Ivins City Staff Report
City Council Meeting 4/16/2020

Agenda Item: Approve Expenditure for Water Source VRF Test Borehole

Submitted by: Thomas J. Jorgensen, P.E., Assistant Public Works Director

Recommended City Council Action:
Approve expenditure of $12,655 for Water Source VRF Test Borehole

BACKGROUND:

As the Council may be aware, the City is moving forward with the design of the new City Hall. As part of the design process, the mechanical engineer on the project has put together an analysis and recommendation for the HVAC system for the project. The system that is being recommended is called a "Water Source – Variable Refrigerant Flow (VRF)" system.

A VRF system allows for heat/cool to be transferred between temperature-controlled zones within the building without using outdoor unit(s). The system requires a heat pump to exchange and expel heat. In a conventional system the heat pump exchange is air-sourced, meaning that it uses the ambient air to expel heat. The efficiencies for this type of system go down dramatically during the middle of the summer when the outside air temperature is hot. A water source VRF is identical to a conventional system, with the exception that it uses a water-sourced heat pump instead of air-sourced. The heat sink for the water-sourced system is a series of boreholes, drilled approximately 300' into the ground. Pipes are placed in the boreholes and water is then circulated through those pipes, acting as a ground heat exchanger. Essentially, this system is using the cool temperature of the earth to expel heat rather than the outside air. This type of system does not lose efficiencies during the heat of the summer and provides a much more efficient process over the air-sourced system. Not only is this system more efficient during the summer, but the winter as well. Overall, the water-sourced system is 45% more efficient than the conventional air-sourced system.

The water-sourced system is estimated to cost approximately $57,000 more than the air-sourced system but is anticipated to have a simple payback period of 18 years, due to a dramatic reduction in energy costs.

With that being said, a formation thermal conductivity test needs to be conducted to determine if the ground below City Hall is conducive to a water-source system. The test involves drilling a single 300' borehole, installing 600' of pipe with a u-bend at the bottom, grouting around the pipe, and running water through the pipe while running an analysis. This test borehole and pipe assembly will ultimately be used as one of the boreholes within the water-sourced VRF system, so there will not be a lot of money lost, though some is inherently lost due to the economy of scales of doing one hole versus doing multiple holes at once. The test will need to be conducted soon since the results of this test are needed to develop the design of the mechanical systems.

FINDINGS AND ANALYSIS:

A quote was received from Van Boerum & Frank, though VCBO, for a total $12,655. Staff is recommending that Council approve the expenditure.

SUPPORT MATERIALS:

- Formation Thermal Conductivity Test Quote

FINANCIAL IMPACT:

A portion of this expense has been budgeted for this fiscal year. Staff will monitor the budget through the remainder of the fiscal year and if funds are not enough then a budget amendment will be required:

65% -	GL 49-40-830:	$ 8,225.75
20% -	GL 51-42-830:	$ 2,531.00
10% -	GL 52-42-830:	$ 1,265.50
5% -	GL 53-42-830:	$ 632.75
Total		$12,655.00

Respectfully Submitted:

Thomas J. Jorgensen, P.E., Assistant Public Works Director

Content Review:

Dale Coulam, City Manager

VAN BOERUM
& FRANK ASSOCIATES, INC.
CONSULTING ENGINEERS

Corporate Office
Salt Lake City
330 South 300 East
Salt Lake City, UT 84111
T 801 530 3148
F 801 530 3150

St. George
1070 W. 1600 South
Suite #104
St. George, UT 84770
T 435 674 4800
F 435 674 2708

Logan
40 W. Cache Valley Blvd.
Building 1, Suite B
Logan, UT 84321
T 435 752 5081
F 435 752 0335

Arizona
1414 W. Broadway Rd.
Suite #119
Tempe, AZ 85282
T 480 889 5075
F 480 889 5076

MEMORANDUM

DATE: March 26, 2020

TO: Nathan Leavitt / VCBO

FROM: Spencer Howell

PROJECT NO. 20135

PROJECT: Ivins City Hall

RE: GLHE Thermal Conductivity Test

We appreciate the opportunity to provide our services for the Formation Thermal Conductivity test for this project. We propose the following scope:

1. Obtain drilling permits for site through Utah State Division of Water Rights and SLCPU (if required).
2. Drill (1) borehole 300 feet deep.
3. Install DR 11, 1" HDPE pipe with u-bend assembly.
4. Grout with high solids bentonite blended with silica to meet 1.07 btuh/hr per foot deg F.
5. Log drill data including; drill method used, elapsed time, and geological descriptions per vertical foot.
6. Provide test equipment and data acquisitioning computer.
7. Provide a diesel generator capable of 12 KW, 6000 watts, 30 Amps at 240 volt.
8. Provide diesel fuel for the 48 hour test duration.
9. Operate and monitor the test equipment for a period of 48 hours.
10. Provide a written report listing data analysis, formation thermal conductivity, formation thermal diffusivity, and undisturbed soil temperature.

The following items are necessary for us to proceed:

1. A site plan showing the building site and the Ground Loop Heat Exchanger Location (GLHE)
2. The site plan should show some sort of locating marker (survey monument, landmark, etc.) that can be measured from in order to locate the building and GLHE on the site in the field.

Our fee to provide this service is:

Scope	Qty	Unit Cost	Cost
Application, Process & Permits	1	$1,200	$1,200
Drilling mobilization	1	$2,000	$2,000
Drilling, piping, grouting and cleanup (300')	1	$4,100	$4,100
TC Test	1	$2,355	$2,355
Engineering analysis	1	$3,000	$3,000
		Total	$12,655

Please contact us with any questions.

PRINCIPALS
Mechanical: Kim P. Harris, P.E. | Richard G. Reeder, P.E. LEED AP BD+C | Byron Torgersen, P.E. | Jeffrey S Watkins, P.E. | Donald K Bradshaw, P.E. CPD | Benjamin Davis, P.E. | Ladd M. Birch, P.E. | Michael S. Mooney | Neil H. Spencer, P.E. LEED AP BD+C | Wade W. Bennion, P.E. LEED AP BD+C | Steven T. Shepherd, P.E., LEED AP BD+C | Brad W. Rosenhan, P.E. | Ray D. Vernon, P.E. LEED AP BD+C | J. Howard Van Boerum, P.E., FACEC (emeritus) | John D. Frank, P.E. (emeritus)
Electrical: Barry L. Hulet, P.E. | Lawrence A. Rember
Civil and Fire Protection: David P. Baranowski, P.E.