This report has been prepared for the sole use of Taos Ski Valley, Inc., specifically for the design of the 250,000 gallon water storage tank to be located within the Taos Ski Valley, New Mexico and not for the use by any third parties.

We make no other warranty, either expressed or implied. Any person using this report for bidding or construction purposes should perform such independent investigation as they deem necessary to satisfy themselves as to the surface and subsurface conditions to be encountered and the procedures to be used in the performance of work on this project. If conditions encountered during construction appear to be different than indicated by this report, this office should be notified.

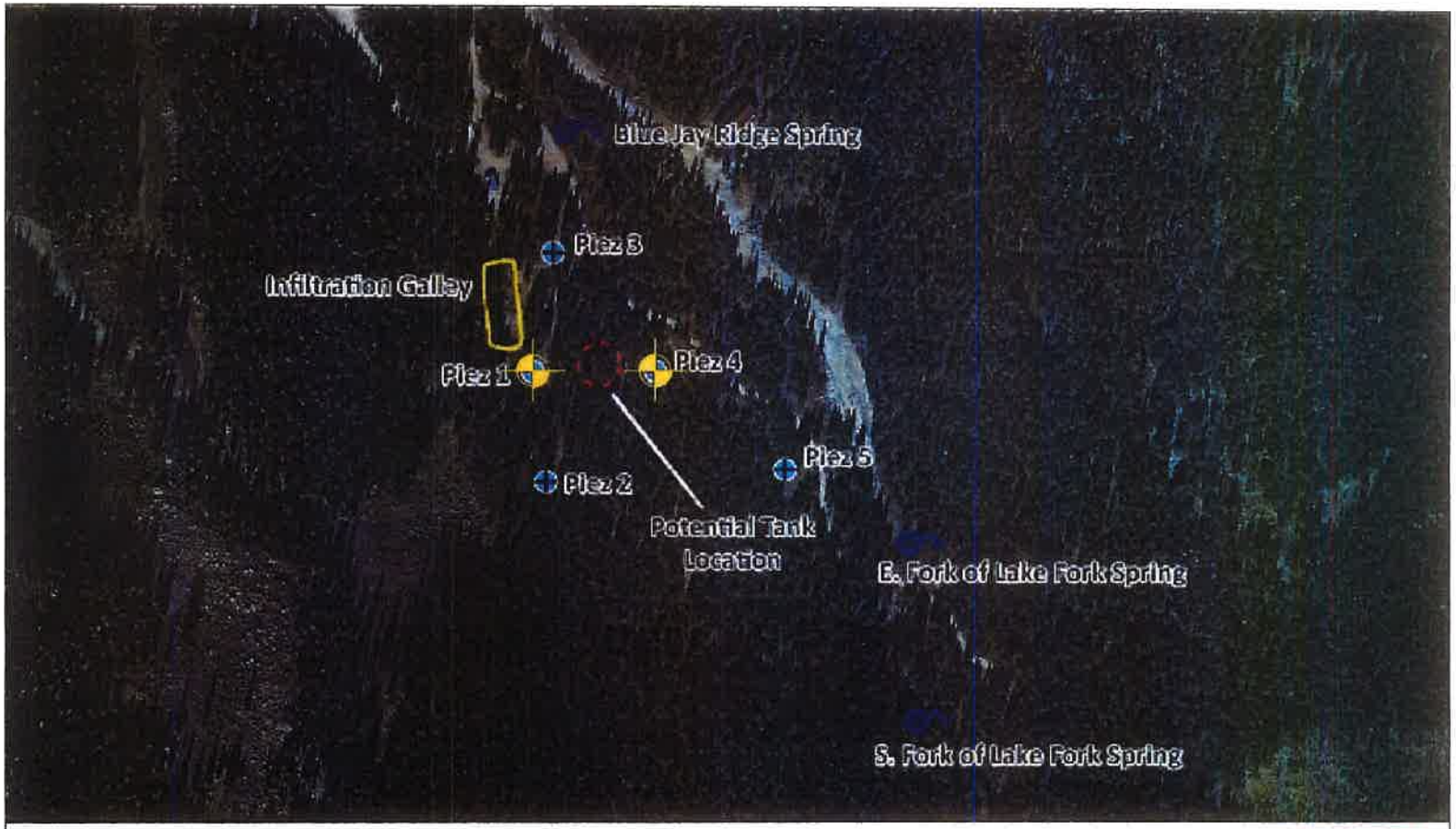
All soil samples will be discarded 60 days after the date of this report unless we receive a specific request to retain the samples for a longer period of time.

GEO-TEST, INC.
3204 RICHARDS LANE
SANTA FE,
NEW MEXICO
87507
(505) 471-1101
FAX (505) 471-2245

8528 CALLE ALAMEDA NE
ALBUQUERQUE,
NEW MEXICO
87113
(505) 857-0933
FAX (505) 857-0803

2805-A LAS VEGAS CT.
LAS CRUCES,
NEW MEXICO
88007
(575) 526-6260
FAX (575) 523-1660

BORING LOCATION MAP



Piezometer Location Map

Original Piez 3 location moved and Piez 4 eliminated at request of VTSV staff on 9/6/2017.

Piez 1 moved closer to infiltration gallery due to drilling rig access issues. New location approved by VTSV Staff on 9/8/2017.

GLORIETA GEOSCIENCE, INC.

250,000 gallon Water Tank
Taos Ski Valley, New Mexico
Job No. 1-71005

Figure 1

Yellow piezometer borings were utilized in the preparation of this report.

N W E S

GEO-TEST
GEOTECHNICAL ENGINEERING
AND MATERIAL TESTING

GEO-TEST

Project: 250,000 Gallon Water Tank
Date: 09/08/2017 Project No: 1-71005
Elevation: Type: Tube Ex

LOG OF TEST BORINGS

NO: Piez 1

GROUNDWATER DEPTH

During Drilling: 13.5 After 24 Hours:

DEPTH (Ft)	SAMPLE INTERVAL	TYPE	N. BLOWS/FT	MOISTURE %	DRY DENSITY (pcf)	USC	DESCRIPTION
0		SS	4-6-48 54	4		GM	SILTY GRAVEL with COBBLES and BOULDERS, non-plastic, very dense, slightly moist, brown
5		SS	10-14-15 29	3		GW-GM	WELL GRADED GRAVEL with SILT, SAND and COBBLES, non-plastic, dense to medium dense, slightly moist to wet, light brown
10		SS	11-8-3 11	2			
15							
20							Total Depth = 18.6 feet
25							* Note: This boring log was derived in order to show USCS soil classifiactions and SPT counts based on data provided by Glorieta Geoscience. This log does not represent data gathered by Geo-Test, Inc.
30							
35							

N blows/ft: 20 40 60 80 — 54, 29, 11

LOG OF TEST BORING 1-71005 250,000 GALLON WATER TANK, TAOS.GPJ GEO TEST.GDT 10/31/17

LEGEND

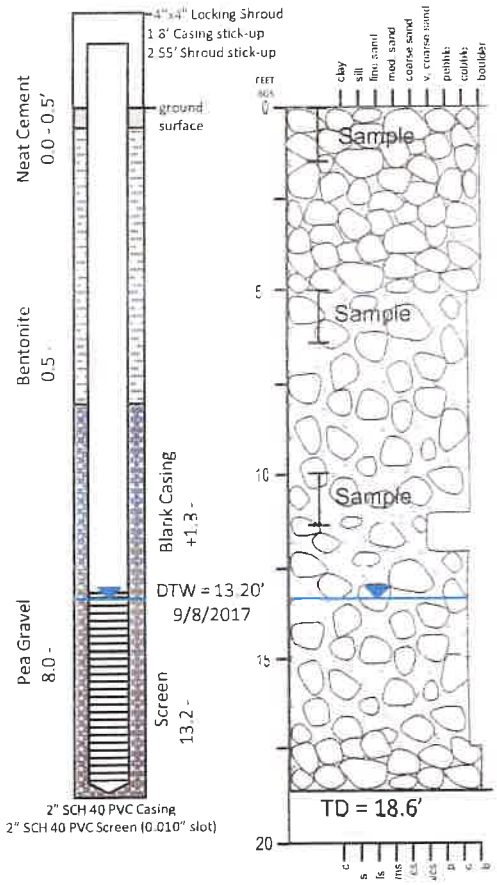
SS - Split Spoon
AC - Auger Cuttings
UD/SL - Undisturbed Sleeve
AMSL - Above Mean Sea Level
CS - Continuous Sampler
UD - Undisturbed
ST - Shelby Tube

Stratification lines represent approximate boundaries between soil types. Transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurments were made.

Piezometer Completion Piez 1

Lithologic Description

Lithologic Log



0-5.0 ft: Angular course cobble-boulder granite and amphibolite, minor vein quartz, +/- phyllite; 1-1.5 ft split spoon sample 14" recovery, 0-2" darkened soil horizon, brown, silty fine sand, 2-9" oxidized loose sandy angular gravel, 9-14" granite boulder

5.0-11.0 ft: Loose VCS, Angular pebble-cobble-gravel, composition same as above; 5-6.5 ft split spoon 12" recovery, 0-12" granite and amphibolite cobbles, angular pebbles, CS-VCS

11.0-11.5 ft: Angular-subangular pebble-cobble-gravel, composition granite and amphibolite; light brown poorly sorted, slightly clayey MS-VCS; 10-11.5 ft split spoon sample 8" recovery, granite and amphibolite angular-subangular pebble-cobble-gravel, light brown poorly sorted slightly clayey MS-VCS

12.0-15.0 ft: Subrounded-subangular loose sandy pebble-gravel, amphibolite, granite, vein quartz, phyllite. Water at ~13.5 feet

15-17.5 ft: Same as above, poor recovery

17.5-18.6 ft: Amphibolite boulder

Surveyed Location: 460783 mE, 4047592 mN
UTM NAD83 13S

Piez 1 (RG-96901-POD1): Piezometer Lithology and Completion
Lithologic log and completion schematic of Piez 1 located at Taos Ski Valley, Inc. Logged by Paul Drakos, P.G. on 9/8/2017.

GLORIETA GEOSCIENCE, INC.

GEO-TEST

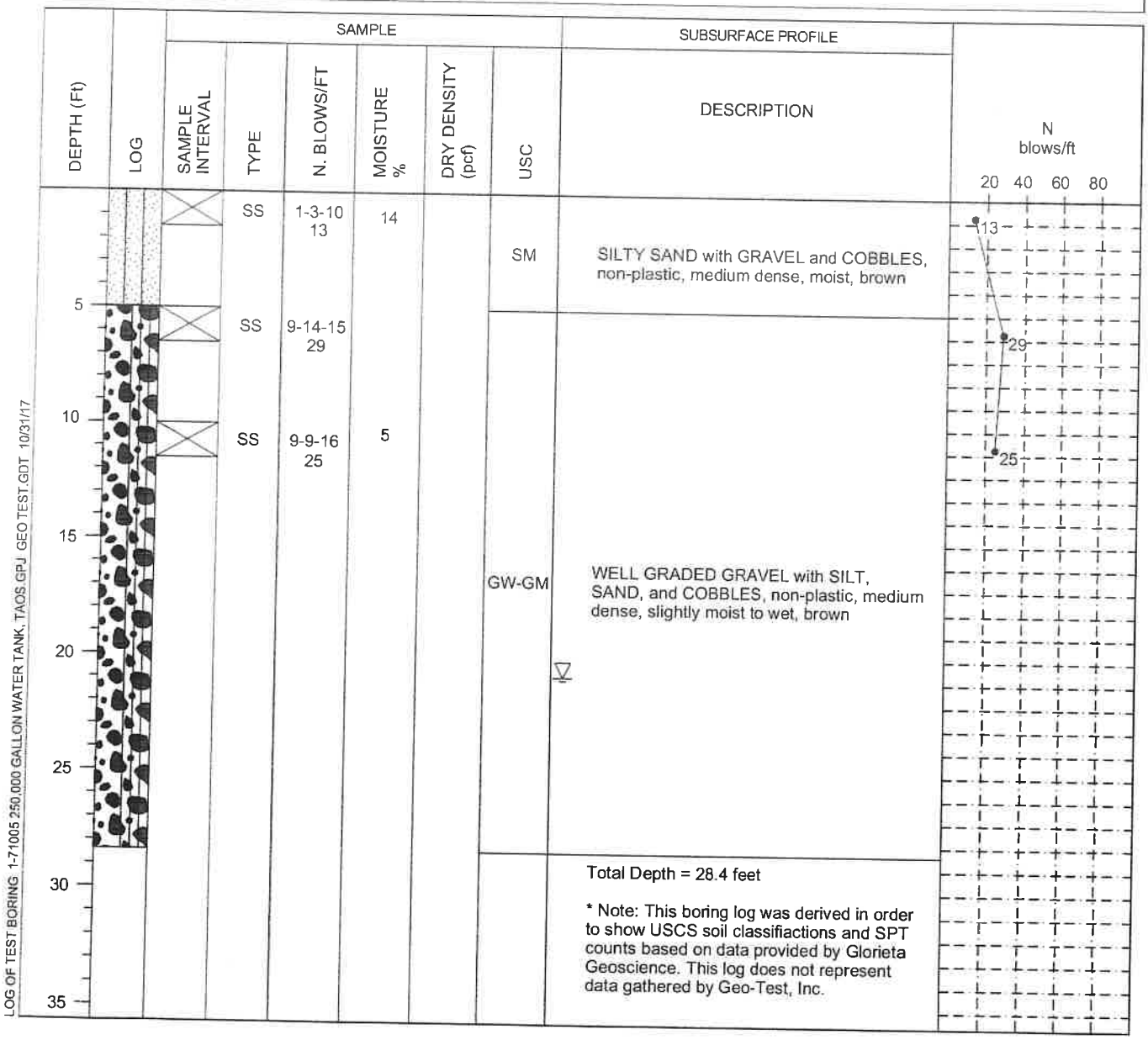
Project: 250,000 Gallon Water Tank
Date: 09/08/2017 Project No: 1-71005
Elevation: Type: Tube Ex

LOG OF TEST BORINGS

NO: Piez 4

GROUNDWATER DEPTH

During Drilling: 20.6 After 24 Hours:



LOG OF TEST BORING 1-71005 250,000 GALLON WATER TANK, TAOS.GPJ GEO TEST.GDT 10/31/17

LEGEND

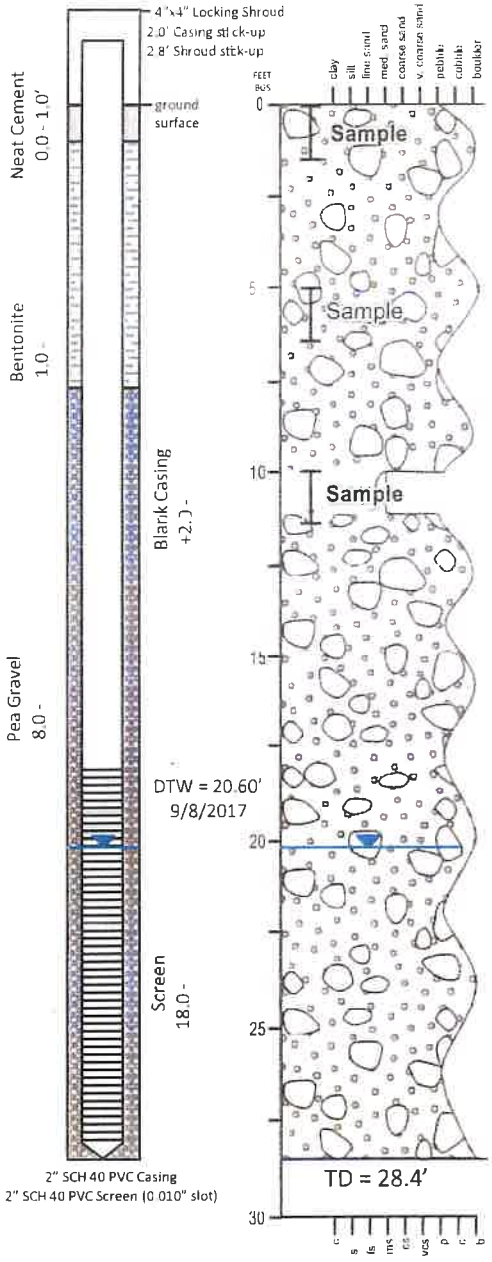
SS - Split Spoon
AC - Auger Cuttings
UD/SL - Undisturbed Sleeve
AMSL - Above Mean Sea Level
CS - Continuous Sampler
UD - Undisturbed
ST - Shelby Tube

Stratification lines represent approximate boundaries between soil types. Transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurments were made.

Piezometer Completion Piez 4

Lithologic Description

Lithologic Log



0-5.0 ft: Angular-subrounded granite and amphibolite pebble-cobble-gravel, granite-quartz lithic angular to subrounded VCS; 0-1.5 ft split spoon sample 12" recovery, 0-6" brown slightly clayey soil horizon, 6-12" brown, loose sand and angular gravel

5.0-10.0 ft: Same as above, more VCS than above, vein-quartz; 5-6.5 ft split spoon 7" recovery, 0-7" loose angular amphibolite and minor granite gravel

10.0-15.0 ft: Angular-subrounded granite and amphibolite pebble-cobble-gravel, granite-quartz lithic VCS; 10-11.5 ft split spoon sample 9" recovery; 0-7" course, loose granite gravel, 7" - 9" moist, brown, medium course sand

15.0-20.0 ft: Same as above, slightly more rounded

20.0-25.0 ft: Same as above, more amphibolite than granite

25.0-28.4 ft: Same as above

Surveyed Location: 460851 mE, 4047594 mN
UTM NAD83 13S

Piez 4 (RG-96901-POD5): Piezometer Lithology and Completion

Lithologic log and completion schematic of Piez 4 located at Taos Ski Valley, Inc. Logged by Paul Drakos, P.G. and April Jean Tafoya on 9/7 - 9/8/2017.

GLORIETA GEOSCIENCE, INC.

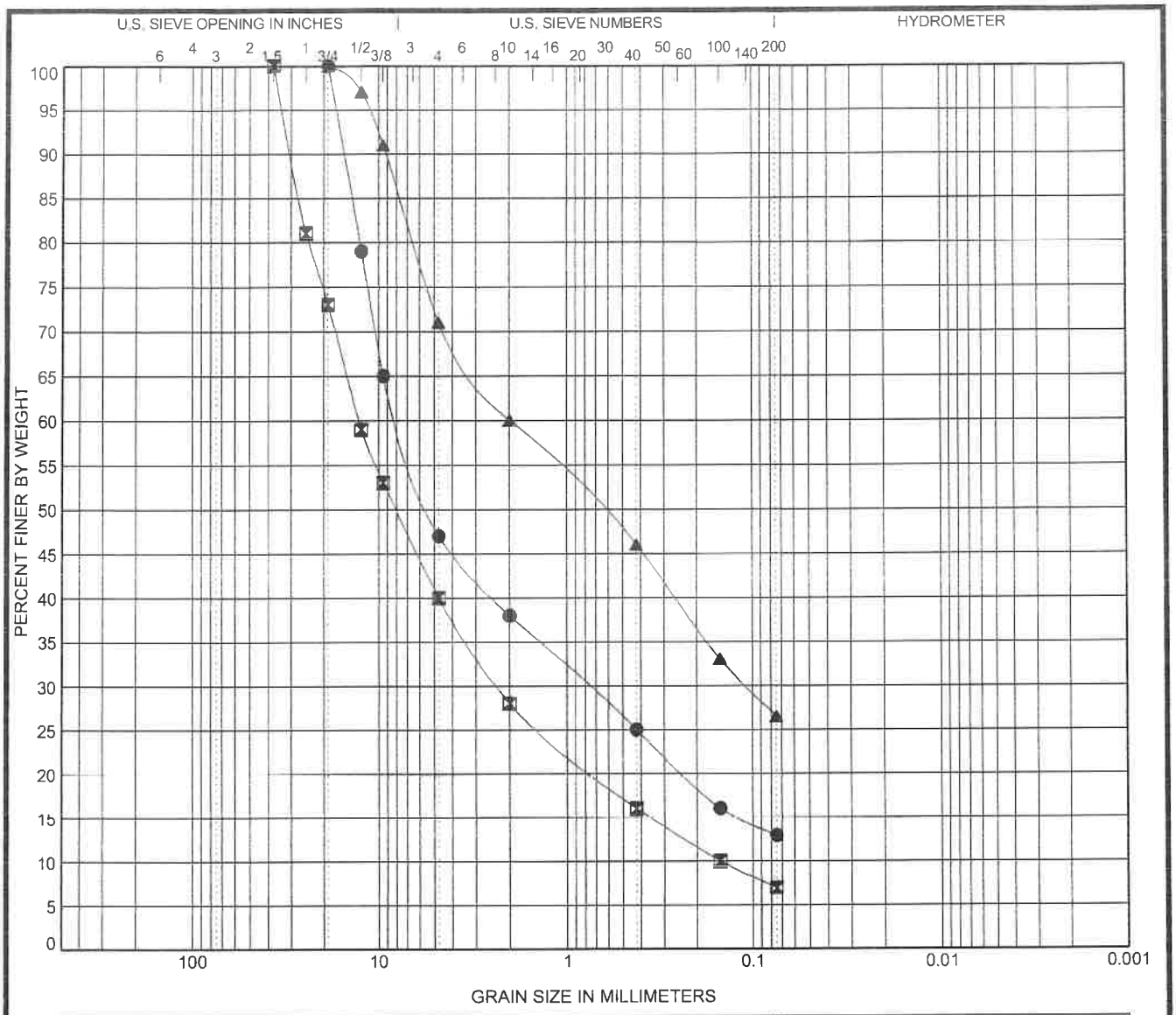
SUMMARY OF LABORATORY RESULTS

TEST HOLE	DEPTH (FEET)	UNIFIED CLASS	(%) MOIST	LL	PI	SIEVE ANALYSIS PERCENT PASSING											
						NO 200	NO 100	NO 40	NO 10	NO 4	3/8"	1/2"	3/4"	1"	1 1/2"	2"	4"
Piez 1	1.0	GM	4.2	NP	NP	13	16	25	38	47	65	79	100				
Piez 1	5.5	GW-GM	3.2	NP	NP	7	10	16	28	40	53	59	73	81	100		
Piez 1	10.5		2.3														
Piez 4	1.0	SM	14.1	NP	NP	27	33	46	60	71	91	97	100				
Piez 4	10.5		4.6														

GEO-TEST

LL = LIQUID LIMIT
PI = PLASTICITY INDEX
NP = NON PLASTIC or NO VALUE

Project: 250,000 Gallon Water Tank
Location: Taos Ski Valley, NM
Number: 1-71005



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	Piez 1	1.0	SILTY GRAVEL with SAND(GM)	NP	NP	NP		
⊠	Piez 1	5.5	WELL-GRADED GRAVEL with SILT and SAND(GW-GM)	NP	NP	NP	2.76	85.86
▲	Piez 4	1.0	SILTY SAND with GRAVEL(SM)	NP	NP	NP		

Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
Piez 1	1.0	19	7.836	0.771		53.0	34.1	12.9	
Piez 1	5.5	37.5	12.879	2.31	0.15	60.0	33.1	6.9	
Piez 4	1.0	19	2	0.109		29.0	44.5	26.5	

GEO-TEST

GRAIN SIZE DISTRIBUTION

Project: 250,000 Gallon Water Tank

Location: Taos Ski Valley, NM

Number: 1-71005

US GRAIN SIZE 1-71005 250,000 GALLON WATER TANK, TAOS.GPJ GEO_TEST.GDT 10/30/17

APPENDIX B. ALPINE HYDROLOGY OF PHOENIX SPRING AND LAKE FORK OF THE RIO HONDO, TAOS SKI VALLEY, NM

Alpine Hydrology of Phoenix Spring and Lake Fork of the Rio Hondo, Taos Ski Valley, NM

Paul Drakos, P.G., Jay Lazarus, and Jim Riesterer, P.G.

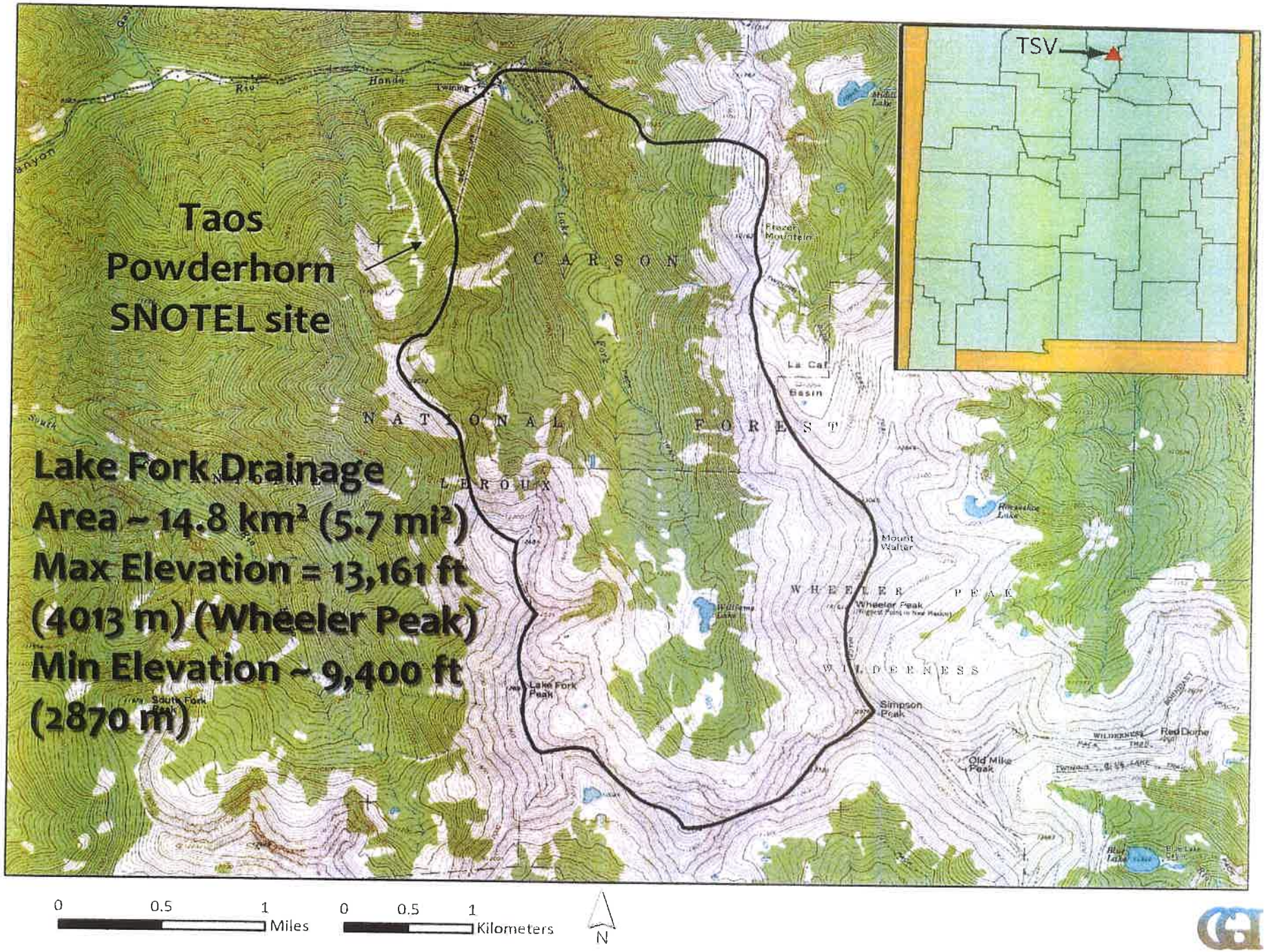
Glorieta Geoscience, Inc.
Santa Fe, NM
www.glorietageo.com

Purpose of Study

- Phoenix Spring is Currently Sole Drinking Water Source for Village of Taos Ski Valley/Taos Ski Area
- Develop a Conceptual Model of the Groundwater and Surface Water hydrology of Lake Fork Basin
- Determine Recharge Sources for Phoenix Spring Complex and Lake Fork of the Rio Hondo
- Collect Stream Flow Data During Low Flow Conditions to Evaluate Storage Needs for Snowmaking for Taos Ski Area
- Provide Hydrogeologic Framework for Source Water Protection

Methodology

- Sample summer (monsoonal) precipitation, winter snowpack for ^{2}H, ^{18}O, ^{3}H (limited subset)
- Install piezometers upgradient of Phoenix Spring
- Collect weekly (summer/fall) to monthly (winter) water level data for two years (September 2017 – September 2019)
- Sample springs, piezometers, Williams Lake for ^{2}H, ^{18}O, ^{3}H (limited subset)
- Conduct stream gaging/seepage runs on Lake Fork and upper Rio Hondo


Taos
Powderhorn
SNOTEL site
Lake Fork Drainage
Area ~ 14.8 km² (5.7 mi²)
Max Elevation = 13,161 ft
(4013 m) (Wheeler Peak)
Min Elevation ~ 9,400 ft
(2870 m)
TSV
CARSON
NATIONAL FOREST
WHEELER PEAK
WILDERNESS
Wheeler Peak
Mount Walter
Simpson Peak
Old Mike Peak
Lake Fork Peak
Frazer Mountain
La Cal Basin
0 0.5 1 Miles
0 0.5 1 Kilometers
N

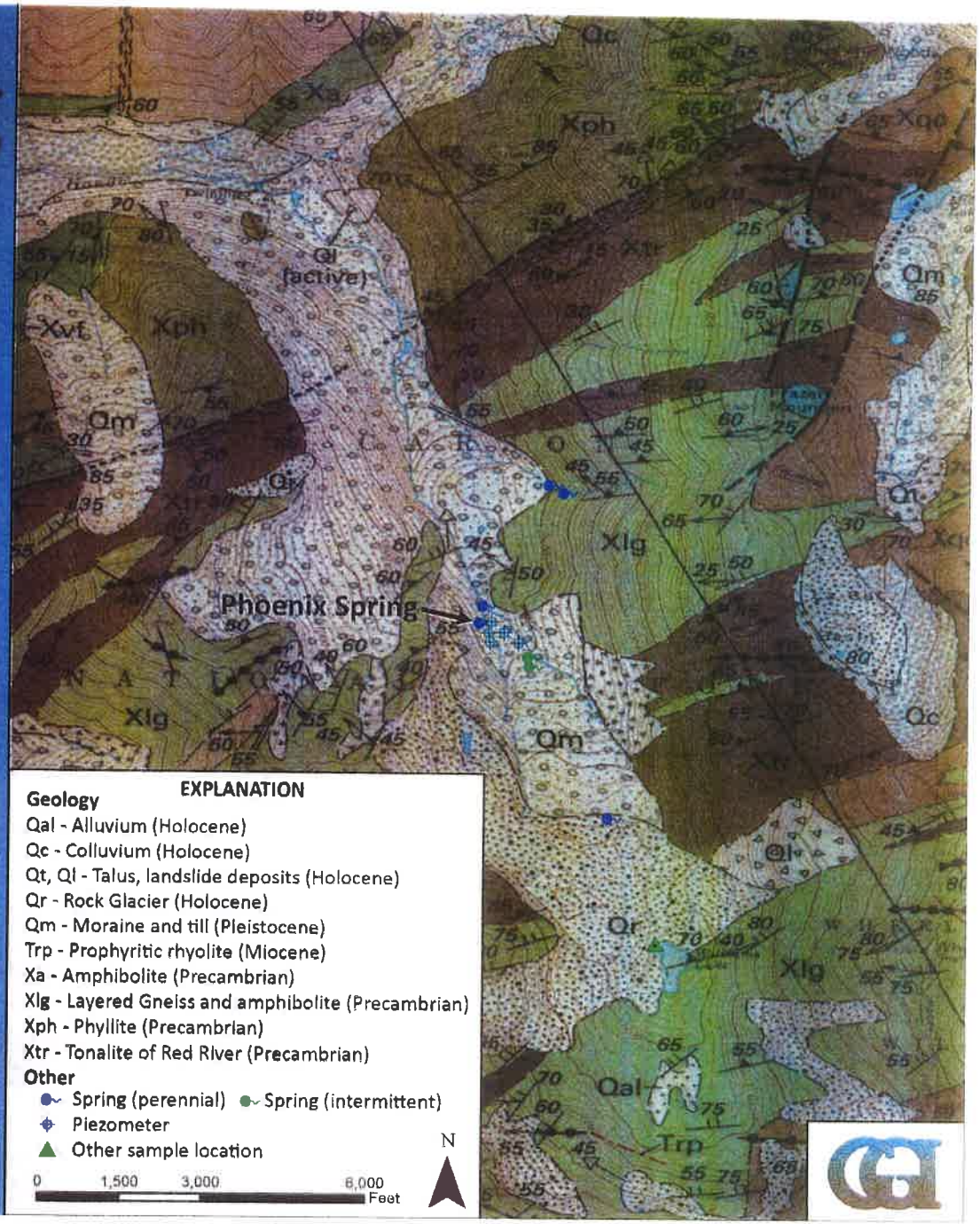
Williams Lake Cirque

- Dominated by rock glacier, talus deposits and fractured bedrock
- No surface water flow out of cirque

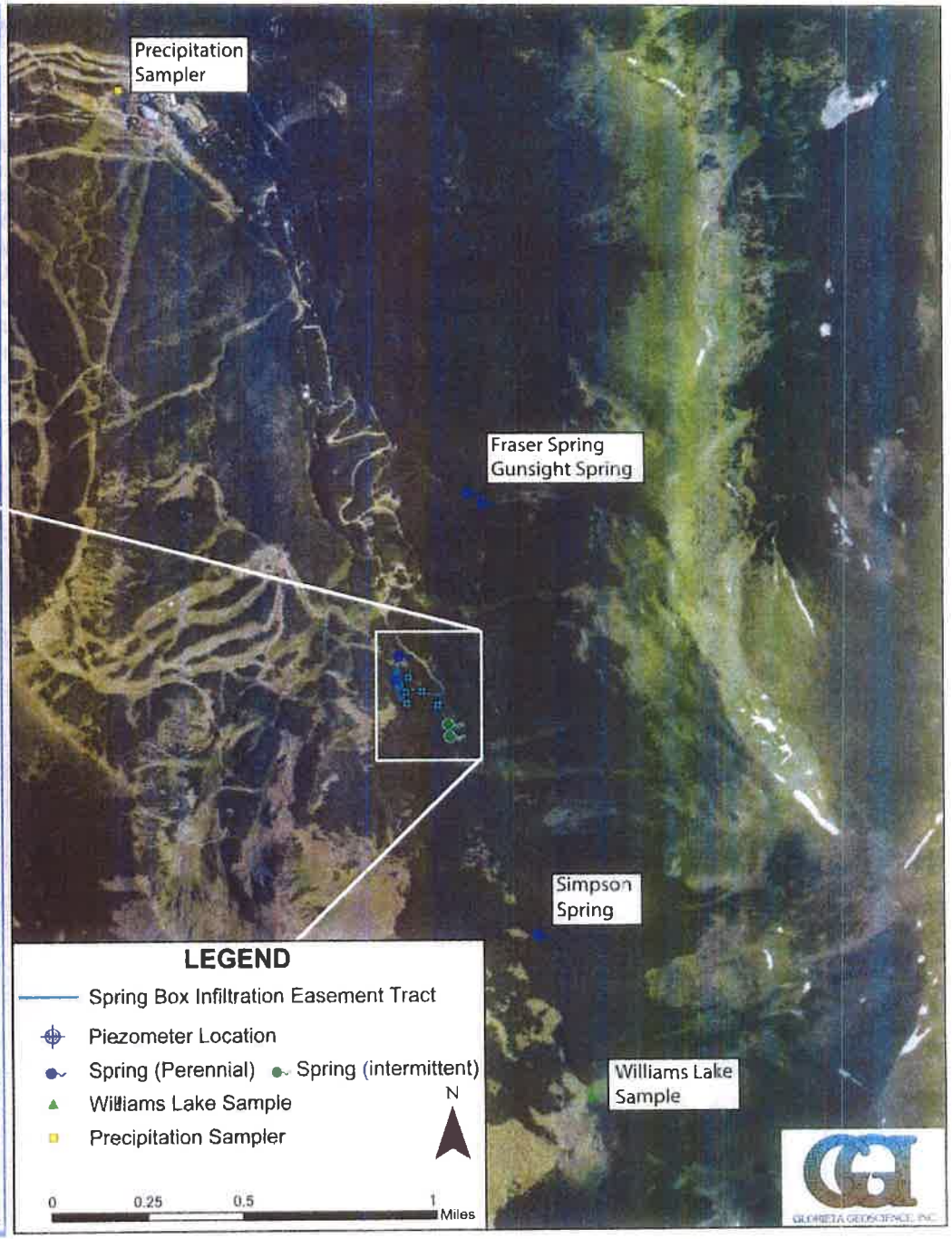
Geologic Setting

- Phoenix Spring discharge controlled by bedrock constriction formed by Precambrian amphibolite and gneiss

Source: Lipman and Reed, 1989



Precipitation sampler, piezometers and spring locations

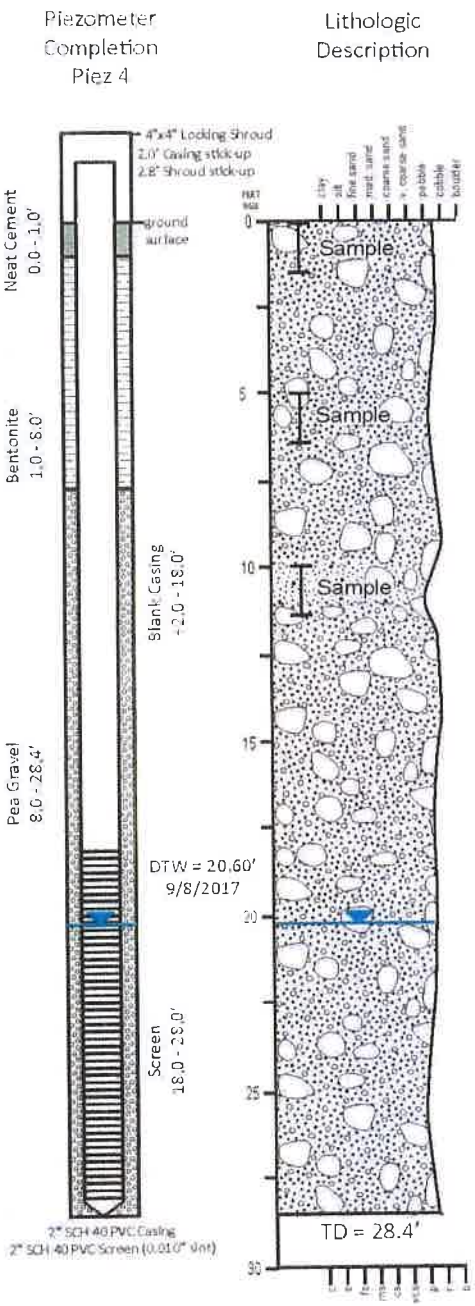


Drilling Program

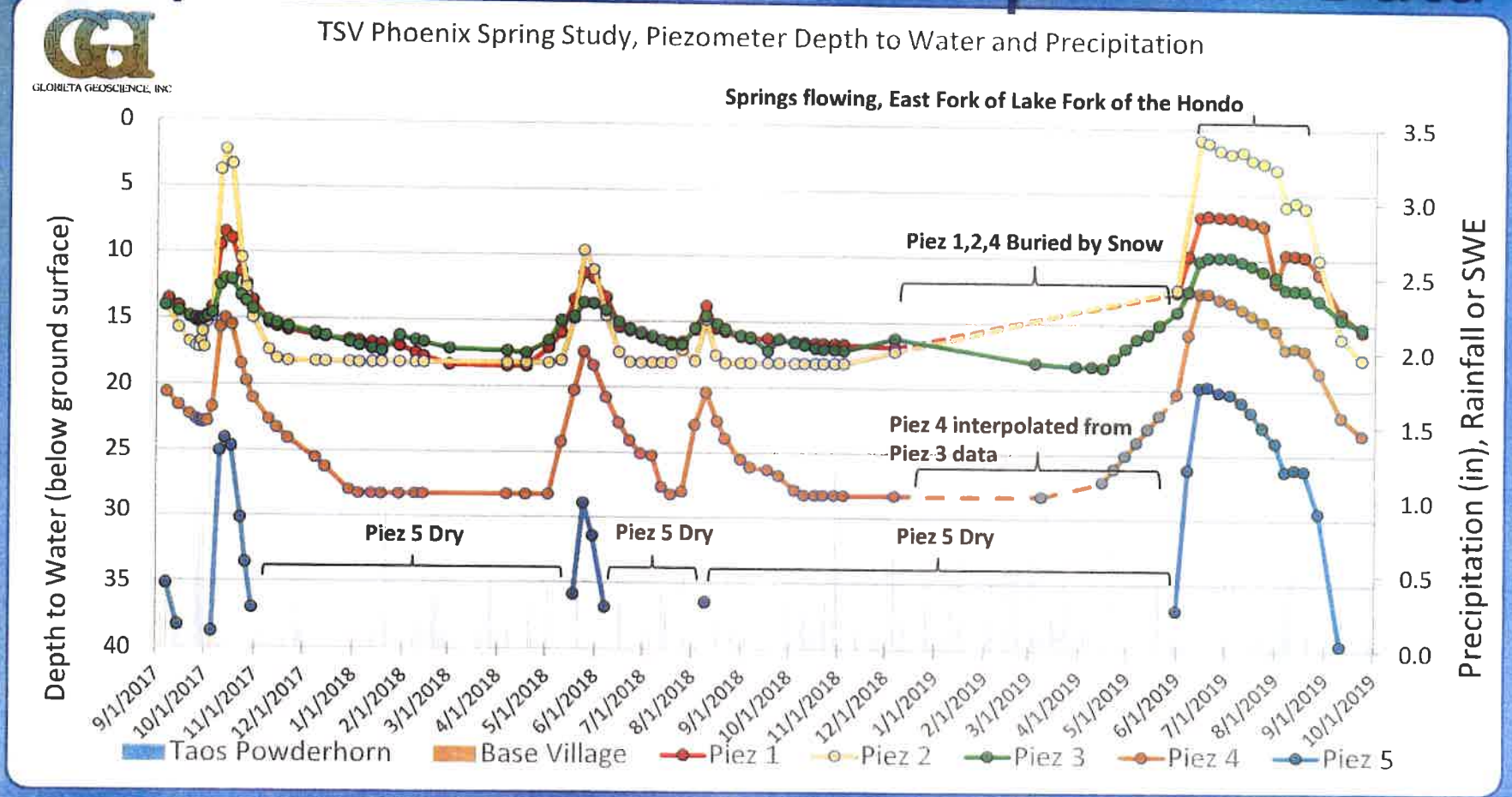
- Five piezometers completed to depths from 18 to 40 ft

Drilling Program

- Piezometers completed into glacial deposits, 5 to 15 ft into unconfined aquifer



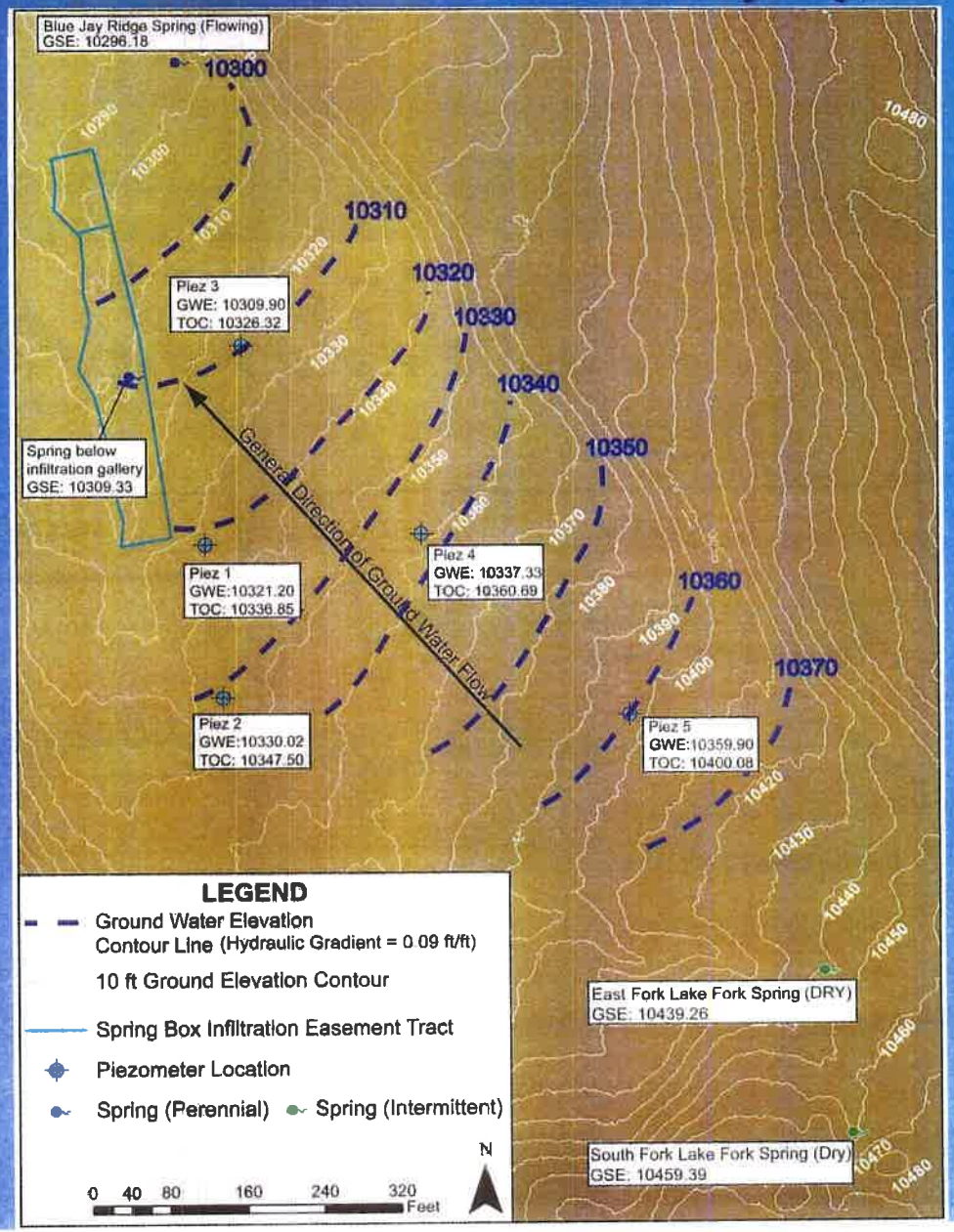
Depth to Water and Precipitation Data



- Approx 2-week lag, late-summer precip and recharge event
- DTW in piezometers upgradient of Spring typically 10-25 ft bgs (late summer/fall)
- Water levels approach "static" conditions during winter

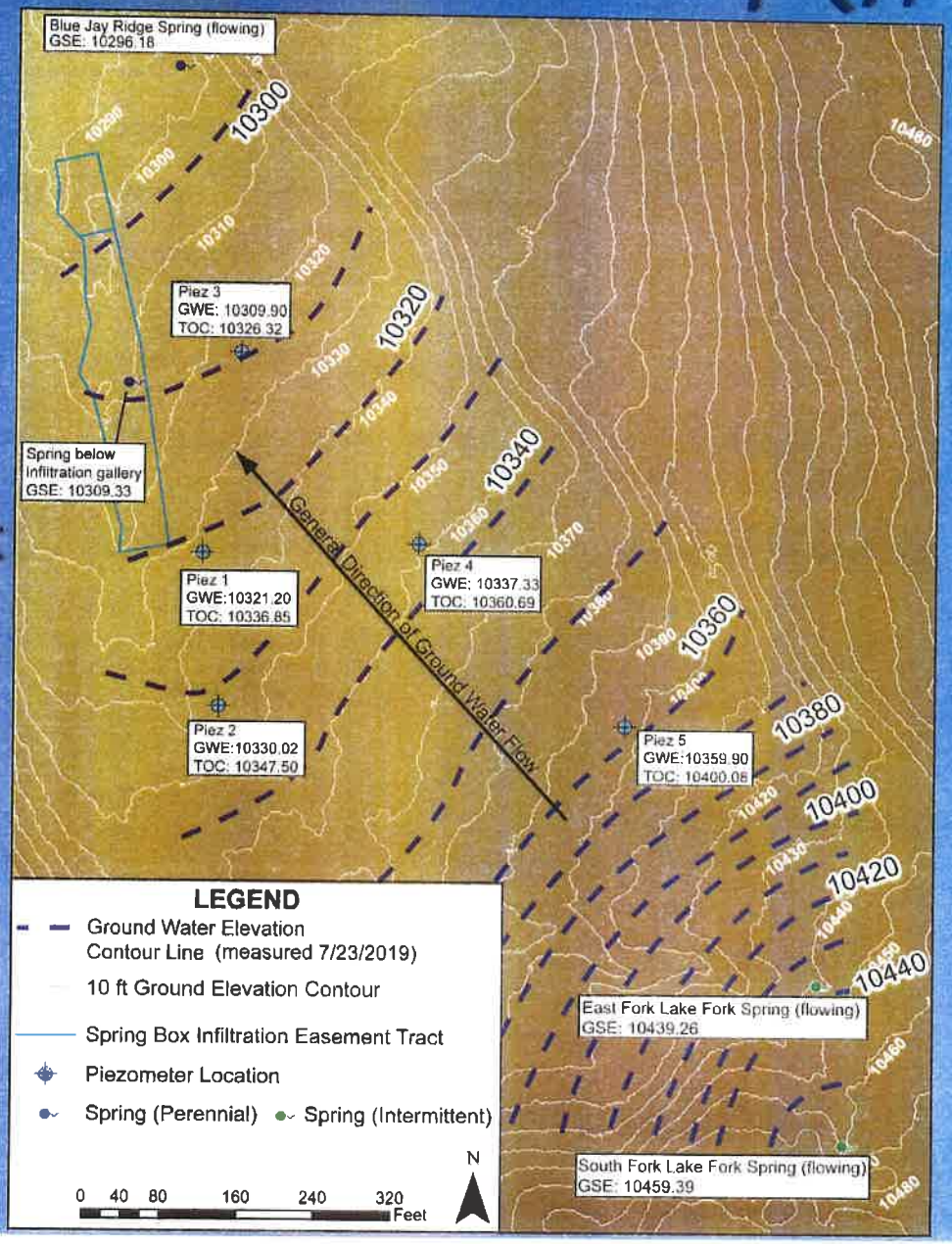
Potentiometric surface map (9/14/2017)

- Intermittent springs not flowing
- GW flow direction NW, 0.09 ft/ft



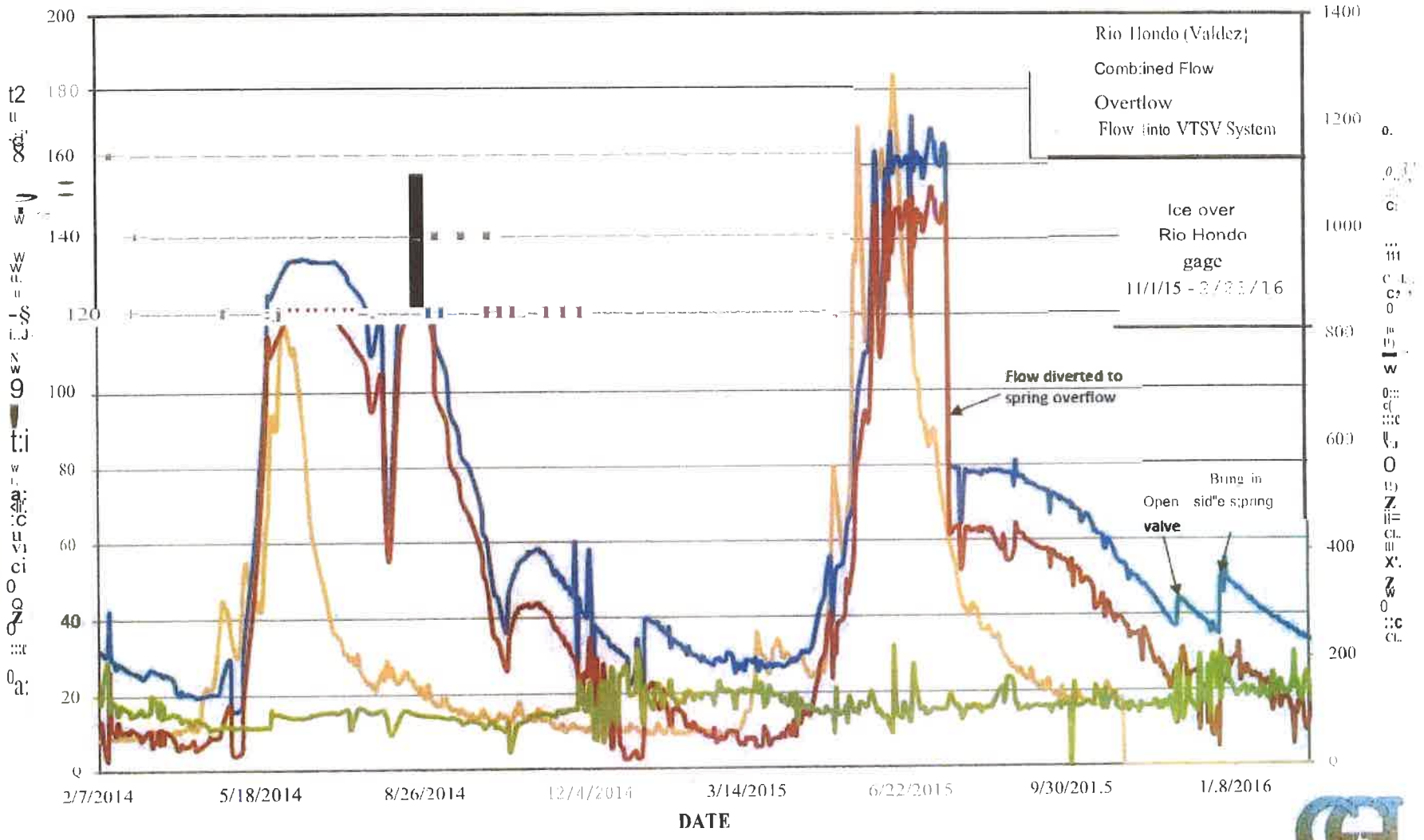
Potentiometric surface map (7/23/2019)

- Intermittent springs flowing
- GW flow direction NW, 0.12 ft/ft



Annual Variation in Phoenix Spring Flow

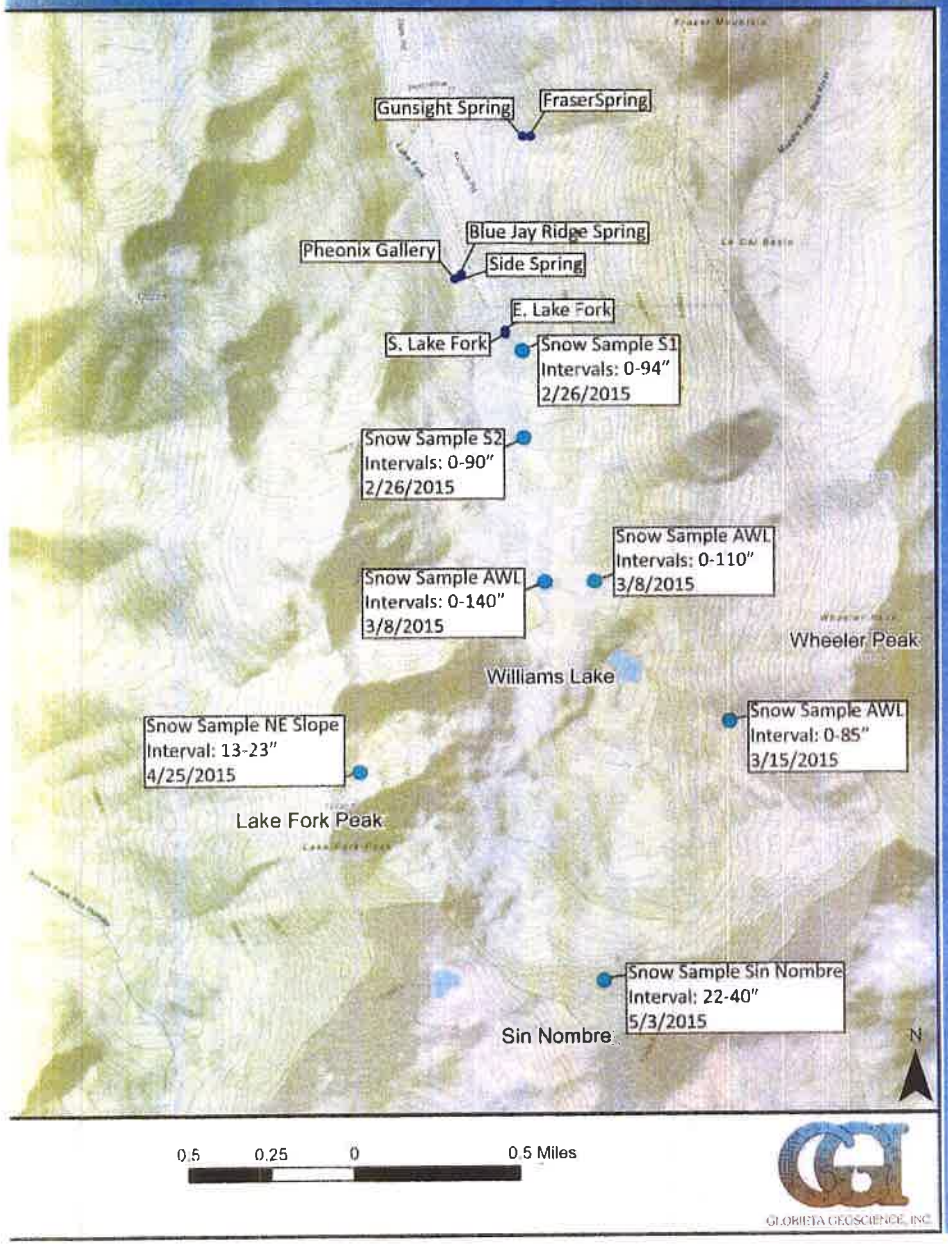
Figure 3. Total Discharge from Phoenix Spring (GPM) and Rio Hondo near Valdez (USGS SITE 08267500, CFS)



Precipitation and Snow Sampling

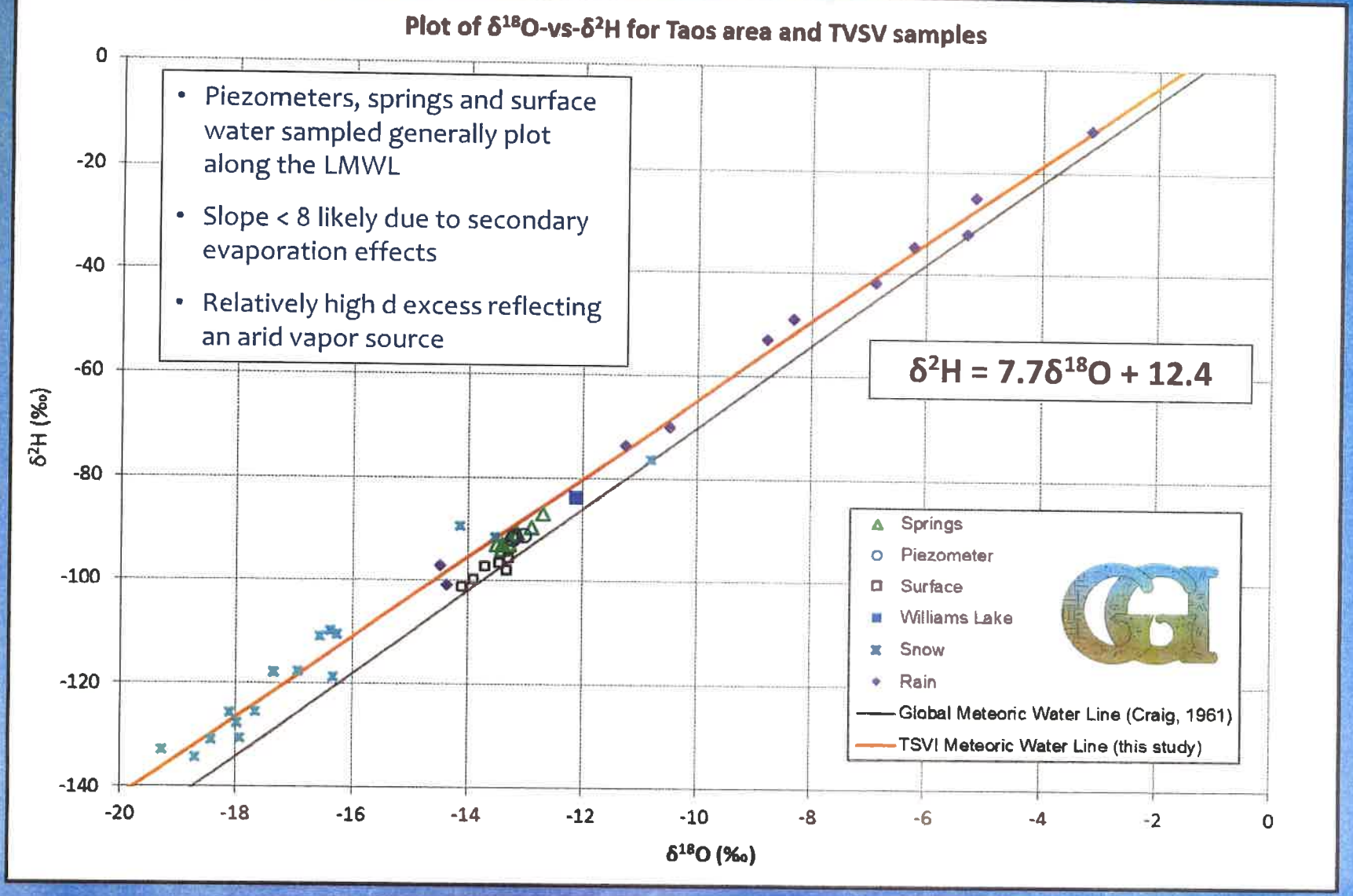
- Precipitation samples collected 7/27/2017 - 10/6/2017
- Snowpack samples collected 2/2/2015 - 5/3/2015

Distribution of Snow Samples



- Snowpack samples from upper Lake Fork and Cirque
- Discrete layers, multiple intervals from most locations

TSV & Taos Area Stable Isotopes

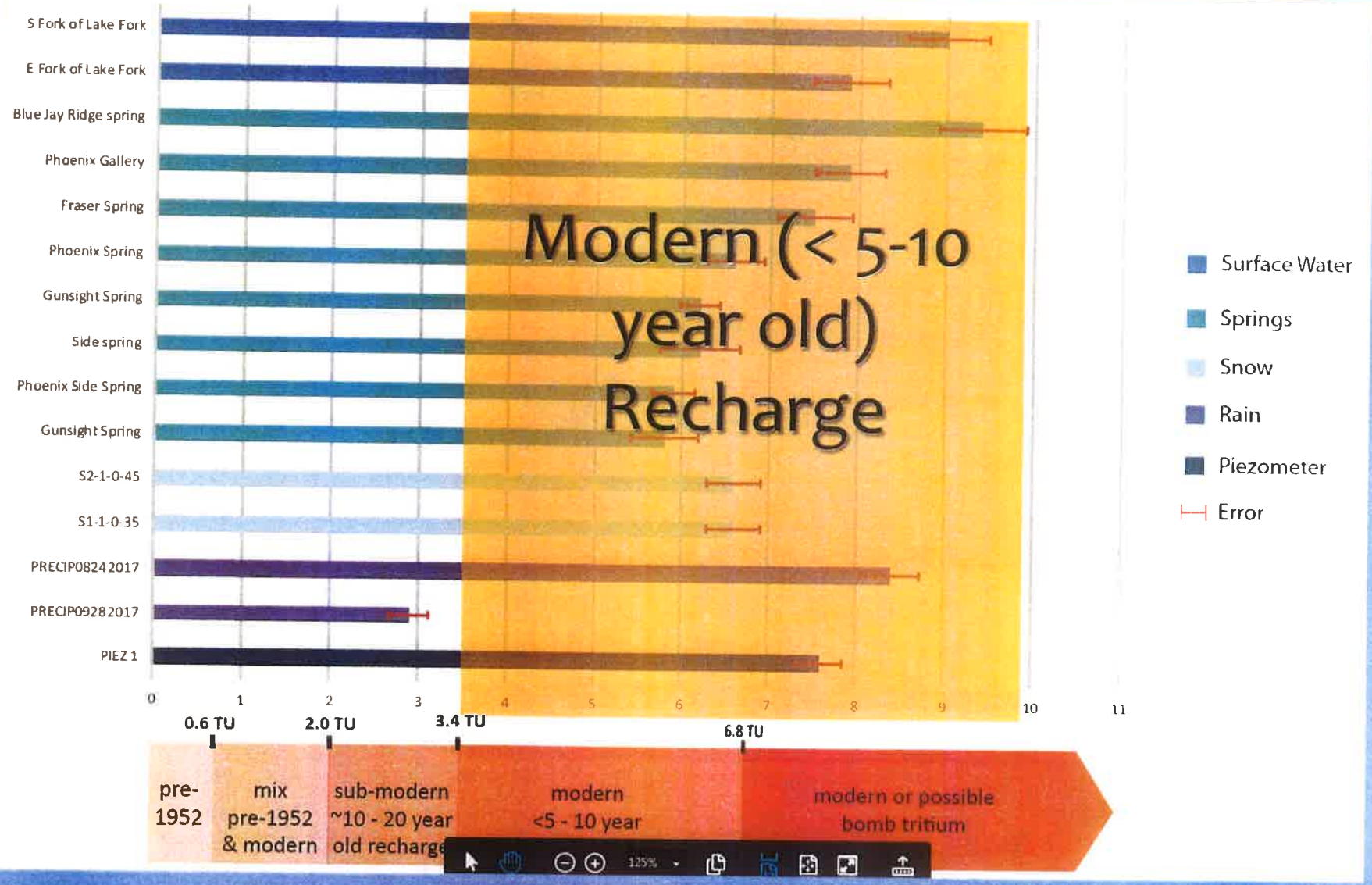


EMMA: End Member Mixing Analysis
Preliminary Results

O^{18}		H^2	
Average Rain	45%	Average Rain	41%
Average Snow	55%	Average Snow	59%

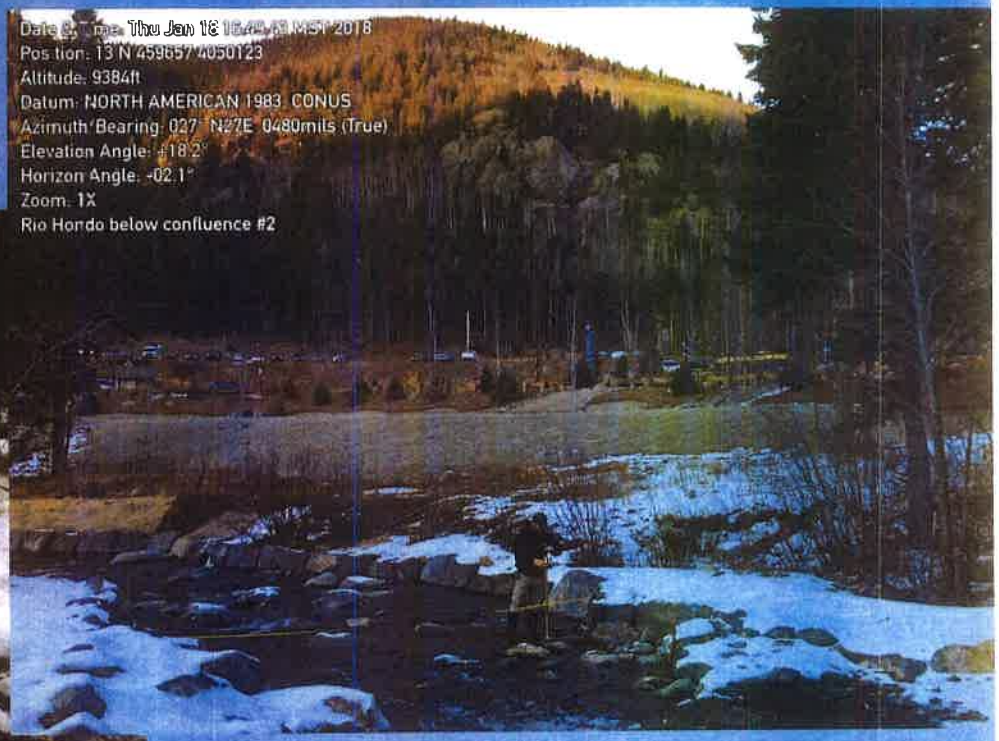
- Two component (1) precipitation as rain, (2) precipitation as snow
- Average of four sampling time periods (February, June, October, November)
- This study Indicates winter precipitation contributes ~55-60% groundwater recharge (possibly skewed by 2017 monsoonal event)
- Tolley et al. (2015) estimate 68% - 88% of groundwater recharge due to winter precipitation

Tritium Data



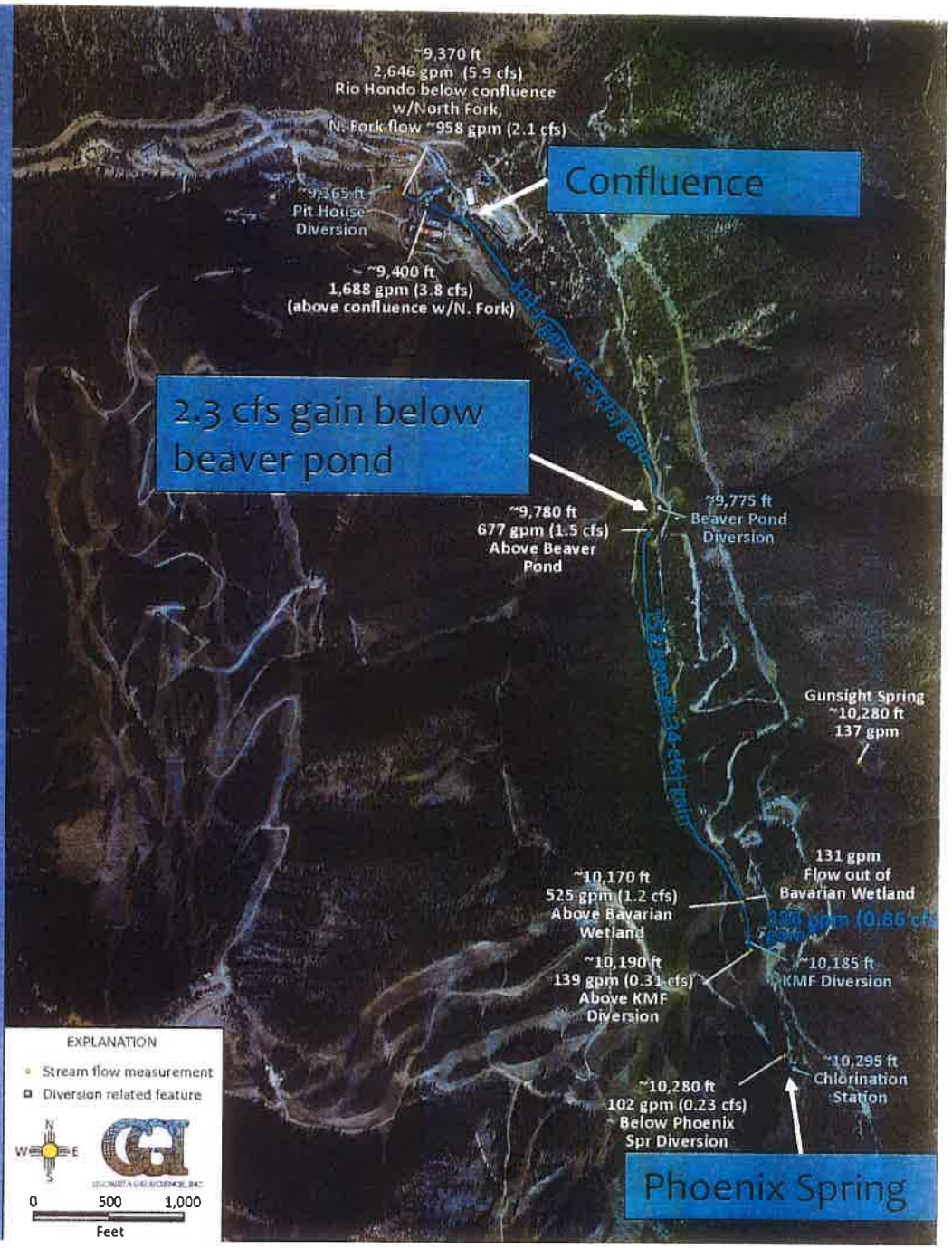
Stream Gaging

- Conduct seepage runs from Lk Fork to upper Rio Hondo
- Weekly flow measurements January-early February, October-December, 2018
- Low Flow conditions

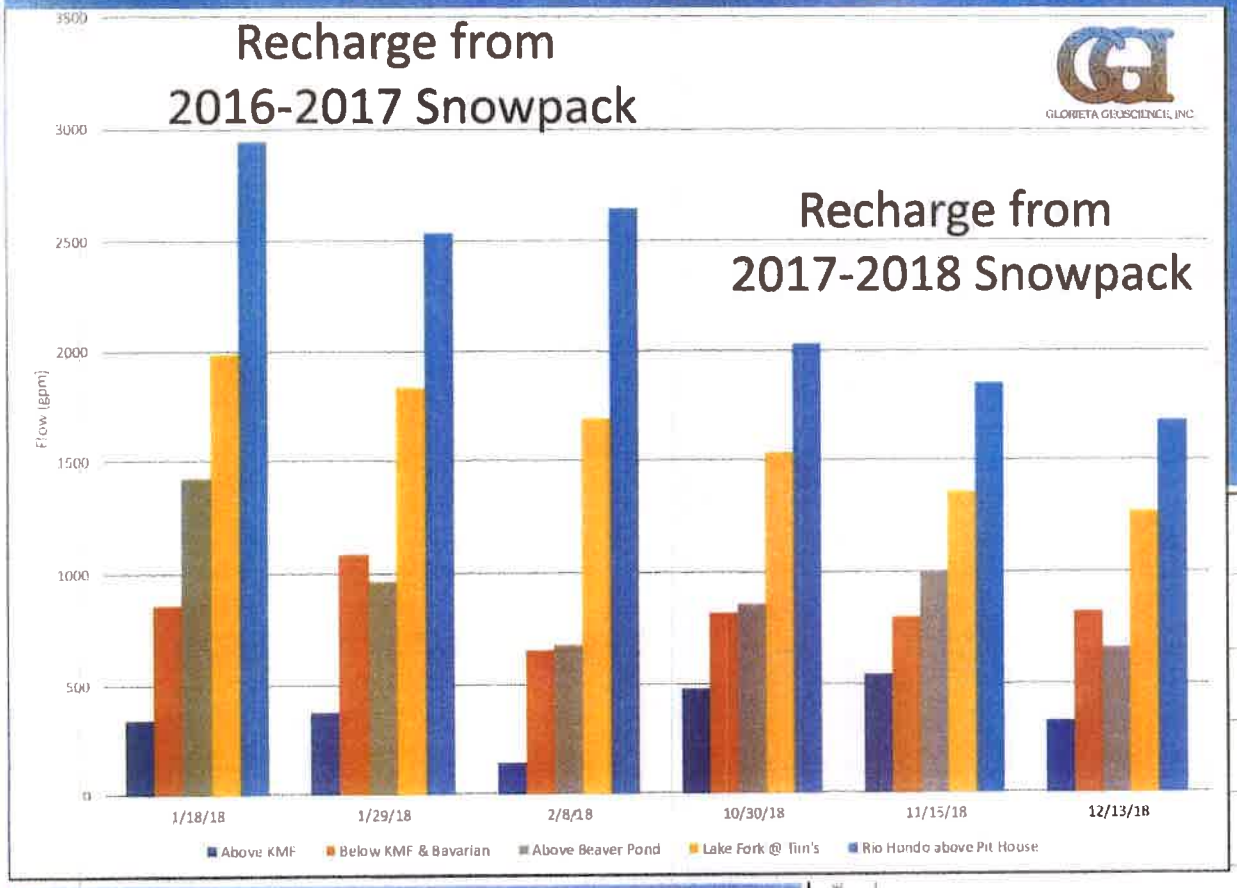


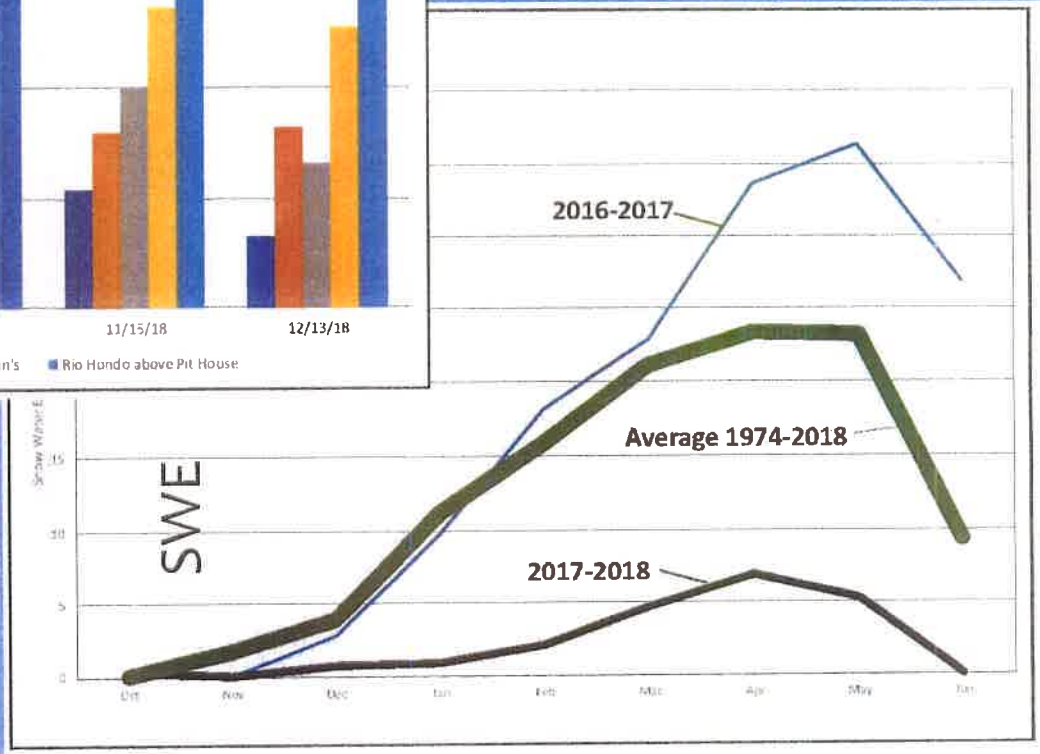
Stream Flow Measurements 2-8-2018

- Lk Fork gains 3.5 cfs in 2.3 km between Phoenix Spring and confluence
- Most of gain (2.3 cfs) is along lower ~3600 ft (1.1 km) of stream
- Spring discharge important source

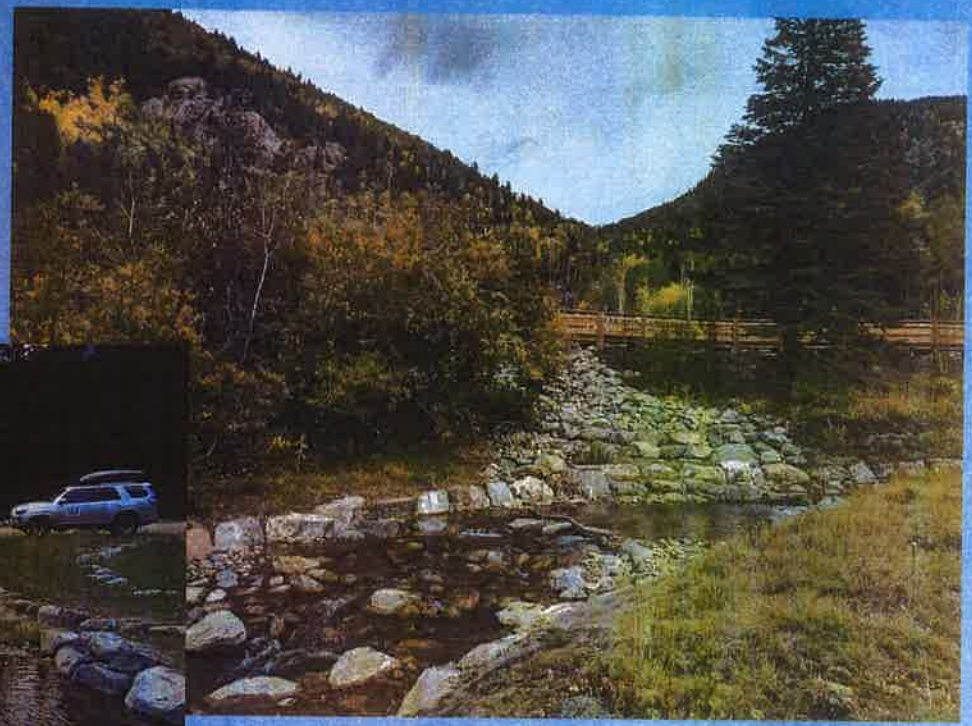


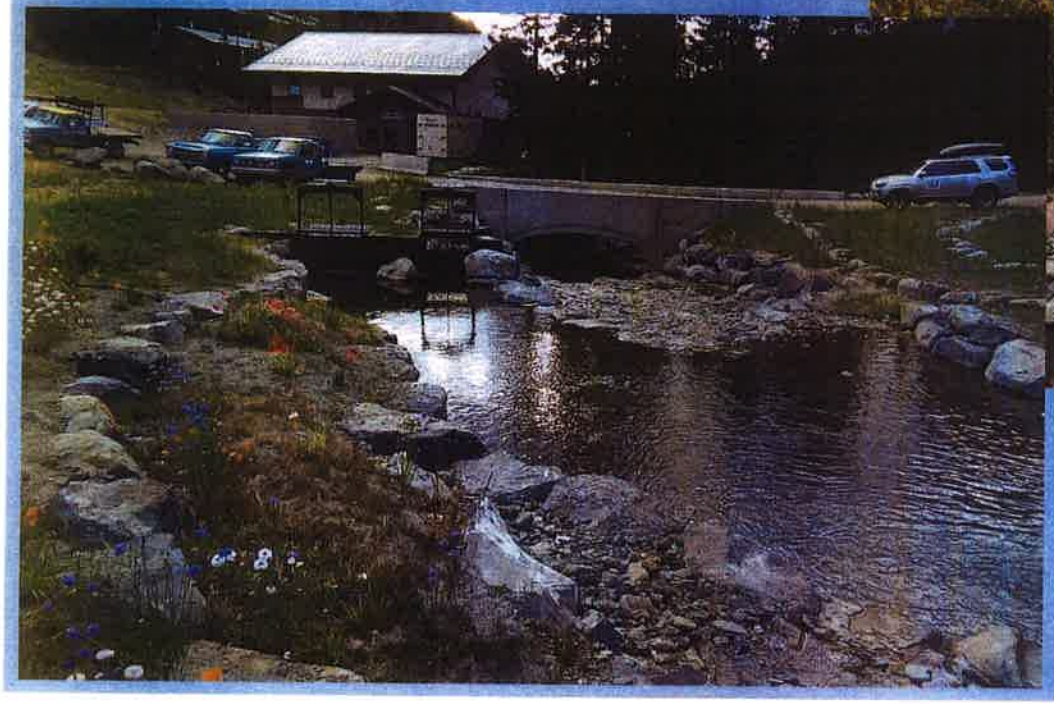
Stream Flow - ~1 Year Lag from Winter Precipitation





Understanding of Stream Flow Dynamics and Controls on Recharge May be Used to Guide Snowmaking Strategies and Stream Restoration Projects



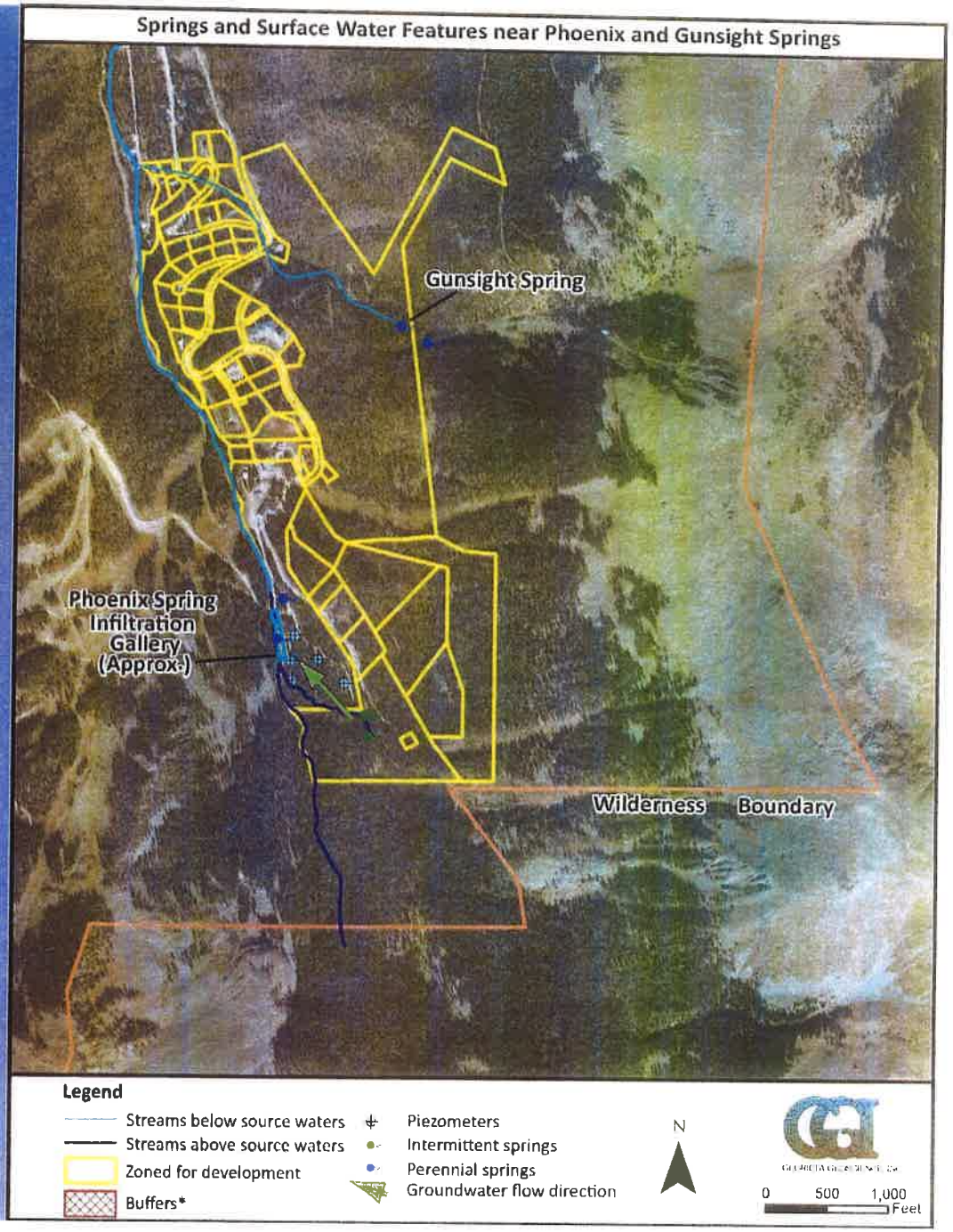


Snowmaking Strategies and Stream Flow

- November-February flow in the Lake Fork and Rio Hondo are controlled primarily by the previous year's snow pack
- Monsoonal precipitation likely of secondary importance
- The total gain in flow from above the KMF diversion to the Rio Hondo above the Pit House diversion during low flow conditions is approximately 2.9 cfs
- Data used to develop model for sizing storage to balance snowmaking needs with maintaining in-stream flows for fish habitat

Conceptual hydrologic model for SWPP development

- Modern recharge to Phoenix Spring
- Gunsight Spring important second water source for Village



SWP Zones for Phoenix Spring
Zone B is Watershed Above Spring

This product is for reference purposes only and is not to be construed as a legal document or survey instrument.

Phoenix Spring Source Water Protection (Revised Nov. 2019)

Create: Leonard Rice Engineers INC., SaqeGIS, V: SV

SWP Zones for Phoenix Spring
Zone A is Immediate Vicinity of Spring

This product is for reference purposes only and is not to be construed as a legal document or survey instrument.

Phoenix Spring Source Water Protection (Revised Nov. 2019)

Create: Leonard Rice Engineers INC., SageGIS, VTSV

BMPs for Zones A and B Include:

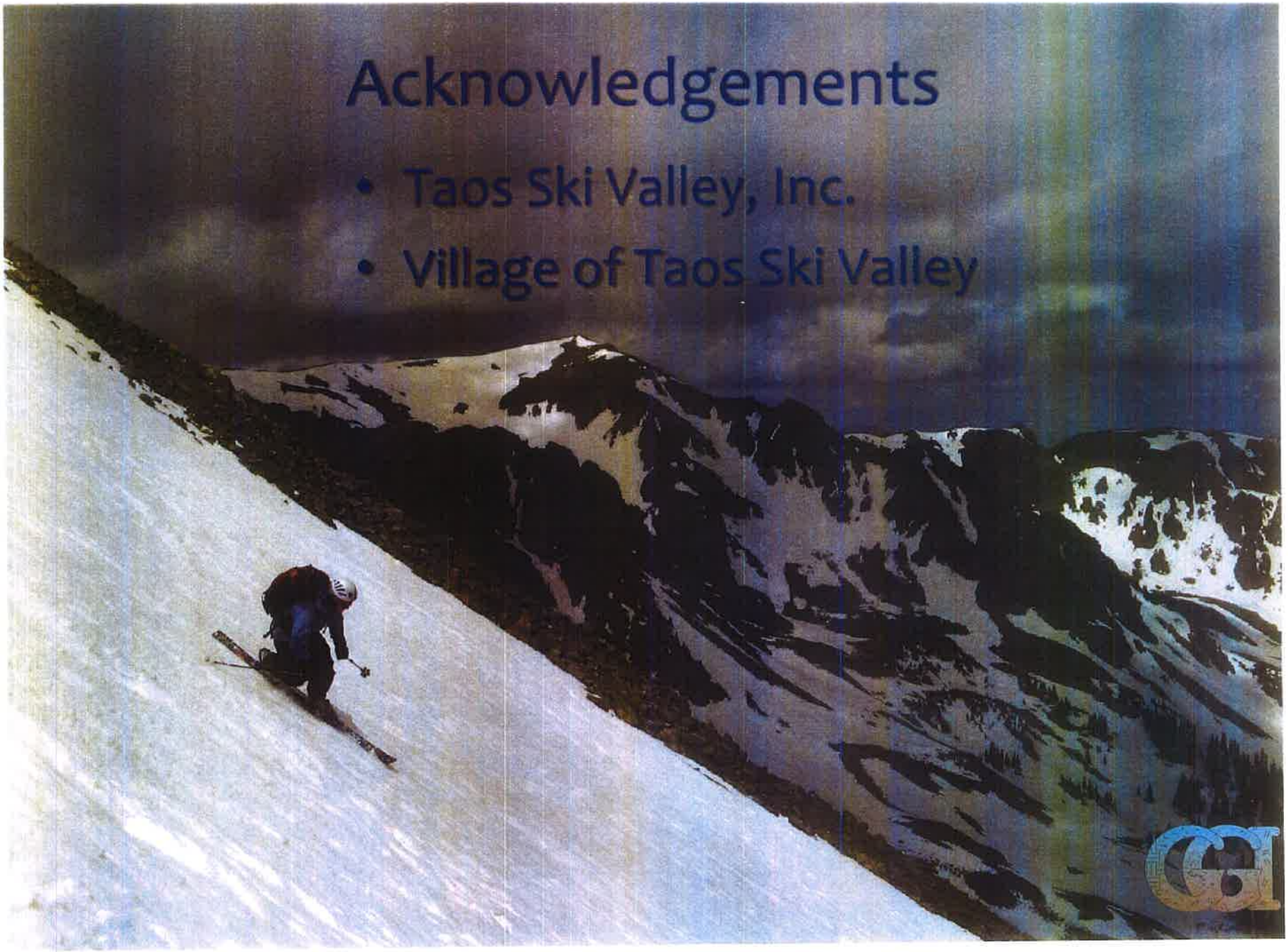
- Fire Management/Forest Thinning
- No Septic Systems
- No USTs
- Construction Practices to Minimize Runoff from Trails
- Human Waste Management in Wilderness Area
- Ski Area, Village, Acequia Association, Taos Pueblo, Amigos Bravos and other Stakeholders participated

Conclusions

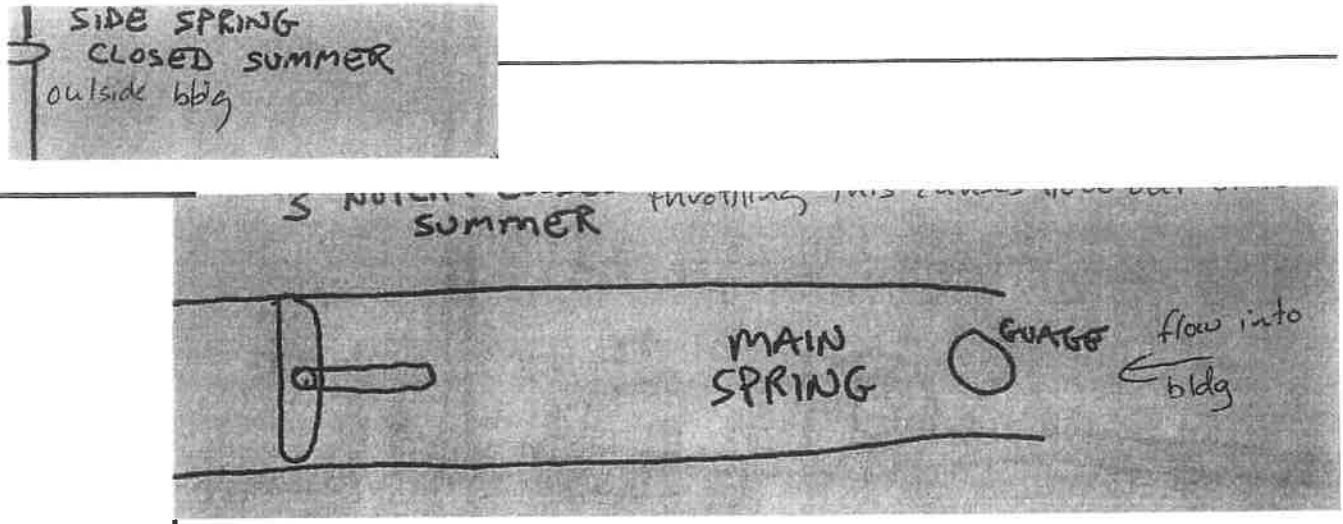
- Phoenix spring discharges at bedrock constriction, which reduces cross sectional area of aquifer in glacial deposits
- Winter precipitation contributes ~55-88% of recharge to springs
- Shallow groundwater is recharged by monsoonal precipitation with an approximate two-week lag time
- Phoenix and other springs in the area show modern recharge
- Lake Fork gains ~ 3 cfs from Phoenix Spring to Confluence during low flow conditions (~7500 ft or 2.3 km)
- Nov-Feb flows in the Lake Fork and Rio Hondo are controlled primarily by the previous year's snow pack
- Study informed SWPP development and allowed development of model for sizing storage to balance snowmaking needs with maintaining in-stream flows for fish habitat

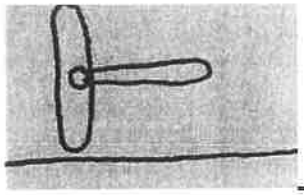
Acknowledgements

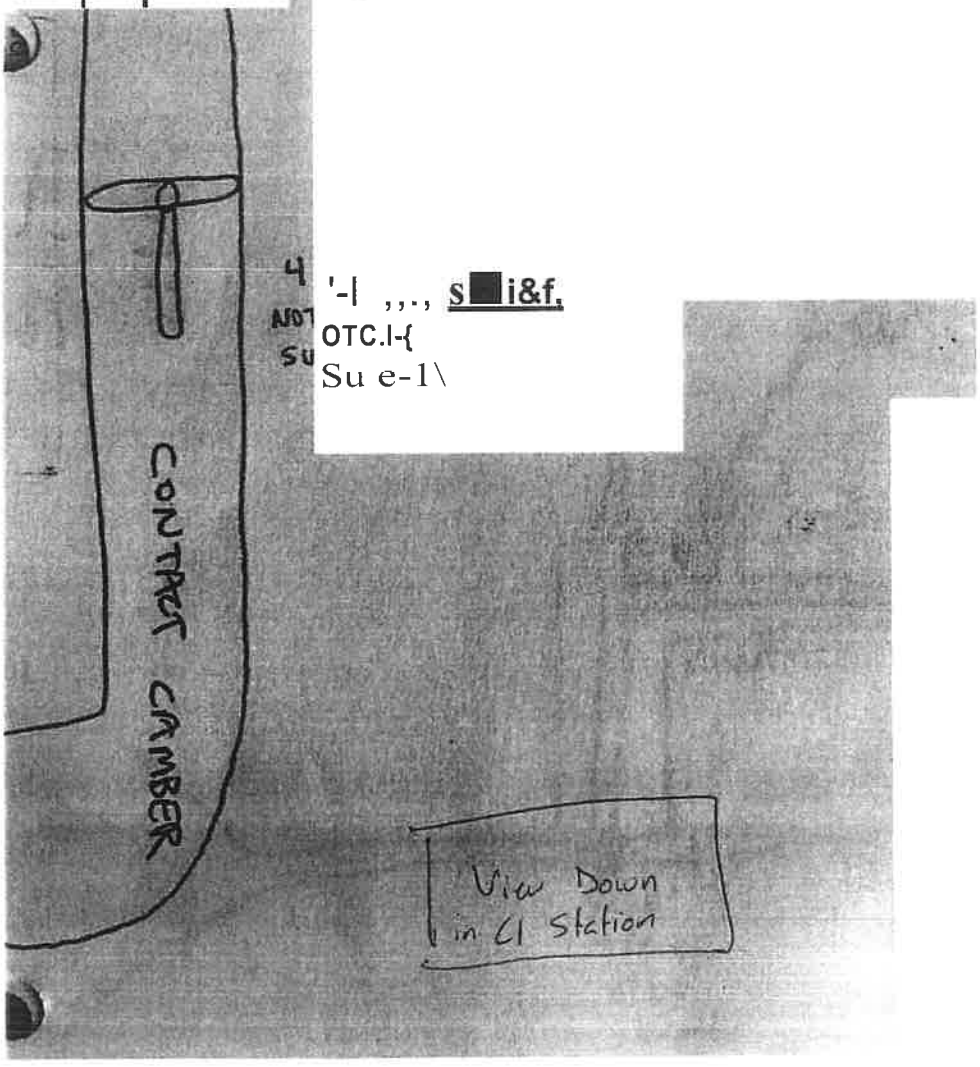
- Taos Ski Valley, Inc.
- Village of Taos Ski Valley



APPENDIX C. SCHEMATIC OF SPRING COLLECTION SYSTEM
Provided by VTSV staff, originally drawn by previous system operator







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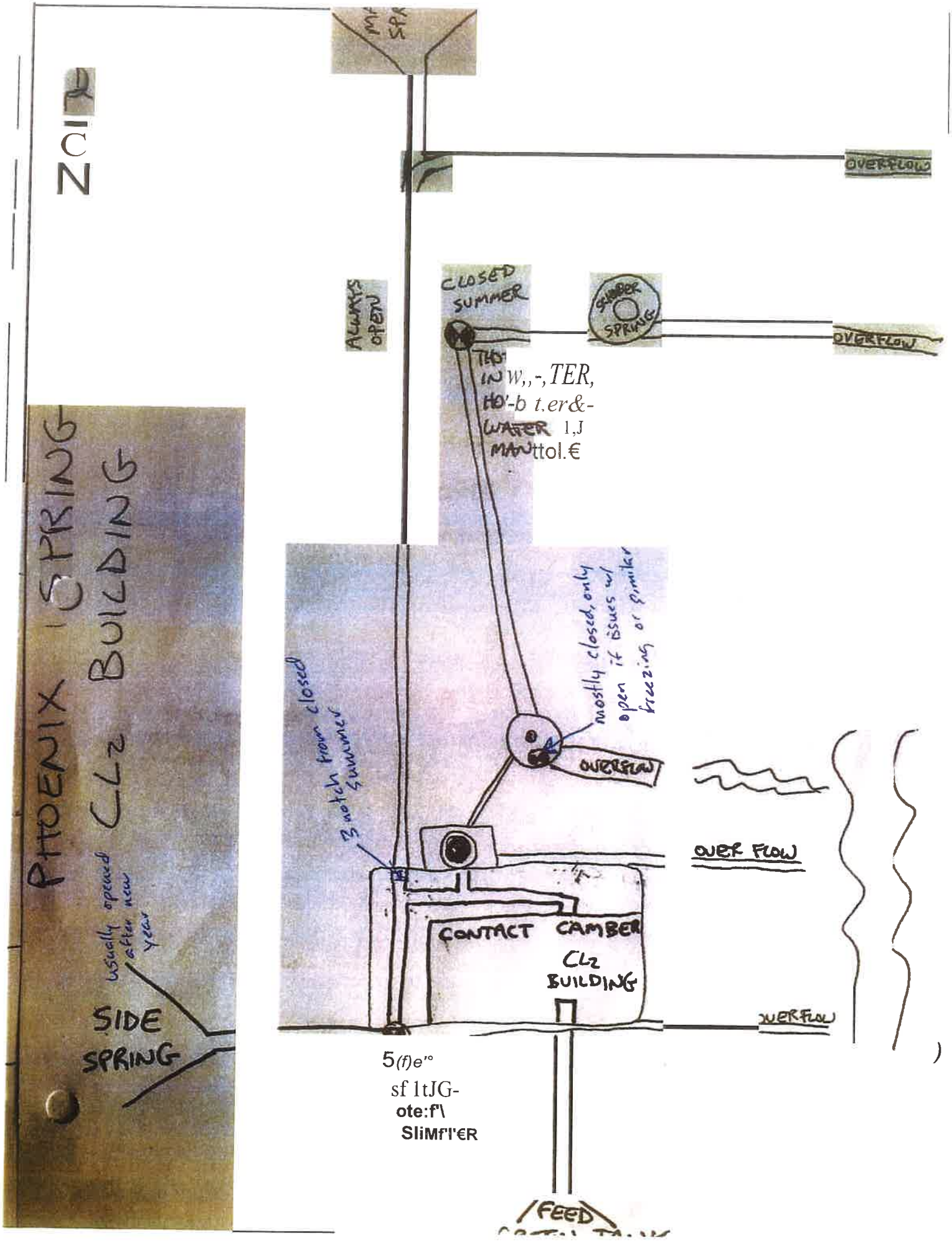
PHOENIX SPRING
CL2 BUILDING
usually opened after new year
SIDE SPRING
ALWAYS OPEN
CLOSED SUMMER
SUMMER SPRING
OVERFLOW
OVERFLOW
mostly closed, only open if issues w/ freezing or sprinkler
3 notch from closed summer
OVERFLOW
OVER FLOW
CONTACT CAMBER
CL2 BUILDING
OVERFLOW
FEED

APPENDIX D. GGI Summary of NMBGMR Public Comment Draft entitled "Climate Change in New Mexico over the Next 50 Years: Impacts on Water Resources"

Prepared by Jay Lazarus and Paul Drakos

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Memo to: Peter Talty, Taos Ski Valley, Inc.
From: Jay Lazarus, Paul Drakos, P.G., GGI
Date: October 25, 2021
Re: Review of Public Comment Draft of "Climate Change in New Mexico over the Next 50 Years: Impacts on Water Resources" prepared by the New Mexico Bureau of Geology and Mineral Resources

INTRODUCTION

As requested by Mr. Peter Talty of Taos Ski Valley, Inc. (TSVI), Glorieta Geoscience, Inc. (GGI) has reviewed the Public Comment Draft of "Climate Change in New Mexico over the Next 50 Years: Impacts on Water Resources" prepared by the New Mexico Bureau of Geology and Mineral Resources on September 16, 2021. Our review focused on the impact of Climate Change in mountainous regions of New Mexico and specifically how climate change can impact water availability for snow-making and municipal purposes in the Lake Fork and Rio Hondo watersheds. The Draft Report is a comprehensive research document that predicts increasing temperatures and decreasing snowpack in mountainous regions of New Mexico. It is our opinion that the conclusions presented in the report do not compel TSVI to submit Public Comments as the data and conclusions are based on widely accepted scientific research, and other than reducing greenhouse gas emissions, the authors do not make specific recommendations for actions to be taken. The Draft Report is pretty much a compendium of climate research conducted to date in New Mexico with predictions of how climate change will affect specific ecosystems throughout the State.

We present key findings from the Draft Report followed by our conclusions and recommendations. GGI's conclusions and recommendations in this memo look at the next 50 years of TSVI's operations with the Draft Report's predictive climate change scenarios occurring. Additionally, since high-altitude snow pack and precipitation control recharge to the Phoenix Spring complex, TSVI anticipates climate change-related questions from the Village of Taos Ski Valley (Village) as part of the Village's analysis of TSVI's Water Master Plan and this memo provides some strategies for collaboration with the Village on climate change.

KEY FINDINGS

Greenhouse gas emissions

All evidence suggests that the average temperature for all parts of New Mexico will increase over the next 50 years. Models indicate that the amount of temperature increase will depend on the amount of greenhouse gasses added to the atmosphere in the future. In a higher- side greenhouse gas emission scenario, the average projected temperature increase across the state is a staggeringly high 7°F over the 70-year period between 2000 and 2070. In lower emission scenarios, temperature will continue to climb at a rate closer to what has been observed during the past 30 years, leading to a lower, but still significant average temperature increases of

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about 5°F. In all currently envisioned cases, temperatures state-wide and around all of the southwestern US will rise significantly. A 5°F temperature increase will have a significant effect on TSVI's snow-making, especially in dry or "late" snow years.

Impacts of Increasing Temperature

- Changes in snowpack elevations and snow water equivalent (SWE)
- Changes in available water volumes and timing of water availability
- Increasing precipitation in the form of rain rather than snow due to increasing temperatures
- Smaller spring runoff volumes and/or earlier runoff that will impact water availability for irrigation and for ecological and species needs
- Milder winters and hotter summers, resulting in longer growing seasons and increased plant and human water use
- Increased evaporative losses from reservoirs, streams, and soils due to hotter, drier conditions
- Increased evapotranspiration by agricultural and riparian plants
- An increase in extreme events, including both droughts and floods

Snow and Snowmelt Runoff

Snowpack at high elevations is projected to decline very substantially by 2070 across the southwestern U.S. (USGCRP, 2017; Mote et al., 2018), continuing a long-term decrease in snowpack that has been observed (including in the Rio Grande headwaters by Chavarria and Gutzler, 2018) over the past half-century. The projected decrease in snowpack occurs as the result of warmer temperature, despite possible increases in total winter precipitation, as estimated for the Rio Grande headwaters. Projections indicate large declines in snowpack in the western United States and shifts to more precipitation falling as rain than snow in the cold season in many parts of the central and eastern United States.

Long-term changes in the snowmelt and snow-water equivalent (SWE) from snow monitoring stations in western North America were researched and 34% of stations exhibit increasing winter snowmelt trends and SWE declines. Snowmelt trends are highly sensitive to temperature and an underlying warming signal, whereas SWE trends are more sensitive to precipitation variability. Thus, continental-scale snow water resources are in steeper decline than inferred from SWE trends alone. More winter snowmelt will complicate future water resource planning and management (Musselman, et al, 2021)

Mountainous regions of New Mexico will be particularly impacted by a warming climate, and these impacts will cause downstream effects in other regions of the state. The atmospheric temperature in mountainous regions will rise over the next 50 years at a rate similar to the rest of the state. The highest elevations are very likely to experience sharp declines in snowpack, which will melt earlier and generate less snowmelt runoff. Higher temperatures will lead to higher levels of evapotranspiration across the state, but the relative increase in

evapotranspiration rates over the next 50 years will be higher in New Mexico's mountainous regions. Less snowmelt and higher evapotranspiration lead to proportionally less water available to recharge aquifers and support plant growth

There has been a trend toward earlier snowmelt and a decrease in snowstorm frequency on the southern margins of climatologically snowy areas. Winter storm tracks have shifted northward since 1950 over the Northern Hemisphere. Northern Hemisphere spring snow cover extent, North America maximum snow depth, snow water equivalent in the western United States, and extreme snowfall years in the southern and western United States have all declined, while extreme snowfall years in parts of the northern United States have increased. The effect of windblown dust is also a concern, as dust production associated with lower soil moisture content becomes more prevalent. The primary hydrologic impact of dust-on-snow is an increased rate of snowmelt associated with more extreme dust deposition, producing earlier peak streamflow rates on the order of 1–3 weeks. Snowmelt runoff has been occurring earlier as average spring temperatures rise. The effect of earlier snowmelt has already been evidenced as acequias are cleaning their ditches earlier each spring in anticipation of earlier snowmelt.

Snowpack has been declining over the past several decades in association with warming temperatures and increases in dust blowing onto snow (Livneh, el al, 2015), promoting earlier snowmelt. When snowpack becomes dust-covered, the snow's ability to reflect solar radiation decreases, causing more solar radiation to be absorbed, and therefore more rapid melting. With less water available to acequias, more fields will be fallowed, adding to the potential for more dust to blow off.

Another robustly projected impact of warming temperatures over the next 50 years is that the average snowpack in the mountains on April 1, typically the time of maximum snowpack, will steadily decrease. This effect will likely be exacerbated by increased dustiness in parts of the state, which also promotes early melting of snow. This decreased snowpack will, in turn, impact the timing and quantity of runoff, reducing flow in the Rio Grande and other major snow-fed rivers. Furthermore, increased evaporation and sublimation of snowpack and subsequent runoff in a warmer climate further reduces the amount of snowmelt water that reaches rivers. Also, over the next 50 years, we are likely to experience more variability in precipitation from year to year, including anomalously wet years interspersed with periods of more extreme drought.

Tree-ring studies across southwestern North America have shown that profound droughts lasting multiple decades have occurred once or twice per century for at least a thousand years (Gutzler, 2004; Watkins, 2006). Peak snowmelt runoff occurs earlier in nearly all computer simulations. On a Statewide basis, there will likely be less runoff in the Rio Grande, putting additional pressure on New Mexico to deliver wet water to Texas to comply with the terms of the Rio Grande Compact, and likely less water available to San Juan/Chama Project contractors.

There is general consensus that increasing temperature will reduce snowmelt runoff but quantifying the reduction is difficult at present.

CONCLUSIONS

1. In the next 50 years, Taos Ski Valley will likely experience:
    a. Sharp declines in snowpack, which will melt earlier and generate less snowmelt runoff
    b. Less streamflow in the Lake Fork and Rio Hondo, resulting in less water available for snowmaking
    c. Less San Juan/Chama water available to contracting entities, potentially reducing the Village's municipal and snow-making water supply
    d. Continued increased likelihood of fires
    e. More light-absorbing aerosols being blown onto the snowpack in early spring
    f. Less water for downstream acequias resulting in more land being fallowed and creating more dust that when blown onto snowpack, results in earlier spring snowmelt, and increases the rate at which the snowpack melts
    g. A smaller early-season snow-making window (already decreasing)
2. At current rates of temperature increase, the predicted 5°F to 7°F temperature increase over the next 50 years will have a significant effect on TSVI's snow-making operations, especially in dry or "late" snow years.

RECOMMENDATIONS

Taos Ski Valley, Inc.

1. Focus on how TSVI can continue to reduce its CO_2 emissions
2. Increase TSVI and VTSV water storage
3. Conduct forest thinning/management on private and Forest Service lands
4. Make as much snow as possible for both TSVI needs and spring release to downstream irrigators
5. Continue to add more snow guns
6. Get a better understanding of high mountain precipitation cycles similar to GGI's piezometer/recharge analyses
7. Explore cloud seeding in partnership with VTSV, US Forest Service, Taos Pueblo, NM Interstate Stream Commission, Taos Valley Acequia Association/Rio Hondo acequias and Natural Resources Conservation Service (NRCS)
    a. Not all clouds are suitable for seeding and seeding must be adapted to the cloud conditions
    b. Researchers at the National Center for Atmospheric Research in Boulder state that cloud seeding enhances snowfall under the right conditions
    c. NM has had cloud seeding law on the books that claims its sovereign rights to moisture over its land mass (needs more research)
    d. Cloud seeding has been done for many years in Colorado and California and until COVID, Vail had an annual budget line item for cloud seeding and allegedly increased precipitation in specific clouds by 24%

e. Cloud seeding will also benefit irrigators and summer recreational activities

Village of Taos Ski Valley

1. Implement GGI and DEC's recommendations in the Water Master Plan
2. Reduce VTSV system losses
3. Develop and connect Gunsite Spring into Village treatment and distribution system
4. Prepare and implement a water conservation plan
5. Reduce its CO_2 emissions
6. More effectively manage runoff, erosion, and sedimentation from Village roads
7. Continue to pursue forest thinning projects
8. Participate as a cloud-seeding partner

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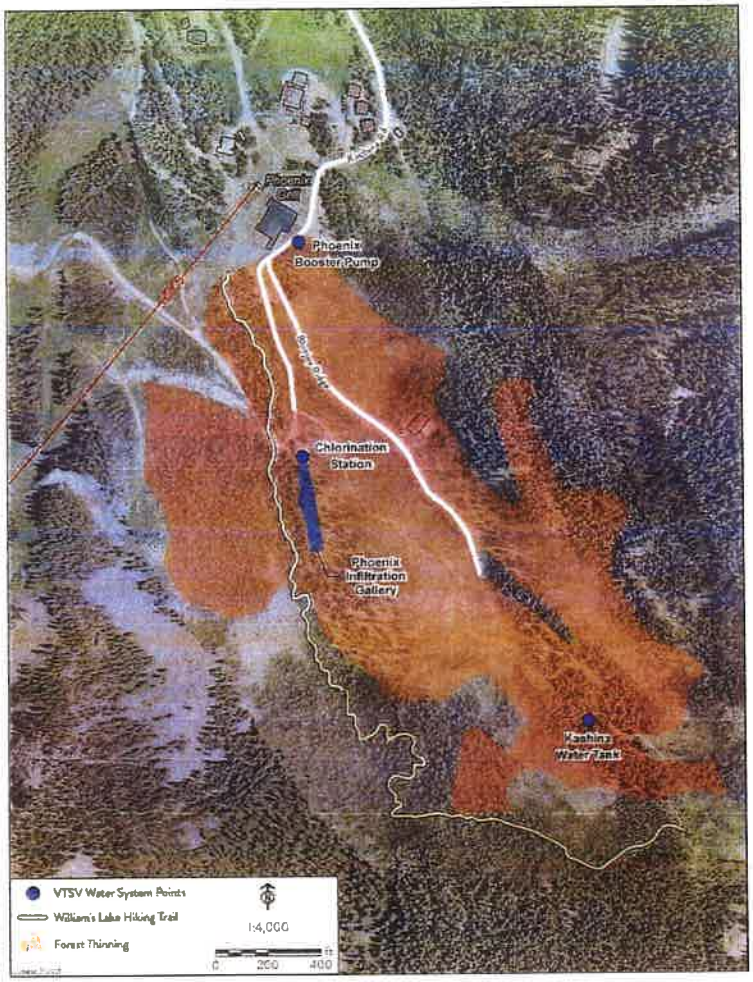
VILLAGE OF TAOS SKI VALLEY

WATER MASTER PLAN
TECHNICAL MEMORANDUM



PREPARED FOR:
VILLAGE OF TAOS SKI VALLEY
TAOS SKI VALLEY, INC.

DECEMBER 2021

PREPARED BY:

Gary H. Bierner, P.E.
Tappan J. Mahoney, P.E.

DENNIS ENGINEERING COMPANY

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VILLAGE OF TAOS SKI VALLEY

WATER MASTER PLAN
TECHNICAL MEMORANDUM

DECEMBER 2021

Prepared by the undersigned, whose seal as a Professional Engineer, licensed to practice as such in the State of New Mexico, is affixed below:

Gary H. Bierner, P.E.
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GARY H. BIERNER
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26787
12-16-2021
PROFESSIONAL ENGINEER

DEC
DENNIS ENGINEERING COMPANY

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1 EXECUTIVE SUMMARY

The Village of Taos Ski Valley (VTSV) is a small community in Taos County located within the Carson National Forest in northcentral New Mexico. This technical memorandum was prepared by Dennis Engineering Company (DEC) with information provided by VTSV, Taos Ski Valley, Inc. (TSVI), and Glorieta Geoscience, Inc. (GGI) to evaluate the existing water distribution system, current and projected system demand and related infrastructure to recommend improvements to provide the community with a more reliable water distribution system. The scope of this technical memorandum includes the following tasks:

- Evaluation of water usage data provided by VTSV.
- Evaluation of the existing water distribution facilities serving the community.
- Evaluation of the water system reliability under the current and future demand conditions and recommend improvements.
- Prioritize recommended improvements.

1.1 NEED FOR THE IMPROVEMENTS

VTSV's water distribution system is supplied by the Phoenix Spring Complex. The existing water distribution system is shown in Figure 3-2. Historically, the Phoenix Spring Complex has provided adequate water to meet system demand; however, it has been observed by VTSV, typically during the week of spring break, that the Phoenix Spring struggles to meet demand in times of high demand and low spring flow. As such, historic and future supply from the Phoenix Spring Complex has been evaluated by GGI in a separate report (Riesterer, Drakos, & Lazarus, 2021). Based on GGI's evaluation of the Phoenix Spring, it is recommended that a low monthly average flow of 144 gallons per minute (gpm) (207,360 gallons per day (gpd)) and a low 5-day average flow of 126 gpm (181,440 gpd)[1] be utilized for planning purposes. Additionally, DEC evaluated flow into the system from the Phoenix Spring Chlorination Station (CS) and total system usage (metered and estimated unmetered usage) from February 2014 to December 2020 to determine the reliability of the water distribution system.

Based on DEC's evaluation, it was determined that peak system demand typically occurs December through March of each year with the greatest demand experienced in January. **During peak demand, it was observed that unaccounted-for water is, on average, 74%, meaning the distribution system customers utilize approximately 26% of the water metered at the Phoenix Spring CS.** EPA has estimated that, on average, water loss in systems throughout the United States is sixteen percent (16%) (U.S. Environmental Protection Agency, 2013). Additionally, per NMAC 17.12.750.15, unaccounted-for water exceeding fifteen percent (15%) of the total production should be given special attention in order to reduce excessive losses of water. It should

[1] In this technical memorandum, the unit's gpm and gpd are used to identify water flow rate. Traditionally, gpm is used to describe water demands such as average daily demand, max daily demand, and peak hourly demand. For the benefit of VTSV, the unit gpd is utilized for water demand and unaccounted-for water.

be noted that within VTSV's water distribution system the percentage of unaccounted-for water is related to system demand as when demand increases, unaccounted-for water decreases, suggesting that the longer the water remains in the system, the more unaccounted-for water will be experienced. It was observed in January of 2020 when VTSV experienced their highest demand on record (73,639 gpd) for the subject data interval, unaccounted-for water decreased to 63%.

Per discussions with VTSV, TSVI, and GGI, consideration of climate change and based upon improvements proposed within the Village, the following scenarios were analyzed to determine water supply, water demand and minimum unaccounted-for water.

1. Complete build-out of the Core Village Base Area and Kachina with a 20% increase in visitation.
2. Complete build-out of the Core Village Base Area and Kachina with a 20% increase in visitation and incorporation of Amizette into the water system.
3. Complete build-out of the Core Village Base Area and Kachina with a 20% increase in visitation and incorporation of Amizette with growth into the water system.

As shown in Table 4-2, Scenario 3 results in a water demand of 125,000 gpd, requiring unaccounted-for water be decreased to a maximum of 31%. It is recommended that VTSV work towards reducing unaccounted-for water to a maximum of 25% to provide adequate supply contingencies if larger demand is experienced or failures within the distribution system occur.

Considering the estimated low monthly average flow of 207,360 is experienced, VTSV would not be able to satisfy the existing system demand in March of 2022. **As such, VTSV should actively work towards reducing unaccounted-for water within the distribution system to ensure the distribution system can continue to meet existing system demands and permit growth within the Village.**

1.2 RECOMMENDED IMPROVEMENTS

The following is a list of recommended improvements to actively address unaccounted-for water.

1) Install new electromagnetic flow meters in separate vaults to meet manufacturer's recommended clear distances on the Green Tank inlet and outlet. These new meters should be used to verify unaccounted-for water between the Chlorination Station and the Green Tank.

2) Install master meters within the water distribution system at the locations and in the order identified in Figure 5-1 to isolate segments of the water distribution system. The readings provided by the intermediate meters should be analyzed in conjunction with customer meter readings on a monthly basis to identify and document unaccounted-for water. This data should be monitored for a minimum of one year. If after one year it is apparent that a particular isolated segment of the distribution system is responsible for large amounts of

unaccounted-for water, VTSV should consult with a water leak detection specialist to identify the best method to locate the damaged waterlines. Options are available, such as American Leak Detection and GPRS out of Albuquerque, NM. If VTSV suspects that the distribution waterlines within an isolated segment are subject to future leaks, such as segments with thin-walled PVC waterlines or galvanized waterlines, the entire water line within the isolated segment should be replaced.

3) Commence with a meter replacement program for all existing customer meters to ensure that all customer meters are scheduled to be replaced prior to the end of their service life (typically 15 to 20 years).

4) Establish a Water Loss Control Program to monitor and track progress towards decreasing unaccounted-for water. Additional information about AWWA's Water Loss Control Program and their free Water Audit Software can be found at: https://www.awwa.org/Resources-Tools/Resource-Topics/Water-Loss-Control.

2 INTRODUCTION

2.1 PURPOSE AND SCOPE

This technical memorandum was prepared by Dennis Engineering Company (DEC) for the Village of Taos Ski Valley (VTSV) and Taos Ski Valley, Inc. (TSVI) with information provided by VTSV, TSVI, and Glorieta Geoscience, Inc. (GGI). The purpose of this document is to evaluate the existing water distribution system, current and projected system demand and related infrastructure to recommend improvements to provide the community with a more reliable water distribution system. The scope of this technical memorandum includes the following tasks:

- Evaluation of water usage data provided by VTSV.
- Evaluation of the existing water distribution facilities serving the community.
- Evaluation of the water system reliability under the current and future demand conditions and recommend improvements.
- Prioritize recommended improvements.

2.2 PROJECT AREA

VTSV is located in Taos County in the northcentral part of the State of New Mexico within the Carson National Forest, approximately 19 miles northeast of Taos, NM and approximately 29 miles southeast of Questa, NM along NM State Road 522. Figure 2-1 shows the regional location of VTSV.

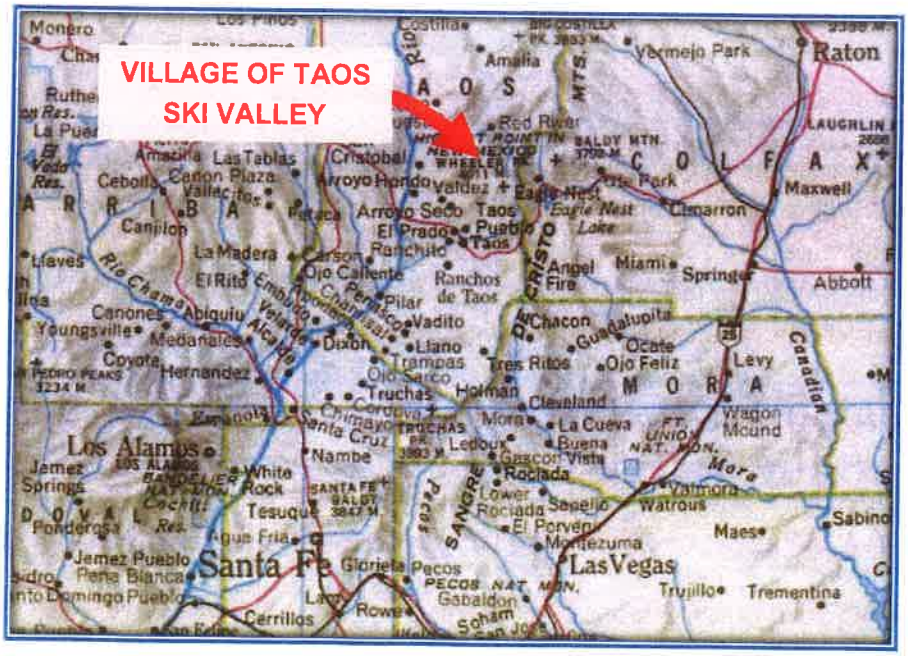


Figure 2-1. Regional Location Map

3 EVALUATION OF THE EXISTING WATER SUPPLY AND DISTRIBUTION SYSTEM

The following sections present an overview of the existing water distribution system. The existing system layout is shown in Figure 3-2.

3.1 EXISTING WATER DISTRIBUTION SUPPLY

3.1.1 PHOENIX SPRING COMPLEX

VTSV's primary source of potable drinking water is provided by the Phoenix Spring Complex as described in the GGI's "Assessment of Historic and Projected Flows from the Phoenix Spring Complex." The infiltration gallery and related infrastructure which collects flow from the Phoenix Spring Complex and transfers the flow to the chlorine contact chamber will not be discussed in-depth in this technical memorandum as this infrastructure is discussed in GGI's referenced water supply report.

3.1.2 CHLORINE CONTACT CHAMBER (CHLORINATION STATION)

Flow from the Phoenix Spring Complex enters the chlorination station (CS) by an 8-inch ductile iron waterline and a 4-inch ductile iron waterline. The flow from the Phoenix Spring Complex is then chlorinated and enters the chlorine contact chamber which discharges into the distribution system, or the flow is directed into an overflow basin which discharges directly into the Lake Fork. Flow directed to the distribution system is metered by an 8-inch Ultra Mag electromagnetic flow meter and flow directed to the overflow is metered by a 10-inch Ultra Mag electromagnetic flow meter (see Appendix A for information on Ultra Mag electromagnetic flow meters). Both meters were installed in 2012 and meter calibration was verified in 2021.

Upon evaluating the metered data from February 2014 to December 2020, it was observed that flow directed to the distribution system and flow directed to the overflow is dependent on water supply and water demand. In times of high demand and low spring flow, a larger percentage of spring flow is diverted into the distribution system and in times of low demand and high spring flow, a larger percentage of spring flow is diverted to the overflow. Based on review of the metered information from 2014 to 2020, it was determined that at no time during this period has 100% of the available spring flow entered the distribution system. This suggests that flow from the Phoenix Spring Complex has adequately met historic water demand. Upon review of the CS design, it was determined that 100% of the Phoenix Spring flow could be diverted to the distribution system, if necessary.

3.2 EXISTING WATER DISTRIBUTION SYSTEM

3.2.1 EXISTING DISTRIBUTION WATERLINES

There are approximately 35,000 LF of distribution waterlines throughout VTSV. These distribution waterlines are comprised of 10-inch, 8-inch, 6-inch, 4-inch and 2-inch ductile iron, PVC, and galvanized waterlines. The VTSV operator has indicated the PVC waterlines within the distribution system are not C-900 PVC and are similar to Sch. 40 PVC. The operator noted that these lines are brittle and subject to damage with movements in the earth. Water systems have moved away from utilizing Sch. 40 PVC for water distribution mains as Sch. 40 PVC is inferior to other products on the market, such as DR 18 C-900 PVC or ductile iron pipe. Based on available GIS data and maps provided by VTSV and TSVI, it is estimated that approximately 35% of the water distribution system is comprised of 12,200 LF of 8-inch, 6-inch, 4-inch and 2-inch PVC waterlines.

Galvanized waterlines are subject to corrosion overtime which can reduce flow through the waterlines and cause pinholes to develop within the waterlines. Currently, 3% of the water distribution system is comprised of 1,200 LF of galvanized 2-inch waterlines.

Ductile iron waterlines are effective in areas of ground movement provided joints are correctly installed and secured. Approximately 27% of the water distribution system is comprised of 9,500 LF of recently installed (2010-2020) 10-inch, 8-inch, and 4-inch ductile iron waterlines. These recently installed ductile iron waterlines are located within the Core Village Base Area, Commercial/ Business Base Area, Kachina Commercial/ Business zone, near the Pioneer Glade Tank and Kachina Water Storage Tank. Each joint of these new ductile iron waterlines was mechanically restrained with joint harnesses and were pressure tested. These lines are considered in good condition and are unlikely to contribute to unaccounted-for water.

The remaining 35% of the water distribution system is comprised of 12,300 LF of 8-inch and 6-inch ductile iron waterlines installed prior to 2010.Depending on when these waterlines were installed and the manner in which they were installed, there is a possibility that these waterlines contribute to unaccounted-for water.

3.2.2 EXISTING WATER DISTRIBUTION STORAGE AND PUMPING FACILITIES

The water storage system is comprised of three storage tanks located in various locations throughout the water system. The three tanks are the Green Tank, Pioneer Glade Tank, and the Kachina Water Storage Tank, which combine for a storage capacity of 750,000 gallons. Currently, there is only one booster station within the distribution system, and it is the Kachina Booster Station, located east of the Phoenix Day Lodge (See Figure 3-2).

3.2.2.1 *Green Tank*

The Green Tank is a round, partially buried 250,000-gallon steel water storage tank with an unknown installation date. A tank inspection was performed in September 2008 and indicated

extensive rust spots (<1% of surface is rusted) on the interior roof and walls, few isolated rust spots (<0.3% of surface is rusted) on the interior floor and noted that approximately 33% of the surface was rusted for the perimeter floor welds. The tank inspection report recommended the Green Tank be cleaned and inspected every 3 to 5 years (See Appendix B for complete tank inspection report).

The tank level is controlled by an altitude valve installed on the tank inlet. The inlet and outlet of the tank are metered by 6-inch mechanical Neptune HP Turbine meters of unknown age (see Appendix C for information on Neptune NP Turbine Meter). During a site visit it was observed that the upstream and downstream clear distance between valves and fittings do not appear to meet the manufacturer's recommendations. Considering the size limitations within the existing meter and altitude valve vault, it does not appear that the piping can be reconfigured to provide adequate upstream and downstream clear distances. Meter accuracy can be affected if the recommended upstream and downstream clear distances are not satisfied.

Based on the metered data for the Green Tank inlet and outlet and metered data for the Phoenix Spring Complex inlet, the water distribution system is currently experiencing approximately 80,000 gallons per day (gpd) of unaccounted-for water in this segment, which is approximately 36% of the total water supplied from the Phoenix Spring Complex and approximately 60% of total unaccounted-for water. **Determining the accuracy of the Green Tank meters is essential to determine if this unaccounted-for water is accurate or a result of inaccurate meter readings.**

3.2.2.2 *Pioneer Glade Tank*

The Pioneer Glade Tank is a round, buried 250,000-gallon concrete water storage tank that was constructed in 2010. The tank has one dedicated 4-inch inlet and one common 10-inch inlet/ outlet. A 4-inch altitude valve is installed on the dedicated 4-inch inlet and there is a 10-inch, two-way altitude valve installed on the common 10-inch inlet/outlet. These altitude valves control the water level within the Pioneer Glade Tank. Flow into and out of the Pioneer tank is not metered.

During the construction of the Pioneer Glade Tank, approximately 2,000 LF of 10-inch ductile iron distribution waterline was installed to connect the existing distribution system to the tank outlet.

3.2.2.3 *Kachina Water Storage Tank*

The Kachina Water Storage Tank is a rectangular buried 250,000-gallon concrete water storage tank constructed in 2020. The tank has two 125,000 gallon internal chambers, Chamber 1 and Chamber 2, with individual mixing systems. The chambers have individual common inlet/ outlets. The inlet/outlets are piped outside of the tank through a concrete vault. Within the vault, the common inlet/ outlet for Chamber 1 is metered whereas the common inlet/outlet for Chamber 2 is not metered. The tank is filled and water levels are maintained by the Kachina Booster Station located east of the Phoenix Day Lodge.

During construction of the Kachina Water Storage Tank approximately 960 LF of 8-inch ductile iron distribution waterline was installed to connect the tank outlet line to the portion of the water distribution system previously supplied by the Kachina Booster Station. VTSV is currently locating an 8-inch ductile iron waterline previous installed so that the Kachina Water Storage Tank can provide flow to the Kachina Village. Additionally, VTSV is investigating the need for a pressure reducing/ sustaining valve to connect the Kachina Water Storage Tank to the remainder of the water distribution system. **It is recommended that VTSV pursue all improvements necessary to connect the Kachina Water Storage Tank to both the Kachina Village and the remainder of the water distribution system.**

3.2.2.4 *Kachina Booster Station*

The Kachina Booster Station is located east of the Phoenix Day Lodge and provides water to the Kachina Water Storage Tank and the Schnitzer Cabin. The booster station utilizes two 15hp, vertical multi-stage vertical pumps to provide water to the Kachina Water Storage Tank. The motor and electrical components were upgraded in 2020 as a part of the Kachina Water Storage Tank project. Flow from the booster station is metered by a 2-inch Ultra Mag electromagnetic flow meter.

The meter readings from the Kachina Booster Station were analyzed; however, the meter was not transmitting readings for the years 2019 and 2020; therefore, the data available for outflow from the Kachina Booster Station was limited.

3.2.3 FIRE SUPPRESSION CAPABILITIES

3.2.3.1 *Current Fire Suppression Capabilities*

VTSV provides fire suppression by utilizing fire hydrants located throughout the distribution system. The VTSV fire hydrant flows observed in October 2020 are included in Appendix D. Based on these observed fire hydrant flows, the minimum flow provided by the existing fire hydrants is 448 gpm and the maximum flow provided by the existing fire hydrants is 1,574 gpm. Per the NMED-CPB Recommended Standards for Water Supply Systems, 2006 Edition, typical ranges of fire flow requirements are as follows:

1. Single Family Residential: 500 to 1,500 gpm for at least 2 hours.
2. Apartments/ Condominiums: 2,500 gpm for at least 4 hours
3. Commercial: 4,000 gpm for at least 4 hours

Actual fire protection requirements should be determined based on recommendations from the Insurance Service Office (ISO) working directly with VTSV.

Additionally, upon reviewing the existing fire hydrant layout, it appears that multiple fire hydrants are installed on 4-inch diameter water mains. Per Recommended Standards for Water Works, 2018 Edition, the minimum size of water mains providing fire protection and serving fire hydrants shall

be 6-inch diameter. 4 inch water mains within the distribution system which provide fire protection should be evaluated to determine if the 4-inch water mains are capable of providing adequate fire protection.

In this technical memorandum, available fire flow was analyzed for four different scenarios. Scenario 1 is available fire flow for residents and businesses located between the Green Tank and Pioneer Glade Tank, utilizing available fire flow from the Green Tank. Scenario 2 is available fire flow for residents and businesses located between the Green Tank and Pioneer Glade Tank utilizing available fire flow from the Green Tank and Kachina Water Storage Tank. Scenario 3 is available fire flow for residents and businesses located below the Pioneer Glade Tank utilizing available fire flow from the Green Tank and Pioneer Glade Tank. Scenario 4 is available fire flow for residents and businesses located below the Pioneer Glade Tank utilizing available fire flow from the Green Tank, Pioneer Glade Tank and Kachina Water Storage Tank. These four scenarios are based on utilizing only emergency storage and do not account for total available storage (operating storage + emergency storage) The 2-hour and 4-hour available fire storage for each scenario is identified below.

- Scenario 1:
  - 2-hour available fire flow: 1,965 gpm
  - 4-hour available fire flow: 983 gpm
- Scenario 2:
  - 2-hour available fire flow: 2,261 gpm
  - 4-hour available fire flow: 1,131 gpm
- Scenario 3:
  - 2-hour available fire flow: 3,621 gpm
  - 4-hour available fire flow: 1,811 gpm
- Scenario 4:
  - 2-hour available fire flow: 3,917 gpm
  - 4-hour available fire flow: 1,959 gpm

3.2.3.2 *Future TSVI 5MG Snow Making Storage Tank*

TSVI has plans to design and construct a non-potable 5 million gallon (MG) water storage tank to utilize for snow making. TSVI is planning to construct the necessary related infrastructure so that the 5MG storage tank could be used as back-up fire protection against catastrophic issues and forest fires. It should be noted that since it is non-potable water, water from the 5MG storage tank could not be used for or connected directly to the distribution system, but could include fire hydrants and lines through a separate non-potable water system.

3.3 UNACCOUNTED-FOR WATER (WATER LOSS)

EPA has estimated that, on average, water loss in systems throughout the United States is 16 percent (U.S. Environmental Protection Agency, 2013). Per NMAC 17.12.750.15, unaccounted-for water exceeding fifteen percent (15%) of the total production should be given special attention in order to reduce excessive losses of water. As illustrated in Table 3-1, VTSV's annual average unaccounted-for water is eighty percent (80%) of the total water supplied by the Phoenix Spring Complex, not including the Phoenix Spring overflow, from 2014 to 2020. Unaccounted-for water varies seasonally with demand. During peak usage, December through March, unaccounted-for water decreases to an average of seventy-four percent (74%) and during the off-season, unaccounted-for water increases to an average of eighty-three percent (83%). **Unaccounted-for water results in additional expenditures for electrical and chemical costs, which is an unnecessary burden on VTSV and its water consumers. The total unaccounted-for water from February 2014 through December 2020 is approximately 342 million gallons (1,050 acre-feet) or 135,000 gallons per day.**

As noted above, unaccounted-for water is related to system demand, as when demand increases, unaccounted-for water decreases, suggesting that the longer the water remains in the system, the more unaccounted-for water will be recorded. In January 2020, VTSV experienced their highest water demand on record (73,639 gpd) for the subject data interval and unaccounted for water decreased to 63%. The percentage of unaccounted-for water vs water demand from February 2014 through December 2020 was plotted with a trend line. The trend line, as shown in Figure 3-1, indicates that there is a correlation between unaccounted-for water and water demand.

Table 3-1. Historic Unaccounted-for Water

Historic Unaccounted-for Water			
Year	Annual	Peak Season*	Off-Season
2014	77%	--	87%
2015	82%	73%	88%
2016	82%	72%	87%
2017	84%	74%	88%
2018	86%	77%	90%
2019	77%	78%	78%
2020	74%	69%	63%
Average	80%	74%	83%

*Peak Season includes usage from December of the previous year.

--Spring flows for December 2013 and January 2014 were unavailable therefore the unaccounted-for water for the 2014 Peak Season is undeterminable.

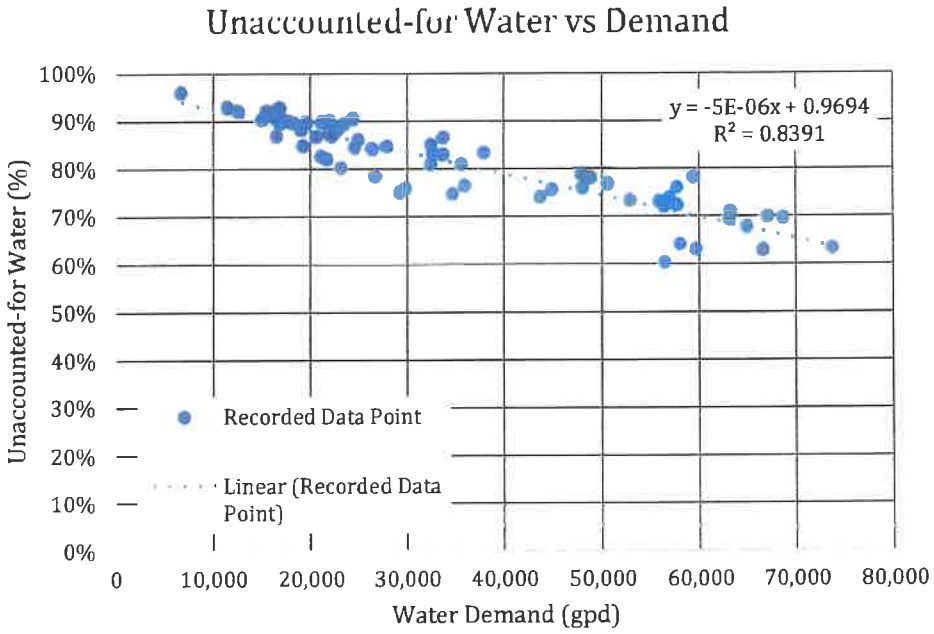
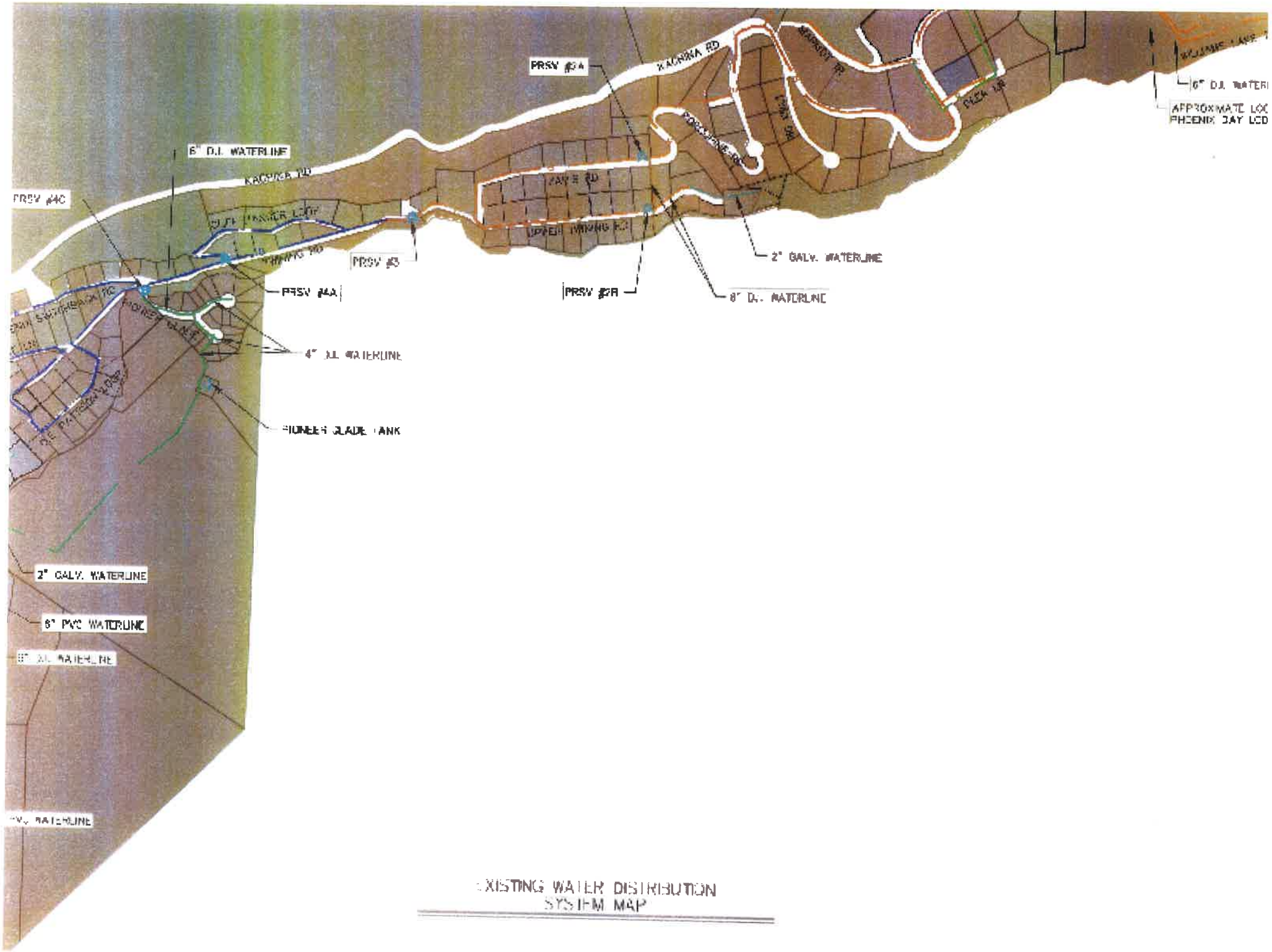


Figure 3-1. Unaccounted-for Water vs. Demand



EXISTING WATER DISTRIBUTION
SYSTEM MAP

4 CURRENT AND ESTIMATED FUTURE WATER DEMAND

4.1 CURRENT WATER DEMAND

4.1.1 ANNUAL WATER DEMAND

Water demand within VTSV is highly seasonal with peak demand occurring in December through March. Beginning in April, water demand decreases significantly, rebounds slightly from June through August and then decreases again until demand begins to increase in late November, early December.

Customer usage, metered bypass and unmetered (estimated) bypass provided by VTSV was analyzed from February 2014 to December of 2020. During this period, the average water usage was 12.5 MG per year (38 acre-feet) or 35,000 gpd. On average, 6.7 MG (55,000 gpd) was documented through customer meters, metered bypass, and estimated unmetered bypass during the peak season while 5.8 MG (24,000 gpd) was documented through customer meters, metered bypass, and estimated unmetered bypass during the off-season. It was estimated that the Base Area – Core Village zone utilizes 50% of the total water consumption while the Base Area – Commercial/ Business zone utilizes 25% of the total water consumption. As such, the Base Area – Core Village and Base Area – Commercial/ Business utilize 75% of the total water consumption. The remaining 25% of total water consumption is distributed throughout the Kachina Commercial/ Business, Residential, Farming & Recreation and Special Use zones.

4.1.2 PEAK WATER DEMAND

As identified above, peak water demand occurs from December thru March of any given year. Through examination of VTSV's metered records, coordination with VTSV, TSVI, and GGI, it was determined that peak usage should be evaluated considering low spring flow occurs during the same time of year. In GGI's report, GGI analyzed spring flow to determine when supply from the Phoenix Spring Complex is of greatest concern. **Based on analysis of the water usage, review of GGI's report and discussions with VTSV and TSVI, it was determined the month of March is of greatest concern.**

Table 4-1 identifies the monthly average spring flow, flow to the CS, average daily demand, maximum daily demand and peak hourly demand for peak usage from December 2014 to March 2020. As indicated by Table 4-1, the largest peak demand typically occurs in January with demand in February and March being several thousand gallons per day less. Though, on average, March experiences less demand than January or February, it is estimated that the average maximum daily demand of 100,000 gallons per day is experienced for at least five (5) consecutive days during spring break. **When high demand, storage capacity and unaccounted-for water is considered, and the estimated 5-day average low flow of 181,000 gpd is experienced during spring break, the water system will have difficulty providing flow to the consumers.**

Considering that the Kachina Water Storage Tank is not currently connected to the water distribution system, it is estimated that the Green Tank and Pioneer Glade Tank will utilize all of their available operating storage within 20 hours. Once these tanks drop below operating storage, the storage tanks will require continuous fill to meet system demand until demand drops below the maximum daily demand. Once the Kachina Water Storage Tank is placed into service, and considering both chambers are full, it is estimated that the operating storage will deplete in 48 hours.

Table 4-1. Historic Water Demand

Historic Water Demand					
December					
	Average Spring Flow (gpd)	Average Spring Flow to CC (gpd)	Average Daily Demand (gpd)	Maximum Daily Demand (gpd)	Peak Hourly Demand (gpd)
2014	344,396	186,420	35,520	63,936	106,560
2015	403,699	208,285	57,026	102,646	171,077
2016	329,373	198,676	47,882	86,187	143,646
2017	449,317	198,289	33,649	60,568	100,947
2018	369,679	252,293	33,649	60,568	100,947
2019	332,223	183,522	44,765	80,576	134,294
Average	372,000	205,000	43,000	76,000	127,000
January					
2015	343,706	199,962	64,854	116,738	194,563
2016	445,685	206,649	55,696	100,252	167,087
2017	327,693	216,666	50,439	90,791	151,318
2018	323,990	221,842	66,935	120,483	200,805
2019	298,332	270,274	59,253	106,655	177,758
2020	387,473	200,397	73,639	132,550	220,917
Average	355,000	220,000	62,000	112,000	186,000
February					
2015	295,492	197,598	52,773	94,992	158,320
2016	351,272	204,846	63,000	113,401	189,001
2017	334,309	215,870	63,136	113,644	189,407
2018	316,627	221,267	48,685	87,632	146,054
2019	264,801	239,536	57,573	103,631	172,718
2020	301,672	179,439	66,466	119,638	199,397
Average	311,000	210,000	59,000	106,000	176,000
March					
2015	275,051	200,564	56,238	101,229	168,714
2016	296,934	207,772	57,642	103,755	172,925
2017	280,909	216,694	56,786	102,214	170,357
2018	268,249	224,764	47,744	85,940	143,233
2019	251,736	224,899	68,518	123,332	205,553
2020	253,356	168,259	43,571	78,428	130,714
Average	272,000	208,000	56,000	100,000	166,000

4.2 ESTIMATED FUTURE WATER DEMAND

4.2.1 BASE LINE WATER DEMAND

This technical memorandum utilized the 2019 VTSV Water Metered log as the last full year of service pre-COVID 19. The Water Metered log has been cross referenced to those properties that were connected to the water system and serviced in 2019. As a consequence, the 2019 Service Area differs from the Land Use Assumptions accepted by Village Council in September 2021 which represents all properties in the Village of Taos Ski Valley.

In aggregate, the 2019 Service Area is comprised of the following:

2019 Service Area:

Multi-Family & Condos	276 units
Hotel rooms	108 units
Single Family Residential	103 units
Commercial Square Footage	155,272 sq. ft.

Additional information relating to the Water System Service Area is identified in Appendix I.

4.2.2 PROJECTED WATER DEMAND

4.2.2.1 *Projected Water Demand Assumptions*

To forecast future demand, this technical memorandum made several assumptions as it relates to the future Service Area. These assumptions are noted below and described further in Section 4.2.2.2.

1. All of Amizette is included within the Service Area.
2. A 100% build-out of all remaining Residential zoned properties in both main Village and Amizette.
3. A 20% growth factor in the existing 2019 Service Area to reflect increased demand.
4. A full build-out of the 2012 Conceptual Master Plan for the Core Village (See Appendix G).
5. A full build-out of the October 2021 Kachina Area Master Plan (See Appendix H)
6. A timeline of a 25-year build-out
7. VTSV remedies the average 74% unaccounted-for water that currently exists within the water distribution system and reduces unaccounted-for water to 25%. Note – NMAC 17.12.750.15 recommends that unaccounted-for water be addressed upon exceeding15% water loss.

8. A 0.5% loss compounded annually to the supply of water from the Chlorination Station to account for impacts from Climate Change.

In aggregate, the Projected Service Area based on VTSV's Land Use Assumptions is comprised of the following:

Projected Service Area:

Multi-Family & Condos	635 units
Hotel Rooms	276 units
Single Family Residential	271 units
Commercial Square Footage	205,572 units

For additional information relating to the Baseline and Projected Water Demand, refer to Appendix E.

4.2.2.2 *Projected Water Demand*

This technical memorandum has identified that water supply in the month of March is of greatest concern as during this month, water supply is at its lowest and water demand is significant as it coincides with Texas spring break. Per GGI's report climate change will result in a further decrease in supply during the month of March. To account for climate change, GGI's estimated low monthly average flow of 207,360 gpd was reduced by 0.5% yearly through the estimated build-out period of 25-years. Considering this reduction in supply due to climate change, and if the estimated low monthly average flow of 207,360 gpd is experienced, if VTSV does not address the unaccounted-for water that the distribution system is currently experiencing, VTSV will no longer be able to meet the existing system demand in March of 2022. **As such, it is recommended that VTSV actively work towards decreasing unaccounted-for water within the distribution system to ensure that VTSV can continue to meet system demand and permit growth within the Village.**

The following Service Area growth scenarios were analyzed to determine the projected system demand and determine the minimum amount of unaccounted-for water to meet system demand:

1. Complete build-out of the Core Village Base Area and Kachina with a 20% increase in visitation.
2. Complete build-out of the Core Village Base Area and Kachina with a 20% increase in visitation and incorporation of Amizette into the water system.
3. Complete build-out of the Core Village Base Area and Kachina with a 20% increase in visitation and incorporation of Amizette with growth into the water system.

Table 4-2 identifies the climate change adjusted low monthly flow, distribution system demand and maximum unaccounted-for water to satisfy system demand for each scenario. The minimum

unaccounted-for water to satisfy demand identified in Table 4-2 is the theoretical value based on the assumptions identified in Section 4.2.2.1; however, **it is recommended that VTSV work towards reducing unaccounted-for water to a maximum of 25% to provide adequate supply contingencies if larger demand is experienced or failures within the distribution system occur.**

Table 4-2. Service Area Growth Scenarios

Scenario	Adjusted Estimated Average Water Supply (GPD)	Distribution System Demand (GPD)	Maximum Unaccounted-for Water to Satisfy Demand (%)
Build-out for Base Village and Kachina w/ 20% Increase in Visitation	182,000	116,000	36%
Build-out for Base Village and Kachina w/ 20% Increase in Visitation and Incorporation of Amizette	182,000	123,000	32%
Build-out for Base Village and Kachina w/ 20% Increase in Visitation and Incorporation of Amizette w/ Growth	182,000	125,000	31%

5 RECOMMENDED IMPROVEMENTS TO ADDRESS UNACCOUNTED-FOR WATER

The following sections present proposed improvements to address unaccounted-for water within VTSV. The proposed improvements are identified in Figure 5-1.

5.1 RECOMMENDED IMPROVEMENTS

5.1.1 VERIFY SOURCE AND INTERMEDIATE METER ACCURACY

5.1.1.1 *Phoenix Spring System-in and Overflow Meters*

Per discussions with the VTSV operator, James Kircher with Yukon & Associates, Ltd. was recently on-site and verified that the Phoenix Spring Complex system-in and overflow meters are correctly calibrated. As discussed in Section 3.1.2, these meters were installed in 2012. The expected service life of these meters is 30-years. As such, VTSV should plan to replace these meters within the next 20 years.

5.1.1.2 *Green Tank Inlet and Outlet Meters*

As mentioned in Section 3.2.2.1, the age and accuracy of the Green Tank inlet and outlet mechanical Neptune meters are unknown. Additionally, it appears that the that these meters do not satisfy the upstream and downstream clearance requirements identified in the manufacturer's published installation and maintenance guide.

To ensure accurate flow measurements, the Neptune Meters should be replaced with Ultra Mag electromagnetic flow meters and placed in a separate vault, ensuring that upstream and downstream clearance requirements are satisfied (see Detail A1, Figure 5-1).

5.1.2 INSTALLATION OF MASTER METERS TO ISOLATE DISTRIBUTION SYSTEM

5.1.2.1 *Installation of Intermittent Master Meters*

The installation of additional master meters are necessary to isolate portions of the water distribution system to identify locations of unaccounted-for water. **It is recommended that VTSV install Ultra Mag electronic flow meters in individual vaults with buried gate valves upstream and downstream of the vault to isolate the meters in event that the meters need to be taken off-line for maintenance (See Detail A1, Figure 5-1).** It is not shown in Detail A1, but it is recommended that bypass piping be installed at each of these locations in the event that the meters need to be taken off-line for an extended period of time. Each master meter location should be evaluated during design to determine the feasibility and necessity of bypass piping. Figure 5-1 identifies the location and proposed priority that master meters be installed.

The data from the master meters should be monitored in conjunction with customer meter readings on a monthly basis to identify potential unaccounted-for water. This data should be analyzed for a minimum of one year to identify and document unaccounted-for water. **If after one**

year it is apparent that an isolated segment of the distribution system is responsible for a large quantity of unaccounted-for water, VTSV should consult with a water leak detection specialist to identify the best method to locate the damaged waterlines. Options are available, such as American Leak Detection and GPRS out of Albuquerque, NM. If VTSV suspects that the distribution waterlines within an isolated segment are subject to future leaks, such as segments with thin-walled PVC waterlines or galvanized waterlines, the entire waterline within the isolated segment should be replaced.

5.1.3 VERIFY CUSTOMER METER ACCURACY

5.1.3.1 *Residential and Commercial Customer Meters*

VTSV does not currently test meters for accuracy or have a meter replacement program to ensure that customer meters are replaced prior to the end of their service life. Depending on the meter manufacturer, meter service life is generally 15 to 20-years. Per discussions with VTSV, customer meters are replaced on an "as needed" basis. Considering the severity of water loss within the water distribution system, **it is recommended that VTSV replace all customer meters within the distribution system and begin a meter replacement program to ensure that all customer meters are scheduled to be replaced prior to the end of their service life.**

If VTSV is aware of new or recently installed meters, VTSV should test these meters for accuracy. Portable water meter test kits, such as the Recordall Portable Small Meter Tester (0.25 – 25 gpm) or Recordall Portable Large Meter Tester (0.5 – 500 gpm) (see Appendix F for product information), are available for purchase. If meter accuracy is confirmed, the meters should be added to the meter replacement program. If meters are inaccurate, the meters should be replaced.

5.1.4 ESTABLISH A WATER LOSS CONTROL PROGRAM

VTSV should establish a Water Loss Control Program, such as the free Water Audit Software provided by AWWA to monitor and track progress towards decreasing unaccounted-for water. Additional information about AWWA's Water Loss Control Program and their free Water Audit Software can be found at: https://www.awwa.org/Resources-Tools/Resource-Topics/Water-Loss-Control.

5.2 PRIORITY OF RECOMMENDED IMPROVEMENTS

5.2.1 PRIORITY NO. 1

Install new master meters in separate vaults for the Green Tank inlet and outlet to ensure recommended upstream and downstream clear distances are satisfied. By installing these new master meters, the distribution waterline between the CS and Green Tank (~4,600 LF) can be isolated. As identified in Section 3.2.2.1, the meter readings from existing mechanical meters indicate an apparent average unaccounted-for water of 80,000 gpd (60% of the total documented unaccounted-for water).

5.2.2 PRIORITY NO. 2

Install a new master meter at the intersection of Twining Road and Pioneer Glade, prior to the branch line to Pioneer Glade. The installation of this meter along with the installation of the master meter on the Green Tank outlet and customer meters will isolate approximately 3,200 LF of 8-inch ductile iron waterline, 1,600 LF of 6-inch ductile iron waterline, 1,400 LF of 8-inch PVC waterline, and 1,200 LF of 4-inch PVC waterline. All waterlines isolated were installed prior to 2010 and are likely to contribute to unaccounted-for water. **It is important to prioritize this segment as it not only provides water to residential lots but is the only water main that provides water from the Green Tank to the Pioneer Glade Tank and the remainder of the Core Village Base Area and Commercial/ Business Base Area.**

5.2.3 PRIORITY NO. 3

Install four (4) new master meters. One master meter should be installed on the 4-inch inlet to the Pioneer Glade Tank in a separate valve vault. This meter along with customer meters will isolate approximately 400 LF of 8-inch ductile iron waterline and 800 LF of 4-inch ductile iron waterline. All waterlines in this isolated segment were installed after 2010 and are unlikely sources of unaccounted-for water; however, it is necessary to isolate these waterlines in order to evaluate the remainder of the isolated segment.

The remaining three (3) master meters should be installed at the intersection of Twining Road and Ernie Blake Road. One meter should be installed southeast of the intersection along Twining Road, another should be installed northwest of the intersection along Twining Road and the final meter should be installed west of the intersection along Ernie Blake Road. These three master meters, along with customer meters, will isolate approximately 2,000 LF of 8-inch PVC waterline and 4,400 LF of 4-inch PVC waterline. All waterlines isolated in this segment were installed prior to 2010 and are likely to contribute to unaccounted-for water. Additionally, these waterlines supply the Core Village Base Area and Commercial/ Business Base area, which accounts for the majority of water usage within the system.

5.2.4 PRIORITY NO. 4

Install a new master meter on the 6-inch ductile iron waterline installed in 2017 near the Children's Center. This meter, along with customer meters, will isolate approximately 750 LF of 6-inch PVC waterline and 2,200 LF of 2-inch PVC waterline. All waterlines isolated in this segment were installed prior to 2010 and are likely to contribute to unaccounted-for water. The primary users for this isolated segment are those located along Firehouse Rd. and VTSV's wastewater treatment facility.

5.2.5 PRIORITY NO. 5

As noted in Section 3.2.3.1, there are locations within the distribution system where 4-inch water mains are utilized for fire protection. There is approximately 1,200 LF of 4-inch PVC water mains in

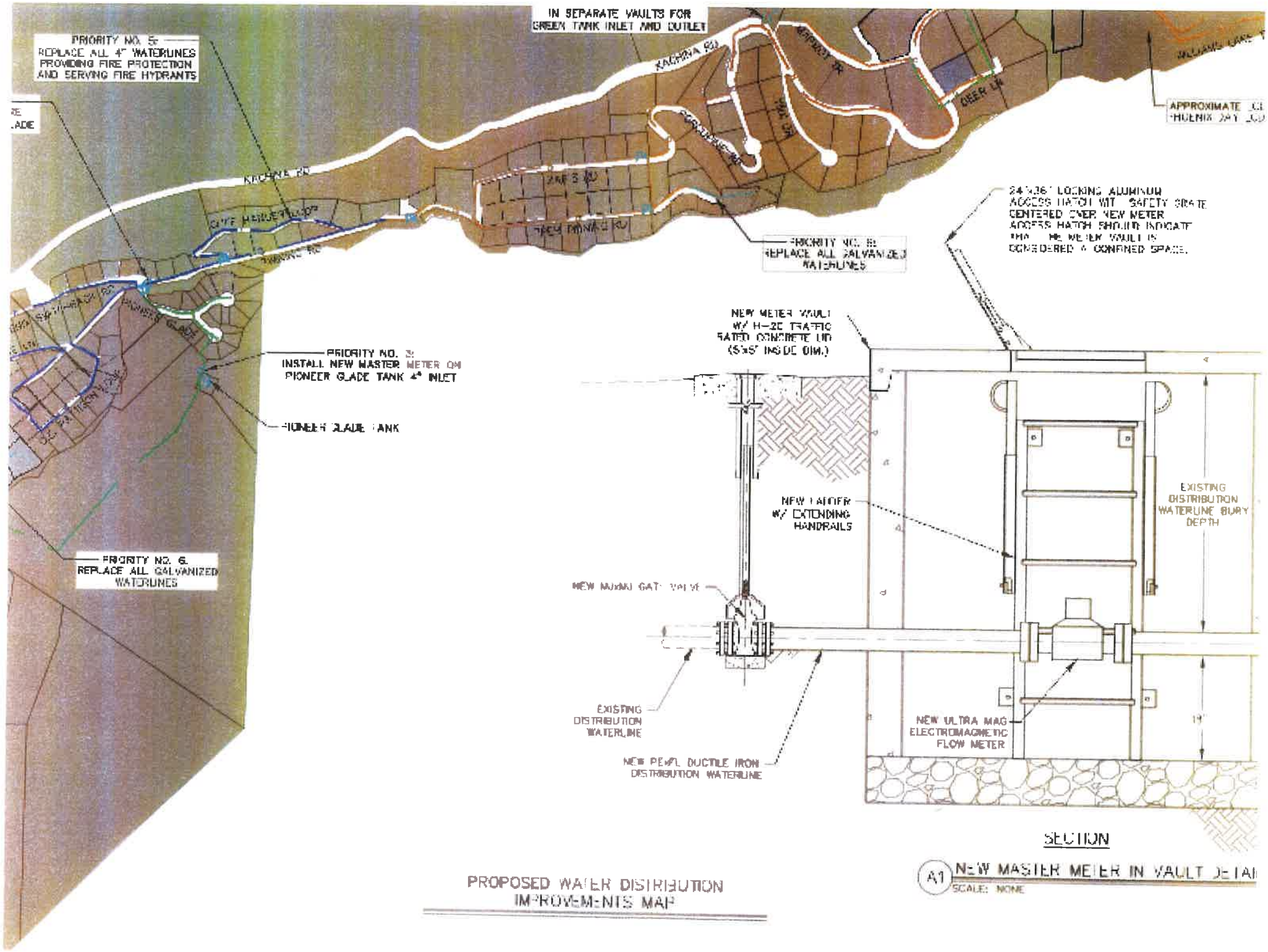
the segment isolated by the master meters identified in Priority No. 3 and 4,400 LF of 4-inch PVC water mains in the segment isolated by the master meters identified in Priority No. 4 utilized for fire protection. These water mains should be thoroughly evaluated to determine fire protection capabilities. If it is determined that these 4-inch water mains are unable to provide adequate fire protection, these water mains should be immediately replaced with adequately sized water mains to satisfy water protection needs.

5.2.6 PRIORITY NO. 6

Based on available mapping, there are approximately 1,200 LF of 2-inch galvanized water lines within the distribution systems. Galvanized waterlines are subject to corrosion overtime which can reduce flow through the waterlines and cause pinholes to develop within the waterline. Galvanized waterlines should be replaced with adequately sized ductile iron waterlines to provide a more reliable water system.

5.2.7 PRIORITY NO. 7

Replace all customer meters and begin a meter replacement program to ensure that all customer meters are scheduled to be replaced prior to the end of their service life (typically 15 to 20 years).



PROPOSED WATER DISTRIBUTION IMPROVEMENTS MAP

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 RECOMMENDATIONS

VTSV is currently experiencing excess unaccounted-for water within their water distribution system. It is recommended that VTSV pursue all proposed improvements outlined in this technical memorandum in attempt to reduce unaccounted-for water to twenty-five (25%), or less. By reducing unaccounted-for water to 25% or less, VTSV will be able to utilize a greater amount of water from the Phoenix Spring Complex, thereby allowing VTSV to expand without immediately pursuing a separate water source. Additional benefits to reducing unaccounted-for water is that VTSV will save expenses related to energy and disinfection costs no longer needed for disinfecting water lost to the system.

In general, water systems with more than one source of water supply are more reliable. As noted above, if unaccounted-for water is decreased to 25% or less, VTSV will not have to immediately pursue a separate water source; however, considering the Phoenix Spring Complex is the only water source for VTSV, VTSV should consider the development of Gunsite Spring pending the outcome of the investigations discussed in GGI's report.

6.2 PROJECT FUNDING OPTIONS

The following are known sources of funding in the state for water projects such as those outlined in this report. It should be noted that multiple funding sources require a planning document outlining specific projects with the submission of the funding application.

USDA - Rural Development (RD)	
Water and Environmental Programs (WEP)	The USDA-RD program provides water and wastewater funding to rural areas (with a population of less than 10,000). Applications are accepted year-round. USDA funding is considered a loan first, and then after evaluation of the entity's financial information, the amount of grant is determined. Additional information can be obtained by contacting USDA-RD at 505-761-4955 or visiting their website at www.rd.usda.gov.
New Mexico Legislature	
Capital Outlay	Capital Outlay funding is appropriations made by the New Mexico legislature. The project monies are funded by the General Fund, Capital Projects Fund or by the proceeds generated by the sale of Severance Tax Bonds (STB) and is considered a grant. Applications are submitted in January/February during the legislative session and require the signature of the senator/representatives of the respective area.

	Capital Outlay requests can be for a variety of projects but typically include water, wastewater, solid waste, storm drains, planning/reports and essential community facilities. Additional information can be obtained from the entities legislators or respective Council of Governments.
New Mexico Environment Department (NMED) Programs	
Program Name	*Brief Description*
Rural Infrastructure Program (RIP)	The purpose of this program is to provide financial assistance to local authorities for the construction or modification of water, wastewater or solid waste facilities. RIP may also be used as a bridge loan for other funding sources to provide initial engineering or other services. Eligible projects include: Pollution control projects Water tanks and pipelines New sewer interceptors and collectors, Water and sewer system rehabilitation Infiltration/inflow correction Treatment plant improvements Non-point source projects Septic tanks Solid waste facilities Applications are accepted year-round and are available through NMED's website (https://www.env.nm.gov/forms/). For additional information, contact the RIP Program Administrator at 505-469-3365 or 505-469-3459 or by email at nmenv-cpbinfo@state.nm.us.
New Mexico Finance Authority (NMFA) Programs	
Water Trust Board (WTB)	There are five categories of eligible projects: Water Conservation or Recycling, Treatment or Reuse Flood Prevention Water Storage, Conveyance, and Delivery Watershed Restoration Endangered Species Act. Water Trust Board funding consists of a loan, grant and match and are considered state funding. Per the 2022 Application Overview and Frequently Asked Questions, the interest rate on the loan is 0%. Applications are accepted annually and are typically due in October. For additional information, contact NMFA at 1-877-275-6632 or wtbadmin@nmfa.net.
Drinking Water State Revolving Loan Fund (DWSRLF)	The DWSRLF program provides low cost financing for construction and improvements to drinking water facilities. Eligible projects include:

	New and replacement water sources, treatment, transmission and distribution lines Storage SCADA Infrastructure to interconnect or regionalize Energy efficient and water conservation Installation and replacement of water meters. Applications are accepted throughout the year but are only reviewed in August, November and February. Interest rates vary between 0% and 4%; contingent upon the type of system (public vs. private) and disadvantage status. DWSRLF funding is considered federal funding; it is co-administered by NMFA and NMED – Drinking Water Bureau. Subsidies are available, however, the best chances of receiving subsidies is during the first application period of the year (February). Additional information is available through NMFA DW@nmfa.net or 1-877-275-6632.
Local Government Planning Fund (LGPF)	Eligible projects (planning documents) for NMFA's LGPF program include: Preliminary Engineering Reports Environmental Information Documents that are compliant with the State's Drinking Water Revolving Loan Fund Plans to implement the Local Economic Development Act Water Conservation Plans Comprehensive Plans Priority infrastructure projects identified on the entities Capital Improvement Plans Economic development feasibility studies Asset Management Plans Energy Audits Applications for planning funds are accepted monthly and are considered state funds. LGPF is limited to $50,000 per planning document and $100,000 per entity per 24 month period. The funding consists of a grant and entity match, the percentages of which are contingent upon median household income, local burden ratio and other considerations as identified in the rules government the LGPF. Additional information can be obtained by contacting NMFA at 1-877-275-6632.
Department of Finance and Administration – Local Government Division (DFA-LGD) Programs	
Community Development Block Grant (CDBG)	The CDBG program is administered by the New Mexico Department of Finance Authority. Eligible projects include: Water

	Wastewater Storm water drainage Solid waste Planning reports Essential community facilities The maximum amount that can be applied for is $750,000 and this funding is considered federal funding. Funding from the CDBG program is a grant and there is a matching requirement (either 5% or 10%, contingent upon rural or non-rural status). Applications are accepted annually, usually in the spring; however, in 2021, applications were accepted in September. Additional information can be obtained by call DFA-LGD at 505-827-8051 or at DFA's website (www.nmdfa.state.nm.us).

7 REFERENCES

Great Lakes - Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers. (2018). *Recommended Standards for Water Works.* St. Paul: Minnesota's Bookstore Communications Media Division.

New Mexico Environmental Department - Construction Programs Bureau. (2006). *Recommended Standards for Water Facilities.*

Riesterer, J., Drakos, P., & Lazarus, J. (2021). *Assessment of Historic and Projected Phoenix Spring Flows.*

U.S. Environmental Protection Agency. (2013, July). *Water Audits and Water Loss Control for Public Water Systems.* Retrieved from https://www.epa.gov/sites/default/files/2015-04/documents/epa816f13002.pdf

APPENDIX A: ULTRA MAG ELECTROMAGNETIC FLOW METER

MODEL UM06 AND UM08

ULTRA MAG® ELECTROMAGNETIC FLOW METER
150 PSI FLANGED TUBE METER, SIZES 2" thru 48"
300 PSI FLANGED TUBE METER, SIZES 2" thru 48"

M-SERIES SIGNAL CONVERTER

UltraLiner TECHNOLOGY

DESCRIPTION

MODELS UM06 AND UM08 FLANGED TUBE ULTRA MAG meters are manufactured to the highest standard available for magmeters. They incorporate microprocessor technology to offer very low flows and broad rangeability. The flanged end tube design permits use in a wide range of applications with up to 300 PSI working pressure. Flanged ends are Class "D" flat face flanges (150 PSI) or Class "F" raised face flanges (300 PSI). The fabricated tube is stainless steel with steel or stainless steel flanges and is lined with UltraLiner™, an NSF approved, fusion bonded epoxy material.

INSTALLATION is made similar to placing a short length of flanged end pipe in the line. The meter can be installed vertically, horizontally, or inclined on suction or discharge lines. The meter must have a full pipe of liquid for proper operation. Fluid must be grounded to the downstream flange of the sensor either via internal grounding electrodes (4 - 12") or using McCrometer 316 SS Grounding Rings. Any 90 or 45 degree elbows, valves, partially opened valves, etc. should not be placed closer than five pipe diameters upstream and two pipe diameters downstream. All blending and chemical injection should be done early enough so the flow media is thoroughly mixed prior to entering the measurement area.

SIGNAL CONVERTER: The M-Series signal converter is the reporting, input and output control device for the sensor. The converter allows the measurements, functional programming, control of the sensor and data recording to be communicated through the display and inputs/outputs. The M-Series microprocessor-based signal converter has a curve-fitting algorithm to improve accuracy, dual 4-20mA analog outputs, an RS485 communication port, an 8 line graphical backlit LCD display with 3-key touch programming, and a rugged enclosure that meets IP67. In addition to a menu-driven self-diagnostic test mode, the converter continually monitors the microprocessor's functionality. The converter will output rate of flow and total volume. The converter also comes standard with password protection and many more features.

OPTIONAL:

DC powered converter (10-35 VDC, 21 W)
Meter mounted converter
Extended warranty
Hastelloy® electrodes
ANSI or DIN flanges
Special lay lengths, including ISO standard lay lengths
Converter sun shield
Modbus Protocol RS485

SPECIFICATIONS

WARRANTY	2 Years
ACCURACY TESTS	3-point wet flow calibration of every complete flow tube with its signal converter. If desired, the tests can be witnessed by the customer. The McCrometer test facilities are traceable to the National Institute of Standards & Technology. Uncertainty relative to flow is ±0.15%
ACCURACY	Plus or minus 0.5% of actual flow
REPEATABILITY	±0.05% or ±.0008ft/s (±0.25mm/s), whichever is greater
HEAD LOSS	None. No obstruction in line and no moving parts
PRESSURE RANGE	150 PSI maximum working pressure (UM06) 300 PSI maximum working pressure (UM08)
TEMPERATURE RANGE	Operating: -10 to 77°C (14 to 170°F) Storage: -15 to 77° C (5 to 170° F)
VELOCITY RANGE	.2 to 32 FPS
BI-DIRECTIONAL FLOW	Forward and reverse flow indication and forward, reverse, net totalization are standard with all meters
CONDUCTIVITY	5 µs/cm
LINER	UltraLiner NSF approved, fusion bonded epoxy
ELECTRODES	Type 316 stainless steel, others optional
POWER SUPPLY	AC: 90-265VAC/45-66 Hz (20W/25VA) or DC: 10-35VDC (21W). AC or DC must be specified at time of ordering.
OUTPUTS	Dual 4-20mA Outputs: Galvanically isolated and fully programmable for zero and full scale (0-21mA) Four separate digital programmable outputs: open collector transistor usable for pulse, frequency, or alarm settings. • Volumetric Pulse • Hardware Alarm • Flow Rate (Frequency) • Empty Pipe • Directional Indication • Range Indication • High/Low Flow Alarms
EMPTY PIPE SENSING	Zero return when electrodes are uncovered
ALARMS	Programmable alarm outputs
DIGITAL TOTALIZER	M-Series restrictive based on pipe size. Cubic Meter, Cubic Centimeter, Milliliter, Liter, Cubic Ddecimeter, Decaliter, Hecaliter, Cubic Inches, American Gallons, Imperial Gallons, Cubic Feet, Standard Barrel, Oil Barrel, Cubic Yard, American Kilogallon, Imperial Kilogallon, Acre Feet, Megagallon, Imperial Megagallon
RATINGS	Metering Tube: NEMA 6P/IP68 with remote converter Electronics enclosure: IP67 and CE Certified

McCROMETER
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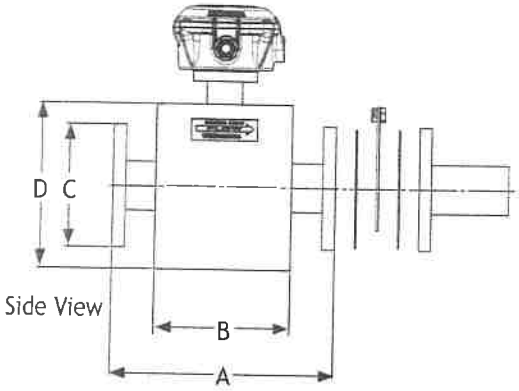
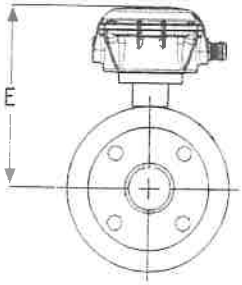
ULTRA MAG

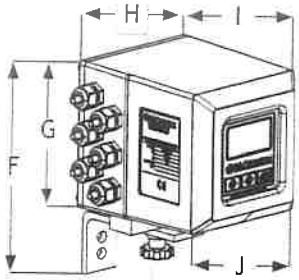
MODEL UM06 AND UM08

ELECTROMAGNETIC FLOW METER



2" and 3" Models Body Style

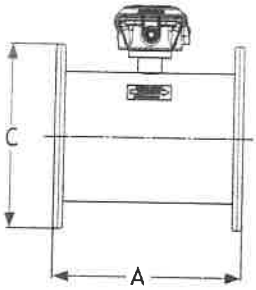


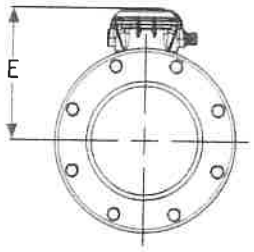


Bracket mounting holes are 0.27"

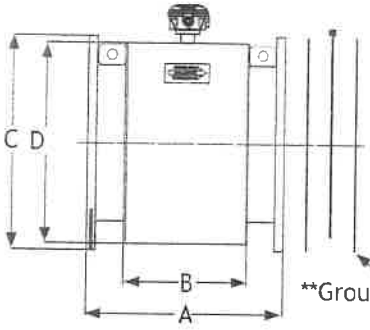
F	9.06"
G	5.75"
H	5.75"
I	6.69"
J	5.44"

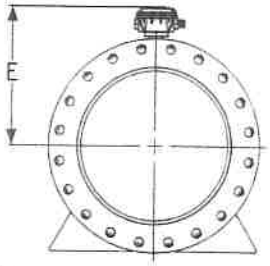
Converter Dimensions





4" to 12" Models Body Style





**Grounding Rings are 0.125" thick.

14+" Models Body Style

Pipe Size (Nominal)	Meter Pipe ID	Flow Ranges GPM Standard .2 to 32 FPS Min - Max	DIMENSIONS (Lay Lengths)							Estimated Shipping Weight (lbs.)	
			A*		B	C		D	E		
			UM06	UM08		UM06	UM08			UM06	UM08
2"	2.156	2 - 340	11.00	11.00	6.70	6.00	6.50	7.90	9.26	93	107
3"	3.250	5 - 730	13.40	13.40	6.70	7.50	8.25	9.40	10.01	97	111
4"	3.750	8 - 1,140	13.40	13.40	n/a	9.00	10.00	n/a	8.06	78	108
6"	5.750	19 - 2,660	14.60	14.60	n/a	11.00	12.50	n/a	9.06	82	138
8"	7.375	33 - 4,870	16.10	17.25	n/a	13.50	15.00	n/a	10.06	115	195
10"	9.750	52 - 7,670	18.50	18.50	n/a	16.00	17.50	n/a	10.46	144	247
12"	11.750	74 - 11,180	19.70	19.70	n/a	19.00	20.50	n/a	12.31	193	342
14"	13.625	90 - 16,070	21.70	22.75	12.00	21.00	23.00	20.30	15..46	321	476
16"	15.625	118 - 20,900	23.60	25.25	14.20	23.50	25.50	21.10	16.21	390	645
18"	17.625	150 - 26,480	23.60	25.25	14.20	25.00	28.00	21.10	17.21	446	750
20"	19.563	185 - 32,720	25.60	28.25	16.20	27.50	30.50	24.80	18.26	588	874
24"	23.500	270 - 47,180	30.70	35.75	21.70	32.00	36.00	29.60	20.11	769	1,568
30"	29.250	420 - 73,620	35.80	41.75	26.50	38.75	43.00	35.90	23.26	1,261	2,317
36"	35.250	610 - 105,930	46.10	46.10	28.20	46.00	50.00	42.70	26.66	1,696	2,915
42"	41.250	830 - 144,370	48.05	**	32.10	52.75	**	48.35	29.99	**	**
48"	47.250	1,080 - 188,430	50.00	**	36.00	59.50	**	54.00	33.31	**	**

* Laying lengths for meters with ANSI Class 150 Flanges are equal to UM08 laying lengths

** Consult factory

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APPENDIX B: GREEN TANK INSPECTION REPORT

Liquid Engineering Corporation

Potable Water Reservoir Contamination, Health and Safety Report

Job No ""-2- - .0- _ Utility L LAS6---Qf" Tues SI:1 V4/U-Y(ns) L U:Sc2 IC6 J'5-.J--

InspectorX M Team Leader 3l:--ce.4..-..c. ----- Date CJ-/")- [Fori!ii]

Complies With: AWWA • OSHA • ANSI • NIOSH • NAVFAC • NFPAC

Contamination & Health Checklist •

Air Vents	Type mushroom # 1 Screen Conditions: (Good) Fair Poor
Hatches	Type Square # 2 Secured Properly: (Yes) No Properly Sealed: (Yes) No
Exterior Overflow	Flapper: Yes (No) Screen: (Yes) No Gasket: (Yes) Condition: (Good) Fair Poor
~~Cathodic Cov~~	~~Covers in Place: Yes No Gaskets: Yes No Properly Sealed: Yes No # of Covers~~
Roof to Wall Joint	Welded: (Yes) No Properly Sealed: (Yes) No
Roof Integrity	Holes: Yes (No) Cracking: Yes (No) Standing Water: Yes (No) Other none
Wall Integrity	Holes: Yes (No) Cracking: Yes (No) Other: none
Manway Integrity	Leaks: Yes (No) Condition: (Good) Fair Poor
Water Clarity	General Appearance: Clear Odor: none Other none
Floating Surface Debris	Type: None Source: n/A
~~Hypalon Floating Cover~~	~~Condition: Good Fair Poor Holes: Yes No Tears: Yes No~~
~~Telemetry Penetrations~~	~~Properly Sealed: Yes No~~
Other Discrepancies	None

• Facility Safety Compliance Checklist •

Exterior Ladder

Overall Ladder	Condition Fair Poor Offset Landings Yes(@# itl/..i Height ___
Ladder Vandal Guard	Present Yes No / Vandal Guard Locked Yes
Ladder Rails & Rungs	Condition Fair Poor Missing/Damaged Rungs Yes (@)
Rung Spacing & Depth	Spacing 1_ In (ma) 12) Toe depth ___ in (min 7")
Rail Spacing & Size	Width _ (min 2) Thickness _Ll.(f_in (min U,. Rail to Rail _jJJ_!_ In (max 16")
Safety Climb System	Type Cage Notched Rail Cable Grab- Other Condition Fair Poor
Number & Locations	Wall .1.... Leg Roof ___ Riser Pipe ___ Other ___
Ladder Attachments	(Welded) Bolted Other

Manways

Type and Size	Type: oval S Other Size 5:;... (24" 18"X22"mm) # :L -
Support Structure	Dogged Davit Arm Other Condition Fair Poor
Number & Locations	Wall ..Z. Roof ___ Riser Pipe ___ Other ___

Hatches

Hatch Type and Size	Round Rectangle Other (24" 24 X15" min) 0.5
Hatch & Lid Lip Height	Hatch (4"min.) ___ " lid (2 mm.) 2 •7=.

Balconies & Railing

Deck/Walkways	Condition Good. fair Poor Width
Hand Rails	Condition Goo rf\,;\=air ___ (42" min) No. Rails ___ (min 2)
Toe Rail	Co ___ Poor Height (4" min.)
Welds/ Attachments	Condition Good Fair Poor

Safety Tie-Off Points	cl Type: G o o d F Poor
Antennas	Type Omni Directional Receiving # ___

Other Discrepancies None

Additional Information NONE

DISCLAIMER

Unless otherwise noted, the findings contained in this report were neither prepared nor reviewed by a licensed Professional Engineer but are based on the experience, training and visual examination of the inspector, the Dive Maintenance Technician.

Liquid Engineering Corporation

Circular Tank Diagram / Information Worksheet

Job# 3S1110 Tank Name:#/ {2SO t6 <:,/&\ Date: 4-lt-z-og

WALLS Q-4 Q-1 Q-2 Q-3

Roof line

'Srn1ihv'1
$14 51 ,eVI.J5
- :'rsoutT£EJ I:lv.s:r
lJ ovu;;5 {/4,,)/A,/<,)

Floor line A...t_ aV14/J Mv-rs

Testing and Discrepancy Locations

ROOF

-STAINING
- SURFACE CORROSION

Q-4 Q-1 Q-3 Q-2

ALL QUADRANTS 2

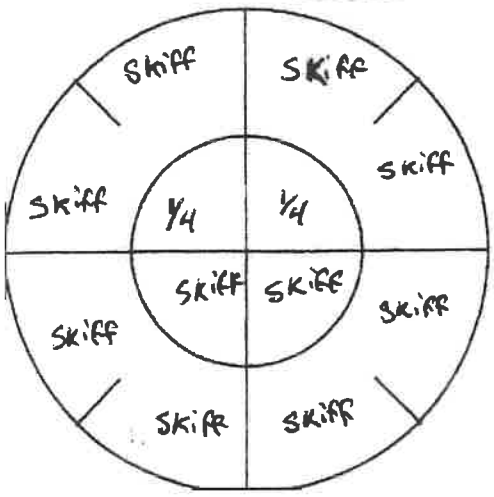
FLOOR

-rsol.411
IAJ/ /Ju
- S .,-,:/ IJ IJ(.)

/<v:ST IJVL£ 5
vt:, D1Jm19G,£., <Y,." AVE.)

Q-1 Q-3 Q-2

ALL QUADRANTS 2

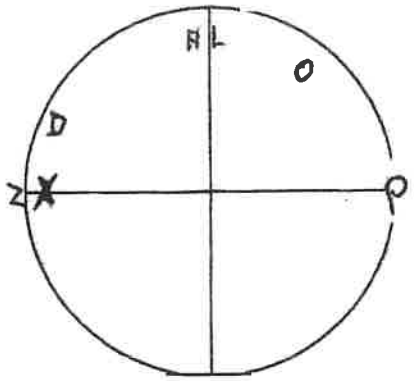


Sediment Depth Meaeurement11

Average Sediment Depth= The sum of **all measurements taken,** divided by the number of **measurements taken.**

Average Sediment Depth: 5 tFF Cubic Yardage:___

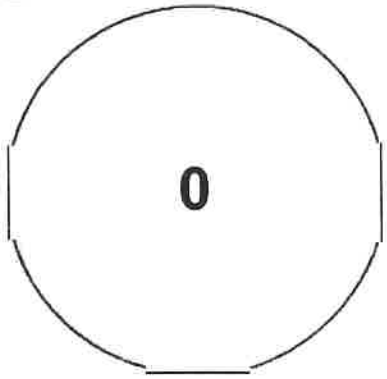
Type of Sedim nt: S lt...T.) M/\J VV1AfJG6AIJ



Plumbing & Structure Location

Plumbing and Structure **Codes**

O:aOutlet X=Intet **Z=Manway**
V=Vent D=Dre,n S=Sump
L=Ladder H=Hatch P=Overflow
F=Float level Indicator
T=Telemetry



Column Placement =+

T -um[J
Base Structure
Top Structure
u (U) I
n \ (I

Steel Concrete Other ____

Liquid Engineering Corporation

Steel Potable Water Reservoir Inspection Report

Job No :-:-64(0 Utility vvLA(-t:: DE1A"IS L tz: VAh(-:-I Tank [illegible]

AMERICAN WATER WORKS ASSOCIATION

ANSI/AWWA M42 / 0101-53 (R86)

SSPC Legend
Society for Protective Coatings

RUST GRADE	DESCRIPTION
10	No rusting, or< 0.01% of surface is rusted
9	Minute rusting, < 0.03% of surface is rusted
8	Few isolated rust spots < 0.1% of surface is rusted
7	Few isolated rust spots, < 0.3% of surface is rusted
6	Extensive rust spots, < 1% of surface is rusted
5	Rusting to the extent of 3% of surface area
4	Rusting to the extent of 10% of surface area
3	Approximately 1/6th of the surface (17%) is rusted
2	Approximately 1/3rd of the surface (33%) is rusted
1	Approximately ½ of the surface (50%) is rusted
0	Approximately 100% of the surface is rusted

NACE Legend
National Association of Corrosion Engineers

CORROSION GRADE	DESCRIPTION
A	None
B	Uniform Surface Corrosion
C	Pitting
D	Concentration Cell
E	Galvanic
F	Stress Corrosion Cracking
G	Erosion Corrosion
H	Intergranular
I	Dealloying

AWS Legend
American Welding Society

WELD GRADE	DESCRIPTION
L	Satisfactory
M	Spatter
N	Porosity
O	Convexity / Concavity
P	Cracks
Q	Inclusions
R	Incomplete Fusion
S	Incomplete Penetration
T	Undercut
U	Underfill
V	Overlap
W	Unable to Evaluate

INTERIOR RESERVOIR ROOF1

	QUADRANT1			QUADRANT 2			QUADRANT3			QUADRANT4		
	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS
Vents	++		V...I									
Roof Panels		D	../	C..	1Sb	../		bD	W	L	?::b	bC
Roof Support Structure		1?::>12		&.		L	I	B			n	I L
Roof Support Gussets		"f::,b	2	t.,			C.,	:&I>	../	t..		\v

Protective Coating **Good Poor:** Blistering - Chalking - Checking - Cracking - Delamination - Growth - Pinholes - Staining - Saggs/Runs

Blisters/ Avg. Size ______ **Pitting /Avg.Size** ______

INTERIOR RESERVOIR WALLS1

	QUADRANT 1			QUADRANT2			QUADRANT3			QUADRANT4		
	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS
Wall to Roof Weld		b	L	l.d	.::b	.t'		1S.	'IAL	f-:,	0	'vIL
Lower Ring Panels		1?	W	t,	&	vV		i:	C:	cG		W
Middle Ring Panels		'n	v.J	6		"r"		h	L./	6	"15	
Upper Ring Panels					i::.				'vV	Co		Vv:'
Interior Ladder	8	-:.:	L							R	3::.	I..

Protective Coating **Good QPoor:** Blistering - Chalking - Checking - Cracking - Delamination - Growth - Pinholes-

Blisters/ Avg. Size ______ Pitting **/Avg.Size** JltL. ______

INTERIOR RESERVOIR FLOOR1

	QUADRANT 1			QUADRANT 2			QUADRANTJ			QUADRANT4		
	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS
Perimeter Weld	:2	(3/X	L-		B/JC	L	..:i	./3IJC	L	oZ	-f3t)C	L-
Floor Sketches (Panels)	7	BtJC	L--		8/JC	L	i	BtJC	L	7	L30C	C..,

Protective Coating **Good Poor:** Blistering - Chalking - Checking - Cracking - Delamination - Growth - Pir tes - SaggsIR uns

Blisters/ Avg. Size ______ **Pitting /Avg.Size** Y:'I}. ______

DISCLAIMER

liquid Engineering Corporation

Section 17: Immediate Needs Assessment

Job No.: 35410 Tank Name: -1 Cz-:;o t;.G) Date q-l':.-05

I. Health & Safety Items

0 Safety Climb System Installation: Not Recommended (Semi ... u.o:::-;,l

0 Vent Screen Repairs: _.s -Si. 1-P. !"1'f f.J.:i::f 2.....J:;:f!.!l'fd!. ::u:J!J-

II. Testing Items

0 Dye Testing For Leak Evaluation: v.O flk...

☐ Presence of Lead Test (Interior/ Exterior) Au.. n.S... ...C.T...

III. Destructive Testing Items

0 % Of Lead Test (Interior / Exterior)(Coating samples IJ/9 removed for laboratory analysis): ....v..rl""I.I...

0 Coating Adhesion Testing (Interior / Exterior): ...

Specific written authot1zation required to perform destructive tasting. Destructive tests include touch-up of coating system.

IV. Repair Items

0 Epoxy Coating Repairs: llali:.l 70 Jka&..5. i-x.It)Q2 i?u Pw l? f tl-' tu-5 (I r

0 Temporary Leak Repairs: ..v/ .Q...

0 Float Operated Level Indicator Repairs / Maintenance: AJ/l l (rx:TE')IZuAL 7k<NJ1&Zi?lj.)

0 Hypalon Repairs:--

V. Security Related Items

(Critical security upgrade information is immediately available.)

()!Ptank Vents Are Not Equipped With A Security Vent Shroud.

Tank Hatches Are Not Equipped With A Security Hatch Locking Device.

la' Tank Perimeter Not Adequately Secured:

EPA - Mandated Vulnerability Assessment Not Completed

Additional Description of Recommended Work

* CLEAN AND INSPECT EVERY 3 TO 5 YEARS.

* SECURITY RELATED ITEM LISTED ABOVE

* RECOMEND 16 TO 20 HOURS OF EPOXY

The above noted additional work is considered immediately necessary and recommended to be completed. Some items may be completed in conjunction with work currently being performed while the field crew is on site.

Authorized Utility Signature:

Signing above acknowledges that recommendations have been made for additional work that may be necessary and can be accomplished while the LEC crew is on site. Signing above does not authorize additional work. An additional authorization will be prepared to authorize any additional work deemed

Liquid Engineering Corporation

Steel Potable Water Reservoir Inspection Report

Job No "55LJ(()

Utility 1-a1k--E-0£ :::M... ..Stt VAfleY Tank___ ..1 ....-'.'-'.G....'-. t:'--

INTERIOR RESERVOIR SUPPORT COLUMNS,

	QUADRANT1			QUADRANT 2			QUADRANT3			QUADRANT4		
	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS
Column Structures	Cf	8	L-									
Column Base Structure	g	B	L.									
Column To Roof Stucture	1	B	L									

Protective Coating Fair Poor: Blistering - Chalking - Checking - Cracking - Delamination - Growth - Pinholes - — Saggs/Runs

Blisters/ Avg. Size tJIA Pitting / Avg. Size ____ .:A):: t;11._______________

INTERIOR RESERVOIR PLUMBING COMPONENTS

	QUADRANT1			QUADRANT 2			QUADRANT3			QUADRANT 4		
	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS
Inlet Plumbing										9	13	C...
Outlet Plumbing	g	fJ	L									
Manways		---								ct	th	L
Floor Drains										q	l2	L.
Interior Overflows		---			/:)	L						

EXTERIOR RESERVOIR ROOF,

	QUADRANT1			QUADRANT 2			QUADRANT3			QUADRANT4		
	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS
Vents		6	L..									
Roof Panels		(b	L		Q	L			L.		r:	L
Access Hatches	g		L.									

Protective Coating ifil1' Poor Blistering - Cracking - Delamination - Growth - Pinholes - — Saggs/Runs

Blisters/ Avg. Size UOne Pitting /Avg.Size ..:.W......./'-----'-14,,-"'------------

EXTERIOR RESERVOIR WALLS,

	QUADRANT1			QUADRANT2			QUADRANT3			QUADRANT 4		
	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS	SSPC	NACE	AWS
Wall to Roof Weld	C\	&	l...	c::	lb	'	o'_		L-	:'	(Q	L
Lower Ring Panels / Middle Ring Panels	CJ:	!;i	f-.	'1	Ce	II		a.	'L	6\	6Ci	L
Upper Ring Panels	0.	le	L...		5.	L			l...		e.	L...
Interior Overflows					-6	L-						

Protective Coating Good Poor: Blistering — - Cracking - Delamination - Growth - Pinholes - — Saggs/Runs

Blisters/ Avg. Size IA Pitting /Avg.Size AJ I14

FOOTINGS / FOUNDATION,

Footings / Foundations Satisfactory__________ Cracking I(\ ) Spalling ~~Erosion/Exposed Agg~~regale__________

Anchor Bolts Satisfacto A- Rusted / Corroded (If Excessive) Diameter=

TOWER SUPPORT STRUCTURES,

Tower Legs/ Columns Satisfactory __________ Alignment __________ Settling __________ ~~Rust / Corrosion~~ __________

Riser Pipe Satisfactory__________Align_ entl Settling __________ ~~Frost Casing~~ __________ Rusted / Corroded __________

Rods & Turnbuckles Satisfactory Turnlu lc Tension ~~Rod Tension~~ __________ Cotter Pins/Rod Nuts__________

Leg shoes/ Brackets fi Rusted I Corroded __________ Pitting / Cracking__________

Other___ ----::==•••__===--

Liquid ering Corporation

Circular Tank Diagram / NOT D OFT Coating Adhesion D Presence of Lead 0

Job# :::s.c..ll\f) Tank Name ,u-) (.?. ") vt:. s/tS) Date: g-J'J-08

WALLS Q-4 Q-1 Q-2 Q-3

of line

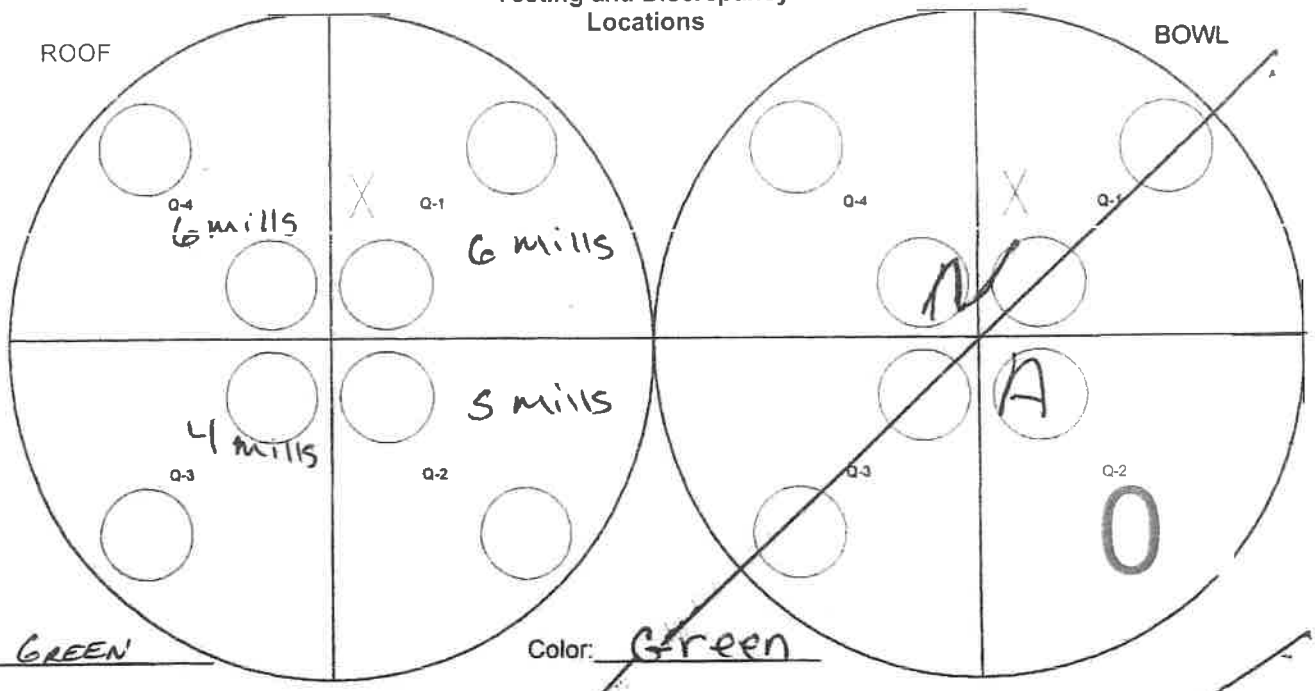
Color: G-- rei'n

(vi LL<:>

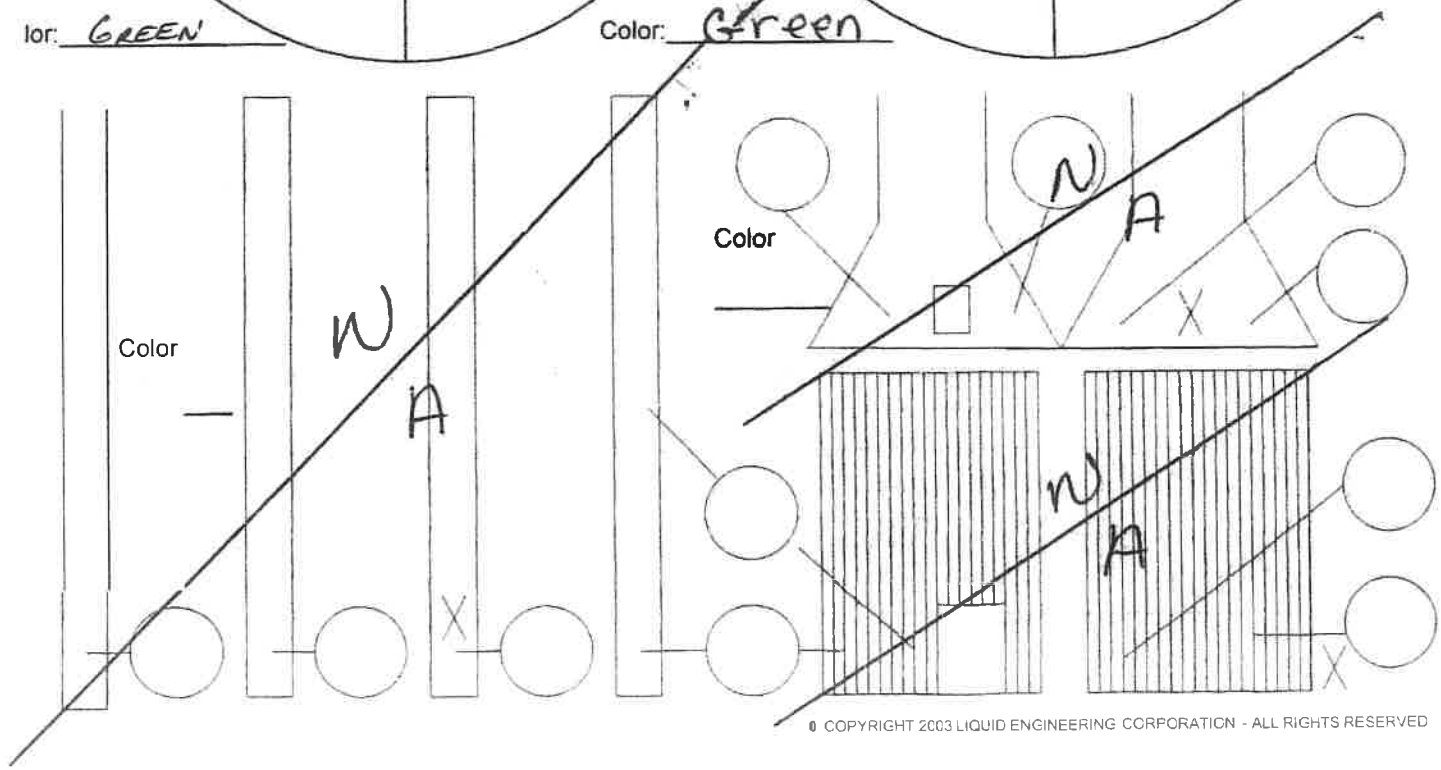
G)xG) 0 0 G)@ 0 0

or line

Testing and Discrepancy Locations



lor: GREEN Color: Green



Liquid Engineering Corporation

Steel Water Reservoir Exterior Condition Worksheet

Job No 3.SIIIo Tank Name: - -• V--'-(..1..,._S:?...._--'.t'.. c... f).. .[(5.) ----- Date 9-tr:>::cq.

Section 9. General Tank Security

Is the tank surrounded by a security fence?	Yes (N)
Are the access gates locked?	Yes (f4
Is the tank equipped with a vandal guard on the primary access ladder?	Yes
Is the vandal guard locked?	Yes
Are all of the access hatches equipped with electronic monitoring devices?	Yes ®
Are all of the vents equipped with security vent shrouds?	Yes ®
Does the exterior of the tank show signs of trespass?	Yes (N-o)
Does the surrounding geography of the tank obscure it from public **view?**	Yes 0
Are the external plumbing components housed in a secure vault or out building?	es') No
Is the area surrounding the tank well lit?	I(ffi) No
Are there any additional security features associated with this tank or surrounding **area?** If yes describe in additional remark!; section.	Yes (_No)

Additional Remarks and Measurements

APPENDIX C: NEPTUNE HIGH PERFORMANCE TURBINE METER

A PRODUCT SHEET OF NEPTUNE TECHNOLOGY GROUP

High Performance Turbine Meter

Neptune® High Performance (HP) Turbine water meters offer some of the widest flow ranges of any turbine meters on the market.

All HP Turbine water meters meet or exceed the latest performance and accuracy requirements of AWWA C701 and maximum continuous flow rates may be exceeded by as much as 25% for intermittent periods.

Construction

Each HP Turbine consists of a rugged, lead free, high-copper alloy maincase, an AWWA Class II turbine measuring element, and a roll-sealed register. The maincase is corrosion-resistant, lightweight, and compact. Inlet and outlet connections are flanged. Strainers are available to prevent debris from entering the meter and to reduce the effects of uneven water flow due to upstream piping variations.

The unitized measuring element (UME) allows for quick, easy, in-line interchangeability. Water volume is measured accurately at all flows by a specially-designed assembly. The hydrodynamically-balanced, thrust-compensated rotor relieves pressure on the thrust bearings to minimize wear and provide sustained accuracy over an extended operating life. Direct coupling of the rotor to the gear train eliminates revenue loss due to slippage during fast starts and line surges. A calibration vane allows in-field calibration of the UME to lengthen service life and to ensure accurate registration.

The roll-sealed register eliminates leaking and fogging. A magnetic drive couples the register with the measuring element.

Application

The HP Turbine water meter is designed for applications where flow rates are consistently moderate to high.

Systems Compatibility

Adaptability to all present and future systems for flexibility.

Warranty

Neptune provides a limited warranty with respect to its HP Turbine water meters for performance, materials, and workmanship.

When desired, owner maintenance is easily accomplished by in-line replacement of major components.

KEY FEATURES

Roll-Sealed Register

- Magnetic-driven, low-torque registration ensures accuracy
- Impact-resistant register design with flat glass for readability
- 1:1 ratio, low-flow indicator identifies leaks
- Bayonet mount allows in-line serviceability
- Tamperproof seal pin deters theft
- Date of manufacture, size, and model stamped on dial face

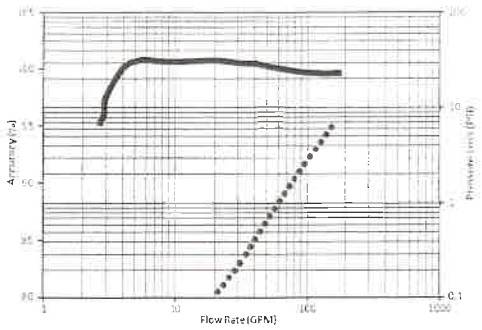
Lead Free Maincase

- Made from lead free, high-copper alloy
- NSF/ANSI 61 and 372 certified
- Compact design is lightweight and easy to handle
- Sturdy, durable, corrosion-resistant
- Resists internal pressure stresses and external damage
- Residual value

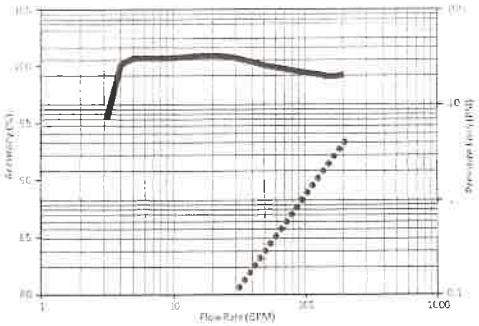
Turbine Measuring Element

- Excellent low-flow sensitivity and wide flow ranges available at 98.5% - 101.5% accuracy
- Direct coupling of rotor to gear train prevents slippage and ensures accurate registration
- Interchangeable measuring element allows for in-line service
- Hydrodynamically-balanced rotor
- Reusable O-ring gasket on 3" - 10" sizes

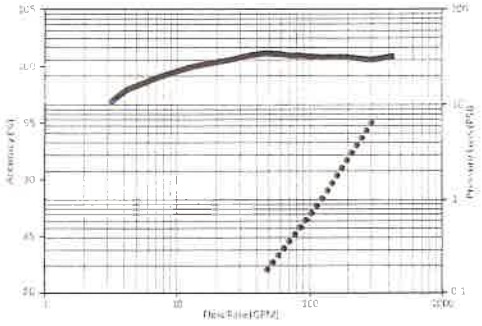
1 1/2" Accuracy



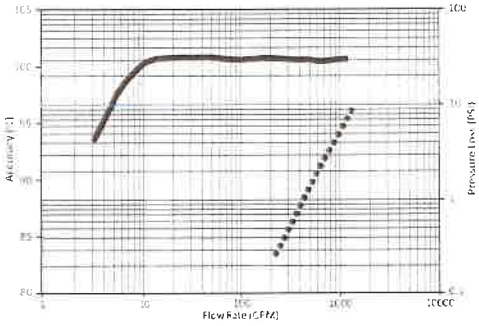
2" Accuracy



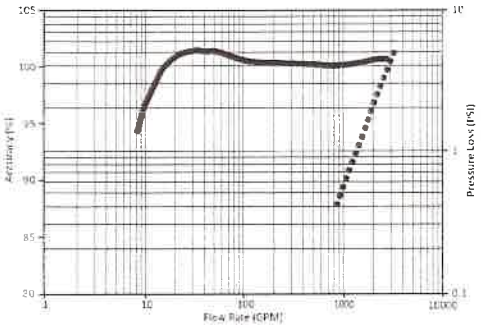
3" Accuracy



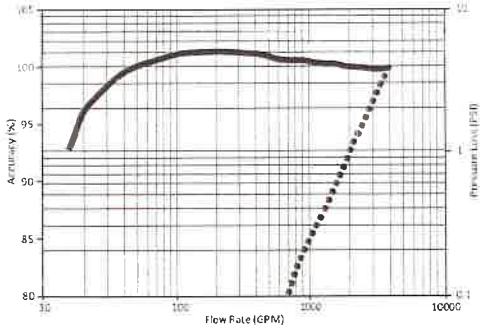
4" Accuracy



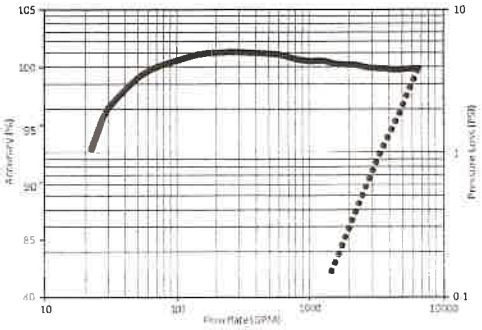
6" Accuracy



8" Accuracy



10" Accuracy



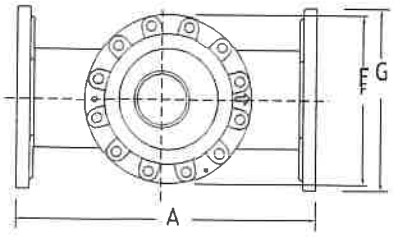
These charts show typical meter performance. Individual results may vary.

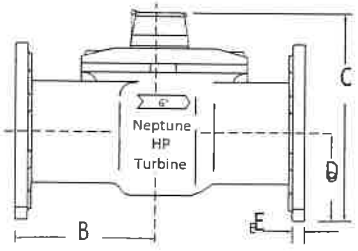
Operating Characteristics

Meter Size	Normal Operating Range @100% Accuracy (±1.5%)	Maximum Intermittent Flow	AWWA Standard
1½"	4 to 160 US gpm 0.91 to 36.3 m³/h	200 US gpm 45.4 m³/h	4 to 120 US gpm 0.91 to 27.3 m³/h
2"	4 to 200 US gpm 0.91 to 45.4 m³/h	250 US gpm 56.8 m³/h	4 to 190 US gpm 0.91 to 43.2 m³/h
3"	5 to 450 US gpm 1.14 to 102.2 m³/h	560 US gpm 127.2 m³/h	8 to 435 US gpm 1.8 to 98.8 m³/h
4"	10 to 1,200 US gpm 2.27 to 272.5 m³/h	1,500 US gpm 340.7 m³/h	15 to 750 US gpm 3.4 to 170.3 m³/h
6"	20 to 2,500 US gpm 4.55 to 567.8 m³/h	3,100 US gpm 704.1 m³/h	30 to 1,600 US gpm 6.8 to 306.6 m³/h
8"	35 to 4,000 US gpm 7.95 to 908.5 m³/h	5,000 US gpm 1135.6 m³/h	50 to 2,800 US gpm 11.4 to 635.9 m³/h
10"	50 to 6,500 US gpm 11.36 to 1476.3 m³/h	8,000 US gpm 1817 m³/h	75 to 4,200 US gpm 17.0 to 953.9 m³/h

Dimensions

Meter Size	A	B	C-STD	C-ProRead™	C-E-CODER® and ProCoder® Products	D	E	F	G	Weight
	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)	in (mm)	lbs (kg)
1½"	10 (254)	6½ (165)	7⅛ (181)	7⁹⁄₁₆ (192)	7¾ (197)	1¾ (44)	¾ (19)	4½ (114)	5⅜ (137)	19 (8.6)
2"	10 (254)	6½ (165)	7⅝ (194)	8¹⁄₁₆ (204.8)	8¼ (210)	2⅛ (54)	¹³⁄₁₆ (21)	4½ (114)	5⅜ (137)	20 (9.1)
3"	12 (305)	6 (152)	10 (254)	10⁷⁄₁₆ (265.1)	10⅝ (270)	3¾ (95)	⅝ (16)	6¼ (159)	7½ (191)	40 (18.1)
4"	14 (356)	6½ (165)	10⅞ (276)	11⁵⁄₁₆ (287.3)	11½ (292)	4½ (114)	¾ (19)	8⅛ (206)	9 (229)	52 (23.6)
6"	18 (457)	8⅝ (219)	13 (330)	13⁷⁄₁₆ (341.3)	13⅝ (346)	5½ (140)	1 (25)	10¼ (260)	11 (279)	115 (52.2)
8"	20 (508)	9⅝ (244)	15½ (394)	15¹⁵⁄₁₆ (404.8)	16⅛ (409)	6¾ (171)	1⅛ (29)	10¼ (260)	13½ (343)	195 (88.4)
10"	26 (660)	12⅝ (321)	15½ (394)	15¹⁵⁄₁₆ (404.8)	16⅛ (409)	8 (203)	1¼ (32)	10¼ (260)	16 (406)	275 (124.7)





Specifications

Application

- Cold water measurement of flow in one direction

Maximum operating pressure:

- 175 psi (1206 kPa)

Maximum operating temperature:

- 80°F

Register

- Direct reading, center-sweep, roll-sealed, magnetic drive with low-flow indicator

Measuring element

- AWWA Class II Turbine, hydrodynamically-balanced rotor

Guaranteed Systems Compatibility

All HP Turbine water meters are guaranteed adaptable to our ARB® V, ProRead™ (ARB VI), ProCoder™, E-CODER®, E-CODER®)R900*i*™, E-CODER®)R450*i*™, TRICON®/S, TRICON/E®3, and Neptune meter reading systems without removing the meter from service.

Options

Sizes

- 1½", 2", 3", 4", 6", 8", 10"

Units of measure:

- U.S. gallons, imperial gallons, cubic feet, cubic metres

Register Types

- Remote reading systems*: ARB V, ProRead, ProCoder, E-CODER, E-CODER)R900*i*, E-CODER)R450*i*, TRICON/S, TRICON/E3

** Consult factory for meter performance specifications when fitted with ARB.*

- Reclaim

Companion flanges

- 1½" and 2" (oval): bronze
- 3", 4", 6": bronze or cast iron
- 8" and 10": cast iron

Strainer

- 1½"- 6" NSF/ANSI 61 lead free high copper alloy
- 1½"-10" NSF/ANSI 61 lead free Rilsan® nylon-coated ductile iron

Registration

Registration (6-wheel odometer, per sweep hand revolution)		
	1½", 2", 3", 4"	6", 8", 10"
1,000 US Gallons		✓
1,000 Imperial Gallons		✓
100 US Gallons	✓	
100 Imperial Gallons	✓	
100 Cubic Feet		✓
10 Cubic Feet	✓	
10 Cubic Metres		✓
1 Cubic Metre	✓	

Register Capacity (6-wheel odometer)		
	1½", 2", 3", 4"	6", 8", 10"
1,000,000,000 US Gallons		✓
1,000,000,000 Imperial Gallons		✓
100,000,000 US Gallons	✓	
100,000,000 Imperial Gallons	✓	
100,000,000 Cubic Feet		✓
10,000,000 Cubic Feet	✓	
10,000,000 Cubic Metres		✓
1,000,000 Cubic Metres	✓	

NEPTUNE TECHNOLOGY GROUP

#winyourday

neptunetg.com

Neptune Technology Group
1600 Alabama Highway 229
Tallassee, AL 36078
(800-633-8754 | +1 334 283-7282

APPENDIX D:VTSV OBSERVED FIRE HYDRANT FLOWS

WATERWAY
Because your hose knows

Taos Ski Valley Fire Department
2020 Hydrant Testing Report
Testing completed on 10/19/2020

TAG #	Hydrant Dia.	Coeff.	Year	Make	Location	Stat. Press.	Res. Press.	Flow Press.	Total GPM	Flow Hydrant	Notes
BR1	2.5	0.9	1981	Mueller	Bluejay Ridge (Just South of Kachina Rd)	80	22	7	452	BR5	
BR2	2.5	0.9	2008	Mueller	100 Kachina Rd (Bavarian Chalets)	78	21	7	448	BR5	
BR3	2.5	0.9	2012	Mueller	100 Kachina Rd (Bavarian Chalets Entrance)	X	X	X	X	X	OUT OF SERVICE- No water/flow.
BR5	2.5	0.9	UNK	Waterous	91 Kachina Rd	80	29	8	518	BR6	
BR6	2.5	0.9	1981	Mueller	Deer Ln (SW of Williams Lake Trail Head & Parking)	79	38	9	612	BR5	
BR9	2.5	0.9	2005	Mueller	Kachina Rd (NE of Lynx Dr)	X	X	X	X	X	OUT OF SERVICE- No water/flow.
CH2	2.5	0.9	1981	Mueller	61 Cliff Hanger Loop	70	35	20	910	ZAP3	
CH3	2.5	0.9	UNK	Waterous	Phoenix Switchback Rd & Twining Rd	109	35	20	829	ZAP3	
CH4	2.5	0.9	2008	Mueller	Burroughs Rd & Lily Ln	X	X	X	X	ZAP3	OUT OF SERVICE- Once the hydrant was on and water was flowing a loud POP came from the 3 o clock outlet and water came pouring out where it meets the barrel.
CH6	2.5	0.9	1981	Mueller	Chipmunk Ln & Coyote Ln	90	15	12	560	CH3	All cap chains broken/missing
EB1	2.5	0.9	UNK	Mueller	5 Thunderbird Rd	X	X	X	X	X	Unable to test due to construction in the area.
EB3	2.5	0.9	UNK	UNKNOWN	116 Sutton Pl	X	X	X	X	X	Unable to test due to construction in the area.
EB5	2.5	0.9	2017	Mueller	106 Sutton Pl	70	24	20	785	EB2	
EB6	2.5	0.9	2001	Mueller	5 Firehouse Rd (Near Lift House)	90	20	10	557	EB5	
EB7	2.5	0.9	1981	Mueller	22 Firehouse Rd	100	18	15	641	EB10	All cap chains broken/missing
EB8	2.5	0.9	UNK	Waterous	22 Firehouse Rd (Condominiums)	80	10	20	696	EB10	
EB9	2.5	0.9	2015	Mueller	2 Ernie Blake Rd (N of The Blake Hotel)	78	25	20	788	EB2	
EB10	2.5	0.9	2017	Mueller	3 Firehouse Rd	108	24	10	544	EB7	
KAC1	2.5	0.9	2002	Mueller	Porcupine Rd (W of Kachina rd)	85	48	15	881	KAC3	
KAC2	2.5	0.9	2004	Mueller	Porcupine Rd (SW of turning into Zap's Rd)	92	78	15	1574	KAC3	
KAC3	2.5	0.9	2004	Mueller	98 Zap's Rd (NW of Porcupine Rd)	85	49	20	1032	ZAP2	
KAC4	2.5	0.9	2011	Mueller	57 Zap's Rd	100	65	15	1015	ZAP2	
KAC5	2.5	0.9	2010	Mueller	165 Twining Rd	115	75	20	1197	ZAP3	
KAC6	2.5	0.9	2005	Mueller	174 Twining Rd	108	70	20	1181	ZAP3	
PHX1	2.5	0.9	1981	Mueller	48 Twining Rd	81	22	20	764	CH3	
PHX2	2.5	0.9	1981	Mueller	35 Twining Rd	98	65	10	844	CH3	
PHX3	2.5	0.9	2013	Mueller	4 O E Pattison Loop	106	20	15	650	PHX1	

WATERWAY
Because your hose knows

Taos Ski Valley Fire Department
2020 Hydrant Testing Report
Testing completed on 10/19/2020

TAG #	Hydrant Dia.	Coeff.	Year	Make	Location	Stat. Press.	Res. Press.	Flow Press.	Total GPM	Flow Hydrant	Notes
PHX4	2.5	0.9	2012	Mueller	10 Ernie Blake Rd (Lake Fork Condos)	118	81	21	1301	PHX2	
PHX5	2.5	0.9	1981	Mueller	15 Twining Rd (St Bernard Condominiums)	107	70	21	1220	PHX2	
PHX6	2.5	0.9	2012	Mueller	1 Wolf Ln	89	51	25	1158	PHX2	
ZAP1	2.5	0.9	UNK	Waterous	23 Zap's Rd	95	45	15	869	ZAP3	
ZAP2	2.5	0.9	2005	Mueller	112 Twining Rd	79	50	21	1128	ZAP3	
ZAP3	2.5	0.9	UNK	Waterous	Twining Rd (N of Zap's Rd)	98	48	16	853	ZAP1	
No M	2.5	0.9	2012	Mueller	Deer Ln (S of Williams Lake Trail Head & Parking)	X	X	X	X	X	OUT OF SERVICE- No water/flow.
Unma	2.5	0.9	UNK	UNKNOWN	154 Twining Rd	X	X	X	X	X	Unable to locate hydrant, fresh pile of dirt/rubble where hydrant used to be.

Total Hydrants Tested **35**

Please note all failed Hydrants should remain out of service until properly repaired and re-tested. Any Hydrants removed from service shall have failed tags attached.

Waterway, Inc. will inspect and service test all Fire Hydrants in accordance to the standard of NFPA 291. It is expressly understood and agreed that Waterway, Inc. shall not be deemed or held liable, obligated or accountable upon or under any guarantees or warranties, express or implied, statutory, by operation of law, or otherwise, relative to the use of any tested fire hydrants after the date of inspection. Furthermore, Waterway, Inc. will not be held liable, obligated or accountable for any fire hydrant that fails during testing under specified conditions.

APPENDIX E:TSVI BASELINE AND ESTIMATED FUTURE DEMAND

Village of Taos Ski Valley
Water Study Land Use Assumptions

December 17, 2021

RESIDENTIAL				
		Potential Growth		
Type and Location	Water Service Baseline (2019)	Base & Kachina	Amizette (existing)	Amizette (growth)
SINGLE FAMILY RESIDENCES				
Base & Kachina				
Residential Zone	71	106		
Commercial/Business Zone	32			
Sub-total	103	106	-	-
Amizette				
Residential Zone			7	17
Commercial/Business Zone			14	24
Sub-total	-	-	21	41
Total	103	106	21	41
Total (cumulative)	***103***	***209***	***230***	***271***
HOTEL ROOMS				
Base & Kachina				
Blake Hotel	80			
Alpine Suites	24			
Hotel St. Bernard		27		
Brownell Chalets	4			
Kachina Lodging Units		51		
Sub-total	108	78	-	-
Amizette				
Amizette Inn			12	
Columbine Inn			36	
Austing Haus			23	
Taos Mountain Lodge			10	
Cottam Mountain Cabin			1	
Cottam Mountain House			4	
Cottam's Lodge			4	
Sub-total	-	-	90	-
Total	108	78	90	-
Total (cumulative)	***108***	***186***	***276***	***276***
MULTI-FAMILY				
Base & Kachina				
Als Run Condo's	3			
Edelweiss Lodge	30			
Kandahar Condo's	27			
Lake Fork Condo's	13			
Powderhorn Condo's	15			
Rio Hondo Condo's	22			
Predock Condo's	18			
St. Moritz Condo's	8			
Sierra del Sol Condo's	32			
Snakedance Condo's	33			
Snow Bear Condo's	12			
Twining Condo's	20			
Wheeler Peak Condo's	25			
Bavarian Chalets	6			
TSV Housing Units	12			
Blake Hotel - Penthouses		9		
Blake Hotel - Residences		24		
Parcel C - Thunderbird		23		
Parcel I - Strawberry Hill*		24		

Type and Location	Water Service Baseline (2019)	Potential Growth		
		Base & Kachina	Amizette (existing)	Amizette (growth)
Parcel E - Burroughs*		32		
Parcel H - Mogul Medical*		13		
Parcel F - Resort Center*		10		
Kachina Cabins		47		
TSV Rio Hondo Townhomes		36		
Beausoleil		80		
Other Development		25		
Sub-total	276	323	-	-
Amizette				
Inn at Taos Valley			28	
Stream Side			8	
Sub-total	-	-	36	-
Total	276	323	36	-
Total (cumulative)	***276***	***599***	***635***	***635***
Total Residential Units (cumulative)	**487**	**994**	1,141	1,182

**Assumes 50% of maximum yield per 2012 Core Village Master Plan*

NON-RESIDENTIAL SPACE (SF)				
Facility	Water Service Baseline (2019)	Potential Growth		
		Base & Kachina	Amizette (existing)	Amizette (growth)
TSVI - Rio Hondo Learning Center	31,000			
TSVI - Pit House	3,872			
TSVI - VMF Washbay	7,000			
TSVI - VMF Main	7,000			
TSVI - Little Maintenance Facility	3,000			
TSVI - Resort Center Admin/BOH	30,000			
TSVI - Resort Center F&B	30,000			
TSVI - Donut Shop	200			
Stray Dog Cantina	4,000			
192 Restaurant	5,000			
Hondo Bar Restaurant	5,000			
Blonde Bear/Naranja Rest.	5,000			
TSVI - Public Restrooms (plaza)	200			
TSVI - Public Restrooms (RC)	400			
TSVI - Public Restrooms (Blake)	200			
TSVI - Mogul Medical	4,000			
Blake Pool	800			
Blake Fitness	2,500			
Blake Spa	2,500			
Edelweiss Spa	600			
Bavarian	10,000			
Bavarian Public Restrooms	500			
TSVI - Phoenix Grill Restroom	2,500			
Beausoleil F&B		10,000		
Cid's Market		2,000		
Nitro Fog/Juice Bar		500		
Firehouse/Office		10,000		
Office #2		10,000		
Public Restrooms		400		
Kachina Nordic Spa		7,500		
Pools		2,400		
Fitness Centers		7,500		
Total Commercial SF	155,272	50,300	-	-
Total Cumulative SF (full build)	**155,272**	**205,572**	**205,572**	**205,572**

Village of Taos Ski Valley
Water Capacity & Demand Analysis Summary (March)
December 17, 2021

		Water Service Baseline	Growth Potential			
			Existing + 20%	Base Village & Kachina	Amizette (existing)	Amizette (expansion)
Land Use Assumptions	(A)					
Single Family Homes		103	-	106	21	41
Hotels		108	-	78	90	-
Multi-Family		276	-	323	36	-
Total Lodging Units		487	-	507	147	41
Total - Cumulative Units		487	487	994	1,141	1,182
Non-Residential Space (SF)		155,272	-	50,300	-	-
Cumulative (SF)		155,272	155,272	205,572	205,572	205,572
Water Demand ('000 gal)						
Baseline (2019 data)	(B)	1,553		-	-	-
Growth		-	311	1,749	223	56
Total Demand (Cumulative)		**1,553**	**1,863**	**3,612**	**3,835**	**3,891**
Water Capacity Scenarios ('000 gal)*	(C)					
1. Current Capacity w/75% leakage		**1,599**	**1,599**	**1,599**	**1,599**	**1,599**
Surplus/(Shortfall) - thousand gallons		*46*	*(264)*	*(2,013)*	*(2,236)*	*(2,292)*
Surplus/(Shortfall) - %		*3%*	*-14%*	*-56%*	*-58%*	*-59%*
2. 50% leakage + 12.5% climate loss		**2,812**	**2,812**	**2,812**	**2,812**	**2,812**
Surplus/(Shortfall) - thousand gallons		*1,259*	*949*	*(800)*	*(1,023)*	*(1,079)*
Surplus/(Shortfall) - %		*81%*	*51%*	*-22%*	*-27%*	*-28%*
3. 35% leakage + 12.5% climate loss		**3,656**	**3,656**	**3,656**	**3,656**	**3,656**
Surplus/(Shortfall) - thousand gallons		*2,103*	*1,793*	*44*	*(179)*	*(235)*
Surplus/(Shortfall) - %		*135%*	*96%*	*1%*	*-5%*	*-6%*
4. 25% leakage + 12.5% climate loss		**4,218**	**4,218**	**4,218**	**4,218**	**4,218**
Surplus/(Shortfall) - thousand gallons		*2,665*	*2,355*	*606*	*383*	*327*
Surplus/(Shortfall) - %		*172%*	*126%*	*17%*	*10%*	*8%*

(A) See attached Land Use Assumption schedule for details.

(B) Based on 2019 data from VTSV with reductions for Pizza Shack, Terry Sports, Phoenix Grill leak and Hotel St. Bernard which are non-recurring or incorporated into the future growth projection. March makes up 16% of annual water consumption.

(C) Climate change is assumed to reduce water capacity by one-half percent (.5%) annually for a 12.5% loss over the next 25 years.

Village of Taos Ski Valley
Annual Water Usage Projection

December 17, 2021

EXISTING BASELINE WATER CONSUMPTION*

Type	Units	SF	Avg SF	Occ % (est)	Annual Gallons* Total	Per Unit	Per Rm Nt	Per SF	Note
Single Family Residential	103	309,000	3,000	30%	1,122,780	10,901	100	4	
Multi-Family Residential	276	297,300	1,077	35%	3,184,676	11,539	90	11	
Hotel	108	73,200	678	40%	1,896,679	17,562	120	26	Alpine Village inflating the avg
F&B	7	88,700	12,671		1,954,140	279,163		22	
TSVI Commercial Ops		55,872			407,930			7	
Public Restrooms	5	4,300	860		888,280	177,656		207	
Pools	1	800	800		50,000	50,000		63	
Fitness Centers	1	2,500	2,500		200,000	200,000		80	
Spa's	2	3,100	1,550		65,000	32,500		21	
Total Current	**503**	**834,772**			**9,769,485**				

*Based on 2019 metered consumption per VTSV adjusted for any non-recurring use (e.g. leaks, discontinued operations)

NEW WATER CONSUMPTION

Type	Units	Usable SF	Avg SF	Occ %	Annual Gallons Total	Per Unit	Per Rm Nt	Per SF	Note
Baseline + 20%									
Single Family Residential	-	-			224,556				Assumes 20% visitation bump
Multi-Family Residential	-	-			636,935				Assumes 20% visitation bump
Hotel	-	-			379,336				Assumes 20% visitation bump
F&B	-	-			390,828				Assumes 20% visitation bump
TSVI Commercial Ops	-	-			81,586				Assumes 20% visitation bump
Public Restrooms	-	-			177,656				Assumes 20% visitation bump
Pools	-	-			-				
Fitness Centers	-	-			40,000				Assumes 20% visitation bump
Spa's	-	-			13,000				Assumes 20% visitation bump
Condo (new)									
Blake Penthouses	9	27,000	3,000	36%	347,069	38,563	293	13	Not included in 2019 baseline
Blake Residences	24	35,000	1,458	42%	449,904	18,746	122	13	Not included in 2019 baseline
Parcel C - Thunderbird	23	39,000	1,696	42%	501,321	21,797	142	13	Per CV Master Plan Yield
Parcel I - Strawberry Hill	24	36,000	1,500	42%	462,758	19,282	126	13	Per CV Master Plan Yield
Parcel E - Burroughs	32	48,000	1,500	42%	617,011	19,282	126	13	Per CV Master Plan Yield
Parcel H - Mogul Medical	13	19,500	1,500	42%	250,661	19,282	126	13	Per CV Master Plan Yield
Parcel F - Resort Center	10	15,000	1,500	42%	192,816	19,282	126	13	Per CV Master Plan Yield
Rio Hondo Townhomes	36	63,000	1,750	42%	809,827	22,495	147	13	Placeholder
Beausoleil	80	120,000	1,500	42%	1,542,527	19,282	126	13	Placeholder
Other Development	25	37,500	1,500	42%	482,040	19,282	126	13	Placeholder
Hotel									
HSB (open year round)	27	13,500	500	48%	349,797	12,955	74	26	Backed out of 2019 baseline
Single Family	97	339,500	3,500	35%	1,480,325	15,261	119	4	Baseline rate + 20%
F&B									
Beausoleil F&B	1	10,000			220,309	220,309		22	Placeholder
Cid's Market	1	2,000			44,062	44,062		22	Not included in 2019 baseline
Nitro Fog/Juice Bar	1	500			11,015	11,015		22	Not included in 2019 baseline
TSVI Commercial Ops									
Firehouse/Office	1	10,000			73,012	73,012		7	Baseline rate + 20%
Office #2	1	10,000			73,012	73,012		7	Baseline rate + 20%
Public Restrooms	1	400			82,631	82,631		207	Placeholder - location and need TBD
Pools									
Parcel C	1	800			60,000	60,000		75	Baseline rate + 20%
Parcel I	1	800			60,000	60,000		75	Baseline rate + 20%
Beausoleil	1	800			60,000	60,000		75	Placeholder
Fitness Centers									
Parcel C	1	1,500			144,000	144,000		96	Baseline rate + 20%
Parcel I	1	1,500			144,000	144,000		96	Baseline rate + 20%
Parcel E	1	1,500			144,000	144,000		96	Baseline rate + 20%
Parcel H	1	1,500			144,000	144,000		96	Baseline rate + 20%
Beausoleil	1	1,500			144,000	144,000		96	Placeholder
Kachina									
Kachina Nordic Spa	1	7,500			720,000	720,000		96	Assumes same rate as fitness
Block 2 (Cabins)	17	34,000	2,000	30%	364,208	21,424	196	11	Condo as reference
Block 3, Lot 2-4 ,7 (Cabins)	30	45,000	1,500	30%	482,040	16,068	147	11	Condo as reference
Block 4 (Lodge Units)	12	6,000	500	30%	155,465	12,955	118	26	Hotel as reference

Type	Units	Usable SF	Avg SF	Occ %	Annual Gallons Total	Per Unit	Per Rm Nt	Per SF	Note
Block 3, Lot 6 (Lodge Units)	18	9,000	500	30%	233,198	12,955	118	26	Hotel as reference
Phoenix Lodge (Lodge Units)	21	10,500	500	30%	272,065	12,955	118	26	Hotel as reference
Block 3, Lot 1 (Wild. Homes)	2	10,000	5,000	30%	36,336	18,168	166	4	Single Family as reference
Blue Jay Ridge (Single Fam)	3	15,000	5,000	30%	54,504	18,168	166	4	Single Family as reference
Lake Fork (Single Fam)	4	20,000	5,000	30%	72,672	18,168	166	4	Single Family as reference
Total New Water Usage	**522**	**992,800**			**13,224,480**				
TOTAL (Projected)	**1,025**	**1,827,572**			**22,993,965**				
Increase from baseline	*104%*	*119%*			*135%*				

AMIZETTE

Amizette (existing)	Units	SF	Avg SF	Occ % (est)	Annual Gallons* Total	Per Unit	Per Rm Nt	Per SF	
Single Family	21	42,000	2,000	35%	152,611	7,267	57	4	
Hotel	90	36,000	400	35%	932,793	10,364	81	26	
Multi-Family	36	28,800	800	35%	308,505	8,570	67	11	
Total Increase	**147**	**106,800**			**1,393,909**				
TOTAL w/Amizette (existing)	**1,172**	**1,934,372**			**24,387,875**				
Increase from baseline	*133%*	*132%*			*150%*				
Amizette (growth)									
Single Family	39	97,500	2,500	35%	354,275	9,084	71	4	
Hotel									
Multi-Family									
Total Increase	**39**	**97,500**			**354,275**				
TOTAL w/Amizette (ALL-IN)	**1,211**	**2,031,872**			**24,742,150**				
Increase from baseline	*141%*	*143%*			*153%*				

APPENDIX F: METER TESTING PRODUCT INFORMATION

Badger Meter

Portable Small Meter Tester

Model PSMT

DESCRIPTION

The Model PSMT Portable Meter Tester is designed for field testing meters 1/2...1 inch. Tests may be performed without removing the meter from service using a hose connection downstream of the meter. Additionally, adapters are provided for testing meters that have been removed from service.

Through routine testing of meters in service, change-out programs may be developed to aid in ensuring that the installed base of meters is providing accurate measurement to maximize revenue. Additionally, the PSMT may be used to demonstrate meter accuracy during customer inspections.

Construction

The PSMT is a self-contained portable test meter with all control valves, hose connections, fittings, and pressure gauges permanently installed in a rugged, weatherproof plastic portable case. The case is built to MIL-C-4150J specifications for long service life in harsh field conditions. The case may be closed and locked while the tester is in service in the event long-term evaluations are needed.

Accessories included with the tester allow various testing connections for a variety of meter sizes:

- One (1) 2 in. pressure gauge
- Two (2) 3/4 in. × 39 in. reinforced flexible hoses
- Fittings for connection to 1/2 in., 5/8 in., 3/4 in. and 1 in. meters
- Test ring to allow starting all tests at zero
- Complete operating instructions laminated to the case cover

Internal Piping

All internal fittings are soldered brass or copper, except plastic tubing for pressure gauge. Connection to the test meter is made using standard meter connection fittings. The 2 inch pressure gauge provides visual indication of water system pressure. The inlet control valve is a quick acting one-quarter turn ball valve installed upstream of the meter for accurate test starts and stops. The outlet globe valve—located downstream from the meter—allows reliable flow rate adjustment.

Field Connections

External connection to the tester is made using standard 3/4 inch male hose connections located on the exterior of the case. Two (2) 3/4 in. × 39 in. rugged reinforced flexible hoses are provided for field connection of the PSMT.

SPECIFICATIONS

Operating Range	0.25... 25 gpm (1.0...95 lpm)
Overall Accuracy	100% ± 1.5%
Maximum Operating Temperature	80° F (27° C)
Maximum Operating Pressure	100 psi (6.9 bar)
Register Type	Sealed magnetic drive
Units of Measure	Gallons, cubic feet or cubic meters
Test Resolution	0.1 gallons, 0.01 cubic feet, 0.01 cubic meters using a register test ring
Meter Size Test Capacity	1/2 in., 5/8 in., 5/8× 3/4 in., 3/4 in. and 1 in.
Connections	3/4 in. x 39 in. reinforced flexible hose

MATERIALS

Meter	Nutating disc engineering thermoplastic
Case	Weatherproof, high-impact structural copolymer
Overall Size	18-1/2 in. × 14-1/16 in. × 6-1/16 in. (470 mm × 357 mm × 154 mm)
Total Weight	10 lb (4.5 kg)

PART NUMBERS

Part Number	Description
64343-001	Portable small meter tester, gallons
64343-002	Portable small meter tester, cubic feet
64343-004	Portable small meter tester, cubic meters

Badger Meter

Portable Large Meter Tester

Model PLMT

DESCRIPTION

The Badger Meter Portable Large Meter Tester (PLMT) consists of a 5/8 in. Recordall® Model 25 meter for measuring low flows (0.25...25 gpm) and a 3 in. Recordall Turbo Series Fire Hydrant meter for measuring high flows (25...450 gpm).

Applications

The PLMT is used in testing the performance of any make of large potable cold water meter (sizes 1-1/2...10 in.). Testing can be performed without removing the meter from the service line.

Benefits of Testing

The PLMT is an invaluable tool in helping water utilities earn full revenue on all water distributed to customers. By checking the accuracy of meters already in service, the utility can easily determine when under-registration is curtailing water revenue.

Accuracy and revenue performance of meters can be affected by a number of factors, including the length of time in service, overloading and damage from other causes. Because of its one-person portability, the device makes regular testing possible without removing the meter from the line and taking it back to a repair shop.

Small utilities with limited facilities can use the test meter in their own shops to check the performance of meters before and after repair.

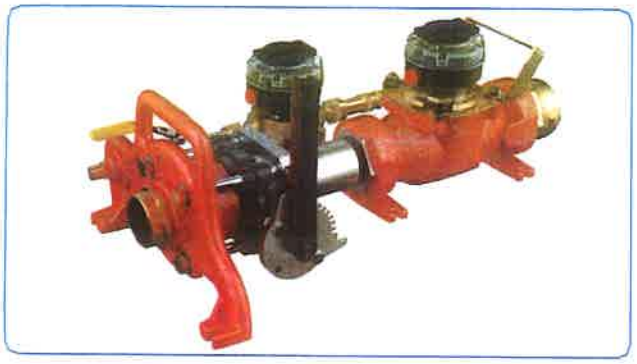
Construction

Flow rates through the PLMT are controlled by two valves.

The high flow side uses a butterfly valve operated with the option of either a detent handle (*Figure 1*) or gear operator (*Figure 2*) depending on your measurement needs.

Figure 1: Detent handle

Figure 2: Gear operator



The low flow side uses a ball valve to control water flow. To better isolate the flow and detect any leaks, the PLMT comes standard with two output paths (high side and low side). An optional flow combiner tee is available to combine low and high side outflow.

Figure 3: Optional flow combiner tee

The assembly also includes a gauge port for a customer supplied pressure gauge/transducer.

The entire assembly is corrosion resistant and is designed for easy operation and handling by one person.

Two 12-1/2 ft sections of fire hose, 1 in., 1-1/2 in. and 2 in. test plug adapters and a spanner wrench are included with the portable tester.

Magnetic Drive

Direct magnetic drive, through the use of high-strength magnets, provides positive, reliable and dependable register coupling.

Operating Performance

The tester contains all equipment necessary for field testing, including fire hoses and standard adapters. With the accessibility of a test tee on the line, the unit tests all Badger Meter and competitive large meter products.

The 5/8 in. Recordall Model 25 and 3 in. Recordall Turbo Series Fire Hydrant water meters meet or exceed the latest applicable AWWA performance and accuracy standards. A certified accuracy test curve is provided with the assembly.

Sealed Register

The standard registers consist of a straight-reading, odometer-type totalization display, 360° test circle with center sweep hand and flow finder to detect leaks. Permanently sealed, dirt, moisture, tampering and lens fogging problems are eliminated.

(Optional) Resettable Registers

Two (2) electronic resettable registers with ER-9 style single indicators provide rate of flow and totalization for the main line and bypass meters. The totalization resettable function can be disabled. Flow rate function is programmed independently of the totalization. See the ER-9 User Manual for programming details. The flow rate value is approximate and if a more specific value is required, follow the procedure outlined in the PLMT Application Data Sheet for flow rate calculation.

Maintenance

The PLMT is designed and manufactured to provide long-term service with minimal maintenance.

Hose Couplings

The PLMT is equipped with (2-1/2...7-1/2 in. NST) fire hose swivel couplings as standard equipment unless otherwise specified.

MATERIALS

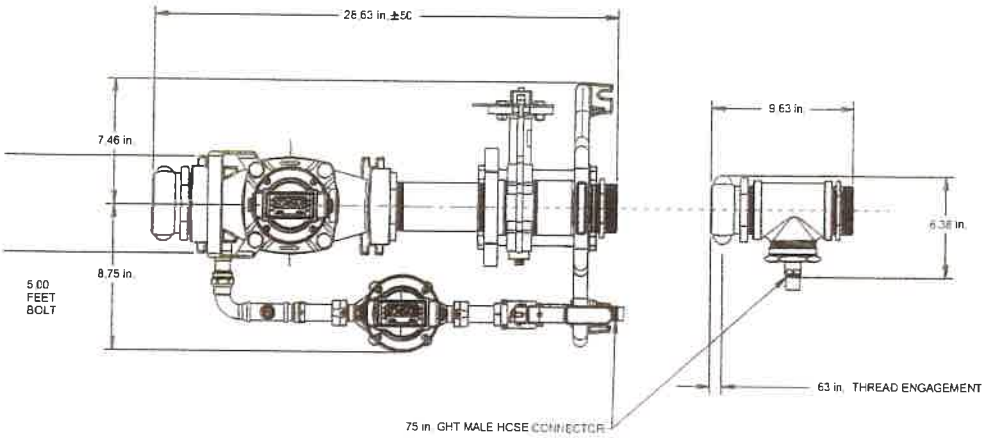
Meter Housing	Disc: Lead-free bronze alloy Turbo: Heat treated aluminum alloy
Housing Cover	Lead-free bronze alloy
Measuring Elements	Thermoplastic
Trim	Stainless steel
Connection Screen	Thermoplastic
Magnets	Ceramic
Magnet Spindles	Stainless steel
Register Cover	Bronze: non-resettable register Thermoplastic: resettable register
Flow Restriction Plate	Stainless steel
Inlet Screen	Stainless steel with elastomer

SPECIFICATIONS

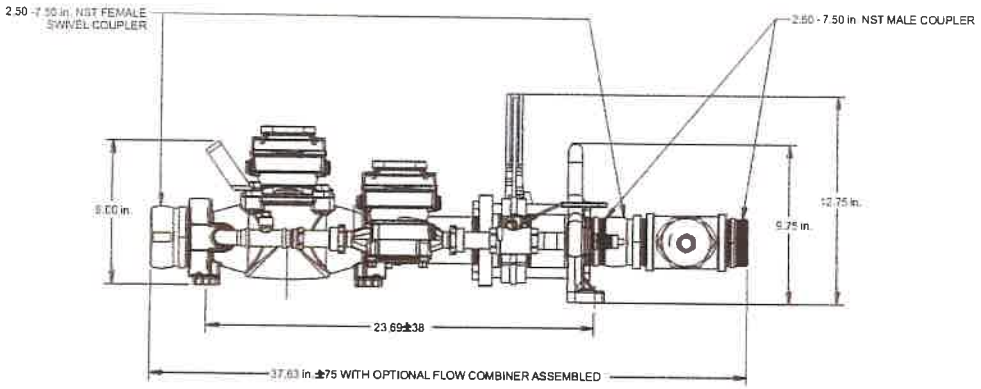
Typical Operating Range (100% ±1.5%)	(0.1...113 m^3/h) 1/2...500 gpm	
Typical Low Flow (Min. 95%)	1/4 gpm (0.06 m^3/h)	
Maximum Continuous Flow	450 gpm (102.2 m^3/h)	
Pressure Loss at Maximum Continuous Operation	45 psi at 450 gpm (3.1 bar @ 102.2 m^3/h)	
Max. Operating Temperature	80° F (26° C)	
Max. Operating Pressure	150 psi (10 bars)	
Register Type	Straight reading, permanently sealed magnetic drive (standard)	
Register Capacity	Disc:	10,000,000 gallons 1,000,000 cubic feet 100,000 cubic meters
	Turbo:	100,000,000 gallons 10,000,000 cubic feet 1,000,000 cubic meters
Weight with 10-position Detent Handle	93 lb (includes accessories)	
Weight with Gear Operator	101 lb (includes accessories)	
Shipping Weight with 10-position Detent Handle	104 lb (includes all accessories plus optional flow combiner accessories)	
Shipping Weight with Gear Operator	113 lb (includes all accessories plus optional flow combiner accessories)	
Main Line Valve	Butterfly valve	
Bypass Valve	Ball valve	
Meter Adaptors	1 in., 1-1/2 in. and 2 in. test plug adapters	
Fire Hose	Two 12-1/2 ft lengths	
Test Rings	Two provided	

DIMENSIONS

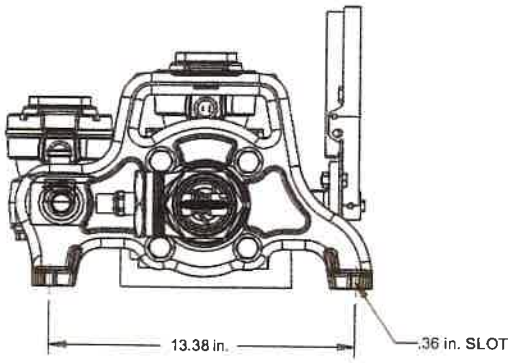
PLMT with Detent Handle



Top view

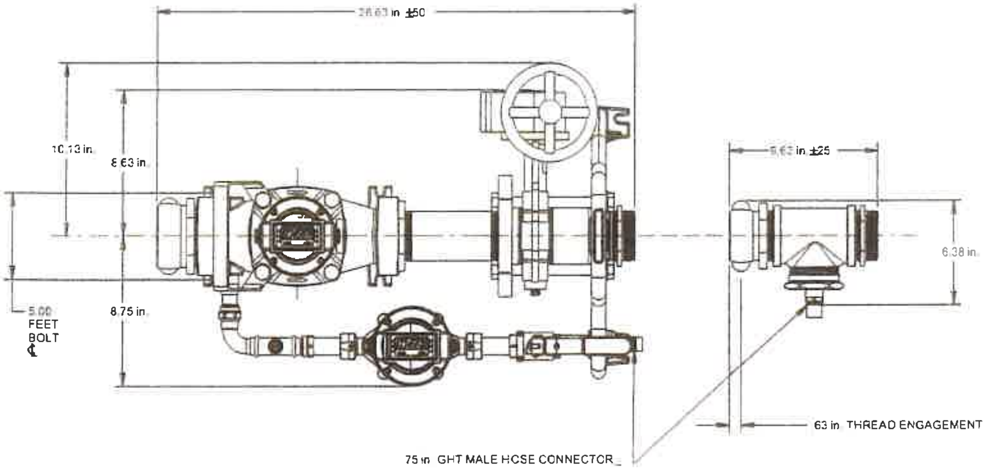


Side view

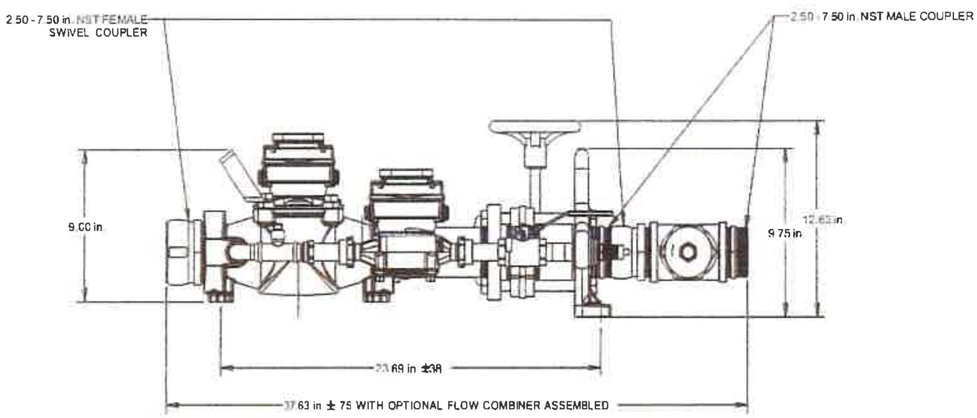


End view

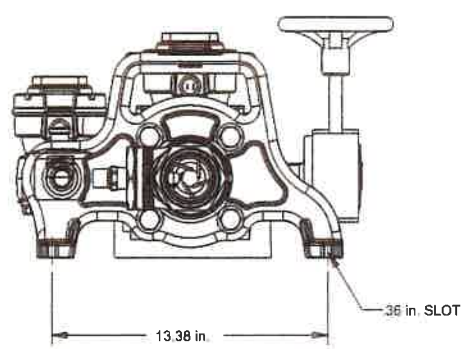
PLMT with Gear Operator



Top view



Side view



End view

www.badgermeter.com

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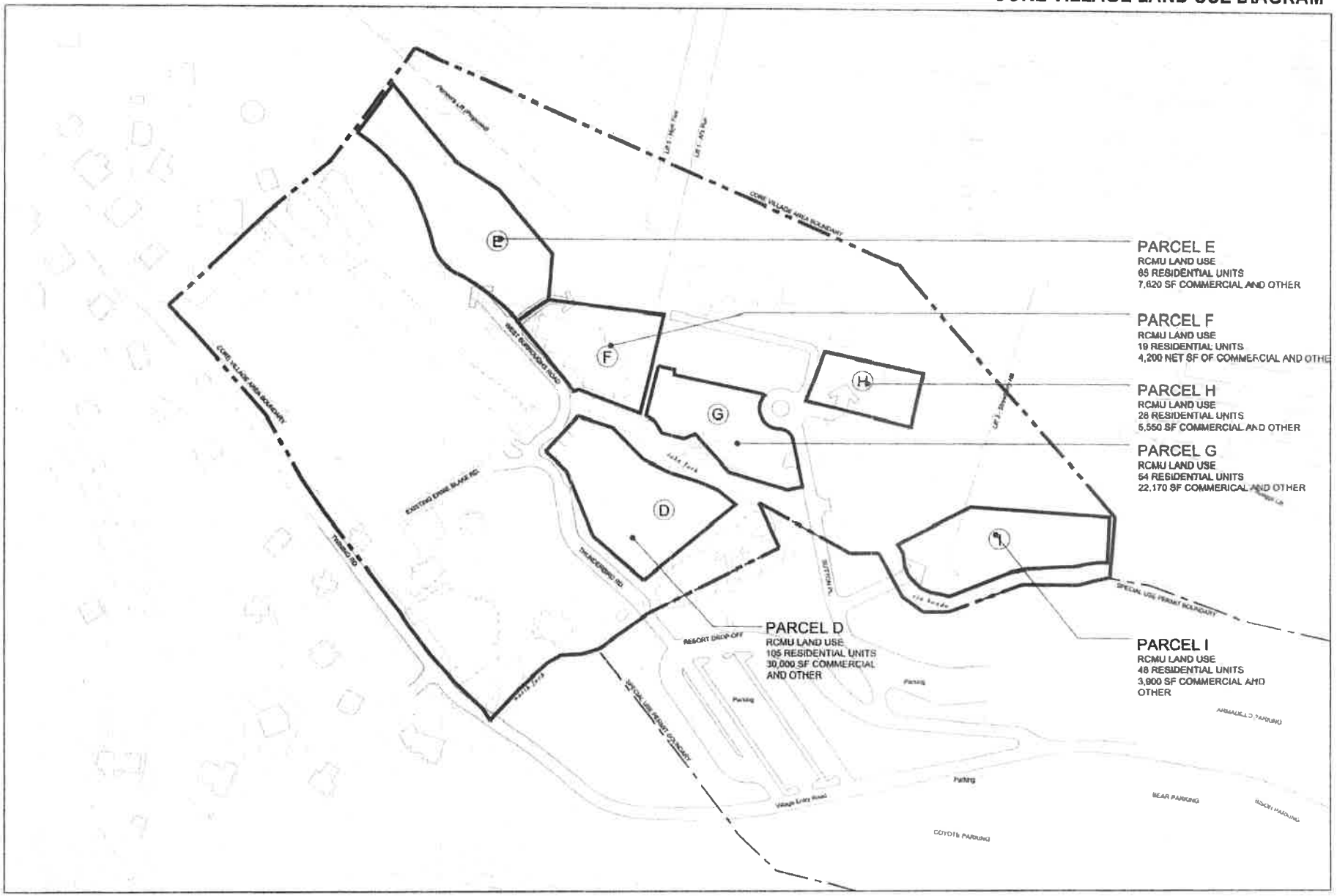
APPENDIX G: CONCEPTUAL MASTER PLAN CORE VILLAGE

CORE VILLAGE LAND USE DIAGRAM



TAOS SKI VALLEY CORE VILLAGE REVITALIZATION (SOUTHERN PORTION)

The proposed land uses and infrastructure improvements depicted on this plan are subject to review and modification by the Village of Taos Ski Valley and the respective property owners and thus subject to change without notice. This plan should not be relied upon as an accurate depiction of the final development or infrastructure for the Core Village at Taos Ski Valley.

APPENDIX H: KACHINA AREA MASTER PLAN

ial uses

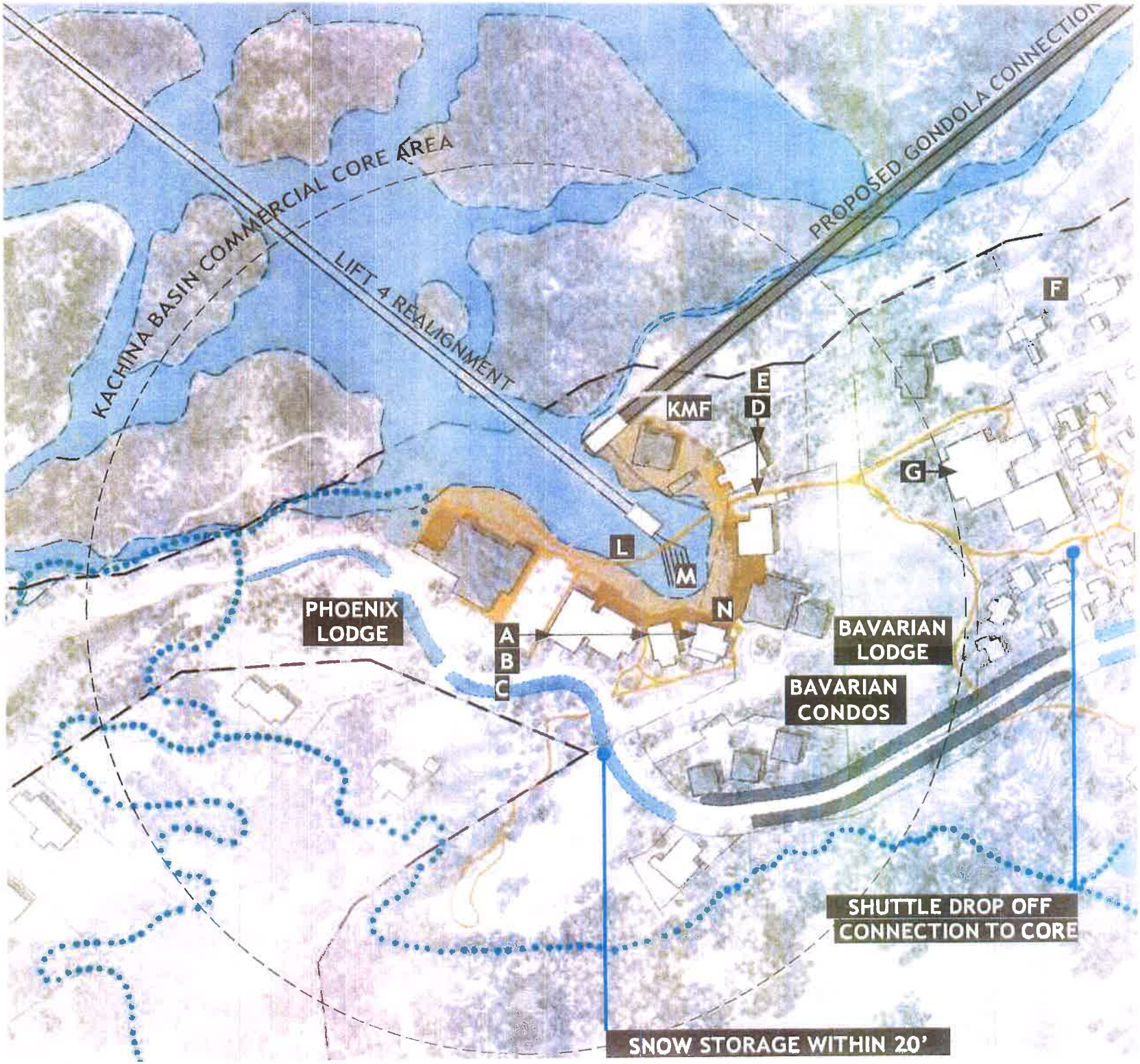
modations (3-5 total)

ces

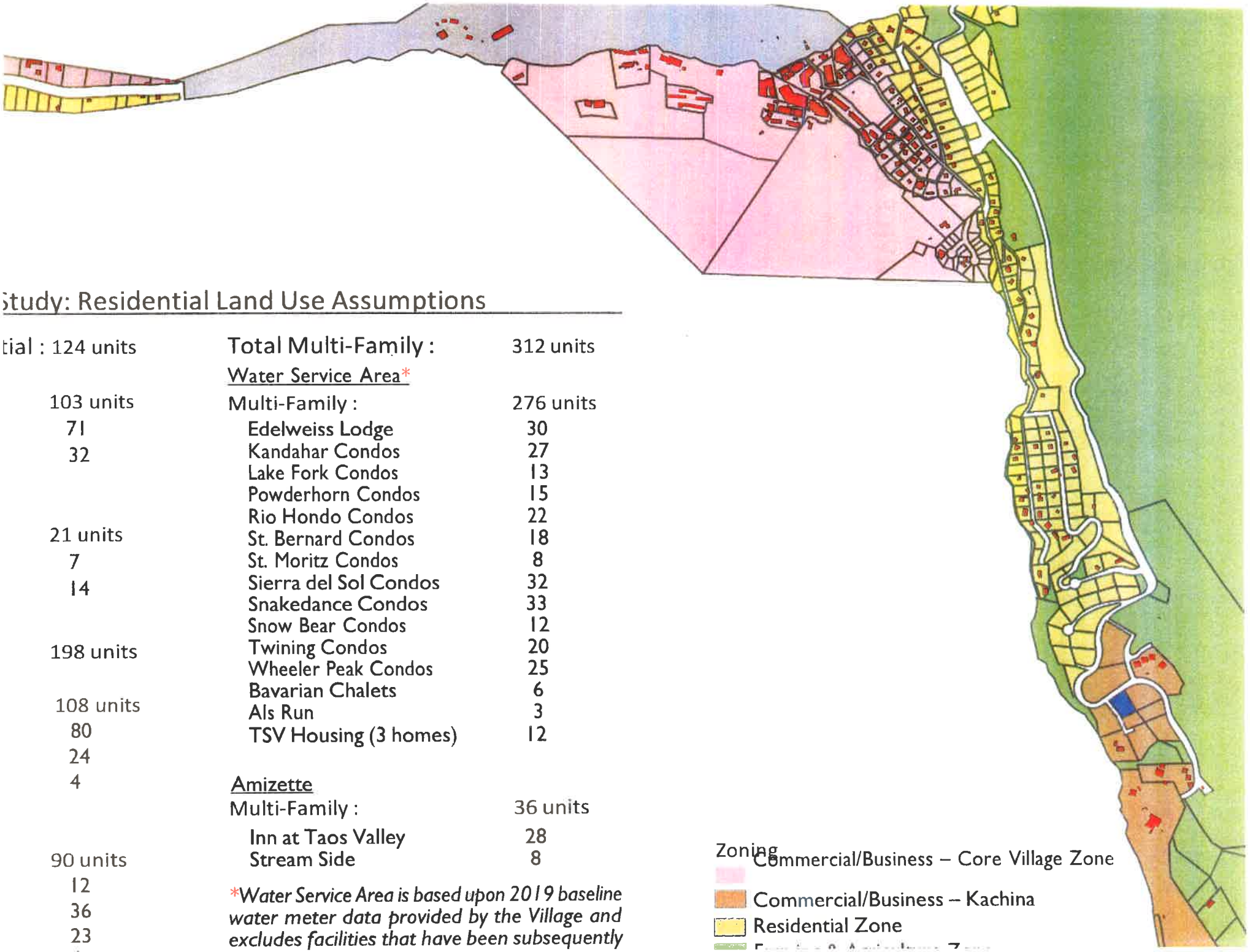
spa

modations (3-5 total)

Northside trails



APPENDIX I: FUTURE WATER SYSTEM SERVICE AREA



Study: Residential Land Use Assumptions

tial : 124 units	Total Multi-Family :	312 units
	Water Service Area*	
103 units	Multi-Family :	276 units
71	Edelweiss Lodge	30
32	Kandahar Condos	27
	Lake Fork Condos	13
	Powderhorn Condos	15
	Rio Hondo Condos	22
21 units	St. Bernard Condos	18
7	St. Moritz Condos	8
14	Sierra del Sol Condos	32
	Snakedance Condos	33
	Snow Bear Condos	12
198 units	Twining Condos	20
	Wheeler Peak Condos	25
	Bavarian Chalets	6
108 units	Als Run	3
80	TSV Housing (3 homes)	12
24		
4	Amizette	
	Multi-Family :	36 units
	Inn at Taos Valley	28
90 units	Stream Side	8
12		
36		
23		

*Water Service Area is based upon 2019 baseline water meter data provided by the Village and excludes facilities that have been subsequently

HART HOWERTON
NEW YORK · SAN FRANCISCO

October 17th, 2022

Mr. Patrick Nicholson
Village of Taos Ski Valley
Director of Planning & Community Development

Re: **Hotel St. Bernard – Village DRT Comment Responses**

Dear Mr. Nicholson,

Thank you for the opportunity to discuss our previous Hotel St. Bernard (HSB) Village DRT responses in our October 4, 2022 review meeting. Below please find updated responses and attachments coming out of comments from that meeting. As always please let us know any questions or items requiring further discussion.

Water Consumption

1. Applying the water consumption rates in the water study and the below assumptions to The Blake results in 1,768,000 gallons of water on an annual basis. Please see attached **Exhibit #1 Water Study - Blake Comparison**, for comparison to the previously submitted **Exhibit #2 – CUP Water Demand Analysis**, dated September 1, 2022. Also, for your reference, please see the attached **Exhibit #4 – Village Metered Data**, dated July 31,2022.

    a. 40% annualized occupancy
    b. 24 multi-family units (penthouses and suites)
    c. 65 standard rooms
    d. 1 pool (vs 2 pools for HSB)
    e. 50% less fitness area than HSB
    f. 75% less spa area than HSB

2. The water consumption for The Blake for the past twelve months ending July 2022 was 1,687,000 gallons (per Village water data). This is 87,000 (5%) gallons less than the projection above with the projection being more conservative.

3. Within the water study is a focus on the month of March since that is the most sensitive time of the year when comparing supply and demand. Anticipated water demand in the water study for March 2022 was 1,675,000 gallons. Per Village data, the actual consumption was 1,657,000 gallons. This is a negligible difference that reinforces the underlying assumptions in the water study.

4. We feel a comparison of the Multi-family rate (90 gallons/occupied night) vs Hotel rate (120 gal/occupied night) should consider the following:

    a. Alpine Village Suites (hotel) product which was recognized to have extremely high consumption for its size when the water study was completed inflated the hotel rate. For the seven months ending July 2022 Alpine Village has consumed 407,000

gallons which is identical to The Blake Residences which has at least 60% more square footage. Without Alpine Village hotel rate should be around 100 gallons/night.

b. On the flip side The Blake Residences has used about 25% more water than anticipated in the water study which would put it's consumption at 110 gallons/night.
c. Overall, these adjustments pretty much cancel each other out for HSB given its mix of hotel and multi-family space.

5. We anticipate the HSB requiring 275,000 gallons of water each March. When looking at the Village water capacity in the month of March per the water study it would require a nominal improvement on the 75% loss/leakage rate to cover this added demand. Given the joint efforts and commitments by TSVI and the Village to address this critical matter as a priority there is high confidence this nominal improvement will be achieved, at a very minimum, by the time the HSB re-opens.

6. These findings reinforces the Water Study and associated Land Use Assumption and projected water consumption. Please note, the Blake Residences are using more water than the assumed 90 gal/occupied night vs actual of 110 gal/occupied night. This difference though is negligible in gross consumption.

Upper Sutton Drive Improvement

As discussed, several improvements are currently being proposed to improve the Pedestrian Traffic Safety crossing Sutton Place to and from the Gondolita Plaza. These improvements include the items listed below. Please see the attached **Exhibit #3 Revised Upper Sutton Streetscape Improvements**, dated October 2022 for further detail and locations.

a. Regrading of the roadway within the Village ROW below the 12% maximum slope.
b. Adding snow melted paving throughout, with a heated trench drain at the northern lower side to prevent freezing runoff into adjacent areas.
c. Adding a new stop sign.
d. Replacing existing retaining wall along Snakedance.
e. Creating a new sidewalk and steps up the hill on the western HSB side of Sutton Place, providing a new pedestrian walkway that is separated from traffic from the Gondolita Plaza up to the flat portion of Plaza St. Bernard, then across Allee Mayer to the Ski Yard.

Fire Department Connection

As requested, we have added back the proposed Fire Hydrant at the northeast corner of the HSB along Allee Mayer. Please see the attached **Exhibit #3 Revised Upper Sutton Streetscape Improvements**, dated October 2022, page titled Fire Protection Diagram for further detail and locations.

Best regards,

Carl Pearson

CPearson@harthowerton.com

For and on behalf of Hart Howerton, Ltd.

Hotel St. Bernard
Exhibit #1 - CUP Water Demand Analysis
9/1/2022 (updated 10/15/22 for comparison to The Blake)

HSB Projected Water Demand by Month															The Blake
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual	12 months
Days		31	28	31	30	31	30	31	31	30	31	30	31	365	365
Occupancy		80%	80%	85%	15%	0%	25%	40%	40%	30%	25%	10%	50%	40%	40%
Room Nights		1,314	1,314	1,397	246	-	411	657	657	493	411	164	822	7,886	12,994
% of Annual Occupancy		17%	17%	18%	3%	0%	5%	8%	8%	6%	5%	2%	10%	100%	
Multi-Family Units															
Count	23														24
Gallons/room night*	90	51,336	46,368	54,545	9,315	-	15,525	25,668	25,668	18,630	16,043	6,210	32,085	301,392	315,360
Hotel Rooms															
Count	30														65
Gallons/room night*	120	89,280	80,640	94,860	16,200	-	27,000	44,640	44,640	32,400	27,900	10,800	55,800	524,160	1,138,800
Food & Beverage															
SF	15,220														
Annual gal/sf*	22														
Gallons		55,807	55,807	59,295	10,464	-	17,440	27,903	27,903	20,928	17,440	6,976	34,879	334,840	83,710
Pools															
Count	2														1
Annual gal/pool*	50,000	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	2,500	100,000	2,500	2,500	127,500	55,000
Fitness Center															
SF	2,500														1,250
Annual gal/sf*	80														80
Gallons		33,333	33,333	35,417	6,250	-	10,417	16,667	16,667	12,500	10,417	4,167	20,833	200,000	100,000
Spa															
SF	7,500														1,800
Annual gal/sf*	21														21
Gallons		26,250	26,250	27,891	4,922	-	8,203	13,125	13,125	9,844	8,203	3,281	16,406	157,500	39,375
Common Area Restrooms															
SF	1,705														
Annual gal/sf*	21														
Gallons		5,968	5,968	6,340	1,119	-	1,865	2,984	2,984	2,238	1,865	746	3,730	35,805	35,805
Total Gallons		**258,506**	**244,898**	**274,506**	**49,651**	**2,500**	**81,084**	**130,503**	**130,503**	**96,801**	**180,002**	**33,934**	**162,504**	**1,645,392**	**1,768,050**

*Water consumption rate per Water Study accepted by Village Council.

Village Water Capacity (in thousand gallons) - March						
	2022	2023	2024	2025	2026	Notes (all per Water Study accepted by Village)
Water Capacity	1,599	2,227	2,849	3,150	3,760	Assumes decrease of water line loss from 75% to 40% by 2026
Water Demand						
Baseline	1,553	1,553	1,553	1,553	1,553	Per data provided by Village with adjustments for obsolete facilities
BR & Penthouses	104	104	104	104	104	Consists of 33 multi-family residences
Visitation Growth		31	62	93	124	Assumes 2% annual visitation growth from current baseline
Multi-Family Growth				109	109	Placeholder for Parcel C and Rio Hondo development sites - timing TBD
Single Family Growth	10	20	29	39	49	Assumes four (4) new homes per year
Commercial Growth	9	20	32	170	193	Consists primarily of Parcel D commercial and new Firehouse Complex
HSB					275	Per analysis above
Total Water Demand	1,676	1,728	1,781	2,069	2,408	
Surplus/(Shortfall)	**(77)**	**499**	**1,069**	**1,081**	**1,353**	

Hotel St. Bernard
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9/1/2022 (updated 10/15/22 for comparison to The Blake)

HSB Projected Water Demand by Month

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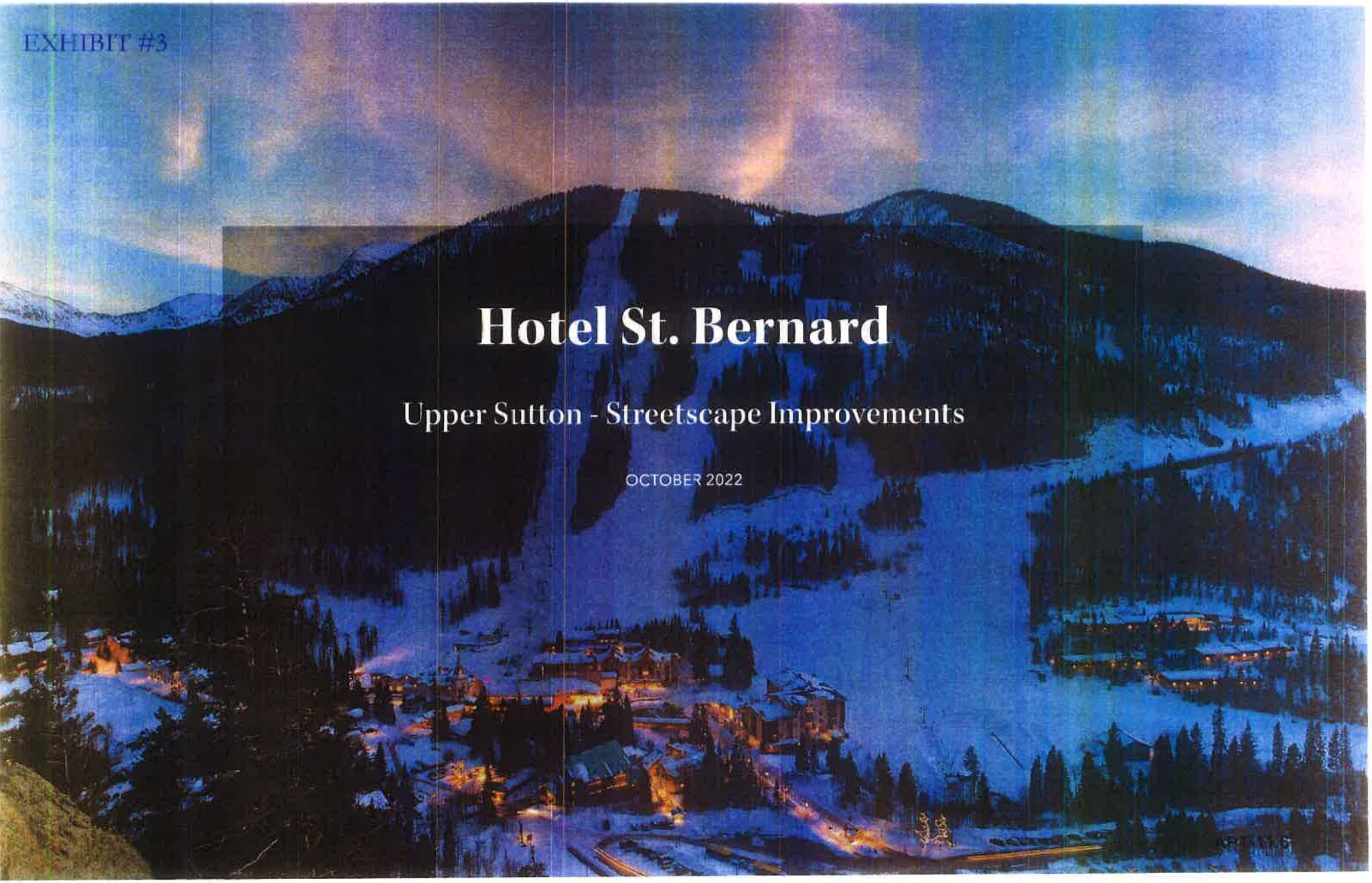
EXHIBIT #3



Hotel St. Bernard

Upper Sutton - Streetscape Improvements

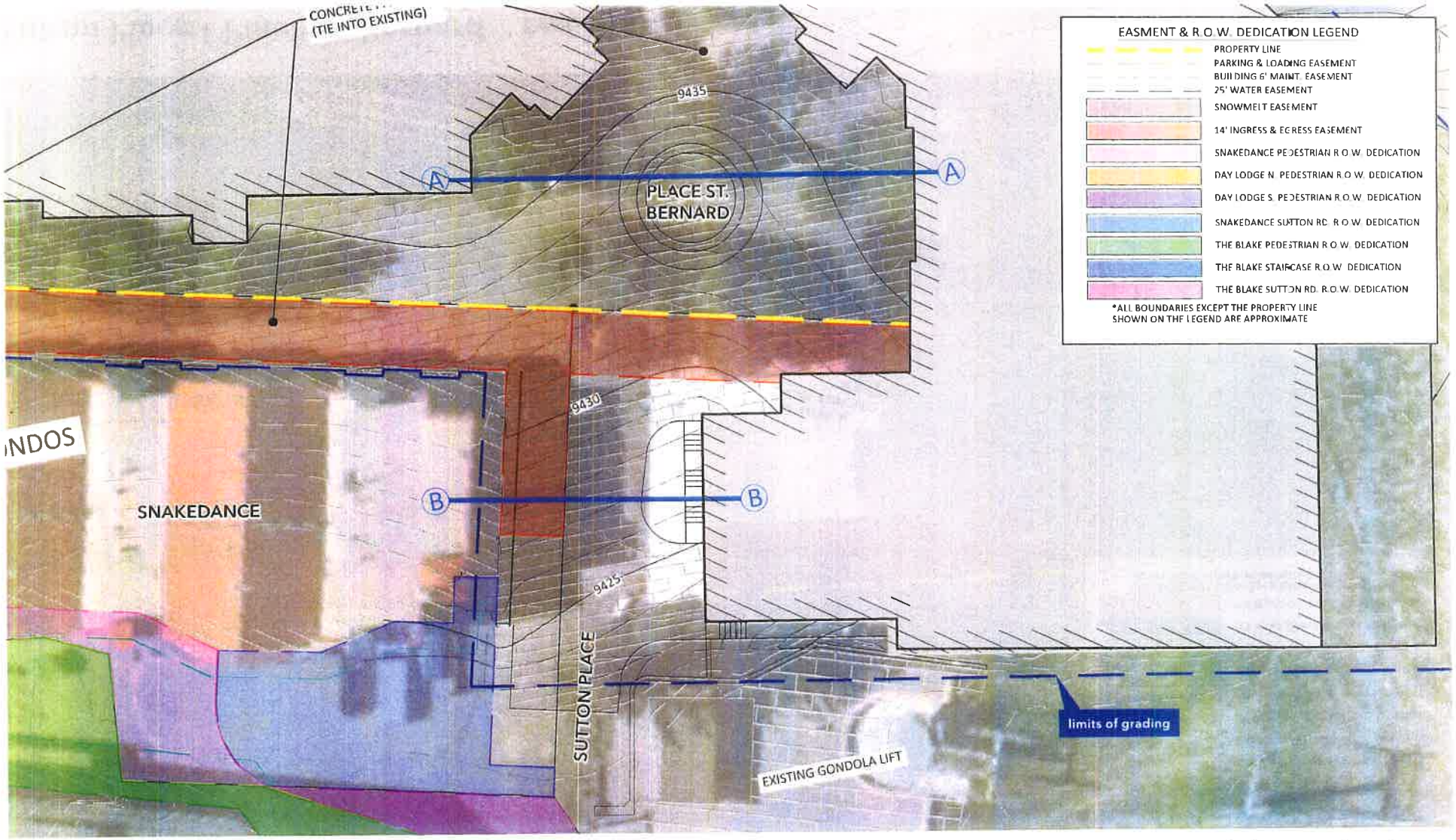
OCTOBER 2022

Sutton Place + Place St. Bernard | Existing Design

0 20 40'

1" = 20'

APT-11.7



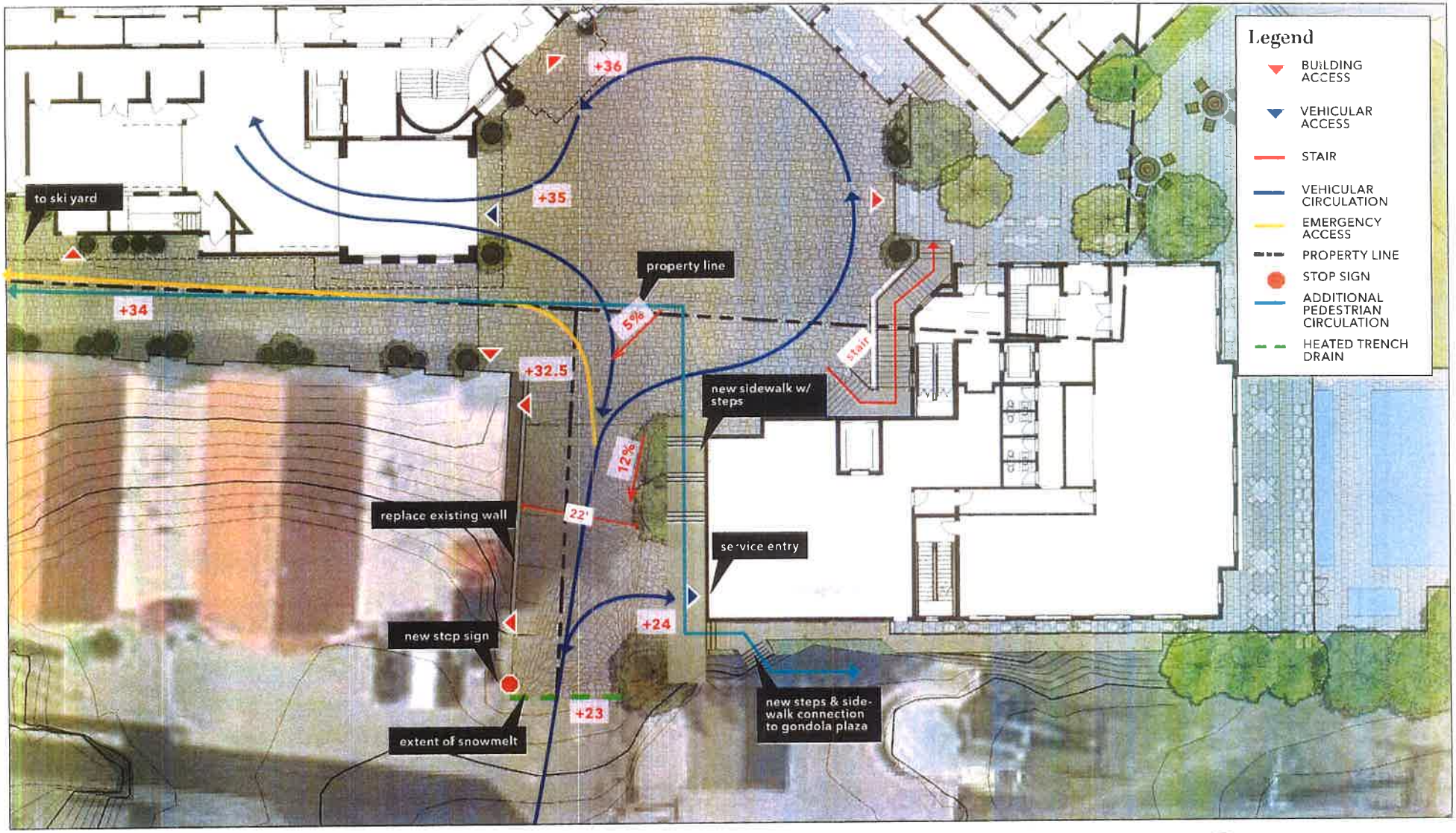
Sutton Place + Place St. Bernard | Proposed Design (Civil)

Sutton Place + Place St. Bernard | Existing

1

0 20 40'

1" = 20'

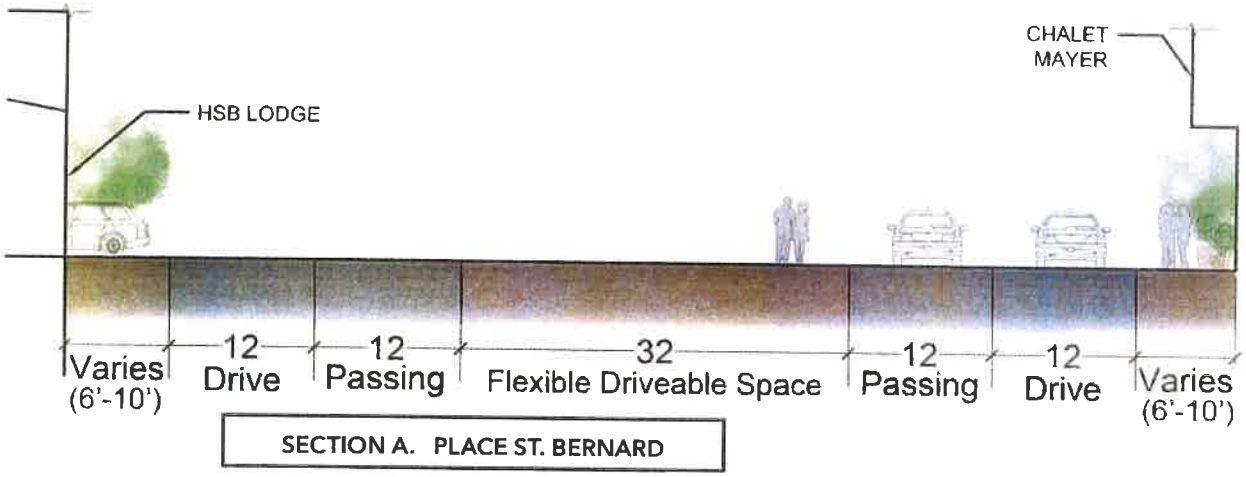


Sutton Place + Place St. Bernard | Proposed Design

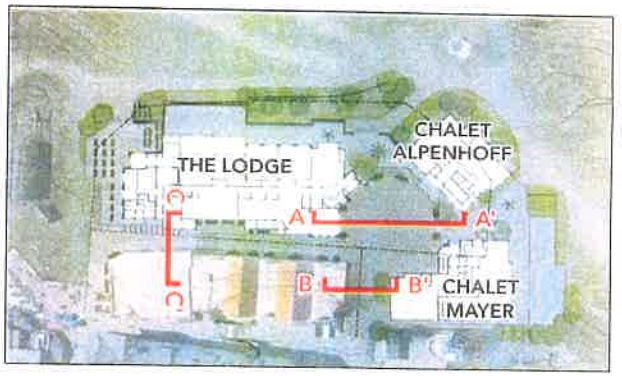
0 20 40'

1" = 20' at 11" x 17"

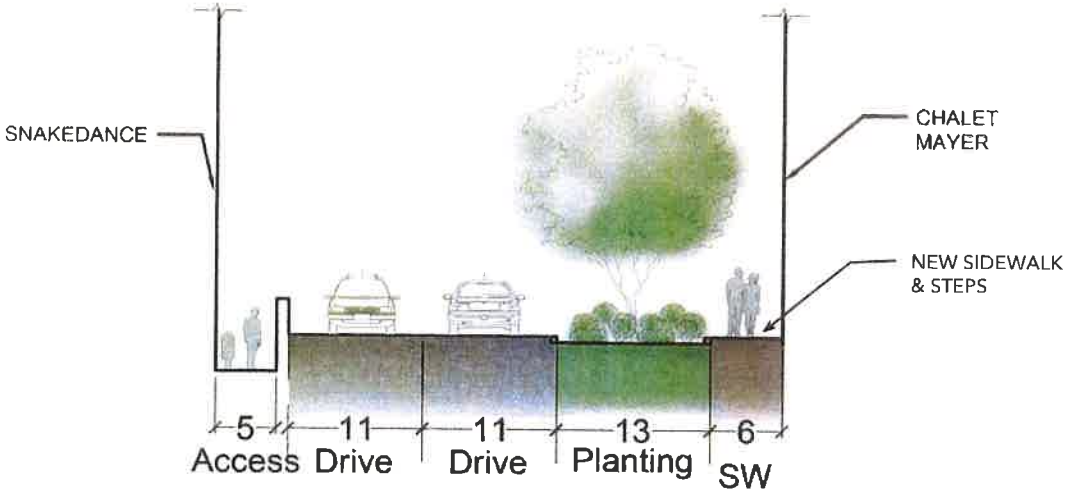
APT-11.10



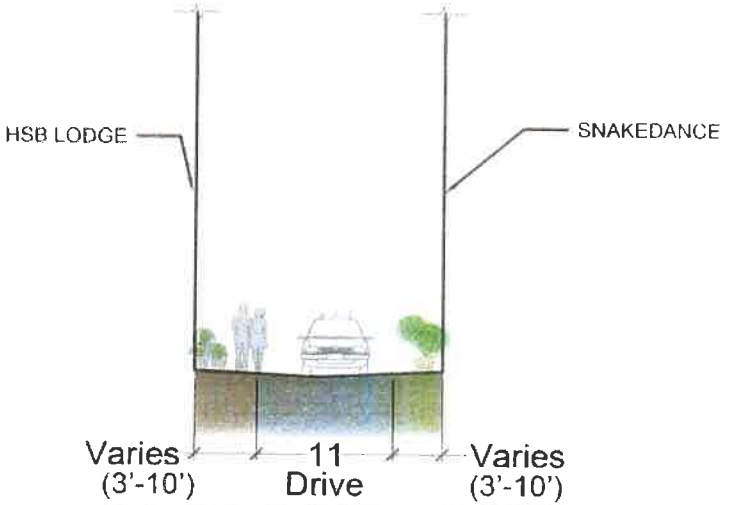
SECTION A. PLACE ST. BERNARD



KEY MAP

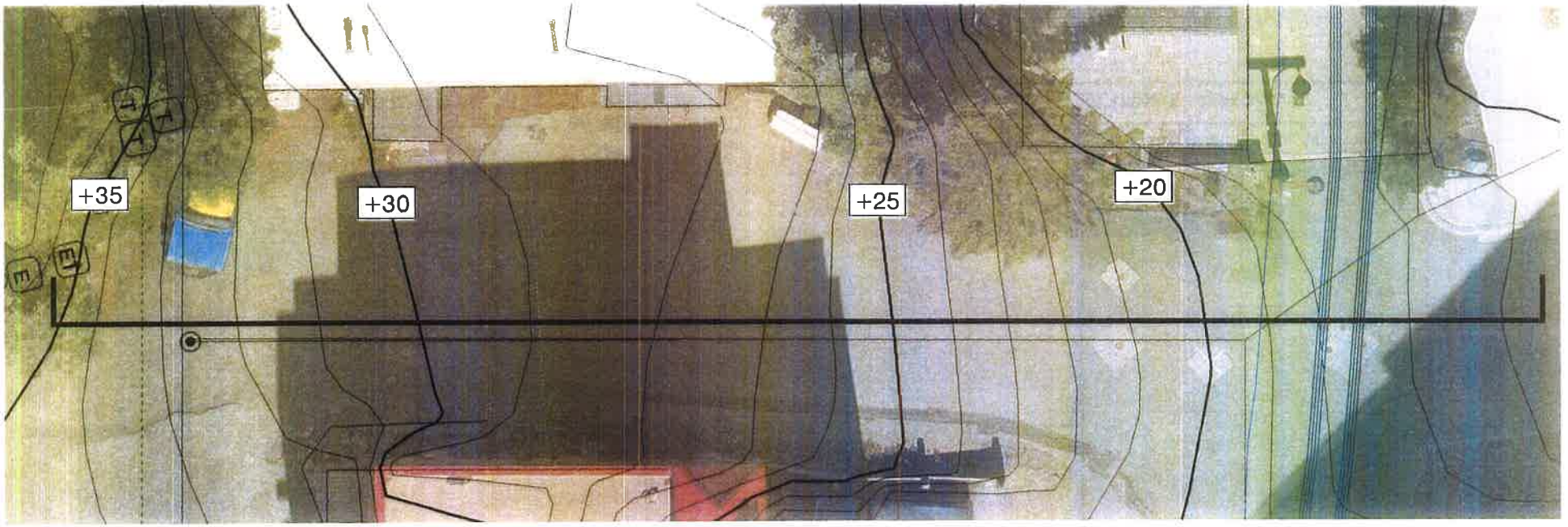


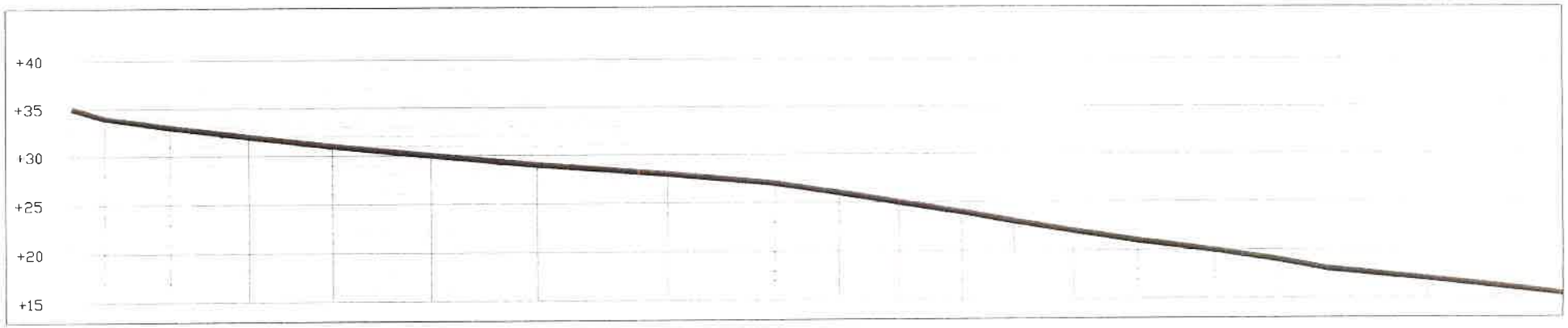
SECTION B. SUTTON PLACE



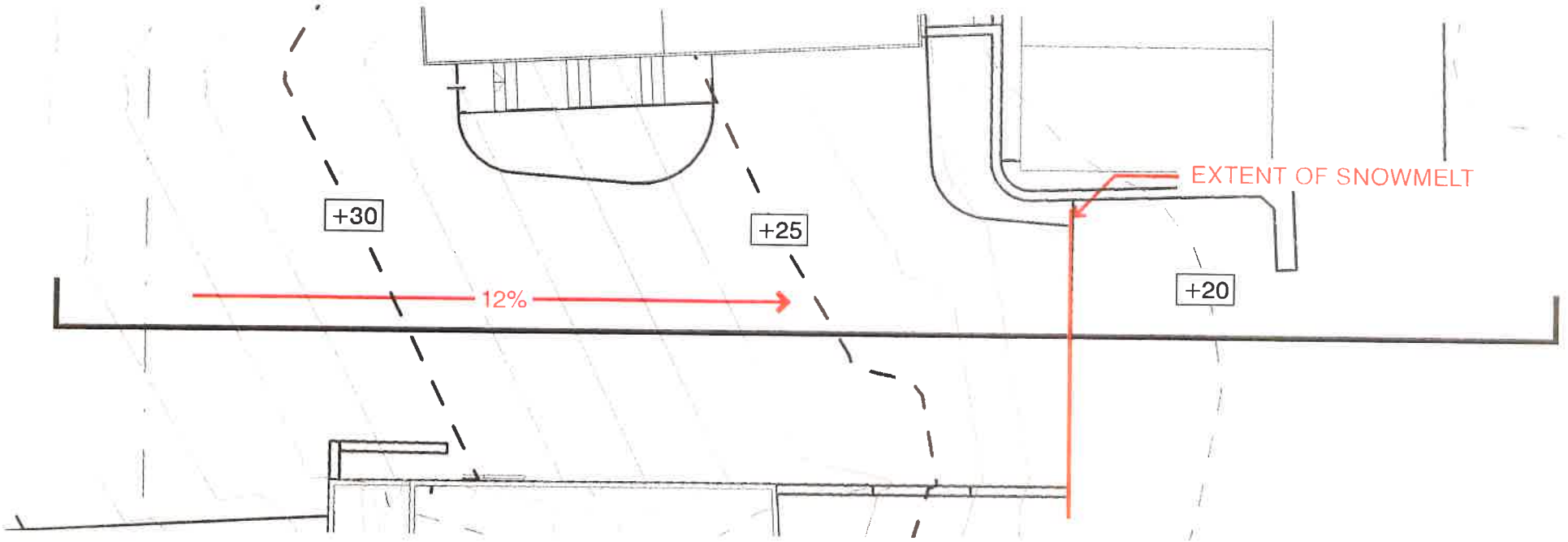
SECTION C. ALÉE MAYER

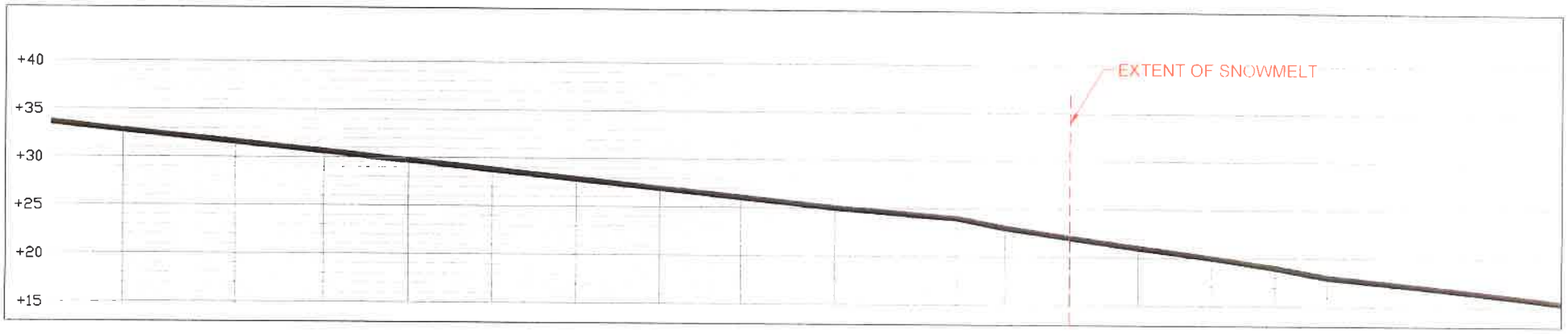
HSB Streetscapes | Sections



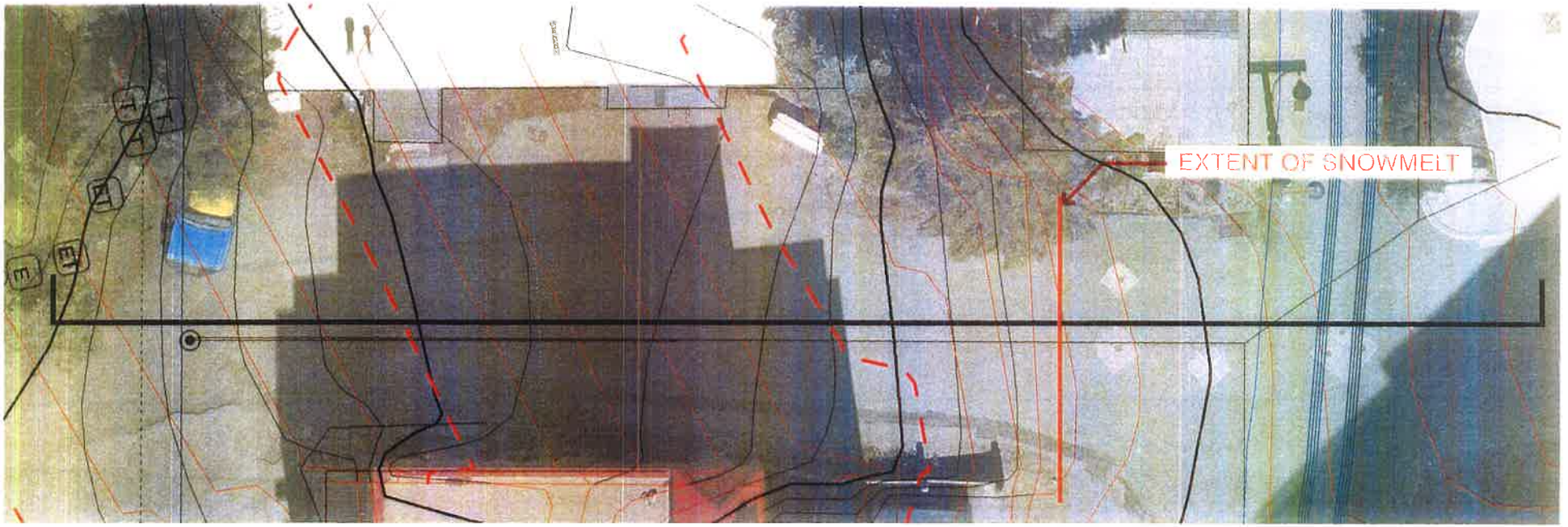


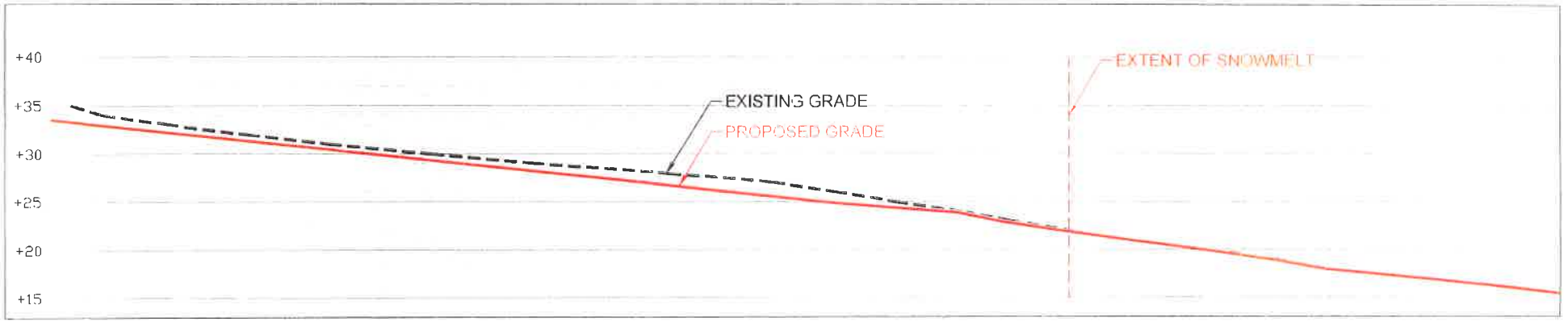
Existing Street Section | Upper Sutton Place



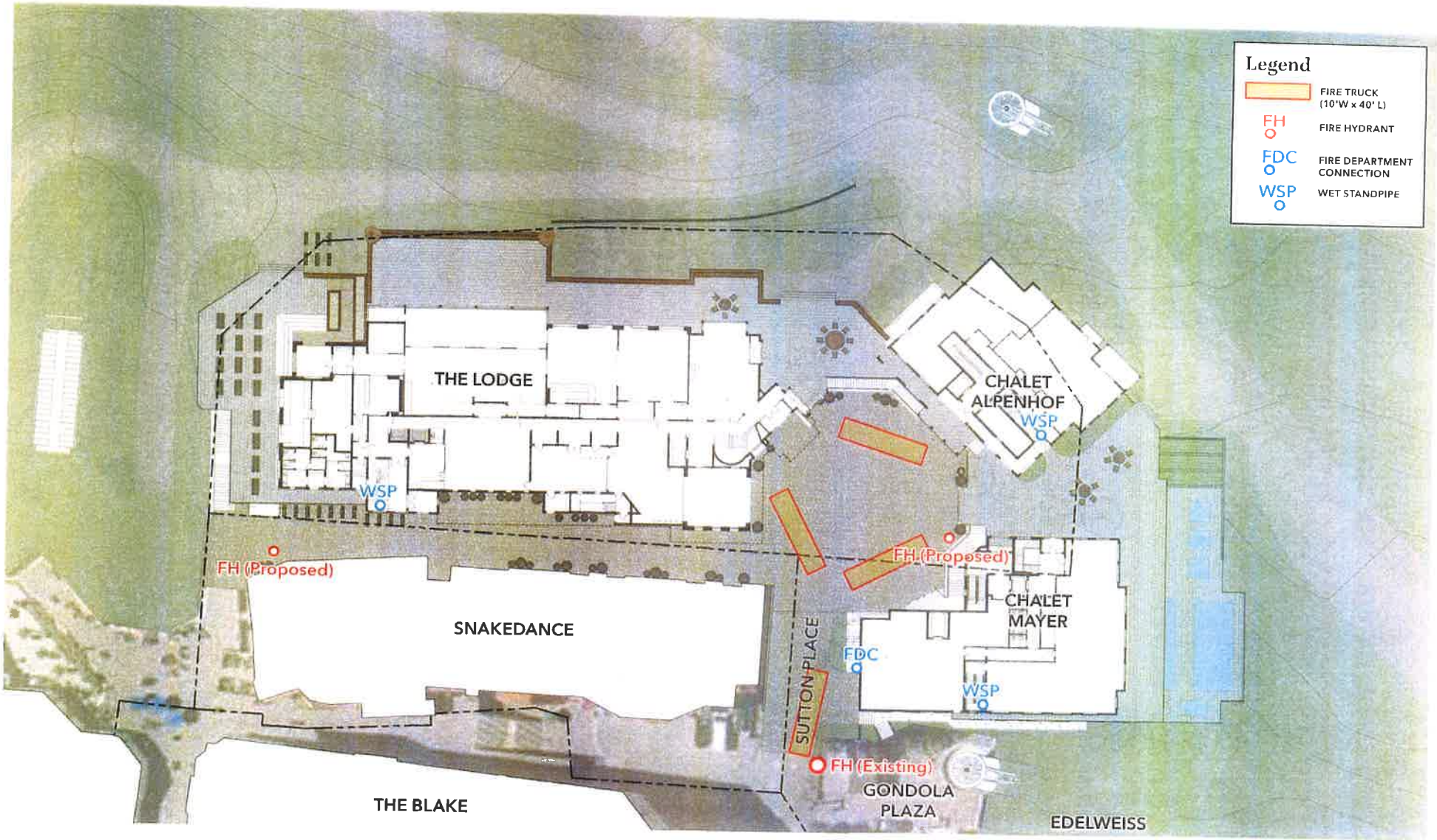


Proposed Street Section | Upper Sutton Place

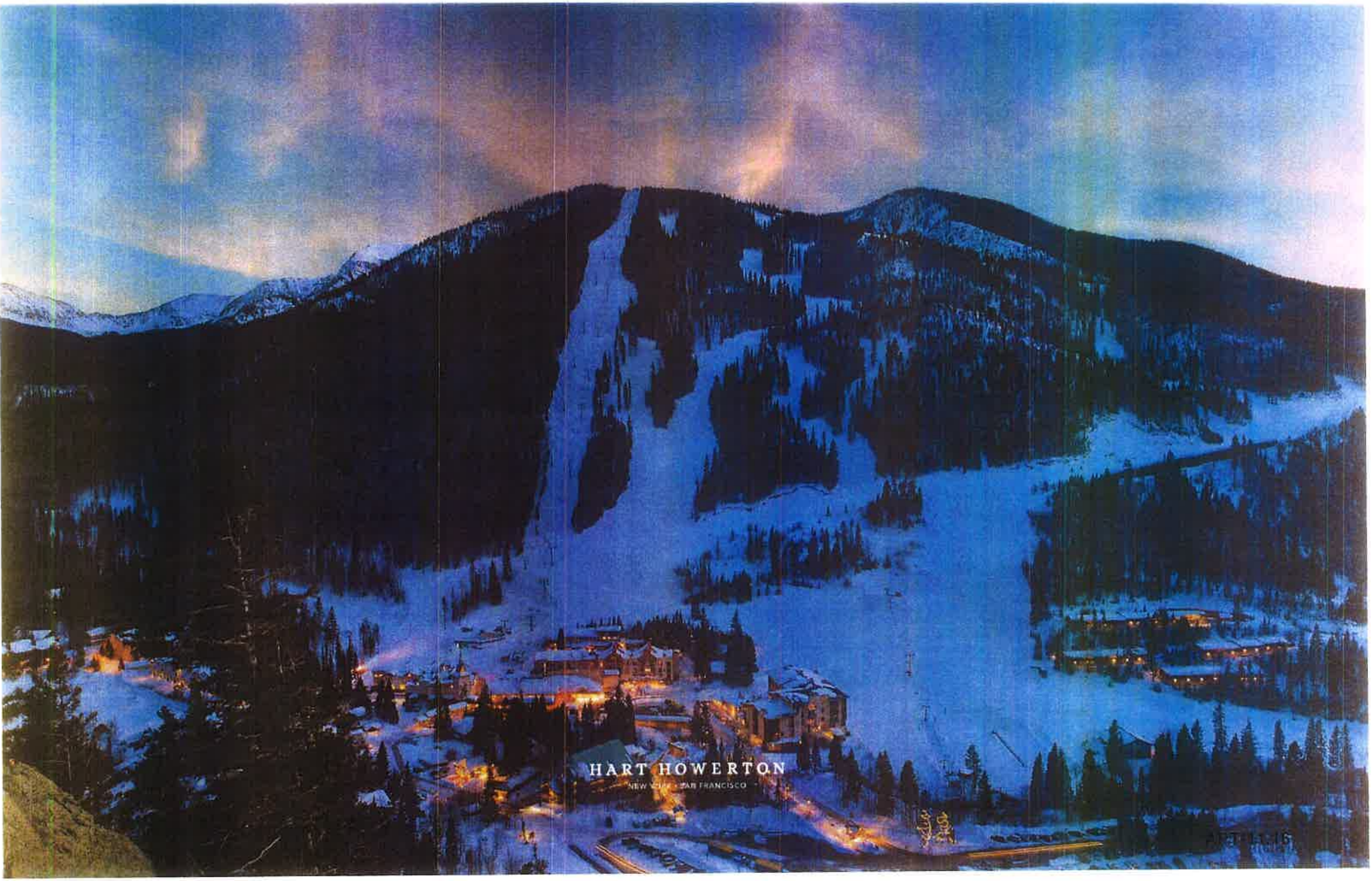




Street Section Comparison | Upper Sutton Place



Fire Protection Diagram


HART HOWERTON