Water Quality Monitoring Plan for the West Pasco County Class III Landfill

October 2013

Water Quality Monitoring Plan
For The West Pasco County Class III Landfill

Prepared for

PASCO COUNTY, FLORIDA

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Section 1
General Aspects of the Plan

Pasco County owns and operates the West Pasco Class III Landfill (hereon referred to as the "site") located at 14230 Hayes Road, Spring Hill, Florida. The site is located approximately ten miles west of the Gulf of Mexico and is an integral unit of the Pasco County Resource Recovery Facility. The site is currently permitted to operate under Permit No. 26255-001-SO. The West Pasco Class III Landfill and Recycling Center is permitted under Chapters 62-4 and 62-701, Florida Administrative Code (F.A.C.). The site is equipped with a geosynthetic liner and leachate collection system. Collected leachate is directed to one of two underground storage tanks referred to as Tank #1 and Tank #2 and is piped directly to the Shady Hills Advanced Wastewater Treatment Facility.

This water quality monitoring plan (WQMP) for the West Pasco County Class III Landfill updates the WQMP dated March 2008 that replaced the initial plan that was submitted to, and approved by the Florida Department of Environmental Protection (FDEP) in 1988. The initial WQMP was part of the document titled *Geotechnical/Hydrogeologic Investigation, Proposed Class III Sanitary Landfill, Hays Road Site, Pasco County, Florida* prepared by Jammal & Associates, Inc. dated May 26, 1987. The Jammal & Associates, Inc. document is a complete geotechnical report describing the regional and site-specific geology, hydrogeology, topography and soil types of the area now occupied by the site. The report was submitted with the original permit application and was approved by the FDEP. This existing information is still considered valid and will only be referenced and or briefly summarized in this report which also references other sources of information that address subsurface conditions within the Pasco County Resource Recovery Facility. The primary reason for submitting an updated new WQMP is to reflect the installation of monitor wells that were proposed in the WQMP dated March 2008.

The Class III disposal unit is primarily a construction and demolition (C & D) disposal unit. C & D debris is described as materials generally considered to be not water soluble and non-hazardous in nature, including but not limited to steel, glass, brick, concrete, asphalt material, pipe, gypsum wallboard, and lumber, from construction, destruction, or renovation projects. Yard trash and/or lot clearing debris are not accepted for disposal in the Class III unit.

The following plan is designed to meet the current rule requirements in Chapter 62-701.510, F.A.C.. The revised plan is based on the hydrogeological investigation provided with the original plan, the WQMP dated March 2008, and results of continued monitoring in accordance with the WQMP.

Section 2
Site Soils & Topography

2.1 Soils

In general, the soil materials at the site consist of a varying thickness of sandy material overlying clayey materials of varying thickness and consistency, which in turn overlie either significantly weathered limestone material with clay or more intact weathered limestone materials. The upper sandy materials are generally light colored fine sand to slightly silty fine sand that contain less than 10% fines passing the No. 200 sieve. These sandy materials are generally poorly graded and vary in relative density from loose to medium dense.

Occasionally there are clayey sand materials of low plasticity beneath the fine sand. When present, these clayey sand materials generally represent transition materials from the upper sands to the lower more plastic clayey materials. More often, the materials directly underlying the fine sand are sandy clay to clay materials that exhibit moderate to high plasticity, are greenish-gray to green in color. These clayey materials form a semi-confining unit between the overlying sands and underlying limestones.

The predominant surficial soil type at the site, as classified by the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS), is Chandler fine sand, 0 to 5% slopes, although there are also several areas of Tavares sand, 0 to 5% slopes, and Sparr fine sand, 0 to 5% slopes. Tavares sand and Candler fine sand are described by the NRCS as nearly level to gently sloping, moderately drained (Tavares) to excessively drained (Chandler) soils. Both soils consist of fine sand to a depth of greater than 80 inches. The permeability of both soils is rapid to very rapid. Sparr fine sand is a nearly level to gently sloping, somewhat poorly drained soil on seasonally wet uplands. The soil consists of a fine sand to a depth of approximately 42 inches and is a sandy clay loam to a depth of about 80 inches. Permeability is moderate to rapid.

2.2 Topography

The site is located in a relatively flat section of the Pamlico Terrace within the Gulf Coastal Lowlands physiographic province along the west coast of Florida. In this portion of Pasco County, the Gulf Coastal Lowlands province is bounded on the east by the Brooksville Ridge, a distinct north-south trending sand ridge reaching elevations of about 290 feet above mean sea level (MSL). To the west of the ridge, land surface elevations decline to MSL along the Gulf Coast. The average original ground surface elevation in the vicinity of the site was on the order of +50 feet NGVD with less than 10 feet of topographic relief throughout most of the site.

The area is drained primarily by Buckhorn Creek and the Pitachascotee River. No natural surface water bodies or lakes occur in the landfill area. There is a stormwater retention pond located immediately north of the site and a borrow area located immediately east of the site. Numerous lakes and ponds exist to the south of the site. The major surface water feature in the vicinity of the site is Crews Lake, a linear northeast-trending lake located about 1.5 miles to the east.

Section 3
Water Quality Monitoring Systems

The water quality monitoring systems currently include the sampling of groundwater and leachate. Leachate monitoring will cease in accordance with rule change that no longer requires leachate quality monitoring. The details of the existing and proposed monitoring systems are described in the following subsections. Because there are no existing or proposed surface water discharges at the site, no surface water monitoring points are currently monitored or proposed for monitoring. Leachate from the facility is collected in two leachate collection tanks which are sampled separately. The monitoring of groundwater currently consists of obtaining static water level measurements and sampling one monitor well completed within the surficial aquifer, three monitor wells completed in the Upper Floridan aquifer, four surficial aquifer piezometers and three Upper Floridan aquifer piezometers. However, because none of the existing monitor wells were within 50 feet of the disposal unit, installation of three new monitor wells to be completed in the Upper Floridan aquifer were proposed in the March 2008 WQMP to meet the rule requirements for detection monitor wells. Two of the three wells have been installed.

Due to the steady lowering of water levels in the surficial clastic deposits above the Upper Floridan Aquifer that have taken place regionally in Pasco County, the static water level in the surficial deposits has dropped below the base of the sand interval and into the clayey interval. As a result, monitor wells associated with the site that are completed within the surficial deposits are not capable of yielding a significant amount of groundwater. Therefore, by definition, the surficial aquifer is not present in the vicinity of the site. Because the surficial aquifer is not currently present, the Upper Floridan is the uppermost aquifer and there are no proposed additional surficial aquifer monitor wells proposed at this time. However, the existing monitor wells completed in the surficial deposits will be retained in the monitoring plan and attempts to obtain static water level readings and groundwater samples from these wells will continue to be made in accordance with Chapter 62-701.510(6), F.A.C. In the event water levels rise enough in the surficial deposits to consistently yield a significant amount of groundwater to the existing shallow monitor wells, monitoring of groundwater quality in the surficial aquifer will be performed.

3.1 Groundwater Monitoring System

The groundwater monitoring system has been designed to meet the current rule requirements in Chapter 62-701.510(3), F.A.C based on the existing subsurface conditions. The locations of existing and proposed monitor wells of the groundwater monitoring system are presented in **Figure 3-1**. As long as sufficient quantities of groundwater are available, routine groundwater samples are collected semi-annually from all background and detection monitor wells designated in this plan. Upper Floridan aquifer monitor well 2MW-7 is designated as the background monitor well and wells 4MW-21 and 4MW-22 are designated as the detection wells. Well 4MW-23 will be installed when cells III and IV are placed in service. Well 2MW-7 is designated as a surficial aquifer monitor well, but is generally dry.

In addition to the monitor wells that comprise the groundwater quality monitoring system, there are seven existing monitor wells located downgradient of the disposal unit that are designated as

piezometers. Three of the wells are completed in the Upper Floridan aquifer and four are completed in surficial deposits.

The alphanumeric well numbering system was originally established so that wells with the "4MW" designation were 4-inch diameter PVC Type II monitoring wells with completions in the Upper Floridan aquifer and wells with the "2MW" designation were 2-inch diameter PVC Type II wells screened in the base of the permeable sand unit within the clastic surficial aquifer. However, in 2001, 2-inch diameter PVC well materials were installed and grouted in monitor well 4MW-7 after a blockage in the open hole portion of the well was removed. In addition, 2-inch diameter PVC well materials have been installed in 4MW-3A; however in this well the well materials were reportedly just lowered to the total depth of the original open-hole interval after the well was cleaned out. Based on field observations and confirmation with Pasco County Lab personnel, well screens have also been installed in monitor wells 4MW-8 and 4MW-9. The well materials in these four wells reportedly consist of screen across the former open-hole interval and riser pipe to the surface.

Any additional monitor wells to be installed and included in this monitoring plan will be constructed in compliance with the requirements outlined in Chapter 62-701.510(3), F.A.C. or in compliance with modifications to the requirements as coordinated with the FDEP. Monitoring wells which are damaged beyond repair or which will be abandoned due to lateral expansions of the landfill or the construction of new solid waste disposal units will be properly plugged so that they do not act as a conduit for any leachate release to the groundwater. All such wells will be filled and sealed in accordance with the rules of the Southwest Florida Water Management District (SWFWMD), from bottom to top with neat cement grout. The Department will be notified in writing before any monitoring wells are abandoned or plugged and will be given access, at reasonable times, to witness or inspect the plugging operations. There are no groundwater quality detection sensors or leak detection systems currently installed or proposed for installation at the facility.

3.1.1 Existing Monitor Wells and Piezometers

The existing monitor wells at the site include one surficial aquifer wells (2MW-7 and three Upper Floridan aquifer wells (4MW-7, 4MW-21, and 4MW-22). The locations of these wells are shown in Figure 3-1. Well construction details for these monitoring wells are included in **Table 3-1**. Groundwater monitoring data collected since 2005 from all of the existing monitor wells associated with the site that are completed in the clastic surficial deposits above the Upper Floridan Aquifer indicate the surficial aquifer to be dry in the immediate vicinity of landfill.

Wells 2MW-3A, 2MW-8, 2MW-9, and 2MW-10, completed in the base of the permeable sand unit within the clastic surficial deposits above the Upper Floridan Aquifer, and 4MW-3A, 4MW-8 and 4MW-9, completed in the Upper Floridan aquifer, are designated as piezometers. Although these wells are located downgradient of the disposal unit, they are located beyond 50 feet from the edge of waste in the disposal unit. Groundwater levels in these piezometers will be measured semi-annually.

3.1.2 Background Groundwater Quality Interpretation

The background monitor well 2MW-7, completed in the surficial aquifer, is typically dry. The other background monitor well (4MW-7), is completed in the Upper Floridan aquifer. No exceedances of any Primary or Secondary Drinking Water Standards established in 62-550 F.A.C., or any Groundwater Cleanup Target Levels (GCTLs) established in Table 1 of Chapter 62-777 F.A.C. were identified in any of the groundwater samples collected from either of these wells during the sampling events completed semi-annually from the second half of 2010 through 2012.

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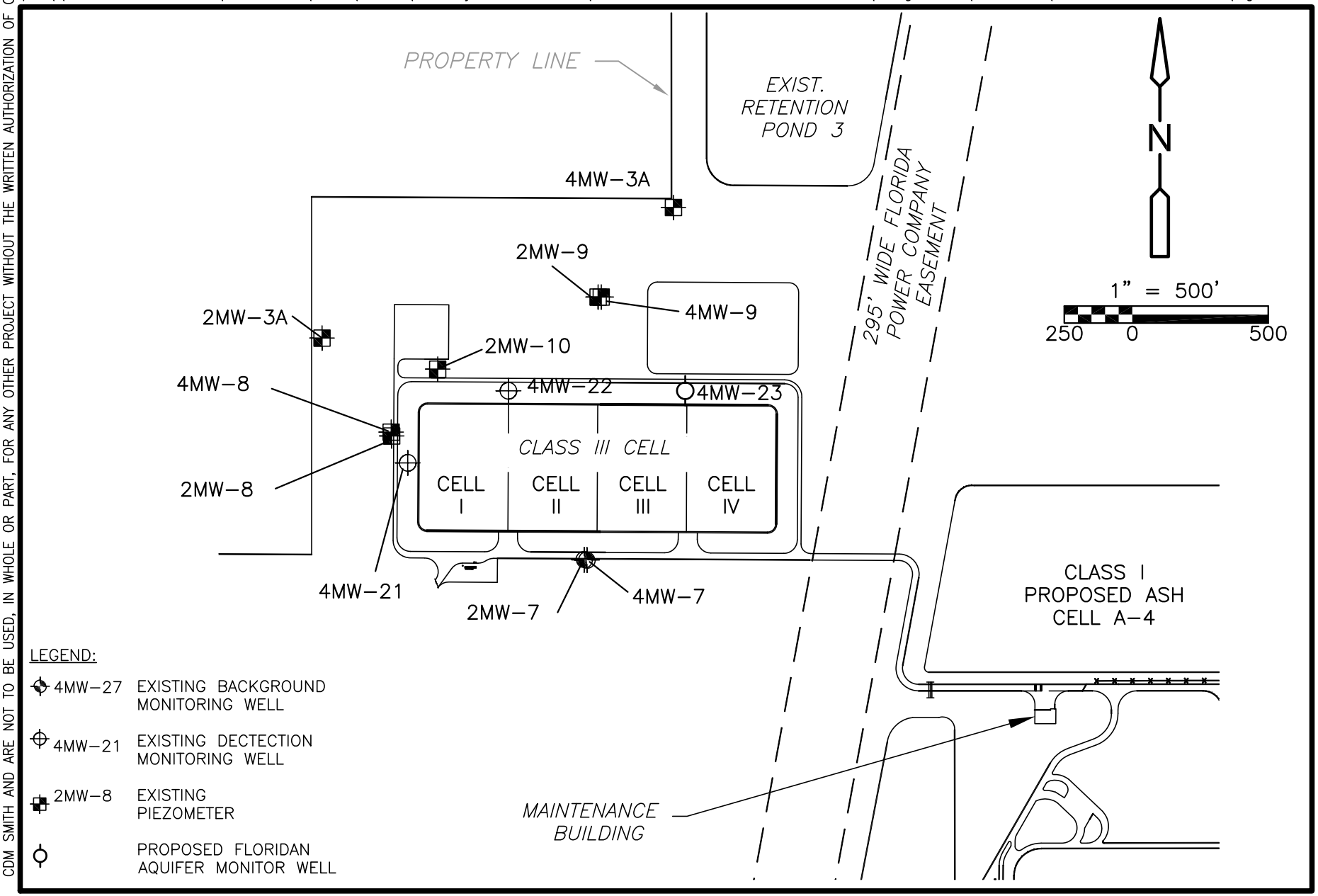

Figure No. 3-1
GROUNDWATER MONITOR WELLS AT THE
WEST PASCO COUNTY CLASS III LANDFILL

Table 3-1. Construction Summary of Existing Monitor Wells and Piezometers
West Pasco Class III Landfill

Well I.D.	Designation	Location		Ground Elevation		Top of Casing		Screened Section					Top of LS	Total Depth
		Latitude North	Longitude West	(ft NAVD)	(ft NGVD)	(ft NAVD)	(ft NGVD)	Well Type (dia.)	Length	Depth (ft bls)	Elevation (ft NGVD)	Lithology	(ft bls)	(ft bls)
Surficial Aquifer														
2MW-3A	Piezometer	28° 22' 26"	82° 34' 18"	45.80	46.79	49.02	50.01	Screened (2")	5	9.5 - 14.5	37.29 to 32.29	SD	23.0	15.0
2MW-7	Background	28° 22' 19"	82° 34' 07"	48.97	49.96	51.76	52.75	Screened (2")	6	6.0 - 12.0	43.96 to 37.96	SD	30.0	12.0
2MW-8	Piezometer	28° 22' 23"	82° 34' 15"	48.43	49.42	50.98	51.97	Screened (2")	5	7.0 - 12.0	42.42 to 37.42	SD & Cly SD	25.0	13.0
2MW-9	Piezometer	28° 22' 28"	82° 34' 06"	49.20	50.19	51.30	52.29	Screened (2")	7	4.0 - 11.0	46.19 to 39.19	SD	28.0	11.0
2MW-10	Piezometer	28° 22' 25"	82° 34' 13"	47.82	48.81	51.64	52.63	Screened (2")	7	5.0 - 12.0	43.81 to 36.81	SD	25.0	12.0
Floridan Aquifer														
4MW-3A	Piezometer	28° 22' 31"	82° 34' 03"	49.55 (conc)	50.54 (conc)	51.93	52.92	Screened (2")	28	22.0 - 50.0	28.54 to 0.54	LS	22.0	50.0
4MW-7	Background	28° 22' 19"	82° 34' 07"	48.76	49.75	51.63	52.62	Screened (2")	25	22.0 - 47.0	27.75 to 2.75	CL & LS	30.0	50.0
4MW-8	Piezometer	28° 22' 23"	82° 34' 15"	48.78	49.77	50.88	51.87	Screened (4")	33	32.0 - 65.0	17.77 to -15.23	LS	25.0	65.0
4MW-9	Piezometer	28° 22' 28"	82° 34' 06"	49.35	50.34	51.79	52.78	Screened (4")	30	30.0 - 60.0	20.34 to -9.66	CL & LS	28.0	60.0
4MW-21	Detection	28° 22' 22"	82° 34' 14"	Not Measured	49.10	Not Measured	51.46	Screened (2")	15	24.2 - 39.2	24.90 to 9.90	CL & SD	>40.0	40.0
4MW-22	Detection	28° 22' 25"	82° 34' 10"	Not Measured	50.85	Not Measured	53.44	Screened (2")	15	30.3 - 45.3	20.55 to 5.55	CL & LS	29.0	46.0

NOTES:

Lithology of Screened interval and Top of Limestone are based on cross-section interpretation or information from boring logs.

Elevation Data in NAVD are from Pasco County Engineering Sves Survey dated 1/22/07.

Elevation Data in NGVD for all wells except 4MW-21 & 4MW-22 are from Pasco County Engineering Sves Survey dated 1/22/07 converted to NGVD.

Elevation Data in NGVD for 4MW-21 & 4MW-22 are from Pasco County Engineering Sves Survey dated 12/1/08.

3.1.3 Proposed Additional Monitor Well

One detection well will be installed downgradient from the active disposal Cells 3 and 4 of the Class III landfill disposal unit prior to the placement of waste in these cells. Proposed monitor well 4MW-23, which will be installed prior to the activation of Cells 3 & 4, will be installed within 50 feet north of the north end of the boundary between the two cells. The well will be located approximately 340 feet west of the northeast corner of Cell 1 of the disposal unit. This location is also approximately 650 feet east of the proposed monitor well 4MW-22. The proposed detection well MW-23 will be completed in the Upper Floridan aquifer and will be constructed using 2-inch diameter PVC casing with 15-foot well screens. Although this new monitor well will have the "4MW" designation, it will be constructed of 2-inch diameter PVC casing and screen. Prior to activating Cells 3 & 4, monitor well 4MW-23 will be installed within 50 feet north of the north end of the boundary between the two cells.

The expected depth, thickness, and lithology of the subsurface units in the vicinity of the West Pasco County Class III Landfill are based on information obtained from lithologic cross-sections generated by Law Engineering and Environmental Services (LAW) dated 5/1/95, and from other lithologic information obtained from geotechnical studies done for this area. The cross-sections were apparently constructed using the lithologic boring logs developed during the installation of eight of the nine existing monitor wells. The borings for the wells completed in the surficial deposits were advanced a total of 10 to 13 feet below land surface (bls), while the borings for the wells completed in the Floridan Aquifer were advanced a total of 50 to 65 feet bls. Within this depth interval, three lithologic units were identified. The surficial sand unit appears to be relatively consistent in thickness ranging from 9.5 to 11.5 feet in thickness while the underlying clay confining layer ranges from two to twelve feet thick, locally thinning to the west and south. The top of the limestone in the vicinity of the disposal unit, according to the information from the cross-sections, ranges from 12 to 34 feet bls. However, other information sources suggest depths to the limestone in this area to range from 22 to 30 feet bls.

Based on a review of the water level fluctuations of Upper Floridan aquifer wells 4MW-3A, 4MW-7, 4MW-8, and 4MW-9 around the West Pasco County Class III Landfill, the potentiometric surface has dropped an average of approximately 11 feet in each of the four wells over the past four years. Assuming the depth to limestone ranges 22 to 30 feet bls at these four locations, the current potentiometric surface in the four Floridan monitor wells ranges from about 3 feet above the top of limestone (in 4MW-7) to as much as 4.5 feet below the top of the limestone (in 4MW-3A).

The construction details for proposed well 4MW-23 are shown on **Figure 3-2**. A test boring shall be conducted at the proposed well location or a drilling method that allows for the accurate identification of stratigraphic units to verify the depth and thickness of the confining unit and the top of the limestone. The well screen slot and sand pack shall be sized to the formation of the targeted monitoring zone. Unless the competent limestone of the Upper Floridan aquifer exhibits a different lithology from that described from previous borings performed at the facility, a 0.01-inch slotted screen and a sand pack of 20/30 silica sand with two feet of 30/65 fine sand seal will be used. The proposed wells will either be installed using standard mud rotary drilling methods with surface casing set into the top of the Upper Floridan Aquifer or using sonic drilling methods and placing neat cement grout in the annulus between the production casing and the borehole above the fine sand seal. The construction materials and methods will conform to the construction requirements stipulated in Chapter 62-701.510(3)d, F.A.C.

The well should be constructed of 2”-diameter PVC pipe with a 15-foot screened interval, the top of which should be placed at the top of the limestone as long as at least five feet of the clay is determined to be present over the limestone. If there is less than five feet of clay overlying the limestone, the top of the screen will be installed approximately two feet below the top of the limestone so the sand pack will not extend above the top of the limestone. The current elevation of the potentiometric surface is expected to be approximately 24.5 feet NGVD in this area and the ground elevation at the proposed well location is expected to be approximately 48 feet NGVD. So, if there is at least five feet of clay over the limestone and the top of the limestone is encountered at approximately 26 feet bls, the well screen would be installed from 22 to 7 feet NGVD and the static water level in the well would be two and a half feet above the top of the screen. Although the static water level in the well is expected to be above the top of the screen, a 15-foot screen is proposed because of the consistent lowering of the potentiometric surface that has been observed in recent years.

3.2 Surface Water Monitoring System

The access road encompassing the landfill area and the disposal unit berms are elevated above existing ground elevations to prevent any surface water from entering the waste-filled area. Additionally, a large swale is located at the base of the landfill slope on the interior side of the access road. The swale is designed to receive run-off from the current pre-developed and future closed-out areas of the site. The bottom of each landfill disposal unit is lined and positioned above the seasonal high water table to prevent any lateral flow into the waste-filled areas in the unlikely event that standing water was to accumulate in the swale. All stormwater conveyances are inspected at least weekly to verify adequate performance. Conveyances not performing adequately shall be repaired within three working days. All inspections and repairs to the stormwater management system are kept on file at the facility.

There are no designed pathways for stormwater that collects in the swale to be discharged to surface water bodies located outside the boundaries of the facility. However, in the event that a discharge of surface water from the facility should occur, a sample will be collected at the point of discharge from the property. If the discharge is into a flowing body of water located outside the boundary of the facility, a sufficient number of upgradient and downgradient sample locations will be used to allow the effect of the discharge from the landfill to be measured.

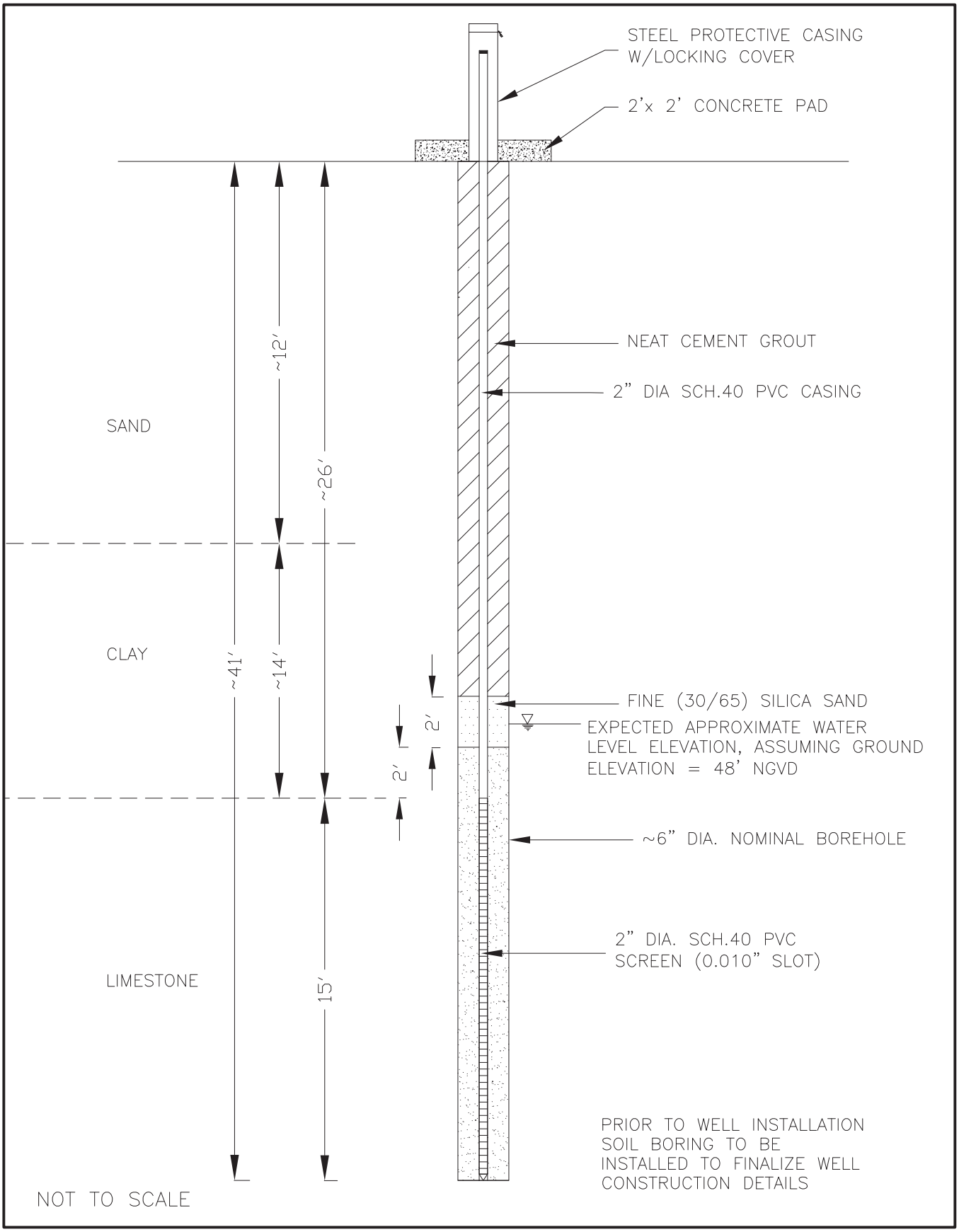

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FIGURE 3-2
PROPOSED WELL CONSTRUCTION AT WEST
PASCO COUNTY CLASS III LANDFILL
FLORIDAN WELL 4MW-23

Section 4

Sampling Analysis and Water Quality Monitoring Reporting Requirements

4.1 Laboratory Analysis Activities

The Pasco County Environmental Laboratory conducts the required groundwater and leachate sampling and analysis for the site. The sampling and analysis procedures used by the laboratory, including sampling equipment decontamination, field measurements, and sample shipment, shall be performed in accordance with Chapter 62-160, F.A.C. Chemical analyses that are not performed at the county laboratory are contracted out under an agreement with other state-approved laboratories. Pasco County Environmental Laboratory and any contracted laboratories are NELAC-certified and/or are certified with and utilize procedures and methods approved by the Florida Department of Health.

4.2 Initial and Routine Groundwater Sampling and Analysis

On a semi-annual basis, an attempt will be made to collect static water level measurements from all of the monitor wells and piezometers associated with the site. The precision of the measurements will be plus or minus 0.01 foot. Groundwater surface contour maps will be prepared for each event. The maps will include groundwater elevations in feet above National Geodetic Vertical Datum (NGVD) for each well and/or piezometer from which valid water level readings can be obtained. Although wells completed in strata that might comprise the surficial aquifer are typically dry, attempts to measure water levels will continue to be made semi-annually for all monitor wells and the results recorded, including the wells currently proposed to be designated strictly as piezometers.

Routine groundwater samples will be collected on a semi-annual basis from all background and detection monitor wells designated in Section 3.1 of this plan and any future monitor wells to be installed in association with the Class III landfill as long as sufficient water after purging can be obtained. These samples will be analyzed for the parameters listed in Chapter 62-701.510(7)a, F.A.C. These parameters are also presented in **Appendix A**. Any new monitor wells installed in association with the site will be analyzed for the parameters listed in Chapter 62-701.510(7)a and Chapter 62-701.510(7)c, F.A.C. for the initial sampling event.

4.3 Initial and Routine Surface Water Sampling and Analysis

There are no surface water discharges or sample monitoring locations designated at the site. However, in the event that a discharge to surface water from the site should occur, at least one sample will be collected at the point of discharge from the property.

If flow from the site discharges into a flowing surface water body outside the boundary of the site, a sufficient number of upgradient and downgradient sample locations will be used to allow the effect of the discharge from the site. These samples will be analyzed for the parameters listed in Chapter 62-701.510(7)b. These parameters are also presented in Appendix A.

4.4 Water Quality Monitoring Reporting

The County will report all water quality monitoring results to the FDEP semi-annually in accordance with Chapter 62-701.510(8)(a). The water quality data will be provided to the FDEP in an electronic format consistent with requirements for importing into the FDEP databases. The County will notify FDEP at least 14 days before the sampling is scheduled to occur so that the FDEP may collect split samples. The report will contain the following data:

- Facility name and identification;
- Sample collection and analyses dates;
- Analytical results, including all peaks;
- Identification number and designation of all monitoring points;
- Applicable water quality standards;
- Quality assurance, quality control notations;
- Method detection limits;
- STORET code numbers for all parameters;
- Water level data including elevation at top of casing and surface for each well on site at a precision of plus or minus 0.01 feet NGVD.

This report will also provide updated groundwater maps at contour intervals no greater than one-foot with groundwater elevations and flow directions, and a summary of any water quality standards or criteria that have been exceeded.

In accordance with Chapter 62-701.510(8)(b), every two and one-half years and at the time of permit renewal, the County will submit to the FDEP a technical report summarizing and interpreting the water quality data and water level measurements collected during the past two and one-half years. The report will be prepared, signed and sealed by a professional geologist or professional engineer with experience in hydrogeologic investigations. The report will contain, at a minimum, the following data:

- Tabular and graphical displays of any data which shows that a monitoring parameter has been detected, including hydrographs for all monitor wells;
- Trend analyses of any monitoring parameters detected;
- Comparisons among shallow, middle, and deep zone wells;
- Comparisons between upgradient and downgradient wells;
- Correlations between related parameters such as total dissolved solids and specific conductance;
- Discussion of erratic and/or poorly correlated data;

- An interpretation of the groundwater contour maps, including an evaluation of groundwater flow rates;
- An evaluation of the adequacy of the water quality monitoring frequency and sampling locations based upon site conditions.

All field and laboratory records specified in Chapter 62-160.600 through 630, F.A.C., shall be made available to the FDEP and be retained for the design period of the landfill.

Section 5

Evaluation Monitoring, Prevention Measures and Corrective Action

5.1 Evaluation Monitoring

If monitoring parameters are detected in detection wells in concentrations which are significantly above background water quality, or which are at levels above FDEP's water quality standards or criteria specified in Chapter 62-520, F.A.C., the County may resample the wells within 30 days after the sampling data is received, to confirm the data. Should the County choose not to resample, FDEP will consider the water quality analysis as representative of current ground water conditions at the site. If the data is confirmed, or if the County chooses not to resample, the County shall notify FDEP in writing within 14 days of this finding. Upon notification by FDEP, the County shall initiate evaluation monitoring as follows:

- Routine monitoring of all monitoring wells, surface water monitoring locations and leachate sampling locations shall continue according to the requirements of Chapter 62-701.510(6), F.A.C.
- Within 90 days of initiating evaluation monitoring and annually thereafter, the County shall sample and analyze a representative sample of the background wells and all affected detection wells for the parameters listed in Chapter 62-701.510(8) (d), F.A.C. Any new parameters detected and confirmed in the affected downgradient wells shall be added to the routine ground water monitoring parameter lists required in Chapter 62-701.510(6), F.A.C. for the affected wells.
- Within 90 days of initiating evaluation monitoring, the County shall install (if necessary) and sample compliance monitoring wells at the compliance line of the zone of discharge and downgradient from the affected detection monitoring wells. These wells shall be installed according to the requirements of Chapter 62-701.510(3)(d), F.A.C. and samples from these wells and the affected detection wells shall be analyzed quarterly for the parameters listed in Chapter 62-701.510(7)a and Chapter 62-701.510(8)c, F.A.C.
- Within 180 days of initiating evaluation monitoring, the County shall submit a contamination evaluation plan to the appropriate FDEP District Office. This plan shall be designed to delineate the extent and cause of the contamination, in order to predict the likelihood that FDEP water quality standards will be violated outside the zone of discharge, and to evaluate methods to prevent any such violations. After FDEP and the County agree that the plan is so designed, the County shall implement this plan and submit a contamination evaluation report in accordance with the plan. All reasonable efforts shall be made by the County to prevent further degradation of water quality from the landfill activities.
- If, during the evaluation monitoring period, all concentrations for the parameters listed in 62-701.510(8)(a) and (c), F.A.C. are at or below background values, the County may submit a request to FDEP for approval to discontinue quarterly evaluation monitoring. However, the

County shall not discontinue evaluation monitoring and return to routine monitoring until authorized to do so by FDEP.

5.2 Prevention Measures and Corrective Actions

If the contamination evaluation report submitted by the County within 180 days of initiating evaluation monitoring indicates that water quality standards are likely to be violated outside the zone of discharge, the County shall, within 90 days, submit a prevention measures plan to the FDEP. Upon approval, the County shall initiate prevention measures to prevent such violations. If any contaminants are detected and confirmed in compliance wells in concentrations which exceed both background levels and FDEP water quality standards or criteria, or are detected and confirmed in detection wells in concentrations which are above FDEP water quality minimum criteria, the County shall notify the FDEP within 14 days of this finding and shall initiate corrective actions. Evaluation monitoring shall continue according to the requirements of Chapter 62-701.510(7) (a), F.A.C.

Section 6
Groundwater Flow Velocity

In 2001, hydraulic conductivity (K) testing was conducted on two existing monitor wells completed in the Upper Floridan Aquifer at the Pasco County Class I Landfill, which is located approximately 700 feet east of the site and within the Pasco County Resource Recovery Facility. The tests conducted were recovery tests following groundwater pumping and the data was analyzed using the Theis's Recovery Method (Kruseman, G.P., and de Ridder, N.A., Analysis and Evaluation of Pumping Test Data, Second Edition, ILRA Publication 47, 1991). Application requires that the well is pumped at a constant flow rate and the rate of water level recovery is recorded once pumping has ceased. The test results and data calculations are included in **Appendix B**. The estimated transmissivity (T) for well 4MW-13D is approximately 85 square feet per day (ft^2/d). The estimated T value for well 2MW-18D is approximately 4.3 ft^2/d.

Based on the boring logs available for the site, the portion of Upper Floridan Aquifer penetrated by the test wells ranges from highly weathered limestone to sandy calcareous clay and represents either the Tampa Limestone, if present, or otherwise the Suwannee Limestone. Based on Jammal (1987), the upper limestone formations are approximately 100 feet thick at the site. However, it is unlikely that the well tests were hydraulically impacted by such an aquifer thickness because of interbedded, lower permeability zones. Applying an assumed thickness equal to the open interval of these wells to be conservative, K values of approximately 9 feet per day (ft/d) for 4MW-13D and 0.3 ft/d for 2MW-18D are obtained. Although these variations are high, such variations are not uncommon for single well tests conducted in the variable matrix of the Upper Floridan aquifer.

Copies of the contour maps depicting the interpreted groundwater flow in the Upper Floridan aquifer from water level data collected in 2011 and 2012 are in Appendix B. Groundwater elevation maps of the Upper Floridan aquifer at the site indicate the groundwater flow direction to be generally to the north. This conforms to the regional interpretation of groundwater flow. The average hydraulic groundwater flow gradient (i) determined from data collected in 2010, 2011 and 2012 is summarized in **Table 6-1**.

Table 6-1. Water Level Elevations From All Monitor Wells and Piezometers From August 2010 to August 2012

Monitor Well	Water Level Measurements (FT NGVD*)				
	2010	2011		2012	
	8/23/10	*2/17/11*	*8/9/11*	*2/28/12*	*8/14/12*
2MW-3A	DRY	DRY	DRY	DRY	DRY
2MW-7	DRY	DRY	DRY	DRY	DRY
2MW-8	DRY	DRY	DRY	DRY	DRY
2MW-9	DRY	DRY	DRY	DRY	DRY
2MW-10	DRY	DRY	DRY	DRY	DRY
4MW-3A	25.54	24.26	24.88	24.04	31.38
4MW-7	28.54	26.57	29.56	26.34	33.57
4MW-8	27.87	26.37	30.29	26.15	33.22
4MW-9	26.18	24.88	27.90	24.67	31.53
4MW-21	27.74	26.18	29.11	25.91	33.36
4MW-22	26.22	24.95	26.59	24.69	32.14
Hydraulic Gradient	0.0022	0.0017	0.0042	0.0017	0.0017

Note:
Hydraulic gradient estimated using a three-point solution with water level elevations from monitor wells 4MW-7, 4MW-8, and 4MW-3A

*National Geodetic Vertical Datum of 1929 (NGVD 29)

Based on these calculations, the average hydraulic gradient (i) in the upper Floridan Aquifer is be approximately 0.0023. Based on the results of the hydraulic conductivity tests performed in 2001 described above, a conservative hydraulic conductivity (K) value for the Floridan Aquifer of 9.0 feet per day was calculated. Combining these values with the assumption that the effective porosity (n) of the Upper Floridan aquifer is 15% and using the two-dimensional form of Darcy's Law:

$$V = Ki/n$$

Where

V = average linear velocity in feet/day

K = hydraulic conductivity in feet/day

N = effective porosity in percent (estimated)

i = hydraulic gradient

V = 9 x 0.0017 / .15

V = 0.1 feet per day or just over 16 feet per 6 months

As summarized in the calculations above, the groundwater flow velocity (V) in the Floridan Aquifer is calculated to be approximately 0.14 foot per day or approximately 25.5 feet per 6 months. Local hydraulic conductivity values have not been determined for the surficial aquifer at the site due to the

absence of groundwater in the shallow monitor wells resulting from the current low water levels in the surficial deposits.

Appendix A
List of Water Quality Monitoring Parameters

The following list of water quality monitoring parameters shall be used for each type of sampling to be done.

Groundwater Sampling

Groundwater sampling to be done in accordance with Chapter 62-701.510(7)(a), F.A.C. will include:

Field Parameters

- Static water level in wells before purging
- Specific conductivity
- pH
- Dissolved oxygen
- Turbidity
- Temperature
- Colors and sheens (by observation)

Laboratory Parameters

- Total ammonia – N
- Chlorides
- Iron
- Mercury
- Nitrate
- Sodium
- Total dissolved solids (TDS)
- Those parameters listed in 40 CFR Part 258 Appendix I

Surface Water Sampling

Surface water sampling to be done in accordance with Chapter 62-701.510(7)(b), F.A.C. will include:

Field Parameters

- Specific conductivity
- pH
- Dissolved oxygen
- Turbidity
- Temperature
- Colors and sheens (by observation)

Laboratory Parameters

- Unionized ammonia
- Total hardness
- Biochemical oxygen demand (BOD_5)
- Iron
- Mercury
- Nitrate
- Total dissolved solids (TDS)
- Total organic carbon (TOC)
- Fecal coliform
- Total phosphorus (as mg/L P)
- Chlorophyll A
- Total nitrogen
- Chemical oxygen demand (COD)
- Total suspended solids (TSS)
- Those parameters listed in 40 CFR Part 258 Appendix I

Additional Water Quality Sampling

Additional Water Quality Sampling to be done in accordance with Chapter 62-701.510(7)(c), F.A.C. will include:

Laboratory Parameters

Those parameters listed in 40 CFR Part 258 Appendix II

Appendix B
Pumping Test Data

Hydraulic conductivity (K) testing was conducted on two existing monitor wells completed in the Upper Floridan Aquifer at the West Pasco Class I Landfill which is located adjacent to the West Pasco Class III Landfill. The tests were conducted on wells 4MW-13D and 2MW-18D. The tests conducted were recovery tests following groundwater pumping and the data was analyzed using the Theis's Recovery Method (Kruseman, G.P., and de Ridder, N.A., Analysis and Evaluation of Pumping Test Data, Second Edition, ILRA Publication 47, 1991). Application requires that the well is pumped at a constant flow rate and the rate of water level recovery is recorded once pumping has ceased. Graphs of the test results from the two wells are attached. The estimated transmissivity (T) for well 4MW-13D is calculated to be approximately 85 square feet per day (ft^2/d). The estimated T value calculated for well 2MW-18D is approximately 4.3 ft^2/d. Based on the boring logs available for the site, the portion of Upper Floridan Aquifer penetrated by the test wells ranges from highly weathered limestone to sandy calcareous clay and represents either the Tampa Limestone, if present, or otherwise the Suwannee Limestone. Based on Jammal (1987), the upper limestone formations are approximately 100 feet thick at the site. However, it is unlikely that the well tests were hydraulically impacted by such an aquifer thickness because of interbedded, lower permeability zones. Applying an assumed thickness equal to the open interval of these wells to be conservative, K values of approximately 9 feet per day (ft/d) for 4MW-13D and 0.3 ft/d for 2MW-18D are obtained. Although these variations are high, such variations are not uncommon for single well tests conducted in the variable matrix of the Upper Floridan Aquifer. In estimating the groundwater flow velocities, the higher K value is used to be conservative.

$V = Ki/n$

$V = 9 \times 0.0015 / .15$

V = 0.1 feet per day or just over 16 feet per 6 months

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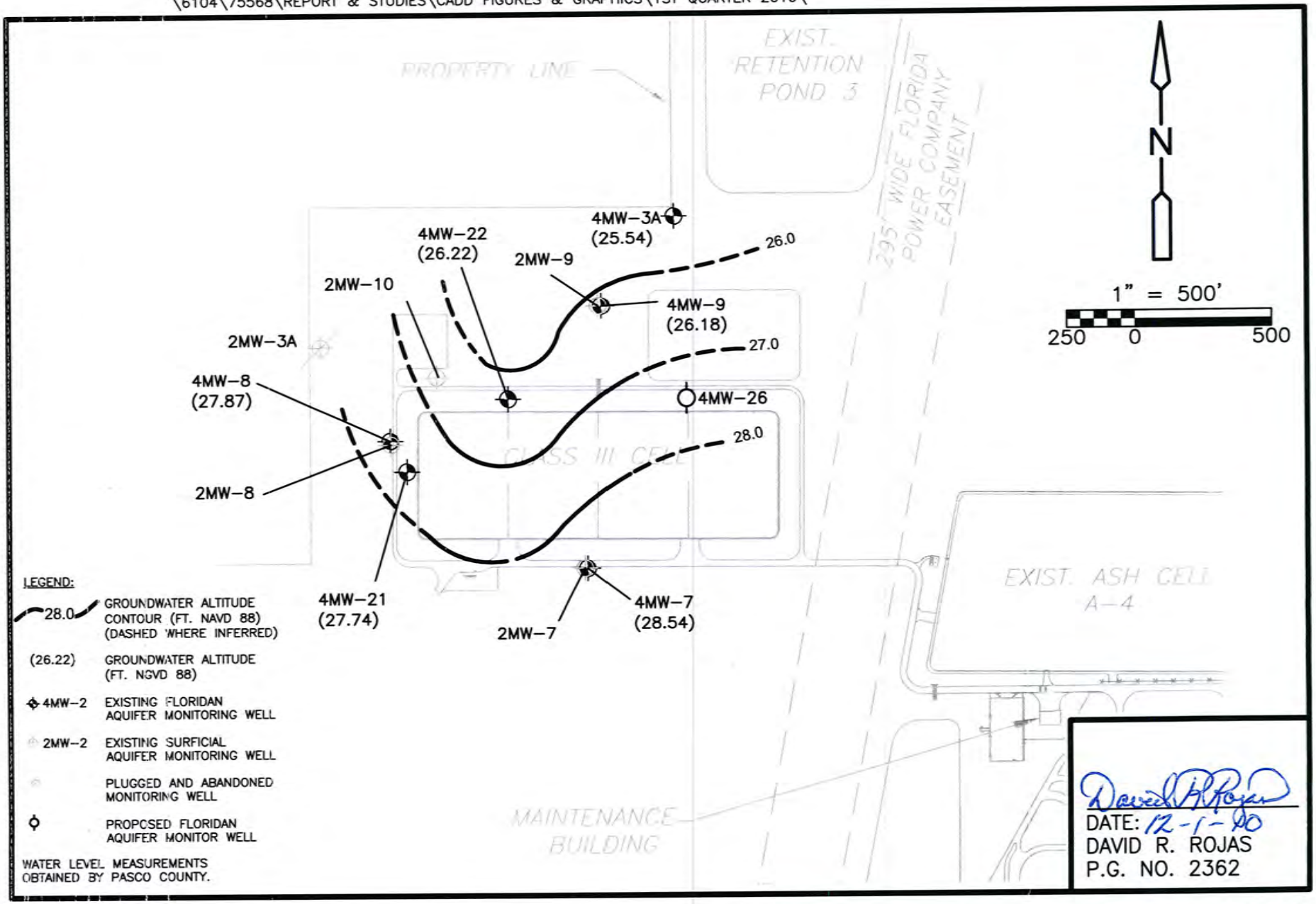

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Floridan Aquifer Groundwater Contour Map - August 23, 2010
Third Quarter, 2010
West Pasco Class III Landfill
Pasco County Florida

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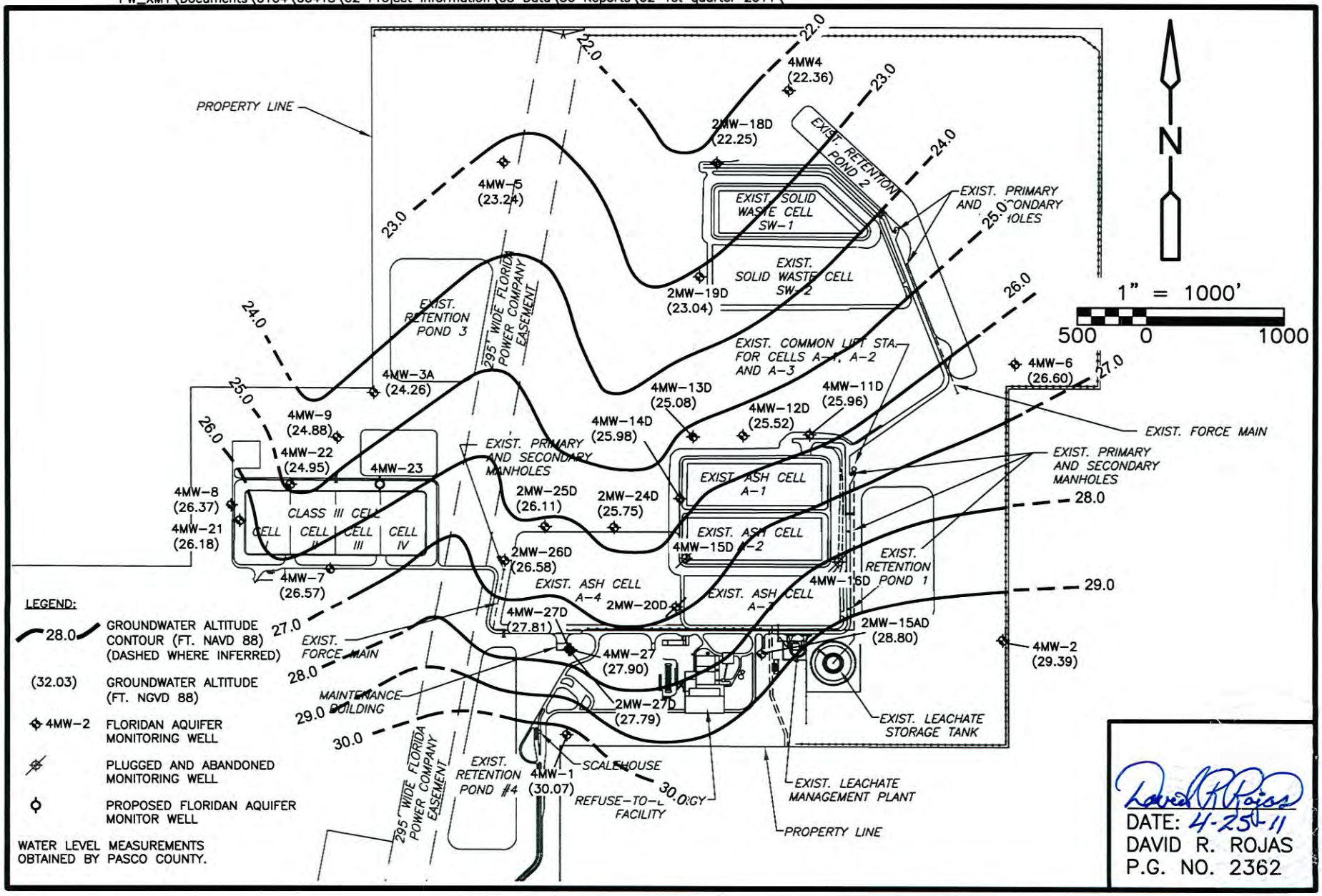

DATE: 4-25-11
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Floridan Aquifer Groundwater Contour Map - February 17, 2011
First Quarter, 2011
West Pasco Resource Recovery Facility

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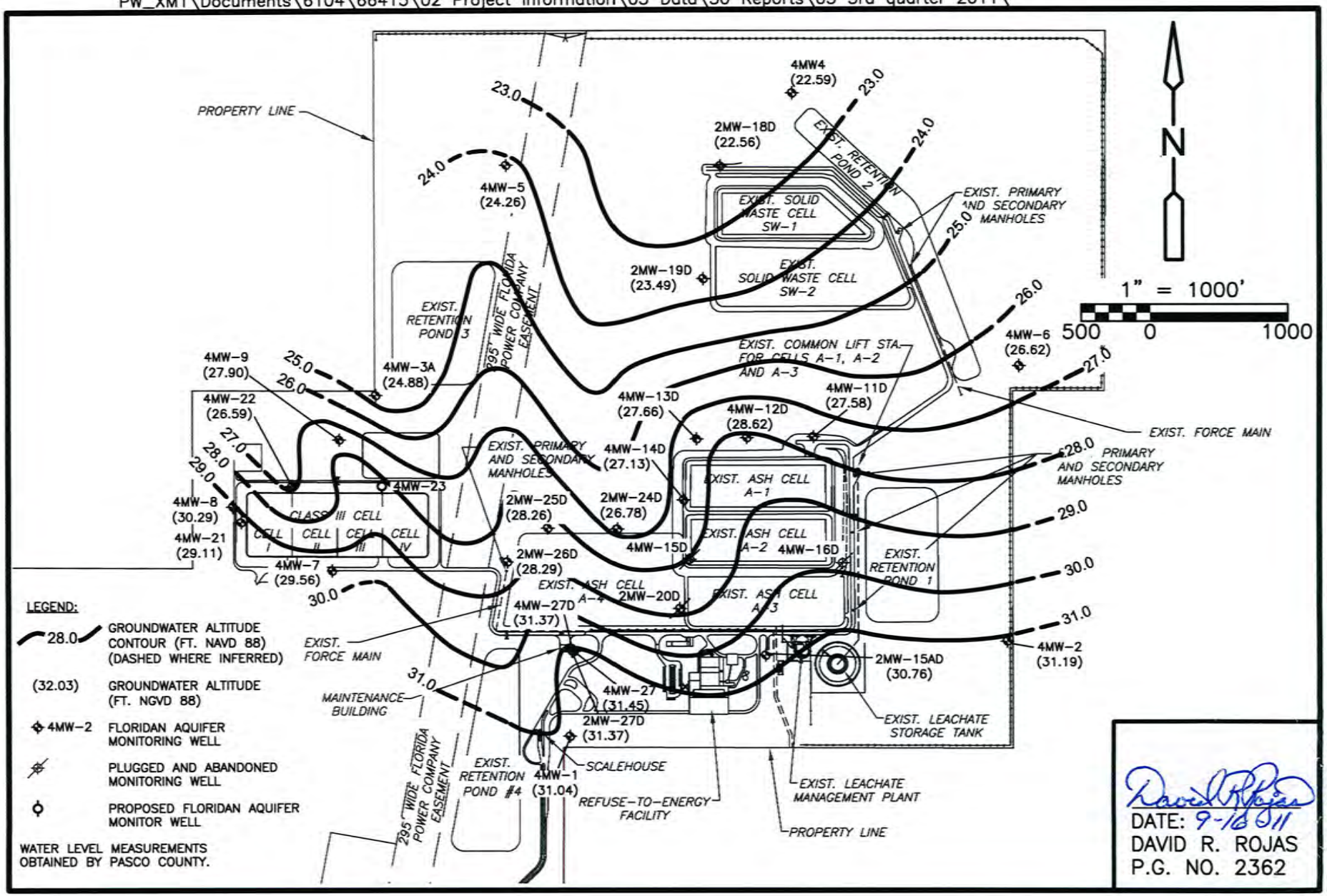

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Floridan Aquifer Groundwater Contour Map - Reference File
Third Quarter, 2011
West Pasco Resource Recovery Facility

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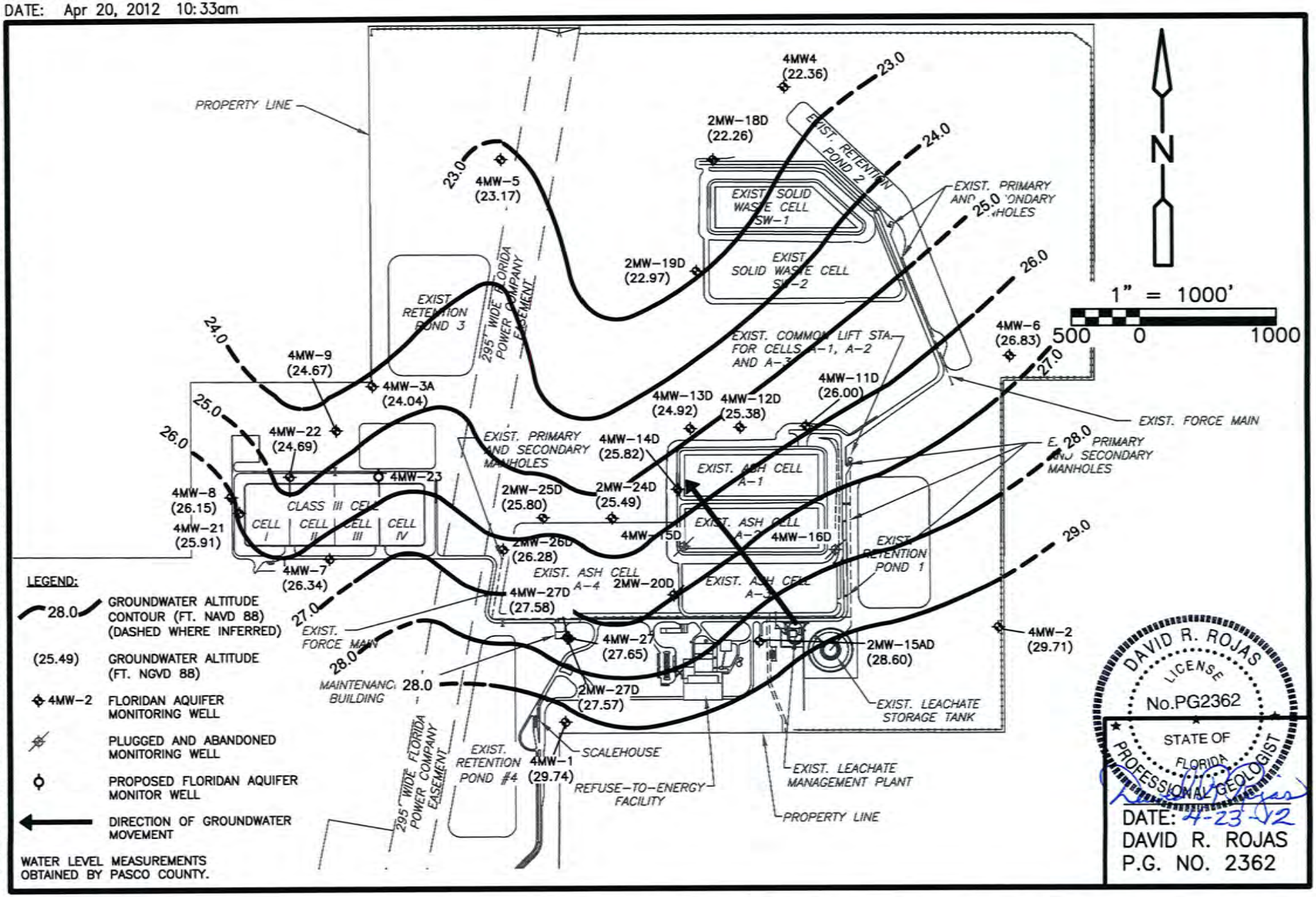

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Floridan Aquifer Groundwater Contour Map - February 28, 2012
First Quarter, 2012
West Pasco Resource Recovery Facility

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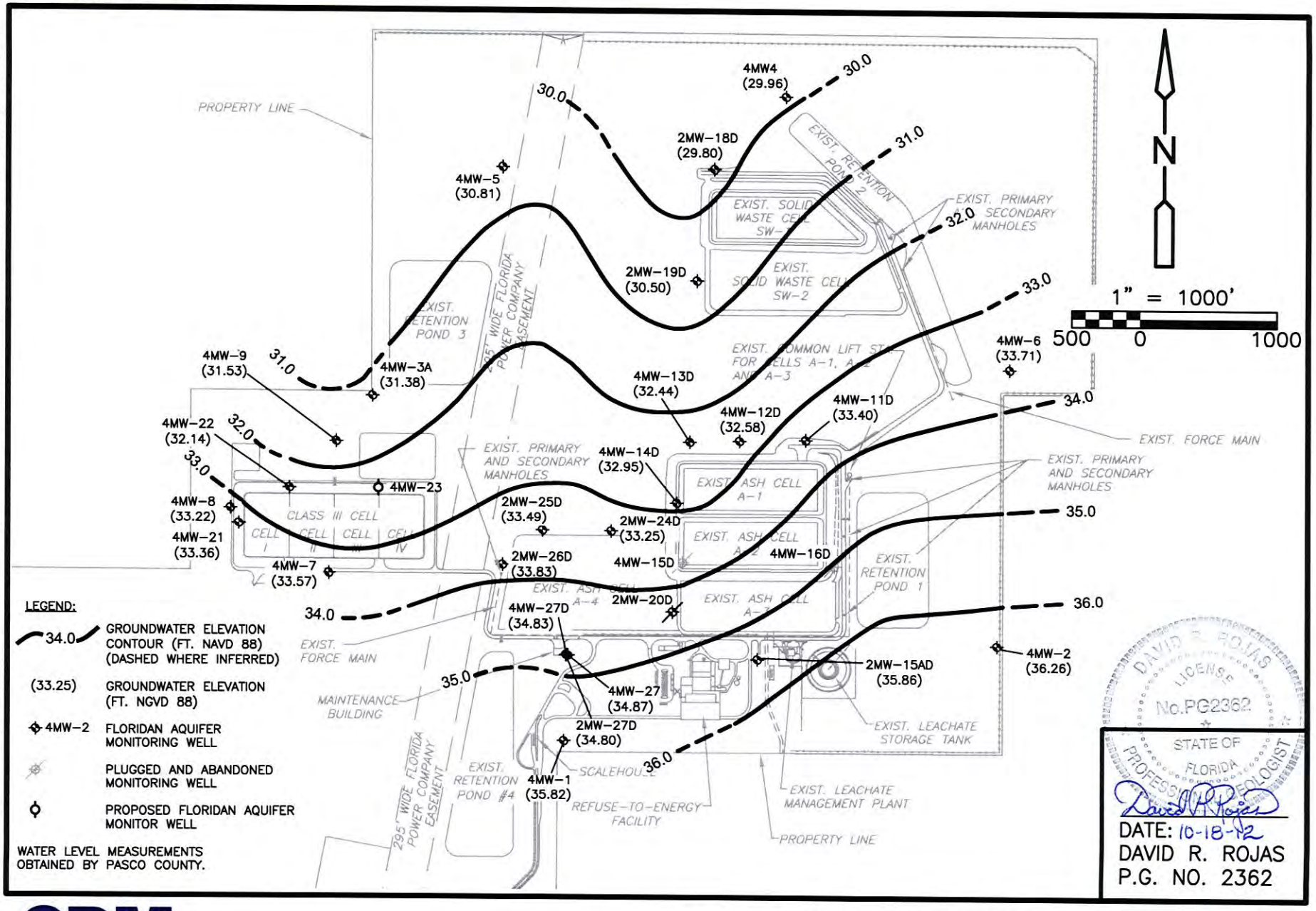

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Floridan Aquifer Groundwater Contour Map - August 14, 2012
Third Quarter, 2012
West Pasco Resource Recovery Facility