Mosaic Fertilizer, LLC
13830 Circa Crossing Drive
Lithia, FL 33547

Tel (813) 500-6000
www.mosaicco.com

June 2, 2014

VIA EMAIL
RETURN RECEIPT REQUESTED

Joseph Haberfeld, P.G.
Florida Department of Environmental Protection
2600 Blair Stone Road M.S. 3500
Tallahassee, Florida 32399

RE: Class V Permit Renewal Application (0272939-001-UC) - Mosaic South Pasture Mine Aquifer Recharge and Recovery Project (ARRP) Hardee County, FL

Dear Mr. Haberfeld:

Attached please find an application to renew the Class V well construction permit No. 0272939-001-UC for the Mosaic South Pasture Mine Aquifer Recharge and Recovery Project. This application is submitted via email in PDF format, with one physical copy to follow. Under separate cover, a check for the application fees for a Class V permit renewal in the amount of $750 will be sent directly to your attention at the address listed above.

We trust that this information meets with your approval. Please contact me directly at 863-375-4321) if you require any additional information regarding this submittal.

Sincerely,

Mosaic Fertilizer, LLC

Gary A. Blitch
Sr. Manager, Technical Services

Attachments
Y:\MOSAIC\FDEP\UIC Renewal\Cover letter application transmittal.docx (FILE 0754)

cc: D. T. Huth (Mosaic)
David Jellerson (Mosaic)
C. A. Kovach (Mosaic)
A. E. Platt (Mosaic)
Jim Bays (CH2M HILL)
Rafael Vazquez-Burney P.E. (CH2M HILL)
Pete Larkin P.G. (CH2M HILL)

Mosaic South Pasture Mine
Aquifer Recharge and Recovery Project
Hardee County, FL

Florida Department of Environmental Protection Class V, Group 2, Injection Well Construction Permit No. 0272939-001-UC Renewal Application

Prepared for
Mosaic Fertilizer, LLC
Hardee County

Prepared by

CH2MHILL®

4350 West Cypress Street
Suite 600
Tampa, FL 33607-4155

CH2M HILL Project No. 494945

June 2014

Contents

List of Tables

Acronyms and Abbreviations

AOR	Area of Review
ARRP	Aquifer Recharge and Recovery Project
bls	Below land surface
DFW	Deep Floridan well
DWSs	Drinking Water Standards
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FGS	Florida Geological Survey
FIPR	Florida Institute for Phosphate Research
ft2/d	feet squared per day
IAS	Intermediate aquifer system
LPZ	Lower permeable zone
MCL	Maximum Contaminant Level
mg/L	Milligrams per Liter
MGD	Million gallons per day
msl	Mean sea level
pCi/L	Picocuries per liter
RZMW	Recharge Zone Monitor Well
SAS	Surficial aquifer system
SMW	Shallow Monitor Well
SWFWMD	Southwest Florida Water Management District
TDS	Total dissolved solids
TON	Threshold Odor Number
TRW	Test Recharge Well
UFA	Upper Floridan aquifer
UPZ	Upper permeable zone
USGS	United States Geological Survey
UV	Ultra-violet
WCP	Well construction permit
WQCE	Water Quality Criteria Exemption
WUP	Water use permit
µg/L	Micrograms per Liter

SECTION 1

FDEP Application to Construct/Operate/ Abandon Class I, III, or V Injection Well Systems

Florida Department of Environmental Protection

Twin Towers Office Bldg., 2600 Blair Stone Road,
Tallahassee, Florida 32399-2400

DEP Form No:	62-528.900(1)
Form Title:	Application to Construct/ Operate/Abandon Class I, III, or V Injection Well Systems
Effective Date:	
DEP Application No.:	(Filled in by DEP)

APPLICATION TO CONSTRUCT/OPERATE/ABANDON
CLASS I, III, OR V INJECTION WELL SYSTEMS

Part I. Directions

A. All applicable items must be completed in full in order to avoid delay in processing this application. Where attached sheets or other technical documentation are utilized in lieu of the blank space provided, indicate appropriate cross-reference in the space and provide copies to the Department in accordance with C. below. Where certain items do not appear applicable to the project, indicate N/A in the appropriate spaces.

B. All information is to be typed or printed in ink.

C. Four (4) copies of this application and four (4) copies of supporting information such as plans, reports, drawings and other documents shall be submitted to the appropriate District/Subdistrict office. An engineering report is also required to be submitted to support this application pursuant to the applicable sections of Rule 62-528, F.A.C. The attached list* shall be used to determine completeness of supporting data submitted or previously received. A check for the application fee in accordance with Rule 62-4.050, F.A.C., made payable to the Department shall accompany the application.

D. For projects involving construction, this application is to be accompanied by four (4) sets of engineering drawings, specifications and design data as prepared by a Professional Engineer registered in Florida, where required by Chapter 471, Florida Statutes.

E. Attach 8 1/2″ x 11″ USGS site location map indicating township, range and section and latitude/longitude for the project.

PART II. General Information

A. Applicant Name Gary A. Blitch Title Sr. Mngr. Tech. Services

Address P.O. Box 1549

City Wauchula State Florida Zip 33873-0000

Telephone Number 863-375-4321

B. Project Status: ☐ New ☒ Existing

☐ Modification (specify) Existing Permit No. 0272939-001-UC

*"Engineering and Hydrogeologic Data Required for Support of Application to Construct, Operate and Abandon Class I, III, or V Injection Wells"

C. Well Type: ☐ Exploratory Well ☒ Test/Injection Well

D. Type of Permit Application

☐ Class I Test/Injection Well Construction and Testing Permit

☐ Class I Well Operation Permit

☐ Class I Well Operation Repermitting

☐ Class I Well Plugging and Abandonment Permit

☐ Class III Well Construction/Operation/Plugging and Abandonment Permit

☐ Class I Exploratory Well Construction and testing Permit

☒ Class V Well Construction Permit

☐ Class V Well Operation Permit

☐ Class V Well Plugging and Abandonment Permit

☐ Monitor Well Only

E. Facility Identification:

Name Mosaic Fertilizer, LLC - South Pasture Mine

Facility Location: Street 2220 Mine View Road

City Bowling Green County Hardee

SIC Code(s) 1475

F. Proposed facility located on Indian Lands: Yes ☐ No ☒

G. Well Identification:

Well No. 1 of 1 Wells
(total #)

Purpose (Proposed Use) Recharge the Upper Floridan Aquifer

Well Location: Latitude: 27° 34′ 25.27″ Longitude: 81° 57′ 8.21″
(attach separate sheet(s), if necessary, for multiple wells)

Subpart B. General Project Description:

H. General Project Description: Describe the nature, extent and schedule of the injection well project. Refer to existing and/or future pollution control facilities, expected improvement in performance of the facilities and state whether the project will result in full compliance with the requirements of Chapter 403, F.S., and all rules of the Department. Attach additional sheet(s) if necessary or cross-reference the engineering report.

See Section 2 Project Description

DEP Form No:	62-528.900(1)
Form Title:	Application to Construct/ Operate/Abandon Class I, III, or V Injection Well Systems
Effective Date:	
DEP Application No.:	(Filled in by DEP)

PART III. Statement by Applicant and Engineer

A. Applicant

I, the owner/authorized representative* of Mosaic, certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment. I understand that this certification also applies to all subsequent reports submitted pursuant to this permit. Where construction is involved, I agree to retain the design engineer, or other professional engineer registered in Florida, to provide inspection of construction in accordance with Rule 62-528.455(1)(c), F.A.C.

Gary A. Blitch — Signed

6-2-14 — Date

Gary A. Blitch, Senior Manager, Technical Services — Name and Title (Please Type)

863 375-4321 — Telephone Number

*Attach a Letter of Authorization.

B. Professional Engineer Registered in Florida

This is to certify that the engineering features of this injection well have been designed/examined by me and found to be in conformity with modern engineering principles applicable to the disposal of pollutants characterized in the permit application. There is reasonable assurance, in my professional judgement, that the well, when properly maintained and operated, will discharge the effluent in compliance with all applicable statutes of the State of Florida and the rules of the Department. It is also agreed that the undersigned will furnish the applicant a set of instructions for proper maintenance and operation of the well.

RAFAEL VAZQUEZ-BURNEY ★ LICENSE ★ No. 70768 ★ STATE OF FLORIDA ★ PROFESSIONAL ENGINEER

(Please Affix Seal)

Rafael Vazquez-Burney — Signed

Rafael Vazquez-Burney — Name (Please Type)

CH2M HILL, Engineers Inc. — Company Name (Please Type)

4350 WEST CYPRESS ST. #600 TAMPA, FL 33607 — Mailing Address (Please Type)

Florida Registration No. 70768 Date 6/2/14 Phone No. (813) 281-7766

ENGINEERING AND HYDROLOGIC DATA
REQUIRED FOR SUPPORT OF APPLICATION
TO CONSTRUCT, OPERATE, AND ABANDON
CLASS I, III, OR V INJECTION WELL SYSTEMS

The following information shall be provided for each type of permit application.

A. CLASS I TEST/INJECTION WELL CONSTRUCTION AND TESTING PERMIT

1. A map showing the location of the proposed injection wells of well field area for which a permit is sought and the applicable area of review. Within the area of review, the map must show the number or name, and location of all producing wells, injection wells, abandoned wells, dry holes, surface bodies of water, springs, public water systems, mines (surface and subsurface), quarries, water wells and other pertinent surface features including residences and roads. The map should also show faults, if known or suspected. Only information of public record and pertinent information known to the applicant is required to be included on this map.

2. A tabulation of data on all wells within the area of review which penetrate into the proposed injection zone, confining zone, or proposed monitoring zone. Such data shall include a description of each well's type, construction, date drilled, location, depth, record of plugging and/or completion, and any additional information the Department may require.

3. Maps and cross sections indicating the general vertical and lateral limits within the area of review of all underground sources of drinking water, their position relative to the injection formation and the direction of water movement, where known, in each underground source of drinking water which may be affected by the proposed injection.

4. Maps and cross sections detailing the hydrology and geologic structures of the local area.

5. Generalized maps and cross sections illustrating the regional geologic setting.

6. Proposed operating data.

   (a) Average and maximum daily rate and volume of the fluid to be injected;

   (b) Average and maximum injection pressure; and,

   (c) Source and an analysis of the chemical, physical, radiological and biological characteristics of injection fluids.

7. Proposed formation testing program to obtain an analysis of the chemical, physical and radiological characteristics of and other information on the injection zone.

8. Proposed stimulation program.

9. Proposed injection procedure.

10. Engineering drawings of the surface and subsurface construction details of the system.

11. Contingency plans to cope with all shut-ins or well failures, so as to protect the quality of the waters of the State as defined in Rule 62-3 and 62-520, F.A.C., including alternate or emergency discharge provisions.

12. Plans (including maps) and proposed monitoring data to be reported for meeting the monitoring requirements in Rule 62-528.425, F.A.C.

13. For wells within the area of review which penetrate the injection zone but are not properly completed or plugged, the corrective action proposed to be taken under Rule 62-528.300(5), F.A.C.

14. Construction procedures including a cementing and casing program, logging procedures, deviation checks, proposed methods for isolating drilling fluids from surficial aquifers, proposed blowout protection (if necessary), and a drilling, testing and coring program.

15. A certification that the applicant has ensured, through a performance bond or other appropriate means, the resources necessary to close, plug or abandon the well as required by Rule 62-528.435(9), F.A.C.

B. CLASS I INJECTION WELL OPERATION PERMIT

1. A report shall be submitted with each application for a Class I Well operating permit, which shall include, but not be limited to, the following information:

   (a) Results of the information obtained under the construction permit described in A. CLASS I TEST/INJECTION WELL CONSTRUCTION AND TESTING PERMIT, including:

      (1) All available logging and testing program data and construction data on the well or well field;

      (2) A satisfactory demonstration of mechanical integrity for all new wells pursuant to Rule 62-528.300(6), F.A.C;

      (3) The actual operating data, including injection pressures versus pumping rates where feasible, or the anticipated maximum pressure and flow rate at which the permittee will operate, if approved by the Department;

      (4) The actual injection procedure;

      (5) The compatibility of injected waste with fluids in the injection zone and minerals in both the injection zone and the confining zone; and,

      (6) The status of corrective action on defective wells in the area of review.

   (b) Record drawings, based upon inspections by the engineer or persons under his direct supervision, with all deviations noted;

   (c) Certification of completion submitted by the engineer of record;

   (d) If requested by the Department, operation manual including emergency procedures;

(e) Proposed monitoring program and data to be submitted;

(f) Proof that the existence of the well has been recorded on the surveyor's plan at the county courthouse; and,

(g) Proposed plugging and abandonment plan pursuant to Rule 62-528.435(2), F.A.C.

C. CLASS I WELL OPERATION REPERMITTING

1. An updated map showing the location of the injection wells or well field area for which a permit is sought and the applicable area of review. Within the area of review, the map must show the number or name, and location of all producing wells, injection wells, abandoned wells, dry holes, surface bodies of water, springs, public water systems, mines (surface and subsurface), quarries, water wells and other pertinent surface features including residences and roads. The map should also show faults, if known or suspected. Only information of pubic record and pertinent information known to the applicant is required to be included on this map.

2. A tabulation of data on all wells within the area of review which penetrate into the injection zone, confining zone, or monitoring zone. Such data shall include a description of each well's type, construction, date drilled, location, depth, record of plugging and/or completion, and any additional information the Department may require.

3. Maps and cross sections indicating the general vertical and lateral limits within the area of review of all underground sources of drinking water, their position relative to the injection formation and the direction of water movement, where known, in each underground source of drinking water which may be affected by the injection.

4. Maps and cross sections detailing the hydrology and geologic structures of the local area.

5. Generalized maps and cross sections illustrating the regional geologic setting.

6. Contingency plans to cope with all shut-ins or well failures, so as to protect the quality of the waters of the State as defined in Rule 62-3 and 62-520, F.A.C., including alternate or emergency discharge provisions.

7. For wells within the area of review which penetrate the injection zone but are not properly completed or plugged, the corrective action proposed to be taken under Rule 62-528.300(5), F.A.C.

8. A certification that the applicant has ensured, through a performance bond or other appropriate means, the resources necessary to close, plug or abandon the well as required by Rule 62-528.435(9), F.A.C.

9. A report shall be submitted with each application for repermitting of Class I Well operation which shall include the following information:

   (a) All available logging and testing program data and construction data on the well or well field;

(b) A satisfactory demonstration of mechanical integrity for all wells pursuant to Rule 62-528.300(6), F.A.C.;

(c) The actual operating data, including injection pressures versus pumping rates where feasible, or the anticipated maximum pressure and flow rate at which the permittee will operate, if approved by the Department;

(d) The actual injection procedure;

(e) The compatibility of injected waste with fluids in the injection zone and minerals in both the injection zone and the confining zone;

(f) The status of corrective actin on defective wells in the area of review;

(g) Record drawings, based upon inspections by the engineer or persons under his direct supervision, with all deviations noted;

(h) Certification of completion submitted by the engineer of record;

(i) An updated operation manual including emergency procedures;

(j) Proposed revisions to the monitoring program or data to be submitted; and,

(k) Proposed plugging and abandonment plan pursuant to Rule 62-528.435(2), F.A.C.

D. CLASS I WELL PLUGGING AND ABANDONMENT PERMIT

1. The reasons for abandonment.

2. A proposed plan for plugging and abandonment describing the preferred and alternate methods, and justification for use.

   (a) The type and number of plugs to be used;

   (b) The placement of each plug including the elevation of the top and bottom;

   (c) The type and grade and quantity of cement or any other approved plugging material to be used; and,

   (d) The method for placement of the plugs.

3. The procedure to be used to meet the requirements of Rule 62-528.435, F.A.C.

E. CLASS III WELLS CONSTRUCTION/OPERATION/PLUGGING AND ABANDONMENT PERMIT

Construction Phase

1. A map showing the location of the proposed injection wells or well field area for which a permit is sought and the applicable area of review. Within the area of review, the map must show the number or name, and location of all producing wells, injection wells, abandoned wells, dry holes, surface bodies of water, springs, public water system, mines (surface and subsurface), quarries, water wells and other pertinent surface features including residences and roads. The map should also show faults, if known or suspected. Only information of public record and pertinent information known to the applicant is required to be included on this map.

2. A tabulation of data on all wells within the area of review which penetrate into the proposed injection zone, confining zone, or proposed monitoring zone. Such data shall include a description of each well's type, construction, date drilled, location, depth, record of plugging and/or completion, and any additional information the Department may require.

3. Maps and cross sections indicating the general vertical and lateral limits within the area of review of all underground sources of drinking water, their position relative to the injection formation and the direction of water movement, where known, in each underground source of drinking water which may be affected by the proposed injection.

4. Maps and cross sections detailing the hydrology and geologic structures of the local area.

5. Generalized maps and cross sections illustrating the regional geologic setting.

6. Proposed operating data:

   (a) Average and maximum daily rate and volume of the fluid to be injected;

   (b) Average and maximum injection pressure; and,

   (c) Source and an analysis of the chemical, physical, radiological and biological characteristics of injection fluids, including any additives.

7. Proposed formation testing program to obtain an analysis of the chemical, physical and radiological characteristics of and other information on the injection zone.

8. Proposed stimulation program.

9. Proposed injection procedure.

10. Engineering drawings of the surface and subsurface construction details of the system.

11. Contingency plans to cope with all shut-ins or well failures or catastrophic collapse, so as to protect the quality of the waters of the State as defined in Rule 62-3 and 62-520, F.A.C., including alternate or emergency discharge provisions.

12. Plans (including maps) and proposed monitoring data to be reported for meeting the monitoring requirements in Rule 62-528.425, F.A.C.

13. For wells within the area of review which penetrate the injection zone but are not properly completed or plugged, the corrective action proposed to be taken under Rule 62-528.300(5), F.A.C.

14. Construction procedures including a cementing and casing program, logging procedures, deviation checks, proposed methods for isolating drilling fluids from surficial aquifers, and a drilling, testing and coring program.

15. A certificate that the applicant has ensured, through a performance bond or other appropriate means, the resources necessary to close, plug or abandon the well as required by Rule 62-528.435(9), F.A.C.

16. Expected changes in pressure, native fluid displacement, direction of movement of injection fluid.

17. A proposed monitoring plan, which includes a plan for detecting migration of fluids into underground sources of drinking water, a plan to detect water quality violation in the monitoring wells, and the proposed monitoring data to be submitted.

Operation Phase

1. The following information shall be provided to the Department prior to granting approval for the operation of the well or well field:

   (a) All available logging and testing program data and construction data on the well or well field;

   (b) A satisfactory demonstration of mechanical integrity for all new wells pursuant to Rule 62-528.300(6), F.A.C.;

   (c) The actual operating data, including injection pressure versus pumping rate where feasible, or the anticipated maximum pressure and flow rate at which the permittee will operate, if approved by the Department;

   (d) The results of the formation testing program;

   (e) The actual injection procedure; and,

   (f) The status of corrective action on defective wells in the area of review.

Plugging and abandonment Phase

1. The justification for abandonment.

2. A proposed plan for plugging and abandonment describing the preferred and alternate methods.

   (a) The type and number of plugs to be used;

   (b) The placement of each plug including the elevation of the top and bottom;

   (c) The type and grade and quantity of cement or any other approved plugging material to be used; and,

   (d) The method for placement of the plugs.

3. The procedure to be used to meet the requirements of Rule 62-528.435, F.A.C.

F. EXPLORATORY WELL CONSTRUCTION AND TESTING PERMIT

1. Conceptual plan of the injection project. Include number of injection wells, proposed injection zone, nature and volume of injection fluid, and proposed monitoring program.

2. Preliminary Area of Review Study. Include the proposed radius of the area of review with justification for that radius. Provide a map showing the location of the proposed injection well or well field area for which a permit is sought and the applicable area of review. Within the area of review, the map must show the number or name, and location of all producing wells, injection wells, abandoned wells, dry holes, surface bodies of water, springs, public water systems, mines (surface and subsurface), quarries, water wells and other pertinent surface features including residences and roads. The map should also show faults, if known or suspected. Only information of public record and pertinent information known to the applicant is required to be included on this map.

3. Proposed other uses of the exploratory well.

4. Drilling and testing plan for the exploratory well. The drilling plan must specify the proposed drilling program, sampling, coring, and testing procedures.

5. Abandonment Plan.

G. CLASS V WELL CONSTRUCTION PERMIT

(This form should be used for Class V Wells instead of Form 62-528.900(3), F.A.C., when there is a need for a Technical Advisory Committee and an engineering report.)

1. Type and number of proposed Class V Wells:

_____ Wells Receiving Domestic Waste

_____ Desalination Process Concentrate Wells (Reverse Osmosis, etc.)

_____ Aquifer Storage and Recovery Wells

_____ Aquifer Remediation Wells

_____ Salt-water Intrusion Barrier Wells

_____ Cooling Water Return Flow Wells Open-looped System

_____ Subsidence Control Wells

_____ Sand Backfill Wells

_____ Experimental Technology Wells

_____ Wells used to inject spent brine after halogen recovery

_____ Radioactive Waste Disposal Wells*

_____ Borehole Slurry Mining Wells

_____ Other non-hazardous Industrial or Commercial Disposal Wells

(explain) _____

1 Other (explain) Group II Recharge Well

*Provided the concentrations of the waste do not exceed drinking water standards contained in Chapter 62-550, F.A.C.

2. Project Description:

(a) Description and use of proposed injection system;

(b) Nature and volume of injected fluid (the Department may require an analysis including bacteriological analysis) in accordance with Rule 62-528.635(2)(b), F.A.C.; and,

(c) Proposed pretreatment.

3. Water well contractor’s name, title, state license number, address, phone number and signature.

4. Well Design and Construction Details. (For multi-casing configurations or unusual construction provisions, an elevation drawing of the proposed well should be attached.)

   (a) Proposed total depth;

   (b) Proposed depth and type of casing(s);

   (c) Diameter of well;

   (d) Cement type, depth, thickness; and,

   (e) Injection pumps (if applicable): _____ gpm @ _____ psi

   Controls: _____

   _____

   _____

5. Water Supply Wells - When required by Rule 62-528.635(1), F.A.C., attach a map section showing the locations of all water supply wells within a one-half (1/2) mile radius of the proposed well. The well depths and casing depths should be included. When required by Rule 62-528.635(2), F.A.C., results of bacteriological examinations of water from all water supply wells within one-half (1/2) mile and drilled to approximate depth of proposed well should be attached.

6. Area of review (When required by Rule 62-528.300(4), F.A.C.)

   Include the proposed radius of the area of review with justification for that radius. Provide a map showing the location of the proposed injection well or well field area for which a permit is sought and the applicable area of review. Within the area of review, the map must show the number or name, and location of all producing wells, injection wells, abandoned wells, dry holes, surface bodies of water, springs, public water systems, mines (surface and subsurface), quarries, water wells and other pertinent surface features including residences and roads. The map should also show faults, if known or suspected. Only information of public record and pertinent information known to the applicant is required to be included on this map.

H. CLASS V WELL OPERATION PERMIT

(Final report of the construction that includes the following information may be submitted with the application to operate.)

1. Permit Number of Class V Construction Permit: _____

2. Owner’s Name: _____

3. Type of Wells: _____

4. Construction and Testing Summary:

(a) Actual Dimensions:

Diameter (inches)	Well Depth (feet)	Casing Depth (feet)

(b) Result of Initial Testing

5. Proposed Operating Data:

(a) Injection Rate (GPM);

(b) Description of injected waste; and,

(c) Injection pressure and pump controls.

6. Proposed Monitoring Plan (if any):

(a) Number of monitoring wells;

(b) Depth(s);

(c) Parameters;

(d) Frequency of sampling; and,

(e) Instrumentation (if applicable) Flow _____

Pressure _____

I. CLASS V WELLS PLUGGING AND ABANDONMENT PERMIT

1. Permit number of Class V construction or operating permit.

2. Type of well.

3. Proposed plugging procedures, plans and specifications.

4. Reasons for abandonment.

J. MONITOR WELL PERMIT

This section should be used only when application is made for a monitor well only. If a monitor well is to be constructed under a Class I, III, or V injection well construction permit, it is necessary to fill in this section.

1. A site map showing the location of the proposed monitor wells for which a permit is sought. The map must be to scale and show the number or name, and location of all producing wells, injection wells, abandoned wells, dry holes, water wells and other pertinent surface features including structures and roads.

2. Maps and cross sections indicating the general vertical and lateral limits within the area of review of all underground sources of drinking water, their position relative to the injection formation and the direction of water movement, where known, in each underground source of drinking water which may be affected by the proposed injection.

3. Maps and cross sections detailing the hydrology and geologic structures of the local area.

4. Generalized maps and cross sections illustrating the regional geologic setting.

5. Proposed formation testing program to obtain an anlysis of the chemical, physical and radiological characteristics of and other information on the monitor zone(s).

6. Proposed monitoring procedure.

7. Engineering drawings of the surface and subsurface construction details of the monitoring system.

8. Proposed monitoring data to be reported for meeting the monitoring requirements in Rule 62-528.425, F.A.C.

9. Construction procedures including a cementing and casing program, logging procedures, deviation checks, proposed methods for isolating drilling fluids from surficial aquifers, proposed blowout protection (if necessary), and a drilling, testing and coring program

10. Monitor Well Information:

    ☐ On-site ☐ Multizone ☐ Single-zone

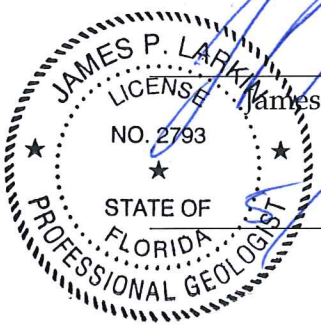
    ☐ Regional ☐ Other (specify) _____

    Proposed Monitoring Interval(s) _____

    Distance and Direction From Associated Injection Well _____

Professional Geologist

The geological evaluation and interpretations in the *Mosaic South Pasture Mine Aquifer Recharge and Recovery Project Hardee County, FL Florida Department of Environmental Protection Class V, Group 2, Injection Well Construction Permit No. 0272939-001-UC Renewal Application, May 2014,* were prepared by or reviewed by a Licensed Professional Geologist in the State of Florida.



James P. Larkin, P.G.

5/30/14
Date

2793
License No.

PART II. General Information

Subpart B. General Project Description

SECTION 2

Project Description

2.1 Introduction

Mosaic Fertilizer, LLC (Mosaic) operates phosphate production facilities throughout Florida. Of these, the South Pasture Mine is an approximately 25,000-acre phosphate mining reserve owned by Mosaic in Hardee County. After mining and beneficiation, the graded phosphate rock is shipped north by rail to the Mosaic Plant City Facility. The South Pasture Mine and the Plant City Facility were previously owned and operated by CF Industries, Inc., under the names, Hardee Phosphate Complex and Plant City Phosphate Complex, respectively. Subsidiaries of the Mosaic Company acquired the phosphate business of CF Industries, Inc., in March 2014. **Figure 2-1** is a location map of the South Pasture Mine.

This application is for the renewal of Mosaic's Class V, Group 2, Test Injection Well Construction Permit No. 0272939-001-UC issued August 3, 2009 as part of the Aquifer Recharge and Recovery Project (ARRP) at the South Pasture Mine. The test injection well was not constructed within the duration of this permit; however the ARRP wetland treatment system was constructed in 2011 serving as a demonstration project to establish the treatment efficiency of the system and applicability of the treated water for aquifer recharge. The renewal of this permit will allow Mosaic to implement the aquifer recharge component of the ARRP over the next permit cycle (typically 5 years), if determined appropriate.

2.2 Aquifer Recharge and Recovery Project Background

Hardee County and the Mosaic South Pasture Mine are located in the Southern Water Use Caution Area (SWUCA) designated by the Southwest Florida Water Management District (SWFWMD). The SWUCA is an area of declining seasonal and average ground water levels in the Upper Floridan aquifer. For several years the Hardee County Board of County Commissioners has recognized the potential role the phosphate industry could play in addressing the stressed groundwater resource in the SWUCA, and has been encouraging the phosphate industry to undertake water resource development projects to demonstrate this potential. Concurrently, SWFWMD identified the capture, treatment and aquifer injection of surface water and stormwater in this part of central Florida as a viable alternative water supply option in the 2006 Regional Water Supply Plan. The concept of using existing above ground basins and sand tailings for water storage and treatment in central Florida has been proposed over the years as an important method of retaining surface waters for supply. With this rationale, a water resource/water recharge development project, known as the ARRP, was investigated and developed on a portion of the South Pasture Mine.

The ARRP was constructed within a 1,012-acre portion of the South Pasture Mine under the enabling legislation of Florida Statute Ch. 378.212 (g) in lieu of undertaking the previously approved reclamation of that area after mining. Enacted in 2003, this legislation allows for granting a variance to typical mine reclamation requirements when a project provides an improvement in water availability in the basin and does not cause adverse impacts to water resources in the basin.

As originally conceived, the ARRP centers on storing mine recirculation water (including reclaimed domestic wastewater) in an existing impoundment containing sand-clay mix soils; naturally treating that water through a series of cells consisting of high quality reclaimed wetlands constructed in an adjacent impoundment containing sand-clay mix soils; filtering the water through a sand tailings filter basin; and then injecting 2 to 4 million gallons per day (MGD) of water into the Upper Floridan aquifer to facilitate aquifer recovery and provide a potential water supply offset for future development in Hardee County. **Figure 2-2** depicts the general location and layout of the proposed ARRP.

2.2.1 Conceptual ARRP Plan

The ARRP was developed in phases through implementation of an adaptive design process, where the treatment wetland, wildlife habitats, and aquifer recharge components are designed to complement and contribute to the reclamation goals of the ARRP. The components of the ARRP system include the reservoir, treatment wetland, sand filter basin, and recharge well (see **Figure 2-3)**.

The following sections provides an overview of the major components of the ARRP system.

F
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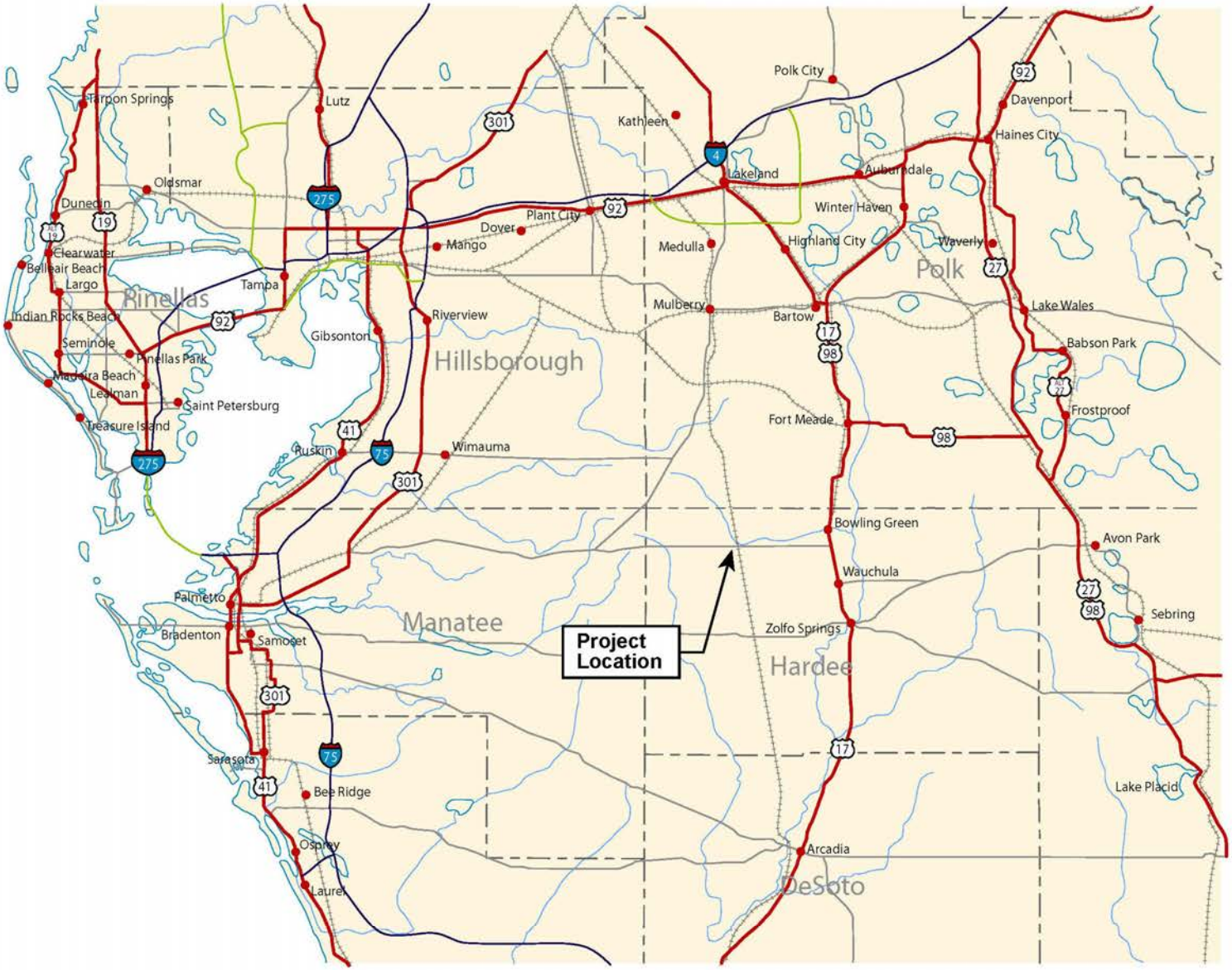

FIGURE 2-1
Area Location Map
Mosaic Aquifer Recharge and Recovery Project

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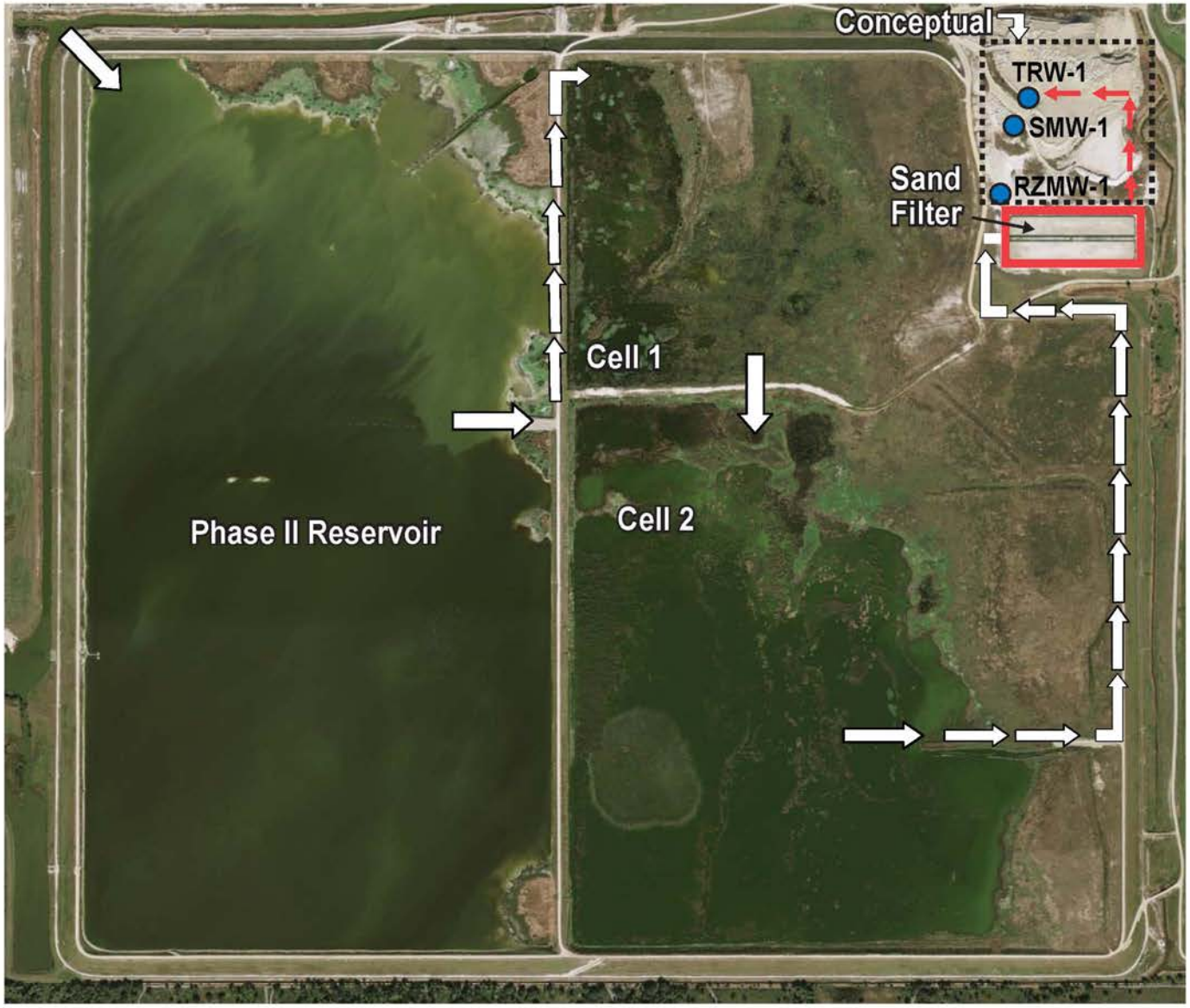

FIGURE 2-2
Project Site Map
Mosaic Aquifer Recharge and Recovery Project

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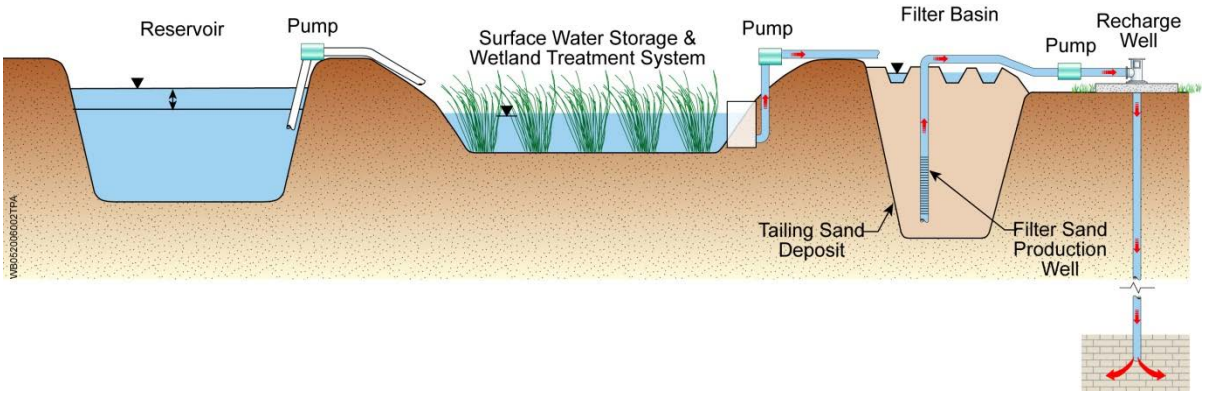
FIGURE 2-3
ARRP Components Cross Section



2.2.2 Treatment Wetland

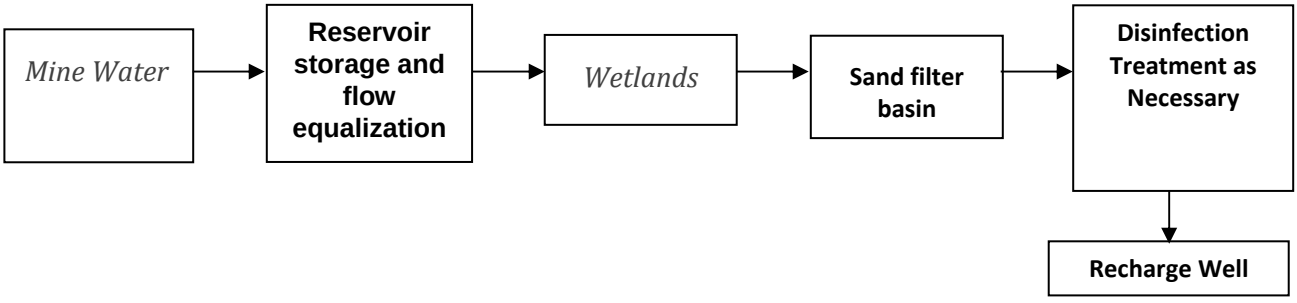
Because the original reclamation plan centered on vegetating the W-1 Phase I sand/clay mix basin with native Florida upland and wetland plant species, portions of the W-1 Phase I basin was always intended to be a wetland. Given this original expectation, the wetland was modified by the addition of a central dividing berm with hydraulic control structures, and inflow and outflow pump stations were configured to allow flow to run the entire length of the wetland.

The treatment wetland plan was based upon modeling to predict the water quality of the effluent being discharged to the sand filter basin and eventually to the recharge well. Those modeling tools were:

1. A consolidation model calibrated for the sand-clay mix substrate at the South Pasture Mine;
2. Hydrology spreadsheet model, supported by a long term precipitation period-of-record analysis, to determine the system hydrology; and
3. Performance model to predict the reduction of selected inflow parameters by the treatment wetland.

When fully implemented as a recharge system, the process flow would be as characterized in **Figure 2-4**:

FIGURE 2-4
Flow Diagram for Stormwater Treatment and Aquifer Recharge



The treatment wetland design is based on the existing W-1 Phase 1 sand-clay mix settling area land form as predicted after initial consolidation through active dewatering. The hydrologic process is based on concepts developed through demonstrations implemented by the Florida Institute for Phosphate Research[1] (FIPR) and from a "barrel" test of the process with South Pasture Mine recirculation water. Both pilot programs (performed by Schreuder, Inc.) proved successful and encouraged further development of the full scale project.

[1] Now known as "Florida Industrial and Phosphate Research."

Finally, a wetland pilot study was completed between August and October 2006 at the South Pasture Mine as a proof-of-concept. Surface drainage waters were pumped through a reclaimed wetland, and changes in water quality constituents were monitored along the flow path. That study established that site surface waters showed reductions in phosphorus, inorganic nitrogen, suspended solids and coliform bacteria through the wetland.

Collectively, the ARRP planning and design efforts established that configuring the proposed reclamation site as a treatment wetland was feasible, and that a typical hydroperiod could be sustained that would sustain wetland habitats and achieve the original objective of creating balanced, natural vegetative communities.

2.2.3 Reservoir

The reservoir, W-1 Phase II, is being maintained in its current status as a water storage facility for site operations, and for supplemental treatment capacity of the ARRP. The operation & maintenance (O&M) of the reservoir have included the management of nuisance species of vegetation, e.g., cattails, which otherwise could reduce the storage capacity of the system and provide a seed source for possible overpopulation of the treatment wetland.[2] The reservoir and embankments are operated and maintained as required under Ch. 62-672, Florida Administrative Code (FAC).

2.2.4 Treatment Wetland

The treatment wetland within W-1 Phase I was designed to reduce the concentrations of selected constituents in the mine water prior to introduction into the sand filter and eventually into the recharge well, when constructed. Wetland vegetation was planted in two treatment cells (Cells I and II), and water control facilities were designed and constructed.

The development of the treatment wetland portion of the ARRP followed this general sequence of activities:

1. Map existing wetland communities
2. Chemically treat and/or mechanically remove cattails & other nuisance vegetation
3. Dewater site
4. Enclose initial treatment wetland cell (Cell 1) with sand tailings
5. Excavate spreader canals and collection canals
6. Establish herbaceous vegetation
7. Hydrate wetland in Cell 1 to control growth of herbaceous vegetation
8. Plant upland habitat and fringe hardwood swamp to meet reclamation requirements
9. Continue dewatering the remainder of the treatment wetland
10. Develop next cell (Cell 2) in the same manner as Cell 1.

2.2.5 Sand Filter

Sand tailings, already emplaced in the northeast corner of the ARRP site, were used to construct a sand filter basin for media-based treatment through filtration of the wetland outflow. Additional treatment for pathogen inactivation may also be considered to provide final polishing before aquifer injection, if needed and practicable. The sand filter system is integral to the injection well pumping system and provides up to 2 to 4 MGD recharge capacity.

[2] Although cattails are a desirable species for purposes of water treatment, they are considered undesirable for high quality wetland reclamation establishment.

2.2.6 Aquifer Recharge

Aquifer recharge is a proven technology successfully employed by many utilities and industries throughout Florida. The proposed recharge well would be complemented with monitoring wells and water quality testing protocols established to meet state groundwater discharge criteria.

2.3 Legislative Approval

The ARRP is made possible through a 2003 Florida Statute change which addressed the long-term need to develop water resource projects to meet water demand associated with the continued growth of the State, especially Central Florida.

The Florida Legislature in 2003 passed legislation which was codified into Section 378.212 (1) (g), F.S., and provided the following opportunities for phosphate mining reclamation:

> **(g) To accommodate reclamation that provides water supply development or water resource development not inconsistent with the applicable regional water supply plan approved pursuant to s. 373.0361, provided adverse impacts are not caused to the water resources in the basin. A variance may also be granted from the requirements of part IV of chapter 373, or the rules adopted there under, when a project provides an improvement in water availability in the basin and does not cause adverse impacts to water resources in the basin.**

The ARRP has the potential to treat and recharge into the Floridan aquifer up to 4 MGD of mine water, which will assist in the recovery of the Upper Floridan aquifer within the SWUCA. The implementation of the ARRP is consistent with the surface water/stormwater alternative water supply options set forth in the SWFWMD's 2006 Regional Water Supply Plan (RWSP). As summarized in Chapter IV, the RWSP called for the capture of excess surface water flows in the upper Peace River area, treatment of those waters in clay settling areas and treatment wetlands, and then injection of those treated waters into the Upper Floridan aquifer.

2.4 Regional Hydrogeology

The following discussion of the Hardee County hydrogeology is largely taken from the following studies:

- Beach, M. and Chan, D., (2003). Southern District Ground-Water Flow Model, Version 1.0, a SWFWMD Technical Report, Southwest Florida Water Management District.
- Metz, P.A., (1995). Hydrogeology and Simulated Effects of Ground-Water Withdrawals for Citrus Irrigation, Hardee and DeSoto Counties, Florida, US Geological Survey Water Resources Investigation Report 93-4158.
- Duerr, A.D., and Enos, G.M., (1991) Hydrogeology of the intermediate aquifer system and Upper Floridan aquifer, Hardee and De Soto Counties, Florida, US Geological Survey Water Resources Investigation Report 90-4104.

The hydrogeologic units underlying the study area are, in descending order, the surficial aquifer system (SAS), the intermediate aquifer system (IAS), the Upper Floridan aquifer (UFA), and the middle confining unit (MCU). **Table 2-1** depicts the generalized hydrostratigraphy of the study area. The uppermost water-bearing unit, the SAS, consists predominantly of sand. These sand deposits are underlain by the IAS, primarily of the Hawthorn Group, which separates the SAS from the UFA. The UFA is a multilayered sequence of relatively high and low permeability carbonate units.

Groundwater, the principal source of water supply in Hardee County, is obtained from the SAS, IAS, and UFA. The SAS has limited use because of the low yield to wells and the potential for contamination. Water withdrawn from the SAS is used primarily for lawn irrigation and livestock watering. The IAS is used extensively in some parts of Hardee County as a source of water for irrigation and public and domestic

supply. The yield to wells and total withdrawals of water from this aquifer system are greater than those of the surficial aquifer, but are much less than those of the deeper UFA. The UFA is the principal source of water supply in the study area. Water withdrawn from the Upper Floridan aquifer is used for agricultural, industrial, public, and domestic supply. Wells open to the UFA yield large quantities (up to millions of gallons per day) of fresh groundwater.

The study area lies entirely in the physiographic zone described by White (1970) as the Polk Upland, which corresponds approximately to a marine terrace or plain that was formed by the advancement of rising seas during the Pleistocene Epoch. The Polk Upland is a broad, sandy area that ranges in altitude from 100 to 245 feet above sea level. The study area is drained by Payne Creek and Lettis Creek, tributaries of the Peace River. The Peace River flows southward for about 70 miles from its source in Polk County into Charlotte Harbor in Charlotte County. Other major tributaries that flow into the Peace River include Charlie Creek, Joshua Creek, Horse Creek, and Prairie Creek.

TABLE 2-1
Regional Hydrogeologic Framework

<table>
<tr><th>Series</th><th colspan="3">Stratigraphic Unit</th><th colspan="2">Hydrogeologic Unit</th><th>Lithology</th></tr>
<tr><td>Holocene to Pliocene</td><td colspan="3">Undifferentiated Surficial Deposits</td><td colspan="2">Surficial Aquifer System</td><td>Sand, silty sand, clayey sand, peat, and shell</td></tr>
<tr><td rowspan="5">Miocene</td><td rowspan="5">Hawthorn Group</td><td rowspan="2">Peace River Formation</td><td>UICU</td><td rowspan="5">Intermediate Aquifer System</td><td rowspan="2">Predominantly phosphatic clay, gray to green to brown, plastic, ductile, minor sand, residual limestone and dolostone</td></tr>
<tr><td>PZ 2</td></tr>
<tr><td>Arcadia Formation</td><td>MICU</td></tr>
<tr><td rowspan="2">Tampa Member</td><td>PZ 3</td><td rowspan="2">Limestone, gray to tan, sandy, soft, clayey, minor sand, phosphatic. Chert found locally</td></tr>
<tr><td>SCU</td></tr>
<tr><td colspan="2">Oligocene</td><td>Suwannee Limestone</td><td>UPZ</td><td rowspan="3">Upper Floridan Aquifer</td><td>Limestone, cream to tan, sandy, vuggy, fossiliferous</td></tr>
<tr><td rowspan="4">Eocene</td><td colspan="2">Ocala Limestone</td><td rowspan="2">SCU</td><td>Limestone, white to tan, friable to micritic, fine-grained, soft, abundant foraminifera</td></tr>
<tr><td rowspan="3">Avon Park Formation</td><td>LPZ</td><td rowspan="3">Limestone and dolomite. Limestone is tan, recrystallized. Dolomite is brown, fractured, sucrosic, hard. Peat found locally at top. Interstitial gypsum in lower part.</td></tr>
<tr><td colspan="2">Middle Confining Unit</td></tr>
</table>

2.4.1 Hydrogeologic Framework

The hydrogeologic units underlying the study area consist of deposits of sand, clay, marls, and carbonates that were deposited in a marine environment. Wilson and Gerhart (1982) grouped the units into four major lithologic sequences of hydrologic significance. From youngest to oldest, these sequences are:

1. Surficial sand deposits, generally less than 100 feet thick;
2. A heterogeneous clastic and carbonate section of interbedded limestone, dolomite, sand, clay, and marl generally greater than several hundred feet thick;
3. A carbonate section of limestone and dolomite, generally more than 1,000 feet thick; and
4. Carbonate rocks containing intergranular anhydrite and gypsum.

The first three sequences constitute distinct water-bearing units of interest to this study: the SAS, IAS, and the UFA. The UFA is underlain by the fourth sequence, the middle confining unit of the Floridan aquifer system.

2.4.1.1 Surficial Aquifer System

The unconfined SAS is the permeable hydrogeologic unit contiguous with land surface. This aquifer is composed principally of unconsolidated to poorly indurated clastic deposits. The SAS consists of predominately fine sand and interbedded clay, marl, shell, and phosphorite. More than one permeable zone may be present where these deposits are interbedded.

2.4.1.2 Intermediate Aquifer System

The IAS includes all water-bearing units (aquifers) and confining units between the overlying SAS and the underlying UFA. The IAS consists of the undifferentiated deposits of Pleistocene and Pliocene age and the Hawthorn Group of Pliocene and Miocene age. The IAS consists of at least three hydrogeologic units: a clayey and pebbly sand, clay, and marl upper confining unit that separates the uppermost water-bearing unit in the IAS from the SAS; one to three water-bearing units composed primarily of carbonate rocks, sand, and discontinuous beds of sand and clay; and a sandy clay or clayey sand lower confining unit that lies directly over the UFA (Ryder, 1985). The diversity in lithology of the IAS reflects the variety of depositional environments in west-central Florida that occurred during the Pliocene and Miocene Epochs. These environments included open-marine, shallow-water, coastal-marine, and fluvial and estuarine processes (Gilboy, 1985).

The IAS consists of confining units and multiple permeable zones bounded by the SAS above and the UFA below. The IAS functions not only as an aquifer system, but, in places, as the intermediate confining unit (ICU) between the SAS and the UFA. The IAS is generally consistent with the Miocene age, Hawthorn Group stratigraphic unit. The IAS ranges in thickness from only a few feet in central Hillsborough County to over 700 feet thick in Charlotte County. The IAS is more or less of consistent thickness from east to west but thickens from north to south. As the IAS thickens, it becomes more productive moving from the north to the south.

The IAS is reported to consist of three principal permeable zones designated PZ1, PZ2, and PZ3 (Barr, 1996). The upper permeable zone, PZ1, may be as thick as 80 feet, but is generally much thinner. The existence of PZ1 is restricted primarily to southern and western Sarasota County and western Charlotte County. PZ1 is often well connected hydraulically to the SAS, and of local significance only. The middle permeable zone, PZ2, ranges in thickness from 20 to 190 feet. PZ2 is generally well separated hydraulically from both the upper and lower permeable zones and is more productive than PZ1. The lower permeable zone, PZ3, ranges in thickness from 0 to 300 feet thick. PZ3 is sometimes in excellent hydraulic connection with the underlying UFA and is generally the most productive permeable zone of the IAS. Depending on location, this aquifer may be recharged by leakance from the overlying SAS or by upward leakance from the underlying UFA.

2.4.1.3 Floridan Aquifer System

The Floridan aquifer system, as defined by Miller (1986, p. 44), is a vertically continuous sequence of carbonate rocks of generally high permeability that are hydraulically connected in varying degrees and are characterized by permeability generally an order to several orders of magnitude greater than those rocks bounding the system above and below. The Floridan aquifer system in the study area consists of two aquifers: the UFA, which contains freshwater, and the Lower Floridan aquifer, which contains highly mineralized water. The UFA and Lower Floridan aquifer are separated by the middle confining unit (Miller, 1986). The UFA commonly consists of a few highly permeable zones separated by less permeable zones (Johnston and Bush, 1988).

Throughout much of the study area, however, there is enough vertical interconnection between the permeable zones for these zones to function as a single hydrogeologic unit (Ryder, 1985). The top of the UFA is the horizon below which carbonate rocks consistently occur. The base of the UFA, the middle confining unit, is characterized by limestone with a drastically reduced permeability due to the presence of intergranular evaporites. In the study area, the rocks below the middle confining unit have relatively low transmissivity and commonly do not contain freshwater (Ryder, 1985). Only the freshwater part of the Floridan aquifer system, the UFA, is of interest in this study. The base of the freshwater flow system is considered the top of the middle confining unit.

Hydraulic Properties

The UFA, which is the most productive and widely used aquifer in the study area, consists of the Suwannee Limestone, the Ocala Limestone, and the Avon Park Formation. Thickness of the UFA ranges from 1,200 feet in northeastern Hardee County to 1,400 feet in western Hardee County. The UFA consists of limestone and dolomite containing solution-enlarged fractures that commonly yield abundant supplies of water to wells.

The most productive part of the aquifer generally occurs in a fractured dolomite section within the Avon Park Formation. The fractured dolomites in this unit are the principal sources of water to large-capacity irrigation wells in the study area (Wilson and Gerhart, 1982).

The aerial distribution of transmissivity of the UFA, as determined from aquifer tests and specific capacity tests and results of flow model calibration show great variability. Transmissivities determined from aquifer tests of the UFA range from 70,600 feet squared per day (ft^2/d) to more than 850,000 ft^2/d. The large range in transmissivities is characteristic of fractured-rock aquifers and could be due to variations in the number and size of fractures intercepted by the test well or variations in the extent of the aquifer penetrated by the well. Storage coefficients for the UFA were estimated to range from $1.0x10^{-4}$ to $1.2x10^{-4}$ (dimensionless).

An upper flow, or permeability, zone (UPZ) includes most of the Suwannee Limestone and sometimes the overlying Tampa Formation of the Hawthorn Group. The permeability of this unit is principally intergranular with little contribution from secondary porosity (Basso, 2001).

There are no significant permeable zones within the Ocala Limestone in the area of the southern District. This unit comprises a slight semi-confining unit over most of the area of interest. However, water levels in wells completed above and below this unit show little difference in value.

The lower flow, or permeability, zone (LPZ) occurs principally in the Avon Park Formation and is sometimes referred to as the “high T zone” or the “highly permeable zone.” Fracturing and secondary porosity are the principal mechanism of this permeability. Transmissivities in this permeable zone range from about 5,000 ft^2/day to over 1,600,000 ft^2/day.

2.5 Local Hydrogeology

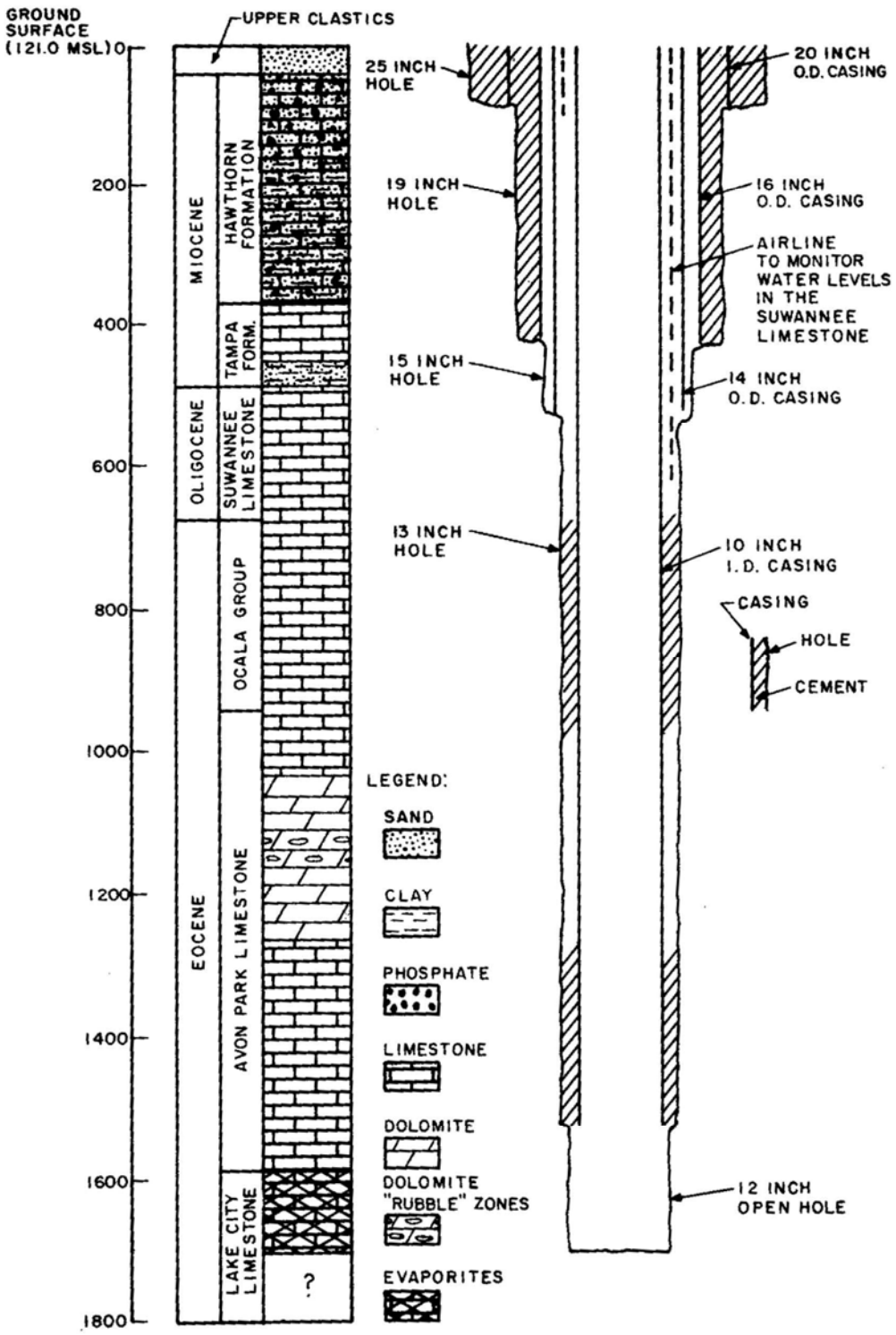
In 1975 a comprehensive water supply investigation was completed at the project site in support of a Consumptive Use Permit application that was subsequently submitted to the District on behalf of the previous owner (CF Industries, Inc.). As part of this investigation, 31 wells were drilled at the South Pasture Mine site. These wells included the following:

- 1 Deep Floridan Aquifer Test Well (Deep Floridan Well)
- 1 Production Test Well
- 5 wells completed into the IAS
- 5 wells completed into the UFA
- 18 wells completed into the SAS

The results of this drilling program were documented in the report titled, *Consumptive-Use Application Supporting Report, Hardee County Phosphate Project, Hardee County Florida, prepared by Dames & Moore for CF Industries, Inc., Volumes I and II, 1975.*

Much of the following information is taken from the above referenced report. Of primary interest is the construction and testing of the Deep Floridan Well (DFW) which was constructed first to provide depths and thicknesses of water-bearing zones and confining beds, for use in the design of subsequent production and observation wells, and provide geologic data for regional correlation. The DFW was completed to 1,702 feet below land surface (bls) and converted into a dual-zone monitor well. The final casing string (10-inch-diameter) is completed into the lower portion of the Avon Park Formation. The annulus between the 10-inch-diameter casing and the 14-inch-diameter casing allows measurement of water level in the Suwannee Limestone. **Figure 2-5** shows well construction detail and lithologic detail encountered during drilling. Formation contacts were identified using cuttings, geophysical logs and fossils encountered in the drill cuttings.

Notice that some of the formation names are outdated. The Ocala Group is now known as the Ocala Limestone. The Tampa Formation is now known as the Tampa Member of the Arcadia Formation. The Lake City Limestone is no longer recognized as a separate formation and has been merged with the Avon Park Limestone, which is now known as the Avon Park Formation.



Reference: Dames & Moore, 1975

Note: Formation names as originally presented in Dames & Moore, 1975

FIGURE 2-5
Stratigraphic Column for Deep Floridan Well (DFW)
Mosaic Aquifer Recharge and Recovery Project

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Figure 2-6 is a summary of lithologic and geophysical logs collected during construction and testing of the DFW. Notice the presence of dolomite from approximately 1,020 to 1,250 feet bls and the presence of a "rubble zone" between 1,100 and 1,200 feet bls. The dolomite zone and in particular the "rubble zone" corresponds to the high transmissivity zone commonly encountered in the Avon Park Formation. Column five from the left shows water quality changes with depth. Total Dissolved Solids (TDS) and sulfate concentrations from discrete depth samples are shown. **Table 2-2** lists analytical results for groundwater samples collected at discrete depths during construction of DFW and analyzed for TDS, chloride, sulfate and sodium concentrations. Samples were collected at depths of 550, 1,000, 1,122, 1,236, 1,320, 1,410, 1,510 and 1,650 feet bls. TDS concentration increased gradually with depth but did not exceed 500 mg/L until below 1,400 feet bls. Likewise, sulfate, chloride and sodium concentrations were relatively low and did not increase significantly until below 1,400 feet. Results indicate that groundwater encountered at depth at the project site is relatively fresh.

TABLE 2-2
Discrete Depths Water Quality Analyses

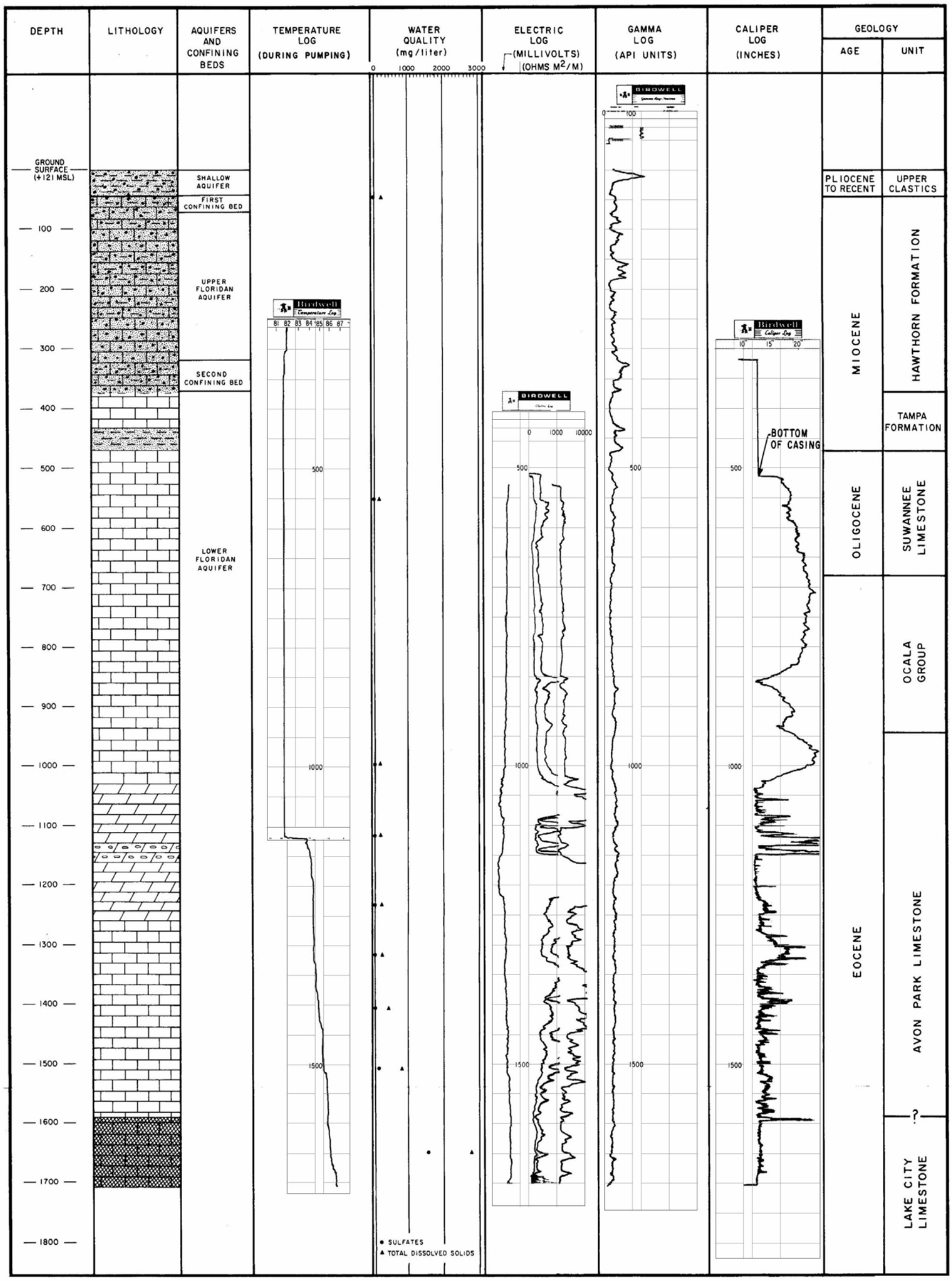
Depth	Sulfate	Chloride	TDS
550	60	8.7	201
1,000	60	8.2	225
1,122	64	8.7	231
1,236	80	9.2	274
1,320	85	8.9	289
1,410	84	10	448
1,510	209	13	835
1,650	1,590	18	2,792

Notes:
Depths are in feet bls
TDS – Total Dissolved Solids
Concentrations are in mg/L

Multiple and extensive aquifer performance tests were performed during the course of the water supply investigation. A total of 28 tests were performed, including 18 SAS tests, 2 tests of the IAS and 8 tests of the UFA. Static water level measurements, pumping tests and downhole flowmeter surveys indicated significant differences in permeability within the UFA. In terms of water level, the UFA appears to act as one interconnected hydrologic unit. There appeared to be minor differences in potentiometric head in the individual formations. In general, water levels decrease with depth. The regional direction of groundwater flow in the UFA is towards the southwest (Dames and Moore, 1975). Transmissivities for the individual formations were defined as follows:

Tampa Member	400 ft^2/d
Suwannee Limestone	4,000 to 6,700 ft^2/d
Ocala Limestone	1,600 ft^2/d
Upper Avon Park Formation	3,300 ft^2/d
Avon Park "Dolomite"	267,000 ft^2/d

The Avon Park "Dolomite" appears to coincide with an interval of cavernous porosity and associated large permeability commonly found in west-central Florida, such that this interval is often utilized for deep well injection of domestic treated wastewater and brine concentrate from reverse osmosis water treatment plants. During testing the Avon Park "Dolomite" was pumped at rates as high as 5,700 gallons per minute, which is an indication of the extreme permeability associated with this zone. **Table 2-3** is a summary of aquifer characteristics defined during completion of the water supply investigation in 1975.



LEGEND:

SAND, CLAY, PHOSPHATE, LIMESTONE, DOLOMITE, "RUBBLE" ZONE, EVAPORITES

Reference: Dames & Moore, 1975

FIGURE 2-6
Hydrogeologic Index, Northwestern Hardee County
Mosaic Aquifer Recharge and Recovery Project

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Aquifers and Confining Beds		Physical Properties: Thickness (feet)	Physical Properties: Depth (feet below ground surface)	Physical Properties: Dominant Lithic Type	Hydrological Properties: Representative Transmissivity (GPD/ft)	Hydrological Properties: Storage coefficient	Hydrological Properties: Static Water Level (12/75) (Ft above MSL)	Hydrological Properties: Vertical Hydraulic Gradient (ft/ft)	Hydrological Properties: Horizontal Hydraulic Gradient (ft/ft)
Shallow Aquifer (undifferentiated clastic deposits)		40	0-40	Clay with Sand	3000	10^{-8} to 10^{-1}	118		variable
First Confining Bed (basal undifferentiated clastics/ upper Hawthorn)		30	40-70	Clay				.9	
Upper Floridan Aquifer (Hawthorn Formation)		250	70-320	Limestone with Clay	1000	10^{-5} to 10^{-3}	89		
Second Confining Bed (basal Hawthorn clays)		50	320-370	Clay with Limestone				.9	
Lower Floridan Aquifer	Tampa Formation	60	370-430	Limestone	3000				
	Sand/Clay Unit	35	430-465	Sand/Clay			45		
	Suwannee Limestone	210	465-675	Limestone	30,000-50,000	10^{-3} to 10^{-2}	45		.0002
	Ocala Group	270	675-945	Limestone	12,000		45		
	Avon Park Limestone	90	945-1035	Limestone	25,000				
	Dolomite Unit	230	1035-1265	Dolomite	>2,000,000				
		330	1265-1595	Limestone/ Dolomite			45		
	Lake City Limestone	107+	1595-1702+	Limestone	1,400		45-		

Reference: Dames & Moore, 1975

TABLE 2-3
Summary of Aquifer and Confining Bed Characteristics
at Mosaic Hardee County Phosphate Project Site
Mosaic Aquifer Recharge and Recover Project

The “dolomite unit” from 1,035 feet to 1,265 feet bls is the recommended recharge zone for this well construction permit application. Based upon the above referenced site specific data, sufficient permeability is present in this interval to allow the recharge of up to 4 MGD as proposed in the ARRP, which is the subject of this Mosaic application. **Figure 2-7** shows and **Table 2-4** lists the proposed well construction characteristics for the recharge well system, which consists of the test recharge well (TRW-1), recharge zone monitor well (RZMW-1) and shallow monitor well (SMW-1). TRW-1 and RZMW-1 will be completed into the “dolomite unit” while SMW-1 will be completed into a producing zone in the Suwannee Limestone.

TABLE 2-4
Recharge System Well Constructions Details

Well	Casing Diameter (inches)	Casing Depth (feet bls)	Open Hole Interval (feet)
Test Recharge Well TRW-1	32	75	1,050-1,250
	24	750	
	16	1,050	
Recharge Zone Monitor Well RZMW-1	18	75	1,050-1,250
	12	300	
	6	1,050	
Shallow Monitor Well SMW-1	18	75	600-700
	12	300	
	6	600	

The recharge well is designed to accept up to 4 MGD of highly treated effluent from the ARRP system for recharge to an extremely permeable interval approximately 1,000 to 1,300 feet bls. The recharge zone monitoring well (RZMW-1) will provide an additional point of compliance for applicable groundwater discharge standards. A shallower monitoring well, SMW-1, will be constructed to monitor the next major permeable zone overlying the recharge zone and likely contained within the Suwannee Limestone.

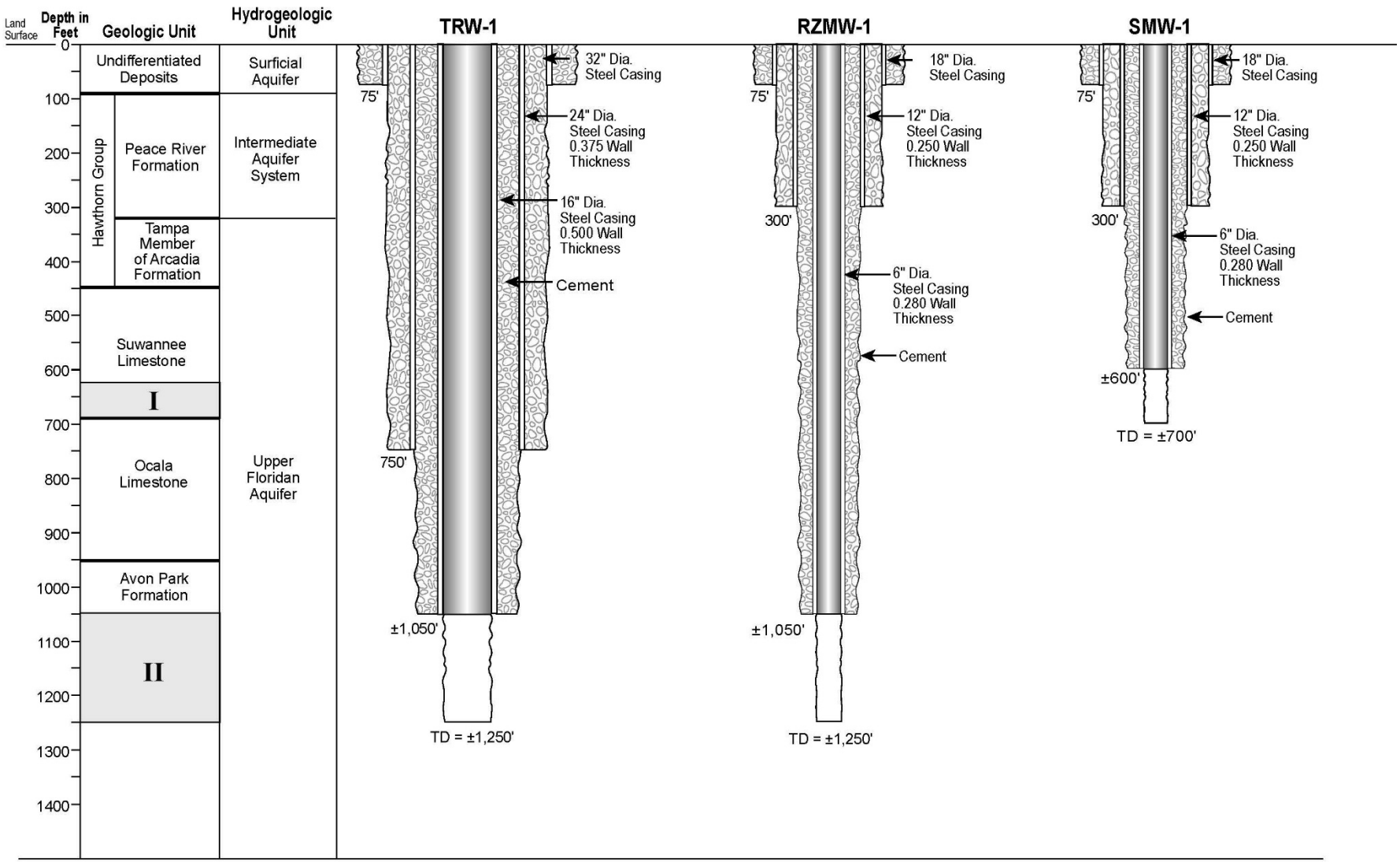

FIGURE 2-7
Mosaic Recharge Well System Well Construction Details
Mosaic Aquifer Recharge and Recovery Project

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SECTION 3

Responses to Part (G) Class V Well Construction Permit

Re: Permit Application Page 11 of 14

3.1 G. Class V Well Construction Permit

3.1.1 Type and Number of Proposed Class V Wells

The proposed system consists of one (1) Class V/Group 2 recharge well and two (2) associated monitor wells.

3.1.2 Project Description

(a) Description and use of proposed injection system.

A description of the proposed recharge well system can be found in Section 2. The proposed locations of the recharge well and associated monitor wells are shown on **Figure 3-1**, which is an aerial photograph of the proposed well site. TRW-1 (test recharge well) is located at the northeast corner of the site. It is proposed that RZMW-1 (recharge zone monitor well) be located approximately 650 feet southwest of TRW-1. SMW-1 will be located approximately 150 feet southwest of TRW-1. The location of the wells are conceptual and may change once the multiple factors that dictate the siting of the wells (site conditions, site access, pipeline alignments, etc.) are fully vetted in the final design of the well system. It is anticipated that the location of the wells will be near to the sand filters as shown in **Figure 3-1**. Any changes to the location of the wells will be sent to the Department for approval prior to finalizing the design. This request will include any additional or updated supporting information required by the Department in order to modify the permit.

(b) Nature and volume of injected fluid (The Department may require an analysis including bacteriological analysis) in accordance with Rule 62-528.635(2)(b), FAC:

The proposed injection fluid for the recharge system is treated mine recirculation water contained in the Mosaic South Pasture Mine. Mine recirculation water principally comprises rainwater capture, stormwater runoff from the mine, groundwater, and reclaimed domestic wastewater received from the City of Wauchula and Hardee County.

To meet the regulatory criteria for injection in a GII aquifer the treated water from the wetland treatment system must reliably meet primary drinking water standards (DWS) as specified in Chapter 62-550.310, Florida Administrative Code (FAC) and secondary drinking water standards as specified in 62-550.320, FAC. If secondary DWS are not met, a water quality criteria exemption (WQCE) can be requested for these parameters.

Table 3-1 lists the results of the primary and secondary DWS water quality analyses collected from the sand filter from 2012 through 2014. Treated water from the sand filters would be the source water for the proposed recharged well. The samples met most primary DWS. For the primary DWS, samples exceeded the maximum contaminant level (MCL) for Ethylene Dibromide (EDB), Di(2-ethylhexyl)phthalate (DEHP), arsenic, and total and fecal coliform bacteria. Only one sample of the four collected exceeded EDB, DEHP, and arsenic. The concentration of the single EDB exceedance was 0.048 µg/L which is above the State DWS MCL of 0.02 µg/L but below the Federal DWS MCL of 0.05 µg/L. The concentration of the single DEHP exceedance was 6.2 µg/L, which is slightly over the DWS MCL of 6 µg/L. The MCL of 0.01 mg/L for arsenic was exceeded once in all samples by a concentration of 0.013 mg/L, which was atypically higher than the other sample values collected from various locations throughout the treatment wetland, which ranged from <0.002 mg/L to 0.008 mg/L.

FIGURE 3-1
Conceptual Well Site Map
Mosaic Aquifer Recharge and Recovery Project

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TABLE 3-1

Summary of Primary and Secondary Drinking Water Standards for Mosaic Reclaimed Wetland - Post Sand Filter

State Primary Drinking Water Standards: Inorganics					
Parameter	**MCL**	**No. of Samples**	**No. Exceeding MCL**	**Minimum Concentration**	**Maximum Concentration**
Antimony (ug/L)	6	4	0	0.44	0.98
Arsenic (ug/L)	10	4	1	3.6	13
Barium (mg/L)	2	4	0	0.0027	0.0065
Beryllium (ug/L)	4	4	0	0.11	0.13
Cadmium (ug/L)	5	4	0	0.14	1.4
Chromium (ug/L)	100	4	0	1	10
Cyanide (ug/L)	200	4	0	4.8	4.8
Fluoride (mg/L)	4	24	0	1.6	2.8
Lead (ug/L)	15	4	0	0.076	2.4
Mercury (ug/L)	2	4	0	0.064	0.064
Nickel (ug/L)	100	4	0	0.28	1.3
Nitrate - as N (mg/L)	10	4	0	0.039	0.97
Nitrite - as N (mg/L)	1	4	0	0.022	0.18
Selenium (ug/L)	50	4	0	2.2	22
Sodium (mg/L)	160	24	0	10.5	105
Thallium (ug/L)	2	4	0	0.067	0.84

State Primary Drinking Water Standards: Radionuclides and Microbial					
Parameter	**MCL**	**No. of Samples**	**No. Exceeding MCL**	**Minimum Concentration**	**Maximum Concentration**
Radium 226 and 228 (pCi/l)	5	3	0	2.5	3.2
Gross Alpha (pCi/l)	15	3	0	5.7	14.1
Total Coliforms (CFU/100mL)	4	24	15	1	6600
Fecal Coliforms[1] (CFU/100mL)	0	23	21	0	660

State Secondary Drinking Water Standards					
Parameter	**MCL**	**No. of Samples**	**No. Exceeding MCL**	**Minimum Concentration**	**Maximum Concentration**
Aluminum (mg/L)	0.005 to 0.2	4	1	0.061	0.22
Chloride (mg/L)	250	24	0	10.2	48.4
Copper (mg/L)	1	4	0	0.00073	0.0017
Color (PCU)	15	24	23	15	150
Fluoride (mg/L)	2	24	12	1.6	2.8
Foaming Agents (mg/L)	0.5	4	0	0.043	0.09
Iron (mg/L)	0.3	24	14	0.013	1.75
Manganese (mg/L)	0.05	24	2	0.002	0.177
Odor (TON)	3	4	3	1	8

State Primary Drinking Water Standards: Organics					
Parameter	**MCL**	**No. of Samples**	**No. Exceeding MCL**	**Minimum Concentration**	**Maximum Concentration**
Endrin (µg/L)	2	4	0	0.0069	0.007
Lindane [G-BHC] (µg/L)	0.2	4	0	0.0071	0.0072
Methyoxychlor (µg/L)	40	4	0	0.0068	0.0069
Toxaphene (µg/L)	3	4	0	0.091	0.093
2,4-D (µg/L)	70	4	0	1.5	1.5
2,4,5-TP [Silvex] (µg/L)	50	4	0	0.32	0.32
THMs - Total (µg/L)	100	4	0	0.31	0.45
Trichloroethene (µg/L)	3	4	0	0.25	0.25
Tetrachloroethene (µg/L)	3	4	0	0.25	0.25
Carbon Tetrachloride (µg/L)	3	4	0	0.27	0.27
Vinyl Chloride (µg/L)	1	4	0	0.32	0.32
1,1,1-Trichloroethane (µg/L)	200	4	0	0.32	0.32
1,2-Dichloroethane (µg/L)	3	4	0	0.21	0.21
Benzene (µg/L)	1	4	0	0.15	0.15
Ethylene Dibromide (µg/L)	0.02	4	1	0.0067	0.048
Cis-1,2-Dichloroethene (µg/L)	70	4	0	0.45	0.45
1,2-Dichloropropane (µg/L)	5	4	0	0.46	0.46
Ethylbenzene (µg/L)	700	4	0	0.2	0.2
Monochlorobenzene (µg/L)	100	4	0	0.35	0.35
o-Dichlorobenzene (µg/L)	600	4	0	0.26	0.26
Styrene (µg/L)	100	4	0	0.2	0.21
Toluene (mg/L)	1	4	0	0.0002	0.0002
Trans-1,2-Dichloroethene (µg/L)	100	4	0	0.34	0.34
Xylenes - Total (mg/L)	10	4	0	0.00048	0.00048
Dichloromethane (µg/L)	5	4	0	0.2	0.2
1,2,4-Trichlorobenzene (ug/L)	70	4	0	0.21	0.21
1,1,2-Trichloroethane (ug/L)	2	4	0	0.39	0.39
Alachlor (µg/L)	3	4	0	0.26	0.26
Atrazine (µg/L)	3	4	0	0.16	0.16
Carbofuran (µg/L)	40	4	0	0.28	0.28
Chlordane (µg/L)	2	4	0	0.048	0.049
Dibromochloropropane (µg/L)	0.2	4	0	0.0095	0.068
Heptachlor (µg/L)	0.4	4	0	0.006	0.0061
Heptachlor Epoxide (µg/L)	0.2	4	0	0.0052	0.0053
Polychlorinated Biphenyl (µg/L)	0.5	4	0	0.11	0.11
Pentachlorophenol (µg/L)	1	4	0	0.069	0.069

TABLE 3-1

Summary of Primary and Secondary Drinking Water Standards for Mosaic Reclaimed Wetland - Post Sand Filter

State Primary Drinking Water Standards: Inorganics					
pH (at Collection Point)[1] (s.u.)	6.5 - 8.5	48	0	6.81	8.35
Silver (mg/L)	0.1	4	0	0.000059	0.00059
Sulfate (mg/L)	250	24	1	32.5	311
Total Dissolved Solids (mg/L)	500	24	1	325	597
Zinc (mg/L)	5	4	0	0.011	0.036

Pathogens (Unregulated)					
Parameter	**MCL**	**No. of Samples**	**No. Exceeding MCL**	**Minimum Concentration**	**Maximum Concentration**
Giardia (cysts/100L)	--	#N/A	#N/A	#N/A	#N/A
Crytosporidium (oocysts/100L)	--	#N/A	#N/A	#N/A	#N/A

Notes

1. Maximum Contaminant Level (MCL) per Rules 62-550.310 and 62-550.320, FAC.
2. Abbreviations:

pCi/l: Picacurries/liter — ppb = parts/billion
NA = Not Applicable — ppm = parts/million
MFL: Million Fibers/Liter > 10 um.

State Primary Drinking Water Standards: Organics					
Dalapon (µg/L)	200	4	0	1	1
Di(2-ethylhexyl)phthalate (µg/L)	6	4	1	1.5	6.2
Di(2-ethylhexyl)adipate (µg/L)	400	4	0	0.95	0.95
Dinoseb (µg/L)	7	4	0	0.86	0.86
Diquat (µg/L)	20	4	0	7.6	7.6
Endothall (µg/L)	100	4	0	1.7	2.8
Glyphosate [Roundup] (µg/L)	700	4	0	6.5	6.5
Hexachlorobenzene (µg/L)	1	4	0	0.0063	0.0064
Hexachlorocyclopentadiene (µg/L)	50	4	0	0.012	0.63
Oxamyl [Vydate] (µg/L)	200	4	0	0.57	0.57
Benzo(a)pyrene (µg/L)	0.2	4	0	0.096	0.096
Picloram (µg/L)	500	4	0	0.23	0.23
Simazine (µg/L)	4	4	0	0.19	0.19
p-Dichlorobenzene (µg/L)	75	4	0	0.19	0.19
1,1-Dichloroethene (µg/L)	7	4	0	0.24	0.24

Coliform counts were reduced significantly through the ARRP system by natural processes but total coliforms exceeded the geometric mean MCL of 4 CFU/100 mL in 16 out of 25 samples, and exceeded the fecal geometric mean MCL of 0 MPN/100 mL in 22 of 25 samples. The effectiveness of the wetland treatment system will continue to be evaluated with regard to applicability for groundwater recharge. If the recharge well is implemented in the future, it is understood that the source water for injection must meet the regulatory requirements for aquifer recharge into a GII aquifer.

The water quality from the sand filters currently exceeds the MCL for some secondary water quality standards. Mosaic anticipates that a WQCE will be petitioned for any secondary DWS not met. Based on the most recent water quality from the sand filters (Table 3-1) iron, odor, color, fluoride, and potentially aluminum and manganese would require a WQCE prior to initiating recharge activities at the proposed well. At the time Mosaic decides to proceed with implementation of the recharge well system, the most recent water quality data will be re-evaluated to determine which secondary parameters may require a WQCE.

Injection Volume

The proposed volume of injection fluid is, in part, based on injection well capacity. It is estimated that the injection rate will range from 1 to 4 MGD with an average recharge rate of approximately 2 MGD. The total injection volume per year is anticipated to be approximately 730 MG.

(c) Proposed pretreatment

The treatment system is described in Section 2. Mine recirculation water is stored in an existing sand-clay mix reservoir area (W-1 Phase II), then naturally treated through a series of wetland cells constructed in an adjacent sand-clay mix area (W-1 Phase II), then filtered through a sand-tailings system. If required, additional treatment will be considered for pathogen inactivation. Injection of the water into the UFA via the recharge well will immediately follow the sand filters and any additional disinfection processes that may be needed.

Re: Permit Application Page 11 of 14

3.2 G.3. Water Well Contractor's Name, Title, State License Number, Address, Phone Number and Signature

The above information will be provided to the Florida Department of Environmental Protection (FDEP) when Mosaic contracts with a licensed water well contractor to drill the recharge well system.

Re: Permit Application Page 12 of 14

3.3 G.4. Well Design and Construction Details

(a) The estimated total depth of TRW-1 is 1,250 feet bls (see Table 2-4 and Figure 2-7).

(b) All casing that will be used for TRW-1 will consist of new steel casing conforming to ASTM A53 Grade B, or equal. Casing diameter, length (total depths), and types of casing are presented on Figure 2-7 and Table 2-4.

(c) The nominal diameter of the final casing of TRW-1 is 16 inches with a wall thickness of 0.5 inches.

(d) Type II Portland cement will be used. Bentonite gel will be added to the neat cement grout to aid in cementing through the more permeable zones. A nominal 3-inch thick cement sheath (or greater) within the well annulus will be emplaced continuously from ground level to the bottom of each casing string.

(e) A large capacity centrifugal pump will be used to inject the treated water. The formation pressure is not expected to exceed 50 pounds per square inch.

Re: Permit Application Page 12 of 14

3.4 G.5. Water Supply Wells

A comprehensive well inventory utilizing information in the public record as required by the FDEP regulations was conducted within a 2-mile radius of the proposed Class V, Group 2 recharge well. This information is contained in Section 4 of this application.

3.5 G.6. Area of Review

A two-mile radius was selected for the area of review (AOR) for this permit application. This radius was selected as a suitable distance from the recharge well system where operations at the injection site are not expected to impact other potential competing users outside of this AOR. An estimate of the horizontal extent of the recharge water within the recharge zone is provided in **Appendix A**. The distances are rudimentary estimates of the average distance the recharge water may be reasonably expected to travel from the recharge well under certain assumptions. The calculation shows the 5 year and 10 year estimate based on an injection volume average of 2 MGD. Other assumptions with regard to aquifer characteristics are listed in the Appendix. The calculations estimate that the injected water may extend to a radius of approximately 0.37 miles from the well after 5 years and 0.53 miles after 10 years. Based on these estimates, a 2-mile AOR is very conservative.

Figure 3-2 is a topographic map showing the project location and 2-mile AOR. The topographic map consists of portions of United States Geological Survey (USGS) quadrangles Ft. Green and Duette. Surface bodies of water, roads, and other features are also shown on Figure 3-2. The topography of the area is relatively flat with elevations that range from 105 feet above mean sea level (msl) towards the southwest to 115 feet msl towards the eastern region of the AOR. Other than wetland habitats, Shirttail Branch is the nearest prominent surface water feature to the AOR. Located north of the injection well system, Shirttail Branch flows from southwest to northeast and joins Payne Creek. No known faults or springs are located within the AOR based on existing public records. Mosaic phosphate mine operates within the AOR.

A comprehensive well inventory showing all known wells located within the AOR is shown on similar topographic maps, and is presented in Section 4 of this application.

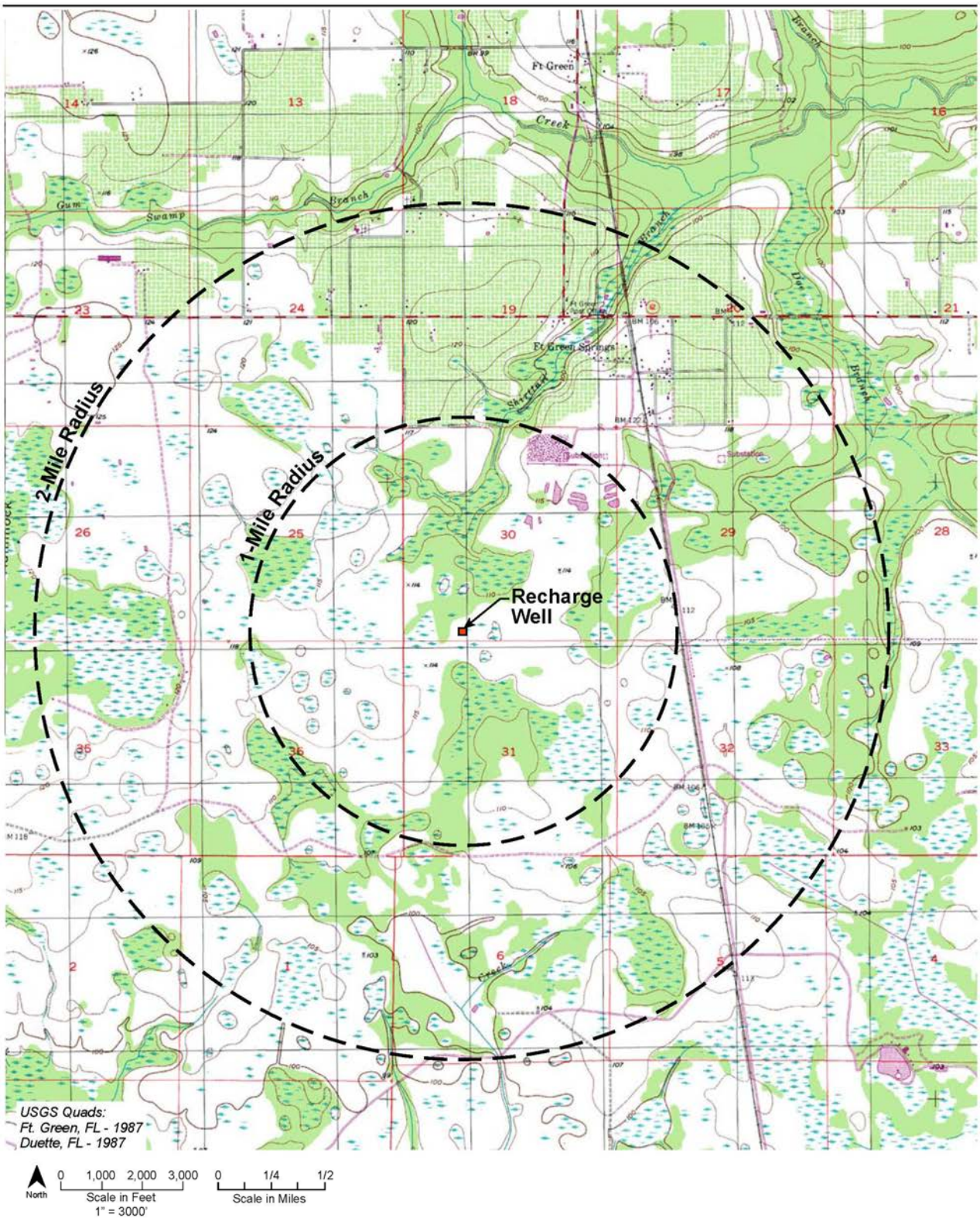

FIGURE 3-2
Topographic Map and Area of Review
Mosaic Aquifer Recovery and Recharge Project

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SECTION 4

Water Supply Wells in the Area of Review

4.1 Water Supply Wells in the Area of Review

4.1.1 (G)(5) Water Supply Wells

A well inventory was completed using information in the public record. The AOR included the area enclosed within a two-mile radius of the proposed Class V, Group 2, recharge well system. Information on existing wells within the two-mile radius was acquired from the SWFWMD, the USGS, and the Florida Geological Survey (FGS).

4.1.1.1 SWFWMD Well Construction Permits

The inventory identified well construction permits (WCPs) on file with the SWFWMD for wells within the AOR. A WCP must be obtained for each new well before construction can begin, regardless of well diameter, well depth, or type of use. The WCP database is organized by Section, Township, and Range.

Figure 4-1 shows the AOR and proposed recharge well. **Figure 4-1** consists of portions of the USGS quadrangles for Ft. Green and Duette. The number and type of WCPs for each section that is within the AOR are shown according to well use abbreviation. A total of 228 WCPs were issued by the SWFWMD within the sections that fall within the AOR. Monitor wells are the most common type with 68 of 228 total. Domestic supply (58 wells) and irrigation wells (33 wells) are the second and third most common well types. Many of these are likely located outside of the 2-mile AOR, but are located within sections that encompass a portion of the AOR. Only 1 domestic WCP and 4 public supply WCPs are listed within the sections that are within the 1 mile radius of the proposed recharge well. All of these public supply WCPs are owned by Mosaic. The domestic WCP has a well depth listed at 144 feet.

Figure 4-2 shows the location of all WCPs within the AOR that have a listed total depth greater than 450 feet and **Table 4-1** provides information for each of these WCPs. Many of the records for these WCPs do not have actual coordinates for the well location and therefore the coordinates listed in the database is actually the centroid of the section in which the well is located. Twenty six (26) WCPs were identified that have a well depth of 450 feet or greater. The depth of 450 feet was chosen as it is the top of the Suwannee Limestone Formation. Of the 26 wells, 22 have depths listed as 700 feet or greater, which represents the approximate base of the Suwannee Limestone. All of the WCPs within 1-mile of the recharge well are owned by Mosaic. Only one well has a well use listed as public supply (No. 22) and it is owned by Mosaic. The corresponding water use permit (WUP) for this well (Figure 4-3) has the well use listed as mining (WUP No. 5).

4.1.1.2 SWFWMD Water Use Permits

SWFWMD WUPs must be obtained by users owning wells that are 6 inches in diameter or greater or that use more than 100,000 gallons per day. WUPs are issued in addition to the WCPs. A WCP allows well construction, whereas the WUP dictates withdrawal allocations for the well. **Figure 4-3** shows the distribution of permitted wells within the AOR, with depths that exceed 450 feet bls. The WUP are differentiated on the map based on whether they have permitted allocations listed in the SWFWMD database. Details for each withdrawal point are provided in **Table 4-2**. A summary of the twenty eight WUPs shown on **Figure 4-3** is provided below.

- Wells numbered 1 through 5, 7, 12, 17, 18, 21 through 25, and 28 are owned by Mosaic.
- Only wells 2, 3, 4, 21-23, 28 are located within the 1-mile radius AOR.
- Well 2, 7, 28 are listed as plugged.
- All WUP wells within 1-mile of recharge well are owned by Mosaic, including all wells listed as “CF Industries.”
- Wells 1 through 13 have listed total depths of 1,000 feet bls or greater, which is near or within the proposed recharge zone depth (1,050 to 1,250 feet bls). Of these 6, 8-11, and 13 are not owned by Mosaic. Of the wells not owned by Mosaic, all are listed as irrigation wells, and are greater than 1-mile from the proposed recharge well.

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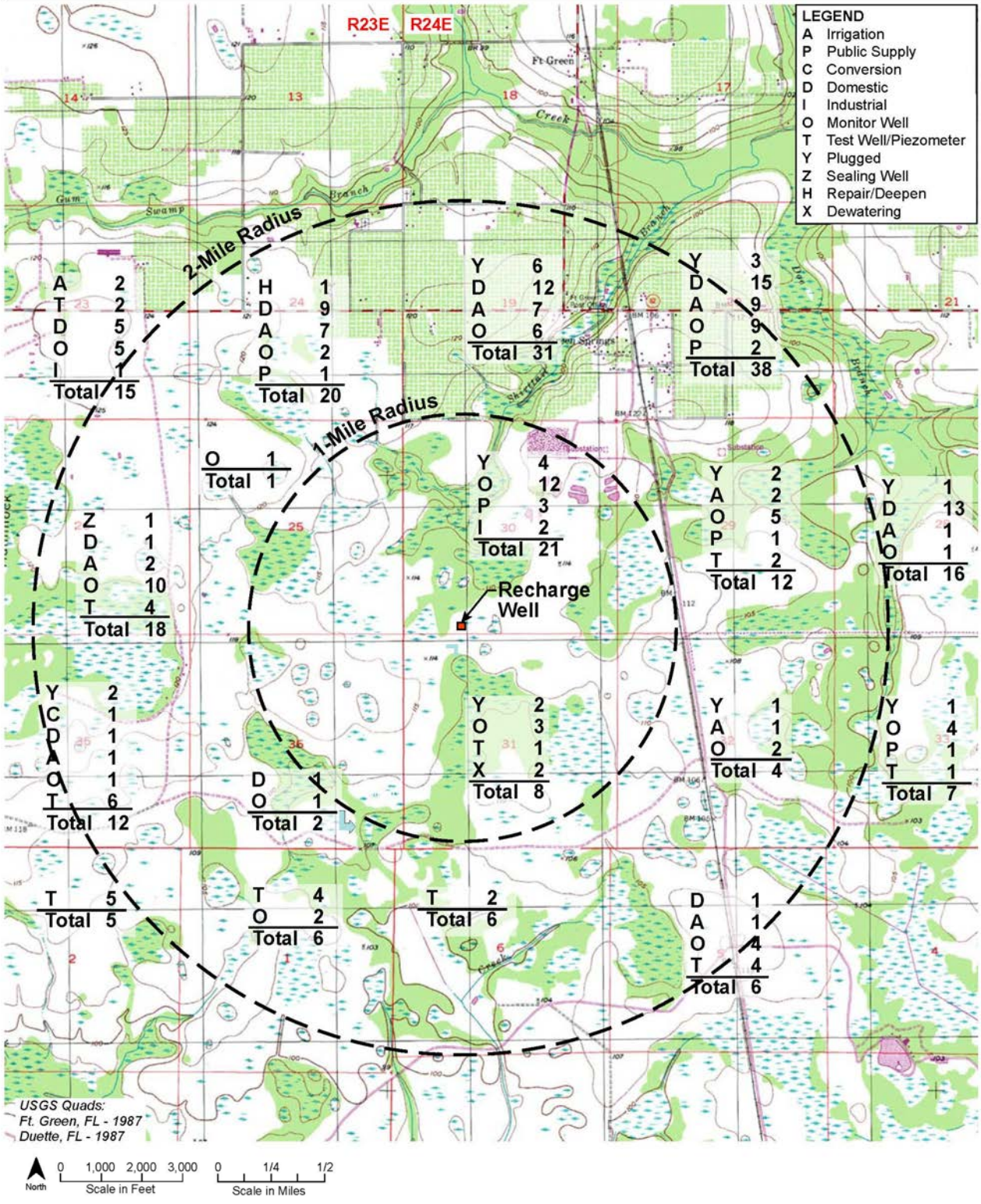

FIGURE 4-1
SWFWMD Well Construction Permit Inventory-May 19, 2014
Mosaic Aquifer Recharge and Recovery Project

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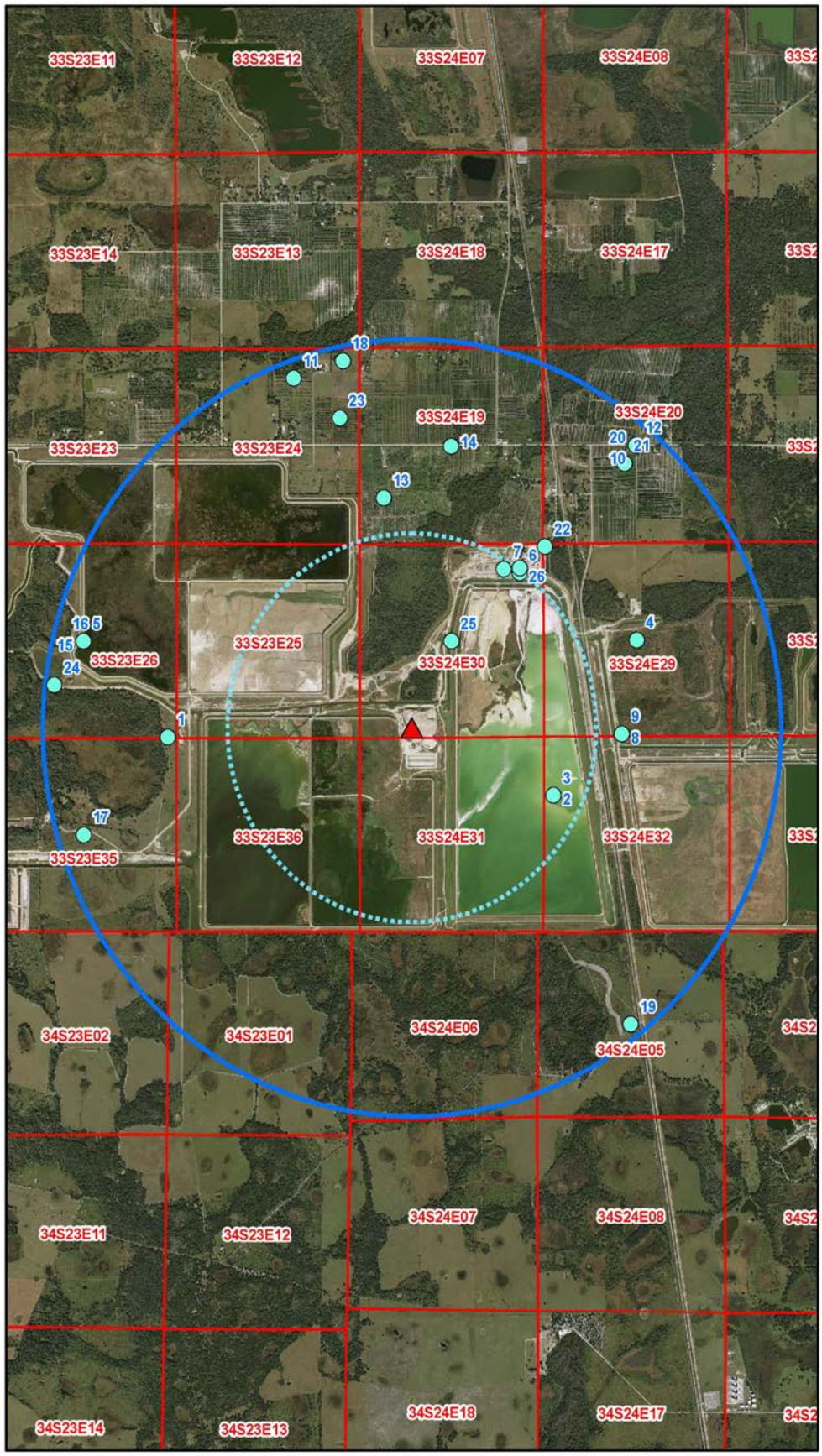

FIGURE 4-2
SWFWMD Well Construction Permits Greater than 450 feet in Depth

Mosaic Aquifer Recharge and Recovery Project

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TABLE 4-1
SWFWMD WCPs Greater than 450 feet in Depth

MAP No.	WCP PERMIT	WELL USE	CASING DIAMETER (in)	CASING DEPTH (ft)	WELL DEPTH (ft)	OWNERNAME	LATITUDE	LONGITUDE	SEC	TWNSHP	RNG	ISSUE_DT
1	328788	MONITOR	16	1505	1702	C F Realty	27 34 22.80	81 58 25.89	26	33	23	1/1/1970
2	555861	PLUGGED	10	440	1300	Cf Industries, Inc.	27 34 07.12	81 56 23.26	32	33	24	7/29/1994
3	527926	IRRIGATION	10	470	1300	Cf Industries, Inc.	27 34 07.12	81 56 23.26	32	33	24	7/28/1992
4	438189	IRRIGATION	10	426	1152	Larry Coker	27 34 48.90	81 55 56.81	29	33	24	9/18/1987
5	328787	TEST	30	972	1130	C F Realty	27 34 48.59	81 58 52.74	26	33	23	1/1/1970
6	562266	INDUSTRIAL	24	420	1110	Cf Industries, Inc.	27 35 07.00	81 56 34.00	30	33	24	1/10/1995
7	561030	INDUSTRIAL	16	448	1100	Cf Industries, Inc.	27 35 08.00	81 56 39.00	30	33	24	12/6/1994
8	438188	IRRIGATION	10	420	1021	Larry Coker	27 34 23.62	81 56 01.49	29	33	24	9/18/1987
9	584232	PLUGGED	10	1020	1020	Cf Industries, Inc.	27 34 23.62	81 56 01.49	29	33	24	10/7/1996
10	489063	IRRIGATION	8	452	1000	Charles Abbott & Josephine Abbott As Tr Of Rev Trusts 12/13/90	27 35 41.31	81 55 57.04	20	33	24	11/13/1989
11	512695	IRRIGATION	31	205	992	John D Hancock	27 35 59.34	81 57 45.86	24	33	23	4/17/1991
12	488153	IRRIGATION	8	450	990	Robert Charles & Robin Elaine Abbott	27 35 41.31	81 55 57.04	20	33	24	10/24/1989
13	486604	IRRIGATION	12	433	983	Albritton & Albritton	27 35 27.12	81 57 17.26	19	33	24	9/26/1989
14	337171	IRRIGATION	6	395	954	Abbott	27 35 41.03	81 56 55.77	19	33	24	1/1/1970
15	328783	IRRIGATION	16	510	950	C F Realty	27 34 48.59	81 58 52.74	26	33	23	10/10/1975
16	328784	IRRIGATION	20	890	950	C F Realty	27 34 48.59	81 58 52.74	26	33	23	10/10/1975
17	328785	IRRIGATION	16	489	950	C F Realty	27 33 56.49	81 58 52.66	35	33	23	1/1/1970
18	373677	TEST	6	500	877	Grayson V. & Patti C. Braddock	27 36 04.01	81 57 30.23	24	33	23	4/16/1982
19	326672	IRRIGATION	8	445	868	Shackleford	27 33 05.51	81 55 58.81	5	34	24	1/1/1970
20	500086	IRRIGATION	10	411	840	U.S. Agri-Chemicals, Inc.	27 35 41.31	81 55 57.04	20	33	24	6/7/1990
21	517874	IRRIGATION	8	78	733	John M Ullrich	27 35 36.38	81 56 00.66	20	33	24	10/8/1991
22	557589	PUBLIC SUPPLY	8	460	700	Cf Industries, Inc.	27 35 14.00	81 56 26.00	30	33	24	9/22/1994
23	352095	IRRIGATION	6	136	625	Arch Albritton	27 35 48.64	81 57 31.17	24	33	23	3/12/1980
24	778549	SEALING WATER	6	458	623	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	27 34 36.85	81 59 02.01	26	33	23	9/25/2008
25	370579	PRIMARY CASING	4	315	460	C F Mining	27 34 48.59	81 56 55.71	30	33	24	11/23/1981
26	571953	PRIMARY CASING	4	460	460	C. F. Industries, Inc.	27 35 08.23	81 56 33.99	30	33	24	9/15/1995

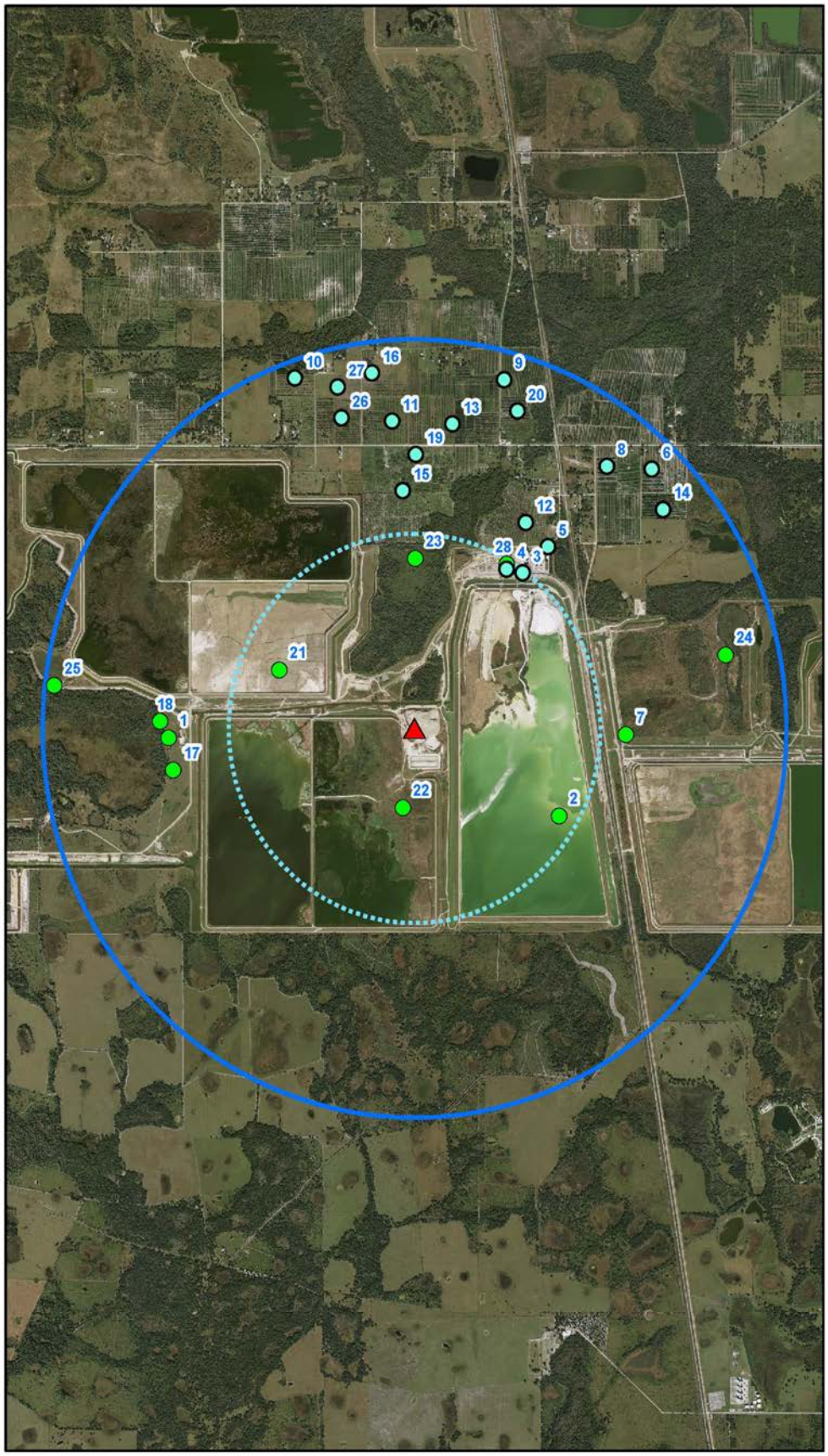

FIGURE 4-3
WUP Wells Greater than 450 feet in Depth

Mosaic Aquifer Recharge and Recovery Project

CH2MHILL

TABLE 4-2
SWFWMD Water Use Permits Greater than 450 feet in Depth

MAP No.	SITE ID	WUP PERMIT	OWNERNAME	STATUS	WELL TYPE	PERM_AVG_A	PERM_CROP	PERM_PK_MN	PERMITTED	CASING DEPTH (ft)	CASING DIAMETER (ft)	WELL DEPTH (ft)	LATITUDE	LONGITUDE	SEC	TWNSHP	RNG
1	65299	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Existing	Monitor	0	0	0	0	1505	16	1702	27 34 22.80	81 58 25.89	26	33	23
1	65299	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Existing	Monitor	0	0	0	0	1505	16	1702	27 34 22.80	81 58 25.89	26	33	23
2	615551	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Plugged	Mining	0	0	0	0	470	10	1300	27 34 01.74	81 56 22.59	32	33	24
2	615551	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Plugged	Mining	0	0	0	0	470	10	1300	27 34 01.74	81 56 22.59	32	33	24
3	331056	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Existing	Mining	6370000	0	7385100	6370000	450	24	1200	27 35 07.00	81 56 34.00	30	33	24
3	331056	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Existing	Mining	6370000	0	7385100	6370000	450	24	1200	27 35 07.00	81 56 34.00	30	33	24
4	329057	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Existing	Mining	50400	0	62000	50400	448	20	1100	27 35 08.00	81 56 39.00	30	33	24
4	329057	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Existing	Mining	50400	0	62000	50400	448	20	1100	27 35 08.00	81 56 39.00	30	33	24
5	322863	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Existing	Mining	5300	0	14600	5300	448	8	1100	27 35 14.00	81 56 26.00	29	33	24
6	631274	9810	Charles Abbott & Josephine Abbott As Tr Of Rev Trusts 12/13/90	Existing	Irrigation	36900	1127500	254300	53700	0	10	1100	27 35 34.85	81 55 53.12	20	33	24
6	322863	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Existing	Mining	5300	0	14600	5300	448	8	1100	27 35 14.00	81 56 26.00	29	33	24
7	702209	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Plugged	General Agricultural	0	0	0	0	420	10	1021	27 34 23.60	81 56 01.49	29	33	24
7	702209	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Plugged	General Agricultural	0	0	0	0	420	10	1021	27 34 23.60	81 56 01.49	29	33	24
8	631121	9744	Charles Abbott & Josephine Abbott As Tr Of Rev Trusts 12/13/90	Existing	Irrigation	11100	864100	76300	16100	452	8	1000	27 35 35.64	81 56 07.37	20	33	24
9	614708	3292	Joe L Davis Sr & J W Crews Jr	Existing	Irrigation	87500	4260000	743000	134200	0	10	1000	27 35 58.88	81 56 39.76	19	33	24
10	249711	9708	Kenneth Thompson	Existing	Irrigation	20100	1252800	158900	29300	0	10	1000	27 35 59.34	81 57 45.86	24	33	23
11	630234	9416	Causey Land Trust; John Causey, Jr & Gem C Gough, Trustees	Existing	Irrigation	16900	720000	127100	24800	150	8	1000	27 35 47.78	81 57 15.20	19	33	24
12	614774	3338	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Existing	Irrigation	30400	633600	228900	44600	0	8	1000	27 35 20.52	81 56 33.01	19	33	24
13	24931	3292	Joe L Davis Sr & J W Crews Jr	Existing	Irrigation	29000	1440000	257000	44500	0	8	1000	27 35 46.99	81 56 56.15	19	33	24
14	631120	9743	Robert Charles & Robin Elaine Abbott	Existing	Irrigation	14500	634500	128000	22300	450	8	990	27 35 23.96	81 55 49.64	20	33	24
15	624921	7332		Existing	Irrigation	84500	3600000	635700	124000	161	12	983	27 35 29.04	81 57 11.76	19	33	24
16	82208	8220	Albert E & Elizabeth Abbott	Existing	Irrigation	16300	561600	127200	22900	395	6	954	27 36 00.71	81 57 21.53	19	33	24
17	615519	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Existing	Monitor	0	0	0	0	489	10	950	27 34 14.08	81 58 24.52	35	33	23
17	615519	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Existing	Monitor	0	0	0	0	489	10	950	27 34 14.08	81 58 24.52	35	33	23
18	615543	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Existing	Monitor	0	0	0	0	890	8	950	27 34 27.20	81 58 28.61	26	33	23
18	615543	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Existing	Monitor	0	0	0	0	890	8	950	27 34 27.20	81 58 28.61	26	33	23
19	624920	7332		Existing	Irrigation	38000	864000	286100	55800	50	8	810	27 35 38.81	81 57 07.67	19	33	24
20	633357	10667	Paul Mislevy as Trustee	Existing	Irrigation	12100	1015200	106700	18600	0	8	750	27 35 50.48	81 56 35.61	19	33	24
21	615554	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Proposed	Sealing Water Well	0	0	102300	0	450	6	650	27 34 41.00	81 57 51.00	25	33	23
21	615554	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Proposed	Sealing Water Well	0	0	102300	0	450	6	650	27 34 41.00	81 57 51.00	25	33	23
22	615556	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Proposed	Sealing Water Well	0	0	102300	0	450	6	650	27 34 04.00	81 57 12.00	31	33	24
22	615556	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Proposed	Sealing Water Well	0	0	102300	0	450	6	650	27 34 04.00	81 57 12.00	31	33	24
23	615555	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Proposed	Sealing Water Well	0	0	102300	0	450	6	650	27 35 11.00	81 57 08.00	30	33	24
23	615555	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Proposed	Sealing Water Well	0	0	102300	0	450	6	650	27 35 11.00	81 57 08.00	30	33	24

TABLE 4-2
SWFWMD Water Use Permits Greater than 450 feet in Depth

MAP No.	SITE ID	WUP PERMIT	OWNERNAME	STATUS	WELL TYPE	PERM_AVG_A	PERM_CROP	PERM_PK_MN	PERMITTED	CASING DEPTH (ft)	CASING DIAMETER (ft)	WELL DEPTH (ft)	LATITUDE	LONGITUDE	SEC	TWNSHP	RNG
24	615557	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Proposed	Sealing Water Well	0	0	102300	0	450	6	650	27 34 45.00	81 55 30.00	29	33	24
24	615557	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Proposed	Sealing Water Well	0	0	102300	0	450	6	650	27 34 45.00	81 55 30.00	29	33	24
25	615563	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Existing	Sealing Water Well	0	0	204600	0	450	6	650	27 34 36.85	81 59 02.01	26	33	23
25	615563	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Existing	Sealing Water Well	0	0	204600	0	450	6	650	27 34 36.85	81 59 02.01	26	33	23
26	88605	5858	Frank Albritton	Existing	Irrigation	29600	864000	222500	43400	136	6	625	27 35 48.64	81 57 31.17	24	33	23
27	633999	5858	Frank Albritton	Existing	Irrigation	16100	259200	120800	23600	0	8	600	27 35 56.90	81 57 32.35	24	33	23
28	615522	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Plugged	Mining	0	0	0	0	315	4	460	27 35 09.36	81 56 39.17	30	33	24
28	615522	3669	Mosaic Fertilizer, LLC /Attn: Wayne Albritton	Plugged	Mining	0	0	0	0	315	4	460	27 35 09.36	81 56 39.17	30	33	24

USGS Well Inventory Data

Figure 4-4 shows the locations of wells contained within the USGS database and located within the AOR. **Table 4-3** provides additional information on these wells. This query of the USGS database was conducted as part of the permit application submitted in 2006 with the purpose of identifying any historical wells that may have been constructed prior to well permitting by the water management district. Since any new wells constructed since 2006 would be identified in the SWFWMD WCP and WUP database, a new query of the USGS database was not conducted. Eight wells were identified within the AOR. All eight wells are located more than 1 mile from the recharge well. Wells 6, 7 and 8 are owned by Mosaic. Well 6 is the Deep Floridan Well, previously referenced in Section 2.

TABLE 4-3
USGS Well Inventory

ID	Owner and Location	Latitude	Longitude	Well Depth (feet)
1	George Turner Well Near Fort Green Springs FL	27 35 16	81 55 55	90
2	33S24E19 735156141243 Near Fort Green FL	27 35 41	81 56 41	20
3	NO 73515722414 Near Fort Green FL	27 35 45	81 57 02	930
4	Griffin Grove Near No 735156223132 Fort Green FL	27 35 47	81 56 13	950
5	NO 735156224142 Near Fort Green FL	27 35 48	81 56 01	580
6	Mosaic Deep Well Near Fort Green FL	27 34 21	81 58 27	1702
7	Mosaic UF-3 Well Near Wauchula FL	27 34 23	81 58 29	375
8	Mosaic Deep Well LF1 Near Fort Green FL	27 34 24	81 58 25	1200

FGS Well Inventory Data

Two FGS wells were identified within the AOR. **Figure 4-5** shows their locations, and **Table 4-4** provides additional information. This query of the FGS database was conducted as part of the permit application submitted in 2006 with the purpose of identifying any historical wells on file with the FGS that may have been constructed prior to well permitting by the water management district. Since any new wells constructed since 2006 would be identified in the SWFWMD WCP and WUP database, a new query of the FGS database was not conducted. The wells shown in **Figure 4-5** and in **Table 4-4** are privately owned and are less than 210 feet deep. Neither well is believed to be used for supply or irrigation. Both wells are located more than 1 mile from the recharge well.

TABLE 4-4
FGS Well Inventory

ID	Township	Range	Section	Latitude	Longitude	Well Owner	Total Well Depth (feet)	Casing Depth (feet)
1	19	33	24	27.59437	81.9405	Reuben McQuaig	210	68
2	29	33	24	27.57946	81.9321	CF Realty SA Well #12	45	----

Mosaic Well Data

Mosaic maintains an extensive database of wells known to be present on their property. **Table 4-5** lists a subset of this database and contains all wells located within or near the AOR that are greater than 450 feet in total depth. The locations of the wells are shown on **Figure 4-6**. All nine of these wells were included in the well databases previously reviewed. Wells 1 and 2 are located nearest to the recharge well, about 1 mile distant. Wells 4 through 7 are located between 1 and 2 miles due west of the recharge well. Wells 8 and 9 are located more than 2 miles from the recharge well. Well 6 is the Deep Floridan Well previously discussed in detail in Section 2. The current status of each well is also shown on **Table 4-5**, with four of the wells listed as inactive or capped.

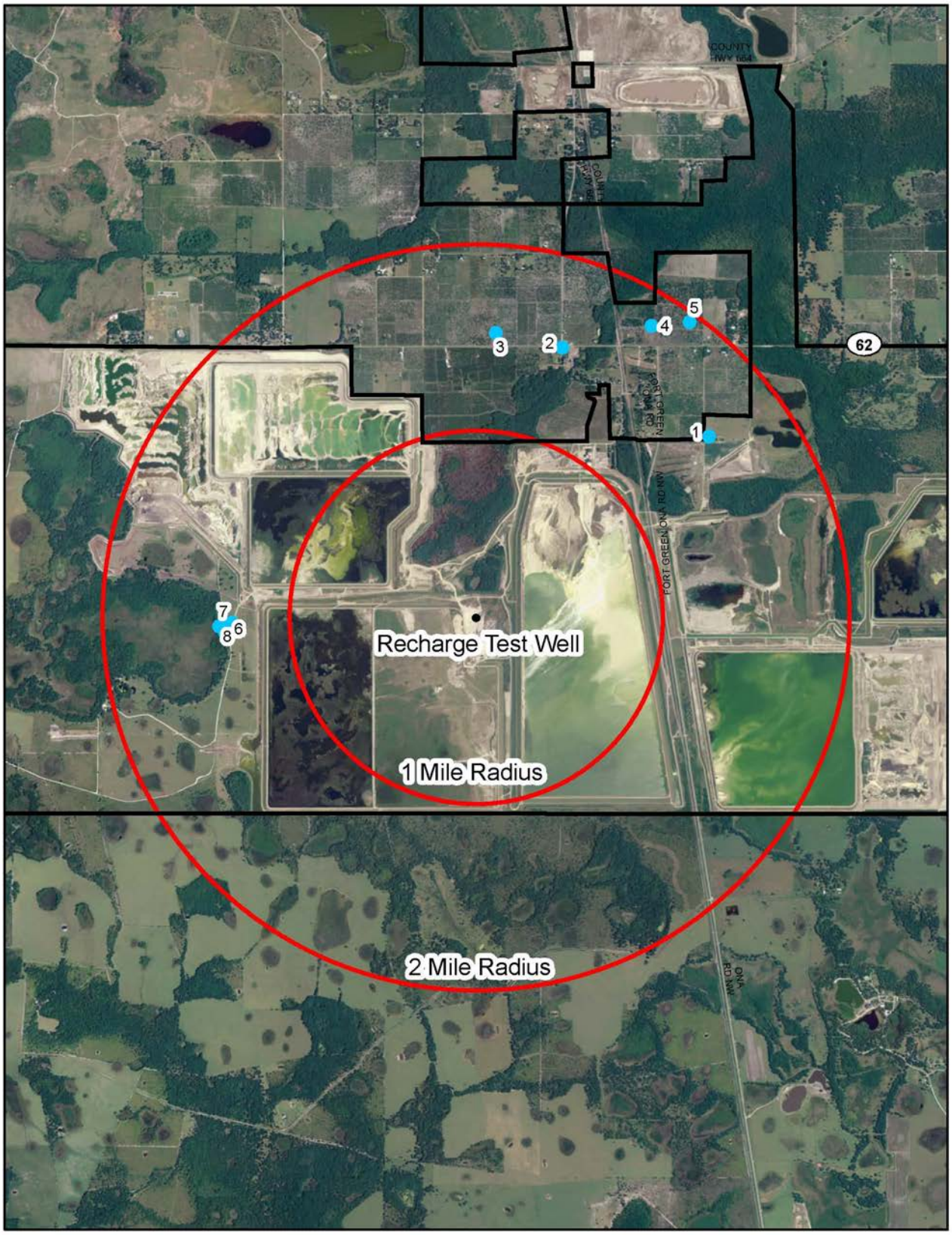

Figure 4-4
USGS Well Survey
Mosaic Aquifer Recharge and Recovery Project

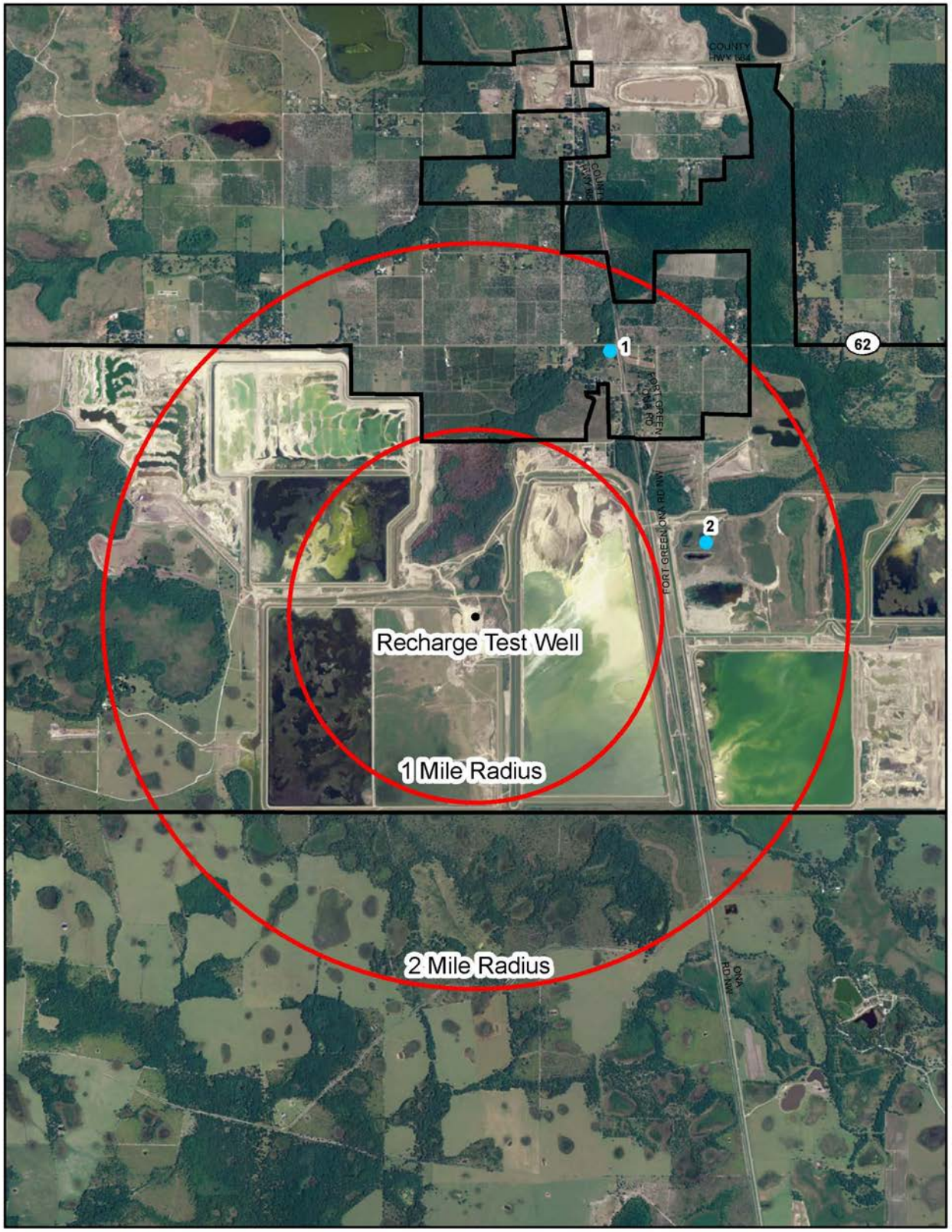

Figure 4-5
FGS Well Survey
Mosaic Aquifer Recharge and Recovery Project

TABLE 4-5
Mosaic Well Inventory

ID	Permit No.	User ID	Withdrawal Longitude	Withdrawal Latitude	S-T-R	Well Dia. (in)	Depth (ft) Total/Cased	Well Description	Current Status
1	203669	E	815639	273508	30-33-24	20	1100/448	Production (S. Pasture)	Active
2	203669	D	815634	273507	30-33-24	24	1200/450	Production (S. Pasture)	Active
3	203669	G	815626	273514	30-33-24	8	700/460	Sanitary (S. Pasture)	Active
4	203669	LF-1	815825	273425	26-33-23	16	950/510	DRI Monitoring (Floridan)	Active
5	203669	LF-2A	815829	273427	26-33-23	8	950/890	DRI Monitoring (Floridan)	Inactive
6	203669	DF	815826	273422	26-33-23	16	1702/500	DRI Monitoring (Floridan)	Active
7	203669	LF-3	815825	273414	35-33-23	10	950/489	DRI Monitoring (Floridan)	Inactive
8	20003076	Ash 1	815903	273321	2-34-23	10	1000/300	Agricultural	Capped
9	20003076	Well 3	815823	273238	1-34-23	12	1000/300	Agricultural	Capped

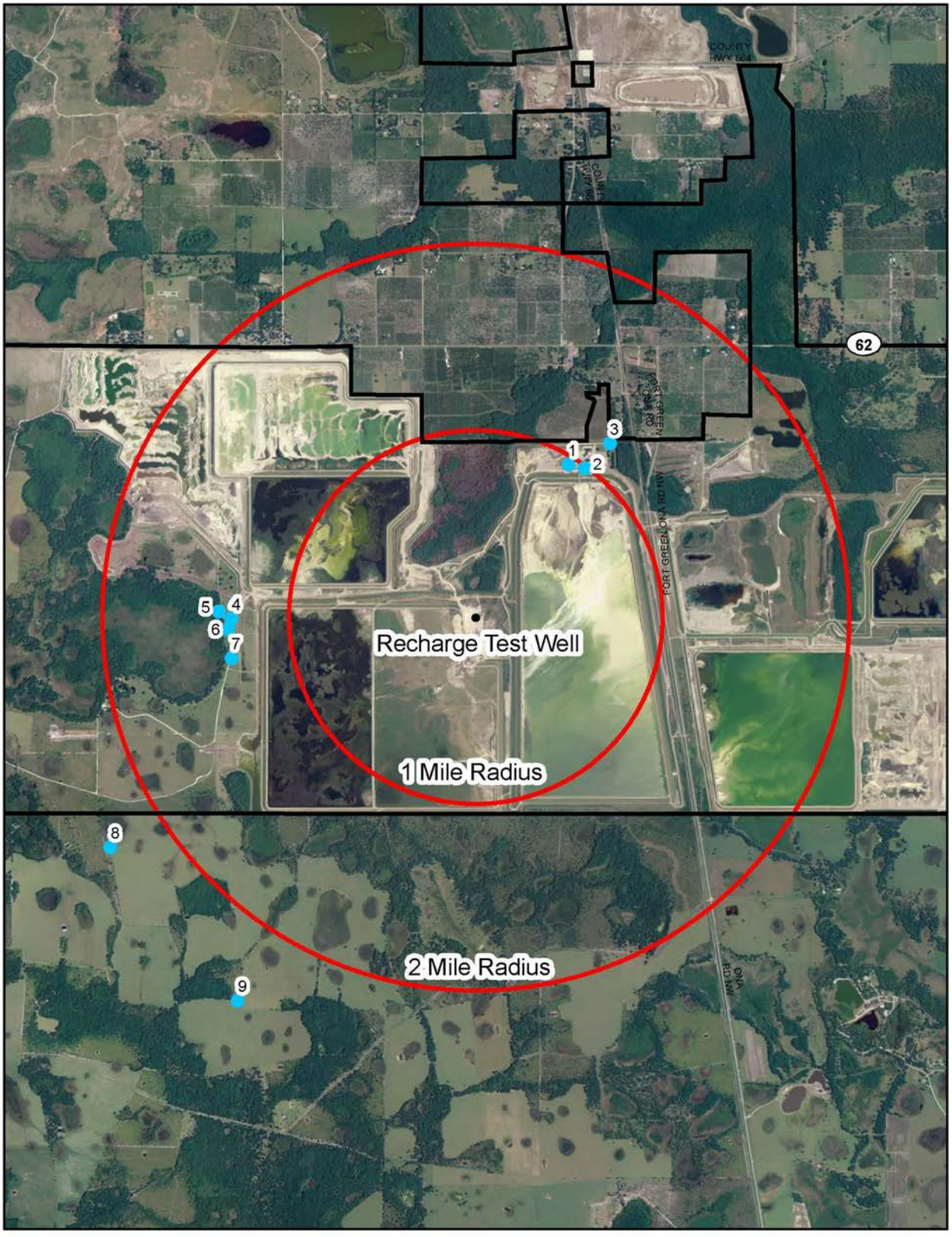

Figure 4-6
Mosaic Well Survey
Mosaic Aquifer Recharge and Recovery Project

SECTION 5

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Appendix A
Calculation of Lateral Extent of Recharge Water

RECHARGE WELL - Volume Calculation

1) Projected Volume (MG) to be injected (maximum)

Rate (GPD)	2,000,000	5	10	years
Days per year	365	3,650,000,000	7,300,000,000	gallons

2) Equation for volume of cylinder:

r=(V/ π nh)^0.5

where:

r=Radius of AOR (ft)

V= Volume (ft^3) from step 1

h= thickness of storage zone (ft) accepting fluids, h= 200 ft

n= effective porosity, n= 0.2

3) Calculation of projected radius of groundwater flow:

	years	
UNITS	5	10
MG	3,650,000,000	7,300,000,000
ft^3	487,934,029	975,868,059

Using the formula from step two, the following radii (ft) are found:

5	10	year
1970	2787	feet
0.37	0.53	miles

Assumptions and qualifiers when using this method to estimate lateral distances of injected flow:

The injection zone is homogenous and isotropic *

no leakance occurs between the overlying and underlying geologic units *

no density differences between the injected water and the native groundwater

the direction, magnatude, and temporal variations of the groundwater gradient are not accounted for

**These assumptions are not believed to exist in the receiving aquifer*

The cylindrical volume calculation is used only to provide a gross estimation of the average distance the injected water may extend laterally from the injection well.