

Final Summary Report

Federal Agency and Organization: DOE EERE – Geothermal Technologies Program

Recipient Organization: Boise City Corporation

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Project Title: Geothermal System Extension to Boise State University and
Geothermal System Extension to Injection Well

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Project Summary:

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The City of Boise operates and maintains the nation's largest geothermal heating district. Today, 91 buildings are connected, providing space heating to over 5.5 million square feet, domestic water heating, laundry and pool heating, sidewalk snowmelt and other related uses.

Approximately 300 million gallons of 177°F geothermal water is pumped annually to buildings and institutions located in downtown Boise. The closed loop system returns all used geothermal water back into the aquifer after heat has been removed via an Injection Well. Water injected back into the aquifer has an average temperature of 115 °F.

This project expanded the Boise Geothermal Heating District (Geothermal System) to bring geothermal energy to the campus of Boise State University and to the Central Addition Eco-District. In addition, this project also improved the overall system's reliability and increased the hydraulic capacity.

Initially this project focused on providing geothermal energy to Boise State University to reduce utility costs, reduce the use of fossil fuels, improve the air quality, and provide an opportunity for hands-on research on different geothermal uses and material selection.

Boise State University identified nine (9) buildings, new and existing, desiring to connect onto the geothermal system. The geothermal pipeline extension was surveyed and designed by a local engineering firm, JUB Engineers, in coordination with Boise State facility engineers, with the design completed in May 2011.

Pipeline construction was awarded to Titan Technologies and work began in August 2011. Work continued through August 2013, halted multiple times to accommodate Boise State University and community functions.

Currently, there are now ten (10) buildings at Boise State University using geothermal as a primary heating source. These buildings are: Micron Business and Economics Building (MBEB), Interactive Learning Center (ITLC), Morrison Center (MORR), Multipurpose Classroom Building (MPCB), Math and Geoscience Building (MAGE), Student Union Building (STUN), Administration Building (ADMN), Environmental Research Building (ERB), Vivarium (VIVE) and the Boise State Alumni Center (ALUM).

Also, two (2) additional Boise State University buildings will be connecting onto the geothermal system with the next 18 months. They are the new Fine Arts Building and the new Material Science Building. Boise State University is committed to provide geothermal energy to all new facilities, and desires to renovate existing facilities to use geothermal energy. Boise State University has become the City's largest geothermal customer.

All buildings at Boise State University have redundant heat sources and are operating more efficiently than anticipated. The City of Boise requested changes to the project scope in February 2015 (Modification 004). The change of project scope included not constructing the last phase of the Boise State University extension (Broadway geothermal lines) and to use the remaining funds to construct a secondary line to the geothermal injection well. The secondary line to the injection well provides redundancy for the entire geothermal heating district system, including Boise State University, and will significantly improve the system hydraulics.

Design services were again awarded to JUB Engineers, and the pipeline construction contract was awarded to Titan Technologies. Construction began in August 2016 and was completed April 2017.

The route of the secondary line to the injection well is positioned within the Central Addition, a district of downtown Boise, currently being redeveloped, in which is modeled as an eco-district. Buildings within this district are encouraged to use sustainable building materials, renewable energy, on-site storm water infiltration and other related sustainability efforts.

The City highly encourages buildings within this district to connect onto the geothermal system, and incentivizes use of the collected-used geothermal water (115 °F). The intent is to extract additional geothermal energy while conserving the amounts of water needed to be pumped from the aquifer. (Basically heating more space with the same amount of water). Because of this pipeline extension, one (1) new building, the Marriott Residence Inn, has connected onto the geothermal system, with the building opening later this year in October 2017. The City is currently in discussions with additional property owners and developers of connection to the geothermal system within the Central Addition District.

In total, this project added over 4 miles of geothermal pipeline; approximately 16,392-linear feet of main lines and 5,073 of service lines. This project also provides for improved system

hydraulics and improved system reliability. This project provides a huge improvement and large expansion of the Boise Geothermal Heating District.

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Phase 1, Task 1 – Design

Design of the Boise State University pipeline and development of construction drawings for the pipeline construction, building conversions and building controls and instrumentation.

Pipeline design, plan specifications, and building conversion designs were competitively bid and awarded to JUB Engineers in January 2010. Design drawings were started in April 2010 and were finalized April 2011. The design drawings included everything from the Capitol connection at the Boise Art Museum, to the Boise State University Student Union Building, (Phase 1 Task 1) and also included 30% of the design drawings from the Student Union Building to Broadway Ave (Phase 2 Task 4).

Phase 1, Task 2 – Construction

Construction of the pipeline extension from the Boise art Museum to the Boise State Student Union Building, connection of six buildings to the system, modifications to the building HVAC systems, and installation of building controls and instrumentation.

Pipeline construction was competitively bid and awarded to Titan Technologies. There was a period of pipeline construction from August 2011 through March 2012; it was postponed then resumed August 2012 through October 2012.

Phase 2, Task 3 – Environmental Review

Complete environmental review process in conjunction with Phase 1 proposed projects to bring geothermal to the Boise State University campus.

The environmental review process was completed in January 2011.

Phase 2, Task 4 – Design

Design of the pipeline and development of construction drawings for a pipeline extension to the east end of the Boise State University campus. (From the Student Union Building to Broadway

Ave), and design and development of construction drawings for the future pipeline crossing across the Broadway Bridge.

Construction design continued from April 2011 to September 2012 for the pipeline extension from the Student Union Building to Euclid Street to Broadway Avenue. Construction drawings were completed and revised based on site conditions experienced during the initial construction (Phase 1, Task 2)

Phase 2, Task 5 – Construction

Construction of the pipeline extension from the Boise State Student Union Building to Broadway Ave., connection of two buildings to the system, and construction of essential components for a future pipeline crossing of the Broadway Bridge.

There were multiple times that pipeline construction was halted in order to accommodate Boise State University and its facility functions. Construction started again in June 2013, and extended geothermal pipeline from the Student Union Building to Euclid Street to Broadway Avenue. This work extended pipeline outside of the University impact area. This portion of work was completed in August 2013.

Phase 2, Task 6 – Research and Study on the Use of Direct Use Geothermal Heat

As a part of future coursework and research at Boise State University provide the students and researchers hands-on access to a variety of campus buildings using geothermal heat.

In February 2013, Boise State University completed a failure analysis report for stainless steel repair clamps used on the existing geothermal system in downtown Boise. As corrosion has always been an obstacle for material selection, this latest analysis helps direct the use and types of stainless steel and other materials used. Partially based upon this research and report, specific grades of stainless steel are now being specified. A copy of the failure analysis report can be provided by request.

Phase 2, Task 7 – Design

Design of the pipeline and development of construction drawings for an extension of the geothermal system to the existing geothermal injection well. (Capitol Blvd. to 5th Street and 5th Street to the Injection Well) This extension will provide additional service area and also provide an alternative line to the existing injection well. This extension will remove an existing hydraulic restriction to the injection well, improving the entire system hydraulics.

In May 2015, a task order was signed between the City and JUB Engineering for the design and specifications of the geothermal pipeline extension through the Central Addition. In December 2015, 90% design drawings were put on hold as a Construction Manager was hired.

The City identified savings and benefits to partner with other departments and agencies as multiple construction projects were planned within the same vicinity. Capital City Development Corporation hired a Construction Manager CM/GC, GUHO, to coordinate the various projects.

Once GUHO was involved, in coordination with JUB Engineering, combining projects, estimating costs, and value engineering led to the completion of the construction drawings and specifications in March 2016.

Phase 2, Task 8 – Construction

Construction of a new pipeline extension to the existing injection well. The construction will extend from Capitol Blvd to 5th Street (on Broad Street) & Broad Street to the Injection Well (on 5th Street), approximately 1300 linear feet of supply and collection pipeline.

Due to anticipated long lead time for geothermal pipe and fittings (12 weeks), it was determined best practice to purchase these materials prior to awarding the construction contract.

In June 2016, GUHO prepared the pipe material procurement package for bid. After the formal bidding process, the contract was awarded to Thermal Pipe Systems, the same supplier that was awarded the pipe for the Boise State University extension.

In August 2016, GUHO selected Titan Technologies as the best qualified sub-contractor to install the geothermal pipe.

Construction began in October 2016 and lasted through June 2017.

Phase 2, Task 9 – Design

Design and development of construction drawings for new geothermal lines within the area referred as the Central Addition District (an area bounded by Front and Myrtle Streets). The pipeline extension will provide geothermal service to areas currently unable to use geothermal energy as a primary heat source.

Task was not started or completed due to uncertainty of the location of future development.

Phase 2, Task 10 - Construction

Construction of new pipeline(s) to provide geothermal service within the Central Addition District. A single or combination of pipeline extensions will be constructed to serve existing and future developments able to use geothermal energy as the primary heating source.

Task was not started or completed due to uncertainty of the location of future development.