Pine Ridge Reservation Project
Sewage Collection System Design

ABE527
March 31, 2006

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**Pine Ridge Reservation Project: Sewage Collection System**

**Project Scope**

Our team is in the preliminary stages of designing the wastewater collection system for a trailer park on the Pine Ridge Reservation in South Dakota. Currently, our team is gathering the information needed to move into the design process. We contacted the South Dakota State Plumbing Commission to obtain the plumbing codes that our design must abide by (e.g. manhole spacing, min. cover). They informed us that the State of South Dakota follows the “2003 Uniform Plumbing Code”. During the design process, our team will also reference “Water Supply and Pollution Control” 7th edition written by Warren Viessman and Mark Hammer. “Computer Applications in Hydraulic Engineering” 6th edition by Haested Methods Inc. will be referenced during the SewerCAD analysis.

We will be working closely with Engineers without Borders during the entire process to ensure that our design meets expectations and will not obstruct other components of the project being designed by other teams. We are currently in contact with Jennifer Allen, which is our main contact at Engineers without Borders, to get the location and elevation information for the existing sewer line that we will connect to. We have also requested topographic maps that will aid us in the design process.

**SewerCAD Software**

The modeling software our team decided to use was SewerCAD. After researching and talking with a practicing Sanitation Engineer, we found that SewerCAD software is viewed as a complete and easy to use sewer analyzing software package. SewerCAD works very similarly to WaterCAD; both software packages accept detailed information
and analyze system components as one complete system. It would be very easy in this software package to make changes and run various simulations to design our sewer collection system.

SewerCAD has several capabilities and the two most important factors are system set-up and system evaluation. A sewer collection system can be closely set up to replicate actual field parameters and analyzed. Some common sewer elements the software includes are manholes, junction chambers, wet wells, pumps, pump stations, pressure junctions, and pipes. The information inputted into these elements include elevation (ground, rim, and sump elevations), material, diameter, invert (upstream and downstream invert), node loading, infiltration rate, pump curves, gravity or pressurized pipes, etc. The entire collection system is analyzed using the input information to determine flow rates, flooding potential, pressures, profiles, and sanitary loading.

Currently, we have not completed the actual design of the sewer collection system, and the methods used by the software are unknown. The SewerCAD software package is not available on campus, therefore, the limited software package that came with our ABE 527 textbook will be utilized. The software may limit the number of pipes that can be analyzed in a system. If this is the case, we will analyze sections of the system individually. We will treat the sections as nodes, and put them together to run an analysis on the entire system.
**Sewer System Design**

The system for this project will be designed to carry sewage only, as opposed to Combined Sewer systems that carry storm runoff. Although this is not a Combined Sewer system, it is necessary to include the possibilities of having excess flow from rainfall infiltration. Flow and weather data as well as topographic information will be used to design a gravity-controlled sewer system for the community.

**Conceptual Model of SewerCAD Analysis**

Once the system is designed, SewerCAD will be used to determine if it meets design regulations. If the system does not meet requirements, portions of it will be redesigned, and we will reevaluate it with SewerCAD. This process will be repeated until a system that meets appropriate guidelines is created.

SewerCAD uses three steps to analyze the system design. First, rainfall and flow data are entered along with physical parameters of the components of the sewer system. This information is used to calculate the Wet Well Inflow from the gravity-controlled portion of the system. This information is then used to calculate pressure, velocity, and time-varied Wet Well levels in the pressurized portion of the system. Then, these calculations are entered as data for the gravity portion of the system, and hydraulic and HGL profiles are created along with backwater analyses. The software repeats this cycle for all time steps in the system to create an overall, long-term analysis. The diagram on the following page illustrates the process.
Conclusion

SewerCAD provides a fairly easy method for analyzing our system. We expect to use the software to evaluate our designs, and we will redesign components of the system when needed. The process of design and analysis will be repeated as many times as necessary to develop a sanitary sewer system that meets the regulations dictated by the plumbing codes for the area.