

Fragmentation

D. Calcareous Fen Study

Under the regulatory authority vested in DNR under Minnesota Statute 103G.233, any activity that has the potential to drain, fill, alter, or otherwise degrade a calcareous fen, either directly or indirectly, requires a DNR approved fen management plan. In order to determine the impacts of gravel mining on the local fens, DNR Division of Water installed a number of groundwater monitoring wells and began collecting data from them in the late 1990's. Assessing impacts of aggregate mining on the fens poses a number of difficulties. First, the fens are dependent on ground water flows that cannot be seen. Ground water can be monitored by drilling wells and measuring water levels at regular intervals, but this is point data. Activity between the wells is interpolated but cannot be verified without drilling more wells. Even with many data collection points, accuracy in the prediction of ground water elevations and flow patterns will be limited to the number of years data have been collected. This situation is similar to the availability of data for climate and flood prediction: hydrologists usually have records covering 100 years of precipitation and stream flow but still cannot predict what will happen in the future. The ability to improve prediction increases with the length of record-keeping. Limited data are available from a short period of time for the analysis of groundwater flows to the fens in the study area.

Geologists have determined the current groundwater elevation. Like the land above it, the groundwater slopes from east to west with a slight northeast to southwest tilt. Figure 26 shows the groundwater contours as measured by DNR. Notice that a ridge has formed south of the School Trust Fund mine and another north of the Zillmer pond. Open bodies of water allow for accelerated loss of moisture through evaporation. This condition draws soil moisture along with groundwater toward the open body of water. In order to protect the fens and compensate for limited data, DNR has established a 10' buffer elevation above the groundwater contours. This will compensate for seasonal and annual fluctuations in groundwater which is fed by annual precipitation. The impact of these findings on mining will be explored in the Aggregate Resources section of this report (pages 32-33).

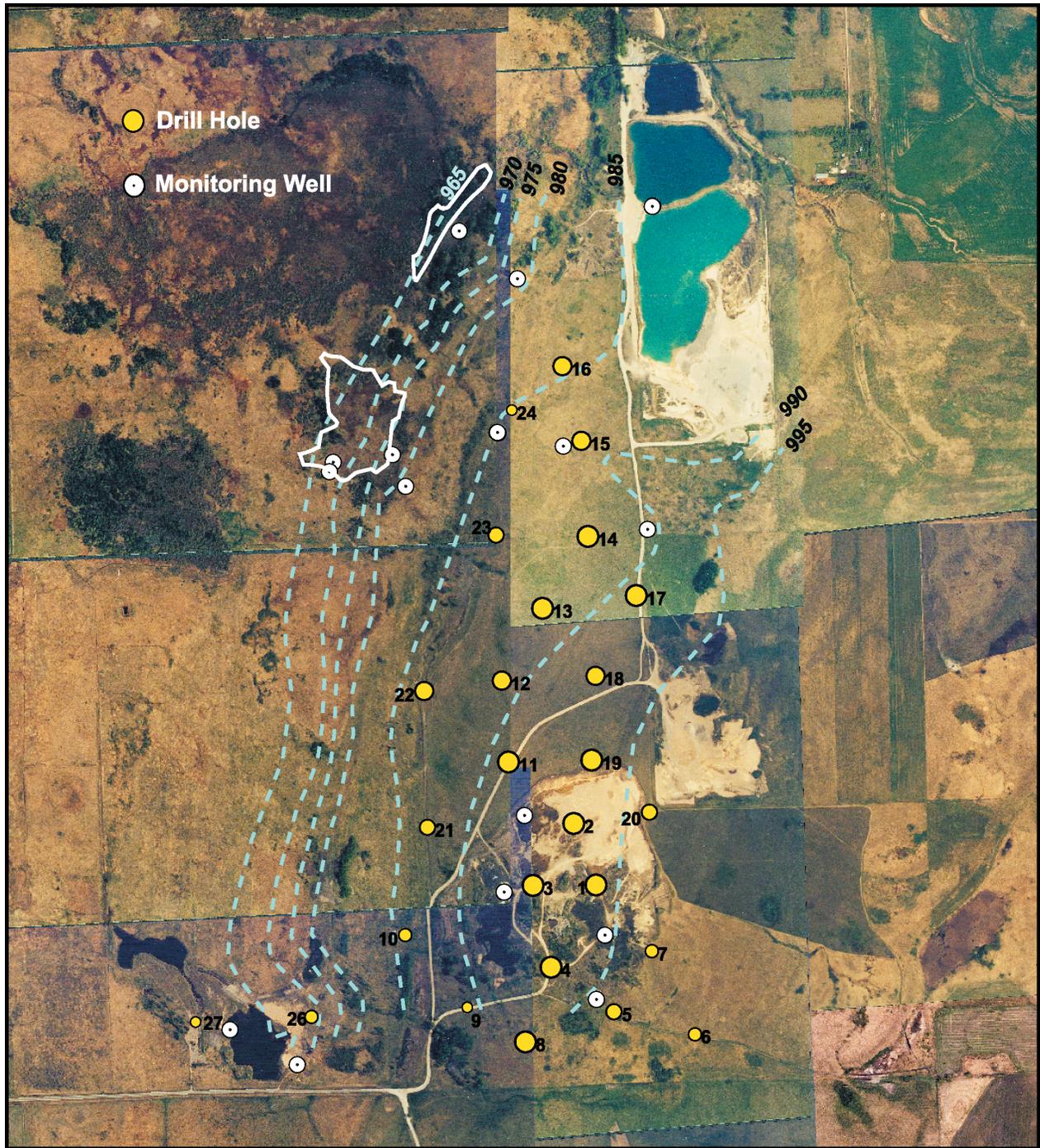


Figure 26: Blue contours represent the water table slope. Fens are outlined in white, white dots mark the location of groundwater monitoring wells and yellow dots mark rotosonic drill holes.