Septic System Tributary Interaction Study

Las Vegas, Nevada

2003

Research conducted by the

Southern Nevada Water Authority

In cooperation with the Clark County,

Department of Air Quality and Environmental Management

by

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INTRODUCTION

Water quality in the Las Vegas Wash and its tributaries reflects the urban nature of the Las Vegas Valley watershed. The presence of coliform bacteria in the Las Vegas Valley washes prompted the Clark County, Department of Air Quality and Environmental Management to investigate possible sources of bacteriological influence. The Southern Nevada Water Authority partnered with the Department of Air Quality and Environmental Management to determine if individual sewage disposal systems (ISDS), or septic systems were a source of coliform bacteria in the Las Vegas Wash tributaries.

The purpose of this study was to determine the contributions to water quality from ISDS discharge to the Las Vegas Wash tributary network through the shallow groundwater system. This research was conducted in response to elevated coliform counts on the tributary network in the Las Vegas Valley (Valley). Coliform sources include: wildlife, human waste, and urban runoff. This study identified areas in the Valley where discharge from ISDS may have influenced water quality in both shallow groundwater and in the tributary network. A sampling program was developed to assess the magnitude of ISDS effects.

Areas of likely contribution of affected shallow groundwater are those with the highest density of ISDS. Neighborhoods constructed in a rural setting ahead of municipal infrastructure typically have high density ISDS use as is currently observed throughout the Valley (Figure 1). Most of the homes built in suburban and rural residential portions of the Valley are built with ISDS, septic systems due to a lack of nearby municipal infrastructure. The results of urban growth out of phase with municipal infrastructure are areas with ISDS high density use, surrounded by a low density of use, or no ISDS use at all.

Areas with high ISDS density were compared to areas where dry weather channel flow in the tributaries had a likely inflow from shallow groundwater, which is based on classic concepts of a gaining stream associated with an unconfined aquifer. Reaches of Duck Creek, Flamingo Wash and Sloan channel were selected for suitability.

This research was initiated with the expectation that if ISDS were influencing water quality in the tributaries, then the influence could be determined by monitoring for specific water quality parameters that are attributed to human activities. In addition to coliform bacteria, monitoring for general chemistry and for pharmaceuticals and personal care products (PPCP) tested the following hypothesis:

Individual Sewage Disposal Systems transmit coliforms to the shallow groundwater system and ultimately to the Las Vegas Wash tributary system.

ASSUMPTIONS

1) ISDS leach fields contribute to the shallow groundwater system.
2) Areas with a higher density of ISDS will have greater impact on the shallow groundwater system.
3) ISDS close to streams have a more pronounced impact on stream water quality than will ISDS further away.
4) Evaporation and water-mineral reaction with stream bank materials do not significantly contribute to changes in chemistry observed along a stream reach.
5) High-salinity groundwater and lower-salinity irrigation runoff are major influences on chemistry in the Las Vegas Wash tributary network.

Based on these assumptions, areas with a high density of ISDS were considered most likely to impact shallow groundwater and stream reaches.

Areas with a high density ISDS are areas where the number of septic systems within one mile approach or exceed the guidelines for a density of 119 ISDS per square mile as recommended by the State of Nevada. In order to determine the density ISDS areas, a density map was constructed using Spatial Analyst© in Arcmap® (Figure 1). Registered ISDS were linked by parcel number to the county assessors parcel database. The coordinates of the centers of these parcels were utilized to calculate the density of ISDS. The results were then color shaded to represent areas of high density and low density. The graphical representation of ISDS density was utilized when estimating areas of likely impact to stream reaches.

SITE SELECTION AND DESCRIPTION

Tributary reaches investigated include: Duck Creek, Flamingo Wash, and Sloan Channel (Figure 2). Ten sample sites among these tributary reaches were identified based on the following selection criteria: 1) sites within the area of the shallow groundwater system where base flow is likely to occur, 2) sites near an area with a high density ISDS, and 3) a shallow groundwater monitor well along a likely flow path between an area with a high density of ISDS and a active stream channel. Criteria were expanded to include seeps or springs flowing into an active wash in place of existing monitor wells. Wells springs, or seeps were not present at the Flamingo Wash or Sloan Channel areas. Exploratory boreholes were therefore hand augered to gain access to shallow groundwater. At the Duck Creek area the discovery of an existing monitor well meant there was no need to auger a hole.

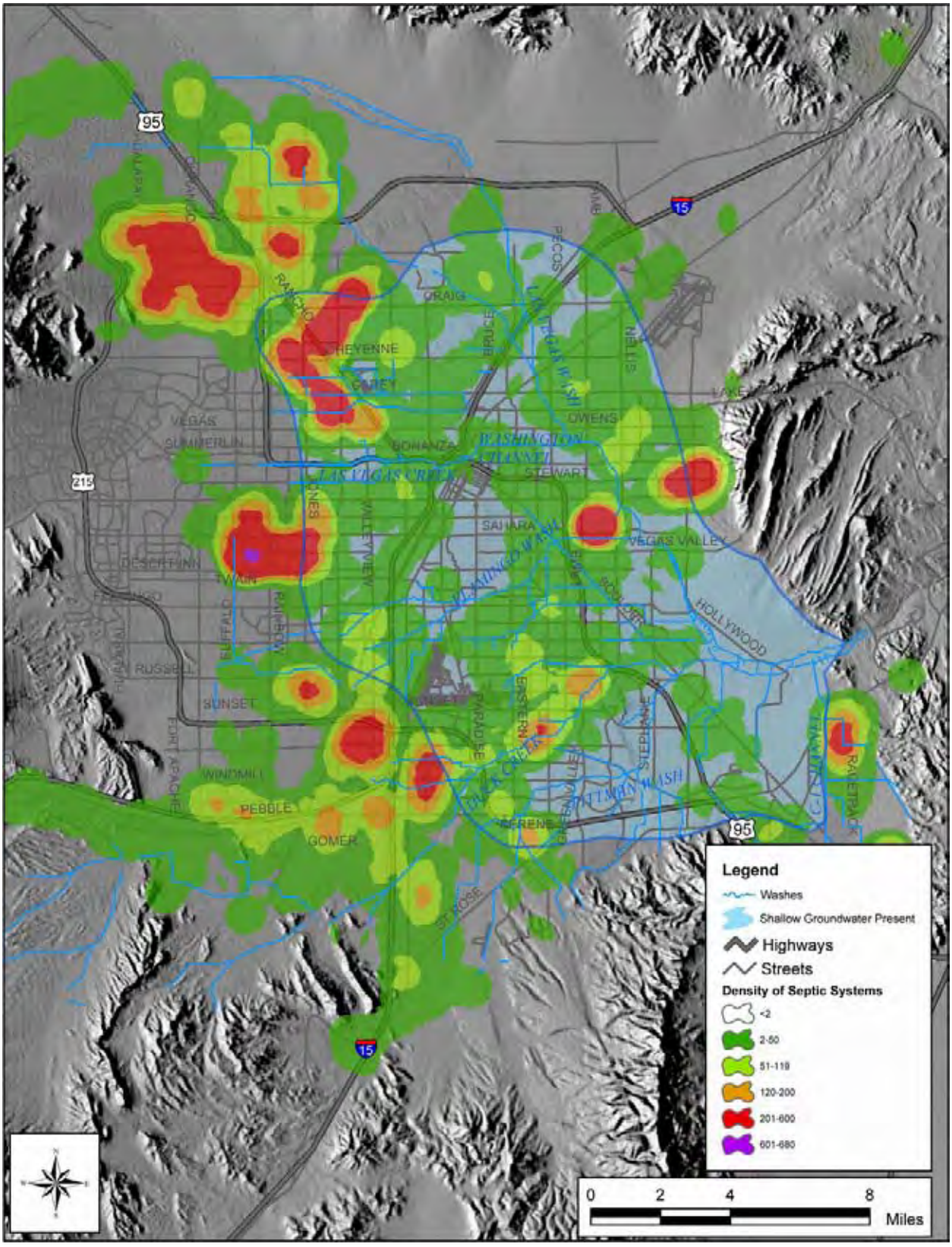

Figure 1. Map Detailing the Individual Sewage Disposal Systems (ISDS) in the Las Vegas Valley. Density is based on a count of ISDS within one square mile.

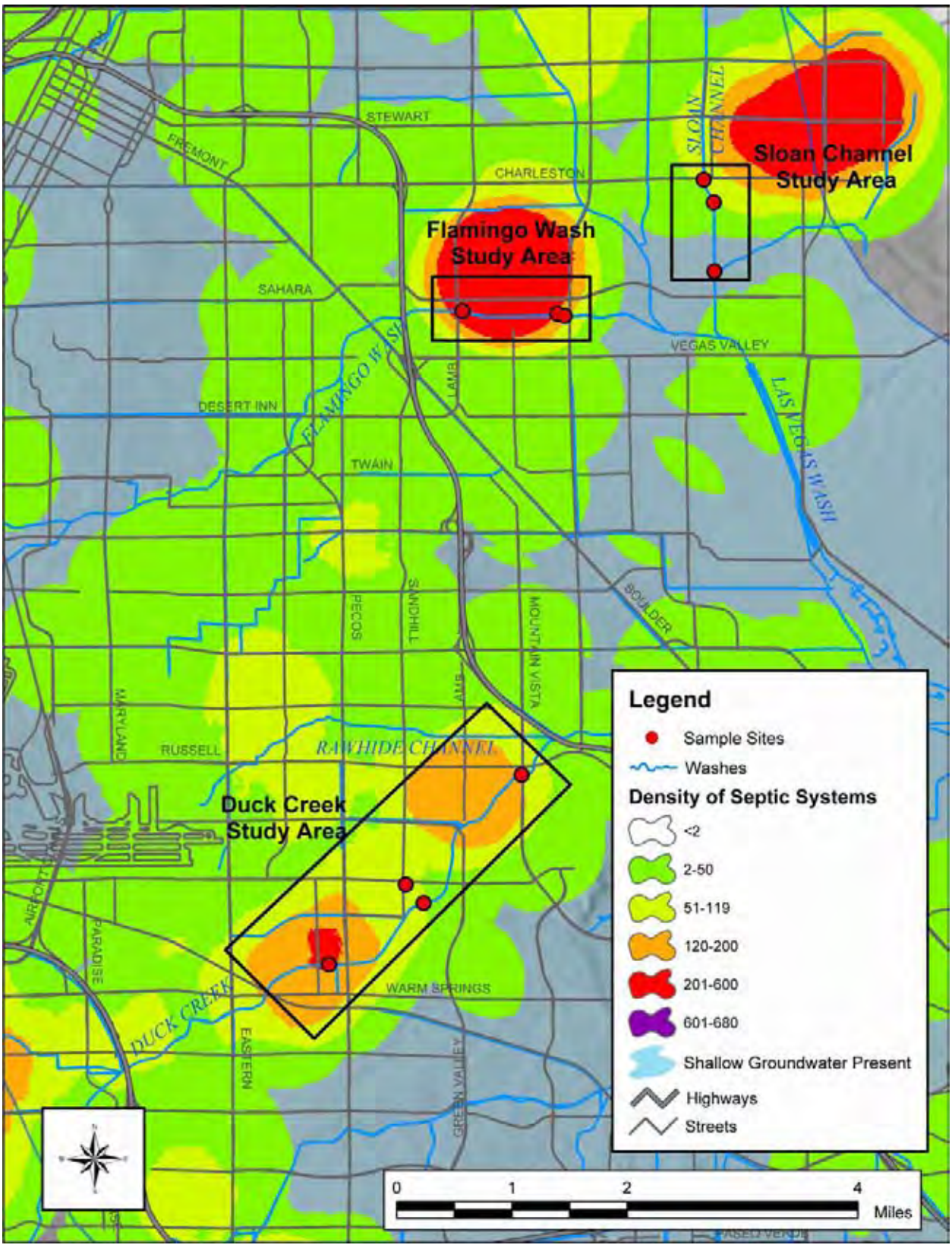

Figure 2. Map detailing the high density individual sewage disposal systems (ISDS) areas for focused study. Density is based on a count of ISDS within one square mile.