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WASTE WATER DISPOSAL: WASTE TO WATERFOWL WETLANDS

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ABSTRACT

Geothermal energy applications are inherently site specific since it constrains direct use to within a few miles of the resource. For this reason geothermal will be developed in a wide variety of geographic and environmental locations. Hence, the potential limiting factors to direct-use applications may vary from site to site and region to region.

This paper will discuss one direct-use application project and the approach used to solve a major limiting factor, the disposal of spent geothermal fluids.

INTRODUCTION

Warm Springs, Montana is the site of the Montana State Mental Hospital and is located approximately 15 miles south of Deer Lodge in the southwestern part of Montana in Deer Lodge County. The facility is situated in the southern portion of the Deer Lodge Valley on the west side of Interstate 90 and U.S. 10. The valley covers an area of approximately 300 square miles and is roughly 33 miles long (N-S) by 9 miles wide (E-W).

The Warm Springs State Hospital Geothermal Demonstration Project is a direct-use application designed to provide space heating for two buildings, approximately 60,000 sq. ft., and domestic water heating for the entire facility. The conceptual geothermal system design will utilize at peak heating demand 300 gpm at 170°F. The spent geothermal fluid will exit the system at 70°F and discharge into clay-lined ponds northeast of the facility (see Figure 1). These ponds will be utilized for containment of the spent geothermal fluid to provide a wetland habitat for migratory waterfowl.

ENVIRONMENTAL

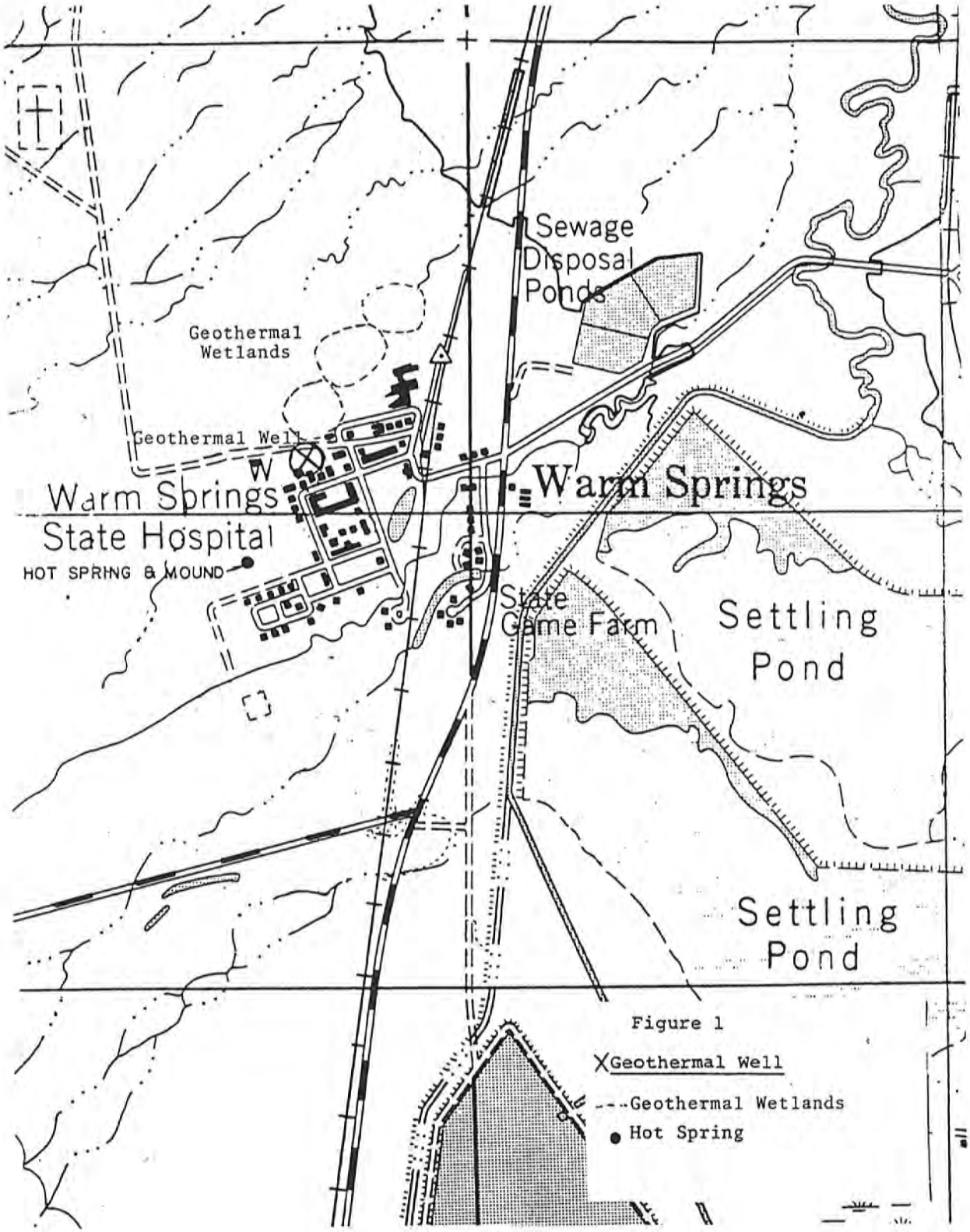
Geothermal effluents have been utilized for a variety of beneficial and economical purposes. Gutman (1976) reported on the use of geothermal waters in hydroponics, and Minohara and Sekioka (1976) outlined its utilization for cultivating plants and breeding animals near Tokyo, Japan. Recently, attention has been focused upon the use of geothermal effluents for the creation of wetlands habitat. A large measure of this attention has originated within the U.S. Fish and Wildlife Service, which initiated funding of a geothermally-derived wetlands feasibility study in 1979. This study was to emphasize possible wetlands development in the arid regions of the western United States (U.S. Fish and Wildlife Service, 1979).

The use of geothermal effluents in the creation of wetlands habitat raises a number of questions concerning potential environmental benefits and drawbacks. The questions which arise are multidisciplinary; however, the U.S. Fish and Wildlife Service (1979) has identified water quality concerns and ecological compatibility as the key unknowns influencing the success or failure of the utilization of geothermal waste waters in wetlands development.

Armstead (1976) included hydrogen sulfide, carbon dioxide, silica, heat, and the presence of toxic substances as potential types of environmental pollutants derived from geothermal developments. Although most, if not all, of these parameters bear monitoring, toxic substances which might exist will be closely scrutinized, and the possibility of bioaccumulation in the faunal and the floral components of the wetlands should be investigated also.

As the Warm Springs State Hospital geothermal wetlands are developed, environmental monitoring and effluent control systems should be evolved based upon a variety of factors including the following:

- The effects upon the water quality of nearby streams and groundwater aquifers resulting from geothermal discharge and ponding of the effluents;
- The effects upon the surrounding surface water and groundwater hydrology resulting from geothermal discharge and the ponding of the effluents;


Sewage
Disposal
Ponds
Geothermal
Wetlands
Geothermal Well
Warm Springs
Warm Springs
State Hospital
HOT SPRING & MOUND
State
Game Farm
Settling
Pond
Settling
Pond
Figure 1
XGeothermal Well
---Geothermal Wetlands
● Hot Spring

The effects of, and possible mitigating measures regarding, elevated concentrations of certain chemical constituents within the effluent waters; and

The effects of elevated water temperature upon the structure, diversity, and productivity of the floral and faunal communities which develop within the wetlands.

Located near the Anaconda Company (ARCO) tailings ponds north of Anaconda, Montana, the Warm Springs State Hospital wetlands development area lies within a recognized waterfowl breeding and migration area (BLM, 1979). The proposed location of the wetlands should provide additional waterfowl habitat within a semi-arid climatic region. In addition, if properly managed these geothermally-derived wetlands could provide open water habitat and highly productive feeding areas during periods of severe winter weather or normal ice cover.

Under a possible multiple use scenario, the Montana Department of Health and Environmental Sciences (MDHES) is investigating the possibility of utilizing the Warm Springs wetlands development as a rearing facility for the mosquitofish (Gambusia affinis). MDHES has an ongoing mosquito control program which utilizes transplanted populations of mosquitofish (Jamison, 1979), and under this potential scenario, the fish would be removed as needed for use in the statewide mosquito control program. As the mosquitofish is known to thrive in thermally affected waters (McFarlane, 1976; Montana Department of Health and Environmental Sciences, 1978), this program has potential as an economically and environmentally viable by-product of the geothermally-derived wetlands development at Warm Springs State Hospital.

From an environmental standpoint, the Warm Springs geothermal wetlands development offers many avenues of potential and promise. However, as in any newly developing approach, certain inherent problems do exist. Approaching these problems carefully and on firm scientific footing should ensure the development of an environmentally, economically, and aesthetically pleasing area, from which much new and useful information can be gathered.

LEGAL

Federal and State statutes were reviewed for statements of legislative policy regarding the creation of wetlands using spent geothermal fluids. (The state search was restricted to the thirteen western states: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.)

There is no legislation dealing explicitly with this subject, nor have any jurisdictions addressed this question administratively. In order to develop an understanding of the legal structure within which such a wetlands project must operate, it was therefore necessary to review and synthesize legislation relating to wetland preservation, water use, water pollution control, geothermal resource development, fish and wildlife management, and flood control.

Because of the variety of approaches taken by the states, few general rules can be defined, but a number of central issues can be mentioned which will require resolution:

- Does the state geothermal law or geothermal regulatory agency impose any conditions on the disposal of geothermal fluid?
- Are spent geothermal fluids subject to appropriation under the state's water use laws?
- Is an artificial wetland a "beneficial use" of state waters under the state's water use law?
- Is a pollution discharge permit required for discharge of geothermal fluid into an artificial wetland?
- Will the wetland overflow into other state waters, thereby requiring a discharge permit?
- Is state or federal financing available for development of wildlife habitat and acquisition of lands and waters for such purposes?
- Can a conservancy district mechanism be used for private wetland development?

CONCLUSIONS

In summary the utilization of spent geothermal fluids to create wetlands for migratory waterfowl appears to be a viable alternative to injection or direct surface discharge. However, each development must be handled as a separate case based on the particular environmental and legal constraints of that site or region.

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