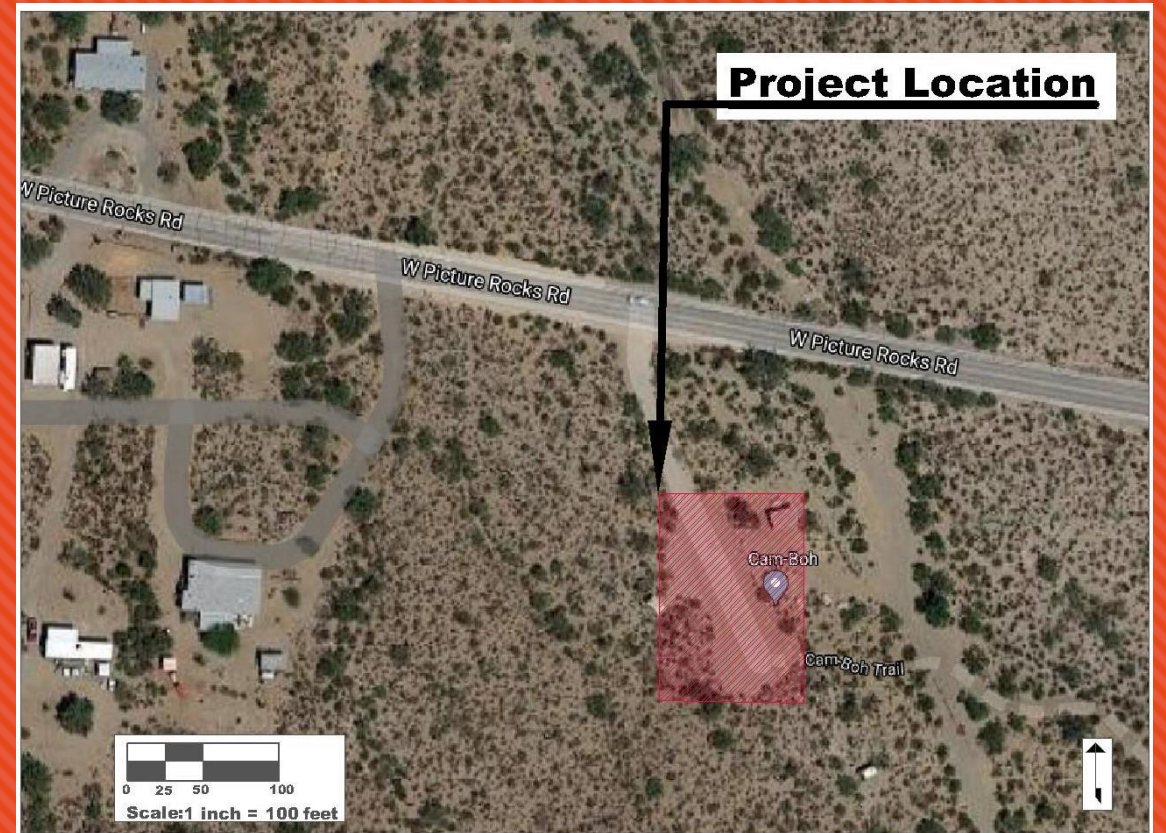


Saguaro National Park Parking Lot Assessment and Design

Tucson, Arizona

Client: Richard Goepfrich, Facility Manager for Saguaro National Park



Project Team: Julia Trivers, Desmin Fontaine, and Dylan Edens

Northern Arizona University

CENE 486C- Engineering Design

November 12, 2020



Introduction: Project Description

Project Objective: Assess the current Cam-boh Picnic Area parking lot and create a redesigned lot for the designed user

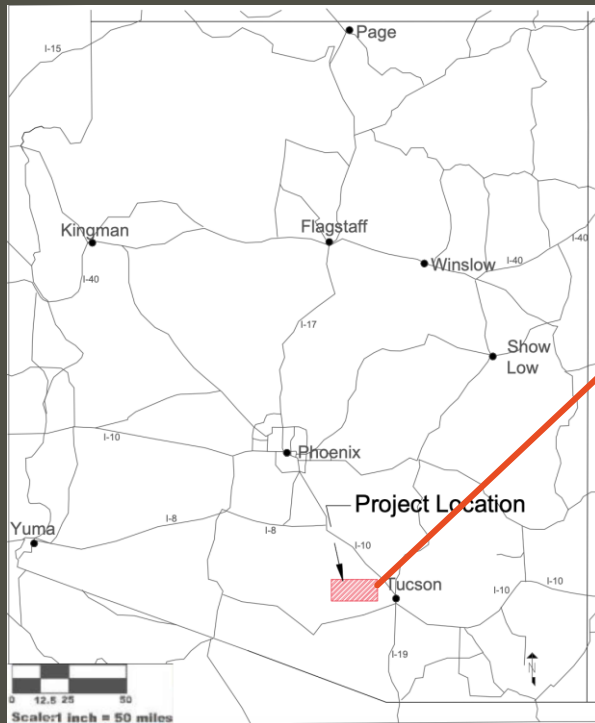


Figure 1: Arizona State View

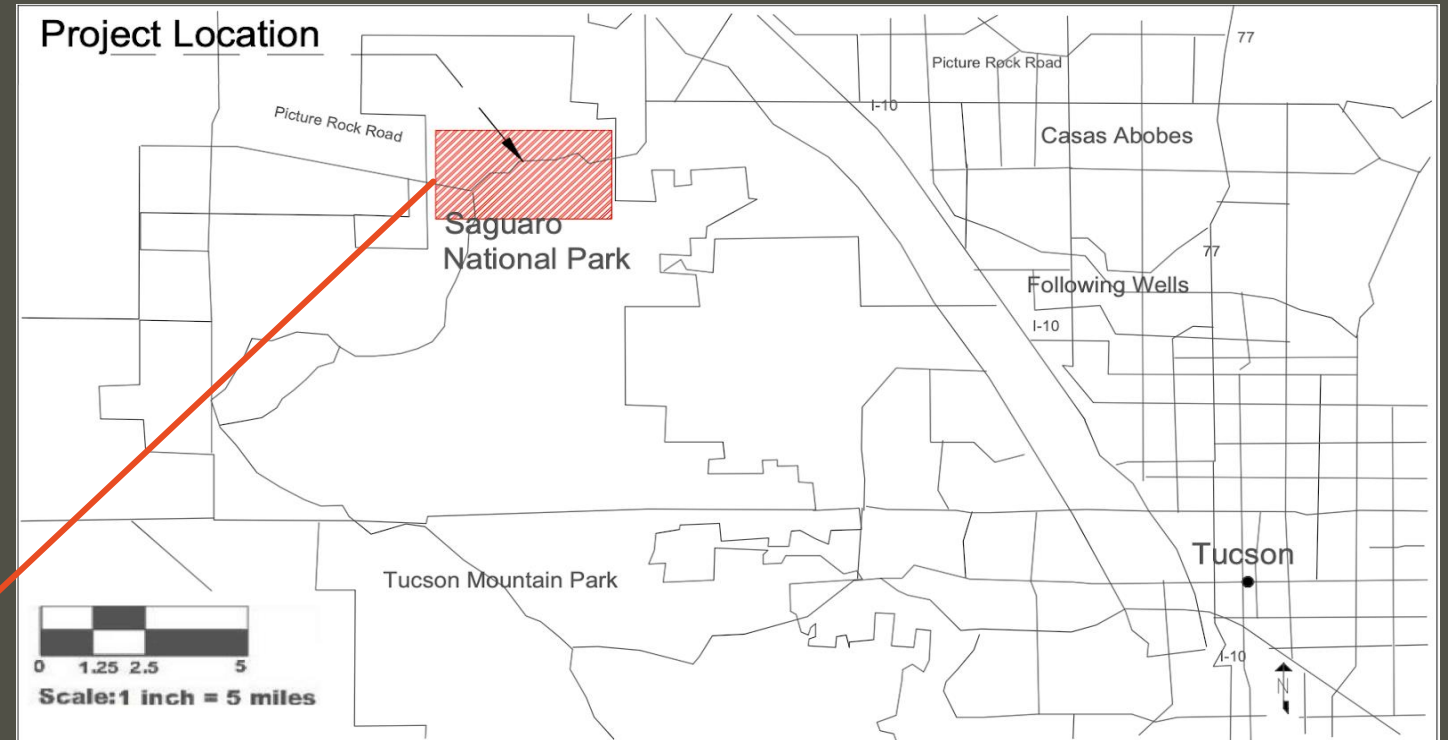


Figure 2: City of Tucson View

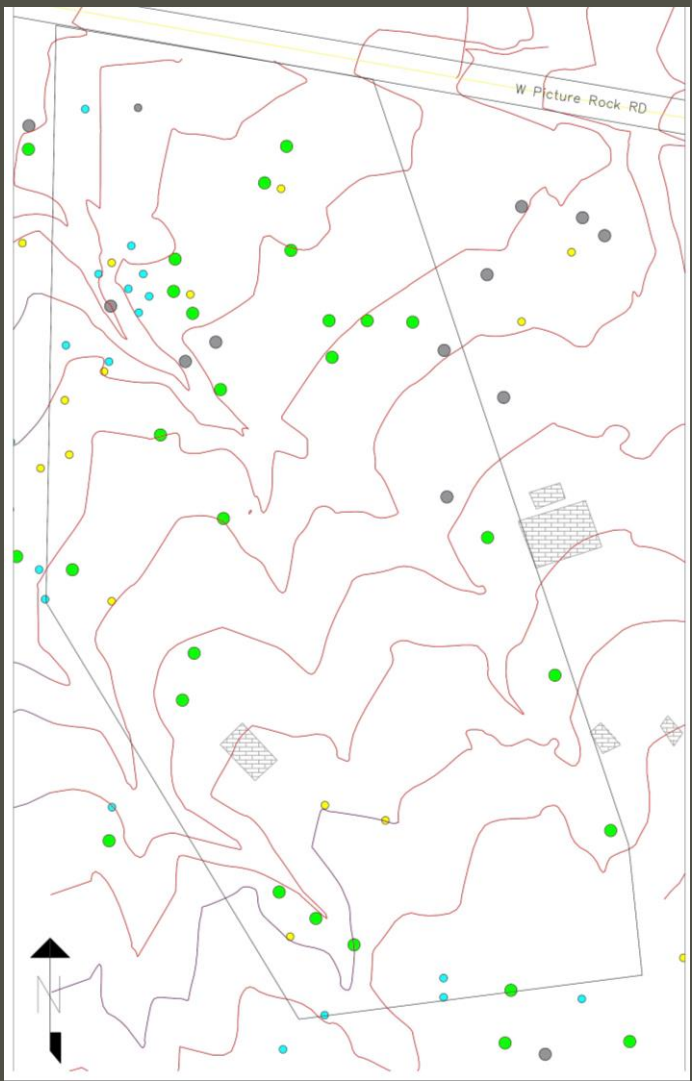
Project Criteria

- Available space for new lot
- Protection and removal of native plants
- Adequate drainage
- Permits truck-trailer parking
- ADA compliant

Existing Site: 4.5 square acres
Elevation: 2,493 feet

Field Work/Survey Analysis

Goal: Travel to the site in Tucson, Arizona to take a visual, site, and vegetation survey as well as collect geotechnical samples



- Protected Species**
- Ironwood
 - Palo Verde
 - Saguardo (Short)
 - Saguardo (Tall)

Figure 3: Provided Existing Species Location



Figure 4: Provided 2 ft. Contour Map

The site investigation was not conducted due to travel restrictions, instead the 2-foot contour map was provided by Pima County and the vegetation map was provided by the client.

Geotechnical Considerations

Goal: Obtain/calculate geotechnical properties through classifications (AASHTO/USCS) to aid in the pavement design

- Using a boring log from a project occurring in Mesa, Arizona:
 - Assumed soil type is Sandy Clay Loam
 - USCS classification- CL, SC (Lean Clayey Sand)
 - AASHTO classification- A-6
 - Group Index- 0
- Selection of Subbase:
 - Gravel lot:
 - Crushed (Graded) Stone base- 6 inches
 - Soil-Aggregate Subbase- 4 inches
 - Asphalt pavement lot:
 - Hot Mix Asphalt with aggregate- 2 inches
 - Soil-Cement Base- 6 inches
 - Soil-Aggregate Subbase- 4 inches

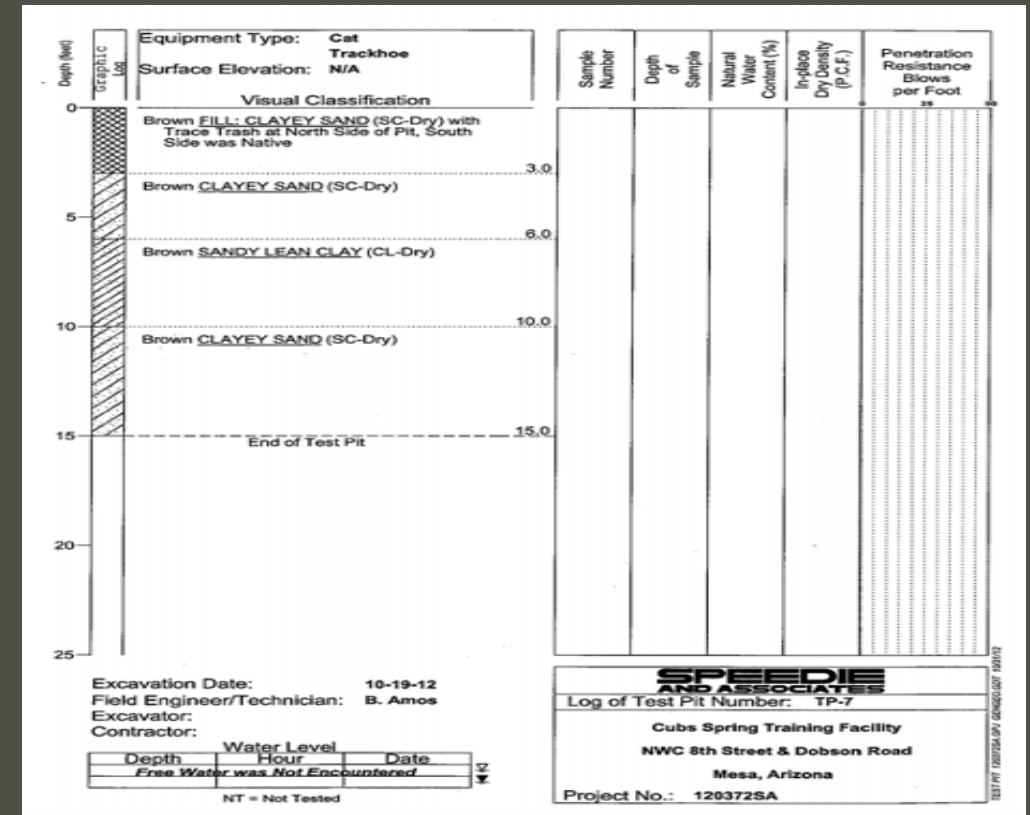


Figure 5: Boring log of Union Office Complex in Mesa, Arizona

Subgrade Considerations

Goal: Obtain/calculate Subgrade properties to aid in the pavement design

- Gravel Lot Drainage Coefficients-
 - Consisted of two layers
 - Crushed (graded) Stone- 0.14
 - Soil-Aggregate Subbase- 0.05
 - The drainage coefficient used in Pima County, AZ- 1.25
- The Structural Number for the gravel lot was estimated to be 1.

- Asphalt Pavement Lot Drainage Coefficients-
 - Consisted of three layers
 - Hot Mix Asphalt- 0.44
 - Soil-Cement Base- 0.15
 - Soil-Aggregate Subbase- 0.05
 - The drainage coefficient used in Pima County, AZ- 1.25
- The Structural Number for the asphalt Pavement lot was estimated to be 3.

$$SN = a_1 D_1 + a_2 D_2 m_2 + a_3 D_3 m_3$$

where

a_1, a_2, a_3 = layer coefficients representative of surface, base, and subbase courses, respectively (see Section 2 3 5),

D_1, D_2, D_3 = actual thicknesses (in inches) of surface, base, and subbase courses, respectively, and

m_2, m_3 = drainage coefficients for base and subbase layers, respectively (see Section 2 4 1)

Equation 1: Equation used to determine the Structural Number

Hydrology and Hydraulics Analysis

Goal: Analyze the existing and proposed hydraulic infrastructure from required Pima County storm events

Pre-Development Conditions	
Sub Basin Area (Acres)	4.5
Length of Longest Watercourse (ft)	1439
Watershed Type	Undeveloped Foothills
Channel Slope (ft/ft)	0.024
Basin Factor	0.035
Vegetative Cover Density (%)	90
Vegetative Cover Type	Desert Brush
Impervious Cover (%)	5
Soil Type	C
Curve Number	90

Table 1: Pre-Development Inputs

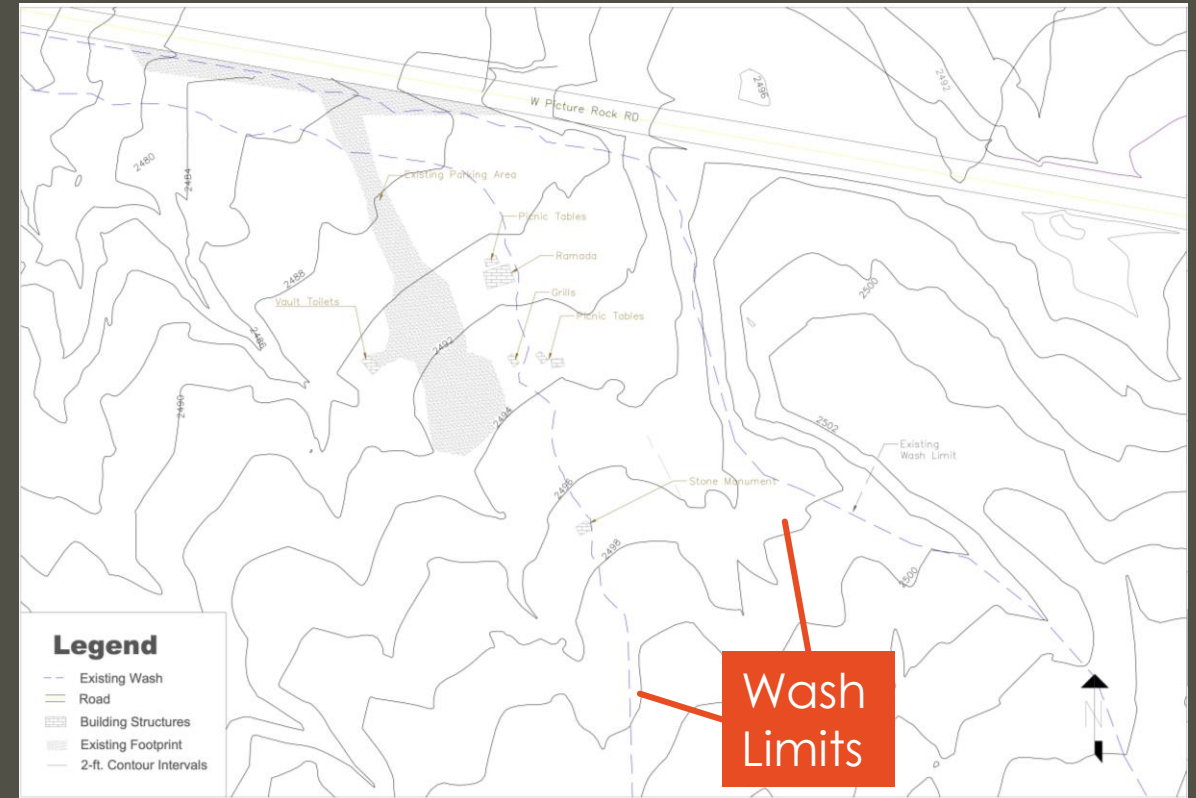


Figure 6: Existing Conditions

Post-Development Conditions (gravel)	
Vegetative Cover Density (%)	85
Impervious Cover (%)	10

Table 2: Post-Development (gravel) Inputs

Post-Development Conditions (asphalt)	
Vegetative Cover Density (%)	85
Impervious Cover (%)	10

Table 3: Post-Development (asphalt) Inputs

100 Year Storm			
	Pre-Development	Post-Development (gravel)	Post-Development (asphalt)
Peak Discharge (CFS)	26.1	26.2	28

Table 4: Pre vs. Post-Development Conditions Outputs

Utilized NRCS Cross Section Analyzer to

- Plot a cross section of the channel of interest
- Δ flow due to increased impervious surfaces (pre-development vs post development i.e. gravel & asphalt)

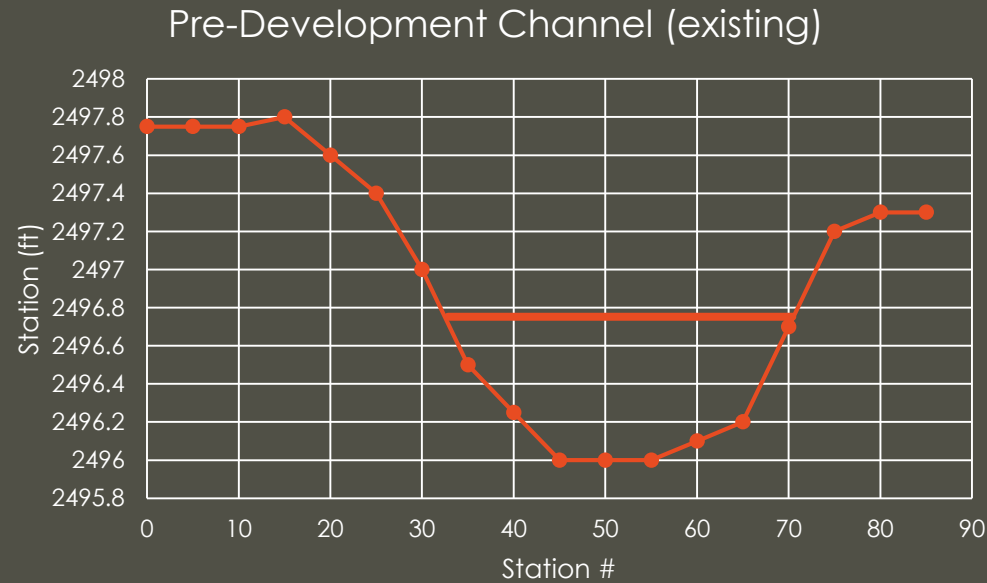


Figure 7: Pre-Development Conditions

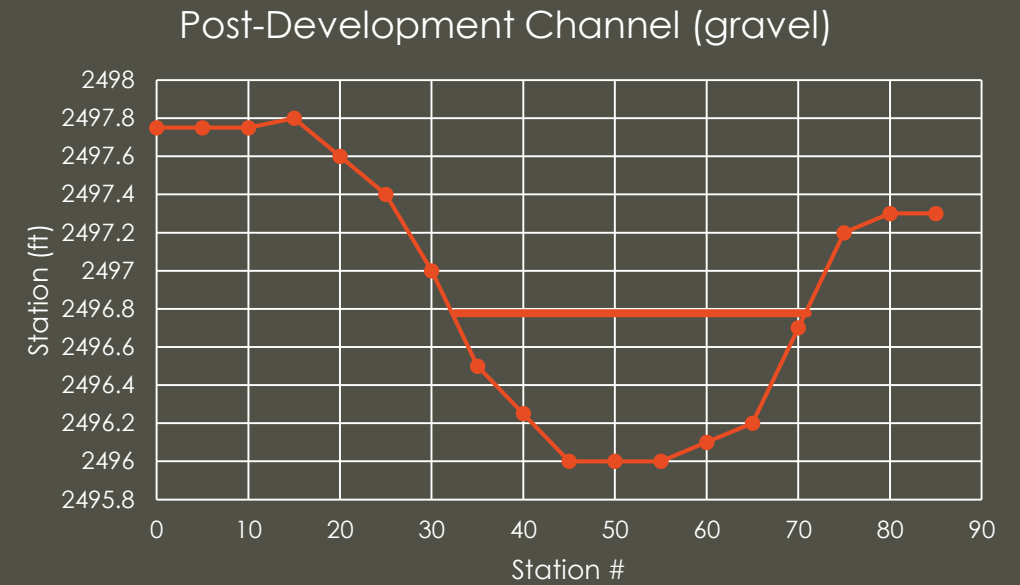


Figure 8: Post-Development Conditions (gravel)

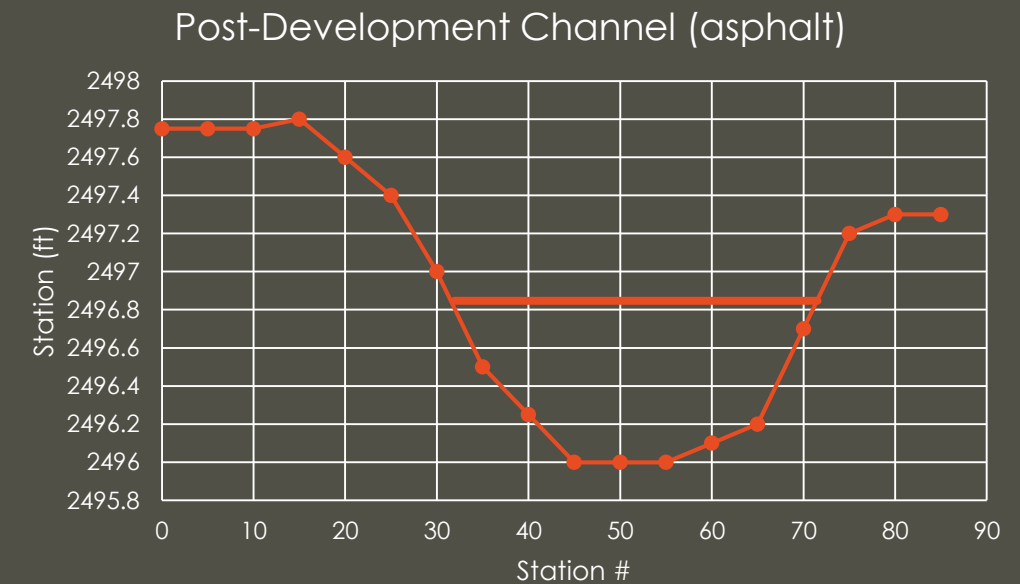


Figure 9: Post-Development Conditions (asphalt)

Traffic and Visitation Statistics

Goal: Obtain a daily count of visitors to the Camboh Picnic Area to design a lot that will account for the increase of visitors

Visitors in Saguaro National Park in 2019

950,000



Visitors in Saguaro National Park in 2020

1,026,226



Figure 10: Typical Horse Trailer and Truck



Figure 11: Equestrian Trail in Arizona

Parking Lot Design and Development

Goal: From the analyses completed, concluded on an overall flow size of lot and parking stalls while adhering to ADA, local, and federal standards

Overall Lot Dimension and Flow of Traffic

- Constrained to design around existing structures
- 169'-09" (width) x 443'-03" (length)
- Circular pattern

Parking stalls Dimensions

- Design vehicle - Truck-trailer combination
- 45 degree angled
- 3 ADA parking stalls (8' x 18')
- 5 Passenger vehicle stalls (9' x 25'-06")
- 15 Truck-trailer vehicle stalls (18' x 55'-00")

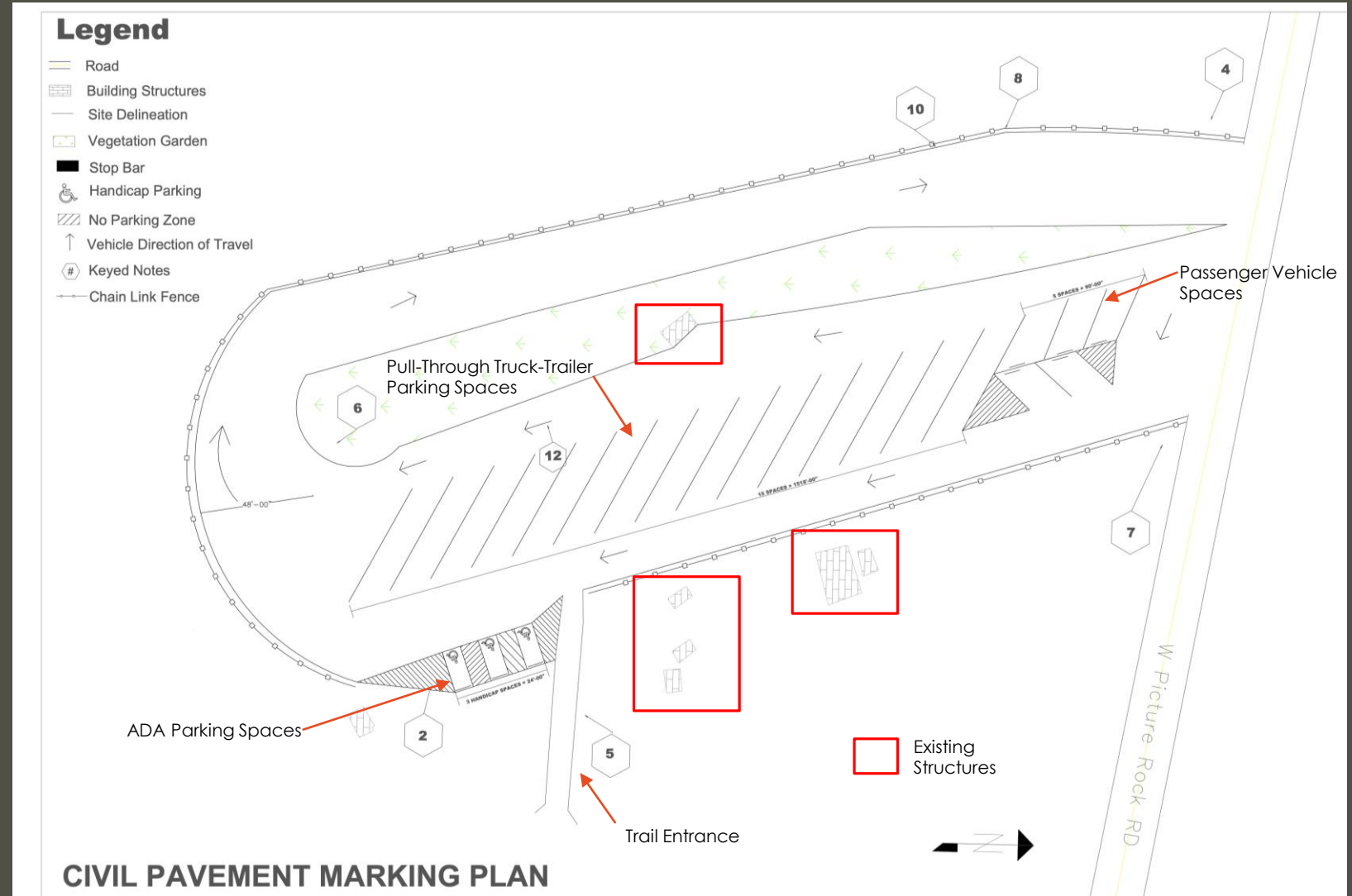


Figure 12: Overall Parking Lot Design

SAGUARO NATIONAL PARK PARKING LOT ASSESSMENT AND DESIGN TUCSON, ARIZONA

Cam-Boh Picnic Area Information

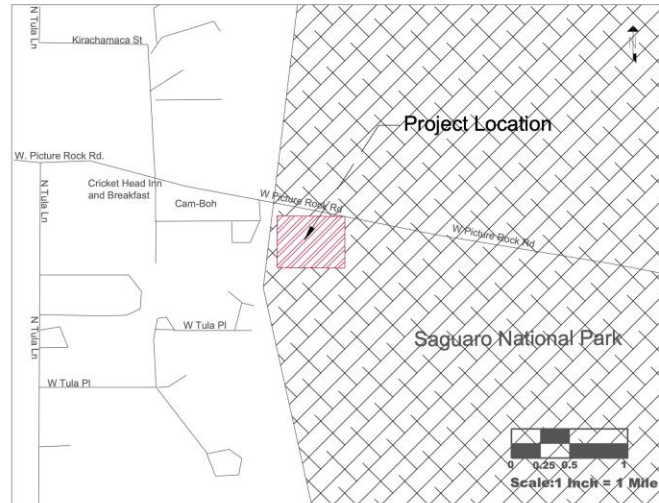
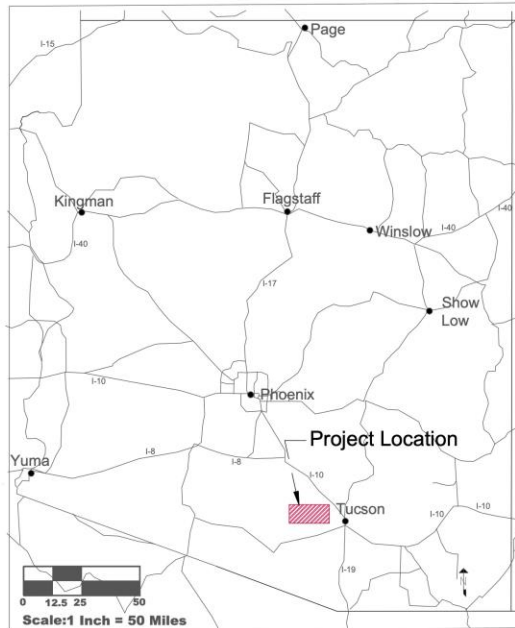
Coordinates: 32.3189633°N, -111.1662121°W

Elevation: 2,493 feet (760 meters)

USGS Topo Map Quad: Avra

Jurisdiction: National Park Service

Client: Richard Goepfrich, Saguaro National Park Chief
of Facility Management

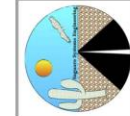


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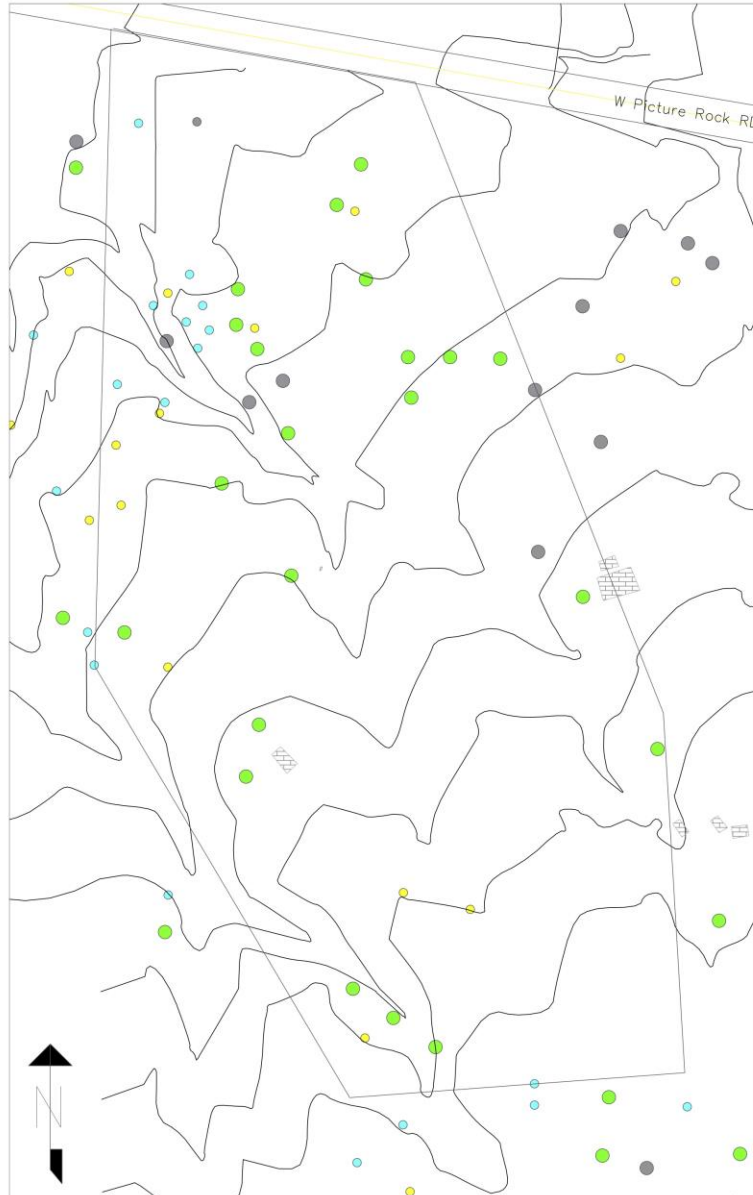
- | | |
|-------------------------|-----------------------------|
| Project Location | Existing Vegetation |
| Existing Wash | Stop Bar |
| Road | Handicap Parking |
| Building Structures | No Parking Zone |
| Existing Footprint | Vehicle Direction of Travel |
| 2-ft. Contour Intervals | Keyed Notes |
| Site Delineation | Wood Fence |
| Vegetation Garden | Chain Link Fence |

Sheet Index		
Content	Sheet #	DWG #
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Proposed Site Layout	3	G-3
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Pavement Marking Details	6	C-2
Pavement Cross Section	7	C-3
Civil Gravel Marking Plan	8	C-4
Gravel Marking Details	9	C-5
Gravel Cross Section	10	C-6
Erosion Control	11	C-7
Signage Plan	12	S-1

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SCALE: N/A		DRAWING: FOR LTR		COVER PAGE	
DESIGNED: FOR LTR		CHECKED: OK		XX XX XX XX	
DESIGNER: S.E.		CHECKED: OK		HEADQUARTERS	
Saguaro Systems Engineering, Contact Information					
Drew Foster - Email: dfoster@sse.com Phone: (520)220-3388					
Drew Foster - Email: dfoster@sse.com Phone: (520)220-3422					
John Trevis - Email: jtrevis@sse.com Phone: (520)220-3384					
REVISIONS					
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2	90% Submittal	11/03	DJF		
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4					
DRAWING NO. G-1					
SHT NO. 1 OF 12					



Vegetation Relocation Plan



EXISTING VEGETATION LOCATION MAP

Legend

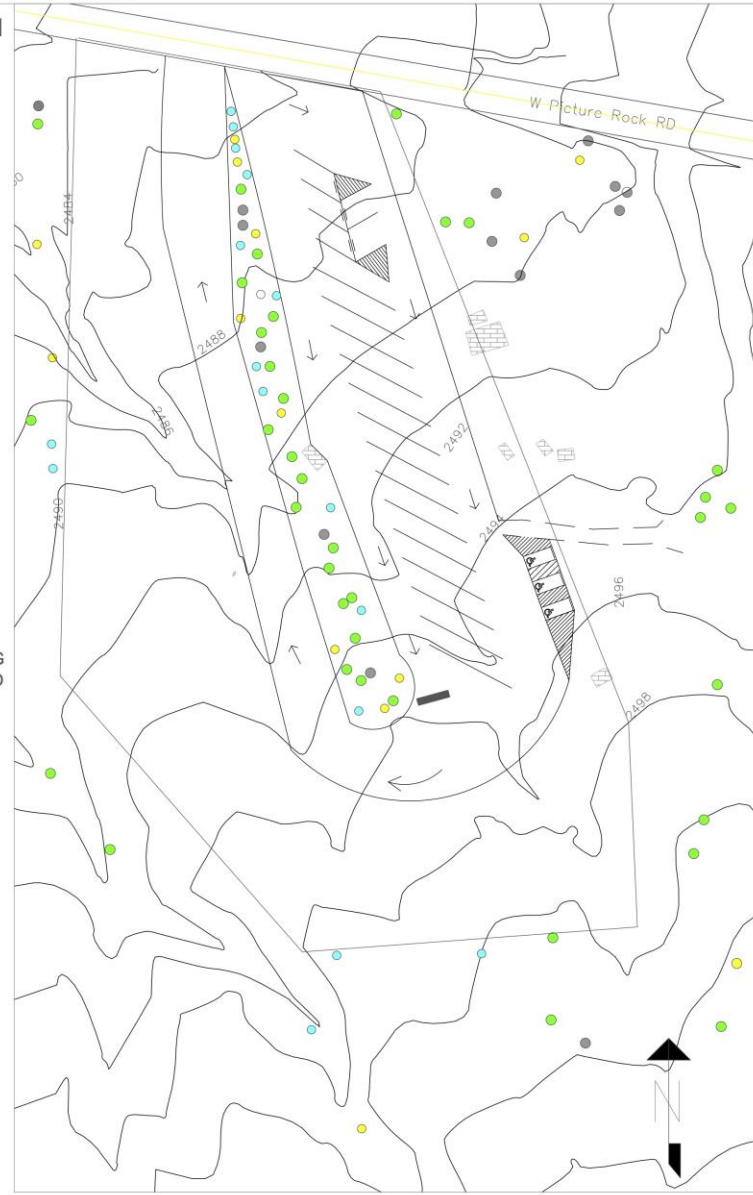
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- Building Structures
- Site Delineation
- Vegetation Garden
- Stop Bar
- Handicap Parking
- No Parking Zone
- Vehicle Direction of Travel

Protected Species

- Ironwood
- Palo Verde
- Saguaro-Short
- Saguaro-Tall

RELOCATION NOTES:

1. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO VERIFY ALL PROTECTED SPECIES LOCATIONS PRIOR TO ANY RELOCATION OF THE PROTECTED SPECIES IN THE EXISTING BOUNDARY OF THE PROJECT, PRIOR TO CONSTRUCTION.
2. ALL PROTECTED SPECIES LOCATED INSIDE THE EXISTING BOUNDARY WILL BE MOVED TO DESIGNATED VEGETATION AREA OR OUTSIDE THE PROJECT PARAMETER.
3. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO MINIMIZE THE DISTURBANCE OF THE SITE AREAS AND TO DESIGN AND IMPLEMENT BEST MANAGEMENT PRACTICES AS REQUIRED BY AZDEQ.
4. THE CONTRACTOR HAS THE ABILITY TO REMOVE ALL VEGETATION THAT IS NOT OUTLINED AS BEING PROTECTED, TO STABILIZE THE EXISTING AREA FOR THE DESIGN.
5. ALL VEGETATION SHALL BE MOVED FROM THE EXISTING LAYOUT TO THE PROPOSED LAYOUT.













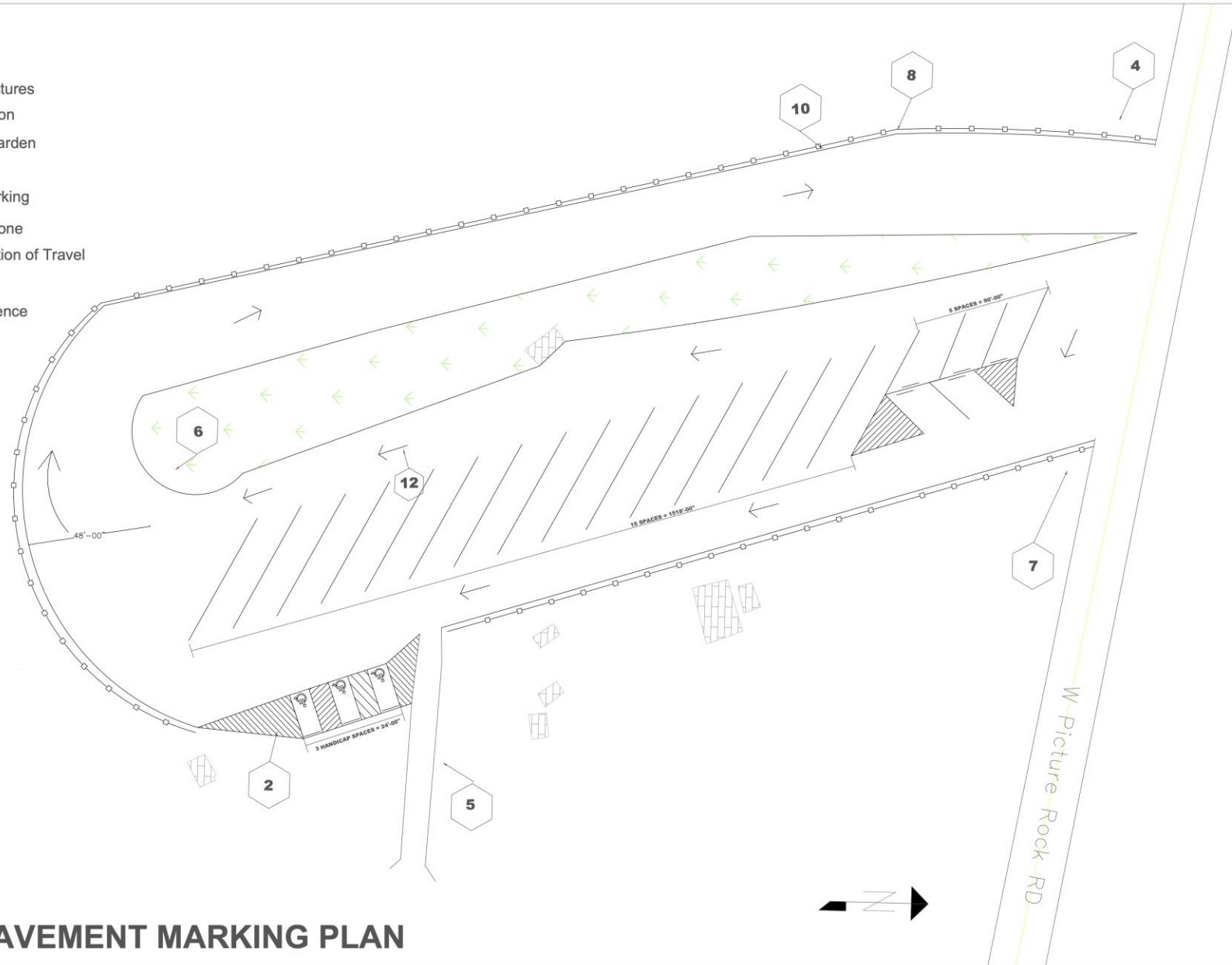
PROPOSED VEGETATION LOCATION MAP

Saguaro Systems Engineering Contact Information		Saguaro Parking Lot Design Tucson, AZ	
Client: Fortino, Ence, d'Almeida, sds, Phone: (520)300-2066	DATE: 11/03/20	SCALE: 1" = 30'	DRAWN: JCF
Dylan Gatto: dylan.gatto@sage.com, Phone: (520)300-3422	DESIGNED: SLE	CHECKED: OK	DATE: 11/03/20
John Traves: john.traves@sage.com, Phone: (520)300-2066			
REVISIONS		DRAWING NO.	
NO.	DESCRIPTION	DATE	BY
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2	90% Submittal	11/03	DJF
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4			
SHT NO.		OF	
4		12	

Site Delineation Plan

Legend

-  Road
-  Building Structures
-  Site Delineation
-  Vegetation Garden
-  Stop Bar
-  Handicap Parking
-  No Parking Zone
-  Vehicle Direction of Travel
-  Keyed Notes
-  Chain Link Fence



CIVIL PAVEMENT MARKING PLAN

Seguro Parking Lot Design Tucson, AZ

Civil Pavement Marking Plan

0 4.5 9 18

Job No. 1
 DATE: 11/03/20
 SCALE: 1" = 18'
 DRAWN: J. Trivers
 DESIGNER: S.E.
 CHECKED: DR. Hester/MSH

Seguro Systems Engineering Contact Information
 General Inquiries Email: info@seguro.com Phone: (520)252-2888
 Design Inquiries Email: design@seguro.com Phone: (520)252-3422
 Job Inquiries Email: jobinquiries@seguro.com Phone: (520)252-2888

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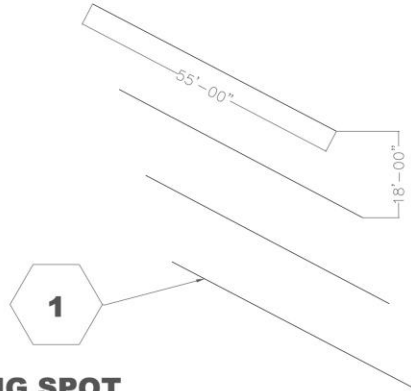
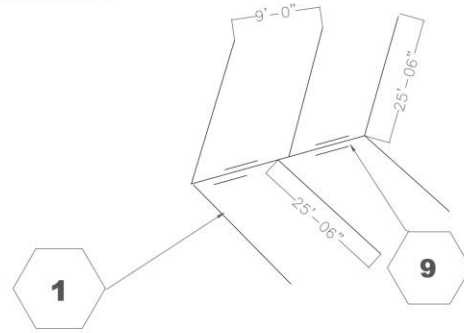
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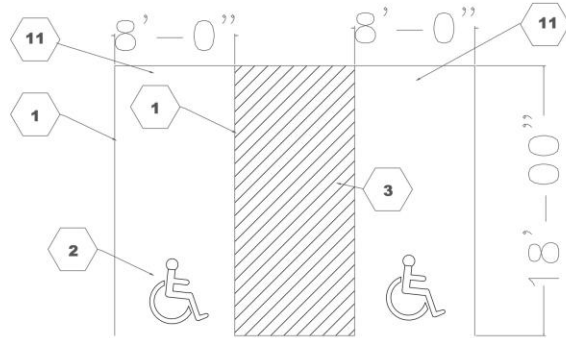
SHT NO. 5 OF 12

Gravel Detail Sheet

DETAIL 1: TYPICAL PARKING SPOT



DETAIL 2: TYPICAL PULL-THROUGH PARKING SPOT



DETAIL 3: TYPICAL HANDICAP



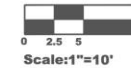
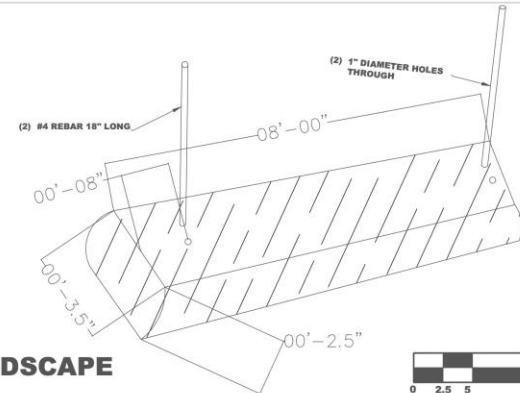
CIVIL GRAVEL MARKING PLAN DETAILS

SHEET NOTES

- ALL PAVEMENT MARKINGS SHALL BE INSTALLED IN ACCORDANCE WITH THE LATEST EDITION OF "ARIZONA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (AZMUTCD)" AND THE FHWA'S "STANDARD HIGHWAY SIGNS" BOOK'S SECTION 10 FOR LETTER AND ARROW DETAILS.
- ALL PARKING SPACES SHALL BE DIMENSIONED AS SPECIFIED IN DETAIL 1-3.
- ALL PARKING SPACES SHALL BE PAINTED WITH 2" FLAT TRAFFIC WHITE INVERTED STRIPING SPRAY PAINT (REFERRED TO PAINT).
- ALL HATCHED AREAS SHALL BE 2" WHITE LINES AT 3' INTERVALS ANGLED AT 45 DEGREES.
- PROVIDE AND INSTALL ALL SIGNS AND CAR STOPPERS AS INDICATED ON THE PLANS.
- CONTRACTOR SHALL INSTALL NPS SUPPLIED LOT IDENTIFIER AND RESERVED PARKING SIGNS. CONTRACTOR SHALL SUBMIT REQUEST TO NPS FOUR WEEKS PRIOR TO INSTALLATION OF SIGNS TO ALLOW NPS TO TRACK SUPPLYING OF SIGNS. CONTRACTOR SHALL SUPPLY ALL MOUNTING HARDWARE FOR THE LOCATIONS DIRECTED BY NPS.

KEYED NOTES

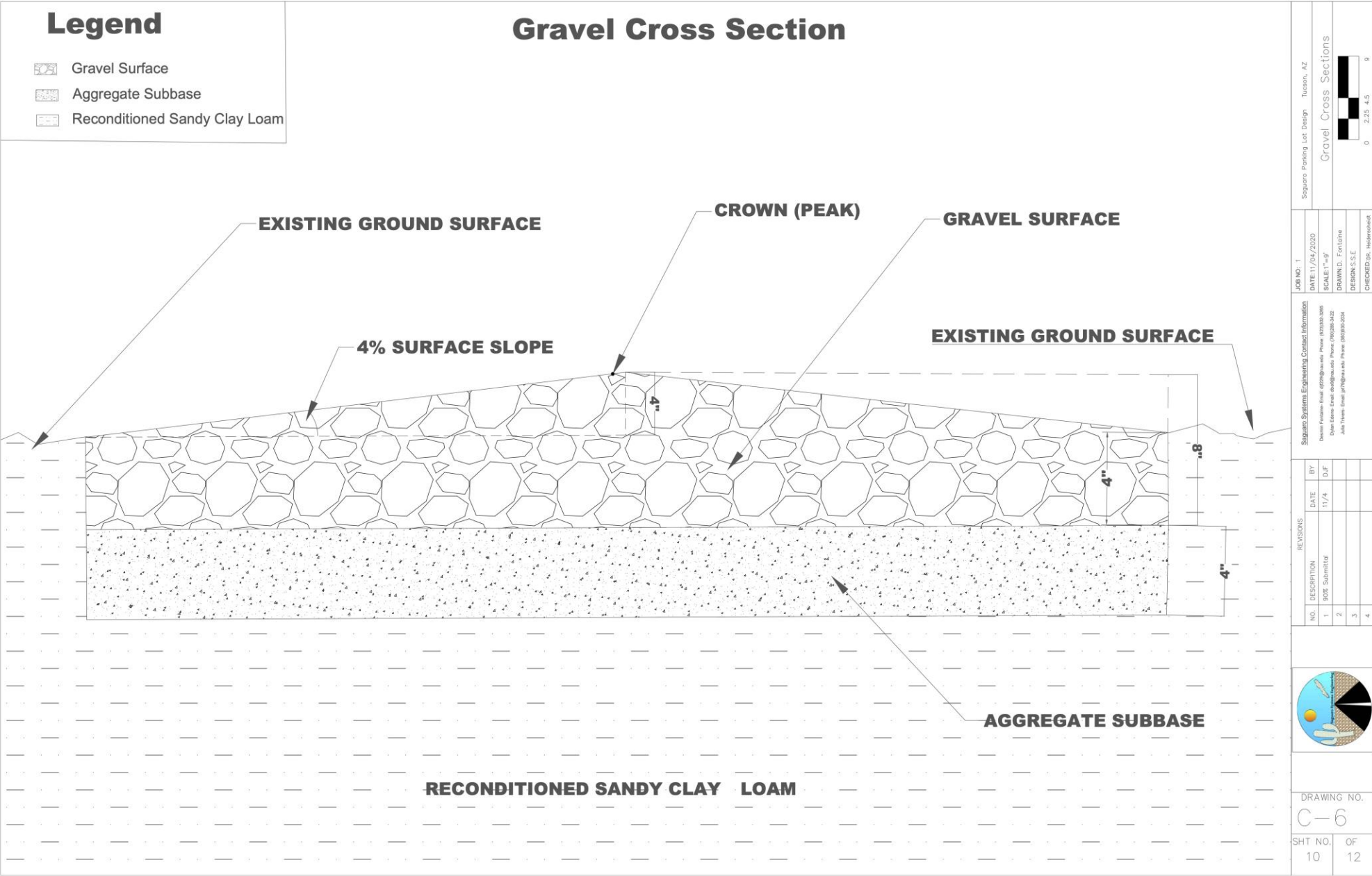
- 2 INCH SOLID WHITE MARKING PAINT LINE.
- WHITE PAVEMENT MARKING PAINT LEGENDS AND SYMBOLS. SEE NOTE 1.
- 2 INCH SOLID YELLOW MARKING PAINT LINE.
- DO NOT ENTER SIGN.
- TRAIL HEAD ENTRANCE.
- YIELD SIGN.
- CAM-BOH PICNIC AREA ENTRANCE SIGN.
- CHAIN FENCE OFFSET BOUNDARY 2 FT (SEE PAVEMENT DESIGN FOR DETAIL).
- CONCRETE BUMPER BLOCKS (10X) (SEE DETAIL 4).
- PARKING LOT/VEGETATION BOUNDARY WITH PAINT.
- ADA HANDICAP PARKING SIGN STANCHION SYSTEM.
- ARROWS SHALL BE INSTALLED PER 2 INCH SOLID WHITE MARKING PAINT LINE.



DETAIL 4: 8 FT. LANDSCAPE TIMBER BLOCK

JOB NO. 1		DATE: 11/03/20		Saguano Parking Lot Design - Tucson, AZ	
SCALE: N/A		DRAWN: J. Trivers		Gravel Marking Details	
DESIGN: S.C.E.		CHECKED: J.R. Holmquist		XX XX XX XX	
Saguano Systems Engineering Contact Information					
Dustin Forster - Email: dforster@saguano.com Phone: (520)202-3008					
Dylan Coates - Email: dcoates@saguano.com Phone: (520)202-3422					
Alec Trivers - Email: atrivers@saguano.com Phone: (520)202-3004					
REVISIONS					
NO.	DESCRIPTION	DATE	BY	D/F	D/F
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2	90% Submittal	11/03			
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4					
DRAWING NO. C-5					
SHT NO. 9		OF 12			

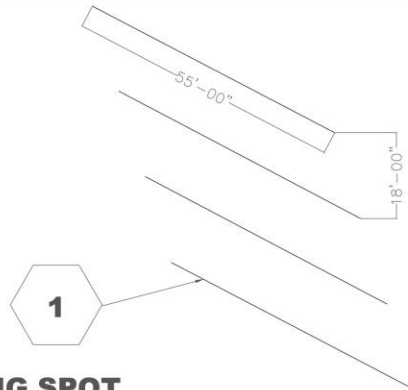
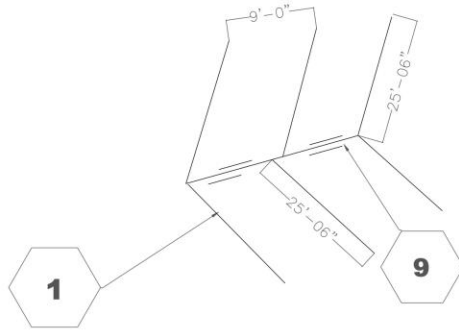
Gravel Cross Section



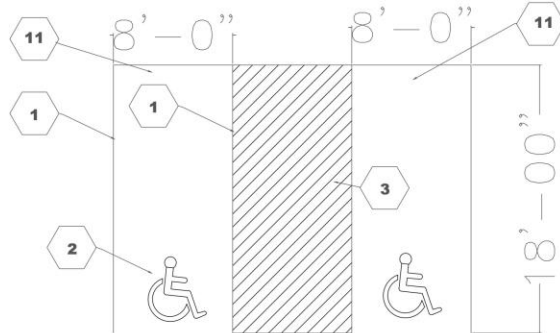
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DATE 11/04/2020		Gravel Cross Sections																										
SCALE 1" = 9'		0 2.25 4.5 9																										
DRAWN/D. Fontaine		DESIGNED/S.E.																										
CHECKED/D.R. Heilmann																												
<p>Saguaro Systems Engineering Contact Information</p> <p>Owner: Phoenix Road #4776@phoenix.az.gov (602)333-3366 Design: Phoenix Road #4776@phoenix.az.gov (602)333-3366 Job Title: Road #4776@phoenix.az.gov (602)333-3366</p>																												
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SHT NO. 10		OF 12																										

Asphalt Detail Sheet

DETAIL 1: TYPICAL PARKING SPOT



DETAIL 2: TYPICAL PULL-THROUGH PARKING SPOT



DETAIL 3: TYPICAL HANDICAP



CIVIL PAVEMENT MARKING PLAN DETAILS

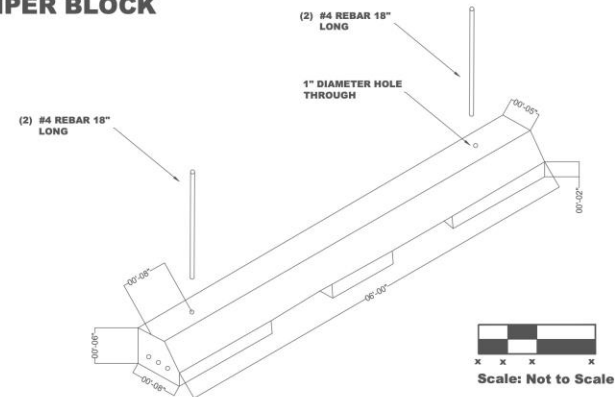
SHEET NOTES

- ALL PAVEMENT MARKINGS SHALL BE INSTALLED IN ACCORDANCE WITH THE LATEST EDITION OF "ARIZONA MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (AZMUTCD)" AND THE FHWA'S "STANDARD HIGHWAY SIGNS" BOOK'S SECTION 10 FOR LETTER AND ARROW DETAILS.
- ALL PARKING SPACES SHALL BE DIMENSIONED AS SPECIFIED IN DETAIL 1-3.
- ALL PARKING SPACES SHALL BE PAINTED WITH 2" FLAT TRAFFIC WHITE INVERTED STRIPING SPRAY PAINT (REFERRED TO PAINT).
- ALL HANDICAP HATCHED AREAS SHALL BE 2" YELLOW LINES AT 3" INTERVALS ANGLED AT 45 DEGREES.
- PROVIDE AND INSTALL ALL SIGNS AND CAR STOPPERS AS INDICATED ON THE PLANS.
- CONTRACTOR SHALL INSTALL NPS SUPPLIED LOT IDENTIFIER AND RESERVED PARKING SIGNS. CONTRACTOR SHALL SUBMIT REQUEST TO NPS FOUR WEEKS PRIOR TO INSTALLATION OF SIGNS TO ALLOW NPS TO TRACK SUPPLYING OF SIGNS. CONTRACTOR SHALL SUPPLY ALL MOUNTING HARDWARE FOR THE LOCATIONS DIRECTED BY NPS.

KEYED NOTES

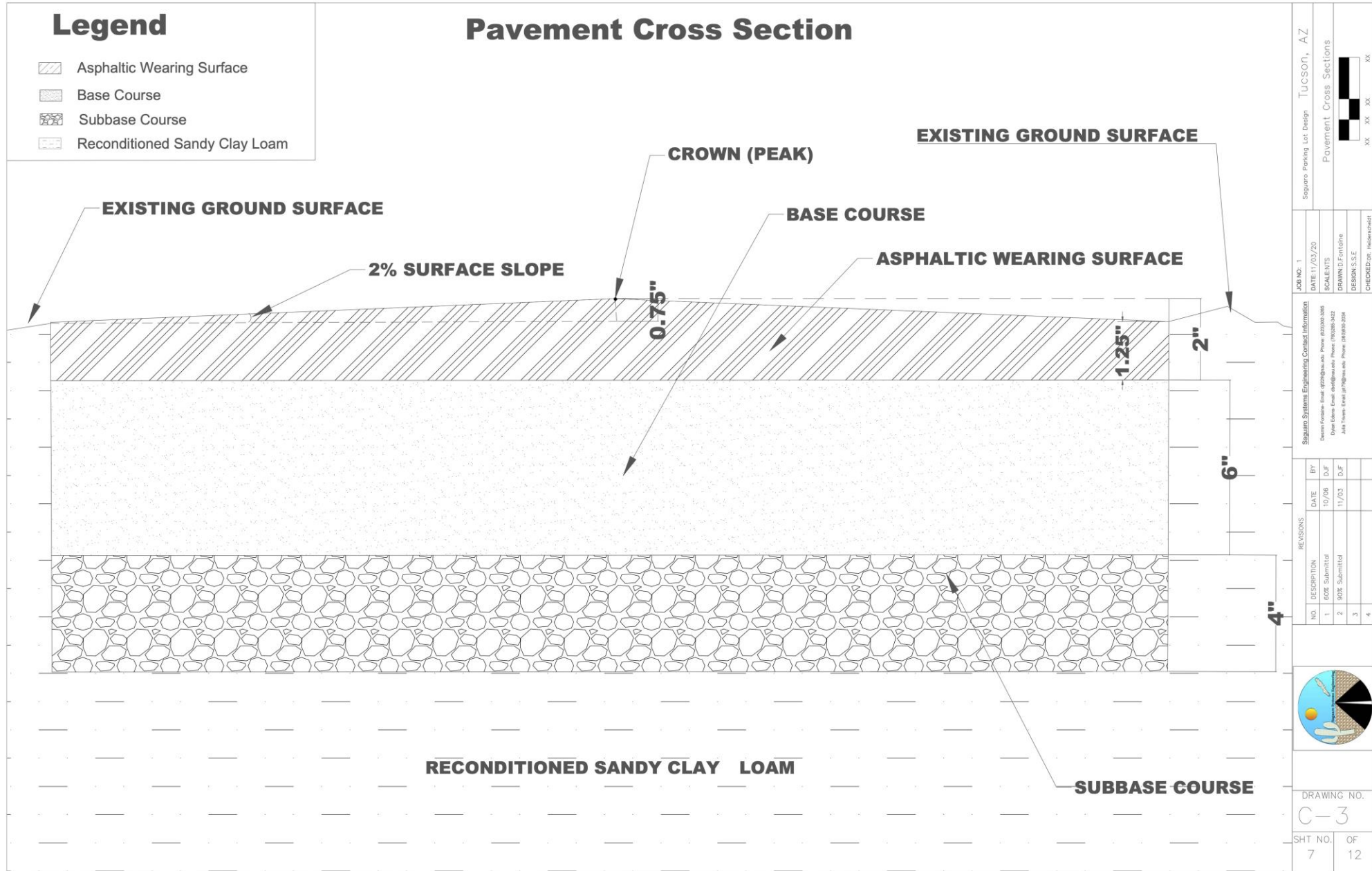
- 2 INCH SOLID WHITE MARKING PAINT LINE.
- WHITE PAVEMENT MARKING PAINT LEGENDS AND SYMBOLS. SEE NOTE 1.
- 2 INCH SOLID YELLOW MARKING PAINT LINE.
- DO NOT ENTER SIGN.
- TRAIL HEAD ENTRANCE.
- YIELD SIGN.
- CAM-BOH PICNIC AREA ENTRANCE SIGN.
- CHAIN FENCE OFFSET BOUNDARY 2 FT (SEE PAVEMENT DESIGN FOR DETAIL).
- CONCRETE BUMPER BLOCKS (10X) (SEE DETAIL 4).
- PARKING LOT/VEGETATION BOUNDARY WITH PAINT.
- ADA HANDICAP PARKING SIGN STANCHION SYSTEM.
- ARROWS SHALL BE INSTALLED PER 2 INCH SOLID WHITE MARKING PAINT LINE.

DETAIL 4: 6' BUMPER BLOCK



JOB NO.: 1		Sagamore Parking Lot Design - Tucson, AZ	
DATE: 11/03/20		Pavement Marking Details	
SCALE: 1/4"			
DRAWN: J. Triviers		DESIGN: S.S.E	
CHECKED: J. Heisterkamp			
Sagamore Systems Engineering Contact Information Denver: Phone: Email: 303300.3085 Dyer: Phone: Email: 404300.3085 Julia Triviers: Email: jtriviers@ssae.com Phone: 303300.3084			
REVISIONS		BY	DATE
NO.	DESCRIPTION	DATE	BY
1	60% Submittal	10/20	DJF
2	90% Submittal	11/03	DJF
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4			
DRAWING NO.		C-2	
SHT NO.	OF		
6	12		

Asphalt Cross Section



JOB NO. 1
 DATE: 11/03/20
 SCALE: NTS
 DRAWING: Fontaine
 DESIGNED: S.E.
 CHECKED: Dr. Heiser/Hart

Saguro Systems Engineering Contact Information
 Design Offices: East: 4800 Saguaro Blvd. Phoenix, AZ 85024
 Office: 1000 N. 19th Avenue, Phoenix, AZ 85012
 All Times: EST (Pacific Time)

NO.	DESCRIPTION	DATE	BY
1	60% Submittal	10/06	D.F.
2	90% Submittal	11/03	D.F.
3			
4			

Saguaro Parking Lot Design TUCSON, AZ
 Pavement Cross Sections
 XX XX XX XX

DRAWING NO. C-3
 SHT NO. 7 OF 12

Erosion Control Plan



Wash Erosion Sediment Control

- 1. ROCK FOR EROSION PROTECTION OF ROADWAY DITCHES, WHERE REQUIRED, MUST BE OF SOUND QUARRY ROCK, PLACED TO A DEPTH OF 1' AND MUST MEET THE FOLLOWING SPECIFICATIONS: 4"-8" ROCK/40%-70% PASSING; AND 1'-2" ROCK/10%-20% PASSING. RECYCLED CONCRETE SHALL NOT BE USED FOR EROSION PROTECTION, INCLUDING TEMPORARY STABILIZATION ELSEWHERE ON THE SITE.**
- 2. THE EROSION SEDIMENT CONTROL FACILITIES SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE DETAILS ON THE APPROVED PLANS. LOCATIONS MAY BE MOVED TO SUITE FIELD CONDITIONS, SUBJECT TO APPROVAL BY THE ENGINEER AND THE CITY OF TUCSON INSPECTOR.**
- 3. THE ESC FACILITIES ON INACTIVE SITES SHALL BE INSPECTED AND MAINTAINED A MINIMUM OF ONCE A MONTH OR WITHIN 48 HOURS FOLLOWING A STORM EVENT BY THE CONTRACTOR DURING CONSTRUCTION.**
- 4. THE IMPLEMENTATION OF THIS ESC PLAN AND THE CONSTRUCTION, MAINTENANCE, REPLACEMENT, AND UPGRADING OF THESE ESC FACILITIES IS THE RESPONSIBILITY OF THE PERMITTEE/CONTRACTOR UNTIL ALL CONSTRUCTION IS APPROVED.**
- 5. MAINTENANCE OF THE EROSION AND SEDIMENT CONTROL ITEMS MUST BE CONTINUALLY PROVIDED DURING THE DURATION OF THE LAND DISTURBANCE ACTIVITY BY THE CONTRACTOR. MAINTENANCE AND CORRECTIVE ACTIONS FOLLOWING THE COMPLETION OF THE PROJECT SHALL BE NOTED IN THE SWPPP DOCUMENTATION OF NPS AND CORRECTIVE MEASURES IS THE RESPONSIBILITY OF NPS.**

Legend

- Vehicle Direction of Travel
- Handicap Parking
- Road
- Building Structures
- Vegetation Garden
- 2-ft. Contour Intervals
- Rip Rap Control

JOB NO. 1
 DATE 11/03
 SCALE N/A
 DRAWN S.E.
 DESIGNED: Forthofer
 CHECKED BY: Instrument

SQUARE Parking Lot Design Tucson, AZ
Erosion Control

Sagarino Systems Engineering Contact Information
 Owner: Forthofer, Email: forthofer@sseng.com, Phone: (520)333-3333
 Designer: Forthofer, Email: forthofer@sseng.com, Phone: (520)333-3333
 Job Title: Forthofer, Email: forthofer@sseng.com, Phone: (520)333-3333

REVISIONS	
NO.	DESCRIPTION
1	80% Submittal
2	80% Submittal
3	
4	

DATE	BY
10/06	D.F.
11/03	D.F.




DRAWING NO. C-7
 SHT NO. 11 OF 12

Signage General Notes

SIGNING GENERAL NOTES

- ALL EQUIPMENT/MATERIALS AND CONSTRUCTION SHALL MEET OR EXCEED THE REQUIREMENTS CONTAINED IN THE CURRENT PIMA ASSOCIATION OF GOVERNMENTS (PAG) STANDARD SPECIFICATIONS AND THE STANDARD DETAILS FOR PUBIC IMPROVEMENTS, THE SPECIAL PROVISIONS AND THE APPROVED PLANS. ALL SIGNING SHALL BE INSTALLED IN ACCORDANCE WITH THE PC SIGNING DESIGN MANUAL.
- SIGNS MAY BE MODIFIED AND LOCATIONS ADJUSTED TO FIT CONDITION AT THE DISCRETION OF THE TRAFFIC ENGINEER.
- POST LENGTHS INDICATED ON SIGN SUMMARY SHEETS ARE APPROXIMATE. THE CONTRACTOR SHALL VERIFY ACTUAL POST LENGTHS.
- ALL SIGN LOCATIONS ARE APPROXIMATE, THE CONTRACTOR SHALL VERIFY ACTUAL SIGN LOCATIONS WITH THE TRAFFIC ENGINEER PRIOR TO THE INSTALLATION OF ANY SIGNS.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING ALL WORK WITH ARIZONA 811 (1-800-782-5348) TWO BUSINESS DAYS BEFORE INSTALLING ALL TRAFFIC SIGNS IN THE FIELD AND FOR MAINTAINING ALL SIGNING UNTIL PROJECT IS APPROVED FOR "CONSTRUCTION ACCEPTANCE" BY PIMA COUNTY.
- ALL SIGNS SHALL HAVE TYPE XI SHEETING OR AN EQUIVALENT. ALL WARMING SIGNS HAVING YELLOW BACKGROUND SHALL USE FLUORESCENT YELLOW SHEET. ALL GROUND MOUNTED SIGNS SHALL HAVE AN ANTI GRAFFITI COATING APPLIED TO SIGN FACE, 3M #1160 FILM OR EQUIVALENT.
- A 3"x2" PRESSURE SENSITIVE, UV RESISTANT LABEL INDICATING THE SIGN MANUFACTURERS NAME AND DATE OF MANUFACTURE SHALL BE PLACED IN THE UPPER RIGHT CORNER OF THE BACK OF ALL SIGNS EXCEPT STREET NAME SIGNS AT THE TIME OF INSTALLATION. STREET NAME SIGNS SHALL INCLUDE A SIGN IDENTIFICATION DECAL AS SHOWN ON PIMA COUNTY SIGNING DETAIL 9-22A.
- ALL NEW SIGNS SHALL HAVE 0.080 GAUGE, RADIUS CORNER, ALUMINUM BACKING UNLESS OTHERWISE NOTED.
- PRIOR TO DISTURBING ANY TRAFFIC SIGNS, A SIGN CONDITION INVENTORY OF ALL EXISTING SIGNING SHALL BE CONDUCTED BY THE CONTRACTOR AND PROVIDED TO THE PIMA COUNTY SIGN SHOP SUPERVISOR (520) 724-2630. INVENTORY SHALL INDICATE CURRENT SIGN LOCATION AND CONDITION, INCLUDING ANY EXISTING DAMAGE OF DEFICIENCIES.
- ALL SIGNS AND POSTS BEING RE-USED ON THIS PROJECT SHALL BE STOCKPILED IN A MANNER TO AVOID DAMAGE AND MAINTAIN THE INTEGRITY OF THE SIGNS. SAFE STORAGE OF STOCKPILE AND ANY DAMAGE TO THE STOCKPILE SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

SIGNAGE SCHEDULE

SIGN TYPE	QUANTITY	SIZE	SHEET DETAIL	REFERENCE	LOCATION	PICTOGRAM
YIELD	1	36" x 36"	6	MUTCD	2B.08	
DO NOT ENTER	1	30" x 30"	4	MUTCD	2B.37	
HANDICAP PARKING SIGN STANCHION SYSTEM	4	12' x 18"	12	2010 ADA STANDARDS FOR ACCESSIBLE DESIGN		
SAGUARO NATIONAL PARK CAMBOH PICNIC AREA SIGN	1	UTILIZE TO EXISTING SIGN	8	REFER TO EXISTING SIGN	REFER TO EXISTING SIGN	

Saguaro Systems Engineering Contact Information Saguaro Systems Engineering 1000 N. Oracle Rd. Suite 100 Tucson, AZ 85705 Phone: (520) 298-1234 Fax: (520) 298-1234 Web: www.sse.com		Saguaro Parking Lot Design Tucson, AZ	
JOB NO. 1		SIGNAGE & STRIPING	
DATE: 11/03	SCALE: N/A	DESIGNER: J. Trivers	CHECKED: DR. Heiser
DATE: 10/06	DATE: 11/03		
BY: D.F.	BY: D.F.		
DESCRIPTION: 60% Submittal	DESCRIPTION: 90% Submittal		
NO. 1	NO. 2	NO. 3	NO. 4
			
DRAWING NO. S-1			
SHT NO. 12	OF 12		

Construction and Engineering Costs

Goal: Provide to the client a total cost estimation of the implementation and engineering costs associated with this project

Item	Qty	Unit	Unit Price (\$)	Total (\$)
Geotechnical Analysis				
Land Survey	1	LS	N/A	N/A
Complete Soil Test	1	LS	N/A	N/A
Earthwork				
Cut	15	HR	64	960
Fill	15	HR	64	960
Subgrade Preparation	1	LS	500	500
Paving/Subgrade Materials				
2" Hot Mix Flexible Pavement	1400	SY	8.5	11900
Soil-Cement Base	1000	CY	4.5	4500
Striping and Signage				
Striping/Signage	1	LS	2000	2000
Miscellaneous				
Testing/Quality Control	1	LS	1000	1000
Inspection	1	LS	2000	2000
Construction Management	1	LS	3000	3000
Equipment	3	HR	39	117
Maintenance	1	LS	750	750
Contingency				
Unforeseen Issues	1	LS	1500	1500
			TOTAL (\$)	29187.00

Table 5: Gravel Estimated Cost

Item	Qty	Unit	Unit Price (\$)	Total (\$)
Geotechnical Analysis				
Land Survey	1	LS	N/A	N/A
Complete Soil Test	1	LS	N/A	N/A
Earthwork				
Cut	20	HR	64	1280
Fill	20	HR	64	1280
Subgrade Preparation	1	LS	800	800
Paving/Subgrade Materials				
2" Hot Mix Flexible Pavement	8400	SY	2.5	21000
Soil-Cement Base	1400	CY	8.5	11900
Granular Base	950	CY	15	14250
Striping and Signage				
Striping/Signage	1	LS	2000	2000
Miscellaneous				
Testing/Quality Control	1	LS	1500	1500
Inspection	1	LS	2000	2000
Construction Management	1	LS	3000	3000
Equipment	10	HR	39	390
Maintenance	1	LS	500	500
Contingency				
Unforeseen Issues	1	LS	3000	3000
			TOTAL (\$)	62900

Table 6: Asphalt Estimated Cost

Impacts

Goal: Aid in the final design by conducting a feasibility tool to assess the impacts of the project on society, economy, and the environment



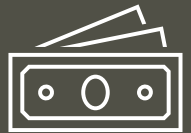
Environmental

- Preservation the environment
- Delineation area boundaries
- Relocation of protected species



Social

- Decrease stress and depression
- Safe place for recreation
- Strong relationships with the community



Economical

- Local employment
- New industries of businesses services and/or food
- New infrastructure

Economical
Impact

Environmental
Impact

Social Impact



Questions?

Acknowledgement to:

Grading Instructor: Dr. Jeffrey Heiderscheidt
Technical Advisor: Nate Reisner
Client: Richard Goepfrich
NAU College of Engineering, Informatics, and
Applied Sciences

Even though the project had restrictions due to COVID-19 the below objectives were met.

- ✓ Redesigned lot
- ✓ Protection of native species
- ✓ Adequate drainage
- ✓ Permits truck-trailer parking
- ✓ ADA compliant