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Design Consideration for Solar Powered Wastewater Treatment Facility for Agriculture and Potable Usage on Acoma Pueblo Reservation

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ABSTRACT

Environmental stewardship has long been a guiding principle among indigenous peoples. Acoma Pueblo, located approximately 45 miles west of Albuquerque, New Mexico, shares these values. They are exploring how to incorporate these values into future development projects. As such, Acoma recently created a wastewater treatment facility to provide irrigation water to nearby crops. Treatment facilities like this further sustainable practices and benefit the community but may draw power from the grid. This report looks at design considerations for possible photovoltaic utilization at the site to offset current power and monetary costs. Lessons learned from a larger, municipal wastewater treatment center will be applied with special considerations for Acoma Pueblo's values and unique wastewater treatment facility configuration.

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ACRONYMS AND DEFINITIONS

Abbreviation	Definition
PV	photovoltaic
SBR	sequencing batch reactors

1. INTRODUCTION

Water and environmental stewardship have always been a high priority for the indigenous peoples of the southwestern United States. The people of Acoma, who reside in what is now New Mexico, share this belief and are incorporating it into their future development projects. One of their projects, a wastewater treatment facility, is geared towards providing water that can be used for local irrigation.

1.1. Location

Acoma Pueblo, located 45 miles west of Albuquerque, New Mexico, has approximately 5,000 members and consists of four main communities. The main village, Sky City, is located on top of a rock mesa approximately 13 miles south of I-40. The other three communities are all located along I-40. Acomita is the community closest to Albuquerque with McCartys further west and Anzac being the most westerly Acoma community. The treatment facility is located east of Acomita near Acomita Lake. Figure 1shows the approximate location of the facility (red dot) in relation to, I-40 (yellow), local communities (labelled), and the Rio San Jose (blue).

Figure 1. Relative location of Acoma communities (labelled) and Water Treatment Facility (red dot)

2. ALBUQUERQUE WASTEWATER UTILITY

There are lessons to learn from a nearby wastewater treatment facility that utilizes photovoltaic (PV) to supplement 50% of the plant's power consumption. The facility is in Albuquerque's South Valley region near the Rio Grande and can process 50 million gallons of water per day. In addition to PV power generation, the treatment facility also collects methane and reuses water for its processes. Figure 2shows a satellite image of the facility. The facility's storage tanks where they collect methane are marked with an "A". The PV panels that collect power are marked with a "B". Treated water from the facility is then recycled back into the Rio Grande (marked with a "C"). The recycled water accounts for a third of the river's recharge. Albuquerque Wastewater Utility hopes to increase the total amount in the future to replenish the local water table. This combination of renewable technologies is something that tribal wastewater utilities could emulate.

Figure 2. Albuquerque water treatment facility

3. ACOMA WASTEWATER TREATMENT FACILITY

Lessons from the Albuquerque Wastewater Utility were taken and applied to the unique goals of Acoma Pueblo's wastewater treatment facility. Efforts were coordinated with the Pueblo of Acoma Tribal Utility Director, Arvind Patel and Community Planner and former 1st Lt. Governor for the Pueblo of Acoma, Raymond Concho. They met with the team and took them on site visits to the treatment facility. When the team visited the facility, they were walked through the process of how the solid waste is cleaned through the facility, and were given a demonstration of the mechanics of treating water for Acoma. The technology that the facility currently utilizes functions like sequencing batch reactors (SBR), mechanically rotating the wastewater and adding oxygen to allow for microorganisms to break down the waste organically.

Figure 3 illustrates the current wastewater treatment process used in Acoma. The water quality is currently 2B for the state of New Mexico [1]. This class only qualifies the treated water for irrigation use . Acoma's facility uses their water for irrigating crops, which is alfalfa in the surrounding villages. The goal for Acoma is to update the current technology so that it can produce higher water quality that is potable for humans and wildlife. As represented in Figure 1, the Rio San Jose flows right along the location of the facility (pink dot) and is at a roughly 1,000 feet distance from the facility. Taking advantage of this close distance will be able to help emulate the same outflow process that Albuquerque's facility uses.

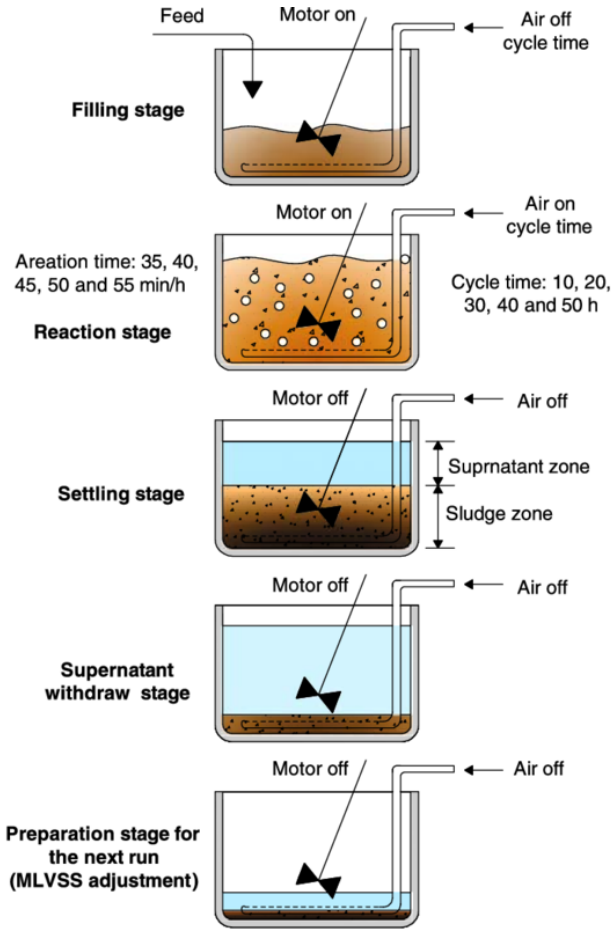

Figure 3. Example of a sequential batch reactor process

Acoma's wastewater facility could benefit from onsite solar panels to increase the tribe's use of renewable energy. Discussions with current facility employees yielded two locations for potential panel locations. Represented in the map on Figure 4 is a car port with solar panels on the roof, which was a result of a worker's former request for a carport to cover work vehicles. Since some of the surrounding land is owned by community members for alfalfa production there was limited space surrounding the facility for panels. These solar panels will stand at about 6-10 feet to mitigate impact on wildlife and prevent damage to the panels. There is also fencing along the site that can restrain some wildlife; however, there are cases where dogs have gotten into the site. The potential sites also have a flat surface that can make installment and maintenance of the panels easier. There are also options for solar panels to be located on the roof tops of the buildings in the facility since the peaks of the roof will allow for sunlight to hit the panels coming from the east and west of the site.

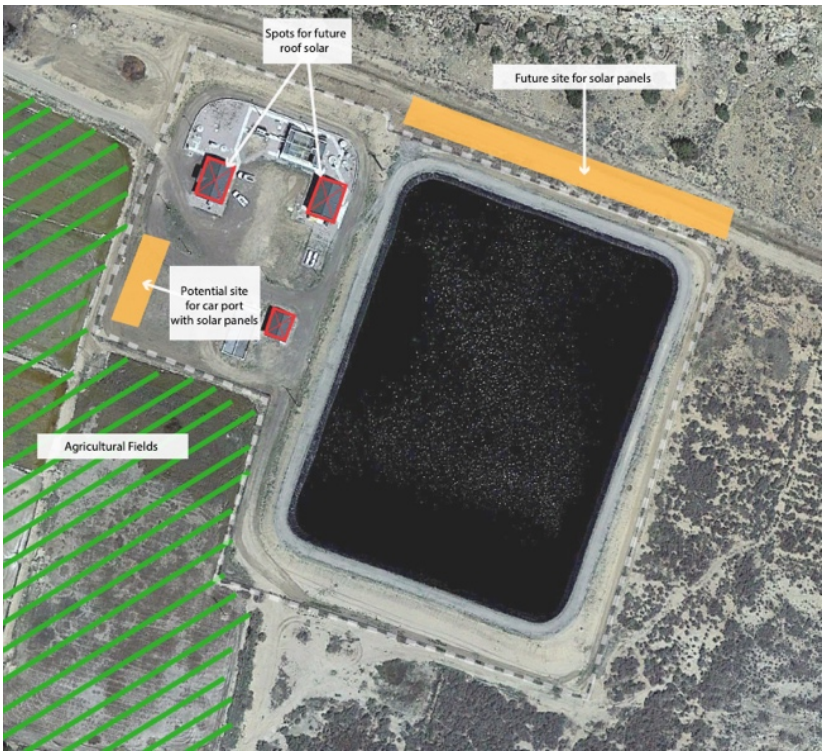

Figure 4. Potential location for photovoltaic panels at Acoma water treatment facility

Figure 5 shows potential outflow paths from the treatment facility and the proposed wetlands site. The future wetlands is a design in process by the tribe. It is meant to recharge the surrounding water table and irrigate local crops. The yellow dashed line shows the railroad tracks that run along the river. Any outflow to the Rio San Jose would need to take the tracks into consideration. There are two options for outflow into the Rio San Jose. The first would take outflow underneath the current railroad tracks and would require an engineered solution to get water to the other side. Although the shorter of the two routes, this could result in a higher overall cost due to construction under a railway. The second option is to construct a 1.15 mi channel parallel to the railroad. Water could then cross underneath the rail through a previously constructed underpass. There would need to be some monitoring and infrastructure that the water is undisturbed by pollution and human activity.

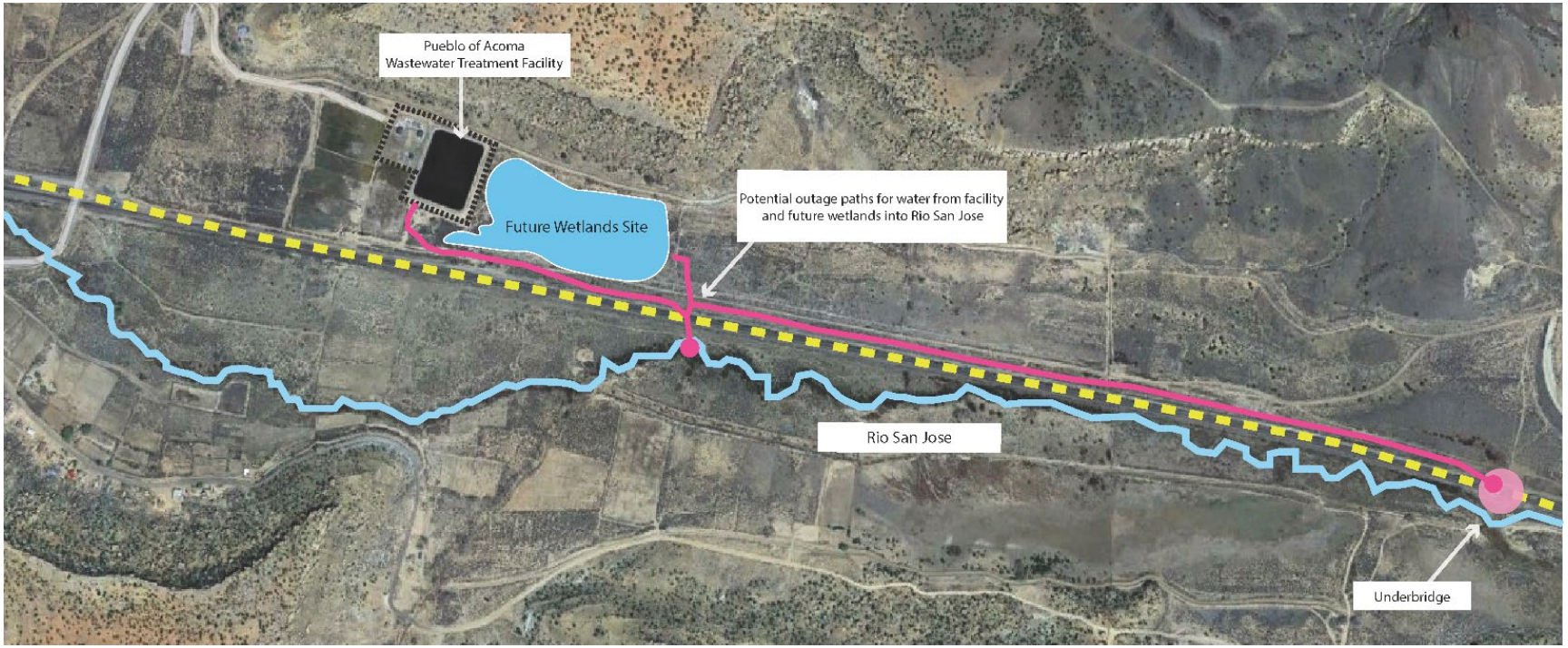

Figure 5. Potential location of wetlands near Acoma water treatment facility

4. CONCLUSION

Implementing these wastewater systems in the Pueblo of Acoma would allow the tribe to recycle water using energy efficient methods. Implementing solar panels would increase the use of renewable energy on the reservation and save the tribe money in operating costs. The success of the project will benefit Acoma by improving water quality that is used for local agriculture, increasing the amount of green energy on the tribe's land, and providing the potential revenue from selling renewable energy.

REFERENCES

[1] Patel, A. (2019, July 25) Personal Interview

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