

HISTORY

High nitrate levels in the Concho River have been an issue of concern for many years. The 1994 CRP Final Report confirmed the problem and recommended additional studies, particularly in that area upstream of FM 1692. The study also identified several tributaries draining the watershed south of the river between Miles and Paint Rock. Subsequent to that report, monitoring for nitrates has become an integral part of CRP sampling objectives for the Concho River. In 1998, the upper basin steering committee identified this problem as a priority for the Clean Rivers Program. This report provides additional information on nitrate levels and reaffirms the need for additional and more focused investigations. Although the FY2000-2001 work plan has reduced the sampling frequency for stations on the Concho River, nitrates will continue to be monitored in an effort to understand why there are elevated levels and to possibly determine the cause.



RESULTS AND DISCUSSION

The Concho River typically gains nitrates as it travels downstream from San Angelo. Of the six mainstream sample stations, two stand out as problem areas. The FM 1692 station and the Paint Rock station both showed much higher nitrogen levels than the other four stations. The three tributaries (Kickapoo Creek, Dry Hollow, and Lipan Creek) draining the watershed south of the river were characterized by having very high levels of nitrates, however, relatively low discharge rates minimized their impact on the mainstream river.

A review of the nitrate levels for each station indicates a increasing trend over time with apparent reduction in nitrate levels during the period of November 1995 to August 1999. The stations at Paint Rock, FM 1692, and the sites for Kickapoo Creek, Dry Hollow, and Lipan Creek had significant perturbations in nitrate levels over time. The peak levels are typically seen during the winter, while the lower levels are seen during the summer months. This phenomenon is probably a function of primary production being at its peak during the summer which results in a much greater consumption of the nitrates by plants within the water column. The positive trend is somewhat misleading because during this time period discharge levels at the sites also decreased.

To better understand the impact of nitrates on the aquatic system, the levels were converted to a loading factor by using the measured discharge when the sample was taken and calculating the tonnage of nitrates for a 24-hour period. Loading varied significantly over time. Because of this variation, each station's loading was plotted on the same scale to effect a standardized comparison for the entire river reach (San Angelo to Paint Rock). The stations at Paint Rock and FM 1692 had the greatest nitrate loading.

The Texas Natural Resource Conservation Commission established a 10 mg/l drinking water standard. This standard is due in part to the health effects from well water with high nitrate levels. Nitrate levels greater than 10 mg/l have been shown to cause methemoglobinemia, also known as blue baby syndrome. The Paint Rock station exceeded the 10 mg/l nitrate standard nine (9) times out of forty-three (43) sample events. This is a 21% exceedance rate for the station.

Significant loads at Paint Rock occurred in March and October of 1996 and again in December of 1997. Drought conditions throughout 1998 and 1999 resulted in much lower levels.

The FM 1692 station exceeded the 10 mg/l nitrate standard fifteen (15) out of forty (40) sample events. This is a 37.5% exceedance rate for the station. Although the overall loads of nitrates to the river are greater here than that seen at Paint Rock, a similar cessation in loading was also seen from March 1998 through 1999.

Tributary loading to the Concho River by Kickapoo Creek, Dry Hollow, and Lipan Creek was less than observed loading at Paint Rock and FM 1692. It is significant to note that Dry Hollow and Lipan Creek are characterized by much higher levels of nitrates than seen in other tributaries. From November 1995 to June 1999, Dry Hollow exceeded the 10 mg/l standard 27 times out of 39 sample events. This is a 69% exceedance rate. The mean level of nitrates at the station was 13.6 mg/l. For Lipan Creek the exceedance rate was 76.9% (10 out of 13 samples were over the 10 mg/l level) with an average level of 18.2 mg/l. This is important because these tributaries are very short in length and both are characterized by generally perennial flow which originates from springs. It is also important to note that each of these tributaries has had essentially no flow during the past two years as a result on the ongoing drought.

CONCLUSIONS

The occurrence of high nitrate levels in the Concho River is not a new problem. Paint Rock residents have been aware of the problem for several decades and the recent monitoring for the Clean Rivers Program (since 1993) continue to affirm this problem. A parallel study (Lange, 1999) conducted by the Lipan-Kickapoo Water Conservation District confirmed the presence of high nitrates in the Lipan Aquifer. Water wells within the District were sampled three times (July 1998, October 1998, and March 1999) and the nitrate levels plotted on maps for each sample period. Because of the shallow nature of the Lipan Aquifer, ground water naturally discharges both by seepage (springs) to the Concho River (and its tributaries) as well as by evapotranspiration (Lange, 1999). The prevailing thought is that intensive agricultural land-use over the past 50-75 years has resulted in a concentration of nitrates in the soil zone and with the advent of flood irrigation, these nitrates have been leached from the soil into the ground water and concentrated over time. This is probably the cause of the high levels measured in Dry Hollow and Lipan Creek during periods of discharge.

The high levels seen at FM 1692 are not as easily explained. Some of the loading at that station can probably be attributed to seepage to the river, but not all. If there are other causes, they are unknown at this time. Potential sources may be confined animal feeding operations (CAFO's) in the vicinity of Miles and possibly the Miles waste water treatment plant. All of these facilities are in compliance with their permit restrictions which precludes any discharge to surface waters. However, incipient leaching to groundwater may possibly be occurring. Because the Lipan-Kickapoo Water Conservation District has no jurisdiction north of the Concho River, there has not been any sampling of the groundwater in that area. The sampling and testing for nitrates in groundwater in the vicinity of Miles and south to the river should be considered.

RECOMMENDATIONS

1. The Concho River watershed should be investigated to locate seeps and/or springs that are supplementing river discharge. All seeps and springs should be located and fixed with GPS equipment. Samples should be taken at the time the seeps are found and shipped to a certified lab for analysis. Each seep or spring should be monitored on a quarterly basis for nitrate levels plus an estimate of the discharge.
2. Water wells north of the Concho River between the San Angelo WWTP and the city of Miles should be evaluated for monitoring. A subset of wells should be selected for quarterly monitoring of nitrates and static level measurements. If existing wells are insufficient to adequately sample the study area, test wells should be drilled for this purpose. This investigation should mirror that which was completed by the Lipan-Kickapoo Water Conservation District south of the river and included in their ongoing comprehensive study.
3. All CAFO's located between the San Angelo WWTP and the city of Miles should be identified and evaluated for potential nitrate leaching to groundwater resources (i.e., Lipan Aquifer). Water wells at or near these facilities should be prioritized for inclusion in the well investigation (number 2 above).

For further information on the Clean Rivers Program contact watershed@lcra.org.