Rein in the Runoff

Alternative Stormwater Management Practices that Address the Environmental, Social, and Economic Aspects of Water Resources in the Spring Lake Watershed (MI)

FINAL PROJECT REPORT

September 2009

(Revised: January 2010)

Co-Principal Investigator/Project Manager: Elaine Sterrett Isely
Principal Investigator: Alan D. Steinman
Technical Team Members: Kurt Thompson, Jon Vander Molen, John Koches

Technical Team Members: Sanjiv Sinha, Lisa Huntington

Funding provided by Michigan Sea Grant and NOAA
Stakeholder Team Members: Chuck Pistis, Dan O'Keefe

Technical Team Member: Paul Isely, Department of Economics

Stakeholder Team Member: Tim Penning, School of Communications

Chapter 6: Population Growth and Stormwater Pollution

Utilizing the combined results of different model outputs, stakeholder input, and field surveys of Spring Lake Watershed conditions, the Rein in the Runoff project team developed forecasts of future land use and land cover change related to population growth and projected development in the Spring Lake Watershed. These forecasts were then used to model the results of such development on the pollutant loads to Spring Lake as a result of stormwater runoff. Ecological forecasts such as these can help assist planning and decision-making, but they do come with some level of uncertainty (Clark et al. 2001). For such ecological forecasts to be useful, the underlying scientific information must be as accurate as possible, and its communication to the public must be effective. These technical and resource constraints may be large, but not insurmountable (Nilsson et al. 2003).

Accordingly, this chapter examines the forecasted effects of continued population growth and the accompanying land use changes in the Spring Lake Watershed. The project team applied PLOAD model runs (see Appendix A) to the results of the Population Allocation Model (PAM) analysis, the technical details of which are described in Appendix K. These combined results provide one potential future for the Spring Lake Watershed, assuming no change – or “business as usual”. Obviously, changes in policies or practices by the watershed stakeholders – including the widespread implementation of stormwater best management practices (BMPs) – would lead to different future outcomes.

POTENTIAL LAND USE CHANGES RESULTING FROM CONTINUED POPULATION GROWTH IN THE SPRING LAKE WATERSHED

Assuming that there is no change in current conditions, the model outputs from the PAM analysis conducted by the project team graphically show how the Spring Lake Watershed stakeholders could possibly develop and populate their watershed into the future. The population and allocation spatial data generated by PAM for 2010, 2020, 2030, and 2040 utilized the current population growth rate of 1.76% (PAM Scenario 1). These were then converted to land use and land cover GIS (geographic information system) data layers, and used to update the 2006 land use and land cover data for the watershed (Figure 6-1). This analysis focused on the increase in residential lands, but Figure 6-1 makes the concurrent loss of other land uses and land covers quite evident.

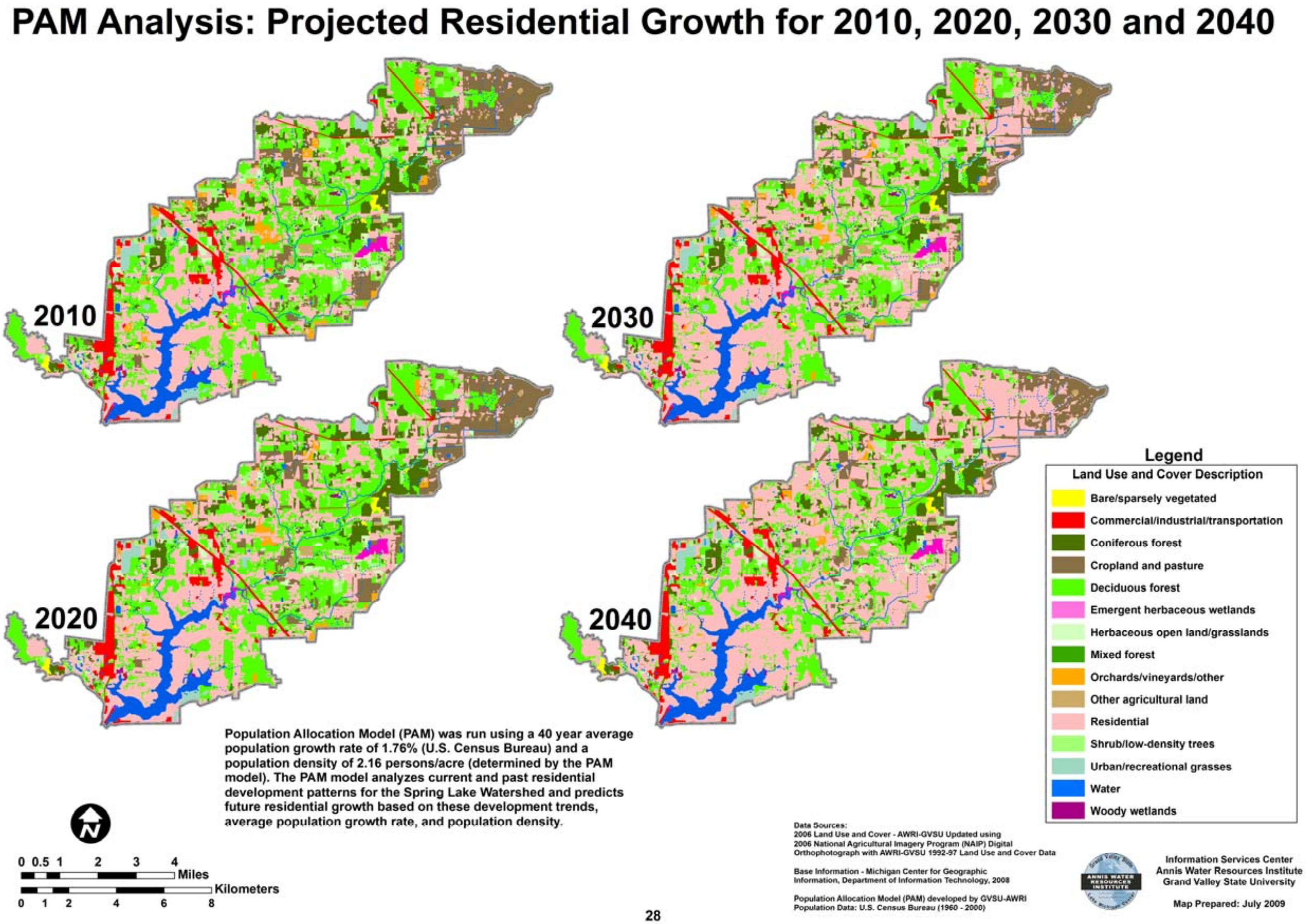

Figure 6-1. Projected land use and land cover changes in the Spring Lake Watershed in 2010, 2020, 2030, and 2040, based on the Population Allocation Model's (PAM) projected residential growth and population allocation.

EFFECTS OF FUTURE DEVELOPMENT ON POLLUTANT LOADS TO SPRING LAKE

The Rein in the Runoff project team then ran PLOAD on these projected future Spring Lake Watershed land use and land cover data for 2010, 2020, 2030, and 2040, to determine how this future residential growth might affect the pollutant loadings throughout the watershed. (For a detailed discussion of the PLOAD methodology utilized by the Rein in the Runoff project team, please see Appendix A.) The resulting linked model outputs showed projected increases in pollutant loads from 2010 – 2040 of 29% for Total Nitrogen (TN), 34% for Total Phosphorus (TP), and 25% for Total Suspended Solids (TSS) (Table 6-1). Although PAM projected residential growth throughout the entire Spring Lake Watershed, the highest pollutant loads were again seen in the sub-basins closest to Spring Lake for TN (Figure 6-2), TP (Figure 6-3), and TSS (Figure 6-4).

Table 6-1. PLOAD Results for Pollutant Loads from the Spring Lake Watershed based on the Population Allocation Model's (PAM) Forecasted Residential Growth and Patterns of Development in 2010, 2020, 2030, 2040.

Year	Residential Land Use and Land Cover		Total Nitrogen (lbs/yr)	Total Phosphorus (lbs/yr)	Total Suspended Solids (lbs/yr)
	Acres	% of Watershed			
2010	10,532.06	31.14	68,268	13,456	851,146
2020	12,248.19	36.22	73,239	14,639	904,040
2030	14,415.62	42.62	79,524	16,113	971,524
2040	17,218.64	50.89	87,966	18,090	1,062,751
Change from 2010 - 2040:	**6,586.58**	**19.75**	**19,698**	**4,634**	**211,605**

These patterns of development assumed that population growth would remain steady at the current rate of 1.76% (U.S. Census Bureau 2009), and were based on the current zoning ordinances and other regulations currently in effect throughout the Spring Lake Watershed. Certainly, if development continues unchecked, without proper stormwater BMPs to help control these pollutant loads to Spring Lake, the water quality in the lake and adjoining waterways will worsen. However, the implementation of stormwater BMPs – in particular Low Impact Development (LID) strategies – for new development will help limit the impact of increased pollutant loads associated with continued residential growth.

Recall that LID techniques attempt to mimic presettlement hydrology – or at least to maintain the hydrologic status quo. Although the project team did not re-run these linked model results with the suite of BMPs implemented in the high priority areas identified for the Spring Lake Watershed (see Figure 4-2 in Chapter 4), earlier model results showed that even without more development, the nutrient loads to Spring Lake will need to be controlled (see Table 4-2 in Chapter 4). The implementation of LID BMPs in new development projects would keep the stormwater runoff problem from worsening; however, these practices also need to be incorporated into already existing developed areas throughout the watershed.

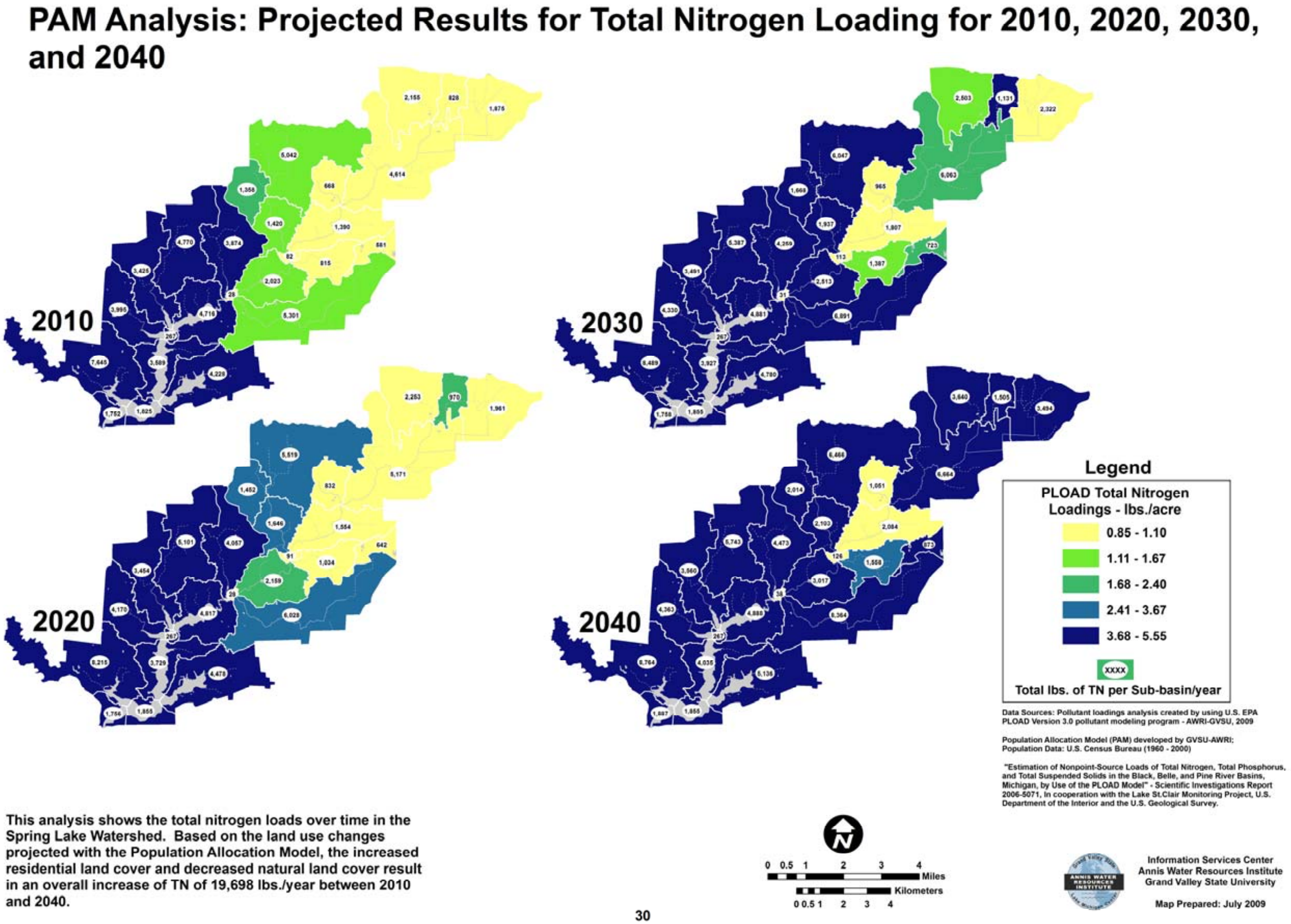

Figure 6-2. Linked model results from PAM and PLOAD for Total Nitrogen (TN) mapped to the ArcSWAT sub-basins for the Spring Lake Watershed based on projected residential growth and development in 2010, 2020, 2030, and 2040.

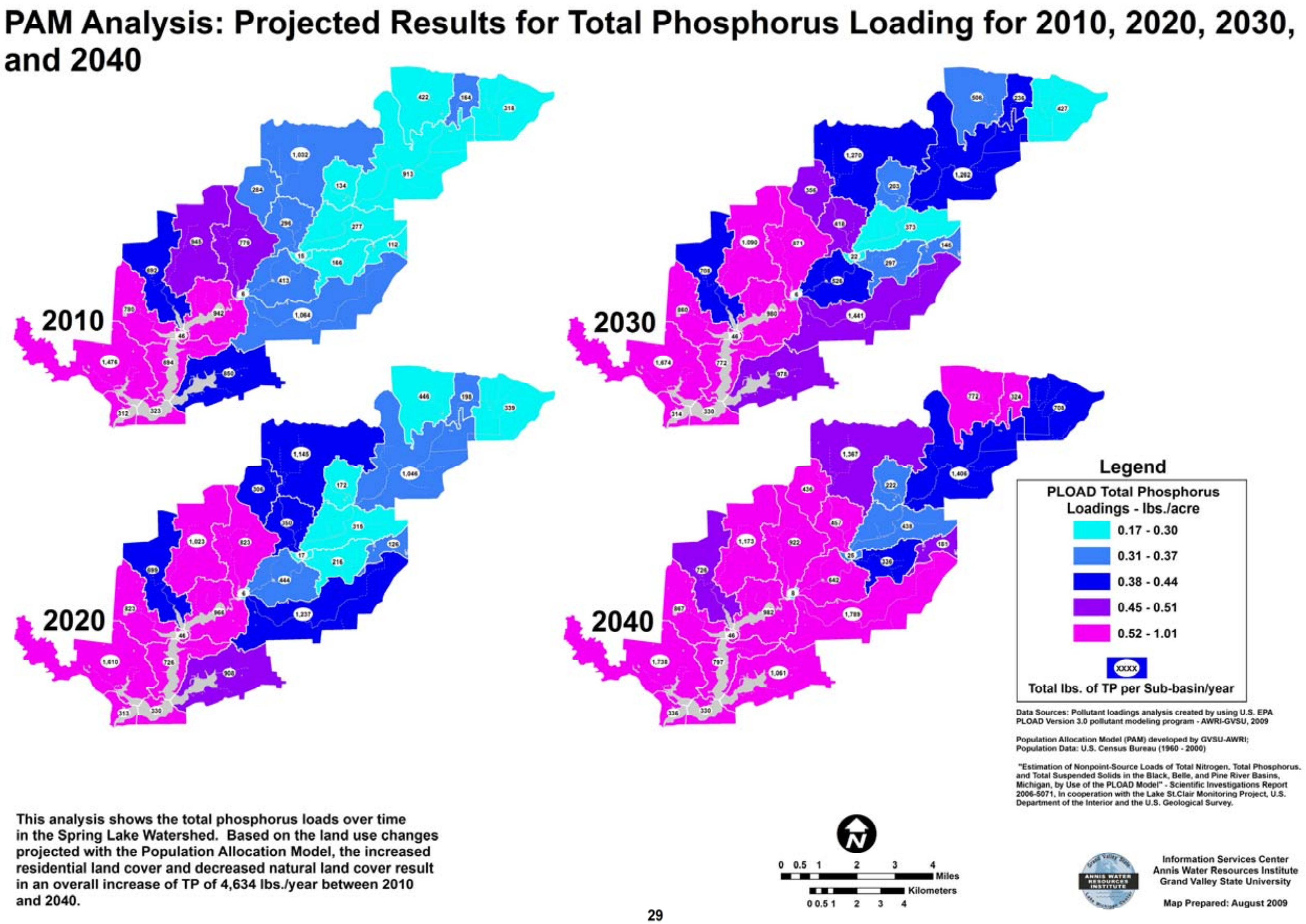

Figure 6-3. Linked model results from PAM and PLOAD for Total Phosphorus (TP) mapped to the ArcSWAT sub-basins for the Spring Lake Watershed based on projected residential growth and development in 2010, 2020, 2030, and 2040.

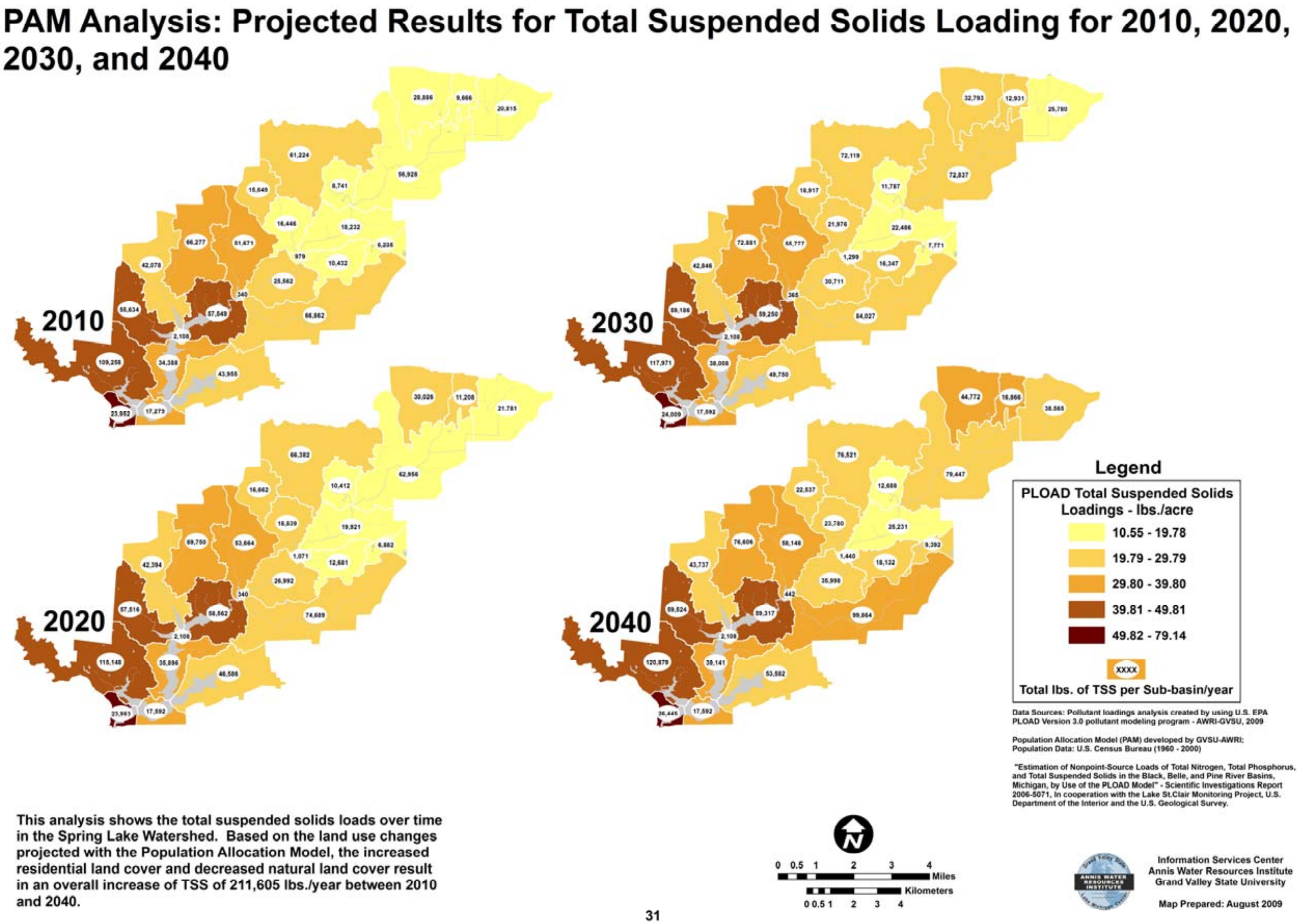

Figure 6-4. Linked model results from PAM and PLOAD for Total Suspended Solids (TSS) mapped to the ArcSWAT sub-basins for the Spring Lake Watershed based on projected residential growth and development in 2010, 2020, 2030, and 2040.