Manley Hot Springs

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INTRODUCTION

Located just north of the Tanana River, Manley Hot Springs is one of many low-temperature geothermal systems in interior Alaska, but one of only a few situated on the road system. There is currently a hot springs bathhouse/greenhouse operated by Gladys Dart on the original hot springs property. Her nephew, John R. Dart, has begun a produce farm utilizing the warm water to promote a longer and more accelerated growing season in his fields and greenhouses.

HISTORY

We presume that Alaskan natives knew about the hot springs, although there is no obvious evidence for native use. John Karshner was apparently the first white person to make use of them. Karshner started a homestead and vegetable farm on 278 acres in 1902. By 1906, with financial assistance from "Frank Manley" (real name: Hillyard Bascom Knowles), Karshner had extensive poultry, hog, and dairy barns, greenhouses, and commercial truck gardens, all heated by the warm water (Figure MHS-1). Meanwhile, Manley built the four-story Hot Springs Resort Hotel, supposedly with "45 guest rooms, steam heat, electric lights, hot baths, bar, restaurant, billiard room, bowling alley, barber shop and an Olympic-size indoor swimming pool". The area became a service and supply point for miners in the Eureka and Tofty mining districts and possibly other communities along the Tanana River, as the warm ground allowed for vegetable and animal farming year-round. By 1910 the population exceeded 500.

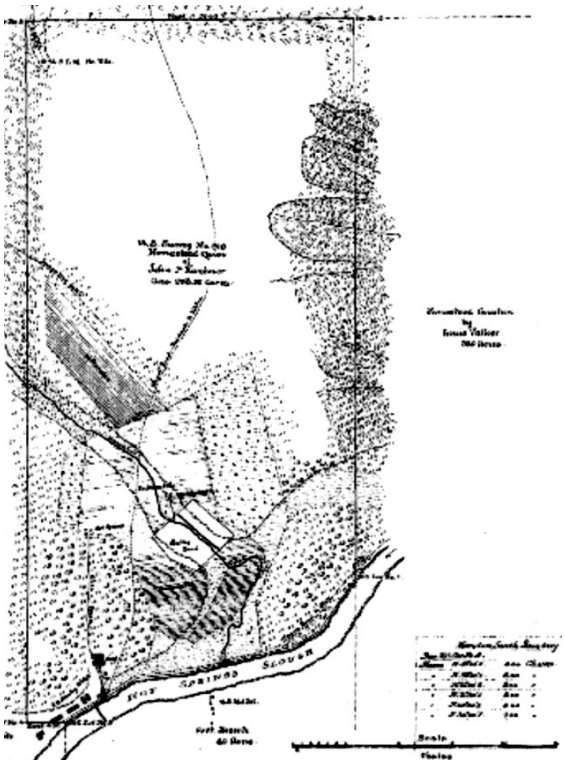

Figure MHS-1: Plat of Karshner's homestead claim for 278.92 acres. The lined areas indicate cultivated land. The poultry yard straddles Karshner Creek.

Manley was a 'sharp businessman', which, translated from Gilded Age terminology, usually meant 'unscrupulous'. (At best.) At any rate, he was widely despised by many of his business partners and was involved in extensive litigation—even with his own lawyer. A variety of stories have circulated concerning why he adopted the name of Manley and abandoned his wife and two children. Almost certainly the story that he was a Texan horse thief was a lie spread by his enemies. (Well, the horse thief part was likely a lie.) So when the resort burned to the ground in 1913 and the Karshner clan was widely suspected of arson, no formal investigation took place. At about the same time, having stripped out the high-grade modern placers and encountering permafrost in the buried placers, the mining boom in the Eureka and Tofty areas collapsed. By 1920, the community known as Hot Springs had a population of 29. Meanwhile, John Karshner died and his widow received a patent for the homestead in 1916.

In the 1950's the Karshner lands—which essentially lay idle since the 1920s—were purchased by Chuck and Gladys Dart. The Darts constructed a greenhouse and grew (grow) incredible flowers at one of the

major springs. In 1957 the Postmaster changed the name of the community to Manley Hot Springs, so as to not confuse Hot Springs, AK with Hot Springs, Ark. [The latter was a notorious hide-out for criminals in the 1920s and 30s and had an unsavory reputation.] Hence, the Eureka-Tofty region is officially the 'Hot Springs district', even though there is no place called Hot Springs in the area. Continued existence of the community was more-or-less assured by completion of the Elliot highway to Manley Hot Springs in 1959. Starting in 1982 the State of Alaska maintained the Elliott Highway year around. A new greenhouse with a small pool was opened by the Darts in 1985. In the last year, John Dart (whom you'll meet) has created Dart-AM Farms (on land purchased from his aunt some time ago) with the intention of using the hot water to heat year-round greenhouses and grow vegetables. He has already begun selling produce from his first greenhouse at the Farmers' Market in Fairbanks.

As part of the Alaska Native Claims Settlement Act in 1971, the Bean Ridge Native Corporation (BRNC) was created. It owns all the land not privately held in the immediate Manley Hot Springs area. The BRNC has been aspiring for years to get some commercial value from hot water in the area, but this effort has been hindered by the absence of hot springs on their land. In the last two years TDX Power, owned by the Tanadgusix Native Corporation, has spent nearly $1million in geophysical studies attempting to find a hot water 'mother lode' on BRNC land. They've also applied for $1 million in grants from the State of Alaska to get a low-temperature power plant built at Manley Hot Springs.

According to the 2000 census, the population of Manley Hot Springs is 72.

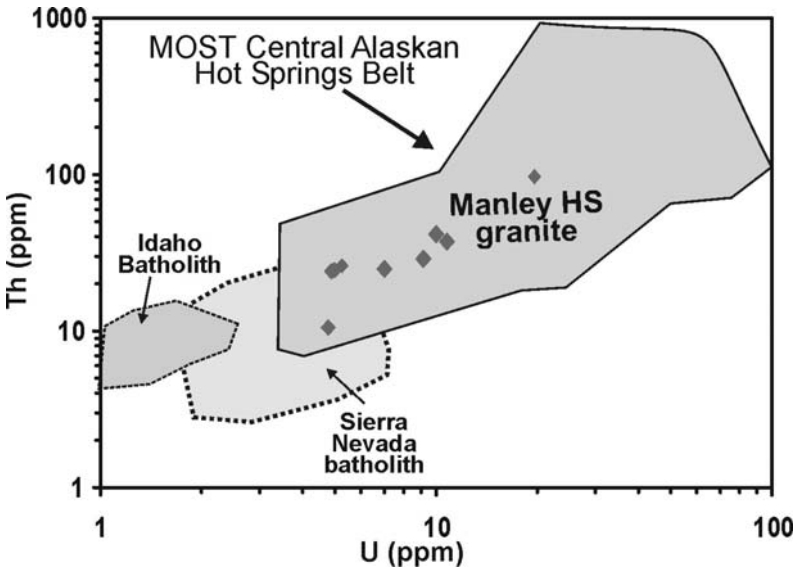

Figure MHS-2: U and Th contents of samples from the Manley Hot Springs Granite (dark diamonds) compared that that of typical rocks from the Central Alaskan Hot Springs Belt, the Sierra Nevada Batholith, and the Idaho Batholith. Modified from Kolker (2008).

MANLEY HOT SPRINGS GEOLOGY

There are a number of natural springs and seeps in the Manley Hot Springs area which discharge water at temperatures of 18 -59^{o}C (64-138^{o}F). Chalcedony geothermometry suggests reservoir temperatures of 70-90^{o}C (160-195^{o}F). Manley Hot Springs is one of the many low-temperature geothermal systems in interior Alaska located within or adjacent to a U-Th-rich ('high heat production') granitic body. Its U and Th contents are 3-10 times that of a typical subduction-related granitic rock (Figure MHS-2). The Manley Hot Springs Granite also contains anomalous concentrations of Be, B, Sn, F, and Rb.

One can say, "The bedrock geology of the MHS area is…" but that would be an exaggeration. What's mostly seen in the area are surficial deposits and vegetation. The bedrock geology is largely a matter of guesswork. Our current best guess (Figure MHS-3), based on a combination of traverses through the woods, rocks brought up from drilling, new roadcuts, and airborne geophysics, is a modification of Reifenstuhl et al. (1998).

Why did we make those modifications? To begin, because **known** areas of hornfels (Figure MHS-4) are magnetic lows (reversely magnetized?); where there aren't such magnetic lows around the Manley Hot

Springs pluton, there aren't any hornfels, and the granite has to be in fault contact with sedimentary rocks. Thus, we depict the eastern contact as a fault rather than the intrusive contact shown. (We'll **briefly** look at both the faulted granite and the hornfels along the Tofty-Manley road as we return from Tofty.) Mapping along a trail going towards the pluton from the south shows an abrupt contact between unhonfelsed flysch and hornfels—presumably a fault (heavy dashed line, bottom Figure MHS-3). Then there's a thin triangle of hornfels between the pluton to the north and the sedimentary rocks to the south. (We'll see examples of both the hornfelsed and unhornfelsed rocks drilled from John Dart's property.) The resistivity map shows both general locations of the major rock types (flysch is conductive; unbroken granite is resistive) but also highlights likely faults from linear conductivity zones (Figure MHS-5).

Now, to put things together: the thermal anomaly, as indicated by known warm seeps and limited soil temperature measurements outlines a peanut-shaped, NE-elongated zone that more-or-less (given the incomplete knowledge of the local geology) sits at the intersections of several steeply-dipping faults at the edge of the Manley Hot Springs granite. A very detailed aeromagnetic map of the immediate Manley Hot Springs area (Figure MHS -6) shows a small magnetic high more-or-less coincident with the thermal anomaly. You can also (barely) make out the outline of the Dart-AM Farms property (the NW corner is ~ intersection of sections 8,9,16, and 17). Our current best guess is that the NW corner of the property—where John Dart had his production well drilled (Figure MHS-7)—is near the center of the thermal anomaly. The proposed fault is just about under John's greenhouse. We'll see evidence for warm ground and both geomorphic and bedrock features at John's property.

REFERENCES CITED

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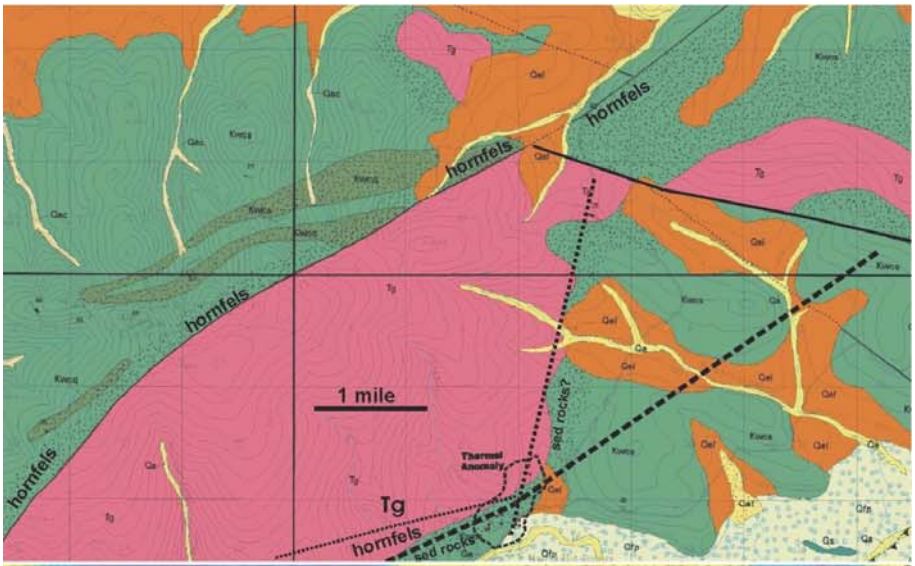

Figure MHS -3: Geology of the Manley Hot Springs area, modified from Reifenstuhl et al. (1998). Thermal anomaly from East (1982).

(Pink) Tg = Manley Hot Springs granite; K units = eK flysch; stippled pattern = hornfels, (orange) Qel = loess; Qfp = flood plain deposits; (yellow) Qal = alluvium

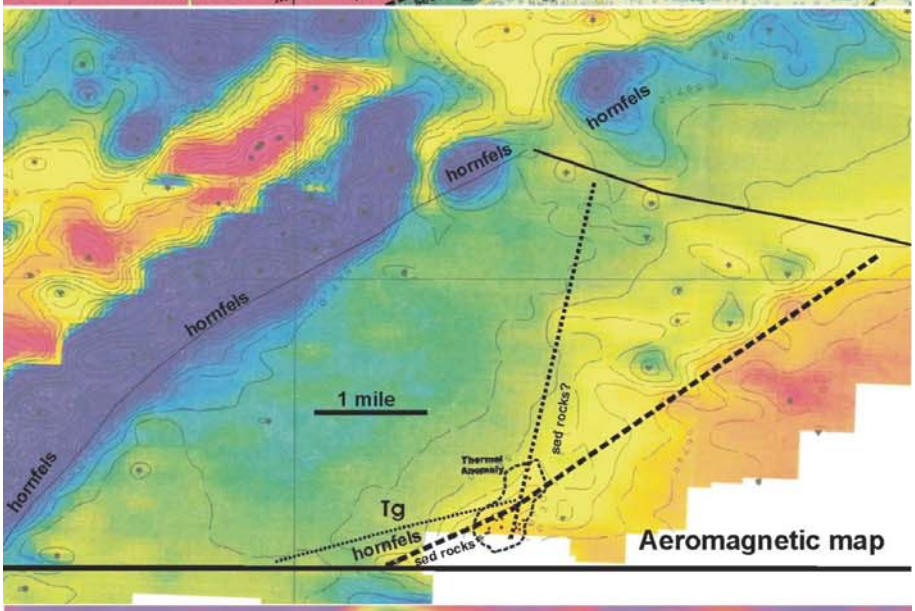

Figure MHS -4: Aeromagnetic map of the Manley Hot Springs area with fault, contact, and thermal anomaly zone annotations.

Color bar: similar to that for the magnetic map of the Livengood area: Indigo (very low) → blue (low) → green→ yellow→orange (high) → red (very high). Note lack of magnetic low adjacent to southern and eastern contacts of the pluton.

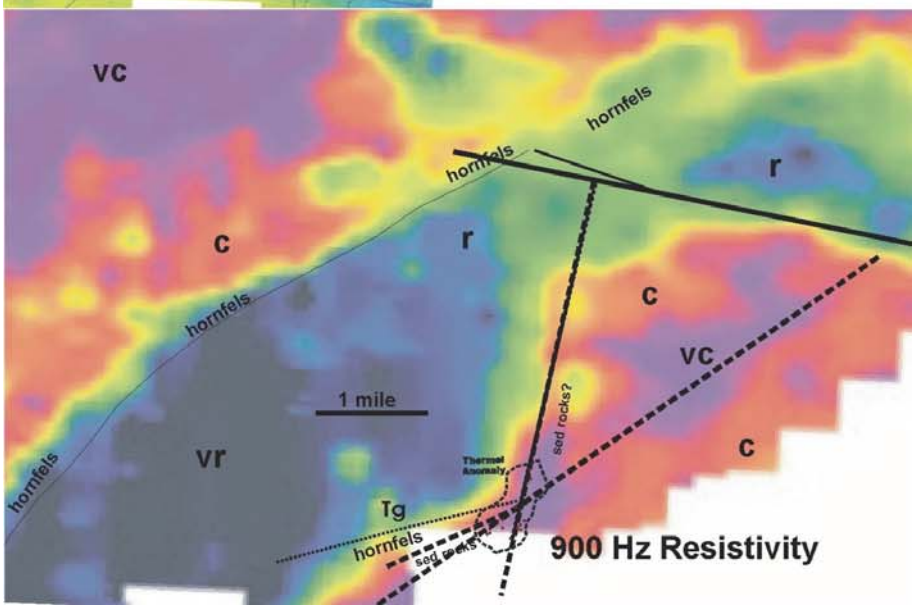

Figure MHS -5: 900 Hz Aeroresistivity map of the Manley Hot Springs area with annotations. Color bar: black (very resistive) → blue (resistive) → green→ yellow→orange→ red (conductive) → purple (very conductive). Shale in the Cretaceous flysch contains significant carbon and is conductive. Granite (unfaulted) is resistive; fault zones are conductive.

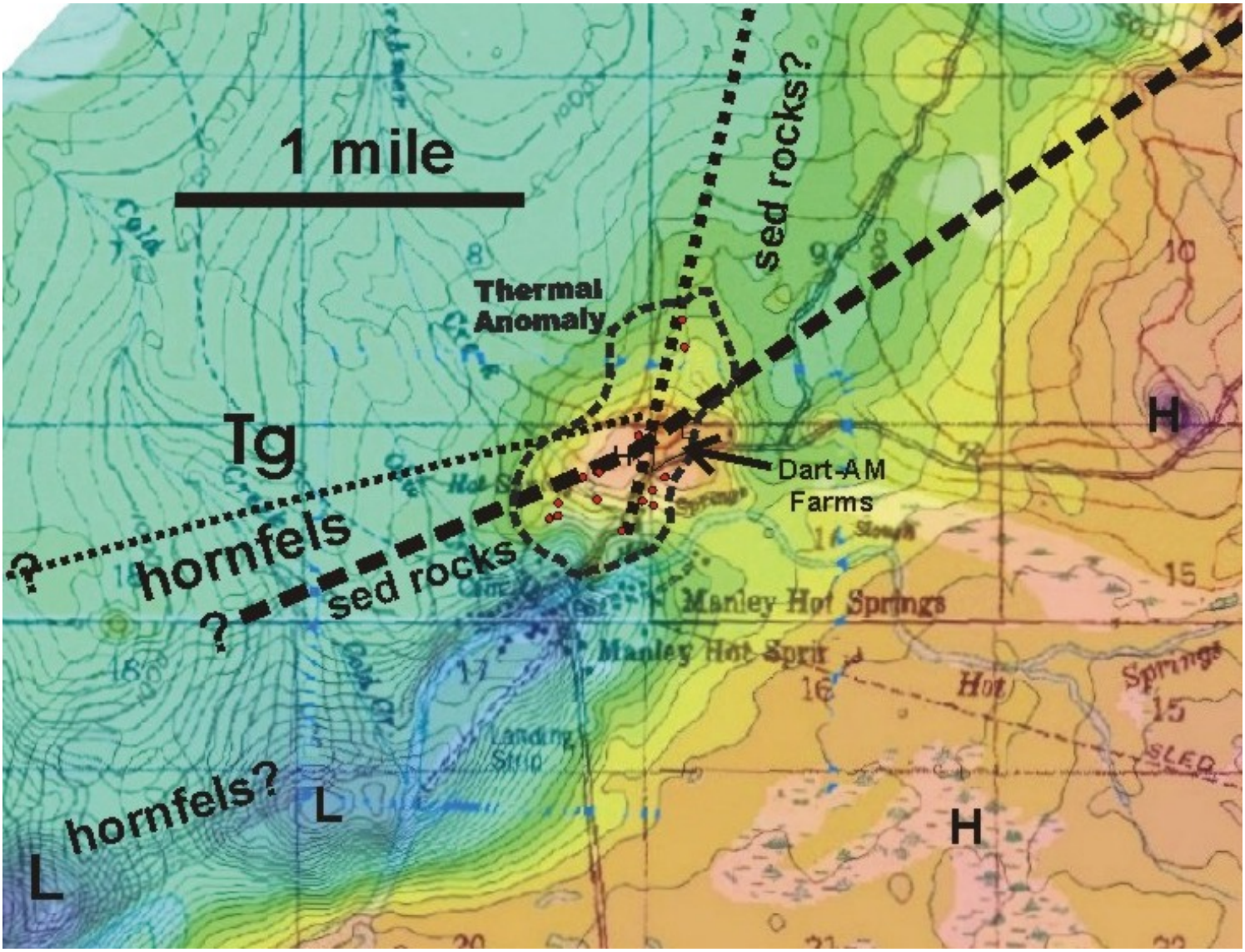

Figure MHS -6: Detailed aeromagnetic map of the immediate Manley Hot Springs area, annotated with suspected faults, contacts, and the known thermal anomaly. Blue (L) = mag low → pink (H) mag high. Note a small aeromagnetic high more-or-less outlines the thermal anomaly. Location of Dart-AM farms property is approximate. The map shows the OLD (unpaved) Elliot highway and not the new (paved) road. The horizontal line with Manley Hot Springs written on both sides is latitude 65°, the boundary between the Tanana and Kantishna River Quadrangles.

ARCTIC DRILLING, INC.
P.O. BOX 58317
FAIRBANKS, ALASKA 99711
Phone: (907) 451-8708 Fax: (907) 452-4485

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF MINING, LAND & WATER
WATER WELL RECORD

Drilling Started: 7 / 21 / 2010 Completed: 7 / 24 / 2010

Legal Description:		BLOCK	LOT	Property Owner Name & Address:
City/Borough:	Subdivision:		4	DARTAM FARMS Manley Hot Springs
Manley				

Meridian _____ Township _____ Range _____ Section _____, _____ ¼ of _____ ¼ of _____ ¼ of _____ ¼

BOREHOLE DATA: (from ground surface) Material: Type, Color & wetness	Depth From	Depth To
Silt	0	5
Silt with rocks	5	10
Loose, broken schist rocks	10	50
loose broken rocks with clay/goo, wet	50	60
10 gpm water from 60 feet		
goo and rock, less water	60	80
fairly hard fractured rock	80	84
fractured rock/water 10-30 gpm	84	98
fractured rock, 150 gpm warm water	98	100
rocky, 150 gpm	100	115
harder rock, fractures, more water	115	135
harder rock , less fractured	135	148
hard rock, fractured more water,	148	150

Drilling method: ☒ Air rotary, ☐ Cable tool ☐ Other _____
Well use: ☐ Public supply, ☒ Domestic, ☐ Other _____

Depth of hole: 150 ft, Casing stickup: 2 ft
Casing type: STEEL Thickness .040/.250 inches
Casing diameter: 12 inches Casing depth 100 ft
Liner type: _____ Diameter: _____ inches Depth: _____ ft

Static water (from top of casing): 40 ft on 7 / 24 / 10
Pumping level & yield: 150 feet after 1 hours at 700 gpm
Recovery rate: 500-700 gpm, Method of testing: AIR LIFT
Development method: AIR SURGE Duration: 1.5 HOURS

Well intake opening type: ☐ Open end ☒ Open hole
☐ Screened; Start: N/A ft, Stopped _____ ft
Screen type: _____ Slot/mesh size _____
☐ Perforated; Start: _____ ft, Stopped _____ ft
Start: _____ ft, Stopped _____ ft
Note: .....

Grout type: clay and rock Volume 6 cf
Depth; from 0 ft, to 20 ft

Pump intake depth: N/A ft
Pump size _____ hp Brand name _____

Was well disinfected upon completion? ☐ Yes ☒ No
Method of disinfection: .....

Driller comments/ disclaimers: .....
Well log depth measurements from top of casing .....
Well water est 120 degrees .....
Well output estimated at 500 to 700 gpm .....

Well driller name: Dan Brotherton .....
Company name: ARCTIC DRILLING, INC. .....

Figure MHS-7: Drill log from production well at Dart-AM Farms, drilled July 2010.