

### GORDON SERVICES – KEENE PIT ACID MINE DRAINAGE DETECTION INITIAL RESPONSE ACTION PLAN



57 Route 9, Keene, New Hampshire City of Keene Tax Map 215 Block 7 Town of Sullivan Tax Map 583 Lot 46 & 46-1

**Prepared For:** 

Gordon Services 250 North Street Jaffrey, New Hampshire 03452

### **Prepared By:**

FRONTIER GEOSERVICES 127 OLD WARNER ROAD BRADFORD, NEW HAMPSHIRE 03221

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April 6, 2025 Frontier Project No. 2024012





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#### 1.0 INTRODUCTION

Frontier Geoservices, LLC. (Frontier) has completed an acid mine drainage potential investigation at the property located at 57 Route 9, in the City of Keene, Cheshire County, New Hampshire The parcels comprising the Site are identified by the City of Keene's Assessor's office on Tax Map 215 as Block 7 (102.7-acres) and the Town of Sullivan, New Hampshire, Assessor's office on Tax Map 5 Lot 46 (172-acres) and 46-1 (25.82-acres.) The Site is currently owned by G2 Holdings, LLC. of 250 North Street, Jaffrey, New Hampshire. Please refer to **Figure 1** for a **Site Location Map**.

Currently, the Site operates as a gravel and earth removal operation for Gordon Services. The current operations are permitted to only encompass one area, Period 1, of the Site. Gordon Services wishes to expand their current operations to include additional excavation in Period 8 and new excavations in Periods 1 - 7. Please refer to **Figure 2** for a **Site Plan**.

Applicants proposing Earth Excavation are required to provide the information requested in The City of Keene's Article 25 Earth Excavation Regulation. This report provides the information requested in the City of Keene's Article 25.3.6 Toxic or Acid Forming Materials. Investigation activities included the sampling of materials from eight (8) bedrock monitoring wells; BRW-1 through BRW-8. Results from the investigation are included in the *2024 Acid Mine Drainage Potential Report*, drafted by Frontier.

Results from the investigation and analysis identified the potential for acid mine drainage at the Site and as such a surface and groundwater monitoring program is proposed to detect any potential acid mine drainage from the mining area. Additionally, pre-detection mitigation efforts are also proposed.

This document provides initial response actions which will be implemented if there are detections of acid mine drainage in surface and/or groundwater. It should be noted that this document is not intended to provide a complete list of remedial options which may implemented beyond the initial response actions.

### 2.0 ACID MINE DRAINAGE DEFINITION

Acid mine drainage is defined by highly acidic, low pH water (<6 SU) that is rich in dissolved heavy metals including arsenic, copper, iron, manganese, nickel and lead. The combination of these characteristics will be used to identify acid mine drainage as prescribed in the proposed water quality monitoring program described below. Individual exceedances of standards will not solely be used to identify the presence of acid mine drainage, but rather consistent relationships between field parameters and analytical results which are indicative of acid mine drainage, i.e. low pH water with high concentrations of dissolved heavy metals.

### 3.0 PROPOSED GROUNDWATER MONITORING PROGRAM

Due to the potential for water at the Site to be affected by acid mine drainage it is proposed that wells SRL-10, SRL-12, BRW-7 and BRW-8 be monitored on a bi-annual basis in the months of April and October. Additionally, samples will be collected from surface water infiltration features constructed throughout the project. All surface water being conveyed from the proposed excavation is to be directed into a surface water infiltration basin. The construction and placement of surface water infiltration features will be iterative based on project progression. Currently there is one surface water infiltration feature located in the western area of Period 8. Infiltration basins are to be lined with 1-foot of 2-inch minus, crushed, limestone gravel as a precautionary measure to neutralize any potential

acid mine drainage. As new infiltration features are constructed at the Site they will be added to the sampling program.

Field parameters including pH, specific conductance, oxidation reduction potential, dissolved oxygen and turbidity and laboratory analysis of dissolved and total metals including arsenic, copper, iron, manganese, nickel and lead will be performed at each sampling location. Baseline, pre-excavation monitoring will consist of the collection of two (2) rounds of samples collected a minimum of 14 calendar days apart. Results will be reviewed in comparison to the New Hampshire Department of Environmental Services (NHDES) Ambient Groundwater Quality Standards (AGQS). All results will be forwarded to the City of Keene Community Development Department within 45 days of sample collection.

Please refer to Figure 2 for a Proposed Water Quality Monitoring Location Map.

### 4.0 APPICABLE REGULATORY STANDARDS

The water quality monitoring program consists of both surface water monitoring and groundwater monitoring. Applicable standards for surface water monitoring were established from the New Hampshire Department of Environmental Services (NHDES) Env-Wq 1700 Surface Water Quality Regulations.

Analyte	Standard
Specific Conductance	No Standard
<b>Oxidation Reduction Potential</b>	No Standard
Dissolved Oxygen	75%/ 5mg/L
Turbidity	10 NTU (beyond naturally occurring conditions)
pH	6.0 SU
Arsenic	150 μg/L, (a,b)
Copper	2.3 μg/L (b,c)
Iron	1,000 μg/L
Manganese	No Standard
Nickel	13.3 µg/L (a,c)
Lead	0.41 μg/L (a,c)

- (a) The letter "a" shall indicate that criteria for these metals are expressed as a function of the water effect ratio (WER), and that because the values displayed in Env Wq 1700, Table 1703-1 correspond to a WER of 1.0, metals Adopted Rules 2-25-25 18 18 criteria for different WERs shall be determined using the procedures described in the EPA publication "Interim Guidance on Determination and Use of Water-Effect Ratios for Metals", EPA-823-B-94-001, dated February 1994.
- (b) The letter "b" shall indicate that the values presented for aquatic life protection are dissolved metals and for hardness-dependent metals are based on a hardness of 20 mg/L. To convert dissolved to total recoverable metal, the equations and tables in Env-Wq 1703.23 shall be used. To calculate dissolved or total recoverable freshwater criteria for hardness-dependent metals for hardness values other than 20 mg/l, the equations and tables shown in Env-Wq 1703.23 and Env-Wq 1703.24 shall be used.

(c) The letter "c" shall indicate that the freshwater aquatic criteria for these metals are expressed as a function of the total hardness, as mg/L CaCO3 of the surface water, and that because the values displayed in Table 1703-1 correspond to a total hardness of 20 mg/L the aquatic life criteria for other hardness values expressed as calcium carbonate shall be calculated using the equations and tables in Env-Wq 1703.23 and Env-Wq 1703.24.

Applicable standards for groundwater monitoring were established from the NHDES Env-Or 600 Contaminated Site Management, Table 600-1 Ambient Groundwater Quality Standards. It should be noted that the applicable standard for heavy metals will be applied to the dissolved heavy metal concentration in groundwater as dissolved concentrations are a better indicator of bioavailability.

Some heavy metals may naturally occur at concentrations that exceed the applicable standard, as such, baseline sampling will be used to determine the "background" concentrations of metals which exceed the applicable standard but are interpreted to be naturally occurring. In these instances, the determination of the contribution of acid mine drainage to the concentration of heavy metals will be established by the observance of an increasing trend in the concentration of the subject heavy metal.

Analyte	Standard
Specific Conductance	No Standard
Oxidation Reduction Potential	No Standard
Dissolved Oxygen	75%/ 5 mg/L
Turbidity	10 NTU (beyond naturally occurring conditions)
pН	6.0 SU
Arsenic	5 μg/L,
Copper	1,300 μg/L
Iron	300 μg/L
Manganese	300 μg/L
Nickel	100 μg/L
Lead	15 µg/L

#### 5.0 PROPOSED INITIAL RESPONSE ACTION – ACID MINE DRAINAGE DETECTION

As previously mentioned, acid mine drainage is defined by highly acidic, low pH water (<6 SU) that is rich in dissolved heavy metals including arsenic, copper, iron, manganese, nickel and lead. The combination of these characteristics will be used to identify acid mine drainage as prescribed in the proposed water quality monitoring program described below. Individual exceedances of standards will not solely be used to identify the presence of acid mine drainage, but rather consistent relationships between field parameters and analytical results which are indicative of acid mine drainage, i.e. low pH water with high concentrations of dissolved heavy metals.

If a surface and/or groundwater sampling location presents results that are indicative of the formation of acid mine drainage NHDES And the City of Keene will be notified immediately. Furthermore, the following immediate initial response actions will be implemented.

1. All active quarrying/mining operations occurring in the affected area will cease and exposed bedrock surfaces shall be expeditiously restored to have a minimum thickness of 3-feet of cover material. The cover material shall consist of a minimum of 30% clay content. Cover

material shall be compacted in 1-foot lifts. The intent of the clay content and compaction is to limit air and surface water contact with the source of the acid mine drainage.

- 2. Any affected drainages which may be contributing/conveying acid mine drainage shall be armored with 1-foot of 2-inch minus, crushed, limestone gravel.
- 3. The frequency of surface water and groundwater monitoring for acid mine drainage will be increased to a quarterly basis.
- 4. All surface water within <sup>1</sup>/<sub>2</sub>-mile downgradient of the detected acid mine drainage shall be sampled within 2-weeks of the initial detection and be included in the surface water monitoring program.
- 5. Sampling of all domestic water supply wells within <sup>1</sup>/<sub>2</sub>-mile of the affected area for acid mine drainage parameters will occur within 2-weeks of the initial detection and continue to be sampled on a quarterly basis.
  - a. If acid mine drainage is detected in a domestic water supply well the homeowner shall be offered to have a "point-of-use" water treatment system installed and maintained while a new, unimpacted, domestic water supply is made available at no cost to the homeowner.
- 6. A groundwater quality assessment in the areas adjected to the detected acid mine drainage will be initiated.
  - a. The Groundwater Quality Assessment shall include the installation of a minimum of three (3) monitoring wells; one upgradient of the affected surface water, and two down-gradient of the affected surface water. Additional monitoring wells may be required to determine the horizontal and vertical distribution of the groundwater impacts.
  - b. Groundwater samples will be collected within 2 weeks of installation and analyzed for acid mine drainage parameters listed above. A second, confirmatory round of sampling will occur 2-weeks after the initial sampling round. Monitoring wells will be sampled on a quarterly basis if acid mine drainage impacts are detected. If results indicate acid mine drainage may have traveled further downgradient additional monitoring wells may be required.

The proposed initial response actions are not intended to present a complete list of remedial options and mitigation. Additional remedial methods may include the impoundment and chemical neutralization of any surface water being derived from the source area, construction of remedial wetlands, and pumping and treatment of impacted groundwater. These remedial methods, and/or others, may be implemented if the conditions of the initial acid mine drainage dictates.

## **FIGURES**

Figure 1 Site Location Map



Figure 2

## Site Plan/ Water Quality Monitoring Location Map



С	NITORING
	FREQUENCY
	BI-ANNUALLY
	BI-ANNUALLY UNTIL START OF PERIOD 8
	BI-ANNUALLY AFTER START OF PERIOD 1
	BI-ANNUALLY AFTER START OF PERIOD 21
	BI-ANNUALLY AFTER START OF PERIOD 5
	BI-ANNUALLY AFTER START OF PERIOD 8
Г	

WATER LEVEL MONITORING						
MONITORING LOCATION	FREQUENCY					
SLR-10	MONTHLY					
SLR-11	MONTHLY					
SLR-12	MONTHLY					
MW-2	MONTHLY					
MW-4	MONTHLY					
BR-7	MONTHLY					
BR-8	MONTHLY					
SWS-6	MONTHLY					
SWS-7	MONTHLY					
SWS-8	MONTHLY					
SWS-9	MONTHLY					
SWS-10	MONTHLY					
SWS-11	MONTHLY					

					GRANITE		civil engineering	land planning	municipal services
	ВΥ	Ð	٩٢						
REVISIONS	COMMENTS	PROJECT SUBMITTAL	REVISED PER CITY COMMENTS						
	DATE	12/20/24	2/3/25						
	No.	-	2						

# GRANITE **ENGINEERING**

civil engineering 

land planning municipal services

> Dow Street, Tower 2, Suite 421 Manchester, New Hampshire 03101 603.518.8030

> > www.GraniteEng.com

**OCATION** KEENE TAX MAP 215 LOTS 7 & 8

SULLIVAN TAX MAP 5 LOTS 46 & 46-1 **57 ROUTE 9 KEENE & SULLIVAN, NEW HAMPSHIRE** CHESHIRE COUNTY

## **GORDON SERVICES** KEENE

**MONITORING PLAN** 

PROJECT No.	DATE:		SCALE:
23–0201–1	EBRURARY	′ 3, 2025	HORIZ.
SHEET:	I OF	1	1"=125'

. LAND OWNERS WITHIN  $\frac{1}{2}$  MILE OF THE EXCAVATION SITE WILL BE OFFERED GROUNDWATER QUALITY MONITORING. 2. NOTIFICATIONS WILL BE MADE TO LANDOWNERS WITH THE OPTION TO ALLOW OR DECLINE MONITORING.

SAMPLES WILL BE ANALYZED FOR VOLATILE ORGANIC COMPOUNDS AND NITRATE. 5. RESULTS WILL BE SENT TO THE LAND OWNER, THE CITY OF KEENE, & TOWN OF SULLIVAN.

7. BI-ANNUAL BASIS OF WELLS TWO (2) YEARS FOLLOWING THE CEASE OF OPERATIONS AT THE SITE AND RECLAMATION. SAMPLES WILL BE ANALYZED FOR VOLATILE ORGANIC COMPOUNDS AND NITRATE.

. IF ADVERSE IMPACTS ARE NOTED, THE APPLICANT WILL IMMEDIATELY BE NOTIFIED TO CEASE BEDROCK EXCAVATION. 9. IF MONITORING INDICATES THE EXCAVATION ACTIVITIES CAUSED THE IDENTIFIED CONTAMINATION, A LICENSED NH WELL

CONTRACTOR WILL BE IMMEDIATELY RETAINED FOR INSTALLATION OF A NEW WATER SUPPLY WELL IN AN AREA THAT HAS

ALL ACTIVITIES RELATED TO BLASTING SHALL FOLLOW BEST MANAGEMENT PRACTICES (BMPS) TO PREVENT CONTAMINATION OF GROUNDWATER INCLUDING PREPARING, REVIEWING AND FOLLOWING AN APPROVED BLASTING PLAN; PROPER DRILLING, EXPLOSIVE HANDING AND LOADING PROCEDURES; OBSERVING THE ENTIRE BLASTING PROCEDURES; EVALUATING BLASTING PERFORMANCE; AND

(1) LOADING PRACTICES. THE FOLLOWING BLASTHOLE LOADING PRACTICES TO MINIMIZE ENVIRONMENTAL EFFECTS SHALL BE

(a) DRILLING LOGS SHALL BE MAINTAINED BY THE DRILLER AND COMMUNICATED DIRECTLY TO THE BLASTER. THE LOGS SHALL INDICATE DEPTHS AND LENGTHS OF VOIDS, CAVITIES, AND FAULT ZONES OR OTHER WEAK ZONES ENCOUNTERED AS WELL AS GROUNDWATER CONDITIONS. IF A FRACTURE OR WATER BEARING ZONE IS ENCOUNTERED IN A BOREHOLE,

(b) EXPLOSIVE PRODUCTS SHALL BE MANAGED ON SITE SO THAT THEY ARE EITHER USED IN THE BOREHOLE, RETURNED TO THE DELIVERY VEHICLE, OR PLACED IN SECURE CONTAINERS FOR OFF SITE DISPOSAL.

(c) SPILLAGE AROUND THE BOREHOLE SHALL EITHER BE PLACED IN THE BOREHOLE OR CLEANED UP AND RETURNED TO AN APPROPRIATE VEHICLE FOR HANDLING OR PLACEMENT IN SECURED CONTAINERS FOR OFF-SITE DISPOSAL. (d) LOADED EXPLOSIVES SHALL BE DETONATED AS SOON AS POSSIBLE AND SHALL NOT BE LEFT IN THE BLASTHOLES OVERNIGHT, UNLESS WEATHER OR OTHER SAFETY CONCERNS REASONABLY DICTATE THAT DETONATION SHOULD BE

(e) LOADING EQUIPMENT SHALL BE CLEANED IN AN AREA WHERE WASTEWATER CAN BE PROPERLY CONTAINED AND HANDLED IN A MANNER THAT PREVENTS RELEASE OF CONTAMINANTS TO THE ENVIRONMENT. (f) EXPLOSIVES SHALL BE LOADED TO MAINTAIN GOOD CONTINUITY IN THE COLUMN LOAD TO PROMOTE COMPLETE DETONATION. INDUSTRY ACCEPTED LOADING PRACTICES FOR PRIMING, STEMMING, DECKING AND COLUMN RISE NEED TO

(2) EXPLOSIVE SELECTION. THE FOLLOWING BMPS SHALL BE FOLLOWED TO REDUCE THE POTENTIAL FOR GROUNDWATER

(a) EXPLOSIVE PRODUCTS SHALL BE SELECTED THAT ARE APPROPRIATE FOR SITE CONDITIONS AND SAFE BLAST EXECUTION. (b) EXPLOSIVE PRODUCTS SHALL BE SELECTED THAT HAVE THE APPROPRIATE WATER RESISTANCE FOR THE SITE CONDITIONS PRESENT TO MINIMIZE THE POTENTIAL FOR HAZARDOUS EFFECT OF THE PRODUCT UPON GROUNDWATER. (3) PREVENTION OF MISFIRES. APPROPRIATE PRACTICES SHALL BE DEVELOPED AND IMPLEMENTED TO PREVENT MISFIRES. (4) MUCK PILE MANAGEMENT. MUCK PILES (THE BLASTED PIECES OF ROCK) AND ROCK PILES SHALL BE MANAGED IN A MANNER TO REDUCE THE POTENTIAL FOR CONTAMINATION BY IMPLEMENTING THE FOLLOWING MEASURES:

(b) MANAGE THE INTERACTION OF BLASTED ROCK PILES AND STORMWATER TO PREVENT CONTAMINATION OF WATER SUPPLY (5) SPILL PREVENTION MEASURES AND SPILL MITIGATION. SPILL PREVENTION AND SPILL MITIGATION MEASURES SHALL BE

IMPLEMENTED TO PREVENT THE RELEASE OF FUEL AND OTHER RELATED SUBSTANCES TO THE ENVIRONMENT. THE MEASURES

STORAGE OF REGULATED SUBSTANCES ON AN IMPERVIOUS SURFACE.

WHEREVER POSSIBLE, KEEP REGULATED CONTAINERS THAT ARE STORED OUTSIDE MORE THAN 50 FEET FROM SURFACE WATER AND STORM DRAINS, 75 FEET FROM PRIVATE WELLS, AND

SECONDARY CONTAINMENT IS REQUIRED FOR CONTAINERS CONTAINING REGULATED SUBSTANCES STORED OUTSIDE,

EXCEPT WHEN IN USE, KEEP CONTAINERS CONTAINING REGULATED SUBSTANCES CLOSED AND SEALED.

HAVE SPILL CONTROL AND CONTAINMENT EQUIPMENT READILY AVAILABLE IN ALL WORK AREAS.

USE FUNNELS AND DRIP PANS WHEN TRANSFERRING REGULATED SUBSTANCES.

(a) THE TRAINING OF ON-SITE EMPLOYEES AND THE ON SITE POSTING OF RELEASE RESPONSE INFORMATION DESCRIBING WHAT TO DO IN THE EVENT OF A SPILL OF REGULATED SUBSTANCES.

(b) FUELING AND MAINTENANCE OF EXCAVATION, EARTHMOVING AND OTHER CONSTRUCTION RELATED EQUIPMENT WILL COMPLY WITH THE REGULATIONS OF NHDES [NOTE THESE REQUIREMENTS ARE SUMMARIZED IN WD-DWGB-22-6: "BEST MANAGEMENT PRACTICES FOR FUELING AND MAINTENANCE OF EXCAVATION AND EARTHMOVING EQUIPMENT" OR ITS

SUBSURFACE DATA									
PROPOSED	LEDGE	DEPTH TO	WELL	GROUNDWATER					
GRADE		GROUNDWATER	BOTTOM	ELEV.					
880.0	873.0	NONE FOUND	873.0	NONE FOUND					
855.0	NONE TO 829.0	42.9	828.0	841.1					
855.0	NONE TO 795.5	NONE TO 45.2	817.8	826.3					
885.0	877.5	1.5	850.5	883.5**					

SUBSURFACE DATA FROM TEST PIT, BORING, AND WELL INSTALLATION LOGS CONTAINED IN THE LIMITED GEOHYDROLOGIC INVESTIGATION BY SLR