AGENDA

DATE	Thursday, March 25th, 2021; 9:00 AM – 11:30 AM (PDT)
LOCATION	https://global.gotomeeting.com/join/481174597 ; Call-In #: 1 866 899 4679; Access Code: 481-174-597
STAKEHOLDER ADVISORY GROUP LIST	Ken Payne, P.E., (El Dorado Water Agency, Rick Lind (EN2R) ; Karen Bender, REHS, RD (El Dorado County -EMD); Jason Burke (City of South Lake Tahoe); Scott Carroll (CA Tahoe Conservancy); Andrea Buxton (Tahoe Resource Conservation District); Brian Grey, P.G. (Lahontan Regional Water Quality Control Board); Michael Conger (TRPA); Joey Keely, Nicole Bringolf (USFS – LTBMU); Nakia Foskett (Lakeside Park Water Co.); Jennifer Lukins (Lukins Brothers Water Co); Daniel Larson (Tahoe Keys Water Co.); Harold Singer (Community Rate Payer); and John Thiel, PE (South Tahoe PUD)
PLAN MANAGER	Ivo Bergsohn, PG, HG (South Tahoe PUD)

BASIN MANAGEMENT OBJECTIVES (BMO)

1. Maintain a sustainable long-term groundwater supply.
2. Maintain and protect groundwater quality.
3. Strengthen collaborative relationships with local water purveyors, governmental agencies, businesses, private property owners and the public.
4. Integrate groundwater quality protection into local land use planning activities.
5. Assess the interaction of water supply activities with environmental conditions.
6. Convene an on-going Stakeholders Advisory Group (SAG) as a forum for future groundwater issues.
7. Conduct technical studies to assess future groundwater needs and issues.
8. Identify and obtain funding for groundwater projects.

WORKSHOP OBJECTIVES

OBJECTIVES

1. Receive an update on current activities for the Tahoe South Subbasin Alternative.
2. Learn about recent and planned activities for the SCAP Regional Plume Investigation in the South Y Area.
3. Discuss results from the Survey of Private Well Owners Survey.
4. Learn about recent hydrologic modeling work for the 50-year water budget projections developed for the Tahoe South Subbasin Alternative.

SEE REVERSE FOR AGENDA

AGENDA

Time	Description	
9:00	**Roll call (5-Minutes)**	**SAG**
9:05	**TSS (6-005.01) - Open Forum (10-Minutes)** **Topics outside the subject matter of the SAG and not listed on the Agenda.**	**Round Robin**
9:15	**TSS Alternative - Progress Update** • **Outreach** • **TSS Alternative**	**I. Bergsohn, STPUD**
9:30	**Survey of Private Well Owners** • **Methods** • **Results** • **SAG Round Robin/ Q &A**	**J. Brand, STPUD**

9:45	**SCAP Regional Plume Investigation**
	• **Historical Database**
	• **Updated Subsurface Sections**
	• **Technical Report**
	• **2021 Field Work**
	  ○ **Inactive Monitoring Well Destructions**
	  ○ **Sentry Well Installations**
	  ○ **Soil Gas Investigations**
	• **SAG Round Robin/ Q &A**
		A. Shepard/ M. Novak, AECOM

10:25	**5-minute BREAK**	

10:30	**TSS (6-005.1) – 50-year Water Budgets Projections**
	• **Climate Scenario & Growth Assumptions**
	• **Model Results (preliminary)**
	• **Predicted Impacts**
	  ○ **PWS Wells**
	  ○ **Private Wells**
	• **SAG Round Robin/ Q &A**
		S. Rybarski/ M. Hausner DRI

11:15	**Adjourn**	

Tahoe South Subbasin (6-005.01) Alternative
MEETING NOTES
Thursday, March 25th, 2021; 9:00 am - 11:30 am
Location: On-Line Meeting
https://global.gotomeeting.com/join/481174597
Call-In #: 1 866 899 4679; Access Code: 481-174-597

SAG ATTENDEES:
John Thiel, PE; Ivo Bergsohn, PG, HG (STPUD); Ken Payne, PE (El Dorado Water Agency); Rick Lind (El Dorado Water Agency); Brian Grey, P.G., Abby Cazier (Lahontan Regional Water Quality Control Board); Michael Conger (Tahoe Regional Planning Agency); Jason Burke (City of South Lake Tahoe); Nicole Bringolf (USFS- Lake Tahoe Basin Management Unit); Andrea Buxton (Tahoe Resource Conservation District); Jennifer Lukins (Lukins Brothers Water Co); Daniel Larson (Tahoe Keys Water Co.); Nakia Foskett (Lakeside Mutual Water Company)

Participants: 32

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Roll Call
Roll-Call Sheet

Roll Call

South Tahoe Public Utility District

TVS SUBBASIN (6-005.01)
ALTERNATIVE

2021 STAKEHOLDERS ADVISORY GROUP
WORKSHOP No. 1

Thursday, March 25, 2021
(9:00 AM – 11:30 AM)

https://global.gotomeeting.com/join/481174597

Call-In #: 1 866 899 4679; Access Code: 481-174-597

NAME	AFFILIATION	PRESENT	ABSENT	NOTE
John Thiel, P.E.	STPUD	X		
Jason Burke	City of SLT	X		
Andrea Buxton	TRCD		X	Scheduling Conflict
Michael Conger	TRPA	X		
Ken Payne, P.E.	EDCWA	X		Rick Lind representing EDWA
Robert Lauritzen, PG	EDCEMD		X	
Karen Bender, REHS, RD	EDCEMD	X		
Brian Grey	LRWQCB	X		
Joe Keely	USFS - LTBMU		X	
Nicole Bringolf	USFS - LTBMU	X		
Jennifer Lukins	LBWC	X		
Daniel Larson	TKWC	X		
Nakia Foskett	LMWC	X		
Scott Carroll	CTC	X		
Harold Singer	Retired	X		
Ivo Bergsohn, PG, HG (Plan Mngr.)	STPUD	X		

Tahoe South Subbasin (6-005.01) Alternative
MEETING NOTES
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TVS Basin (6-5.01) - Open Forum (Group)
Current groundwater-related topics outside Agenda

I. Bergsohn, STPUD

- SGMO Office Items
  - DWR Household Water Supply Shortage System: On-line reporting system used to report Domestic Wells experiencing a water supply shortage; https://mydrywatersupply.water.ca.gov/report/
  - Draft California's Groundwater – Update 2020 (Bulletin 118) Released; Public Webinar on March 30, 2021, 12:00 PM to 1:30 PM; Fact Sheet included in Meeting Materials
- 2020 SAG Workshop 2 (December 17, 2020) Meeting Notes/Presentations posted on Groundwater Management Plan Web page;
- 2020 WY Annual Report Draft has been completed (Below Normal WY; GW Production > GW Recharge) – currently in-review; Due to DWR Thursday, April 1st;will be posted on GMP Webpage after April 1st
- 2021 WY; On trajectory for another Below Normal Water Year (Hagan's Meadow SNOTEL 508: 15.9" thru 3/23/2021)

TVS SUBBASIN ALTERNATIVE - PROGRESS UPDATE (I. Bergsohn, STPUD, 15 Minutes)

IB reported on progress in conducting the first 5-year update of the 2014 GMP, referred to as the Tahoe Valley South Subbasin (TVS Subbasin) Alternative (due to DWR by January 1, 2022). Current progress for the Alternative includes satisfying Public Notification Requirements, including identifying TVS Subbasin Stakeholders, development of Interested Parties Lists; and development of a Participation Notice describing how Stakeholders and Interested Parties may participate in the update process. A review and assessment of the 2014 GMP was also completed. The assessment involved re-evaluating the existing plan in light of current groundwater conditions and the need to incorporate groundwater information developed since adoption of the existing plan in 2014. Additional work is in-progress to address eight (8) Recommended Actions identified by DWR during assessment of the 2014 GMP. This new information will be used to address new groundwater management plan requirements added under SGMA which will also be incorporated into the Alternative. IB provided a slide showing the current status of this new work, as well as a quick look ahead to the work planned for the Alternative over the next three (3) months.

SURVEY OF PRIVATE WELL OWNERS (Jason Brand, STPUD, 15 Minutes)
Handouts: Well Owner Survey Combined (2/24/2021)

JB reported on the District's Survey of Private Well Owners and some findings from the survey results. The objectives of this work were to inform private well owners of the District as a Groundwater Sustainability Agency (GSA) and its role in groundwater management within the TVS Subbasin; encourage private well owners to participate in the SAG; and reach-out to private well owners to better understand private well ownership, well usage, well condition water quality and well owner concerns. The survey was conducted in two phases; PWOS I (August – October 2017) involved the survey of 370 well owners; PWOS II (June- September 2020) involved the survey of 134 well owners; including private CWS, NTNC, TNC, SSWS and Domestic well systems.

Through PWOS surveys, the locations of 335 private wells within the TVS Subbasin were confirmed; another 118 sites were confirmed to not have a private well; at 51 sites property owners were uncertain whether a well existed on the property. Major findings from the survey include; high majority of confirmed private wells are in use (292/335 responses); most of the properties were second homes (192/390 responses); the majority of private well owners use

their well on a daily basis (191/336 responses). Aesthetic water quality parameters (taste, color, odor) and purity were the top qualities well owners liked most; the majority of the well owners did not express any water quality concerns, of those that did, contaminants and " other" were the most common responses. A minority of respondents (56/336) were interested in receiving information about connecting to a public water system; and 135/336) were interested in joining the SAG. Recommendations from the PWOS include; continue updating well owners that have expressed interest in the SAG; continue working to contact the remaining ~160 private well owners (estimated) that have not been reached; and continue outreach to build positive relationships with private well owners.

Discussion (Group)

Has District been able to cross-reference confirmed well locations with EDC well construction information? How many wells are potential risks as vertical conduits for contamination? Good question, JB has not attempted to investigate private well construction information.

EDC would like to coordinate with District to identify the remaining ~160 well owners who have not been contacted. EDC does not regulate private wells, but does permit well construction, modification and destruction; question on well at 2717 Lake Tahoe Blvd (District checked it's PWOS records and found that the subject property is listed as a potential well site and is one of the remaining ~160 well owners which have not responded to the PWOS).

Vertical conduit evaluation is task within scope of current SCAP investigation

SCAP REGIONAL PLUME INVESTIGATION (A. Shepard, M. Novak, AECOM, 40 Minutes)

Michael Novak, Hydrogeologist reported on progress of the on-going Site Cleanup Subaccount Program (SCAP) Regional Investigation being performed by AECOM for LRWQCB. Primary objectives for this investigation include; 1) Improve Conceptual Site Model through better understanding of subsurface lithology; and lateral and vertical plume delineation; 2) Support next steps, sentry well siting and design; preferential pathway analysis (e.g., sewer line, surface water pathways) and feasibility of remedial options to protect well users and stakeholders.

Recent Work: 22 Sonic Borings (to 300 ft); 57 CPT borings (to 100 ft); groundwater samples (6 – 8 per location). Lithology data was logged in accordance with USCS and grouped based on associated permeability's (e.g. silt & clay -low to Sand & Gravels – High). Earth Volumetric Studio (EVS) modeling software was used both lithologic and groundwater sampling dataset (2017 – present; if multiple sample events at a location, max concentrations used) to develop an 3-D interpolated subsurface model of the PCE contaminant plume.

Cross-Sections: A-A' oriented South to North, parallel with direction of GW flow): Lithology's: new high resolution data shows that potential confining layers (clays) previously interpreted as continuous layers ; are likely to be discontinuous lenses (< 1 mile in extent); Aquifer is interpreted as single unit; ; confining layers do not sub-divide the aquifer into distinct units (e.g. shallow, intermediate, and deep). Chemical: diving plume, shallow in up-gradient area s(at south end), spreading vertically as it migrates in down-gradient direction. Plume dispersion may in part be influenced by lithologic heterogeneity; B-B'- similar to A-A' in terms of lithology; chemically- shallow not as deep as along west side of plume; uncertainty in interpolation between main body of plume and PCE detections found in TKWC #1.

Discussion (Group):

How will the plume delineation inform the source area investigation? Reply: Understanding plume geometry will help identify targets for future source investigation efforts; help with evaluation of source area inventory and planning of future soil-gas investigations.

Dashed perimeter- can you please speak to that? Dashes represent inferred extent of plume.

How strong an influence do the clay lenses have on the distribution of PCE in the subsurface? That is a plausible explanation; hesitant to make that determination-lacking vertical hydraulic gradient data within plume.

Next Steps: Sentry Well Program – allow for GW monitoring immediately up-gradient of threatened public water supply wells (planned for July/August 2021) – LBWC #1; LBWC #5 /TKWC #2; TKWC #1; TKWC #2. Vertical Conduit Destruction: private well locations will be added to EVS model to identify potential conduits and potential candidates for well decommissioning (June/July 2021); Soil-gas sampling- Chlorinated hydrocarbons – toxicity with respect to soil vapors released from plume; will collect soil gas samples at south end of plume to evaluate vapor-intrusion pathway (impacts to indoor air) (July/August 2021); Non-Municipal Well Sampling (June 2021).

Discussion (Group):

Will discrete vertical sampling be part of the Sentry Well Installation program? Yes- very interested in vertical distribution; could be part of program, still considering different screen designs for sentry well installation

Will sentry well installation be able to provide information to indicate single or multiple source areas? Sentry well installations would not directly address that question; sentry well installations would provide multi-depth water level data to calculate hydraulic gradients (vertical and horizontal). Sentry wells may also help to inform pathway analysis; for example; whether plume was influenced by sewer system.

What is being considered to reduce PCE in groundwater? Not a key objective for next season (2021); but is objective for long-term.

How fast is the plume moving? Current AECOM dataset is not adequate to assess plume migration rate; may be able to start addressing those questions as groundwater monitoring data is collected. (Note: available plume migration rates were estimated from data collected during the South Y Feasibility Study, both from field investigation and F&T Model results).

What are the other water quality parameters to be sampled during the Sentry Well Monitoring Program (naturally-occurring Ur and Arsenic is being detected in TKWC Wells); likely that Ur sampling would not be added to LRWQCB sampling program.

Is AECOM data being evaluated to justify interim clean-up (for example; spot clean-up in selected areas; installation of an up-gradient recovery well to reduce impact to TKWC #1)? May be potential opportunity for interim remedial clean-up; source area investigations that should be helpful to inform these decisions.

Has information from plume delineation changed LRWCB source inventory? No; source inventory has not changed; data is being used to inform planned source area investigations.

Tahoe South Subbasin (6-005.01) Alternative
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TSS Alternative 50-yaer Water Budget Projections (S. Rybarski, M. Hausner, DRI, 45 Minutes)
Handouts: TSS Alternative Groundwater Model Evaluation

Susie Rybarski, Assistant Research Scientist reported on current progress of modeling work completed by DRI to address DWR Recommended Actions. Presentation focused on work being conducted to address RA-1, RA-2 and RA-3 (developing 50-year water budgets); RA-6 (evaluating depletions of Interconnected Surface Waters (ISWs)); and RA-7 (defining Sustainable Management Criteria (SMCs)).

50-year Water Budgets: goals- incorporate climate effects and changes in pumping; extend climate projections to 2099. Annual pumping rates projected using Ca Dept. of Finance long –term population growth rate (2010- 2060) for El Dorado County (0.37%). Projected recharge rates and lake stages were developed for a baseline model (average conditions) plus five (5) climate scenarios developed using global climate models (CMIP5) for 2075 – 2099; Q1 – warm and dry; Q2 – hot and dry; Q3- hot and wet; Q4- warm and wet; and Q5- increased temperature with no change in precipitation.

GW Recharge: used mean of GW recharge previously calculated by DRI (Pohl et all, 2018). Evaluation of mean and median recharge show earlier seasonal shift (from May to March) in timing of recharge for Q2 and Q4 scenario compared to baseline.

Groundwater Pumpage: projected from 2020 using 2007 WY pumping rates (maximum rates (1983 – 2019)); TKWC, LBWC and LPA were assigned future maximums defined by Kennedy Jenks in their water demand analysis for the District's service area (KJ, 2020); District's pumping was allowed to increase above its future maximum through 2099 (conservative model). Total pumpage was distributed to existing wells based on WY 2019 pumpage distribution and historical season pumping patterns; Pumping from LBWC #5 was started during WY 2021 to account for completion of wellhead treatment system to remove PCE from groundwater for this well. Added pumpage at private well locations were estimated based on District's private well owner survey results.

Lake Stage: lowest stage elevation based on submerged tree stump elevation (6214.9 ft) dated to 6,300 yrs BP (Lindstrom, 1990) used for Q2 scenario; and high stage elevation based on 1983 – 2015 average; were used to develop a two-point regression of lake stage elevation versus recharge to identify projected lake stages for the other climate scenarios. Decline rates were developed for a "composite drought" using observed declines in lake stage during recent drought periods (WY 2012 -2014; WY 1987 – 1994); the composite drought stage declines were then used to develop a "composite stage" decline for the Q2 scenario until the lowest stage elevation was reached. Lake Stage for Q3 and Q4 scenarios were set at the legal limit (6229.1 ft).

Private Well Impacts: projected model results were used to compare changes in groundwater level elevations across TVS Subbasin between historical (2019 WY) and projected baseline (2070 WY) and Q2 (2070 WY) scenarios. For the 332 private well locations identified; 38 sites had DTW > 50 ft under the baseline scenario; compared to 73 sites under the Q2 scenario; 34 sites are show to have DTW.50 ft for historical period. The average declines at private wells ranged from 3.7 ft (baseline) to 15 ft (Q2).

Community Supply Wells (District, TKWA, LBWC and LPA); compare projected groundwater pumping levels for Q2 scenario to top of well screen elevations for active community production wells. Model results show that pumping levels will not decline below top of screen elevations in all wells evaluated. The minimum predicted pumping level above the top of screen elevation is 46.5 feet at the South Upper Truckee Well No. 3.

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ISWs: GW Management Area (GMA); area defined by model cells with >50% stream capture in any model layer. GMA delineation involved: 1) running a transient baseline model with no pumping (WY 2020 – 2099) for comparison to the baseline model (pumping only) and the five climate scenarios (pumping + climate effects) to produce monthly/annual depletion analysis; 2) spatial baseflow depletion analysis to show where depletion of baseflow is occurring in streams; and capture analysis to show where majority of pumping would capture flow directed toward streams versus directed to Lake Tahoe. General pattern in baseline, Q1, Q2 and Q5 shows initial depletion predominantly from storage until hydrologic system equilibrates to simulated climate conditions (recharge; lake stage). After equilibration, depletion is predominantly from streams (baseflow) or groundwater flow to Lake Tahoe. The relative differences in depletions between scenarios are controlled by the magnitude of reductions in recharge and differences in lake stage between the different scenarios. Q3 and Q4 (wet scenarios) show negative baseflow and storage depletion resulting in increased baseflow to streams and increased groundwater storage. Review of depletion distributed by month shows seasonal impact on groundwater storage; basin fills during winter months and depletes during summer. Capture analysis –shows where a hypothetical well would be expected to cause an increase in aquifer recharge due to losses in flow from ISWs. Results from models with and without the hypothetical well are then compared to see where water from the cell is captured from ISWs (i.e., lake vs. baseflow). Analysis run on both baseline and Q2 (worst-case) scenarios

Next Steps: develop SMCs for chronic lowering of GW levels; reductions in GW Storage; degraded GW quality; and depletions of ISWs; set sustainable thresholds within range of historic variability; identify data gaps and recommend methods to address; receive feedback from SAG on proposed SCMs.

Discussion (Group):

Model assumptions: Population growth based on County Average; land use planners believe there will be a much larger proportion of year-round homeowners in the future, was this taken into consideration? KJ water demand assessment considered water demand at total build-out; District pumpage used in 50-year water projections exceeded KJ water estimates, future pumpage projections are believed to be conservative.

Low lake stage level; did DRI also consider findings from study of submerged tree stumps found in Fallen Leaf Lake (FLL) - (mid-evil Drought)? DRI looked at it, but did not use as there were no elevations from that study for Lake Tahoe.

Baseline pumping used most conservative (highest historic pumping rates) from WY 2007, any reason why 2007? 2007 coincides with population peak before recession; and prior to subsequent movement of population away from South Lake Tahoe.

ADJOURN (11:30 AM)

TAHOE SOUTH SUBBASIN (6-005.01)
2021 SAG Workshop 1
March 25, 2021

TSS Alternative - Update

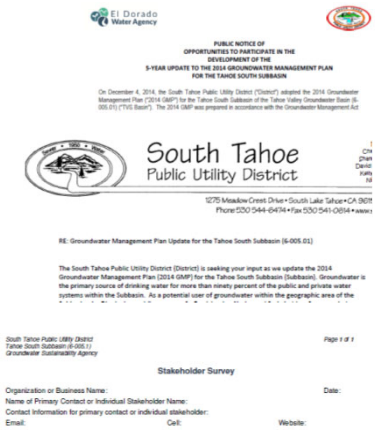
I. Bergsohn, PG, HG
South Tahoe Public Utility District

2014 GMP Update - Overview

- Public Notification (§ 10723.2; § 10723.4; § 10727.8)
- Periodic Review and Assessment (§ 10728.2)
  - Evaluate 2014 GMP
  - Assess Groundwater Conditions
  - Adjust Plan/Management Objectives
- Address DWR Recommended Actions
- Prepare Tahoe South Subbasin (TSS) Alternative

Public Notification

- Interested Persons List (§ 10723.4)
- Participation Notice (§ 10727.8)
  - https://stpud.us/news/groundwater-management-plan/
  - https://www.edwateragency.org/Pages/Water-Agency-Newsroom.aspx
  - Media Release
  - Tier I & II Stakeholders Mailers
  - Tier III Stakeholders Email



El Dorado Water Agency

PUBLIC NOTICE OF OPPORTUNITIES TO PARTICIPATE IN THE DEVELOPMENT OF THE 5-YEAR UPDATE TO THE 2014 GROUNDWATER MANAGEMENT PLAN FOR THE TAHOE SOUTH SUBBASIN

South Tahoe Public Utility District

RE: Groundwater Management Plan Update for the Tahoe South Subbasin (6-005.01)

The South Tahoe Public Utility District (District) is seeking your input as we update the 2014 Groundwater Management Plan (2014 GMP) for the Tahoe South Subbasin (Subbasin). Groundwater is the primary source of drinking water for more than ninety percent of the public and private water systems within the Subbasin. As a potential user of groundwater within the geographic area of the

Stakeholder Survey

Organization or Business Name: Date:
Name of Primary Contact or Individual Stakeholder Name:
Contact information for primary contact or individual stakeholder:
Email: Cell: Website:

Periodic Review and Assessment

- Evaluate 2014 GMP (100% Complete)
  - Identify new sections to address new GSP requirements under SGMA
  - Reorganize GMP to incorporate new information
- Assess Groundwater Conditions (<50% Complete)
  - Groundwater Conditions
  - Groundwater Storage
  - Groundwater Quality
  - Interconnected Surface Water (ISW) Interactions
  - Groundwater Dependent Ecosystems (GDEs)
  - Water Budget
  - Sustainable Yield
  - Assessment of Potential Overdraft Issues
  - Potential Climate Change Impacts
  - Characterization of Undesirable Results
- Adjust Plan/Management Objectives (20% Complete)
  - Incorporate new information
  - Identify data gaps, future groundwater management projects and activities
  - Update 2014 Implementation Plan

DWR Recommended Actions (RAs)

RA	Description
RA-1	Provide water budget information in Tabular Form for historical, current and projected water budgets.
RA-2	Provide a projected water budget over the 50-year planning and implementation horizon, incorporating climate change effects.
RA-3	Reconcile the different future water demand projections between the Groundwater Management Plan (GMP) and Urban Water Management Plan (UWMP) and incorporate the reconciliation in the projected water budget.
RA-4	To understand change in groundwater storage for the Subbasin, the water budget calculated by the South Tahoe Groundwater Model should be calculated within the Subbasin boundary rather than the surrounding watershed area inclusive of the Subbasin.
RA-5	Provide additional explanation in the first five-year update for how pumping may impact plume migration or cause degraded water quality.
RA-6	Provide estimates of the quantity and timing of depletions of interconnected surface water; define what would cause depletions to become significant and unreasonable.
RA-7	Define quantitative criteria for groundwater levels, storage and depletion of interconnected surface water that can be used to objectively determine compliance of the Plan with the objectives of SGMA on an on-going basis.
RA-8	Provide a description of how the data gaps identified will be addressed; specifically the projects identified in Table 10-1 for BMO 5 - dependent upon District funding.

Current Status

RA	Description	Status
RA-1, RA-2, RA-3	Updated water budgets for the 50-year planning horizon	Modeling Evaluation/ COMPLETED
RA-4	Water budget within the Subbasin boundary.	COMPLETED
RA-5	How pumping may impact plume migration or cause degraded water quality.	In-Progress (> 50% Complete)
RA-6	Quantity and timing of depletions of Interconnected Surface Waters (ISW)	In- Progress (<50% Complete)
RA-7	Quantitative criteria for groundwater levels, storage and depletion of ISW.	In- Progress (<25% Complete)
RA-8	Data gaps and recommend methods to address them.	In- Progress (<25% Complete)

Calendar

Date	Description
4/15/2021	Public Hearing: 2020 WY Annual Report
6/23/2021 (proposed)	2021 SAG Workshop 2

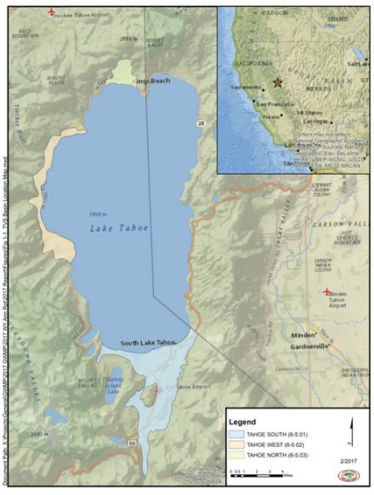
QUESTIONS/COMMENTS

TAHOE SOUTH SUBBASIN (6-005.01)
2021 SAG I WORKSHOP
March 25, 2021

Survey of Private Well Owners
Phase I & II Summary of Results

Jason Brand
South Tahoe Public Utility District

TAHOE SOUTH SUBBASIN
Survey of Private Well Owners



OBJECTIVES

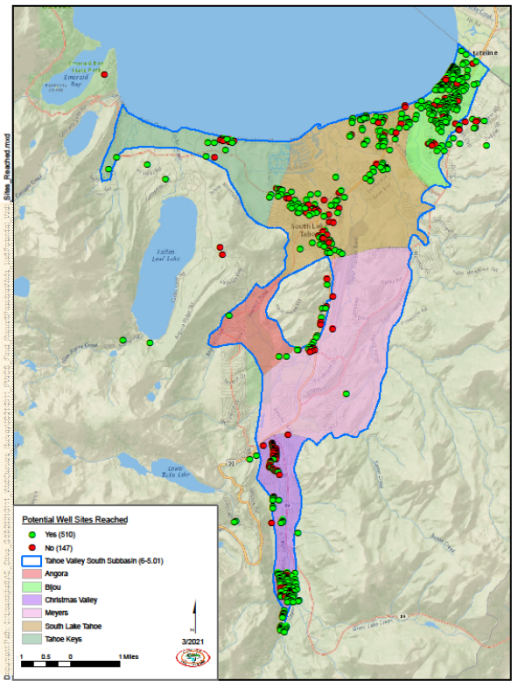
- Inform Private Well Owners of GSAs & Groundwater Management
- Encourage Private Well Owners to participate in the SAG
- Reach-out to Private Well Owners to better understand:
  - Well Ownership and confirm location
  - Water Usage
  - Well Condition
  - Water Quality
  - Well Owner Concerns

Private Wells

Wells - inferred (~ 670)

Survey conducted for 76% or 509 sites

Types
- Domestic
- CWS
- NTNC
- TNC
- SSWS



PWOS I

August – October 2017

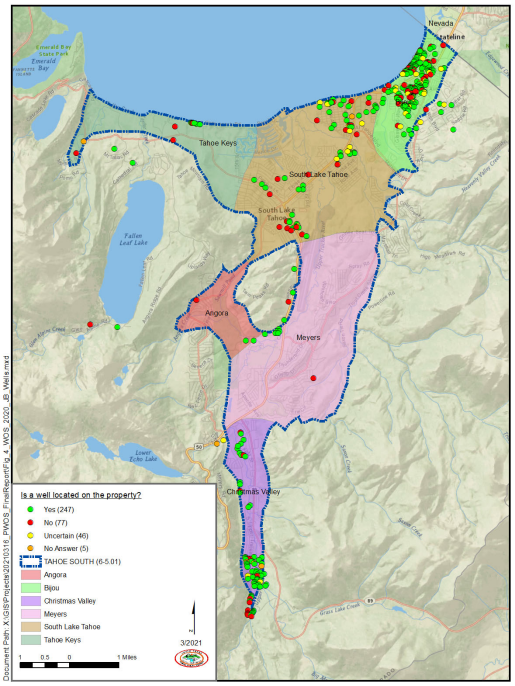
Methods

- Direct Mail
- Door to Door
- Online/Web Portal
- Telephone

Completed Well Survey (370)

- Yes (247)
- No (77)
- Uncertain (46)

TVS Groundwater Basin Survey of Well Owners (Allegro, 2018)



PWOS II

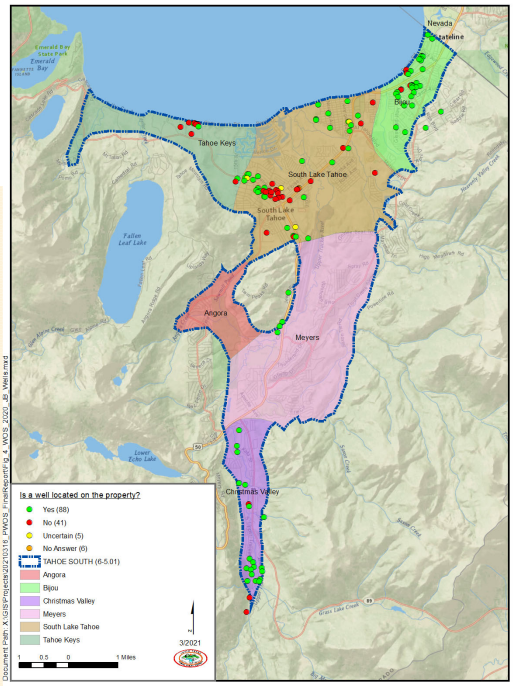
June – September 2020

Methods

- Direct Mail
- Email
- Online/Web Portal
- Telephone
- Incentives – Water quality test, well inspection, guidance

Completed Well Survey (134)

- Yes (88)
- No (41)
- Uncertain (5)



PWOS Combined

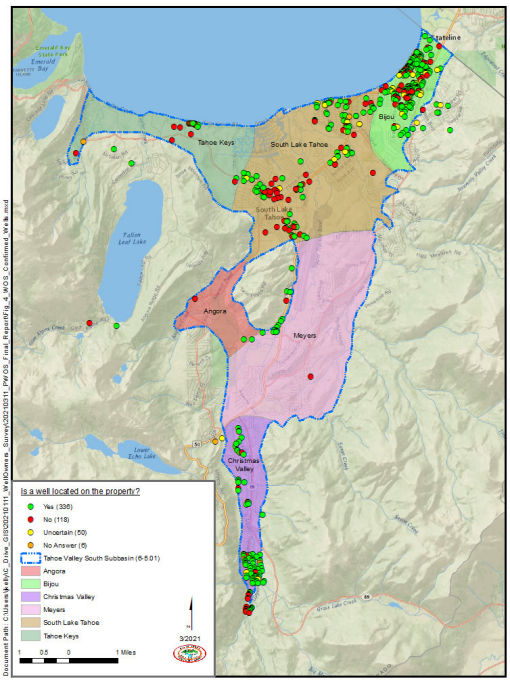
2017 and 2020

Possible Well Sites (670)

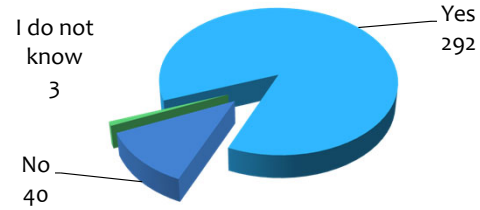
Completed Well Survey (509)

- Yes (335)
- No (118)
- Uncertain (50)

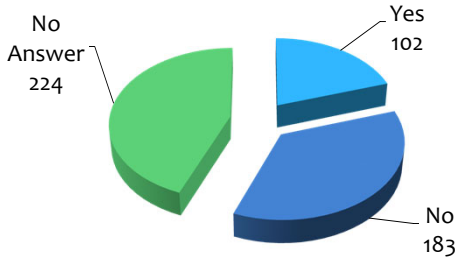
Final Report April 2021



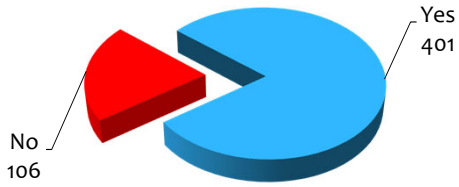
Is the well in use?



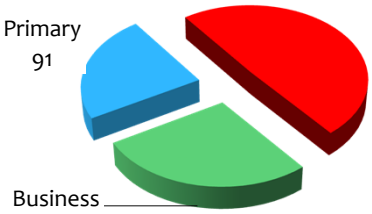
May I view the well?



Are you the owner?



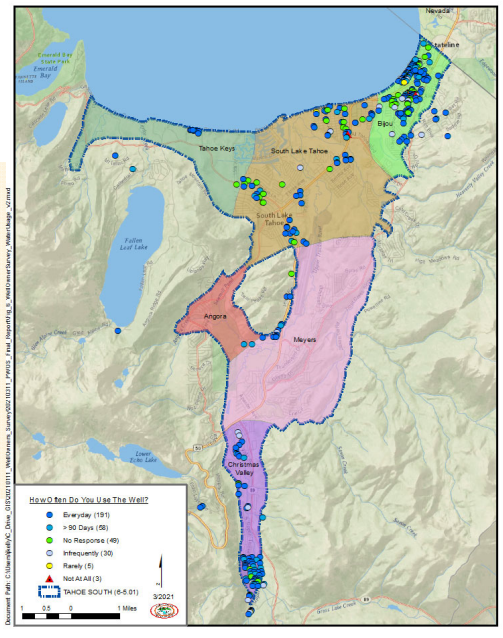
How do you use the property?

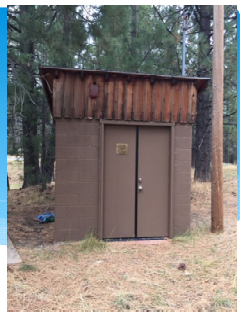


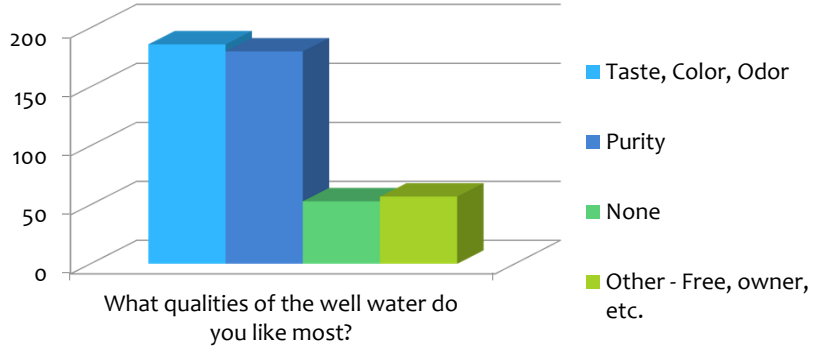
Well Use

How Often Do You Use the Well?

- Everyday (191)
- Less than 90 days (58)
- No Response (49)
- Infrequently (30)
- Rarely (5)
- Not at all (3)



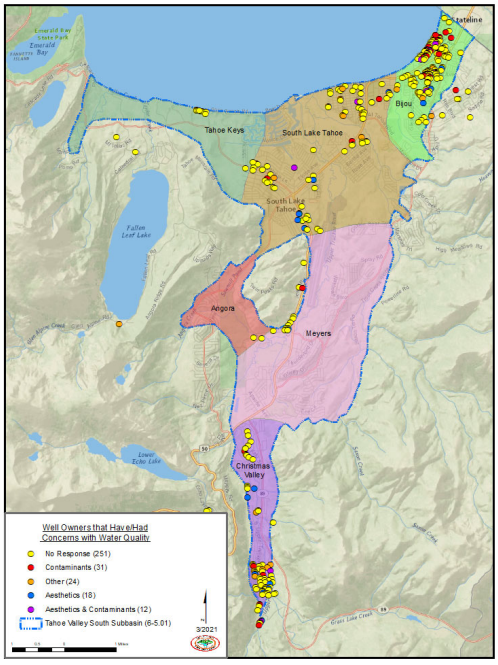




Water Quality

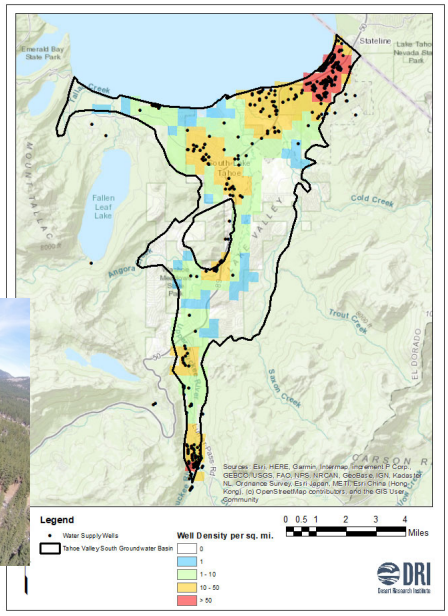
Well owners that have/had concerns with water quality

- No Response (251)
- Contaminants (31)
- Other (24)
- Aesthetics
- Aesthetics & Contaminants (12)



Well Density

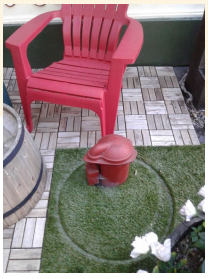
Well density per square mile

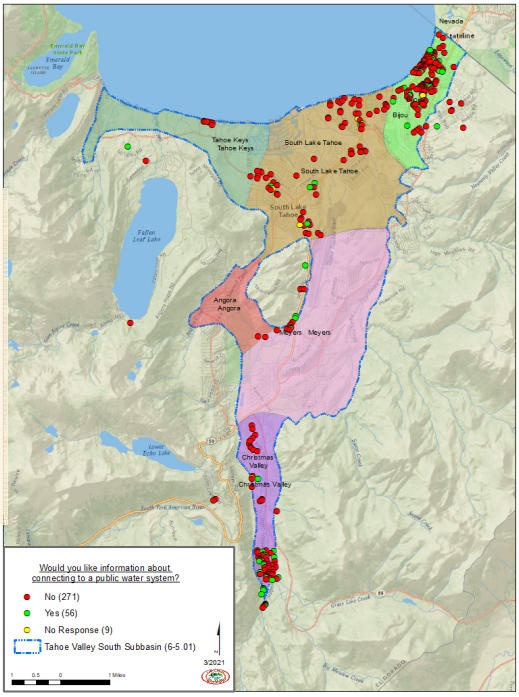


Connection ?

Would you like information about connecting to a public water system?

- Yes (56)
- No (271)
- No Response (9)

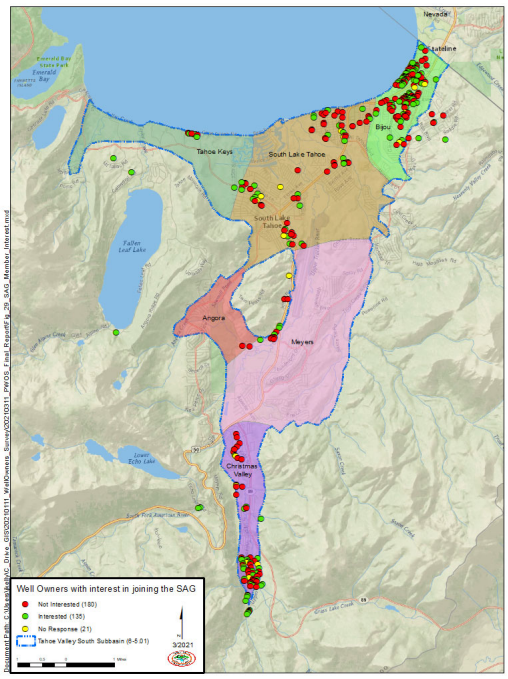




SAG Interest ?

Well owners with interest in joining the SAG

- Interested (135)
- Not interested (180)
- No Response (21)



PWOS Status

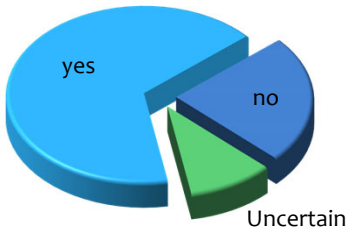
Goal to conduct survey and confirm well sites - **670**

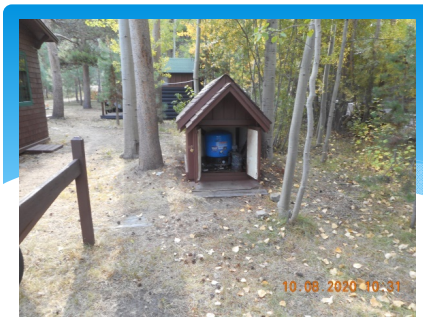
Surveys Conducted – **509** or **76%**

- Yes – **335**
- No – **118**
- Uncertain – **50**
- No response

Well sites not confirmed **~160**

Is there a well?





Recommendations

- Continue updating contacts of well owners that have expressed interest in being part of the SAG
- Continue working to contact properties that have not been reached ~160
- Work to create a positive relationship between Private well owners and other partner groups

South Tahoe Public Utility District

Survey of Private Well Owners

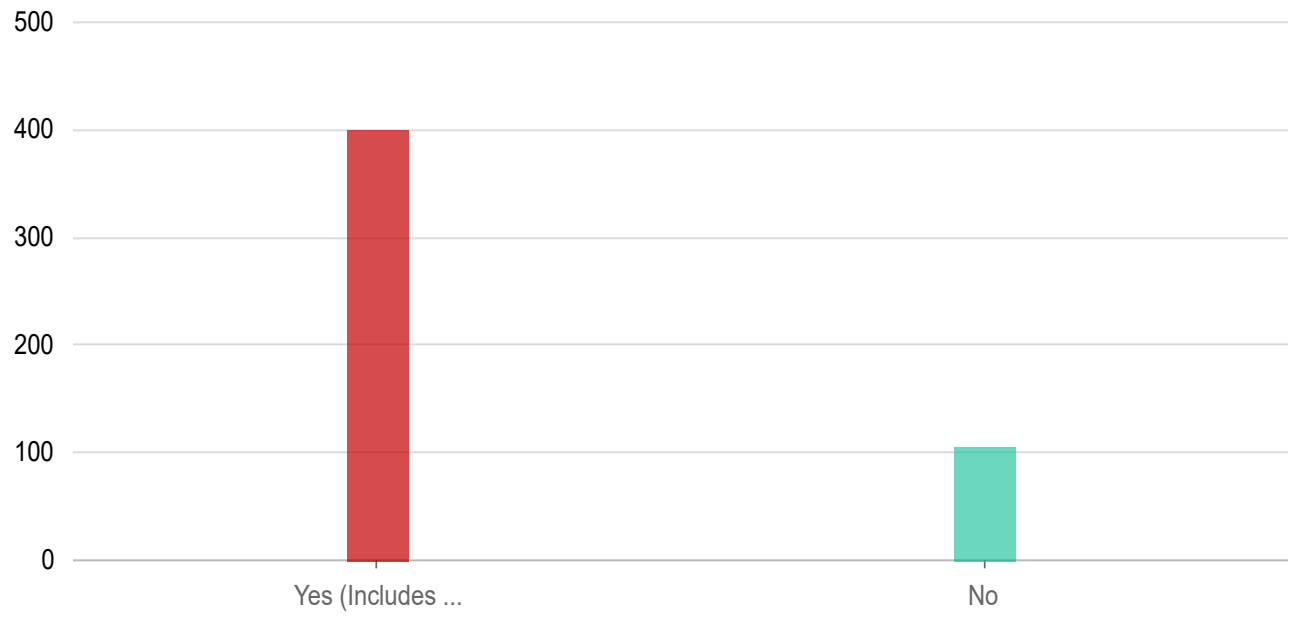
Questions

Jason Brand
South Tahoe Public Utility District

Well Owner Survey Combined

About Property Ownership and Usage

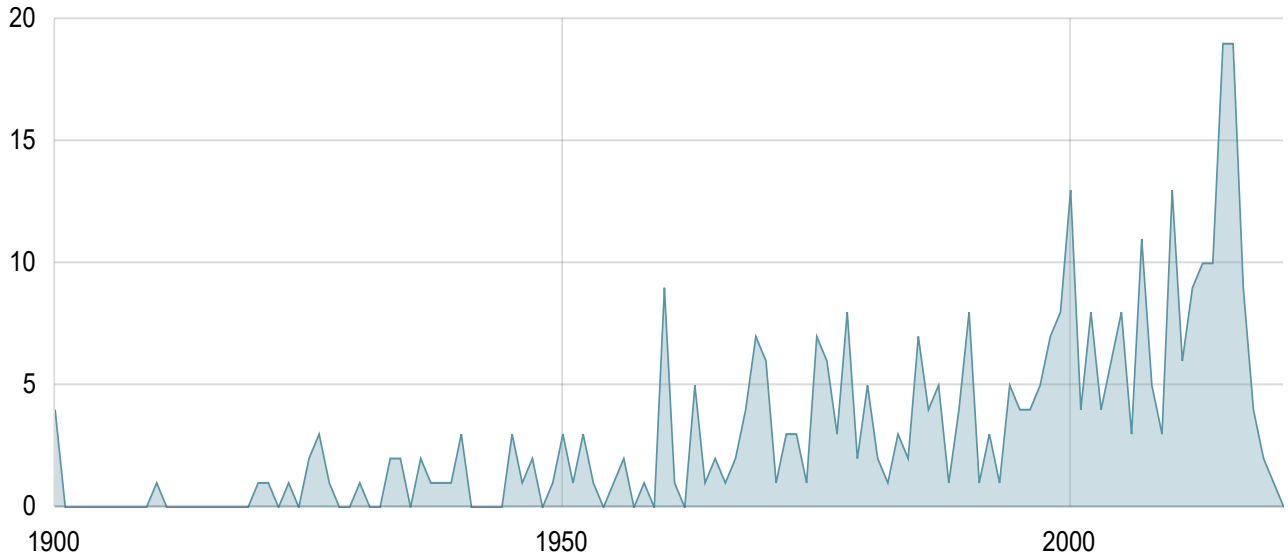
○ Are you the property owner at this address?



Answers	Count	Percentage
Yes (Includes Property Managers)	401	78.78%
No	106	20.83%

Answered: 507 Skipped: 2

○ Since when have you owned this property?



Date	Count
Jan 1, 1900 - Jan 1, 1901	4
Jan 1, 1910 - Jan 1, 1911	1
Jan 1, 1920 - Jan 1, 1921	1
Jan 1, 1921 - Jan 1, 1922	1
Jan 1, 1923 - Jan 1, 1924	1
Jan 1, 1925 - Jan 1, 1926	2
Jan 1, 1926 - Jan 1, 1927	3
Jan 1, 1927 - Jan 1, 1928	1
Jan 1, 1930 - Jan 1, 1931	1
Jan 1, 1933 - Jan 1, 1934	2
Jan 1, 1934 - Jan 1, 1935	2
Jan 1, 1936 - Jan 1, 1937	2
Jan 1, 1937 - Jan 1, 1938	1
Jan 1, 1938 - Jan 1, 1939	1

Jan 1, 1939 - Jan 1, 1940	1
Jan 1, 1940 - Jan 1, 1941	3
Jan 1, 1945 - Jan 1, 1946	3
Jan 1, 1946 - Jan 1, 1947	1
Jan 1, 1947 - Jan 1, 1948	2
Jan 1, 1949 - Jan 1, 1950	1
Jan 1, 1950 - Jan 1, 1951	3
Jan 1, 1951 - Jan 1, 1952	1
Jan 1, 1952 - Jan 1, 1953	3
Jan 1, 1953 - Jan 1, 1954	1
Jan 1, 1955 - Jan 1, 1956	1
Jan 1, 1956 - Jan 1, 1957	2
Jan 1, 1958 - Jan 1, 1959	1
Jan 1, 1960 - Jan 1, 1961	9
Jan 1, 1961 - Jan 1, 1962	1
Jan 1, 1963 - Jan 1, 1964	5
Jan 1, 1964 - Jan 1, 1965	1
Jan 1, 1965 - Jan 1, 1966	2
Jan 1, 1966 - Jan 1, 1967	1
Jan 1, 1967 - Jan 1, 1968	2
Jan 1, 1968 - Jan 1, 1969	4
Jan 1, 1969 - Jan 1, 1970	7
Jan 1, 1970 - Jan 1, 1971	6

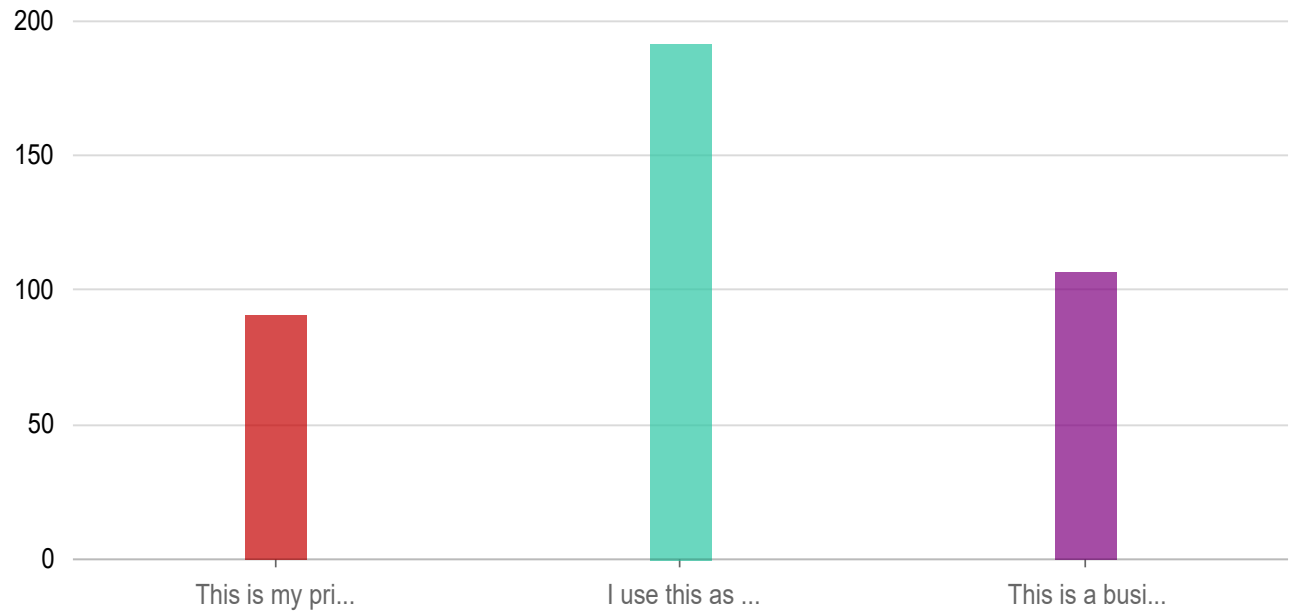
Jan 1, 1971 - Jan 1, 1972	1
Jan 1, 1972 - Jan 1, 1973	3
Jan 1, 1973 - Jan 1, 1974	3
Jan 1, 1974 - Jan 1, 1975	1
Jan 1, 1975 - Jan 1, 1976	7
Jan 1, 1976 - Jan 1, 1977	6
Jan 1, 1977 - Jan 1, 1978	3
Jan 1, 1978 - Jan 1, 1979	8
Jan 1, 1979 - Jan 1, 1980	2
Jan 1, 1980 - Jan 1, 1981	5
Jan 1, 1981 - Jan 1, 1982	2
Jan 1, 1982 - Jan 1, 1983	1
Jan 1, 1983 - Jan 1, 1984	3
Jan 1, 1984 - Jan 1, 1985	2
Jan 1, 1985 - Jan 1, 1986	7
Jan 1, 1986 - Jan 1, 1987	4
Jan 1, 1987 - Jan 1, 1988	5
Jan 1, 1988 - Jan 1, 1989	1
Jan 1, 1989 - Jan 1, 1990	4
Jan 1, 1990 - Jan 1, 1991	8
Jan 1, 1991 - Jan 1, 1992	1
Jan 1, 1992 - Jan 1, 1993	3
Jan 1, 1993 - Jan 1, 1994	1

Jan 1, 1994 - Jan 1, 1995	5
Jan 1, 1995 - Jan 1, 1996	4
Jan 1, 1996 - Jan 1, 1997	4
Jan 1, 1997 - Jan 1, 1998	5
Jan 1, 1998 - Jan 1, 1999	7
Jan 1, 1999 - Jan 1, 2000	8
Jan 1, 2000 - Jan 1, 2001	13
Jan 1, 2001 - Jan 1, 2002	4
Jan 1, 2002 - Jan 1, 2003	8
Jan 1, 2003 - Jan 1, 2004	4
Jan 1, 2004 - Jan 1, 2005	6
Jan 1, 2005 - Jan 1, 2006	8
Jan 1, 2006 - Jan 1, 2007	3
Jan 1, 2007 - Jan 1, 2008	11
Jan 1, 2008 - Jan 1, 2009	5
Jan 1, 2009 - Jan 1, 2010	3
Jan 1, 2010 - Jan 1, 2011	13
Jan 1, 2011 - Jan 1, 2012	6
Jan 1, 2012 - Jan 1, 2013	9
Jan 1, 2013 - Jan 1, 2014	10
Jan 1, 2014 - Jan 1, 2015	10
Jan 1, 2015 - Jan 1, 2016	19
Jan 1, 2016 - Jan 1, 2017	19

Jan 1, 2017 - Jan 1, 2018	9
Jan 1, 2018 - Jan 1, 2019	4
Jan 1, 2019 - Jan 1, 2020	2

Answered: 364 Skipped: 145

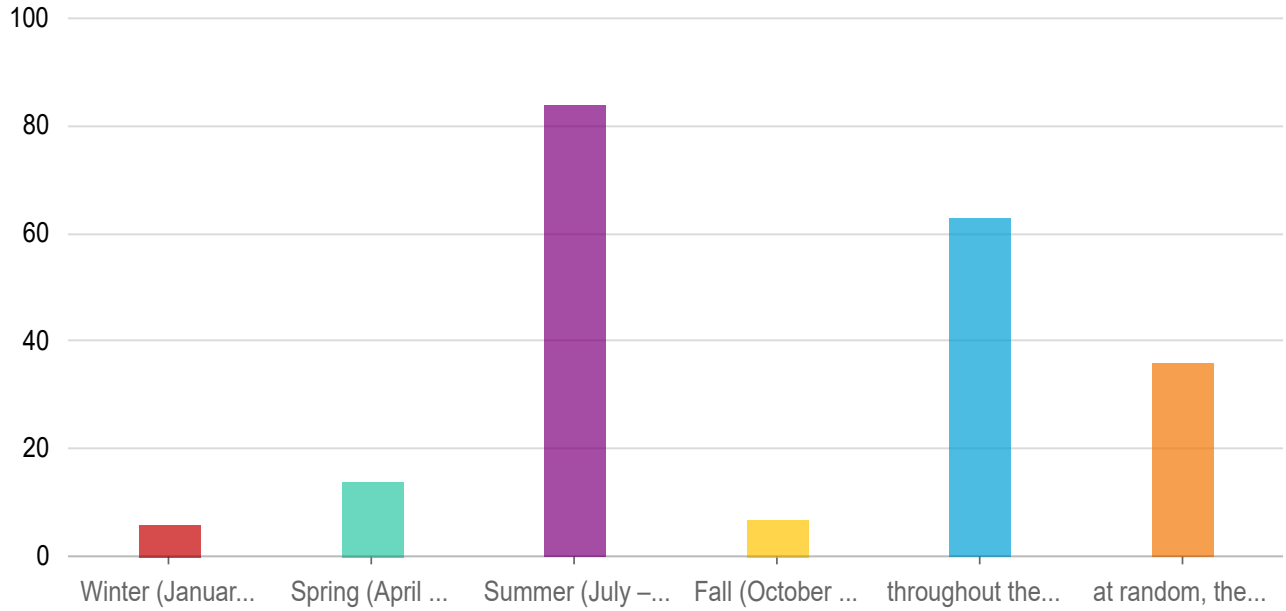
○ As owner, which best describes your relationship to this property?



Answers	Count	Percentage
This is my primary residence.	91	17.88%
I use this as a second home / vacation residence.	192	37.72%
This is a business property.	107	21.02%

Answered: 390 Skipped: 119

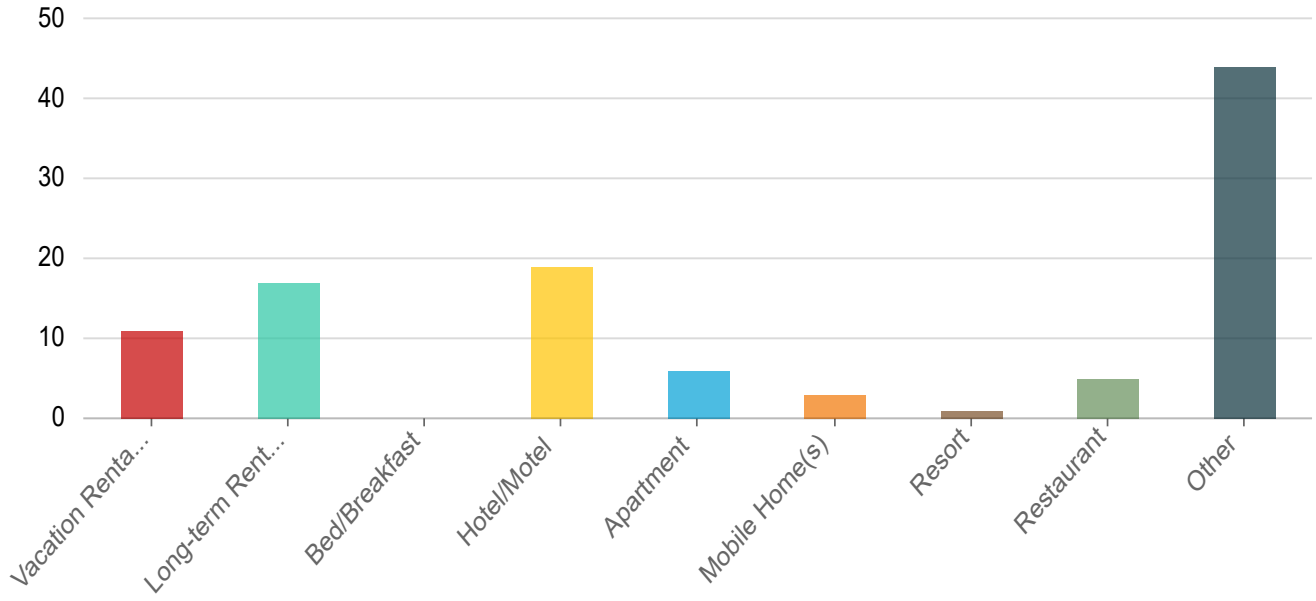
○ As a second home I use this property primarily:



Answers	Count	Percentage
Winter (January – March)	6	1.18%
Spring (April – June)	14	2.75%
Summer (July – September)	84	16.5%
Fall (October – December)	7	1.38%
throughout the year	63	12.38%
at random, there is no particular season I am here	36	7.07%

Answered: 178 Skipped: 331

○ **Please select the best description of the business(es) use of this address.**

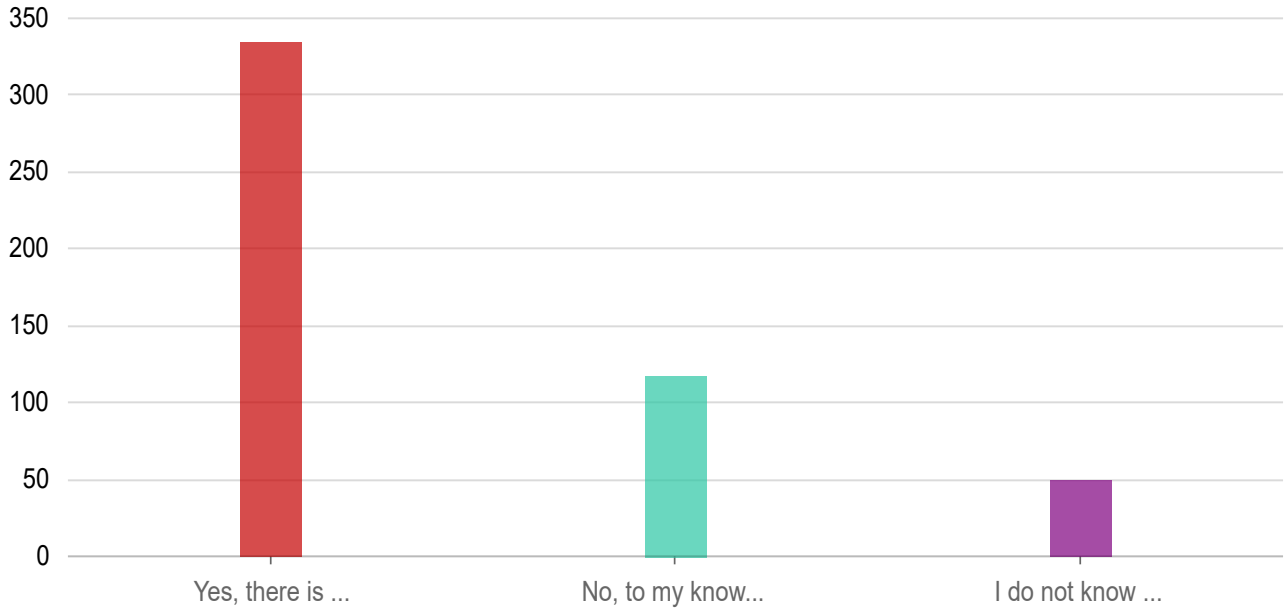


Answers	Count	Percentage
Vacation Rental	11	2.16%
Long-term Rental	17	3.34%
Bed/Breakfast	0	0%
Hotel/Motel	19	3.73%
Apartment	6	1.18%
Mobile Home(s)	3	0.59%
Resort	1	0.2%
Restaurant	5	0.98%
Other	44	8.64%

Answered: 106 Skipped: 403

About the Well and Water Use

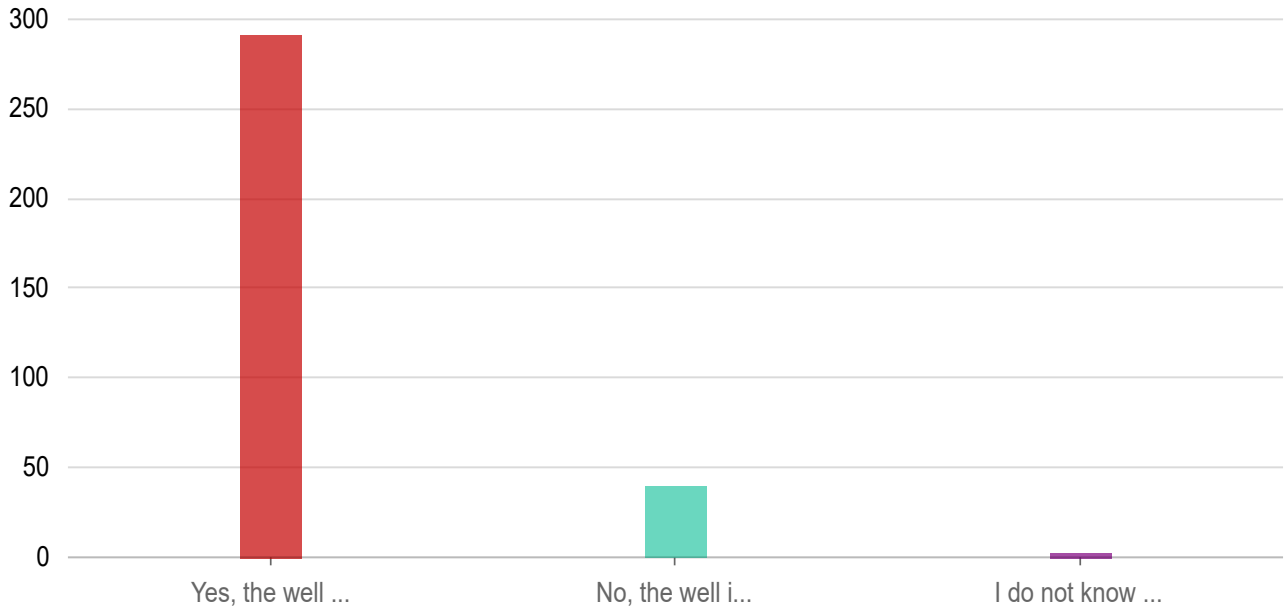
○ **Is there a well at this property?**



Answers	Count	Percentage
Yes, there is a well.	335	65.82%
No, to my knowledge there is not a well.	118	23.18%
I do not know if there is a well on this property.	50	9.82%

Answered: 503 Skipped: 6

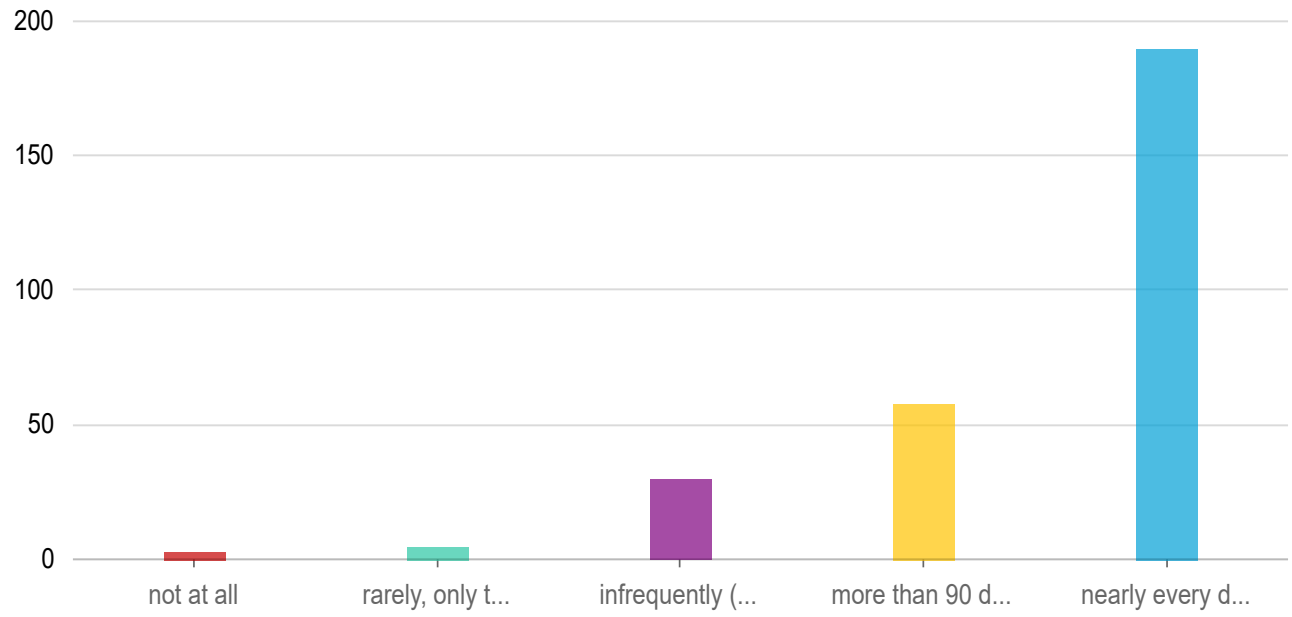
○ **Is the well in use?**



Yes, the well is used.	292	57.37%
No, the well is not used.	40	7.86%
I do not know whether the well is used.	3	0.59%

Answered: 335 Skipped: 174

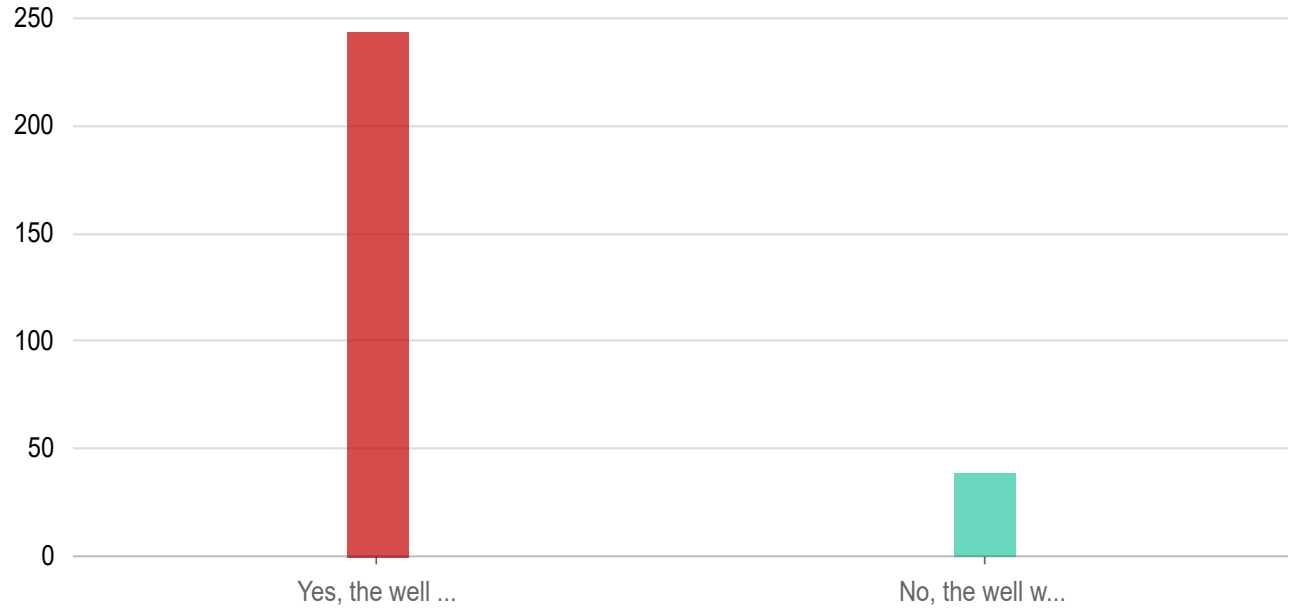
How often do you use the well?



Answers	Count	Percentage
not at all	3	0.59%
rarely, only to check or maintain it (less than 15 days a year)	5	0.98%
infrequently (approx. 15 to 90 days a year)	30	5.89%
more than 90 days a year (but not every day)	58	11.39%
nearly every day	190	37.33%

Answered: 286 Skipped: 223

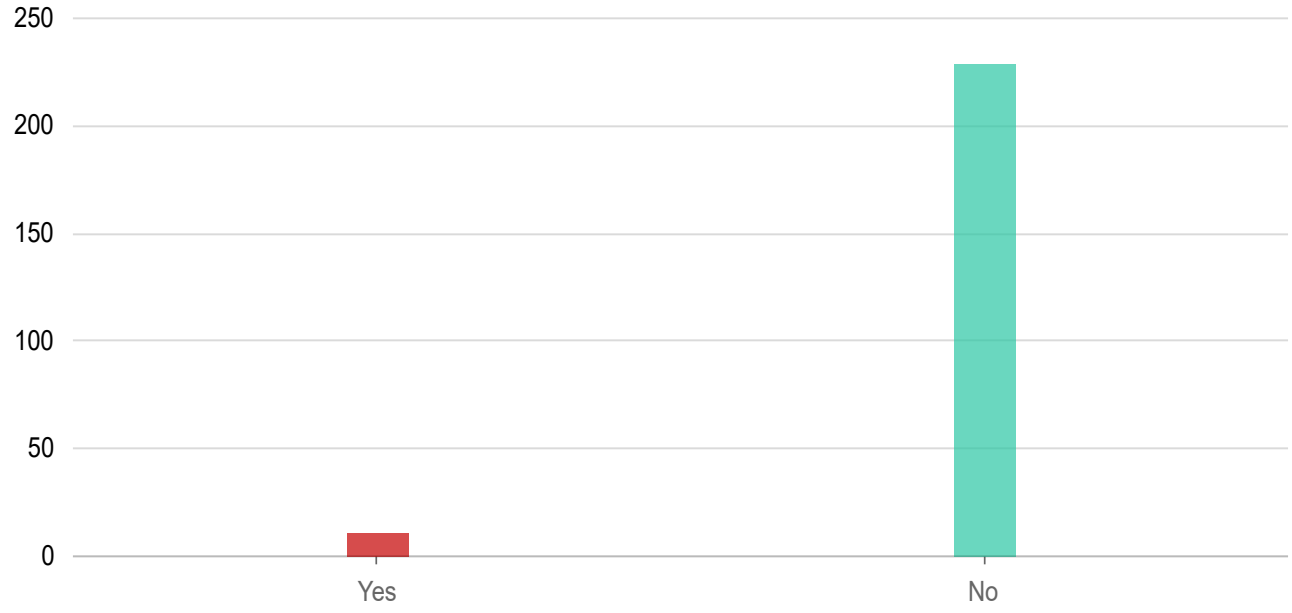
Is the well the primary source of household or business water?



Answers	Count	Percentage
Yes, the well is the primary source of water.	244	47.94%
No, the well water is not used for household or business purposes but is used solely for irrigation.	39	7.66%

Answered: 283 Skipped: 226

○ Is there a secondary, or backup, source of household water?

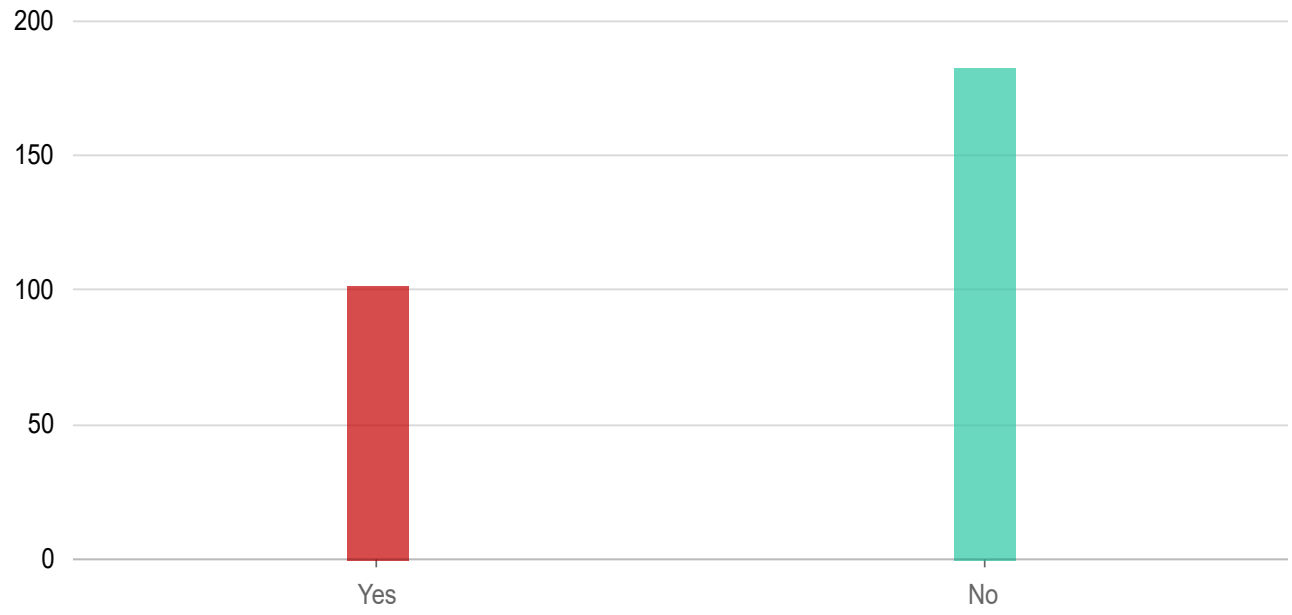


Answers	Count	Percentage

Yes	11	2.16%
No	229	44.99%

Answered: 240 Skipped: 269

○ **May [I/We] view the well?**

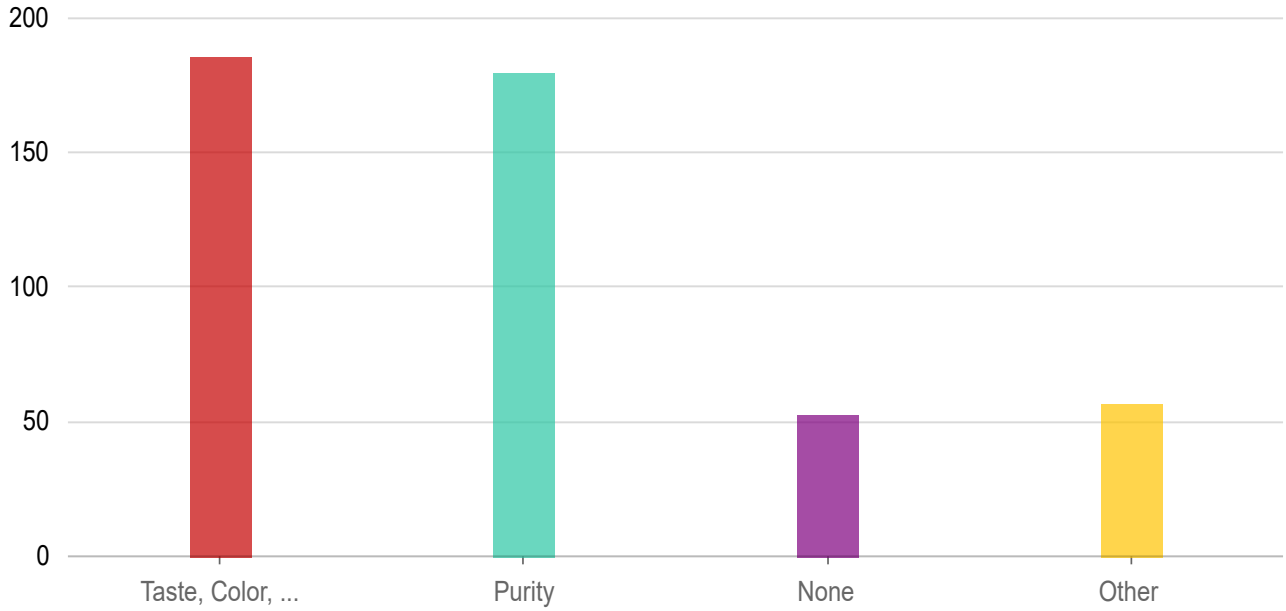


Answers	Count	Percentage
Yes	102	20.04%
No	183	35.95%

Answered: 285 Skipped: 224

About the Well Water Quality

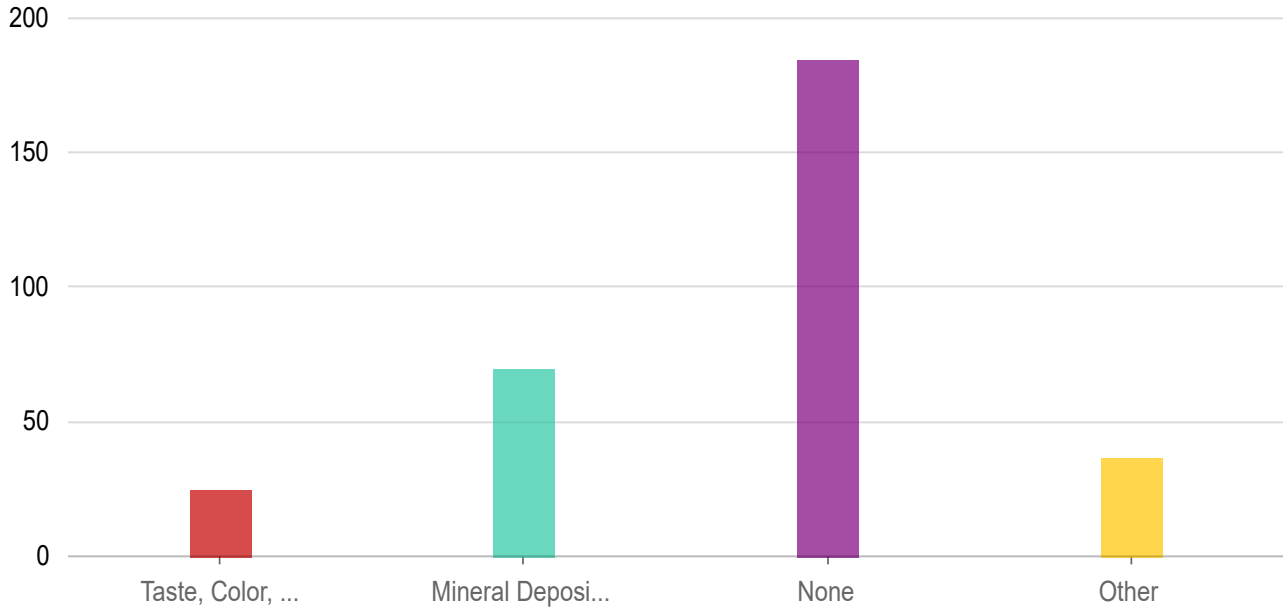
○ **What qualities of the well water do you most like?**



Answers	Count	Percentage
Taste, Color, Odor	186	36.54%
Purity	180	35.36%
None	53	10.41%
Other	57	11.2%

Answered: 302 Skipped: 207

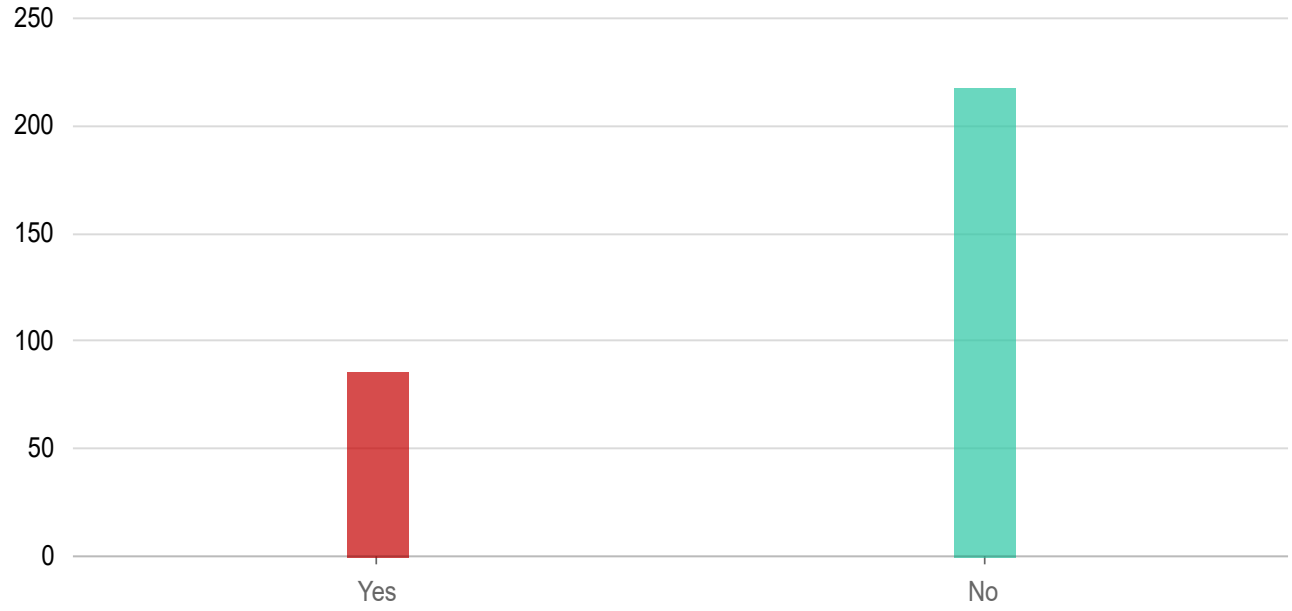
○ **What qualities of the well water do you most dislike?**



Answers	Count	Percentage
Taste, Color, Odor	25	4.91%
Mineral Deposits	70	13.75%
None	185	36.35%
Other	37	7.27%

Answered: 300 Skipped: 209

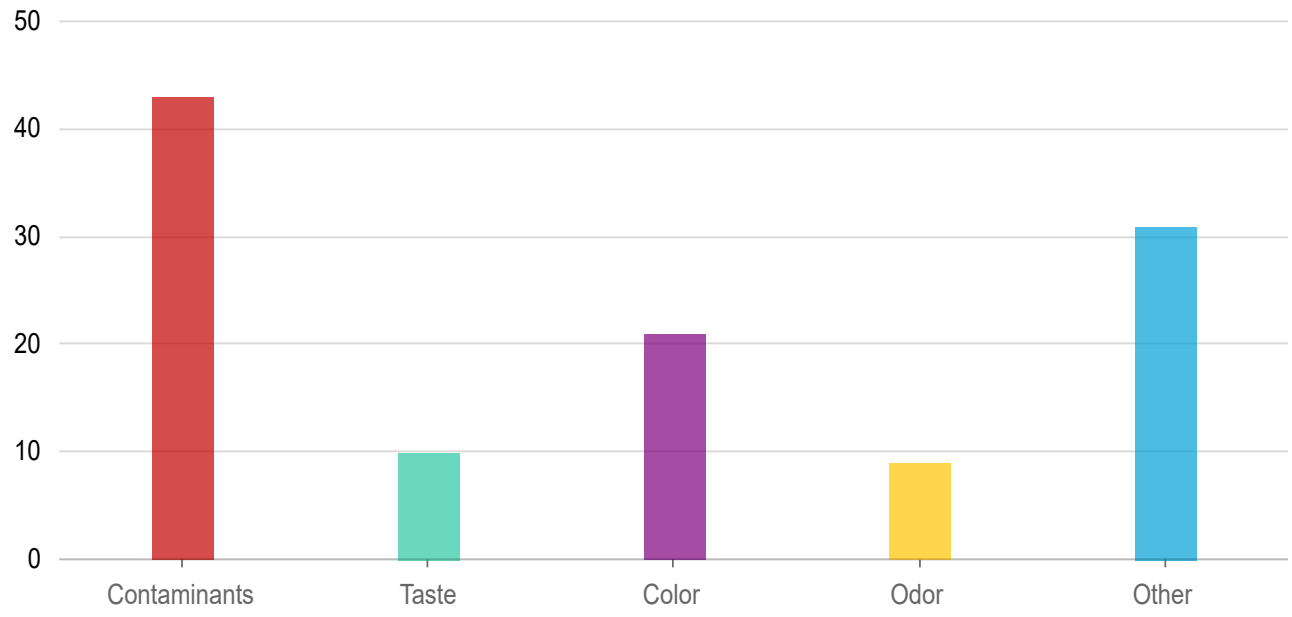
○ **Do you now or have you ever had any concern about the well water?**



Answers	Count	Percentage
Yes	86	16.9%
No	218	42.83%

Answered: 304 Skipped: 205

○ The well water concern is/was in regard to:



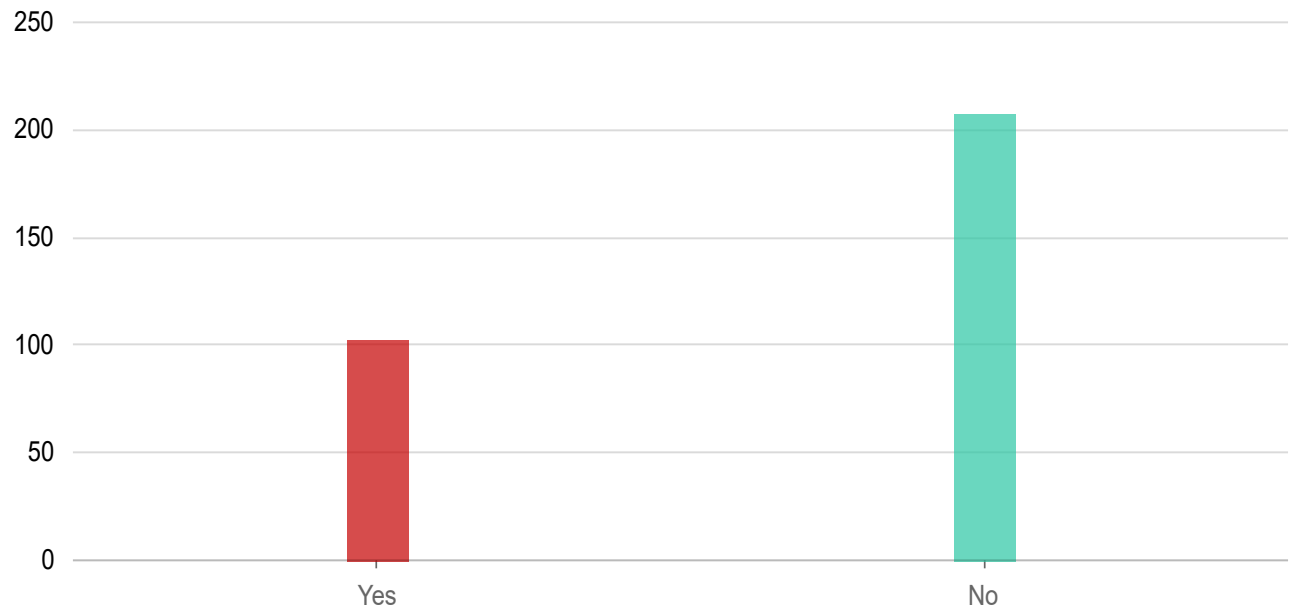
Answers	Count	Percentage

Contaminants	43	8.45%
Taste	10	1.96%
Color	21	4.13%
Odor	9	1.77%
Other	31	6.09%

Answered: 85 Skipped: 424

About the Water Well Condition

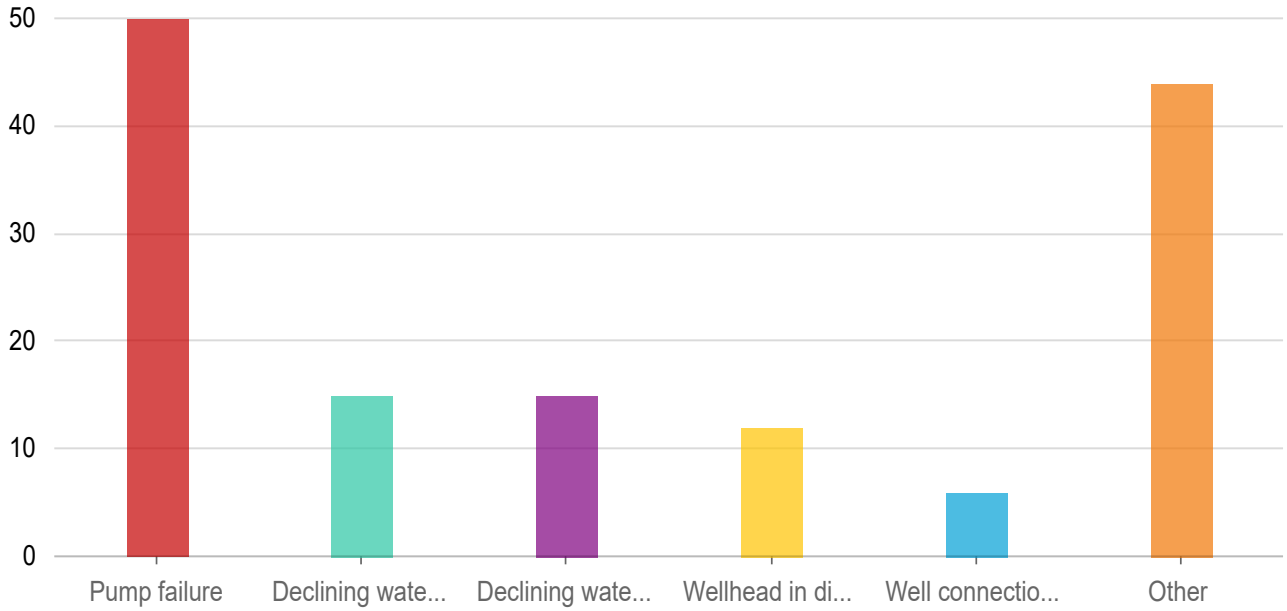
○ Do you now or have you ever had any concern about the well system?



Answers	Count	Percentage
Yes	103	20.24%
No	208	40.86%

Answered: 311 Skipped: 198

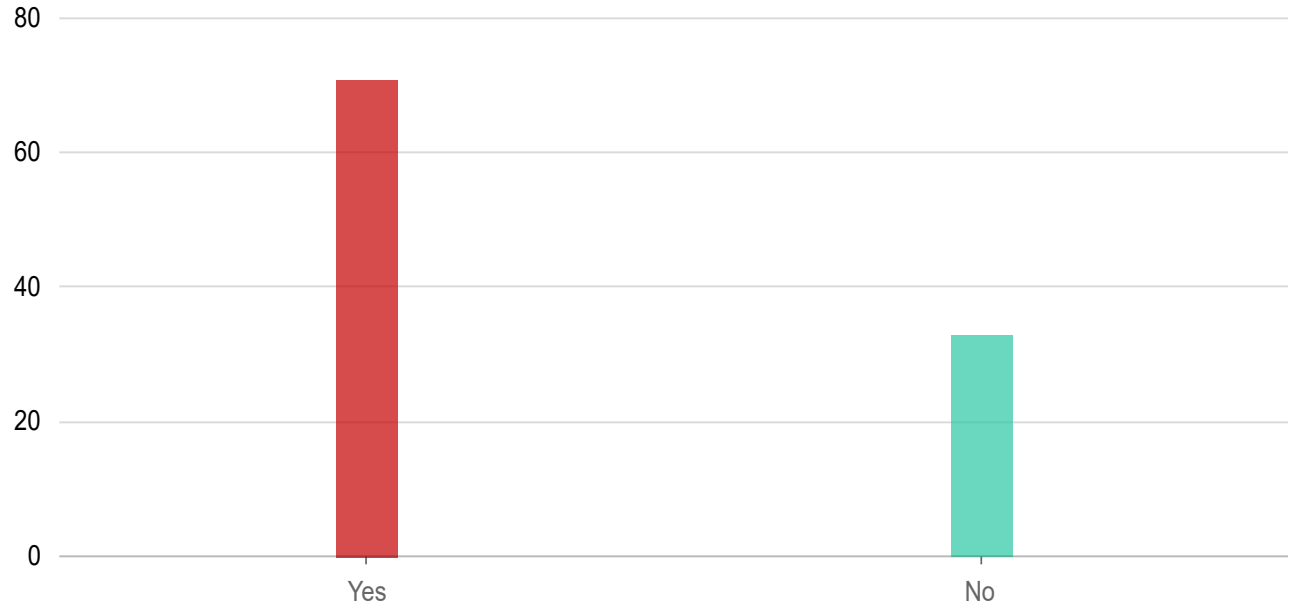
○ Well concerns:



Answers	Count	Percentage
Pump failure	50	9.82%
Declining water production	15	2.95%
Declining water quality	15	2.95%
Wellhead in disrepair or lacking tight seal	12	2.36%
Well connection to house	6	1.18%
Other	44	8.64%

Answered: 103 Skipped: 406

○ **Has the concern about the system been resolved?**

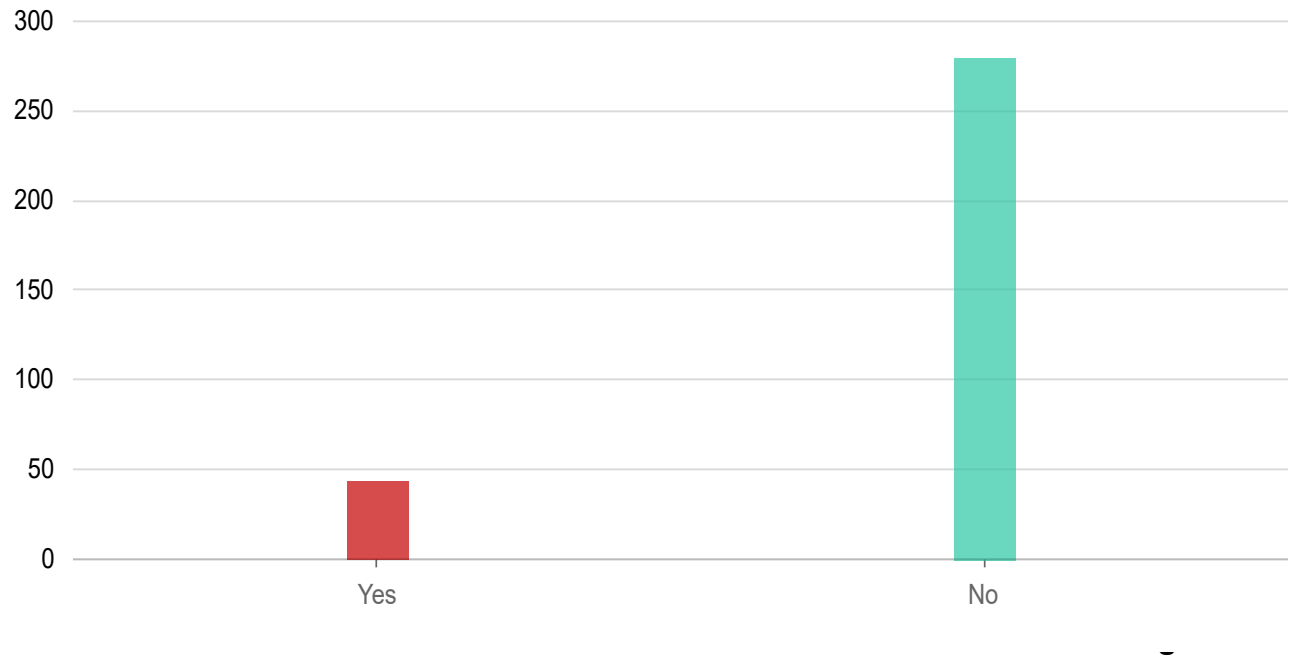


Answers	Count	Percentage
Yes	71	13.95%
No	33	6.48%

Answered: 104 Skipped: 405

About Support Available to Well Owners, Users and Managers

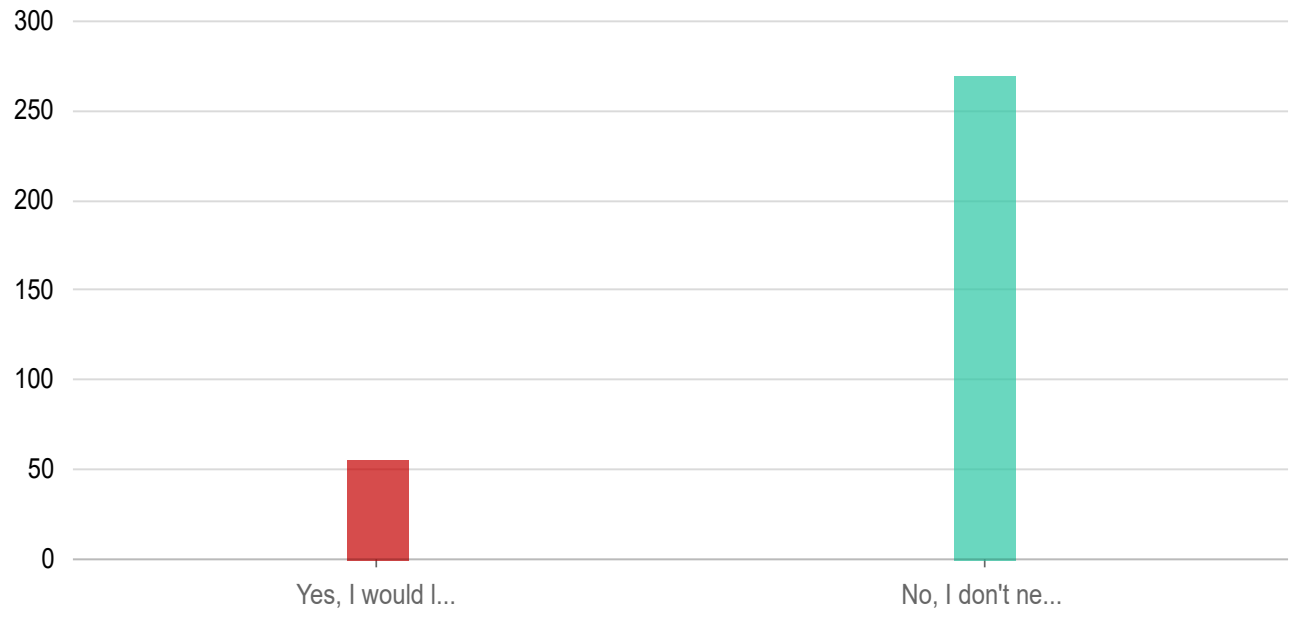
○ Are you interested in receiving information about County guidelines and requirements for well aban…



Yes	44	8.64%
No	280	55.01%

Answered: 324 Skipped: 185

○ Would you like information about connecting to a public water system?

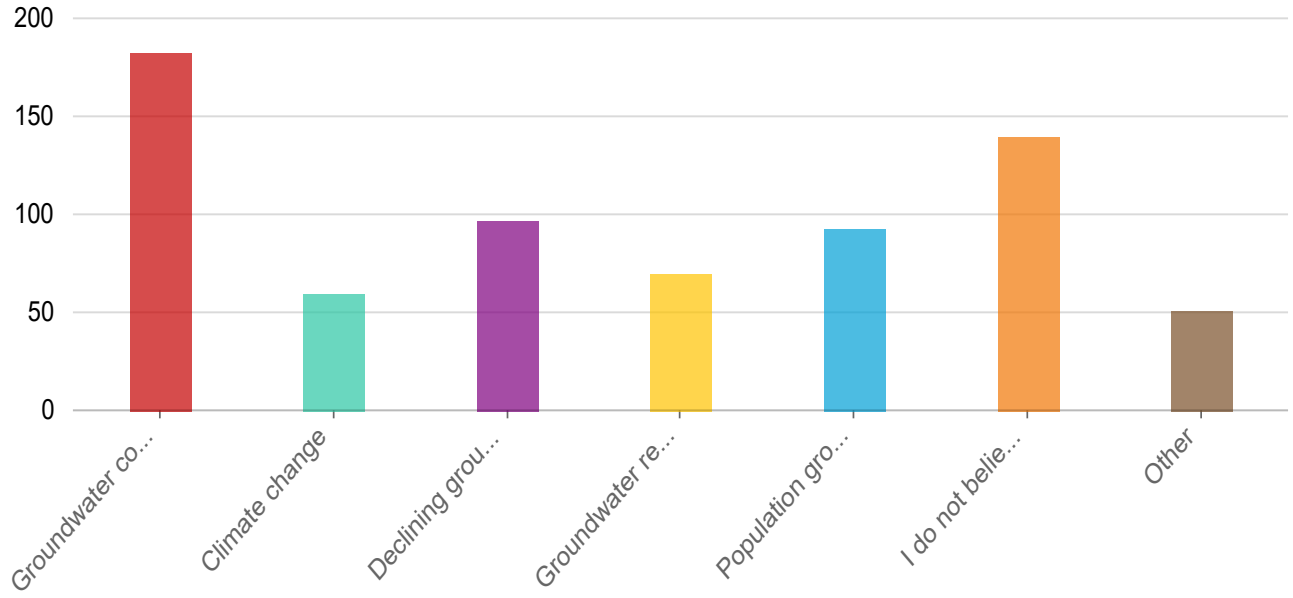


Answers	Count	Percentage
Yes, I would like to know more about connecting to the public water system.	56	11%
No, I don't need any information about connecting to the publi c water system.	270	53.05%

Answered: 326 Skipped: 183

About Groundwater

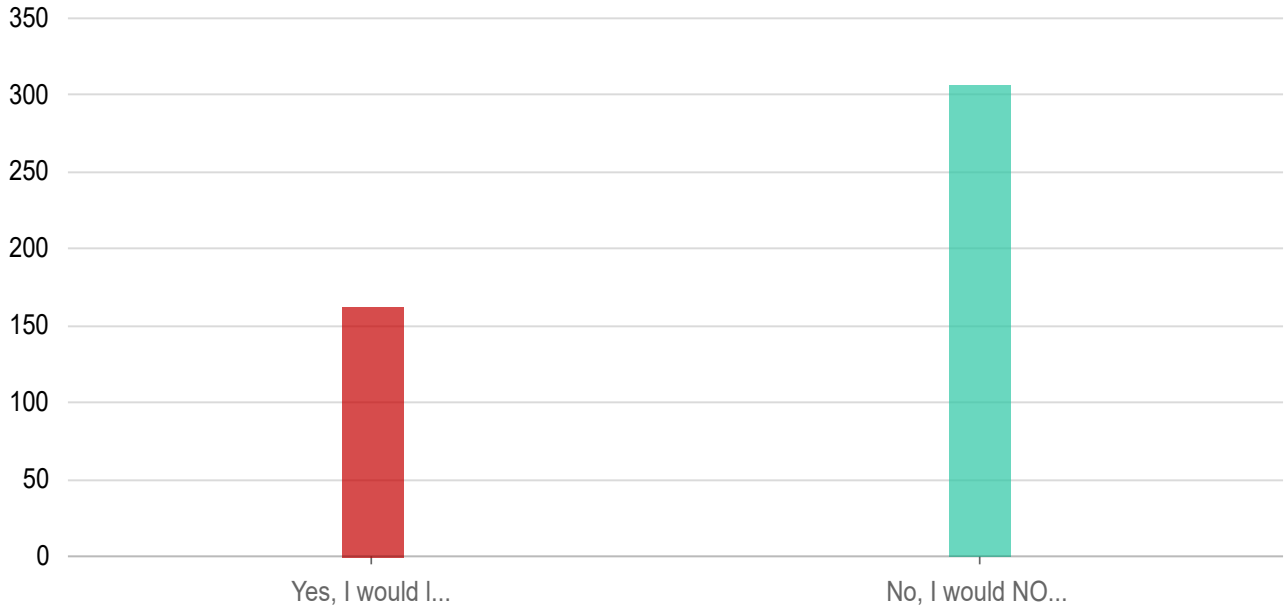
○ What do you consider the top three groundwater concerns in our South Tahoe community?



Answers	Count	Percentage
Groundwater contamination	183	35.95%
Climate change	60	11.79%
Declining groundwater levels	97	19.06%
Groundwater regulation	70	13.75%
Population growth; future water demands	93	18.27%
I do not believe there are any groundwater-related concerns in the South Shore area.	140	27.5%
Other	51	10.02%

Answered: 408 Skipped: 101

○ **Would you like to receive occasional District email updates about local groundwater management an…**



Answers	Count	Percentage
Yes, I would like to be on the District's groundwater email list	163	32.02%
No, I would NOT like to be on the District's groundwater email list	307	60.31%

Answered: 470 Skipped: 39

Tahoe Valley South Subbasin Groundwater Management Plan Stakeholder Advisory Group Workshop March 25, 2021

Site Cleanup Subaccount Program (SCAP) Regional PCE Investigation Update

Michael Novak, PG
AECOM

Introduction

- Site Cleanup Subaccount Program (SCAP) Regional Investigation Tasks
  - Records Review and Inventory Development
  - Regional PCE Plume Investigation
  - Vertical Conduit Evaluation and Destruction
  - Non-Municipal Water Supply Well Sampling
  - Soil Gas Sampling
  - Sentry Well Network Installation

2

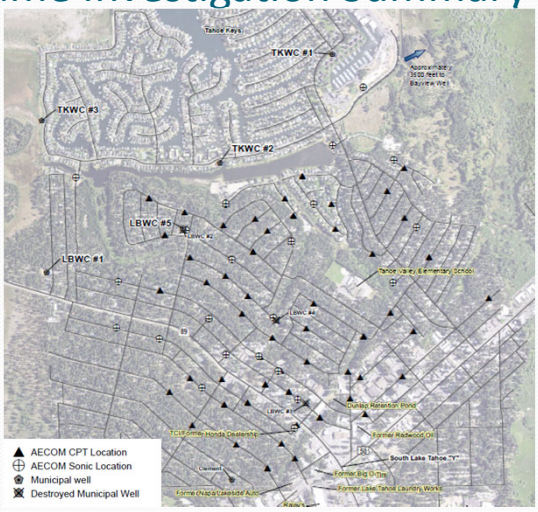
Regional PCE Plume Investigation Objectives

- Improve Conceptual Site Model
  - Develop understanding of regional subsurface lithology
  - Estimate lateral and vertical extent of PCE plume
- Support next steps
  - Design sentry wells (locations and depths of PCE near supply-well screen intervals)
  - Identify preferential pathways contributing to contaminant transport
  - Evaluate feasibility of potential remedial and receptor protection options

3

Regional PCE Plume Investigation Summary

- 22 sonic borings advanced to 300 feet bgs
- 57 Cone Penetration Test (CPT) borings advanced to 100 feet
- Approximately 6 - 8 groundwater samples collected per location



4

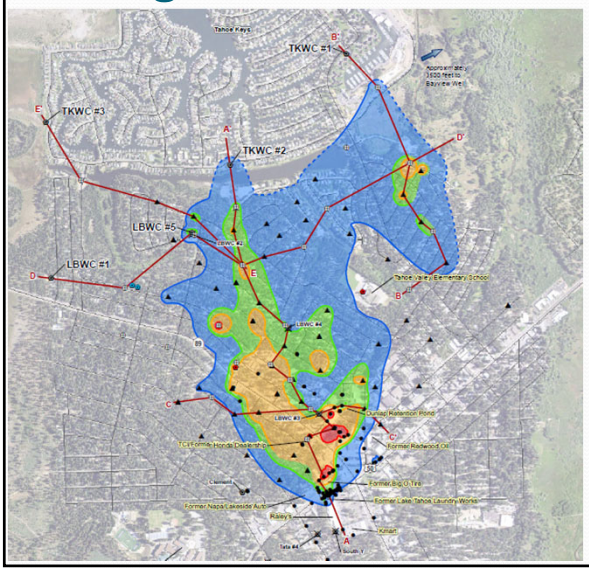
Lithology Groupings

- Continuous cores from the sonic borings were logged in accordance with the Unified Soil Classification System (USCS).
- CPT tip resistance and sleeve friction used to estimate soil type
- Earth Volumetric Studio™ (EVS) modeling software utilized to develop 3D lithologic model of the entire plume utilizing "Indicator Kriging".

USCS	Lithology
GP GW	Gravel
SM/SW-SM SW-SM SW-SP SP-SM SW/SP SP SW SW/SP-SM	Sand
SM SC SM/SP GM	Silty and clayey sand and gravel
SM/ML SP/CL SP/ML SP/ML/SM SP-SM/ML SW/ML CL/SP ML/SM ML/SP ML/SW	Interbedded sand, silt and clay
CL/ML CL-ML MH ML ML/CL CL	Silt and Clay

5

Boring and Cross Section Location Map



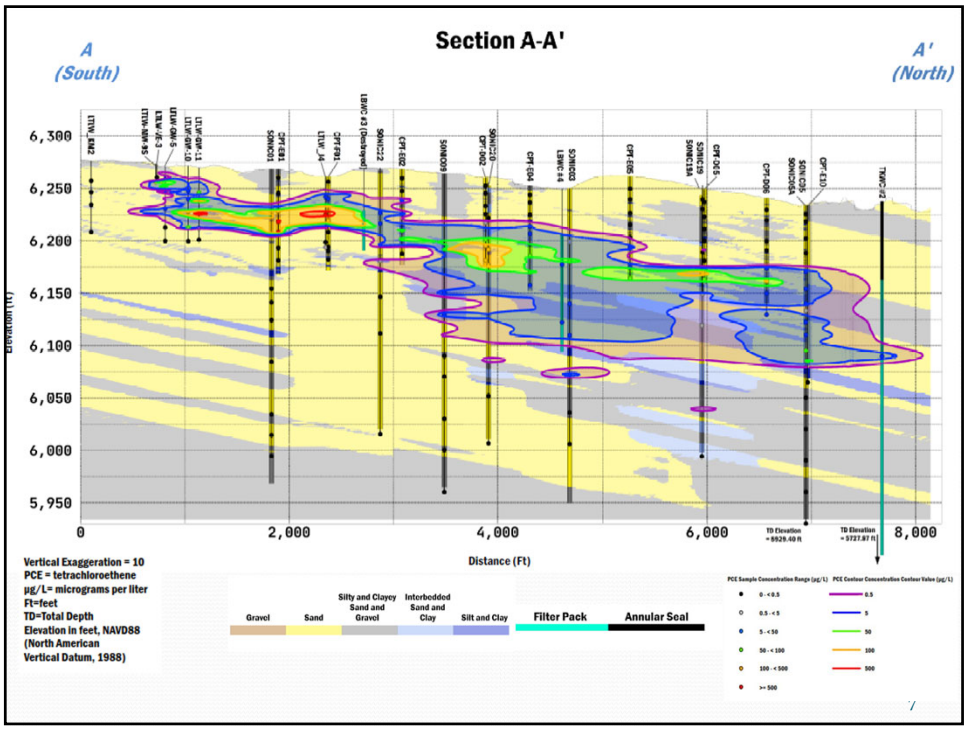
- AECOM CPT Location
- AECOM Sonic Location
- Historical Investigation Sample Location
- Municipal well
- Destroyed Municipal Well
- Private Well
- Small Community Well
- Cross Section Location

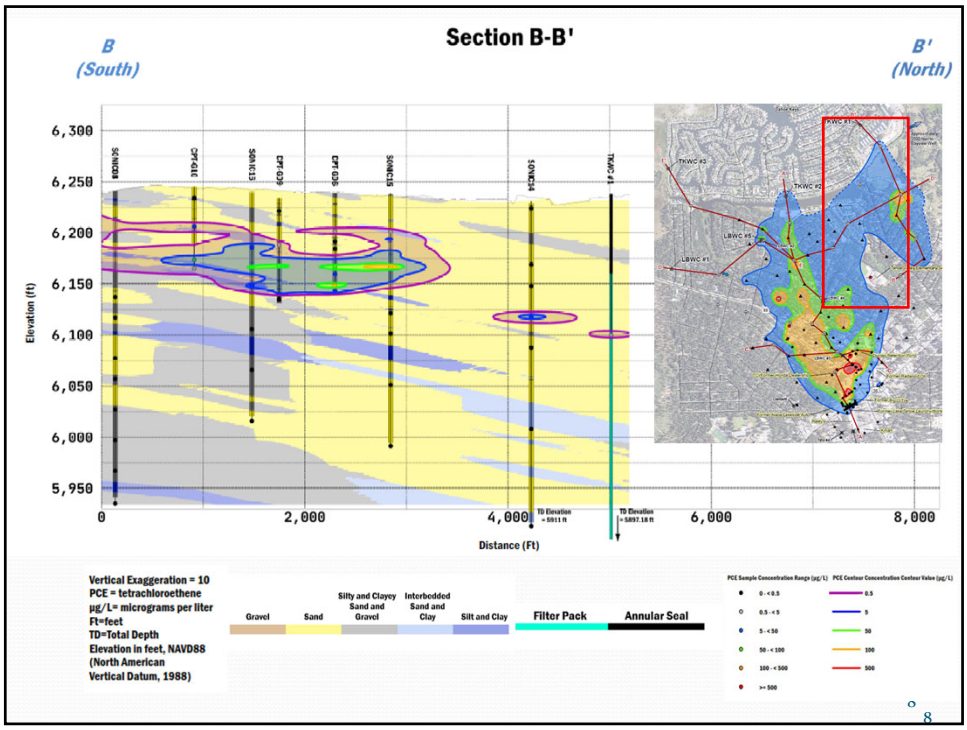
AECOM Sampled PCE Concentration Contours

- 5 - 50 µg/L
- 50 - 100 µg/L
- 100 - 500 µg/L
- >500 µg/L

PCE concentration data from January 1st, 2017 to present. Max concentration from 2018 to present was used if multiple sampling events were conducted over the past four years.

6


Section A-A'
A
(South)
A'
(North)
Elevation (ft)
Distance (Ft)
Vertical Exaggeration = 10
PCE = tetrachloroethene
µg/L= micrograms per liter
Ft=feet
TD=Total Depth
Elevation in feet, NAVD88
(North American
Vertical Datum, 1988)
Gravel
Sand
Silty and Clayey Sand and Gravel
Interbedded Sand and Clay
Silt and Clay
Filter Pack
Annular Seal


Section B-B'
B
(South)
B'
(North)
Elevation (ft)
Distance (Ft)
Vertical Exaggeration = 10
PCE = tetrachloroethene
µg/L= micrograms per liter
Ft=feet
TD=Total Depth
Elevation in feet, NAVD88
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Vertical Datum, 1988)
Gravel
Sand
Silty and Clayey Sand and Gravel
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Silt and Clay
Filter Pack
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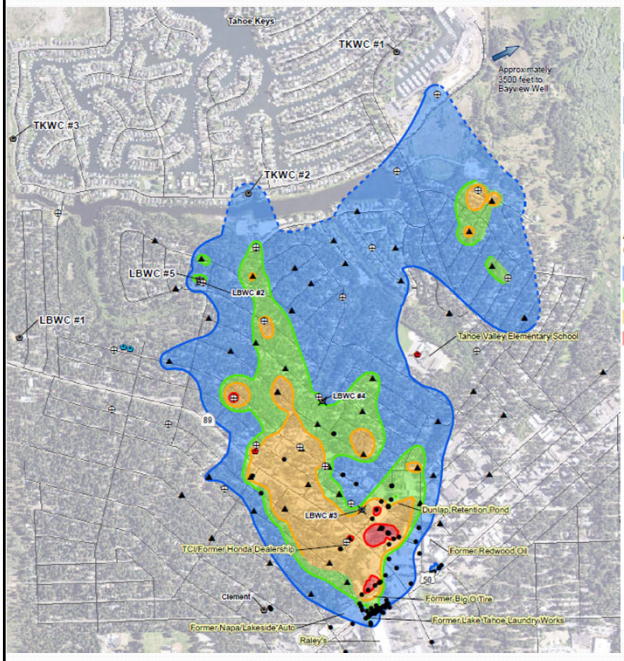

PCE Isoconcentration Map

AECOM Sampled PCE Concentration Contours

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- 50 - 100 µg/L
- 100 - 500 µg/L
- >500 µg/L

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- AECOM CPT Location
- AECOM Sonic Location
- Historical Investigation Sample Location
- Municipal well
- Destroyed Municipal Well
- Private Well
- Small Community Well
- Cross Section Location

9

2021 SCAP Schedule Summary

- **Sentry Well Installation and Sampling**
  - Evaluate receptor inventory against lithology and PCE plume
  - Work with stakeholders to finalize location and construction details
  - Well Installation, Development and Sampling – July/August 2021
- **Vertical Conduit Destruction**
  - Evaluate vertical conduit inventory against lithology and PCE plume to identify potential vertical conduits
  - Well Decommissioning (if warranted) of select, prioritized vertical conduits – June/July 2021

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2021 SCAP Field Schedule Summary (continued)

- **Soil Gas Sampling**
  - Identify proposed sampling locations based on Source Area Inventory, evaluation of shallow groundwater contamination, and potential vapor-intrusion receptors
  - Complete soil gas investigation and risk screening
  - Fieldwork July/August 2021
- **Non-Municipal Well Sampling**
  - Identify proposed new sampling locations based on receptor inventory and participant response
  - Sampling June 2021

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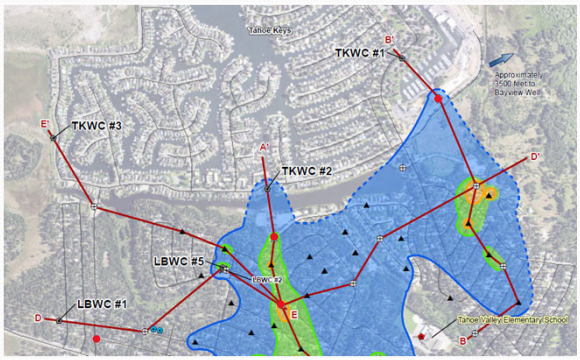
Sentry Well Network Installation

- Task Objective: Install sentry well network upgradient from threatened/impacted receptors



- Sentry well network installation anticipated to occur in July/August 2021
- Contract task includes four semi-annual monitoring events

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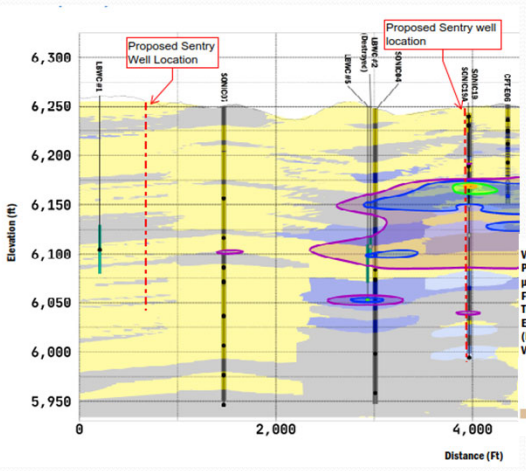
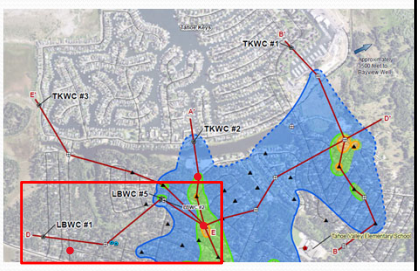
LBWC #1 and LBWC #5 Cross Section





Vertical Exaggeration = 10
PCE = tetrachloroethene
µg/L= micrograms per liter
Ft=feet
TD=Total Depth
Elevation in feet, NAVD88
(North American
Vertical Datum, 1988)

PCE Sample Concentration Range (µg/L): 0 - < 0.5; 0.5 - < 5; 5 - < 50; 50 - < 100; 100 - < 500; >= 500
PCE Contour Concentration Contour Value (µg/L): 0.5; 5; 50; 100; 500

Gravel | Sand | Silty and Clayey Sand and Gravel | Interbedded Sand and Clay | Silt and Clay

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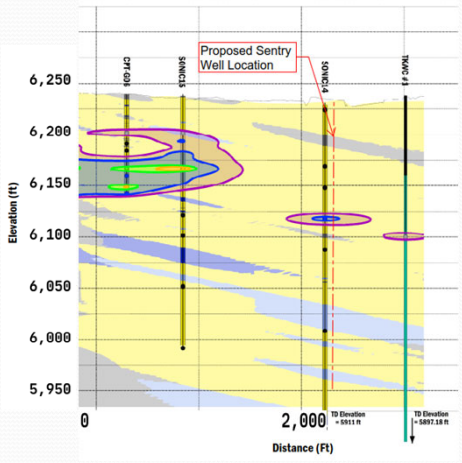
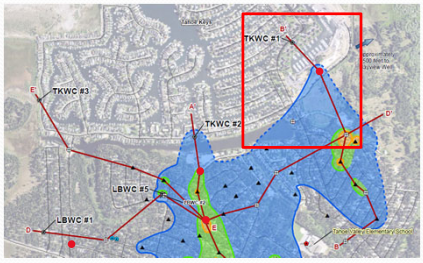
TKWC#1 Cross Section





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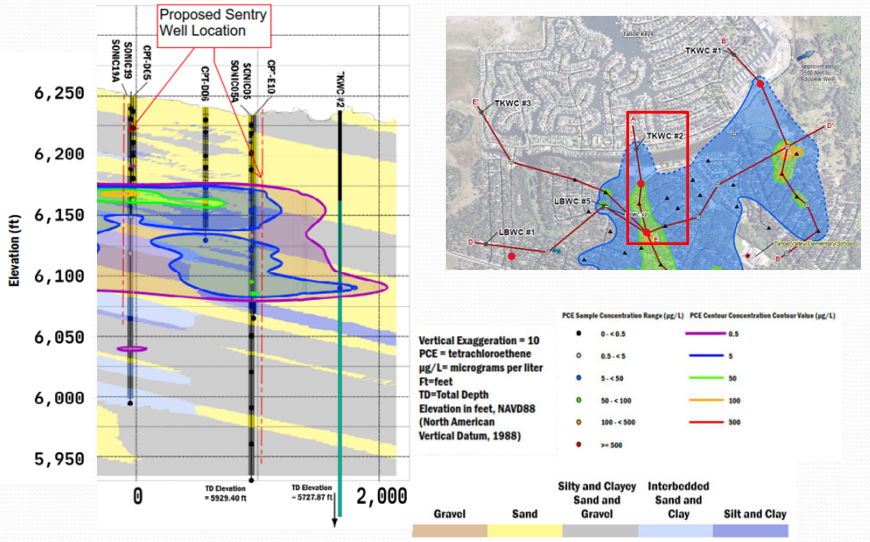
PCE Contour Concentration Contour Value (µg/L): 0.5; 5; 50; 100; 500

Gravel | Sand | Silty and Clayey Sand and Gravel | Interbedded Sand and Clay | Silt and Clay

14

TKWC #2 Cross Section



15

Soil Gas Sampling

- Task Objective: Evaluate potential threat to human health from vapor intrusion
  - Install shallow (5 ft) and deeper (10 ft) soil gas probes
  - Soil vapor samples will be collected in accordance with the Active Soil Gas Investigation Advisory
  - Conduct a Tier 1 Human Health Risk Assessment using soil gas investigation data
- Soil gas sampling anticipated to occur in August/September 2021

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Non-Municipal Water Supply Well Sampling

- Task Objective: Identify and sample domestic wells
  - 8 domestic wells sampled in October 2019
  - PCE was not detected above the RL of 0.5 ug/L in the 7 active wells and detected at 0.5 ug/L in the inactive well at Tahoe Valley Elementary
  - Two active wells were identified and property owners did not allow access
- Second round of sampling scheduled for June 2021
  - Re-sample 8 original wells sampled in 2019 plus any other identified threatened receptor wells

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Questions?

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GWMP 5-Year Update
Groundwater Model Evaluation

Susie Rybarski
Mark Hausner

DRI
Desert Research Institute

DWR Recommended actions To be addressed

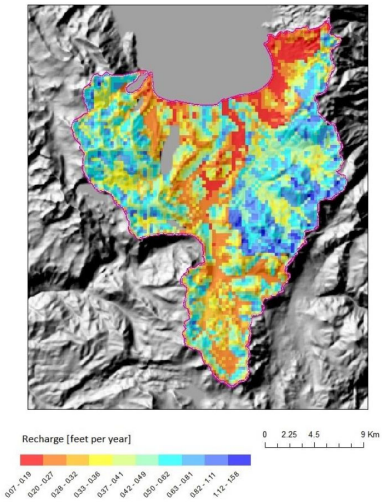
- **RA-1:** Provide water budget information in tabular form for the historical, current, and projected water budgets.
- **RA-2:** Provide a projected water budget incorporating climate change over the planning and implementation horizon of 50 years. Address the apparent discrepancy between the Groundwater Management Plan indicating a shift from snow to rain and the Urban Water Management Plan indicating no detrimental effects on the Subbasin.
- **RA-3:** Reconcile the differing future water demand trend projections between the Groundwater Management Plan, Urban Water Management Plan, and incorporate the reconciliation into the projected water budget.
- **RA-5:** Provide additional explanation for how pumping may impact plume migration or cause degraded water quality.
- **RA-6:** Provide estimates of the quantity and timing of depletions of interconnected surface water and further define what would cause depletions to become significant and unreasonable for the Subbasin.
- **RA-7:** Define quantitative criteria for groundwater levels, storage, and depletion of interconnected surface water that can be used to objectively determine compliance of the Plan with the objectives of SGMA on an ongoing basis.
- **RA-8**: Provide a description of data gaps and how they will be addressed

DRI tasks to address recommended actions

- **Task 1:** Develop updated water budgets for the 50-year planning horizon, including climate change and population growth (Addresses RA-1, RA-2, RA-3).
- **Task 2:** Summarize findings from the South Y PCE Model for inclusion in the plan (Addresses RA-5).
- **Task 3:** Delineate a Groundwater Management Area (GMA) based on the capture of water from streams and develop area-specific sustainability indicators and minimum thresholds for the undesirable results "depletion of interconnected surface water" (Addresses RA-6).
- **Task 4:** Recommend for the entire basin a set of quantitative sustainability indicators, representative monitoring sites, and minimum thresholds designed to prevent the undesirable results:
  - Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon
  - Significant and unreasonable reduction of groundwater storage
  - Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies
  - Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water
- **Task 5:** Identify data gaps that arise in addressing these issues and make recommendations on how to address those gaps (Addresses RA-8).

Task 1: Develop 50-year water budgets

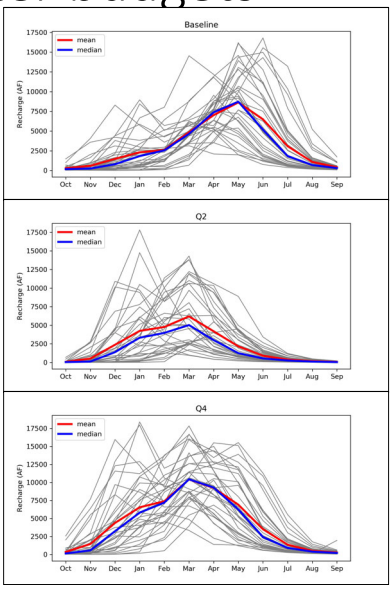
- Predictive water budgets must incorporate climate effects and changes in pumping
- Extended climate projections previously developed to address 2014 GWMP BMOs to 2099
- Projected annual pumping rates according to projections of population growth and water demand (California Dept of Finance, 2020) following historical seasonal distribution
- Existing South Tahoe groundwater model has been updated with revised recharge rates, projected pumping, and projected lake stages for a baseline model and 5 projected climate scenarios; models run through 2099



Task 1: Develop 50-year water budgets

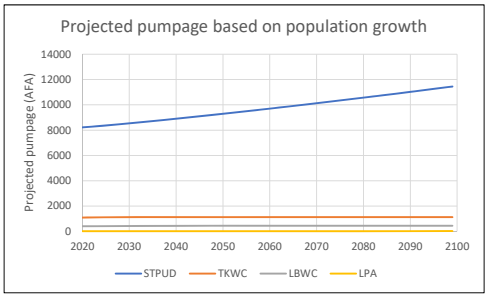
- Five climate scenarios previously developed using global climate models (CMIP5) for 2075-2099
  - Q1 – warm and dry
  - Q2 – hot and dry
  - Q3 – hot and wet
  - Q4 – warm and wet
  - Q5 – hot with no change in precipitation
- GW recharge calculated in GSFLOW for each climate scenario allows for spatial and temporal variability in recharge rates based on precipitation and temperature
- Climate scenarios assume warming/precipitation changes begin immediately; compare to historical baseline to create an envelope for predicted changes to flow budgets

Simulation	Mean (AF)	Median (AF)
Baseline	38790	34282
Q1 (warm/dry)	29206	24249
Q2 (hot/dry)	26026	19040
Q3 (hot/wet)	48254	41174
Q4 (warm/wet)	52303	46839
Q5 (warm)	36564	31119



Task 1: Develop 50-year water budgets

- Projecting pumping to future demand
  - Population projections (El Dorado County, 2020)
    - Estimated El Dorado County population growth rate for 2010-2060 = 0.37%
- Baseline (initial) pumping defined by 2007 pumpage (most conservative), future maximums defined by KJ, 2020 estimates.
- Total estimated pumpage distributed across wells in each system according to the ratio of use in 2019, and according to historical seasonal distribution to allow for monthly stress periods (LBWC 5 assumed to be online starting 10/2021).
- Pumpage at private well locations estimated based on PWOSI and PWOSII survey results



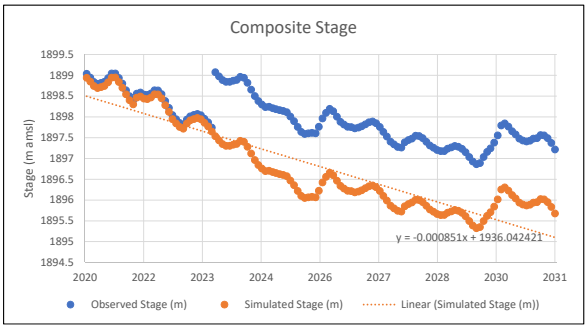
System	Future Maximum (AFA) 2007 rates + future requirement from KJ, 2020
STPUD	9241
LBWC	441
TKWC	1121
LPA	77

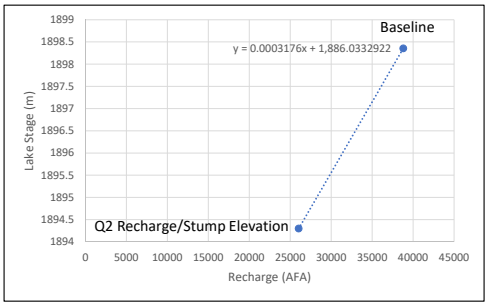
Lake Stage

- Lowest elevation submerged tree stump in Lake Tahoe at 6,214.9 ft dated to 6,300 yrs BP (Lindstrom, 1990) (compare to average of 6,228.2 ft for 1983-2015).
- Corresponding middle Holocene temperature increase of 3-5C, and reduction of runoff to Tahoe of >30% (Benson et al, 2002).
- Dry scenarios assume reduction of precipitation of 17%, temperature increase of 3-5C.
- Use 6,214.9 as low stage for Q2 (hot and dry) scenario

Lake Stage

- Generated a 'composite drought', using observed declines in stage for WY 2012-2014 and 1987-1994
- Used rate declines for Q2 (hot and dry), until mid-Holocene tree stump elevation was reached
- For all other scenarios, use stage/recharge regression to estimate equilibrium stage





Scenario	Recharge (AFA)	Lake Stage (ft)	WY Simulated	Notes
Baseline	38,790	6,228.2	2020-2099	Stage from mean of 1983-2015
Q1 (warm/dry)	29,206	6,218.2	2020-2099	Stage estimated from baseline and Q2 recharge/stage slope
Q2 (hot/dry)	26,026	6,214.9	2020-2099	Stage from submerged mid-Holocene tree stump elevation
Q3 (hot/wet)	48,254	6,232.0	2020-2099	Stage at legal limit
Q4 (warm/wet)	52,303	6,232.0	2020-2099	Stage at legal limit
Q5 (warm)	36,564	6,225.9	2020-2099	Stage estimated from baseline and Q2 recharge/stage slope

DRI tasks to address recommended actions

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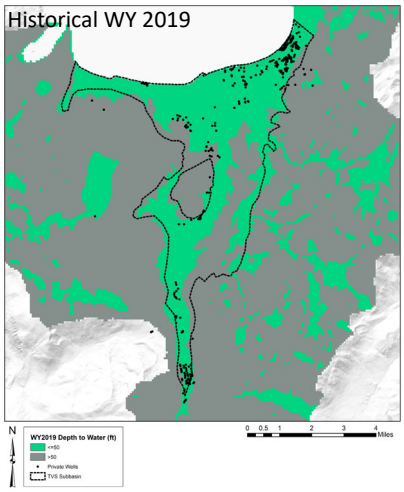
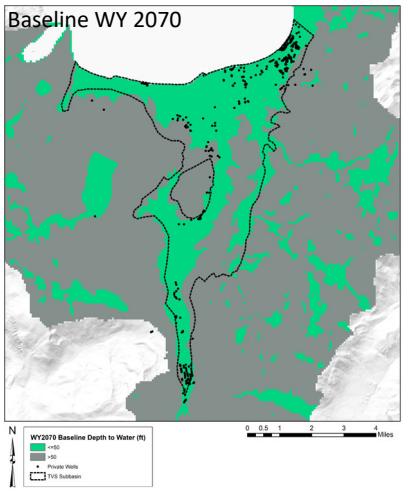
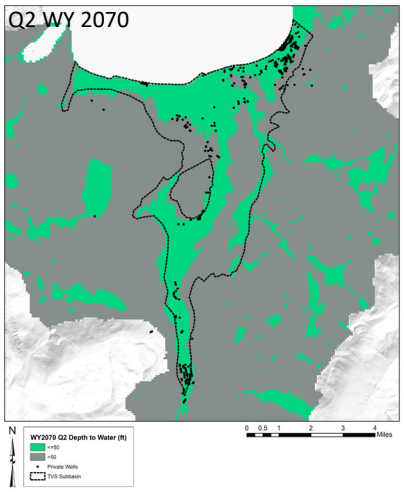
Private Well Impacts







Private Well Impacts

- 332 private wells
- Baseline WY2070 average decline in water levels at private wells = 3.7 ft
- Q2 WY2070 average decline in water levels at private wells = 15 ft

Scenario	Number of wells at DTW > 50 ft	Mean DTW (ft)	Median DTW (ft)
Historical WY 2019	34	20.90	13.12
Baseline WY2070	38	24.59	19.69
Q2 WY 2070	73	35.90	32.81

Production well drawdown/screened interval comparison

- Simulated drawdown assessed for Q2 (hot & dry) scenario from beginning of model run to end of WY 2070
- Predicted water levels adjusted to measured 11/2019 water levels where available

Well	Surface Elevation	Screen Top (ft)	Screen Bottom (ft)	WY 2070 Q2 Predicted WL Elevation (ft)	WY 2070 Q2 Predicted Height Above Screen (ft)
ALTAHOE2	6,255.37	6,145.44	5,855.44	6,201.59	56.15
ARROWHEAD3	6,343.10	6,088.97	6,058.97	6,283.99	195.02
BAKERSFIELD	6,313.74	6,183.10	6,003.09	6,273.99	90.89
BAYVIEW	6,255.49	6,071.59	5,711.59	6,212.79	141.19
COLLEGE	6,283.75	6,033.21	5,923.21	6,229.13	195.92
EIKSCLUB2	6,286.88	6,143.65	6,025.65	6,243.77	100.12
GLENWOOD5	6,259.00	6,143.65	6,025.65	6,219.25	75.59
HELEN2	6,250.18	6,160.27	6,100.26	6,206.87	46.61
LPA Well 3	6,244.31	6,075.31	5,903.31	6,219.17	143.86
LUKINSBROTHERS1	6,245.00	6,113.07	6,063.07	6,209.85	96.78
LUKINSBROTHERS2	6,245.00	6,113.07	6,089.07	6,211.79	98.72
LUKINSBROTHERS5	6,240.00	6,099.07	6,060.07	6,211.79	112.72
PALOMA	6,268.27	6,080.40	5,860.40	6,202.82	122.42
SUNSET	6,249.43	5,975.60	5,820.60	6,203.46	227.86
TAHOEKEYS1	6,235.00	6,110.07	5,923.07	6,210.55	100.47
TAHOEKEYS2	6,240.00	6,102.07	5,749.07	6,211.09	109.02
TAHOEKEYS3	6,237.00	6,062.07	5,937.07	6,207.57	145.50
UPPERTRUCKEE3	6,403.71	6,326.08	6,086.07	6,372.58	46.50
VALHALLA	6,256.87	6,143.65	6,025.65	6,206.83	63.18

DRI tasks to address recommended actions

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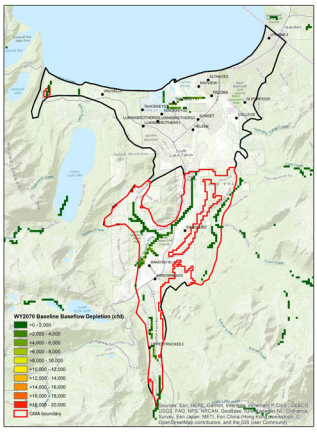
- **Task 5:** Identify data gaps that arise in addressing these issues and make recommendations on how to address those gaps (Addresses RA-8).

Task 3: Delineate a groundwater management area/develop sustainability indicators and minimum thresholds for this area

- Ran a groundwater model with no pumping (i.e. dynamic steady-state) for comparison with climate scenarios to produce monthly/annual depletion analyses.
- Spatial baseflow depletion analysis.
- GMA delineated using a capture map analysis, defined by cells expressing greater than 50% stream capture in any model layer.

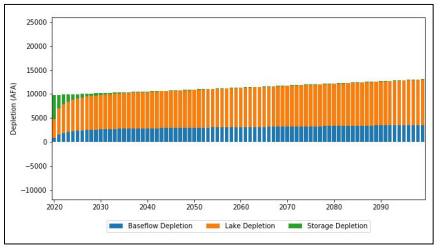


Depletion Analysis

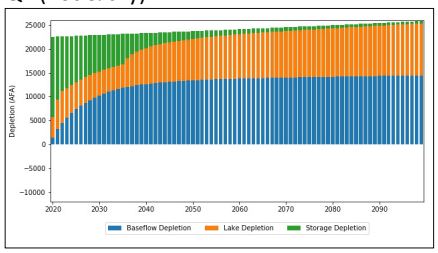
- Transient baseline model (WY2020-2099) with no pumping run for depletion analysis.
- Depletion of each flow budget component is calculated as the difference between the scenario flow budget and the no-pumping baseline model.
- For the baseline model, total system depletion is equal to the pumping rate; for climate models, total system depletion differs from the pumping rate with changes in recharge and lake stage.
- For Q3 and Q4 (wet scenarios), negative baseflow and storage depletions indicate an increase in those flows compared to the no-pumping transient simulation.

Depletion Analysis

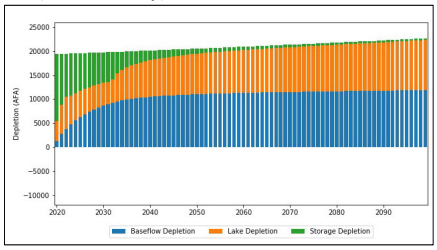
Baseline



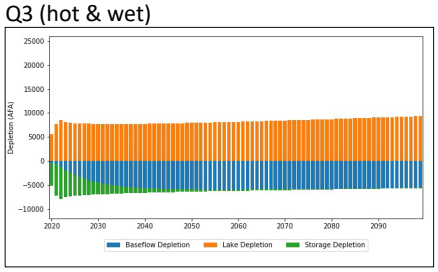
Q2 (hot & dry)



Q1 (warm & dry)

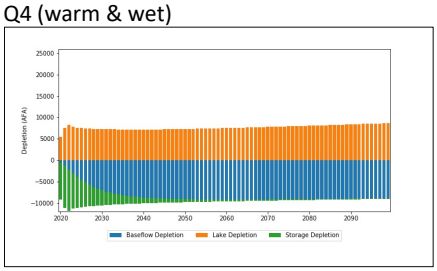


Q3 (hot & wet)

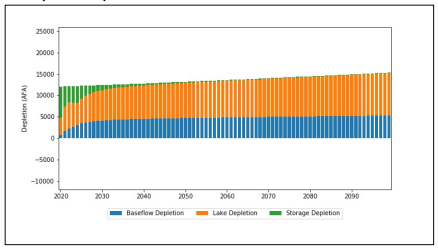


Depletion Analysis

Q4 (warm & wet)

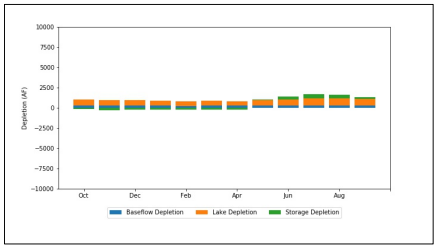


Q5 (warm)

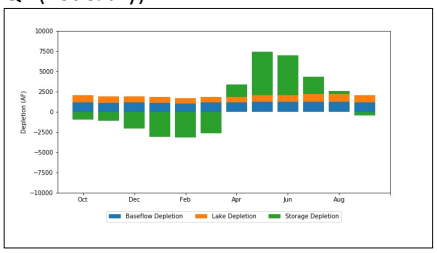


WY 2070 Monthly Depletion Analysis

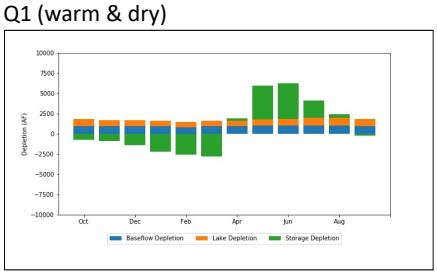
Baseline



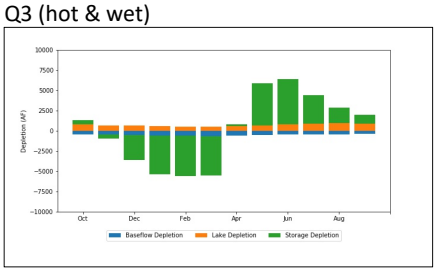
Q2 (hot & dry)



Q1 (warm & dry)

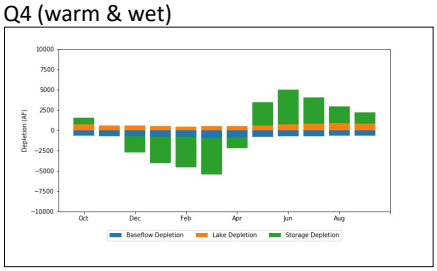


Q3 (hot & wet)

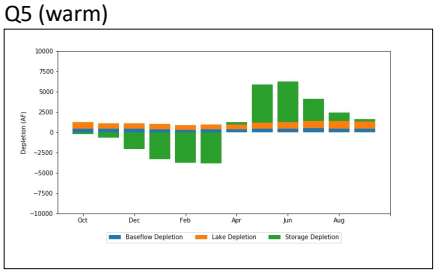


Depletion Analysis

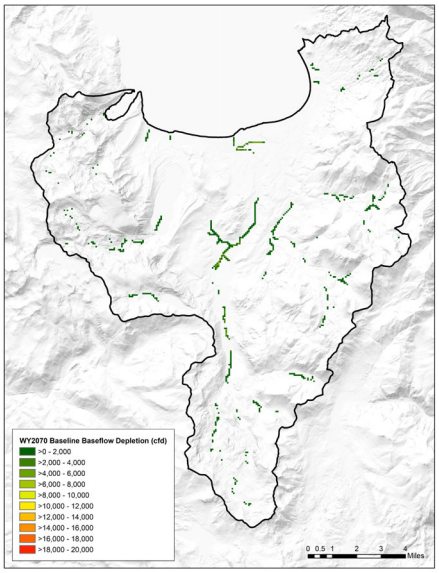
Q4 (warm & wet)

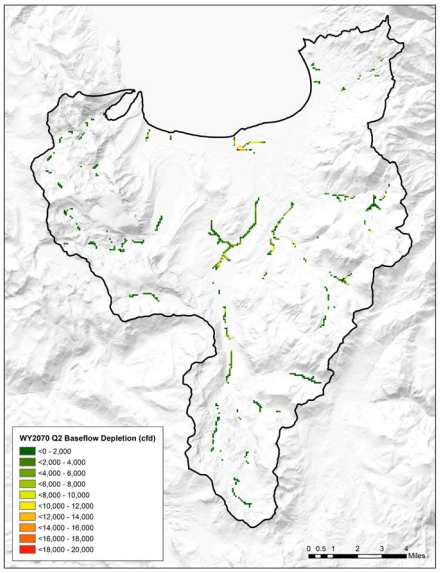


Q5 (warm)



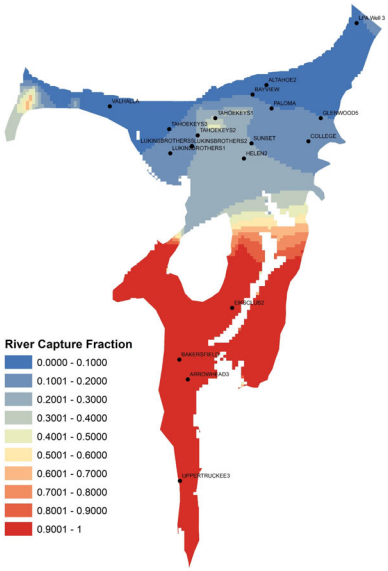
Baseflow Depletion Maps



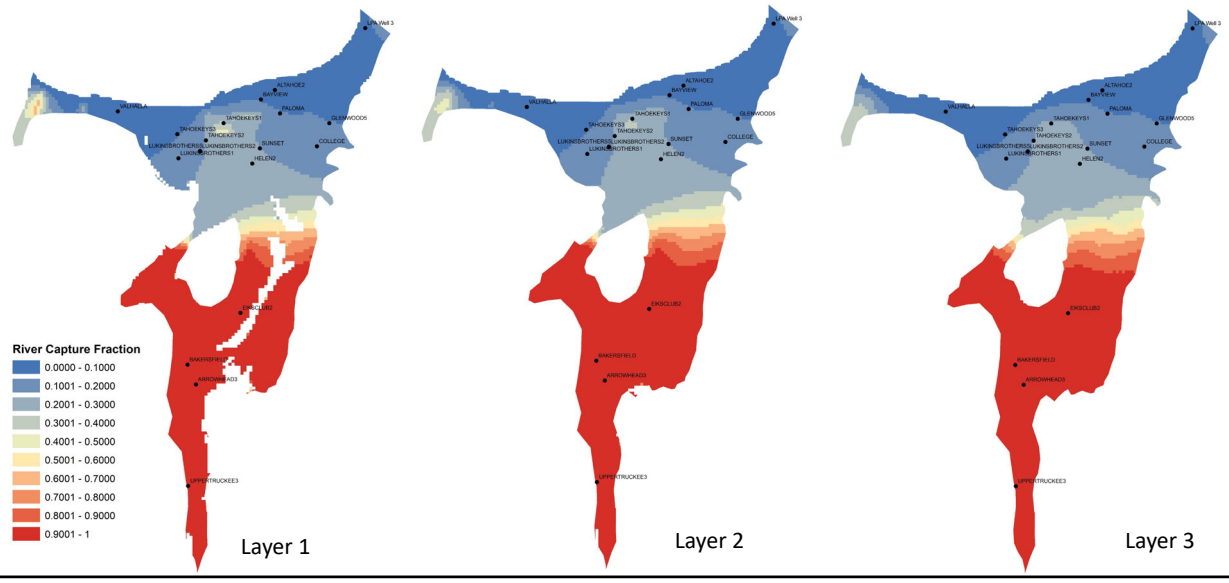


TASK 3: DELINEATE A GROUNDWATER MANAGEMENT AREA/DEVELOP SUSTAINABILITY INDICATORS AND MINIMUM THRESHOLDS FOR THIS AREA

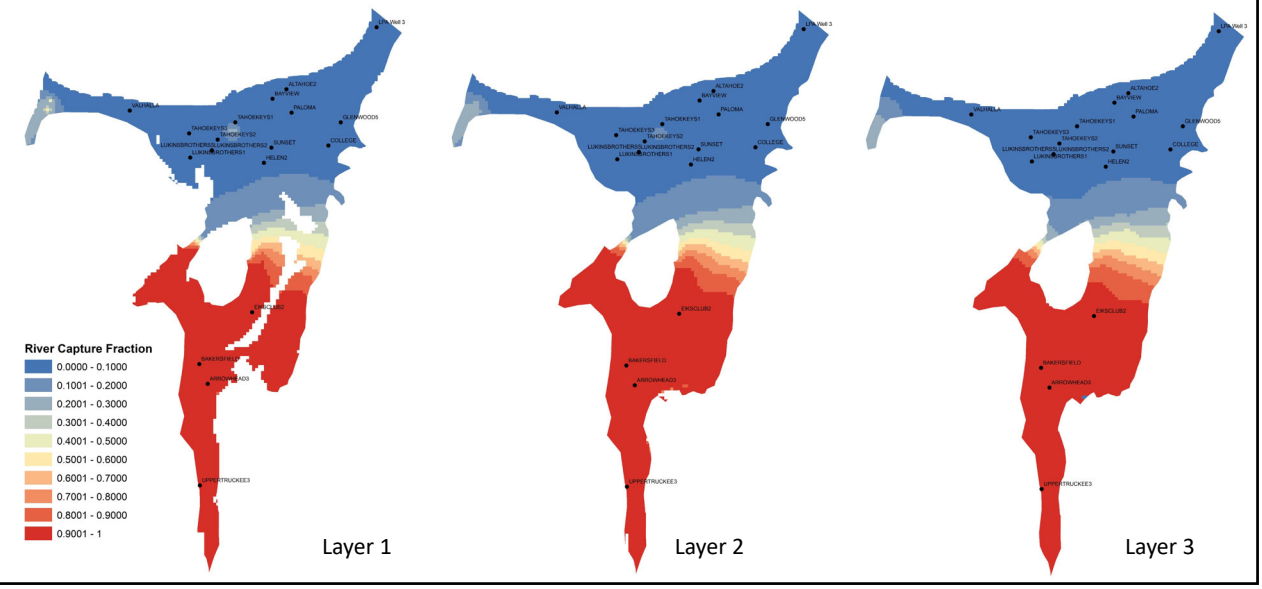
- Used to show spatially where a hypothetical well would be expected to cause an increase in aquifer recharge due to losses from interconnected surface-water features (capture).
- Capture analysis run on the steady-state model, with all municipal wells pumping at their most conservative (i.e. highest) rate from future projected rates.
- The same analysis was run on a steady-state model with the recharge rates defined by the most conservative climate scenario (hot/dry) to provide a worst-case end member.
- GMA is defined by any cells expressing greater than 50% stream capture in any model layer



Baseline Capture

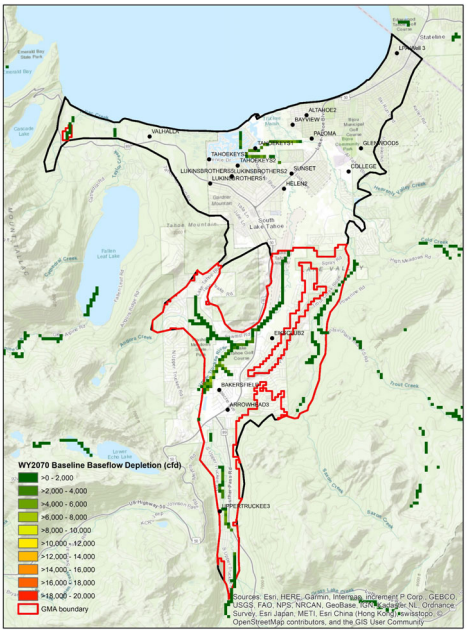


Q2 Capture



GMA

- Defined by area with greater than 50% river capture.
- Baseline GMA is more conservative.



NEXT STEPS

- Recommend for the entire basin a set of quantitative sustainability indicators, representative monitoring sites, and minimum thresholds designed to prevent the undesirable results:
  - Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply if continued over the planning and implementation horizon
  - Significant and unreasonable reduction of groundwater storage
  - Significant and unreasonable degraded water quality, including the migration of contaminant plumes that impair water supplies
  - Depletions of interconnected surface water that have significant and unreasonable adverse impacts on beneficial uses of the surface water
- Goal is to set thresholds within the range of historic variability; dependent on model results.
- Identify data gaps and recommend methods to address them
- Proposed thresholds/indicators will be presented to stakeholders to solicit feedback prior to finalization of recommendations to the District.