



PIMA COUNTY  
REGIONAL FLOOD CONTROL DISTRICT  
97 EAST CONGRESS STREET, THIRD FLOOR  
TUCSON, ARIZONA 85701-1797

SUZANNE SHIELDS, P.E.  
DIRECTOR  
July 18, 2008

(520) 243-1800  
FAX (520) 243-1821

Mr. John Bodenchuk, Recharge Program Manager  
Arizona Department of Water Resources  
Water Management Division  
3550 N. Central Avenue  
Phoenix, Arizona 85012

**Re: Response to Second Incomplete and Incorrect Determination for Underground Storage Facility Application No. 71-563876.0006**

Dear Mr. Bodenchuk:

We have reviewed your June 12, 2008 letter and have addressed the items you have listed:

**Facility Design**

An as-built well diagram and well driller report are attached for well HP-2, as requested (**Attachment 1**).

**Hydrologic Feasibility**

**Bullet #1:** Montgomery & Associates, Inc. completed a soils characterization and infiltration test study in 1996 for the Lower Santa Cruz Replenishment Program, which included two test pits located at the Marana High Plains Effluent Recharge Project (MHPERP) site and one test pit at the Lower Santa Cruz Recharge Project (LSCR) site. A summary of the soils characterization and infiltration test results is provided in **Attachment 2**, along with the approximate elevations of the basin bottoms as determined using the as-builts for the two projects. Based on this study, highly permeable, coarse-grained soils (gravel and sand mixtures) are present at depths of five feet below the bottom of Recharge Cell No. 2 and six to seven feet below the bottom of Recharge Cell No. 4. Gravelly soils were encountered at a depth of about 13 feet at the one test pit located within the LSCR site, which has a completed basin bottom elevation of 16 feet below land surface.

A soils characterization study was also conducted by the Pima County Regional Flood Control District (PCRFD) in 2006 to verify the presence of coarser-grained soils below the recharge cells. **Attachment 3** displays the results of this study, which are similar to those observed in the Montgomery & Associates study. Our excavation of a trench in Recharge Cell No. 2 (Pond No. 2) indicates a sand/gravel mixture five feet below the surface that is indicative of large infiltration rates similar to the LSCR results. These soils are better characterized as well graded sands and gravels (SW and GW) that have a higher estimated infiltration rate than the mixtures described in the Montgomery (1996) report.

The average monthly infiltration rate observed at LSCR for the 2005 Calendar Year was just over six feet per day (**Attachment 4**). Since the proposed modifications to MHPERP would provide direct access to similar types of soil, we are predicting a significant increase in infiltration rates observed within all the recharge cells. Due to differences in the characteristics of CAP water and effluent, we are aware that long-term infiltration rates will most likely be lower at MHPERP. However we estimate that rates of one-half to one-third of those seen at LSCR can be reasonably maintained. This would almost double the current rates observed in Recharge Cell

No. 2 (from 0.5-1.5 feet/day to 1-3 feet/day), and most likely double the current rates observed in Recharge Cell Numbers 1, 3 and 4 (from 0.25-0.5 feet/day to 0.5-1.0 feet/day).

**Bullet #2:** PCRFC D does not intend to construct any of the improvements prior to the pre-recharge inspection or activation of the new permit. However, one modification will already be in place and the other improvements are planned within a reasonable time period after permit approval. A phasing plan showing the planned improvements and associated recharge volumes is provided in **Attachment 5**. Based on annual results to date, we expect a baseline volume of 350 acre-feet can be maintained with the inclusion of the Equalization Basin in the recharge acreage. Over the next two years, planned improvements, as described in **Table 4 (Attachment 5)**, will bring the total annual recharge volume up to 600 acre/feet per year.

Based on the soil types observed in the two studies and the infiltration rates maintained at LSCR P, it is reasonable to believe infiltration in Recharge Cell No. 2 will increase from its current average of 0.6 feet per day to about 1.5 feet per day after improvements are constructed. Assuming a minimum of 180 days of operation within the year, recharge in Recharge Cell No. 2 would total 350 acre-feet per year. This is more than a 200 acre-feet per year increase than what is currently being recharged (requested volume is 150 acre-feet more). The six recharge enhancement trenches will increase the three-dimensional surface area within Recharge Cell Numbers 1, 3 and 4 by 1,088 square-feet, with a majority of the area exposed to coarse-grained, highly permeable sediments. Infiltration rates of three to four feet per year can be reasonably expected within the trenches, thus increasing total recharge for each recharge cell by 30 to 40 acre-feet per year. Thus, the overall recharge for the project would increase by 90 to 120 acre-feet per year (requested volume is 100 acre-feet more).

Infiltration rates will be maintained though regular maintenance (clearing, grubbing and ripping of the basin bottoms) and reconstruction of the recharge enhancement trenches as needed. Other contingencies, as identified in **Table 4a (in Attachment 5)**, may be implemented when trenches become clogged and higher infiltration rates cannot be maintained with regular maintenance.

### Monitoring Plan

Attached is the table of flow devices to be used for measuring inflows into the recharge project and individual recharge cells (**Attachment 6**). The Mag Meter, at Monitor Point FMeq, will be the primary measurement device for monitoring water volumes used in the recharge credit calculations.

If you have any questions, please call me at (520) 205-8358 or Frank Postillion at (520) 243-1853.

Sincerely,



David Scalero, Principal Hydrologist  
Water Resources Division – Regional Flood Control District

DS/fp/ap

cc: Brad DeSpain, Town of Marana; Frank Postillion, PCRFC D

- Attachment 1: As-Built Diagram and Well Completion Report for HP-2
- Attachment 2: Graphic Logs and Estimated Infiltration Capacity for Sediments at MHPERP and LSCR P
- Attachment 3: Log of Pond Samples at MHPERP for November 14, 2006
- Attachment 4: 2005 Basin Infiltration Rates for the Lower Santa Cruz Recharge Project
- Attachment 5: Improvements and Annual Recharge Volume Phasing Plan
- Attachment 6: Water Quantity Monitoring Device

Attachment 1  
As-Built and Well Driller Report for HP-2

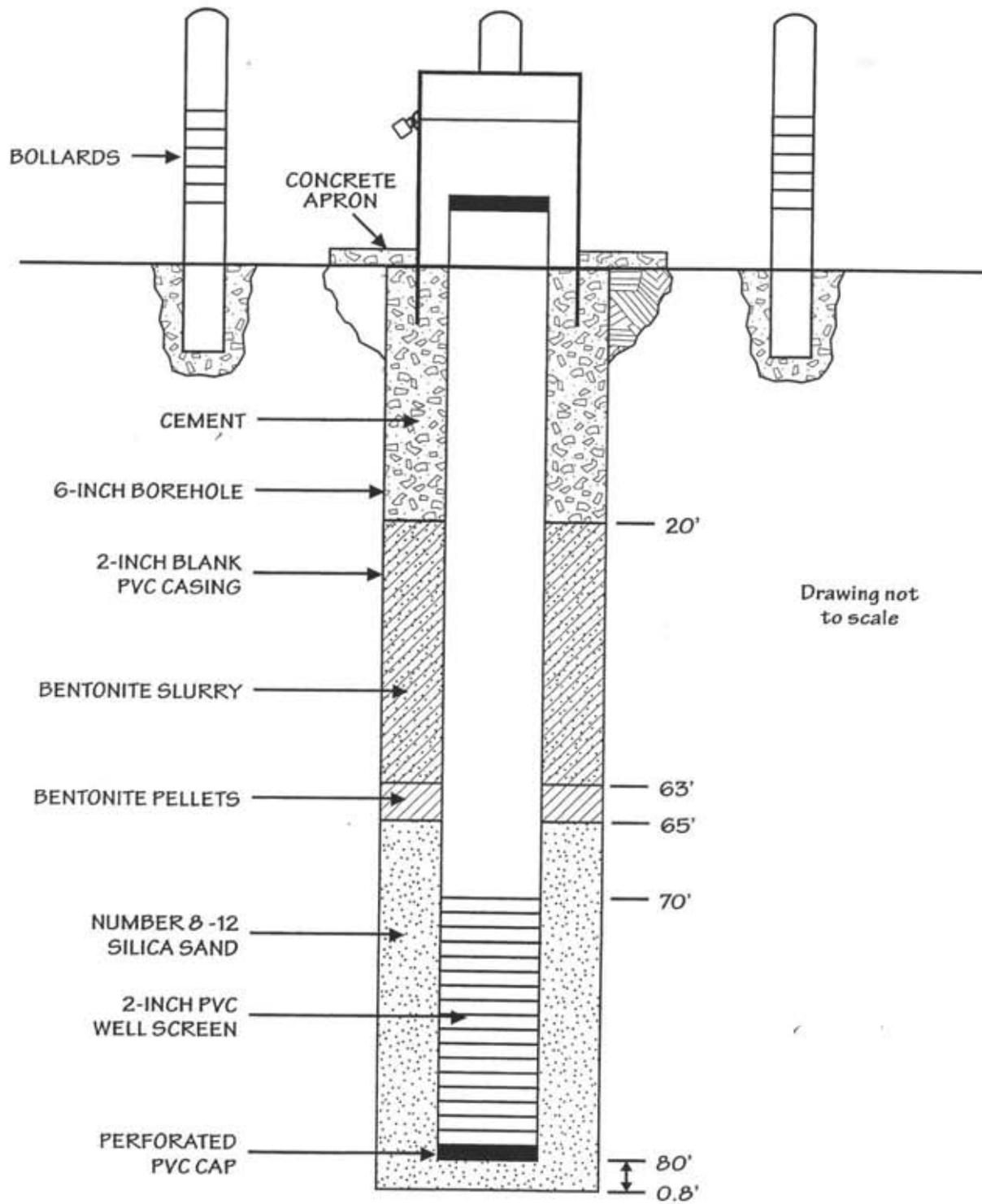


Figure 13  
 AS-BUILT DIAGRAM • PIEZOMETER HP-2  
 Pima County Regional Flood Control District



**Arizona Department of Water Resources**  
 Information Management Unit  
 P.O. Box 33589 Phoenix, Arizona 85067-3589  
 (602) 771-8627 • (800) 352-8488  
 www.azwater.gov

**Well Driller Report  
 and  
 Well Log**

THIS REPORT MUST BE FILED WITHIN 30 DAYS OF COMPLETING THE WELL.  
 PLEASE PRINT CLEARLY USING BLACK OR BLUE INK.

FILE NUMBER  
 WELL REGISTRATION NUMBER  
**55 - 593607**  
 PERMIT NUMBER (IF ISSUED)

**SECTION 1. DRILLING AUTHORIZATION**

**Drilling Firm**

<b>Mail To:</b>	NAME GEOMECHANICS SOUTHWEST, INC.	DWR LICENSE NUMBER 498
	ADDRESS 7400 S. NOGALES HIGHWAY, #4	TELEPHONE NUMBER (520) 889-7787
	CITY/STATE/ZIP TUCSON/ARIZONA/85706	FAX (520) 889-8561

**SECTION 2. REGISTRY INFORMATION**

**Well Owner**

FULL NAME OF COMPANY, ORGANIZATION, OR INDIVIDUAL  
 PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT

MAILING ADDRESS  
 97 E. CONGRESS ST., 3RD FLOOR

CITY/STATE/ZIP CODE  
 TUCSON/ARIZONA/85701

CONTACT PERSON NAME AND TITLE  
 DAVID SCALERO, PRINCIPAL HYDROLOGIST

TELEPHONE NUMBER (520) 243-1858 FAX (520) 243-1826

WELL NAME (e.g., MW-1, PZ-3, Lot 25 Well, Smith Well, etc.)  
 HP-2

**Location of Well**

WELL LOCATION ADDRESS (IF ANY)

TOWNSHIP (N/S) 11S	RANGE (E/W) 11E	SECTION 33	160 ACRE SW ¼	40 ACRE NE ¼	10 ACRE SE ¼
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LATITUDE 32 ° 25 ' 43.1 "N Degrees Minutes Seconds			LONGITUDE 111 ° 13 ' 33.9 "W Degrees Minutes Seconds		
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METHOD OF LATITUDE/LONGITUDE (CHECK ONE)  
 \*GPS: Hand-Held  \*GPS: Survey-Grade

LAND SURFACE ELEVATION AT WELL  
 Feet Above Sea Level

METHOD OF ELEVATION (CHECK ONE)  
 \*GPS: Hand-Held  \*GPS: Survey-Grade  
 \*GEOGRAPHIC COORDINATE DATUM (CHECK ONE)  
 NAD-83  Other (please specify):

COUNTY PIMA	ASSESSOR'S PARCEL ID NUMBER BOOK 217 MAP 51 PARCEL 0010
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**SECTION 3. WELL CONSTRUCTION DETAILS**

<b>Drill Method</b> CHECK ALL THAT APPLY <input type="checkbox"/> Air Rotary <input checked="" type="checkbox"/> Bored or Augered <input type="checkbox"/> Cable Tool <input type="checkbox"/> Dual Rotary <input type="checkbox"/> Mud Rotary <input type="checkbox"/> Reverse Circulation <input type="checkbox"/> Driven <input type="checkbox"/> Jetted <input type="checkbox"/> Air Percussion / Odex Tubing <input type="checkbox"/> Other (please specify):	<b>Method of Well Development</b> CHECK ALL THAT APPLY <input type="checkbox"/> Airlift <input type="checkbox"/> Bail <input type="checkbox"/> Surge Block <input type="checkbox"/> Surge Pump <input type="checkbox"/> Other (please specify):	<b>Method of Sealing at Reduction Points</b> CHECK ONE <input checked="" type="checkbox"/> None <input type="checkbox"/> Packed <input type="checkbox"/> Swedged <input type="checkbox"/> Welded <input type="checkbox"/> Other (please specify):
	<b>Condition of Well</b> CHECK ONE <input type="checkbox"/> Capped <input checked="" type="checkbox"/> Pump Installed	<b>Construction Dates</b> DATE WELL CONSTRUCTION STARTED SEPTEMBER 24, 2002 DATE WELL CONSTRUCTION COMPLETED SEPTEMBER 24, 2002

I state that this notice is filed in compliance with A.R.S. § 45-596 and is complete and correct to the best of my knowledge and belief.

SIGNATURE OF QUALIFYING PARTY

DATE  
 7.14.08

Well Driller Report and Well Log

WELL REGISTRATION NUMBER  
**55 - 593607**

**SECTION 4. WELL CONSTRUCTION DESIGN (AS BUILT)** (attach additional page if needed)

Depth	
DEPTH OF BORING 80.8 Feet Below Land Surface	DEPTH OF COMPLETED WELL 80.0 Feet Below Land Surface

Water Level Information			
STATIC WATER LEVEL N/A Feet Below Land Surface	DATE MEASURED 09/24/2002	TIME MEASURED	IF FLOWING WELL, METHOD OF FLOW REGULATION <input type="checkbox"/> Valve <input type="checkbox"/> Other:

Borehole			Installed Casing													
DEPTH FROM SURFACE		BOREHOLE DIAMETER (inches)	DEPTH FROM SURFACE		OUTER DIAMETER (inches)	MATERIAL TYPE ( T )				PERFORATION TYPE ( T )					SLOT SIZE IF ANY (inches)	
FROM (feet)	TO (feet)		FROM (feet)	TO (feet)		STEEL	PVC	ABS	IF OTHER TYPE, DESCRIBE	BLANK OR NONE	WIRE WRAP	SHUTTER SCREEN	MILLS KNIFE	SLOTTED		IF OTHER TYPE, DESCRIBE
0	80	6.0	0	70	2.0		X									
			70	80	2.0									X		0.020

Installed Annular Material												
DEPTH FROM SURFACE		ANNULAR MATERIAL TYPE ( T )							FILTER PACK			
FROM (feet)	TO (feet)	NONE	CONCRETE	NEAT CEMENT OR CEMENT GROUT	CEMENT-BENTONITE GROUT	BENTONITE			IF OTHER TYPE OF ANNULAR MATERIAL, DESCRIBE	SAND	GRAVEL	SIZE
						GROUT	CHIPS	PELLETS				
0	20			X								
20	63					X						
63	65							X				
65	80.8									X		#10 X 20



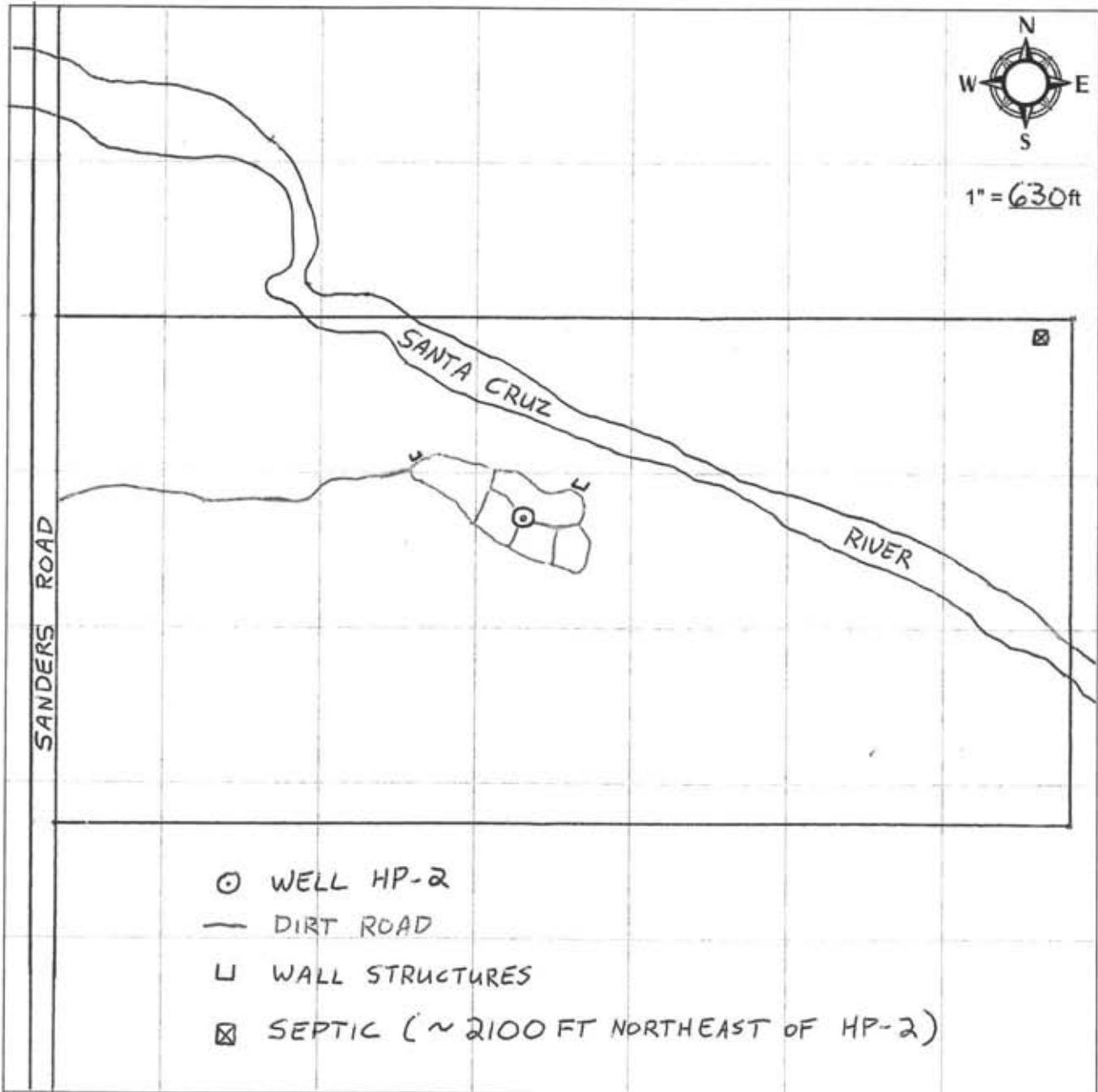
Well Driller Report and Well Log

WELL REGISTRATION NUMBER  
55 - 593607

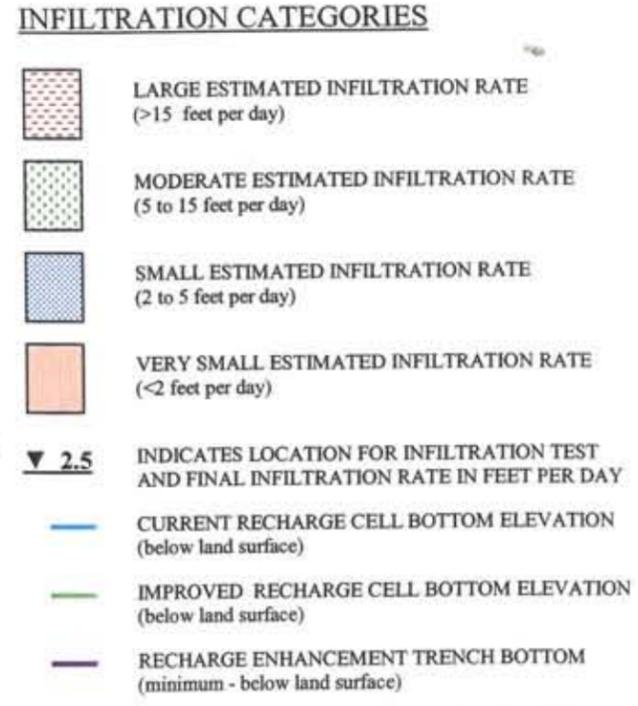
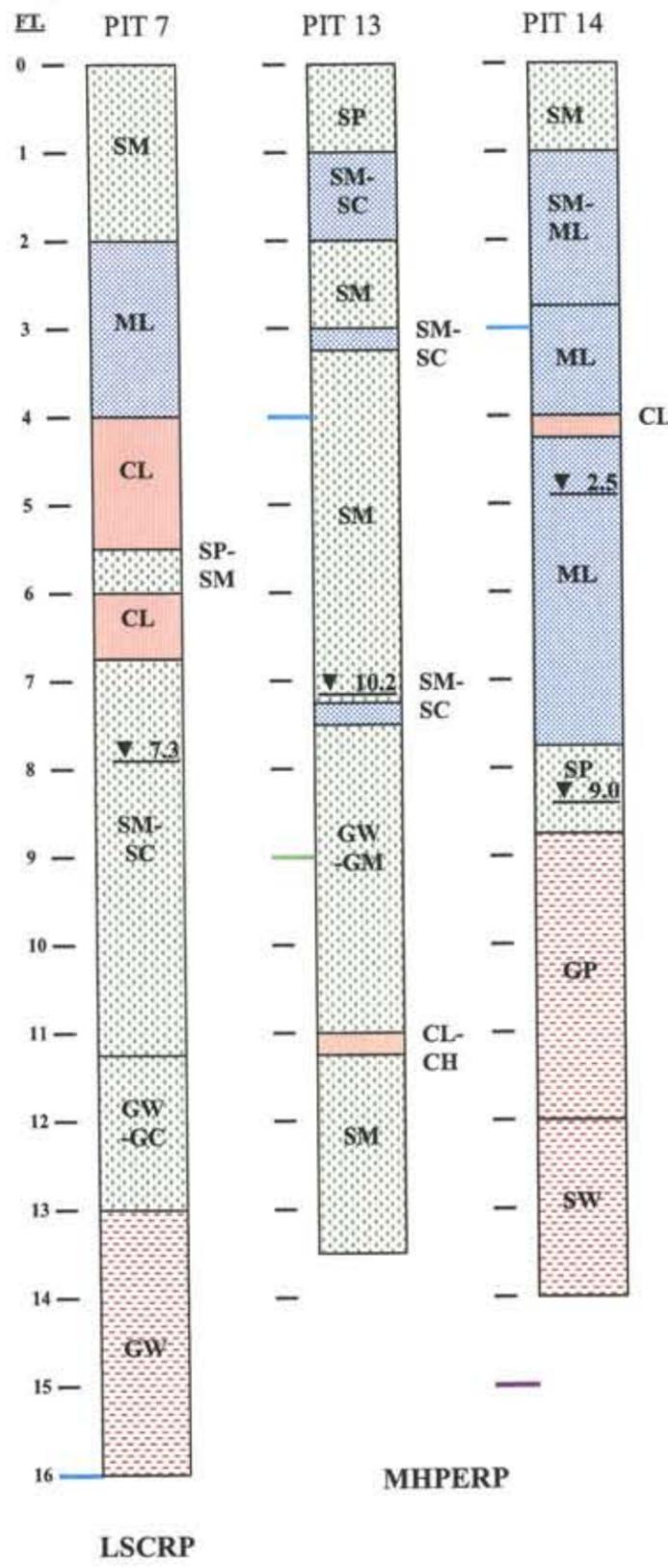
**SECTION 6. WELL SITE PLAN**

NAME OF WELL OWNER PIMA COUNTY REGIONAL FLOOD CONTROL DISTRICT	COUNTY ASSESSOR'S PARCEL ID NUMBER BOOK 217	MAP 51	PARCEL 0010
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- ❖ Please draw the following: (1) the boundaries of property on which the well was located; (2) the well location; (3) the locations of all septic tank systems and sewer systems on the property or within 100 feet of the well location, even if on neighboring properties; and (4) any permanent structures on the property that may aid in locating the well.
- ❖ Please indicate the distance between the well location and any septic tank system or sewer system.



Attachment 2  
Graphic Logs and Estimated Infiltration Capacity for Sediments  
at the Marana High Plains Effluent Recharge and  
the Lower Santa Cruz Recharge Projects  
(Test Pits 7, 13 and 14)



### UNIFIED SOIL CLASSIFICATION SYSTEM

#### COARSE-GRAINED SOILS (<50% SILT AND CLAY)

GW	WELL GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% FINES
GP	POORLY-GRADED GRAVELS OR GRAVEL-SAND MIXTURES, LESS THAN 5% FINES
GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES, MORE THAN 12% FINES
SW	WELL-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% FINES
SP	POORLY-GRADED SANDS OR GRAVELLY SANDS, LESS THAN 5% FINES
SM	SILTY SANDS, SAND-SILT MIXTURES, MORE THAN 12% FINES
SC	CLAYEY SANDS, SAND-CLAY MIXTURES, MORE THAN 12% FINES

#### FINE-GRAINED SOILS (>50% SILT AND CLAY)

ML	INORGANIC SILTS; SANDY SILTS; CLAYEY, SANDY SILTS; SILTY OR CLAYEY FINE SANDS
CL	INORGANIC SILTY OR SANDY CLAYS OF LOW TO MEDIUM PLASTICITY; SANDY CLAYEY SILTS; CLAYEY SILTS
CH	INORGANIC SILTY OR SANDY CLAYS AND CLAYEY SILTS OF HIGH PLASTICITY

NOTE: Dual symbols indicate either:  
 1) sediments of both lithologies or  
 2) sediments of intermediate lithology



INFILTRATION TEST PIT  
 LSCRP Lower Santa Cruz Recharge Project  
 MHPERP Marana High Plains Effluent Recharge Project  
 NORTH  
 SCALE 1 : 11,227

**MARANA HIGH PLAINS EFFLUENT RECHARGE PROJECT**  
**UNDERGROUND STORAGE FACILITY APPLICATION NO. 71-563876.0006**

## GRAPHIC LOGS OF ESTIMATED INFILTRATION CAPACITY FOR SEDIMENTS AT TEST PITS 7, 13 & 14

SOURCE: Errol L. Montgomery & Associates, Inc. 1996. Results of Soils Characterization and Infiltration Tests at the Lower Santa Cruz River Site for Recharge Feasibility Investigations, Northwest Replenishment Program, Pima County, Arizona

Attachment 3  
Log of Pond Samples at MHPERP for November 14, 2006

**Pima County Materials Laboratory Analyses  
Marana High Plains Recharge Site  
Log of Pond Samples for November 14, 2006**

POND	DEPTH BELOW BOTTOM	% PASSING - #40 SIEVE	% PASSING - #200 SIEVE	SOIL CLASSIFICATION
2	1	94	34.4	Silty fine sand
2	4	95	53.4	Fine sandy silt
2	5 - 6	94	4.7 <sup>a</sup>	Fine sand (poorly graded)
2	6 - 7	47	1.5 <sup>a</sup>	Fine to medium sand
2	8 - 9	38	2.4 <sup>a</sup>	Medium to fine sand
2	9 - 10	26	0.8 <sup>a</sup>	Medium-fine-coarse sand
2	12 - 13	26	1.5 <sup>a</sup>	Medium to fine sand
4	0.5 - 1	97	46.9	Silty fine sand
4	2	99	60.9	Fine sandy silt
4	2.5 - 3	97	65.9	Fine sandy silt
4	6.5 - 7	95	50.4	Fine sandy silt
4	7.5 - 8	24	5.9	Well graded medium and fine sand with coarse sand
4	9.5 - 10	72	7.0	Fine sand with cobbles
4	10 - 11	24	4.7	Well graded medium to fine sand with cobbles
4	10.5 - 11	46	16.8	Well graded fine to medium sand
4	12 - 12.5	9	2.7	Medium to coarse sand

<sup>a</sup> These soils are better characterized as well graded sands and gravels (SW and GW), which have a higher estimated infiltration rate than the GW-GM mixtures described in the 1996 study by Errol L. Montgomery & Associates, Inc.

Attachment 4  
2005 Basin Infiltration Rates for the  
Lower Santa Cruz Recharge Project

LOWER SANTA CRUZ RECHARGE PROJECT  
 BASIN INFILTRATION RATES (VOLUMETRIC METHOD)  
 2005

<b>Lower Santa Cruz Recharge Project</b>			
<b>DATE</b>	<b>VOLUME DELIVERED</b>	<b>TOTAL ACREAGE</b>	<b>INFILTRATION RATE (FT/DAY)</b>
22-Jan	130	21.40	6.07
13-Feb	131	21.40	6.12
16-Mar	125	21.40	5.84
14-Apr	122	17.80	6.85
20-May	98	18.40	5.33
21-Jun	133	21.40	6.21
23-Jul	128	17.80	7.19
19-Aug	125	18.40	6.79
25-Sep	128	21.40	5.98
8-Oct	125	21.40	5.84
25-Nov	126	17.80	7.08
19-Dec	132	21.40	6.17

Source: 2005 Annual Monitoring Report, Lower Santa Cruz Recharge Project, Central Arizona Water Conservation District, Water Control Department, February 23, 2006.

Attachment 5  
Improvements and Annual Recharge Volume Phasing Plan

### Annual Recharge Volumes Requested per Facility Improvement Phasing Plan

Phase	Planned Improvements	Implementation Period	Increased Annual Volume (estimated))	Annual Recharge Volume Requested	Feasibility
Current (Pilot Phase)	None	Current operation	0 AF	320 AF	Maximum annual recharge achieved over 5-year pilot phase
Phase I	Addition of Equalization Basin as a recharge cell (+0.62 acres)	Upon receiving permit (2009)	30 AF	350 AF	Annual delivery to the Equalization Basin minus delivery to the recharge cells (averaged over 5 years)
Phase II	Excavation of recharge enhancement trenches in Recharge Cells 1, 3 and 4	Spring 2009 – Fall 2009	100 AF	450 AF	Infiltration increased with exposure to gravel bottoms within the recharge enhancement trenches <sup>1</sup>
Phase III	Excavation of Recharge Cell 2 down to a depth of 5-7 feet below land surface	Fall 2009 – Spring 2010	150 AF	600 AF	Infiltration increased from removal of silty sands and exposure to gravel-sand mixtures in cell bottom <sup>1</sup>
Phase IV (if needed)	Construction of Contingencies 1-4 (Table 4a) as needed	Post-Spring 2010 (if needed)	25-50 AF	600 AF	Contingencies will be constructed as appropriate if recharge volumes fall below requested amount

<sup>1</sup> Increased infiltration rates are estimated using information provided by Errol L. Montgomery & Associates in 1996 and Central Arizona Project, 2006.

**Table 4. Description of Modified Recharge Basins**

Cell	Acreage	Basin Level (min/max)	Characteristics
Equalization Basin	0.62	2 ft./5 ft.	Settling and recharge basin; side slopes planted with riparian vegetation
1	0.63	3 in./12 in.	Perimeter and side slope vegetation; 2 recharge enhancement trenches in cell bottom with dimensions of 2 feet wide by 40 feet long by 12 feet deep.
2	1.21	3 in./5-7 ft.	Bare soil; 5-7 foot deep trench extending down the middle of the basin and sloping upward from the sides
3	0.78	3 in./12 in.	Perimeter and side slope vegetation; 2 recharge enhancement trenches in cell bottom with dimensions of 2 feet wide by 40 feet long by 12 feet deep.
4	1.26	3 in./12 in.	Perimeter vegetation; grass-lined bottom; 2 recharge enhancement trenches in cell bottom with dimensions of 2 feet wide by 40 feet long by 12 feet deep.

**Table 4a. Description of Design Contingencies**

Cell	Contingency #1	Contingency #2	Contingency #3	Contingency #4
Equalization Basin	Settling and recharge basin; side slopes planted with riparian vegetation	Settling and recharge basin; side slopes planted with riparian vegetation	Settling and recharge basin; side slopes planted with riparian vegetation	Settling and recharge basin; side slopes planted with riparian vegetation
1 thru 4*	Perimeter and side slope vegetation; 4, 36-inch diameter by 15-foot deep dry wells using perforated culvert pipe with pea gravel fill material	2 sets of recharge dry wells, each connected with a 100-150 foot of 36-inch slotted culvert pipe in the permeable strata and filled with pea gravel	Earthen ridges and furrows 1.5 feet wide and 6 feet deep aligned north to south to fit basin configuration	Earthen ridges and furrows over trenches that are 1.5 feet wide and 6 feet deep aligned to fit basin configuration and backfilled with permeable materials (sand, gravel and/or cobble)

\* Note: Different design contingencies may be used in each basin or a combination of contingencies may be used in each basin based on field investigations

Attachment 6  
Water Quantity Monitoring Devices

## Water Quantity Monitoring

Monitor Point	Measuring Device	Parameter	Cadastral	Location	Monitoring Frequency	Reporting Frequency
FMeq	Flow meter with totalizer <sup>1</sup>	Total inflow to Facility	D-11-11-33dbc	See Figure 2	Daily	Annually
FM1	Flow meter with totalizer <sup>2</sup>	Water inflow to Recharge Cell 1	D-11-11-33cad		Daily	Annually
FM2	Flow meter with totalizer <sup>2</sup>	Water inflow to Recharge Cell 2	D-11-11-33cad		Daily	Annually
FM3	Flow meter with totalizer <sup>2</sup>	Water inflow to Recharge Cell 3	D-11-11-33cad		Daily	Annually
FM4	Flow meter with totalizer <sup>2</sup>	Water inflow to Recharge Cell 4	D-11-11-33cad		Daily	Annually

<sup>1</sup> Magnetoflow® Mag Meter, BadgerMeter, Inc.

<sup>2</sup> American Sigma 950 Flow Meter with Submerged Area/Velocity Probe