EMID-701987

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Los Alamos Field Office
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Los Alamos, New Mexico 87544
(240) 562-1122

Date: April 14, 2022
Refer To: N3B-2022-0146

Ramona Martinez, District Manager
Upper Pecos Basin
Water Resource Allocation Program
Water Rights Division
New Mexico Office of the State Engineer
407 Galisteo Street
Santa Fe, NM 87504-5102

STATE ENGINEER'S OFFICE
SANTA FE, NEW MEXICO
2022 APR 14 AM 9:10

Subject: Resubmittal of Regional Aquifer Well R-73 WR-07 Permit Application and submittal of Regional Aquifer Well R-73 WD-09 Artesian Well Plan of Operations

Dear Ms. Martinez:

Enclosed are three hard copies and an electronic version of the "WR-07 Application for Permit to Drill a Well with No Water Right" form, and the "WD-09 Artesian Well Plan of Operations" form for Regional Aquifer Well R-73. Included in the submittal is the backup information as requested in the denial of the previous application for R-73 ("Regional Aquifer Well R-73 Monitoring Permit Application, OSE File No. RG-A0308," dated April 6, 2022). As required by the New Mexico Office of the State Engineer, a check for $5.00 is included.

If you have questions, please contact Christian Maupin at (505) 695-4281 (christian.maupin@em-la.doe.gov) or Cheryl Rodriguez at (505) 414-0450 (cheryl.rodriguez@em.doe.gov).

Sincerely,

for

Joseph Murdock
Program Manager
Environment, Safety and Health
N3B-Los Alamos

Sincerely,

ARTURO DURAN
Digitally signed by ARTURO DURAN
Date: 2022.04.14 12:34:37 -06'00'

Arturo Q. Duran
Office of Quality and Regulatory Compliance
U.S. Department of Energy
Environmental Management
Los Alamos Field Office

Enclosure(s): Three hard copies and one electronic copy

1. Response to the State of New Mexico Office of the State Engineer Letter, "Regional Aquifer Well R-73 Monitoring Permit Application, OSE File No. RG-A030," (Denial of Regional Aquifer Well R-73 Monitoring Permit Application), Dated April 6, 2022
2. Form WR-07 Application for Permit to Drill a Well with No Water Right
3. Form WD-09 Artesian Well Plan of Operations

cc (letter and enclosure[s] emailed):
Neelam Dhawan, NMED-HWB
Rick Shean, NMED-HWB
Chris Catechis, NMED-RPD
M. Lee Bishop, EM-LA
Thomas McCrory, EM-LA
Michael Mikolanis, EM-LA
David Nickless, EM-LA
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**Response to the State of New Mexico Office of the State Engineer Letter,
"Regional Aquifer Well R-73 Monitoring Permit Application, OSE File No. RG-A030,"
(Denial of Regional Aquifer Well R-73 Monitoring Permit Application),
Dated April 6, 2022**

INTRODUCTION

To facilitate review of this response, the State of New Mexico Office of the State Engineer (NMOSE) comments are included verbatim. The U.S. Department of Energy (DOE) Environmental Management Los Alamos Field Office responses follow each NMOSE comment.

COMMENTS

NMOSE Comment

1. *As the annular dimensions change in relation to the size of the open-borehole and the "centralizers" being placed at 120 degrees from each other, it will need to be demonstrated how casing will maintain the minimum distance in the variance request.*

DOE Response

1. DOE is not requesting a variance and has provided information in Attachment A demonstrating how the minimal annular space requirement will be met. Following the calculations provided by the NMOSE, DOE has increased the size of the caster assembly to create a minimum of 2 in. between the well casing and the 14-in. and 16-in. drive casings. In addition, Attachment A provides a description of the well construction process demonstrating that the casters are designed to center the well casing in the drive casing during construction of the well, while the annular fill materials support the well casing as the drive casing is removed.

NMOSE Comment

2. *Packer design specifications including but not limited to weight and seating pressure.*

DOE Response

2. DOE has provided the design specifications for the packer in Attachment B.

NMOSE Comment

3. *Production tubing specifications including but not limited to type of materials, pounds per foot and tensional hanging forces.*

DOE Response

3. DOE has provided the tubing specification in Attachment C.

NMOSE Comment

4. Pump specification including but not limited to manufacturer, type, weight, and torque.

DOE Response

4. DOE has provided the pump specification in Attachment D. Although the appropriate pump will be selected based on the results of an aquifer test in the completed well, two likely candidate pumps are highlighted for NMOSE consideration.

Attachments to the Response

N3B Los Alamos

Attachment A

DISCUSSION

Clearance between the well casing and the borehole wall is created by installation of the well casing within the 14-inch drive casing and maintained by the annular fill material as the drive casing is incrementally removed. This document explains how the incremental well construction process centers the well casing in the borehole and provides calculations for the expected annular space for the planned construction method (**Figure 1**) and for an extreme scenario where the 14-inch drive casing is not used to center the well casing during installation (**Figure 2**). An updated design for a 2.75-inch caster is presented in **Figure 3**.

During the installation process the drive casing will be driven to a depth of 1300 feet. It is estimated that a minimum range of 825 feet to 1300 feet will comprise a 14-inch drive casing in a 16-inch borehole. The drive casing will then be filled with bentonite pellets to a depth of 5 feet from the estimated total depth (bottom of the borehole), at which point the drive casing will be pulled up 3 feet from the bottom of the borehole. The pellets will fill the annular space left by the removal of the drive casing and maintain the central location of the well casing. The process of filling the interior of the drive casing with a few feet of bentonite pellets or filter pack or transition sand, and then raising the drive casing a few feet, will be repeated until the 16-inch drive casing/18-inch borehole segment is reached. The force of the ~500-ft of annular fill material locks the well casing in a centered position in the borehole.

The process will be repeated for the 16-inch segment, between the depths of an estimated maximum of 825 feet and ~375 feet. Between ~375 and 100 feet, the 18-inch segment will be pulled using the same method. Finally, at approximately 60-foot depth, the remaining annular space will be filled with neat, type I/II Portland cement while pulling the 20-inch drive casing.

Because of the nature of the installation process, the casing will be supported throughout. On one end, the drill rig acts as a simple support and maintains tension through the length of the casing. On the other end, the first ~500 feet of pipe is secured with no issues as the 14-inch drive casing is removed. This creates a cantilever support for the remaining ~800 feet of pipe. The tension created by the drill rig reduces sagging in the pipe, while the cantilever end provides additional support and removes some of the load. As the fill process continues, more of the pipe is locked in and the load continuously decreases, decreasing sag. As the top end of the well casing is held in tension by the drill rig, no calculations for deflection of the well casing at ground surface are presented.

Figure 1 shows a cross section of the borehole, drive casing, and well casing assuming that the 14-inch drive casing and casters center the well casing. As shown in **Figure 1**, this annular space is ~3.625 inches at the top well bore in the 16-inch borehole and ~3.125 inches at the bottom of the well bore. Using NMOSE's maximum deflection calculation for the casing, 0.066 inches, the casing maintains a minimum 3.059-inch distance from the borehole between the casters, well above the required 2 inches on the bottom side of the borehole.

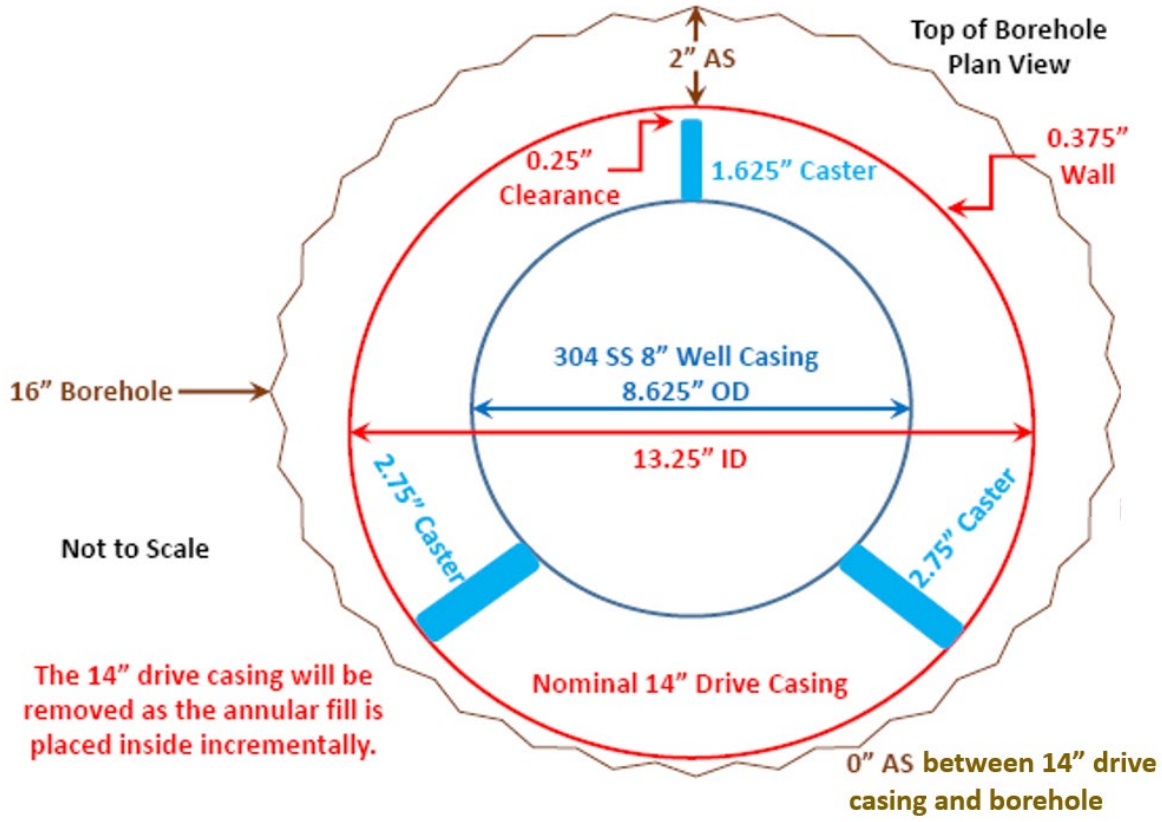


Figure 1: Plan View of Borehole and Casings (2.75-inch casters on the bottom)

Figure 2 presents the absolute minimum annular space between the well casing and the 16-inch well bore, assuming the extreme case where the 14-inch drive casing is not used during well construction and the annular fill provide no support for the well casing within the 16-inch borehole. These calculations are based on caster assembly length is 2.75-inch, increased from 2.5-inch in order to increase the distance (l) to a minimum of 2-inch.

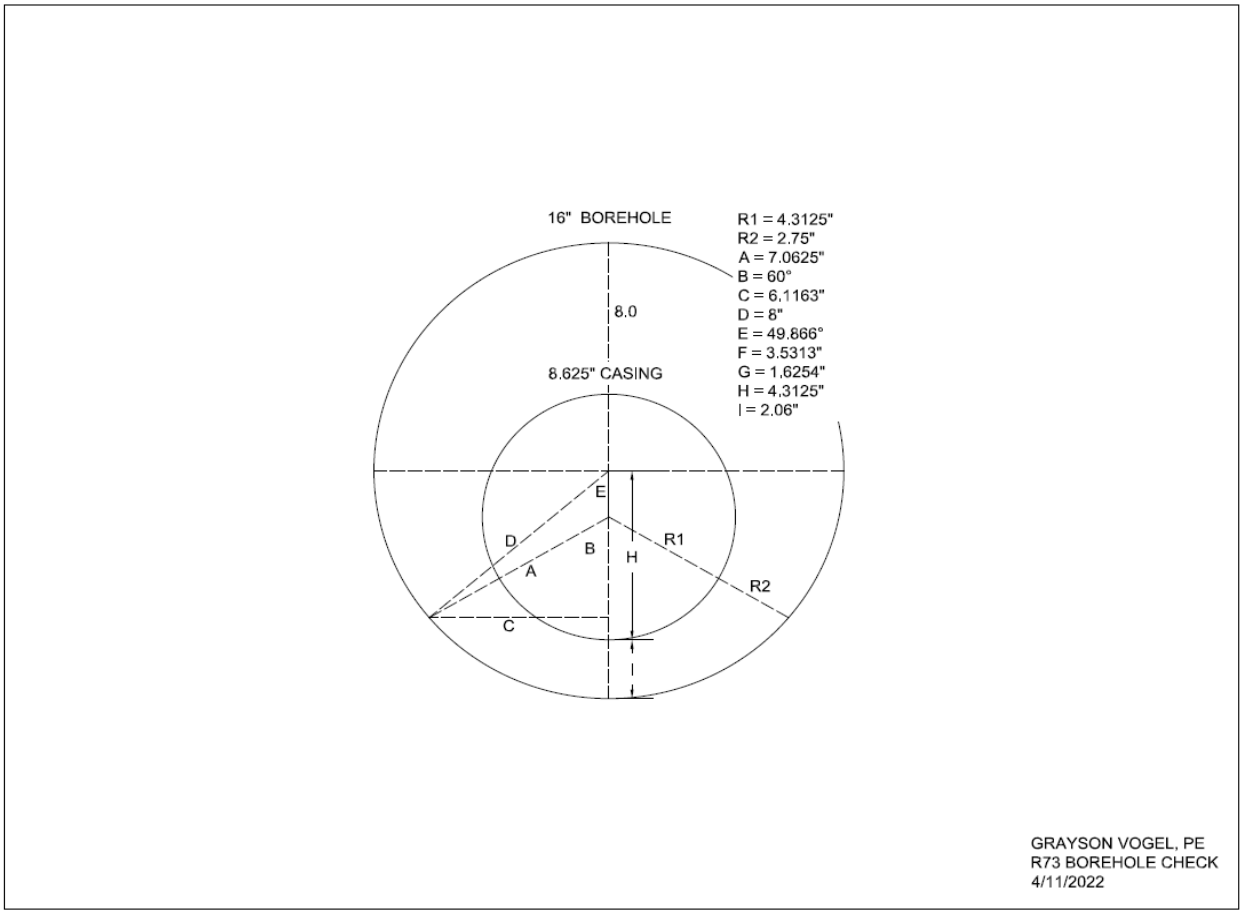


Figure 2: 16" Borehole (assume no drive casing used during annular fill placement and 2.75-inch casters)

Figure 3 presents the updated pipe caster design with an increased standoff of 2.75-inch to ensure a 2-inch minimum annular space between the well casing and the 16-inch borehole.

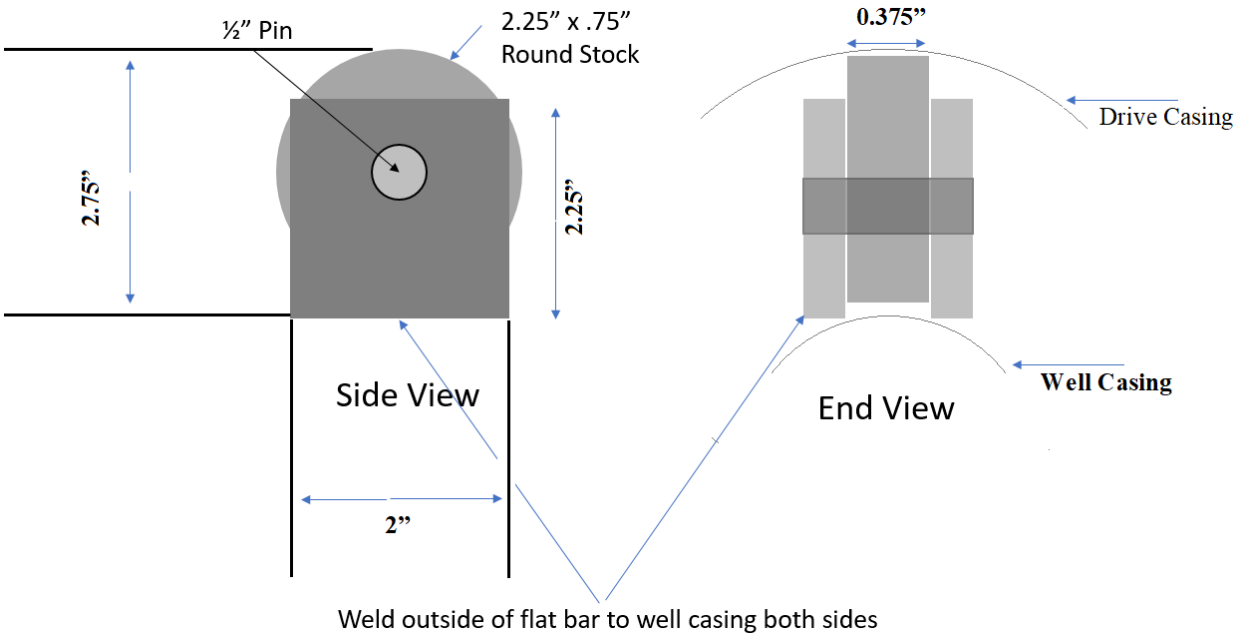


Figure 3: 2.75-Inch Standoff Pipe Casters

N3B Los Alamos

Attachment B

CUSTOMER: Tetra Tech, Inc Los Alamos National Laboratory WELL # R-70
INVOICE #12562 SERIAL #30391

This packer has a 2.375" OD x 0.218" wall type 304 stainless steel through pipe with NUE 10-round threads: Do not exceed 5,000 pounds of pull or push, or a joint may fail. Know the joint strengths of all connections: the pipe string is only as strong as its weakest joint. Do not exceed the maximum Borehole Differential Pressure Rating (BDPR). This packer has a Viton (DuPont) cover. Use care in handling so the cover is not cut or torn. This packer is for use in 8" ID casing. Do not use in open boreholes. All metal parts are 304 and 316 stainless steel.

Casing ID or Borehole Diameter (inches)	Pressure to Stretch Rubber Element to Casing or Borehole (psi)	1) This packer has been proof tested to 300 psi in a 8.0" ID pipe without apparent leakage or damage. 2) Do not exceed the following maximum Borehole Differential Pressure Rating.
8.0	50	125 psi Borehole Differential Pressure Rating

Call **1-800-55-BASKI** or **(303) 789-1200** if you have any questions.

The **borehole differential pressure** is the difference between the test zone pressure below the packer and the borehole pressure above the packer. The pumping drawdown and the downhole injection pressure over the static water level in a well are two examples of borehole differential pressure. The above estimate of this packer's Borehole Differential Pressure Rating is based on a friction coefficient of 0.25. But **caution** should be exercised! Bacterial and mold slimes reduce the friction coefficient, and the Borehole Differential Pressure Rating could be lower.

The packer inflation pressure is not the same as the Borehole Differential Pressure Rating. The minimum inflation pressure, at the packer, is the sum of the pressures necessary to **1)** match the water pressure above the packer (submergence pressure) or to match an injection pressure, **2)** stretch the rubber element out to the borehole wall **(see the above table)**, and **3)** seat the packer firmly against the well casing or borehole wall to prevent any movement caused by the borehole differential pressure.

For the above hole size **only**, 10 psi seating pressure will hold approximately 50 psi borehole differential pressure, based on a friction coefficient of 0.25. In other words, seating pressure is approximately the **borehole differential pressure divided by 5**. Again, use **caution!** Bacterial and mold slimes reduce the friction coefficient. The result is that the same 10 psi seating pressure will hold l**ess** borehole differential pressure across the packer than stated above. If you suspect the presence of bacterial and mold slimes, you may wish to divide by a smaller number to increase the seating pressure (e.g., 3).

PACKER DESCRIPTION

You have purchased a Baski Inflatable Packer. This is a fixed head packer with Multi-Ply™ reinforcement the entire length of the element. This fully reinforced ReFlex™ (Pat. Pend.) packer design represents the latest in industry developments. Tire and hose manufacturers use reinforcement in rubber to increase the strength and durability of the end products. The choice of reinforcement is industry specific, and is based on the performance needed. As packer manufacturers, we have developed the optimum combination of reinforcement and rubber for abrasion resistance and high pressure ratings. And this packer is resistant to permanent deformation. Resistance to permanent deformation means that the packer returns to its original outside diameter, even after many inflations in the packer's largest recommended hole size. Multi-Ply™ construction results in a thicker element, with up to a 1/2" thick reinforcement, which resists puncture and abrasion. Our Multi-Ply™ element construction conforms to strict quality control measures to assure rugged performance in the field. The reinforcement on the ends of this element prevents the extrusion, and failure, of the rubber element into the annular area between the outside diameter of the packer and the inside diameter of the casing. This is a common mode of failure for packers without reinforcing (the so called "balloon" type packers).

Other features include: 1) Metal components of the packer are stainless steel, 300 series; 2) the fully reinforced element is attached to the metal parts by crimping metal collars onto the element ends: a proven method used with rotary hoses and hydraulic fittings; 3) This packer has been proof tested to 300 psi in a 8.0" ID chamber; 4) the outer cover is a fluoro elastomer (like DuPont's Viton); the rest of the element is natural rubber; 5) this is a bulkhead style packer and will pass 8 1/4" OD (max) tubes or wires between the 2.375" OD through pipe, and the ID of the mandrel upon which the packer is built.

This Baski Inflatable Packer should provide long, excellent service when properly used and cared for. With proper care, you should not need to disassemble this packer. Nevertheless, should the need arise, please call our factory for assistance.

There are several numbers stamped on the ends of the packer. To track your packer, we need the FIVE digit number (including any decimals). This number may appear as 10125, or 10125.1, or 10125.4. This number represents our invoice number, and, in decimal extensions, multiple packers sold on the same invoice. This number also appears on the title pages of these instructions. Other FIVE digit numbers are internal quality control codes. Examples are "22355" and "24665". These never have decimal extensions. Not all packers will have the five-digit coding stamped on the end. Besides the above, packers are stamped with their highest working pressure (e.g., "100 psi. Pressures may also be expressed as "100 psi proof", showing the pressure to which the packer was proof tested. The customer decides the working pressure by applying a safety factor to the proof pressure.

This packer is for use in casing. This packer should never be used in open boreholes or in casing larger than 8.0” ID.

JOB PREPARATION

It is important to read the introductory pages with this packer's specific invoice and serial number for safety warnings, equipment pressure ratings and joint strength. Read these Packer Instructions carefully and follow any examples provided. Everything on these pages should be addressed and thoroughly understood before proceeding. In particular, you should get an idea of the packer's inflation pressure. If there are any questions about inflation pressure for the packers, it is best to resolve them now, before going out in the field. Call our factory for assistance if necessary; our trained staff in Technical Services will be happy to help.

For a successful packer application, consider the following: The packer that you plan to use must have an adequate Borehole Differential Pressure Rating for your job. The outside diameter of the packer must be small enough to fit through the smallest part of your casing, screen, borehole, pitless adapter, etc. Also, the hole size, where the packer is set, must be within the range of the packer's recommended hole sizes. A packer is not as strong in its largest recommended hole size as in smaller holes.

Blow out inflation tubing before connecting it to the packer. This should insure that there is no dirt to clog inflation lines, making inflation or deflation of the packer difficult or impossible. It is best to use filters to insure that the gas (or liquid) inflation fluids are clean. This is not generally a problem with gas inflation because of the large inflation ports incorporated into the design of the packer ends. However, with liquid inflation, on deep sets, every precaution should be taken to reduce the risk of inflation line blockage. All tubing, connection fittings, gauges, filters, etc. should have pressure ratings consistent with the pressures for which the packer is designed.

This packer has precision, lathe-cut threads. The packer may be tightened into the downhole string by applying wrenches to the 1" through pipe. DO NOT APPLY WRENCHES ONTO THE PACKER ITSELF.

Know the hanging string weight and record it. As the packers and other equipment are lowered into the hole, carefully watch the weight gauges for any indication that the string is hung up in the hole.

Once the packer is at the desired depth, you must calculate inflation pressures. The introductory pages, with warnings and specifications, provide information on inflation pressures. This information is used on packer inflation pressure worksheets (if any) that are supplied.

ADDITIONAL COMMENTS REGARDING LANL WELL R-70 SAMPLING SYSTEM

The "R70.pdf" drawing shows the configuration of the well. "R70 Assembly.pdf" is a print that will guide you in assembling the sampling system. Each component, tubing line, and fitting in "R70 Assembly.pdf" is referenced to the packing list by a line item number. Numbers in parentheses are quantities of that part used at a given location.

The 4 pump leads pass through the top head of the pump shroud by way of 3/16" tube x 1/4" male NPT stainless steel Swagelok drill through fittings. The ferrules in each fitting are replaced with two 2-104 o-rings. The nut on a drill-through fitting should be tightened just past finger tight. Do not over tighten the drill through fittings. Make sure all unused ports are plugged on the packer head, the liquid inflation chamber, and the pump shroud.

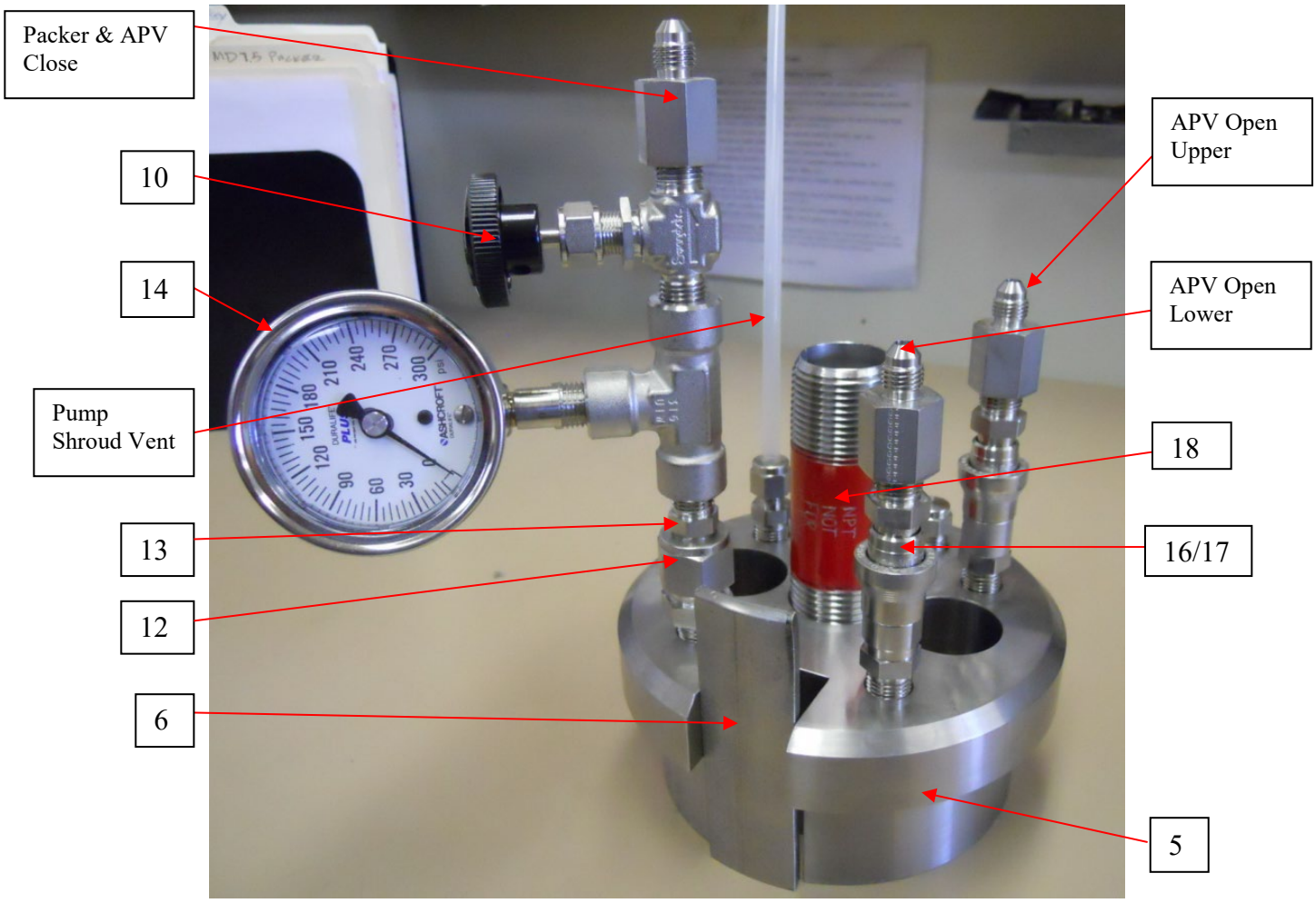
The slotted deep well brakeline sockets are provided for tightening fittings on crowded bulkheads where space restrictions make it difficult to use an open end wrench. These are to be used ONLY for tightening the nut and ferrules of a tubing connector. They are not designed to tighten the main body of a straight male connector fitting; i.e., you should not attempt to tighten the 1/4" male NPT thread of the Swagelok fittings with these sockets.

A 2.375" male NUE x 2" male NPT stainless steel nipple is provided for the top of the wellhead as a sampling nipple. This nipple has been painted red and engraved so that it is not used as a lifting nipple. It is capped, when not in use, with a (white) schedule 40 PVC cap. Do NOT lift the string with this nipple. A stainless steel lifting nipple with 2.375" NUE threads on both ends is provided for this purpose. We recommend a makeup torque of 500 ft-lbs for the 2.375" NUE threaded joints. All pipe and tubing threads need a thread sealant.

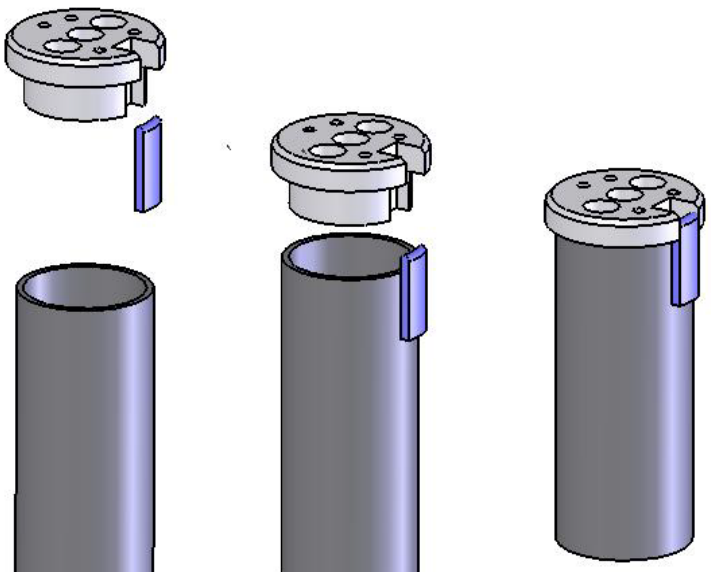
Well head assembly: The wellhead fittings can be installed with open end wrenches or standard deep well sockets, but not the slotted type provided. See the picture on the following page for a possible wellhead configuration. Note that the wellhead in the picture is a different size wellhead, yet the configuration is the same as what is provided for well R-70.

Three 1/4" ID hydraulic hoses are provided for connecting the nitrogen regulator to the wellhead. Each hose has a stainless 1/4" JIC female swivel end connection. These swivels can be tightened with a standard open end wrench until "snug". Do not over tighten the swivel fittings. A short length of 1/4" OD nylon tubing can be used for connection to the pump shroud vent line at the wellhead. This is for directing any high pressure airflow away from the wellhead. This safety precaution is optional in cases where the static water level in the well is close to the pump level.

The "key" shown in the pictures (next page) acts as an anti-rotational device as well as an orientation fixture for the wellhead. It should be welded to the outside of the casing, with a portion of it extending into the well head's slot cut for the submersible pump cable. It is probably optional as an anti-rotational device, since the weight of the string will most likely keep the head from rotating. It is useful for orientation if the area around the well head is cluttered, and the head must go on in the same relative position each time in order to clear objects.



See Packing List for line item descriptions.



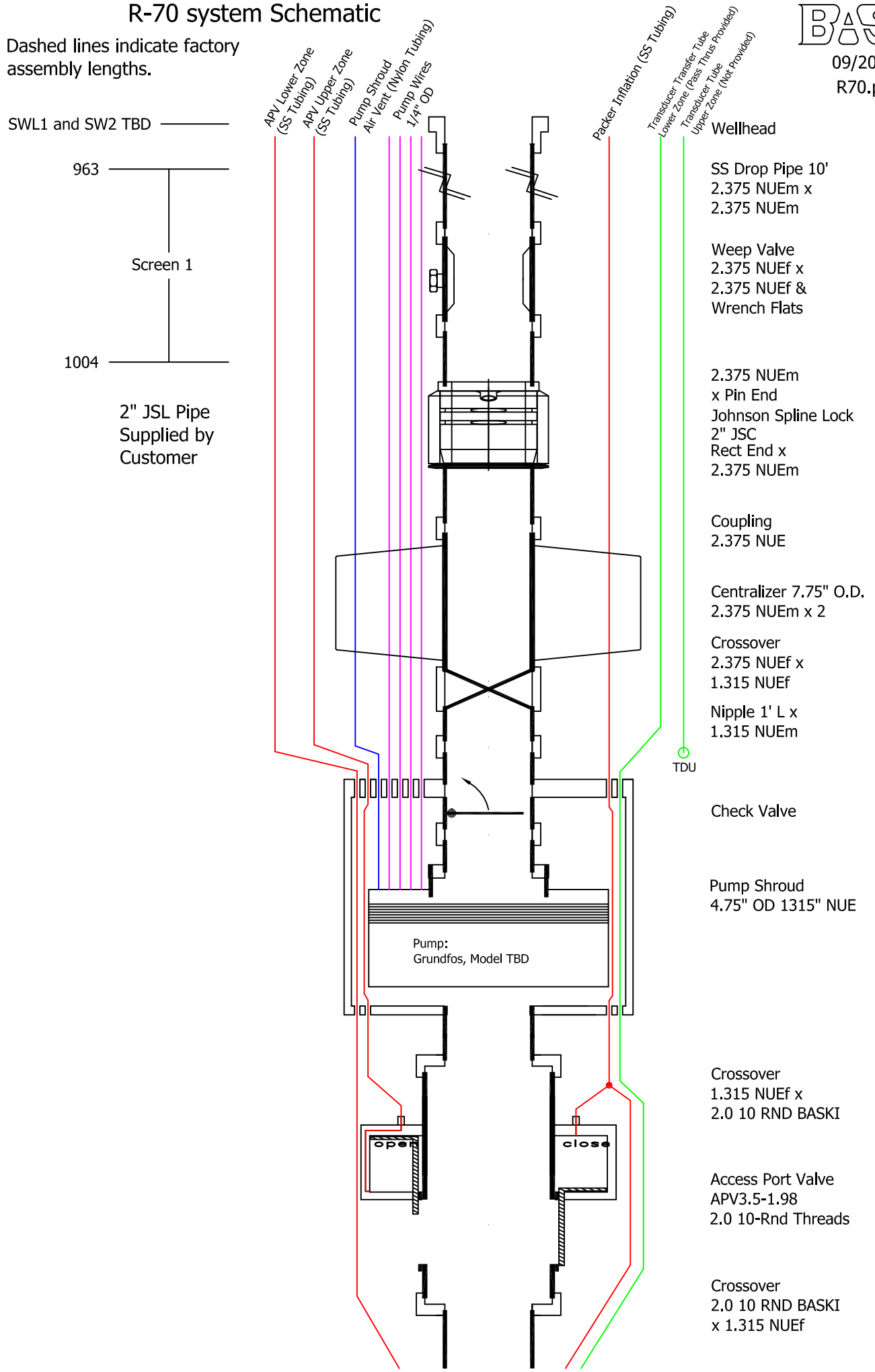
R-70 system Schematic

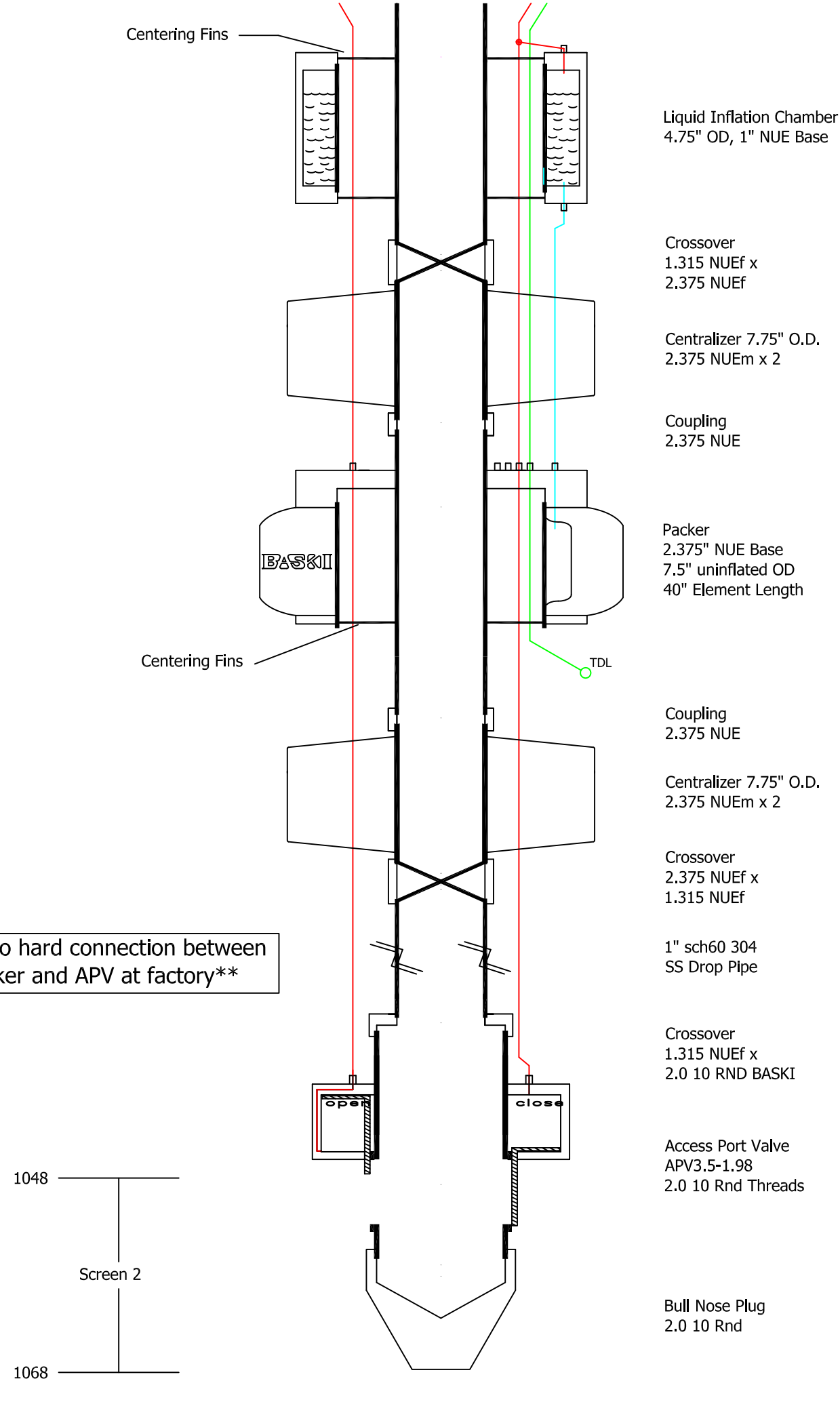
Dashed lines indicate factory assembly lengths.

BASKI

09/20/19

R70.pdf




Centering Fins
Liquid Inflation Chamber
4.75" OD, 1" NUE Base
Crossover
1.315 NUEf x
2.375 NUEf
Centralizer 7.75" O.D.
2.375 NUEm x 2
Coupling
2.375 NUE
BASKI
Packer
2.375" NUE Base
7.5" uninflated OD
40" Element Length
Centering Fins
TDL
Coupling
2.375 NUE
Centralizer 7.75" O.D.
2.375 NUEm x 2
Crossover
2.375 NUEf x
1.315 NUEf
No hard connection between packer and APV at factory
1" sch60 304
SS Drop Pipe
Crossover
1.315 NUEf x
2.0 10 RND BASKI
open
close
Access Port Valve
APV3.5-1.98
2.0 10 Rnd Threads
1048
Screen 2
1068
Bull Nose Plug
2.0 10 Rnd

	FAMILY	QTY	MODEL/DESCRIPTION	BOX #	COMMENTS
1	SURF	1	R580-400-AL		Nitrogen Regulator, 400 psi delivery
2	SURF	3	1/4m37°x1/4mnpt ss adapt		Parker 4-4 FTX-SS
3	SURF	3	1/4IDx25 ft hydraulic hose		1/4m37°f swivel ends w/plugs
4	WH	0	deep wall brakeline wrench/socket 3/8~9/16		Previously supplied
5	WH	1	well head body		For 8" ID Casing, 2.375" NUE threads
6	WH	1	well head body key (anti-rotational tab)		
7	WH	8	1/4tx1/4mnpt ss SL smc		Swagelok SS-400-1-4
8	WH	5	1/4t ss SL tubing body caps		Swagelok SS-400-P
9	WH	3	1/4tx1/4mnpt ss SL DT		Drill Through Fitting
10	WH	1	SS valve		Swagelok SS-1KM4
11	WH	1	1/4" tee		Swagelok SS-4-T
12	WH	1	1/2tx1/4mnpt smc		Swagelok SS-810-1-4
13	WH	1	1/2 tube adapter		Swagelok SS-8-TA-1-4
14	WH	1	pressure gauge		Ashcroft Type 1009 Duralife
15	WH	3	1/4fnptx1/4f37°w/cap		Parker 4-4 GTX-SS/4-FNTX-SS
16	WH	2	quick connect body and protector		Swagelok SS-QC4-B-4PM/SS-QC4-BP
17	WH	2	quick connect stem and protector		Swagelok SS-QC4-S-4PM/SS-QC4-SP
18	WH	1	2mnpt x 2.375mnue ss xover, 6" oal, OD painted Red		top of WH, sampling only, no lifting
19	WH	2	1/4mnpt ss hx plug		Swagelok SS-4-P
20	WH	1	2.375mnue x 2.375mnue, x 16" ss lift nipple		
21	WH	1	2fnpt pvc threaded cap, s40		for top of WH
22	PS	1	1mnpt x 1mnpt ss check valve		inside shroud
23	PS	1	1mnpt nipple ss 8"		inside shroud
24	PS	1	1npt cplg ss		inside shroud
25	PS	1	2mnpt s 1fnpt bushing ss		inside shroud
26	PS	12	1/4tx1/4mnpt ss SL DT		Drill Through Fitting
27	PS	5	0.170wx1/4mnpt ss SL DT		pump wires, 2 ea 104 orings/fitting
28	PS	10	1/4mnpt ss hx plug		Swagelok SS-4-P
29	PS	2	1/4tx1/4mnpt ss SL smc		air vent, Swagelok SS-400-1-4
30	PS	4	1/4t ss x ~9 ft		pass thrus
31	PS	1	PS w/ heads, bolts, o-rings		Pump Shroud
32	PS	13	1/4t ss SL tubing union		Swagelok SS-400-6
33	APVu	1	APV 3.5-2.0 10-rnd		Upper Access Port Valve, SN 27017
34	APVu	1	1/8fnpt y-block		
35	APVu	6	1/4tx1/8mnpt ss SL smc		y-block and APV ports
36	APVu	2	1fnuex2.0 female 10-rnd ni60 cplg		
37	LIC	1	LIC 1mnue		Liquid Inflation Chamber, SN 26880
38	LIC	1	1/8fnpt y-block		
39	LIC	2	1/4t ss x ~12 ft		pass thru LIC for APVL and TDL
40	LIC	1	1/4t ss x ~3 ft		packer inf. APVu to top side of y-block
41	LIC	1	1/4t ss x ~8 ft		packer inf. pass thru LIC from bottom side of y-block
42	LIC	2	1/4tx1/4mnpt ss SL smc		Swagelok SS-400-1-4
43	LIC	5	1/4tx1/8mnpt ss SL smc		y-block and LIC bottom ports
44	LIC	3	1/4mnpt ss hx plug		Swagelok SS-4-P
45	LIC	3	1/8mnpt ss hx plug		Swagelok SS-2-P
46	LIC	15	1/4t ss SL tubing union		Swagelok SS-400-6
47	PAK	1	1nue cplg ni60		connect LIC and Pak BP's
48	PAK	1	packer 1mnue w/ j-tube attached		Packer, SN 26822
49	PAK	4	1/4tx1/4mnpt ss SL smc DT		3 pass thrus, 1 j-tube
50	PAK	5	1/4mnpt ss hx plug		Swagelok SS-4-P
51	PAK	3	1/4t ss x ~9 ft		pass thrus
52	APVl	1	APV 3.5-2.0 10-rnd		Lower Access Port Valve, SN 27019
53	APVl	3	1/4tx1/8mnpt ss SL smc		Swagelok SS-400-1-2

54	APVl	1	1fnuex2.0 female 10-rnd ni60 cplg		
55	ORNG	84	o-rings (use 3) for 1/4tx1/4mnpt DT		66 in DT's, 18 extra
56	ORNG	4	o-rings (use 2) for PS		
57	BNP	1	2.0 female 10-rnd ni60 bull cap		
58	DPIPE	19	1nue couplings ni60		
59	DPIPE	2	1" ss pup joint tbe 1nue, 10 ft		
60	DPIPE	3	1" ss pup joint tbe 1nue, 5 ft		
61	DPIPE	3	1" ss pup joint tbe 1nue, 3 ft		
62	DPIPE	5	1" ss pup joint tbe 1nue, 2 ft		
63	DPIPE	6	1" ss pup joint tbe 1nue, 1 ft		
64	TUBE	1350	1/4" 316SS tubing on a spool		label: "packer & apv close"
65	TUBE	1350	1/4" 316SS tubing on a spool		label: "apv open upper"
66	TUBE	1350	1/4" 316SS tubing on a spool		label: "apv open lower"
67	TUBE	1350	1/4" nylon tubing on a spool, clear		label: "pump shroud vent"
68	PUMP	1	Grundfos pump and motor		customer to supply
69	MISC	1	2.375 NUE pup joint, 10 ft OAL		For below wellhead
70	MISC	1	2.375" fnue Weep valve holder		
71	MISC	1	2.375" mnue x 2" JSL male crossover		below weep valve, to connect to JSL
72	MISC	1	2.375" mnue x 2" JSL female crossover		crossovers to downhole components
73	MISC	3	4-fin centralizers, 7.75" OD, 2.375" mnue		to keep downhole items centralized
74	MISC	3	2.375" fnue x 1.315" fnue xover, Ni60		
75	MISC	4	2.375" NUE Coupling, Ni60		
76	MISC	1	2oz bottle Dow 200, 200cs assbly fluid		
77	MISC	1	2 oz bottle Dow 710R		for APV, if needed
78	MISC	1	8oz bottle Snoop		Leak detection liquid
79	MISC	1	Bottle of Jet Lube 'V-2' Thread Sealant		
80	MISC	450	feet of stainless banding		
81	MISC	100	buckles		
82	MISC	1	Hardware organizer box for spare fittings		
83	MISC	1	CD with digital pictures		

BASKI

Manufacturer of Inflatable Packers, Testing Tools, ASR Valves and other products for investigating, controlling and producing the ***EARTH'S FLUIDS™***
Phone: (303) 789-1200 • (800) 55-Baski • Fax: (303) 789-0900
Email: sales@baski.com • Website: www.baski.com

April 8, 2022

Cecilia Sadler
Tetra Tech, Inc.
3500 Trinity Drive, #C1
Los Alamos, NM 87544

Dear Ms. Sadler:
The custom inflatable packer we have made previously for the sampling system for well R-70 and which we are currently manufacturing for wells R-71 and R-72 is 7.5" OD and approximately 8 ft in length.

The estimated weight of this packer is between 250 and 300 pounds.

Sincerely,
Nick Hemenway
Engineering

N3B Los Alamos

Attachment C

Schedule 80 Male-X-Male Drop Pipe

The information in pink does not apply as the highest gpm flow rate is ~10gpm. For 2" drop pipe noted in this table, the minimum flow rate is noted as 46gpm.

Nominal Pipe Size (in.)	OD (in.)	Min. Wall (in.)	Approx. Weight (lbs./ft.)	ASTM Water Pressure Rating (psi)	Flow Rate		Friction Loss psi/ 100 ft.	Rec Max Depth (ft.) Surface Discharge Pressure				Tensile Strength (lbs.)
					GPM	ft./sec.		30 psi	40 psi	50 psi	60 psi	
1	1.32	0.18	0.42	270	11	5	4.10	610	590	570	550	640
					18	8	11.10	530	510	500	480	
					22	10	16.60	480	470	450	430	
1.25	1.66	0.19	0.56	225	20	5	3.20	490	470	450	430	880
					32	8	8.30	450	420	400	390	
					40	10	12.90	410	390	370	360	
1.5	1.90	0.20	0.67	200	28	5	2.80	460	430	410	390	1,070
					44	8	7.00	420	400	380	360	
					55	10	11.00	390	370	350	330	
2	2.38	0.22	0.93	175	46	5	2.10	370	350	330	310	1,480
					74	8	5.50	350	330	310	290	
					92	10	8.50	330	310	290	270	
3	3.50	0.30	1.90	160	103	5	1.40	360	330	310	290	Call*
					165	8	3.60	340	320	300	280	
					206	10	5.70	330	300	290	270	
4	4.50	0.34	2.78	140	180	5	1.10	290	270	250	230	Call*
					287	8	2.80	280	260	240	220	
					360	10	4.30	270	250	230	210	
5	5.56	0.38	3.87	125	285	5	0.90	250	230	200	180	Call*
					455	8	2.20	240	220	200	180	
					570	10	3.50	230	210	190	170	
6	6.63	0.43	5.31	120	410	5	0.70	250	230	200	180	Call*
					650	8	1.80	240	220	200	180	
					820	10	2.90	240	220	190	170	
8	8.63	0.50	8.06	105	720	5	0.60	200	180	160	140	Call*
					1140	8	1.40	200	180	160	130	
					1440	10	2.20	200	180	150	130	

*Please contact Customer Service Department Representative for recommendations regarding your installation.

Note

In practice, field installations encompass flow velocities from 5 - 10 ft./sec. To avoid potentially dangerous surge pressures and to minimize friction losses, keep pipe flow velocities below 8 ft./sec. Tensile values assume nominal thread engagement and are based on 6,000 PSI yield and minimum wall with 6:1 safety factor.

Information highlighted in yellow does apply as we normally use the 2" drop pipe as a standard for all monitoring wells of 8inch diameter well casing.

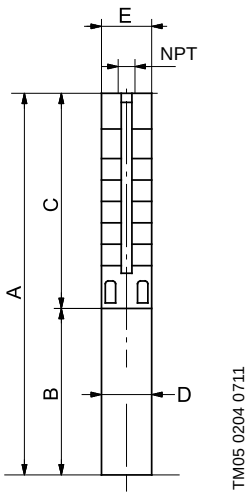
N3B Los Alamos

Attachment D

4" and larger wells - continued
SP 10S (10 gpm) / 4 inch motor

Pump model	Nom. head [ft]	Ph	Volts [V]	Motor [Hp]		Dimensions A [in. (mm)]	B [in. (mm)]	C [in. (mm)]	D [in. (mm)]	E [in. (mm)]	Net weight (complete) [lb]
10S, motor dia. 4 inch, 2 wire motor, 60 Hz - rated flow 10 gpm (1.25" NPT)											
10S05-6	116	1	230	.5	■	22.05 (560)	10.99 (279)	11.07 (281)	3.74 (95)	3.98 (101)	20.7
10S05-9	174	1	115	.5	■	24.53 (623)	10.99 (279)	13.55 (344)	3.74 (95)	3.98 (101)	24.3
			230	.5	■	24.53 (623)	10.99 (279)	13.55 (344)	3.74 (95)	3.98 (101)	23.4
10S07-12	233	1	230	.75	■	27.60 (701)	11.58 (294)	16.03 (407)	3.74 (95)	3.98 (101)	24.3
10S10-15	291	1	230	1	■	30.67 (779)	12.17 (309)	18.51 (470)	3.74 (95)	3.98 (101)	29.7
10S15-21	407	1	230	1.5	■	37.17 (944)	13.71 (348)	23.47 (596)	3.74 (95)	3.98 (101)	35.1
10S, motor dia. 4 inch, 3 wire motor, 60 Hz - rated flow 10 gpm (1.25" NPT)											
10S05-6	116	1	230	.5	■	24.77 (629)	13.71 (348)	11.07 (281)	3.74 (95)	3.98 (101)	21.6
10S05-9	174	1	115	.5	■	24.53 (623)	10.99 (279)	13.55 (344)	3.74 (95)	3.98 (101)	25.4
			230	.5	■	24.53 (623)	10.99 (279)	13.55 (344)	3.74 (95)	3.98 (101)	24.3
10S07-12	233	1	230	.75	■	27.60 (701)	11.58 (294)	16.03 (407)	3.74 (95)	3.98 (101)	28.8
10S10-15	291	1	230	1	■	30.67 (779)	12.17 (309)	18.51 (470)	3.74 (95)	3.98 (101)	29.7
10S15-21	407	1	230	1.5	■	37.17 (944)	13.71 (348)	23.47 (596)	3.74 (95)	3.98 (101)	35.1
		3	230	1.5	■	35.63 (905)	12.17 (309)	23.47 (596)	3.74 (95)	3.98 (101)	32.4
			460	1.5	■	35.63 (905)	12.17 (309)	23.47 (596)	3.74 (95)	3.98 (101)	36.0
10S20-27	524	1	230	2	•	47.92 (1217)	19.49 (495)	28.43 (722)	3.74 (95)	3.98 (101)	45.9
		3	230	2	■	42.13 (1070)	13.71 (348)	28.43 (722)	3.74 (95)	3.98 (101)	44.1
			460	2	■	42.13 (1070)	13.71 (348)	28.43 (722)	3.74 (95)	3.98 (101)	44.1
10S30-34	659	1	230	3	•	58.59 (1488)	22.6 (574)	35.99 (914)	3.74 (95)	3.98 (101)	81.9
		3	230	3	•	53.98 (1371)	18.00 (457)	35.99 (914)	3.74 (95)	3.98 (101)	74.7
			460	3	•	53.98 (1371)	18.00 (457)	35.99 (914)	3.74 (95)	3.98 (101)	74.7
10S50-48DS	931	1	230	5	•	74.18 (1884)	26.62 (676)	47.56 (1208)	3.74 (95)	4.25 (108)	103.5
		3	230	5	•	70.16 (1782)	22.60 (574)	47.56 (1208)	3.74 (95)	4.25 (108)	103.5
			460	5	•	70.16 (1782)	22.60 (574)	47.56 (1208)	3.74 (95)	4.25 (108)	103.5
10S50-58DS	1124	1	230	5	•	89.49 (2272)	26.62 (676)	62.88 (1597)	3.74 (95)	4.25 (108)	132.3
		3	230	5	•	85.48 (2171)	22.60 (574)	62.88 (1597)	3.74 (95)	4.25 (108)	132.3
			460	5	•	85.48 (2171)	22.60 (574)	62.88 (1597)	3.74 (95)	4.25 (108)	132.3

10S



TM05 0204 0711

E = Maximum diameter of pump including cable guard and motor.

Notes:
Control box is required for 3-wire, single-phase applications. Data does not include control box.
DS designation = Built into sleeve, 1 - 1/2" NPT, 6" minimum well diameter.
Performance conforms to ISO 9906. 1999 (E) Annex A. Minimum submergence is 2 feet.

- ■ MS 402 motor.
- • MS 4000 motor.

File No.

NEW MEXICO OFFICE OF THE STATE ENGINEER

WR-07 APPLICATION FOR PERMIT TO DRILL

A WELL WITH NO WATER RIGHT

(check applicable box):

For fees, see State Engineer website: http://www.ose.state.nm.us/

Purpose:	☐ Pollution Control And/Or Recovery	☐ Ground Source Heat Pump
☐ Exploratory Well (Pump test)	☐ Construction Site/Public Works Dewatering	☐ Other(Describe):
☒ Monitoring Well	☐ Mine Dewatering	

A separate permit will be required to apply water to beneficial use regardless if use is consumptive or nonconsumptive.

☐ Temporary Request - Requested Start Date: Requested End Date:

Plugging Plan of Operations Submitted? ☐ Yes ☒ No

1. APPLICANT(S)

Name: U.S. Dept of Energy Environmental Management, Los Alamos	Name: U.S. Dept of Energy Environmental Management, Los Alamos
Contact or Agent: check here if Agent ☐ Cheryl Rodriguez, FPD	Contact or Agent: check here if Agent ☒ Joseph T. Sena
Mailing Address: 1200 Trinity Drive, Suite 400	Mailing Address: 1990 Diamond Dr. MS M992
City: Los Alamos	City: Los Alamos
State: Zip Code: NM 87544	State: Zip Code: NM 87544
Phone: (505) 414-0450 ☐ Home ☒ Cell Phone (Work):	Phone: (505) 551-2964 ☐ Home ☒ Cell Phone (Work):
E-mail (optional): cheryl.rodriguez@em.doe.gov	E-mail (optional): joseph.sena@em-la.doe.gov

FOR OSE INTERNAL USE

Application for Permit, Form WR-07, Rev 11/17/16

File No.:	Trn. No.:	Receipt No.:
Trans Description (optional):		
Sub-Basin:	PCW/LOG Due Date:	

2. WELL(S) Describe the well(s) applicable to this application.

Location Required: Coordinate location must be reported in NM State Plane (NAD 83), UTM (NAD 83), or Latitude/Longitude (Lat/Long - WGS84).
District II (Roswell) and District VII (Cimarron) customers, provide a PLSS location in addition to above.

☒ NM State Plane (NAD83) (Feet)
☐ NM West Zone
☐ NM East Zone
☒ NM Central Zone

☐ UTM (NAD83) (Meters)
☐ Zone 12N
☐ Zone 13N

☐ Lat/Long (WGS84) (to the nearest 1/10th of second)

Well Number (if known):	X or Easting or Longitude:	Y or Northing or Latitude:	Provide if known: -Public Land Survey System (PLSS) (*Quarters or Halves , Section, Township, Range)* OR - Hydrographic Survey Map & Tract; OR - Lot, Block & Subdivision; OR - Land Grant Name
R-73 (angled)	1641025.102	1768126.468	

NOTE: If more well locations need to be described, complete form WR-08 (Attachment 1 – POD Descriptions)
Additional well descriptions are attached: ☐ Yes ☒ No **If yes, how many**_____

Other description relating well to common landmarks, streets, or other:

Well is on land owned by: U.S. Department of Energy

Well Information: NOTE: If more than one (1) well needs to be described, provide attachment. Attached? ☐ Yes ☒ No
If yes, how many_____

Approximate depth of well (feet): 1,170 to 1,270 vertical ft bgs	Outside diameter of well casing (inches): 8.625
Driller Name: Holt Services	Driller License Number: WD-1780

3. ADDITIONAL STATEMENTS OR EXPLANATIONS

Well R-73 will be drilled at an angle of approximately 25 degrees from vertical with an azimuth of approximately N40E. The coordinates provided are at the well head and approximate linear depth along the borehole is 1,300 to 1,400 linear feet. In reference to the well pad surface elevation, the depth of the well will be between 1,170 to 1,270 vertical ft below ground surface at a drilled angel of 25 degrees from vertical. It is part of the LANL Chromium Project. Both the drilling work plan and the New Mexico Environment Department's approval with modification are attached to this WR-07. The purpose of R-73 is to characterize the nature and extent of the eastern portion of the chromium plume and to monitor IM performance. This well is intended to be a permanent monitoring well. R-73 will be monitored quarterly.

FOR OSE INTERNAL USE

Application for Permit, Form WR-07

File No.:	Trn No.:

4. SPECIFIC REQUIREMENTS: The applicant must include the following, as applicable to each well type. Please check the appropriate boxes, to indicate the information has been included and/or attached to this application:

Exploratory:	**Pollution Control and/or Recovery:**	**Construction De-Watering:**	**Mine De-Watering:**
☐ Include a description of any proposed pump test, if applicable.	☐ Include a plan for pollution control/recovery, that includes the following: ☐ A description of the need for the pollution control or recovery operation. ☐ The estimated maximum period of time for completion of the operation. ☐ The annual diversion amount. ☐ The annual consumptive use amount. ☐ The maximum amount of water to be diverted and injected for the duration of the operation. ☐ The method and place of discharge.	☐ Include a description of the proposed dewatering operation, ☐ The estimated duration of the operation, ☐ The maximum amount of water to be diverted, ☐ A description of the need for the dewatering operation, and, ☐ A description of how the diverted water will be disposed of.	☐ Include a plan for pollution control/recovery, that includes the following: ☐ A description of the need for mine dewatering. ☐ The estimated maximum period of time for completion of the operation. ☐ The source(s) of the water to be diverted. ☐The geohydrologic characteristics of the aquifer(s). ☐The maximum amount of water to be diverted per annum. ☐The maximum amount of water to be diverted for the duration of the operation. ☐The quality of the water.
Monitoring: ■ Include the reason for the monitoring well, and, ■ The duration of the planned monitoring.	☐ The method of measurement of water produced and discharged. ☐ The source of water to be injected. ☐ The method of measurement of water injected. ☐ The characteristics of the aquifer. ☐ The method of determining the resulting annual consumptive use of water and depletion from any related stream system. ☐ Proof of any permit required from the New Mexico Environment Department. ☐ An access agreement if the applicant is not the owner of the land on which the pollution plume control or recovery well is to be located.	**Ground Source Heat Pump:** ☐ Include a description of the geothermal heat exchange project, ☐ The number of boreholes for the completed project and required depths. ☐ The time frame for constructing the geothermal heat exchange project, and, ☐ The duration of the project. ☐ Preliminary surveys, design data, and additional information shall be included to provide all essential facts relating to the request.	☐The method of measurement of water diverted. ☐The recharge of water to the aquifer. ☐Description of the estimated area of hydrologic effect of the project. ☐The method and place of discharge. ☐An estimation of the effects on surface water rights and underground water rights from the mine dewatering project. ☐A description of the methods employed to estimate effects on surface water rights and underground water rights. ☐Information on existing wells, rivers, springs, and wetlands within the area of hydrologic effect.

ACKNOWLEDGEMENT

I, We (name of applicant(s)), Cheryl Rodriguez, Joseph T. Sena
Print Name(s)

affirm that the foregoing statements are true to the best of (my, our) knowledge and belief.

CHERYL RODRIGUEZ Digitally signed by CHERYL RODRIGUEZ Date: 2022.04.13 16:25:03 -06'00'
Applicant Signature

Joseph T. Sena Digitally signed by Joseph T. Sena Date: 2022.04.13 15:30:14 -06'00'
Applicant Signature

ACTION OF THE STATE ENGINEER

This application is:

☐ approved ☐ partially approved ☐ denied

provided it is not exercised to the detriment of any others having existing rights, and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare and further subject to the attached conditions of approval.

Witness my hand and seal this _____ day of _____ 20 _____ , for the State Engineer,

_____, State Engineer

By: _____ _____
Signature Print

Title: _____
Print

FOR OSE INTERNAL USE

Application for Permit, Form WR-07

File No.:	Trn No.:

Attachment to the Application WR-07
Permit to Drill a Well with No Water Right

EMID-701778

DEPARTMENT OF ENERGY
Environmental Management Los Alamos Field Office (EM-LA)
Los Alamos, New Mexico 87544

EMLA-2022-BF018-02-001

November 30, 2021

Mr. Rick Shean
Bureau Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Drive East, Building 1
Santa Fe, NM 87505-6313

Subject: Submittal of the Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-73

Dear Mr. Shean:

Enclosed please find two hard copies with electronic files of the "Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-73." Submittal of this work plan fulfills a proposed fiscal year 2022 milestone of Appendix B of the 2016 Compliance Order on Consent.

If you have any questions, please contact Joe Sena at (505) 551-2964 (joseph.sena@em-la.doe.gov) or Cheryl Rodriguez at (505) 414-0450 (cheryl.rodriguez@em.doe.gov).

Sincerely,

ARTURO DURAN

Digitally signed by ARTURO DURAN
Date: 2021.11.29 12:20:45 -07'00'

Arturo Q. Duran
Compliance and Permitting Manager
Environmental Management
Los Alamos Field Office

Enclosure(s):
1. Two hard copies with electronic files – Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-73 (EM2021-0764)

cc (letter and enclosure[s] emailed):
Laurie King, EPA Region 6, Dallas, TX
Raymond Martinez, San Ildefonso Pueblo, NM
Dino Chavarria, Santa Clara Pueblo, NM
Chris Catechis, NMED-DOE-OB/-RPD
Steve Yanicak, NMED-DOE-OB

Jennifer Payne, LANL
Stephen Hoffman, NA-LA
Peter Maggiore, NA-LA
William Alexander, N3B
Emily Day, N3B
Sherry Gaddy, N3B
Jeff Holland, N3B
Danny Katzman, N3B
Thomas Klepfer, N3B
Kim Lebak, N3B
Joseph Legare, N3B
Dana Lindsay, N3B
Pamela Maestas, N3B
Christian Maupin, N3B
Joseph Murdock, N3B
Bruce Robinson, N3B
Troy Thomson, N3B
Steve Veenis, N3B
Steve White, N3B
M. Lee Bishop, EM-LA
John Evans, EM-LA
Michael Mikolanis, EM-LA
David Nickless, EM-LA
Cheryl Rodriguez, EM-LA
Hai Shen, EM-LA
emla.docs@em.doe.gov
n3brecords@em-la.doe.gov
Public Reading Room (EPRR)
PRS Website

Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-73

Primary Objectives and Purpose	This work plan presents the objectives, drilling approach, and conceptual design for groundwater monitoring well R-73. The primary objective for R-73 is to further characterize chromium contamination in the eastern portion of the chromium plume (Figure 1). R-73 was proposed in the "Assessment Report for the Evaluation of Conditions in the Regional Aquifer Around Well R-70" to characterize vertical extent of contamination in the vicinity of R-70 and to further assess potential effects of pumping from nearby water-supply well PM-3 (N3B 2021, 701506). Chromium concentrations in the deeper of two screens at R-70 (screen 2) were initially approximately 270 ppb and have since declined to a concentration of approximately 207 ppb as of September 2021. The concentrations in the upper screen (screen 1) were approximately 30 ppb in January 2021 and are at approximately 12 ppb as of September 2021. The decreases in concentration at R-70, screens 1 and 2, may be in response to chromium interim measure (IM) operations (Figure 2). However, even in light of the decreasing chromium concentrations in R-70 screen 2, the vertical extent of contamination in the vicinity of R-70 is not defined and it is also unknown how IM operations may be affecting potential contamination at depth. The proposed approach for R-73 includes characterizing vertical extent with R-73 screen 2 placed deeper within the aquifer than R-70 screen 2. The specific depth of R-73 screen 2 will be determined from information gained during drilling and geophysical logging. The vertical distance between R-70 screen 2 and R-73 screen 2 will be proposed in a well-design package submitted to the New Mexico Environment Department (NMED) after drilling for review and approval. The upper screen proposed for R-73 would be in the interval represented by R-70 screen 2 to further characterize and monitor downgradient extent of chromium contamination and IM performance. A shallower position for the upper screen, set somewhere in the R-70 screen 1 interval, was considered in order to evaluate whether there are higher chromium concentrations present in strata within that interval. However, the R-70 screen 1 interval for the R-73 upper screen is not proposed because a higher priority is placed on the benefit of characterizing and monitoring IM-related changes in the downgradient extent of chromium in the R-70 screen 2 interval. Because of constraints on drilling locations posed by terrain and cultural sites in the R-70 area, the proposed drilling site would be from an eastern extension of the existing R-70 well pad. The well would be drilled at an angle of approximately 25 degrees from vertical with an azimuth of approximately N40E that would result in an intersection of the regional aquifer at a location approximately as shown in Figure 1. This approximate 25-degree angle from vertical will result in a lateral offset of approximately 400 ft from the R-73 wellhead to the intersection of the water table. The offset to the well screens within the regional aquifer would add approximately an additional 50 ft of offset from the wellhead. This configuration would also result in screen positions approximately 350 ft downgradient of R-70. The importance of this proposed target for R-73 is to ensure reasonable proximity to R-70 for the purpose of characterizing the vertical extent of contamination observed in R-70 screen 2. Figure 3 shows two cross-sections; one along a line from CrEX-5 through R-70 to the proposed R-73 location, and a second along a line from R-45 through R-70 to the proposed R-73 location. The stratigraphy and position of R-73 screen 2 is conceptual and will be refined and included in the final well-design package submitted to NMED after drilling for review and approval.
Drilling Approach	The proposed drilling approach for R-73 will use fluid-assisted, air-rotary, reverse circulation with casing-advance methods. Telescoping casing sizes between 24 in. and 14 in. and dual-rotary methods will be used to advance the borehole to a depth within the upper 200 ft of the regional aquifer. This approach will produce a borehole that can accommodate an approximately 3-in. annular filter pack around the 8-in. well screen.

Drilling Fluids, Composition, and Use	Fluids and additives will be used to facilitate drilling and may include those previously authorized for use by NMED, including the following: • Potable water, municipal water supply, to aid in delivery of other drilling additives and to cool the drill bit, • QUIK-FOAM, a blend of alcohol ethoxy sulfates, used as a foaming agent to lift cuttings, and • AQF-2, an anionic surfactant, used as a foaming agent to lift cuttings. Given the diameter and length proposed for the borehole, fluids may be used for the borehole's entire length, including within the regional aquifer. Complete records will be maintained detailing the type, amount, and volume of fluids and additives used and the depth at which fluids or additives were added to the borehole.
Potential Groundwater Occurrence and Detection	Although perched-intermediate groundwater was not encountered at R-70, it could be encountered during drilling of R-73. Methods to identify perched-intermediate groundwater will include driller's observations, water-level measurements, and borehole video. The top of the regional aquifer is projected to occur at approximately 860 ft below ground surface (or approximately 950 linear ft along the angled borehole).
Geophysical Testing	Geophysical logging will be conducted when the borehole has been drilled to total depth. Logging data will be used to refine estimates of the top of regional saturation and to characterize the hydraulic properties of strata beneath the water table. Downhole directional surveys will be made in the angled borehole at several points during drilling (e.g., just below the top of basalt and at prescribed depths within the basalt) to ensure aquifer intersection targets are met.
Cuttings Characterization	Cuttings collection and characterization methods are intended to optimize representative retention of the fine-grained fraction, particularly within the regional aquifer.
Well Development	The well filter pack may be developed by both mechanical and chemical means. Mechanical means include airlift swabbing, bailing, and pumping. Chemical means include the use of additives to remove clays and/or chlorination to kill bacteria that may be introduced during well completion. Filter pack development during placement will be considered complete when less than 2/10 ml/L of sand is passing through the well screen. • After initial airlift swabbing and bailing during filter pack placement, a 6-in. submersible pump will be used to complete the development process following well completion. A 6-in. pump will be capable of removing significantly higher volumes of water than the 4-in. pump that will be part of the final sampling system. Sand production will be measured with a Rossum Sand Tester. • Water-quality parameters will be measured in a flow-through cell. The parameters to be monitored are pH, specific conductance, dissolved oxygen, temperature, turbidity, oxidation-reduction potential, and total organic carbon (TOC). • If water-quality parameters cannot be brought to within the target values specified below during well development, the use of chemical well development may be discussed with NMED. No chemicals will be added without NMED's approval. Chemical development methods that may be used include AQUA-CLEAR PFD or a similar product to remove clays, and/or chlorination with sodium hypochlorite. Well development will be considered complete when target water-quality parameters and sand production quantities are met and a volume of water equivalent to that which was introduced into the aquifer during drilling and construction is removed. The target water-quality parameters are turbidity <5 nephelometric turbidity units and TOC <2 ppm. The target sand production quantity is less than 1 mg/L.
Hydraulic Testing	Both screened intervals will be hydraulically tested following development.

Water-Quality Sampling	If perched-intermediate groundwater is encountered, attempts will be made to collect screening-level samples using air-lifting or bailing methods. The first groundwater samples from the completed well will be collected at the end of the hydraulic test in each of the two screens. These samples will be analyzed for metals, general inorganics (including nitrate, perchlorate, sulfate, etc.), semivolatile organic compounds, volatile organic compounds, and radionuclides (including low-level tritium). Subsequent samples will be collected from the dedicated sampling system described below.
Sampling System Installation	A dual-access-port valve sampling system will be designed and installed in the well. The system will be capable of delivering water to the surface separately from each screened interval. The system will use a typical 4-in. pump and motor to maintain sampling purge rates at or near 5 gallons per minute. An inflatable packer will be part of the system to achieve separation between the screen intervals. The total amount of time the two screen intervals are in cross-communication with one another will be documented for the entire project, and the sampling system will be used to purge cross-flow from the appropriate screen before sampling.
Investigation-Derived Waste Management	Investigation-derived waste will be managed in accordance with Standard Operating Procedure (SOP) N3B-EP-DIR-SOP 10021, "Characterization and Management of Environmental Programs Waste." This SOP incorporates the requirements of applicable U.S. Environmental Protection Agency and NMED regulations, U.S. Department of Energy orders, and Newport News Nuclear BWXT-Los Alamos, LLC (N3B) requirements. The primary waste streams will include drill cuttings, drilling water, drilling fluids and additives, development water, purge water generated during hydraulic testing, decontamination water, and contact waste. Drill cuttings will be managed in accordance with the NMED-approved "Decision Tree for the Land Application of Drill Cuttings" (April 2016). Drilling, purge, and development waters will be managed in accordance with the NMED-approved "Decision Tree for Land Application of Drilling, Development, Rehabilitation, and Sampling Purge Water" (November 2016). Initially, drill cuttings and drilling fluids will be stored in a lined pit. Representative samples of the drill cuttings and drilling fluids will be collected and analyzed, and waste determinations will be made from validated data. If validated analytical data show these wastes cannot be land-applied, they will be removed from the pit, containerized, and placed in accumulation areas appropriate for the type of waste. Development and hydraulic testing water that meets the requirements to be treated and land-applied will be managed under Discharge Permit 1793. Decontamination water will be containerized separately at the point of generation, placed in an accumulation area appropriate to the type of waste, and directly sampled. Contact waste will be containerized at the point of generation, placed in an appropriate accumulation area, and characterized using acceptable knowledge or the media with which it came in contact.
Schedule	The drilling and installation of R-73 will occur in fiscal year 2022. A letter report documenting completion of the well and collection of first samples (at the end of the hydraulic test in each screen) will be submitted to NMED by August 31, 2022. This completion date is dependent, in part, on both NMED's approval of the drilling work plan no later than February 1, 2022, and subsequent approval of the drilling permit application by the New Mexico Office of the State Engineer by March 31, 2022.

REFERENCE

The following reference list includes documents cited in this report. Parenthetical information following each reference provides the author(s), publication date, and ERID, ESHID, or EMID. This information is also included in text citations. ERIDs were assigned by the Laboratory's Associate Directorate for Environmental Management (IDs through 599999); ESHIDs were assigned by the Laboratory's Associate Directorate for Environment, Safety, and Health (IDs 600000 through 699999); and EMIDs are assigned by N3B (IDs 700000 and above). IDs are used to locate documents in N3B's Records Management System and in the Master Reference Set. The NMED Hazardous Waste Bureau and N3B maintain copies of the Master Reference Set. The set ensures that NMED has the references to review documents. The set is updated when new references are cited in documents.

N3B (Newport News Nuclear BWXT-Los Alamos, LLC), June 2021. "Assessment Report for the Evaluation of Conditions in the Regional Aquifer Around Well R-70," Newport News Nuclear BWXT-Los Alamos, LLC, document EM2021-0321, Los Alamos, New Mexico. (N3B 2021, 701506)

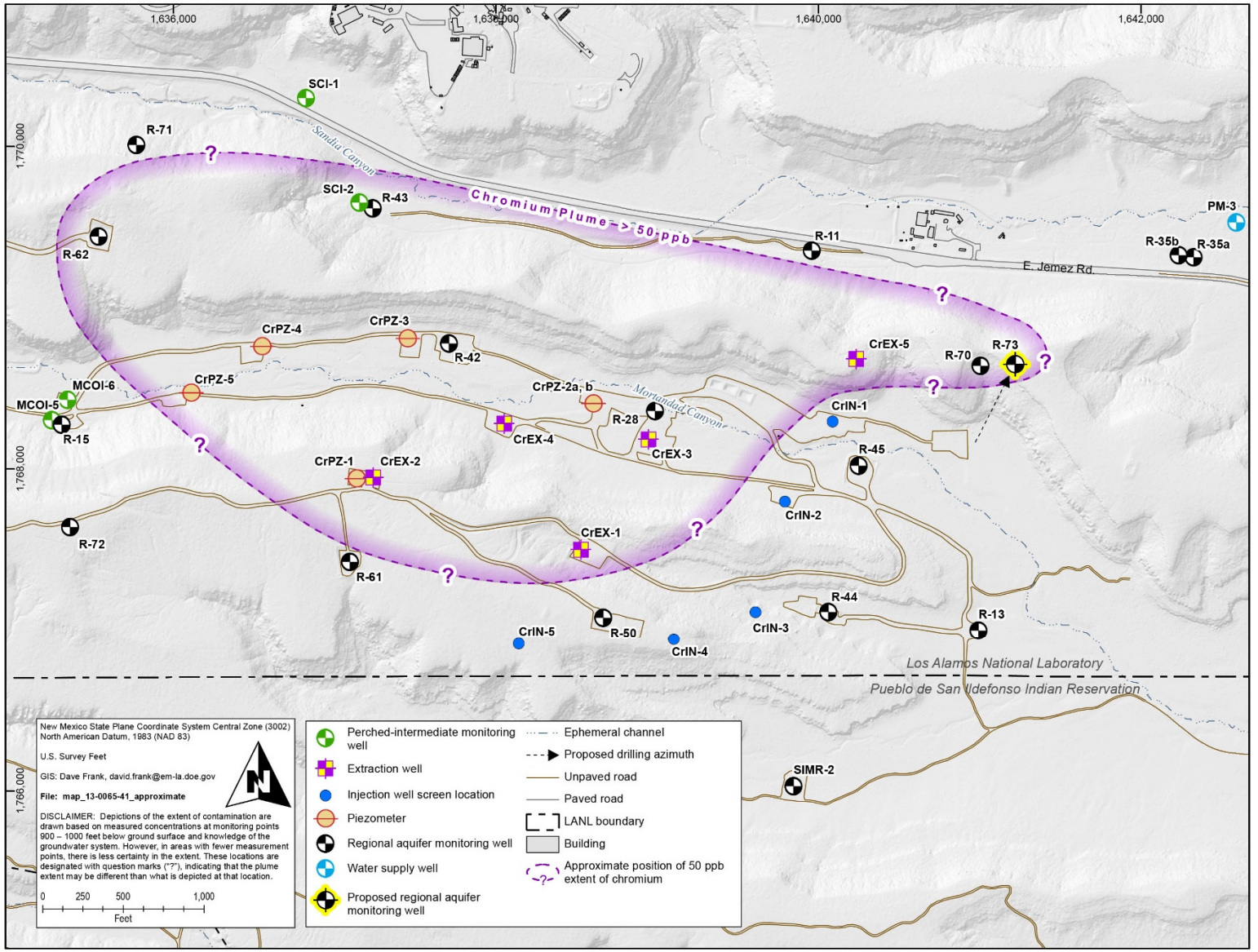


Figure 1 Proposed location for R-73 showing the drilling azimuth and the approximate location for screens within the regional aquifer

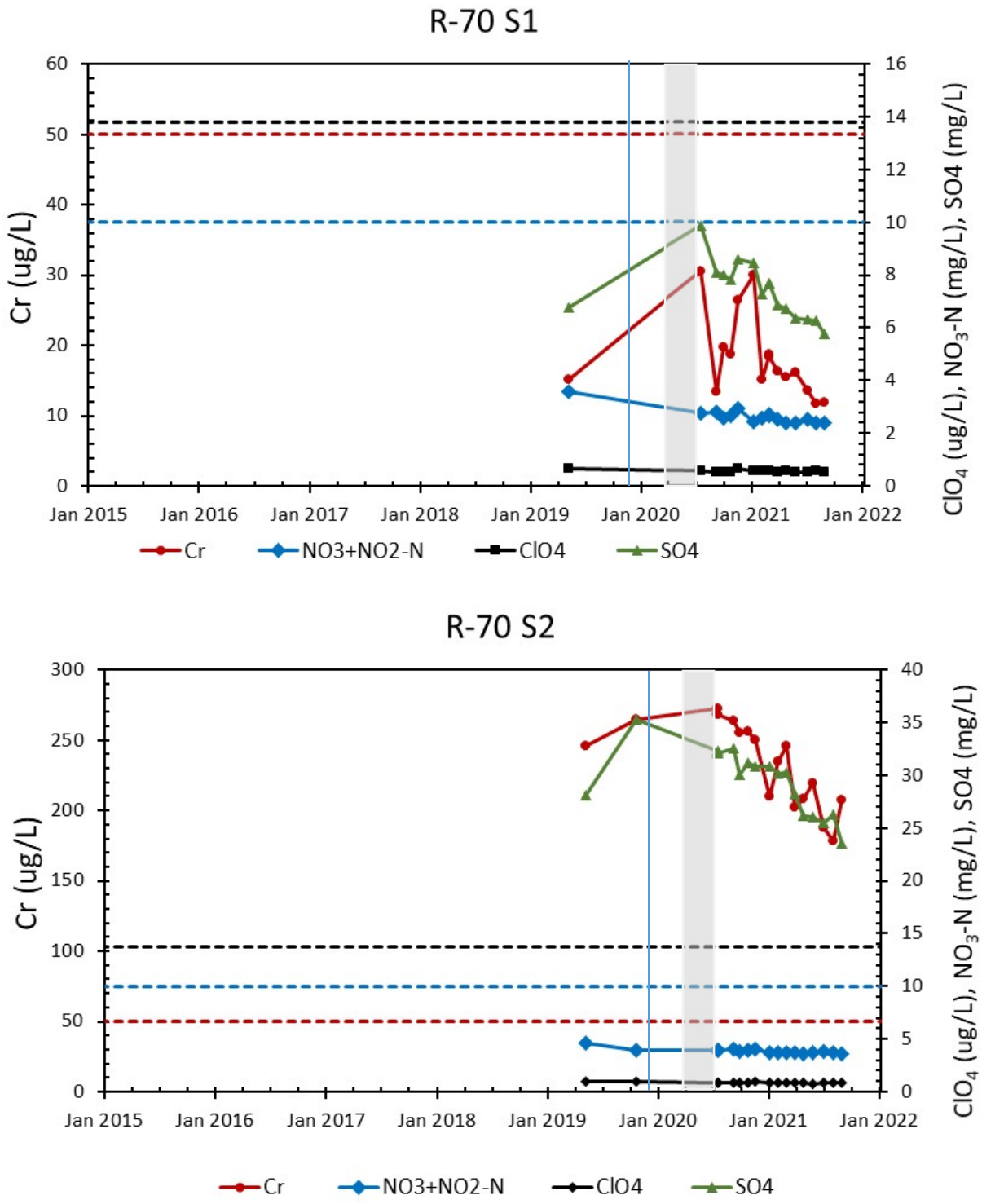
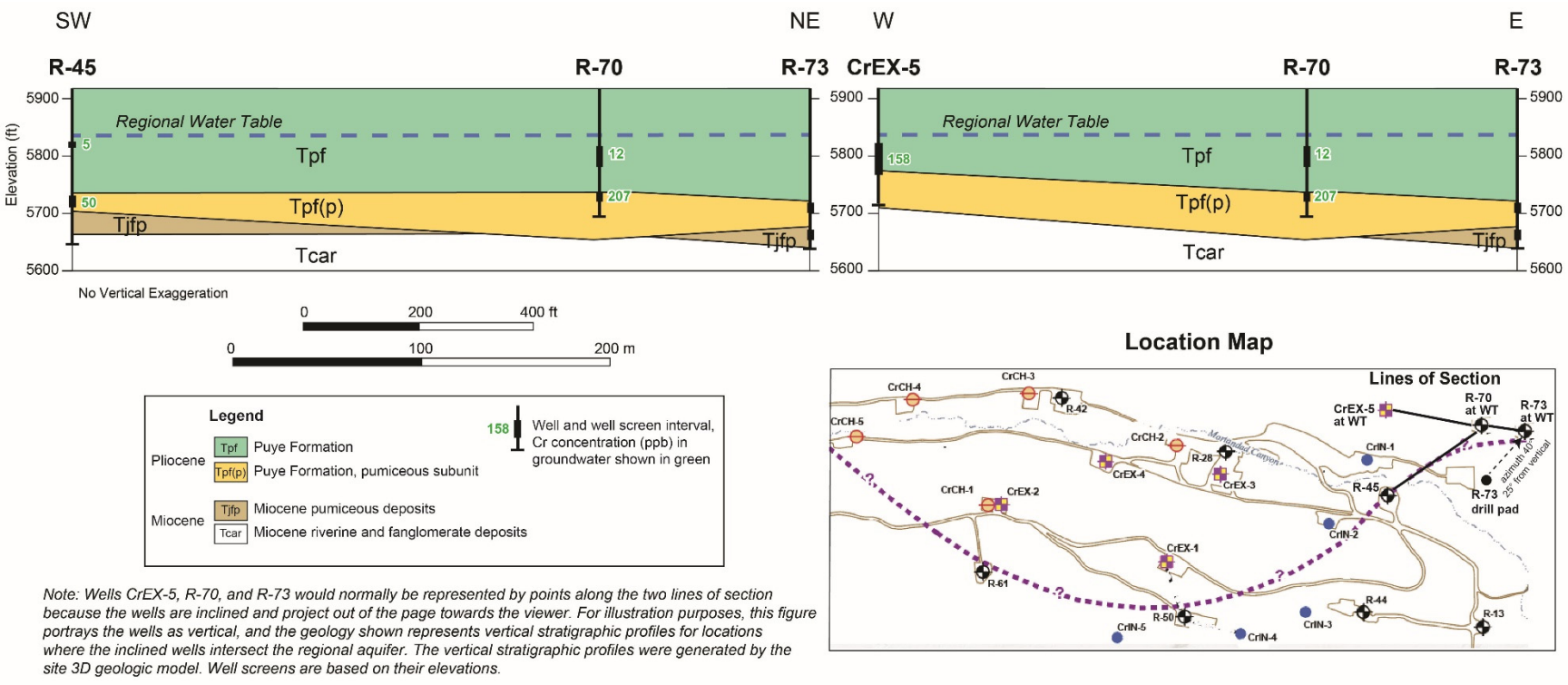


Figure 2 **Trends for chromium, nitrate (as nitrogen), perchlorate, and sulfate at R-70 Screen 1 (S1; top) and R-70 Screen 2 (S2; bottom). The vertical blue line represents the start of eastern area IM operations. The vertical shaded area represents the COVID-19-related shutdown period in 2020. Horizontal dashed lines correspond to the applicable groundwater standard for chromium (red), nitrate (blue), and screening level perchlorate (black). The groundwater standard for sulfate is 600 mg/L.**



Note: Wells CrEX-5, R-70, and R-73 would normally be represented by points along the two lines of section because the wells are inclined and project out of the page towards the viewer. For illustration purposes, this figure portrays the wells as vertical, and the geology shown represents vertical stratigraphic profiles for locations where the inclined wells intersect the regional aquifer. The vertical stratigraphic profiles were generated by the site 3D geologic model. Well screens are based on their elevations.

Figure 3 **Cross-sections from R-45 to R-73 (left) and CrEX-5 to R-73 (right) showing proposed approximate well screen positions for R-73**

December 8, 2021

Arturo Duran, Designated Agency Manager
Environmental Management, U.S. Department of Energy
Los Alamos Field Office
1200 Trinity Drive, Suite #400
Los Alamos, New Mexico 87544

RE: APPROVAL WITH MODIFICATIONS
DRILLING WORK PLAN FOR CHROMIUM GROUNDWATER PROJECT REGIONAL AQUIFER MONITORING WELL R-73
LOS ALAMOS NATIONAL LABORATORY
EPA ID#NM0890010515
HWB-LANL-21-066

Dear Arturo Duran,

The New Mexico Environment Department (NMED) received the United States Department of Energy's (DOE) *Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-73* (Workplan) on November 30, 2021 to fulfil Fiscal Year 2022 Milestone No. 6, Appendix B of the 2016 Order on Consent. The Workplan is dated November 30, 2021 and referenced as EM2021-0764. In the June 2021 *Assessment Report for the Evaluation of Conditions in the Regional Aquifer Around Well R-70,* DOE recommended installation of regional aquifer monitoring well R-73 to characterize the vertical extent of chromium contamination near monitoring well R-70. Monitoring well R-70 was completed in May 2019 at the northeast portion of the chromium plume.

NMED approves the Workplan with the following modifications:

1. DOE must adhere to the purpose, design, and construction criteria for regional aquifer monitoring wells as set forth in NMED's November 3, 2020 amended approval letters[1,2] for regional aquifer monitoring wells and the June 11, 2021 Final Decision letter[3].

2. DOE must provide NMED with daily reports each morning, including weekends and holidays, as was provided during the drilling operations for installing regional aquifer monitoring wells R-71 and R-72.

3. DOE must hold weekly meetings with NMED to provide updates and planned activities on the drilling

[1] Letter from K. Pierard to A. Duran, November 3, 2020, "*Amended Approval Letter Drilling Work Plan for Regional Well R-72.*"
[2] Letter from K. Pierard to A. Duran, November 3, 2020, "*Amended Approval Letter Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-71*."
[3] Letter from K. Pierard to A. Duran, June 11, 2021, "*Final Decision, Response to Amended Approval Letter for Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-71 and Amended Approval Letter for Drilling Work Plan for Chromium Groundwater Project Regional Aquifer Monitoring Well R-72.*"

status from initiation of drilling operations to collection of first samples.

4. DOE must allow for field groundwater sampling at the end of each drilling run, estimated to be about every 20 feet, during the drilling operation conducted within all groundwater-bearing units, specifically the regional aquifer. NMED will collect groundwater samples after each run during the drilling operation, or the samples may be collected by DOE under NMED's chain-of-custody protocol as done during drilling of regional aquifer monitoring well R-71. In accordance with Section XXVII of the 2016 Order on Consent, DOE shall allow any authorized NMED representative to enter the Facility to obtain environmental samples.

5. The target depth for Screen 2 must be in the Chamita Formation. DOE must plan to install a 10-foot long screen in the Chamita Formation and account for drilling through flowing sands to set Screen 2.

6. NMED must review DOE's recommendations within five business days, excluding weekends and state holidays.

7. Hydraulic testing must be removed from the Workplan. Appendix C, E Section II and F Section I.B.6.c of the 2016 Order on Consent defines the appropriate standards and reports where hydraulic testing are to be conducted and presented. DOE must submit an appropriate standard operating procedure for NMED's review and comment before submitting workplans to conduct NMED-approved hydraulic testing[4]. NMED will not accept any report that contains the hydraulic testing methodology, rationale and analyses used at monitoring well R-70[4].

8. DOE must provide NMED access and 15-day written notice per Section XXVII.B. to collect first samples.

9. DOE must include the driller's Well Record and Log in the well completion report.

10. DOE must share all groundwater chemistry results for regional aquifer well R-73 with NMED as soon as results are received from analytical laboratories.

[4] Letter from K. Pierard to A. Duran, May 25, 2021, *Notice of Disapproval – Completion Report for Regional Aquifer Well R-70, Revision 1, and the Response to the New Mexico Environment Department's Draft Comments on the Completion Report for the Regional Aquifer Well R-70*.

Should you have any questions regarding this correspondence, please contact Christopher Krambis (505) 231-5423.

Sincerely,

Rick Shean

Digitally signed by Rick Shean
Date: 2021.12.08 13:14:36 -07'00'

Rick Shean
Chief
Hazardous Waste Bureau

cc:
N. Dhawan, NMED HWB
C. Krambis, NMED HWB
M. Petersen, NMED HWB
C. Catechis, NMED RPD
P. Longmire, NMED GWQB
S. Yanicak, NMED-DOE-0B
K. Boyko, NMED-DOE-OB
R. Martinez, San Ildefonso Pueblo, NM
D. Chavarria, Santa Clara Pueblo, NM
L. Bishop, EM-LA
C. Rodriguez, EM-LA
C. Maupin, N3B
E. Day, N3B
W. Alexander, N3B
P. Maestas, N3B
emla.docs@em.doe.gov
RegDocs@EM-LA.DOE.GOV

File: 2021 LANL, Drilling Work Plan for Regional Aquifer Monitoring Well R-73
HWB LANL-21-066

ARTESIAN WELL PLAN OF OPERATIONS

(for new well construction and repairs)

An Artesian Well Plan of Operations shall be filed with and approved by the Office of the State Engineer prior to commencing the drilling or repairing of an artesian well.

A detailed diagram of the proposed artesian well shall be attached to this plan.

I. FILING FEE: There is no filing fee for this form.

II. GENERAL / WELL OWNERSHIP:

Office of the State Engineer POD Number (Well Number) for well (if known): Well R-73 (POD Number unknown)

Name of well owner: Department of Energy (DOE) Environmental Management, Los Alamos Field Office (EM-LA)

Mailing address: 1200 Trinity Drive, Suite 400

City: Los Alamos State: New Mexico Zip code: 87544

Phone number: (505) 551-2964 E-mail: joseph.sena@em-la.doe.gov

III. WELL DRILLER INFORMATION:

Well Driller contracted to provide drilling services: Holt Services

New Mexico Well Driller License No.: WD-1780 Expiration Date: 6/05/2022

IV. WELL INFORMATION:

1) Will this well be used for any type of monitoring program? Yes If yes, please describe in section V; applicant should be familiar with the need for specialty materials or design required for the monitoring program.

2) Will the well tap or penetrate brackish, saline, or otherwise poor quality water? Yes If yes, please provide additional detail in section V.

3) Depth of top of the anticipated artesian aquifer: ~860 feet below ground level (bgl).

4) Is a flowing artesian head anticipated? No

5) Will a pitless adapter be installed in the well? No

6) GPS Well Location: Latitude: 35 deg, 51 min, 34.237 sec
Longitude: -106 deg, 14 min, 52.608 sec, NAD 83

7) Will permanent surface casing be installed? Yes If yes, provide details below. (Note: surface casing is shallow casing generally set above the confining unit overlying the artesian aquifer and is considered optional).

a) Diameter of borehole to be drilled for the surface casing: 26 inches.

b) Proposed surface casing depth: 3 feet below ground level.

c) Surface casing material, grade: LCS, sched 40

d) Inside diameter (ID): 15.25 inches.

e) Outside diameter (OD): 16 inches.

f) Wall thickness: 0.375 inches.

g) Casing joint connection type (**note whether welded, glued, coupled, etc. If coupled, include outside diameter OD and the length in inches, and also the number of threads per inch.**):

Surf Csg is just a protective casing, no connection. Well is drilled w/ temporary welded drive csg

h) Interval of proposed surface casing annular sanitary seal: 0 to 60 feet below ground level.

i) Surface casing sanitary seal material:

Portland Cement (Type I/II)

8) Artesian casing (Note: artesian casing shall be set adequately into the confining unit overlying the artesian aquifer; in some designs this may also be the production casing; NMOSE inspection requirements apply to installing, grouting and testing the artesian casing):

a) Diameter of borehole to be drilled for the artesian casing: 16 - 24 inches.

b) Proposed artesian casing depth: 1170 - 1270 vertical feet below ground level.

c) Artesian casing material, grade: SS-A304, sched 40S

d) Inside diameter (ID): 7.981 inches.

e) Outside diameter (OD): 8.625 inches.

f) Wall thickness: 0.322 inches.

g) Casing joint connection type (**note whether welded, glued, coupled, etc. If coupled, include outside diameter (OD) and the length in inches, and also the number of threads per inch.**)

Bevel Weld

h) Type and spacing of artesian casing centralizers:

SS-A304, 2.75-in welded pipe casters, vertical spacing of 40 ft, circumferential spacing of 120°.

i) Manufacturer and model of float shoe:

j) Method of annular grout placement: check one Pressure Grout ☐ Tremmie Pipe ☑

k) Interval of proposed annular grout: 60 to ~860 feet below ground level.

l) Proposed annular grout mix: See p) gallons of water per 94 pound sack of Portland cement.

m) Cement type proposed: PFAS free Bentonite Pellets (below water) or chips 3/8" (above water)

n) Theoretical volume of annular grout required: 1557 cubic feet

o) Will the grout be:
☐ batch-mixed and delivered to the site
☑ mixed on site

p) Grout additives requested, and percent by dry weight relative to cement: (See AWWA Standard A100-06 or Halliburton red book; common additives: calcium chloride, bentonite solution, pozzolan ash):

PFAS free 3/8" Bentonite Pellets (below water) or chips (above water) will be tremmied into place while also tagging seal surface as the seal is being placed. Grout is not necessary for this completion as this is not an artesian well. 14" drive casing will function as the borehole wall while drilling and installing well casing and screen. As annular materials are being installed via tremmie, the drive casing will be pulled out. Portland Cement (Type I/II) will be placed up to 3 ft. bgl as the remaining drive casing is pulled out.

q) Additional notes and calculations:

Once all the drive casing it out and the Portland cement has cured for over 12 hrs, the surface casing will be placed and Portland (Type I/II) poured to surface (3ft bgl to 0 ft bgl). Once cured for a minimum of 24 hrs, a 6" concrete pad will be placed around the surface casing for additional protection at ground surface. Potential perched-intermediate groundwater occurrences at this site will not be artesian, nor is the target zone in the regional aquifer.
If perched-intermediate groundwater occurrences are encountered, they are sampled during drilling and then a 20 ft barrier of bentonite pellets are placed to seal these off during drilling from the regional aquifer.

9) Production casing (set through the artesian casing and into the artesian aquifer; may not be necessary if the artesian casing is used as the production casing):

a) Will you be using a production casing within the artesian casing? N/A If yes, provide a description of the following in section V:

i. Diameter of borehole to be drilled for production casing; casing joint connection type - note whether coupled, welded, glued, etc.; proposed production casing depth; and inside diameter, outside diameter, wall thickness, casing material, and casing material grade of production casing.
ii. List the proposed screened/ perforated interval(s) if you plan to use well screen or perforated casing.
iii. List the vertical intervals and seal or fill material if the annulus between the production casing and artesian casing/borehole is to be sealed/ filled.

V. ADDITIONAL INFORMATION: List additional information below, or on separate sheet(s):

R-73 is being installed at a 25^0 from vertical with an azimuth of approximately N30E to characterize and monitor for potential constituents in the regional aquifer. The well will contain two screened intervals selected to sample water from two different horizons in the Puye formation. The screened intervals will be separated by an inflatable packer installed as part of the Baski sampling system. The well construction methodology and design will ensure separation of each monitored portion of the aquifer regardless of what constituents are present.
The upper screen filter pack will be isolated from the lower screen filter pack by tremmie placed PFAS free 3/8" Bentonite Pellets/chips. This annular seal will be isolated from the lower and upper screen filter packs by two feet of tremmie placed #60 or finer sand below and above it. There will be ~150ft between the lower and upper screens. The well casing wlil be constructed inside the 14-in outer drive casing. The outer drive casing will act as a guide and be pulled as the annular materials are being placed around the well casing, minimizing interaction between the zones. A temporary packer will also be placed between upper and lower screens while performing initial development of the upper screen after the lower screen filter pack has been placed and initially developed. This will minimize interaction between screened intervals. After installation of the Baski sampling system, the packer will be tested and three well volumes plus calculated cross-flow volumes will be purged from the each screen. The Baski 7.5"-d un-inflated OD packer (packer gland is 40" long) is covered with a fluoroelastic polymer (DuPont Viton™) inflated by a nitrogen pressurized, liquid inflation chamber. A preliminary well diagram is attached.

VI. SIGNATURE:

I, Joseph T. Sena , say that I have carefully read the foregoing Artesian Well Plan of Operations and any attachments, which are a part hereof; that I am familiar with the rules and regulations of the State Engineer pertaining to the plugging of wells and will comply with them, and that each and all of the statements in the Artesian Well Plan of Operations and attachments are true to the best of my knowledge and belief.

Joseph T. Sena Digitally signed by Joseph T. Sena Date: 2022.04.13 15:33:47 -06'00' — 4/12/2022

Signature of Applicant — Date

Robert Stadeli Digitally signed by Robert Stadeli Date: 2022.04.12 13:42:19 -07'00' — 4/12/2022

Signature of Well driller — Date

VII. ACTION OF THE STATE ENGINEER:

This Artesian Well Plan of Operations is:

☐ Approved subject to the attached conditions.

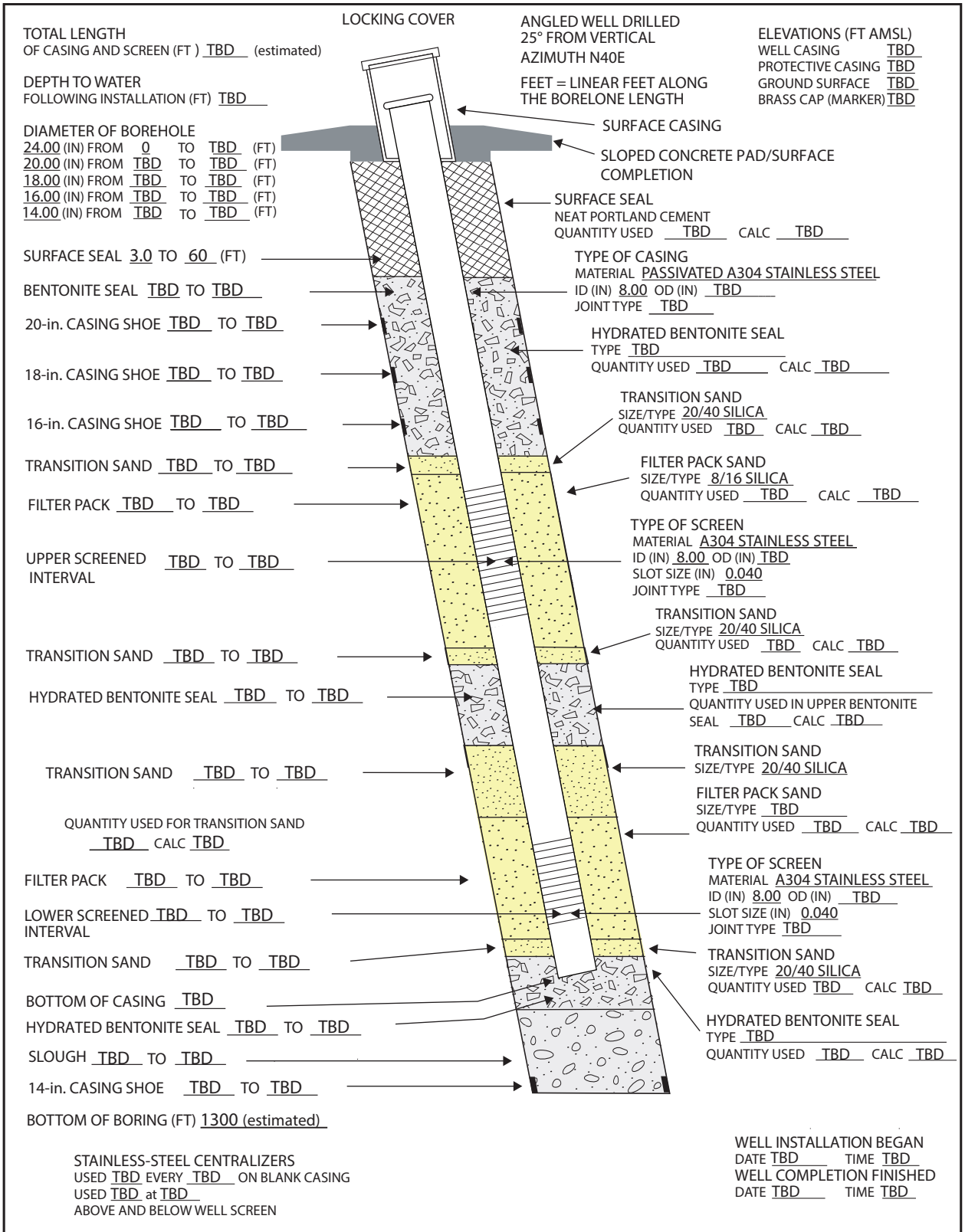
☐ Not approved for the reasons provided on the attached letter.

Witness my hand and official seal this _____ day of _____ , _____

_____,State Engineer

By: _____

Attachment to Form WD-09
Artesian Well Plan of Operations



N3B Los Alamos

Date: February 22, 2022
File Name: R-73 Conceptual Well Construction

Well R-73 Conceptual Well Construction Diagram
Technical Area 05 (TA-05)
Los Alamos National Laboratory
Los Alamos, New Mexico

R-73

NOT TO SCALE