

**FULL BASELINE REPORT PENDING. EXISTING ENVIRONMENT SUMMARY  
AND WELL LOGS ARE ATTACHED AS PLACEHOLDERS.**

**OPERATING PERMIT APPLICATION  
MONTANA LIMESTONE RESOURCES**

**APPENDIX A-2  
BASELINE HYDROLOGY REPORT**

October, 2014

## **2.2 HYDROLOGY**

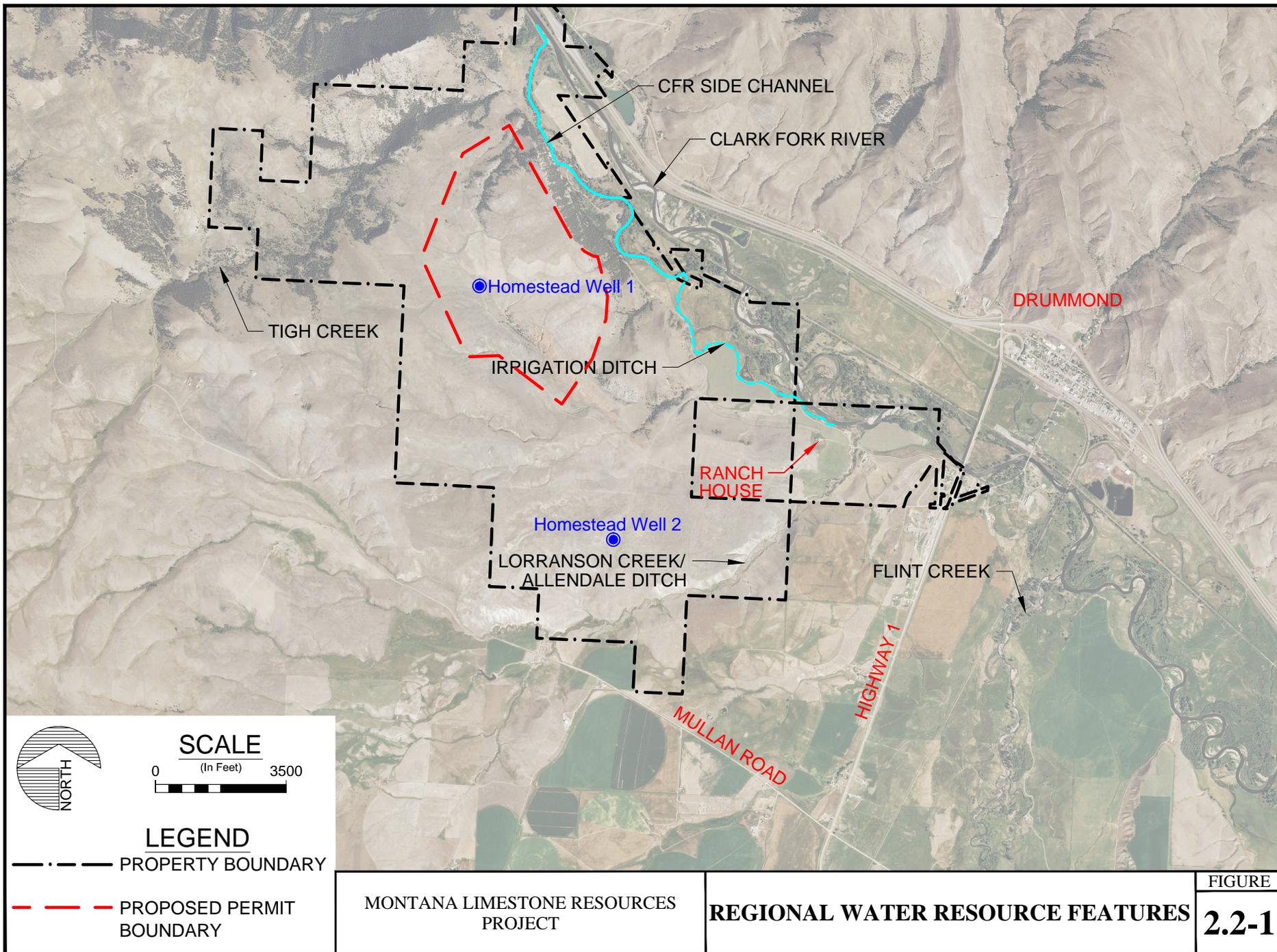
This section describes hydrologic features and conditions in and around the project area, and the MLR Project hydrologic monitoring program and results to date. Additional detail is included in Appendix A-2, with supporting information provided in various sections of this application, including Sections 3.2.6 “Mine Water Management”, 3.11 “Operational Water Monitoring”, and 4.13 “Post-Operation Water Monitoring”.

### **2.2.1 Local Water Resources**

The MLR Project lies within the Clark Fork River drainage, a first-order tributary to the Columbia River (hydrologic unit code 17010202). Primary surface water features in the general vicinity of the MLR project include the Clark Fork River (CFR), a slough or side channel associated with the CFR, Tigh Creek, a small creek southeast of the project site, and Flint Creek (Figure 2.2-1). The Clark Fork River drainage bottom lies immediately northeast of the project site with the main river channel approximately 0.5 miles northeast of the proposed limestone quarry. Continuous streamflow data from USGS gaging station 12331800, located approximately 13 miles downstream of the project area, includes a maximum and minimum daily average flow rate of 7740 cfs on June 10, 2011 and 185 cfs on August 22, 2013, respectively, for the October 2007 through August 2014 period of record (Appendix A-2).

A small slough or side channel of the Clark Fork River flows from southeast to northwest along the western edge of the floodplain between the river and proposed mine site. The side channel receives seasonal flow from the Clark Fork River via an irrigation ditch, from irrigation return flows, and possibly from shallow groundwater recharge. Based on the relative elevations of the side channel invert and river at their upstream junction, the side channel does not receive direct flow from the Clark Fork River (other than via the irrigation ditch) except during very high runoff years.

The Tigh Creek drainage lies approximately 0.5 miles northwest of the proposed mine facilities and is a tributary to the Clark Fork River. Despite the considerable drainage size, Tigh Creek is typically dry. Since initiation of baseline monitoring activities in 2013, no flow has been observed in Tigh Creek and no indications of recent flow, such as newly scoured sections of the creek bottom or recent debris piles, have been recorded. Based on conversations with local ranchers, Tigh Creek typically flows only in response to very high intensity precipitation or snowmelt events. The large cobble/boulder creek bed material indicates the drainage does experience periodic high intensity, short-duration flows. The abundant Madison Limestone outcrops in the drainage suggest that any ephemeral surface flow that may occur quickly infiltrates into the limestone. The lack of surface flow also indicates that the local and regional groundwater tables lie some distance below the creek bed, even in the lower reaches of Tigh Creek.



A small creek is located south/southeast of the proposed mine facilities (Figure 2.2-1). Although unnamed on the USGS topographic map, the creek is referred to as Lorranson Creek (MBMG 1997) and as Allendale Ditch elsewhere; both names are used to refer to the unnamed creek in this report. The majority of creek flow is derived as tail water from Allendale Ditch (fed by Flint Creek approximately 10 miles south of the project area) and other irrigation return flows. The creek is also fed by a number of springs located two to three miles south of the project area and south of Mullan Road (Figure 2.2-1). The creek would likely be dry most of the year if not for the irrigation return flows (MBMG 1997).

Flint Creek is located east of Highway 1, about 3.5 miles east of the proposed limestone quarry and plant site. Flint Creek is a first-order tributary of the Clark Fork River extending approximately 36 miles from Georgetown Lake to the Clark Fork River. As noted above, flow in Lorranson Creek is derived in part from Flint Creek through the Allendale Ditch. Otherwise, Flint Creek is not considered to be a significant hydrologic feature in terms of mine planning due to its distance from the limestone quarry and plant site.

Pre-existing information on local groundwater resources is limited due to a general lack of development in the immediate project area. Two old wells associated with former homesteads are located within the general project area including Homestead Well 1 and Homestead Well 2 (Figure 2.2-1). Homestead Well 1 is a 6-inch-diameter steel-cased well located near the proposed plant site. The well is 47 feet deep with the depth to water about 29 feet below ground surface (bgs) (see Section 2.2.2.2). Homestead Well 2 is a four-foot-diameter dug well located southeast of the proposed plant site. This well is 55 feet deep with a water level of about 52 feet bgs. Both of the homestead wells are believed to be completed in shallow perched groundwater systems within tertiary sediments, although well logs are not available for either well.

Two domestic water supply wells are located at the ranch house about one mile west of the proposed mine area (Figure 2.2-1). One of the wells is 65 feet deep and is completed in "blue-green shale". According to the well log, the static water level was 20 feet bgs and well yield was 20 gpm in May 2010 when the well was completed. According to the home owner, the second well is 200 feet deep although no log or water level data are available for that well. Water levels and yields in both wells have reportedly declined in recent years to the point where a new domestic well will be required to supply the ranch house in the future (Appendix A-2).

Based on the scant hydrologic information outlined above, it is apparent that water resources in the proposed mine area are limited despite its proximity to the Clark Fork River. The lack of flow in Tigh Creek indicates that local and regional groundwater levels occur below the elevation of Tigh Creek. The two closest surface water features, the CFR side channel and Lorranson Creek both flow only in response to irrigation return flows. Limited yields in the two ranch house wells at depths of up to 200 feet also suggest a general lack of water resources in the immediate mine area. Additional information collected through MLR's baseline hydrologic investigations is presented in the following sections.

## 2.2.2 Water Resource Monitoring Program

Hydrologic data collection has been ongoing at the MLR site since spring 2013. Hydrologic data have been obtained through MLR’s baseline water resources monitoring program as described in the project water resources monitoring plan (Hydrometrics 2014), as well as from MLR’s exploration drilling program. MLR’s baseline monitoring program scope and results are described below, with additional detail provided in Appendix A-2.

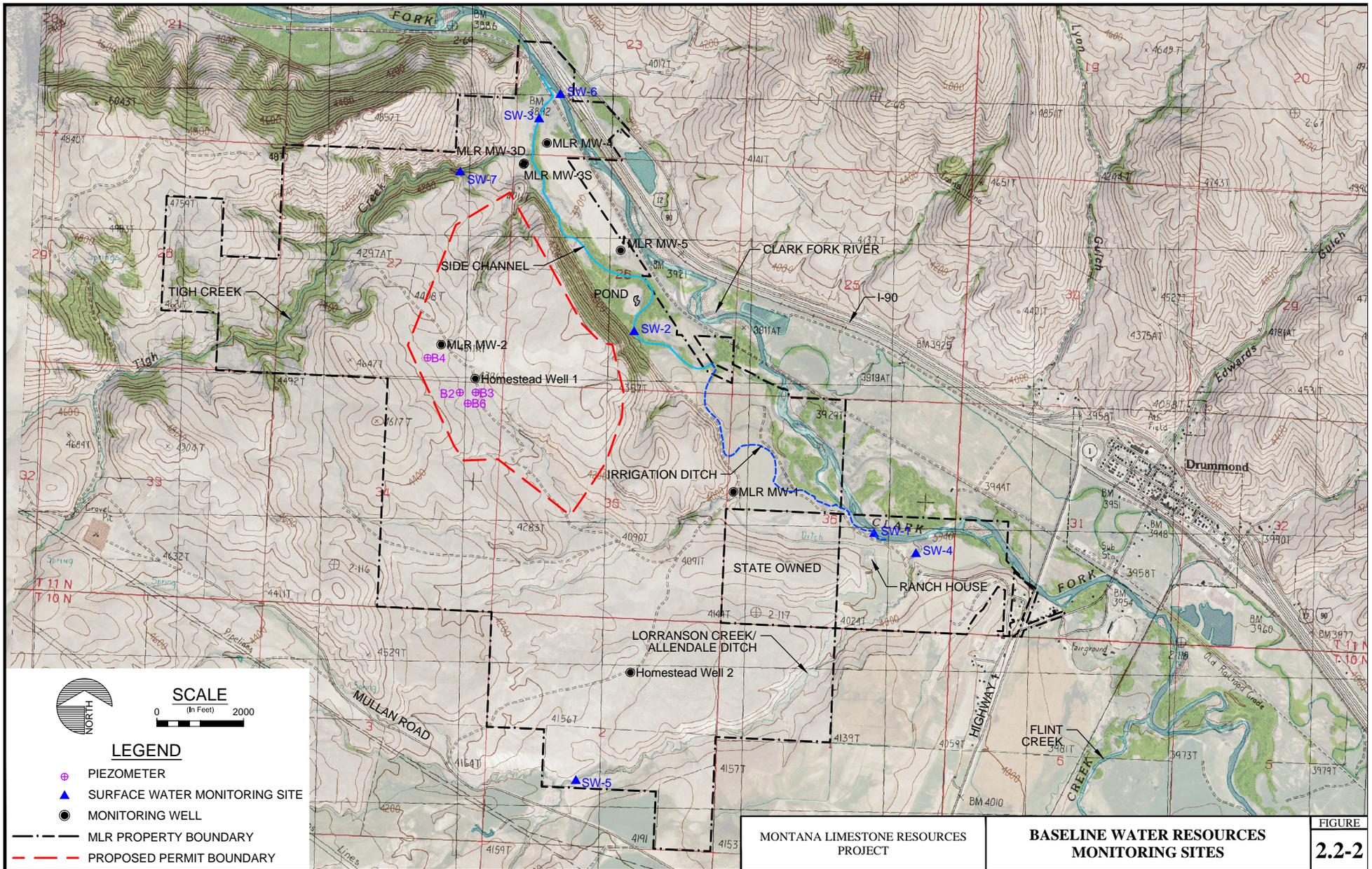
### 2.2.2.1 Surface Water Monitoring

Baseline surface water monitoring began in June 2013 in accordance with the draft project baseline water resources monitoring plan. The surface water program includes seasonal monitoring at eight stations. The eight sites include two sites on the Clark Fork River side channel immediately northeast of the proposed mine facilities, one site on the irrigation ditch feeding the side channel, one site on the Clark Fork River downstream of the project site, two sites on Lorranson Creek, one at the mouth of Tigh Creek, and one at a manmade pond on the Clark Fork River floodplain. Surface water monitoring locations are described in Table 2.2-1 and shown on Figure 2.2-2. The monitoring schedule is shown in Table 2.2-2.

**Table 2.2-1  
Baseline Water Resources Monitoring Sites – Montana Limestone Resources Project**

Site	Coordinates (approx.)		Description
	Lat	Lon	
SW-1	46.6641	-113.1713	Head of irrigation ditch feeding side channel. Represents Clark Fork River water quality.
SW-2	46.6763	-113.1947	Clark Fork River side channel intermediate to SW-1 and SW-3.
SW-3	46.6898	-113.2045	Clark Fork River side channel near downstream end.
SW-4	46.6625	-113.1686	Unnamed creek near downstream end.
SW-5	46.6474	-113.2083	Unnamed creek upstream section; below Mullan Road crossing.
SW-6	46.6914	-113.2034	Clark Fork River downstream of project.
SW-7	46.6863	-113.2110	Mouth of Tigh Creek
Pond	46.6785	-113.1951	Excavated pond on CFR Floodplain

Monitoring locations are shown on Figure 2.2-2.



**Table 2.2-2  
Baseline Water Resources Monitoring Schedule**

	June 2013	August 2013	June 2014	August 2014	Fall 2014 (pending)
<b>Surface Water</b>					
SW-1	X	X	X <sup>1</sup>	X	X <sup>1</sup>
SW-2	X	Dry	X <sup>1</sup>	X	X <sup>1</sup>
SW-3	X	Dry	X <sup>1</sup>	X	X <sup>1</sup>
SW-4	X	X	X <sup>1</sup>	X	X <sup>1</sup>
SW-5	X	X	X <sup>1</sup>	X	X <sup>1</sup>
SW-6	X	X	X	X	X
SW-7	Dry	Dry	Dry	Dry	X <sup>1</sup>
Pond Site	X	X	X	X	X
<b>Groundwater</b>					
MW-1	---	---	X	X	X
MW-2	---	---	X	X	X
MW-3	---	---	X	X	X
MW-4	---	---	X	X	X
MW-5	---	---	X	X	X

<sup>1</sup>Bed sediment sampling conducted in June and fall 2014 as part of surface water monitoring activities.

Note: Groundwater levels will be recorded on a monthly basis.

Monitoring site SW-1 is located on the main irrigation ditch supplying the majority of flow to the Clark Fork side channel. SW-1 is located at the headgate on the Clark Fork River, and as such, water at this site is representative of the Clark Fork River water. Information collected from SW-1 provides data on upgradient surface water conditions in both the side channel and the Clark Fork River. Monitoring sites SW-2 and SW-3 are located at the middle and downstream end of the Clark Fork River side channel, respectively (Figure 2.2-2). SW-3 is located downstream of all currently proposed mine facilities. Site SW-2 is located intermediate to the upstream and downstream monitoring sites to further define baseline conditions within the side channel. Monitoring stations SW-1, SW-2 and SW-3 allow establishment of baseline surface water conditions along the Clark Fork River drainage bottom adjacent to the proposed mine facilities, for both mine permitting purposes and for comparison to future mine operational phase hydrologic data.

Surface water sites SW-4 and SW-5 are located on Lorranson Creek/Allendale Ditch south/southeast of the project area. SW-4 is located near the downstream end of the drainage immediately downstream of the current access road. SW-5 is located upstream of the proposed mine facilities downstream of Mullan Road. The two sites span the area of the proposed access road creek crossing.

Site SW-6 is located on the Clark Fork River downstream of the proposed mine facilities. Although monitoring sites SW-1, SW-2 and SW-3 (along the Clark Fork River side channel) are intended to provide baseline surface water data upgradient and downgradient of the site, SW-6 is included to provide downgradient surface water data in the event that the side channel goes dry seasonally.

SW-7 is located at the mouth of the deeply incised drainage of Tigh Creek. Although Tigh Creek has always been dry, SW-7 is visited during each monitoring event and will be sampled if flow is observed.

The “Pond” site is located on the Clark Fork River floodplain northeast of the proposed mine facilities. Monitoring the pond provides data on the CFR alluvial groundwater system adjacent to the proposed facilities.

In addition to surface water sampling, bed sediment samples were collected in June 2014 at all surface water monitoring locations exhibiting flow, including Surface Water Monitoring Sites 1 through 6 (Figure 2.2-2). The streambed sediment sampling is intended to document baseline sediment metals concentrations in light of historic mining activities upstream of the MLR site. Sediment samples were collected concurrently with the June surface water monitoring event, and will be collected during the fall (October or November) 2014 surface water sampling event as well (Hydrometrics 2014).

Surface water monitoring results are summarized in Table 2.2-3, with complete results provided in Appendix A-2. As noted above, most surface water samples have been sampled twice in 2013 and 2014 (Table 2.2-2), except when dry. All eight surface water sites are scheduled to be sampled again in fall 2014 under the baseline monitoring program.

The baseline monitoring data show surface waters in the project area to be alkaline, with average field-measured pH values ranging from 7.79 at SW-2 (Clark Fork River side channel) to 8.29 at SW-1 (the irrigation ditch at upstream Clark Fork River). Average TDS (total dissolved solids) concentrations at sites SW-1, -2, -3 and -6, all on or connected to the river, range from 251 mg/L at site SW-6 (downstream Clark Fork River) to 329 mg/L at SW-2. TDS concentrations were higher at the two Allendale Ditch sites, with an average TDS of 854 mg/L at upstream site SW-5 and 801 mg/L at SW-4. The higher TDS at these sites is attributed to the effects of irrigation return flows south of the project area. Sulfate concentrations show similar trends, with average concentrations ranging from 47 to 79 mg/L at the Clark Fork River and side channel sites, and 345 to 358 mg/L at the two Allendale Ditch sites (Table 2.2-3).

Nutrient concentrations are variable across the site with individual total nitrogen concentrations ranging from <0.01 mg/L to 0.50 mg/L at all sites. No significant differences were noted in total nitrogen at the Allendale Ditch sites compared to the other monitoring sites. Average phosphate concentrations ranged from 0.039 to 0.057 mg/L at the river and side channel sites, and 0.077 to 0.098 mg/L at the two Allendale Ditch sites (SW-4 and SW-5). Again, the higher phosphate concentrations are attributed to the irrigation return water comprising most of the flow at these sites.

Trace metal concentrations generally were low in the 2013/2014 surface water samples, with many constituents near or below the analytical detection limits. Constituents consistently near or below the detection limits include aluminum, beryllium, chromium, cobalt, nickel, silver and thallium. Of all these parameters, arsenic was the most elevated relative to applicable surface water quality standards, with arsenic exceeding the 0.01 mg/L human health standard in most surface water samples (only the Pond site on the Clark Fork River floodplain was consistently below the 0.01 mg/L concentration). Copper, iron and mercury also exceeded applicable water quality standards but on a less consistent basis, with the most exceedences recorded at Clark Fork River site SW-6. The entire water quality database and exceedence summary is provided in Appendix A-2.

**Table 2.2-3  
Summary of Baseline Surface Water Quality Data – Montana Limestone Resources**

FIELD PARAMETERS	Units	MLR SW-1				MLR SW-2				MLR SW-3				MLR SW-4				MLR SW-5				MLR SW-6			
		Min	Max	Ave	N	Min	Max	Ave	N	Min	Max	Ave	N	Min	Max	Ave	N	Min	Max	Ave	N	Min	Max	Ave	N
Flow (cfs)	cfs	3.81	15.95	9.52	4	1.22	4.25	2.38	3	0.15	1.13	0.60	3	2.67	6.98	4.80	4	0.10	2.29	1.52	4				
Dissolved Oxygen	mg/L	7.7	11.92	9.31	4	5.09	9.11	7.27	3	5.73	8.63	7.26	3	7.69	11.00	9.31	4	8.42	10.55	9.67	4	6.6	10.9	8.8	4
pH	S.U.	8.03	8.66	8.29	4	7.56	8.02	7.79	3	7.83	8.20	8.01	3	7.97	8.31	8.12	4	8.08	8.27	8.19	4	7.90	8.26	8.06	4
Conductivity	µmhos/cm	332	582	461	4	474	502	492	3	421	495	460	3	1052	1106	1092	4	1109	1237	1147	4	298	448	384	4
Water Temperature	°C	16.5	19.2	17.7	4	16	19.4	17.2	3	15.6	18.2	17.2	3	14.7	16.1	15.3	4	15.0	17.8	16.0	4	14.9	15.6	15.3	4
<b>PHYSICAL PROPERTIES</b>																									
Total Suspended Solids	mg/L	14	41	24	4	<10	<10	NA	3	<10	41.00	NA	3	20	50	32	4	<10	17	NA	4	<10	58	NA	4
Total Dissolved Solids	mg/L	220	392	306	4	305	351	329	3	273	323	298	3	757	828	801	4	813	964	854	4	212	291	251	4
<b>INORGANICS</b>																									
Total Alk-as CaCO3	mg/L	120	200	162.5	4	170	170	170	3	150	170	163	3	240	260	250	4	240	270	258	4	120	180	153	4
Chloride	mg/L	3	14	7.5	4	6	8	7	3	5	8	7	3	20	31	24	4	9	42	34	4	3	11	6	4
Sulfate	mg/L	35	120	75	4	69	85	79	3	54	82	70	3	320	370	345	4	300	480	358	4	23	71	47	4
Fluoride	mg/L	0.3	0.5	0.4	4	0.4	0.4	0.4	3	0.4	0.4	0.4	3	0.5	0.6	0.5	4	0.5	0.5	0.5	4	0.3	0.5	0.4	4
<b>NUTRIENTS</b>																									
Nitrogen, Total	mg/L	<0.01	0.41	NA	4	<0.01	0.5	NA	3	<0.01	0.41	NA	3	<0.01	0.30	NA	4	<0.01	0.37	NA	4	0.30	0.50	0.40	4
Orthophosphate as P	mg/L	0.027	0.063	0.045	4	0.053	0.060	0.057	3	0.030	0.055	0.040	3	0.053	0.095	0.077	4	0.066	0.154	0.098	4	0.018	0.074	0.039	4
<b>TOTAL RECOVERABLE METALS</b>																									
Aluminum (dissolved)	mg/L	<0.009	<0.009	NA	4	<0.009	<0.009	NA	3	<0.009	0.011	NA	3	<0.009	0.011	NA	4	<0.009	0.017	NA	4	<0.009	0.03	NA	4
Antimony	mg/L	0.0005	0.0008	0.000625	4	<0.005	0.0006	NA	3	<0.0005	0.0006	NA	3	<0.0005	<0.0005	NA	4	<0.005	<0.005	NA	4	0.0006	0.0009	0.0008	4
Arsenic	mg/L	0.013	0.018	0.0155	4	0.011	0.015	0.012	3	0.013	0.015	0.014	3	0.017	0.019	0.018	4	0.003	0.013	0.010	4	0.012	0.019	0.015	4
Barium	mg/L	0.057	0.074	0.066	4	0.062	0.068	0.065	3	0.058	0.077	0.068	3	0.055	0.062	0.058	4	0.061	0.087	0.069	4	0.058	0.081	0.069	4
Beryllium	mg/L	<0.0008	<0.0008	NA	4	<0.0008	<0.0008	NA	3	<0.0008	<0.0008	NA	3	<0.0008	<0.0008	NA	4	<0.0008	<0.0008	NA	4	<0.0008	<0.0008	NA	4
Cadmium	mg/L	<0.00003	0.00019	NA	4	0.00003	0.00007	0.00005	3	0.00007	0.00011	0.00010	3	<0.00003	0.00004	NA	4	<0.00003	<0.00003	NA	4	0.00004	0.00026	0.00013	4
Calcium	mg/L	43	76	59.5	4	55	62	59	3	53	61.00	57	3	125	147	134	4	140	195	157	4	39	57	50	4
Chromium	mg/L	<0.005	<0.01	NA	4	<0.005	<0.01	NA	3	<0.005	<0.01	NA	3	<0.005	<0.01	NA	4	<0.005	<0.01	NA	4	<0.005	<0.01	NA	4
Cobalt	mg/L	<0.005	<0.01	NA	4	<0.005	<0.01	NA	3	<0.005	<0.01	NA	3	<0.005	<0.01	NA	4	<0.005	<0.01	NA	4	<0.005	<0.01	NA	4
Copper	mg/L	0.005	0.043	0.01975	4	0.007	0.009	0.008	3	0.009	0.018	0.013	3	<0.002	0.002	NA	4	<0.002	<0.002	NA	4	0.006	0.055	0.025	4
Iron	mg/L	0.13	0.98	0.4375	4	0.04	0.09	0.07	3	0.05	0.37	0.16	3	0.39	0.93	0.70	4	0.22	0.48	0.32	4	0.08	1.20	0.50	4
Lead	mg/L	0.0005	0.0074	0.002975	4	<0.0003	0.0005	NA	3	0.0003	0.0014	0.0007	3	<0.0003	0.0007	NA	4	<0.0003	0.0003	NA	4	0.0004	0.0095	0.0037	4
Magnesium	mg/L	10	20	14.75	4	12	15	14	3	12	16	14	3	35	40	37	4	27	36	33	4	9	15	12	4
Manganese	mg/L	0.023	0.128	0.0725	4	0.009	0.031	0.020	3	0.005	0.028	0.014	3	0.040	0.051	0.048	4	0.090	0.142	0.108	4	0.022	0.154	0.083	4
Mercury	mg/L	0.000006	0.00015	4.85E-05	4	<0.000005	<0.000005	NA	3	<0.000005	0.0000071	NA	3	<0.000005	<0.000005	NA	4	<0.000005	<0.000005	NA	4	0.000006	0.00026	0.000081	4
Molybdenum	mg/L	0.003	0.006	0.0045	4	0.003	0.004	0.004	3	0.004	0.005	0.0047	3	0.017	0.021	0.019	4	<0.002	0.007	0.007	4	0.002	0.004	0.003	4
Nickel	mg/L	<0.001	<0.002	NA	4	<0.001	<0.002	NA	3	<0.002	0.001	NA	3	<0.001	<0.002	NA	4	<0.001	0.001	NA	4	<0.001	<0.002	NA	4
Potassium	mg/L	3	6	4.5	4	4	5	5	3	4	5	5	3	17	18.00	17.8	4	4	15	12	4	2	4	3.3	4
Selenium	mg/L	<0.001	0.0005	NA	4	<0.001	0.0002	NA	3	<0.0002	<0.001	NA	3	0.0010	0.0020	0.0015	4	<0.0002	0.003	NA	4	<0.0002	<0.001	NA	4
Silver	mg/L	<0.02	0.0002	NA	4	<0.0002	<0.02	NA	3	<0.0002	<0.02	NA	3	<0.0002	<0.02	NA	4	<0.0002	<0.02	NA	4	<0.0002	0.0003	NA	4
Sodium	mg/L	10	24	16.75	4	14	17	16	3	14	18	16	3	49	54	51	4	45	54	49	4	9	17	12.8	4
Strontium	mg/L	0.26	0.624	0.4235	4	0.39	0.421	0.407	3	0.350	0.428	0.399	3	1.62	1.82	1.69	4	1.51	2.22	1.70	4	0.200	0.374	0.276	4
Thallium	mg/L	<0.0002	<0.0002	NA	4	<0.0002	<0.0002	NA	3	<0.0002	<0.0002	NA	3	<0.0002	<0.0002	NA	4	<0.0002	<0.0002	NA	4	<0.0002	<0.0002	NA	4
Uranium	mg/L	<0.008	0.0055	0.00445	4	<0.008	0.0047	NA	3	<0.008	0.00	NA	3	0.010	0.011	0.010	4	<0.008	0.011	NA	4	<0.008	0.0049	NA	4

### 2.2.2.2 Groundwater Monitoring

Six monitoring wells have been completed by MLR in the project area for groundwater characterization and baseline monitoring. Monitoring well locations are shown on Figure 2.2-2 and described in Table 2.2-4. The monitoring wells are distributed throughout the proposed mine area to provide information on groundwater hydraulic gradients and generalized flow directions. All monitoring wells were drilled in June or July 2014 using standard air rotary drilling techniques and completed with 4-inch ID schedule 40 PVC casing and 20-slot PVC screen. Well completion and lithologic logs are included in Appendix A-2.

**Table 2.2-4  
Monitoring Well Completion Details**

Well	Northing	Easting	MP Elevation	Screen Interval	Lithology
MW-1	46.66667474	-113.1852836	3960.7	95-125	Cretaceous
MW-2	46.67511534	-113.2127801	4328.3	480-600	Madison Limestone
MW-3D	46.68683221	-113.2059492	3908.1	58-98	Cretaceous
MW-3S	46.68676711	-113.2059843	3906.9	20.5-30.5	Alluvium/Colluvium
MW-4	46.68161756	-113.1966936	3910.1	8-18	Alluvium
MW-5	46.6881815	-113.2039311	3902.1	7.5-17.5	Alluvium

Monitoring well locations are shown on Figure 2.2-2.  
MP-Water level measuring point at top of PVC casing.

Groundwater levels have been monitored on an approximately biweekly schedule since the wells were completed in June/July 2014, with groundwater depths and elevations summarized in Table 2.2-5. With the exception of well MW-3D, groundwater levels have remained relatively constant through the July to August monitoring period. Average depths to groundwater during this period range from about ten feet at wells MW-4 and MW-5, located on the Clark Fork River floodplain, to almost 500 feet at well MW-2, located on top of the limestone ridge near the proposed mine facilities. Depths to water at wells MW-2 and MW-3S, both located near but slightly above the floodplain, each average about 25 feet.

**Table 2.2-5  
Monitoring Well Groundwater Level Data**

	Depth to Groundwater - feet below top of casing					
	MW-1	MW-2	MW-3D	MW-3S	MW-4	MW-5
Min	24.63	494.72	31.28	23.45	8.53	8.70
Max	27.79	496.14	80.81	25.70	11.41	11.38
Ave	25.95	495.53	44.92	25.12	10.15	10.41
	Groundwater Elevation - feet above mean sea level					
	MW-1	MW-2	MW-3D	MW-3S	MW-4	MW-5
Min	3932.91	3832.16	3827.29	3881.20	3898.69	3890.72
Max	3936.07	3833.58	3876.82	3883.45	3901.57	3893.40
Ave	3934.75	3832.77	3863.18	3881.78	3899.95	3891.69

Based on the measured groundwater depths, groundwater elevations range from about 3935 feet above mean sea level (AMSL) at well MW-1 to 3833 feet at MW-2. Average groundwater elevations in Clark Fork River alluvial wells MW-4 and MW-5 are about 3890 to 3900 feet AMSL (Table 2.2-5).

The groundwater elevation at well MW-2, completed in Madison Limestone at 480 to 600 feet below ground surface (bgs), is of interest for two reasons. First, the groundwater elevation at MW-2 is about 65 feet lower in elevation than the Clark Fork River alluvial groundwater (MW-4 and MW-5), and the Clark Fork River itself. The lower bedrock groundwater elevation within the proposed quarry area compared to the Clark Fork River/alluvial groundwater system suggests either a limited interconnection between the two systems, or that the creek loses flow to groundwater in this area. Either way, the relative groundwater levels indicate that groundwater in the mine area does not recharge the Clark Fork River in the vicinity of the MLR project. Second, the groundwater elevation at MW-2, 3833 feet, is 150 to 200 feet lower in elevation than the proposed depth of limestone quarrying, meaning all mining will occur well above the regional bedrock groundwater system. This is consistent with the lack of groundwater encountered during MLR's exploration drilling program, where extensive drilling throughout the limestone orebody encountered no groundwater down to the proposed ultimate pit depth (Appendix A-2, Section 3.2.3).

In addition to the five monitoring wells, and the exploration drill holes noted above and discussed in Appendix A-2, Section 3.2.3, MLR completed a number of geotechnical boreholes near the proposed plant site. The boreholes encountered Tertiary-age Renova Formation sediments overlying volcanic rocks (see Section 2.6), with all of the boreholes encountering saturated conditions near the base of the Renova formation. The saturated zone varied from about 10 feet to 20 feet in thickness, and is perched on top of a coal seam at the base of the Renova. The shallow perched groundwater system appears to be localized within the Renova formation and is most likely responsible for minor seepage observed in the drainage bottom immediately to the east (Appendix A-2). Four of the geotechnical boreholes (B-2, -3, -4, -6, Figure 2.2-2) were completed as piezometers, and are included in MLR's groundwater level monitoring program.

The five monitoring wells were sampled for water quality in June or July 2014 (when first completed), and again in late August. The June/July results are presented in Table 2.2-6, with the August results currently undergoing analyses. Similar to the surface water, groundwater in the project area is alkaline with pH values all above 7.0. Constituent concentrations are generally low with a number of parameters near or below analytical detection limits, and all constituent concentrations less than applicable groundwater quality standards. Additional information on the project area hydrologic conditions is provided in Appendix A-2.

**Table 2.2-6  
June/July 2014 Groundwater Monitoring Results – Montana Limestone Resources**

SITE CODE	MW-1	MW-2	MW-3S	MW-3D	MW-4	MW-5	MW-5 DUP	DI BLANK	RINSATE BLANK
SAMPLE CODE	MLR-1406-200	MLR-1406-208	MLR-1406-201	MLR-1406-207	MLR-1406-202	MLR-1406-203	MLR-1406-204	MLR-1406-205	MLR-1406-206
COLLECTION DATE	6/26/14	7/2/14	6/26/14	7/2/14	6/26/14	6/26/14	6/26/14	6/27/14	6/27/14
<b>FIELD PARAMTERS</b>									
Depth to Water Level (SWL)	24.16	495.5	23.72	37.1	8.21	8.55	--	--	--
Dissolved Oxygen	5.17	0.83	2.33	1.11	2.51	0.46	--	--	--
pH	7.26	7.32	7.02	7.94	7.4	7.1	--	--	--
Conductivity	511	896	506	589	425	515	--	--	--
Water Temperature	10.8	15.9	8.5	10.1	9.9	8.7	--	--	--
<b>PHYSICAL PROPERTIES</b>									
Solids, Total Suspended TSS @ 105 C	518	<10	<10	294	<10	<20	<10	<10	<10
Solids, Total Dissolved TDS @ 180 C	336	638	323	333	273	344	335	<20	<20
Alkalinity, Total as CaCO3	160	170	190	97	150	180	180	<4	<4
Chloride	3	7	6	2	7	6	6	<1	<1
Sulfate	82	300	53	150	43	70	69	<1	<1
Fluoride	1.4	1.4	0.4	1.9	0.4	0.5	0.5	<0.1	<0.1
<b>NUTRIENTS</b>									
Nitrogen, Total	0.8	0.7	0.3	0.2	0.4	0.2	0.2	<0.1	<0.1
Phosphorus, Total as P	0.31	0.05	0.04	1.08	0.03	0.04	0.04	<0.01	<0.01
<b>DISSOLVED METALS</b>									
Aluminum	1.46	<0.009	<0.009	0.029	<0.009	<0.009	<0.009	<0.009	<0.009
Antimony	<0.0005	0.0015	0.0008	<0.0005	0.0007	0.0007	0.0007	<0.0005	<0.0005
Arsenic	0.005	0.006	0.007	0.004	0.006	0.007	0.007	<0.001	<0.001
Barium	0.055	0.027	0.081	0.036	0.056	0.067	0.068	<0.003	<0.003
Beryllium	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008	<0.0008
Cadmium	<0.00003	<0.00003	<0.00003	0.00006	<0.00003	0.00004	0.00004	<0.00003	<0.00003
Calcium	62	115	69	69	54	65	64	<1	<1
Chromium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cobalt	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Copper	<0.002	<0.002	<0.002	<0.002	<0.002	0.002	0.002	<0.002	<0.002
Iron	0.54	0.05	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Lead	0.0003	0.0007	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003	<0.0003
Magnesium	14	36	13	13	11	13	13	<1	<1
Manganese	0.046	0.097	0.003	0.033	<0.001	0.002	0.002	<0.001	<0.001
Mercury	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005
Molybdenum	0.005	0.009	0.003	0.021	0.003	0.005	0.004	<0.001	<0.001
Nickel	0.002	0.006	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Potassium	15	4	4	4	3	4	4	<1	<1
Selenium	0.002	0.002	<0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Silver	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Sodium	24	29	14	8	13	18	18	<1	<1
Strontium	2	0.91	0.31	0.8	0.25	0.34	0.34	<0.01	<0.01
Thallium	<0.0002	0.0004	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Uranium	0.0022	0.0022	0.0047	0.0019	0.0054	0.0044	0.0044	<0.0002	<0.0002
Zinc	<0.008	0.031	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008

Client: Montana Limestone Resources  
 Project: Montana Limestone Resources  
 County: Granite State: Montana  
 Property Owner: Washington Limestone Resources  
 Legal Description: 11N, 13W, 36 BCC  
 Location Description: East of proposed mine  
 Recorded By: Larry Johnson  
 Drilling Company: O'Keefe  
 Driller: Mike Downey  
 Drilling Method: Dual Rotary  
 Drilling Fluids Used: Air/Water  
 Purpose of Hole: Groundwater Monitoring  
 Target Aquifer: First Water  
 Hole Diameter (in): 8"  
 Total Depth Drilled (ft): 125

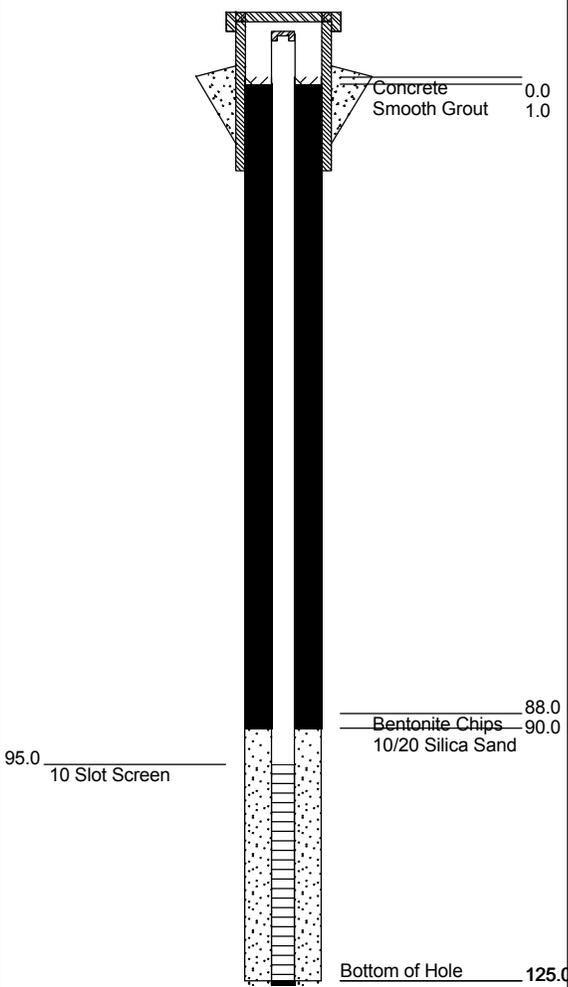
WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	4" Schedule 40 PVC	+2 - 125'
Surface Casing Used?	Y	8" Steel	+2.5' - 3.5'
Screen/Perforations?	Y	0.010-inch slot, Sch 40, PVC	95' - 125'
Sand Pack?	Y	10/20 Silica Sand	90' - 125'
Annular Seal?	Y	Bentonite Chips/Smooth Grout	88' - 90'/1' - 88'
Surface Seal?	Y	Concrete	0' - 1'

DEVELOPMENT/SAMPLING			
Well Developed?	Y	NA	
Water Samples Taken?	Y	NA	
Boring Samples Taken?	Y	Chips	

Northing: 46.66667474 Easting: -113.1852836  
 Static Water Level Below MP: 24.6' Surface Casing Height (ft): 2.5'  
 Date: 6/30/14 Riser Height (ft): 2.0'  
 MP Description: Top of Casing Ground Surface Elevation (ft): 3958.7  
 MP Height Above or Below Ground (ft): 2' MP Elevation (ft): 3960.7

Remarks: Twenty three bags sand, eight bags smooth grout, one bucket Pel Plug.

## WELL CONSTRUCTION



## GRAPHICS

## GEOLOGICAL DESCRIPTION

**0.0 - 20.0'**  
 Colluvium, red brown, dry, silt +/- clay, rounded pebbles to 1 inch of various lithologies including chert, quartzite, and calcareous sandstone.  
 11 feet, increased clay and turns slightly damp.  
 11 - 20 feet, in and out of clayey damp zones and zones with less clay and less moisture.  
 14 feet some calcareous sandstone pebbles; 15 feet dust turns to more gray in color, mostly silt and clay with sparse rounded pebbles, 20 feet red clay and silt with occasional pebbles.

**20.0 - 25.0'**  
 Mudstone, 90 percent red silt and clay with 10 percent red and maroon mudstone chips <1/4 inch in size, mudstone bedrock?

**25.0 - 40.0'**  
 As above, continues to be dry, red clay and silt, with sparse red to maroon mudstone chips. 40 feet, quit drilling for the day, hole sat over night, checked for water with Solinst in the morning and hole was dry to 40 feet.

**40.0 - 55.0'**  
 Mudstone, dry, red to maroon dusty, silt and clay with <10 percent mudstone chips < 1/4 inch, no apparent carbonate.  
 55 feet, start drilling open hole (no casing), some larger (1/2 inch) platy chips, shale?

**55.0 - 93.0'**  
 Mudstone, continue in dry, red to maroon silt and clay, drill returns 10 percent mudstone chips and 90 percent disaggregated silt and clay, dust intermittently turns from red to gray for a foot or two and then back to red but chips remain red to maroon.  
 60 feet, shut off air for 15 minutes then test for water with air lift - no water.  
 75 feet, shut off air for 15 minutes then test for water with air lift - no water.  
 93 feet, cuttings turn damp, shut off air for 15 minutes then test for water with air lift - no water.

**93.0 - 115.0'**  
 Mudstone, continue in damp red to maroon silt and clay with sparse (<10 percent) mudstone chips.

**115.0 - 125.0'**  
 Advanced hole to 125 feet, virtually no drill return but getting traces of wet, red clay. Tripped out of hole to complete well at 125 feet, casing bridged off with wet clay, reenter hole to clear plug and condition hole for well completion, possibly some water coming into hole (had to add water to condition hole).

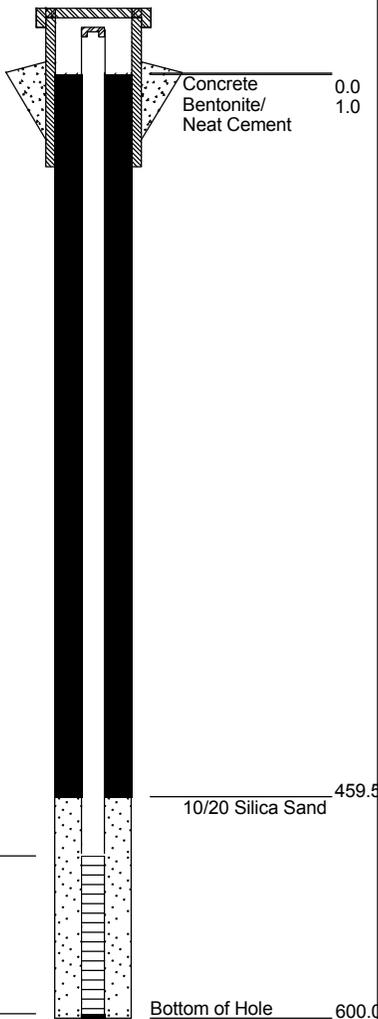
Client: Montana Limestone Resources  
 Project: Montana Limestone Resources  
 County: Granite State: Montana  
 Property Owner: Washington Limestone Resources  
 Legal Description: SE1/4, Sec 27, T11N, R13W  
 Location Description: Near proposed plant site  
 Recorded By: Larry Johnson  
 Drilling Company: O'Keefe  
 Driller: Shane Kraha  
 Drilling Method: Dual Rotary  
 Drilling Fluids Used: Water/Foam  
 Purpose of Hole: Monitoring Well  
 Target Aquifer: Madison Formation  
 Hole Diameter (in): 8"  
 Total Depth Drilled (ft): 600

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	4" Flush Thread Schedule 40 PVC	+1.6' - 600'
Surface Casing Used?	Y	8" Steel	+1.6' - 50'
Screen/Perforations?	Y	20 slot Factory cut	497' - 597'
Sand Pack?	Y	10/20 Silica Sand	459.5' - 598'
Annular Seal?	Y	Bentonite Pellets/Neat Cement	1' - 459.5'
Surface Seal?	Y	Concrete Collar	0' - 1'

DEVELOPMENT/SAMPLING	
Well Developed?	Y Bailed
Water Samples Taken?	Y NA
Boring Samples Taken?	Y Chip Samples
Northing: 46.67511534 Easting: -113.2127801	
Static Water Level Below MP: 494'	Surface Casing Height (ft): 1.6'
Date: 6/18/14	Riser Height (ft): 1.6'
MP Description: Top of Casing	Ground Surface Elevation (ft): 4326.7
MP Height Above or Below Ground (ft): 1.6'	MP Elevation (ft): 4328.3

Remarks: Drilled with air to 160 feet, good returns; set steel casing to 180 feet; drilled with water and generally good returns 180 feet to 275 feet then lost circulation; added foam. Limited returns below top of limestone (276 feet); no indication of well yield due to lost circulation. Used 50 to 80 bags bentonite pellets to backfill annulus in the area of void at 320 feet.

### WELL CONSTRUCTION



### GRAPHICS

### GEOLOGICAL DESCRIPTION

0.0 - 4.0'	Silty clay, dark brown, moist below 1 foot.
4.0 - 19.0'	Clay, silty, plastic, occasional fine gravel stringers, mottled, brown to light brown, slightly moist.
19.0 - 42.0'	Clay, silty, plastic and sticky, tan/yellow brown, few thin gravel stringers below 31 feet (rounded to subrounded clasts).
42.0 - 74.0'	Clay/mudstone, soft, light to medium grey, minor silt and very fine sand, visible mica flecks.
74.0 - 95.0'	Mudstone, soft, light grey, occasional limestone gravel fragments 74 - 85 feet.
95.0 - 115.0'	Mudstone/claystone, soft, medium grey to greenish grey, some dark mica flecks, silty and minor very fine sand.
115.0 - 183.0'	Mudstone/claystone, light to medium grey.
183.0 - 197.0'	Mudstone, reddish brown, top 3 - 4 feet soft then harder siliceous layer 189 - 192 feet.
197.0 - 232.0'	Sandstone, fine grained, silty, chert chips, reddish brown.
232.0 - 240.0'	Sandstone, occasional chert chips, reddish brown and tan.
240.0 - 276.0'	Sandstone, siliceous, chert chips, mostly reddish brown to 240 feet then mostly tan below.
276.0 - 350.0'	Lost returns 267 feet to 283 feet. Below 283 feet limestone dark grey, hard, void 317 to 320 feet.
350.0 - 360.0'	Limestone, cuttings slight tan, medium grey limestone chips.
360.0 - 380.0'	Limestone, light grey, poor returns.
380.0 - 410.0'	Limestone, medium to dark grey, intermittent returns.
410.0 - 415.0'	No returns.
415.0 - 600.0'	Limestone, mostly medium to dark grey but several intervals of tan cuttings; occasional white calcite chips, intermittent returns, generally larger chips in returns below 500 feet.

Client: Montana Limestone Resources  
 Project: Montana Limestone Resources  
 County: Granite State: Montana  
 Property Owner: Washington Limestone Resources  
 Legal Description: T11N, R23W, 23 CCC  
 Location Description: North of proposed mine site  
 Recorded By: Larry Johnson  
 Drilling Company: O'Keefe  
 Driller: Mike Downey  
 Drilling Method: Dual Rotary  
 Drilling Fluids Used: Air/Water  
 Purpose of Hole: Groundwater Monitoring  
 Target Aquifer: First Bedrock Groundwater  
 Hole Diameter (in): 8"  
 Total Depth Drilled (ft): 100

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	4" Schedule 40 PVC	+2' - 98'
Surface Casing Used?	Y	8" Steel	+2.5' - 3.5'
Screen/Perforations?	Y	0.010-inch slot, Sch 40, PVC	58' - 98'
Sand Pack?	Y	10/20 Silica Sand	53' - 98'
Annular Seal?	Y	Kwik Plug Chips 3/8"	1' - 53'
Surface Seal?	Y	Concrete	0' - 1'

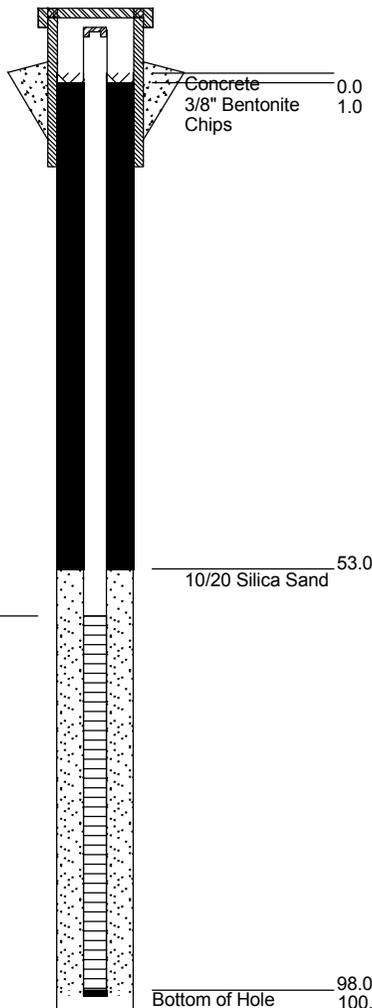
**DEVELOPMENT/SAMPLING**

Well Developed?	Y	NA
Water Samples Taken?	Y	NA
Boring Samples Taken?	Y	Chips

Northing: 46.68683221 Easting: -113.2059492  
 Static Water Level Below MP: 85.6' Surface Casing Height (ft): 2.5'  
 Date: 5/20/14 Riser Height (ft): 2.0'  
 MP Description: Top of 4" Casing Ground Surface Elevation (ft): 3906.1  
 MP Height Above or Below Ground (ft): 2.0' MP Elevation (ft): 3908.1

Remarks: Well was dry at time of completion (5/15/14) but had approximately 13 feet of water in it on 5/20/14. Twenty three bags sand, 18 bags 3/8 inch bentonite chips.

**WELL CONSTRUCTION**



**GRAPHICS**

**GEOLOGICAL DESCRIPTION**

0.0 - 7.0'	Dry, sand and rounded pebbles to 1 inch.
7.0 - 9.0'	Damp sand and silt.
9.0 - 12.0'	Dry, sand and gravel, mixed lithologies, limestone, chert, quartzite.
12.0 - 17.0'	Damp, sand and gravel, pebbles increase to 1.5 inches to 2 inches.
17.0 - 20.0'	No returns.
20.0 - 31.0'	Coarse gravel and sand.
31.0 - 31.5'	Smaller pebbles.
31.5 - 32.0'	Harder drilling, no returns.
32.0 - 32.5'	Brown, damp, clay and silt with 10 percent pebbles.
32.5 - 95.0'	Dark gray to green-gray mudstone.
55 feet	turn off air for 15 minutes, then air lift - no water.
65 feet	turn off air for 15 minutes, then air lift - no water.
85 feet	turn off air for 15 minutes, then air lift - no water.
95 feet	hole sat over night at 95 feet, sound for water with Solinst - no water.
	Casing was plugged when first trying to install well, reentered hole and reamed out hole to 100 feet, still dry. Hole had 2 feet of cave in at bottom at completion.

Client: Montana Limestone Resources  
 Project: Montana Limestone Resources  
 County: Granite State: Montana  
 Property Owner: Washington Limestone Resources  
 Legal Description: T11N, R23W, 23 CCC  
 Location Description: North of proposed mine site  
 Recorded By: Larry Johnson  
 Drilling Company: O'Keefe  
 Driller: Mike Downey  
 Drilling Method: Dual Rotary  
 Drilling Fluids Used: Air/Water  
 Purpose of Hole: Groundwater Monitoring  
 Target Aquifer: First Water  
 Hole Diameter (in): 8"  
 Total Depth Drilled (ft): 30.5

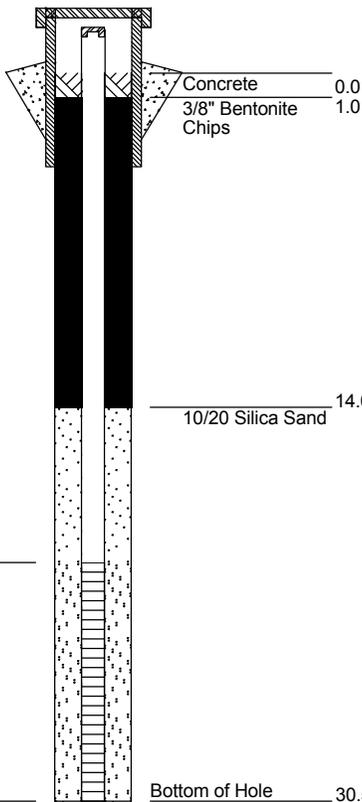
WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	4" Schedule 40 PVC	+2' - 30.5'
Surface Casing Used?	Y	8" Steel	+2.5' - 3.5'
Screen/Perforations?	Y	0.010-inch slot, Sch 40, PVC	20.5' - 30.5'
Sand Pack?	Y	10/20 Silica Sand	14' - 30.5'
Annular Seal?	Y	Kwik Plug Chips, 3/8"	1' - 14'
Surface Seal?	Y	Concrete	0' - 1'

DEVELOPMENT/SAMPLING		
Well Developed?	Y	NA
Water Samples Taken?	Y	NA
Boring Samples Taken?	Y	Chips

Northing: 46.68676711 Easting: -113.2059843  
 Static Water Level Below MP: 25.5' Surface Casing Height (ft): 2.3'  
 Date: 5/20/14 Riser Height (ft): 2.0'  
 MP Description: Top of 4" Casing Ground Surface Elevation (ft): 3904.9  
 MP Height Above or Below Ground (ft): 2.0' MP Elevation (ft): 3906.9

Remarks: Well was dry at time of completion (5/19/14) but had approximately 5 feet of water in it on 5/20/14. Note that nearby channel had started to run water day after well was completed. Fourteen bags sand, five bags 3/8 inch bentonite chips.

## WELL CONSTRUCTION



## GRAPHICS

## GEOLOGICAL DESCRIPTION

0.0 - 13.0'	Dry, sand and rounded cobbles to 1.5 inches.
13.0 - 14.0'	Damp to moist silt with clay.
14.0 - 26.0'	Dry, sand and cobbles. 15 feet, hole sat over weekend at 15 feet, air lift testing at beginning of Monday shift, no water.
26.0 - 30.0'	Green/gray mudstone.
30.0 - 30.5'	Dark gray mudstone (same mudstone as intercepted at 32.5 feet in MW-3D). TD at 30.5 feet. Hole was dry at completion of well.

Client: Montana Limestone Resources  
 Project: Montana Limestone Resources  
 County: Granite State: Montana  
 Property Owner: Washington Limestone Resources  
 Legal Description: T11N, R23W, 23 CCC  
 Location Description: Clark Fork River Floodplain  
 Recorded By: Larry Johnson  
 Drilling Company: O'Keefe  
 Driller: Mike Downey  
 Drilling Method: Dual Rotary  
 Drilling Fluids Used: Air  
 Purpose of Hole: Groundwater Monitoring  
 Target Aquifer: Alluvial Aquifer  
 Hole Diameter (in): 8"  
 Total Depth Drilled (ft): 18

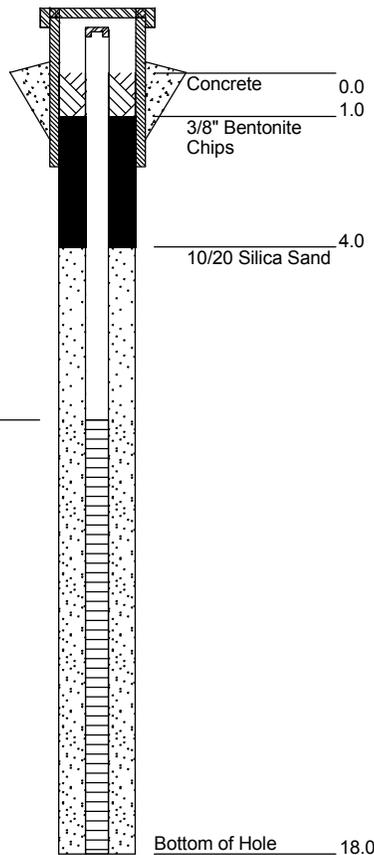
WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	4" Schedule 40 PVC	+2' - 18'
Surface Casing Used?	Y	8" Steel	+2.3' - 3.5'
Screen/Perforations?	Y	0.010-inch slot, Sch 40, PVC	8' - 18'
Sand Pack?	Y	10/20 Silica Sand	4' - 18'
Annular Seal?	Y	Kwik Plug Chips, 3/8"	1' - 4'
Surface Seal?	Y	Concrete	0' - 1'

DEVELOPMENT/SAMPLING		
Well Developed?	Y	NA
Water Samples Taken?	Y	NA
Boring Samples Taken?	Y	Cuttings

Northing: 46.6881815 Easting: -113.2039311  
 Static Water Level Below MP: 7.0' Surface Casing Height (ft): 2.3'  
 Date: 5/20/14 Riser Height (ft): 2.0'  
 MP Description: Ground Surface Ground Surface Elevation (ft): 3900  
 MP Height Above or Below Ground (ft): 2.0' MP Elevation (ft): 3902.1

Remarks: Hole was drilled to 18 feet and sat over night. Water level was at 7 feet when quit for the day, Water was at 7 feet the next morning. Tried setting screen at 17 feet but gravel was washing into hole. Fourteen bags sand, five bags 3/8" chips.

**WELL CONSTRUCTION**



GRAPHICS

**GEOLOGICAL DESCRIPTION**

0.0 - 1.5'  
 Damp, dark brown silt with sand.

1.5 - 2.0'  
 Dry sand and pebbles.  
 2.0 - 10.0'  
 Dry coarse sand, sparse pebbles.  
 8 feet, cuttings turn wet.

10.0 - 18.0'  
 Coarse gravel, cobbles to 2 inches.

Client: Montana Limestone Resources  
 Project: Montana Limestone Resources  
 County: Granite State: Montana  
 Property Owner: Washington Limestone Resources  
 Legal Description: T11N, R23W, 26 BD  
 Location Description: Clark Fork River Floodplain  
 Recorded By: Larry Johnson  
 Drilling Company: O'Keefe  
 Driller: Mike Downey  
 Drilling Method: Dual Rotary  
 Drilling Fluids Used: Air  
 Purpose of Hole: Groundwater Monitoring  
 Target Aquifer: Alluvial Aquifer  
 Hole Diameter (in): 8"  
 Total Depth Drilled (ft): 17.5

WELL COMPLETION	Y/N	DESCRIPTION	INTERVAL
Well Installed?	Y	4" Schedule 40 PVC	+2' - 17.5'
Surface Casing Used?	Y	8" Steel	+2.5' - 3.5'
Screen/Perforations?	Y	0.010-inch slot, Sch 40, PVC	7.5' - 17.5'
Sand Pack?	Y	10/20 Silica Sand	4' - 17.5'
Annular Seal?	Y	Kwik Plug Chips, 3/8"	1' - 4'
Surface Seal?	Y	Concrete	0' - 1'

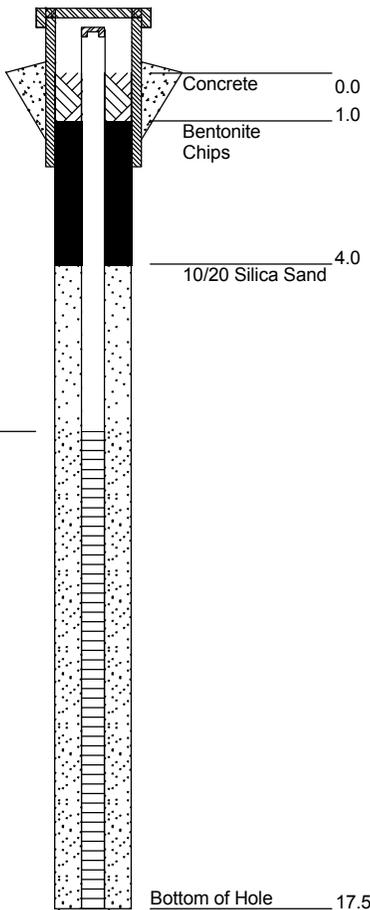
DEVELOPMENT/SAMPLING	
Well Developed?	Y NA
Water Samples Taken?	Y NA
Boring Samples Taken?	Y Cuttings

Northing: 46.68161756	Easting: -113.1966936
Static Water Level Below MP: 9.0'	Surface Casing Height (ft): 2.5'
Date: 5/21/14	Riser Height (ft): 2.0'
MP Description: Top of Casing	Ground Surface Elevation (ft): 3908
MP Height Above or Below Ground (ft): 2.0'	MP Elevation (ft): 3910.1

Remarks:

## WELL CONSTRUCTION



GRAPHICS

## GEOLOGICAL DESCRIPTION

0.0 - 3.0'  
Damp, dark brown sandy silt.

3.0 - 8.0'  
Coarse sand with minor pebbles.

8.0 - 17.5'  
Coarse gravel, cobbles to 1.5 inches.  
8.5 feet, cuttings turn wet.  
15 feet, turn off air, let sit for 10 minutes, air lift evacuates casing but not a lot of volume (air pushing water back into gravel?).  
Advance hole to 17 feet, air lift until no flow, let sit for 15 minutes, water level comes back up to 7.5 feet below ground surface.