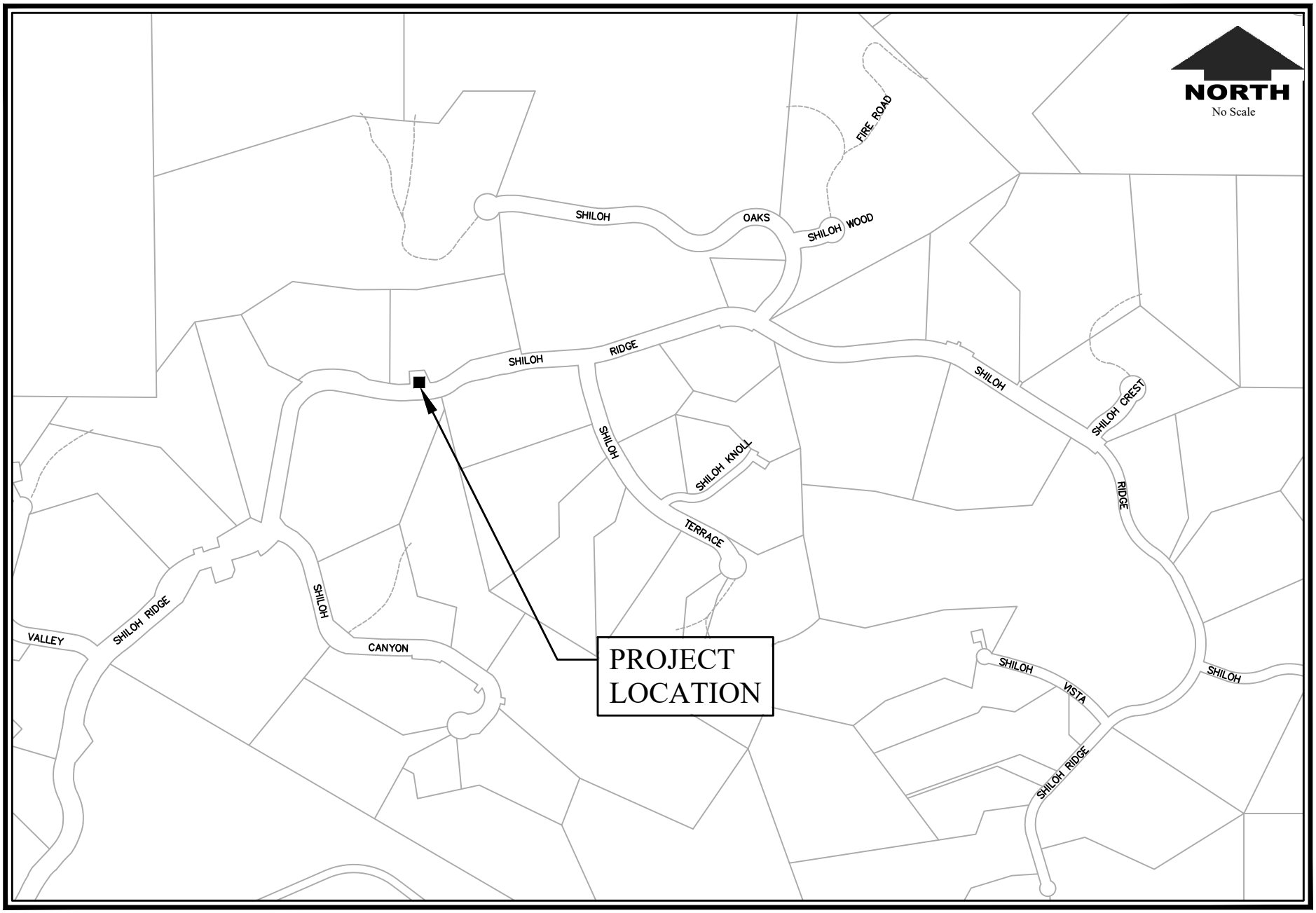
Notes: *Project costs assume well depth, casing diameter, casing and screen material and pump. The well will be similar to those already installed (approximately 100 feet deep, 18-inch casing with chlorine treatment connection).*

Estimate Type: Concept Level

Process Cost Summary by Division

Spec. Division	Subtotal	Notes
1 - General Requirements	$ 21,000	
2 - Sitework	$ 157,000	
3 - Concrete	$ -	
10 - Specialties	$ -	
11 - Equipment	$ 317,000	
15 - Mechanical	$ -	
16 - Electrical	$ 50,000	
Raw Construction Subtotal	**$ 545,000**	
Contractor Overhead & Profit 10%	$ 35,000	Overhead/profit already included in unit cost for well
Sales Tax 8.125%	$ 22,000	Assumes this applies to 50% of Raw Constr. Cost
Estimated Total Construction Cost	**$ 600,000**	
Estimating Contingency 15%	$ 90,000	
Estimated Construction Cost with Contingency	**$ 690,000**	
Environmental Documentation & Permits 5%	$ 35,000	
Design Cost 10%	$ 69,000	
Project Administration and Construction Management Cost 10%	$ 69,000	
Estimated Total Capital Cost	**$ 860,000**	

Item	Description	Size	Units	Quantity	Unit	Unit Cost	Total Cost	Notes
1 - General Requirements							**$ 21,000**	
	Mobilization	10%		1	LS	$20,610	$ 21,000	10% of Division 2 and 16
Item	**Description**	**Size**	**Units**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**	**Notes**
2 - Sitework							**$ 156,100**	
	Sitework							
	Earthwork			1	LS	$20,000	$ 20,000	
	Piping and Appurtenances							
	Ductile Iron Pipe, Coated	12 inch		200	LF	$180	$ 36,000	
	Misc. Butterfly Valves, Etc.	12 inch		9	EA	$2,400	$ 21,600	
	Swing Check Valve	12 inch		1	EA	$5,800	$ 5,800	
	Air Vacuum Valve	12 inch		1	EA	$6,200	$ 6,200	
	Air Vacuum Relief Valve	10 inch		1	EA	$6,200	$ 6,200	
	Surge Anticipator Valve	12 inch		1	EA	$12,500	$ 12,500	
	Pressure Transducer	12 inch		2	EA	$1,500	$ 3,000	
	Desander	10 inch		1	EA	$12,600	$ 12,600	
	Flow Meter	12 inch		2	EA	$6,100	$ 12,200	
	Misc. Gauges, Valves, Etc. Allowance			1	LS	$20,000	$ 20,000	
Item	**Description**	**Size**	**Units**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**	**Notes**
11 - Equipment							**$ 317,000**	
	Well Drilling, Construction, Development and Testing							
	Well Construction and Testing			1	LS	$200,000	$ 200,000	Assumed well depth is 100 feet, reverse rotary drilling method, casing OD is 16.625-inch, 50 feet of blank casing (ASTM A606 Type 4 high strength low alloy carbon steel with 0.312-inch wall thickness), 50 feet of 304L stainless steel continuous wire wrap screen (0.04-inch slot opening), 304L dielectric coupling (Roscoe Moss Co.)
	Verticle Turbine Pump			1	EA	$100,000	$ 100,000	VFD pump
	Pad Structure for Pump or Vault/Manhole			1	LS	$10,000	$ 10,000	
	Water Level Monitor and Temp Logger			1	EA	$2,000	$ 2,000	
	Treatment Facilities							
	Chlorine Connection Equipment			1	LS	$5,000	$ 5,000	
Item	**Description**	**Size**	**Units**	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**	**Notes**
16 - Electrical							**$ 50,000**	
	Electrical and Control			1	LS	$50,000	$ 50,000	



Shiloh Tank Site #2 Enclosures

TOWN OF WINDSOR

Town of Windsor
Five Year Capital Improvement Program
Project Detail Form

Project Name:
Shiloh Tank Site #2 Enclosures

Project No: 1312

Project Description:
Provide CMU block building and fence enclosure for pumps located at Shiloh Water Tank Site #2.

Department:
Public Works - Engineering

Priority:

	Mandate
	Necessary
X	**Desirable**

Justification:
The booster pumps located at the Shiloh 2 tank site are housed in a wooden box which requires maintenance staff to crawl into the box to perform inspection/maintenance. This project will replace the box with a small building and fence enclosure to keep the pumps secure and weather tight, and allow for easier access for maintenance personnel.

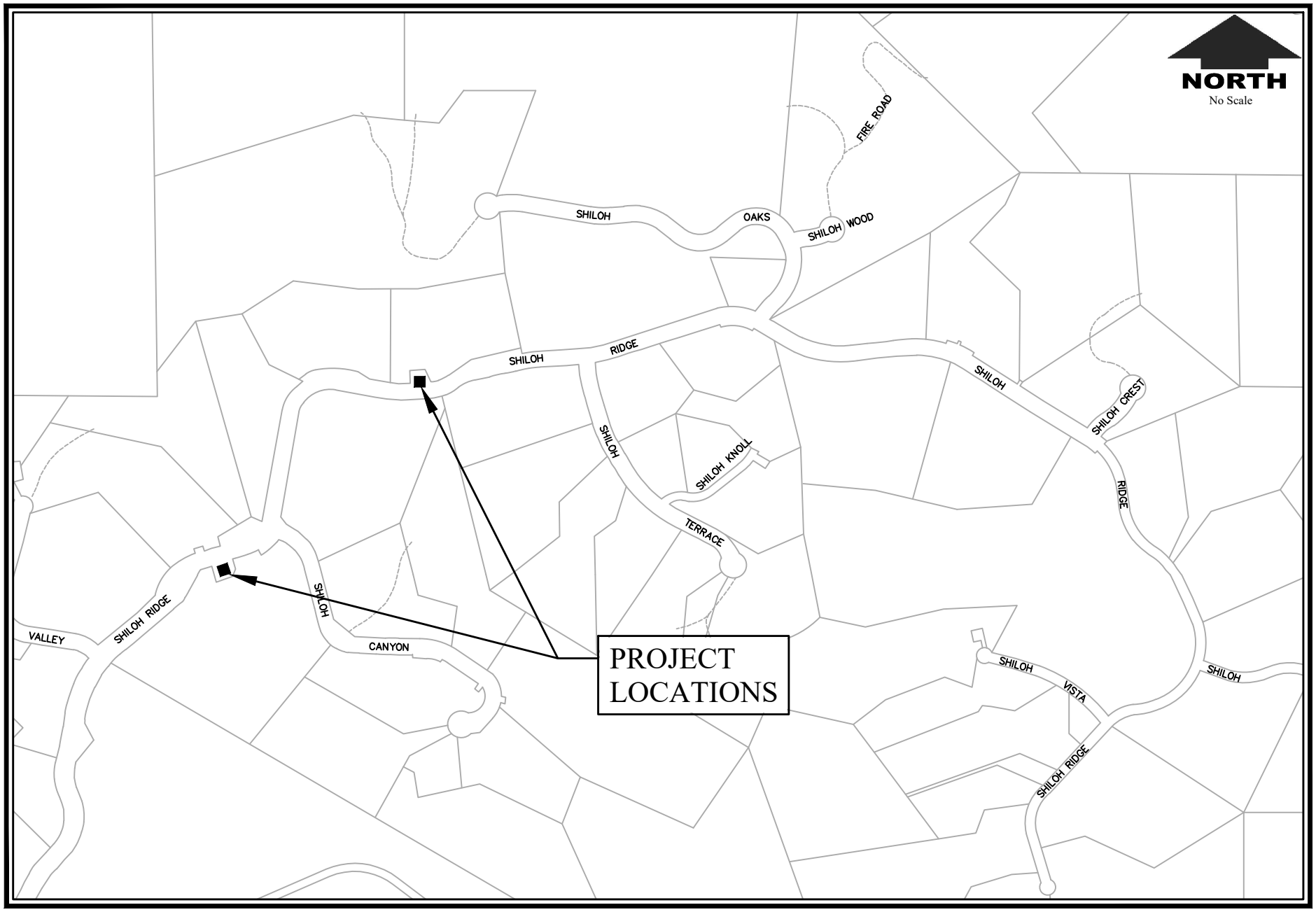
Appropriations beyond the 5 year program period are needed to complete project:

YES ( )
NO (X)

General Plan Consistency:
The Project is consistent with General Plan Public Facilities and Servies Policy PFS-1.7 - The Town shall give high priority in capital improvement programming to funding rehabilitation or replacement of critical infrastructure that has reached the end of its useful life or has capacity constraints.

	Item	Budget FY 18-19	Est Expend FY 18-19		FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	Total
Project Costs:	Design/Environmental	10,000	-		-	11,000	-	-	-	$ 11,000
	Construction	58,000	-		-	63,400	-	-	-	$ 63,400
	Project Management	10,000	-		-	11,000	-	-	-	$ 11,000
	Legal Services/Admin	10,000	-		-	11,000	-	-	-	$ 11,000
	Total	$ 88,000	$ -		$ -	$ 96,400	$ -	$ -	$ -	$ 96,400
Funding Sources:	Water Capital	88,000	-		-	96,400	-	-	-	96,400
	Total	$ 88,000	$ -		$ -	$ 96,400	$ -	$ -	$ -	$ 96,400
Estimated O & M										

Shiloh Tank Sites #1 and #2 Stationary Generators



TOWN OF WINDSOR

Town of Windsor
Five Year Capital Improvement Program
Project Detail Form

Project Name:
Shiloh Tank Sites #1 and #2 Stationary Generators

Project No: New

Project Description:
Purchase, design and construction of two 125 kW fixed set generators at Shiloh Tank Sites #1 and #2 to include site preparation, pad and enclosures, fuel storage equal to 36 hours maximum generator output, and purchase and installation of automatic switchgear.

Department:
Public Works - Engineering

Priority:

	Mandate
X	**Necessary**
	Desirable

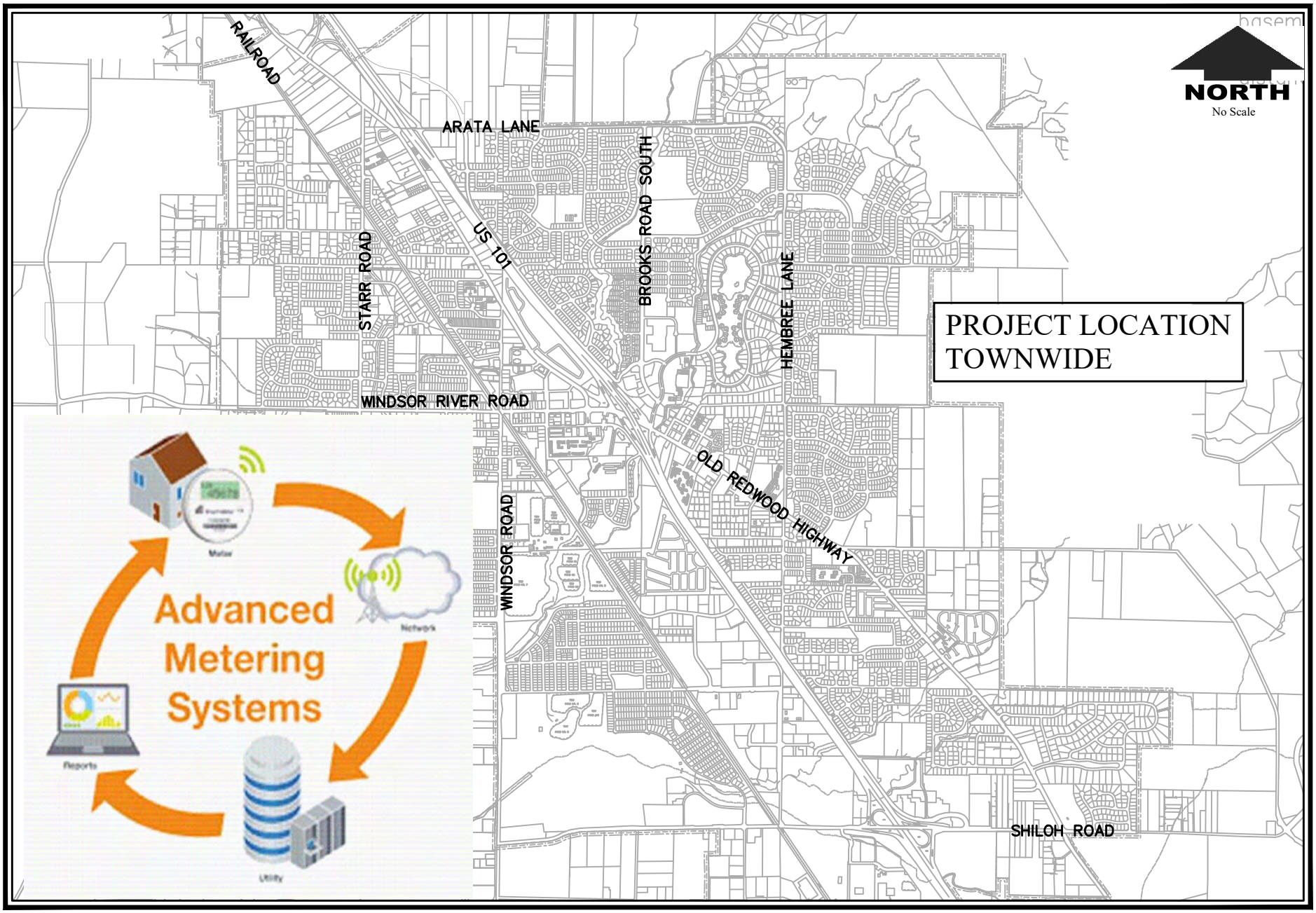
Justification:
The fixed generators are necessary to maintain water tank levels and associated SCADA telemetry during Public Safety Power Shutoffs and other emergencies (fires, earthquake, other) where power disruptions may occur. Currently, staff must shuttle a portable generator between the tank sites during power outages, requiring 24-hr staffing and without the ability to maintain critical SCADA telemetry that is relied on to monitor water tank levels.

Appropriations beyond the 5 year program period are needed to complete project:

YES ( )
NO (X)

General Plan Consistency:
The project is consistent with General Plan Public Facilities and Services Policy PFS-1.1 *Capital Improvement Program* and Policy PFS-1.7 *Priority for Infrastructure* , as well as Public Health and Safety Policy PHS-1.2 *Emergency Response Facilities and Infratructure* .

	Item	Budget FY 18-19	Est Expend FY 18-19		FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	Total
Project Costs:	Design/Environmental						40,000			$ 40,000
	Construction						300,000			$ 300,000
	Project Management						30,000			$ 30,000
	Legal Services/Admin						30,000			$ 30,000
	Total	$ -	$ -		$ -	$ -	$ 400,000	$ -	$ -	$ 400,000
Funding Sources:	Water Capital						400,000			$ 400,000
	Total	$ -	$ -		$ -	$ -	$ 400,000	$ -	$ -	$ 400,000
Estimated O & M										



Townwide Advanced Metering Infrastructure (AMI)

TOWN OF WINDSOR

Town of Windsor
Five Year Capital Improvement Program
Project Detail Form

Project Name:
Townwide Advanced Metering Infrastructure (AMI)

Project No: New

Project Description:
Complete the final phase of automated meter-reading program. This project is completion of the Advanced Metering Infrastructure (AMI) system and includes the installation of collectors and transmitters in the field equipped with GPS antennas and cellular WAN. Also included in the project is software, implementation and staff training for the AMI system.

Department:
Public Works - Engineering

Priority:

	Mandate
	Necessary
X	**Desirable**

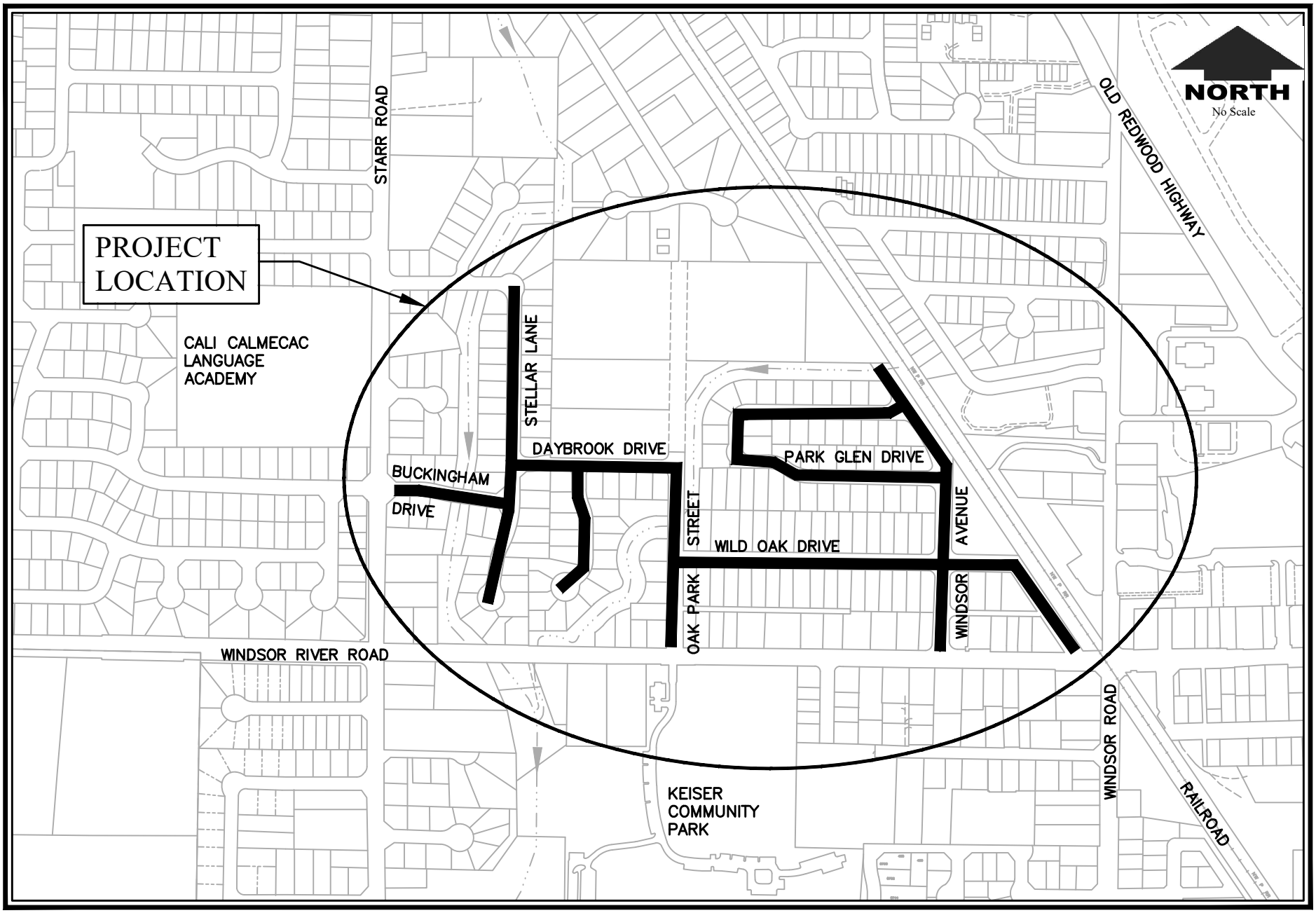
Justification:
All of the Town's potable water meters have been upgraded from manual-read (only) to AMR/AMI compatible meters. The Town system is fully compatible to support an AMI meter-reading and billing system. The final phase of AMI is to install collectors and transpmitters within the District service areas and will also include software and hardware to transmit meter data to the Utility Billing Department. The AMI will support water conservation and leak detection with real-time data and analysis for both the Town and customers.

Appropriations beyond the 5 year program period are needed to complete project:

YES **( )**
NO **(X)**

General Plan Consistency:
The Project is consistent with General Plan Public Facilities and Servies Policy PFS-1.2 - The Town shall continie the offer professional, high-quality service that meets the needs of residents and business.

	Item	Budget FY 18-19	Est Expend FY 18-19		FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	Total
Project	Design	-	-		20,000	-	-	-	-	$ 20,000
	Construction	-	-		175,000	-	-	-	-	$ 175,000
Costs:	Project Management/Admin.	-	-		5,000	-	-	-	-	$ 5,000
	Continegency	-	-		25,000	-	-	-	-	$ 25,000
	Total	$ -	$ -		$ 225,000	$ -	$ -	$ -	$ -	$ 225,000
Funding Sources:	Water Capital	-	-		225,000	-	-	-	-	$ 225,000
										$ -
	Total	$ -	$ -		$ 225,000	$ -	$ -	$ -	$ -	$ 225,000
Estimated O & M										



Wild Oak Water Service Replacement

TOWN OF WINDSOR

Town of Windsor
Five Year Capital Improvement Program
Project Detail Form

Project Name:
Wild Oak Water Service Replacements

Project No: New

Project Description:
Replacement of approximately 215 water services including water service saddles, water service lateral piping, and isolation valves in the neighborhood of Wild Oak Drive Keiser Park.

Department:
Public Works - Engineering

Priority:

	Mandate
X	**Necessary**
	Desirable

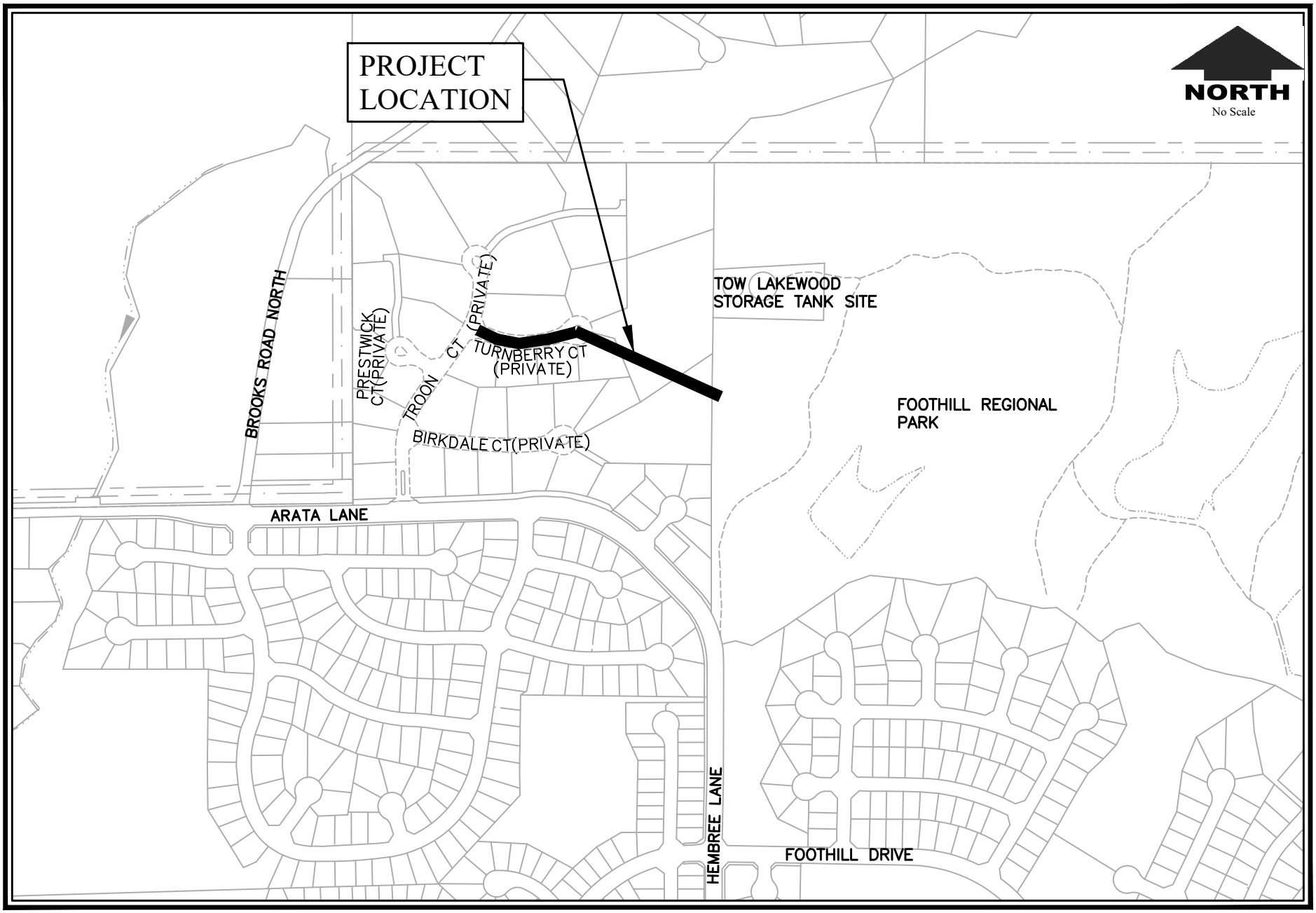
Justification:
The water services in the area of Wild Oak Drive are over 40 years old and due for replacement. The replacement of these services is planned just prior to resurfacing of the streets (pavement overlay) such that future replacement would not deface the newly paved street surface.

Appropriations beyond the 5 year program period are needed to complete project:

YES ( )
NO (X)

General Plan Consistency:
The Project is consistent with General Plan Public Facilities and Servies Policy PFS-1.7 - The Town shall give high priority in capital improvement programming to funding rehabilitation or replacement of critical infrastructure that has reached the end of its useful life or has capacity constraints.

	Item	Budget FY 18-19	Est Expend FY 18-19		FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	Total
Project Costs:	Design/Environmental	-	-		-	-	-	-	38,000	$ 38,000
	Construction	-	-		-	-	-	-	796,000	$ 796,000
	Construction Engineering	-	-		-	-	-	-	103,000	$ 103,000
	Project Management	-	-		-	-	-	-	11,000	$ 11,000
	Legal Services/Admin	-	-		-	-	-	-	5,000	$ 5,000
	Total	$ -	$ -		$ -	$ -	$ -	$ -	$ 953,000	$ 953,000
Funding Sources:	Water Capital (50% match)	-	-		-	-	-	-	476,500	$ 476,500
	Water Grants (50% cost share)	-	-		-	-	-	-	476,500	$ 476,500
	Total	$ -	$ -		$ -	$ -	$ -	$ -	$ 953,000	$ 953,000
Estimated O & M										



Turnberry Court Pipe Improvements

TOWN OF WINDSOR

Town of Windsor
Five Year Capital Improvement Program
Project Detail Form

Project Name:
Turnberry Court Pipe Improvements

Project No: New

Project Description:
Remove and replace 420 ft of existing 8" pipe with 12" pipe along Turnberry Ct and install 550 ft of new 12" pipe through an easement to the Lakewood Tanks supply line.

NOTES: This project includes easement acquisition, costs of which are not included here. The final easement may impact the layout and length of the new 12" pipeline.

Department:
Public Works - Engineering

Priority:

	Mandate
X	**Necessary**
	Desirable

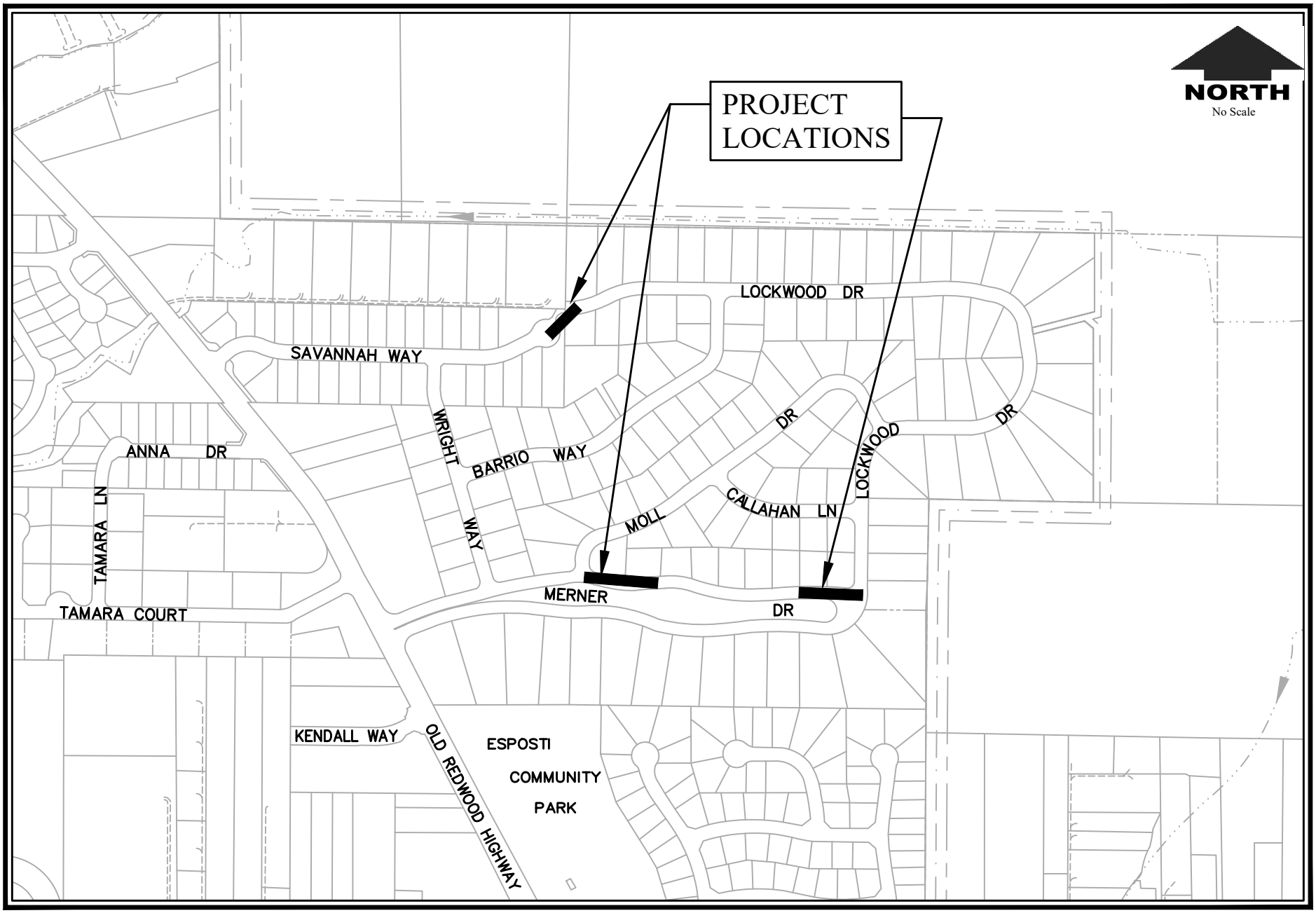
Justification:
This project is needed to meet pressure requirements under fireflow conditions at the end of Turnberry Ct. The addition of the pipe loop also serves as system redundancy for utilizing the Lakewood Tanks.

Appropriations beyond the 5 year program period are needed to complete project:

YES ( )
NO (X)

General Plan Consistency:
The project is consistent with General Plan Public Facilities and Services Policy PFS-1.1 - The Town shall maintain the Capital Improvement Programming (CIP) to ensure the implementation of the General Plan and the adequate and timely provision of public facaility and municipal utility improvement and Policy PFS-1.7 - The Town shall give high priority in capital improvement programming to funding rehabilitation or replacement of critical infrastructure that has reached the end of its useful life or has capacity constraints.

	Item	Budget FY 18-19	Est Expend FY 18-19		FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	Total
Project Costs:	Design/Environmental/Permits	-	-		-	-	85,000	-	-	$ 85,000
	Construction	-	-		-	-	424,000	-	-	$ 424,000
	Project Management/Admin.	-	-		-	-	64,000	-	-	$ 64,000
	Total	$ -	$ -		$ -	$ -	$ 573,000	$ -	$ -	$ 573,000
Funding Sources:	Water Capital Fund	-	-		-	-	573,000	-	-	$ 573,000
	Total	$ -	$ -		$ -	$ -	$ 573,000	$ -	$ -	$ 573,000
Estimated O & M										



Savannah Way and Merner Drive Pipe Construction

TOWN OF WINDSOR

Town of Windsor
Five Year Capital Improvement Program
Project Detail Form

Project Name:
Savannah Way and Merner Drive Pipe Construction

Project No: New

Project Description:
Install three new 8" pipes: between Savanna Wy and Lockwood Dr and on Merner Dr between Moll Dr and Lockwood Dr.

NOTES: This project consists of 3 new pipes: 2 on Merner Dr., and 1 connecting between Savannah Way and Lockwood Dr.

Department:
Public Works Engineering

Priority:

	Mandate
X	**Necessary**
	Desirable

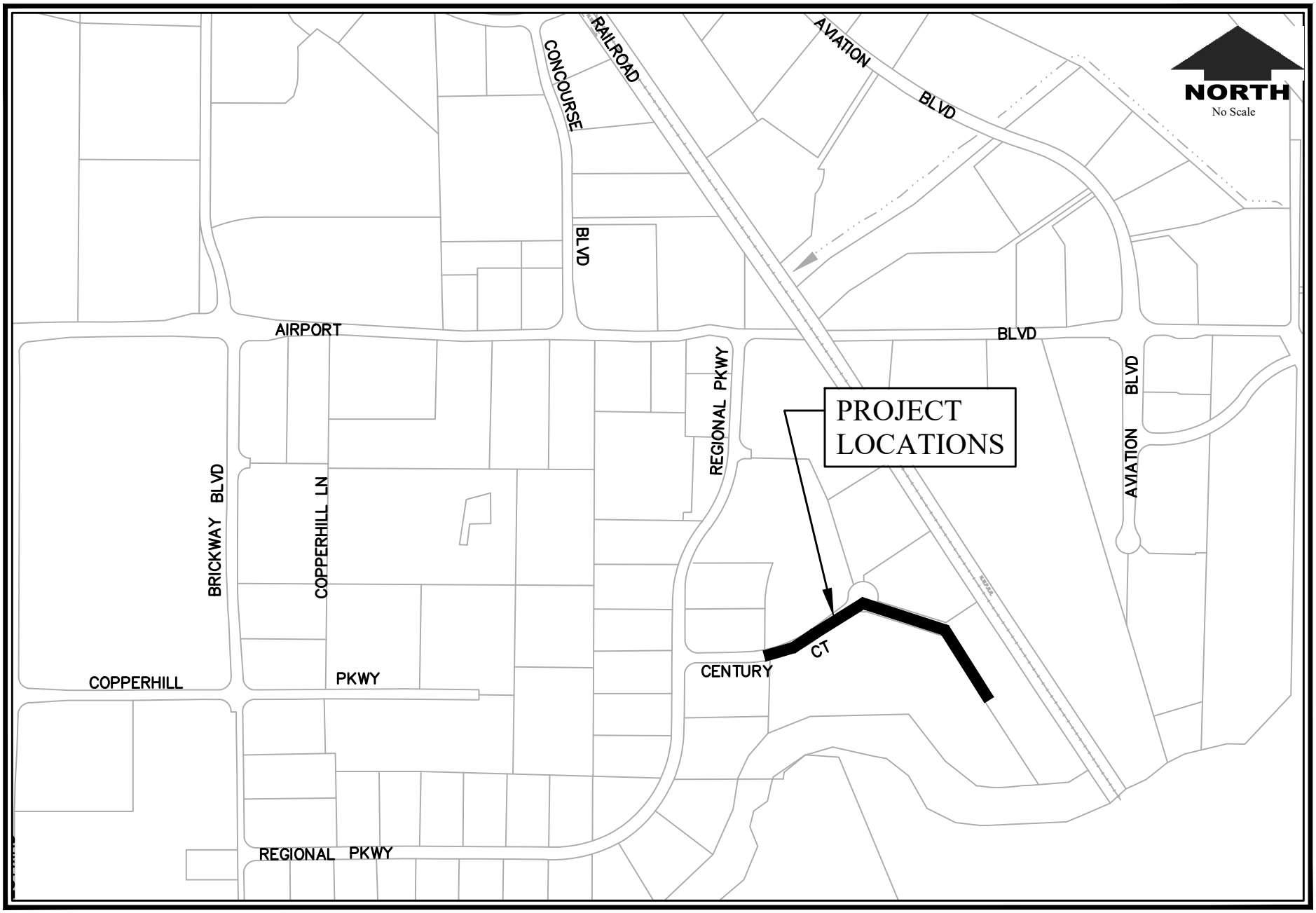
Justification:
This project is needed to meet pressure requirements under fireflow conditions at four existing pipe dead ends. The new pipelines will address the fireflow deficiencies and create new pipe loops for added system redundancy.

Appropriations beyond the 5 year program period are needed to complete project:

YES ( )
NO (X)

General Plan Consistency:
The project is consistent with General Plan Public Facilities and Services Policy PFS-1.1 - The Town shall maintain the Capital Improvement Programming (CIP) to ensure the implementation of the General Plan and the adequate and timely provision of public facaility and municipal utility improvement and Policy PFS-1.7 - The Town shall give high priority in capital improvement programming to funding rehabilitation or replacement of critical infrastructure that has reached the end of its useful life or has capacity constraints.

	Item	Budget FY 18-19	Est Expend FY 18-19		FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	Total
Project Costs:	Design/Environmental/Permits	-	-		-	-	-	-	54,000	$ 54,000
	Construction	-	-		-	-	-	-	235,000	$ 235,000
	Project Management/Admin.	-	-		-	-	-	-	36,000	$ 36,000
	Total	$ -	$ -		$ -	$ -	$ -	$ -	$ 325,000	$ 325,000
Funding Sources:	Water Capital Fund	-	-		-	-	-	-	325,000	$ 325,000
	Total	$ -	$ -		$ -	$ -	$ -	$ -	$ 325,000	$ 325,000
Estimated O & M										



Century Court Pipe Improvements

TOWN OF WINDSOR

Town of Windsor
Five Year Capital Improvement Program
Project Detail Form

Project Name:
Century Court Pipe Improvements

Project No: New

Project Description:
Remove and replace 170 ft of existing 10" pipe with 12" pipe in Century Ct and remove and replace 830 ft of existing 8" pipe with 12" pipe in Century Ct and south into an easement.

NOTES: This project extends to the end of the Town-owned pipe. The pipe continues as a private fire line to the southeastern corner of the property.

Department:
Public Works Engineering

Priority:

	Mandate
X	**Necessary**
	Desirable

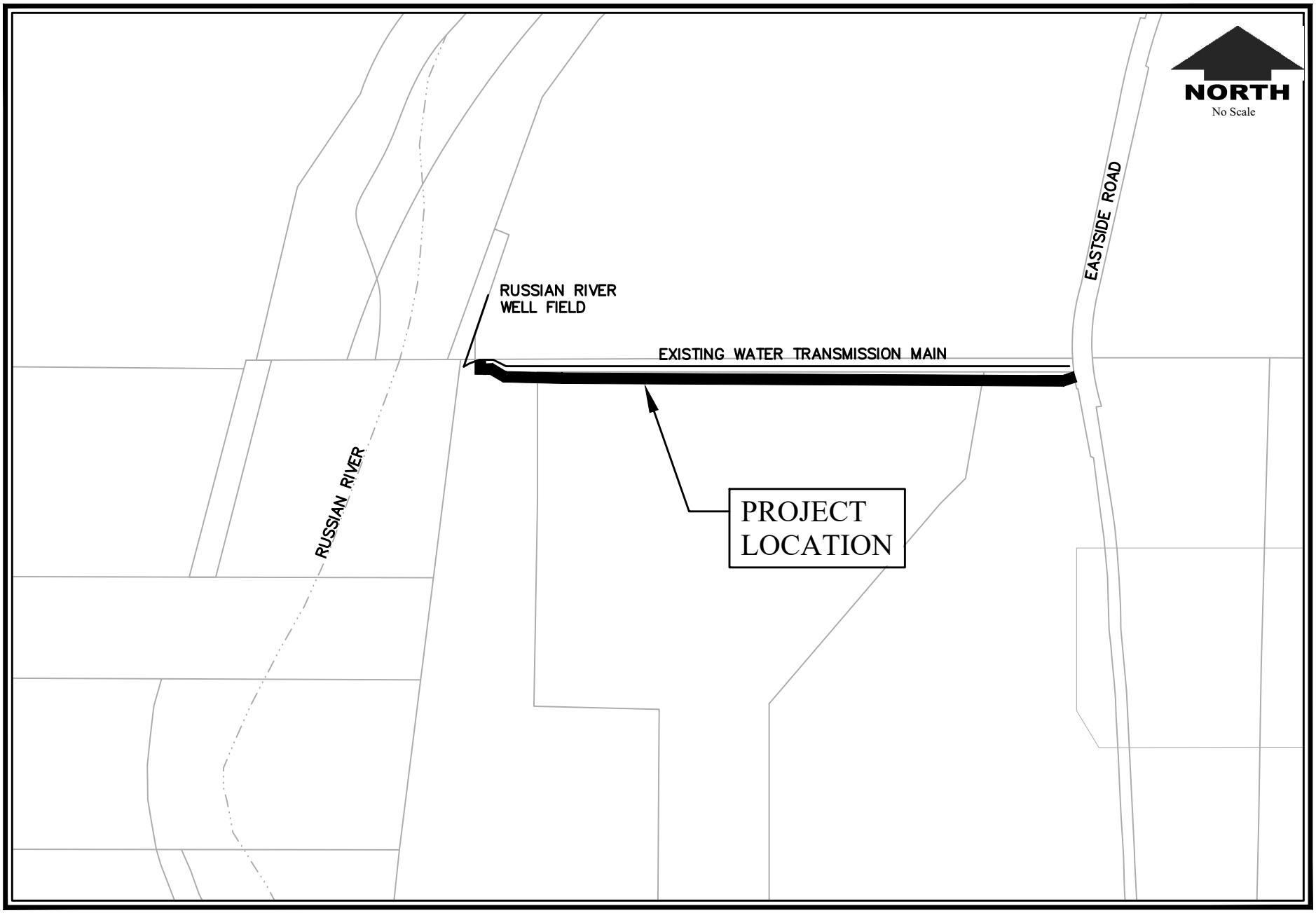
Justification:
This project is needed to meet pressure requirements under fireflow conditions at the end of the Town-owned pipe south of Century Ct.

Appropriations beyond the 5 year program period are needed to complete project:

YES ( )
NO (X)

General Plan Consistency:
he project is consistent with General Plan Public Facilities and Services Policy PFS-1.1 - The Town shall maintain the Capital Improvement Programming (CIP) to ensure the implementation of the General Plan and the adequate and timely provision of public facaility and municipal utility improvement and Policy PFS-1.7 - The Town shall give high priority in capital improvement programming to funding rehabilitation or replacement of critical infrastructure that has reached the end of its useful life or has capacity constraints.

	Item	Budget FY 18-19	Est Expend FY 18-19		FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	Total
Project Costs:	Design/Environmental/Permits	-	-		-	-		109,000	-	$ 109,000
	Construction	-	-		-	-	-	512,000	-	$ 512,000
	Project Management/Admin.	-	-		-	-	-	77,000	-	$ 77,000
							-			
	Total	$ -	$ -		$ -	$ -	$ -	$ 698,000	$ -	$ 698,000
Funding Sources:	Water Capital Fund	-	-		-	-	-	698,000	-	$ 698,000
	Total	$ -	$ -		$ -	$ -	$ -	$ 698,000	$ -	$ 698,000
Estimated O & M										



Water Transmission Reliability at Russian River Well Field
West of Eastside Road

TOWN OF WINDSOR

Town of Windsor
Five Year Capital Improvement Program
Project Detail Form

Project Name:
Water Transmission Reliability at Russian River Well Field West of Eastside Road

Project No: New

Project Description:
Install 2,400 ft of new 18" pipe from the Russian River Well Field (RRWF) to Eastside Road. This is a parallel pipe to the existing 18" supply line coming from the RRWF to the Town's water distribution system.

Department:
Public Works Engineering

Priority:

	Mandate
	Necessary
X	**Desirable**

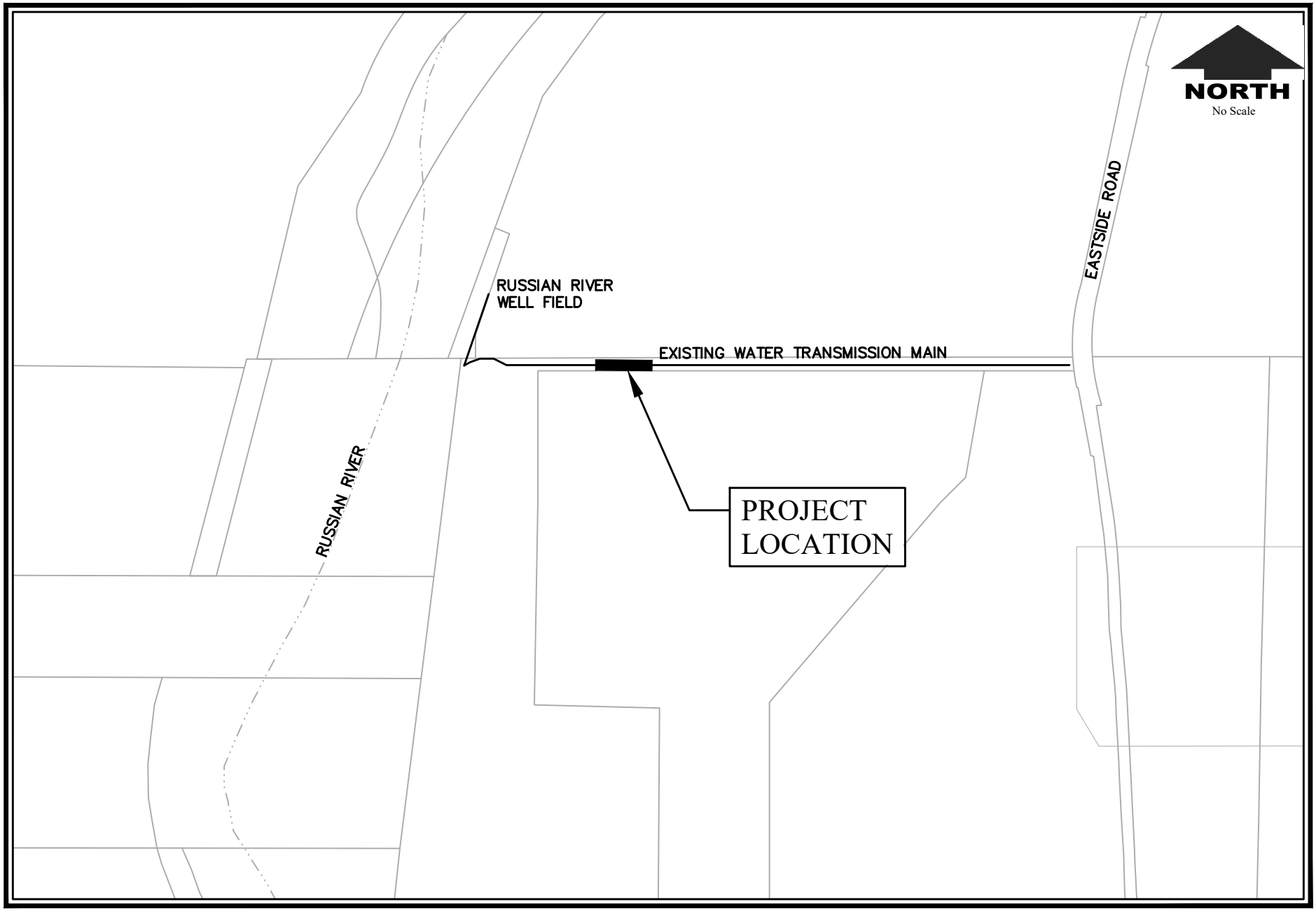
Justification:
This pipe serves as redundancy for the existing supply line from the Russian River Well Field in case the existing pipe is damaged or needs to be serviced. This project supports the Hazard Mitigaiton Plan Mitigation Action 3.2 - Increase redundancy in the Town's water distribution network through multiple back-up connections, particularly across fault zones.

Appropriations beyond the 5 year program period are needed to complete project:

YES ( )
NO (X)

General Plan Consistency:
The project is consistent with General Plan Public Facilities and Services Policy PFS-1.1 - The Town shall maintain the Capital Improvement Programming (CIP) to ensure the implementation of the General Plan and the adequate and timely provision of public facaility and municipal utility improvement and Policy PFS-1.7 - The Town shall give high priority in capital improvement programming to funding rehabilitation or replacement of critical infrastructure that has reached the end of its useful life or has capacity constraints. In additon the project is consistent with Public Heath and Safety Policy PHS-1.2 The Town shall ensure that emergency response facilities and infrastructure are located to avoid hazardous areas and designed to remain functional following a major natural or human-made disaster. When the location of emergency response facilities and infrastructure in such areas cannot be avoides, effective measures should be implemented to minimize potential damage and public inconvience.

	Item	Budget FY 18-19	Est Expend FY 18-19		FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	Total
Project Costs:	Design/Environmental/Permits	-	-		-	-	-	-	246,000	$ 246,000
	Construction	-	-		-	-	-	-	1,345,000	$ 1,345,000
	Project Management/Admin.	-	-		-	-	-	-	201,000	$ 201,000
	Total	$ -	$ -		$ -	$ -	$ -	$ -	$ 1,792,000	$ 1,792,000
Funding Sources:	Water Capital Fund	-	-		-	-	-	-	1,792,000	$ 1,792,000
	Total	$ -	$ -		$ -	$ -	$ -	$ -	$ 1,792,000	$ 1,792,000
Estimated O & M										



Meter Flow Testing Improvements at Russian River Well Field

TOWN OF WINDSOR

Town of Windsor
Five Year Capital Improvement Program
Project Detail Form

Project Name:
Meter Flow Testing Improvements at Russian River Well Field

Project No: New

Project Description:
Design and construction of well-field pipeline improvements for flow meter testing at the Russian River Well Field.

Department:
Public Works Engineering

Priority:

X	**Mandate**
	Necessary
	Desirable

Justification:
The purpose of this project is to design and construct an insertion meter tap in the well-field pipeline to meet volumetric flow testing requirements for the primary water production meter as required by the State Water Board. The project also improves water production data validity for annual water loss audits required by the Department of Water Resources.

Appropriations beyond the 5 year program period are needed to complete project:

YES ( )
NO (X)

General Plan Consistency:
The project is consistent with General Plan Public Facilities and Services Policy PFS-2.1 - The Town shall maintain, implement and periodically update the Master Plan to ensure the reliability and efficiency of the Town's water distribution system, and Policy PFS-2.6 - The Town shall achieve a 20 percent reduction in per-capita water use by 2020 consistent with the States 20x2020 Water Conservation Plan.

	Item	Budget FY 18-19	Est Expend FY 18-19		FY 19-20	FY 20-21	FY 21-22	FY 22-23	FY 23-24	Total
Project Costs:	Design	-	-		50,000		-	-	-	$ 50,000
	Construction	-	-			300,000	-	-	-	$ 300,000
	Total	$ -	$ -		$ 50,000	$ 300,000	$ -	$ -	$ -	$ 350,000
Funding Sources:	Water Capital Fund	-	-		50,000	300,000	-	-	-	$ 350,000
	Total	$ -	$ -		$ 50,000	$ 300,000	$ -	$ -	$ -	$ 350,000
Estimated O & M										



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COMMITMENT & INTEGRITY DRIVE RESULTS



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