



Preliminary Drainage Report

For

Daybreak Industrial Park

City of Eloy, Pinal County, Arizona

Owner/Developer
CARDON HIATT COMPANIES
1223 S. Clearview Avenue; Suite 105
Mesa AZ 85208



APPROVED

CITY OF ELOY ENGINEER

DATE

THE CITY APPROVES THIS REPORT FOR CONCEPT ONLY AND ACCEPTS
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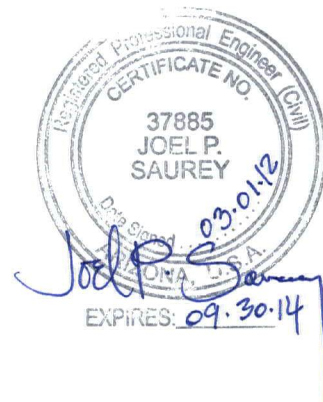
Project No. 11-077.1

Date: December 2011

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1.0 Introduction

Daybreak Industrial Park is a proposed development of approximately 163 Acres located in a portion of Section 16, Township 8 South, Range 8 East of the Gila and Salt River Base and Meridian, in the City of Eloy, Pinal County, Arizona. The property is situated north of Interstate 10, east of the La Palma Road alignment, west of Highway 87, and south of Highway 84 in the City of Eloy. See Figure 1: Vicinity Map.

As the name of the proposed development suggests, the land use of the project will be of an industrial nature. Similar industrial developments in the area have maintained flexibility in distributing large-acre parcels across their property. Industrial users of other similar area developments have been of a variety of service, production, or manufacturing businesses. To the west of the proposed Daybreak Industrial Park is on-going development of the National Gypsum Industrial Facility and the Sunshine Industrial Business Park. The site planning of the proposed Daybreak Industrial Park will assume a similar site planning scheme as these related developments.

The purpose of this Preliminary Drainage Report is to supplement the production of the Preliminary Plat for Daybreak Industrial Park. A Final Drainage Report more fully detailing on-site grading, street capacity, potential phasing, interim conditions, and storm drain will be presented at the time of the Final Plat.

2.0 Flood Insurance Rate Zone

This site is located within FEMA Flood Zone X and FEMA Flood Zone A as shown on FEMA Flood Insurance Rate Map number 04021C1957E and Map number 04021C1975E dated December 4, 2007. See Figure 2: FIRM Map.

Flood Zone X is defined as:

Areas determined to be outside the 0.2% annual chance floodplain.

Flood Zone A is defined as:

Special flood hazard areas subject to inundation by the 1% annual chance flood. No base flood elevations determined.

Flood Zone A is a Special Flood Hazard Area (SFHA). The Flood Zone A on Daybreak Industrial is the result of impoundment of runoff against the Union Pacific Railroad mainline along the north side of the project. The limits of this flood zone is displayed in Figure 2. As part of the preliminary plat, a 30' wide easement has been

added as shown in Exhibit 2: Onsite Drainage Exhibit. The easement has been added to assist in obtaining necessary approvals and permits from the governing agencies at the time of final engineering.

3.0 Existing Site Conditions

The existing site is bounded on the north, east, and south by major transportation corridors. To the north is the Union Pacific Railroad (UPRR) and Highway 84. To the east is Highway 87. To the south is Interstate 10. Sunshine Industrial Park and the National Gypsum Wallboard Facility are to the west of Daybreak Industrial Park. Each is at various stages of design or construction.

The existing Daybreak Industrial Park site is a pecan tree farm. The existing ground slopes to the northwest at between approximately 0.20% and 0.40%.

4.0 Offsite Drainage

The Offsite Drainage evaluation for Daybreak Industrial Park is guided largely by the McClellan Wash Watercourse Master Plan Hydrology by HDR Engineers (2010). Though a draft document, this work is in on-going review and finalization with Pinal County.

There are four aspects of offsite drainage that affect the Daybreak Industrial Park. They are described in Detail in the following sections.

4.1 45 cfs along North (Northeast) Boundary

Daybreak Industrial Park is affected by approximately 45 cfs that flows northwest on the south side of the UPRR tracks. This flow is generated, according to the HDR study, by the approximate limits of the project area. This flow represents the only FEMA floodplain to cover the project. A culvert located along the Union Pacific Railroad (UPRR), east of La Palma, and adjacent to the neighboring state land parcel is the eventual outfall of this 45 cfs. A 30' drainage easement has been estimated along the northeast boundary of the project to accommodate this flowing drainage and make consideration for future CLOMR/LOMR processes for this administered special flood hazard area (SFHA). Also, a 40' easement has been provided downstream of the 30' easement to allow for a spreader basin to return flow to pre-developed conditions. Flows from these easements will discharge to the northwest in their historic drainage patterns. See Figure 4 for location of the 30' and 40' easements. See Figure 2 for display of the project FIRM Maps. See Figure 5 for a summary of all offsite flows.

4.2 Regional Flows from South

The Daybreak site is located at the downstream end of a very large regional basin. This offsite flow approaches the project from the south. Area drainage studies rate this flow at approximately 8817 cfs. This regional flow is partially conveyed under Interstate 10 between La Palma and Sunshine in culverts and through the La Palma Interstate 10 Bridge.

Based on prior experience with this regional basin, it is been observed that very little of this flow will reach the Daybreak Industrial site though the culverts under I-10 adjacent to the project. This site is located east of and several feet above the point of discharge from this subarea. Flow in excess of the capacity of the existing facilities in I-10 continues northwest along I-10 and contributes to further downstream points along the Santa Cruz River. See Figure 5: Offsite Drainage Summary

It is estimated that regional runoff that may reach the culverts under I-10 adjacent to the Daybreak project will be lower in magnitude than the runoff that would be generated on the properties located south of and adjacent to the I-10. See Section 4.5 for a discussion of the runoff from the adjacent parcels to the south.

4.3 Wash at the La Palma Alignment

The Daybreak site is affected by the existing wash along the La Palma alignment. From design performed for the neighboring National Gypsum Facility and Sunshine Industrial Park, it has been determined that the wash along the La Palma alignment conveys approximately 350 cfs. The 350 cfs in this wash is a portion of the approximately 8817 cfs from the regional flows from the south.

The wash will be maintained in its current condition. As a part of development of Daybreak Industrial Park, this wash will have to be preserved in its current condition and location. A 45' drainage easement has been provided on the west side of the project to accommodate this existing wash as shown on Figure 4. See Figure 4: Onsite Drainage Map and Figure 5: Offsite Drainage Summary.

4.4 Runoff from I-10

Runoff from the I-10 will be conveyed to the west in drainage swales that have been constructed with the I-10 improvements that are located within the I-10 right-of-way.

It is estimated that runoff from I-10 that may reach the channel adjacent to Daybreak will be lower in magnitude than the runoff that would be generated on the properties located south of and adjacent to the I-10. See Section 4.5 for a discussion of the runoff from the adjacent parcels to the south.

4.5 Adjacent Properties to the South

The Daybreak site is affected by runoff that is generated on properties located south of and adjacent to the I-10. This is runoff generated on the farm fields north of Phillips Road that will flow towards the site. Field investigation has determined that drainage generated south of Phillips Road will flow westerly into the regional wash at the La Palma alignment. See Figure 3: Offsite Drainage Map, for a graphical depiction of the local offsite areas affecting the project. Flow from these local offsite areas will be conveyed under the I-10 freeway by existing culverts corresponding to each of the drainage areas. See Figure 5: Offsite Drainage Summary.

Offsite runoff from the culverts under I-10 will be conveyed in the existing drainage swale constructed within ADOT right-of-way. A supplemental onsite drainage easement located on the south side of the development has been provided for potential conveyance of drainage towards the wash at the La Palma alignment.

The size of the drainage easement provided on the south side of the project (north side of the I-10 freeway) has been estimated based conveyance of the runoff generated on the parcels south of the project west to the wash at the La Palma alignment. Peak flows from these drainage areas have been estimated using the rational method for preliminary sizing of this drainage easement.

5.0 Onsite Drainage

The onsite drainage scheme of this project is to allow each of the thirteen parcels to capture and retain the 100-year, 2-hour rainfall event on the parcels. The right of way adjacent to the parcels will also be retained on the adjacent parcels.

5.1 Rainfall Data

Rainfall Data for this project has been taken from upper bound of the 90% confidence interval from NOAA ATLAS 14 ("Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 1, Version 4). The Data taken represents the approximate project location as estimated using Google Earth. Project coordinates are: 32.7300, -111.5246. Results from the Upper Bound of the 90% confidence interval have been used to compute a site specific I-D-F curve (Intensity-Duration-Frequency Curve) and for site specific runoff volumes. See Appendix B for rainfall data from the upper bound of the 90% confidence interval of NOAA ATLAS 14.

5.2 Calculation Methodology – Weighted “C” Values

The runoff coefficients, C, were computed using Table 2-1 from the Pinal County Drainage Manual Volume 2. The C value for the ultimate (developed) parcels has been estimated as 0.88, which is the minimum value stated for “Industrial 2” and the maximum value stated for “Industrial 1”. The C value for the interim parcels has been estimated as 0.50, which is the maximum value for “Undeveloped Desert Rangeland”. The C value for the right of way adjacent to the parcels was estimated as 0.90, which is a conservative estimate based on the proposed roadway cross section. See the Table below for summary of the final weighted runoff coefficients:

Summary of Runoff Coefficients

Description	C
Ultimate Parcels	0.88
Interim Parcels	0.50
Right of Way adjacent to Parcels	0.90

5.3 Onsite Retention

Retention calculations have been performed using Equation 2-4 from the Pinal County Drainage Manual Volume 2. Retention basins will be designed to retain 100% of the 100-year 2-hour storm event in both the interim and developed conditions. See Appendix B for retention calculations. See Figure 4: Onsite Drainage Map for locations of Parcels.

Final site plans for each of the Parcels are not yet determined; therefore there has not been any graphical representation of the basins in the drainage

exhibits. However, the retention calculations located in Appendix B give an approximate acreage that will be required for retention for both the interim and ultimate conditions. These required acreages can be used in the planning of the Parcels. Final drainage calculations should be performed for each Parcel to ensure retention of the 100-year, 2-hour storm event.

Ultimate retention basins will be designed, per Section 3.10.3 “Basin Configuration” of the Pinal County Drainage Manual Volume I: Design Criteria, to have a maximum slope of 4:1 and a maximum ponded depth of 3 feet with 1 foot of freeboard.

Interim retention basins will be designed to have a maximum ponded depth of 1.0’ to allow basin dewatering without drywells. Interim basins will be constructed with paving and grading plans for this project.

5.4 Retention Basin Dewatering

Retention basins will be designed to dewater in 36 hours or less. Retention basins will be designed to dewater by means of surface percolation. Where retention basins are not able to percolate in 36 hours via surface percolation, drywells will be added. Drywells used to achieve the required infiltration rate will be registered with the Arizona Department of Environmental Quality.

6.0 Calculation Methodology – Peak Flow and Time of Concentration

The Rational Method will be used to calculate peak flows at critical locations in the analysis. The Rational Method will be applied as outlined in section 2.2.1 of the Pinal County Drainage Manual Volume 2. Peak flows will be calculated as follows:

$$Q = C * i * A$$

Where Q is the Peak Discharge, C is the weighted “c” value of the area, i is the rainfall intensity (as defined by the local time of concentration and the site specific IDF curve) in inches per hour, and A is the area in acres.

As required by Pinal County the time of concentration calculations for the street drainage will be performed using the Papadakis and Kazan equation as follows:

$$T_c = 11.4L^{0.5} K_b^{0.52} S^{-0.31} i^{-0.38}$$

Where T_c is the time of concentration (in hours), L is the length of the longest flow path (in miles), K_b is the watershed resistance coefficient, S is the watercourse slope (in feet per mile), and i is the rainfall intensity (in inches per hour).

Intensity will be estimated by linearly interpolating the site specific I-D-F curve that is derived from the NOAA ATLAS 14 data (that is described in section 5.1 of this report) at a specific time of concentration.

As can be seen the time of concentration is a function of the intensity and the intensity is a function of the time of concentration. Therefore the equations will be iterated until both equations can be satisfied. When both equations are satisfied for each sub basin area the resulting values will be applied to that sub basin area and the peak flow at the concentration point will be calculated.

See Appendix B for calculations applicable to this methodology.

7.0 Project Low Outfall and Minimum Finished Floor

The ultimate outfall for the Daybreak Industrial Park is located at the northwest corner of the site at an elevation of 1579.

The finished floor for all facilities will be a minimum of 1 foot above the highest adjacent water surface elevation from a 100-yr storm event including, but not limited to: the high water elevation of adjacent basins, the emergency overflow elevation (EOE) of adjacent retention basins, flow depths in adjacent streets, flow depths in adjacent drainage ways, headwater depths at scuppers, catch basins, or inlets.

8.0 Conclusions

This report concluded that:

- This site has been designed in accordance with the Pinal County standards.
- The majority of Daybreak Industrial Park is located in FEMA Zone X. A portion of Daybreak Industrial is located in FEMA Zone A.
- Offsite flows impacting the property are managed or accommodated by widened tracts and/or planned easements for the developed conditions adequate to convey the discharges.
- This site will create no adverse impacts on any downstream property.
- The finished floor for all structures will be a minimum of 1 foot above the highest adjacent water surface elevation and 1 foot above the EOE of any adjacent retention basins.
- Retention requirements for onsite storm water have been met by onsite surface retention basins.
- Retention calculations are based on the 100-year, 2-hour storm as defined by the upper bound of the 90% confidence interval in NOAA ATLAS 14. Retention has been provided for the site for both the interim (undeveloped) and ultimate (developed) conditions for each individual parcel and across the development.
- Offsite runoff from the culverts under I-10 will be conveyed in the existing drainage channel constructed within ADOT right-of-way. A supplemental onsite drainage easement located on the south side of the parcel has been provided for potential conveyance of drainage towards the wash at the La Palma alignment.
- Runoff from the I-10 will be conveyed in the existing drainage channel constructed within ADOT right-of-way. A supplemental onsite drainage easement located on the south side of the parcel has been provided for potential conveyance of drainage towards the wash at the La Palma alignment.
- Interim basins will be constructed with paving and grading plans for this project.

9.0 References

Pinal County AZ

Pinal County Drainage Manual, Volume 2, Hydraulics.

Pinal County AZ

Pinal County Drainage Manual, Volume I, Design Criteria.

Pinal County AZ

Pinal County Subdivision and Infrastructure Design Manual

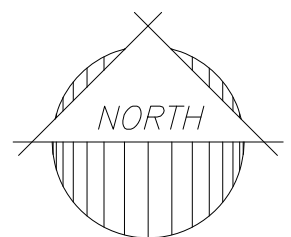
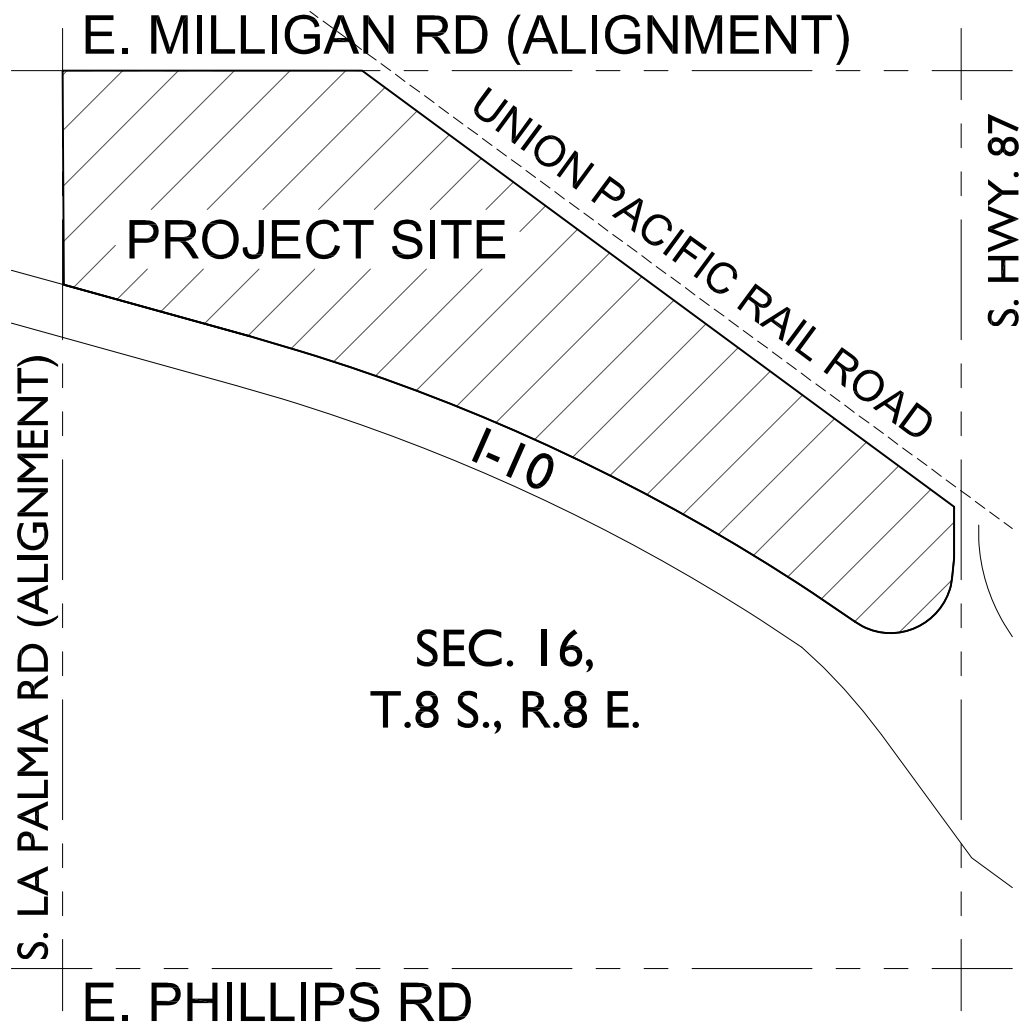
Federal Highway Administration

Hydraulic Engineering Circular Number 14 (HEC 14), Third Edition
“Hydraulic Design of Energy Dissipators for Culverts and Channels”.

HDR Engineers

McClellan Wash Watercourse Master Plan Hydrology (2010)

Appendix A: Figures



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Project:

Daybreak Industrial Park

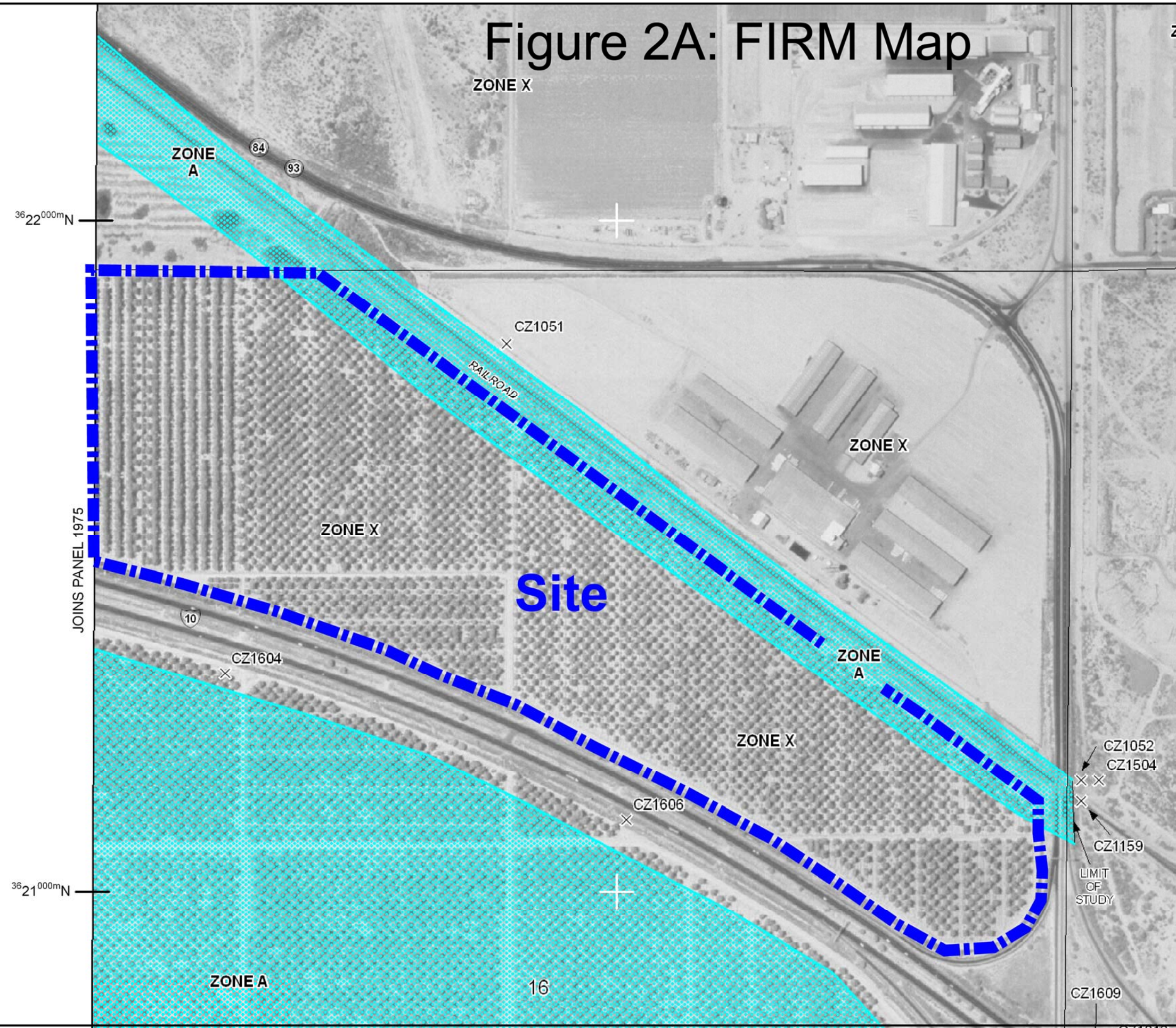
Eloy, Arizona

Figure 1: Vicinity Map

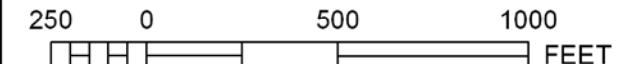


2045 S. Vineyard, Ste. 101, Mesa, Arizona 85210
Phone (480) 503-2250 Fax (480) 503-2258

Figure 2A: FIRM Map



MAP SCALE 1" = 500'



NFIP

PANEL 1957E

FIRM
FLOOD INSURANCE RATE MAP
PINAL COUNTY,
ARIZONA
AND INCORPORATED AREAS

PANEL 1957 OF 2575
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
PINAL COUNTY UNINCORPORATED AREAS	040077	1957	E
ELOY CITY OF	040083	1957	E

Notice to User: The Map Number shown below should be used when placing map orders: the Community Number shown above should be used on insurance applications for the subject community.

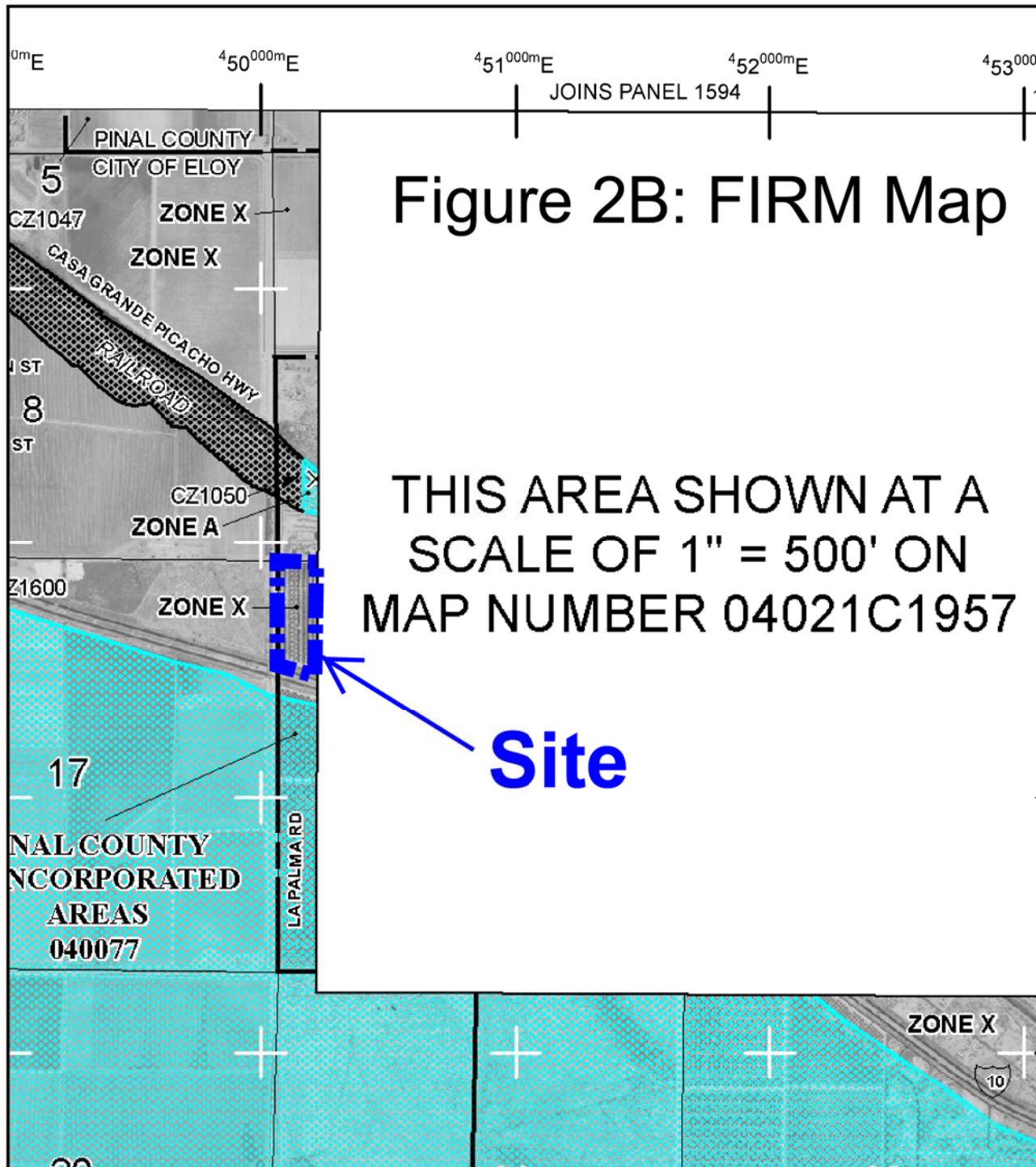


MAP NUMBER
04021C1957E

EFFECTIVE DATE
DECEMBER 4, 2007

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov





MAP SCALE 1" = 2000'

1000 0 2000 4000 FEET

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1975E

FIRM

FLOOD INSURANCE RATE MAP

PINAL COUNTY, ARIZONA

AND INCORPORATED AREAS

PANEL 1975 OF 2575

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
PINAL COUNTY UNINCORPORATED AREAS	040077	1975	E
ELOY CITY OF	040083	1975	E

Notice to User: The Map Number shown below should be used when placing map orders. The Community Number shown above should be used on insurance applications for the subject.



MAP NUMBER

04021C1975E

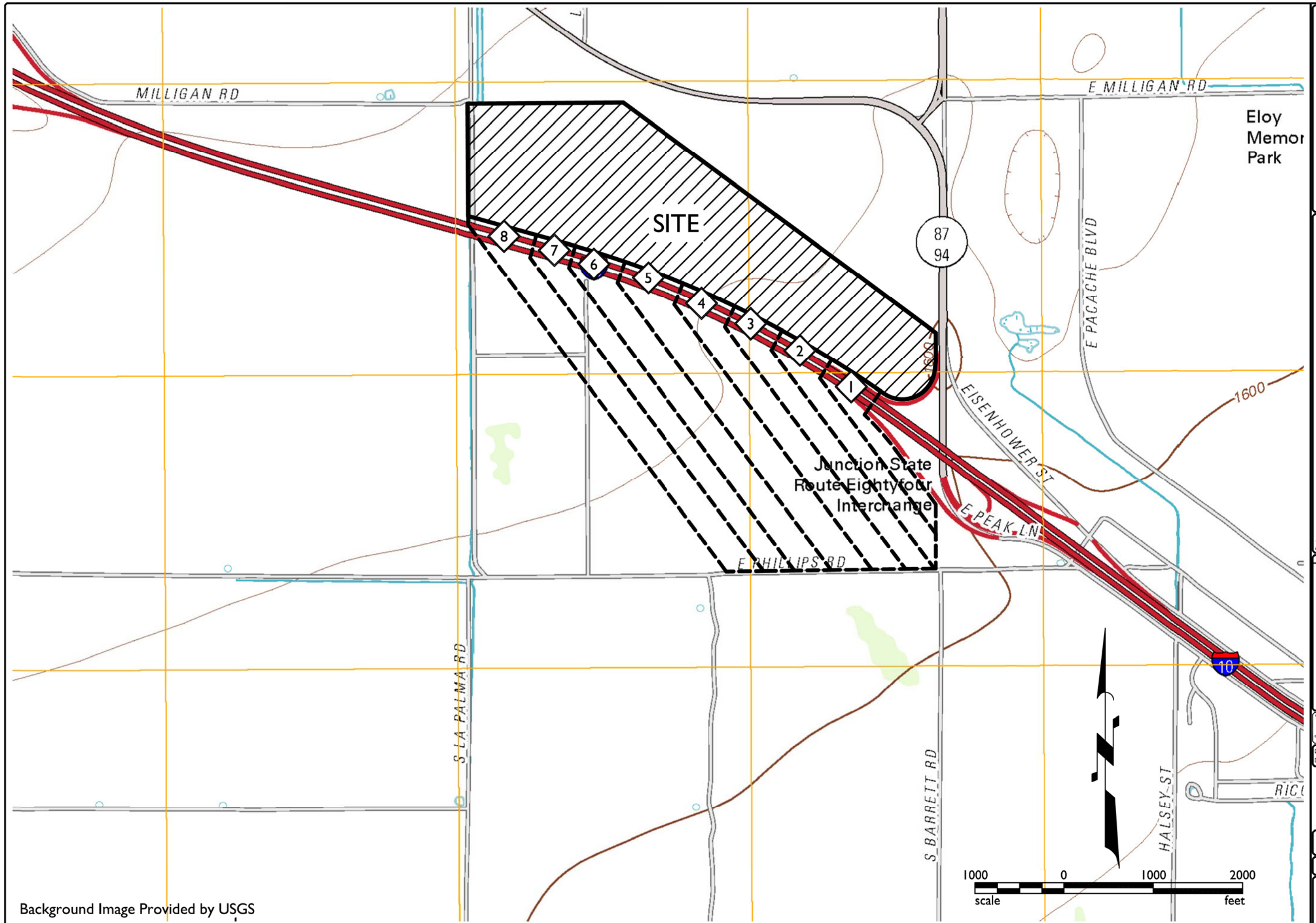
EFFECTIVE DATE

DECEMBER 4, 2007

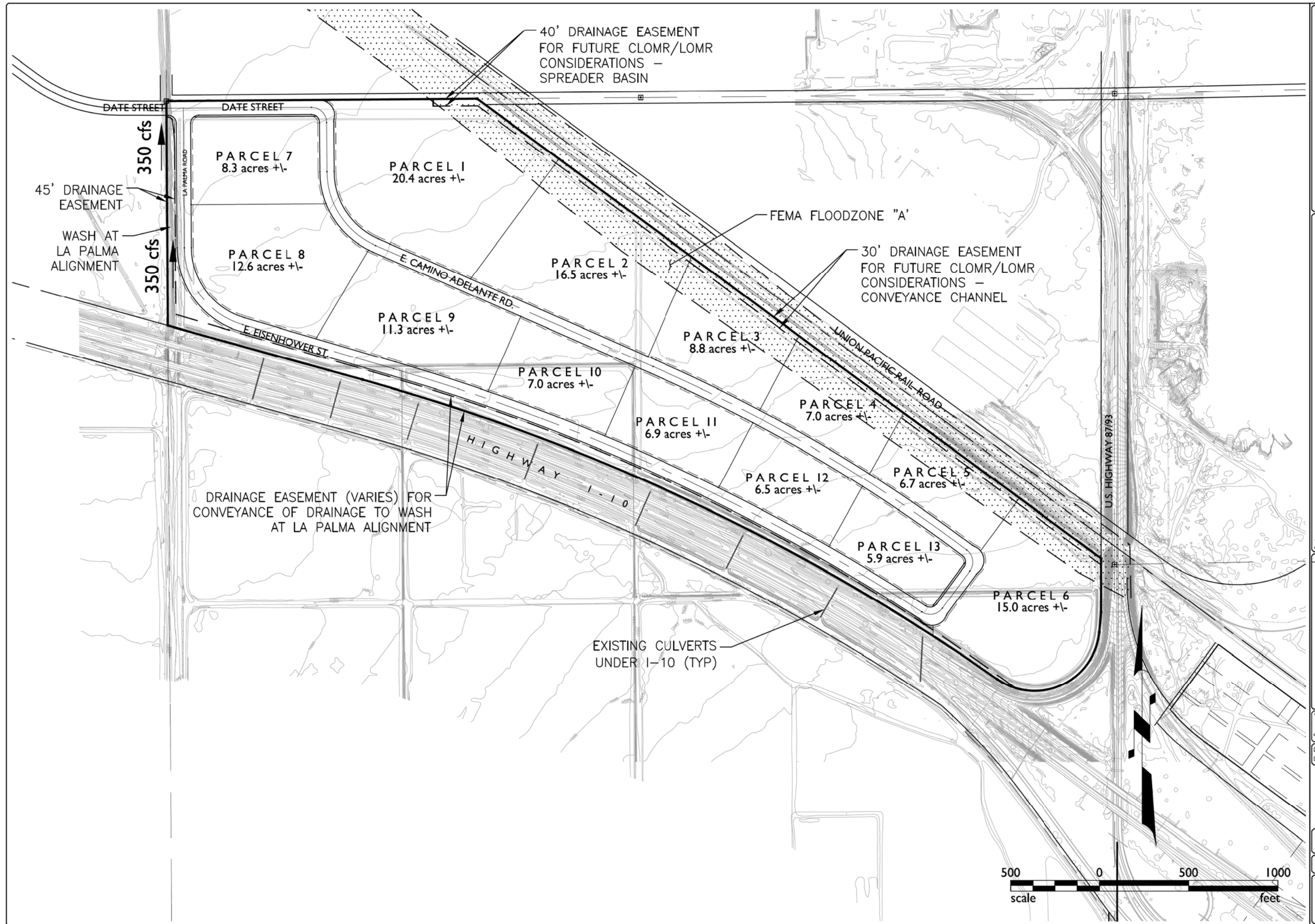
Federal Emergency Management Agency

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Appendix B:

Drainage Calculations

Ultimate Retention Calculations

Project: Daybreak Industrial Park

Storm Event: 100-yr 2-hr

Prepared by: Brian Nicholls

Date: 2/29/2012

$$V = C * A * P / 12^{(1)}$$

Where:

V = Runoff Volume

C = Runoff Coefficient

A = Drainage Area

P = 2.75 in

Surface Retention Basin Characteristics

Depth	3
Side Slope	4

Volume Required and Summary

Basin ID	Sub Basin Area Description	Contributing Area (ft ²)	C =	Volume Required, V _R (cu-ft)	Approximate Area Required (ac)
Parcel 1	Parcel 1	888,624	0.88	179,206	1.77
	Adjacent RW	62,353	0.90	12,860	
	Total	950,977		192,066	
Parcel 2	Parcel 2	718,740	0.88	144,946	1.43
	Adjacent RW	43,640	0.90	9,001	
	Total	762,380		153,947	
Parcel 3	Parcel 3	383,328	0.88	77,304	0.80
	Adjacent RW	27,777	0.90	5,729	
	Total	411,105		83,033	
Parcel 4	Parcel 4	304,920	0.88	61,492	0.66
	Adjacent RW	28,436	0.90	5,865	
	Total	333,356		67,357	
Parcel 5	Parcel 5	291,852	0.88	58,857	0.64
	Adjacent RW	30,081	0.90	6,204	
	Total	321,933		65,061	
Parcel 6	Parcel 6	653,400	0.88	131,769	1.27
	Adjacent RW	22,180	0.90	4,575	
	Total	675,580		136,344	
Parcel 7	Parcel 7	361,548	0.88	72,912	0.95
	Adjacent RW	128,616	0.90	26,527	
	Total	490,164		99,439	

Ultimate Retention Calculations

Project: Daybreak Industrial Park

Storm Event: 100-yr 2-hr

Prepared by: Brian Nicholls

Date: 2/29/2012

Parcel 8	Parcel 8	548,856	0.88	110,686	1.25
	Adjacent RW	112,820	0.90	23,269	
	Total	661,676		133,955	
Parcel 9	Parcel 9	492,228	0.88	99,266	1.16
	Adjacent RW	117,772	0.90	24,290	
	Total	610,000		123,556	
Parcel 10	Parcel 10	304,920	0.88	61,492	0.76
	Adjacent RW	83,871	0.90	17,298	
	Total	388,791		78,791	
Parcel 11	Parcel 11	300,564	0.88	60,614	0.75
	Adjacent RW	85,477	0.90	17,630	
	Total	386,041		78,243	
Parcel 12	Parcel 12	283,140	0.88	57,100	0.72
	Adjacent RW	84,351	0.90	17,397	
	Total	367,491		74,497	
Parcel 13	Parcel 13	257,004	0.88	51,829	0.70
	Adjacent RW	100,475	0.90	20,723	
	Total	357,479		72,552	

Notes:

(1) Equation 2-4 taken from Pinal County Drainage Manual

Interim Retention Calculations

Project: Daybreak Industrial Park

Storm Event: 100-yr 2-hr

Prepared by: Brian Nicholls

Date: 2/29/2012

$$V = C * A * P / 12^{(1)}$$

Where:

V = Runoff Volume

C = Runoff Coefficient

A = Drainage Area

P = 2.75 in

Surface Retention Basin Characteristics

Depth	1
Side Slope	4

Volume Required and Summary

Basin ID	Sub Basin Area Description	Contributing Area (ft ²)	C =	Volume Required, V _R (ac-ft)	Approximate Area Required (ac)
Parcel 1	Parcel 1	888,624	0.50	101,822	
	Adjacent RW	62,353	0.90	12,860	
	Total	950,977		114,682	
Parcel 2	Parcel 2	718,740	0.50	82,356	
	Adjacent RW	43,640	0.90	9,001	
	Total	762,380		91,356	
Parcel 3	Parcel 3	383,328	0.50	43,923	
	Adjacent RW	27,777	0.90	5,729	
	Total	411,105		49,652	
Parcel 4	Parcel 4	304,920	0.50	34,939	
	Adjacent RW	28,436	0.90	5,865	
	Total	333,356		40,804	
Parcel 5	Parcel 5	291,852	0.50	33,441	
	Adjacent RW	30,081	0.90	6,204	
	Total	321,933		39,646	
Parcel 6	Parcel 6	653,400	0.50	74,869	
	Adjacent RW	22,180	0.90	4,575	
	Total	675,580		79,443	
Parcel 7	Parcel 7	361,548	0.50	41,427	
	Adjacent RW	128,616	0.90	26,527	
	Total	490,164		67,954	

Interim Retention Calculations

Project: Daybreak Industrial Park

Storm Event: 100-yr 2-hr

Prepared by: Brian Nicholls

Date: 2/29/2012

Parcel 8	Parcel 8	548,856	0.50	62,890	
	Adjacent RW	112,820	0.90	23,269	
	Total	661,676		86,159	
Parcel 9	Parcel 9	492,228	0.50	56,401	
	Adjacent RW	117,772	0.90	24,290	
	Total	610,000		80,692	
Parcel 10	Parcel 10	304,920	0.50	34,939	
	Adjacent RW	83,871	0.90	17,298	
	Total	388,791		52,237	
Parcel 11	Parcel 11	300,564	0.50	34,440	
	Adjacent RW	85,477	0.90	17,630	
	Total	386,041		52,069	
Parcel 12	Parcel 12	283,140	0.50	32,443	
	Adjacent RW	84,351	0.90	17,397	
	Total	367,491		49,841	
Parcel 13	Parcel 13	257,004	0.50	29,448	
	Adjacent RW	100,475	0.90	20,723	
	Total	357,479		50,171	

Notes:

(1) Equation 2-4 taken from Pinal County Drainage Manual

Project Rainfall Data and IDF Curve

Project: Daybreak Industrial Park

Prepared By: Brian Nicholls

Date: 2/29/2012

Site Specific Rainfall Data

Duration	Storm Event Return Period						
	1 yr	2 yr	5 yr	10 yr	25 yr	50 yr	100 yr
5 min	0.24	0.32	0.43	0.51	0.62	0.71	0.80
10 min	0.37	0.49	0.66	0.78	0.95	1.08	1.22
15 min	0.46	0.60	0.81	0.97	1.18	1.34	1.51
30 min	0.62	0.81	1.09	1.30	1.59	1.80	2.03
60 min	0.77	1.01	1.35	1.61	1.96	2.23	2.51
120 min	0.87	1.13	1.50	1.78	2.15	2.45	2.75

Site Specific IDF Curve

Time	Storm Event Return Period						
	1 yr	2 yr	5 yr	10 yr	25 yr	50 yr	100 yr
5 min	2.88	3.84	5.16	6.12	7.44	8.52	9.60
10 min	2.22	2.94	3.96	4.68	5.70	6.48	7.32
15 min	1.84	2.40	3.24	3.88	4.72	5.36	6.04
30 min	1.24	1.62	2.18	2.60	3.18	3.60	4.06
60 min	0.77	1.01	1.35	1.61	1.96	2.23	2.51
120 min	0.44	0.57	0.75	0.89	1.08	1.23	1.38

Peak Flow Calculations using the Rational Method

Project: Daybreak Industrial Park

Prepared By: Brian Nicholls

Date: 2/29/2012

Time of Concentration calculated using the Papadakis and Kazan Equation

Concentration Point ID	Sub Basin Area Description									Peak Flow Calculations			
	Drainage Area (acres)	Drainage Length (ft)	Watercourse slope	Initial Tc (min)	Kb	Type	Roughness Description	m	b	Weighted C	Local Time of Concentration (min)	Local Intensity (in/hr)	Peak Flow (cfs)
CP1	11.67	1680	0.0028	5	0.0653	B	Low	-0.0138	0.080	0.35	28.31	4.28	17.5
CP2	18.59	2519	0.0028	5	0.0625	B	Low	-0.0138	0.080	0.35	34.06	3.85	25.1
CP3	22.83	3137	0.0028	5	0.0613	B	Low	-0.0138	0.080	0.35	37.71	3.66	29.3
CP4	28.52	3470	0.0028	5	0.0600	B	Low	-0.0138	0.080	0.35	39.31	3.58	35.7
CP5	36.74	3776	0.0028	5	0.0585	B	Low	-0.0138	0.080	0.35	40.57	3.51	45.2
CP6	34.97	4074	0.0028	5	0.0588	B	Low	-0.0138	0.080	0.35	42.43	3.42	41.8
CP7	30.40	4264	0.0028	5	0.0596	B	Low	-0.0138	0.080	0.35	43.91	3.34	35.5
CP8	38.78	4400	0.0028	5	0.0582	B	Low	-0.0138	0.080	0.35	44.06	3.33	45.2

Notes:

Table 2-1: Runoff Coefficients^{1,2}

Land Use Category	2-10 Year		25 Year		50 Year		100 Year	
	min	max	min	max	min	max	min	max
Very Low Density Residential ³	0.33	0.42	0.36	0.46	0.40	0.50	0.41	0.53
Low Density Residential ³	0.42	0.48	0.46	0.53	0.50	0.58	0.53	0.60
Medium Density Residential ³	0.48	0.65	0.53	0.72	0.58	0.78	0.60	0.82
Multiple Family Residential ³	0.65	0.75	0.72	0.83	0.78	0.90	0.82	0.94
Industrial 1 ³	0.60	0.70	0.66	0.77	0.72	0.84	0.75	0.88
Industrial 2 ³	0.70	0.80	0.77	0.88	0.84	0.95	0.88	0.95
Commercial 1 ³	0.55	0.65	0.61	0.72	0.66	0.78	0.69	0.81
Commercial 2 ³	0.75	0.85	0.83	0.94	0.90	0.95	0.94	0.95
Pavement and Rooftops	0.75	0.85	0.83	0.94	0.90	0.95	0.94	0.95
Gravel Roadways & Shoulders	0.60	0.70	0.66	0.77	0.72	0.84	0.75	0.88
Agricultural	0.10	0.20	0.11	0.22	0.12	0.24	0.13	0.25
Lawns/Parks/Cemeteries	0.10	0.25	0.11	0.28	0.12	0.30	0.13	0.31
Desert Landscaping 1	0.55	0.85	0.61	0.94	0.66	0.95	0.69	0.95
Desert Landscaping 2	0.30	0.40	0.33	0.44	0.36	0.48	0.38	0.50
Undeveloped Desert Rangeland	0.30	0.40	0.33	0.44	0.36	0.48	0.38	0.50
Hillslopes, Sonoran Desert	0.40	0.55	0.44	0.61	0.48	0.66	0.50	0.69
Mountain Terrain	0.60	0.80	0.66	0.88	0.72	0.95	0.75	0.95

¹ Runoff coefficients for 25-, 50-, and 100-Year storm frequencies were derived using adjustment factors of 1.10, 1.20 and 1.25, respectively, applied to the 2-10 Year values with an upper limit of 0.95

² The ranges of runoff coefficients shown for urban land uses were derived from lot coverage standards specified in the zoning ordinances for Maricopa Pinal County

³ Runoff coefficients for urban land uses are for lot coverage only and do not include the adjacent street and right-of-way, or alleys.

Weighted runoff coefficients

Many times the ground surface in a tributary area cannot be properly represented using a single runoff coefficient. This is usually because of differences in ground cover. For example, between the right-of-way and the inlet some ground may have vegetative cover while other ground is paved.

A weighted runoff coefficient can be computed by proportion to the subareas using Equation (2-2):

$$C_w = \frac{A_1 C_1 + A_2 C_2 + \dots + A_n C_n}{A_1 + A_2 + \dots + A_n} \quad (2-2)$$

Where:

A_i =Area in the i_{th} subarea, ac
 C_i =Runoff coefficient for the i_{th} subarea

The weighted coefficient (C_w) is used in the Rational Formula just as would a single coefficient.

Point precipitation frequency estimates (inches)

NOAA Atlas 14, Volume 1, Version 5

Data type: Precipitation depth

Time series type: Partial duration

Project area: Southwest

Latitude (decimal degrees): 32.7300

Longitude (decimal degrees): -111.5246

PRECIPITATION FREQUENCY ESTIMATES AT UPPER BOUND OF 90% CONFIDENCE INTERVAL

Duration:	1	2	5	10	25	50	100	200	500	1000 years
5-min:	0.24	0.32	0.43	0.51	0.62	0.71	0.8	0.89	1.01	1.11
10-min:	0.37	0.49	0.66	0.78	0.95	1.08	1.22	1.36	1.54	1.69
15-min:	0.46	0.6	0.81	0.97	1.18	1.34	1.51	1.68	1.92	2.1
30-min:	0.62	0.81	1.09	1.3	1.59	1.8	2.03	2.26	2.58	2.83
60-min:	0.77	1.01	1.35	1.61	1.96	2.23	2.51	2.8	3.19	3.5
2-hr:	0.87	1.13	1.5	1.78	2.15	2.45	2.75	3.07	3.5	3.85
3-hr:	0.95	1.21	1.58	1.87	2.27	2.59	2.93	3.29	3.79	4.2
6-hr:	1.12	1.41	1.79	2.09	2.5	2.83	3.18	3.54	4.04	4.44
12-hr:	1.25	1.58	1.99	2.3	2.74	3.07	3.43	3.79	4.31	4.71
24-hr:	1.39	1.76	2.27	2.68	3.24	3.69	4.15	4.63	5.31	5.84
2-day:	1.52	1.94	2.55	3.03	3.71	4.25	4.82	5.43	6.28	6.98
3-day:	1.62	2.06	2.71	3.23	3.96	4.54	5.17	5.83	6.78	7.55
4-day:	1.71	2.18	2.88	3.42	4.2	4.83	5.51	6.24	7.27	8.12
7-day:	1.9	2.42	3.19	3.81	4.68	5.38	6.13	6.93	8.08	9.02
10-day:	2.13	2.73	3.6	4.29	5.26	6.04	6.87	7.75	9.01	10.03
20-day:	2.63	3.38	4.45	5.26	6.36	7.2	8.07	8.96	10.17	11.1
30-day:	3.08	3.96	5.2	6.15	7.41	8.39	9.4	10.45	11.84	12.95
45-day:	3.6	4.64	6.1	7.17	8.57	9.64	10.73	11.83	13.29	14.41
60-day:	3.97	5.13	6.73	7.89	9.4	10.51	11.64	12.76	14.24	15.36

Date/time (GMT): Tue Dec 20 01:02:32 2011

pyRunTime: 0.0752141475677