

**Silver Springs Basin Management Action Plan Meeting
March 14, 2013 – Technical Discussion on BMAP Boundary**

**Marion County Library Headquarters, Meeting Room C
2720 East Silver Springs Blvd, Ocala, Florida**

Meeting Notes

Goal: Delineate a BMAP boundary for the Silver Springs Springshed

Opening Remarks, Introductions & Meeting Goals – Shane Williams and Mary Paulic

- Everyone was reminded to sign in. Meetings will be held at Library Headquarters until April, then meetings will resume at Growth Services.

Purpose and Goals – Mary Paulic

- After introductions, details of the January meeting were reviewed and expectations for this and future meetings were addressed. FDEP is starting with technical discussions as part of data discovery to understand geographic area.
 - Today will focus on delineation and studies.
 - April- set BMAP boundary, identify additional stakeholders, develop BMAP group organization and discuss land use within the delineated area.
 - May- nitrogen dynamics, sources, data/information and water quality monitoring inventory.
 - June- further discussion on sources.
- BMAP=People + data+ management strategies. The elements of a BMAP include delineating the area; identifying stakeholders; identifying project types, timelines and costs; developing a process for evaluating success (monitoring); and consideration of future growth impacts. All elements are identified in Ch. 403 F.S. Florida Watershed Restoration Act.
- Info, data and presentations will be uploaded to a Silver Springs ftp site:
http://publicfiles.dep.state.fl.us/DEAR/BMAP/Silver_springs/

Introduction to Presentations – Shane Williams – 10:30 AM

- Presentations will focus on ways to delineate the BMAP boundary, and feedback on the preferred approach will be requested at the end of the meeting.
- Possible approaches include using existing potentiometric surface maps or capture zones, which are based on modeling results. Vulnerability assessments and dye studies were also presented.

Silver Springs Group (SSG) Springshed Delineation and Dye Trace Studies – (SJRWMD – 10:40 AM) Presenter: Don Boniol, SJRWMD Hydrologist

- Information for each spring in SJRWMD is available at SJRWMD website.
- Springshed definition- surface and subsurface flow that contributes discharge to all vents at the SS group. Upper Floridan Aquifer (UFA) in this springshed is Ocala Limestone formation, which is a karst aquifer where preferential flow paths have developed.
- 3 methods for springshed delineation- UFA water level data (potentiometric surface); ArcHydro flow direction generator; MODPATH particle tracking.
- Potentiometric surface maps- Evaluation of monitoring well data shows a relatively flat potentiometric surface with high transmissivity in Marion County.
 - Data is available monthly. Staff can look at any month to see UFA wells compared to period of record.
 - Springshed boundaries move short distances as a result of wet and dry climatic conditions but there is no observed trend in the movement of springshed boundaries in any one direction over long periods of time.
- ArcHydro Flow Direction Generator- Used 2010 potentiometric data and 250x250 grid, to show direction and angle of flow for each cell to produce surface grid estimation.
- MODPATH Particle Tracking- head distribution and hydrogeology from NCF MODFLOW were applied to MODPATH particle tracking software to trace flowpaths of groundwater which were then used to estimate 2, 10, 100 and 1,000 yr travel times. The 1,000 yr area corresponds to historically mapped SSG springshed.
- DyeTracer Studies- Objectives: identify pathways and travel times between geographic locations and identify potential sources of groundwater nutrient contamination through direct connections with SSG discharge vents.
 - Extensive evaluation of geophysical profiles to determine best places to inject dye.
 - Injected dye at 4 locations and monitored 5 well locations in addition to vents at Silver Springs. Charcoal packets installed into spring vents- filtered packs were sampled @ 2 week intervals over a period of 509 days.
 - Ocala Civic Theater - 1.4 SW of SSG, dye observed 5-10 days at Mammoth and Boathouse vents, 16-21 days at Blue Grotto and 39-45 days- at Fisherman's Paradise. Estimated Velocity = 68 mi/yr.
 - Tusawilla Stormwater Drainage Well- 5 mi SW of SSG- most of flow is in lower 20ft of open hole which continuously receives water. Seen 294-311 days later at Boathouse. Estimated Velocity= 6 mi/yr.
 - Orange Lake/Heagy Burry- 17mi N of SSG- estimated drainage at sink 24 cfs (5.5 mgd) into the sink. Seen 6-13 days at IFAS Well (2 mi away); 6-13 days Reddick Elementary (4.2 mi); 181-194 days @ MCI (8.5 mi). Estimated Velocity= 16 mi/yr.
 - Pontiac Sink- SW of City of Ocala and SSG- seen 93-113 days at Blue Sky 93 (3.5 mi NE) ; 147-164 days at Ft. King Forest well (4.4 mi NE); 228-260 days at Cedar Hills (2.46 mi due east); not seen at SS vents.
 - Summary- Springshed delineation is similar between 3 methods; springshed boundary is fairly stable; dye tracer shows lateral and vertical anisotropy; a large part of 2 yr capture zone dominated by conduit flow; conduit flow has sig. higher velocities than modeled particle tracking capture zones however, other areas may be dominated by matrix flow.

Q&A (public questions with responses mainly by Don Boniol)

Was there dye tracer monitoring at Rainbow?	Yes, but no detections. Water may have moved faster if there had been rain.
Are capture zones false terms?	Modeled capture zones, didn't take into account conduit flow.
Do you have a graphic of cone of influence under Ocala?	There is a low area of potentiometric surface near Ocala but that may be attributable to Ocala's wells and the spring.
Past geochemical data gave decades in terms of flow. How do you reconcile age of water getting to vents based on slow moving and quick moving water?	Data shows that different flow paths go to different vents. Age dating techniques show average age, not specific age.
Are the southernmost vents in man-made areas?	Yes, found areas of diffuse flow in those vents.
What water quality parameters were looked at for cluster analysis used to estimate age of spring flow?	There is a report for that. 2008 Insightful was contractor. David Toth, author (Cluster Analysis and Principle Component Analysis of Water Quality Data from Silver Springs and Wells in the Springshed, Special Publication SJ2008-SP20)
Comment: Some wells that showed dye also have variability in monthly samples. It would be interesting to look at physical data and chemical data over time to help build more concrete picture of flow.	
Do we need to do more to determine confining layer?	Lots of physical, not a lot of hydrological data. Need to find wells to get that part of the puzzle figured out. Comment: could use public wells to get that data.
Is there a need for more dye tracers?	There are areas that have not been defined. It would be worth doing more in specific areas to identify flow paths.
What is the average cost of a dye tracer study?	Hundreds of thousands. Need lot of time and samples.
Comment: Reddick Elementary isn't using their old well. Their new well is probably 200 ft.	
Land managers are having a hard time determining vulnerability in Indian Lake State Forest for siting facilities. Any idea about how fast water is moving there?	The District is looking at that area to do some more drilling. There aren't many deep wells. State forest is in interesting area where confining layer ends. There was a short dye study conducted with no hits.
Did you track dye tracer out to see how long you got hits?	The POR was 509 days. Some areas got 2 pulses. Some flat lined after the pulse.
Clarification: dye tracer study was not used to develop models	

- Marion County Aquifer Vulnerability Assessment was developed to characterize the natural vulnerability of aquifer. Use for wellhead protection, source water protection, land use planning, and was incorporated into Marion County's Comprehensive Plan (replacing the DRASTIC Index) and Land Development Code (mining and C&D landfills). Stormwater Section uses it to establish watershed management priorities. It was a more detailed analysis than the FGS Florida Aquifer Vulnerability Assessment, which showed Marion County as a red "blob" as highly vulnerable.
- Themes: Evidential- set of continuous spatial data; Response- weights of evidence applied to generate the response theme. Final evidential themes: soil hydraulic conductivity, intermediate confining unit (ICU) thickness; effective karst features.
 - Hydraulic Conductivity- low association with training points in much of county, high association with training points in central and southwestern portion of the county
 - ICU- not present in western Marion. Thick in portions of eastern Marion
 - Karst Features- 25ft DEM for initial closed boundary. Considered closed depressions greater than 2,500 ft² and applied a circular index. Did look at overburden, but this did not match with training points, so did not use on final product.
- Dissolved Oxygen is the training point- higher DO, higher association with atmosphere (i.e. more vulnerable). DO concentration of 5.51 mg/l was training point. Dissolved Nitrogen was considered but there was less correlation than with DO as a training point.
- Final map identifies Most Vulnerable, More Vulnerable, Vulnerable and Less Vulnerable categories. Final report can be found at <http://adgeo.net/mcava.php> .
- Alachua County Aquifer Vulnerability Assessment- similar process to Marion- used existing data/information. Being used as tool for Comp Plan and Land Development Regulations. This map also replaced Alachua's confinement map which was used as a proxy for recharge.
- Four evidential themes- overburden thickness, buffered karst features, hydraulic head difference between surficial and Floridan aquifer systems), soil permeability, etc for layers.
 - Thin overburden in south and west, unconfined aquifer, thickest in NE and East- up to 150/200 ft.
 - Buffered Karst Features- western Alachua karst limestone plain provides most of recharge to Santa Fe. Area in NE not considered vulnerable.
 - Soil permeability- derived from soil survey information. Highly permeable in SW and other areas around the county
 - Hydraulic head- Map shows large hydraulic head in N part of the county
 Advanced Geospatial generalized the map to provide 3 categories, High, Medium and Low, which span the county west to east.
 Reports available online

Q&A (Responses given by Gail Mowry and Robin Hallbourg)

How well do the counties match?	Fairly well, but the maps were not created to edge-match
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What were nitrate concentrations that corresponded to vulnerability levels?	That information is in the reports.
Both maps included karst features and overburden. Could karst impact in areas of high overburden?	Yes, but overburden was not considered in the final response map for Marion.
Are the boundaries at parcel level?	No. For planning purposes, it would have to be a site-by-site analysis.
How were DO and DN used?	For Marion, 72 wells were identified and those in the top 25 percentile were used.
Does Lake County have AVA?	No , but there is one for Wekiva.
Who paid for the AVA maps in Alachua and Marion?	Marion and Alachua (approx. \$82K each)
FGS would be the agency responsible for developing additional AVA maps. Interested commissioners could petition DEP to do them	

Group Discussion on BMAP Boundary – (1:30 PM)

- Audience was asked to discuss the preferred method for establishing the BMAP boundary. There was general consensus that the potentiometric surface maps were the best tool available. Discussion was around which map to use.
- Suggestions:
 - Use the largest springshed area, and target locations within that area. (1,100-1,300 mi² is estimated) There are a lot of tools to assist in deciding where to focus the efforts.
 - Use the smallest area, and target the entire area within the boundary. Recognize that there are TMDLs and adopted BMAPS to the north and south, and that a BMAP will be created for Rainbow to the south and west.
 - Limit history of pot surface to post 2001.
 - Overlay potentiometric maps with physical map to see if there are political/physical boundaries that can be used to simplify.
- Clarification that the boundary doesn't overlap between Rainbow and Silver, it shifts periodically east or west.
- Caution about being clear on the "line" because it ultimately becomes a question of land use. Make sure to define methodology.
- FDEP will put together potentiometric surface, physical and vulnerability maps for April meeting. There may be a need to focus on certain areas in first 5 years of the BMAP. Other information will help focus efforts regardless of final boundary.

In Suwannee, they traced nitrogen from its source to surface water bodies. Is it possible to	Not aware of a way to delineate a springshed by nitrate concentrations, but
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existing farms and monitoring wells to collect N to delineate springshed?	there will be discussions about sources once a springshed boundary is selected.
Early meetings and some maps identify a larger springshed than what is being shown.	All maps are based on potentiometric surface at a certain point in time, based on the best available data at that time.
Can we assume water quality at the springshed boundary is perfect?	We can't make a generalization that water quality is perfect at spring boundary; but we can use water quality to target projects based on sources within the springshed
We need uniformity statewide.	
Why do different potentiometric maps show such different boundaries?	When we look at all the maps together, we may find that there isn't as much difference as we think. The 2004 map was based on 2002 data (represented only 1 year) .
How do we get Putnam involved, since there is a lot of activity planned in that area?	This brings about the point of the importance of setting boundary to include the proper stakeholders.
How long until we start doing something?	We will be collecting data on completed and proposed projects beginning in May and throughout the development of the BMAP.
Should include Villages as shown in the largest map. 101K individuals on SJ side.	The Villages and smaller cities will be contacted.
Could we combine Rainbow and Silver BMAPs to save time and money?	There will be additional discussion between BMAP facilitators and meetings. There are some differences between stakeholder groups and the timeline on Rainbow is a bit behind Silver.

Closing Remarks – (2:50 PM)

- Next meeting April 11. General consensus that the meeting duration was ok for attendees. Community meetings will be important as the process moves along.
- There was some discussion that the topics for the upcoming meetings should be switched.