July 8, 2008

MEMORANDUM

TO: Bruce Wirth, P.E., Deputy Executive Director

THROUGH: Mark Barcelo, P.E., Program Manager MDB

FROM: Ron Basso, P.G., Senior Professional Geologist RB
Michael Beach, P.E., Senior Professional Engineer MJB

SUBJECT: Response to Comments Regarding the District's Evaluation of Kissengen Spring Flow Restoration

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During the last Peace River Basin Management Advisory Committee Meeting on May 22, 2008, several comments were made critical of the District's models and the use of those models in predicting the amount of cutbacks in current groundwater withdrawals needed to return flow to Kissengen Spring. This memorandum provides a response to each comment to help clarify the development and scientific verification of models used and the District's technical approach toward evaluating the water resources of the upper Peace River Basin.

1.0 Introduction

For some background, the District has evaluated impacts due to groundwater withdrawals in the Southern Water Use Caution Area (which includes the Peace River Basin) since the late 1980s. The District completed a regional analysis of the Southern West-Central Florida Groundwater Basin (SWCFGWB) and associated impacts due to withdrawals with the completion of the Eastern Tampa Bay Water Resource Assessment Report in 1993. As part of that assessment, a groundwater flow model (Eastern Tampa Bay Groundwater Flow Model) was also created to evaluate various pumping distributions and how it contributed to water level decline in the Upper Floridan aquifer (UFA).

The model and assessment report underwent rigorous peer review by the United States Geological Survey (USGS) and outside consultants as part of the Southern Water Use Caution Area's Administrative Hearing during the mid-1990s. Since that time, the Eastern Tampa Bay (ETB) model has been used extensively in resource assessments and water supply planning throughout the Southern Water Use Caution Area (SWUCA). One of the main conclusions from the water resource assessment report was that the cumulative impact of all groundwater users in the basin had contributed to a decline in UFA water levels by as much as 50 feet since pre-pumping conditions. This technical finding was upheld by the state hearing officer.

In 2002, the District more closely examined the hydrogeology and groundwater withdrawal impacts in the upper Peace River Basin as part of establishing minimum low flow criteria at Bartow, Ft. Meade, and Zolfo Springs on the Peace River. The central question to be answered was how much existing groundwater withdrawals would need to be reduced to return upward flow from the underlying Upper Floridan aquifer into the river from Bartow to Ft. Meade, which was the natural condition back in the 1940s. Currently, in this section of the river, surface water flows downward into numerous sinkhole features and recharges the groundwater system. As

part of determining how much pumping would need to be cut back to create upward flow, the District also examined the amount of groundwater reduction necessary to return continuous flow at Kissengen Spring – since it served as a focal point for the return of flow through other sinkhole features in the river.

The primary focus in returning upward flow from the Floridan aquifer was during the spring dry season when minimum flow requirements would need to be met to ensure a perennial flow system. Currently, during the spring dry season, minimum low flow requirements are not met at Bartow and Ft. Meade (Figures 1 and 2). This is why the two-month period (April and May) was selected for groundwater withdrawal cutbacks in the model. The District's analysis was summarized in a 2003 technical report which examined both historical water use and aquifer level data in addition to using the ETB model for pumping cutback scenarios.

The main conclusion from the 2003 report was that groundwater withdrawals would need to be substantially cut back to return year round continuous flow to Kissengen Spring. The ETB model was used to reduce April and May basin-wide groundwater withdrawals by 600 to 800 mgd in the SWUCA to return upward flow along the river and to Kissengen Spring. Average April-May withdrawals in the model were about one billion gallons per day. Actual ground water use during April and May in the SWUCA was 920 mgd based on an average of years 2000 and 2005 (Figure 3). The District also examined historic groundwater withdrawals and aquifer levels and concluded that average annual pumping in Polk County would have to be reduced from 250 mgd today to approximately 100 mgd experienced in 1950 when continuous flow last occurred at Kissengen Spring. These reductions would also restore an upward flow component from the Floridan aquifer to most of the river from Bartow to Ft. Meade.

The aforementioned groundwater reductions are based on current water use. For the SWUCA, projected water demand in the next 20 years will require an additional 200 mgd. While a significant percentage of this new water will be met by alternative sources and conservation, land use transition will still require that groundwater sources provide some portion of this demand. These quantities must be considered in any discussion of returning year round or intermittent flow to Kissengen Spring.

More recently, presentations made by District staff during the Peace River Management Plan Stakeholders group meeting in October 2006, reaffirmed the agency's analysis behind groundwater reductions needed to return continuous flow to Kissengen Spring. The District continues to collect additional data in the area by installing monitor wells, updating and refining our models, and funding a cooperative study with the USGS on the karst system in the upper Peace River. To date, none of the recently collected data alters the original estimate of groundwater reduction to return flow to the spring. In addition, even if existing groundwater withdrawals could be reduced by 60 to 80 percent, there is currently no spring vent to return flow since it was physically "plugged" in 1962 after a sinkhole developed in a nearby clay settling area, allowing waste clays to enter underground conduits and seal the original opening.

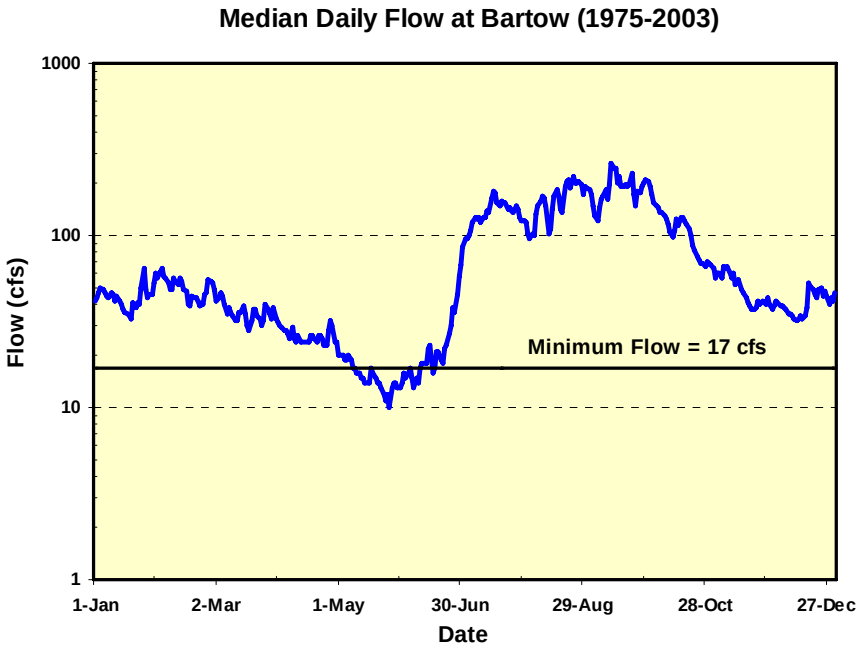

Figure 1. Median daily stream flow at Bartow on the Peace River compared with the SWFWMD minimum low flow criteria.

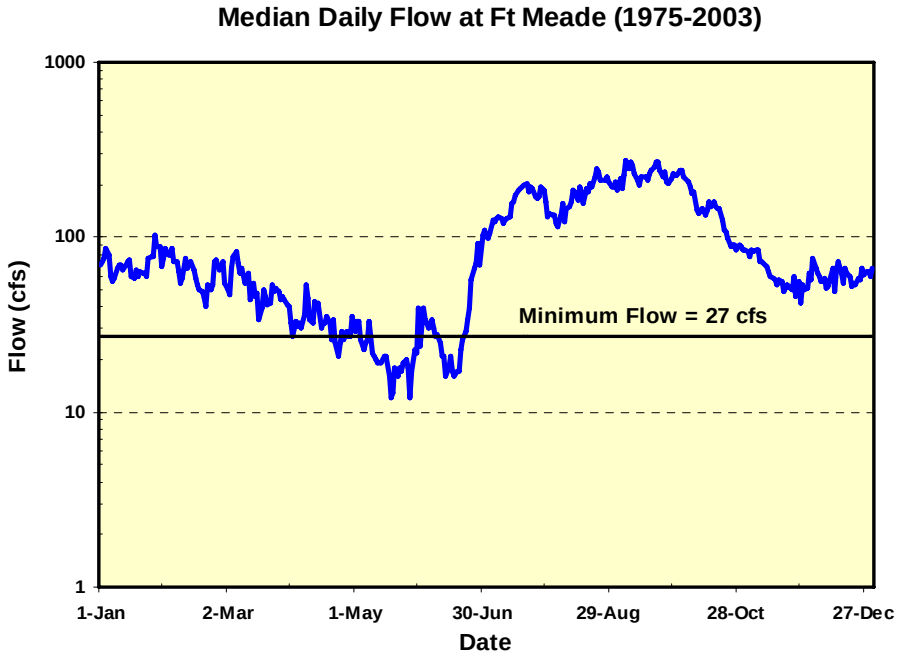

Figure 2. Median daily stream flow at Ft. Meade on the Peace River compared with the SWFWMD minimum low flow criteria.

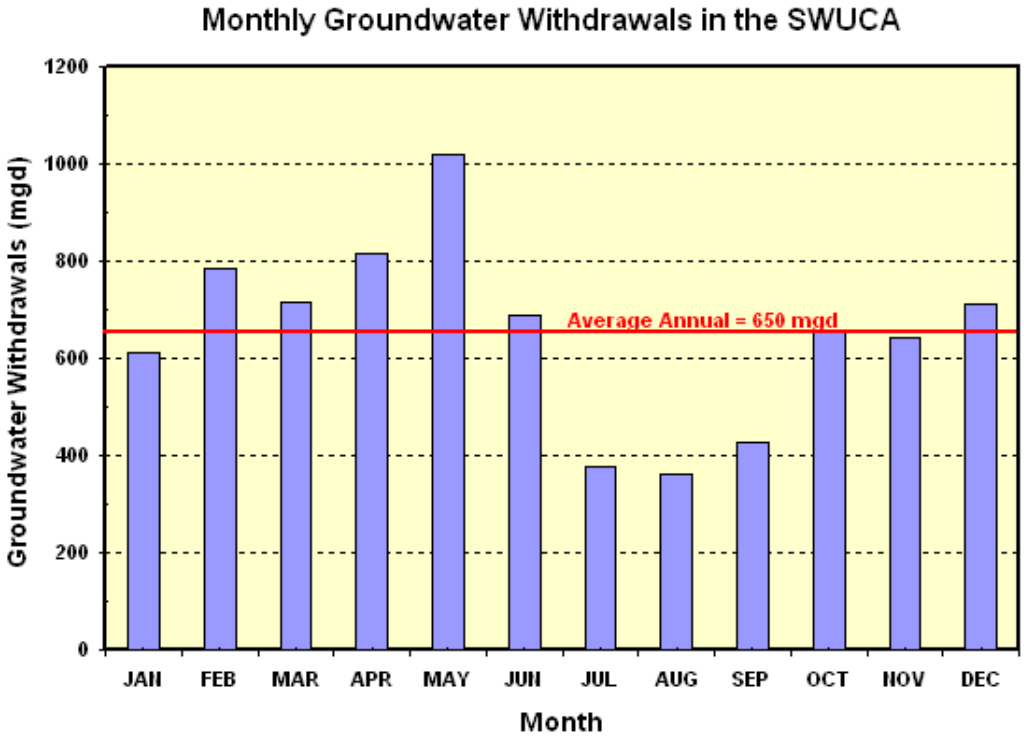

Figure 3. Average monthly groundwater withdrawn in the SWUCA (data is based on an average of year 2000 and 2005 water use).

2.0 Peace River Basin Management Advisory Committee Meeting – Public Comments

The following comments were raised during the last Peace River Management Plan Coordination Committee meeting concerning the District's evaluation of Kissengen Spring. A response to each comment is listed below:

Comment:
It has recently been confirmed that the ETB groundwater flow model used several years ago to evaluate the potential for restoration of flow at Kissengen Spring was run using an 80 percent cut back in groundwater pumpage for a two-month period in a several county area largely unrelated to the historic "springshed" (where the water came from) for Kissengen Spring.

Response:
The historic "springshed" for Kissengen Spring was affected by the cumulative impact of all UFA groundwater withdrawals within the 5,000 square mile SWCFGWB. Groundwater withdrawals from across the basin have contributed to the historic reduction in UFA water levels due to its relatively well-confined nature. The karst features found in a small section of the upper Peace River breach the natural confinement between the river bed and the underlying intermediate and Upper Floridan aquifers. When aquifer levels dropped regionally, this caused cessation of flow from Kissengen Spring and water to drain from the river to the Floridan aquifer.

Ground water discharged upward into the river during pre-pumping conditions (circa 1930). The regional lowering of UFA water levels began in the mid-1930s and accelerated after 1960 reaching its lowest level in the mid-1970s. Groundwater withdrawals in Polk County were around 30 mgd in the mid-1930s, and then increased to around 100 mgd in 1950 at the time continuous flow ended at Kissengen Spring. Groundwater withdrawals continued to increase in Polk County reaching their peak at over 400 mgd in 1975. Currently, withdrawals in Polk County average about 250 mgd due to conservation efforts by mining and agriculture. While water use has declined in Polk County since the mid-1970s, overall groundwater withdrawals in the SWCFGWB have remained rather stable since the mid-1970s generally averaging on a yearly basis between 600 and 700 million gallons per day.

Comment:
The prospect of implementing such severe cutbacks suggested considerable economic harm and alarmed people, as indeed it should. However, far less severe scenarios with only small pumpage reductions (i.e., 5 or 6 percent/year) over a much longer time period (10 - 20 years) were not evaluated for some reason. This is surprising, since the loss of flow at Kissengen Spring developed gradually over a period of tens of years for a variety of reasons. For evaluating the potential restoration of flow, the "patient" should be given sufficient time to recover. A two-month period does not allow sufficient time for this.

Response:
The ETB model was run for two months (April and May) to simulate and quantify the cut back needed during the two highest withdrawal months to return flow to the spring and provide upward flow from the UFA to the river. The overwhelming factor which drives the amount of potential flow to the spring is the elevation of water level in the UFA. Whether one initiates pumping cutbacks at six percent a year for ten years (total of 60 percent reduction in existing use) versus modeling the cutback over a two-month dry season, it still ultimately results in the same amount of reduction. Current ground water use would need to be reduced by 60 to 80 percent.

If the suggestion is that current withdrawals only need to be cutback by six percent total in the basin and the model run for ten or 20 years then the result of this scenario would be the same as reducing the withdrawals by six percent for a short term period. Since the Floridan aquifer is generally well-confined in this basin, when pumping is discontinued water levels almost immediately rebound to their pre-pumping levels. This is evidenced directly during single well pumping tests where water levels are measured continuously during and after pumping. When the pump is turned off during a single well test, water levels in the UFA rebound to pre-pumping levels generally within 24 hours. In the ETB model, nearly all water level response in the UFA occurs within 60 to 90 days after groundwater withdrawals are eliminated.

Comment:
Additionally, major historical withdrawals at the nearby Clear Springs and Noralyn mines have now ceased and aquifer levels have generally been rising in the area as mining operations move south and better water conservation practices are implemented. Considering the estimated $1.8 billion that water managers currently plan to spend addressing water resource issues in the SWUCA by year 2025, additional evaluation of the prospects for restoring Kissengen Spring and natural baseflow to the Upper Peace River should be done. Improved modeling techniques and a considerable amount of new data is now available. It is only appropriate that this important issue be revisited using a "springshed" approach and the best available information and evaluation tools.

Response:
District staff agrees that UFA water levels have risen since the mid-1970s in central Polk County due to improved water conservation practices by the phosphate industry and agriculture. After declining from 40 to 50 feet since the early-1930s, water levels in the UFA have risen 10 to 15 feet since the mid-1970s when groundwater withdrawals in Polk County were over 400 mgd. Today, Polk County groundwater withdrawals are about 250 mgd. Much of the reduced groundwater use by mining, however, has been offset by increasing groundwater withdrawals for public supply and agriculture in other parts of the SWCFGWB. While water use has declined in Polk County since the mid-1970s, overall groundwater withdrawals in the SWCFGWB have remained rather stable since the mid-1970s generally varying between 600 and 700 million gallons per day. In addition, over the next 20 years, it is projected that an additional 200 mgd of water demand will occur across the entire SWCFGWB.

The District has continually analyzed water resource conditions in the upper Peace River. The District partnered with the Florida Department of Environmental Protection (FDEP), and together completed the Peace River Cumulative Impact Study in 2007. That study indicated that there were many causes of decreased Peace River flow over the last 70 years such as climate, land use changes, and historic groundwater withdrawals. Both agencies jointly developed a management plan to coordinate and implement solutions to the water resource challenges in the basin. The District has committed to additional data collection and analysis of the upper Peace River water resource conditions through monitor well construction, aquifer performance tests, and more complex computer flow modeling. The District has funded an investigation into river flow losses with the USGS and a final report is expected in late 2008. Staff plans to conduct additional modeling scenarios when the Peace River Basin integrated model is completed in 2009. The USGS study and additional modeling scenarios are both part of the Peace River Basin Management Plan.

Comment:
The ETB model was flawed because it only simulated groundwater withdrawal reductions for two months.

Response:
As previously stated, the premise that the model is "flawed" is not substantiated by those providing these comments. This criticism appears to be misrepresented as it seems to point toward the simulation time of the model scenario, rather than how well the model performs. The primary focus in returning upward flow from the Floridan aquifer was during the spring dry season when minimum flow requirements would need to be met to ensure a perennial flow system. Currently, during the spring dry season, minimum low flow requirements are typically not met at Bartow and Ft. Meade. This is why the two-month period (April and May) was selected for groundwater withdrawal cutbacks in the model. Since the Floridan aquifer is generally well-confined in this basin when pumping is discontinued, water levels almost immediately rebound to their pre-pumping levels. In the ETB model the vast majority of water level response in the UFA occurs within 60 to 90 days after groundwater withdrawals are eliminated. Running the model any longer than this period would not significantly change the prediction results.

The water level elevation in the UFA determines whether flow could occur at Kissengen Spring – this in turn would also indicate whether aquifer levels are adequate to discharge water through other karst features in the river bed. Recent well data collected by the District shows a good hydraulic connection between the surface, intermediate aquifer, and UFA along the karst

section of the river. UFA water level elevations would need to rise 25 feet in the vicinity of Kissengen Spring during the spring dry season for the potential of continuous flow to return to the spring. If aquifer levels could be met during the dry season, this would insure year round flow of the spring when higher aquifer levels occur due to the cessation of agricultural pumping during the summer rainy season.

3.0 Summary

In conclusion, the District and FDEP continue to work together to solve the water resource challenges in the Peace River Basin as well as the SWUCA. As you are aware, the District has implemented the SWUCA Management Plan, which proposes to limit basin-wide groundwater withdrawals over the next 20 years, provide for alternative water supply to meet future demand, and implement water resource development projects to increase flow in the upper Peace River. Many of the SWUCA Management Plan actions have been included in the FDEP's Peace River Basin Management Plan. Staff, through this memorandum, has worked to address public comments from the Advisory Committee meeting and summarized the District's technical evaluation of the upper Peace River Basin water resource issues. If there are any additional questions or concerns regarding the water resource evaluation of this area, please feel to contact us.

cc: Peace River Basin Management Advisory Committee Members