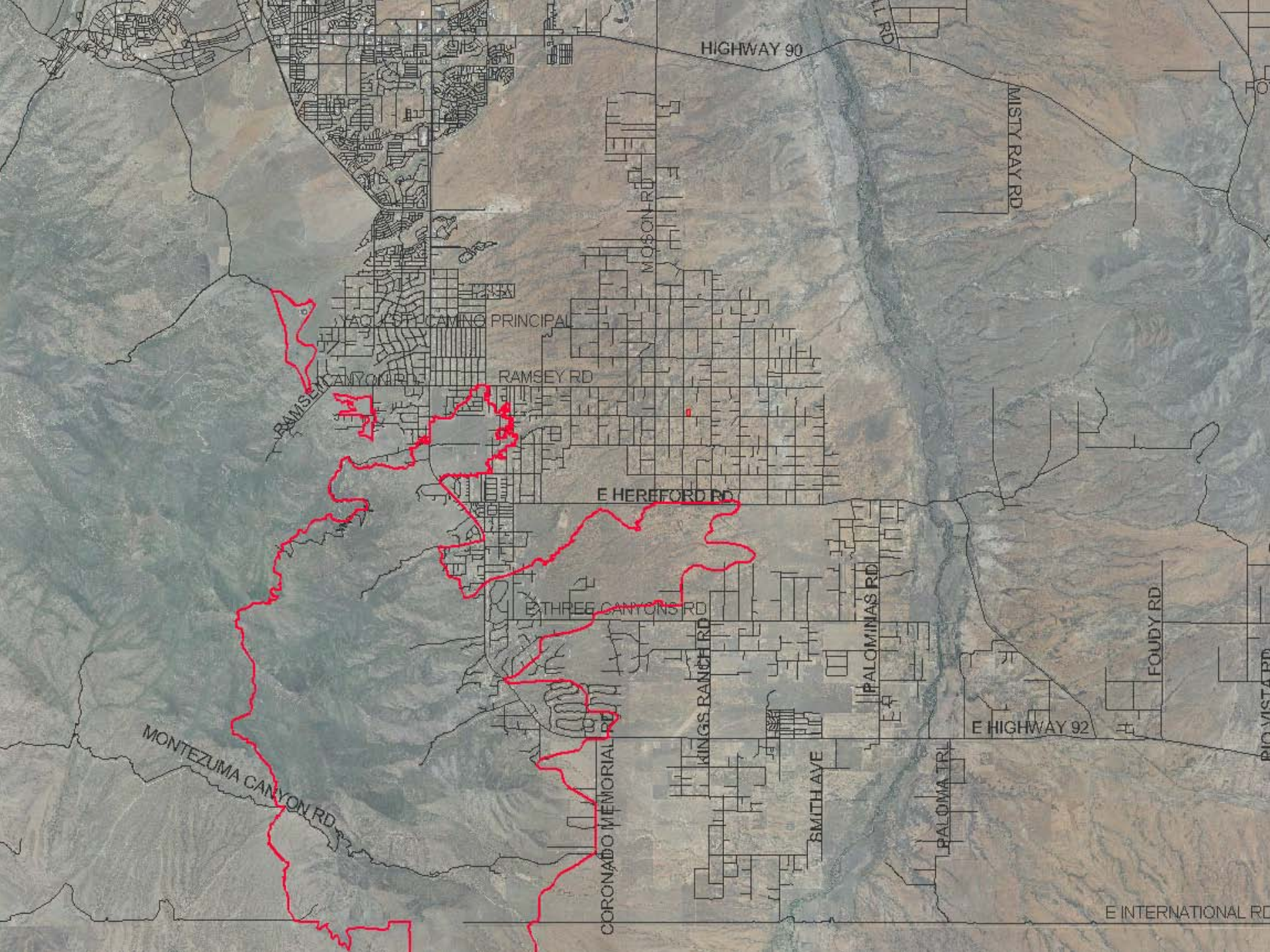
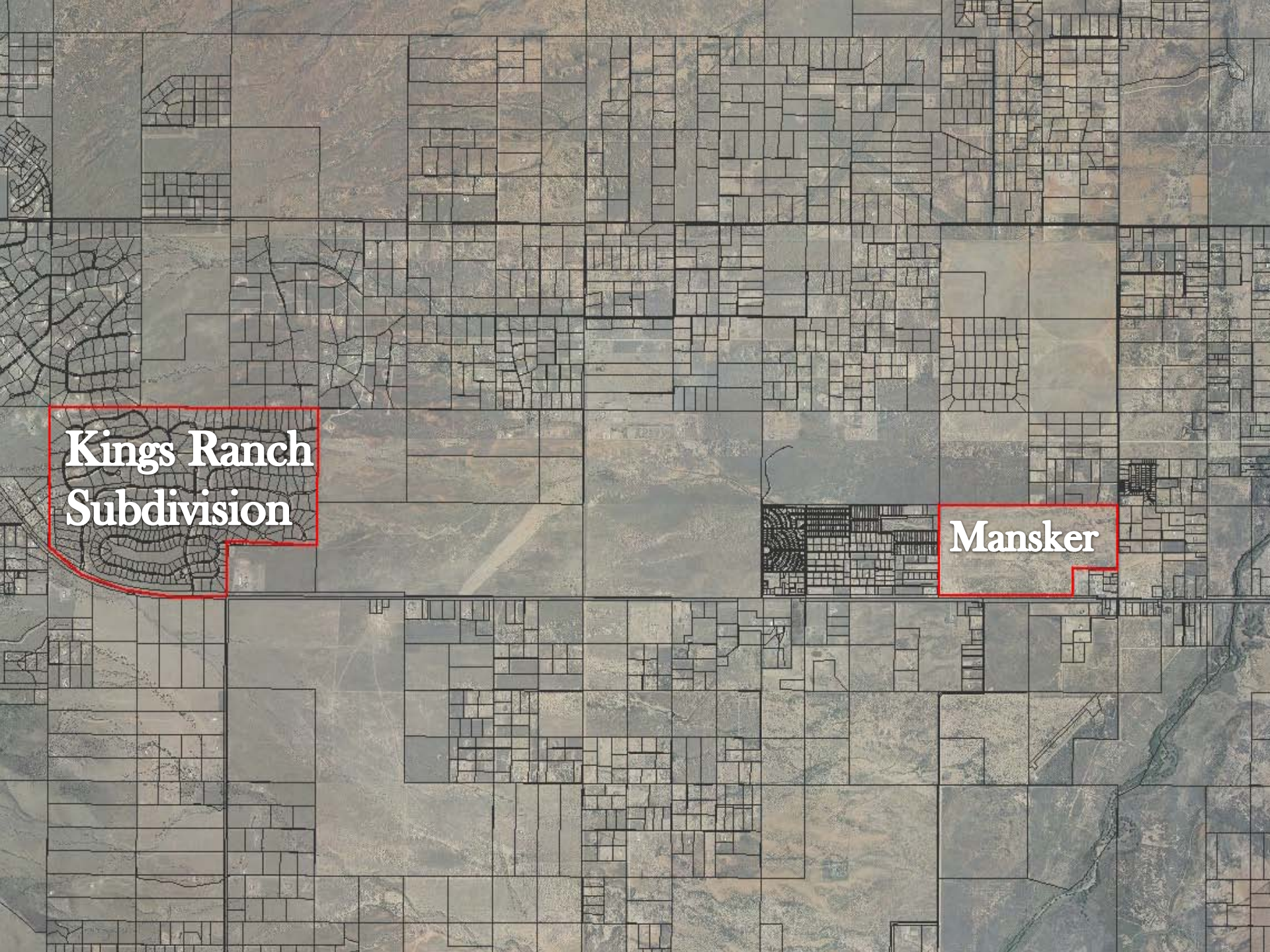
Palominas Recharge Project

A demonstration project for recharge in the Upper San Pedro subwatershed

COCHISE COUNTY


HIGHWAY 90
MISTY RAY RD
MOSON RD
YAQUI CAMINO PRINCIPAL
RAMSEY RD
RAMSEY CANYON RD
E HEREFORD RD
THREE CANYONS RD
PALOMINAS RD
FOUDY RD
KINGS RANCH RD
E HIGHWAY 92
MONTEZUMA CANYON RD
CORONADO MEMORIAL RD
SMITH AVE
PALOMA TRL
E INTERNATIONAL RD

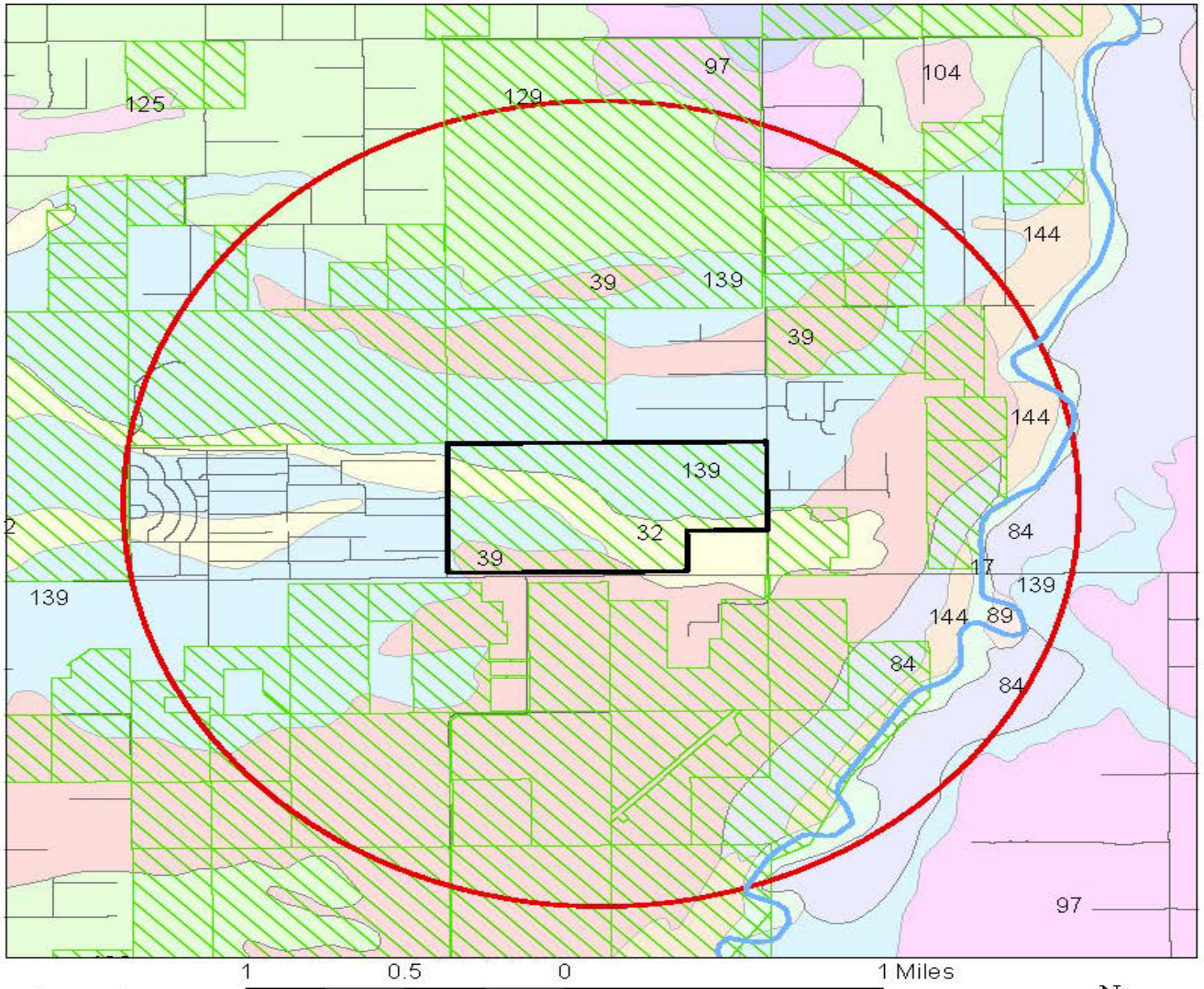

Kings Ranch
Subdivision
Mansker

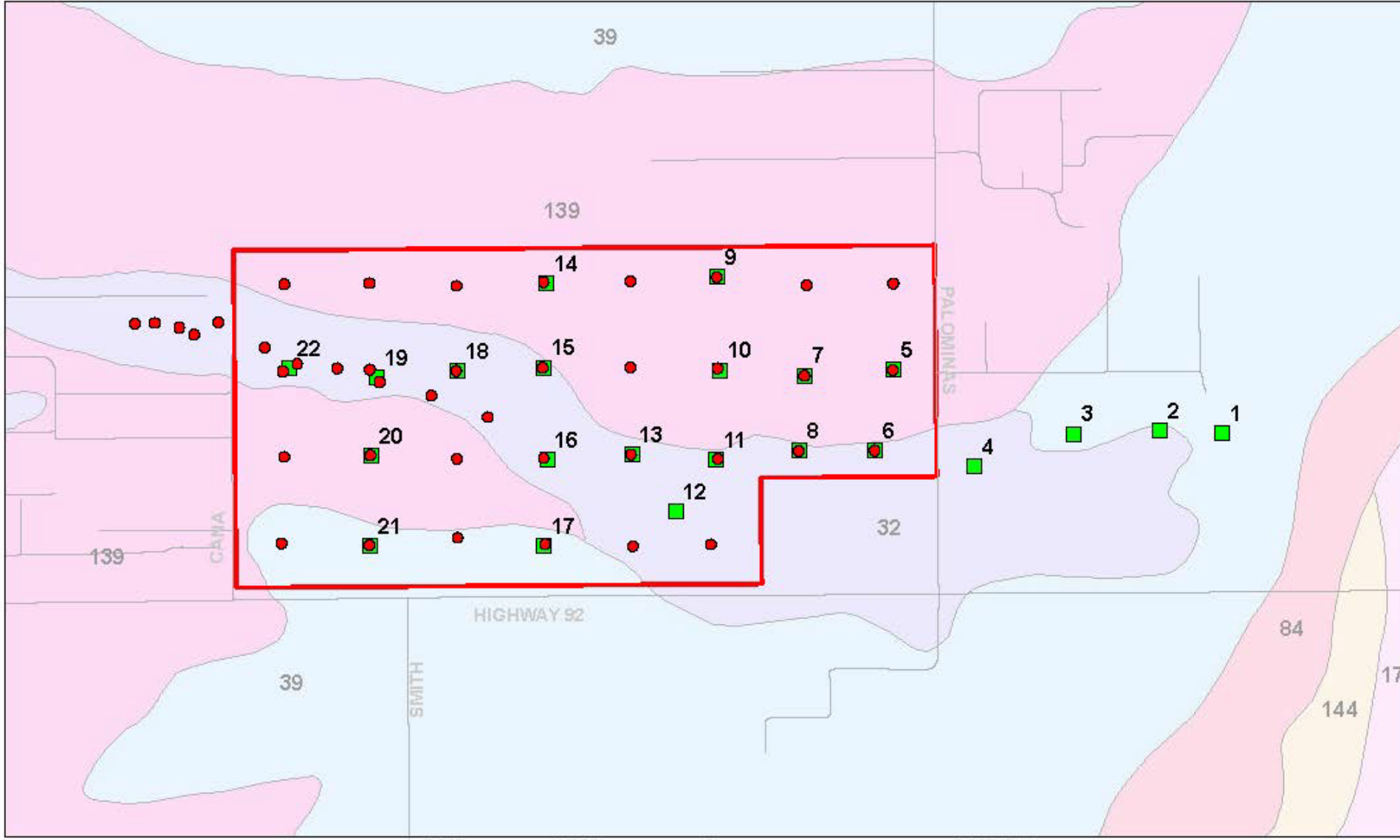
Cochise County Grant

- Grant amount- up to $1,693,265 over 3 years
  - Components:
  - Phase I – Acquisition of Mansker property
    - Analysis and design of Mansker Flood/Recharge facilities
    - GIS tool/database
    - Pipeline Feasibility study and report
  - Phase II – King's Ranch analysis and design
    - Construction of Mansker facilities and monitoring
  - Phase III – Construction of King's Ranch facilities & monitoring
  - Phase IV – Ongoing monitoring and reporting

Recharge Study Sequence

- Mansker site assessment
  - Identify areas with soils/sediments > 2 feet/day infiltration
  - Phase I – Near-surface evaluation
    - Test pits (8 to 12 feet)
    - Infiltration tests
  - Phase II – Deeper sub-surface evaluation
    - Shallow boreholes (surface to groundwater)
  - Location and design
- Screening Level Study to identify other potential sites
  - Review other areas near to Manker that may have good recharge potential


97
104
125
129
144
39
139
39
144
139
32
84
39
17
139
139
144
89
84
84
97
1
0.5
0
1 Miles
Legend
Mansker Parcel
Study Area
Parcels>= 20 acres
San Pedro River
Roads
Soil Map Units
104 - MAJOR COMPLEX, 0 TO 5 PERCENT SLOPES
125 - RIVEROAD AND UBIK SOILS, 0 TO 5 PERCENT SLOPES
129 - SASABE COMPLEX, 0 TO 3 PERCENT SLOPES
139 - TENNECO FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES
N



Legend

- EM34 survey locations
- Proposed Test Pits with ID
- Roads
- Mansker Parcel Boundaries

Soil Map Units

- 139 - TENNECO FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES
- 144 - UBIK COMPLEX, 0 TO 3 PERCENT SLOPES
- 17 - BROOKLINE-FLUVAQUENTS-RIVERWASH COMPLEX, 0 TO 3
- 32 - COMBATE LOAMY SAND, 0 TO 5 PERCENT SLOPES
- 39 - COURTLAND-DIASPAR COMPLEX, 0 TO 3 PERCENT SLOPES
- 84 - GUEST-RIVEROAD ASSOCIATION, 0 TO 1 PERCENT SLOPES

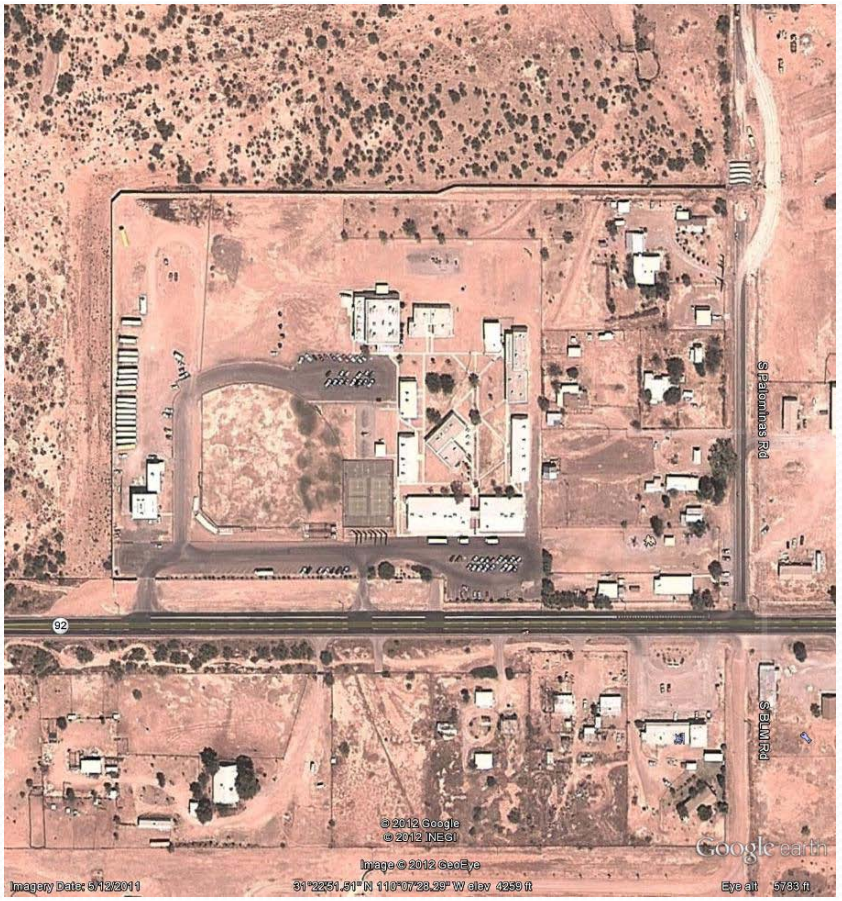
Proposed test pit locations with soil map units

GSA GeoSystems Analysis, Inc.

Soil Map Unit Symbol	Soil Series	Soil Name	Estimated Relative Permeability	Range of % Clay		Permeability Range (inches/hr)	
32	COMBATE LOAMY SAND, 0 TO 5 PERCENT SLOPES	Combate	Moderate-High	3	15	2	20
39	COURTLAND-DIASPAR COMPLEX, 0 TO 3 PERCENT SLOPES	Courtland	Low-Moderate	5	35	0.2	6
		Diaspar		5	35	0.6	6
84	GUEST-RIVEROAD ASSOCIATION, 0 TO 1 PERCENT SLOPES	Guest	Low	30	50	0.06	0.6
		Riveroad		5	50	0.06	6
129	SASABE COMPLEX, 0 TO 3 PERCENT SLOPES	Sasabe sandy	Low-Moderate	5	60	0.06	6
		Sasabe silt loam		10	60	0.06	6
139	TENNECO FINE SANDY LOAM, 0 TO 2 PERCENT SLOPES	Tenneco	Moderate	7	35	0.2	6
144	UBIK COMPLEX, 0 TO 3 PERCENT SLOPES	Ubic silt loam	Moderate	5	20	0.6	6
		Ubic fine sandy loam		5	15	2	6

Palominas Recharge Project

- Flood Control
  - Flooding has been a problem for the Palominas School and surrounding areas for many years. With this in mind, Cochise County has selected the Mansker site for the construction of a flood control detention basin as part of a larger flood control project. Several phases of the project have already been constructed to include flood water diversion wall, culverts and drainage channels. The detention basin would be the last phase of the project.



Palominas Recharge Project

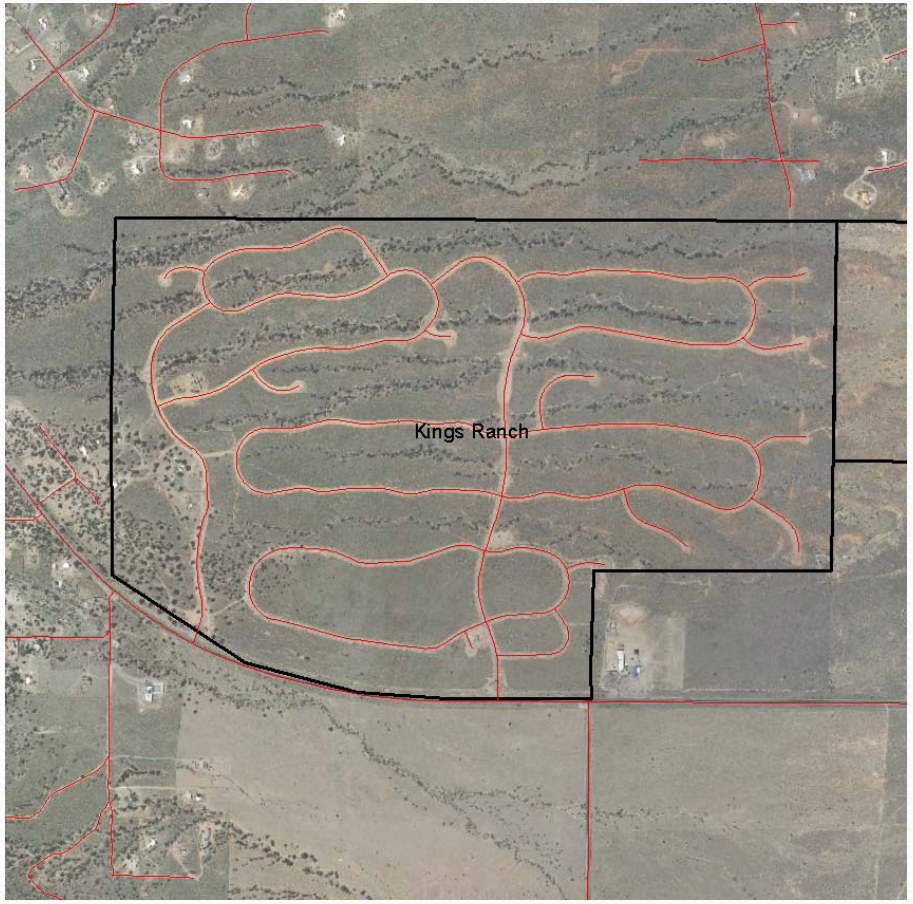
- GIS Database/Inventory
  - To set the framework for longer term, basin wide storm water management, Cochise County will generate a GIS based tool that locates existing and proposed drainage features that are currently or could be susceptible to recharge within the Upper San Pedro Basin. The layers will include existing basins, channels, drainage easements, rights of way throughout the multi-jurisdictional basin. The GIS tool will be used to plan regional detention/recharge systems that build on the existing infrastructure.

Palominas Recharge Project

- Pipeline Feasibility Analysis
  - Development of a tool that measures the feasibility of constructing infrastructure to convey stormwater runoff collected at one site to transfer it to a potential recharge site.
  - The tool will measure feasibility as a function of recharge area, development density, delivery capacity of pipeline, onsite storage, etc.

Palominas Recharge Project

- Kings Ranch (formerly Kinjockity) – Recharge feasibility & onsite capture
  - Kings Ranch will be evaluated using the pipeline feasibility tool
  - Onsite capture and recharge will also be considered for Kings Ranch



Palominas Recharge Project

- Project 3-year timeline
  - 2012
    - Winter - Mansker site feasibility
    - Spring-Summer – Mansker site design, GIS development, Pipeline Feasibility
    - Fall – Kings Ranch site evaluation & prelim. design
  - 2013
    - Mansker site construction
    - Kings Ranch site final design
  - 2014
    - Mansker site monitoring
    - Kings Ranch site construction

Palominas Recharge Project

- Phase I – Project Status
  - Data Collection - Ongoing
  - Preliminary Hydrologic Modeling – to be completed March 2012
  - Alternative Site Recharge Screening – to be completed March 2012
  - Mansker Site Initial Recharge Feasibility – to be completed March 2012
  - Mansker Site Detailed Recharge Feasibility – to be completed May 2012
  - GIS Tool Criteria Development & Model Selection - Geodesy/Encompass platform selected, data sets being identified for collection/compilation
  - Pipeline Feasibility Assessment – Planned for April 2012
  - Kings Ranch Site Recharge Feasibility Assessment - Planned for April – May 2012

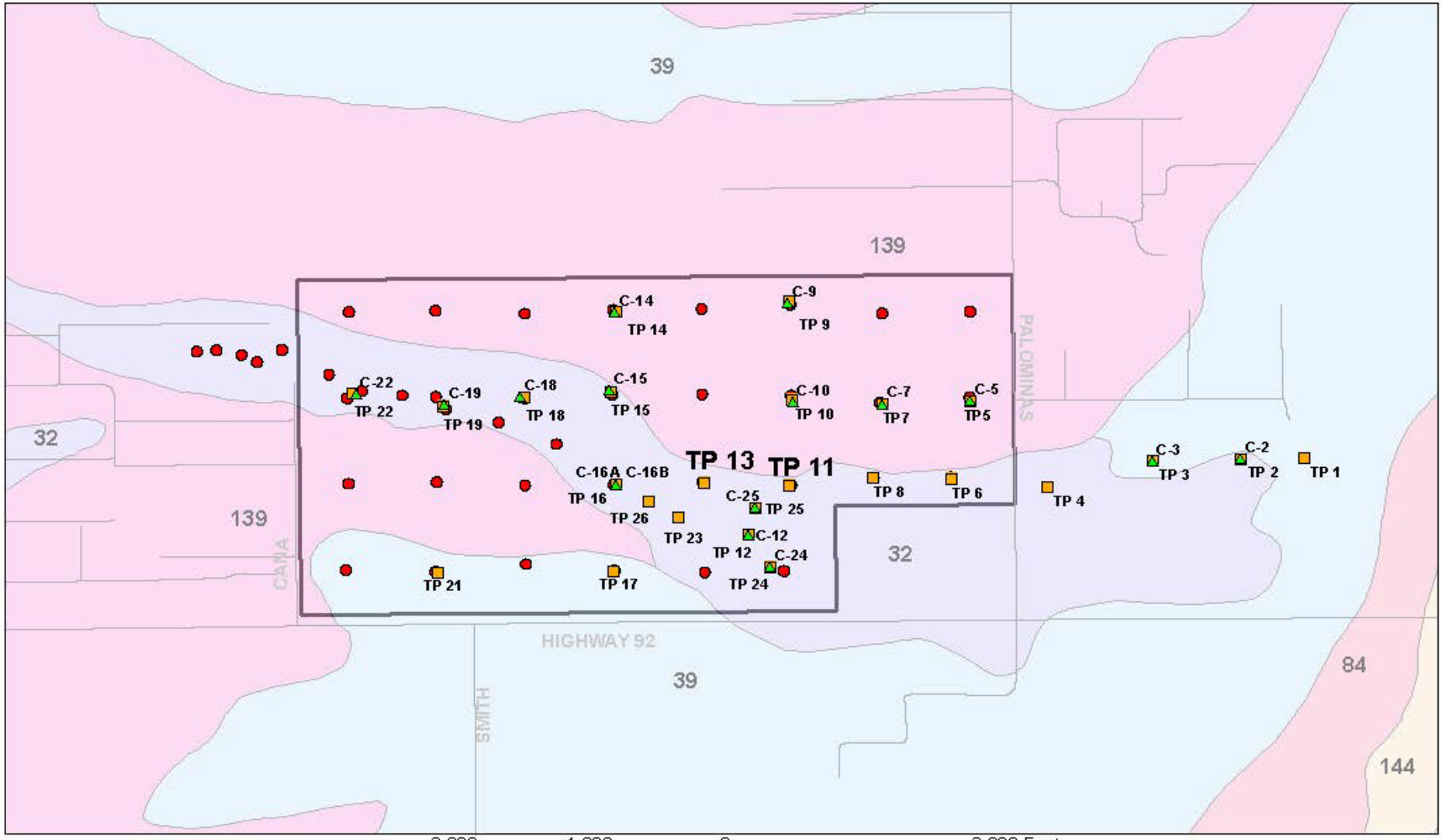


Figure 2 Location of test pits and cylinder infiltrometer tests

Estimated Field Hydraulic Conductivity

Depth (ft bgs)	Pit number																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	22	23	24	25	26
1	4.4	4.4	4.4	0.6	2.3	0.6	2.3	0.6	4.4	2.3	4.4	0.6	0.6	4.4	2.3	0.6	0.6	0.6	4.4	4.4	0.6	0.6	0.6	0.6
2	4.4	4.4	4.4	0.6	0.6	0.6	0.6	0.6	0.6	2.3	2.3	0.6	0.6	2.3	0.6	0.6	0.6	0.6	2.3	2.3	4.4	0.6	4.4	0.6
3	4.4	4.4	4.4	0.6	0.6	0.6	0.6	0.6	0.6	2.3	2.3	0.6	0.6	0.6	4.4	0.6	0.6	0.6	4.4	4.4	2.3	0.6	2.3	4.4
4	4.4	4.4	4.4	0.6	2.3	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	2.3	4.4	0.6	2.3	4.4	4.4	2.3	0.6	2.3	0.6
5	4.4	4.4	4.4	0.6	2.3	0.6	0.6	4.4	0.6	0.6	0.6	4.4	0.6	0.6	0.6	4.4	0.6	2.3	4.4	4.4	2.3	0.6	0.6	0.6
6	0.6	4.4	4.4	0.6	0.6	0.6	0.6	4.4	0.6	0.6	0.6	4.4	0.6	0.6	0.6	4.4	0.6	0.6	4.4	0.6	2.3	0.6		0.6
7	0.6	0.6	4.4	0.6	0.6		0.6	2.3		2.3	0.6	4.4	0.6			4.4	0.6	0.6	4.4	0.6	0.6	0.6		0.6
8	0.6	0.6	4.4	0.6	0.6		0.6	0.6		0.6	0.6	4.4	0.6			4.4			4.4	0.6	0.6	0.6		4.4
9	4.4	0.6	0.6	0.6	0.6		0.6	0.6		0.6		0.6				4.4			4.4					
10		0.6	0.6				0.6			0.6		0.6				4.4								
11																4.4								
12																								
Geomean Hydraulic Conductivity (ft/day)	2.2	1.9	2.9	0.6	0.9	0.6	0.7	1.0	0.8	1.0	1.0	1.3	0.6	1.0	1.3	2.5	0.6	0.8	4.1	1.9	1.5	0.6	1.5	0.9