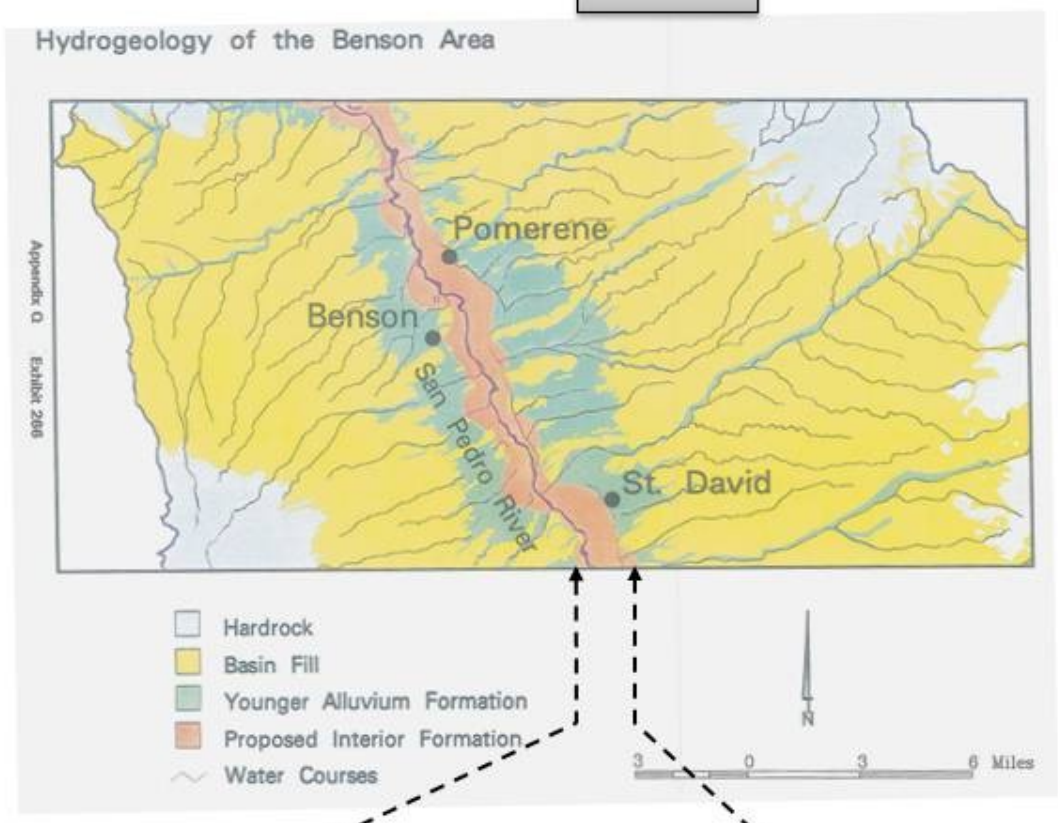
FIGURES

Figure 2-1a

Source: 1994 Subflow Order, Appendix Q

Plan View



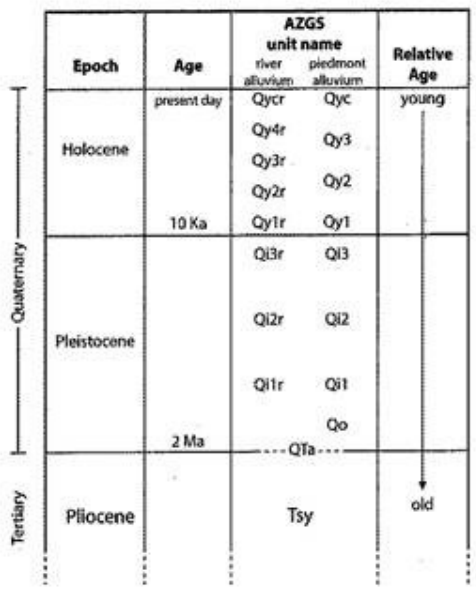


Figure 2-1b

Sources: Table 1 and Fig. 4-1 (AZGS, 2010)

Cross-Section View

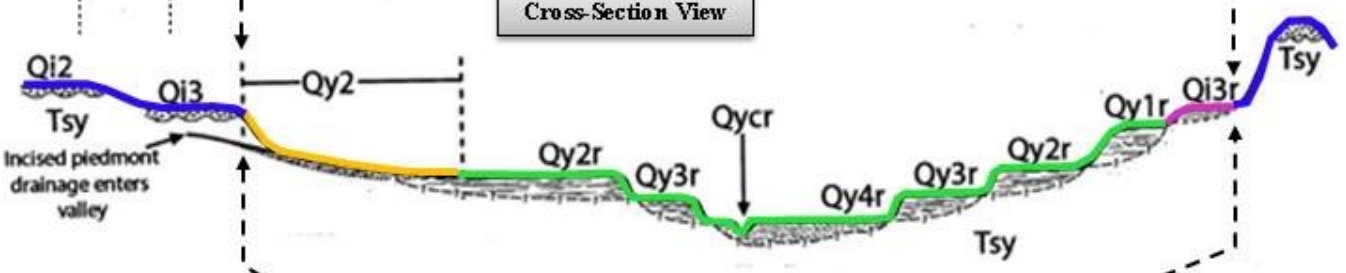


Figure 2-1c

Source: 1994 Subflow Order, Fig. 2-4a.

Cross-Section View

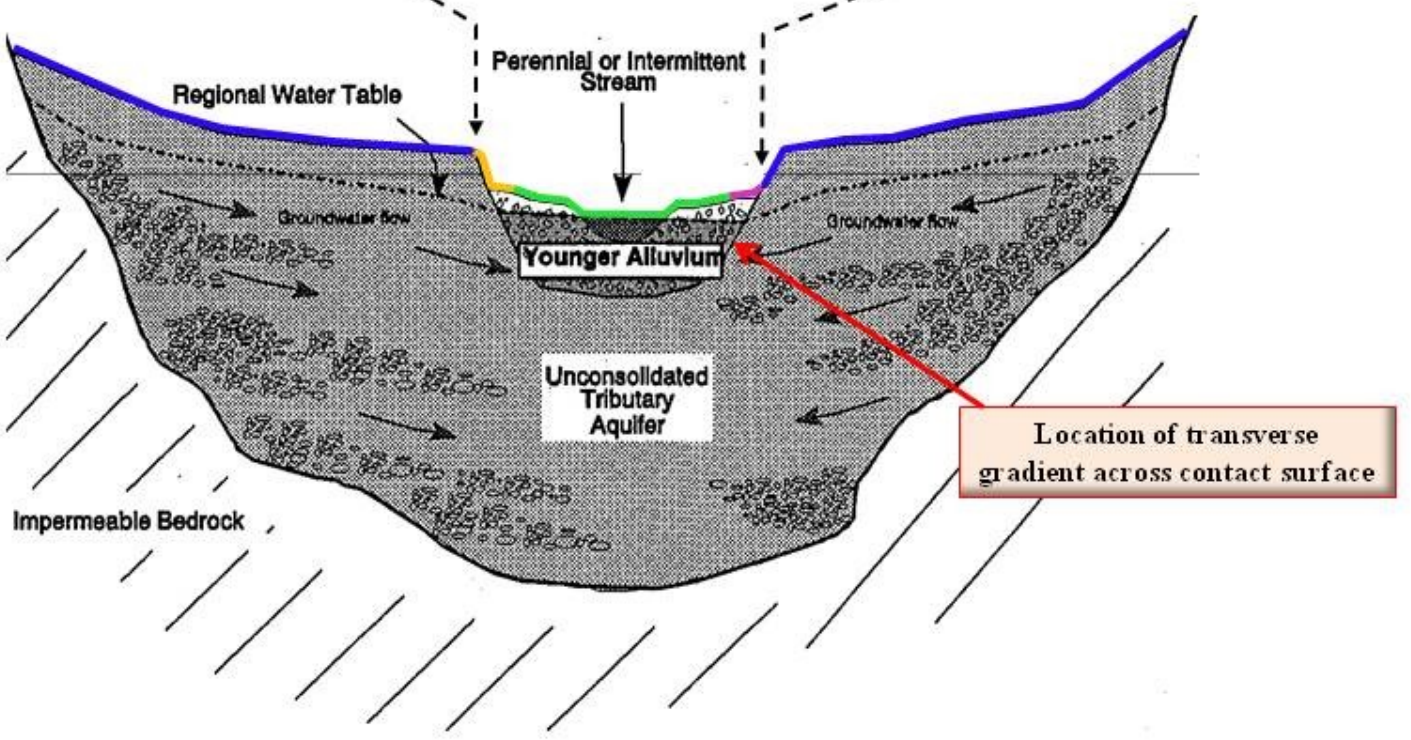


Figure 2-1

Geologic Units and

Hydrogeologic Concepts

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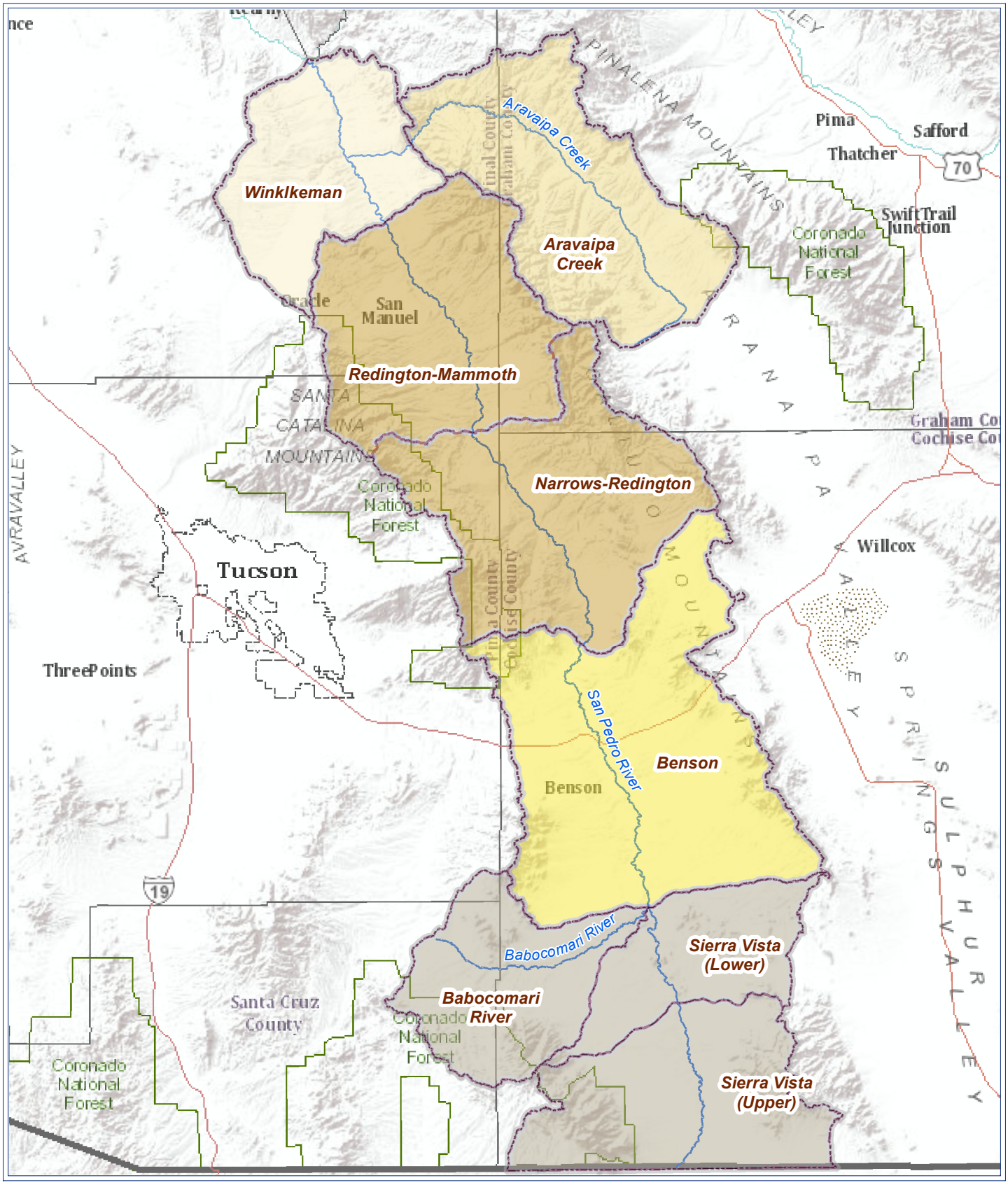

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Base Map: ESRI ArcMap 10.0 World Reference Overlay with Terrain Base

Figure 3-1
San Pedro River Watershed
General Location Map
and Analysis Areas

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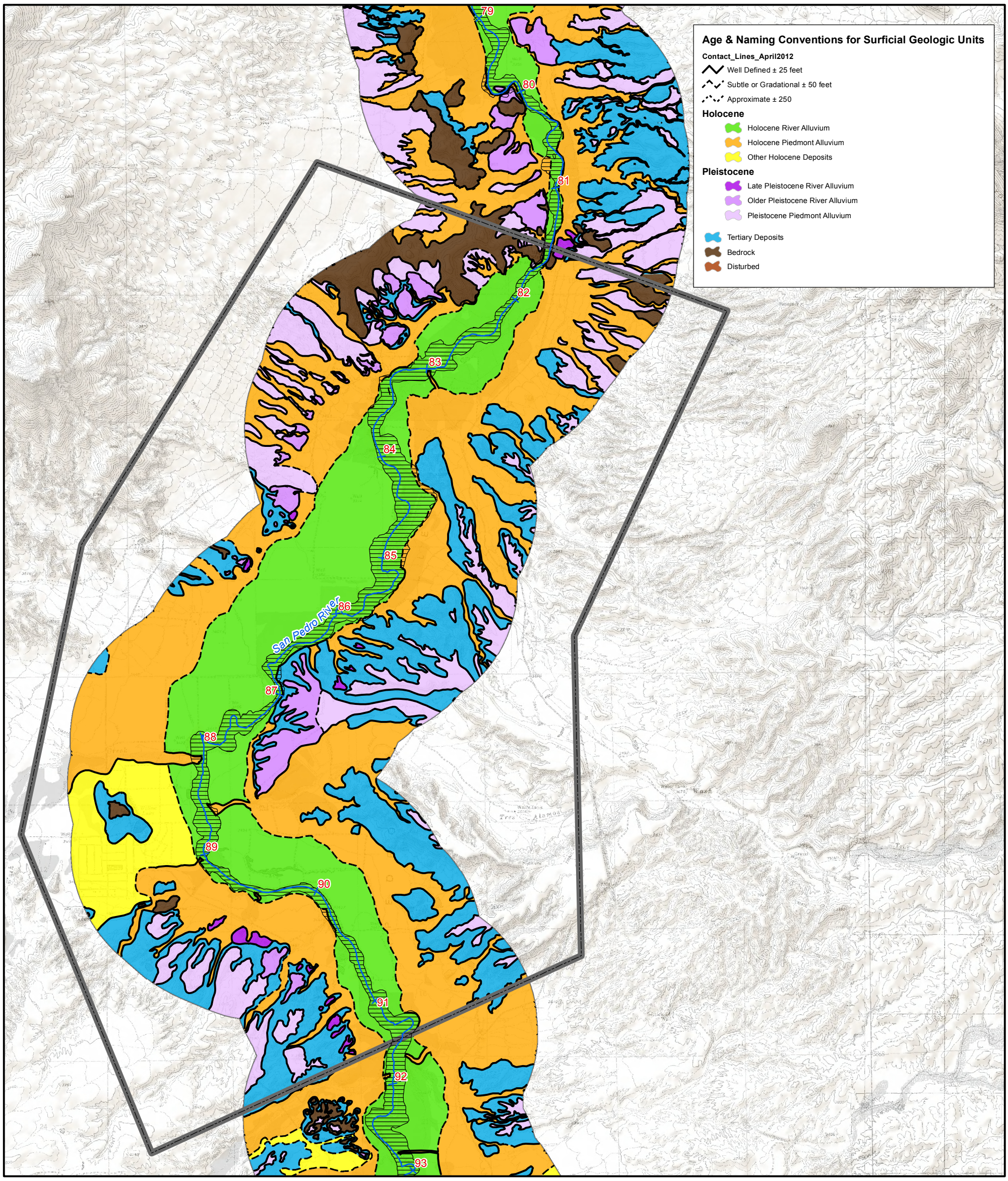

Legend

- San Pedro River
- Project Area Mapped by AZGS (2009)
- Composite Active Floodplain (1930's to 2007)

San Pedro River Subwatersheds

- Aravaipa
- Benson
- Redington
- Sierra Vista
- Winkleman

N

Base Map: USGS 1:24,000 Topographic Map with Shaded Relief

Figure 4.1
Geology Base Map for Preliminary Analysis of Sample Subarea

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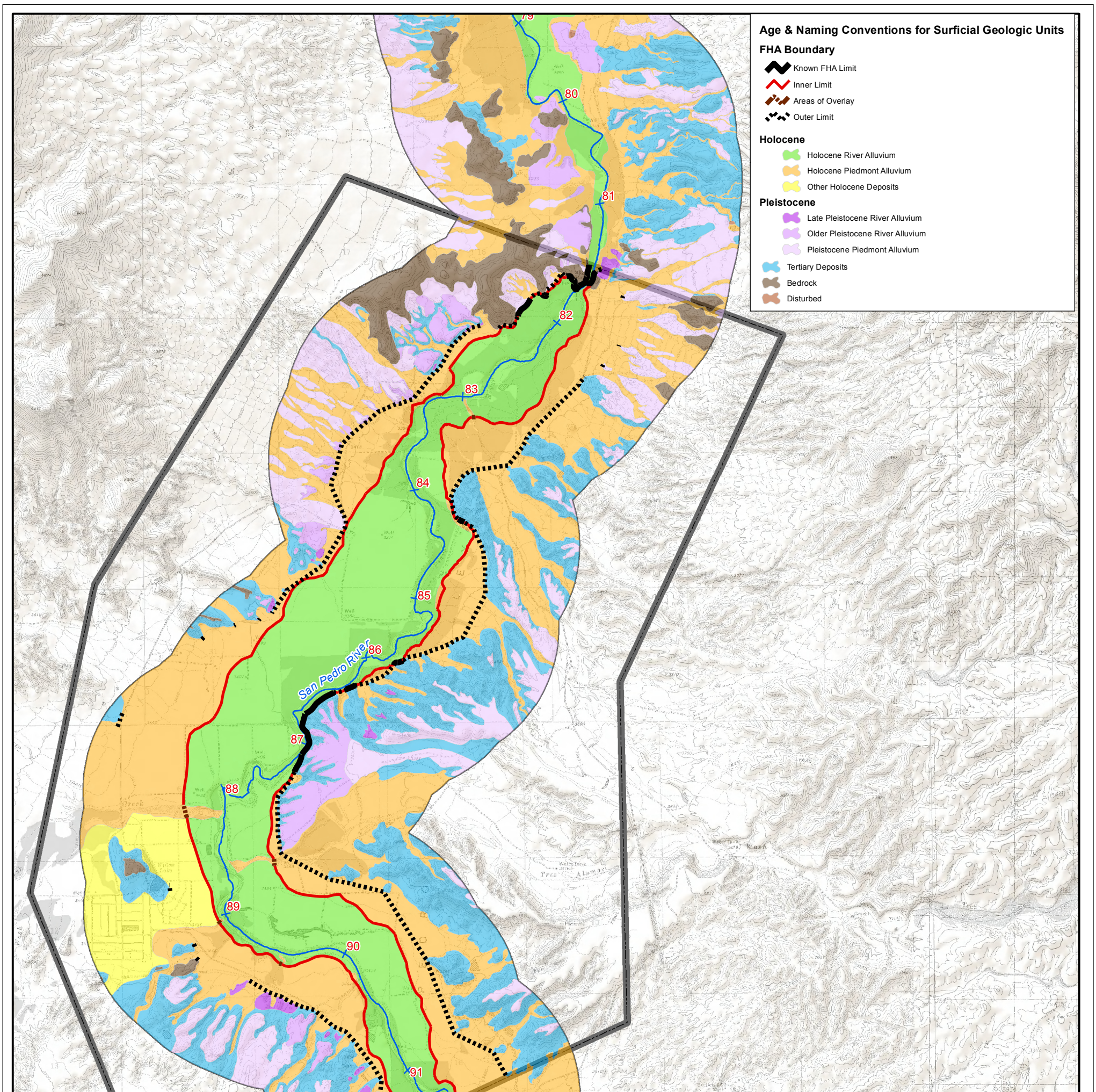
0 1,250 2,500 5,000 Feet



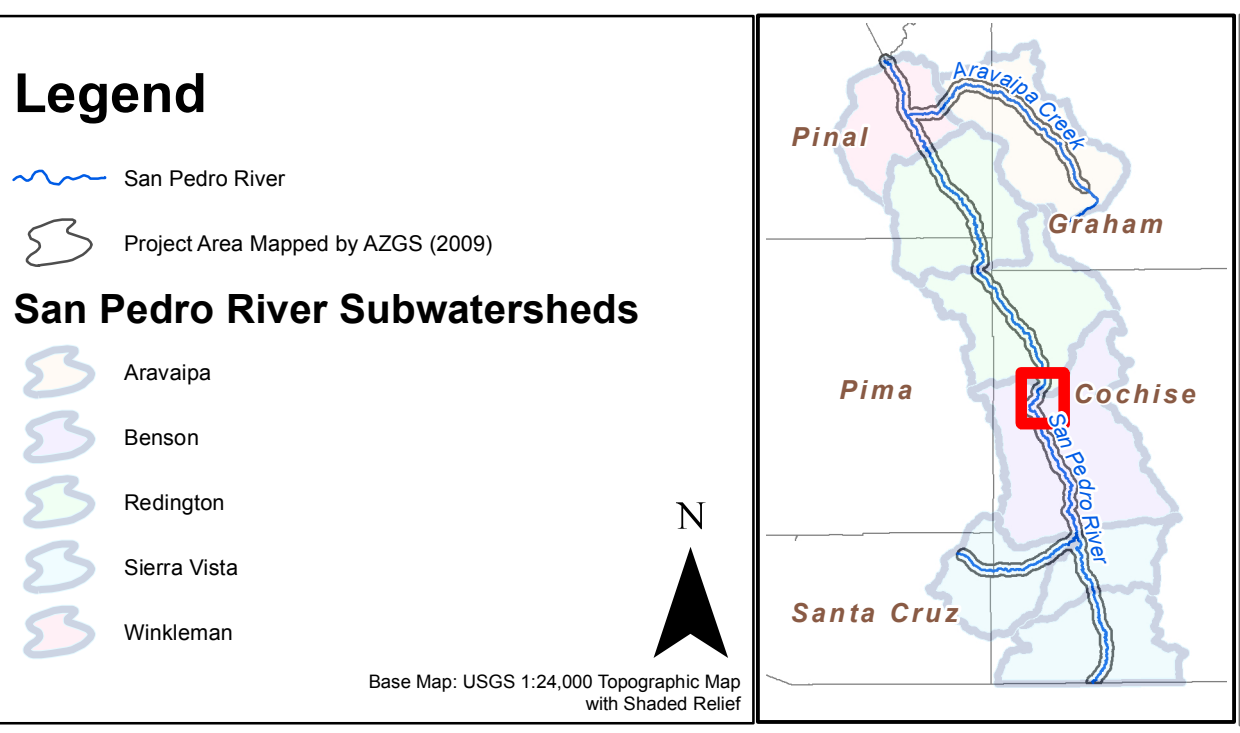


Figure 4-2a
FHA Base Map
for Preliminary Analysis
of Sample Subarea

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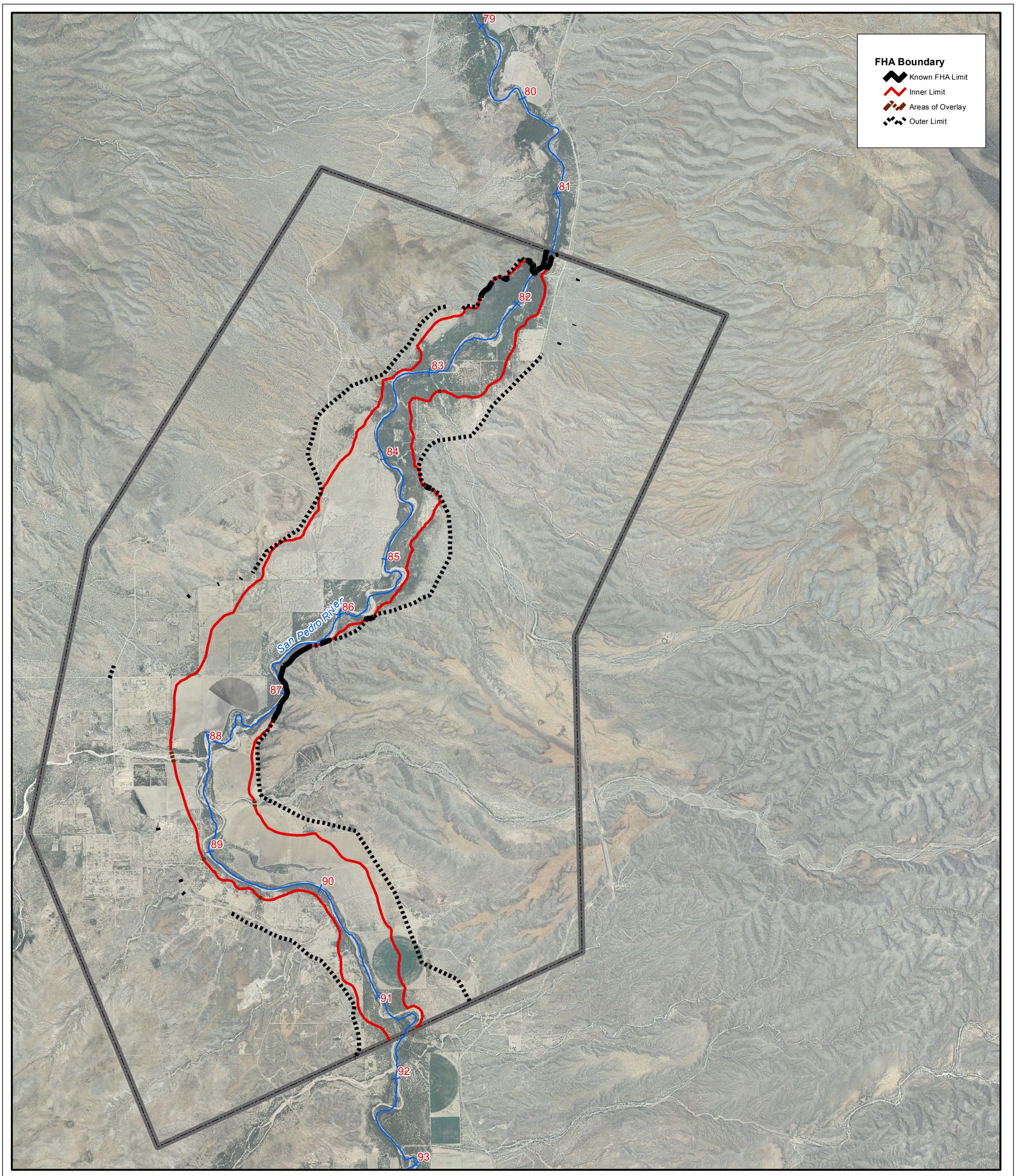
0 1,250 2,500 5,000 Feet



Legend

San Pedro River

Project Area Mapped by AZGS (2009)

San Pedro River Subwatersheds

Aravaipa

Benson

Redington

Sierra Vista

Winkleman

N

Base Map: USGS 1:24,000 Topographic Map with Shaded Relief

Figure 4-2b
FHA Base Map for Preliminary Analysis of Sample Subarea Plotted on Aerial Imagery

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0 1,250 2,500 5,000 Feet

Age & Naming Conventions for Surficial Geologic Units

Holocene
- Holocene River Alluvium
- Holocene Piedmont Alluvium
- Other Holocene Deposits

Pleistocene
- Late Pleistocene River Alluvium
- Older Pleistocene River Alluvium
- Pleistocene Piedmont Alluvium
- Tertiary Deposits
- Bedrock
- Disturbed

79 80 81 82 83 84 85 86 87 88 89 90 91 92 93

82-A 83-B 85-A 88-B 88-A 89-A 90-A

San Pedro River

Legend

- San Pedro River
- Cross Section
- Project Area Mapped by AZGS (2009)

San Pedro River Subwatersheds

- Aravaipa
- Benson
- Redington
- Sierra Vista
- Winkleman

N

Base Map: USGS 1:24,000 Topographic Map with Shaded Relief

Figure 4-3
Location of Selected Cross-Sections for Preliminary Analysis in Sample Subarea

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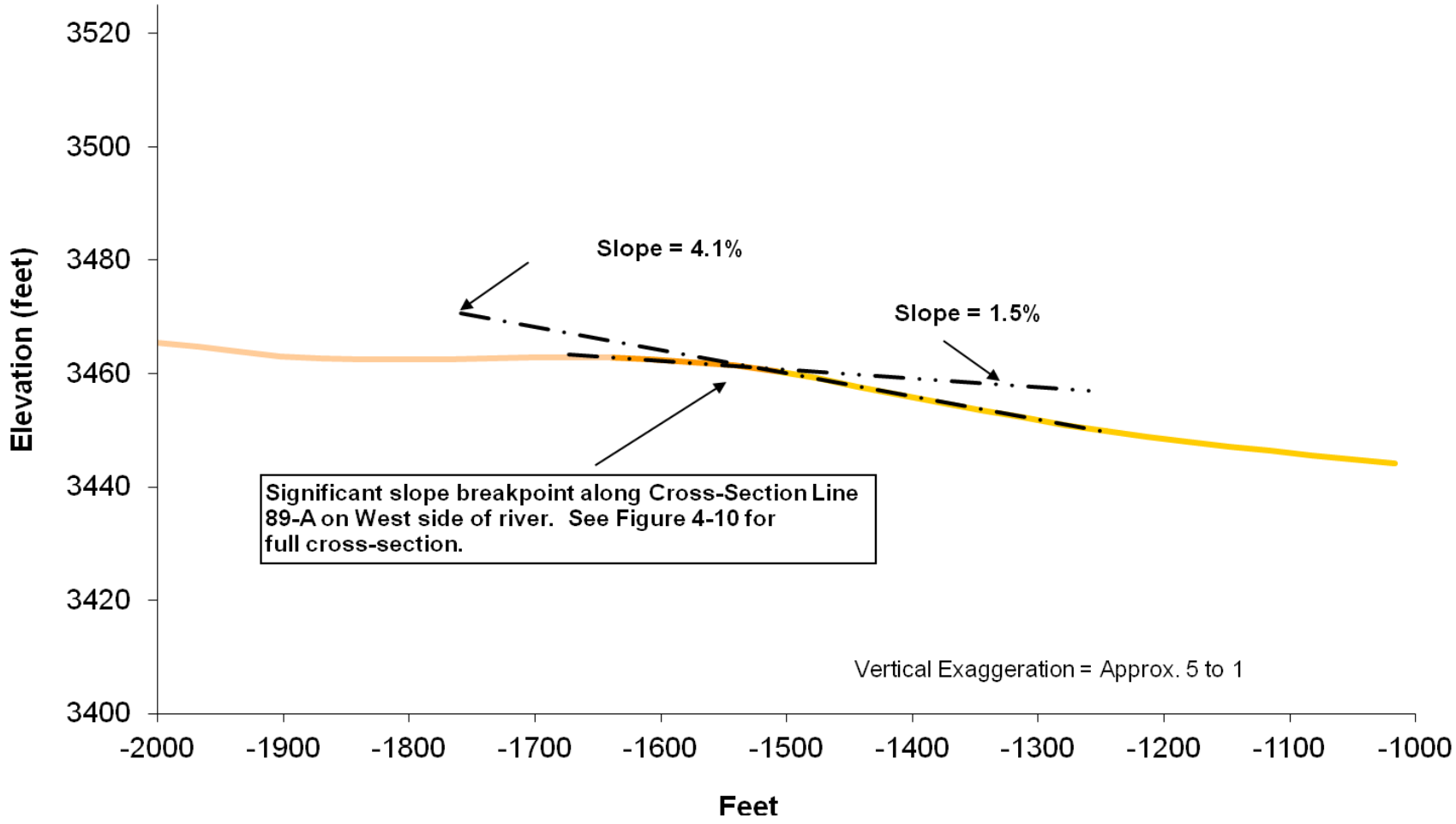
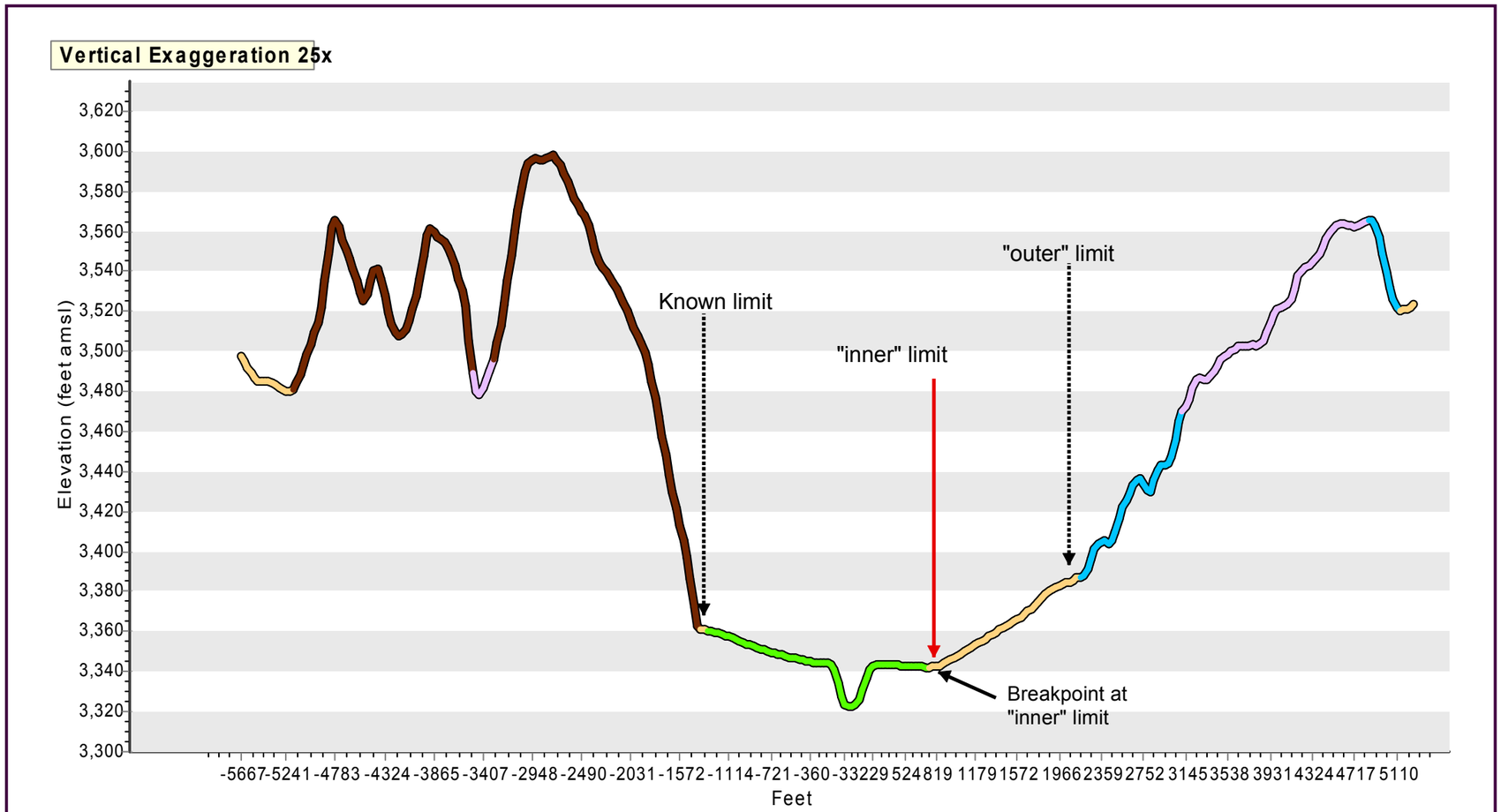
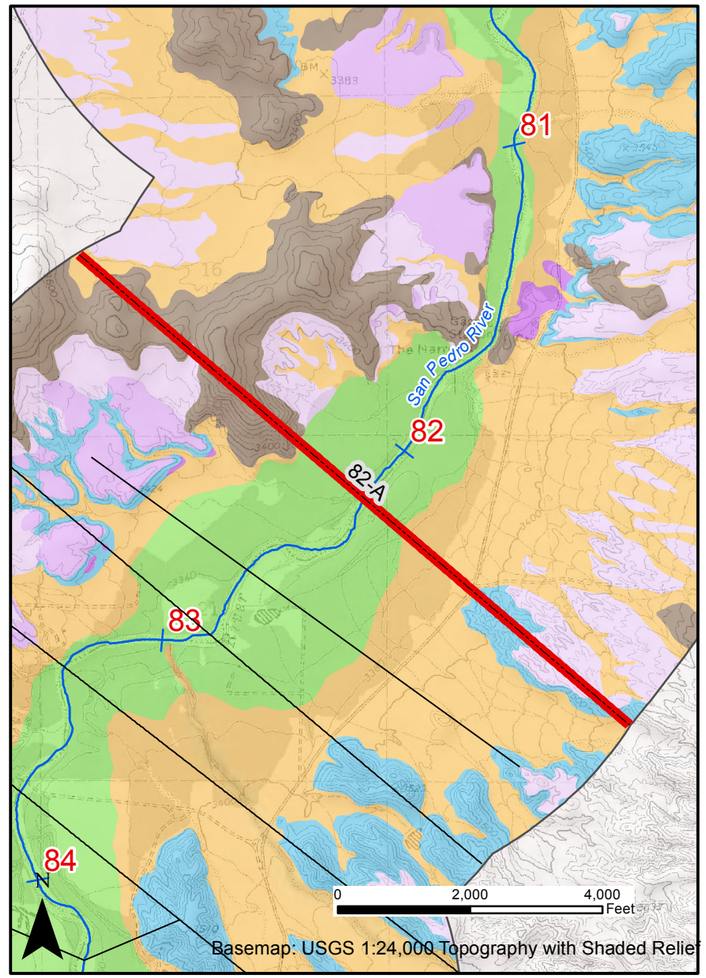
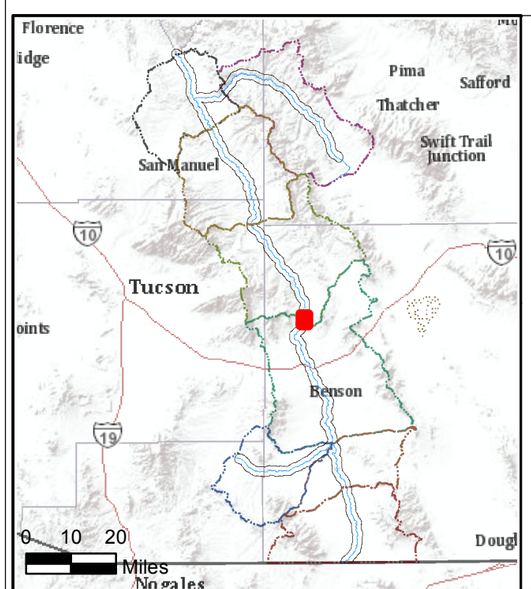
0 1,250 2,500 5,000 Feet

Figure 4-4. Significance Check of Observed Slope Breakpoint for Preliminary Analysis of Sample Subarea









Legend

- Cross Section
- San Pedro River
- Project Area Mapped by AZGS (2009)

Age and Naming Conventions for Surficial Geologic Units

Holocene	Pleistocene
Holocene River Alluvium	Late Pleistocene River Alluvium
Holocene Piedmont Alluvium	Older Pleistocene River Alluvium
Other Holocene Deposits	Pleistocene Piedmont Alluvium

Tertiary Deposits | Bedrock | Disturbed

Figure 4-5
Cross-Section 82-A
for Preliminary Analysis
In Sample Subarea

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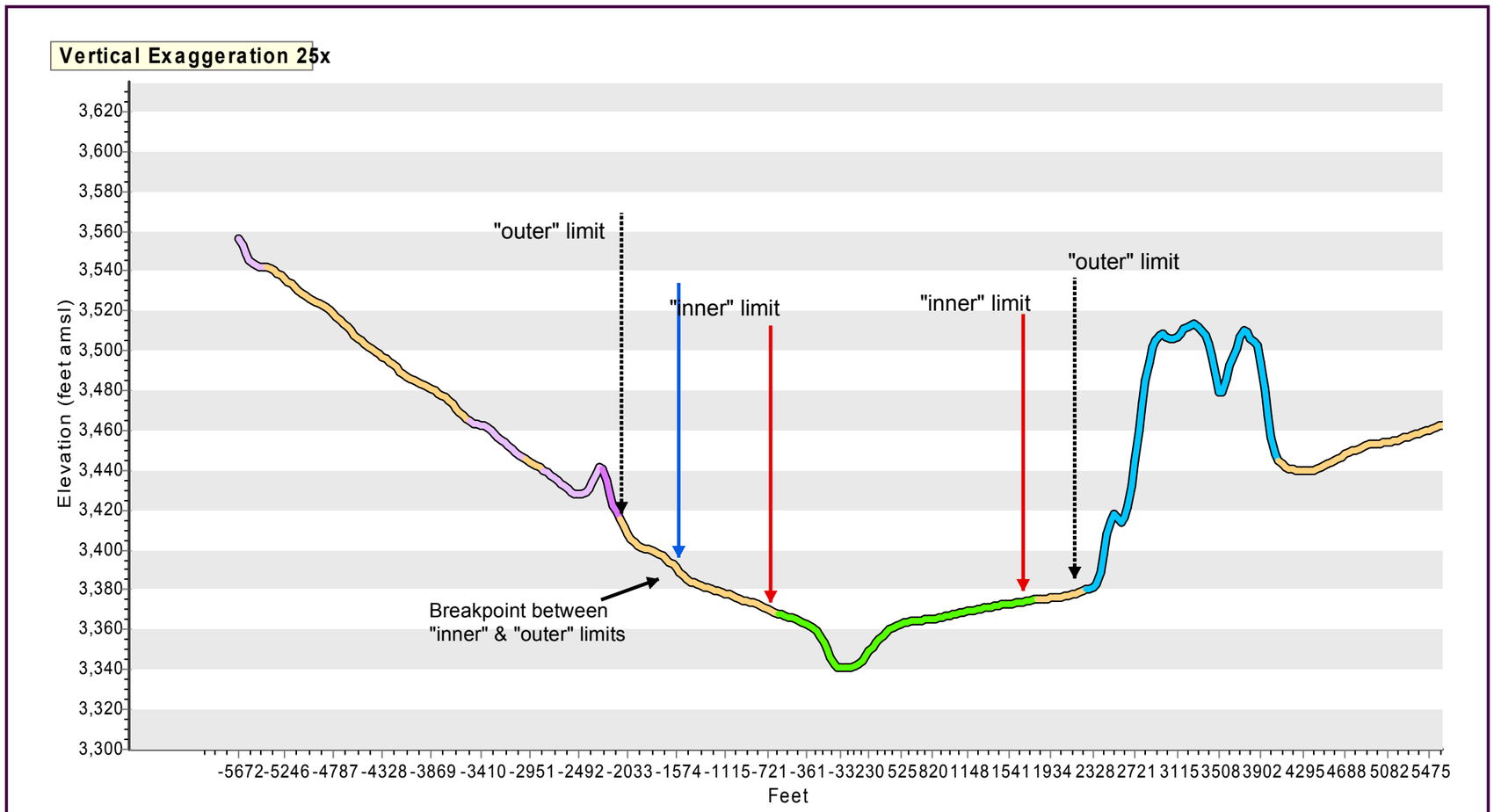

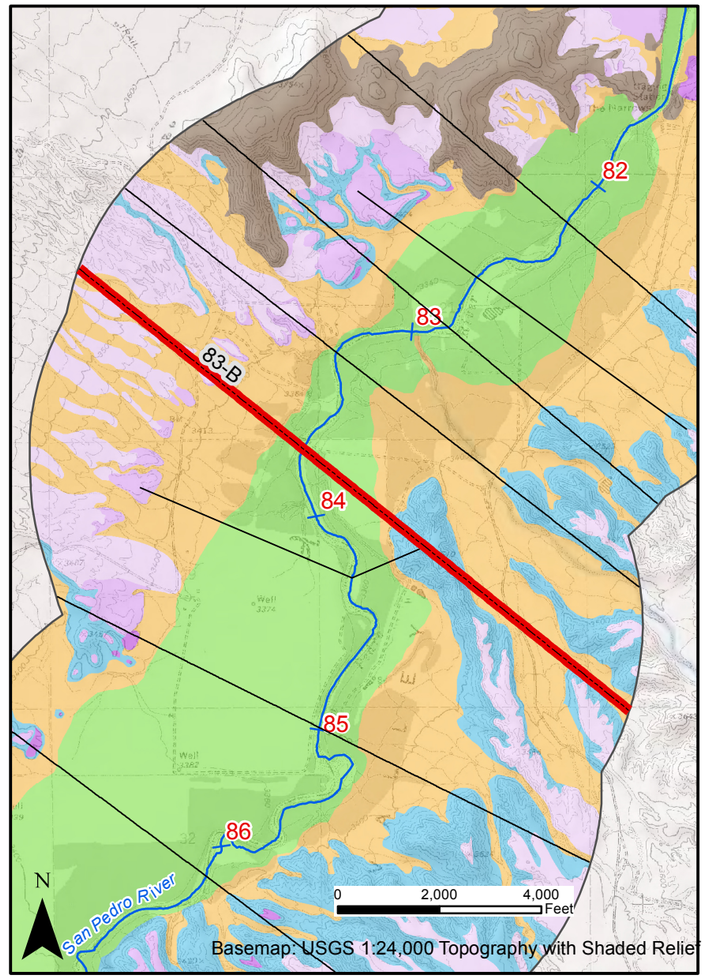

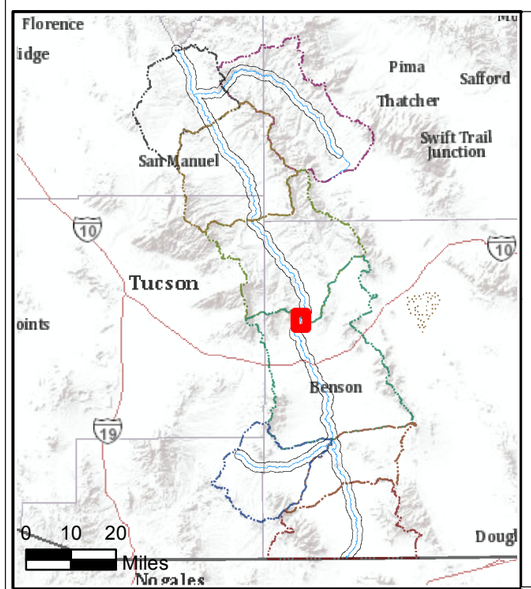

Legend

- Cross Section
- San Pedro River
- Project Area Mapped by AZGS (2009)

Age and Naming Conventions for Surficial Geologic Units

Holocene	Pleistocene
Holocene River Alluvium	Late Pleistocene River Alluvium
Holocene Piedmont Alluvium	Older Pleistocene River Alluvium
Other Holocene Deposits	Pleistocene Piedmont Alluvium

Tertiary Deposits | Bedrock | Disturbed

Figure 4-6
Cross-Section 83-B
for Preliminary Analysis
In Sample Subarea

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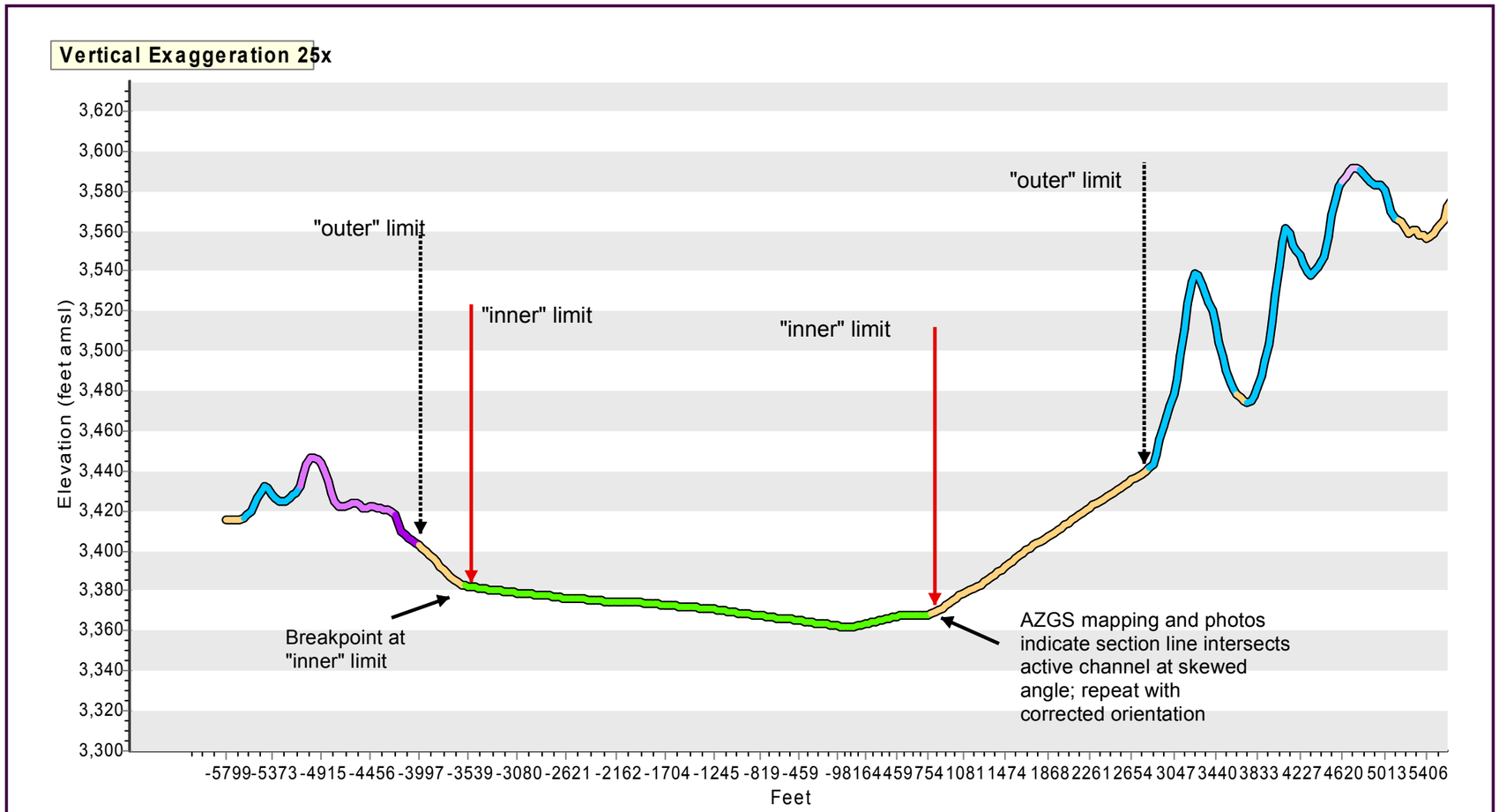

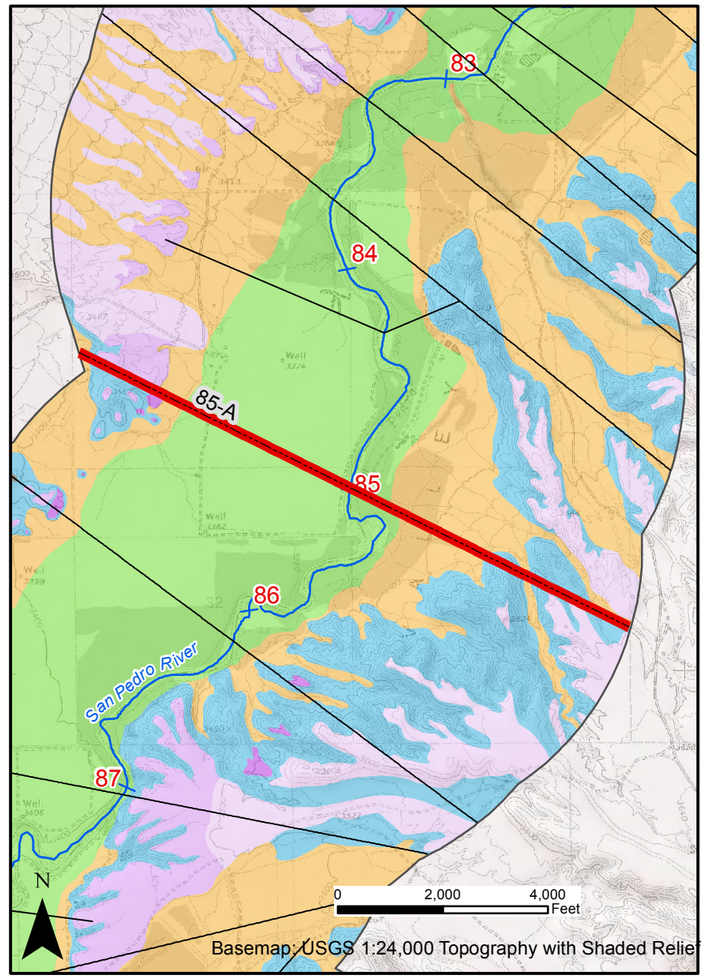

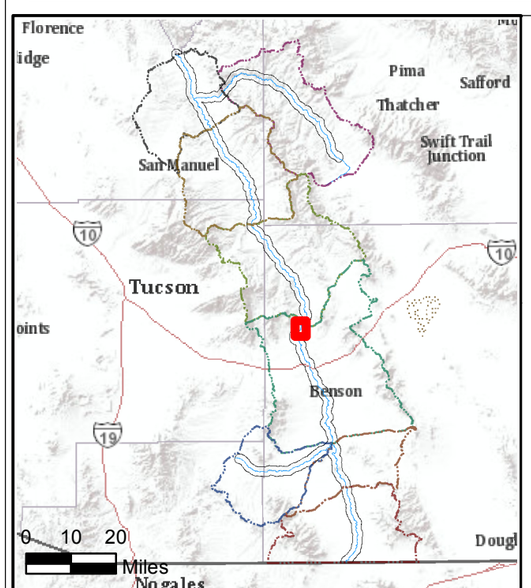

Legend

- Cross Section
- San Pedro River
- Project Area Mapped by AZGS (2009)

Age and Naming Conventions for Surficial Geologic Units

Holocene	Pleistocene
Holocene River Alluvium	Late Pleistocene River Alluvium
Holocene Piedmont Alluvium	Older Pleistocene River Alluvium
Other Holocene Deposits	Pleistocene Piedmont Alluvium

Tertiary Deposits | Bedrock | Disturbed

Figure 4-7
Cross-Section 85-A
for Preliminary Analysis
In Sample Subarea

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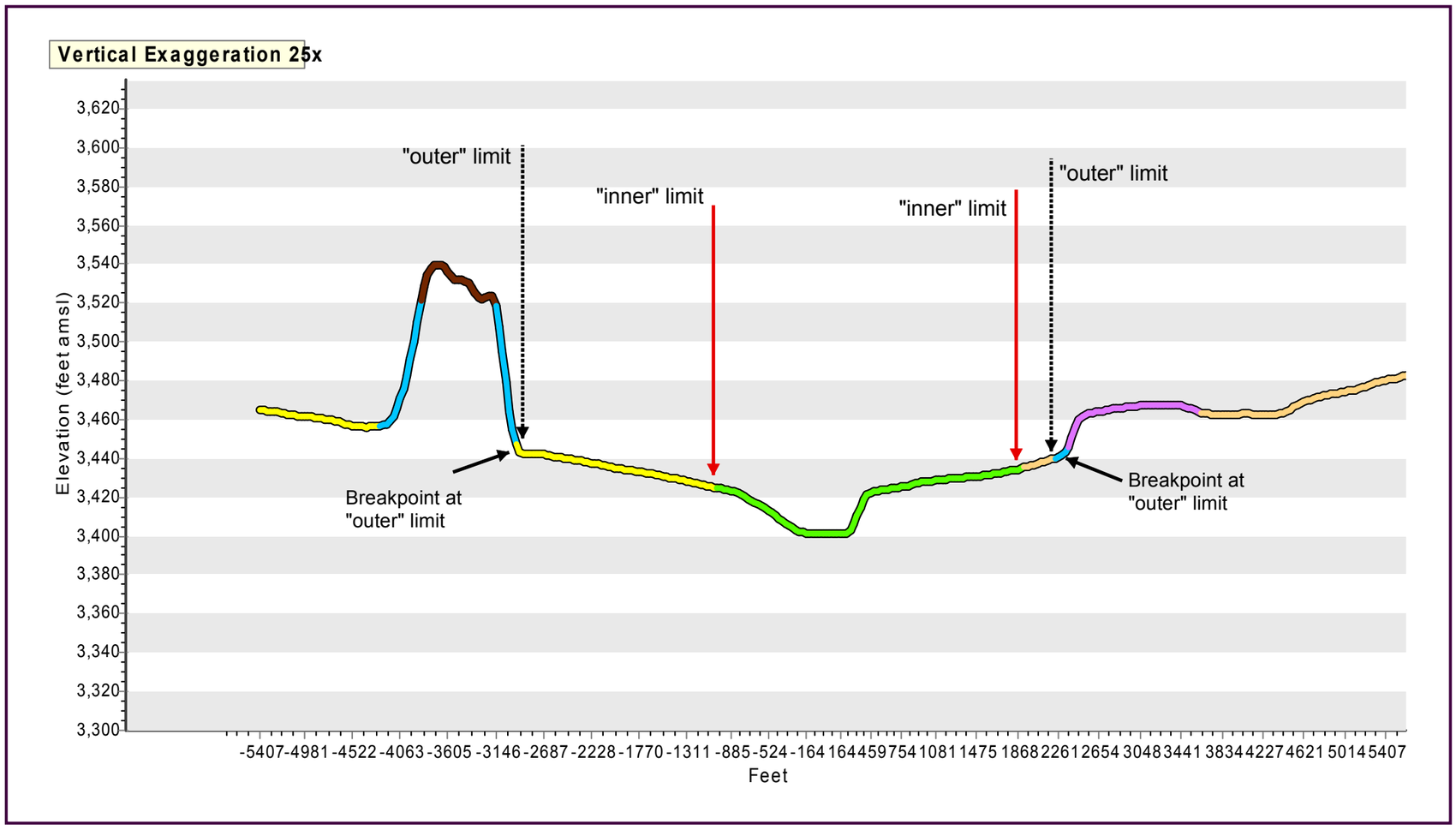

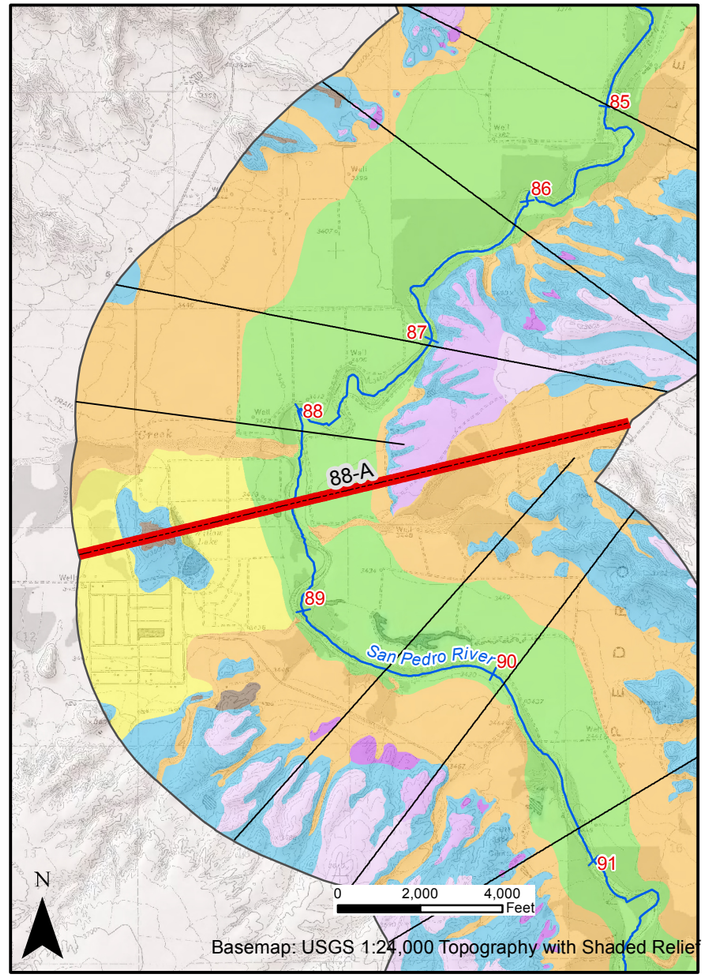

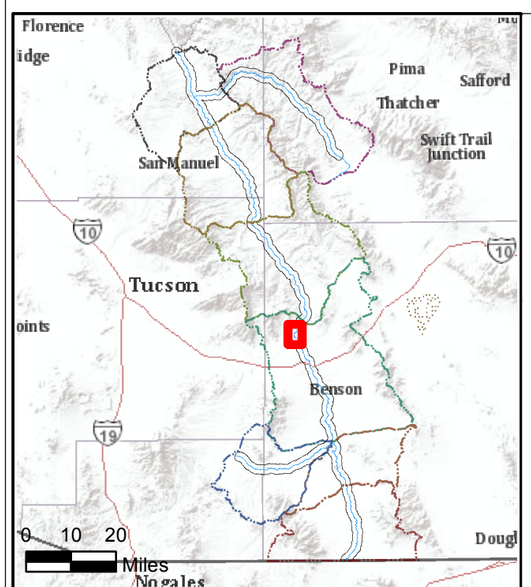

Legend

- Cross Section
- San Pedro River
- Project Area Mapped by AZGS (2009)

Age and Naming Conventions for Surficial Geologic Units

Holocene	Pleistocene
Holocene River Alluvium	Late Pleistocene River Alluvium
Holocene Piedmont Alluvium	Older Pleistocene River Alluvium
Other Holocene Deposits	Pleistocene Piedmont Alluvium

Tertiary Deposits | Bedrock | Disturbed

Figure 4-8
Cross-Section 88-A
for Preliminary Analysis
In Sample Subarea

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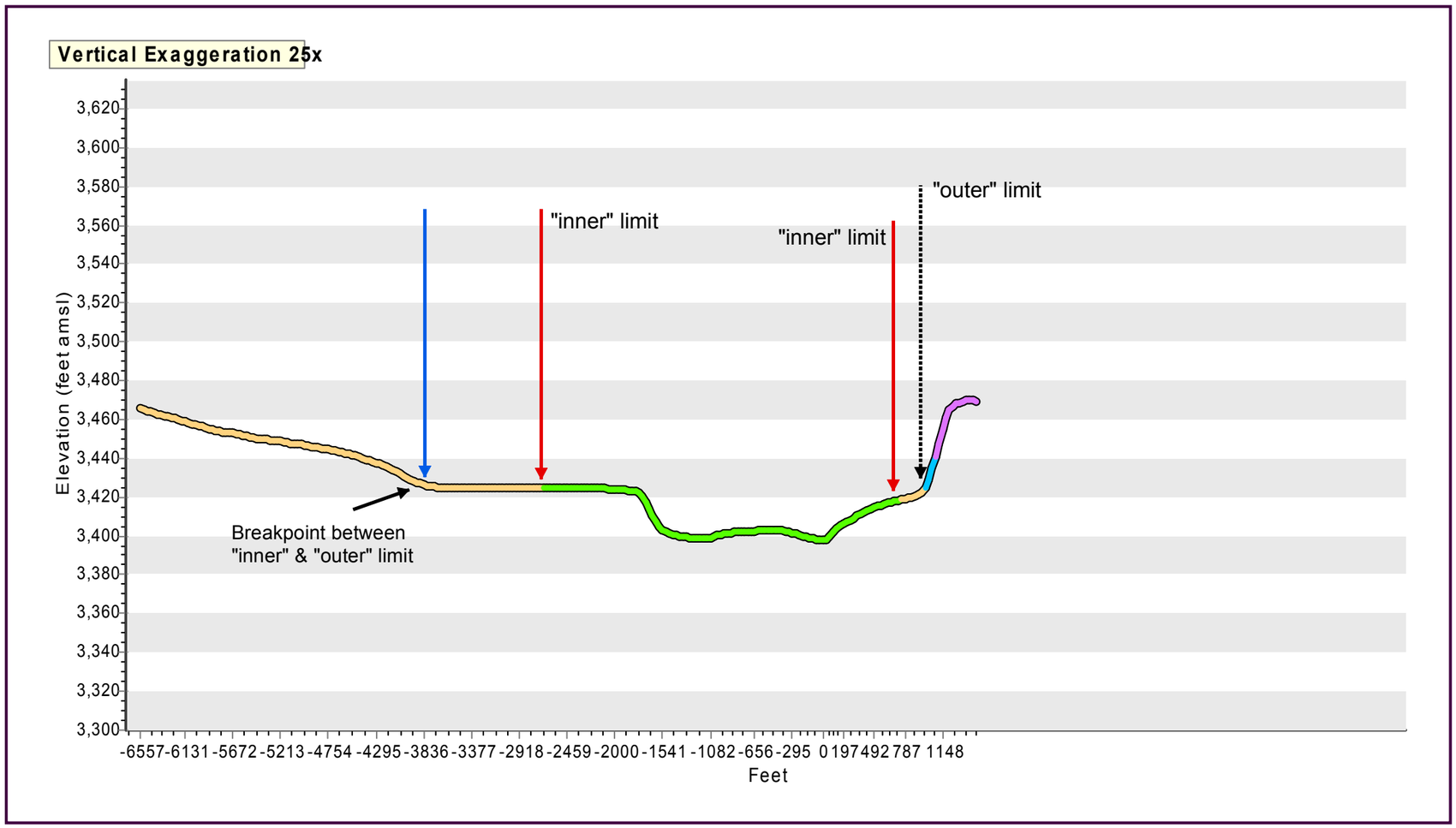

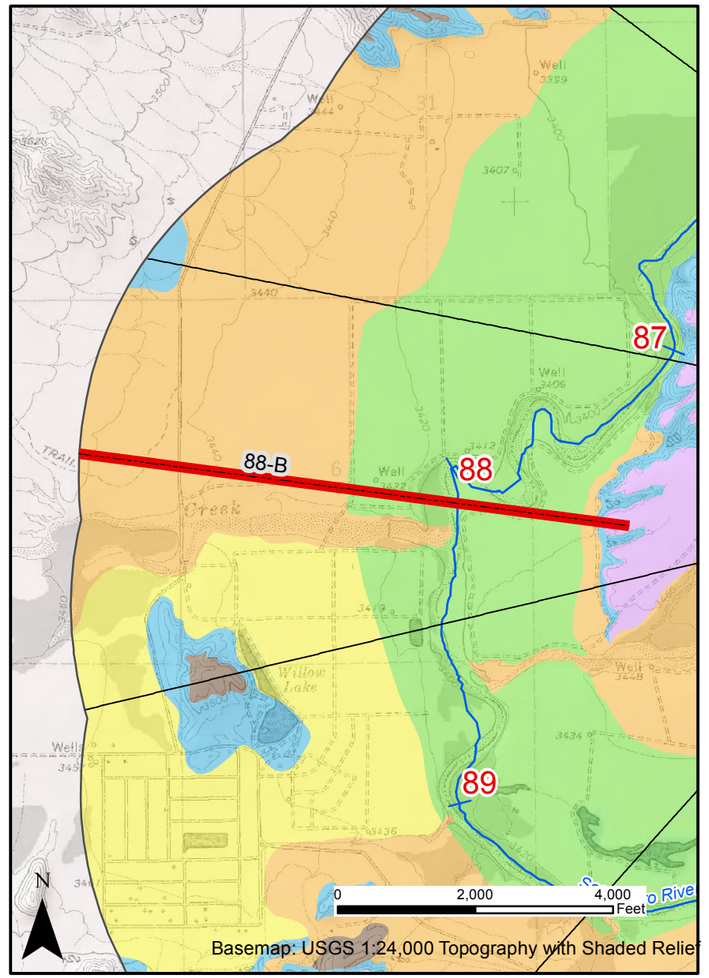

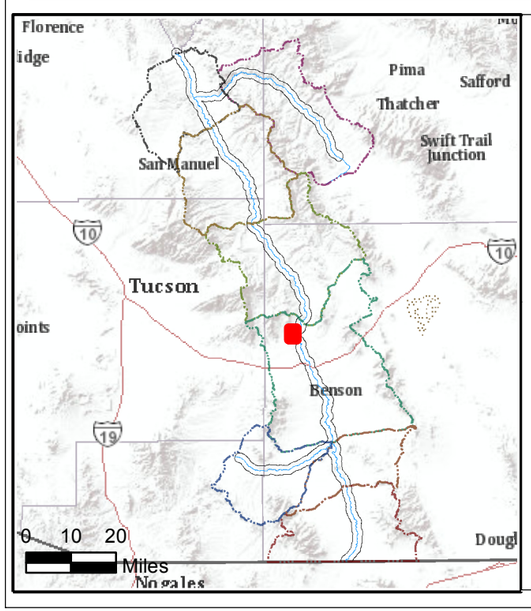

Legend

- Cross Section
- San Pedro River
- Project Area Mapped by AZGS (2009)

Age and Naming Conventions for Surficial Geologic Units

Holocene	Pleistocene
Holocene River Alluvium	Late Pleistocene River Alluvium
Holocene Piedmont Alluvium	Older Pleistocene River Alluvium
Other Holocene Deposits	Pleistocene Piedmont Alluvium

Tertiary Deposits | Bedrock | Disturbed

Figure 4-9
Cross-Section 88-B
for Preliminary Analysis
In Sample Subarea

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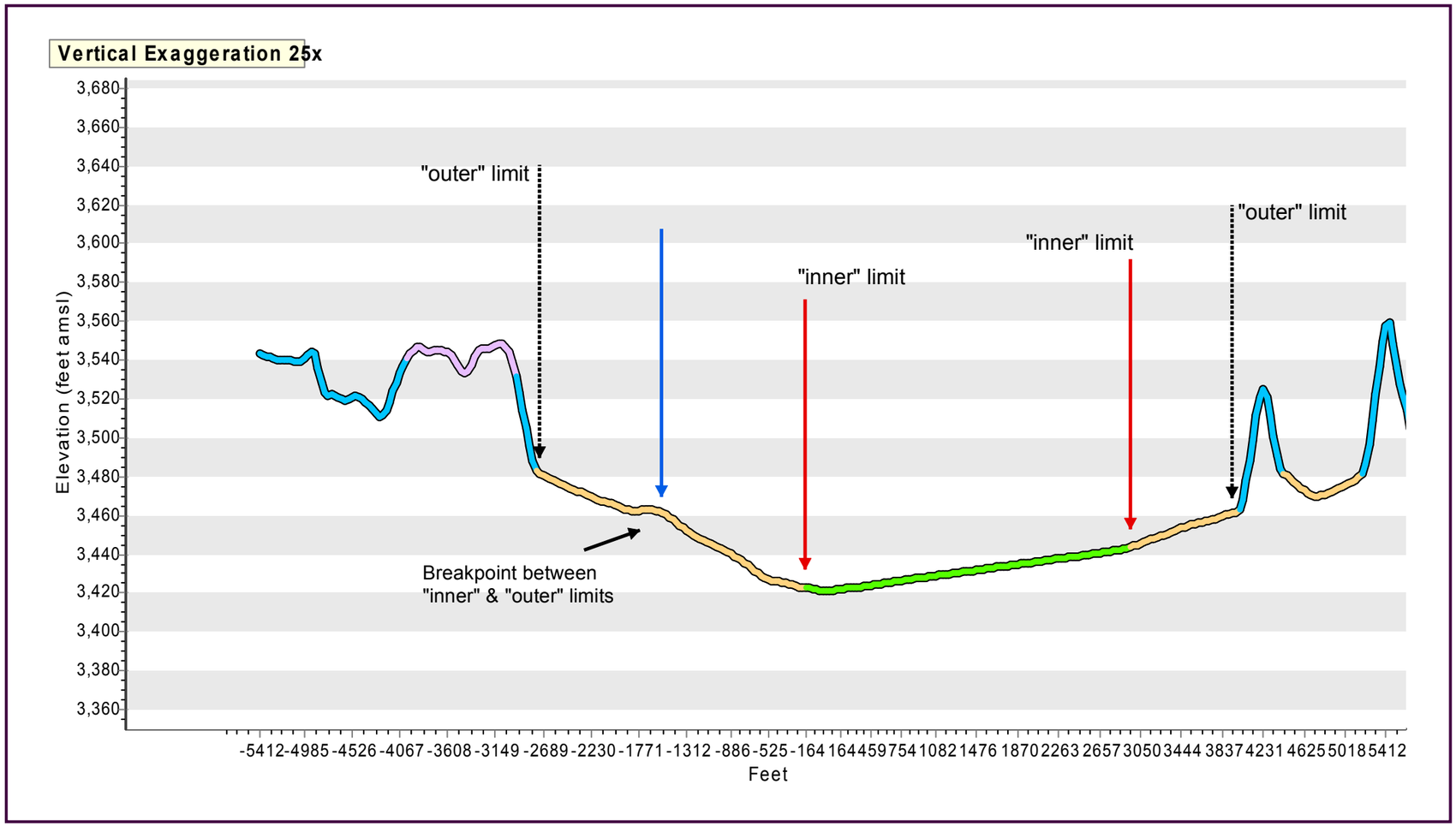

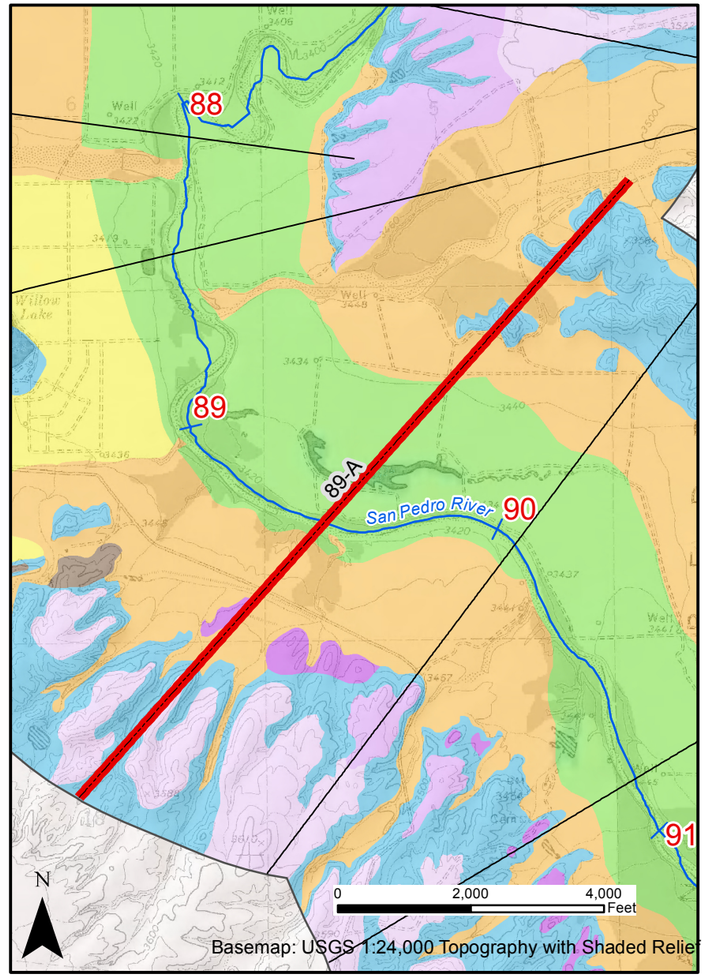

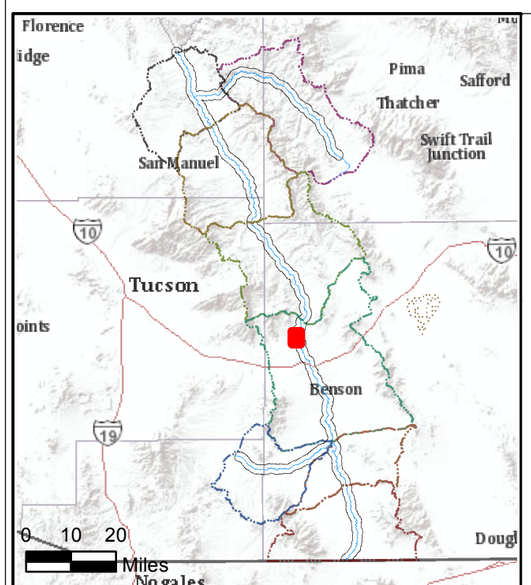

Legend

- Cross Section
- San Pedro River
- Project Area Mapped by AZGS (2009)

Age and Naming Conventions for Surficial Geologic Units

Holocene	Pleistocene
Holocene River Alluvium	Late Pleistocene River Alluvium
Holocene Piedmont Alluvium	Older Pleistocene River Alluvium
Other Holocene Deposits	Pleistocene Piedmont Alluvium

Tertiary Deposits | Bedrock | Disturbed

Figure 4-10
Cross-Section 89-A
for Preliminary Analysis
In Sample Subarea

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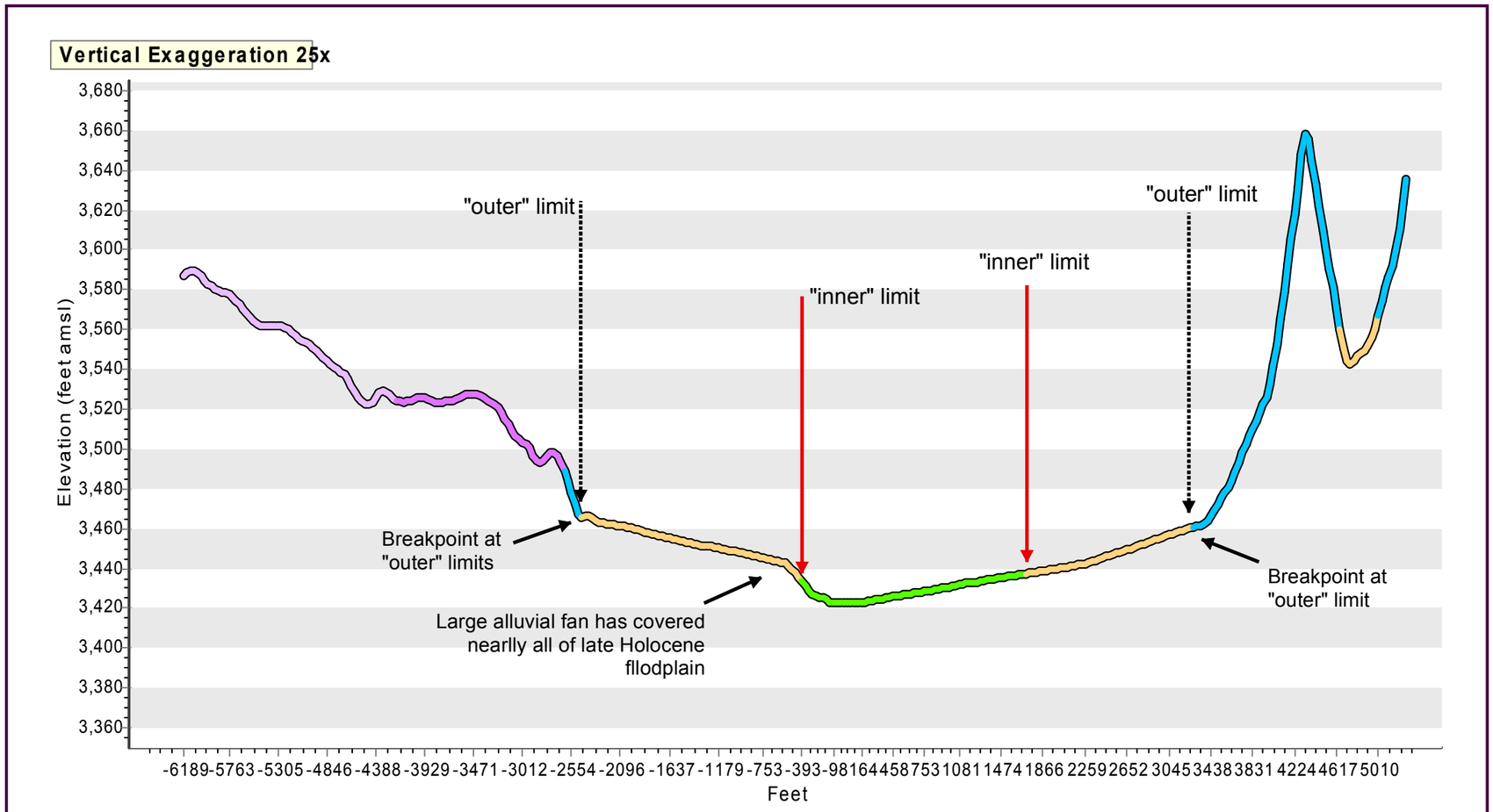

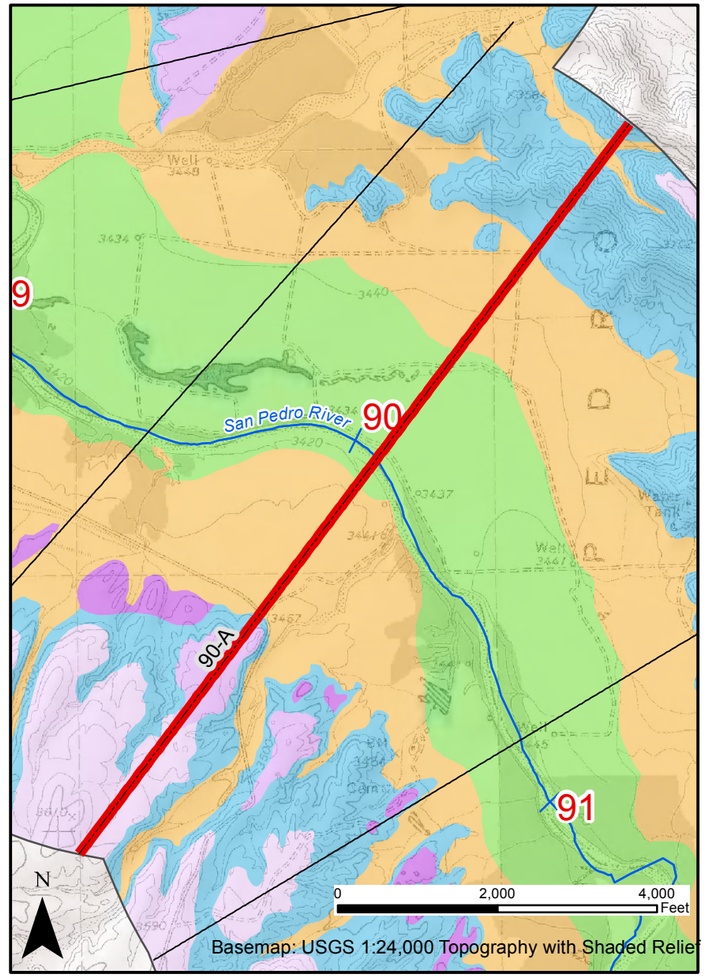

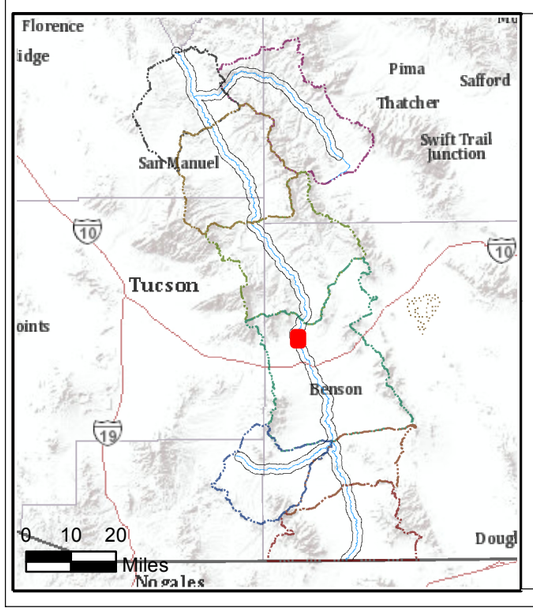

Legend

- Cross Section
- San Pedro River
- Project Area Mapped by AZGS (2009)

Age and Naming Conventions for Surficial Geologic Units

Holocene	Pleistocene
Holocene River Alluvium	Late Pleistocene River Alluvium
Holocene Piedmont Alluvium	Older Pleistocene River Alluvium
Other Holocene Deposits	Pleistocene Piedmont Alluvium

Tertiary Deposits | Bedrock | Disturbed

Figure 4-11
Cross-Section 90-A
for Preliminary Analysis
In Sample Subarea

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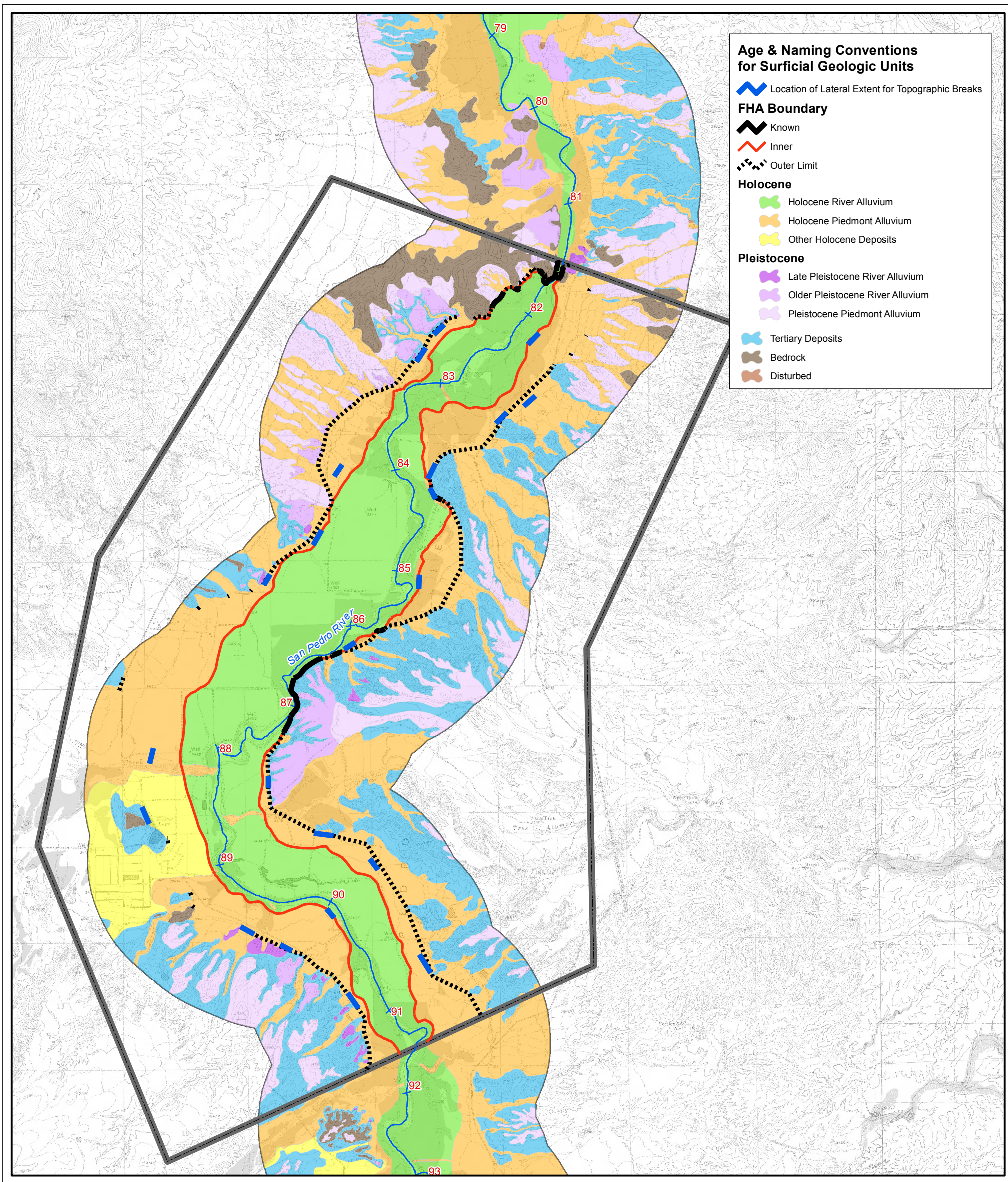

Legend

San Pedro River

Project Area Mapped by AZGS (2009)

San Pedro River Subwatersheds

SUB_WTRSHD_NAME

- Aravaipa
- Benson
- Redington
- Sierra Vista
- Winkleman

N

Base Map: USGS 1:24,000 Topographic Map with Shaded Relief

Figure 4-12a
Lateral Extent of the First SignificantTopographic Feature for Preliminary Analysis in Sample Subarea

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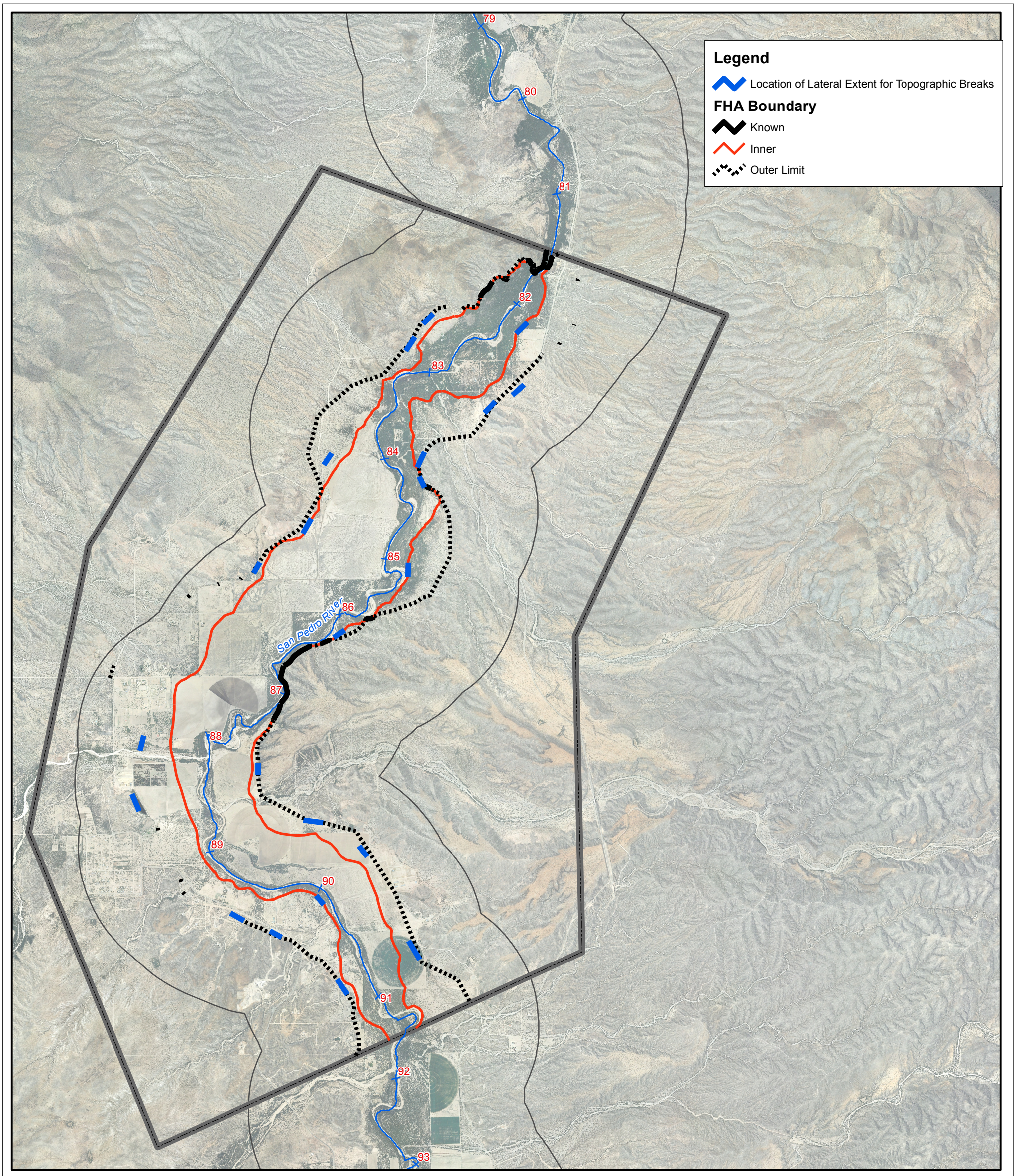
0 1,250 2,500 5,000 Feet



Legend

San Pedro River

Project Area Mapped by AZGS (2009)

San Pedro River Subwatersheds

SUB_WTRSHD_NAME

Aravaipa

Benson

Redington

Sierra Vista

Winkleman

N

Base Map: USGS 1:24,000 Topographic Map with Shaded Relief

Figure 4-12b
Lateral Extent of the First SignificantTopographic Feature for Preliminary Analysis in Sample Subarea Plotted on Aerial Imagery

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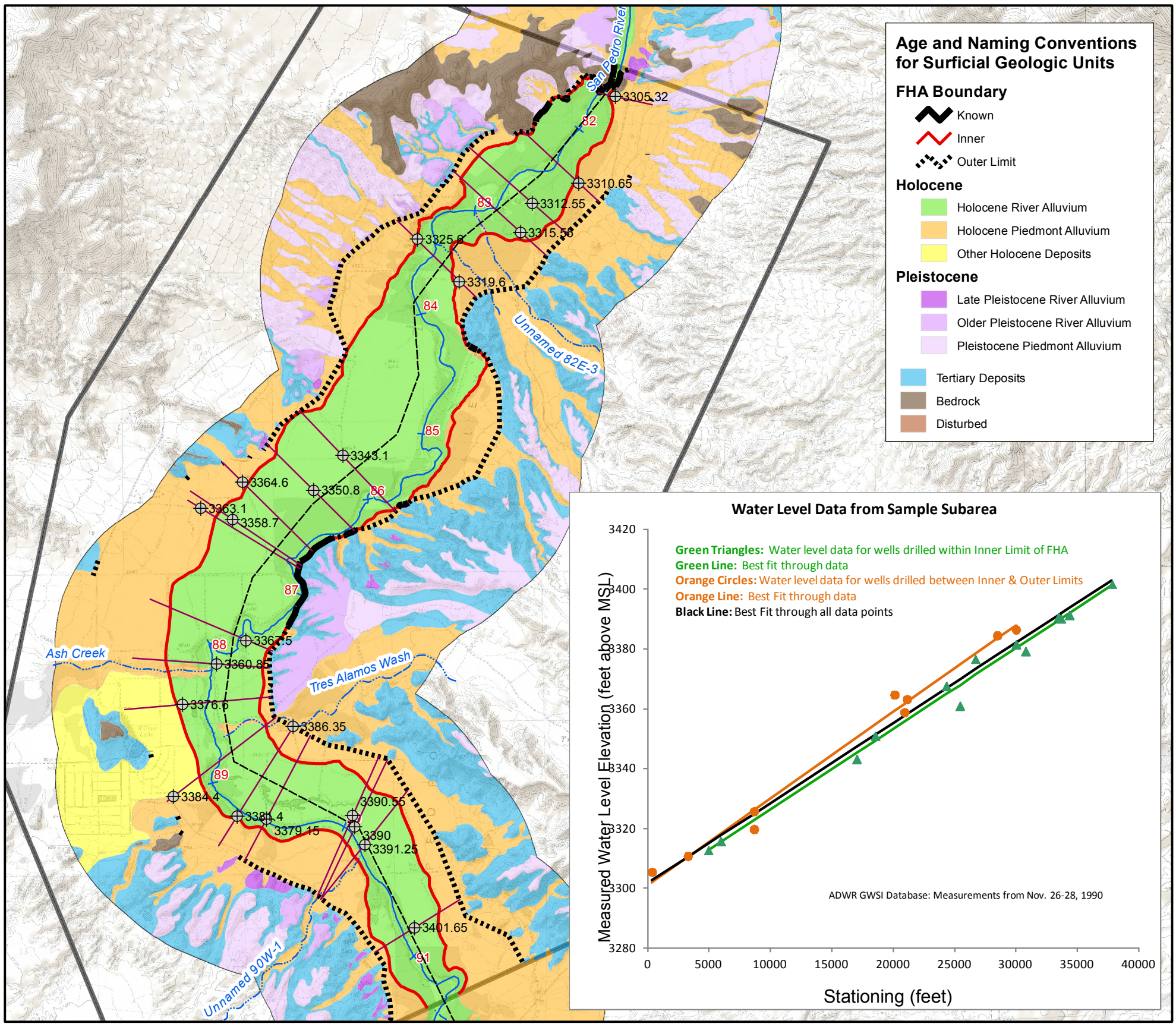
0 1,250 2,500 5,000 Feet



Wells Within FHA Inner Limit		
STA (X)	WL_elev (Y)	Suffface Geologic Unit
4967	3312.55	Holocene River Alluvium
5995	3315.55	Holocene River Alluvium
17035	3343.1	Holocene River Alluvium
18576	3350.8	Holocene River Alluvium
24372	3367.5	Holocene River Alluvium
25445	3360.85	Holocene River Alluvium
26724	3376.6	Holocene River Alluvium
30035	3381.4	Holocene River Alluvium
30814	3379.15	Holocene River Alluvium
33491	3390.55	Holocene River Alluvium
33708	3390	Holocene River Alluvium
34401	3391.25	Holocene River Alluvium
37863	3401.65	Holocene River Alluvium

Regression Results	
Slope	0.0027 +/- 8.4 x 10-5
Intercept	3299.1 +/- 2.3

Regression Statistics	
Model Fit	98.9%
Sample Size	13

Wells Between Inner & Outer Limits		
STA (X)	WL_elev (Y)	Suffface Geologic Unit
377	3305.32	Holocene Piedmont Alluvium
3301	3310.65	Holocene Piedmont Alluvium
8693	3319.6	Holocene Piedmont Alluvium
8693	3325.6	Holocene Piedmont Alluvium
20135	3364.6	Holocene Piedmont Alluvium
20942	3358.7	Holocene Piedmont Alluvium
21150	3363.1	Holocene Piedmont Alluvium
28504	3384.4	Other Holocene Sediments
30035	3386.35	Holocene Piedmont Alluvium

Regression Results	
Slope	0.0029 +/- 1.2 x 10-4
Intercept	3300.8 +/- 2.3

Regression Statistics	
Model Fit	98.6%
Sample Size	9

All Wells	
Regression Results	
Slope	0.0027 +/- 8.1 x 10^{-5}
Intercept	3301.5 +/- 1.9

Regression Statistics	
Model Fit	98.1%
Sample Size	22

N

0 2,000 4,000 8,000 Feet

Base Map: From USGS 1:24000 Topographic Map with Shaded Relief

Legend

- San Pedro River
- Significant San Pedro River Tributary
- Project Area Mapped by AZGS (2009)
- Approximated Center-Line For Subflow
- Stationing Lines
- ⊕3379.1: Water Level Elevation in feet above MSL from wells measured in 1990 and used here

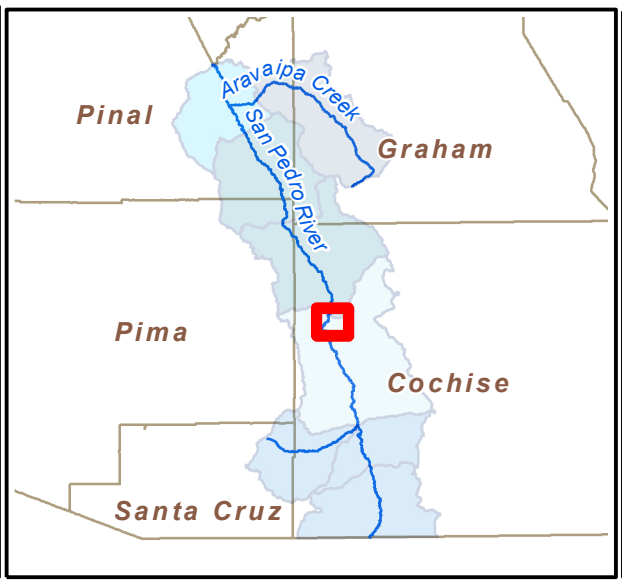


Figure 4-13a
Preliminary Water Level Analysis in Sample Subarea

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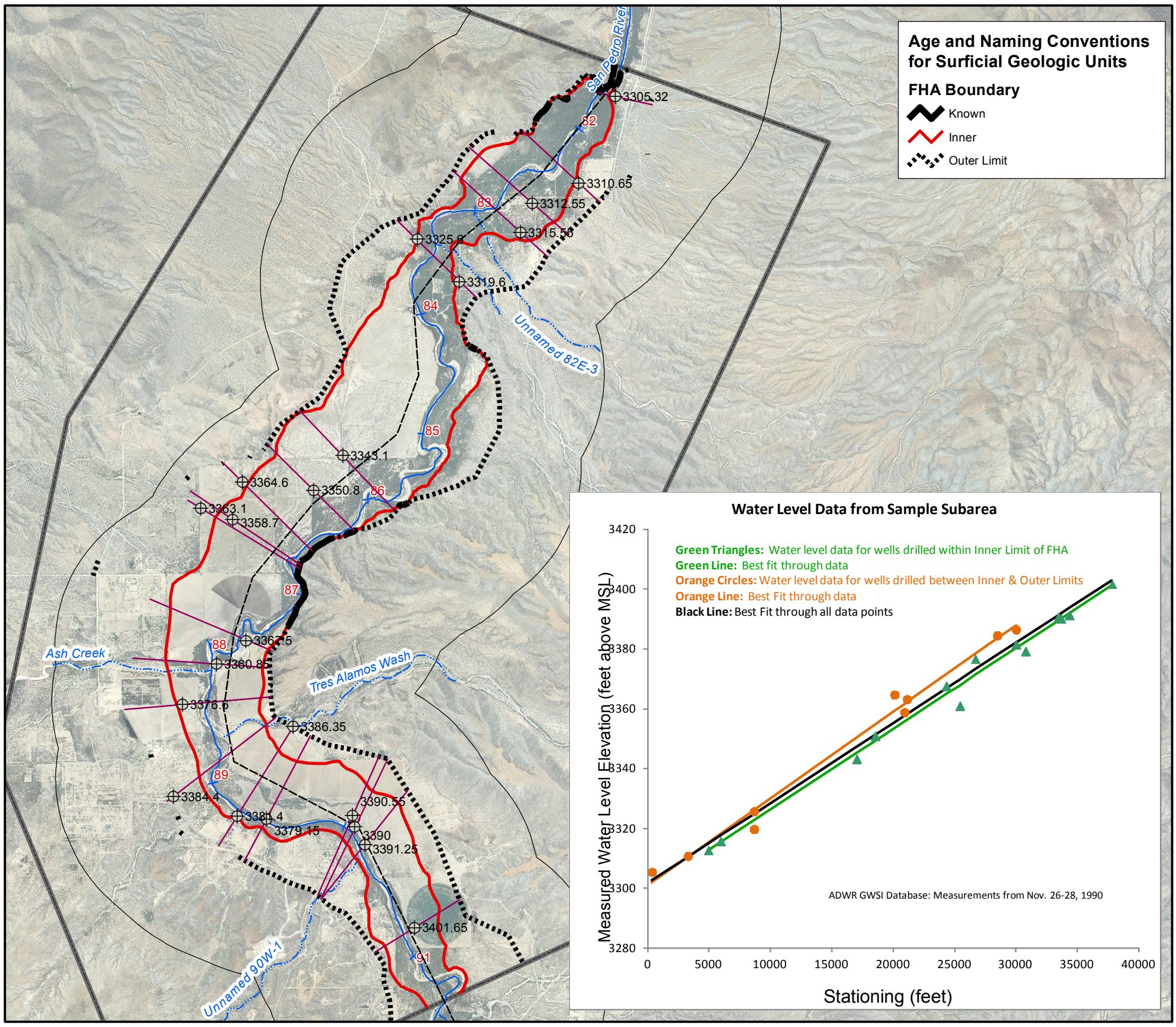

Wells Within FHA Inner Limit		
STA (X)	WL_elev (Y)	Sufface Geologic Unit
4967	3312.55	Holocene River Alluvium
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17035	3343.1	Holocene River Alluvium
18576	3350.8	Holocene River Alluvium
24372	3367.5	Holocene River Alluvium
25445	3360.85	Holocene River Alluvium
26724	3376.6	Holocene River Alluvium
30035	3381.4	Holocene River Alluvium
30814	3379.15	Holocene River Alluvium
33491	3390.55	Holocene River Alluvium
33708	3390	Holocene River Alluvium
34401	3391.25	Holocene River Alluvium
37863	3401.65	Holocene River Alluvium

Regression Results	
Slope	0.0027 +/- 8.4 x 10-5
Intercept	3299.1 +/- 2.3

Regression Statistics	
Model Fit	98.9%
Sample Size	13

Wells Between Inner & Outer Limits		
STA (X)	WL_elev (Y)	Sufface Geologic Unit
377	3305.32	Holocene Piedmont Alluvium
3301	3310.65	Holocene Piedmont Alluvium
8693	3319.6	Holocene Piedmont Alluvium
8693	3325.6	Holocene Piedmont Alluvium
20135	3364.6	Holocene Piedmont Alluvium
20942	3358.7	Holocene Piedmont Alluvium
21150	3363.1	Holocene Piedmont Alluvium
28504	3384.4	Other Holocene Sediments
30035	3386.35	Holocene Piedmont Alluvium

Regression Results	
Slope	0.0029 +/- 1.2 x 10-4
Intercept	3300.8 +/- 2.3

Regression Statistics	
Model Fit	98.6%
Sample Size	9

All Wells	
Regression Results	
Slope	0.0027 +/- 8.1 x 10^{-5}
Intercept	3301.5 +/- 1.9

Regression Statistics	
Model Fit	98.1%
Sample Size	22

N

0 2,000 4,000 8,000 Feet

Base Map: 2010 NAIP Imagery

Legend

- San Pedro River
- Significant San Pedro River Tributary
- Project Area Mapped by AZGS (2009)
- Approximated Center-Line For Subflow
- Stationing Lines

⊕3379.1: Water Level Elevation in feet above MSL from wells measured in 1990 and used here

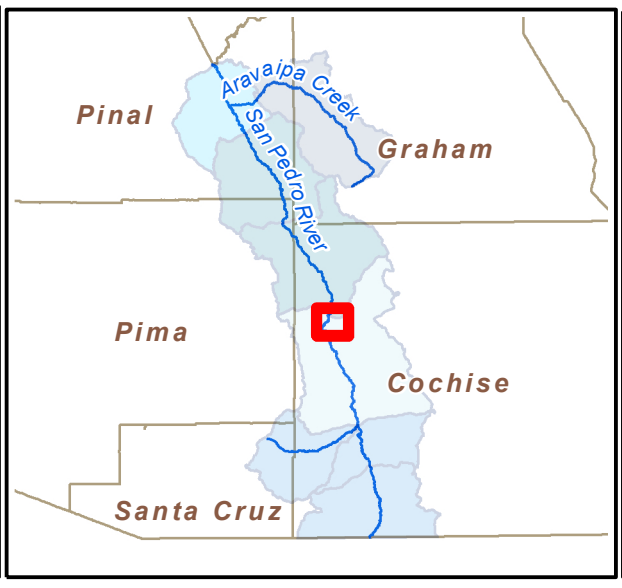

Figure 4-13b
Preliminary Water Level Analysis in Sample Subarea Plotted on Aerial Imagery

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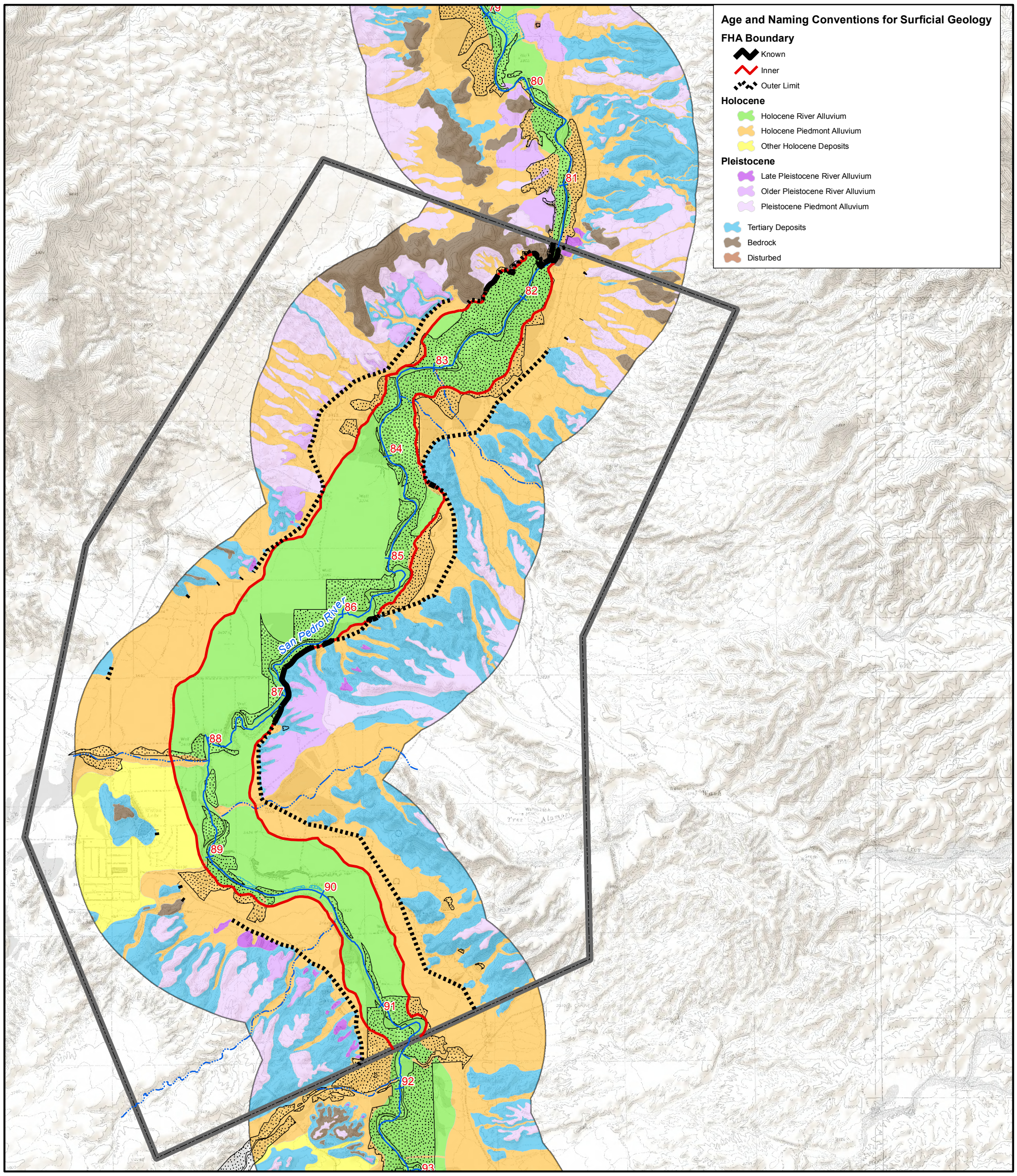

Age and Naming Conventions for Surficial Geology

FHA Boundary

- Known
- Inner
- Outer Limit

Holocene

- Holocene River Alluvium
- Holocene Piedmont Alluvium
- Other Holocene Deposits

Pleistocene

- Late Pleistocene River Alluvium
- Older Pleistocene River Alluvium
- Pleistocene Piedmont Alluvium

- Tertiary Deposits
- Bedrock
- Disturbed

Legend

- San Pedro River
- Project Area Mapped by AZGS (2009)

USFW Riparian Groupings

- Cottonwood-Willow
- Mesquite-Salt Cedar

San Pedro River Subwatersheds

- Aravaipa
- Benson
- Redington
- Sierra Vista
- Winkleman

N

Base Map: USGS 1:24,000 Topographic Map with Shaded Relief

Figure 4-14a
Preliminary Riparian Analysis For Sample Subarea

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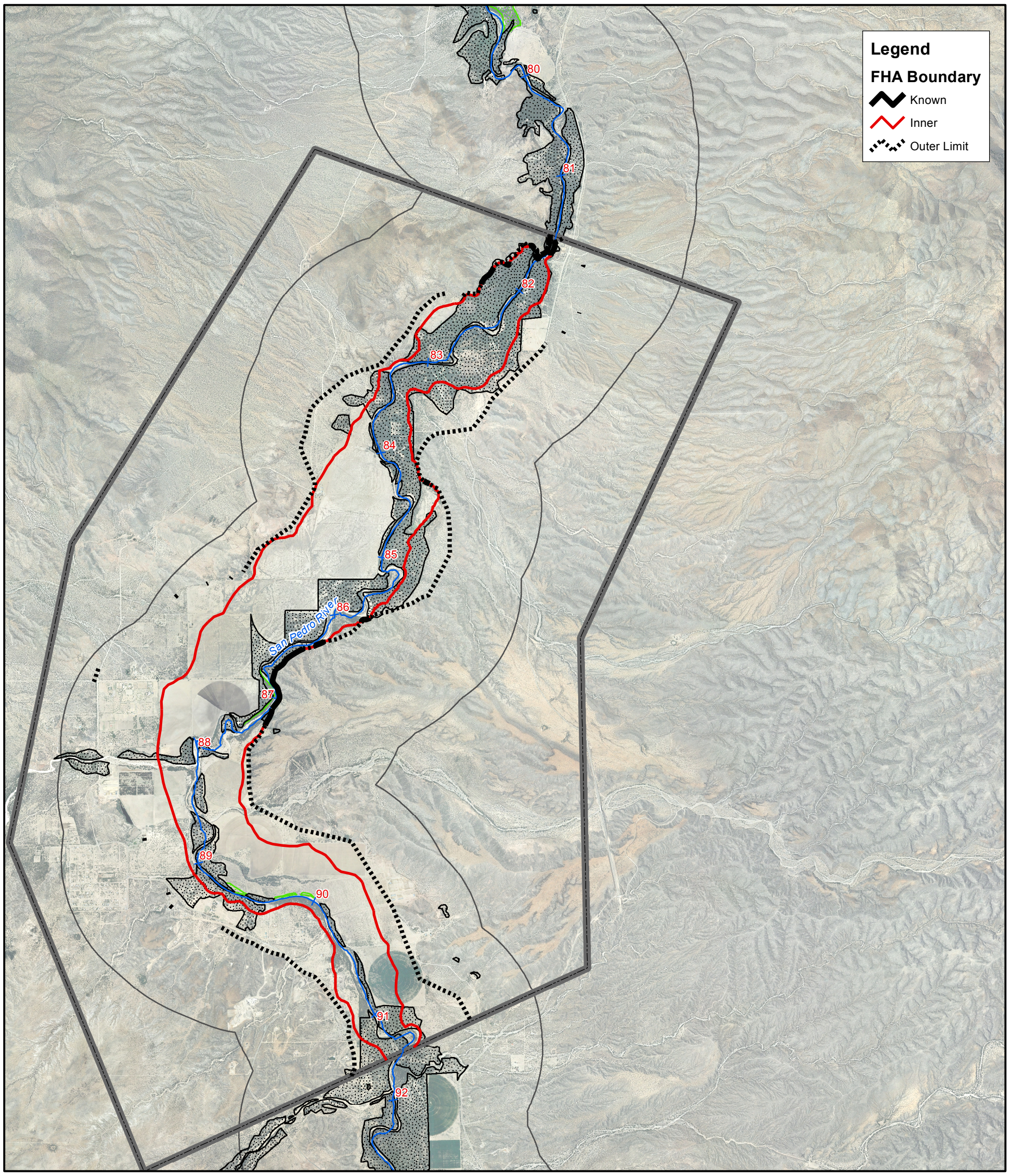
0 2,500 5,000 Feet



Legend

San Pedro River

Project Area Mapped by AZGS (2009)

USFW Riparian Gropings

Cottonwood-Willow

Mesquite-Salt Cedar

San Pedro River Subwatersheds

Aravaipa

Benson

Redington

Sierra Vista

Winkleman

N

Base Map: USGS 1:24,000 Topographic Map with Shaded Relief

Figure 4-14b
Preliminary Riparian Analysis For Sample Subarea Plotted on Aerial Imagery

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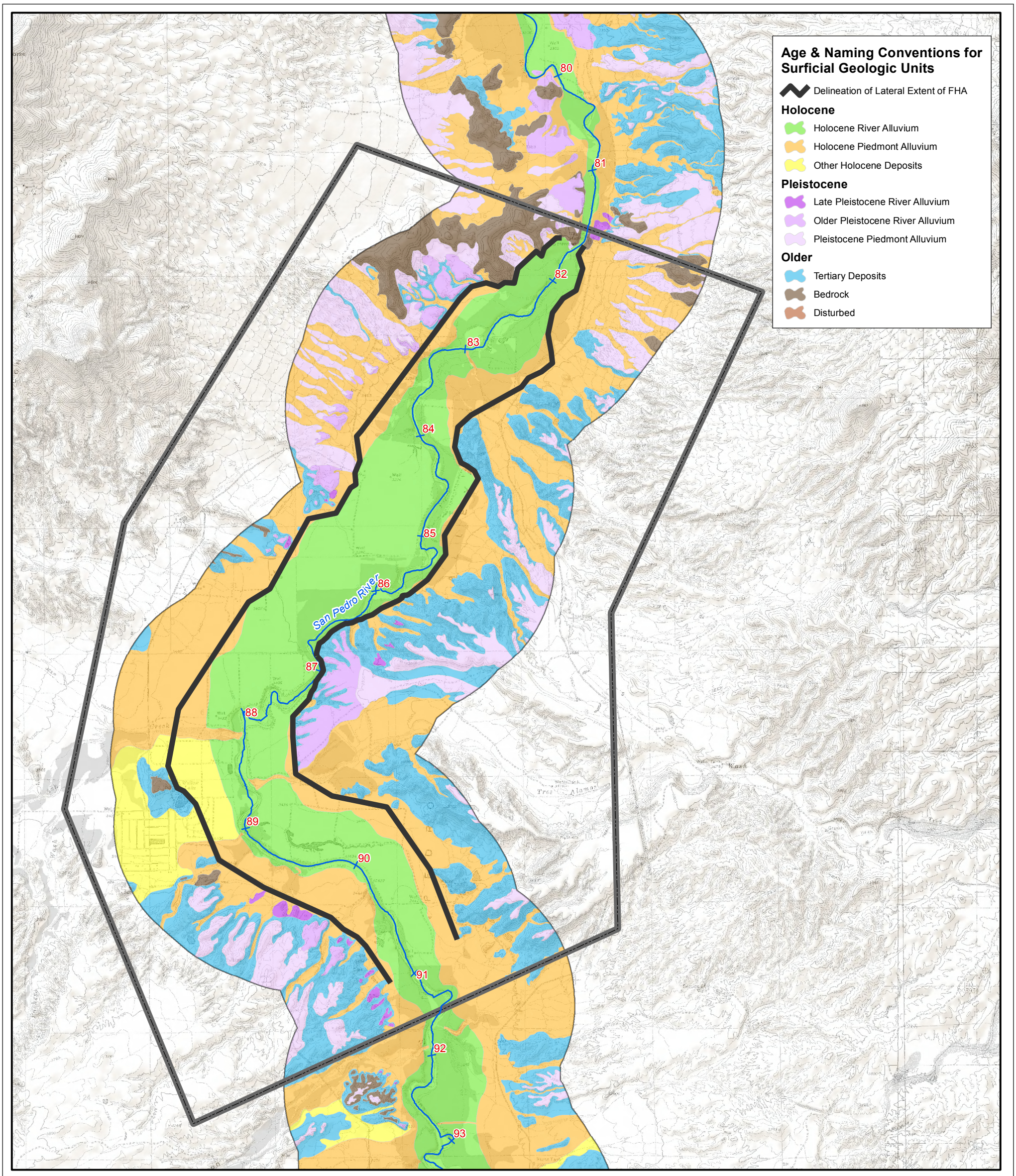
0 2,500 5,000 Feet



Legend

San Pedro River

Project Area Mapped by AZGS (2009)

San Pedro River Subwatersheds

Aravaipa

Benson

Redington

Sierra Vista

Winkleman

N

Base Map: USGS 1:24,000 Topographic Map with Shaded Relief

Figure 4-15a
Lateral Extent of FHA for Preliminary Analysis in Sample Subarea

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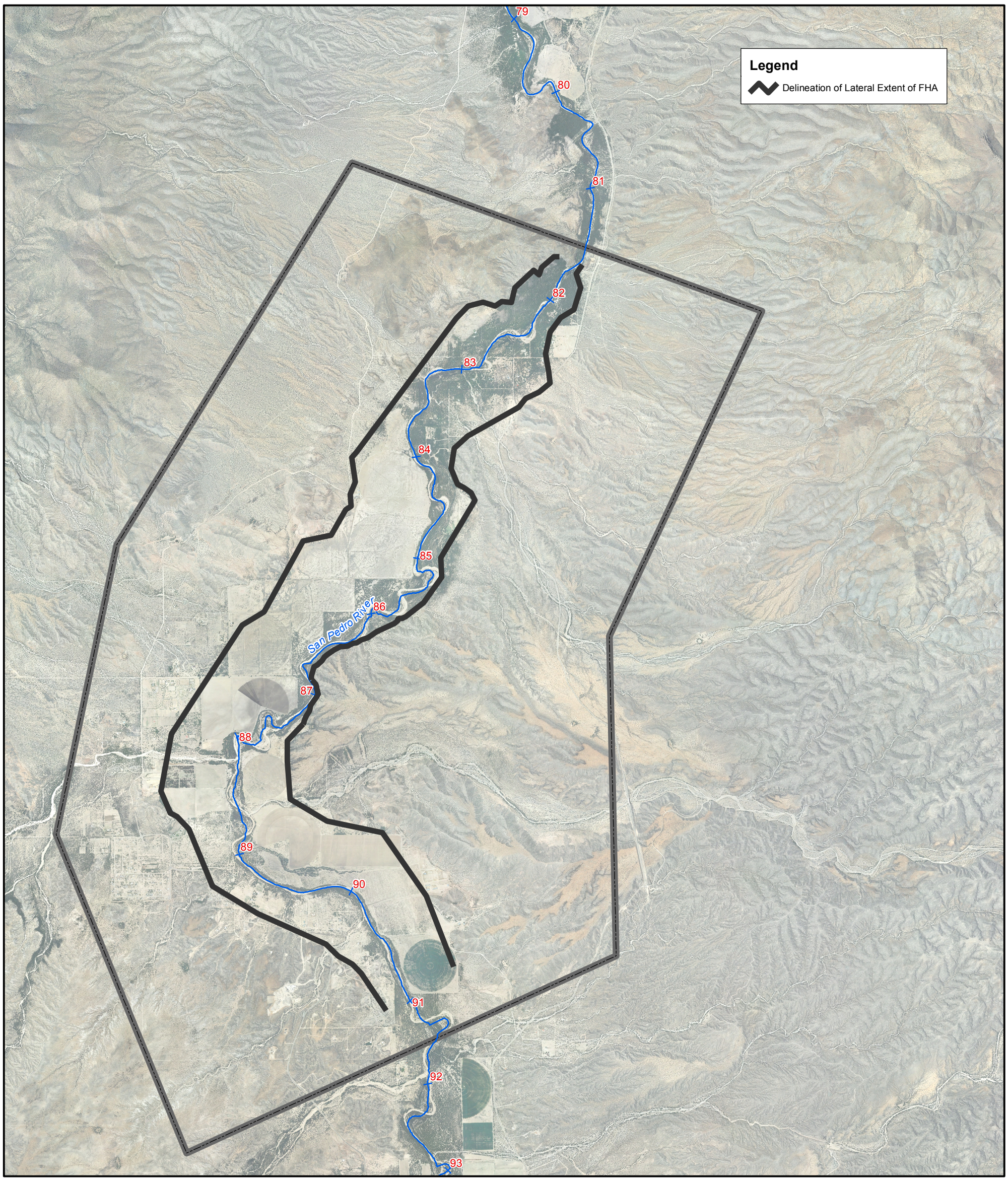
0 1,250 2,500 5,000 Feet



Legend

San Pedro River

Project Area Mapped by AZGS (2009)

San Pedro River Subwatersheds

Aravaipa

Benson

Redington

Sierra Vista

Winkleman

N

Base Map: USGS 1:24,000 Topographic Map with Shaded Relief

Figure 4-15b
Lateral Extent of FHA for Preliminary Analysis in Sample Subarea Plotted on Aerial Imagery

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0 1,250 2,500 5,000 Feet

N

85

86

87

Area of Setback

200 foot Setback Line
Applied at Contact with
"Tributary Aquifer"

100 and 200 foot Setbacks
Applied Except Where
Truncated at Active Channel

100 foot Setback Line
Applied with "Basin Fill Aquifer"

Delineation of Lateral Extent of FHA
at Interior Formation/Basin Fill Boundary

San Pedro River

Feet
0 250 500 1,000

Age & Naming Conventions of Surficial Geologic Units

- Delineation of Lateral Extent of FHA
- 100/200 Foot Setback Line
- Area of Setback

Holocene

- Holocene River Alluvium
- Holocene Piedmont Alluvium
- Other Holocene Deposits

Pleistocene

- Late Pleistocene River Alluvium
- Older Pleistocene River Alluvium
- Pleistocene Piedmont Alluvium
- Tertiary Deposits
- Bedrock
- Disturbed

Legend

- San Pedro River
- Project Area Mapped by AZGS (2009)

San Pedro River Subwatersheds

SUB_WTRSHD_NAME

- Aravaipa
- Benson
- Redington
- Sierra Vista
- Winkleman

Base Map: USGS 1:24,000 Topographic Map with Shaded Relief

Figure 4-16a
Application of Setbacks for Preliminary Analysis in Sample Subarea

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N

Legend

- Delineation of Lateral Extent of FHA
- 100/200 Foot Setback Line
- Area of Setback

85

86

84

Area of Setback

200 foot Setback Line
Applied at Contact with
"Tributary Aquifer"

100 and 200 foot Setbacks
Applied Except Where
Truncated at Active Channel

100 foot Setback Line
Applied with "Basin Fill Aquifer"

Delineation of Lateral Extent of FHA
at Interior Formation/Basin Fill Boundary

0 250 500 1,000 Feet

Legend

San Pedro River

Project Area Mapped by AZGS (2009)

San Pedro River Subwatersheds

SUB_WTRSHD_NAME

- Aravaipa
- Benson
- Redington
- Sierra Vista
- Winkleman

Base Map: USGS 1:24,000 Topographic Map with Shaded Relief

Figure 4-16b
Application of Setbacks for Preliminary Analysis in Sample Subarea Plotted on Aerial Imagery

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