2
DDGE/ET/270584 4

DOE/ET/27058--4

DE85 000639

DIRECT UTILIZATION OF GEOTHERMAL
HEAT IN CASCADE APPLICATION
TO AQUACULTURE AND GREENHOUSE SYSTEMS
AT NAVARRO COLLEGE

Annual Report
for the Period
January 1981 - December 1981

Prepared by
Kenan Smith - Director
Environmental Aquaculture Services

Work Performed Under Contract

DE-FC08-79ET27058
DE-FC08-79ET27058

NAVARRO COLLEGE
Corsicana, Texas

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

MASTER

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

U.S. Department of Energy
CONTRACT MANAGEMENT ANNUAL PROJECT REPORT
1981

TITLE: DIRECT UTILIZATION OF GEOTHERMAL HEAT IN CASCADE APPLICATION
TO AQUACULTURE AND GREENHOUSE SYSTEMS, AT NAVARRO COLLEGE

AGREEMENT:

Number: DE-FC08-79ET27058
Start Date: March 1, 1979
Completion Date: September 30, 1984
Participant: Navarro College
Highway 31 West
P.O. Box 1170
Corsicana, Texas 75110

1981

JANUARY

A short term preliminary injection test on well #2 was performed on January 21, 1981. Results of this test were coupled with production well test results of December 1980; development and testing efforts on well #2 continued.

FEBRUARY

Nothing new in the developments this month, developments about the same as the month of January, 1981. Limited Funding.

MARCH

Limited funding; Investigation continued on the alternatives available to increase injection rate acceptance of well #2.

APRIL

Nothing new in the developments this month, developments about the same as the month of March, 1981. Limited Funding.

MAY

Problems of injection well acceptance rate and alternatives to application of the geothermal resource were being explored.

JUNE

Navarro College submitted a supplemental assessment plan to DOE for consideration. This plan called for plugging the #2 well back to 2400 feet for injection into the Upper Woodbine Formation to eliminate communication between the production well and the disposal well. This plan also called for investigation into a new appli-

cation of resources for aquaculture use.

JULY

Answers to DOE questions concerning the economics/technical feasibility of the project were submitted to DOE on July 9, 1981. Agreement modification A003 from DOE was approved which increased funding for the project.

AUGUST

Navarro College continued to investigate the alternative to injection well enhancement and testing with DOE.

SEPTEMBER

After meeting with DOE personnel, a test of the injection rate for well #2 was planned for October 19, 1981.

OCTOBER

An injection rate acceptance of well #2 was performed on October 19, 1981, thru October 24, 1981. Water was flowed from well #1 (production well) into well #2 (disposal well). Results of this injection test indicated that too much interference with the production well exists and a plug back was required.

NOVEMBER

After consulting with DOE and personnel from the GEO Heat Center at Oregon Institute of Technology, the most probable application system appeared to be for an aquaculture and/or agriculture application of the resource which required a reduced heating load.

DECEMBER

A supplement to the original proposal was submitted to the Department of Energy, which asked for a modification to the project which allowed for a project to use the geothermal resource for heating requirements of an aquaculture and greenhouse system.

Well #2 was plugged back to 2400 feet on December 23, 1981, and determined to have a gravity flow acceptance rate of 60 GCM. This amount of flow was determined to be sufficient to heat the aquaculture/greenhouse demonstration project.

For more explicit details and information see monthly and special reports submitted to the United States Department of Energy, Nevada Operations.

Dr. Lary Reed, Project Director
Navarro College

Kenan C. Smith, Project Coordinator
Navarro College

8 January 1981

Page - 2 -

Task 11. Institutional Factors

Initiated

Task 12. Information Transfer

Initiated

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

None

4.0 VARIANCES/PROBLEMS - None

5.0 OPEN ITEMS

5.1 Injection testing has yet to be performed on Well
No. 2.

6.0 RECENT AND PLANNED ACHIEVEMENTS

The production well (Well No. 1) was tested during the period of December 17-22, 1980. Observations of water levels in both Well No. 1 and No. 2 were made during this period in order to determine well/formation production characteristics. Analysis of the test data will be completed in the near future. After this analysis is completed, injection testing of Well No. 2 will be performed.

C. P. Green, Director
Navarro College

Task 11. Institutional Factors

Initiated

Task 12. Information Transfer

Initiated

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

None

4.0 VARIANCES/PROBLEMS - None

5.0 OPEN ITEMS

5.1 Further development and testing of Well No. 2.

6.0 RECENT AND PLANNED ACHIEVEMENTS

Due to funding constraints, only a short term preliminary injection test was conducted on Well No. 2 on January 21, 1981. The results of this test along with results of Well No. 1 testing performed in December 1980 are presented in the report "Geothermal Injection and Production Well Test Results", Radian Corporation, DCN-81-212-308-09, February 4, 1981.

Once funding for the remainder of FFY 1981 is obtained from DOE, efforts can continue on the system design, including finalization of development and testing efforts for Well No. 2.

C. P. Green, Director
Navarro College

Task 11. Institutional Factors

Initiated

Task 12. Information Transfer

Initiated

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

Once funding is received to continue well development and testing, efforts will be made to arrive directly at a final system design. Bypassing the originally proposed preliminary design should allow a "quicker" construction start date.

4.0 VARIANCES/PROBLEMS

Little work has been performed during this reporting period due to limited funds.

5.0 OPEN ITEMS

5.1 Further development and testing of Well No. 2 to increase its injection capability.

6.0 RECENT AND PLANNED ACHIEVEMENTS

Efforts in investigating methods to increase the injection capability of Well No. 2 will continue when FFY 1981 funds have been approved.

C. P. Green, Director
Navarro College

Task 11. Institutional Factors

Initiated

Task 12. Information Transfer

Initiated

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

Once funding is received to continue well development and testing, efforts will be made to arrive directly at a final system design. Bypassing the originally proposed preliminary design should allow a "quicker" construction start date.

4.0 VARIANCES/PROBLEMS

Little work has been performed during this reporting period due to limited funds.

5.0 OPEN ITEMS

5.1 Further development and testing of Well No. 2 to increase its injection capability.

6.0 RECENT AND PLANNED ACHIEVEMENTS

Efforts in investigating methods to increase the injection capability of Well No. 2 will continue when FFY 1981 funds have been approved.

C. P. Green, Director
Navarro College

25 May 1981
Page - 2 -

Task 11.	<u>Institutional Factors</u>	Initiated
Task 12.	<u>Information Transfer</u>	Initiated

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

None

4.0 VARIANCES/PROBLEMS

Little work has been performed during this reporting period due to limited funds.

5.0 OPEN ITEMS

5.1 Further development and testing of Well No. 2 to increase its injection capability.

6.0 RECENT AND PLANNED ACHIEVEMENTS

Efforts are underway to develop a plan for answering DOE's questions concerning the economic/technical feasibility of the project.

NAME

Project Director
Executive Dean, Navarro College

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

As explained in the "Navarro College Geothermal Demonstration Project Supplemental Assessment Plan", several refinements in the work plan are proposed. These refinements are summarized below.

- . Investigate the feasibility of using the Upper Woodbine as the injection zone instead of the Lower Woodbine.
- . Delete the Navarro County Memorial Hospital from the geothermal retrofit plans. Explore the feasibility of substituting the hospital's heating loads with those of other campus buildings and/or an aquaculture system.
- . Delete the preliminary design stage and proceed directly to the final design stage.

4.0 VARIANCES/PROBLEMS

None

5.0 OPEN ITEMS

- 5.1 Further development and testing of Well No. 2 to increase its injection capability.
- 5.2 DOE response to the 'Supplemental Assessment Plan' discussed in 3.0.

6.0 RECENT AND PLANNED ACHIEVEMENTS

A plan for answering DOE's questions concerning the economics/technical feasibility of the project has been drafted. The final plan will be submitted to DOE for review and approval during early July, 1981.

Dr. Lary L. Reed
Project Director
Navarro College

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

None

4.0 VARIANCES/PROBLEMS

None

5.0 OPEN ITEMS

5.1 DOE Response to the 'Supplemental Assessment Plan'.

6.0 RECENT AND PLANNED ACHIEVEMENTS

A plan for answering DOE's questions concerning the economics/technical feasibility of the project was submitted to DOE/Nevada Operations Office for review and approval on July 9, 1981.

Agreement modification A003 has been received and increases funding from \$450K to \$461K.

Dr. Lary L. Reed
Project Director
Navarro College

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

None

4.0 VARIANCES/PROBLEMS

None

5.0 OPEN ITEMS

None

6.0 RECENT AND PLANNED ACHIEVEMENTS

DOE's response to the planned injection well enhancement and testing was received and reviewed. A meeting with DOE to discuss the enhancement and testing options was scheduled for September 17, 1981.

Dr. Lary L. Reed
Project Director
Navarro College

15 October 1981

Page 2

3.0

TECHNICAL APPROACH OR WORK PLAN CHANGES

See Attachment

4.0

VARIANCES/PROBLEMS

See Attachment

5.0

OPEN ITEMS

None

6.0

RECENT AND PLANNED ACHIEVEMENTS

Based on the attached Testing Plan a well test is planned for the week of October 19 to determine the rate at which water can be injected into the upper woodbine of well number 2 with water being drawn from well number 1.

Dr. Lary L. Reed
Project Director
Navarro College

23 November 1981

Page 2

3.0 TECHNICAL APPROACH OR WORK PLAN CHANGES

See Attachment

4.0 VARIANCES/PROBLEMS

Problems have arisen concerning the rate at which well number two (injection well) will receive the cooled water.

5.0 OPEN ITEMS

None

6.0 RECENT AND PLANNED ACHIEVEMENTS

As a result of the October 19-24 well testing where water was pumped from well number one and injected into well number two, specific recommendations will be made to the Department of Energy during the very near future. It is anticipated various project adjustments will be requested to assure a successful demonstration.

Dr. Lary L. Reed
Project Director
Navarro College