



Pine – Strawberry Water Improvement District

Mass Balance Analysis

Prepared by



TETRA TECH, INC.

February 18, 2010

To Drill or To Store, That is the Question!

- Mr. Taylor asked why the board has not responded to his input regarding storage in several meetings. (February 3 Board Meeting)
- When asked my opinion I stated that “storage only does good when you can fill it” but that I didn’t have enough data to support a good answer.
- After the meeting I asked if the PSWID would authorize me to do a quick Mass-Balance Analysis to determine if the PSWID should pursue sources or storage. (beginning stages of a Master Plan)
- With the authorization the following analysis was conducted.

Analysis

- Mass Balance is Similar to a Checkbook
 - Storage = Inflow – Outflow,
 - Only Difference is Unaccounted for Water
 - System Leaks
 - Inaccurate Meters
 - Storage = Inflow - Outflow - Unaccounted for Water
 - Calculated Every Day of the Year 2010

Ending Storage = (Beginning Storage) – (Demands) + (Source Inflow aka: wells) – (Unaccounted for Water)

Analysis

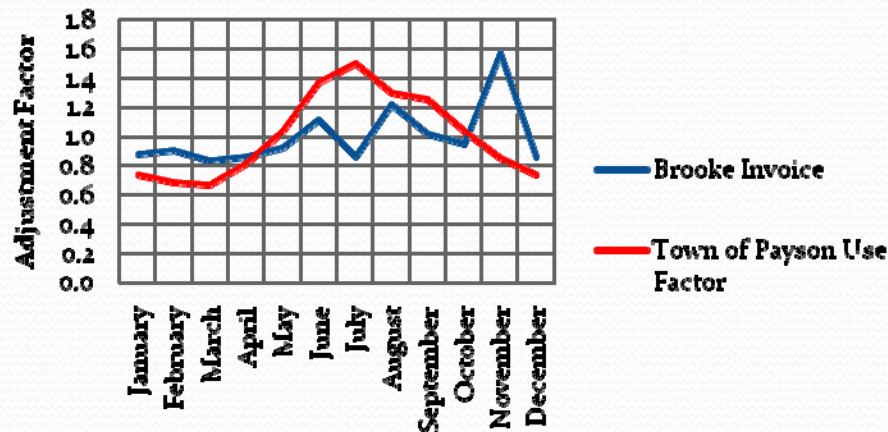
- **Beginning Storage**
 - 1.262 Million Gallons in the PSWID System
- **Demands**
 - 2000 U.S. Census Reports 2,983 people in Pine-Strawberry Voting District
 - 3,039 Active Water Meters in PSWID
 - January Total Gallons Sold is 4,727,317 Gallons
 - Town of Payson Estimates that January results in 74% of Average Use
 - $(4,727,317 \text{ Gallons} / (0.74)) = 6,388,266 \text{ Average Monthly Gallons}$
 - $(6,388,266 \text{ Gallons} / 3,039 \text{ people} / 31 \text{ Days}) = 67.8 \text{ Gallons per Person Per Day}$
 - **Estimated PSWID Average Demand = 68 gallons/person/day**
 - ADEQ Bulletin 10 Design Estimate is 100 gallons/person/day
 - Town of Payson Estimate is 89 gallons/person/day
 - Tetra Tech Estimate of Town of Payson Residential Water Usage is 71 gallons/person/day

Analysis

- **Demands Continued**

- Town of Payson Data from 1975 to 2009 (Monthly Total Demands)
 - Data Shows Monthly Variable Use Throughout The Year
 - More Water In Summer vs. Winter
 - Applied a Monthly Multiplier to Average Use
 - $(\text{Monthly Use} / \text{Annual Average}) = \text{Ratio Month to Average}$
 - Compared To BUI Revenue (T.O.P. Chosen)

Town of Payson vs. Brooke Usage Adjustment Factors

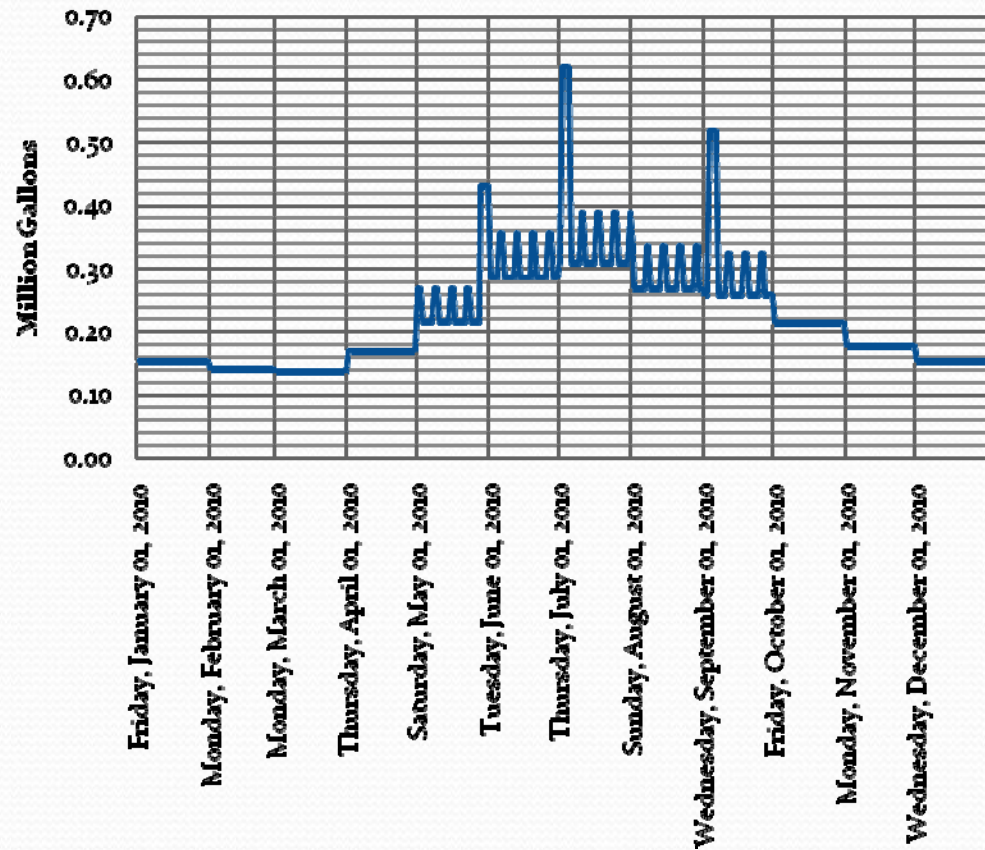


Month	Multiplier
January	0.74
February	0.68
March	0.66
April	0.82
May	1.04
June	1.37
July	1.50
August	1.30
September	1.25
October	1.03
November	0.86
December	0.74

Analysis

- **Demands Continued**
 - Summer Weekends
 - T.O.P. Estimate is 125% (SCADA)
 - Summer Holiday Weekends
 - T.O.P. Estimate is 200% (SCADA)

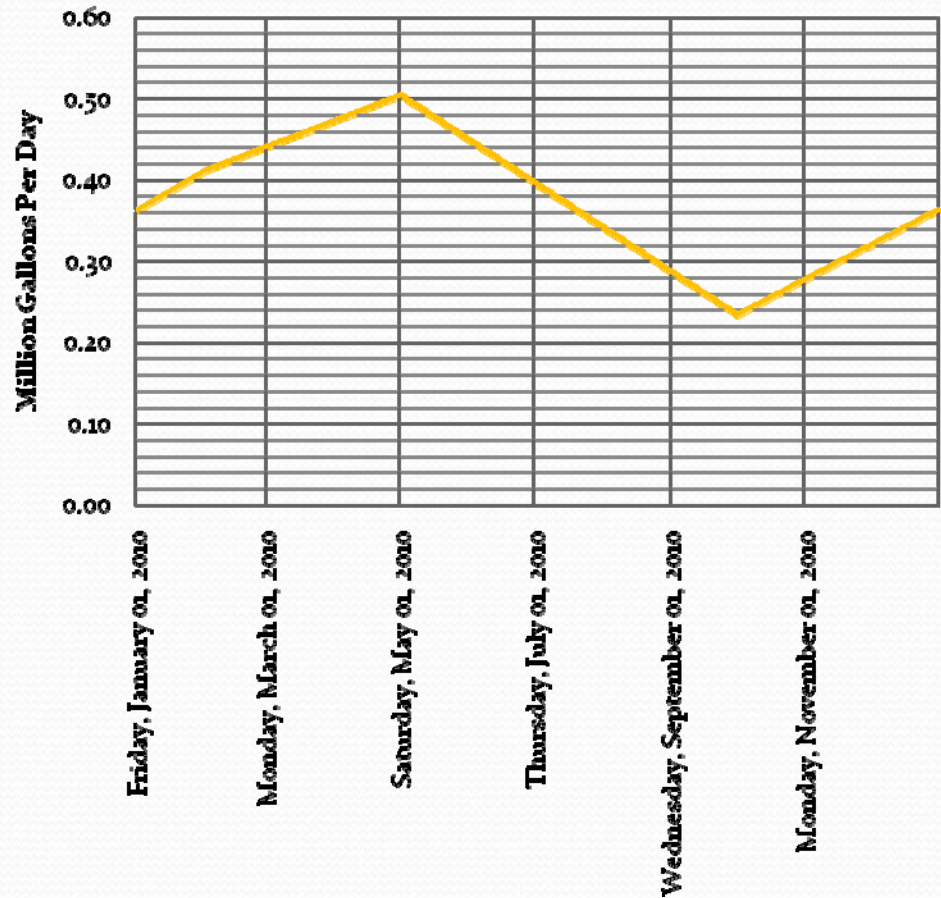
Annual Demands



Analysis

- **Well Production**
 - Changes During the Year
 - Depends on Aquifer Static Level
 - Maximum Production in Spring
 - Minimum Production In Fall
 - PSWID Estimated Production
 - 350 GPM Around May 1, 2010
 - 150-175 GPM Around October 1, 2010

Well Production



Analysis

- **Unaccounted For Water**

- January Data Used

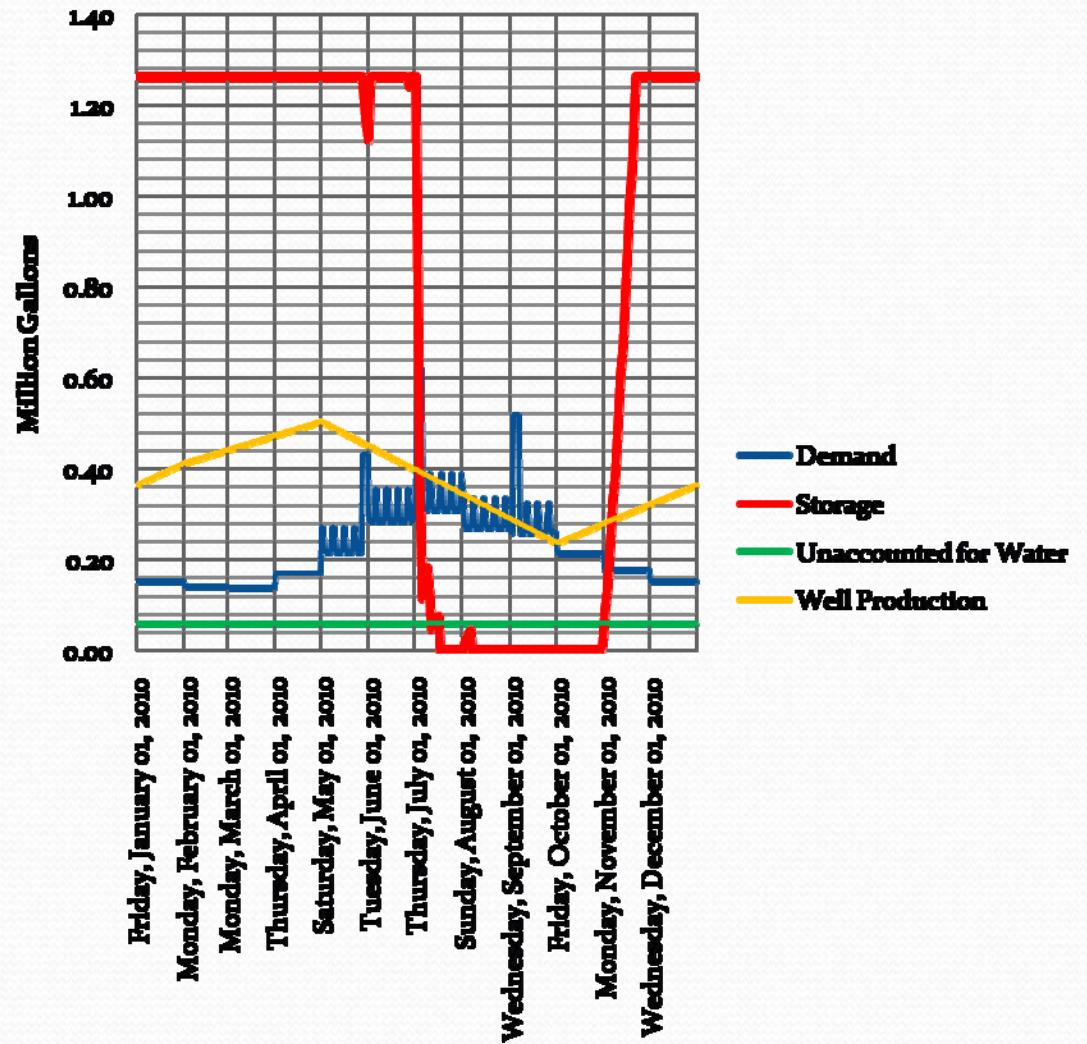
- $(\text{Total Pumped Gallons} - \text{Total Sold Gallons}) / (\text{Total Pumped Gallons}) = \text{Ratio of Unaccounted For Water}$
 - $(6,633,220 - 4,752,451) / 6,633,220 = 0.284 * 100\% = 28.4\% \text{ Unaccounted For Water}$
 - Conservatively Estimated as a Static Water Loss Per Day
 - Meter Replacement May Improve This Number

Scenario 1

- Existing Conditions

- Adequate until 4th of July
- No Storage Until November 1st
- Tanks fill by December 1st

System Characteristics



Scenario 2

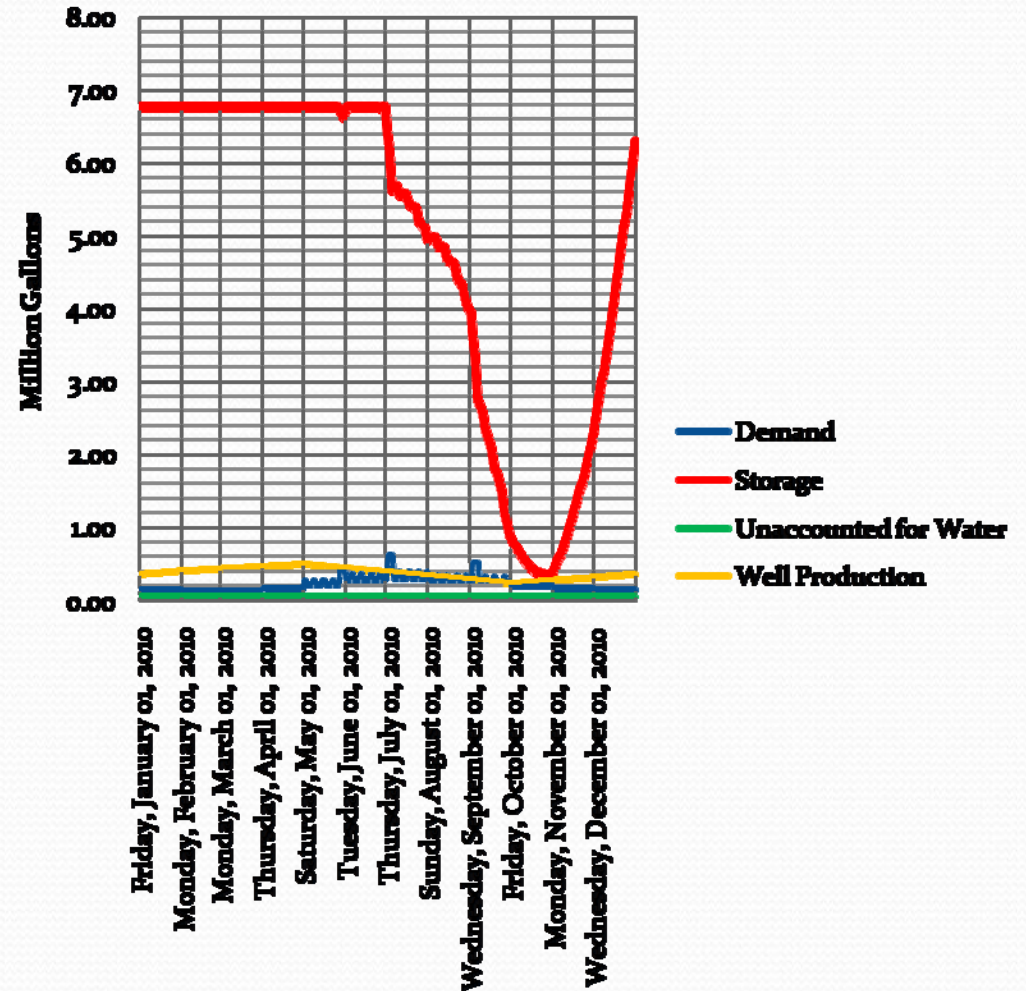
- **Additional Storage**

- Existing Storage = 1.262 Million gal.
- Added 5.5 Million gallons (6.762 total)
- Enough Storage to Make It Thru Year
- Tanks Not Filled By Year End
- Cost approx. \$5.5 million
 - Approximate Cost \$1 per gallon
 - Tank Cost only \$0.65 per gallon quoted
 - Approx. Cost Coe & Van Loo = \$1.8/gallon
 - C&VL estimate = \$9.9 Million

- **Additional Issues**

- EA and Archeological if on USFS
- Construction Fee Over \$50,000
 - Engineered Plans for ADEQ Review
 - ADEQ Approval To Construct
 - SWPPP
 - Construction Time
 - As-Builts to ADEQ
 - Needs ADEQ Approval of Construction

System Characteristics



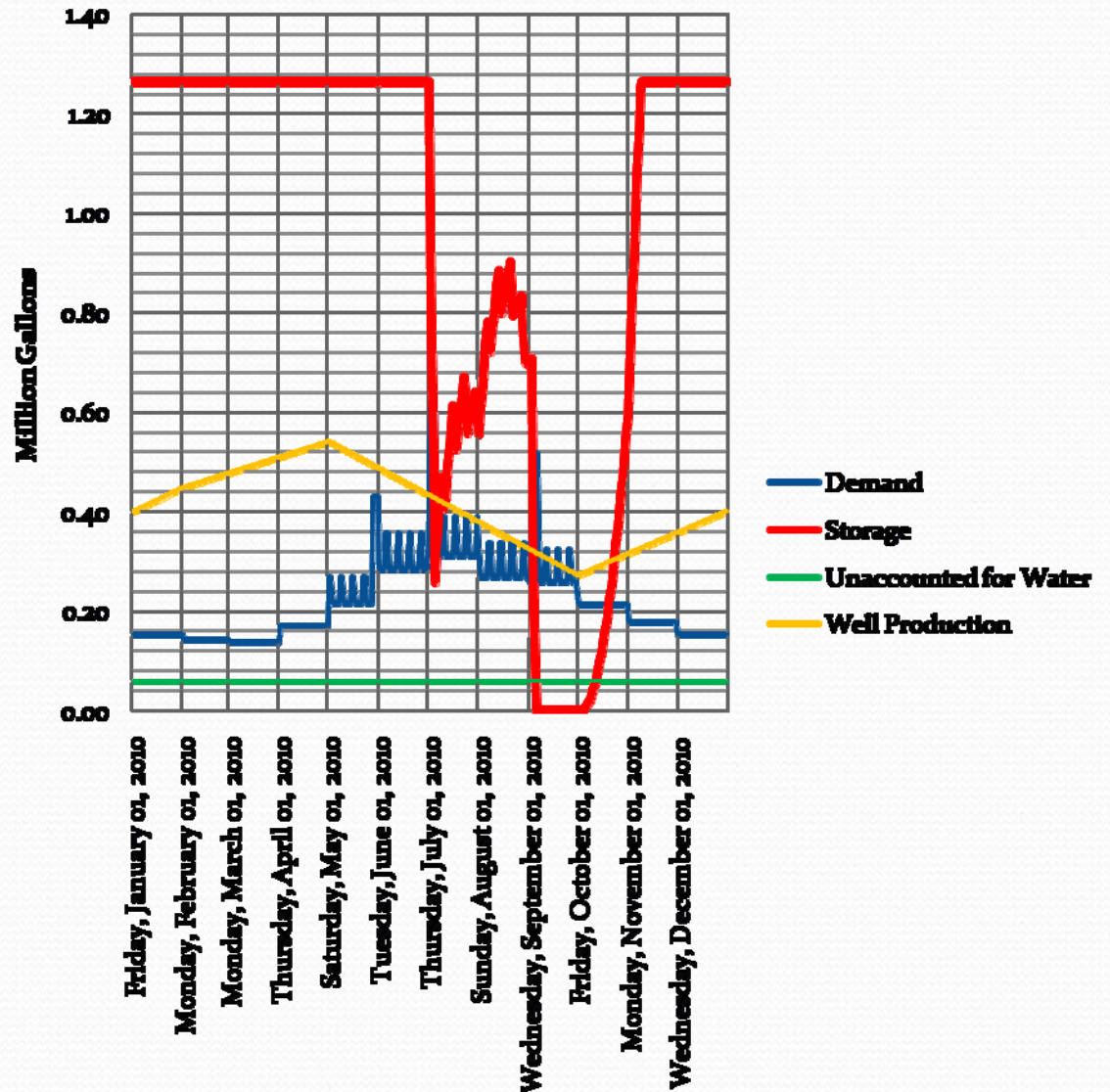
Scenario 3

- **Add SH-3 Well**

- Existing Storage @ 1.262 mil. gal.
- SH-3 @ 25 gpm, 24-hrs
- Make it to Labor Day Weekend
- Begin Recovery October 1st.

- ADEQ Approved Well Source
- \$500,000 Asking Price
- Connection cost under \$50,000
 - No ADEQ Approval To Construct Req'd.
 - Can be on-line by this summer

System Characteristics



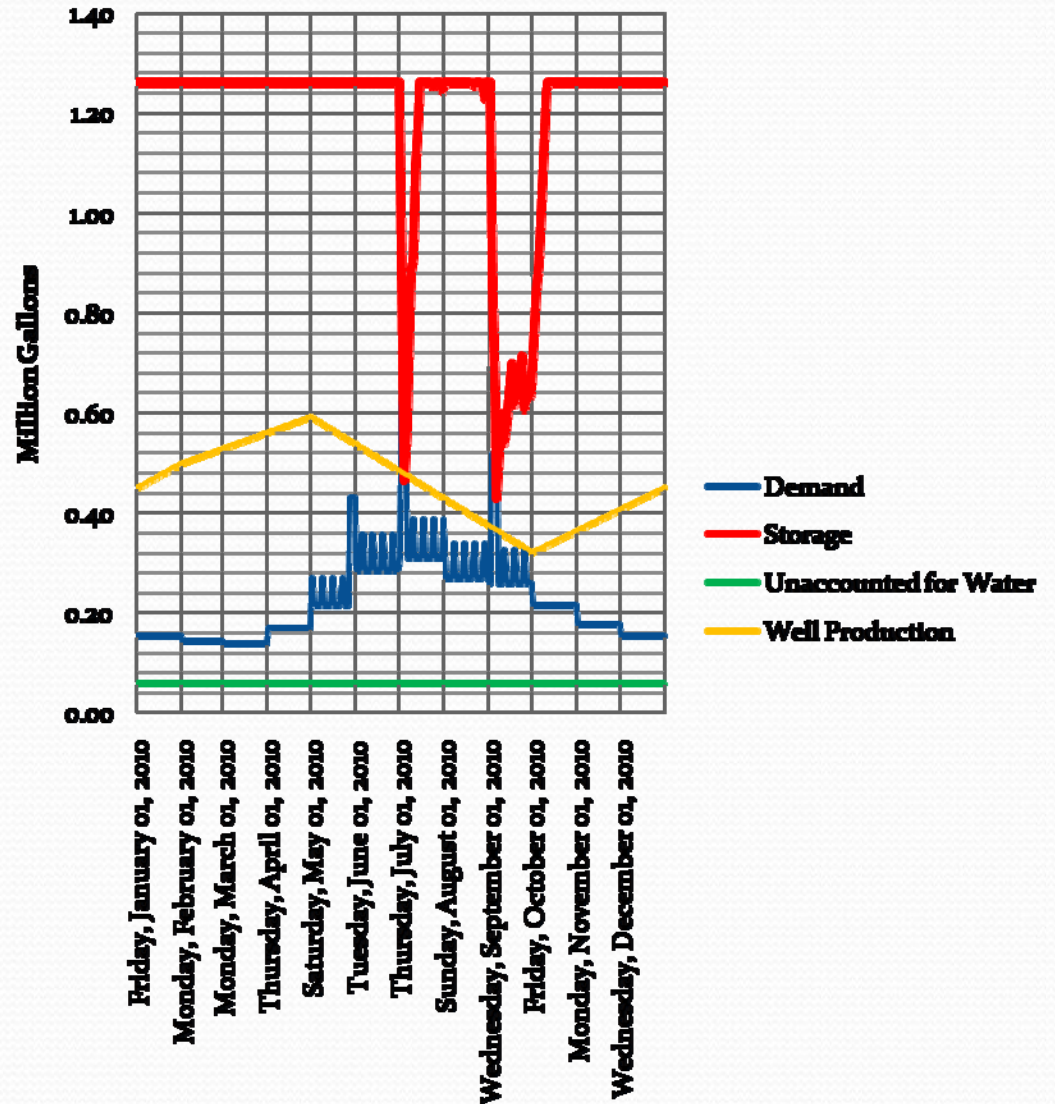
Scenario 4

- **Add SH-3 Well & Milk Ranch**
 - Existing Storage @ 1.262 mil. gal.
 - SH-3 @ 25 gpm, 24-hrs
 - Milk Ranch Proposed at 140 gpm
 - Milk Ranch @ 60 gpm, 24-hrs (per HWR)
 - SURVIVE All Year

- **\$1.2 Million Estimated Cost**
 - \$500,000 Asking Price SH-3 + Connection
 - \$400,000 + Land Asking Price Milk Ranch
 - Well Development
 - Well Connection (2,200 ft @ \$40/ft = \$88,000)

- **Milk Ranch Well Issues**
 - Well Development Completion
 - No ADEQ Source Approval Yet.
 - Connection Fee over \$50,000
 - Engineered Plans for ADEQ Review
 - ADEQ Approval To Construct
 - 404 Permitting for Pine Creek
 - SWPPP
 - Construction Time
 - As-Builts to ADEQ
 - Needs ADEQ Approval of Construction

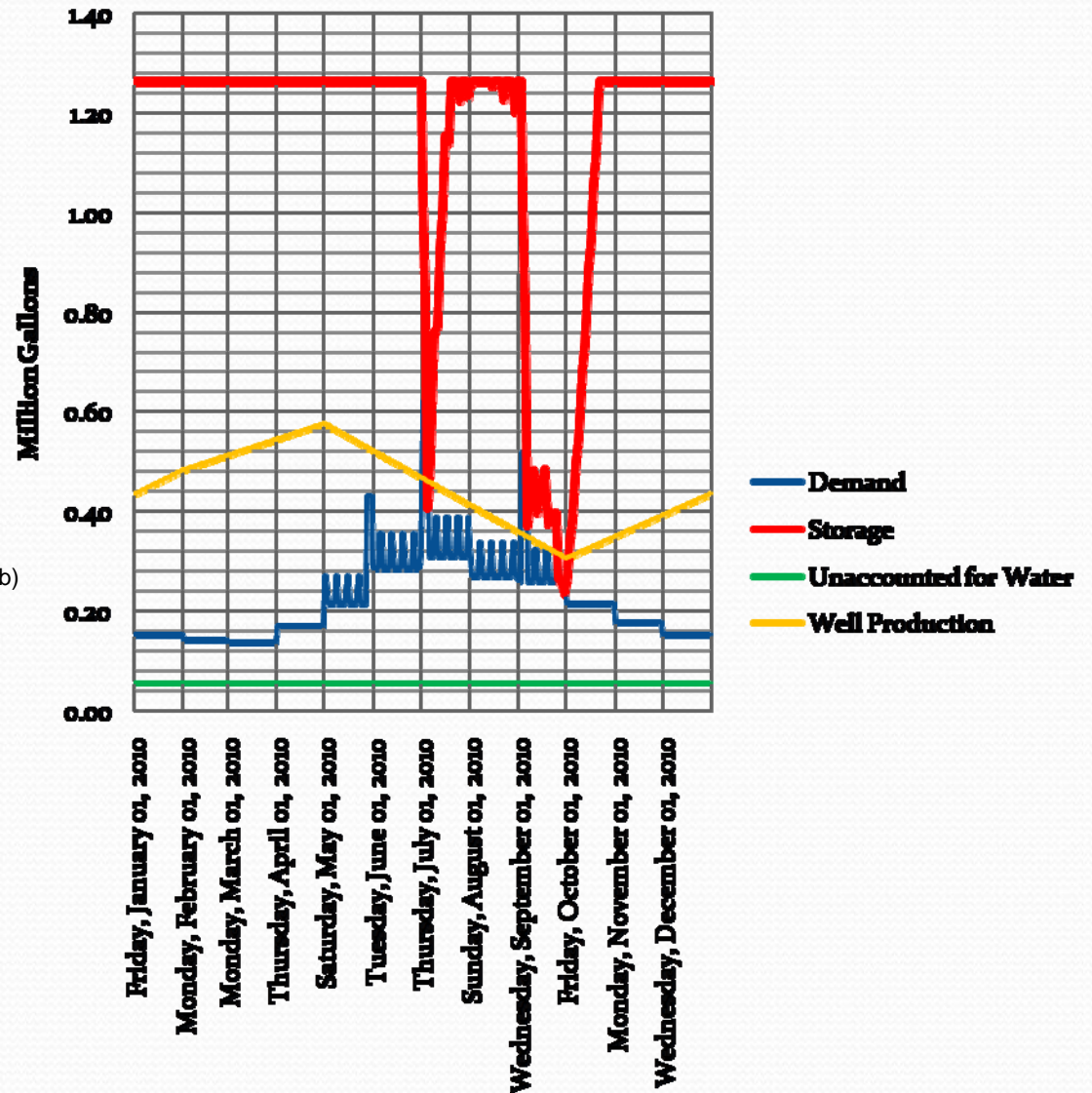
System Characteristics



Scenario 5

- **Add SH-3 Well & Hill Well**
 - Existing Storage @ 1.262 mil. gal.
 - SH-3 @ 25 gpm, 24-hrs
 - Hill Well Proposed at 60 gpm
 - Hill Well @ 25 gpm, 24-hrs (per HWR)
 - SURVIVE All Year
- **\$675,000 Estimated Cost**
 - \$500,000 Asking Price SH-3 + Connection
 - \$1 / year Lease Asking Price Hill Well
 - Well Connection To P-S Waterline (\$74,800)
 - 150 ft -12" boring (\$242 per foot + \$2500 mob)
 - 900 ft-6" waterline (\$40 per ft)
 - Water Line Extension (\$100,000)
 - 1,800 ft – 6" waterline (\$40 per ft no rock)
 - Estimate \$100,000 (with Rock)
- **Hill Well Issues**
 - No ADEQ Source Approval Yet.
 - Connection Fee Over \$50,000
 - Engineered Plans for ADEQ Review
 - ADEQ Approval To Construct
 - SWPPP
 - Construction Time
 - As-Builts to ADEQ
 - Needs ADEQ Approval of Construction

System Characteristics



Recommendations

- Pursue SH-3 Well
 - Negotiate use for this summer (Lease/Purchase?)
 - Construct connection infrastructure ASAP
 - This will buy time until Labor Day Weekend
- Pursue Additional 25 gpm
 - Milk Ranch (Possible Rain for Rent)
 - Jim Hill Well (Possible Rain for Rent)
 - Other Wells (Ivey Well, Spruce Well, Others)
 - Ivey Well and Spruce (\$171,000 each for up to 75 gpm each per HWR)
 - 3 Phase Power
 - Existing Wells owned by the PSWID
 - Quick Connection to existing water mains
 - Possible Special Meetings when information becomes available on pursuits

Questions?



TETRA TECH, INC.