Wellsite Operations Prognosis

Toe Stimulation Treatments

Well 16A(78)-32

April 12, 2022

Contents

I. Background

Energy & Geoscience Institute at the University of Utah (EGI) operates the Frontier Observatory for Research in Geothermal Energy (Utah FORGE, https://utahforge.com/) project on behalf of the Office of Energy Efficiency & Renewable Energy of the U.S. Department of Energy (DOE). Utah FORGE is a dedicated underground geothermal field laboratory (see Appendix A for location and directions). The goal of this project is to circulate fluids through stimulated fractures connecting a pair of highly deviated wells drilled in hot, fractured, ultra-low permeability granite. The first of these wells (16A(78)-32) has been drilled and will be stimulated as described below. Figure 1 shows a casing diagram (as built).

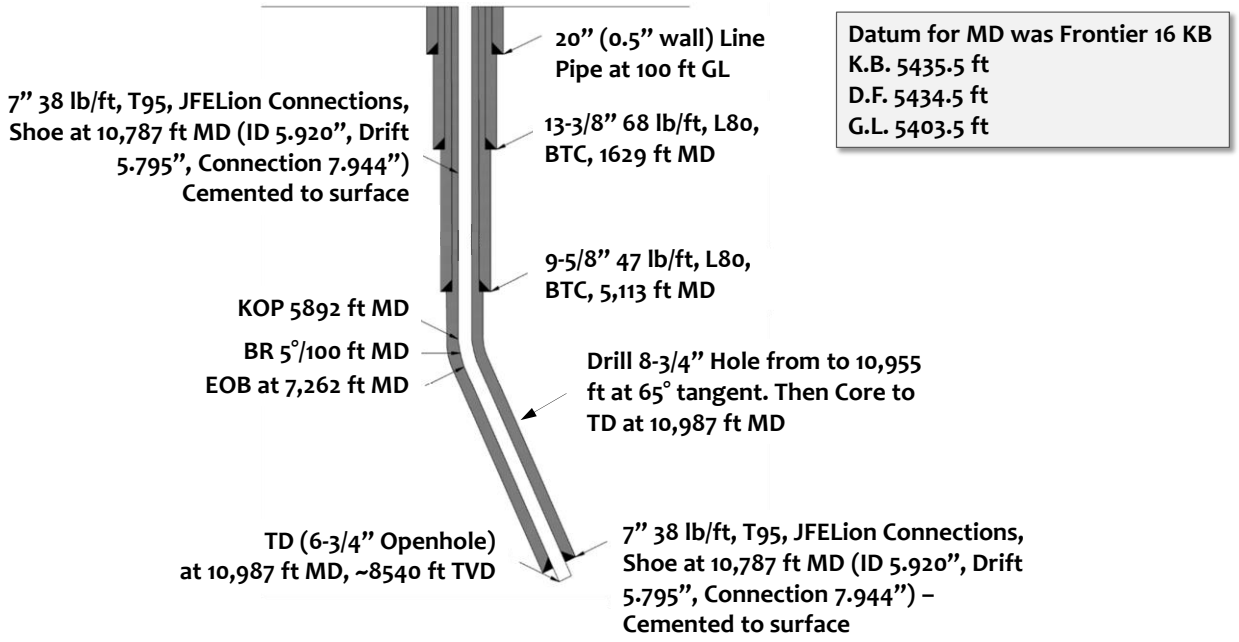


Figure 1. Well 16A(78)-32 as built.

II. Stimulation Treatment Objective

The overall treatment objective is to evaluate the hydraulic fracture geometry created by a low-viscosity (slickwater) and high-viscosity (crosslinked polymer) fluid system. The initial two stages will be performed with the slickwater fluid. The high viscosity fluid system is planned for the third stage. Liberty will provide rheology versus temperature data and expected friction pressure versus rate for all fluid systems recommended. The University of Utah has provided water samples for testing. Water supply for the treatments will be Milford City culinary water.

III COVID-19 Guidelines

Excerpted only. Refer to Appendix B for the full policy

All personnel must be tested within and provide a Negative PCR COVID-19 result no more than 72 hours prior to arriving on site. The test result must be sent to Garth Larsen (Garth@hotrockms.com, cell 435-749-4015). Each individual must provide a photo ID upon entering the site. The following procedures are to be followed by individuals working at the site.

- Upon arrival at the site, and each following day, all personnel will have their temperature taken and fill out a health questionnaire. Anyone with a temperature greater than 100.4°F or reports other health issues will be required to take a COVID-19 test that will be administered at the Check-in Station. If the individual tests positive, they must stay more than 6 ft away from other individuals if outside, or isolated in their company vehicle away from other individuals. The individual's supervisor will discuss the situation with the Site Manager to determine the course of action to be taken. The individual's supervisor will be responsible for arranging transportation off site and providing a replacement within 48 hours.
- All individuals will be required to take a COVID-19 test (antigen home type test by providing a nasal swab that can be read in 15 minutes) at the Check-in Station every three (3) days. The first test will be given three (3) days from the date of the negative test result prior to arrival on the site.
- All individuals are expected wear masks and keep 6 feet apart when in proximity of other people, such as during meetings, training events and other restricted spaces unless use of a mask creates a safety hazard.

IV. Pre-Stimulation Testing and Preparation

1) On March 30th (15 days before the frac) notify the State Engineer that frac'ing will start in two weeks (Jim Goddard; 801-505-8677, jimgoddard@utah.gov).
2) **On April 7th**, begin MI and spot Dalbo Holdings Inc. (DHI) 500-bbl insulated frac tanks on the 16A pad. The timing for spotting all fourteen (14) tanks will depend on how many tanks have previously been staged on the 58-32 pad (for pad locations, see Appendix A).
3) **On April 8th**, MIRU the Rain for Rent (R4R) water management equipment (manifolds, hoses, transfer pumps, etc.). This work can be done concurrently with the spotting of the frac tanks. After all the frac tanks have been spotted, begin filling the frac tanks with Milford culinary water (Rollins Construction & Trucking). The plan is to have a single water hauler connection to offload so filling frac tanks should not interfere with other operations on the 16A pad. Based on the number of trucks committed to hauling water, Rollins can advise on the

expected timing to have all tanks filled. Also begin MIRU of Frontier Drilling Rig 28. It should take approximately three (3) full days to complete the rig-up. Pason needs to arrive before the derrick is raised in order to install instrumentation for measurement of rig operation parameters. Pason will also install additional sensors to monitor rig functions, flowback parameters, etc.

4) **On April 10th**, 48 hr before BOPE ready for testing, notify State Engineer of BOPE testing (Jim Goddard; 801-505-8677, jimgoddard@utah.gov).
5) **On April 11th**, Begin MIRU equipment for microseismic monitoring (Schlumberger, GES, Silixa, Wagstaff). Install geophones as appropriate in three offset wells (58-32, 56-32, 78B-32). These wells will allow triangulation on microseismicity from treatments at the toe of well 16A(78)-32. Confirm Pason EDR recording and communication functionality.
6) **On April 12th,** Liberty Oilfield Services (Liberty) move in and spot frac equipment on location. Frontier continue with rig-up and confirm when completed. Perform BOP testing.
7) **On April 13th**, Liberty continues with rig-up of frac equipment. Frontier to PU & MU 3-1/2" drill pipe and RIH (strap pipe) with bit, scraper, and 5.70" drift sub. Connect the scraper and drift sub ~200 ft above the bit so that they don't exit the 7" casing shoe. RIH and tag the end of the wellbore in the open hole. The 5.70" drift sub run in this trip is to confirm adequate 7" casing ID for subsequent bridge plug run. POOH with 3-1/2" drill pipe, strap each stand and stand drill pipe in the derrick. Compare strap of stands with joints of drill pipe as a confirmation of accuracy. The wellhead stack is shown in Figure 2.
8) **On April 14th**, MIRU MTS Solutions low-rate pump to the Liberty ground manifold so that they will be able to pump through the 2" line to the rig floor. MU Extreme Wireline TCP guns BHA on bottom of the 3-1/2" drill pipe mechanical CCL ~60 ft above the TCP BHA. RIH until the mechanical CCL is near the 7" casing shoe. Pick up drill pipe and locate casing collars with the mechanical CCL. Compare collar locations with the depth of the collars in the 7" casing tally. Lower the drill pipe back down and detect the same casing collars. Correlate at a known depth and pick up drill pipe until the TCP guns are ~50 ft below the 7" casing shoe. **Confirm that all microseismic monitoring sites are recording data before dropping the ball.** Extreme Wireline personnel to drop ball into the drill pipe. RU MTS Solutions to the 3-1/2" drill pipe (3-1/2" IF drill pipe pin X 2" Female WECO 1502 changeover, valves, tee, chicksans, etc. as required) and, with downhole valve closed and prime-up valve open, prime-up MTS Solutions pump with flow diverting through the rig flow line to the mud tanks. Close prime-up valve. Open valve to the drill pipe. MTS Solutions pump at low rate to seat ball and pressure-up the drill pipe to ~**3,000 psi** to fire the TCP guns as a check shot to orient geophone arrays. Extreme Wireline personnel will advise that TCP guns have

fired. POOH with the 3-1/2” drill pipe. Remove TCP equipment from the drill pipe.

9) The casing tally for Well 16A(78)-32 is included in Appendix C.

Hold a meeting with all lead contact persons for each of the services provided, review operational plans, assignments and expected timing. Cover all safety aspects and determine if there are issues to be addressed prior to the start of pumping operations.

Housing needs are being addressed. Most vendor personnel will be staying off-site at hotels located in Milford or Beaver, UT.

Well 16A(78)-32 has been successfully logged to 8,728 ft MD KB (see Figure 1 for KB elevation) where the bottomhole temperature was found to be 430°F. (Refer to Appendix D for a wellbore temperature profile).

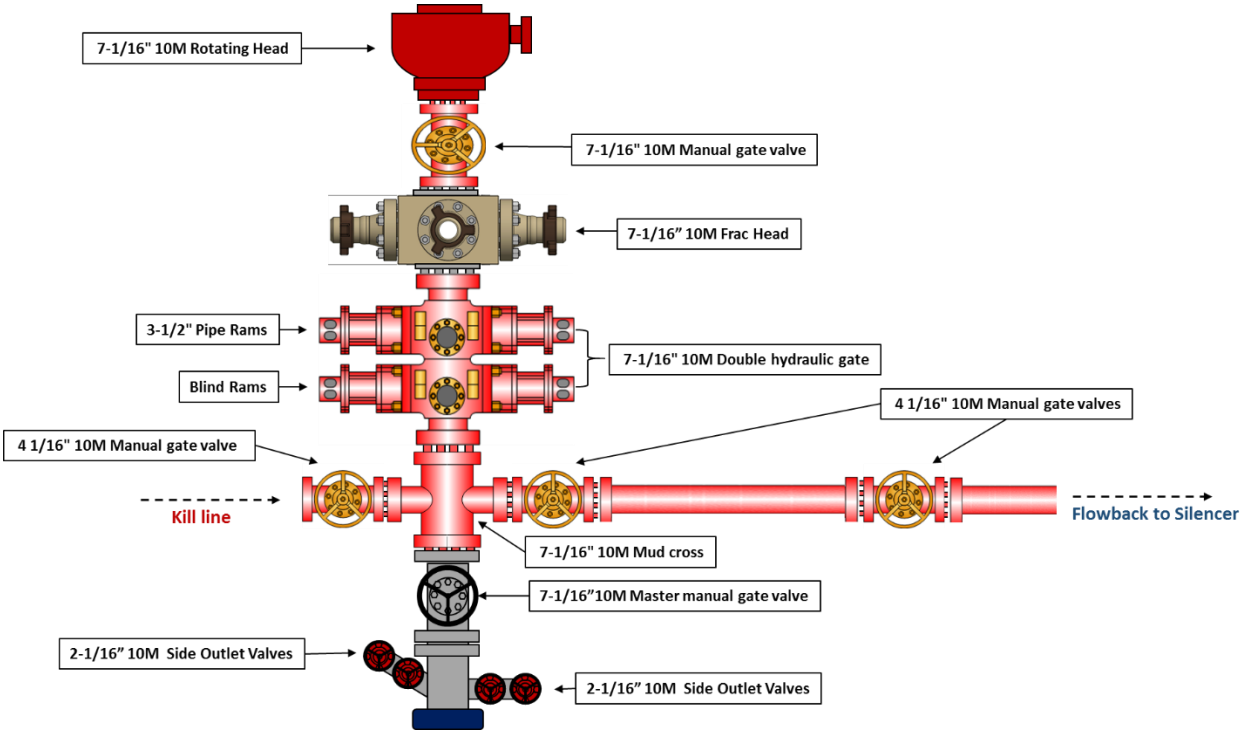


Figure 2. Frac Tree

IV. Fracture Stimulation of Well 16A(78)-32

Measurement of all critical treatment parameters (rates, pressure, density, additives.) should have redundancy (backup) in case there is any failure of the primary measurement. Pressure measurement will be required for the 7” casing at the wellhead, 3-1/2” drill pipe X 7” casing annulus (when pumping down the drill pipe),

and frac pumps. Rig-up of frac treating iron should provide for isolation of the frac pumps from the wellhead so that wellhead pressure and annulus pressure can be measured without possibility of pressure bleeding back through the pumping equipment. Connections points for main instrumentation are shown in Figure 3a and 3b.

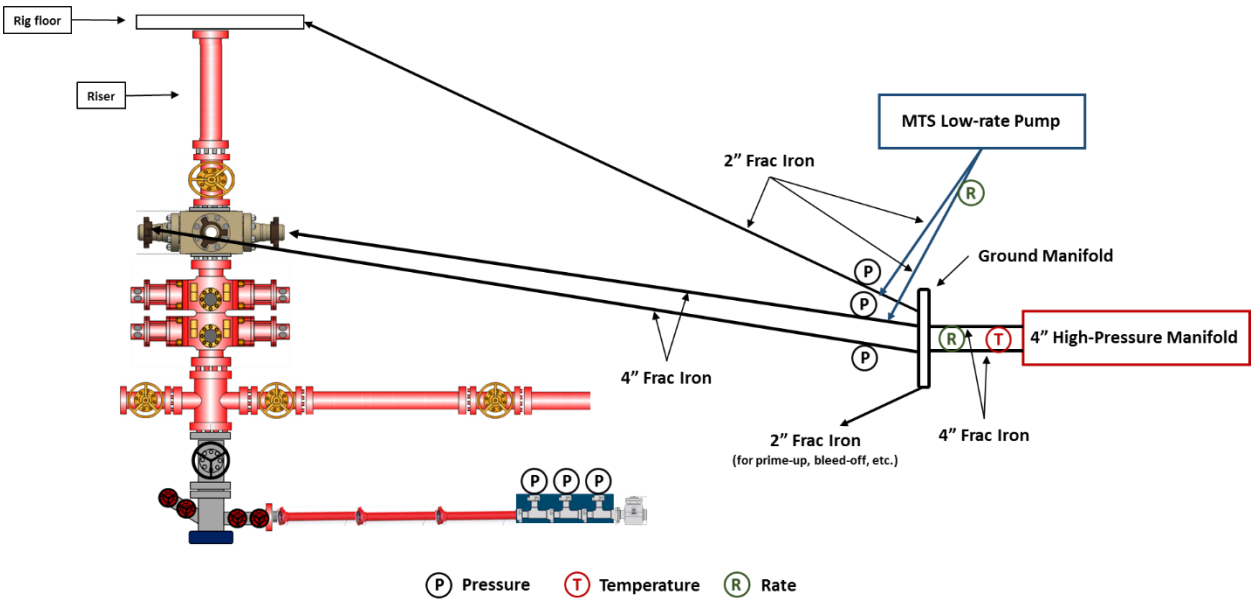


Figure 3a. Instrumentation locations during pumping.

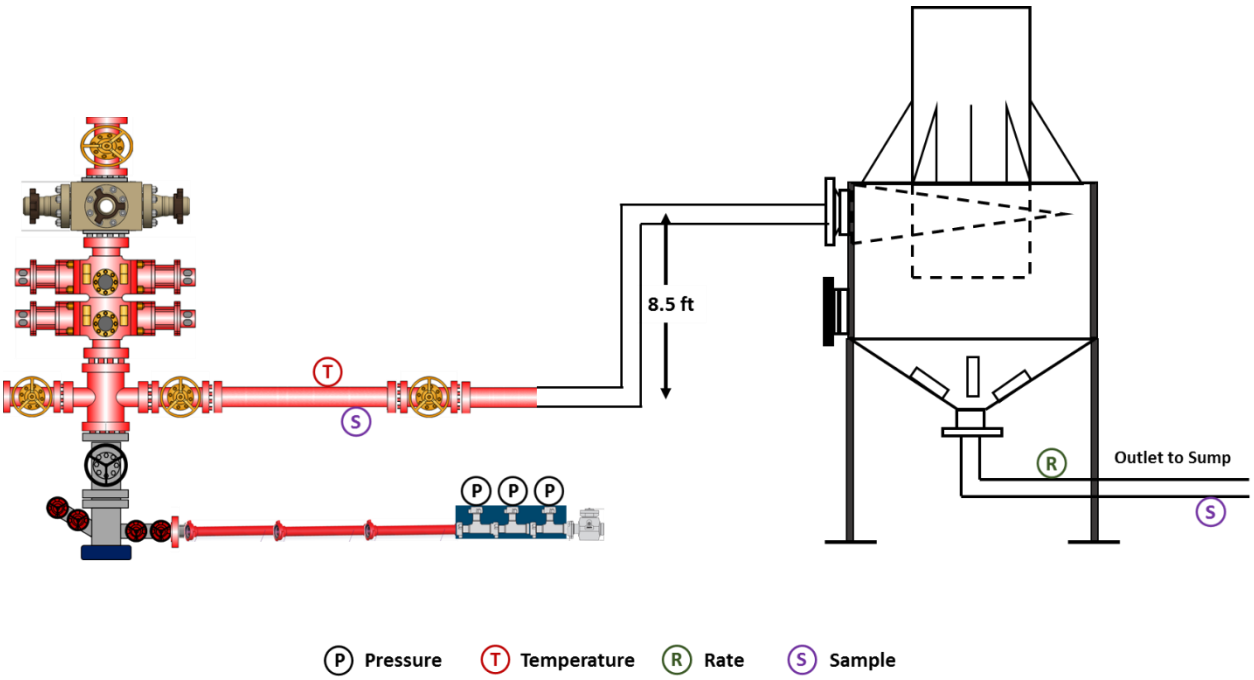


Figure 3b. Instrumentation locations during flowback

IV.1 Tracers

Tag each stage with a different chemical tracer according to the following procedure.

IV.1.1 Zone 1

a) Tracer injection

An appropriate mass of high-temperature, organic tracer (HT Tracer #1) - (mixed in an aqueous solution) will be metered at the designed rate into the fracturing fluid. [**Note:** The addition of tracer will be terminated prior to the end of pumping so that no tracer material remains in the fluid in the wellbore after shutdown. 7", 38 lb/ft T-95 volume is 0.03404 bbl/ft so 367.2 bbls to the 7" casing show @ 10,787 ft MD[1]]. Tracers will be run (and flowback monitored) by Peter Rose or Mike Mella with the University of Utah. They will meter in on the low-pressure side of the Liberty frac equipment rig-up and recover samples from the flowback line.

b) Flowback sampling

During the flowback from the Zone 1 stimulation treatment, approximately 10 water samples will be taken via a sampling port/line into 125-mL opaque Nalgene bottles using a cooling coil that will inhibit flashing of the hot, produced fluid.

c) Tracer analysis

The flowback samples will be analyzed using Solid Phase Extraction (SPE) in combination with Ultra Performance Liquid Chromatography (UPLC). The SPE treatment will allow for the removal of contaminants that might otherwise interfere with tracer analysis.

IV.1.2 Zone 2

The tracer injection, sampling and analysis procedures for Zone 2 will be the same as for Zone 1, with the exception that for Zone 2 the tracer utilized will be HT Tracer #2.

IV.1.3 Zone 3

The tracer injection, sampling and analysis procedures for Zone 3 will be the same as for Zone 1 with the exception that the tracer utilized will be HT Tracer #3.

IV.1.4 Operations

Tracer services will be provided by the University of Utah. Collection of the 10, 125-mL samples will be performed by University of Utah personnel with assistance as requested. Liberty is working with the University to coordinate tracer runs, including the method of adding the tracer to the fracturing fluid on-the-fly, rig-up options, and monitoring

[1] All measured depths are relative to the KB of Frontier Rig 16 (refer to Figure 1)

after flowback. Monitoring for presence of the HT tracers pumped will also occur during drilling of well 16B(78)-32.

There is also a plan to pump microproppant during the third stage treatment. Monitoring for tracers and microproppant will be the responsibility of the University of Utah. Supplying (and pumping) microproppant in Stage 3 will be the responsibility of Liberty. The microproppant is a manmade material so it can ideally be distinguished from reservoir material.

Note: The specification for microproppant is that it be a ceramic material with an apparent density of ≥ 2.60 g/cm^3.

IV.1.5 Flowback Water Sampling

The tracer team will also periodically sample and archive flowback water beyond what is required for tracer analysis. The aim is to get samples for analyzing major and minor species (Li, Na, K, Ca, Mg, B, SiO_2, Cl, SO_4, HCO_3) and stable isotopes (oxygen and hydrogen) using 250 ml HDPE and 30 ml glass bottles, both with threaded lids.

V. Treatment Procedures

The procedures are as follows.

1) Safety meetings as scheduled.
2) Confirm all microseismic and DAS monitoring systems are functional and able to provide near real-time locations of events detected. Confirm all communication systems and real-time microseismic processing equipment are running and functional and can be communicated with the Liberty Treatment Control and Monitoring Vehicle. Confirm timestamping is in place.
3) The Internal Yield (Burst) pressure rating for the 7" casing is 12,830 psi. Accounting for the effect of the high temperature on the performance specifications and the standard 20% safety factor, the maximum allowable pressure would be 9,000 psi. The wellhead is rated to 10,000 psi and allowing the standard 20% safety factor this would result in a maximum allowable pressure of 8,000 psi. [2] **For this reason, the maximum allowable surface pressure for pumping operations will be 8,000 psi.** Liberty will provide an in-line automatic pressure relief valve. Pressure test all frac treating lines upstream of the wellhead to 8,500 psi. Test automatic pressure relief valve opening to verify that it operates successfully at the set pressure of 8,000 psi.

[2] All parties queried anticipate hydrostatic pressure behind the cement.

4) **Fracture Stage - Zone 1:** This will be in the open-hole section of the wellbore. It has previously been hydraulically fractured with a DFIT (see Appendix E).

a) This stage will be pumped down the 7" casing. Pumping down the 7" casing will allow the flexibility to pump at higher rates that may be required to achieve the desired hydraulic fracture geometry (adequate upwards growth).

b) Before the main treatment in this stage, we will pump a 60-minute shear stimulation test (TSS).[3] The design for the TSS would be to pump at a rate to maintain bottomhole pressure (BHP) 500 psi below the minimum horizontal in situ stress (S_{hmin}). From analysis of the previous Diagnostic Fracture Injection Test (DFIT, see Appendix E) that was pumped in this open-hole section of the wellbore, S_{hmin} (average from several injection tests) is 6,222 psi (downhole, to be refined on location). The target BHP (bottomhole pressure) for 500 psi below S_{hmin} would then be 5,722 psi (to be refined on location). Since the hydrostatic pressure with the casing full of water is ~3,690 psi, the target surface pumping pressure for the TSS would be 2,032 psi, presuming the treatment is pumped down the casing where friction pressure is negligible. Based on the previous DFIT, it may not be possible to gear down enough to do this in the open-hole section – 0.25 bpm led to apparent fracturing and there was no evidence of significant fluid movement before that, however there is a fracture present now. During the initial DFIT test the surface pumping pressure was ~2,500 psi at a pump rate of 0.25 bpm. The plan is to begin pumping the TSS at a constant pump rate of 0.1 bpm to see if pumping pressure will stabilize around 2,032 psi. The plan is to pump the TSS for 1 hour but depending on the pressure behavior and microseismicity during the actual pumping, a decision will be made to increase the pumping time by up to 1 hour.

c) After the TSS, shut-in, monitor pressure for one hour.

d) Begin the first stage fracture stimulation treatment by pumping slickwater (water containing friction reducer) at 5 bpm. When the rate stabilizes at 5 bpm, start adding the tracer at the recommended concentration.

[3] McClure, M., and Horne, R. 2013. Characterizing Hydraulic Fracturing with a Tendency-for-Shear-Stimulation Test, SPE 166332.

Hold the rate at 5 bpm for 10 minutes and note if pressure has stabilized. If the treating pressure has stabilized, increase the rate to 10 bpm for 10 minutes followed by rate increases of 5 bpm (holding each rate for 10 minutes) up to a rate of 50 bpm (or the maximum pumping rate achievable at the maximum allowable surface treating pressure) and hold the rate for 30 minutes. This requires 3,750 bbl of water.

Note: If at any time in Step d), the surface pressure exceeds 7,950 psi, reduce the rate by 5 bpm, pump for 30 minutes and proceed to Step e). Continue reducing rate if necessary, during the 30-minute pumping period.

e) After the 30 minutes of pumping at the final rate in Step d) drop the pump rate to 25 bpm (lower if necessary) and hold the rate until there is no water-hammer and/or pressure has stabilized. Maintain nominally constant rate for five minutes (an additional 125 bbl).

f) Decrease the rate in increments to ~5 bpm and hold rate until there is no water-hammer and/or pressure has stabilized after each decrement. Nominally pump for five minutes at each rate level. This will be an additional 250 bbl. Total planned volume for this stage is 4,125 bbl.

g) Shutdown pumps and shut isolation valve(s) on the high-pressure treating line to isolate the pumping equipment from the wellhead.

h) Strap water tanks and any chemicals pumped to compare actual with designed amounts.

i) Conduct post-job safety meeting to discuss any observations, incidents, questions, etc. from the stage 1 injection. Take any required actions (refill water tanks, service equipment, etc.) to prepare for second stage.

j) After a shut-in period of 4 hours to monitor pressure behavior the well will be flowed back. The flowback operation will be managed by the rig crew with oversight from FORGE. The actual procedure will be determined based on the remaining wellhead pressure. The general plan will be to flow back at a low rate through an adjustable choke with the possibility of incremental shut-ins to evaluate the rebound pressures. University to advise if any modification based on sampling required due to tracer material as described previously in this document.

5) **Fracture Stage - Zone 2:** This will be a stage near the end of the 7" casing. Perforate an interval where natural fractures appear to be present, based on existing FMI and other logging data. The actual perforation location will also be constrained from the microseismic events located during the previous stage. The previous stage will be isolated by a 7" bridge plug, and the treating fluid will be slickwater.

a) Pump this stage down the 7" casing. Experience has shown that breaking down the granite formation through perforated casing can be difficult. Sometimes, maximum allowable surface pressure is reached without achieving a breakdown. A decision tree workflow has been developed in the case breakdown cannot be achieved and/or if isolation is not immediately possible. The decision as to which steps to take will be given by the University FORGE representative on the wellsite. The decision workflow is included in Appendix G.

Prepare to RIH and Set Interwell 7" bridge plug on drill pipe

Arrange pre-job meeting with all involved personnel and discuss handling and operation of the tools. Ensure that required retrieving/fishing tools are available. Go through the Completion Schematic with the University FORGE wellsite supervisor and discuss where to take extra caution while running in hole.

b) RIH and Setting Procedure for the Interwell 7" bridge plug.

i. Confirm a drift run/Clean out run has been performed, to verify that the plug may be run to the desired setting depth.

ii. Drift the Hydraulic Running Tool (HRT) with the appropriate ball, verify that it lands on the ball seat and remove the ball from the HRT.

iii. Check the connection between the Hydraulic Setting Tool and the Drill Pipe.

iv. Make up adapter kit to the Bridge Plug and Hydraulic Setting Tool. Ensure that all the connections are secured with lock rings or set screws. **Do not lift the setting tool and plug from horizontal to vertical with setting sleeve made up against the plug.**

v. **REMOVE THE TRANSPORT SCREW.**

Note: Avoid hard start/stop
Take in consideration the well ID and the plug OD when making connections to avoid swabbing the well.

vi. Run in hole. Maximum running speed is 1 stand/min (115 ft/min).

Maximum pressure differential allowed at tool while circulating prior to setting is 600 psi.

Break circulation every 1,500 ft to prevent blocking the ball seat. **The circulation rate should not exceed 5.03 bpm.**

vii. When at setting depth, note Pick-up Weight (PW), Hanging Weight (HW) and Running Weight (RW). If possible, go 15 ft below setting depth. Pull up to setting depth.

viii. Confirm correct setting depth. Drop setting ball and pump it down to the ball seat.

ix. When the ball lands, build up pressure in the Drill Pipe at minimum and steady pump rate. HRT starts to stroke out @ **920 psi**. Theoretical shear off value: **1,610 psi** when plug is set.

Note:

When the pressure reaches the theoretical shear off value, monitor the weight indicator for any changes. If weight indicator shows a weight drop – pick up to previous noted hanging weight to compensate for HRT stroke. **Be aware of shallow set plug:** The HRT setting force will work upwards and will be able to bend the drill pipe if not picked up to previous hanging weight.

Stop at theoretical shear off pressure – if no weight drop or pressure drop have been observed, continue to pressure up 10% above the theoretical shear off value.

If no drop in pressure has been seen at the theoretical shear off pressure + 10%, hold this pressure and pick up on the Drill Pipe with a maximum over pull of 10,000 lbf.

x. When the plug is set and the running tool disconnects, a sudden drop in pressure will be seen.

xi. Lay down weight to verify that plug is set, 4,500 lbf.

xii. Pick up one stand of drill pipe. Connect to drill pipe with rig pump and circulate wellbore with fresh water to completely replace the casing volume. This will ensure that any of the tracer from the stage flowing back is removed from the wellbore before pumping the next frac stage. After wellbore is circulated with fresh water, shutdown pumping and continue to POOH with the drill pipe.

Visually check at surface that the setting prong has been recovered intact and shear stud has sheared properly.

xiii. Perform pressure test of the bridge plug to 6,800 psi. Monitor pressure for 5-10 minutes to ensure plug is isolating the lower portion of the wellbore. If pressure bleed off is greater than 180 psi/min the plug will be considered to have failed to isolate and the University FORGE representative will advise on the next steps to take. [If the bridge plug fails to provide isolation revert to the procedures outlined in Appendix F.

xiv. When out of hole, visually check at surface that the setting prong has been recovered intact and shear stud has sheared properly.

Note: Remove the ball from the HRT or put on the protector cap, to prevent the ball from dropping out from the HRT during lifting.

c) Prepare to run Extreme Wireline TCP guns on drill pipe.

i. MU 3-1/2" drill pipe – 2-3/8 EUE changeover.

ii. Install firing head with 20 ft perforating gun loaded with Perforator, 3.125", 21-gram Hero Charges @ 60°Phasing (6 shots per foot) giving 0.25" casing entrance hole diameter.

iii. RIH with 3-1/2" drill pipe to depth determined by the University FORGE representative. There is no limitation on the running speed for the TCP gun.

iv. Position TCP gun at depth and verify. Drop ball in the drill pipe, connect MTS Solutions pumping equipment to the drill pipe, prime-up and pump ball to seat and pressure up to approximately **3,000 psi** surface pressure. Watch for pressure break while listening at wellhead with microphones provided by Extreme Wireline.

v. After verifying the guns have fired, rig-down the treating line from the drill pipe, POOH with drill pipe and recover the TCP gun and equipment from the drill pipe. Lay down guns for departure and inspection.

vi. Make sure all valves are in the correct position and begin pumping at low rate to breakdown the formation through the perforations. Do not exceed the maximum allowable surface pressure of 8,000 psi. If breakdown is achieved increase pump rate to 5 bpm and compare pressure with the previous stimulation stage when pumping at 5 bpm. If the pressures are comparable move to the next step. If breakdown doesn't occur on the first pumping sequence, bleed-off pressure at the surface and repeat pumping. This can be done several times but if no gain is being made consult

with the University FORGE representative (see Appendix G) to determine the next steps to take.

d) After verifying that everything is in the correct configuration and it is safe to proceed, Liberty to begin the fracture stimulation treatment by pumping slickwater (water containing polyacrylamide friction reducer) at 5 bpm. When rate gets to 5 bpm start adding the tracer at the recommended concentration. Hold treatment rate for 10 minutes and note if pressure has stabilized.

e) Increase the rate to 10 bpm for 10 minutes followed by rate increases of 5 bpm (holding each rate for 10 minutes) up to a total rate of 35 bpm. After pumping for 15 minutes at 35 bpm, perform a hard shutdown, monitor shut-in pressure for 5 minutes and then resume pumping at 35 bpm for another 15 minutes. (Perforation friction pressure may limit the maximum pump rate so it will be necessary to make adjustments on-the-fly.) If pumped as specified, this would be 2,100 bbl.

f) After the final 15 minutes of pumping at the maximum rate, drop the pump rate to 20 bpm and hold the rate until there is no water-hammer and/or pressure has stabilized. Estimated at an additional 100 bbl (i.e., pump for five minutes at this rate).

g) Decrease the rate in 5 bpm increments to ~5 bpm and hold rate at each step until there is no water-hammer and/or pressure has stabilized (nominally 5 minutes per step). Estimated at an additional 150 bbl.

h) After nominally pumping 2,350 bbl, shutdown pumps and shut isolation valve(s) on the high-pressure treating line to isolate the pumping equipment from the wellhead. [**Note:** At the discretion of University FORGE representative, pumping time may be extended based on the viability of safe operations, feedback from microseismic monitoring, availability of water, friction reducer, etc.]

i) Strap water tanks and any chemicals pumped to compare actual with designed amounts.

j) Conduct post-job safety meeting to discuss any observations, incidents, questions, etc. from the stage 2 injection. Take any required actions (refill water tanks, service equipment, etc.) to prepare for the third stage injection test.

k) After a shut-in period of 4 hours to monitor pressure behavior the well will be flowed back. The flowback operation will be managed by the rig crew. The actual procedure will be determined based on the remaining wellhead pressure and FORGE representative will work with rig crew. The general plan will be to flow back at a low rate through an adjustable choke with the possibility of incremental shut-ins to evaluate the rebound pressures. University to advise if any modification based on sampling is required due to tracer material as described previously in this document.

6) **Fracture Stage – Zone 3:** This stage will be somewhat up-hole of the previous perforated zone and will be finalized depending on results of microseismic monitoring in the three offset wells. Perforate an interval where natural fractures appear to be present, based on existing FMI and other logging data. The previous stage will be isolated, and the initial treating fluid will be slickwater and then switched to crosslinked polymer (depending on the results from the previous stage). The plan is also to pump microproppant with the crosslinked polymer fluid.

a) Pump this stage down the 7" casing. Experience has shown that breaking down the granite formation through perforated casing can be difficult. Sometimes, maximum allowable surface pressure is reached without achieving a breakdown. A decision tree workflow has been developed in the case breakdown cannot be achieved and/or if isolation is not immediately possible. The decision as to which steps to take will be given by the University FORGE representative on the wellsite (Appendix G)

Prepare to RIH and Set Interwell 7" bridge plug on drill pipe

Arrange pre-job meeting with all involved personnel and discuss handling and operation of the tools. Ensure that required retrieving/fishing tools are available. Go through the Completion Schematic with the University FORGE wellsite supervisor and discuss where to take extra caution while running in hole.

b) RIH and Setting Procedure for the Interwell 7" bridge plug.
   i. Confirm a drift run/Clean out run has been made, to verify that the plug may be run to the desired setting depth.
   ii. Drift the HRT with the appropriate ball, verify that it lands on the ball seat and remove the ball from the HRT.
   iii. Check the connection between the Hydraulic Setting tool and the Drill Pipe.

iv. Make up adapter kit to the Bridge Plug and Hydraulic Setting Tool. Ensure that all the connections are secured with lock rings or set screws. **Do not lift the setting tool and plug from horizontal to vertical with setting sleeve made up against the plug.**

v. **REMOVE THE TRANSPORT SCREW.**

Note: Avoid hard start/stop
Take in consideration the well ID and the plug OD when making connections to avoid swabbing the well.

vi. Run in hole. Maximum running speed is 1 stand/min (115 ft/min). **Maximum pressure differential allowed at tool while circulating prior to setting is 600 psi.**

Break circulation every 1,500 ft to prevent blocking the ball seat. **The circulation rate should not exceed 5.03 bpm.**

Evaluate RIH speed according to well conditions and BHA.

vii. When at setting depth, note PW, HW and RW. If possible, go 15 ft below setting depth. Pull up to setting depth.

viii. Confirm correct setting depth. Drop setting ball and pump it down to the ball seat.

ix. When the ball landed, build up pressure in the Drill Pipe at minimum and steady pump rate. HRT starts to stroke out @ **920 psi.** Theoretical shear off value: **1,610 psi** when plug is set.

Note:

When the pressure reaches the theoretical shear off value, monitor the weight indicator for any changes. If weight indicator shows a weight drop – pick up to previous noted hanging weight to compensate for HRT stroke.
Be aware on shallow set plug: The HRT setting force will work upwards and will be able to bend the drill pipe if not picked up to previous hanging weight.
Stop at theoretical shear off pressure – if no weight drop or pressure drop have been observed, continue to pressure up 10% above the theoretical shear off value.
If no drop in pressure has been seen at the theoretical shear off pressure + 10%, hold this pressure and pick up on the Drill Pipe with a maximum over pull of 10,000 lbf.

x. When the plug is set and the running tool disconnects, a sudden drop in pressure will be seen.
xi. Lay down weight to verify that plug is set, 4,500 lbf.
xii. Pick up one stand of drill pipe. Connect to drill pipe with rig pump and circulate wellbore with fresh water to completely replace the casing volume. This will ensure that any of the tracer from the stage flowing back is removed from the wellbore before pumping the next frac stage. After wellbore is circulated with fresh water, shutdown pumping and continue to POOH with the drill pipe. Visually check at surface that the setting prong has been recovered intact and shear stud has sheared properly.
xiii. Perform pressure test of the bridge plug to 6,800 psi. Monitor pressure for 5-10 minutes to ensure plug is isolating the lower portion of the wellbore. If pressure bleed off is greater than 180 psi/min the plug will be considered to have failed to isolate and the University FORGE representative will advise on the next steps to take. [If the bridge plug fails to provide isolation revert to the procedures outlined in Appendix F.
xiv. When out of hole, visually check at surface that the setting prong has been recovered intact and shear stud has sheared properly.

Note: Remove the ball from the HRT or put on the protector cap, to prevent the ball from dropping out from the HRT during lifting.

c) Prepare to run Extreme Wireline TCP guns on drill pipe.
i. MU 3-1/2" drill pipe – 2-3/8 EUE changeover.
ii. Install firing head with 20 ft perforating gun loaded with Perforator, 3.125", 21-gram Hero Charges @ 60° Phasing (6 shots per foot) 0.25" casing entrance hole diameter.
iii. RIH with 3-1/2" drill pipe to depth determined by the University representative. There is no limitation on the running speed for the TCP gun.
iv. Position TCP gun at depth and verify. Drop ball in the drill pipe, connect MTS Solutions pumping equipment to the drill pipe, prime-up and pump ball to seat and pressure up to approximately **3,000 psi** surface pressure. Watch for pressure break while listening at wellhead with microphones provided by Extreme wireline.
v. After verifying the guns have fired, rig-down the treating line from the drill pipe, POOH with drill pipe and recover the TCP gun and equipment from the drill pipe. Lay down guns for departure and inspection.

vi. Make sure all valves are in the correct position and begin pumping at low rate to breakdown the formation through the perforations. Do not exceed the maximum allowable surface pressure of 8,000 psi. If breakdown is achieved increase pump rate to 5 bpm and compare pressure with the previous stimulation stage when pumping at 5 bpm. If the pressures are comparable move to the next step. If breakdown doesn't occur on the first pumping sequence, bleed-off pressure at the surface and repeat pumping. This can be done several times but if no gain is being made consult with the University FORGE representative (see Appendix G) to determine the next steps to take.

d) After verifying that everything is in the correct configuration and it is safe to proceed, Liberty to begin the fracture stimulation treatment by pumping crosslinked polymer fluid and microproppant according to the following schedule. [Note: When the pump rate reaches 5 bpm in the first stage start adding the tracer at the recommended concentration.]

It is important to note that when pumping the crosslinked fluid (XL) at the beginning of Stage 3, the 7" casing will still be full of the slickwater fluid (SW). Likewise for the end of Stage 3, the procedure is to switch back to pumping SW (also the organic tracer will be stopped) so that when the treatment is shut down there will only be SW remaining in the casing. Also note in the pumping schedule for Stage 3 that when pumping at 25 bpm (step 5 during the increases in pump rate) there will be a transition from SW to XL fluid going through the perforations. At the end of pumping at 35 bpm (step 7 in the schedule) Liberty will stop pumping XL fluid and switch back to SW to completely displace the XL fluid through the perforations. The treatment schedule is shown in Table 1.

Note: Perforation friction pressure may limit the maximum pump rate so make necessary adjustments on-the-fly. Actual timing on stages when rates are being reduced are based on observation of water hammer response and pressure stabilization (same as for previous frac stages).

e) After nominally pumping 2,350 bbl, shutdown pumps and shut isolation valve(s) on the high-pressure treating line to isolate the pumping equipment from the wellhead. [Note: At the discretion of University FORGE pumping time may be extended based on the viability of safe operations, feedback from microseismic monitoring, availability of water, friction reducer, etc.]

Table 1. Treatment schedule for Stage 3.

Fluid Pumped at Surface (SW or XL)	Stage Time (min)	Cum Pumping Time (min)	Pump Rate (bpm)	Micro-Proppant Conc (ppg)	Stage Fluid Volume (bbl)	Stage Proppant Volume (lbm)	Cum Fluid Volume (bbl)	Cum Prop Volume (lbm)	Fluid at Perfs (SW or XL)
XL	5	10	5	0.00	25	0	25	0	SW
XL	5	15	10	0.50	50	1,050	75	1,050	SW
XL	5	20	15	0.50	75	1,575	150	2,625	SW
XL	5	25	20	0.50	100	2,100	250	4,725	SW
XL	10	35	25	0.75	250	7,875	500	12,600	SW --> XL
XL	15	50	30	0.75	450	14,175	950	26,775	XL
XL	30	80	35	0.00	1,050	0	2,000	26,775	XL
SW	10	90	20	0.00	200	0	2,200	26,775	XL
SW	10	100	15	0.00	150	0	2,350	26,775	XL
SW	5	105	10	0.00	50	0	2,400	26,775	XL
SW	5	110	5	0.00	25	0	2,425	26,775	XL
SW	0	110	0	0.00	0	0	2,425	26,775	SW

f) Strap water tanks and any chemicals pumped to compare actual with designed amounts.

g) Conduct post-job safety meeting to discuss any observations, incidents, questions, etc. from the stage 3 injection.

h) After a shut-in period of 4 hours to monitor pressure behavior the well will be flowed back. The flowback operation will be managed by the rig crew. The actual procedure will be determined based on the remaining wellhead pressure. The general plan will be to flow back at a low rate through an adjustable choke with the possibility of incremental shut-ins to evaluate the rebound pressures. University to advise if any modification based on sampling required due to tracer material as described previously in this document.

i) Depending on the time of day it may be possible to begin rig-down operation for the fracturing equipment.

j) The plan would be to continue with microseismic monitoring until any flowback operations would be complete and beyond as per protocols from the microseismic monitoring team.

k) After flowback operations are completed the process to retrieve the 7" bridge plugs will begin.

7) Prepare to retrieve the upper Interwell 7" bridge plug on drill pipe.

a. Retrieving Procedure

i. Ensure all barriers other than the Bridge Plug has been removed prior to RIH. Verify that the OD's of the BHA is smaller than the ID's in the wellbore.

ii. Drift the GS FRT with the appropriate ball, verify that it lands on the nozzle and remove the ball from the GS FRT.

iii. Check the connection between the GS FRT and the drill pipe.

iv. Connect the GS FRT to the drill pipe. Function test the GS FRT and note the flow rate and pressure needed to activate the Pulling Tool.

v. RIH with the GS FRT. Maximum running speed is 1 stand/min (115 ft/min). Connect to the drill pipe and use rig pumps to break circulation every 1,500 ft to prevent blocking the GS FRT nozzle.

vi. Stop 65 ft above the installed Bridge Plug and note PW, HW and RW.

vii. Before latching onto the plug: Check and verify that the pressures over and below the plug are correct. Pressure above the plug: WHP + Hydrostatic pressure = _____ psi. Expected pressure below the plug: SIWHP when plug was set + Hydrostatic pressure when plug was set + any possible gas influx = _____ psi. If possible, keep a 150 psi over balance above the plug.

Note: Optional - if debris is expected to be present:

Start pumping with 1.8 bpm through the GS FRT while RIH to clean the fish neck area of the Bridge Plug.

Continue to RIH until GS engages the Bridge Plug and set down 4,500 lbf.

Stop pumping. Wait 2 minutes for the fingers to return to the catch position.

viii. Set down 4,500 lbf on the plug.

ix. Perform an over pull to equalize and release the Bridge Plug. When pressure changes are seen, hold tension until the pressure has stabilized. If no over pull is seen and there is a possibility that the

plug has not released, set down 4,500 lbf again, without pumping. If no tag at plug depth, RIH 15 ft deeper to confirm plug retrieval, without pumping.

x. Pull up 3 ft and wait 30 minutes to let the element retract.

Note: Do not pump while pulling out of the hole.

xi. POOH with the Bridge Plug assembly. Take care when going through restrictions. **DO NOT** pump while pulling out of the hole.

xii. When out of the hole, verify that all parts of the BHA are recovered.

xiii. Secure the plug with the slips and attach the dog collar/C-plate. Start pumping to release the GS FRT from the plug. (If needed: Drop the ball into the GS FRT, to make it easier to build up the pressure needed to release.)

8) Repeat the same procedure to retrieve the lower Interwell 7" bridge plug on drill pipe.

Note: Use proper lifting equipment. Due to safety reasons, the Flow release GS pulling tool is not to be used for lifting the plug BHA.

9) If there are no issues with the retrieval of the Interwell 7" Bridge Plugs confirm with the University FORGE representative that this is the end of the planned operations. Over the next few days rig-down operations will be completed with all equipment demobilized from the 16A pad. University FORGE representative to determine what additional actions need to take place (remaining water in the frac tanks to be drained to the rig sump, staging of equipment onto and off of the site in order to ensure safety, etc.) and coordinate all of the activity. Liberty will have priority to rig-down and demobilize all frac equipment from the 16A pad.

End of wellsite operations

VI. Contact Information

Contact information for Key Personnel is compiled in Appendix H.

VII. Traffic Light System

A seismic mitigation plan is in place based on a traffic light concept. All stimulation activities could be amended or suspended in accordance with this mitigation plan,

at any time. The Traffic Light System is included as Table 2. The basis for this is the occurrence of the following.

a) The occurrence of an event with a magnitude (M) greater than or equal to 2 within 3 km of the rig will trigger notification of **Orange**; M greater than or equal to 3 within ~15 km will trigger **Red**.
b) If there are ten or more events with magnitudes greater than or equal to 1, within 3 km, in a 24-hour period, **Orange** is triggered.
c) Confirmation or suspicion of events propagating along a fault plane.

Traffic Light Response is on the following page.

1. When this document was first prepared, an orange trigger was seismicity mapped along a fault plane. Initially, this was considered to be events on the order of 2. Now that there should be good real time microseismicity, we will also watch for microseisms defining a plane that appears to be anomalous to the overall fracture propagation trend – particularly if the events are migrating towards the wellbore – from the perspective of casing integrity (refer to Zeng et al. 2021[4]).
2. It is anticipated that there will be geophones as close to reservoir depth as possible in three wells. If one set of geophones goes down during pumping, it is at FORGE personnel's discretion as to whether to shut down – depending on how much of the stage has been pumped. If two wells lose geophone functionality, the pumping of a particular stage will be ceased until the situation can be evaluated. Volumes pumped after a restart will be at the discretion of FORGE field personnel.

[4] Zeng, B., Zhang, H., Zhou, X., Yang, X., Song, Y., and Chen, Z. 2021. Microseismic Characteristics of Shale Gas Wells with Casing Deformation in Sichuan Basin, ARMA 21–182555th US Rock Mechanics/Geomechanics Symposium held in Houston, Texas, USA, 20-23 June 2021.

Table 2. Draft Microseismicity Stop Light Program[5]

Observations	Actions: Stimulation	Actions: Non-Stimulation
• No anomalous seismic events	• No actions. Follow good engineering and safety practices.	• No actions. Follow good engineering and safety practices.
• M ≥ 2 within 3 km • 10 M ≥ 1 in 24 hr within 3 km • Events propagating along imaged fault plane. THIS INCLUDES MICROSEISMICITY APPARENTLY MOVING ON AN ANOMALOUS PATHWAY. • Total loss of drilling mud that cannot be cured in 30 minutes.	• The Drilling Site Manager (DSM), the Operations Superintendent and the Project Manager must be immediately notified, and the DSM will coordinate appropriate activities on location. • Assemble all personnel at designated muster point and hold an offsite safety meeting. • DSM will immediately terminate pumping. • and initiate controlled flow back with first occurrence of orange. If the well is shut-in, the well will also be flowed back. Do this in an orderly, controlled manner. Ensure that this is done in a safe fashion for personnel, the rig and surface peripherals, integrity of the well and downhole equipment (if feasible). This is done under the authority of the Drilling Site Manager and the Operations Manager, unless directed otherwise by the project manager. • Wait for instructions to resume injection. • Notify all personnel on the FORGE footprint including FORGE staff, contractors, service personnel and visitors. • All unnecessary personnel	• The Drilling Site Manager (DSM), the Operations Superintendent and the Project Manager must be immediately notified, and the DSM will coordinate appropriate activities on location. • Assemble all personnel at designated muster point and hold an offsite safety meeting. • If Orange is triggered because of losses, rig crew and DSM will continue to work on curing the losses. • It may be possible that drilling is resumed with or without returns AFTER consultation with FORGE management, and possibly the DOE and key STAT representatives. • Regardless of the trigger, ensure the safety of all personnel on location, the rig (if present), the integrity of downhole equipment if feasible and safe. • Notify all personnel on the FORGE footprint including FORGE staff, contractors, service personnel and visitors. • All unnecessary personnel are to move away from the wellhead. • Ensure the safety of personnel first and the integrity of the rig and peripheral equipment if that can be safely done. • If drilling is ongoing and conditions are stabilized,

[5] In this protocol M indicates magnitude.

Observations	Actions: Stimulation	Actions: Non-Stimulation
	are to move away from the wellhead. • Ensure the safety of personnel first and the integrity of the rig and peripheral equipment if that can be safely done. • **Operations will cease until a plan to continue is approved by DOE and the STAT. Resumption of injection could include continuation of pumping at a lower rate or with modified protocols.**	POOH or pull into a cased section of the hole. • *If the issue is loss of circulation, cure the losses without shutting down until the losses are cured.* • *If cementing is ongoing, and it is deemed safe to do so, continue until the plug has bumped and secure the well.* • *If logging is ongoing, pull out of the hole.* • *If activities such as setting packers are ongoing, stabilize the well and wait for instructions.* • *Wait for instructions to resume operations.* • **Operations will cease until a plan to continue is approved by DOE and the STAT[6].**
• M ≥ 3 within ~15 km	• The Drilling Site Manager (DSM), the Operations Superintendent and the Project Manager **must be immediately notified.** • **Contact information is available in Appendix H of this document.** • Assemble all personnel at designated muster point and hold an offsite safety meeting. • DSM will immediately terminate pumping and flow back with first occurrence of red. If the well is shut-in, the well will be flowed back. Do this in an orderly, controlled manner. Ensure that this is done in a safe fashion for personnel, the rig and surface peripherals, integrity of the well and downhole equipment (if feasible). This is done	• The Drilling Site Manager (DSM), the Operations Superintendent and the Project Manager must be immediately notified, and the DSM will coordinate appropriate activities on location. • The Drilling Site Manager (DSM), the Operations Superintendent and the Project Manager must be immediately notified. • Contact information is available in Appendix H of this document. • Assemble all personnel at designated muster point and hold an offsite safety meeting. • Ensure the safety of all personnel on location, the rig (if present), the integrity of downhole equipment if feasible and safe. • Notify all personnel on the FORGE footprint including

[6] STAT is the FORGE Science Technology Analysis Team.

Observations	Actions: Stimulation	Actions: Non-Stimulation
	under the authority of the Drilling Site Manager and the Operations Superintendent, unless directed otherwise by the Project Manager. • All unnecessary personnel are to leave the location. • Ensure the safety of personnel and the integrity of the rig and peripheral equipment. • **Secure the well. When it is established to be safe to do so, POOH, and rig down service company.** • **Operations will cease until a plan to continue is approved by DOE and the STAT.**	FORGE staff, contractors, service personnel and visitors, • All unnecessary personnel are to leave the location. • Ensure the safety of personnel and the integrity of the rig and peripheral equipment. • **Secure the well. Operations will cease until a plan to continue is approved by DOE and the STAT.**

Appendix A: Directions and Location Diagrams

The 1.9 square mile FORGE location is just west of the Mineral Mountains, and it is 217 miles south of Salt Lake City and 10 miles NNE of Milford. Figures A-1 and A-2 show the location of the FORGE site relative to Milford, UT. Figure A-3 shows well locations.

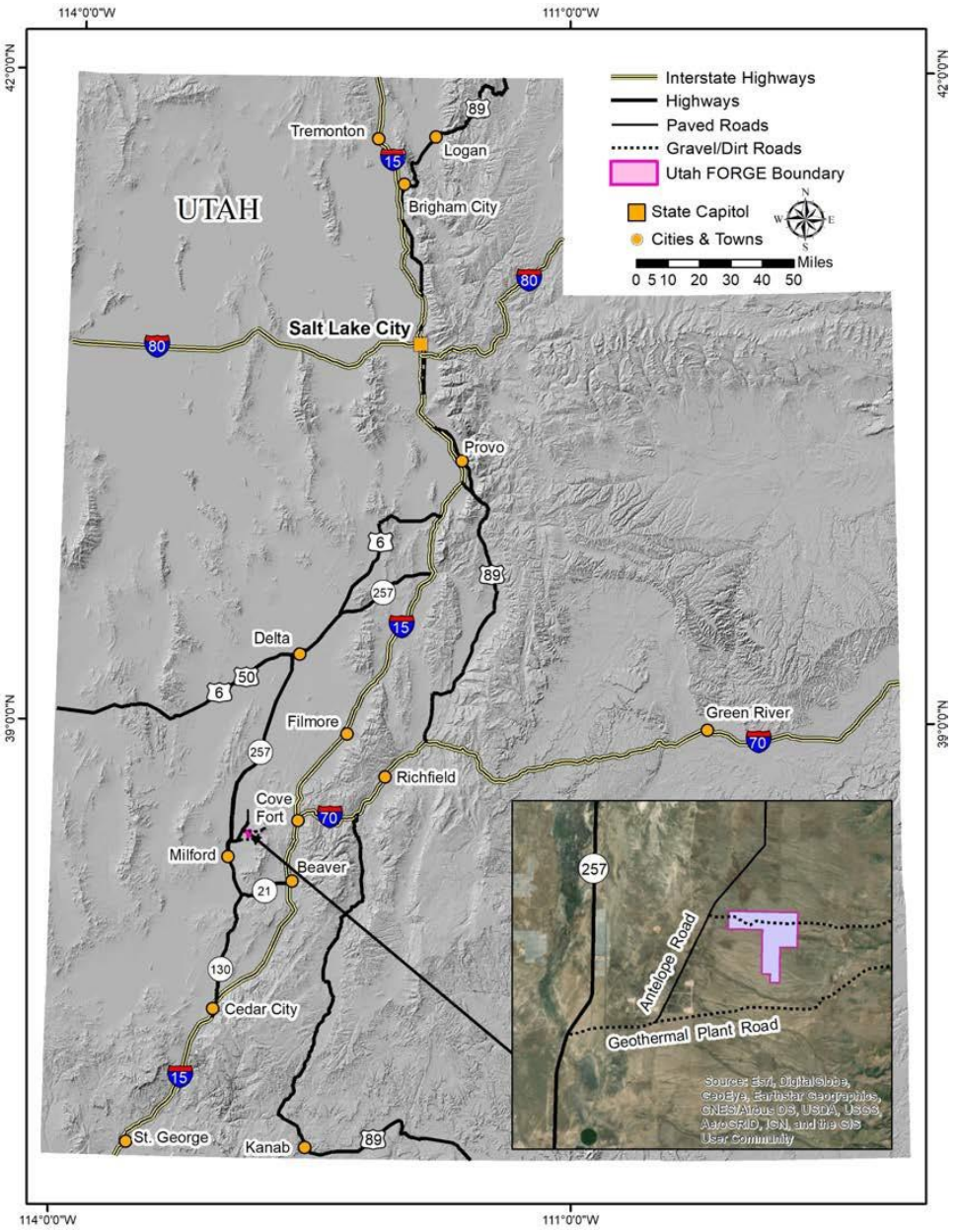


Figure A-1. FORGE location in Utah.

From Milford, the driving directions are as follows. Starting from the intersection of UT-257 and UT-24 in Milford, Utah, directions, and approximate mileages are as follows.

1. Take UT-257 north for ~4.4 miles.
2. Turn right (east) onto Geothermal Plant Road and continue for ~2.7 miles.
3. Turn left (northeast) onto Antelope Point Road (paved) and continue for ~3.5 miles.
4. Turn right (east) onto Salt Cove Road (unmarked, graded road) and continue to wellsite location, following rig signs or similar.

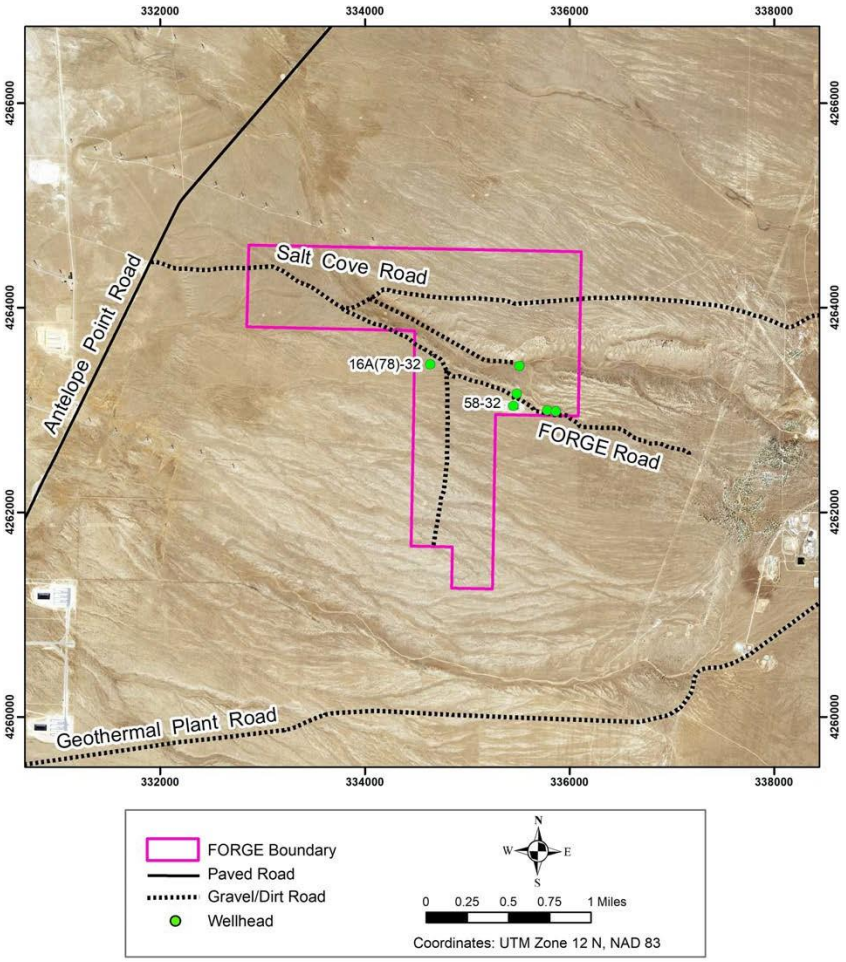


Figure A-2. Access roads to the FORGE location.

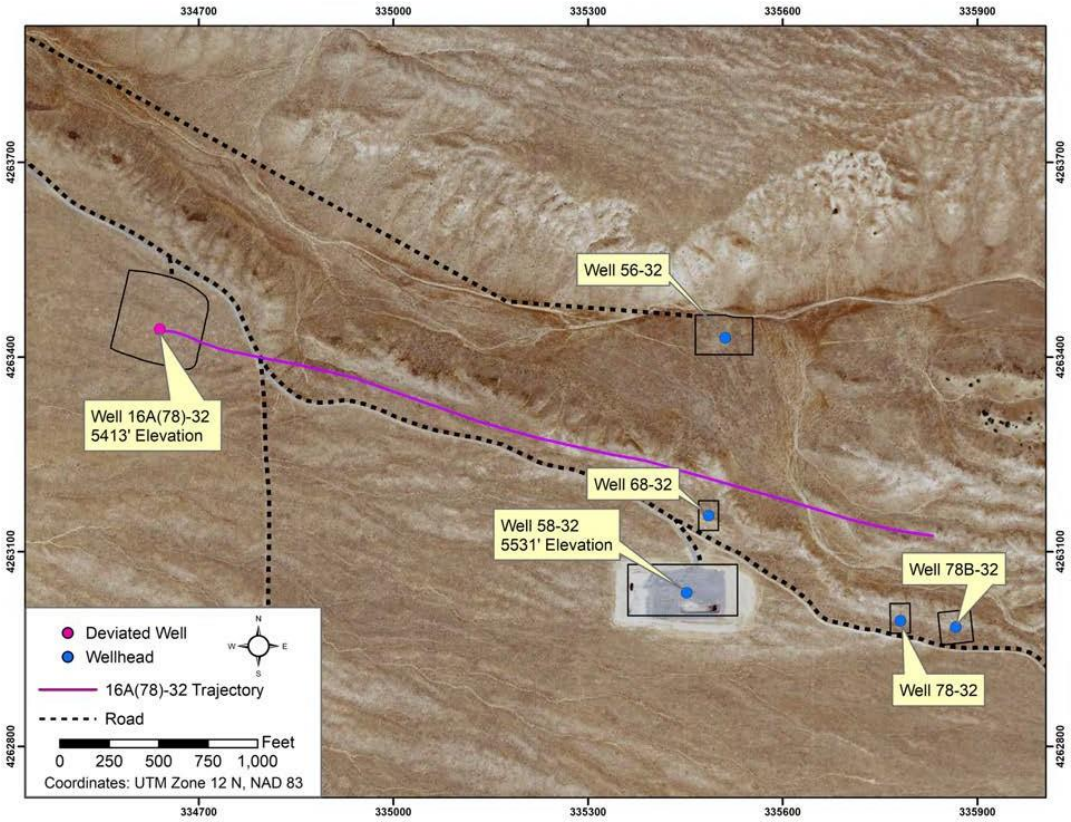


Figure A-3: Well locations and roads on the Utah FORGE site

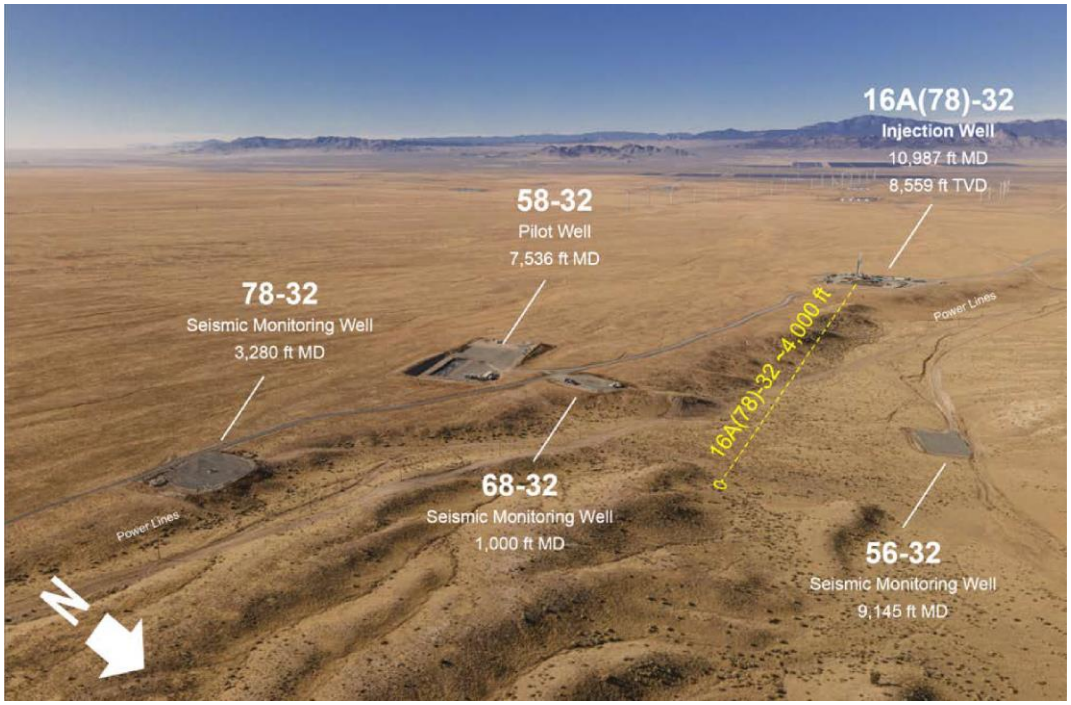


Figure 4: Well 16A(78)-32 location, well course and nearby drill pads.

Appendix B: FORGE COVID Policy

B.1 COVID-19 Protection Requirements for Individuals Working on Site

One of the goals of the Utah FORGE project is to protect the health and safety of everyone entering this site while performing the required operations. In order to mitigate transmission of diseases, the procedures described below will be followed by all individuals working on the site.

1. All personnel must be tested within and provide a Negative PCR COVID-19 result no more than 72 hours prior to arriving on site. The test result must be sent to Garth Larsen (Garth@hotrockms.com, cell 435-749-4015). This individual must provide a photo ID upon entering the site. The following procedures are to be followed by individuals working at the site.
2. Upon arrival at the site, and each following day, all personnel will have their temperature taken and fill out a health questionnaire. Anyone with a temperature > 100.4 F or reports other health issues will be required to take a COVID-19 test that will be administered at the Check-in Station. If the individual tests positive, they must stay more than 6 ft away from other individuals if outside, or isolated in their company vehicle away from other individuals. The individual's supervisor will discuss the situation with the Site Manager to determine the course of action to be taken. **The individual's supervisor will be responsible for arranging transportation off site and providing a replacement within 48 hours.**
3. All individuals will be required to take a COVID-19 test (antigen home type test by providing a nasal swab that can be read in 15 minutes) at the Check-in Station every three (3) days. The first test will be given three (3) days from the date of the negative test result prior to arrival on the site.
4. All individuals are expected wear masks and keep 6 feet apart when in proximity of other people, such as during meetings, training events and other restricted spaces unless use of a mask creates a safety hazard.
5. Because of the short duration of the FORGE project, any individual who tests positive within 72 hours prior to arrival will be required to remain at home**. It is the responsibility of the company to provide a substitute worker to be on site on the day and time agreed on in contract.**

B.2 COVID-19 Protection Requirements for Individuals Not Working on Site

Individuals not working on site, such as those delivering equipment will need to wear a mask, have their temperature taken and asked to fill out a health questionnaire. Individuals showing evidence of illness will not be allowed within 6 ft of other individuals until a negative COVID-19 test result is confirmed. The test will be administered by the guards at the check station (antigen home type test by providing a nasal swab that can be read in 15 minutes). If the individual tests positive, the Site Manager will determine how the equipment will be safely unloaded. Individuals testing

positive will not be allowed in the buildings, other than the outhouse, must remain masked and no closer than 6 ft from other individuals. Once deliveries are completed the individual will leave the site. Utah FORGE will provide clean pens for any signatures that will be required. Individuals feeling sick before leaving for the Utah FORGE site must inform their company which has the responsibility for a providing a substitute who can meet the schedule. Other protocols are given below.

B.3 Standard COVID Protocols:

- Clean surfaces regularly that can come into contact with other individuals.
- Wash hands often and wear gloves when appropriate.
- Maintain 6-foot separation from others when possible.
- If you feel sick, stay home, and contact your supervisor.
- Optimize and utilize PPE such as face shields and goggles as necessary and prudent.
- Cough into your face mask or sleeve if no mask is present
- Clean and sanitize often
- Adhere to the Utah FORGE COVID-19 Protection Requirements

B.4 Local COVID-19 Test Sites:

Cedar City InstaCare ..... Phone 435-865-3440
Milford Valley Memorial Hospital ..... Phone 435-387-2411

Appendix C: Casing Tally for Well 16A(78)-32

WELL NAME FORGE 16A (78)-32

Casing Specs		ID	Wt.	OD	Grade	Thread	Capacity	Set Depth	TD
		5.920	38.00	7.000	T95	JFELion	0.0340	10,787’	10,987’
Run #	Ref #	Description		Length	Cum. Lngth.	Top Depth	Bttm. Depth	String Vol.	
1		SHOE		3.05	3.05	10783.95	10787.00	0.10	
2	1	JFELion		47.69	50.74	10736.26	10783.95	1.73	
3		FLOAT COLLAR		2.38	53.12	10733.88	10736.26	1.81	
4	2	JFELion		47.63	100.75	10686.25	10733.88	3.43	
5		Landing Collar		1.24	101.99	10685.01	10686.25	3.47	
6	3	JFELion		47.08	149.07	10637.93	10685.01	5.08	
7	4	JFELion		47.62	196.69	10590.31	10637.93	6.70	
8	5	JFELion		47.76	244.45	10542.55	10590.31	8.32	
9	6	JFELion		47.43	291.88	10495.12	10542.55	9.94	
10	7	JFELion		46.18	338.06	10448.94	10495.12	11.51	
11	8	JFELion		45.00	383.06	10403.94	10448.94	13.04	
12	9	JFELion		46.86	429.92	10357.08	10403.94	14.64	
13	10	JFELion		46.10	476.02	10310.98	10357.08	16.21	
14	11	JFELion		47.26	523.28	10263.72	10310.98	17.82	
15	12	JFELion		46.27	569.55	10217.45	10263.72	19.39	
16	13	JFELion		44.79	614.34	10172.66	10217.45	20.92	
17	14	JFELion		47.89	662.23	10124.77	10172.66	22.55	
18	15	JFELion		47.58	709.81	10077.19	10124.77	24.17	
19	16	JFELion		47.30	757.11	10029.89	10077.19	25.78	
20	17	JFELion		46.68	803.79	9983.21	10029.89	27.37	
21	18	JFELion		47.03	850.82	9936.18	9983.21	28.97	
22	19	JFELion		47.58	898.40	9888.60	9936.18	30.59	
23	20	JFELion		47.59	945.99	9841.01	9888.60	32.21	
24	21	JFELion		47.43	993.42	9793.58	9841.01	33.82	
25	22	JFELion		46.75	1040.17	9746.83	9793.58	35.41	
26	23	JFELion		46.30	1086.47	9700.53	9746.83	36.99	
27	24	JFELion		47.30	1133.77	9653.23	9700.53	38.60	
28	25	JFELion		47.00	1180.77	9606.23	9653.23	40.20	
29	26	JFELion		46.83	1227.60	9559.40	9606.23	41.79	
30	27	JFELion		47.09	1274.69	9512.31	9559.40	43.40	

31	28	JFELion		47.30	1321.99	9465.01	9512.31	45.01
32	29	JFELion		45.79	1367.78	9419.22	9465.01	46.57
33	30	JFELion		46.93	1414.71	9372.29	9419.22	48.16
34	31	JFELion		47.52	1462.23	9324.77	9372.29	49.78
35	32	JFELion		45.78	1508.01	9278.99	9324.77	51.34
36	33	JFELion		47.43	1555.44	9231.56	9278.99	52.96
37	34	JFELion		46.41	1601.85	9185.15	9231.56	54.54
38	35	JFELion		46.76	1648.61	9138.39	9185.15	56.13
39	36	JFELion		46.65	1695.26	9091.74	9138.39	57.72
40	37	JFELion		46.63	1741.89	9045.11	9091.74	59.30
41	38	JFELion		47.44	1789.33	8997.67	9045.11	60.92
42	39	JFELion		44.82	1834.15	8952.85	8997.67	62.44
43	40	JFELion		47.08	1881.23	8905.77	8952.85	64.05
44	41	JFELion		46.19	1927.42	8859.58	8905.77	65.62
45	42	JFELion		46.79	1974.21	8812.79	8859.58	67.21
46	43	JFELion		47.54	2021.75	8765.25	8812.79	68.83
47	44	JFELion		46.51	2068.26	8718.74	8765.25	70.41
48	45	JFELion		46.95	2115.21	8671.79	8718.74	72.01
49	46	JFELion		47.56	2162.77	8624.23	8671.79	73.63
50	47	JFELion		46.24	2209.01	8577.99	8624.23	75.21
51	48	JFELion		47.45	2256.46	8530.54	8577.99	76.82
52	49	JFELion		47.31	2303.77	8483.23	8530.54	78.43
53	50	JFELion		46.06	2349.83	8437.17	8483.23	80.00
54	51	JFELion		47.43	2397.26	8389.74	8437.17	81.62
55	52	JFELion		45.88	2443.14	8343.86	8389.74	83.18
56	53	JFELion		45.29	2488.43	8298.57	8343.86	84.72
57	54	JFELion		47.63	2536.06	8250.94	8298.57	86.34
58	55	JFELion		47.27	2583.33	8203.67	8250.94	87.95
59	56	JFELion		45.83	2629.16	8157.84	8203.67	89.51
60	57	JFELion		47.30	2676.46	8110.54	8157.84	91.12
61	58	JFELion		45.71	2722.17	8064.83	8110.54	92.68
62	59	JFELion		47.62	2769.79	8017.21	8064.83	94.30
63	60	JFELion		47.62	2817.41	7969.59	8017.21	95.92
64	61	JFELion		47.69	2865.10	7921.90	7969.59	97.54
65	62	JFELion		46.32	2911.42	7875.58	7921.90	99.12
66	63	JFELion		47.57	2958.99	7828.01	7875.58	100.74
67	64	JFELion		47.61	3006.60	7780.40	7828.01	102.36
68	65	JFELion		47.57	3054.17	7732.83	7780.40	103.98

69	66	JFELion		46.56	3100.73	7686.27	7732.83	105.57
70	67	JFELion		47.42	3148.15	7638.85	7686.27	107.18
71	68	JFELion		47.62	3195.77	7591.23	7638.85	108.80
72	69	JFELion		46.99	3242.76	7544.24	7591.23	110.40
73	70	JFELion		47.31	3290.07	7496.93	7544.24	112.01
74	71	JFELion		46.59	3336.66	7450.34	7496.93	113.60
75	72	JFELion		47.59	3384.25	7402.75	7450.34	115.22
76	73	JFELion		47.63	3431.88	7355.12	7402.75	116.84
77	74	JFELion		46.32	3478.20	7308.80	7355.12	118.42
78	75	JFELion		45.73	3523.93	7263.07	7308.80	119.97
79	76	JFELion		47.31	3571.24	7215.76	7263.07	121.58
80	77	JFELion		47.53	3618.77	7168.23	7215.76	123.20
81	78	JFELion		45.74	3664.51	7122.49	7168.23	124.76
82	79	JFELion		46.72	3711.23	7075.77	7122.49	126.35
83	80	JFELion		47.43	3758.66	7028.34	7075.77	127.97
84	81	JFELion		46.23	3804.89	6982.11	7028.34	129.54
85	82	JFELion		47.56	3852.45	6934.55	6982.11	131.16
86	83	JFELion		47.17	3899.62	6887.38	6934.55	132.76
87	84	JFELion		46.64	3946.26	6840.74	6887.38	134.35
88	85	JFELion		47.16	3993.42	6793.58	6840.74	135.96
89	86	JFELion		46.17	4039.59	6747.41	6793.58	137.53
90	87	JFELion		45.88	4085.47	6701.53	6747.41	139.09
91	88	JFELion		47.62	4133.09	6653.91	6701.53	140.71
92	89	JFELion		47.50	4180.59	6606.41	6653.91	142.33
93	90	JFELion		47.29	4227.88	6559.12	6606.41	143.94
94	91	JFELion		47.71	4275.59	6511.41	6559.12	145.56
95	92	JFELion		47.43	4323.02	6463.98	6511.41	147.18
96	93	JFELion		45.45	4368.47	6418.53	6463.98	148.73
97	94	JFELion		47.13	4415.60	6371.40	6418.53	150.33
98	95	JFELion		47.62	4463.22	6323.78	6371.40	151.95
99	96	JFELion		46.67	4509.89	6277.11	6323.78	153.54
100	97	JFELion		47.56	4557.45	6229.55	6277.11	155.16
101	98	JFELion		44.73	4602.18	6184.82	6229.55	156.68
102	99	JFELion		47.63	4649.81	6137.19	6184.82	158.30
103	100	JFELion		46.59	4696.40	6090.60	6137.19	159.89
104	101	JFELion		46.96	4743.36	6043.64	6090.60	161.49
105	102	JFELion		46.49	4789.85	5997.15	6043.64	163.07
106	103	JFELion		47.29	4837.14	5949.86	5997.15	164.68

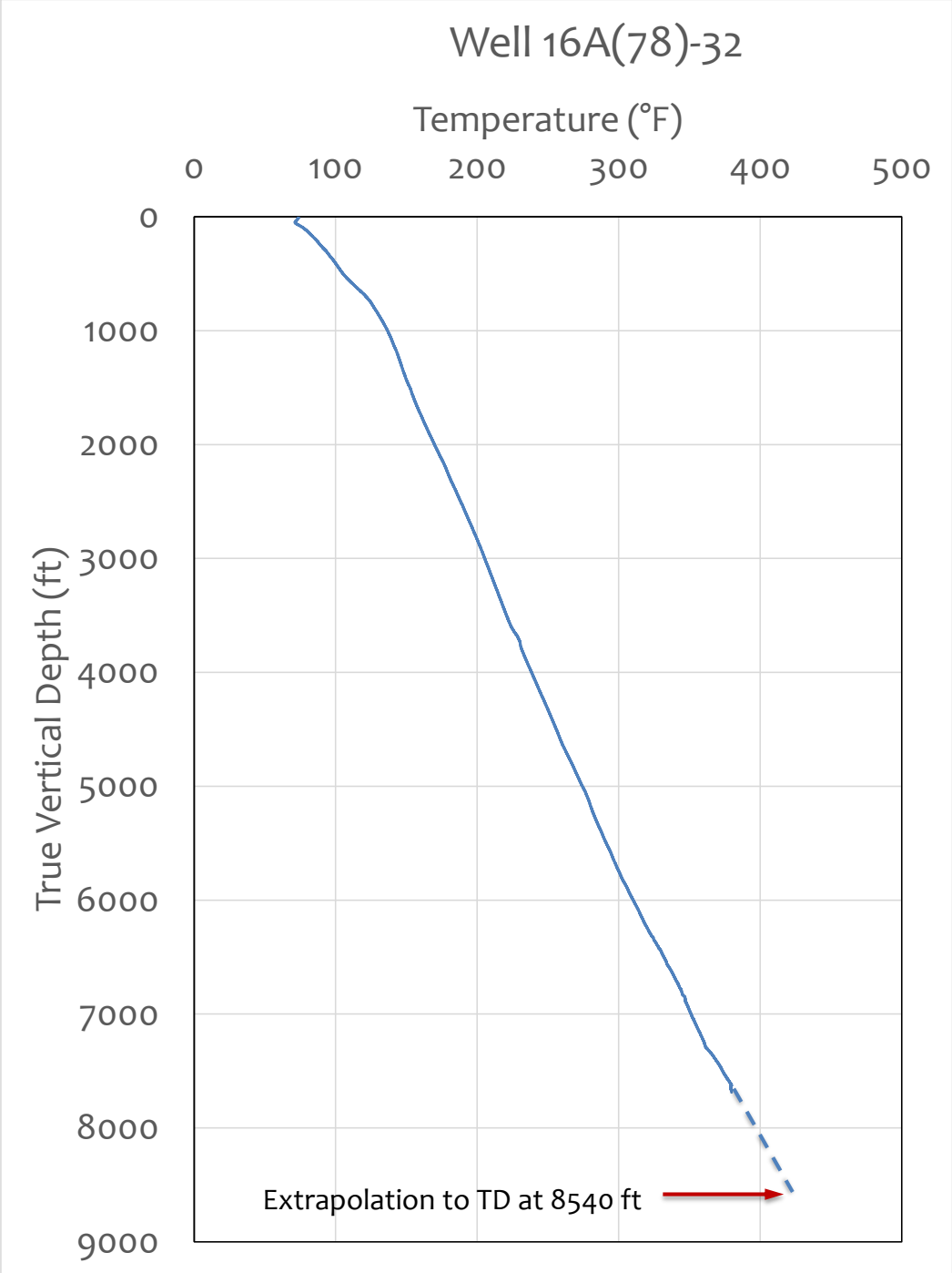
107	104	JFELion		37.13	4874.27	5912.73	5949.86	165.95	
108	105	JFELion		46.35	4920.62	5866.38	5912.73	167.52	
109	106	JFELion		47.29	4967.91	5819.09	5866.38	169.13	
110	107	JFELion		45.48	5013.39	5773.61	5819.09	170.68	
111	108	JFELion		46.61	5060.00	5727.00	5773.61	172.27	
112	109	JFELion		47.08	5107.08	5679.92	5727.00	173.87	
113	110	JFELion		47.30	5154.38	5632.62	5679.92	175.48	
114	111	JFELion		45.56	5199.94	5587.06	5632.62	177.03	
115	112	JFELion		47.73	5247.67	5539.33	5587.06	178.66	
116	113	JFELion		47.28	5294.95	5492.05	5539.33	180.27	
117	114	JFELion		45.68	5340.63	5446.37	5492.05	181.82	
118	115	JFELion		45.87	5386.50	5400.50	5446.37	183.39	
119	116	JFELion		47.60	5434.10	5352.90	5400.50	185.01	
120	117	JFELion		46.33	5480.43	5306.57	5352.90	186.58	
121	118	JFELion		47.81	5528.24	5258.76	5306.57	188.21	
122	119	JFELion		47.31	5575.55	5211.45	5258.76	189.82	
123	120	JFELion		47.12	5622.67	5164.33	5211.45	191.43	
124	121	JFELion		47.02	5669.69	5117.31	5164.33	193.03	
125	122	JFELion		47.05	5716.74	5070.26	5117.31	194.63	
126	123	JFELion		45.55	5762.29	5024.71	5070.26	196.18	
127	124	JFELion		47.56	5809.85	4977.15	5024.71	197.80	
128	125	JFELion		47.11	5856.96	4930.04	4977.15	199.40	
129	126	JFELion		47.37	5904.33	4882.67	4930.04	201.02	
130	127	JFELion		15.05	5919.38	4867.62	4882.67	201.53	PUP JOINT
131	128	JFELion		46.85	5966.23	4820.77	4867.62	203.12	
132	129	JFELion		47.90	6014.13	4772.87	4820.77	204.75	
133	130	JFELion		46.96	6061.09	4725.91	4772.87	206.35	
134	131	JFELion		47.62	6108.71	4678.29	4725.91	207.97	
135	132	JFELion		47.37	6156.08	4630.92	4678.29	209.59	
136	133	JFELion		46.69	6202.77	4584.23	4630.92	211.18	
137	134	JFELion		47.58	6250.35	4536.65	4584.23	212.80	
138	135	JFELion		47.29	6297.64	4489.36	4536.65	214.41	
139	136	JFELion		47.61	6345.25	4441.75	4489.36	216.03	
140	137	JFELion		47.43	6392.68	4394.32	4441.75	217.64	
141	138	JFELion		46.10	6438.78	4348.22	4394.32	219.21	
142	139	JFELion		47.43	6486.21	4300.79	4348.22	220.83	
143	140	JFELion		46.90	6533.11	4253.89	4300.79	222.42	
144	141	JFELion		45.80	6578.91	4208.09	4253.89	223.98	

145	142	JFELion		47.40	6626.31	4160.69	4208.09	225.60
146	143	JFELion		47.29	6673.60	4113.40	4160.69	227.21
147	144	JFELion		46.79	6720.39	4066.61	4113.40	228.80
148	145	JFELion		45.35	6765.74	4021.26	4066.61	230.34
149	146	JFELion		47.55	6813.29	3973.71	4021.26	231.96
150	147	JFELion		46.62	6859.91	3927.09	3973.71	233.55
151	148	JFELion		47.57	6907.48	3879.52	3927.09	235.17
152	149	JFELion		46.87	6954.35	3832.65	3879.52	236.76
153	150	JFELion		47.16	7001.51	3785.49	3832.65	238.37
154	151	JFELion		46.74	7048.25	3738.75	3785.49	239.96
155	152	JFELion		47.62	7095.87	3691.13	3738.75	241.58
156	153	JFELion		47.69	7143.56	3643.44	3691.13	243.21
157	154	JFELion		46.88	7190.44	3596.56	3643.44	244.80
158	155	JFELion		47.72	7238.16	3548.84	3596.56	246.43
159	156	JFELion		47.63	7285.79	3501.21	3548.84	248.05
160	157	JFELion		47.10	7332.89	3454.11	3501.21	249.65
161	158	JFELion		47.74	7380.63	3406.37	3454.11	251.28
162	159	JFELion		47.62	7428.25	3358.75	3406.37	252.90
163	160	JFELion		46.89	7475.14	3311.86	3358.75	254.49
164	161	JFELion		46.36	7521.50	3265.50	3311.86	256.07
165	162	JFELion		47.41	7568.91	3218.09	3265.50	257.69
166	163	JFELion		46.96	7615.87	3171.13	3218.09	259.29
167	164	JFELion		46.28	7662.15	3124.85	3171.13	260.86
168	165	JFELion		47.72	7709.87	3077.13	3124.85	262.49
169	166	JFELion		47.04	7756.91	3030.09	3077.13	264.09
170	167	JFELion		47.30	7804.21	2982.79	3030.09	265.70
171	168	JFELion		45.87	7850.08	2936.92	2982.79	267.26
172	169	JFELion		47.26	7897.34	2889.66	2936.92	268.87
173	170	JFELion		47.57	7944.91	2842.09	2889.66	270.49
174	171	JFELion		46.11	7991.02	2795.98	2842.09	272.06
175	172	JFELion		47.73	8038.75	2748.25	2795.98	273.68
176	173	JFELion		47.41	8086.16	2700.84	2748.25	275.30
177	174	JFELion		46.96	8133.12	2653.88	2700.84	276.90
178	175	JFELion		46.39	8179.51	2607.49	2653.88	278.48
179	176	JFELion		47.04	8226.55	2560.45	2607.49	280.08
180	177	JFELion		47.31	8273.86	2513.14	2560.45	281.69
181	178	JFELion		46.30	8320.16	2466.84	2513.14	283.26
182	179	JFELion		46.44	8366.60	2420.40	2466.84	284.84

183	180	JFELion		47.32	8413.92	2373.08	2420.40	286.46
184	181	JFELion		46.65	8460.57	2326.43	2373.08	288.04
185	182	JFELion		46.70	8507.27	2279.73	2326.43	289.63
186	183	JFELion		45.79	8553.06	2233.94	2279.73	291.19
187	184	JFELion		47.28	8600.34	2186.66	2233.94	292.80
188	185	JFELion		46.18	8646.52	2140.48	2186.66	294.37
189	186	JFELion		47.42	8693.94	2093.06	2140.48	295.99
190	187	JFELion		46.22	8740.16	2046.84	2093.06	297.56
191	188	JFELion		45.81	8785.97	2001.03	2046.84	299.12
192	189	JFELion		47.43	8833.40	1953.60	2001.03	300.74
193	190	JFELion		47.63	8881.03	1905.97	1953.60	302.36
194	191	JFELion		47.36	8928.39	1858.61	1905.97	303.97
195	192	JFELion		46.69	8975.08	1811.92	1858.61	305.56
196	193	JFELion		46.04	9021.12	1765.88	1811.92	307.13
197	194	JFELion		47.01	9068.13	1718.87	1765.88	308.73
198	195	JFELion		45.87	9114.00	1673.00	1718.87	310.29
199	196	JFELion		46.31	9160.31	1626.69	1673.00	311.87
200	197	JFELion		46.18	9206.49	1580.51	1626.69	313.44
201	198	JFELion		47.31	9253.80	1533.20	1580.51	315.05
202	199	JFELion		47.33	9301.13	1485.87	1533.20	316.66
203	200	JFELion		46.12	9347.25	1439.75	1485.87	318.23
204	201	JFELion		46.45	9393.70	1393.30	1439.75	319.81
205	202	JFELion		45.70	9439.40	1347.60	1393.30	321.37
206	203	JFELion		47.66	9487.06	1299.94	1347.60	322.99
207	204	JFELion		47.59	9534.65	1252.35	1299.94	324.61
208	205	JFELion		47.00	9581.65	1205.35	1252.35	326.21
209	206	JFELion		47.25	9628.90	1158.10	1205.35	327.82
210	207	JFELion		47.65	9676.55	1110.45	1158.10	329.44
211	208	JFELion		46.62	9723.17	1063.83	1110.45	331.03
212	209	JFELion		46.48	9769.65	1017.35	1063.83	332.61
213	210	JFELion		47.62	9817.27	969.73	1017.35	334.23
214	211	JFELion		47.24	9864.51	922.49	969.73	335.84
215	212	JFELion		45.89	9910.40	876.60	922.49	337.40
216	213	JFELion		47.48	9957.88	829.12	876.60	339.02
217	214	JFELion		47.71	10005.59	781.41	829.12	340.64
218	215	JFELion		46.61	10052.20	734.80	781.41	342.23
219	216	JFELion		47.33	10099.53	687.47	734.80	343.84
220	217	JFELion		46.62	10146.15	640.85	687.47	345.43

221	218	JFELion		47.02	10193.17	593.83	640.85	347.03
222	219	JFELion		47.56	10240.73	546.27	593.83	348.65
223	220	JFELion		44.77	10285.50	501.50	546.27	350.17
224	221	JFELion		47.28	10332.78	454.22	501.50	351.78
225	222	JFELion		47.62	10380.40	406.60	454.22	353.41
226	223	JFELion		46.72	10427.12	359.88	406.60	355.00
227	224	JFELion		46.63	10473.75	313.25	359.88	356.58
228	225	JFELion		46.30	10520.05	266.95	313.25	358.16
229	226	JFELion		45.32	10565.37	221.63	266.95	359.70
230	227	JFELion		47.65	10613.02	173.98	221.63	361.33
231	228	JFELion		47.06	10660.08	126.92	173.98	362.93
232	229	JFELion		47.59	10707.67	79.33	126.92	364.55
233	230	JFELion		47.20	10754.87	32.13	79.33	366.15
234	231	JFELion		0.00	10754.87	32.13	32.13	366.15
235	232	JFELion		0.00	10754.87	32.13	32.13	366.15
236	233	JFELion		0.00	10754.87	32.13	32.13	366.15
237	234	JFELion		0.00	10754.87	32.13	32.13	366.15
238	235	JFELion		0.00	10754.87	32.13	32.13	366.15
239	236	JFELion		0.00	10754.87	32.13	32.13	366.15
240	237	JFELion		0.00	10754.87	32.13	32.13	366.15
241	238	JFELion		0.00	10754.87	32.13	32.13	366.15
242	112	JFELion		0.00	10754.87	0.00	0.00	366.15
243	113	BTC X JFELion						
244	114	Landing Joint-BTC		0.00	#VALUE!	#VALUE!	#VALUE!	#VALUE!

Appendix D: Static Temperature Profile (after 57 days SI)



Appendix E: DFIT January 2021[7]

In January 2021, a highly deviated injection well, 16A(78)-32, was completed at a total depth of 10,987 ft. The injection well, 16A(78)-32, is highly deviated and is the first of its kind in granitic rock. Drilling of the well was completed in January 2021. The trajectory of well 16A(78)-32 is shown in Figure E-1. This well was drilled on an azimuth of 105° (relative to true north) at a tangent of 65° to the vertical. The well kicked off (the location where directional drilling operations commenced) at 5892 ft measured depth (MD) and started to build at 5°/100 ft until it reached 65°. The production casing shoe is at 10,787 ft MD, and there is a 200 ft openhole section behind it. The total depth (TD) of the well is 10,987 ft. True vertical depth (TVD) at the toe is 8560 ft and the static bottomhole temperature is on the order of 446 °F (230 °C). The horizontal offset is 4074 ft.

Before cementing, 200 ft of 100 mesh sand were spotted at the toe. The casing was run to a setting depth of 10,787 ft MD. A liner hanger was run but failed to set. The liner was pulled, the cement program was redesigned, and the casing was cemented from 10,787' back to the surface, as a long string. The float equipment was drilled out and the sand washed out of the hole, leaving 200 ft of hole available for stress testing.

A packer was run into the hole to isolate the casing. Upon dropping the ball, the packer did not properly set. The planned test procedure was continued using the full annual volume as a dead string. The stages pumped were a low rate microfrac (Figure E-2), a diagnostic fracture injection test (DFIT) with shut-in (Figure E-2 and E-3), a pump-in with flowback (Figure E-3), and a DFIT with the annulus open to the atmosphere. The first three test cycles provided reliable in situ information. *The fourth cycle confirmed that the packer had not sealed.* The specifics of each stage of the injection are as follows.

Cycle 1 was a microhydraulic fracturing test with a low pumping rate (less than 0.6 bpm). During the test, the pumping rate was gradually increased from 0.2 bpm to 0.5 bpm. The shut-in time was relatively short, only 0.5 hours. Cycle 2 was a DFIT with a modest pumping rate of 5.0 bpm that was maintained for 2.5 minutes after rate stabilization. The injected volume was 18.1 bbl. The shut-in time was 17.5 hours. Cycle 3 was a pump-in/flowback test. Flowback test has a potential advantage over an extended shut-in test, in that it can reduce the operation time from days to hours. The pumping procedure during Cycle 3 was similar to Cycle 2; the protocol was injection at 5.0 bpm for about 3 minutes. Immediately after pumping, there was a flowback with a through a 1/64" choke size instead of a prolonged shut-in. After 30 seconds of

[7] Excerpted from GRC paper Xing et al., 2021.

flowback, a three-minute shut-in followed. Then this flowback/shut-in sub-cycle was repeated until the surface pressure was reduced below 500 psi.

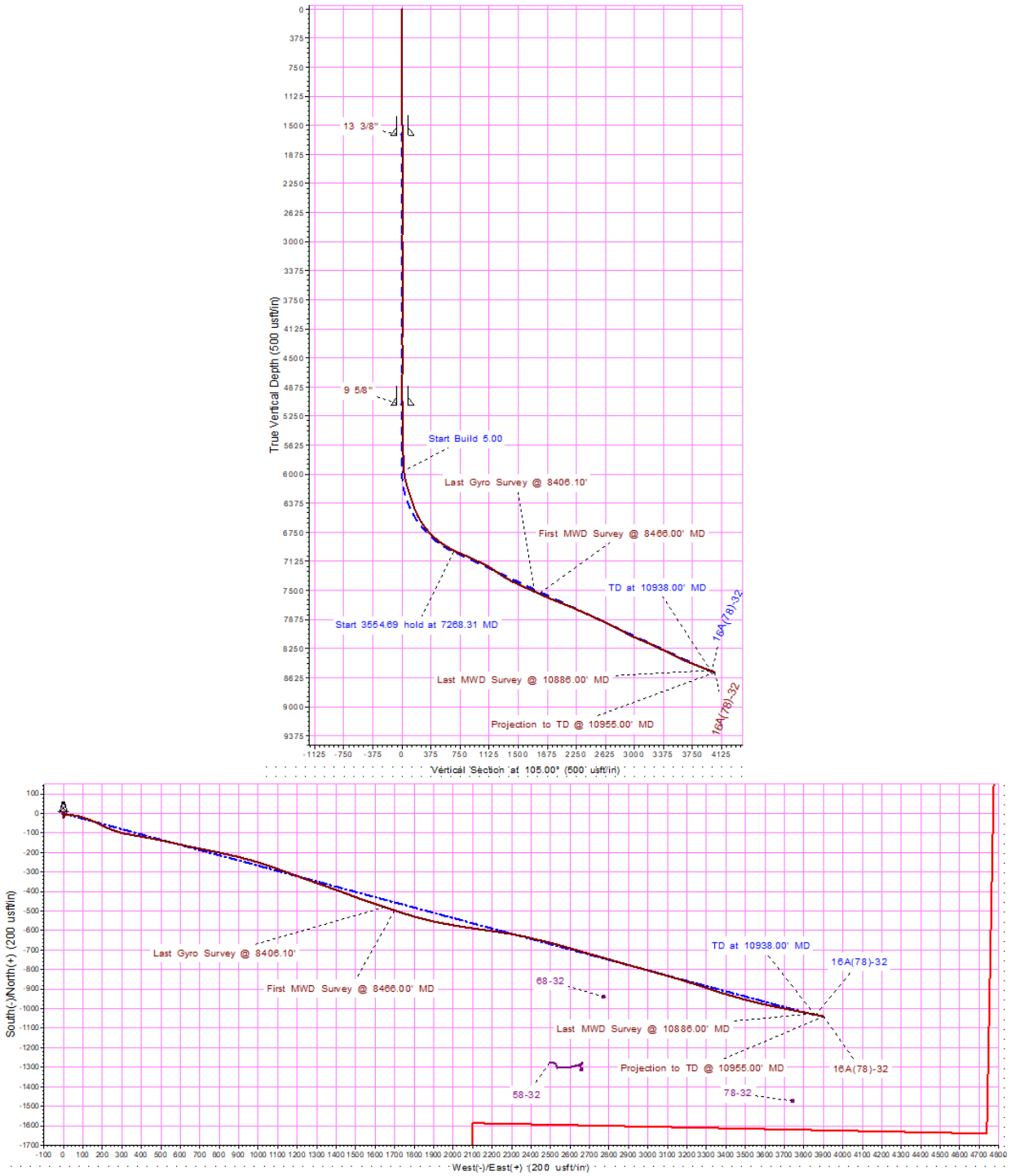


Figure E-1. The trajectory of well 16A(78)-32. The top panel is the directional profile (approximate elevation view), and the bottom panel is the plan view of trajectory at TD before coring.

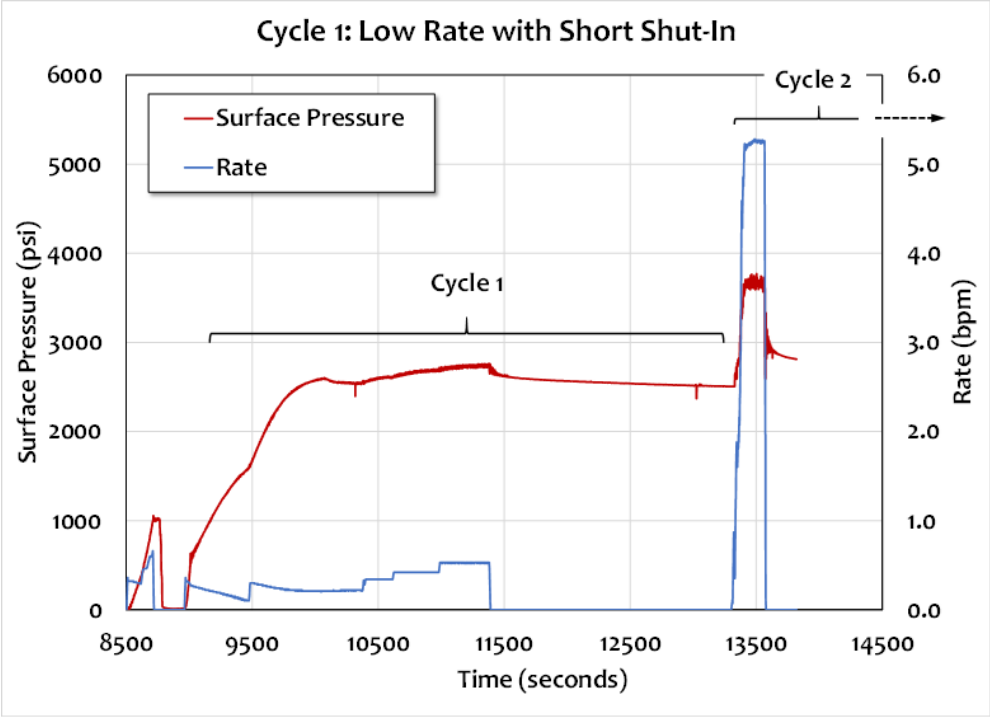


Figure E-2. This is a plot of surface pressure and rate for the first cycle (at rates up to 0.5 bpm), followed by a brief shut-in and then the injection portion of the standard DFIT test and the first part of the shut-in for that cycle.

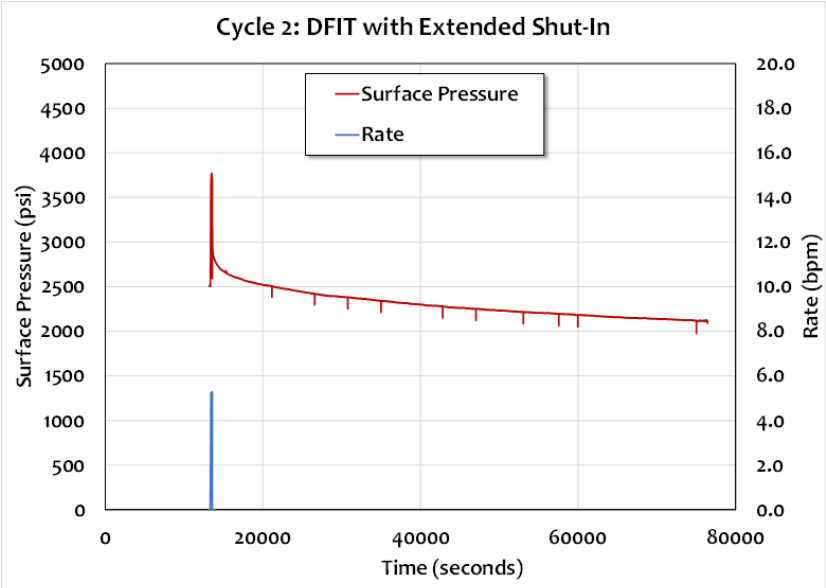


Figure E-2. This is a plot of surface pressure and rate for Cycle 2 (pumping at 5 bpm for 2.5 minutes after rate stabilization), followed by a prolonged shut-in (about 17.5 hr).

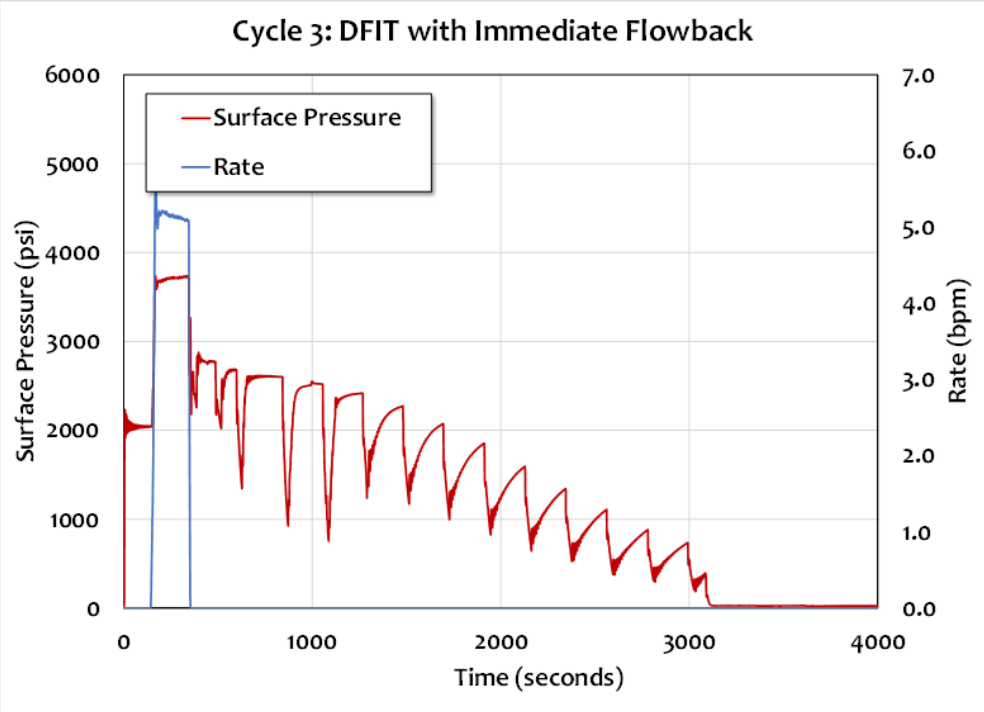


Figure E-3. This is a plot of surface pressure and rate for the third cycle (pumping at 5 bpm for 3 minutes after rate stabilization), followed by a flowback sequence through a 1/64-inch choke (flow for 30 seconds followed by a three-minute shut-in, repeatedly).

Table E-1. Summary of closure stress interpretations for the openhole section of well 16A(78)-32 (TVD 8490 ft)

Cycle	Test Type	Interpretation method	Surface pressure (psi)	Closure stress (psi)	Closure stress gradient (psi/ft)
C1	Microhydraulic fracturing	Reopening pressure	2481	6157	0.73
C1	Microhydraulic fracturing	ISIP	2654	6330	0.75
C1	Microhydraulic fracturing	p vs. $\sqrt{t}$	2536	6212	0.73
C1	Microhydraulic fracturing	Step rate	2432	6108	0.72
C2	DFIT	log-log	2613	6289	0.74
C2	DFIT	G-function	2662	6338	0.75

C3	Pump-in/flowback	Flowback stiffness	2342	6018	0.71
C3	Pump-in/flowback	RNP vs MBT	2543	6219	0.73

There was only surface pressure recorded during the injection testing. The corresponding bottomhole pressure associated with fracture closure can be calculated by adding hydrostatic pressure to the surface pressure. The hydrostatic pressure gradient is 0.433 psi/ft and TVD is 8490 ft corresponding to the beginning of the open hole. Hence, the hydrostatic pressure is 3676 psi.

Permeability, inferred from before-closure analysis for Cycle 2 (DFIT), is 21 μD, which is approximately the maximum value measured on core from offset well 58-32. The permeability-thickness product estimated from Cycle 2 is 4 mD·ft and from Cycle 3, it is 20 mD·ft.

Appendix F: Considerations for Inability to Isolate

In the event that the 7" bridge plug fails (Stage 2 or Stage 3) to provide the specified isolation (loss rate during pressure test of the bridge plug >180 psi/minute) the following considerations are recommended.

1. RIH with the 3-1/2" drill pipe open-ended to ~30 ft above the top of the bridge plug, rig-up pumping equipment to the drill pipe and circulate the required amount of 100-mesh sand for 10 ft of coverage on top of the 7" bridge plug.

    - The volume of the 7", 38 lb/ft T-95 casing is 0.765 ft^3/ft and the bulk density of 100-mesh sand is 92 lb/ft^3. For 10 ft over fill in the casing it would require (92 lb/ft^3 X 0.765 ft^3/ft X 10 ft) 704 lb of 100-mesh sand.

2. Wait for ~ 30 minutes after the 100-mesh sand is spotted to give it time to settle.

3. Perform the pressure test again to see if the leakoff rate is below 180 psi/min.

    a. If yes, POOH with the 3-1/2" drill pipe and continue with the procedure for perforating.

    b. If no, consider the option to spot an additional 10 ft of 100-mesh sand (depending on the change in leakoff rate) or RIH with a second 7" bridge plug and set just above the 100-mesh sand plug.

Note:

If this occurs at night, Liberty would not be available. The low-rate pump used for the shear stimulation test will not be able to mix and pump 100-mesh sand. We will discuss with Liberty to see if a partial crew could be available after suitable off-time to perform this operation outside of daylight hours.

Appendix G: Considerations for Inability to Breakdown

If we are not able to breakdown the perforated interval and achieve a pump rate of 5 bpm at an expected pressure based on the previous stage(s) the following considerations are recommended.

1. RIH with a second set of TCP guns and re-perforate the same interval. After verifying the guns have fired, rig-down the treating line from the drill pipe, POOH with drill pipe and recover the TCP gun and equipment from the drill pipe. Lay down guns for departure and inspection.

2. Repeat the breakdown pumping procedure.

    a. If the breakdown is successful continue with the procedure to fracture stimulate the stage as designed.

    b. If breakdown is not successful plan to circulate and spot 1,000 gal of SpearPoint HT acid at the perforations.

        Note: Prior to spotting the SpearPoint HT acid it is recommended to pickle the drill pipe to prevent any iron being picked up by the reaction of acid with the drill pipe and being injected into the formation. The procedure for performing the pickle treatment would be to pump 1,000 gal of the SpearPoint HT acid down the tubing until the leading edge of the acid reaches the end of the drill pipe. Shut down and reverse circulate by pumping water down the annulus to displace the acid out of the drill pipe and into the rig sump.

3. RIH with the 3-1/2" drill pipe open-ended to approximately 10 ft above the top of the perforated interval. Connect the pumping equipment to the drill pipe, prime-up and pressure test, and then pump 1,000 gal of SpearPoint HT acid to pickle the drill pipe as explained in the note above. After the pickle treatment is completed pump and circulate up the annulus to spot 1,000 gal of SpearPoint HT acid to the end of the drill pipe by displacing the acid with Slickwater and shut down. Close the pipe rams and resume pumping to inject (bullhead) the acid into the perforated interval with 2-3 bbl of over-flush.

4. Let the acid soak for 10-15 minutes and then repeat the breakdown pumping procedure.

    a. If the breakdown is successful POOH with the 3-1/2" drill pipe and continue with the procedure to fracture stimulate the stage as designed.

b. If the breakdown is not successful shutdown pumping and consult with the University FORGE representative on the next steps to take, including the possibility to perforate a new interval.

Appendix H. Contact Information

Medical Emergencies

Axiom	Universal	Office	877-502-9466
Sheriff	Beaver County	Office	435-438-2466
Hospital	Milford Utah	Main Number	435-387-2411
Emergency Response	Utah	24-hour Number	9-1-1
Emergency Response	Beaver County	Les Whitney	435-691-2381
Emergency Fire Department	Beaver County	24-hour Number	435-387-2222

Project Team

Dr. Joe Moore	Office	801-585-6931
Project Manager	Cell (preferred)	801-231-0393
	Email	jmoore@egi.utah.edu
Dr. John McLennan	Office	801-587-7925
Operations Manager	Cell (recommended)	801-634-4412
	Email	jmclennan@egi.utah.edu
Dr. Benjamin Barker	Cell	707 508-9963
Operations Superintendent	Email	bbarker@egi.utah.edu
Mr. Kevin England	Cell	281-731-7816
Senior Advisor	Email	kwengland@comcast.net
Mr. Garth Larsen	Cell	435-749-4015
Site Manager	Email	garth@hotrockms.com
Mr. Clay Jones	Cell	801-634-4801
Geologic Coordinator	Email	cjones@egi.utah.edu

State of Utah Contacts

Jim Goddard	Well Drilling Specialist	Office	801-538-7314
Jim Goddard	Well Drilling Specialist	Cell	801-505-8677
Jim Goddard	Well Drilling Specialist	Email	jimgoddard@utah.gov
Nathan Moses	Regional Engineer	Office	435-586-4231
Nathan Moses	Regional Engineer	Email	nathanmoses@utah.gov
Start Card	Not Required	24 Hour Number	801-538-7416

Service Providers

Service	Provider	Telephone
Access Road and Pad Construction	Rollins Construction: Kelly Rollins	435-691-0934
Automation and Data		
BOP Testing	Rig to arrange	
Bridge Plugs	Interwell	Thomas Bruce
Daily Reports		
Drilling Rig Contractor	Frontier Billy Postma	(435) 503-5765 Billy@frontierdrilling.com
Drillpipe Inspection		
EDR		
Fishing Tools		
Frac Tanks	Dalbo Holdings Inc.	
Frachead	Cameron	
Fuel	Reladyne: Blair Cropper .	435-406-1761 blair.cropper@reladyne.com
Garbage: Dumpster Services	Hughes and Sons Tiffany	(435) 421-2071 Beaver, Utah
H_2S Monitoring	Pason	
Hotshot		
Housing		
Hydraulic Fracturing	Liberty Oilfield Services	
Internet Service		
Perforating	Extreme Wireline Aaron Lamoreaux Bruno Tomaino	 (801) 633-1523 (435) 724-8031
Portable Toilets and Pumping Services		
Stimulation Consultant	Stratagen Billy Peters	
Water Hauling	Rollins Construction: Kelly Rollins	435-691-0934
Welding and Tool Building		
Wireline Logging (CCL)	Schlumberger: Erik Borchardt 1675 Broadway, Suite 900 Denver, CO 80202	Office: 303-352-1206 (preferred) EBorchardt@slb.com 24-hr dispatch is 970-867-3710 or SCDL@slb.com