

**Scope of Work**  
**STMWRF Arsenic Mitigation Project**  
**Phase III**  
**Shallow Groundwater Monitoring**

**Introduction**

This scope of work has been prepared in follow-up to the Phase II investigation of elevated arsenic and boron in shallow groundwater intercepted by the sewer system for the South Truckee Meadows Water Reclamation Facility (STMWRF). Phase II work included installation of 21 shallow monitoring wells, and soils and groundwater sampling. Results have identified a need for additional monitoring wells on the east side of the priority area, generally between Veterans Parkway and the Steamboat Creek, and on the southern boundary of the priority area.

The monitoring well network is proposed to be expanded by adding ten (10) additional wells, seven on the east side, two on the southern edge and one on the southwest edge of the priority area. Locations for additional monitoring wells are shown in attached Figure 1.

Groundwater levels in the monitoring well network will be measured monthly. Four monitoring wells will have daily water level recorders installed. The recorders will be downloaded quarterly. An end of year (December) a groundwater sampling event for arsenic and boron analyses will be conducted, for comparison with the prior year concentrations.

The goal of the monitoring will be to collect data upon which assessment of long-term changes in depth to groundwater and arsenic and boron concentrations. Short-term fluctuations in water levels appear to be modest based on a few months of follow-up monitoring conducted this winter (March and April). Should seasonal changes or precipitation event fluctuations be observed to be more dramatic than currently understood, then additional monitoring measures might be advised, such as equipping additional monitoring wells with daily water level records, or additional water quality analyses.

**Task 1 – Monitoring Well Construction, Groundwater and Soils Sampling and Analyses, and Updated Mapping**

Using a hollow-stem auger drilling rig, nine (9) shallow monitoring wells will be completed on the eastern and southern side of the high priority area. Approximate locations are shown in Figure 1. Completion depths will be approximately 10-feet. The two southern monitoring wells may need to be extend deeper, depending on the depth to groundwater encountered during drilling. A schematic well design is attached.

The monitoring wells will be located in residential low-traffic roadways, and constructed using 2-inch diameter Schedule 40 PVC casing with factory perforated screen from 5-10 feet. The upper borehole

from 4.5 feet to land surface will be sealed with bentonite hole plug and cement. Traffic-bearing manhole covers will be installed at the surface of each well.

During drilling, the soils will be logged and representative soil samples collected from the vadose zone (above the water table). Five (5) additional soil samples will be collected from the vadose zone using a hand auger at a depth of approximately 2-3 feet at locations in public landscaped areas. The soil samples will be analyzed for leachable arsenic, boron, chloride, pH and EC (indicator of salinity).

At the northern-most location (MW-28, Figure 1), a drive point piezometer will be installed rather than a drilled monitoring well, due to access limitations and an anticipated shallow depth to groundwater. The drive point will be installed to an approximately depth of 6 ft, with the lower 3 ft screened. The drive point piezometer will be constructed of 2-inch diameter galvanized steel pipe, and will accommodate water level measurements and water quality sampling, using the same equipment as all other monitoring wells.

The new monitoring wells will be developed by bailing water to remove sediment and prepare the wells for groundwater sampling for chemical analyses. Groundwater samples will be collected for each newly constructed monitoring well, and delivered to a laboratory for analyses of for arsenic, boron, and chloride.

Once the soil and groundwater quality results are received from the laboratories, updated mapping of the distributions of arsenic and boron will be prepared, along with updated mapping of the depth to groundwater, potentiometric water table elevations, and sewer system submergence. An update memorandum will be provided to convey the results.

A summary of tasks to be completed are outlined below:

- Field check locations, mark locations, and get GPS locations of monitoring wells for permits and underground utility clearance.
- Prepare and submit NDWR Monitoring Well (M/O) Waiver Applications for the additional monitoring wells.
- Obtain or amend the City Encroachment Permit (WCCSD to take lead).
- Contract with a drilling company and secure monitoring well construction materials.
- Obtain USA Dig clearances.
- Provide drilling supervision, soil logging, soils sampling, monitor well casing installation and well construction, and wellhead completion for 9 new monitoring wells.
- Install one drive point piezometer monitoring well.
- Submit one representative soil sample from each drilled borehole to an analytical laboratory for testing.
- Conduct additional soil sampling using a hand auger to 2-3 feet in depth in landscaped public areas (parks, school, green belts) at five planned locations. Deliver soils samples to an analytical laboratory for testing.
- Develop new monitoring wells by bailing to remove sediment and prepare for sampling.

- Collect groundwater samples from new monitoring wells, and analyze the samples for arsenic, boron, and chloride concentrations.
- Have new monitoring well tops surveyed for elevation.
- Prepare soil logs, and update potentiometric water level map, depth to groundwater map, shallow groundwater and soil quality maps, and sewer submergence map.
- Issue a supplemental report for the monitoring well network, including logs and data collected from the additional 9 monitoring wells and drive point piezometer, to include the expanded mapping of chemistry and sewer submergence.

Notes:

1. Interflow Hydrology to provide permit fees for NDWR monitoring well waivers.
2. Interflow Hydrology to provide for drilling contractor services under subcontract.
3. Interflow Hydrology to provide for analytical testing of soils and groundwater by appropriate analytical laboratories.

**Task 2 – Monitoring of Groundwater Levels and Quality**

After the installation of the additional monitoring wells, the STMWRF shallow groundwater monitoring well network will comprise 31 wells, plus three pre-existing wells in or near the priority area (34 wells total). Water levels will be manually measured on a monthly basis through December 2019, with four of the monitoring wells equipped with daily water level recorders which will be downloaded quarterly.

One groundwater quality sampling event will take place in December 2019, to compare and contrast with the prior year December 2018 analyses. Groundwater samples will be collected for analytical testing of arsenic, boron, and chloride concentrations. Groundwater will be purged prior to sample collection to assure representative groundwater sampling. Field parameters of pH, EC and temperature will be monitored during purging, and will have stabilized to within 10% between purged well volumes prior to sample collection.

At the conclusion of year 2019 monitoring, a monitoring report will be prepared to document data collected. Observations of seasonal variance in water levels and chemistry will be provided. Recommendations for continued shallow groundwater monitoring will be made. The monitoring report will be issued in January/February 2020.

In order to facilitate County staff taking over future responsibilities for monitoring and data collection from the network, Interflow Hydrology will prepare a Monitoring and Sampling Protocols document. The document will provide information required for staff to locate the monitoring wells, and procedures to follow for water quality sampling, including equipment to be used and recommended QA/QC to follow.

A summary of tasks to be completed during the monitoring period are listed below:

- Provide water level measurements through December.

- Collect groundwater samples from the 31 monitoring wells for analyses of arsenic and boron concentrations at the end of the year (December 2019) to contrast with 2018 water chemistry.
- Prepare a calendar year 2019 monitoring report.
- Prepare a monitoring and sampling guidance document.

Notes:

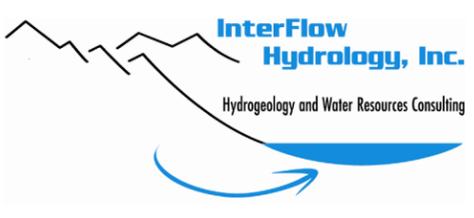
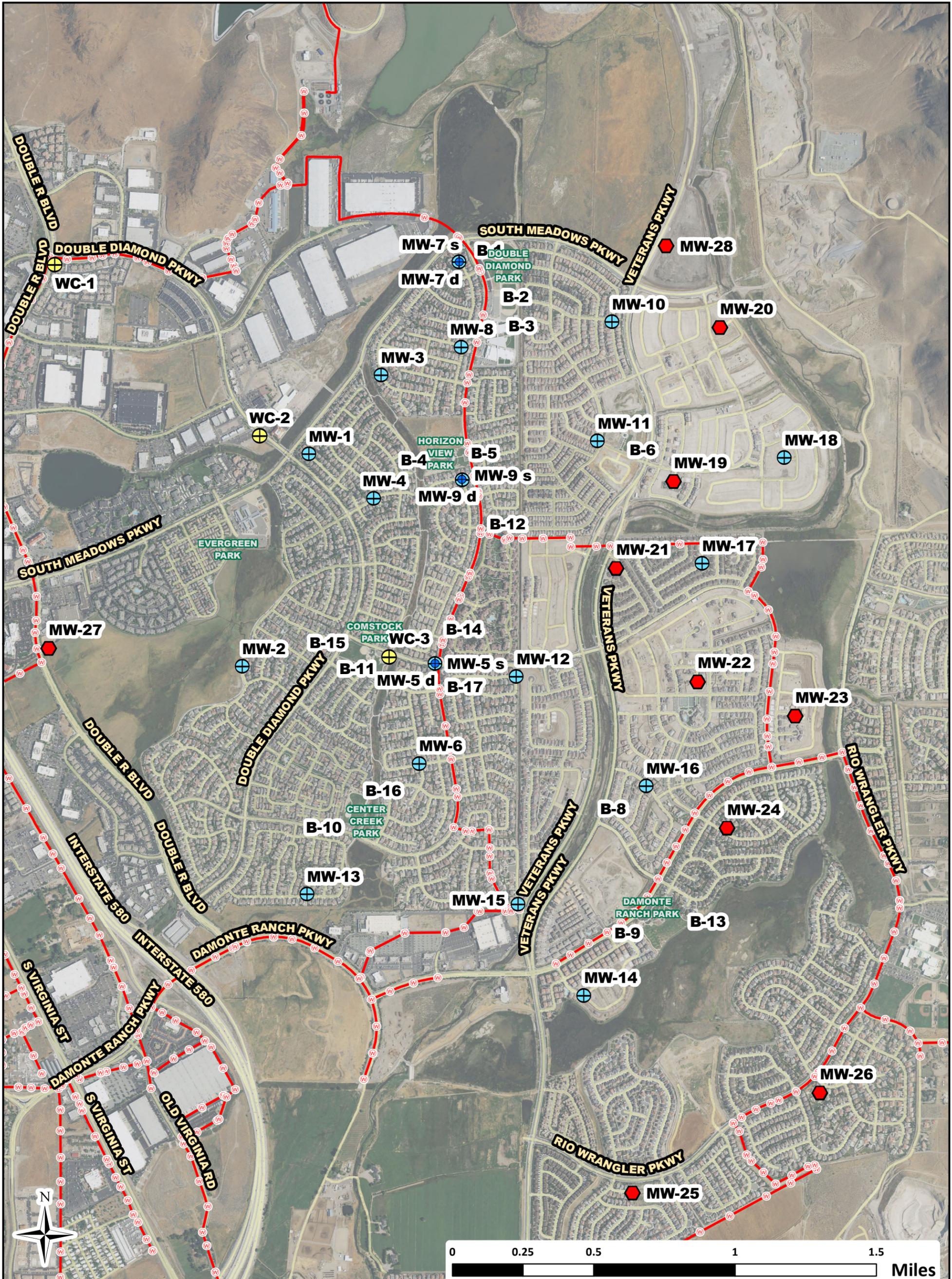
1. Interflow Hydrology will provide water level recorders.
2. Interflow Hydrology will provide for analytical testing of groundwater by an appropriate analytical laboratory.

**Estimated Project Cost Summary**

A summary of estimated costs is presented in Table 1, and a copy of the cost estimate spreadsheet is attached hereto. The project cost estimate has been developed using Interflow Hydrology’s 2019 Standard Fee Schedule, a copy of which is also attached.

**Table 1 – Summary of Estimated Cost for Phase III Hydrogeology Services**

<b>Task Number</b>	<b>Description</b>	<b>Estimated Cost</b>
<b>1</b>	Monitoring Well Network Expansion, Groundwater and Soil Sampling, Updated Mapping and Interpretations, and Supplemental Report Preparation	\$72,510.00
<b>2</b>	Monitoring of Shallow Groundwater Levels, Water Quality Sampling in December 2019, Monitoring Summary Report, and Monitoring Protocols Document	\$47,740.00
<b>Estimated Total</b>		<b>\$120,250.00</b>

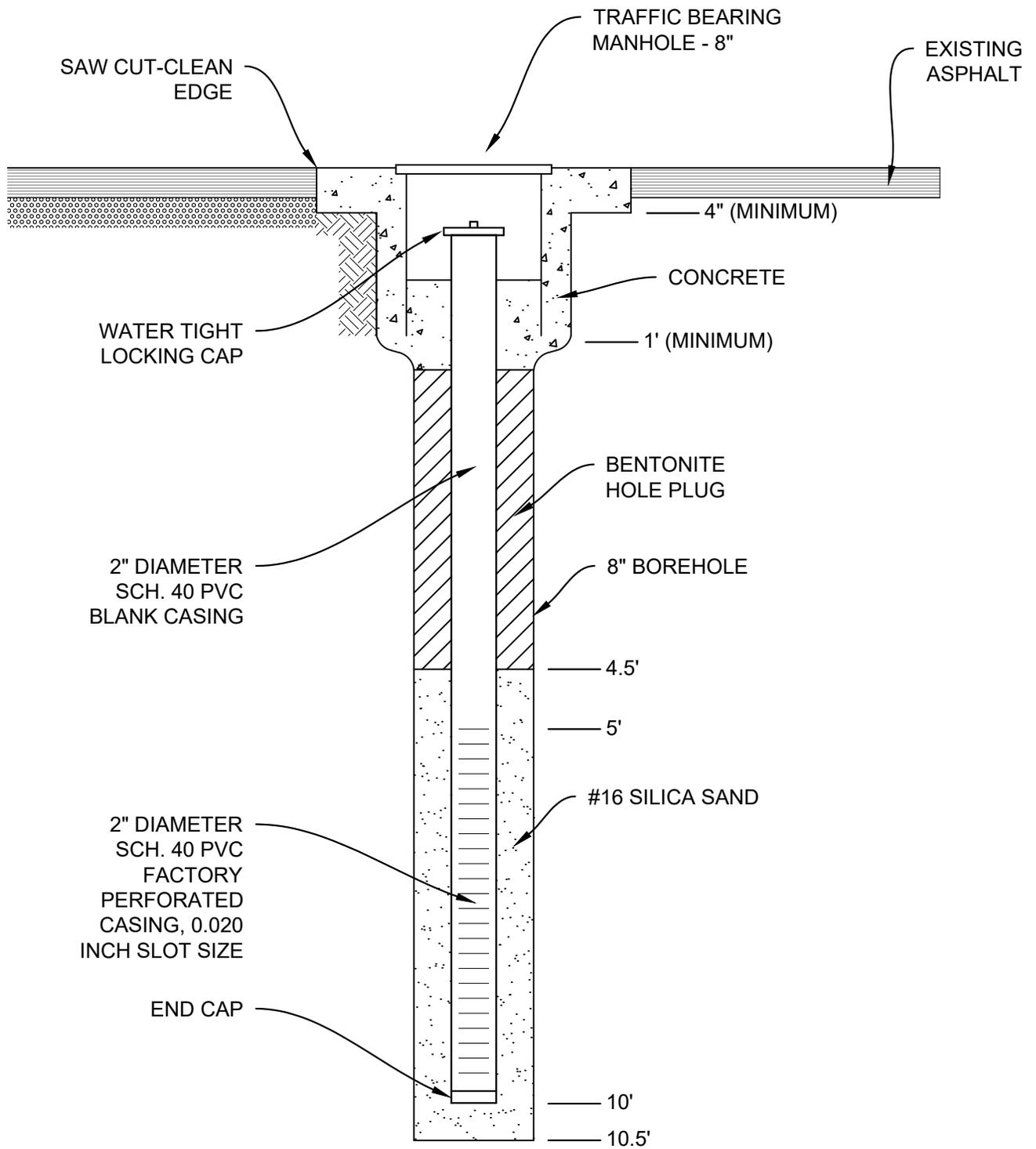


- Legend**
- Monitoring Wells**
- ◆ Proposed Well
  - ⊕ Washoe County Well
  - ⊕ Existing Shallow Well
  - ⊕ Existing Deep Well (d)
  - ⊙ Washoe Sewer Manholes
  - Washoe County Sewer Mains

**Existing and Proposed Monitoring Wells**  
 STMWRF Arsenic Mitigation Project  
 Washoe County Community Services Department  
 Washoe County, Nevada

1:20,000

Coordinate System: WGS 1984 Web Mercator  
 Projection: Mercator Auxiliary Sphere  
 Basemap: ESRI Imagery



NOT TO SCALE  
(NTS)



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WELL SCHEMATIC  
SHALLOW GROUNDWATER MONITORING WELL  
SOUTH TRUCKEE MEADOWS ARSENIC STUDY  
RENO, WASHOE COUNTY, NEVADA

Task Number	Description	Dwight Smith, Principal	Steve Hnat, Geo	Alexa Terrell, Hydrogeo	Patrick Johnson, GIS	Subtotal Professional Services	Misc Expenses	Permit / App Fees	Outside Services / Equipment	Task Total
	Rate	\$140.00	\$105.00	\$95.00	\$90.00					
<b>1</b>	<b>Expand Monitoring Network to the East</b>									
a	Project Startup, Coordination	4		4		\$940.00	\$100.00			\$1,040.00
b	Field Marking of Monitoring Well Locations, USA Dig Notifications	2		12		\$1,420.00	\$100.00			\$1,520.00
c	NDWR M/O Waiver, Washoe County Well Permits, Including Application/Permit Fees	2		6	4	\$1,210.00		\$1,200.00		\$2,410.00
d	Asphalt Cutting at Drilling Locations	1		4		\$520.00	\$100.00			\$620.00
e	Drilling Contractor Services including monitoring well construction materials (Nova Drilling Estimate Feb 2018 plus 20% Continuity and mark-up)	2		4		\$660.00			\$18,800.00	\$19,460.00
f	Drilling Supervision, Logging, Soil Sampling, Monitoring Well Construction and Development, Well Head Completions	8	16	80		\$10,400.00	\$500.00			\$10,900.00
g	Drive Point Piezometer Installation	1	4	4		\$940.00	\$250.00			\$1,190.00
h	New Monitoring Well Development	4		50		\$5,310.00	\$200.00			\$5,510.00
i	New Monitoring Well Sampling and Analyses	4		16		\$2,080.00	\$500.00		\$2,000.00	\$4,580.00
j	Surveying of Monitoring Well Elevations	2		2		\$470.00			\$750.00	\$1,220.00
k	Hand Auger Soil Sampling	2	8	8		\$1,880.00	\$300.00			\$2,180.00
l	Soils Laboratory Analysis	2		4		\$660.00	\$200.00		\$2,000.00	\$2,860.00
	<i>Subtotal - Additional Monitoring Wells and Soils Sampling</i>									\$53,490.00
m	Data Compile, Logs, Updated Mapping	8		80	20	\$10,520.00	\$100.00			\$10,620.00
n	Supplement Report Preparation	20		40	20	\$8,400.00				\$8,400.00
	<i>Subtotal - Analyses Update</i>									\$19,020.00
	<i>Task 1 Total</i>	<i>62</i>	<i>28</i>	<i>314</i>	<i>24</i>	<i>\$37,010.00</i>	<i>\$2,350.00</i>	<i>\$1,200.00</i>	<i>\$23,550.00</i>	<i>\$72,510.00</i>
<b>2</b>	<b>Water Level and Shallow Groundwater Quality Monitoring - 10 months (March 2019 - December 2019)</b>									
a	Monthly Water Level Measurements (March-December)	10		120		\$12,800.00	\$1,000.00		\$2,000.00	\$15,800.00
b	Water Quality Sampling (December) including Analytical Testing	8		100		\$10,620.00	\$1,000.00		\$4,000.00	\$15,620.00
c	Monitoring Report for 2019	20		80	20	\$12,200.00				\$12,200.00
d	Monitoring and Sampling Plan with Protocols	8		24	8	\$4,120.00				\$4,120.00
	<i>Task 2 Total</i>	<i>46</i>	<i>0</i>	<i>324</i>	<i>20</i>	<i>\$35,620.00</i>	<i>\$2,000.00</i>	<i>\$0.00</i>	<i>\$6,000.00</i>	<i>\$47,740.00</i>
	<i>Phase III Total Estimated</i>	<i>108</i>	<i>28</i>	<i>638</i>	<i>44</i>	<i>\$72,630.00</i>	<i>\$4,350.00</i>	<i>\$1,200.00</i>	<i>\$29,550.00</i>	<i>\$120,250.00</i>



## Professional Fee Schedule - 2019

Professional services to be billed on a time and expenses basis in accordance with the following billing rates:

Professional Services:

Dwight L. Smith, PE, PG, CHg, Principal Hydrogeologist	\$ 140.00 per hour
Steve Hnat, PG, Geologist	\$ 105.00 per hour
Alexa Terrell, MS, Hydrogeologist	\$ 95.00 per hour
Patrick Johnson, GIS Specialist	\$ 90.00 per hour

Deposition and Hearing Testimony Rate = 2x standard rate

Field Equipment:

Current-Velocity (Stream Flow) Gage	\$ 50.00 per day
Water Level Transducer-Recorder	\$100.00 per week
Peristaltic Pump for Well Purging and Water Chemistry Sampling	\$ 75.00 per day

Travel - Vehicle Expenses \$ 0.58 per mile  
(Travel time billed at standard hourly rate)

Outside Services & Reimbursable Expenses Cost plus 10%