CONSERVATION PARTNERS

FAX TRANSMITTAL

DATE: April 20, 2004

TO: **Rick Bailey, Kyle Bailey, Judy Bane, Dale Pierson, Don Holyoke, Ric McBrier, Robert Hugie, Donna Metzler, Ty Lewis, Steve Reisenhover, Mary Hofhine, BarbMorra and Bill Howell**

FAX: All-Please distribute

FROM: Marty Zeller

RE: Materials from Mike Lowe and next Meeting

Pages: 8

To Spanish Valley Roundtable Members:
We have scheduled a meeting of the Roundtable for Wednessday May 12 at 2 pm, tentatively at the GWSSA offices in Moab. The purpose of the meeting is to review the results and implications of the mass balance study and Mike Lowe, from the Utah Geological Survey and author of the study will be in attendance. As you recall that draft study recommends the adoption of water quality standards to protect the aquifer that would require10 and 20-acre spacing for new development in Spanish Valley that is not on a community sewer system. In addition, we will review activities that have occurred since our last meeting.

Attached is the correspondance that I received from Mike Lowe that relates to this meeting. I am faxing it since the materials are not in electronic format. It is critical that all of you attend if possible so that a common strategy can be developed to address future growth and development in Spanish Valley. If you have any questions give me a call at 303 831-9378.

Marty Zeller

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March 23, 2004

Marty Zeller, Spanish Valley Roundtable Facilitator
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Dear Mr. Zeller,

This letter is in response to your inquiry regarding the status of our septic-tank density analysis in Moab-Spanish Valley. The Utah Geological Survey's Environmental Sciences Program scientists are currently studying ground-water conditions in Moab-Spanish Valley. As you know, most development in the Grand County portion of Moab-Spanish Valley is on a community sewer system, whereas the San Juan County portion uses septic tank soil-absorption systems for wastewater disposal. In a recent U.S. Geological Survey report (Steiger and Susong, 1997), scientists linked elevated nitrate conditions in some wells in central Moab-Spanish Valley to human impacts, likely septic tank usage. One major purpose of our studies is to apply a ground-water flow model using a mass-balance approach to determine the potential impact of projected increased numbers of septic-tank systems on water quality in the Moab-Spanish Valley valley-fill aquifer and thereby recommend appropriate septic-system density requirements to limit water-quality degradation. Below, I describe the process which we derive our recommendations.

We use a mass-balance approach to evaluate potential septic-tank system impacts on ground-water quality and determine recommended lot sizes. In the mass-balance approach, the nitrogen mass from projected additional septic tanks is added to the current nitrogen mass and then diluted with ground-water flow available for mixing plus the water added by the septic-tank systems themselves. Ground water available for mixing was calculated based on estimated parameters representing existing conditions using a Brigham Young University (Downs and Kovacs, 2000) simulation of the ground-water flow system in Moab-Spanish Valley. From the model, we: (1) grouped areas into three ground-water flow domains (geographic areas with similar characteristics of flow volume per unit area); (2) determined area acreage, ground-water flow volumes, number of existing septic-tank systems, and ambient (background) nitrate concentrations for each domain; and (3) calculated, using the appropriate amount of wastewater and accompanying nitrogen load introduced per septic-tank system, projected nitrogen loadings in each domain based on increasing numbers of septic tank soil-absorption

systems (tables 1 and 2). By limiting allowable degradation of ground-water nitrate concentration to a specific milligram per liter value (described below), we were then able to derive septic-tank density recommendations for each domain.

For each septic system, we used a discharge of 242 gallons (916 L) of effluent per day for a domestic home based on a per capita indoor usage of 70 gallons (265 L) per day (Utah Division of Water Resources, 2001) by San Juan County's average 3.46 person household (U.S.Census Bureau, 2002); most new septic-tank systems likely to be constructed in Moab-Spanish Valley will likely be in San Juan County. We used an estimated nitrogen loading of 54.4 mg/L of effluent per domestic septic tank for nitrogen loadings based on: (1) an average number of people per household of 3.46, (2) an average nitrogen loading of 17 g N per capita per day (Kaplan, 1988, p. 149), and (3) an assumed retainment of 15 percent of the nitrogen in the septic tank (to be later removed during pumping; this number is close to Bauman and Schafer's (1985, in Kaplan, 1988, p. 147) nitrogen concentration in septic-tank effluent of 62 ± 21 mg/L based on the averaged means from 20 previous studies. Ground-water flow available for mixing was determined using the ground-water flow model of Downs and Kovacs (2000).

We calculated one graph for each area based on a range of parameters that affect the amount of ground water available for dilution. We obtained the number of septic-tank systems permitted (post-1980 records) in each area from the Southeast Utah Health Department (Jim Adamson, written communication, 2002; Dave Vaughn, Grand County, verbal communication, 2003; Lance Christie, verbal communication, 2003; Dale Pierson, verbal communication, July 2003). We supplemented this data by identifying potential sites of septic systems from buildings and house dwellings plotted from aerial photographs (Utah State Trust Lands, written communication, 2003); the sites we identified were verified by local county GIS specialist, Dave Vaughn (2003), based on his knowledge of the study area. The plate/map shows historical and permitted septic systems that we have been able to determine from what the locals have provided to us. Attachments of tables 1 and 2 list the number of septic-tank systems estimated for each domain.

For this analysis, we used a total of 210 septic tanks for all the domains, and ranges from a low of 59 (domain 2) to a high of 77 (domain 3) (tables 1 and 2). Background nitrate concentrations for each domain range from 0.78 mg/L (domain 3) to 3.5 mg/L (domain 2). We allow a 1 mg/L degradation above current background levels of nitrate (a value adopted by Wasatch and Weber Counties as an acceptable level of degradation), and additionally, for domain 3, a total degradation value of 3 mg/L, which is 2.2 mg/L above the current background level of 0.78 mg/L (the domain having the greatest area acreage), to calculate recommended septic-system density/lot size there.

Figure 1 shows a plot of projected nitrate concentration versus septic-tank density and number of septic-tank systems in domain 1 in the southeastern part of central Moab-Spanish Valley (attached plate). Background nitrate concentration for domain 1 is 2.68 mg/L. There are 74 septic systems estimated to be in domain. Domain 1 has an area of approximately 1,396 acres, so the existing average septic-system density is 19 acres per

system. Based on our analyses (table 1), estimated ground-water flow available for mixing in domain 1 (figure 1) is 1.08 cubic feet per second. For the domain 1 area to maintain an overall nitrate concentration of 3.68 mg/L (which allows 1 mg/L of degradation), the total number of homes using septic tank soil-absorption systems should not exceed 132 based on the estimated nitrogen load of 54.4 mg/L per septic-tank system (figure 1, table 1). This corresponds to a total increase of approximately 55 added septic systems and an average septic-system density of about 10 acres per system in domain 1 (table 1). We computed recommended septic-tank densities for the other domains in the same manner. Please see the tables and accompanying graphs (figures 2 and 3) for the details of those areas.

The report outlining the preliminary results described above is in draft form. We may not release the report until it has undergone thorough internal and external review, because changes in the report may be necessary due to this review process. We hope to release the report in the coming year. We would be glad to discuss our preliminary results with you and your committee. If you have questions or concerns, please contact me at 801-537-3389, Environmental Sciences Program Manager; or email at: mikelowe@utah.gov. Thank you for your interest.

Sincerely,

Mike Lowe

Mike Lowe

Enclosures: 6
Cc: Mike Lowe
ML/jjw

Table 1. Parameters used to perform a mass-balance analysis for different ground-water flow domains in Moab-Spanish Valley, Grand and San Juan Counties, Utah.

Domain	Area (acres)	Flow* (cubic feet per second)	Average nitrate concentration (background) (mg/L)	Number of wells sampled	Current number of septic tanks permitted+
1	1396	1.08	2.68	16	74
2	3397	2.06	3.50	12	59
3	6749	2.82	0.78	18	77

*data were derived using ground-water flow computer model (see text for explanation).
+septic-system data were provided by the Southeast Utah Health Department (Jim Adamson, 2002) and estimated by the UGS with the aid of Lance Christie, 2003.

Table 2. Results of the mass-balance analysis using the best-estimate nitrogen loading of 54 mg N/L for different ground-water flow domains in Moab-Spanish Valley, Grand and San Juan Counties, Utah.*

Domain	Area (acres)	Flow amount (cfs)	Current density (acres/ system)	Number of septic tanks permitted	Projected number of total septic tanks	Calculated septic-tank density @1 mg/L (acres/ system)	Septic-tank density recomm-endation (acres/ system)
1	1396	1.08	19	74	132	10.5	10
2	3397	2.06	58	59	171	20/15**	20
3	6749	2.82	88	77	222/410+	30/16**	20

*best-estimate calculation is based on a nitrogen load of 17 g N per capita per day (from Kaplan, 1988) for a 3.46-person household and 242 gallons per capita as the amount of water generated per household based on the 2001 Utah State Water Plan (Utah Division of Water Resources, 2001). **second number after/ corresponds to the calculated lot-size recommendation based on an allowable degradation of overall nitrate concentration to be 5 and 3 mg/L, for respective domains 2 and 3.
+ projected amount of septic tanks based on a 20 acre lot-size recommendation.

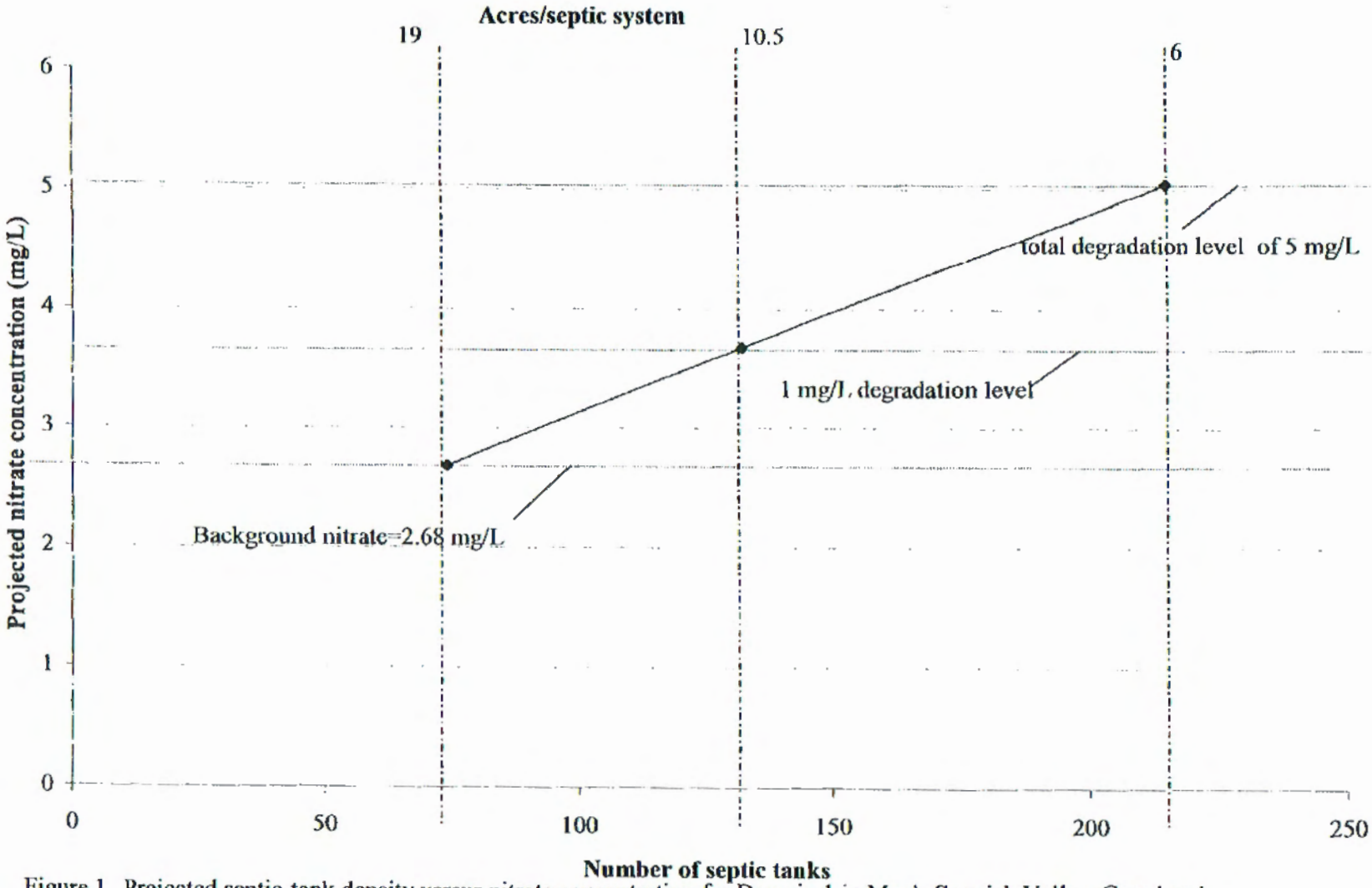

Figure 1. Projected septic-tank density versus nitrate concentration for Domain 1 in Moab-Spanish Valley, Grand and San Juan Counties, Utah, based on 74 existing septic tanks (see table 6).

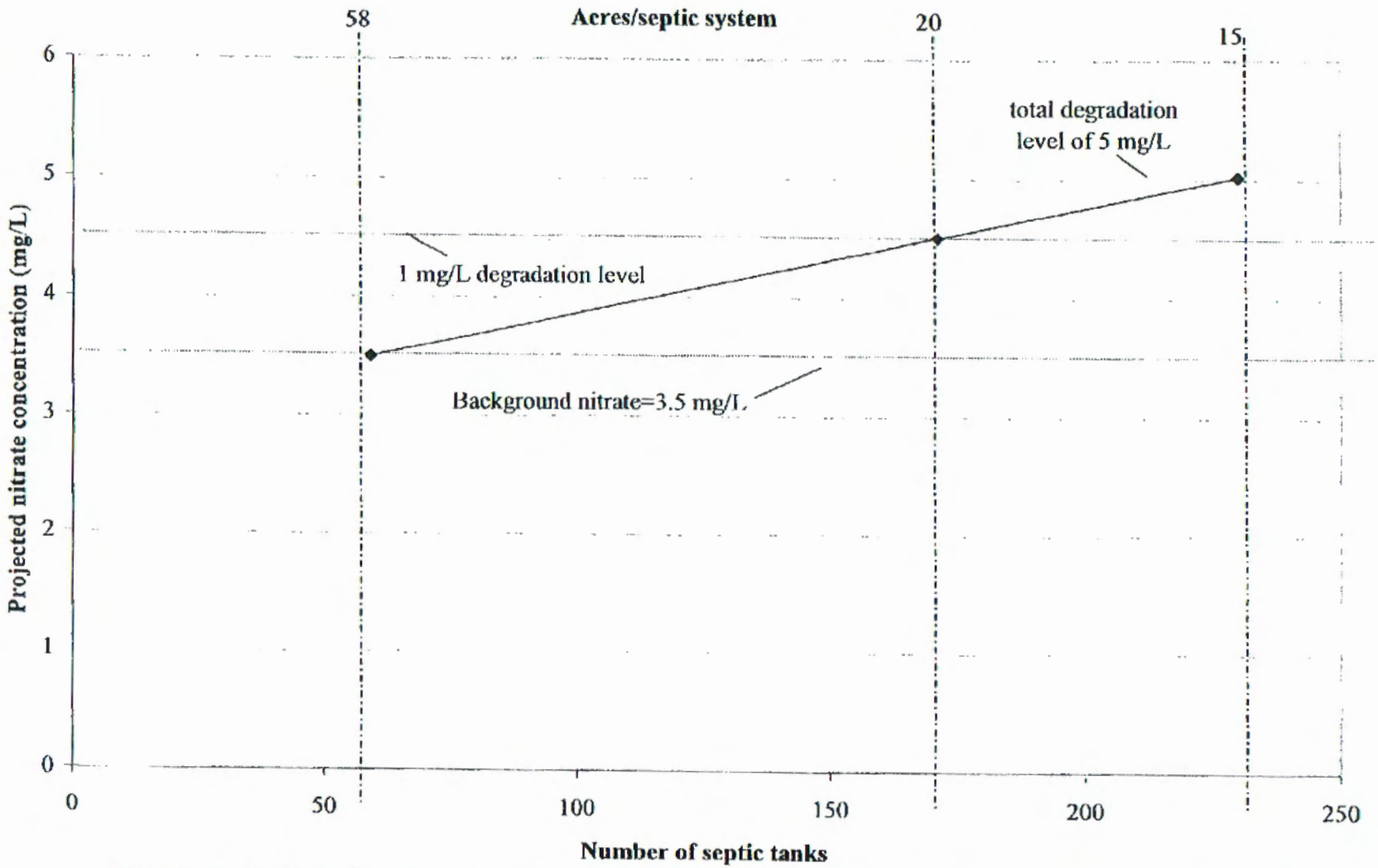

Figure 2. Projected septic-tank density versus nitrate concentration for Domain 2 in Moab-Spanish Valley, Grand and San Juan Counties, Utah, based on 59 existing septic tanks (see table 6).

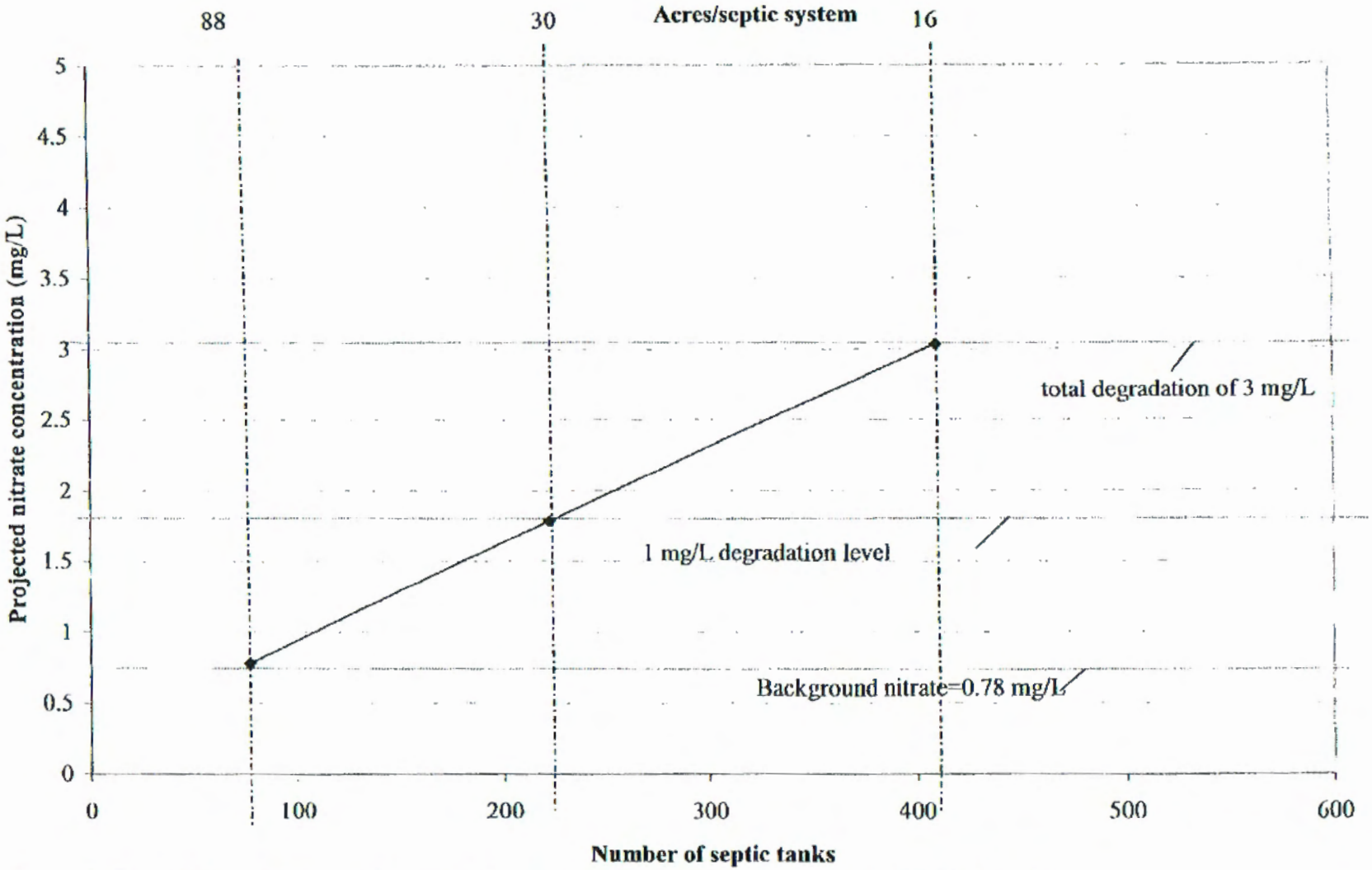

Figure 3. Projected septic-tank density versus nitrate concentration for Domain 3 in Moab-Spanish Valley, Grand and San Juan Counties, Utah, based on 77 existing septic tanks (see table 6).