City of St. Helena
Water and Wastewater Advisory Committee
Regular Meeting
City Hall 1088 College Avenue, St. Helena, CA 94574
Thursday, June 5, 2025 @ 10:30 AM

PLEASE NOTE: Any person who wishes to speak regarding an item on the agenda or make a comment under the "Oral Communication" portion of the agenda may do so, but please observe the time limit of four minutes.

Public comment for meetings will be accepted via email to publiccomment@cityofsthelena.org. All public comments must be emailed at least three hours prior to the meeting. Emailed public comments will not be read out loud but will be publicly available and attached to the on-line agenda.

Page

1. CALL TO ORDER

2. ROLL CALL
Chair: Brent Randol
Vice Chair: Garry Rose
Committee Members: Jay Kouba, Mario Trinchero, Peter White
Alternate Member: Carl Myers
Staff Liaison: Joe Leach, Director of Public Works

3. PUBLIC FORUM:
An opportunity for the public to directly address the Committee on items of interest to the public that are not listed on the agenda. Any person addressing the Committee should provide his or her name and address, and limit comments to four minutes. Because of restrictions imposed by **the Brown Act, the Committee may not engage in substantive discussion, nor take action on matters not described on the agenda.**

4. REPORTS BY STAFF AND BOARD
Reports by staff and/or Committee on items of general interest. Brief questions for clarification may be posed and answered, and Committee may request that items be placed on a future agenda. Except under certain circumstances, **the Brown Act prohibits any other discussion or action by the Water and Wastewater Advisory Committee.**

5. CONSENT CALENDAR:
Members of the Water and Wastewater Rate Study Advisory Committee or the public may ask that any items be considered individually for purposes of considering alternative action, for extended discussion, or for public comment. Unless that is done, on motion may be used to adopt all recommendation actions.

   5.1. Water and Wastewater Advisory Committee Meeting Minutes of May 8, 2025. — 3 - 4

   Water and Wastewater Advisory Committee - 08 May 2025 - Minutes

6. OLD BUSINESS:

7. NEW BUSINESS:

   7.1. Safe Yield Analysis Update 5 - 71
   Prepared By: Joseph Leach, Public Works Director and City Engineer
   Safe Yield Analysis
   Safe Yield Presentation

   7.2. Update From Water Quality Specialist Regarding Seasonal Discoloration and Ongoing Water Quality Improvements

   7.3. Discussion Surrounding Potential of Decommissioning of Lower Reservoir

8. SUBCOMMITTEE UPDATES

   8.1. Factors Contributing to St. Helena's High Utility Rates
   Prepared By: Mario Trinchero, Garry Rose

   8.2. Water Quality
   Prepared By: Peter White, Jay Kouba

   8.3. Storm Incursion
   Prepared By: Peter White, Brent Randol

   8.4. Capital Project Prioritization
   Prepared By: Garry Rose, Jay Kouba

9. FUTURE AGENDA ITEMS

10. ADJOURNMENT

The next regular Water and Wastewater Advisory Committee meeting is scheduled for TBD.

This agenda was posted at City Hall, 1088 College Avenue, St. Helena, California on May 30, 2025.

Rebecca White, Administrative Assistant

In Compliance with the Americans with Disabilities Act, if you need special assistance to participate in this meeting, please call the City Clerk’s Office (707) 968-2742. Notification 72 hours prior to the meeting as required by Section 202 of the Americans with Disabilities Act will enable the City to make reasonable arrangements to ensure accessibility to this meeting.

MINUTES
City of St. Helena
Water and Wastewater Advisory
Committee Meeting
Thursday, May 8, 2025 @ 10:30 AM
City Hall 1088 College Avenue, St. Helena, CA
94574

Present:	Chair: Brent Randol, Vice Chair Garry Rose (arrived late at 10:39 a.m.), Committee Members Jay Kouba, Alternate Member Carl Myers, Staff Liaison: Joe Leach
Absent:	Member Mario Trinchero

1. CALL TO ORDER
Chair Randol called the meeting to order at 10:33 a.m.

2. ROLL CALL

3. PUBLIC FORUM:
No public comment was received.

4. REPORTS BY STAFF AND BOARD
Director of Public Works, Joe Leach advised that the adoption of the Capital Improvement Plan (CIP) is anticipated to go to Council on May 27

5. CONSENT CALENDAR:

5.1. Water and Wastewater Advisory Committee Meeting Minutes of April 24, 2025.

Member Kouba asked for an amendment of the meeting minutes of April 24, 2025 to include the Ad Hoc Committee assignments that were given. The Ad Hoc assignments were as follows:

Water Quality: Members White and Kouba
Storm Incursion: Members Randol and White
Utility Rates: Members Trinchero and Rose
Capital Project Prioritization: Members Kouba and Rose

Member White moved to approve the amended meeting minutes, with Member Kouba seconding the vote. Motion passed unanimously.

6. OLD BUSINESS:
None.

7. NEW BUSINESS:

Workplan Items:

1. Factors Contributing to St. Helena's High Utility Rates
2. Water Quality
3. Storm Incursion
4. Capital Project Prioritization

Each workplan item was reviewed by the subcommittee members. Alternate Member Myers will now serve on the Storm Incursion ad hoc committee. Updates will be provided at the next regularly scheduled meeting.

The Committee decided to meet once a month, with the next committee meeting taking place on Thursday, June 5, 2025 from 10:30 a.m. to 12:30 p.m.

8. ADJOURNMENT

Chair Randol adjourned the meeting at 11:47 a.m.

APPROVED:	**ATTEST:**
____________________________	____________________________
Brent Randol, Chair	Joseph Leach, Director of Public Works

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TECHNICAL MEMORANDUM

DATE: May 30, 2025 | Project No.: 705-60-23-12
SENT VIA: EMAIL

TO: Joe Leach, PE, Director of Public Works, City of St. Helena
Eric Janzen, Assistant Director of Public Works, City of St. Helena

FROM: Elizabeth Drayer, PE, RCE #46872
Jim Connell, PE, RCE #63052

REVIEWED BY: Vanessa Apodaca, PE, RCE #74824

SUBJECT: City of St. Helena Water Supply Safe Yield Update

INTRODUCTION AND BACKGROUND

The City of St. Helena (City) currently utilizes three water supply sources to meet potable water demands within the City: (1) surface water from Bell Canyon Reservoir (treated at the City's Louis Stralla Water Treatment Plant); (2) groundwater from the City's Stonebridge Wells No. 1 and 2; and (3) purchased water from the City of Napa. Historically, supplies from the Bell Canyon Reservoir were the City's primary water supply source; however, recently the City has prioritized the use of water supplies purchased from the City of Napa to meet water demands.

In October 2010, West Yost completed a Water Supply Plan for the City. The primary purpose of the Water Supply Plan was to document a comparison of the City's potable water demand and potable water supply in support of the City's 2030 General Plan Update Environmental Impact Report. As part of the preparation of the Water Supply Plan, a safe yield estimate for Bell Canyon Reservoir was developed under various hydrologic conditions using a spreadsheet-based reservoir yield model. Based on the findings of that work, the City's Safe Yield Committee prepared a March 2011 report summarizing the safe yield estimate for the City's water supply system.

The safe annual yield of the City's water supply system is defined as follows:

> The safe annual yield of the St. Helena water supply system is that quantity of water which can be reliably delivered on an annual basis through most rainfall years, including a Dry Year, without undue hardship on water customers through water shortage restrictions. It is recognized that the safe annual yield, as so defined, could place significant hardship on water customers in a Critically Dry Year or in periods of two or more consecutive Dry Years.

In March 2011, the annual safe yield of the City's potable water system was estimated to be 1,950 acre-feet (AF), with 700 AF from Bell Canyon Reservoir, 450 AF from groundwater and 800 AF from the City of Napa. The net annual safe yield was estimated to be 1,658 AF taking into consideration water system losses of approximately 15 percent.

These previous studies were prepared prior to the recent drought and enhanced regulatory limitations on water use, and prior to the City's revised water supply contract with the City of Napa. In particular, in the period since the safe yield estimate was last updated (in 2011), the City and the State experienced severe weather-related events, ranging from extreme drought to atmospheric rivers, and devastating wildfires. Key events and resulting actions included the following:

- 2011 to 2013: December 2011 marked the beginning of the 2011 to 2017 drought in California. It was the second driest December in California, with many locations experiencing record or near-record dry conditions. By the end of 2013, California had experienced three below-normal rainfall seasons, causing decreased reservoir levels, lower groundwater levels, and abnormally dry vegetation that raised wildfire concerns. Late 2011 through 2014 was the driest period in California's recorded history.
- January 2014: Governor Edmund G. Brown, Jr. proclaimed a State of Emergency and directed State officials to take all necessary actions to prepare for on-going drought conditions (Executive Order B-17-2014).
- April 2014: Governor Edmund G. Brown, Jr. called for actions to strengthen the State's ability to manage water and habitat effectively in drought conditions and called on all Californians to redouble their efforts to conserve water and refrain from wasting water (Executive Order B-25-2014).
- April 2015: For the first time in State history, Governor Edmund G. Brown, Jr. directed the State Water Resources Control Board to implement mandatory water reductions in cities and towns across California to reduce water usage by 25 percent through February 2016, as compared to the amount used in 2013 (Executive Order B-29-2015).
- November 2015: Governor Edmund G. Brown, Jr. called for additional actions to build on the State's ongoing response to record dry conditions and to assist recovery efforts from devastating wildfires (Executive Order B-36-15).
- May 2016: Governor Edmund G. Brown, Jr. issued an executive order "Making Water Conservation a California Way of Life" that built on temporary statewide emergency water restrictions to establish longer-term water conservation measures, including permanent monthly water use reporting, new permanent water use standards in California communities and bans on clearly wasteful practices such as hosing off sidewalks, driveways and other hardscapes (Executive Order B-37-16).
- April 2017: Governor Edmund G. Brown, Jr. lifted the drought emergency in California counties, except for Fresno, Kings, Tulare and Tuolumne where emergency drinking water projects continued to address diminished groundwater supplies. The prohibition on wasteful practices was retained and measures to make water conservation a way of life were advanced (Executive Order B-40-17).
- September/October 2020: The Glass Fire started on September 27, 2020 and burned 67,484 acres and destroyed 1,555 structures in Napa and Sonoma Counties until it was fully contained on October 20, 2020.
- October 2021: On October 24, 2021, California was hit by a strong atmospheric river and bomb cyclone which caused floods, mudflows and wind damage. The storm brought badly needed rain to the drought-stricken region, but also brought flash floods and debris flows along the burn scars of recent wildfires. The City of St. Helena received 9.9 inches of rainfall on that day, the highest daily precipitation ever recorded for the City.

These events, along with the global pandemic which started in early 2020, had varying impacts on the City's water supplies, demands and operations. In response to the severe drought conditions, the City implemented its water shortage emergency regulations as follows:

- On June 23, 2020, City Council adopted Resolution No. 2020-72 establishing Phase I Water Regulations based on St. Helena Municipal Code Section 13.04.230 where conditions requiring the establishment of a Phase II water emergency, as determined by the Director of Public Works, appear to be imminent. At the time of the emergency, the City had extremely low rainfall (20 inches), a forecast for a potential multi-year drought, and Bell Canyon Reservoir was at 60 percent capacity. City Water Operations staff had also implemented changes to conserve Bell Canyon water supplies by optimizing the use of water supplies from the City's Stonebridge Wells and the City's water supply contract with the City of Napa.
- Effective November 1, 2020, the City established a Water Shortage Emergency condition requiring the implementation of Phase II Water Regulations and formation of a Water Advisory Board. At the October 27, 2020, City Council Meeting, the St. Helena City Council adopted Resolution No. 2020-107 making the determination that conditions requiring the establishment of a Phase II water emergency existed and as a result directed City staff to enact a Phase II Water Emergency in accordance with the St. Helena Municipal Code (SHMC).
- In November 2021, based upon criteria established by the City of St. Helena Safe Water Yield Committee and Municipal Code, the Public Works Director ended the Phase II Water Emergency, effective December 2021 (this was memorialized on February 14, 2023 by the City Council approval of Resolution No. 2023-16).
- On July 25, 2023, the City Council approved termination of the Phase I Water Emergency effective as of July 1, 2023.

These events and resulting actions underscore the City's need to adapt to extreme weather events and regulatory changes to ensure a sustainable water supply, comply with State mandates, and build resilience against future climate-related challenges.

In June 2023, the City retained West Yost to prepare an update to the City's safe yield estimate to gain an understanding of the impacts of the recent drought conditions and related actions on the City's water supplies. This Technical Memorandum (TM) describes the evaluation and its findings.

This TM is organized into the following sections:

- Existing City Water Supplies
- Non-Revenue Water
- Recycled Water
- Updated Safe Yield Estimate
- Water Neutrality Policy
- Findings and Recommendations

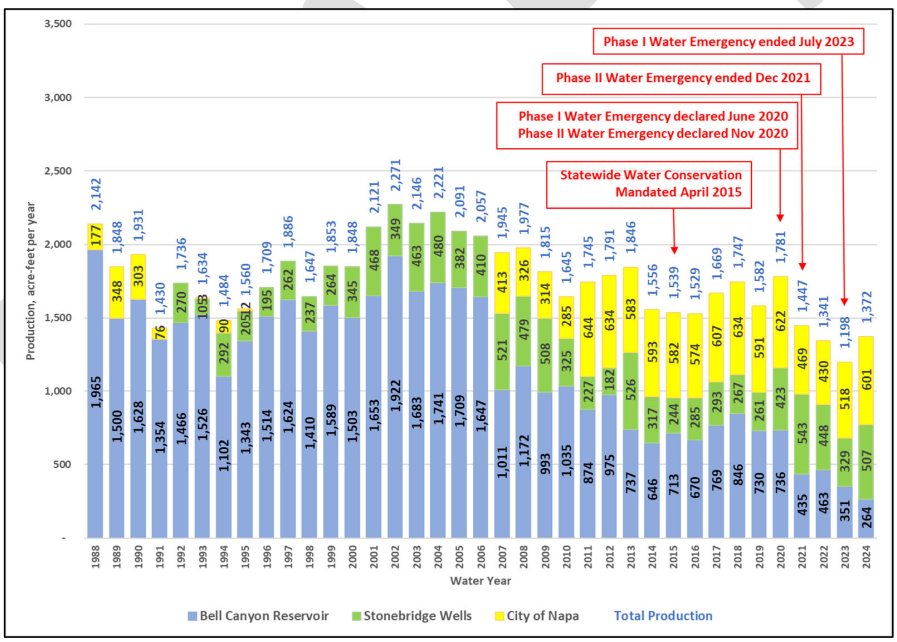
Attachment A to this TM provides a description of the update of the safe yield estimate of the City's Bell Canyon Reservoir, which is summarized in the following sections of this TM.

EXISTING CITY WATER SUPPLIES

The City currently has three potable water supply sources:

- Surface Water from Bell Canyon Reservoir (treated at the City's Louis Stralla Water Treatment Plant)
- Groundwater from the City's Stonebridge Wells No. 1 and 2
- Purchased Water from the City of Napa

The City's historical use of these water supply sources is presented on Figure 1 and in Table 1 by water year[1]. As shown, the annual use of surface water supplies from the Bell Canyon Reservoir in recent years is significantly less than in prior years. Historically, supplies from Bell Canyon Reservoir comprised up to 95 percent of the City's annual water supply. As shown in Table 1, in the last fifteen years, supplies from Bell Canyon Reservoir made up about 43 percent of the City's annual water supply. This reduced use of Bell Canyon Reservoir supplies in recent years is partly because water purchased from the City of Napa has become an increasingly higher percentage of the City's total water supply as the City has prioritized the use of this available supply from the City of Napa. This is particularly demonstrated by the City's use of its water supply sources in 2024, when 44 percent of the supply was purchased from the City of Napa, 37 percent of the supply was pumped from groundwater, and only 19 percent of the supply was from Bell Canyon Reservoir.



Source: Napa Valley Subbasin Groundwater Sustainability Plan (Table 7-8) supplemented with City of St. Helena monthly water production data for Water Years 2020 to 2024.

Figure 1. Annual Water Production

[1] The Water Year extends from October 1 to September 30 and is designated by the calendar year in which it ends. For example, the 2010 Water Year started on October 1, 2009 and ended on September 30, 2010.

Table 1. Historical Water Production by Source

Water Year[(a)]	Bell Canyon Reservoir, AF[(b)]	Stonebridge Wells, AF[(b)]	City of Napa, AF[(b)]	Total Production, AF
2010	1,035	325	285	1,645
2011	874	227	644	1,745
2012	975	182	634	1,791
2013	737	526	583	1,846
2014	646	317	593	1,556
2015	713	244	582	1,539
2016	670	285	574	1,529
2017	769	293	607	1,669
2018	846	267	634	1,747
2019	730	261	591	1,582
2020	736	423	622	1,781
2021	435	543	469	1,447
2022	463	448	430	1,341
2023	351	329	518	1,198
2024	264	507	601	1,373
2010-2024 Average	**683**	**345**	**558**	**1,586**
2010-2024 Average (as a % of total supply)	**43%**	**22%**	**35%**	**100%**
2024 Supplies (as a % of total supply)	**19%**	**37%**	**44%**	**100%**

(a) The Water Year extends from October 1 to September 30 and is designated by the calendar year in which it ends. For example, the 2010 Water Year started on October 1, 2009 and ended on September 30, 2010.

(b) Annual production data for Water Years 2010 to 2019 is taken from Table 7-8 of the Napa County Groundwater Sustainability Plan (dated January 2022) and supplemented with City of St. Helena monthly water production data to provide production totals by supply source for Water Years 2020 to 2024.

It should be noted that the reduced amount of water delivered from the City of Napa in 2021 and 2022 was the result of a pump failure exacerbated by the low delivery pressure from City of Napa. The City was unable to operate the Rutherford Pump Station for several weeks while the pump was being repaired. Therefore, the delivery volume from the City of Napa for Water Years 2021 and 2022 is not representative of the City's annual demand or normal operations. In 2023, water supply from the City of Napa increased as a result of the City of St. Helena reclaiming "unused water" that it was unable to take in 2021 and 2022. The City of St. Helena amended its contract with the City of Napa to allow for extra time to take delivery of water that could not be pumped in 2021 and 2022. This additional volume was a temporary measure and does not constitute an ongoing increase in demand.

The City also has access to non-potable water from the Lower Reservoir that it provides to some irrigation accounts, as well as non-potable wells for non-potable park and landscape irrigation, but their use is restricted to only very small areas. The City's Lower Reservoir was constructed in 1878 to supply potable water to the City and surrounding vineyards. The Lower Reservoir was originally constructed as an off-stream reservoir with diversion facilities on York Creek, tributary to the Napa River. The diversion facilities were removed in 2020, so that the Lower Reservoir's only current water source is inflow from its tributary creek and rainfall in its associated watershed, which covers an area of about 67 acres. The reservoir was initially constructed with a storage capacity of approximately 40 million gallons (125 AF), which was enlarged to approximately 75 million gallons (230 AF) in 1935. However, in 2016, the California Department of Water Resources Division of Safety of Dams restricted the maximum reservoir elevation to 405.2 feet (12.1 feet below the crest of the dam). At that reduced elevation, the storage capacity of the Lower Reservoir is approximately 105 AF. Because of the reservoir's small watershed area, low storage capacity and lack of a water treatment facility, the Lower Reservoir is not considered to be a viable potable water source for the City.

Each of the City's potable water supply sources is described further below.

Bell Canyon Reservoir

Bell Creek (also known as Howell Creek), as impounded in Bell Canyon Reservoir located north of St. Helena, has been the City's primary water supply source for over 50 years. The City maintains water rights Permits 9157 and 14810. Permit 9157 (Application 11816 filed April 8, 1947) indicates that Bell Canyon Reservoir, once constructed, would have a storage capacity of 1,800 AF. This permit allows the City to divert and store 1,800 AF, and directly divert 1 cubic foot per second (cfs) for immediate use between November 15 and April 15 (150 days) of each year. The 1 cfs diverted for immediate use does not count against the 1,800 AF storage limit. Permit 14810 (Application 20625, filed February 21, 1962) indicates that the storage in Bell Canyon Reservoir would be increased to 3,800 AF, and allows the City to divert and store an additional 2,000 AF between November 15 and April 15 of each year. It should be noted that the City's water rights permits were amended in 1989 to include reservoir bypass flows to improve fish habitat. Also, 25 percent of the reservoir capacity is reserved for fire storage.

Water supplies from the Bell Canyon Reservoir are entirely dependent on local rainfall and runoff within the watershed area. The watershed area is relatively small (approximately 2,600 acres), making the reservoir highly susceptible to local climate conditions.

The water delivered from Bell Canyon Reservoir, or directly diverted from Bell Creek, is treated to potable water quality standards at the City's Louis Stralla Water Treatment Plant (LSWTP) prior to delivery to City distribution system customers. The LSWTP began operations in 1980 and was upgraded in 1994. The treatment plant provides complete conventional treatment and has a maximum capacity of 4.30 million gallons per day (mgd) and an average flow of 0.63 mgd[2].

Stonebridge Wells

Two groundwater wells, known as Stonebridge Wells Nos. 1 and 2, provide water supply to the City. The groundwater produced from these wells is treated at a small treatment plant called the Stonebridge Well Complex. The wells are located south of Pope Street, west of the Napa River. The production capacity of Stonebridge Well No. 1 is 245 gallons per minute (gpm)[3] and the production capacity of Stonebridge Well No. 2 is 350 gpm[4]. The City typically operates both wells at the same time. A third well, also near the Napa River but just north of Pope Street, provides untreated water that is used for irrigation in nearby areas, including Jacob Meily Park. Key data on Stonebridge Wells No. 1 and 2 are provided in Table 2.

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[2] City of St. Helena Integrated Utility Master Plan (Section 5.1.1.4), April 2021.

[3] Stonebridge Well No. 1 Water Well Drillers Report, March 1989.

[4] Summary of Operations Report for City of St. Helena Stonebridge Well No. 2, prepared by Richard C. Slade & Associates, January 1997.

Table 2. Stonebridge Wells No. 1 and 2 Construction Details

	Stonebridge Well No. 1[(a)]	Stonebridge Well No. 2[(b)]
Year Constructed	1989	1996
Casing Diameter and Material	8 inches; Class 200 PVC	12 inches; Carbon Steel
Total Depth	420 feet	700 feet
Sanitary Seal Depth	50 feet	101 feet
Screened (Perforated) Interval	70 to 420 feet	135 to 190 feet 210 to 330 feet 350 to 430 feet 470 to 550 feet 570 to 660 feet
Production Capacity	245 gpm	350 gpm

(a) Stonebridge Well No. 1 Water Well Drillers Report, March 1989. Well diameter, depth, screened intervals and casing material confirmed by November 2022 survey performed by Dr. Well, Water Well Services, Inc.
(b) Summary of Operations Report for City of St. Helena Stonebridge Well No. 2, prepared by Richard C. Slade & Associates, January 1997.

The City has had a long-standing policy to reduce its withdrawal of groundwater in non-drought years, limiting production from Stonebridge Wells Nos. 1 and 2 to no more than 20 percent of the total City water demand, except in Phase II or greater water shortage emergencies[5]. As shown in Table 3, years where groundwater comprised a larger percent of the total water supply generally correspond to below average, dry or very dry years. For the period from Water Year 2010 to 2024, groundwater production averaged 19 percent of the total water production in above average, wet and very wet years, while groundwater production averaged 24 percent of the total water production in below average, dry and very dry years.

[5] As defined in the City of St. Helena Municipal Code.

Table 3. Historical Groundwater Production in Various Water Year Types			
Water Year	Water Year Type[(a)]	Annual Groundwater Production, AF[(b)]	Annual Groundwater Production as a Percent of Total Water Production
2010	Wet	325	20%
2011	Wet	227	13%
2012	Normal (Below Average)	182	10%
2013	Normal (Below Average)	526	28%
2014	Dry	317	20%
2015	Normal (Below Average)	244	16%
2016	Normal (Below Average)	285	19%
2017	Very Wet	293	18%
2018	Dry	267	15%
2019	Wet	261	16%
2020	Very Dry	423	24%
2021	Very Dry	543	38%
2022	Normal (Below Average)	448	33%
2023	Wet	329	27%
2024	Normal (Below Average)	507	37%
Average Groundwater Production in Above Average, Wet and Very Wet Years		**287**	**19%**
Average Groundwater Production in Below Average, Dry and Very Dry Years		**374**	**24%**

(a) Water Year Types as defined for the Napa County Groundwater Sustainability Plan (from Table 2-5 of the Napa County Groundwater Sustainability Annual Report – Water Year 2024, dated March 2025).

(b) Annual groundwater production data for Water Years 2010 to 2019 is taken from Table 7-8 of the Napa County Groundwater Sustainability Plan (January 2022) and supplemented with City of St. Helena monthly water production data to provide groundwater production totals for Water Years 2020 to 2024.

The City's Stonebridge wells draw from the underlying Napa Valley Subbasin (Basin Number 2-2.01) of the larger Napa-Sonoma Valley Basin. The Napa Valley Subbasin occupies a northwest trending structural depression in the central Coast Ranges, approximately 40 miles northeast of San Francisco. The Subbasin is bounded to the north, east, and west by portions of the Coast Ranges and on the south by the Napa-Sonoma Marshes Wildlife Area. The Subbasin extends roughly from the City of Napa in the south, to the City of Calistoga in the north, a distance of about 35 miles.

In September 2014, Governor Edmund G. Brown, Jr. signed the Sustainable Groundwater Management Act (SGMA), a three-bill legislative package now codified in Section 10720 et seq. of the California Water Code. Effective in California on January 1, 2015, SGMA provided a framework for the sustainable management of groundwater resources. SGMA encourages groundwater management at the local level. Local agencies formed Groundwater Sustainability Agencies (GSAs) to develop and implement Groundwater Sustainability Plans (GSPs) to guide sustainable management of state-defined groundwater basins.

The Napa Valley Subbasin is classified as a high priority basin by the California Department of Water Resources and was therefore required to develop a GSP in accordance with SGMA requirements. The Subbasin is categorized as high priority primarily due to the amount of irrigated lands, the density of wells, and the degree to which people rely on groundwater in the Subbasin.

The Napa County Groundwater Sustainability Agency (NCGSA, or GSA) was created in December 2019 to manage groundwater resources for the Napa Valley Subbasin consistent with SGMA. The Napa County Groundwater Sustainability Plan Advisory Committee was subsequently established in June 2020 to act as advisors for the development of the GSP and is made up of representatives of various beneficial uses of groundwater in the Subbasin, including the City. The committee provided general input, reviewed draft GSP content, defined sustainable management criteria, and provided input on next steps for GSP implementation. The GSP was completed in January 2022, and the City continues to collaborate with the GSA.

Implementation of the GSP is on-going and includes a number of projects and management actions, as well as continued groundwater monitoring and modeling activities to track and evaluate the impact of projects and management actions on conditions in the subbasin. These projects and management actions include vineyard and winery water conservation, managed aquifer recharge, expanded recycled water use, pumping reductions, and groundwater ordinance and new well permit conditions.

Consistent with the GSP recommended actions, the City is currently preparing a Recycled Water Facilities Plan to explore recycled water options within the City (see additional information below), and, as described above, the City has had a long-standing policy to limit the amount of groundwater use.

Management Action #2 in the GSP specifically calls for a 10 percent reduction in groundwater pumpage throughout the subbasin as compared with the average annual historical pumping from Water Years 2005 to 2014. Per the GSP, implementation of this management action will benefit groundwater storage and will help achieve the subbasin's sustainability goal. The City's average groundwater use from Water Years 2005 to 2014 was 388 AF per year (Stonebridge Wells Nos. 1 and 2); therefore, a 10 percent reduction from that average use would reduce the City's allowable annual pumpage to about 350 AF per year.

City of Napa Water Supply Agreement

In September 2000, the City acquired 1,000 AF per year of State Water Project water entitlements from the Kern County Water Agency under a contract with the Napa County Flood Control and Water Conservation District (NCFCWCD). However, the City did not have an entitlement to capacity in the North Bay Aqueduct system, nor sufficient treatment or transmission facilities to convey said water entitlements to the point of use of its water customers for domestic purposes.

Therefore, in September 2006, the City entered into a long-term Water Supply Agreement with the City of Napa (2006 Agreement). Per the 2006 Agreement, the City of Napa purchased the 1,000 AF of State Water Project water entitlements from the City and agreed to provide a long-term water supply of up to 400 AF per fiscal year to the City (with a minimum annual delivery of 200 AF). The 2006 Agreement has subsequently been amended three times as follows:

- Amendment No. 1, approved in April 2009, increased the supply amount to the City up to 600 AF per year (with a minimum annual delivery of 400 AF).
- Amendment No. 2, approved in January 2011, addressed water that was not delivered in 2010.

- Amendment No. 3, approved in November 2011, increased the minimum annual delivery to the City to 600 AF with an option to request an additional 200 AF of water annually.

The term of the 2006 Agreement is through December 31, 2035.

The quantity of water to be made available and delivered each fiscal year (defined in paragraph 3 of the 2006 Agreement as July 1 of any year through June 30 of the following year) to the City per paragraph 4 of Amendment No. 3 to the 2006 Agreement is as follows:

- **Base Supply.** The City of Napa shall deliver and the City shall accept 600 AF of water annually.
- **Optional Supply.** The City may request an additional 200 AF of water annually. If, in the City of Napa's sole discretion, water supply is available to fulfill the request, the City of Napa will deliver the requested quantity of water to the City. If supplies are not available and if the City of Napa attempts to acquire supplemental dry-year water on a single year basis from an outside source; the City of Napa will add the City's requested quantity to the total quantity requested. The City of Napa makes no guarantees that dry-year water will be available or purchased in any given year. The City of Napa reserves the exclusive right to determine the terms of purchase and to avoid such purchase if the terms are unacceptable or if the City of Napa's need for the water is alleviated. If the City of Napa executes a supplemental dry-year water purchase on a single year basis, the City agrees to purchase the requested amount or a proportional share thereof at the rate described in the amended agreement.

This water is received from the City of Napa water transmission system at the City's Rutherford Pump Station. The City has noted that it has had difficulties receiving the City of Napa water supplies due to hydraulic constraints at the City's Rutherford Pump Station and within the Napa Intertie Transmission Main, as well as low suction pressure resulting from the City of Napa's Dwyer Road Pump Station which is in need of improvements.

NON-REVENUE WATER

Non-revenue water, previously referred to as unaccounted for water, is the difference between the metered quantity of water produced or purchased by the City and the metered quantity of water sold to City customers. Non-revenue water includes unbilled authorized consumption (e.g., firefighting and system maintenance including flushing of hydrants), unauthorized consumption, apparent losses (e.g., billing and metering inaccuracies), and real losses (e.g., pipeline leaks and breaks). As shown in Table 4, the City has had a significant amount of non-revenue water in recent years, up to 25 percent of total water production in FY23/24. The City attributes the majority of its non-revenue water to its aging distribution system (i.e., leakage), as well as the need to frequently flush portions of the distribution system due to water quality issues (i.e., brown water).

Table 4. City of St. Helena Non-Revenue Water

	FY19/20	FY20/21	FY21/22	FY22/23	FY23/24	5-Year Average (FY19/20-FY23/24)
Annual Water Production, AF	1,737	1,663	1,229	1,265	1,365	1,452
Annual Water Consumption, AF	1,634	1,341	1,032	989	1,031	1,205
Non-Revenue Water, AF	**103**	**322**	**197**	**275**	**334**	**246**
Non-Revenue Water, as a percent of total production	**6%**	**19%**	**16%**	**22%**	**25%**	**18%**

Source: City of St. Helena monthly water production data (water shortage forecast reductions.xls), and monthly water consumption data (water summary FY 2006-current.xls) and Annual Drought Reports to the State Water Resources Control Board for Calendar Years 2023 and 2024.

The City recognizes that it must maintain non-revenue water at an acceptable level in its municipal system. Although there is no standard for an acceptable percentage of non-revenue water, a general rule of thumb for an acceptable non-revenue water percentage for a well-managed system is 10 to 15 percent[6].

RECYCLED WATER

The City is currently preparing a Recycled Water Facilities Plan to evaluate the potential for implementation of a recycled water project in the City. The City owns and operates a Wastewater Treatment and Reclamation Plant (WWTRP) that produces disinfected secondary wastewater and discharges treated wastewater to agricultural spray fields and the Napa River when needed. The City is in the process of upgrading its WWTRP with a membrane bioreactor (MBR) process which will upgrade the treated wastewater quality to meet the State's requirements for disinfected tertiary recycled water.

The City is interested in recycling its wastewater to beneficially reuse the water locally, better meet spray field agronomic rates, and provide a new water supply that will offset (reduce) demands on the City's potable water supply. Possible recycled water use within the City includes: landscape irrigation, agricultural/vineyard irrigation, injection or other recharge into the underlying groundwater basin, surface water augmentation (indirect potable reuse), treated water augmentation (direct potable reuse) and other uses as approved in the State's Title 22 regulations. The City may also wish to consider delivering recycled water to users outside the City (e.g., properties within unincorporated Napa County).

UPDATED SAFE YIELD ESTIMATE

The safe annual yield of the St. Helena water supply system is defined as that quantity of water which can be reliably delivered on an annual basis through most rainfall years, including a Dry Year, without undue

[6] The American Water Works Association (AWWA) does not specify a single universally acceptable percentage for non-revenue water (NRW) in public water systems. Instead, AWWA emphasizes the importance of each utility assessing and managing its own NRW levels based on local conditions and system characteristics. The goal is to achieve economically sustainable levels of NRW, which can vary depending on factors like system age, infrastructure condition, and local water scarcity.

The State Water Resources Control Board has recently established water loss standards for urban water retailer suppliers in gallons per connection per day, however, such a standard has not been established for the City of St. Helena as the City serves less than 3,000 connections and less than 3,000 AF of water per year and is therefore not classified as an urban water retail supplier for the purposes of the water loss standards.

hardship on water customers through water shortage restrictions. It is recognized that the safe annual yield, as so defined, could place significant hardship on water customers in a Critically Dry Year or in periods of two or more consecutive Dry Years.

To determine the updated safe yield estimate, each of the City's water supplies was evaluated based on recent hydrologic conditions and supply availability, to the extent that data was available.

Bell Canyon Reservoir

As part of the preparation of the City's 2010 Water Supply Plan, a safe yield estimate for the City's Bell Canyon Reservoir was developed under various hydrologic conditions using a spreadsheet-based reservoir yield model. For this safe yield update, the reservoir yield model was updated using available daily reservoir operations and hydrologic data through July 2023. To estimate how much water could be withdrawn from the reservoir by the City each year, the reservoir yield model used three main inputs: the historical rainfall data from 1951 through 2023, the rainfall-runoff relationship, and the bypass flow requirements. The most critical factor in developing the reservoir operational models is the development of the relationship between rainfall in the watershed and runoff into the reservoir. As the rainy season begins, more rainfall is absorbed by the watershed and less runs off into the creeks and into the reservoir. As the soil becomes saturated following several rain events, the same amount of rainfall would produce a greater amount of runoff and inflow to the reservoir. To develop the rainfall-runoff relationship, monthly calculated reservoir inflow was compared to the monthly total rainfall for each month of available data from 1988 through 2023. Once the rainfall-runoff relationship had been approximated, estimates of the sustainable yield were developed based on different hydrologic assumptions. A description of the reservoir yield model update is provided in Attachment A of this TM.

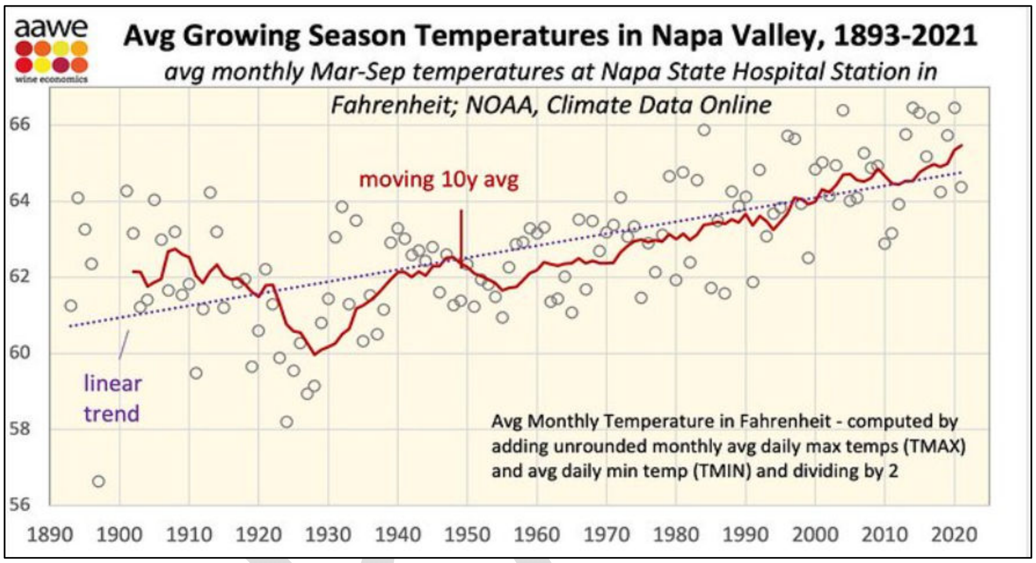
The estimated annual sustainable yield of the Bell Canyon Reservoir is summarized in Table 5. Results are shown based on the previous modeling conducted in 2010 (using daily data from 1988 through 2009) and the updated model (using available daily data from January 2010 through July 2023).

Table 5. Estimated Annual Sustainable Yield of Bell Canyon Reservoir

Condition	Per 2011 Safe Yield Estimate		Per 2025 Safe Yield Update		Percent Reduction in Estimated Annual Sustainable Yield	Notes
	Minimum Rainfall, inches	Estimated Annual Sustainable Yield, acre-feet	Minimum Rainfall, inches	Estimated Annual Sustainable Yield, acre-feet		
Wet Year	38.5	1,070	36.4	895	16%	Corresponds to 40% Exceedance
Normal Year	32.7	970	29.5	733	24%	Corresponds to 60% Exceedance
Below Normal Year	26.0	820	24.8	557	32%	Corresponds to 80% Exceedance
Dry Year	22.0	615	20.8	476	23%	Corresponds to 90% Exceedance
Critical Dry Year	10.4	510	6.0	390	24%	Corresponds to 100% Exceedance

As shown, based on the reservoir model update, the estimated annual sustainable yield has dropped under each hydrologic condition by 16 to 32 percent. This result is not surprising considering the severe drought conditions that occurred during the years that the update encompasses.

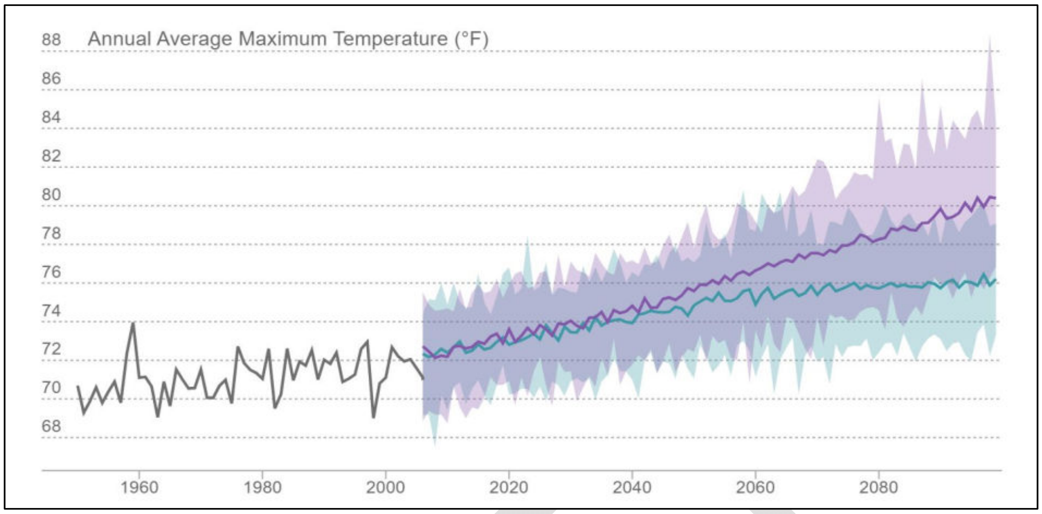
According to the Climate Vulnerability Assessment prepared for the Napa County Regional Climate Action and Adaptation Plan completed in April 2024, the effects of climate change are projected to have significant impacts throughout Napa County in the future, which could further impact the sustainable yield of the City's Bell Canyon Reservoir. As shown on Figure 2, average temperatures in the Napa Valley have increased in the last 100+ years.



Source: American Association of Wine Economists

Figure 2. Average Monthly March – September Temperature in Napa

As shown on Figure 3, the Climate Vulnerability Assessment indicates that annual average maximum temperatures will continue to increase in Napa County in the future. For the City, the annual average maximum temperature is projected to increase in the future, from 71.6°F (average 1961-1990) to 79.9°F (long-term 2070-2099), an increase of 8.3°F. This temperature rise will likely lead to secondary climate change effects such as increased wildfire risk, more frequent extreme heat events, and droughts affecting water supply.



Source: Climate Vulnerability Assessment prepared for the Napa County Regional Climate Action and Adaptation Plan, April 2024.

Figure 3. Napa County Projected Increase in Average Annual Maximum Temperature through 2099

The Climate Vulnerability Assessment also indicates that the City is expected to see an increase in average annual precipitation from 37.3 inches to 48.9 inches, but precipitation patterns will become more variable, with intense storms and shorter wet seasons. This variability could result in wetter wet years and drier dry years, with dry years likely to be followed by additional dry years, increasing the risk of drought.

Understanding these changes is crucial for managing the reservoir's sustainable yield and preparing for future climate impacts. The reservoir's ability to provide consistent water supply will be challenged by these fluctuations, necessitating adaptive strategies to ensure water availability during dry periods.

Stonebridge Wells

As described above, one of the management actions included in the GSP for the Napa Valley Subbasin is to reduce groundwater pumpage throughout the subbasin by 10 percent from the average pumpage for Water Years 2005 to 2014. The City's average groundwater use from Water Years 2005 to 2014 was 388 AF per year. A 10 percent reduction in pumpage compared to the average pumping for Water Years 2005 to 2014 would reduce the average annual safe yield of the City's groundwater supply to about 350 AF (388 AF minus 10 percent). The City could pump more groundwater in dry years if needed to meet water demands. However, long-term pumping exceeding 350 AF per year would violate the reduced pumpage provision in the GSP.

As shown in Table 1, the City's groundwater use over the last fifteen years (Water Years 2010 to 2024) averaged 345 AF per year, which is below the 350 AF average annual safe yield allowed by the GSP.

City of Napa Water Supply Agreement

As described above, the City's water supply agreement with the City of Napa provides the City with an annual water supply of 600 AF with an option to request an additional 200 AF each year. The City is interested in amending its agreement with the City of Napa to solidify the current 200 AF option and make it part of the annual water supply amount.

As noted above, operational issues at the City's Rutherford Pump Station and the Napa Intertie Transmission Main have made taking the full amount of supply from the City of Napa (generally above 600 AF) difficult. This water supply is an important component of the City's water supply portfolio. Therefore, the City should prioritize improvements at the Rutherford Pump Station and Napa Intertie Transmission Main to ensure that the City can take up to its full contractual amount (up to 800 AF) from the City of Napa each year.

Summary of Updated Safe Yield Estimate

The City's overall safe yield estimate is based on the sum of the estimated annual sustainable yield from the Bell Canyon Reservoir, groundwater from the City's Stonebridge Wells, and supplies from the City of Napa, minus the City's non-revenue water. Table 6 provides a summary of the updated safe yield estimate for the City's water system, as compared to the previous safe yield estimate prepared in 2011.

Table 6. Summary of City's Annual Safe Yield Estimate

Supply Source	2011 Annual Safe Yield Estimate, AF	2025 Updated Annual Safe Yield Estimate, AF	Notes
Bell Canyon Reservoir	700	516	Average of Below Normal and Dry Year Safe Yield Estimate (see Table 5 above); 2025 updated estimate is based on available daily reservoir operations data through July 2023 (see Attachment A)
Groundwater (Stonebridge Wells Nos. 1 and 2)	450	350	Updated estimate is based on reduced groundwater pumpage per the GSP (10% reduction from the Water Year 2005 to 2014 average groundwater pumpage); the City could pump more groundwater in dry years if needed to meet water demands, however, long-term pumping above 350 AF per year would violate the reduced pumping provision in the GSP
City of Napa Supply	800	800	Based on full contractual amount from the City of Napa (including the 200 AF option) and assuming the Rutherford Pump Station and the Napa Intertie Transmission Main are operating at capacity
Total Annual Safe Yield Estimate	**1,950**	**1,666**	Sum of estimated safe yield for Bell Canyon Reservoir, groundwater and City of Napa supplies
Non-Revenue Water	(292)	(300)	2011 Annual Safe Yield Estimate was based on 15% non-revenue water; current estimate is based on 18% non-revenue water (average for FY19/20 through FY23/24) (see Table 4 above)
Net Annual Safe Yield Estimate	**1,658**	**1,366**	Total Annual Safe Yield Estimate minus Non-Revenue Water

As shown in Table 6, the City's updated annual safe yield estimate is 1,666 AF (compared to the 2011 annual safe yield estimate of 1,950 AF). Taking the City's non-revenue water into account, the City's updated net annual safe yield estimate is 1,366 AF (compared to the 2011 net annual safe yield estimate of 1,658 AF). The reduction is due to the lower estimated sustainable yield from Bell Canyon Reservoir and the reduced groundwater pumpage in compliance with the GSP.

Comparison to Existing and Future Demand Projections

The City's 2021 Integrated Utility Master Plan (IUMP) included the development of water demand projections through 2040 based on the City's existing water demands, planned development projects within the City and other growth within the City's service area consistent with the City's General Plan Update 2040. The IUMP assumed that future water demands would be met using potable water supplies. Table 7 presents the City's projected water demands.

Table 7. City of St. Helena Projected Water Demands

	Projected Average Day Demand, mgd[a]	Projected Annual Demand, AF
Existing Water Demand[b]	1.45	1,624
Planned Developments	0.13	146
Study Area Growth	0.04	45
Total Future (2040) Water Demand	**1.62**	**1,815**

(a) From Table 4.5 of the City of St. Helena Integrated Utility Master Plan.
(b) Existing water demand is based on the average water production from 2013 to 2017 and includes non-revenue water.

The updated annual safe yield estimate of 1,666 AF is essentially equal to the existing water demand shown in the IUMP (1,624 AF), and is not adequate to meet the projected future demand shown in the IUMP (1,815 AF). However, it should be noted that the existing water demand shown in the IUMP (1,624 AF), based on the average production from 2012 to 2017, is significantly higher than the City's actual water production in the last few years (FY21/22: 1,229 AF; FY22/23: 1,265 AF; FY23/24: 1,365 AF). The lower water production in the last few years is likely a result of the lasting effects of the City's 2020 declaration of Phase I and Phase II Water Emergency conditions and on-going water conservation efforts.

If the existing demand continues to be lower than the existing demand assumed in the IUMP, the projected future demand would also be lower by a similar amount. For example, if the existing demand is assumed to be 1,365 AF as it was in FY23/24, the projected future demand would be 1,556 AF (1,365 AF + 146 AF for Planned Developments + 45 AF for Study Area Growth), and the updated annual safe yield estimate of 1,666 AF would be adequate to meet the projected future water demand.

Potential existing and future supply shortfalls or surpluses based on these demand scenarios are summarized in Table 8.

Table 8. Potential Water Supply Shortfalls or Surpluses

	Projections from Integrated Utility Master Plan, AF	Adjusted Projections based on Recent Water Use Trends, AF
Existing Water Demand	1,624[a]	1,365[b]
Updated Annual Safe Yield Assessment	1,666[c]	1,666[c]
Existing Surplus (Shortfall)[d]	**42**	**301**
Projected Future (2040) Water Demand	1,815[a]	1,556[e]
Updated Annual Safe Yield Assessment	1,666[c]	1,666[c]
Future Surplus (Shortfall)[f]	**(149)**	**110**

(a) From Table 7 above.
(b) Actual water use for FY23/24 from Annual Drought Reports to the State Water Resources Control Board for Calendar Years 2023 and 2024.
(c) From Table 6 above.
(d) Compares the updated annual safe yield assessment to the existing water demand.
(e) Actual water use for FY23/24 plus the future water demand for planned developments and study area growth shown in Table 7.
(f) Compares the updated annual safe yield assessment to the projected future (2040) water demand.

The City remains focused on ensuring that the City has a reliable water supply portfolio to serve its existing and future residents and businesses. As discussed above, the City is currently preparing a Recycled Water Facilities Plan which may identify recycled water projects which could offset (reduce) a portion of the City's existing and/or projected potable water demand. Also, a Water Management Plan is being prepared to further evaluate potential water supply options for the City.

WATER NEUTRALITY POLICY

The City has a Water Neutrality Policy in place which requires that water demand for new development be offset with improvements to existing homes and businesses such that the new development results in no net increase in the City's water demand. Section 13.12.030 of the City Municipal Code has the following provisions related to Water Neutrality:

A. New development shall completely offset its water requirement by installing City-approved ultra-low flush (ULF) toilets and associated water efficient hardware in a sufficient number of existing homes or non-residential properties having toilets that use 1.6 gallons per flush or greater. The required retrofits shall be calculated as specified in the City's Water Neutrality Policy as adopted by council resolution and approved by the Director of Public Works/City Engineer.

B. If the City Council determines that retrofitting of existing residential or non-residential buildings is impractical or constitutes an unusual hardship on an applicant, it may authorize the payment to the City of an in-lieu retrofit fee in lieu of complying with the requirements of subsection A of this section. The in-lieu fee shall be the equivalent of the cost of retrofitting a sufficient number of existing homes with the ULF toilets and other required water-saving devices as described in subsection A of this section. The in-lieu fee shall also include the cost of staff time to accomplish the required retrofitting using the fees collected. The in-lieu fee will be established by resolution. The Public Works Department is authorized to require retrofitting and not accept in-lieu retrofit fee, regardless of hardship, if it appears likely that existing home retrofitting prior to the expected occupancy by the new development can be completed. In the event that an in-lieu fee is accepted, the City will administer a rebate program to retrofit existing homes using the fees collected or may use the fees for another water use efficiency purpose as approved by the City Council. In-lieu fees must be paid upon issuance of a building permit. An applicant may petition the City Council to allow an alternative innovative method of mitigating water use for new development.

Based on the updated annual safe yield estimate described above, enforcement of the City's Water Neutrality Policy remains critical to maintain the availability and reliability of water supplies for the City's existing and future water customers, The City is working on revisions to the Water Neutrality Policy to make its implementation more efficient and its outcomes more effective.

FINDINGS AND RECOMMENDATIONS

The City will need to identify new water supplies, achieve more water savings and/or continue to enforce its water neutrality policy for development to reliably meet the existing and projected future water demand. As noted above, the updated annual safe yield estimate of 1,666 AF may not be adequate to meet the City's projected future water demand as shown in Table 8 above.

The City is currently preparing a Recycled Water Facilities Plan to evaluate the potential for implementation of recycled water projects to offset (reduce) potable water demands. Also, the City is preparing a Water Management Plan to evaluate potential water supply options. At the same time, the City recognizes that new water supply projects are likely to be expensive, potentially increasing the cost of water. Thus, the City should continue to promote water conservation and water use efficiency, seeking to reduce water demand by all classes of users. Furthermore, the City should update its Water Neutrality Policy to clarify allowable actions to be taken to effectively offset water demands associated with new development.

Overall, the recommendations from this update of the City's safe yield estimate are as follows:

- Continue to promote water conservation and water use efficiency by all City water customers.
- Continue to evaluate and mitigate the causes of non-revenue water in an attempt to reduce non-revenue water as much as is cost effective and feasible.
- Amend the Water Supply Agreement with the City of Napa to solidify the additional 200 AF of annual supply which is currently just an option at the City of Napa's discretion.
- Make improvements to the City's Rutherford Pump Station and the Napa Intertie Transmission Main to facilitate the delivery of water supplies from the City of Napa.
- Implement recycled water projects as recommended in the Recycled Water Facilities Plan to offset (reduce) potable water demands.
- Implement water supply projects as recommended in the Water Management Plan (currently being prepared for the City) to bolster the City's water supply availability and reliability.
- Update the Water Neutrality Policy to clarify requirements and improve implementation and enforcement to offset water demands associated with new development.
- Systematically replace aging infrastructure, including leaking pipelines and the Water Treatment Plant Transmission Pipeline.

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Attachment A

Bell Canyon Reservoir Safe Yield Updates

City of St. Helena
Bell Canyon Reservoir Safe Yield Updates

Introduction

The purpose of this document is to present the findings of a statistical study to estimate the yield of the City of St. Helena's (City's) Bell Canyon Reservoir and to document the various data sources and assumptions used in developing the estimates. The safe yield for the Bell Canyon Reservoir was last evaluated in 2010 as part of the City of St. Helena Water Supply Plan.

This document focuses on the following specific topics:

- Description of Bell Canyon Reservoir
- Update of the Reservoir Yield Models
- Estimated Safe and Sustainable Yield

These topics are discussed in more detail below.

Description of Bell Canyon Reservoir

Bell Creek (also known as Howell Creek), as impounded in Bell Canyon Reservoir, has been one of the City's water supply sources for over 50 years.

The City maintains water rights Permits 9157 and 14810. Permit 9157 (Application 11816 filed April 8, 1947) indicates that Bell Canyon Reservoir, once constructed, would have a storage capacity of 1,800 acre-feet. This permit allows the City to divert and store 1,800 acre-feet, and directly divert 1 cubic feet per second (cfs) for immediate use between November 15 and April 15 (150 days) of each year. The 1 cfs diverted for immediate use does not count against the 1,800 acre-foot storage limit.

Permit 14810 (Application 20625, filed February 21, 1962) indicates that the storage in Bell Canyon Reservoir would be increased to 3,800 acre-feet, and allows the City to divert and store an additional 2,000 acre-feet between November 15 and April 15 of each year.

The actual reservoir capacity at the spillway elevation of 422 feet was estimated by James C. Hanson Consulting Civil Engineer (Hanson) in 1997 to be approximately 2,384 acre-feet. The dam height appears to be roughly 95 feet. The height given in Application 20625 is 105 feet. It appears there were plans to increase the height of the dam and increase storage to 3,800 acre-feet. This work apparently did not occur; however, a project was completed that raised the spillway elevation and increased the reservoir storage capacity to 2,384 acre-feet.

The water rights permits were amended on September 7, 1989 to include reservoir bypass flows to improve fish habitat. As used in this document, the terms "bypass" and "release" are defined as follows:

- Bypass – Bell Creek inflow that is discharged to the stream without entering storage.
- Release – Stored water that is discharged to the stream.

The two terms are legal terms, based on the status of the water that is discharged. The physical methods the City uses to discharge bypass flows and releases are the same.

As defined in the water rights permits, if flow from Bell Creek into the reservoir is less than the required bypass, the required stream bypass is set equal to the flow into the reservoir. Exceptions to the required bypasses could be made during severe drought years. The minimum required bypasses are listed in Table 1.

Table 1. Required Bypasses for Fish Habitat

Bypass Period	Required Flow Rate, cfs[(a)]	Volume, acre-feet
December 1 – January 31	4	492
February 1 – February 29	2	111
March 1 – April 15	1	91
Total	—	**694**

(a) If flow into the reservoir is less than the required bypass, the required stream bypass is set equal to the flow into the reservoir. Exceptions to the required bypasses could be made during severe drought years.

The water delivered from Bell Canyon Reservoir, or directly diverted from Bell Creek is treated to potable standards at the Louis Stralla Water Treatment Plant (LSWTP), prior to delivery to City distribution system customers.

Historically, water supplies from the Bell Canyon Reservoir were the City's primary water supply, supplemented with groundwater supplies from the City's Stonebridge wells. However, since 2007, the City has also purchased water supplies from the City of Napa, which has resulted in less water being used from the Bell Canyon Reservoir. In the last five years, water supplies from the Bell Canyon Reservoir represented about 31 percent of the City's water supplies, while groundwater represented about 32 percent and purchases from the City of Napa represented about 37 percent.

Update of the Reservoir Yield Models

Using available operations data from January 2014 through July 2023, West Yost updated two existing water supply models developed in 2010. The first model is the Water Supply Spreadsheet Model that the City can use for water planning and was used to estimate the one-year yields described below. The second model was a long-term model that predicts the reservoirs response to historical rainfall and evaporation data from 1951 through 2023.

It should be noted that a continuous set of daily reservoir operations data for the update period from 2010 through July 2023 was not available due to inconsistent recordkeeping. As shown in Table 2, the data that were available and added to the model (January 2014 through April 2020 and January 2023 through July 2023, with the exception of May 2023) represent both wet and dry years, including drought years; however, without a continuous data set, it is impossible to assess the impacts of the data gaps on the model results.

Table 2. Reservoir Operations Data Availability and Water Year Types

Water Year	Water Year Type[a]	Reservoir Operations Data Available for Update of Reservoir Yield Model?[b]
2010	Wet	No
2011	Wet	No
2012	Below Normal	No
2013	Below Normal	No
2014	Dry	Yes
2015	Below Normal	Yes
2016	Below Normal	Yes
2017	Very Wet	Yes
2018	Dry	Yes
2019	Wet	Yes
2020	Very Dry	Through April 2020 only
2021	Very Dry	No
2022	Below Normal	No
2023	Wet	Through July 2023 (with the exception of May 2023)

(a) Water Year Types as defined for the Napa County Groundwater Sustainability Plan (from Table 2-8 of the Napa County Groundwater Sustainability Annual Report – Water Year 2023, dated March 2024).

(b) Daily records for reservoir level, LSWTP inflow, and Bell Canyon bypass flow are required to update the reservoir model. If one of these three primary inputs are not available for a given date range, then the model cannot be updated.

This section discusses the source data used in the models and the refinement of the relationship between rainfall and runoff.

Data Sources Used to Update the Water Supply Models

To update the Bell Canyon Reservoir models, West Yost received and analyzed several sources of data from the City.

The input factors are listed and briefly described in Table 3. The net inflow to the reservoir is not directly measured and is instead calculated via a water balance equation that is described in the following subsections.

Table 3. Reservoir Model Development Data Source Descriptions		
Data Source Category	General Description	Availability for Model Update
Inflow		
Reservoir Rainfall	Rainfall falling onto Bell Canyon Reservoir	A
Net Inflow	Calculated Bell Canyon Reservoir inflow (includes reservoir seepage and spill)	P
Outflow		
LSWTP Inflow	Water diverted from Bell Canyon Reservoir into the Louis Stralla WTP to meet municipal demands	U
Bell Canyon Bypass	Water released or bypassed from Bell Canyon Reservoir to maintain fisheries flow	U
Reservoir Et	Water lost through surface evaporation	C
Seepage	Water lost through Bell Canyon Reservoir seepage	U
Spill	Water spilled over the dam	C
Storage		
Change in Storage	The change in Bell Canyon Reservoir storage volume based on water elevation readings	P

Notes:
A = Data is available throughout the duration of the updated evaluation period and was provided by the City or accessed from online sources (e.g., CIMIS).
P = Data partially available throughout the duration of the updated evaluation period and was provided by the City.
U = Data unavailable throughout the duration of the evaluation period
C = Calculated value pending availability of other data sources.

These data sources are described in more detail below. Difficulties in using the various data and creating a usable water balance are also described under each data source.

Reservoir Inflow

The reservoir inflows for this analysis include the following:

- Rainfall onto the Reservoir
- Net Inflow

Rainfall onto the Reservoir

Rainfall data were used to estimate rainfall onto the reservoir. The California Irrigation Management Information System (CIMIS) station, located at Oakville, automatically records rainfall data using a tipping bucket rain gauge. The CIMIS stations are weather stations managed by the California Department of Water Resources for irrigation scheduling purposes. Because the CIMIS station is the next closest location that records precipitation data, it was used for the model update because rainfall data were not available from the daily reports or the weekly reports, which had been used for the initial model development.

The volume of rain falling onto the reservoir was calculated by multiplying the inches of rainfall by the reservoir water surface area at the time of the rainfall event. The volume falling outside of the water surface area, but inside the reservoir maximum area, is included in the net inflow value discussed below.

Net Inflow

The City does not directly measure reservoir inflow; therefore, the reservoir inflow is calculated using the following equation:

$$\Delta \text{ Storage} = \Sigma \text{ Inflow} - \Sigma \text{ Outflow}$$

Where:

Δ Storage = change in reservoir storage over a given time period

Σ Inflow = sum of reservoir inflows over the same time period

Σ Outflow = sum of reservoir outflows over the same time period

The net inflow includes all components of the inflow (except the rainfall directly onto the reservoir water surface) and outflows that have not been accounted for. The components of net inflow include:

- Unmeasured inflows into the reservoir (e.g., runoff, groundwater exfiltration)
- Reservoir seepage and spill (outflow)

Net inflow was provided in the form of the Daily Operations Reports. The reports were available for the following date ranges:

- January 2014 through April 2020
- January 2023 through July 2023, with the exception of May 2023

Reservoir Outflow

The original models contained data representing the diversions from Bell Canyon Reservoir to the LSWTP, bypasses and releases from Bell Canyon, and estimated spill volume for the period of 1988 through 2009. However, similar data for the updated evaluation period (2010 – July 2023) were not available. In lieu of the aforementioned reservoir outflow data, the City provided the net inflow for all available date ranges, thus, making the following outflow data nonessential for the model updates. The 2010 Water Supply Plan Appendix B: Bell Canyon Reservoir Yield Study provides detailed descriptions of outflows used to develop the models. A copy of Appendix B has been included as an attachment to this document.

Reservoir Evaporation

The City calculates evaporation by measuring the daily decrease or increase of the water level in an evaporation pan at the LSWTP. Some of the data points were not continuous and sometimes the data points were beyond the normal acceptable range. West Yost found that reasonable reservoir evaporation estimates can be represented by the local CIMIS grass evapotranspiration (ET) rates. Evapotranspiration is an agricultural-based term and includes evaporation from the soil surface and transpiration from plants.

Average monthly ET measured at the CIMIS Oakville station from January 4, 1989 to March 25, 1989 was used to predict daily reservoir evaporation values when daily CIMIS ET rates were unavailable. For the subsequent period (from March 26, 1989 through July 31, 2023), daily ET rates measured at the CIMIS Oakville station were used to estimate reservoir evaporation.

Bell Canyon Storage

The water surface elevation of Bell Canyon Reservoir is measured daily and was provided in the form of the Daily Operations Reports. The reports were available for the following date ranges:

- January 2014 through April 2020
- January 2023 through July 2023, with the exception of May 2023

The reservoir water surface elevation was used to obtain the corresponding reservoir storage volume using stage/storage tables prepared by Western Hydrologic Services as part of the Bell Canyon Reservoir safe yield analysis prepared by Hanson in 2006. The stage/storage tables reported reservoir elevation in 1-foot increments. The reservoir water surface elevation was reported in hundredths of a foot in the daily reports; therefore, West Yost used linear interpolation between water surface elevations and storage volumes.

Rainfall-Runoff Relationship

The most critical factor in developing the reservoir operational models is the development of the relationship between rainfall in the watershed and runoff into the reservoir.

As the rainy season begins, more rainfall is absorbed by the watershed and less runs off into the creeks. As the soil becomes saturated following several rain events, the same amount of rainfall would produce a greater amount of runoff.

In dynamic models, the soil moisture content, and hence the amount of runoff per inch of rain, can be adjusted as the rainy season progresses. A linear spreadsheet model such as the ones used in this update, cannot adjust the soil moisture content throughout the year and each inch of rain is assumed to produce the same amount of runoff, regardless of the season.

The analysis is also hampered by the lack of accurate spill volume data. There are two factors that limit the availability of spill volume data. First, reservoir water surface elevation data are read on a weekly basis. If a storm were to occur, it is quite feasible that the reservoir water surface elevation could rise, the reservoir spills, and the water surface elevation return to the spillway elevation before the next reading. Second, the data frequently indicate that the reservoir is spilling, but do not provide the actual elevation. Some data indicate the water surface elevation as “greater than 422” which is the spillway elevation. Some of the data are in shorter intervals than weekly and sometimes the actual water surface elevation is provided. These data were used to approximate the spill volume during those times.

Not including all the spill volume in the available data limits the data to those storms where the reservoir did not spill, and those storms with dry preceding conditions. The runoff from storms that produce substantial runoff and occur later in the season when the reservoir is spilling are lost. Furthermore, the discontinuous dataset within the added evaluation period (i.e., 2010 – 2023) represents an incomplete picture of the historical trends.

To develop the rainfall-runoff relationship, West Yost compared monthly calculated reservoir inflow to the monthly total rainfall for each month of available data from 1988 through 2023. The data and the resulting trend line are shown on Figure 1. It is interesting to note that the trend line that best fits the data is a polynomial, indicating that the runoff volume is greater per inch of rain during wet years. This relationship is summarized by the following equation:

$$\text{Inflow} = 6.6822*(\text{Rainfall})^2 + 13.009*(\text{Rainfall}) + 33.117$$

Where:

Inflow = Reservoir Inflow in acre-feet per month

Rainfall = Rainfall in inches per month

West Yost suspects that, were the spill volumes included in the analysis, the trend line would be steeper and hence the model would predict more reservoir inflow per inch of rain, particularly during large storm events. This equation was used to estimate the Safe and Sustainable Yields that are discussed below.

Estimated Safe and Sustainable Yield

For purposes of this discussion, the following definitions apply:

- Actual Use = The historical average volume of Bell Creek surface water that the City has treated at the LSWTP
- Safe Yield = The maximum amount of water that would be available to the City in a critical dry year. This calculation does not allow for the use of carryover storage from wet years to dry years
- Sustainable Yield = The maximum amount of water that the City could withdraw from the reservoir each year consistently, i.e., this calculation allows carryover storage from wet years to dry years

As shown in Table 4, the Actual Use of the reservoir from 2018 to 2022 averaged 566 acre-feet per year, while the historical Actual Use averaged 1,460 acre-feet per year from 1990 to 2009. As the City has prioritized the use of available supply from the City of Napa, use of water from Bell Canyon Reservoir has decreased.

Table 4. Bell Canyon Reservoir Actual Use

Calendar Year	Volume of Water from Bell Canyon Reservoir Treated at LSWTP[(a)], acre-feet per year
2018	712
2019	745
2020	601
2021	370
2022	402
5-Year Average (2018-2022)	**566**
20-Year Average (1990-2009)	**1,460**

(a) LSWTP = Louis Stralla Water Treatment Plant.

However, West Yost does not recommend using the Actual Use to project future water supply availability.

The estimated Safe Yield of the reservoir was calculated based on the rainfall and runoff relationship described above. It appears that the volume of runoff in critically dry years would be approximately 503 acre-feet; all of the 503 acre-feet would be bypassed to maintain fish flows in Bell Creek, leaving no water for City use, unless the City were allowed to forgo fish flows under emergency conditions. It should also be noted that 25 percent of the reservoir storage is reserved for fire storage. The estimated annual yield for several conditions is shown in Table 5 and shown graphically on Figure 2.

Table 5. Annual Safe Yield Estimate Summary

Probability of Exceedance, percent[a]	Precipitation, inches[b]	Estimated Reservoir Inflow, acre-feet[c]	Required Bypass, acre-feet[d]	Evaporation, acre-feet[e]	Water Supply Available to City, acre-feet[f]
50	33.7	1,988	1,197	161	631
55	31.7	1,827	1,173	144	510
60	29.5	1,659	1,148	120	392
65	28.1	1,562	1,133	104	325
70	26.9	1,480	1,121	94	266
75	25.8	1,406	1,109	94	203
80	24.8	1,340	1,097	72	171
85	21.3	1,129	1,015	66	48
90	20.8	1,098	995	61	43
95	13.3	741	727	13	1
100	6.0	503	503	—	—

(a) Probability that precipitation and water supplies will be greater than indicated.
(b) Rainfall associated with exceedance probability of water years 1951-2022.
(c) Estimated Reservoir inflow based on statistical data (1988-2022) and calculated inflow. Varies with rainfall pattern.
(d) Possible required bypass based on bypass regulations and normalized rainfall patterns. Varies with rainfall pattern.
(e) Approximate evaporation based on Et and open surface area in reservoir. Low values for evaporation during dry years is indicative of a low reservoir water surface elevation.
(f) Inflow minus bypass and evaporation.

Because of the relationship between rainfall and runoff, and because the rainfall pattern in the Safe Yield analysis was based on average monthly rainfall distribution pattern (as shown on Figure 3), it is possible that the values presented in Table 5 underestimate the actual reservoir conditions that would be experienced.

The Sustainable Yield is a much more useful calculation because it represents the amount of water that could be consistently withdrawn from the reservoir each year and includes the beneficial effect of carrying storage over from wet years to dry years. Once the rainfall-runoff relationship had been approximated, West Yost prepared several estimates of Sustainable Yield with different assumptions. To estimate how much water could be withdrawn from the reservoir by the City each year, the Sustainable Yield model used three main inputs: the historical rainfall data from 1951 through 2022; the rainfall-runoff relationship described above; and, the bypass flow requirements. The model assumes the same volume of water is withdrawn each year for City use and calculates the resulting change in reservoir storage. The lower limit to the drawdown was set to 392 feet, which represents a reserve capacity of approximately 500 acre feet, or 25 percent of total storage.

To match predicted reservoir yield with the probability of receiving Napa Contract Water, discussed below, West Yost estimated the Sustainable Yield of Bell Canyon Reservoir during Normal, Dry, and Very Dry hydrologic years. For purposes of this study, the hydrologic years are:

- Wet Year is defined as the amount of rainfall equal to a 40 percent exceedance rate (36.4 inches or more)
- Normal Year is defined as the amount of rainfall equal to a 60 percent exceedance rate (29.5 inches or more)
- Below Normal Year is defined as the amount of rainfall equal to an 80 percent exceedance rate (24.8 inches or more)
- Dry Year is defined as the amount of rainfall equal to a 90 percent exceedance rate (20.8 inches or more)
- Critically Dry Year is defined as the amount of rainfall equal to a 100 percent exceedance rate (6.0 inches or more). Rainfall less than 6.0 inches per year has not been recorded. A rainfall of 6.0 inches was recorded during calendar year 1976

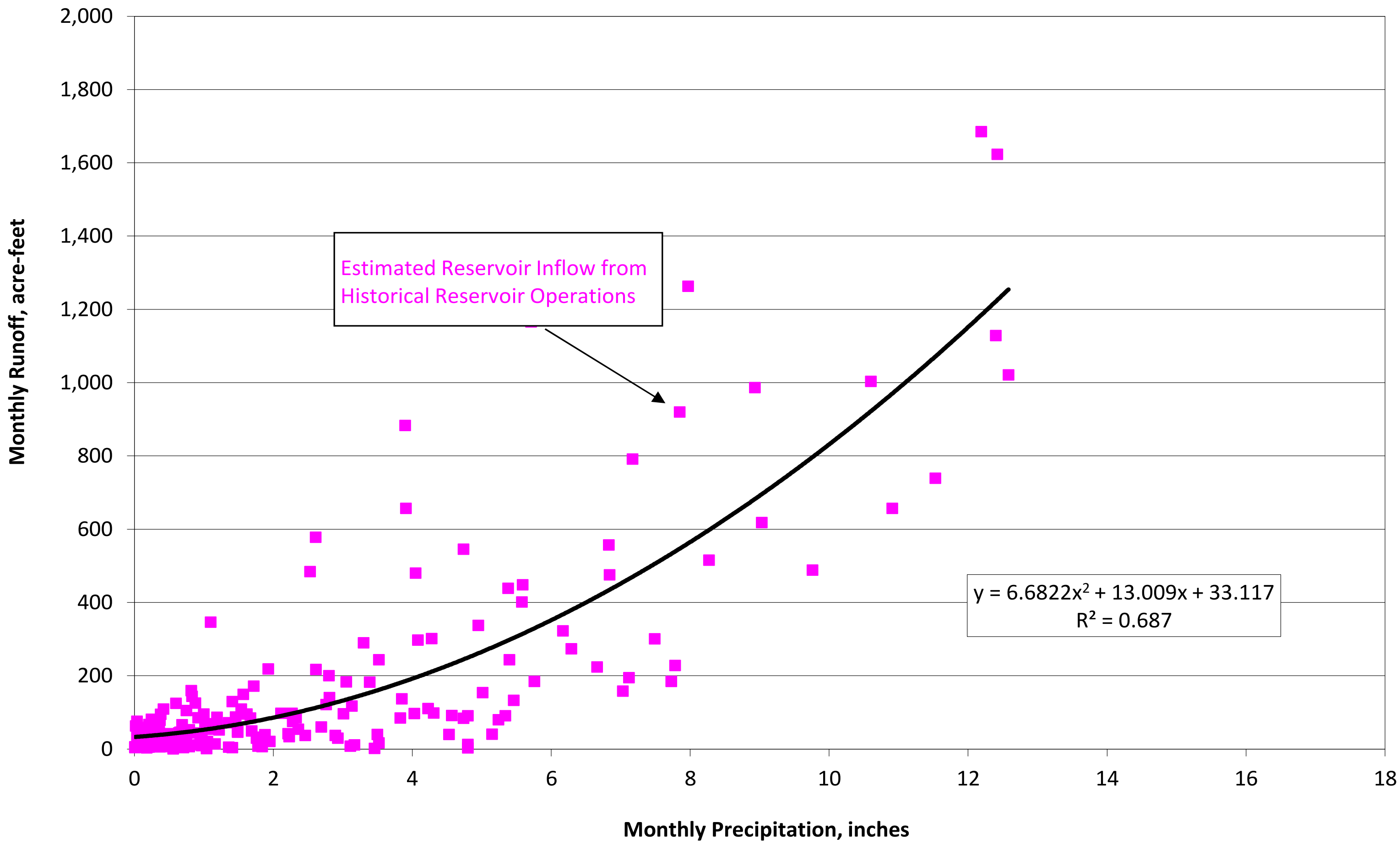
The Sustainable Yield model was run for each of the hydrologic conditions described above. Rainfall in years that had rainfall less than the target amount was replaced by the target amount. The estimated Sustainable Yield based on the above definitions is summarized in Table 6. The estimated Sustainable Yields summarized in Table 6 include required bypass flows and the effects of evaporation.

Table 6. Estimated Sustainable Yield of Bell Canyon Reservoir[(a)]

Condition	Minimum Rainfall, inches	Estimated Sustainable Yield, acre-feet	Notes
Wet Years	36.4	895	Corresponds to 40% Exceedance
Normal Year	29.5	733	Corresponds to 60% Exceedance
Below Normal Year	24.8	557	Corresponds to 80% Exceedance
Dry Year	20.8	476	Corresponds to 90% Exceedance
Critical Dry Year	6.0	390	Corresponds to 100% Exceedance

(a) Based on Sustainable Yield Reservoir Model.

Figure 1. Bell Canyon Reservoir Runoff versus Rainfall



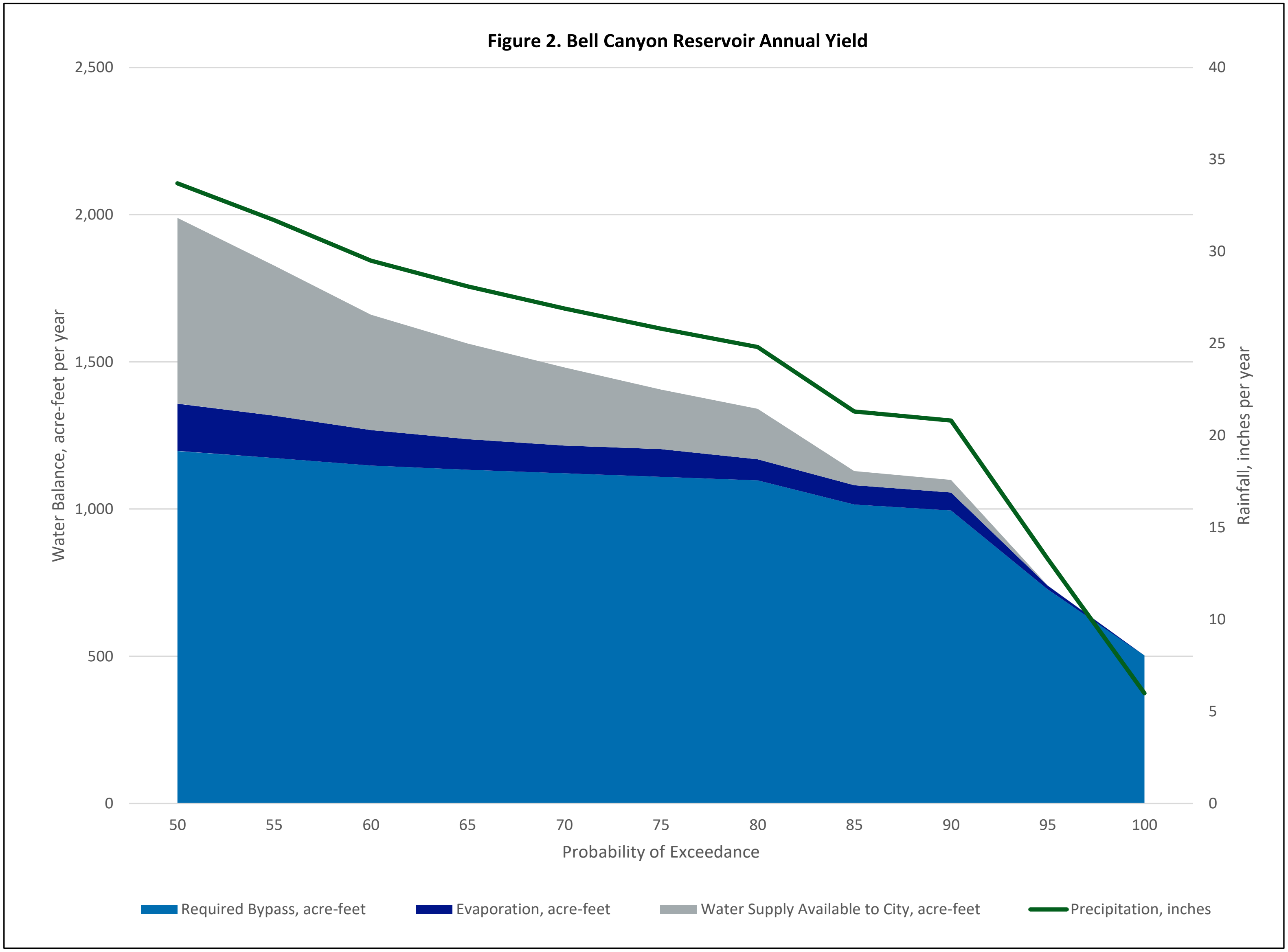
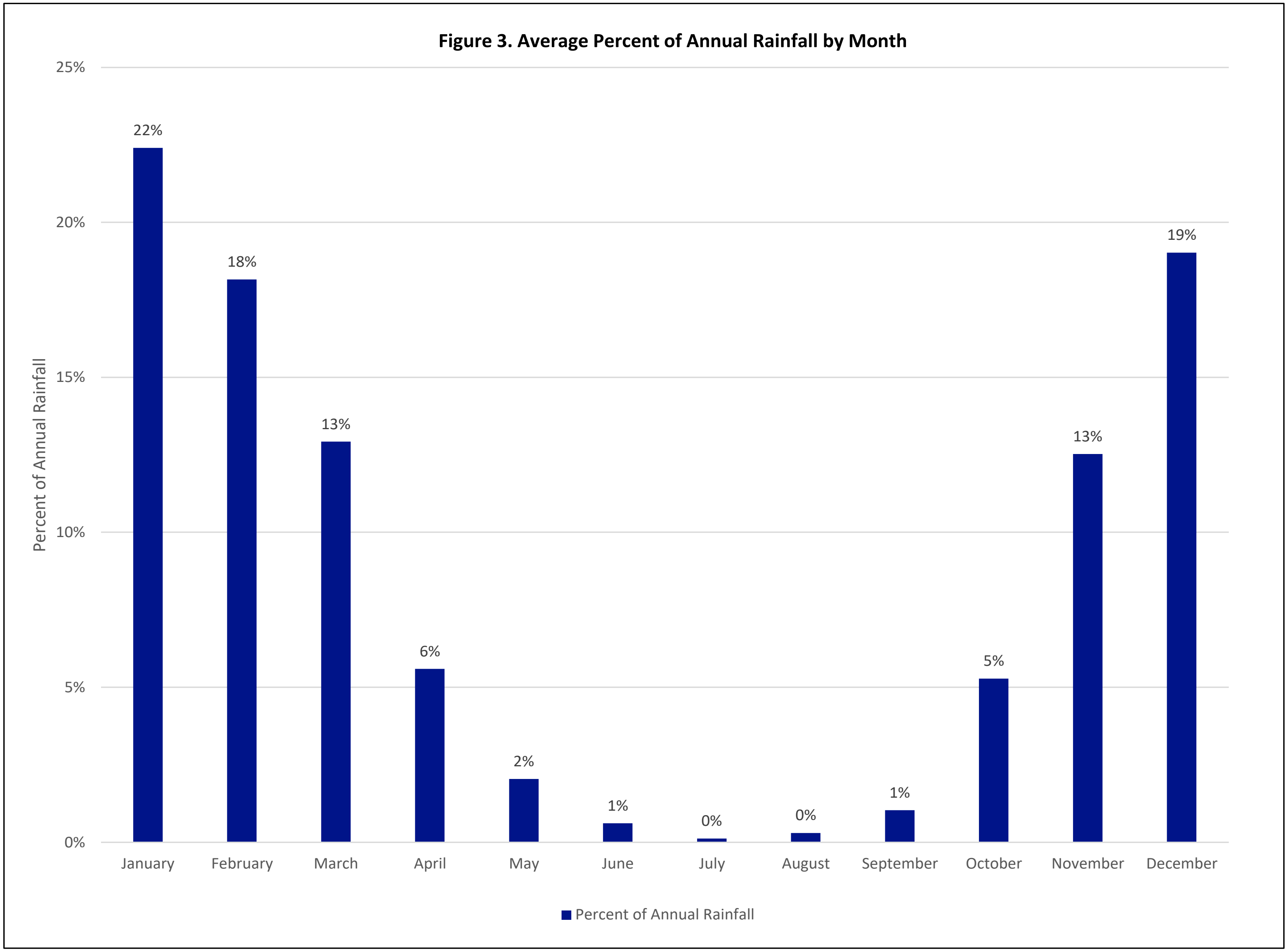


Figure 2. Bell Canyon Reservoir Annual Yield
2,500
2,000
1,500
1,000
500
0
Water Balance, acre-feet per year
40
35
30
25
20
15
10
5
0
Rainfall, inches per year
50
55
60
65
70
75
80
85
90
95
100
Probability of Exceedance
Required Bypass, acre-feet
Evaporation, acre-feet
Water Supply Available to City, acre-feet
Precipitation, inches



WEST YOST
N-C-705-60-23-12-WP-TM-A-F1

City of St. Helena
Safe Yield Estimate

Attachment

2010 Water Supply Plan Appendix B: Bell Canyon Reservoir Yield Study

APPENDIX B

Bell Canyon Reservoir Yield Study

APPENDIX B – BELL CANYON RESERVOIR YIELD STUDY

The purpose of this Appendix is to present the findings of a statistical study to estimate the yield of the City of St. Helena's (City's) Bell Canyon Reservoir and to document the various data sources and assumptions used in developing the estimates.

This Appendix focuses on the following specific topics:

- Description of Bell Canyon Reservoir
- Development of Reservoir Yield Models
- Estimated Average, Safe and Sustainable Yield
- Summary

These topics are discussed in more detail below.

DESCRIPTION OF BELL CANYON RESERVOIR

As described in a memorandum from West Yost Associates (West Yost), dated June 26, 2007, Bell Canyon Reservoir has provided the majority of the City's annual water supply, ranging from 78 to 86 percent, with groundwater providing the balance (14 to 22 percent) of the required supply, averaging 18 percent over the last ten years. Groundwater use has been minimized when there were sufficient reserves in Bell Canyon Reservoir (typically during the late winter through the early fall months February through September) and groundwater use has been maximized when Bell Canyon Reservoir is at its lowest water level or beginning to re-fill in the late fall and early winter.

Bell Canyon Reservoir

Bell Creek (also known as Howell Creek), as impounded in Bell Canyon Reservoir, has been the City's major water supply source for over 50 years.

The City maintains water rights Permits 9157 and 14810. Permit 9157 (Application 11816 filed April 8, 1947) indicates that Bell Canyon Reservoir, once constructed, would have a storage capacity of 1,800 acre-feet. This permit allows the City to divert and store 1,800 acre-feet, and directly divert 1 cfs for immediate use between November 15 and April 15 (150 days) of each year. The 1 cubic feet per second (cfs) diverted for immediate use does not count against the 1,800 acre-foot storage limit.

Permit 14810 (Application 20625, filed February 21, 1962) indicates that the storage in Bell Canyon Reservoir would be increased to 3,800 acre-feet, and allows the City to divert and store an additional 2,000 acre-feet between November 15 and April 15 of each year.

The actual reservoir capacity at the spillway elevation of 422.0 feet has been estimated by James C. Hanson Consulting Civil Engineer (Hanson) to be approximately 2,384 acre-feet. The dam height appears to be roughly 95 feet. The height given in Application 20625 is 105 feet. It appears there were plans to increase the height of the dam and increase storage to 3,800 acre-feet. This work apparently did not occur; however, a project was completed that raised the spillway elevation and increased the reservoir storage capacity to 2,384 acre-feet.

The water rights permits were amended on September 7, 1989 to include reservoir bypass flows to improve fish habitat. As used in this Appendix, the terms “bypass” and “release” are defined as follows:

- Bypass – Bell Creek inflow that is discharged to the stream without entering storage.
- Release – Stored water that is discharged to the stream.

The two terms are legal terms, based on the status of the water that is discharged. The physical methods the City uses to discharge bypass flows and releases are the same.

As defined in the water rights permits, if flow from Bell Creek into the reservoir is less than the required bypass, the required stream bypass is set equal to the flow into the reservoir. Exceptions to the required bypasses could be made during severe drought years. The minimum required bypasses are listed in Table B-1.

Table B-1. Required Bypasses for Fish Habitat

Bypass Period	Required Flow Rate, cfs[a]	Volume, acre-feet
December 1 – January 31	4	492
February 1 – February 29	2	111
March 1 – April 15	1	91
Total	—	694

[a] If flow into the reservoir is less than the required bypass, the required stream bypass is set equal to the flow into the reservoir. Exceptions to the required bypasses could be made during severe drought years.

The water delivered from Bell Canyon Reservoir, or directly diverted from Bell Creek is treated to potable standards at the Louis Stralla Water Treatment Plant (LSWTP), prior to delivery to City distribution system customers.

DEVELOPMENT OF RESERVOIR YIELD MODELS

Using historical operations data from 1988 through 2009, West Yost developed two water supply models. One model is the Water Supply Spreadsheet Model that the City can use for water planning on a frequent basis and was used to estimate the one-year yields described below. The second model was a long-term model that predicts the reservoirs response to historical rainfall and evaporation data from 1951 through 2009. This section discussed the source data used in the models, the development of the relationship between rainfall and runoff, and the model results.

Data Sources Used in Developing the Water Supply Models

To develop the Bell Canyon Reservoir models, West Yost received and analyzed several sources of data from the City.

The input factors are listed and briefly described in Table B-2. Inflow to the reservoir is not directly measured. As described below, net inflow was calculated as a result of the water balance calculations.

Table B-2. Reservoir Model Development Data Source Descriptions

Data Source Category	General Description
Inflow	
Reservoir Rainfall	Rainfall falling onto Bell Canyon Reservoir
Net Inflow	Calculated Bell Canyon Reservoir inflow (includes reservoir seepage and spill)
Outflow	
LSWTP Inflow	Water diverted from Bell Canyon Reservoir into the Louis Stralla WTP to meet municipal demands
Bell Canyon Bypass	Water released or bypassed from Bell Canyon Reservoir to maintain fisheries flow
Reservoir Et	Water lost through surface evaporation
Seepage	Water lost through Bell Canyon Reservoir seepage
Spill	Water spilled over the dam
Storage	
Change in Storage	The change in Bell Canyon Reservoir storage volume based on water elevation readings

These data sources are described in more detail below. Difficulties in using the various data and creating a usable water balance are also described under each data source.

Reservoir Inflow

The reservoir inflows for this analysis include the following:

- Rainfall onto the Reservoir
- Other Inflow

Rainfall onto the Reservoir

Several sources of rainfall data were used to estimate rainfall onto the reservoir. The sources are listed in order of priority.

- **Rainfall obtained from Daily Report** – The rainfall used in the daily reports was given first priority for the mass balance analysis because it was considered the "official" data. Although the source of the data was not indicated, the data from the Daily Reports was likely from the rain gauge located at the LSWTP. West Yost entered the data from the paper daily reports into an Excel spreadsheet.
- **Rainfall obtained from Weekly Reports** – For those time periods where Daily Reports were not available, West Yost used the data from City-prepared Excel weekly report spreadsheets containing daily rainfall measurements. The rainfall data from the daily and weekly reports overlapped for a month. Because the rainfall totals were the same between these two datasets, it appeared they were from the same source.
- **Rainfall measured at Oakville CIMIS Station** – The California Irrigation Management Information System (CIMIS) station, located at Oakville, automatically records rainfall data using a tipping bucket rain gauge. The CIMIS stations are weather stations managed by the California Department of Water Resources for irrigation scheduling purposes. Because the CIMIS station is the next closest location that records precipitation data, it was used for the periods with no available rainfall data from the daily reports or the weekly reports.

The volume of rain falling onto the reservoir was calculated by multiplying the inches of rainfall by the reservoir water surface area at the time of the rainfall event. The volume falling outside of the water surface area, but inside the reservoir maximum area, is included in the net inflow value discussed below.

Net Inflow

The City does not directly measure reservoir inflow; therefore, the reservoir inflow is calculated using the following equation:

$$\Delta \text{ Storage} = \Sigma \text{ Inflow} - \Sigma \text{ Outflow}$$

Where:

Δ Storage = change in reservoir storage over a given time period

Σ Inflow = sum of reservoir inflows over the same time period

Σ Outflow = sum of reservoir outflows over the same time period

The net inflow includes all components of the inflow (except the rainfall directly onto the reservoir water surface) and outflows that have not been accounted for. The components of net inflow include:

- Unmeasured inflows into the reservoir
- Reservoir seepage (outflow)

Reservoir Outflow

The reservoir outflows include the following:

- LSWTP Inflow (outflow from the reservoir)
- Bypasses and Releases from Bell Canyon
- Reservoir Evaporation
- Estimated Spill Volume

LSWTP Inflow Data

Diversions from Bell Canyon Reservoir to the LSWTP were obtained for the period of 1988 through 2009. Some of the data were in electronic format and some were paper records.

The paper totalizer data received from the City was given the highest priority in the mass balance analysis. When the totalizer data were not available, the data from the electronic records were used.

Bypasses and Releases from Bell Canyon

The City bypasses and releases water at a control house located at the bottom of the Dam. Inside the control house is a 42-inch diameter scour pipe and a 24-inch diameter pipe going to the LSWTP. A 10-inch diameter pipe used for controlling stream bypasses and releases tees off of the 24-inch pipeline to the LSWTP. According to City staff, the plug valve on the scour pipe would not seal properly and leaked for several years. City staff estimated the valve to be leaking at a rate of 130 gallons per minute in August 2003. The leaking valve flow rate was assumed to be valid from January 4, 1988 until November 21, 2003 when the plug valve was replaced.

The City currently measures stream bypasses and releases using a magnetic flow meter installed on the 10-inch diameter pipe. An outfall diffuser is installed at the end of the 10-inch pipeline. Prior to installation of the magnetic flow meter, a V-notch weir located downstream of the outlet valve was used to measure bypass and release flows. Typically a staff gauge or pressure transducer is used to measure flow over the V-notch weir. As reported on the weekly report Excel spreadsheets, flows over the V-notch weir have been measured with the following measuring devices:

- Electronic Transducer
- Leaking Valve
- Magnetic Flow Meter
- Staff Gauge
- V-notch weir

Therefore the bypass and release data in the daily reports from the sources listed above should be the same since they are measuring flow at the same location. However, the data are sporadic and when data from one recording device overlaps data from other recording devices, they do not necessarily match, which is a concern. Data contained in the weekly reports associated with the electronic transducer, leaking valve, magnetic flow meter, staff gage, and V-notch weir, were available from October 7, 2002 through December 31, 2007. City staff indicated that the magnetic flow meter data were the most reliable, followed by the staff gauge and the V-notch weir data. The electronic transducer data were considered unreliable due to poor installation.

The flows released from the reservoir are obtained from the following data sources listed in the order of priority:

- Bell Canyon Weekly Reports
- Magnetic Flow Meter
- Staff Gauge
- V-notch weir
- Electronic Transducer
- Leaking valve

The weekly reports used data from the measuring devises discussed above. West Yost obtained the direct measurement data for those periods for which weekly reports were not available.

Reservoir Evaporation

The City calculates evaporation by measuring the daily decrease or increase of the water level in an evaporation pan at the LSWTP. Some of the data points were not continuous and sometimes the data points were beyond the normal acceptable range. West Yost has found that reasonable reservoir evaporation estimates can be represented by the local CIMIS grass evapotranspiration (ET) rates. Evapotranspiration is an agricultural-based term and includes evaporation from the soil surface and transpiration from plants.

Average monthly ET measured at the CIMIS Oakville station from January 4, 1989 to March 25, 1989 was used to predict daily reservoir evaporation values when daily CIMIS ET rates were unavailable. For the subsequent period, (from March 26, 1989 through April 30, 2009), daily ET rates measured at the CIMIS Oakville station were used to estimate reservoir evaporation.

Estimated Spill Volume

When the water surface elevation was greater than the spillway crest elevation of 422 feet, West Yost was able to estimate the volume of the spill. As discussed in the rainfall runoff relationship section, there are several inaccuracies in the spill volume calculation. Spill volume was estimated based on the reservoir water surface elevation and applying a standard overflow weir calculation. The spillway has a shape similar to an ogee weir. The calculation for estimating the flow over an ogee weir is:

$$Q = C_w L h^{3/2}$$

Where:

Q = Discharge in cfs

C_w = coefficient

L= Length of Weir crest in feet

h = height of reservoir water surface over spillway.

The value of C_w ranges from 3.0 to 4.0, and is assumed to be closer to 3.0 when height of water over the spillway is small. For these calculations, a value of 3.0 was assumed for C_w.

It should be noted that using the spill volume calculation method described above, the impact of precipitation events may be over or under estimated. Reservoir level is measured once per week. If the majority of the runoff from the event occurs early in the week and the reservoir surface elevation recovers by the time the reading is taken, the calculations will show little spill, and therefore, little inflow. If, however, the runoff from the event occurs later in the week, and the reservoir elevation is peaking at the time of measurement, the calculation will over estimate the spill and inflow for the week because the instantaneous flow rate over the spillway is applied to the entire week.

The spillway is not a continuous weir. Although not shown on the spillway design plans and not discussed in the January 1997 Bell Canyon Dam and Reservoir Enlargement Preliminary Feasibility Study Report, a rectangular notch has been constructed in the concrete spillway. The notch is blocked with a flashboard. When the water surface elevation in the reservoir is near the spillway crest elevation, water leaks past the flashboard and through other areas of the spillway, such as the toe-drains.

Bell Canyon Storage

The water surface elevation of Bell Canyon Reservoir is measured weekly and recorded for the period of 1988 through 2009.

The reservoir water surface elevation was used to obtain the corresponding reservoir storage volume using stage/storage tables prepared by Western Hydrologic Services as part of the Bell Canyon Reservoir safe yield analysis prepared by Hanson in 2006. The stage/storage tables reported reservoir elevation in one foot increments. The reservoir water surface elevation was reported in hundredths of a foot in the daily reports; therefore, West Yost used linear interpolation between water surface elevations and storage volumes.

Rainfall Runoff Relationship

The most critical factor in developing the reservoir operational models is the development of the relationship between rainfall in the watershed and runoff into the reservoir.

As the rainy season begins, more rainfall is absorbed by the watershed and less runs off into the creeks. As the soil becomes saturated following several rain events, the same amount of rainfall would produce a greater amount of runoff.

In dynamic models, the soil moisture content, and hence the amount of runoff per inch of rain, can be adjusted as the rainy season progresses. A linear spreadsheet model such as the ones used in this study, cannot adjust the soil moisture content throughout the year and each inch of rain is assumed to produce the same amount of runoff, regardless of the season.

The analysis is also hampered by the lack of accurate spill volume data. There are two factors that limit the availability of spill volume data. First, reservoir water surface elevation data are read on a weekly basis. If a storm were to occur, it is quite feasible that the reservoir water surface elevation could rise, the reservoir spills, and the water surface elevation return to the spillway elevation before the next reading. Second, the data frequently indicate that the reservoir is spilling, but do not provide the actual elevation. Some data indicate the water surface elevation as "greater than 422" which is the spillway elevation. Some of the data are in shorter intervals than weekly and sometimes the actual water surface elevation is provided. These data were used to approximate the spill volume during those times.

Not including all the spill volume in the available data limits the data to those storms where the reservoir did not spill, and those storms with dry preceding conditions. The runoff from storms that produce substantial runoff and occur later in the season when the reservoir is spilling are lost.

To develop the relationship, West Yost compared monthly calculated reservoir inflow to the monthly total rainfall for each month from 1988 through 2009. The data and the resulting trend line are shown in Figure B-1. It is interesting to note that the trend line that best fits the data is a polynomial, indicating that the runoff volume is greater per inch of rain during wet years. This relationship

$$\text{Inflow} = 5.3065*(\text{Rainfall})^2 + 30.263*(\text{Rainfall}) + 28.127$$

Where:

Inflow = Reservoir Inflow in acre-feet per month

Rainfall = Rainfall in inches per month

West Yost suspects that, were the spill volumes included in the analysis, the trend line would be steeper and hence the model would predict more reservoir inflow per inch of rain, particularly during large storm events. This equation was used to estimate the Safe and Sustainable Yields that are discussed below.

ESTIMATED AVERAGE, SAFE, AND SUSTAINABLE YIELD

For purposes of this discussion, the following definitions apply:

- Average Yield = The historical average volume of Bell Creek surface water that the City has treated at the LSWTP.
- Safe Yield = The maximum amount of water that would be available to the City in a critical dry year. This calculation does not allow for the use of carryover storage from wet years to dry years.

- Sustainable Yield = The maximum amount of water that the City could withdraw from the reservoir each year consistently, *i.e.* this calculation allows carryover storage from wet years to dry years. This appears to be the definition that Hanson used for “safe yield” in the Master Water Plan discussed above.

According to the Master Water Plan, the Average Yield of the reservoir was 1,500 acre-feet. The use of Napa Water in the past few years has lowered the average yield to approximately 1,460 acre-feet (1990-2009) and just over 1,000 acre-feet for calendar years 2007-2009. The average yield for the period of 1990 through 2009 is shown in Table B-3.

Table B-3. Bell Canyon Reservoir Average Yield

Calendar Year	Volume of Water Treated at LSWTP[(a)], acre-feet
1990	1,632
1991	1,353
1992	1,466
1993	1,528
1994	1,086
1995	1,285
1996	1,511
1997	1,517
1998	1,411
1999	1,592
2000	1,524
2001	1,647
2002	1,942
2003	1,681
2004	1,741
2005	1,617
2006	1,647
2007	1,008
2008	1,022
2009	992
20-Year Average	1,460
3-Year Average	1,007

(a) LSWTP = Louis Stralla Water Treatment Plant

West Yost does not recommend using the Average Yield to project future water supply availability. It is suspected that historical inaccuracies in the bypass flow measurement and operational protocols may have artificially increased the apparent volume of water available to the City. As both bypass flow measurement and operation protocols have improved, Average Yield data will become a more useful statistic in the future.

The estimated Safe Yield of the reservoir was estimated based on the rainfall and runoff relationship described above. It appears that the volume of runoff in critically dry years would be approximately 895 acre-feet; 50 acre-feet of which would be lost to evaporation and 845 acre-feet would be bypassed to maintain fish flows in Bell Creek, leaving no water for City use, unless the City were allowed to forgo fish flows under emergency conditions. The estimated annual yield for several conditions is shown in Table B-4 and shown graphically in Figure B-2.

Table B-4. Annual Yield Estimate Summary

Probability of Exceedence, percent[a]	Precipitation, inches[b]	Estimated Reservoir Inflow, acre-feet[c]	Required Bypass, acre-feet[d]	Evaporation, acre-feet[e]	Water Supply Available to City, acre-feet[f]
50	35.4	2,480	1,300	265	915
55	33.8	2,345	1,285	220	840
60	33.3	2,300	1,280	210	810
65	29.6	1,990	1,230	170	590
70	28.6	1,910	1,215	155	540
75	26.9	1,780	1,165	145	470
80	25.8	1,700	1,150	130	420
85	24.8	1,620	1,140	120	360
90	21.2	1,380	1,100	100	180
95	20.8	1,340	1,080	75	185
100	13.3	895	845	50	—

(a) Probability that precipitation and water supplies will be greater than indicated.
(b) Rainfall associated with exceedence probability of water years 1951-2009.
(c) Estimated Reservoir inflow based on statistical data (1988-2009) and calculated inflow. Varies with rainfall pattern.
(d) Possible required bypass based on bypass regulations and normalized rainfall patterns. Varies with rainfall pattern.
(e) Approximate evaporation based on Et and open surface area in reservoir. Low values for evaporation during dry years is indicative of a low reservoir water surface elevation.
(f) Inflow minus bypass and evaporation.

Because of the relationship between rainfall and runoff, and because the rainfall pattern in the Safe Yield analysis was based on average monthly rainfall distribution pattern (as shown in Figure B-3), it is possible that the values presented in Table B-4 underestimate the actual reservoir conditions that would be experienced.

The Sustainable Yield is a much more useful calculation because it represents the amount of water that could be consistently withdrawn from the reservoir each year and includes the beneficial effect of carrying storage over from wet years to dry years. Once the rainfall to runoff relationship had been approximated, West Yost prepared several estimates of Sustainable Yield with different assumptions. To estimate how much water could be withdrawn from the reservoir by the City each year, the Sustainable Yield model used three main inputs: the historical rainfall data from 1951 through 2009; the rainfall to runoff relationship described above; and, the bypass flow requirements. The model assumes the same volume of water is withdrawn each year for City use and calculates the resulting change in reservoir storage. The lower limit to the drawdown was set to 392 feet, which represents a reserve capacity of approximately 500 acre feet, or 25 percent of total storage.

To match predicted reservoir yield with the probability of receiving Napa Contract Water, discussed below, West Yost estimated the Sustainable Yield of Bell Canyon Reservoir during Normal, Dry, and Very Dry hydrologic years. For purposes of this study, the hydrologic years are:

- Wet Year is defined as the amount of rainfall equal to a 40 percent exceedence rate (38.5 inches or more).
- Normal Year is defined as the amount of rainfall equal to a 60 percent exceedence rate (32.7 inches or more).
- Below Normal Year is defined as the amount of rainfall equal to an 82 percent exceedence rate (26 inches or more). This condition matches the State Water Project Draft 2009 Reliability Report for delivering at least 50 percent of Table B allocation, corresponding to the Napa Contract Water Tier C.
- Dry Year is defined as the amount of rainfall equal to a 90 percent exceedence rate (22 inches or more). This condition matches the State Water Project Draft 2009 Reliability Report for delivering at least 30 percent of Table B allocation, corresponding to the Napa Contract Water Tier B.
- Critically Dry Year is defined as the amount of rainfall equal to a 100 percent exceedence rate (10.4 inches or more). Rainfall less than 10.4 inches per year has not been recorded. A rainfall of 10.4 inches was recorded during calendar year 1976. This condition matches the State Water Project Draft 2009 Reliability Report for delivering at least 5-10 percent of Table B allocation, corresponding to the Napa Contract Water Tier A.

The Sustainable Yield model was run for each of the hydrologic conditions described above. Rainfall in years that had rainfall less than the target amount was replaced by the target amount. The estimated Sustainable Yield based on the above definitions summarized in Table B-5.

Table B-5. Estimated Sustainable Yield of Bell Canyon Reservoir

Condition	Minimum Rainfall, inches	Estimated Sustainable Yield, acre-feet	Notes
Wet Years	38.5	1,070	Corresponds to 40% Exceedence
Normal Year	32.7	970	Corresponds to 60% Exceedence
Below Normal Year	26.0	820	Corresponds to 82% Exceedence
Dry Year	22.0	615	Corresponds to 90% Exceedence
Critical Dry Year	10.4	510	Corresponds to 100% Exceedence

(a) Based on Sustainable Yield Reservoir Model.

The estimated Sustainable Yields summarized in Table B-5 include required bypass flows and the effects of evaporation.

Estimated average annual required bypass for the 1951 through 2009 monthly rainfall data set equaled 1,170 acre-feet per year. The average required bypass for the years 1990 through 2009, based on weekly actual reservoir operations, was estimated to be 905 acre-feet per year. The estimated actual bypass for 1989 through 2009 was approximately 380 acre-feet per year.

If one adds the Average Yield of 1,460 acre-feet (Table B-3) to the actual average bypass value of 380 acre-feet per year, the sum is 1,840 acre-feet per year. Subtracting the average required bypass from the sum provides an estimated sustainable yield of 935 acre-feet per year (shown in Table B-6), which is very similar to the Sustainable Yield estimate for Normal and Below Normal Years shown in Table B-5.

Table B-6. Comparison of Reservoir Operations and Calculated Sustainable Yield

Row	Category	Volume, acre-feet per year	Notes
1	Average Yield (1990-2009)	1,460	From Table B-3
2	Estimated Bypass (1990-2009)	380	Based on analysis of weekly reservoir operations
3	Total Used by City and Bypass (1990-2009)	1,840	Sum of Row 1 and Row 2
4	Estimated Required Bypass (1990-2009)	905	Based on analysis of weekly reservoir operations
5	Total Available to City	935	Row 3 minus Row 4

This comparison indicates that the estimate of Sustainable Yield is valid for planning purposes within a reasonable degree of certainty.

Figure B-1. Bell Canyon Reservoir Runoff versus Rainfall

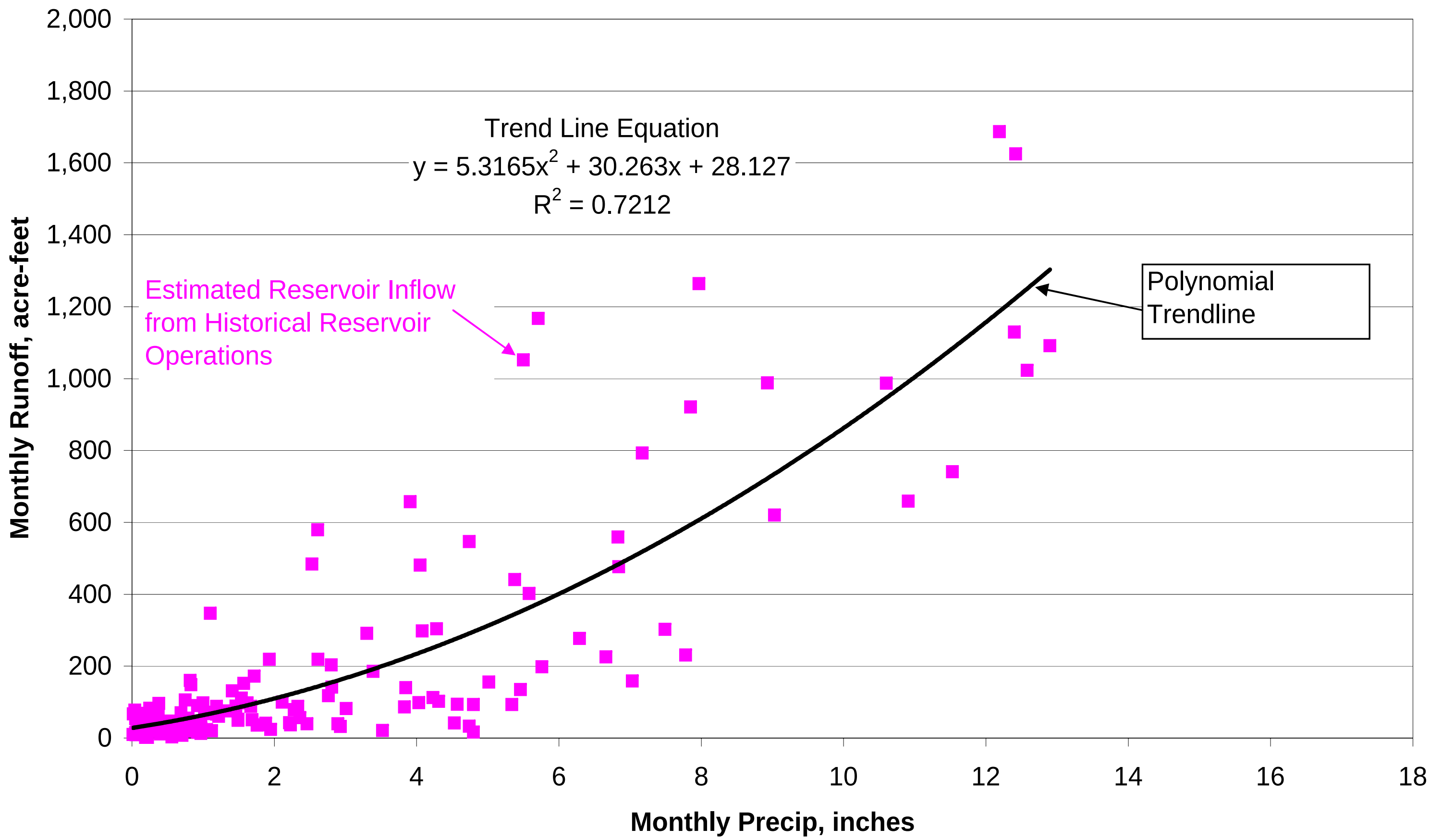


Figure B-2. Bell Canyon Reservoir Annual Yield

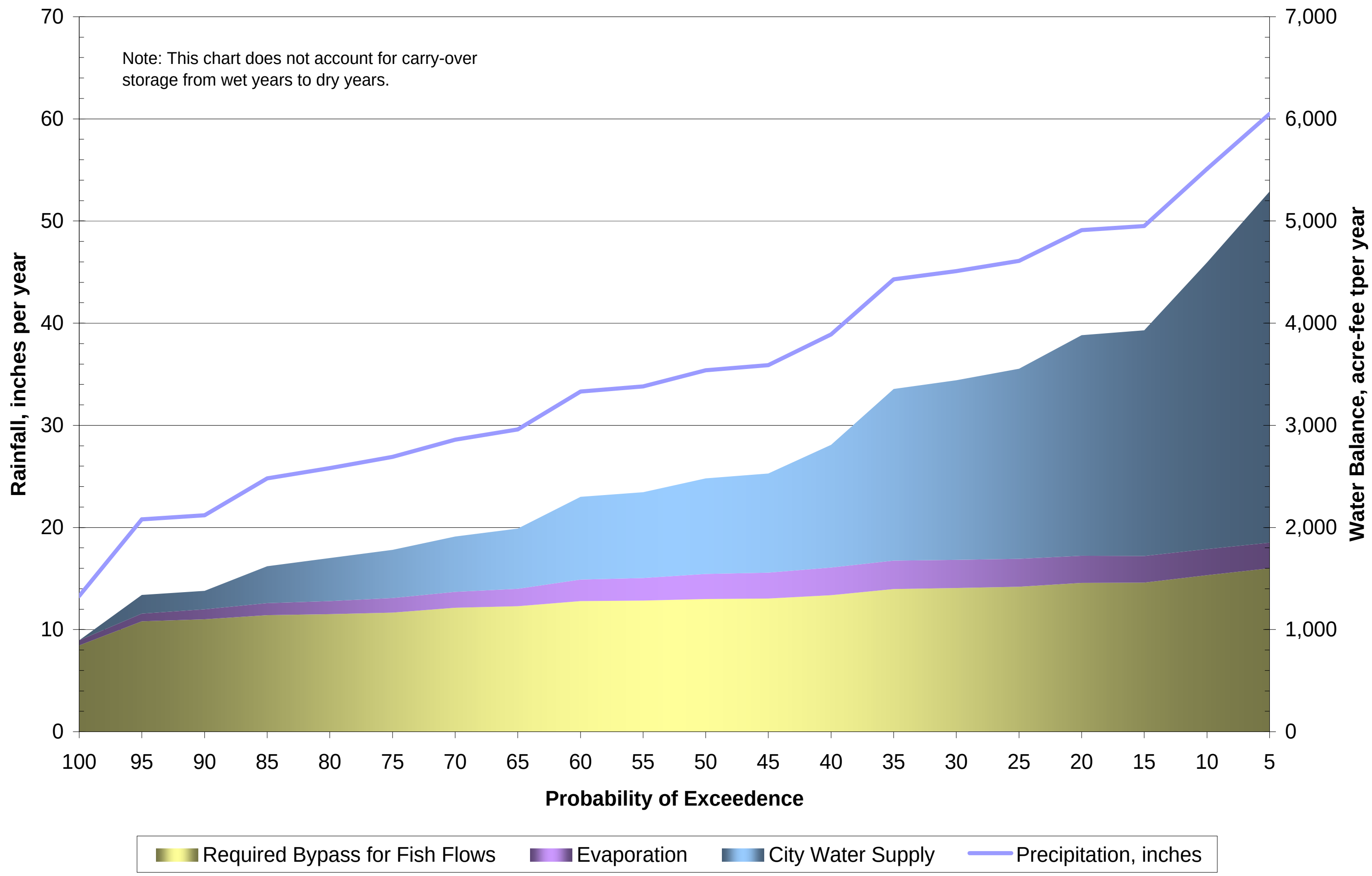
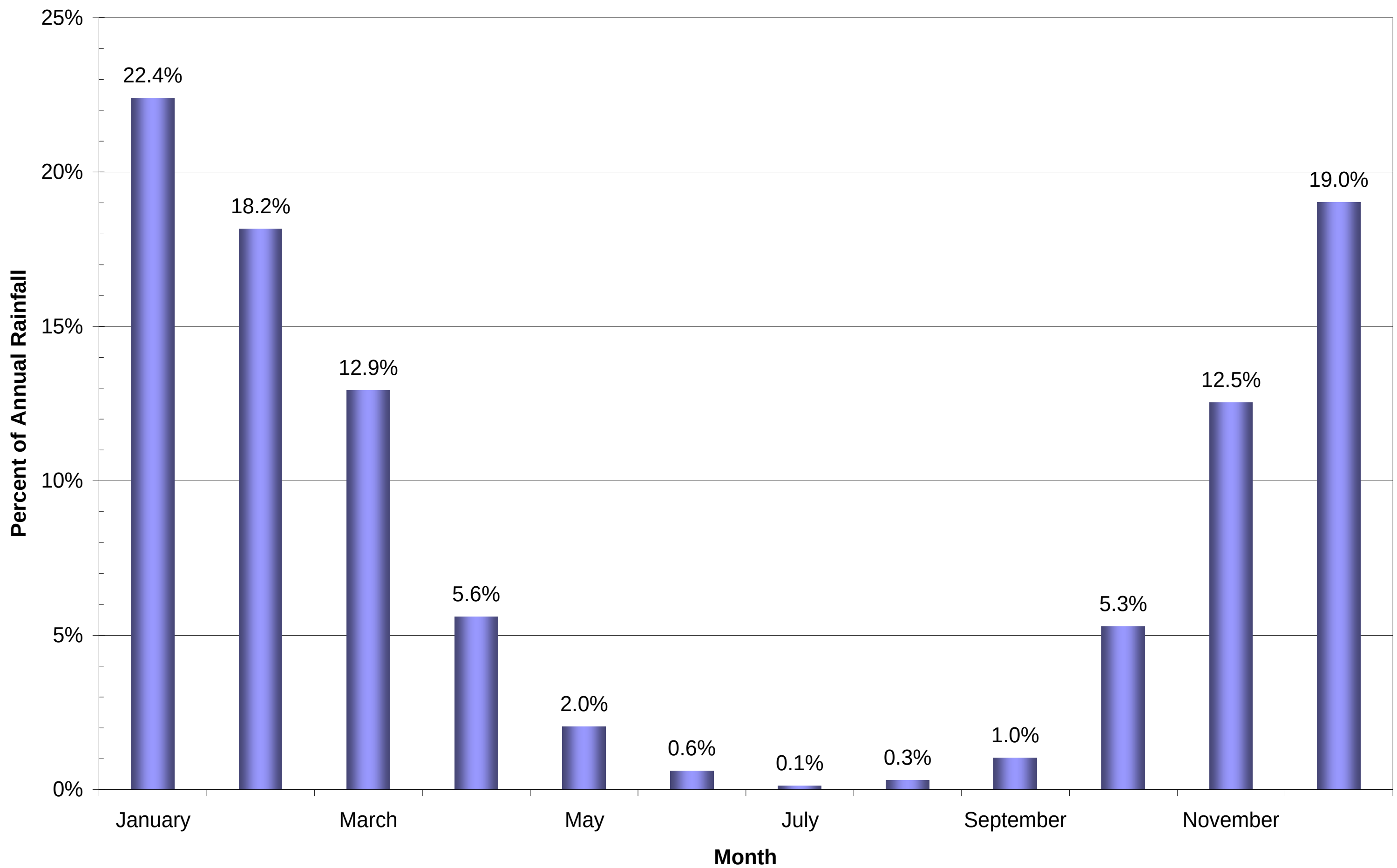


Figure B-3. Average Percent of Annual Rainfall by Month



City of St. Helena
Safe Yield Update

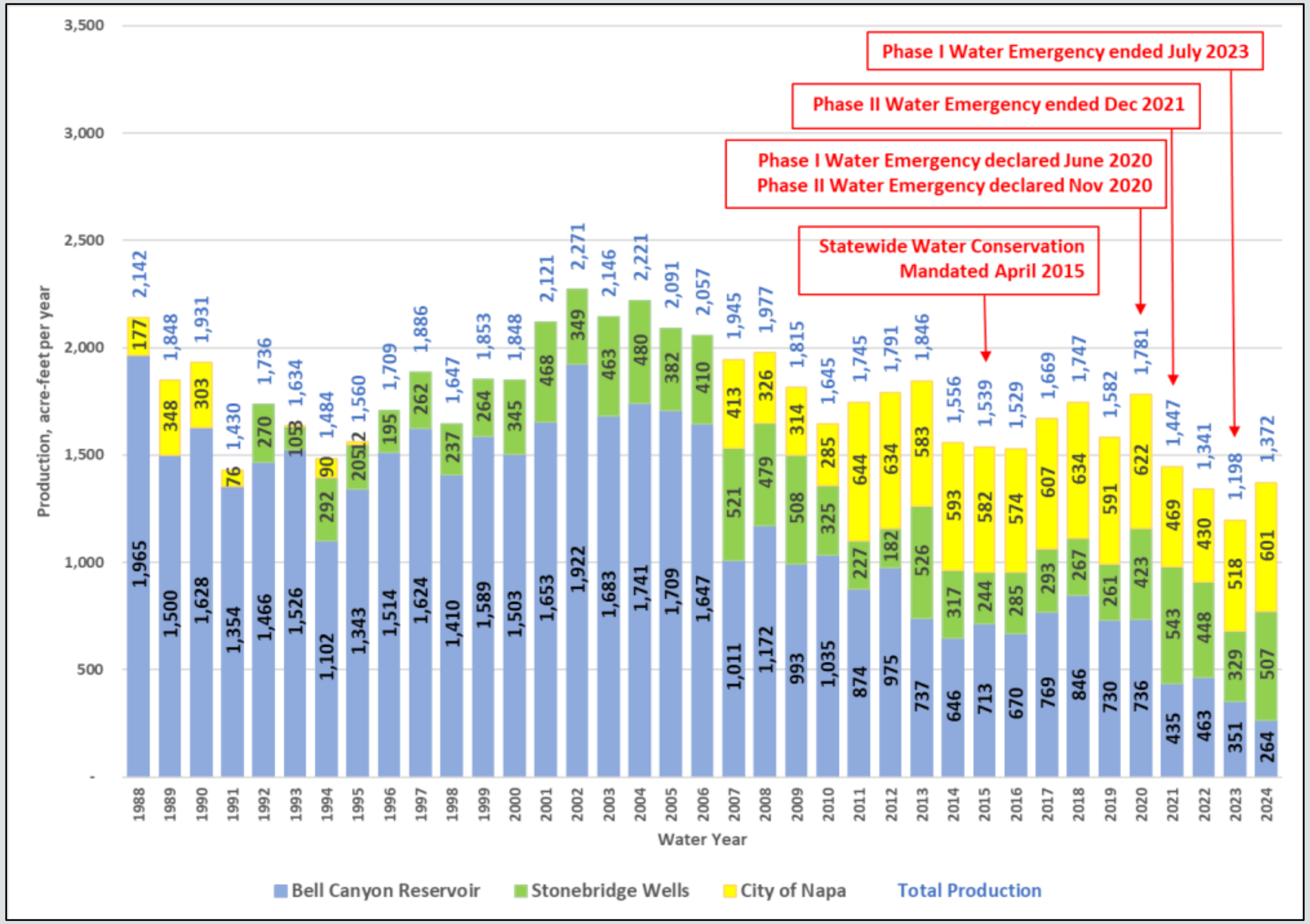
Water and Wastewater Advisory Committee
June 5, 2025

WEST YOST
Water. Engineered.

Presentation Outline

- Safe Yield Update
  - Historical Water Use
  - Preliminary Findings for Safe Yield Update
  - Comparison to 2011 Safe Yield Estimate
  - Comparison to Existing Water Use and Water Demand Projections
  - Recommended Next Steps for Water Portfolio Management

Historical Water Use (Production)



- Bell Canyon Reservoir (blue)
- Stonebridge Wells (green)
- City of Napa Supply (yellow)

2011 Safe Yield Estimate

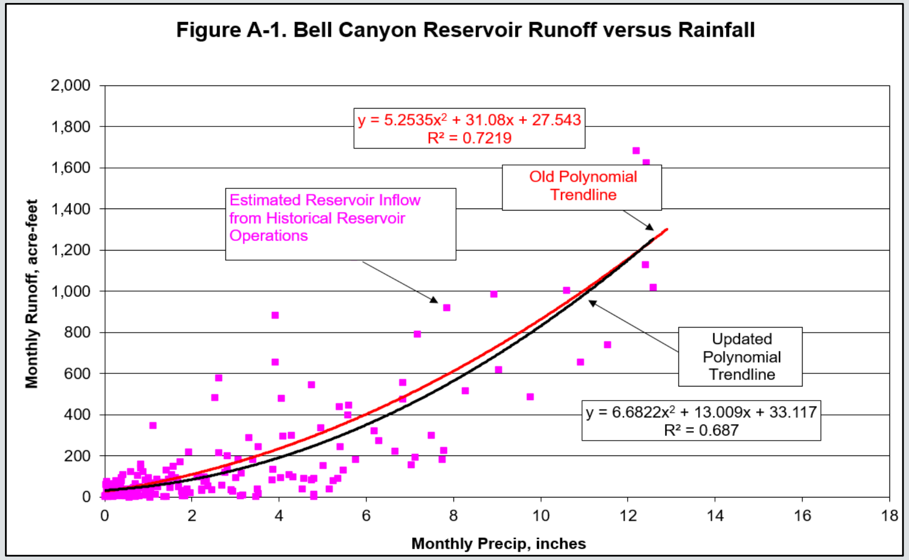
Source	2011 Safe Yield Estimate, AF	
Bell Canyon	700 AF	Average of Below Normal and Dry Year yield estimate
Groundwater	450 AF	
City of Napa	800 AF	Based on full contractual amount
TOTAL	**1,950 AF**	
Non-Revenue Water	(292 AF)	Based on 15% Non-Revenue Water
NET TOTAL	**1,658 AF**	

Updates to Bell Canyon Reservoir Model

- Previous model included daily reservoir operations data from 1988 to 2009
- Model update added available daily reservoir operations data through July 2023, including data for the following periods:
  - January 2014 through April 2020 --- primarily drought years
  - January 2023 through July 2023 --- primarily wet months
- Inadequate data was available for the following periods:
  - 2010 to 2013 --- wet and dry years
  - May 2020 through December 2022 --- dry and normal years

Bell Canyon Reservoir

- Findings based on updated reservoir operations and precipitation data
  - Less precipitation
  - Less runoff for same rainfall event



Condition	Minimum Rainfall, inches	Estimated Sustainable Yield, acre-feet	Notes
Wet Years	36.4 (Δ = -1.9)	895 (Δ = -175)	Corresponds to 40% Exceedance
Normal Year	29.5 (Δ = -3.2)	733 (Δ = -237)	Corresponds to 60% Exceedance
Below Normal Year	24.8 (Δ = -1.2)	557 (Δ = -263)	Corresponds to 80% Exceedance
Dry Year	20.8 (Δ = -1.2)	476 (Δ = -139)	Corresponds to 90% Exceedance
Critical Dry Year	6.0 (Δ = -4.4)	390 (Δ = -120)	Corresponds to 100% Exceedance

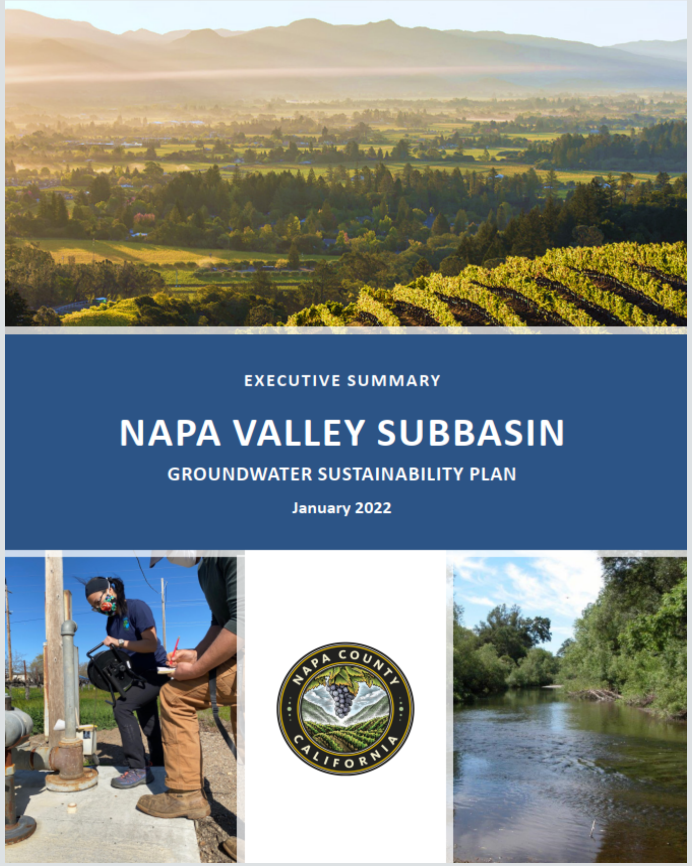
Δ indicates change from 2011 Safe Yield Estimate

Historical Groundwater Use (WY 2010-2024)

Water Year	Water Year Type[a]	Annual Groundwater Production, AF[b]	Annual Groundwater Production as a Percent of Total Water Production
2010	Wet	325	20%
2011	Wet	227	13%
2012	Normal (Below Average)	182	10%
2013	Normal (Below Average)	526	28%
2014	Dry	317	20%
2015	Normal (Below Average)	244	16%
2016	Normal (Below Average)	285	19%
2017	Very Wet	293	18%
2018	Dry	267	15%
2019	Wet	261	16%
2020	Very Dry	423	24%
2021	Very Dry	543	38%
2022	Normal (Below Average)	448	33%
2023	Wet	329	27%
2024	Normal (Below Average)	507	37%

- WY 2010-2024 Average Groundwater Production
  - 345 AF
  - 22% of total annual supply
- Average GW Production in Normal, Wet and Very Wet Years
  - 287 AF
  - 19% of total annual supply
- Average GW Production in Below Normal, Dry and Very Dry Years
  - 374 AF
  - 24% of total annual supply

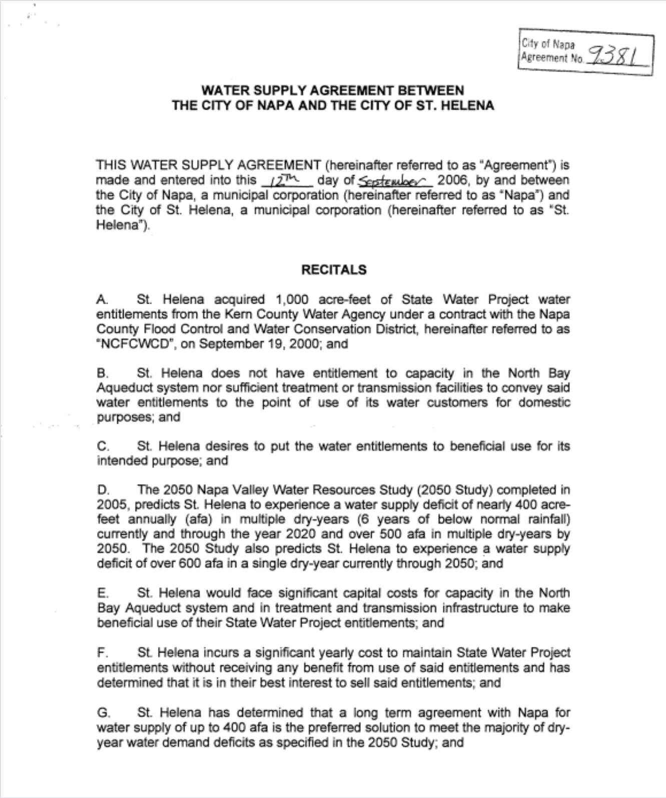
Future Use of Groundwater



The Napa Valley Groundwater Sustainability Plan (GSP) calls for 10% reduction in pumpage compared to average pumping for Water Years 2005-2014

- Average City Groundwater Production for Water Years 2005-2014: 388 AF (Stonebridge Wells No. 1 and 2)
- A 10% reduction would reduce that number to 350 AF
  - May be possible to offset some existing City groundwater use with recycled water
  - Recycled water may also be available to offset private groundwater use resulting in a benefit to the overall groundwater basin

Future Use of City of Napa Water Supply



City of Napa Agreement No. 9381

WATER SUPPLY AGREEMENT BETWEEN
THE CITY OF NAPA AND THE CITY OF ST. HELENA

THIS WATER SUPPLY AGREEMENT (hereinafter referred to as "Agreement") is made and entered into this 12th day of September 2006, by and between the City of Napa, a municipal corporation (hereinafter referred to as "Napa") and the City of St. Helena, a municipal corporation (hereinafter referred to as "St. Helena").

RECITALS

A. St. Helena acquired 1,000 acre-feet of State Water Project water entitlements from the Kern County Water Agency under a contract with the Napa County Flood Control and Water Conservation District, hereinafter referred to as "NCFCWCD", on September 19, 2000; and

B. St. Helena does not have entitlement to capacity in the North Bay Aqueduct system nor sufficient treatment or transmission facilities to convey said water entitlements to the point of use of its water customers for domestic purposes; and

C. St. Helena desires to put the water entitlements to beneficial use for its intended purpose; and

D. The 2050 Napa Valley Water Resources Study (2050 Study) completed in 2005, predicts St. Helena to experience a water supply deficit of nearly 400 acre-feet annually (afa) in multiple dry-years (6 years of below normal rainfall) currently and through the year 2020 and over 500 afa in multiple dry-years by 2050. The 2050 Study also predicts St. Helena to experience a water supply deficit of over 600 afa in a single dry-year currently through 2050; and

E. St. Helena would face significant capital costs for capacity in the North Bay Aqueduct system and in treatment and transmission infrastructure to make beneficial use of their State Water Project entitlements; and

F. St. Helena incurs a significant yearly cost to maintain State Water Project entitlements without receiving any benefit from use of said entitlements and has determined that it is in their best interest to sell said entitlements; and

G. St. Helena has determined that a long term agreement with Napa for water supply of up to 400 afa is the preferred solution to meet the majority of dry-year water demand deficits as specified in the 2050 Study; and

- Annual water supply of 600 AF with an option to request an additional 200 AF each year
- Improvements needed to ensure that City can reliably take up to 800 AF each year
  - Rutherford Pump Station Improvements
  - Napa Intertie Pipeline Project
  - Improvements to City of Napa Dwyer Road Pump Station
  - Updates to Water System Hydraulic Model to better evaluate existing and future conditions and potential solutions

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CITY OF ST. HELENA

Unaccounted for Water (UAFW)
(also referred to as Non-Revenue Water)

	FY19/20	FY20/21	FY21/22	FY22/23	FY23/24	5-Year Average (FY19/20-FY23/24)
Annual Water Production, AF	1,737	1,663	1,229	1,265	1,365	1,452
Annual Water Consumption, AF	1,634	1,341	1,032	989	1,031	1,205
Non-Revenue Water, AF	**103**	**322**	**197**	**275**	**334**	**246**
Non-Revenue Water, as a percent of total production	**6%**	**19%**	**16%**	**22%**	**25%**	**18%**

- Includes Unbilled Authorized Consumption, Unauthorized Consumption, Apparent Losses (billing and metering inaccuracies) and Real Losses (actual water loss due to leaks or breaks)
- There is no overall standard for acceptable non-revenue water; per AWWA, the general rule of thumb for a well-managed system is 10 to 15%

Updated Safe Yield Estimate and Comparison to 2011 Estimate

Source	2011 Safe Yield Estimate, AF	Updated Safe Yield Estimate, AF	
Bell Canyon	700 AF	516 AF	Average of Below Normal and Dry Year yield estimate
Groundwater	450 AF	350 AF	Based on 10% reduction from WY 2005-2014 average pumping per GSP
City of Napa	800 AF	800 AF	Based on full contractual amount
TOTAL	**1,950 AF**	**1,666 AF**	
Non-Revenue Water	(292 AF)	(300 AF)	Based on 18% Non-Revenue Water (average for last five years)
NET TOTAL	**1,658 AF**	**1,366 AF**	Reduction of 292 AF

Comparison to Existing Water Demand

- Recent City Water Demand
  - FY 20/21 Production = 1,663 AF
  - FY 21/22 Production = 1,229 AF
  - FY 22/23 Production = 1,265 AF
  - FY 23/24 Production = 1,365 AF

Updated Safe Yield Estimate = 1,666 AF

- Existing Water Demand shown in the Integrated Utility Master Plan (IUMP) based on average production from 2013-2017 = 1,624 AF

Comparison to Future Demand Projections

- Water Rate Study (2023)
  - Projected Water Sales in FY 27/28 = 1,313 AF (1,526 AF including Non-Revenue Water)
- Integrated Utility Master Plan (IUMP) (2021)
  - Future Water Demand = 1,815 AF (includes Non-Revenue Water)

Updated Safe Yield Estimate = 1,666 AF

	Projected Average Day Demand, mgd[a]	Projected Annual Demand, AF
Existing Water Demand[b]	1.45	1,624
Planned Developments	0.13	146
Study Area Growth	0.04	45
Total Future (2040) Water Demand	**1.62**	**1,815**

Potential Future Water Supply Shortfall

- There is a potential future water supply shortfall of 149 AF based on the projected future (2040) water demand presented in the City's Integrated Utility Master Plan

	Projections from Integrated Utility Master Plan, AF	Adjusted Projections based on Recent Water Use Trends, AF
Existing Water Demand	1,624[a]	1,365[b]
Updated Annual Safe Yield Assessment	1,666[c]	1,666[c]
Existing Surplus (Shortfall)[d]	**42**	**301**
Projected Future (2040) Water Demand	1,815[a]	1,556[e]
Updated Annual Safe Yield Assessment	1,666[c]	1,666[c]
Future Surplus (Shortfall)[f]	**(149)**	**110**

Recommended Next Steps

- Continue to promote water conservation and water use efficiency by all City water customers.
- Continue to evaluate and mitigate the causes of non-revenue water in an attempt to reduce non-revenue water as much as is cost effective and feasible.
  - Replace Napa Intertie Transmission Main and Water Treatment Plant Transmission Main as known sources of leaks
  - Replace old, inefficient meters to account for water consumed
- Amend the Water Supply Agreement with the City of Napa to solidify the additional 200 AF of annual supply which is currently just an option at the City of Napa's discretion.
- Make improvements to the City's Rutherford Pump Station and the Napa Intertie Transmission Main to facilitate the delivery of water supplies from the City of Napa.

Recommended Next Steps

- Implement recycled water projects as recommended in the Recycled Water Facilities Plan to offset (reduce) potable water demands.
- Implement water supply projects as recommended in the Water Management Plan (currently being prepared for the City) to bolster the City’s water supply availability and reliability.
- Update the Water Neutrality Policy to clarify requirements and improve implementation and enforcement to offset water demands associated with new development.
- Systematically replace aging infrastructure, including leaking pipelines and the Water Treatment Plant Transmission Pipeline.

THANK YOU

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