INVESTIGATION OF LAND USE AND NITRATE MIGRATION POTENTIAL IN LITHIA AND BUCKHORN SPRINGS FOCUS AREA

Prepared for:
Tampa Bay Water

SDI Environmental Services, Inc.

Photo: Brandon, Florida, 1890-1990: A Photographic Essay by Lisa W. Rodriguez, University of South Florida Libraries, Tampa Bay History Collection
Lithia and Buckhorn Springs Focus Area, with Lines of Equal Nitrate Concentration in Study Area Groundwater in 1992
Nitrite plus Nitrate Concentration Trends in Lithia Springs

- Linear (1965 through 1991)
  \[ y = 0.0002x - 2.3946 \]
  \[ R^2 = 0.6744 \]

- Linear (1992 through 2004)
  \[ y = -2E-05x + 3.6456 \]
  \[ R^2 = 0.0045 \]
Purpose

- To provide an updated and more detailed discussion of the land uses and nitrate migration potential in the Lithia and Buckhorn Springs Focus Area
- This study will update and expand on the relevant discussions in the 1993 Jones and Upchurch Report
Methodology

- Quantify the nitrate loading potential of land uses and land practices within the Focus Area
- Identify spatial and temporal distributions of problematic land uses and land practices
- Estimate net loading of N to the Focus Area groundwater system over time
- Characterize the potential for pollutants to migrate from the Focus Area to the Springs
  - Vulnerable soils
  - Karst geology
- Compare time history of N loading into the Focus area groundwater to the measured mass loading of N out of Lithia Springs
  - Estimate average groundwater pollutant travel time?
Primary Data Sources

- Typical land-use based N loading and leaching rates
  - Published values, numerous studies conducted in 1990’s and early 2000’s
- Spatial and temporal distributions of land uses and land practices
  - Previous mapping efforts
    - SWFWMD, 1990 (detailed land use map)
    - Jones and Upchurch, 1993
    - FCCDR, 2003 (septic tank locations)
    - Parsons, 2004 (septic tank locations)
  - Maps of sanitary sewer lines (Hillsborough County Water Dept.)
  - Field reconnaissance
- Soils and Geology
  - Jones and Upchurch, 1993
  - SWFWMD SSURGO Database (based on NRCS data)
  - Tampa Bay Water monitor wells
  - SWFWMD 1’-Contour Aerial Maps
Net Nitrate-N Loading to Groundwater System, Summarized by Land Use

- **Citrus**
  - 1940’s through 1960’s – Approx. 100 lb/ac/yr
  - Present – 40-50 lb/ac/yr

- **Septic Tanks**
  - About 40 lb per septic tank per year (Jones and Upchurch, 1993)
    - At 1 septic tank per acre, N loading is similar to citrus
    - At 4 septic tanks per acre, N loading is 3-4 times that of citrus

- **Package Wastewater Treatment Plants**
  - About 30 lb/yr per home served = 90 lb/ac/yr at 3 units per acre

- **Golf Courses**
  - 20-30 lb/ac/yr (combined greens and fairways)

- **Residential and Commercial Landscaping**
  - 0-5 lb/parcel/yr x approx. gross density of 2 units per acre = 0-10 lb/ac/yr
1979 Land Use
1999 Land Use
## Comparison of 1979, 1990, 1999, and 2005 Land Use in the Focus Area

<table>
<thead>
<tr>
<th>Land Use</th>
<th>1979 (acres)</th>
<th>1990 (acres)</th>
<th>1999 (acres)</th>
<th>2005 (acres)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citrus</td>
<td>1,496</td>
<td>940</td>
<td>469</td>
<td>97</td>
</tr>
<tr>
<td>Pasture</td>
<td>501</td>
<td>183</td>
<td>173</td>
<td>53</td>
</tr>
<tr>
<td>Other agricultural</td>
<td>172</td>
<td>46</td>
<td>110</td>
<td>5</td>
</tr>
<tr>
<td>Other open lands (mining, recreational, native lands, water, wetlands)</td>
<td>495</td>
<td>318</td>
<td>345</td>
<td>436</td>
</tr>
<tr>
<td>Residential – medium and high density</td>
<td>1,130</td>
<td>1,931</td>
<td>2,390</td>
<td>3,010</td>
</tr>
<tr>
<td>Residential – low density</td>
<td>574</td>
<td>690</td>
<td>652</td>
<td>616</td>
</tr>
<tr>
<td>Commercial and services</td>
<td>68</td>
<td>96</td>
<td>108</td>
<td>134</td>
</tr>
<tr>
<td>Other urban lands</td>
<td>45</td>
<td>277</td>
<td>234</td>
<td>130</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4,481</strong></td>
<td><strong>4,481</strong></td>
<td><strong>4,481</strong></td>
<td><strong>4,481</strong></td>
</tr>
</tbody>
</table>
Acreage of Citrus and Other Cropland within the Focus Area

![Graph showing acreage of Citrus and Other Cropland from 1968 to 2005. The graph indicates a decrease in acreage over the years, with a significant decrease in Citrus acreage.]
Septic Tank Mapping Methodology

- SDI evaluated the 2003 GIS map prepared for Hillsborough County by FCCDR and the 2004 septic tank permit mapping prepared for Tampa Bay Water by Parsons, Inc.
- Data gaps and inconsistencies were evident.
  - Numerous parcels in the FCCDR database with septic tank permits on file were incorrectly attributed as “confirmed sanitary sewer”
  - Parsons 2004 map only includes septic tanks with post-1997 permits on file.
- SDI obtained maps of the current extent of the County’s central sewer system.
- Each occupied parcel without an available central sewer connection was assumed to be served by a septic tank.
Best Estimate of Parcels Served by Septic Tanks
## Package Wastewater Treatment Plants in the Focus Area

<table>
<thead>
<tr>
<th>Facility Name</th>
<th>Estimated # of Homes Connected</th>
<th>Effluent Disposal Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brandon-Valrico Hills WWTP</td>
<td>355</td>
<td>Percolation Pond</td>
</tr>
<tr>
<td>Brandon Trailer Park</td>
<td>208</td>
<td>Percolation Pond</td>
</tr>
<tr>
<td>Southern Pines MHP</td>
<td>40</td>
<td>Percolation Pond</td>
</tr>
<tr>
<td>Valrico Hills MHP</td>
<td>383</td>
<td>Percolation Pond</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>986</strong></td>
<td></td>
</tr>
</tbody>
</table>

Note: Brandon-Valrico Hills WWTP is expected to go off-line in late 2006.
Sinkholes and Soils Classified by Leaching Potential

Note: Sinkhole locations not field verified
Groundwater Nitrate Vulnerability Map, Lithia and Buckhorn Springs Focus Area

Note: Sinkhole locations not field verified
Comparison of Past and Present Mass Loading of Nitrate into the Focus Area Groundwater and Out of Lithia Springs

![Graph showing comparison of mass loading of nitrate](image_url)
# Estimated Current (2005) Net Annual Loading Rates of Nitrate to Groundwater within the Focus Area

<table>
<thead>
<tr>
<th>Source</th>
<th>Estimated net loading rates of nitrate (as N) to groundwater within the Focus Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Septic Tanks</td>
<td>50 tons per year</td>
</tr>
<tr>
<td>Small Wastewater Treatment Plants</td>
<td>15 tons per year</td>
</tr>
<tr>
<td>Natural Sources</td>
<td>10 tons per year</td>
</tr>
<tr>
<td>Residential and Commercial Landscaping</td>
<td>2-10 tons per year</td>
</tr>
<tr>
<td>Golf Courses</td>
<td>3 tons per year*</td>
</tr>
<tr>
<td>Citrus</td>
<td>2 tons per year</td>
</tr>
<tr>
<td>Other Agricultural Lands</td>
<td>insignificant</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>80-90 tons per year</strong></td>
</tr>
</tbody>
</table>
Conclusions

- The decline in nitrate loading to the groundwater system over the past 25 years is expected to eventually result in a gradual decrease in nitrate concentrations in the Springs (currently about 3 mg/L).
- Magnitude of expected decrease depends on how much residual nitrogen remains.
  - In FY 2007, SWFWMD will re-sample subset of wells from Jones and Upchurch Study
- But, if nothing is done to reduce loadings from septic tanks, N concentrations in the springs will remain well above background levels.
  - 0.2 mg/L historical, Lithia Springs
  - 0.7 mg/L current, Alafia River at Lithia
  - 1.0 mg/L current, Alafia River at Bell Shoals