

NOTICE OF MEETING
PLANNING COMMISSION
CITY OF ST. GEORGE
WASHINGTON COUNTY, UTAH

Public Notice is hereby given that the Planning Commission of the City of St. George, Washington County, Utah, will hold a regular meeting at the St. George City offices located at 175 East 200 North, St. George, Utah on Tuesday, October 13, 2020 commencing at 5:00 pm.

The meeting will also be broadcast via Zoom. Persons who are allowed to comment during the meeting may also do so via Zoom. To login to the meeting you may do so by visiting: <https://zoom.us/j/94404394995> or by calling one of the following phone numbers:

Meeting ID: 944 0439 4995

One tap mobile

+12532158782,,94404394995# US (Tacoma)

+13462487799,,94404394995# US (Houston)

Dial by your location

+1 253 215 8782 US (Tacoma)

+1 301 715 8592 US (Germantown)

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The agenda for the meeting is as follows:

Call to Order

Flag Salute

1. **HILLSIDE PERMIT (HS)**

Consider a request for a Hillside Development Permit to allow development of a residential subdivision to be called “**Summit Estates.**” The property is generally located south of the intersection at Hillrise Drive and Ft. Pierce Drive. The property is currently zoned PD-R (Planned Development – Residential). The owner is V.E. MGMT & Investment Company LC, the representative is Ben Willits, Horrocks Engineers. Case No. 2019-HS-008. (Staff – Wes Jenkins)

2. **ZONE CHANGE AMENDMENT (ZCA)** *(Public Hearing)*

A. Consider a request for a zone change amendment for Summit Estates, the PD Planned Development associated with Webb Hill, to the west of Sienna Canyon development on approximately 70.83 acres. The applicant is proposing forty-two (42) single-family lots at a density of 0.6 dwelling units per acre. The property is generally located on Hillrise Dr, south of Summit Ridge Dr. Case No. 2020-ZCA-037. (Staff – Dan Boles)

B. Consider a request for a zone change amendment for the River Trail Townhomes. On July 9, 2020, the subject property was rezoned to PD-R. The applicant is requesting approval to modify the approved site plan to shift the access road entirely on the site and add one additional unit to the site. The property is generally located at 1400 East Riverside Drive. Case No. 2020-ZCA-033 (Staff – Dan Boles)

C. Consider a request for a zone change amendment to the Desert Color Planned Development zone plan on an approximately 10.65-acre site. The site is generally located in the northern corner of Desert Color at the south-east intersection of I-15 and Southern Parkway. The proposed zone change amendment would make some changes to the previously approved Big Shots Golf Center. Case No. is 2020-ZCA-036 (Staff – Dan Boles)

3. **ZONE CHANGE (ZC)** (Public Hearing)

Consider a request for a zone change from R-1-8 (Single Family 8,000 sq ft lot sizes) to R-2 (Multiple Family, Duplex) on approximately 0.49 acres generally located southwest of the freeway on 900 South at approximately 510 East. Case No. 2020-ZC-035 (Staff – Genna Goodwin)

4. **GENERAL PLAN AMENDMENT (GPA)** (Public Hearing)

A. Consider a request to change the general plan from FP (Flood Plain) to COM (Commercial) on approximately 12 acres generally located at approximately 1600 East 1450 South. Case No. 2020-GPA-015 (Staff – Dan Boles)

B. Consider a request to change the general plan from LDR (Low Density Residential) to COM (Commercial) on approximately 14.75 acres generally located at 910 West 4700 North. Case No. 2020-GPA-013 (Staff – Genna Goodwin)

C. Consider a request to change the general plan from COM (Commercial) and OS (Open Space) to HDR (High Density Residential) on approximately 1.7 acres generally located in two locations at approximately 900 S 250 W and 800 S 250 S. Case No. is 2020-GPA-017 (Staff – Dan Boles)

5. **PRELIMINARY PLAT (PP)**

A. Consider a sixty-three (63) lot residential preliminary plat for “Hidden Valley Phase 10.” Generally located west Hidden Valley Drive. The property is zoned PD-R(Planned Development Residential). The representative is Bob Hermandson. Case No. 2020-PP-028. (Staff – Wes Jenkins)

B. Consider a twenty-eight (28) lot residential preliminary plat for “Red Cliffs Estates.” Generally located between 3210 East and 3430 East and approximately 2300 South. The property is zoned A-1(Agriculture). The representative is Jason Ward. Case No. 2020-PP-029. (Staff – Wes Jenkins)

6. **CITY COUNCIL ACTIONS – October 1, 2020**

The Community Development Director will report on the items heard at City Council from the October 1, 2020 meeting.

1. HS – Hillside Professional
2. ZC – Hillside Professional
3. ZCA – Auburn Hills Ph 18
4. CUP – UT102 Legosity
5. PP – Auburn Hills Ph 18

Brenda Hatch, Development Office Supervisor

Reasonable Accommodation: The City of St. George will make efforts to provide reasonable accommodations to disabled members of the public in accessing City programs. Please contact the City Human Resources Office at (435) 627-4674 at least 24 hours in advance if you have special needs

Hillside Permit

HILLSIDE REVIEW BOARD AGENDA REPORT: 11/20/2019 (Tabled)
HILLSIDE REVIEW BOARD AGENDA REPORT: 09/16/2020
PLANNING COMMISSION AGENDA REPORT: 10/13/2020

HILLSIDE DEVELOPMENT PERMIT

Summit Estates

Case No. 2019-HS-008

Background: On November 20, 2019, the Hillside Review Board met on the site to discuss the project and the request of the applicant. At the meeting, the board discussed several items that they would like to see. The applicant revised their drawings and those revised drawings are attached to this staff report.

On September 23, 2020, the Hillside Review Board reconvened to review the updated reports including the vibration report that was conducted by the applicant. At that meeting, the Hillside Review Board recommended that the Hillside Permit be granted with the condition that a specific note be placed on the plat for lots currently labeled 25 and 26 where it will be delineated in such a way that they are well above the normal standard working with a soils engineer upon construction of the homes and that they need to meet with an engineer before any grading is done and follow the Geotech report, they strictly follow the report as far as any grading on the entire site; when it calls for monitoring, they are to make sure it is being monitored.

Request: This is a request for a Hillside Development Permit allowing development of ‘Summit Estates’ a residential subdivision.

References: Sienna Canyon Master Plan and the Webb Hill land exchange development agreement (1998)

Project: Summit Estates would be a residential subdivision with parcels ranging in size from 0.41 acres up to 6.2 acres in size. The lots would each have the homes placed to minimize cuts and fills.

Owner: V.E. MGMT & Investment Company, LC

Engineer: Horrocks

Representative: Ben Willits, Project Manager

APN: SG-5-3-5-32001

Location:	Intersection of Hillrise Drive & Ft Pierce Drive
Acreage:	Parcel size = 70.83 acres Developable area = 41.88 acres Private open space = 28.95 acres
Current Use:	This area is currently undeveloped with a City R.O.W. used for an access road up to the Webb Hill communication towers and also to the 'Kentucky Lucky Chicken Trail' (<i>a city trail</i>).
General Plan:	OS (Open Space) & VLDR (Very Low Density Residential)
Zone:	Currently PD-R (<i>Part of the original Sienna Canyon Master Plan & per the Webb Hill land exchange development agreement, July 1998</i>).
Open Space:	Over 45% of the project site would be left in open space (due to terrain, hillsides, etc.).
Density:	0.6 du / ac <i>Note: The Webb Hill land exchange development agreement, July 1998 anticipated 54 lots on the subject parcel. However, no variances to this are being requested or anticipated at this time.</i>
Units:	A total of 42 units (0.5 – 6.3 acres) is anticipated to be submitted for with the platting process portion of this projects development.
Permit required:	Section 10-13A-6:A requires that all major development (i.e., cut greater than 4', etc.) on slopes above 20% requires a 'hillside development permit' granted by the City Council upon recommendation from the Hillside Review Board and the Planning Commission.

Applicable Ordinance(s):

10-13A-1: Purpose

The city finds that the health, safety and the general public welfare of the residents of the city will be promoted by establishing standards for the development and excavation of hillside and slope areas located in the city so as to minimize soil and slope instability and erosion, to minimize the adverse effects of grading, cut and fill operations, to preserve the character of the city's hillsides, and to otherwise supplement and amplify the city subdivision and zoning ordinances. The provisions herein are designated to accomplish the following:

- A. Prohibit development of uses which would likely result in a hazardous situation due to slope instability, rock falls or excessive soil erosion.
- B. Provide for safe vehicular circulation and access.

- C. Encourage the location, design and development of building sites in a manner that will minimize the scarring and erosion effects of cutting, filling and grading of hillsides.

% Natural Slope	Dwelling Units (DU) / Acre
0-19	See underlying zone
20-29	2 DU/acre, provided the units are clustered on 30 percent (30%) or less of the land area within this slope category. 70 percent of this slope category shall remain undisturbed. The 70 percent area is based upon the overall area/development rather than per lot. Also see subsections A1, A2, and A3 of this section.
30-39	1 DU/10 acres, provided no more than 5 percent (5%) of the site is disturbed, and 95 percent of the site remains undisturbed. If the cumulative area is at least 1 acre but less than 10 acres, the cumulative area shall be allowed 1 DU.
40	Development is not permitted (0%), except as provided for in subsection A4 of this section.

- D. Encourage preservation of open space by encouraging clusters or other design techniques to preserve the natural terrain.
- E. Where hillside excavation does occur, require that buildings be located in the cut area to minimize the visual effects of scarring. (1998 Document § 10A-1)

Section 10-13A-4: Density and Disturbance Standards

- A. Schedule: In furtherance of the purposes set forth above, density and site disturbance within the hillside development overlay zone shall comply with the following schedule. Any portion of a development parcel having a slope greater than forty percent (40%) shall not be included in the calculation of the area of such parcel for the purposes of determining conformity with the density requirements below:
- A.4. The city council, after considering the recommendation from the hillside review board, and from the planning commission may approve the removal of small hills which contain slopes forty percent (40%) or greater subject to determining the application conforms to all of the following requirements:
- The hill is not contiguous to nor part of a major hillside formation, and
 - The removal of such landform will not create a negative aesthetic impact in the opinion of the city council, and
 - The land area is zoned for residential, commercial, or industrial development. (Ord. 2013-01-001, 1-3-2013)

Section 10-13A-5: Slope and Slope Areas Determined

- B. Procedure: The location of the natural twenty percent (20%), thirty percent (30%) and forty percent (40%) slopes for the purposes of this article shall be determined using the following procedure: (Ord. 2005-07-007, 7-21-2005)
3. Determination of Slope Areas for Density Calculations: Using the contour maps, slopes shall be calculated in intervals no greater than forty feet (40') along profile lines. Points identified as slopes of twenty percent (20%), thirty percent (30%), and forty percent (40%) shall be located on the contour map and connected by a continuous line. That area bounded by said lines and intersecting property lines shall be used for determining dwelling unit density. Small washes or rock outcrops which have slopes distinctly different from surrounding property and not part of the contiguous topography may be excluded from slope determination if, in the opinion of the hillside review board, the exclusion of such small areas from slope determination will not be contrary to the overall purpose of this article. For the purpose of determining developable areas and allowable densities, previously disturbed hillside areas shall be considered on a pre-disturbance natural slope basis, where feasible, as proposed by the applicant's engineer and approved by the hillside review board. Where a property owner restores a previously disturbed area to a natural or near natural condition, the area may be included within a required no disturbance area. (Ord. 2005-07-007, 7-21-2005)

PC Motion Options:

The Planning Commission can recommend several options to the City Council:

1. Denial
2. Approval as presented
3. Approval with specific conditions and comments

Example Motion:

The Planning Commission recommends approval of the Hillside Development Permit for Case No. 2019-HS-008; allowing future development of 'Summit Estates' a proposed residential subdivision.

The applicant shall adhere to the recommendations and conditions recommended in the:

- A. Rock Fall Report (*Note: There is not a rock fall report, but rockfall is mentioned several times in the geotech report – particularly Figure 3B “Rock Fall Hazard Map”.*)
- B. Drainage Report (*Horrocks Project No. UT-1507-1901 dated November 13, 2019,*
- C. Geotechnical Report (*AGEC Project No. 2182014 dated October 23, 2019.*)
- D. Vibration Report (*AGEC Project No. 2182014 dated July 14, 2020.*)

- E. That a specific note be placed on the plat for lots currently labeled 25 and 26 where it will be delineated in such a way that they are well above the normal standard working with a soils engineer upon construction of the homes and that they need to meet with an engineer before any grading is done and follow the Geotech report, they strictly follow the report as far as any grading on the entire site; when it calls for monitoring, they are to make sure it is being monitored.

Narrative / Summary

To: St. George Hillside Committee

From: Ben Willits, Project Manager

Date: October 30, 2019

Subject: Summit Estates Hillside analysis summary



Attached is the Hillside Development package on the Summit Estates (Webb Hill) project.

Site Statistics:

Parcel Size: 70.83 ac *Assessor's Parcel ID:* SG-5-3-5-32001

Location: Intersection of Hillrise & Ft. Pierce Dr. St. George, UT

Existing Site Use: Undeveloped with a City ROW access road to the Webb Hill Comm. Towers and Kentucky Lucky Chicken Trail (City trail).

Zoning and Entitlements:

Currently the site is zoned PD-R as part of the original Sienna Canyon Master Plan and per the Webb Hill Land Exchange Development Agreement, July 1998. The parcel is entitled for 54 lots per said agreement. No variances to this are being requested at this time.

Proposed Project Parcel Planning:

The developers are proposing a low impact, high-end custom residential parcels ranging from 0.5 ac. To over 6.2 ac. in size. Over 45% of the site will be left in open space with the lot and home placement carefully selected so as to minimize cuts and fills to the site. Very strict design guidelines and CC&R's will be placed on the plat and will deed restrict the manner in which the homes will be built.

Earth Moving and Grading Plans:

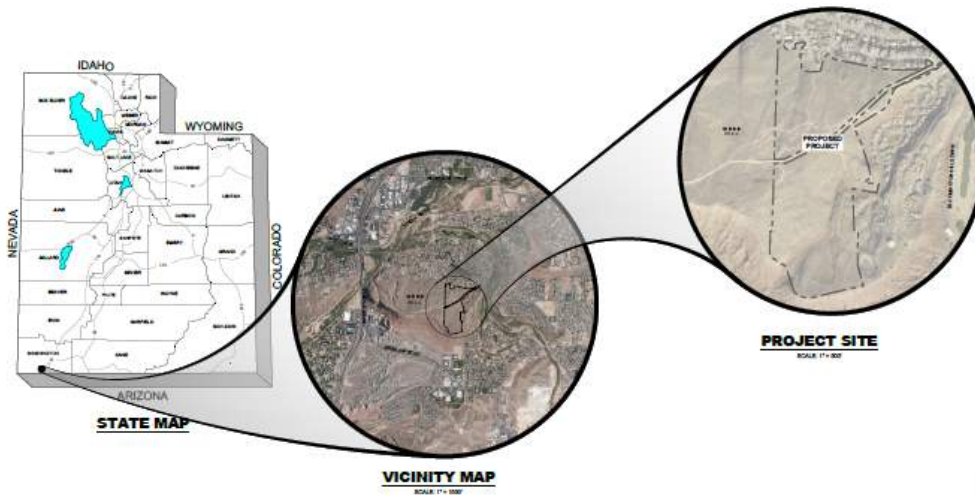
Working in conjunction with our Geotechnical Engineer, AGECE, the site is found to have three primary rock types throughout including: Shale, Sandstone and Siltstone Bedrocks. The onsite bedrock will be used as site grading fill. It will require processing such that the maximum particle size is 4" and at least 60% of the material passes the no.4 sieve. This may require some crushing of the sandstone material. It is anticipated that a rock hammer and/or trencher will be used for utility trenching with the mass grading being ripped with a dozer and hammer. A staging area will be utilized in the lower portion of the site (in ph.2) where a detention basin is designed. This will provide an area away from the higher slopes on site and will keep dust and noise to a minimum to the existing residents. The upper 4-6' of material, depending on the rock hardness, is suitable to be processed in use for backfill of trenches and fill alike. The larger material will be used in natural rock retaining walls per the design. It is anticipated that all of the material will be used on site with only select fill being imported as necessary.

No blasting will occur on site as to minimize the impacts of potential rock fall to the existing Sienna Canyon development below and to the south-east of the project. All home sites will have individual tests and foundation recommendations from AGECE prior to platting and will be graded at time of home construction. They will adhere to the attached strict grading guidelines and plat design criteria.

Proposed Project Schedule:

It is anticipated that the project will be built in two phases with the first phase of improvements beginning in Feb. 2020. The first phase of land development (lots 1-22), which will include a new water tank, is anticipated to take approximately 6 months to complete with a completion date of Aug. 2020. The second phase (lots 23-43) will begin in approximately 2023 and will depend largely on the absorption rate of phase one and the health of the economy.

HILLSIDE PROTECTION PLAN FOR SUMMIT ESTATES ST. GEORGE, UTAH



SHEET INDEX	
SHEET #	SHEET TITLE
101	COVER SHEET & SHEET INDEX
102	GENERAL NOTES
103	EXISTING CONDITIONS
104	PROPOSED CONDITIONS
105	PROPOSED CONDITIONS
106	PROPOSED CONDITIONS
107	PROPOSED CONDITIONS
108	PROPOSED CONDITIONS
109	PROPOSED CONDITIONS
110	PROPOSED CONDITIONS
111	PROPOSED CONDITIONS
112	PROPOSED CONDITIONS
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115	PROPOSED CONDITIONS
116	PROPOSED CONDITIONS
117	PROPOSED CONDITIONS
118	PROPOSED CONDITIONS
119	PROPOSED CONDITIONS
120	PROPOSED CONDITIONS

ENGINEER:
HORROCKS ENGINEERS
201 SOUTH 1000 E., SUITE 101
ST. GEORGE, UT 84770
(435) 666-7888
CONTACT: ALBERT CHAPMAN, PE

OWNER / APPLICANT:
THE MOUNTAIN & RIVER VIEW CO., LLC
1000 SOUTH 1000 E., SUITE 101
ST. GEORGE, UT 84770
CONTACT: DON VANCE

GEOTECHNICAL ENGINEER:
APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.
100 SOUTH 1000 E., SUITE 101
ST. GEORGE, UT 84770
CONTACT: VANCE VANCE, PE



HORROCKS ENGINEERS
201 SOUTH 1000 E., SUITE 101
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CONTACT: ALBERT CHAPMAN, PE

WARNING

THIS PROJECT IS A PRELIMINARY DESIGN. IT IS NOT TO BE USED FOR CONSTRUCTION. ANY CHANGES TO THE DESIGN SHALL BE MADE BY THE ENGINEER.

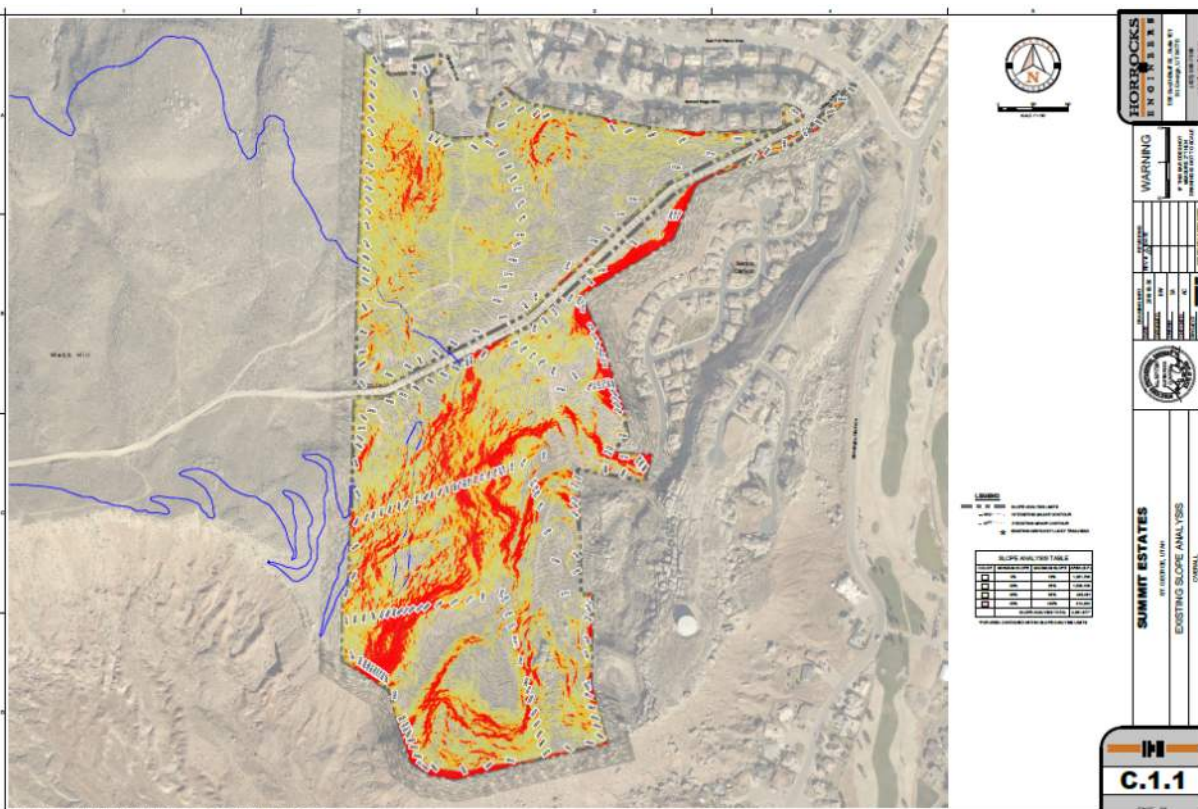
SUMMIT ESTATES
ST. GEORGE, UT

COVER SHEET & SHEET INDEX

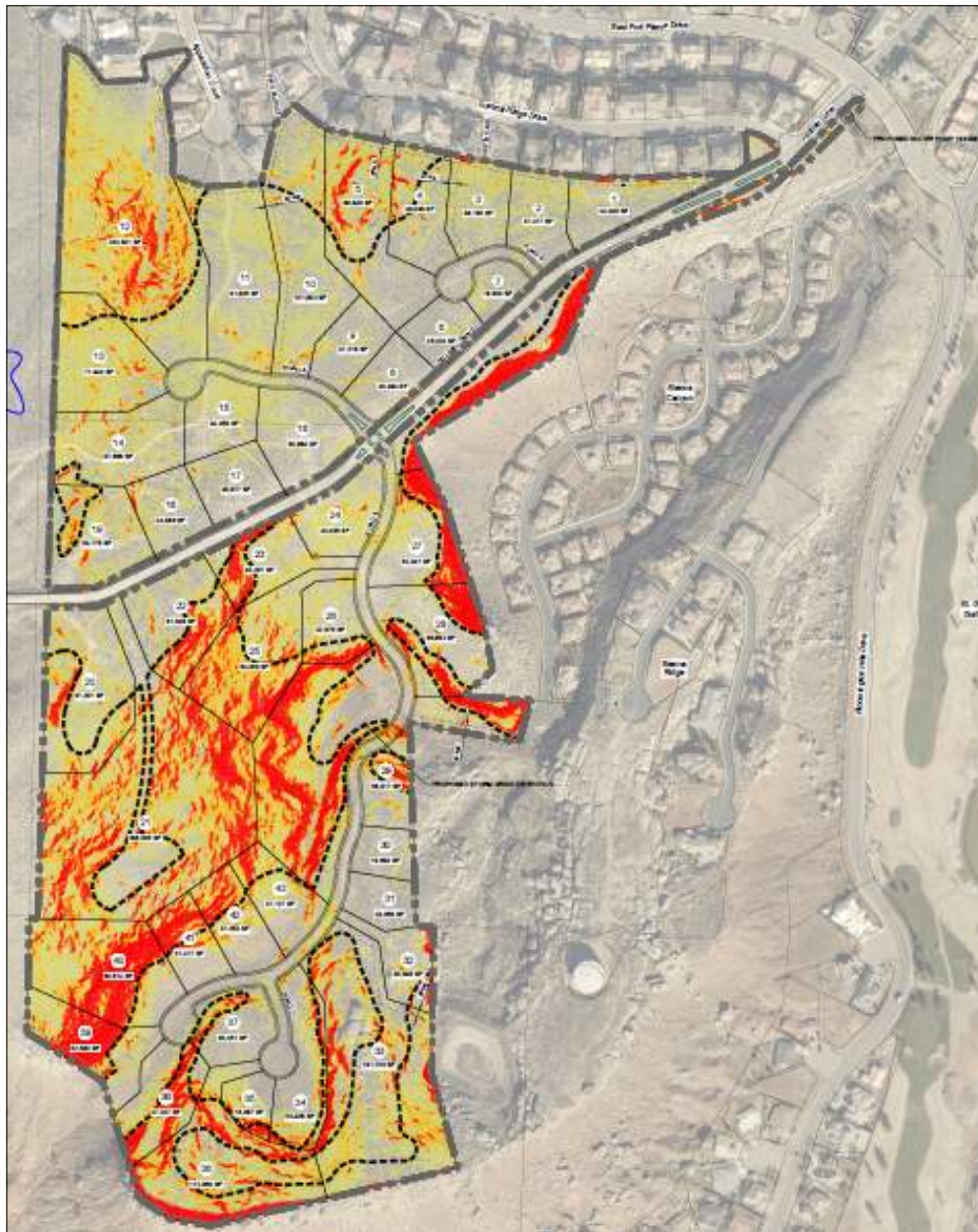
C.O.O.

Vicinity Map





Original Site Plan

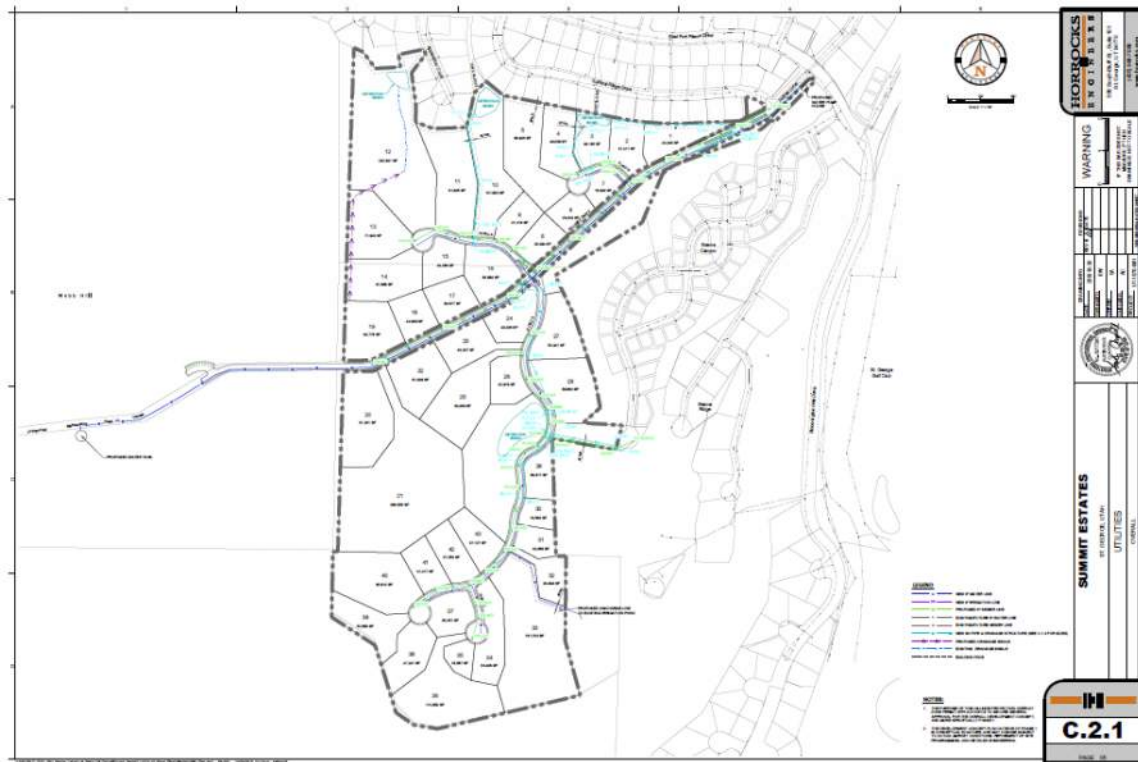


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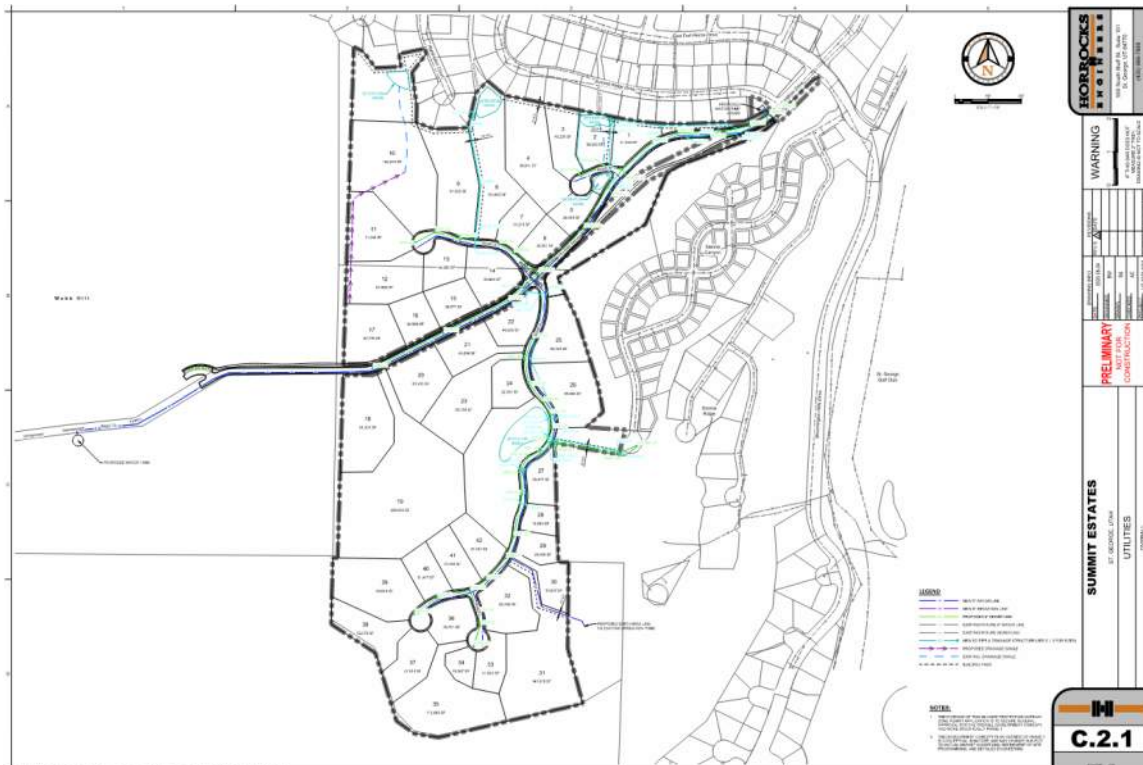
SLOPE ANALYSIS TABLE						
COLOR	PERCENT NATURAL SLOPE	TOTAL ACREAGE	ALLOWED DISTURBANCE	DU/AC	PROPOSED DISTURBANCE AREA (AC.)	PROPOSED DISTURBANCE %
	0-19	30.64	100%	1.6	20.86	68.09%
	20-29	27.60	30%	0.9	8.27	29.97%
	30-39	5.10	5%	1	0.25	4.88%
	>40	7.49	0%	0	0	0%
	TOTAL	70.83			29.38	

SLOPE ANALYSIS TABLE						
COLOR	PERCENT NATURAL SLOPE	TOTAL ACREAGE	ALLOWED DISTURBANCE	DU/AC	PROPOSED DISTURBANCE AREA (AC.)	PROPOSED DISTURBANCE %
	0-19	30.64	100%	1.6	20.86	68.09%
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	30-39	5.10	5%	1	0.25	4.88%
	>40	7.49	0%	0	0	0%
	TOTAL	70.83			29.38	

Original Utilities Drawings



Revised Utilities Drawings



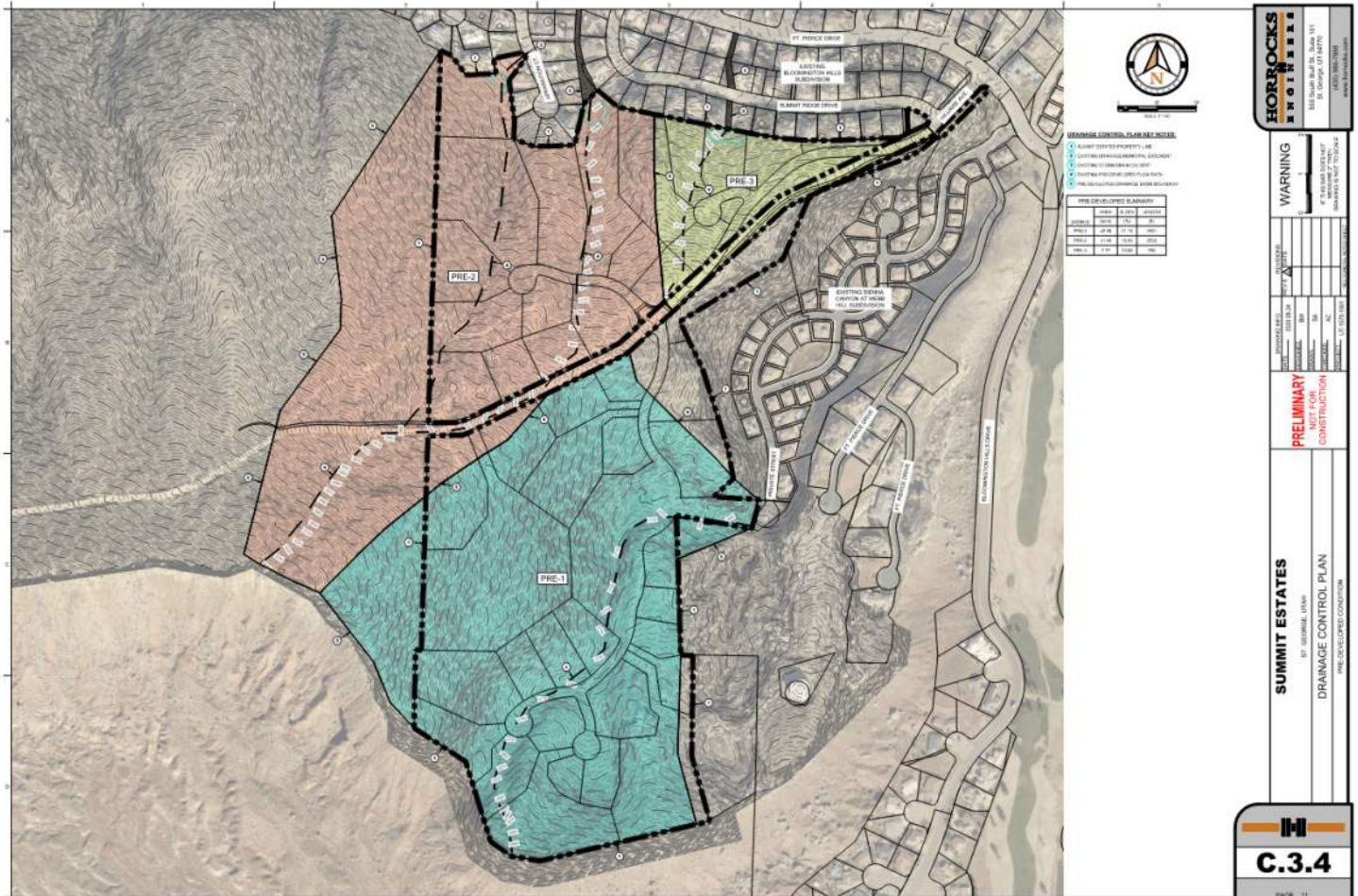
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Updated Digital Terrain



Updated Drainage Control Plan

Pre-Developed Conditions



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C.3.5

PAGE 12

SUMMIT ESTATES

ET GEORGE, TRAC

DRAINAGE CONTROL PLAN

POST-DEVELOPED CONDITION

PRELIMINARY

NOT FOR CONSTRUCTION

ISSUED: 01/01/18

PROJECT: C-3.5

ISSUED DATE	PROJECT DATE	WARNING
01/01/18	01/01/18	A

101 South Blvd. Suite 101
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WARNING
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SUMMIT ESTATES
 ST GEORGE, UTAH
 STREET PROFILES & ROADWAY SECTION
 CORONAL

ENTRANCE MAIN ROAD PROFILE

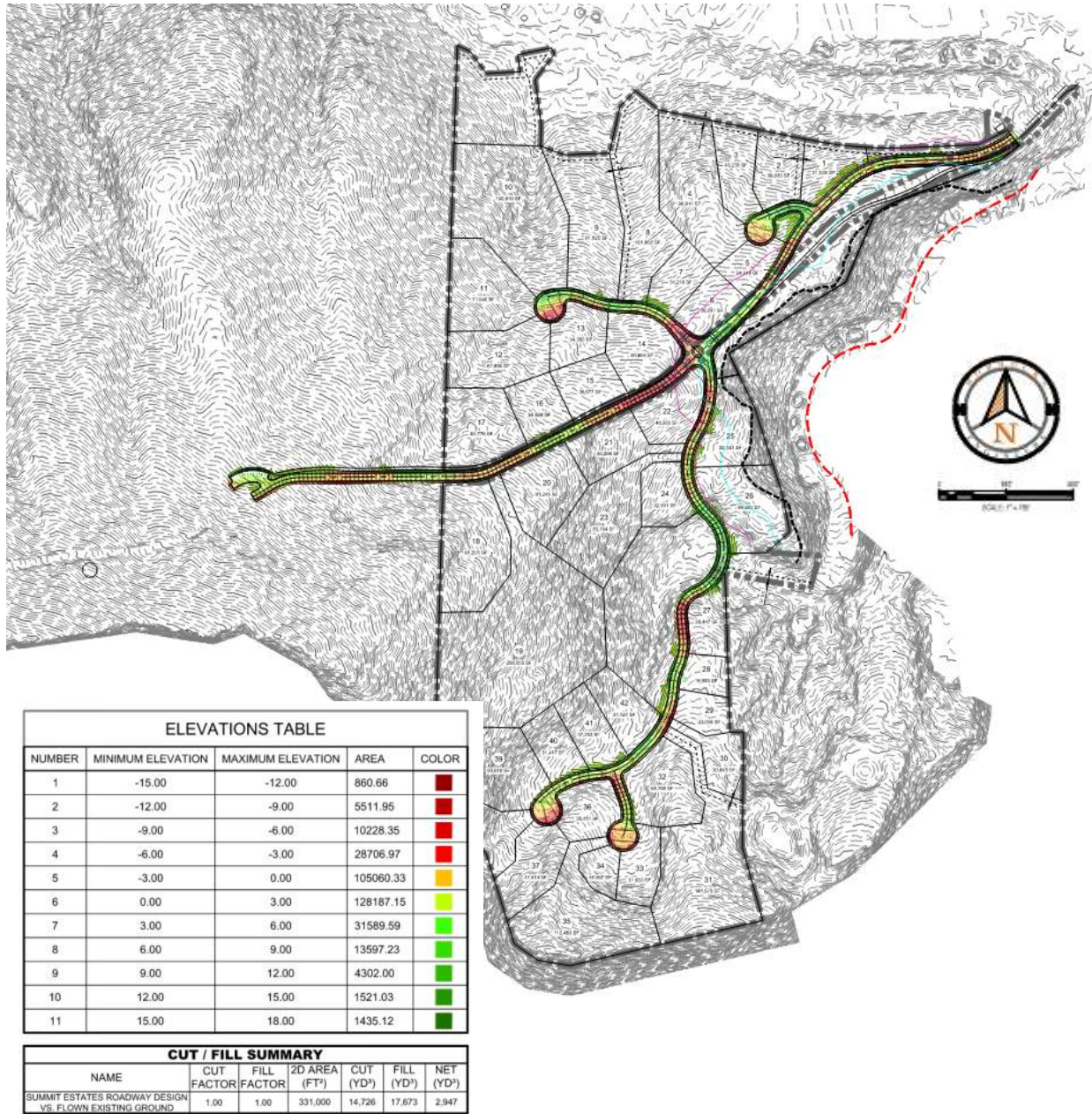
ROAD A PROFILE

ROAD B PROFILE

ROADWAY SECTION

SECTION CANYON SS CONNECTION PROFILE

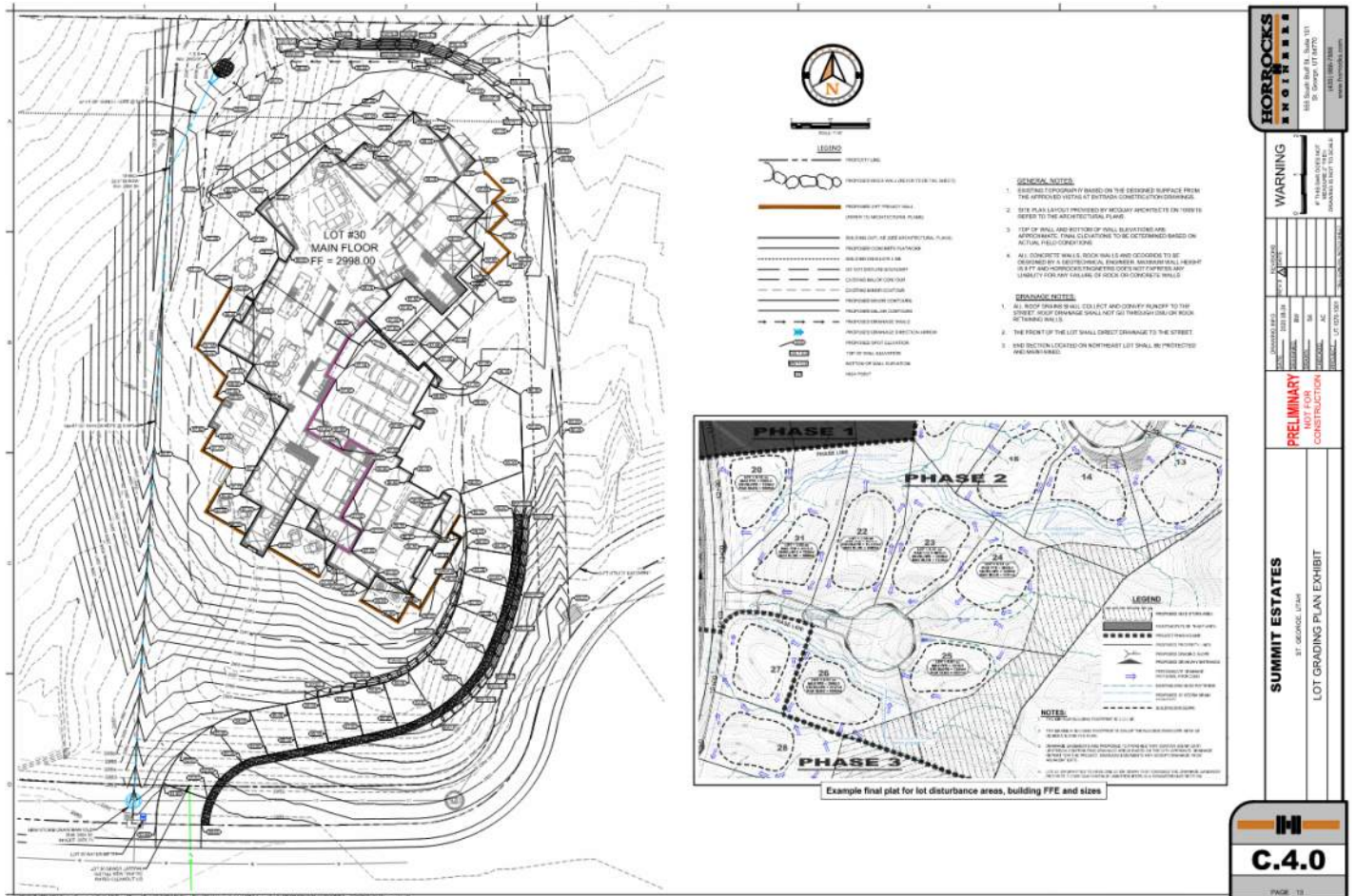
Earthwork Analysis



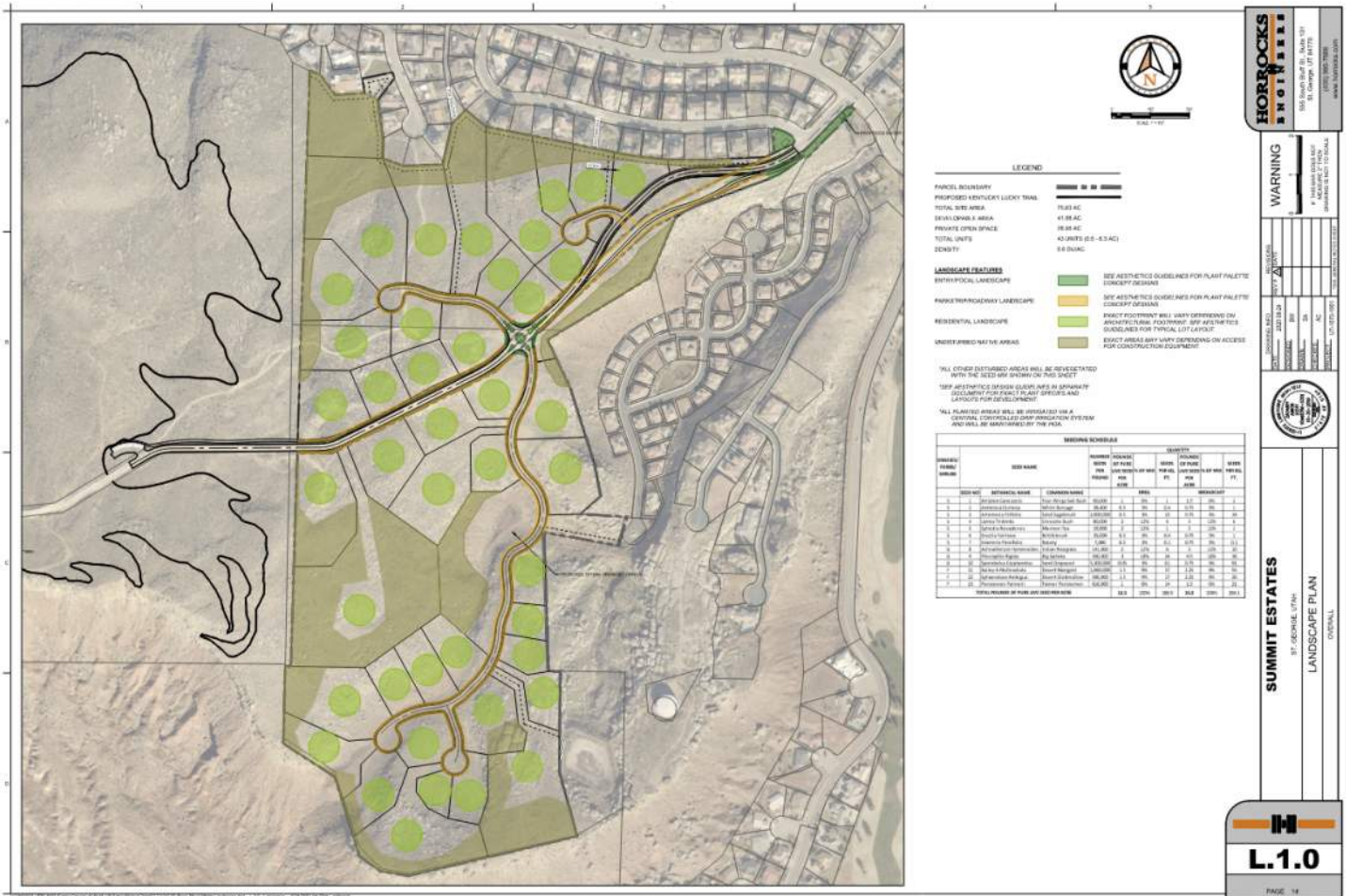
LOT GRADING NOTE:

1. EACH LOT WILL SUBMIT A LOT SPECIFIC GRADING PLAN AT TIME OF CUSTOM HOME BUILD PLAN SUBMITTAL. THESE PLANS WILL ADHERE TO THE LIMITS OF DISTURBANCE FOUND ON THE SITE PLAN AND WILL INCLUDE STRICT CO&RS AND DESIGN GUIDELINES FOR GRADING AND BUILDING IN THE DEVELOPMENT. SEE SHEET C.4.0 FOR EXAMPLES OF LOT SPECIFIC GRADING PLAN.

Lot Grading Plan Exhibit



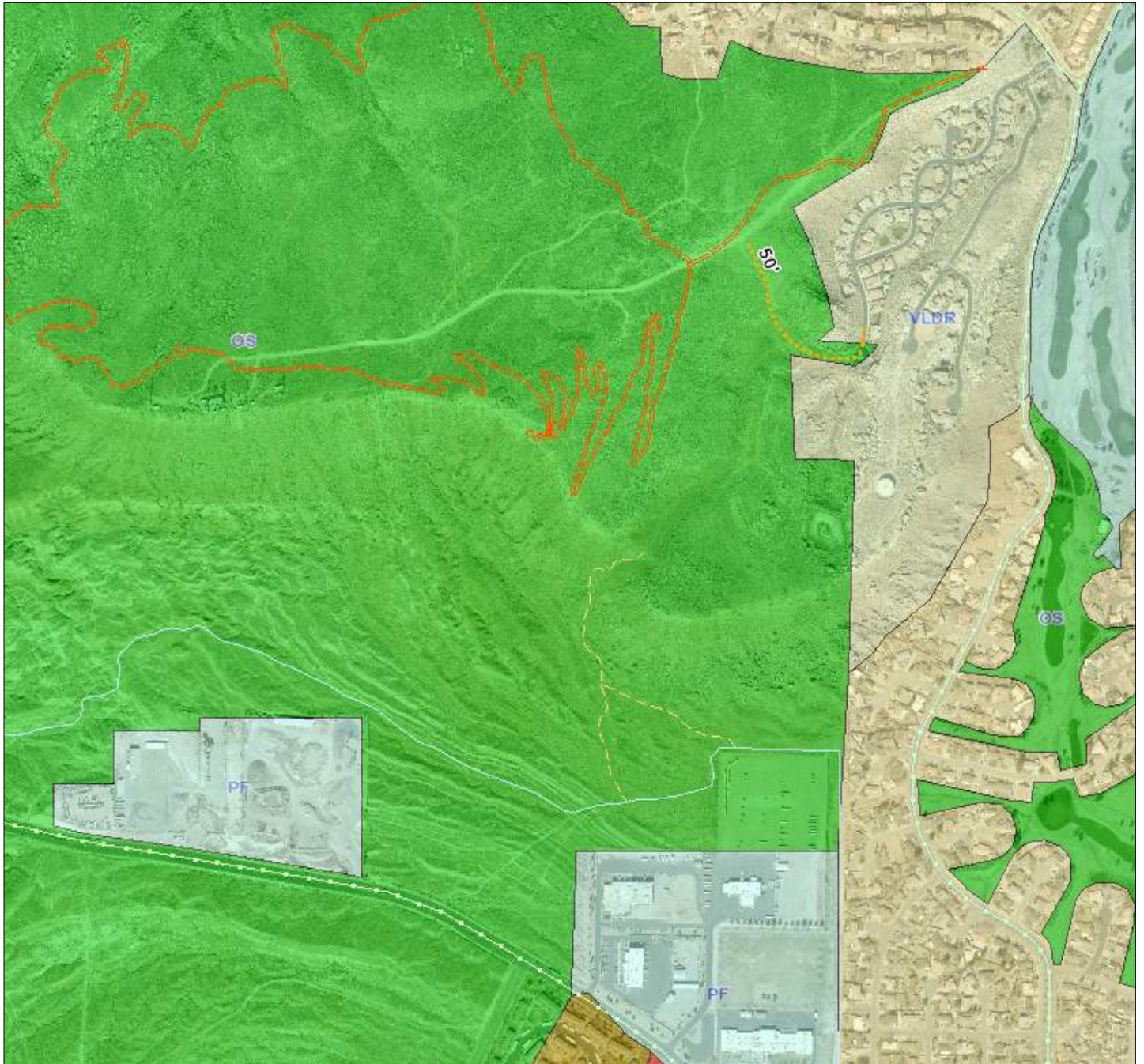
Updated Conceptual Landscape Areas



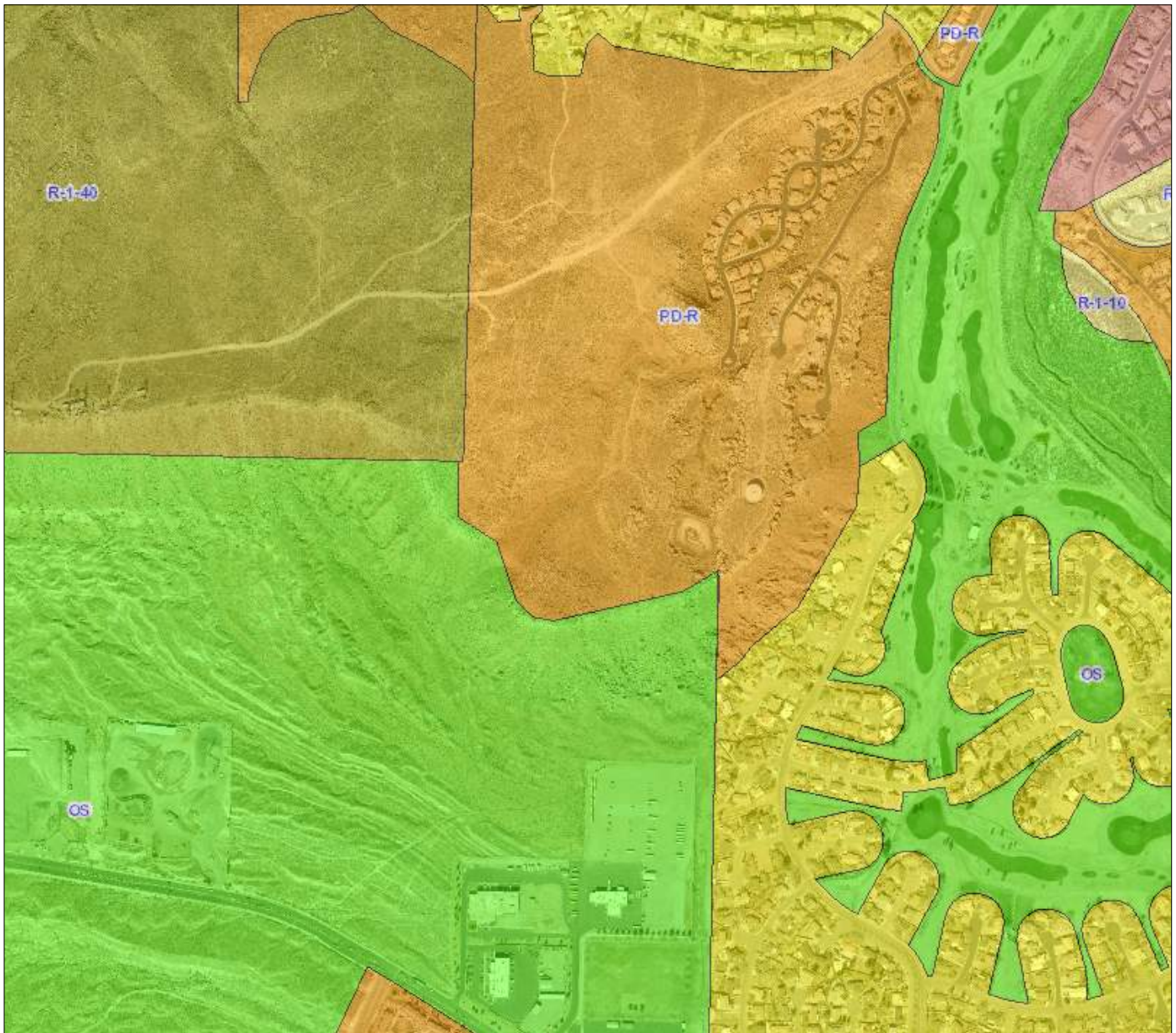
- SEE AESTHETICS GUIDELINES FOR PLANT PALETTE CONCEPT DESIGNS
- SEE AESTHETICS GUIDELINES FOR PLANT PALETTE CONCEPT DESIGNS
- EXACT FOOTPRINT WILL VARY DEPENDING ON ARCHITECTURAL FOOTPRINT. SEE AESTHETICS GUIDELINES FOR TYPICAL LOT LAYOUT.
- EXACT AREAS MAY VARY DEPENDING ON ACCESS FOR CONSTRUCTION EQUIPMENT.

SEEDING SCHEDULE									
GRASSES/ FORBS/ SHRUBS	SEED NAME			NUMBER SEEDS PER POUND	QUANTITY		SEEDS PER SQ. FT.	QUANTITY	
SEED NO.	BOTANICAL NAME	COMMON NAME			POUNDS OF PURE LIVE SEED PER ACRE	% OF MIX		POUNDS OF PURE LIVE SEED PER ACRE	% OF MIX
S 1	Atriplex Canescens	Four Wings Salt Bush	60,000	1	6%	1	1.5	6%	2
S 2	Ambrosia Dumosa	White Bursage	38,400	0.5	3%	0.4	0.75	3%	1
S 3	Artemisia Filifolia	Sand Sagebrush	2,000,000	0.5	3%	23	0.75	3%	34
S 4	Larrea Tridentata	Creosote Bush	80,000	2	12%	4	3	12%	6
S 5	Ephedra Nevadensis	Mormon Tea	19,900	2	12%	1	3	12%	1
S 6	Encelia Farinosa	Brittlebrush	35,000	0.5	3%	0.4	0.75	3%	1
S 7	Krameria Parvifolia	Ratany	7,000	0.5	3%	0.1	0.75	3%	0.1
G 8	Achnatherum Hymenoides	Indian Ricegrass	141,000	2	12%	6	3	12%	10
G 9	Pleuraphis Rigida	Big Galleta	350,000	3	18%	24	4.5	18%	36
G 10	Sporobolus Cryptandrus	Sand Dropseed	5,300,000	0.05	3%	61	0.75	3%	91
F 11	Bailey A Multiradiata	Desert Marigold	1,060,000	1.5	9%	37	2.25	9%	55
F 12	Sphaeralcea Ambigua	Desert Globemallow	500,000	1.5	9%	17	2.25	9%	26
F 13	Penstemon Palmerii	Palmer Penstemon	610,000	1	6%	14	1.5	6%	21
TOTAL POUNDS OF PURE LIVE SEED PER ACRE					16.5	100%	188.9	24.8	100%

General Plan



Zoning Map



Drainage Study

Drainage Report

Summit Estates at Webb Hill

November 13, 2019

Horrocks Project Number
UT-1507-1901

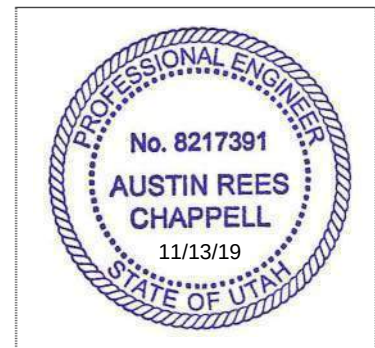
Owner:
V.E. Management & Investment Co., LC
1240 E. 100 S. Suite 12
St. George, UT 84790

Prepared By: Austin Chappell, P.E. of

HORROCKS

ENGINEERS

555 South Bluff Street, Suite 101
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435.986.7888



Engineer's Seal

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SECTION 1: DESCRIPTION OF PROPERTY

1.1 Location & Existing Conditions:

The proposed Sienna Canyon at Webb Hill subdivision is located south of Hillrise Avenue, southwest of the Hillrise Avenue and Summit Ridge intersection. The developed site will include parcel SG-5-3-5-32001, which is located in Sections 5 and 8, Township 43 South, and Range 15 West SLBM.

The existing site is currently undeveloped consisting of primarily natural desert landscape with boulders. There is an existing dirt road that extends from the end of Hillside Avenue to the west side of the project site and continues west.



Figure 1: Project Vicinity Map

SECTION 2: OFF-SITE DRAINAGE

2.1 Off-Site Drainage

The upstream offsite basins generally drain from the southwest to the northeast. The offsite drainage basins remain in the existing condition in the pre and post development conditions. There are two off-site drainage basins identified as OFF-1 and OFF-2 located on the western boundary of the project site. See Figure C.3.5, Post Development Drainage Control Plan in Appendix A for basin boundaries, areas



and flow patterns. The two basins are both undeveloped areas and are also comprised of existing natural desert landscape and boulders. Runoff from Basin OFF-1 drains from the southwest of the basin to the northwest where it impacts the project site. Runoff from Basin OFF-2 drains from the southwest of the basin to the northwest where it impacts the project site.

All runoff generated by these off-site drainage areas is included in the Siena Canyon site's hydrologic and hydraulic analysis provided in this report.

SECTION 3: ON-SITE DRAINAGE

On-site drainage is separated into two categories, existing (pre-development conditions) and proposed (Post development conditions). See Figures C.3.4 and C.3.5 in Appendix A for basin delineations, flow patterns, and basin areas. Each category is described as follows:

- Existing on-site drainage generally originates from southwest and flows towards northeast. Runoff from existing on-site drainage Basin PRE-1 generally drains from the west and is conveyed to the east where it discharges from the project site near the southwest end of the Sienna Canyon at Webb Hill existing development. The runoff from basin PRE-2 drains from the southwest to the north where it discharges from the project site at a drainage easement that connects to Apparation Court and at the drainage easement that connects to Summit Ridge Drive. Runoff generated from existing on-site drainage Basin PRE-3 drainage from the south to the north where it discharges through a drainage easement the connects to Summit Ridge Drive. The project site includes natural washes created from natural storm events.
- This study proposes to improve existing earthen Hillrise Avenue into (XXX) pavement. The avenue exists from the northeast corner of the project site and extends towards southwest direction. Additionally, two roadways are proposed; Road A and Road B. Road A extends towards northwest and southwest directions from centerline of Hillrise Avenue. Road B extends only towards northwest direction from the centerline of Hillrise Avenue.

The proposed flow patterns generally match the existing flow patterns. Proposed on-site drainage Basin POST-1 drains to the low point in Road A south of Hillrise Avenue. There is a proposed detention basin, DB1, which reduces flows to pre-developed conditions. The runoff from onsite Basin POST-2A drains north to the onsite, local Detention Basin DB-2A discharges through the drainage easement and into Apparation Court. Runoff from onsite basin POST-2B is conveyed north through the developed site to the onsite, local Detention Basin DB-2B and reduces the developed peak runoff to below the pre-development peak runoff. Runoff from onsite basin POST-3 is conveyed north through the developed site to the onsite, local Detention Basin DB-3 and reduces the developed peak runoff to below the pre-development peak runoff. The runoff from DB-3 discharges through the existing drainage easement and into Summit Ridge Drive. See Section 10 of this report for details of the proposed drainage improvements

SECTION 4: MASTER PLANNED DRAINAGE

A review of the City of St. George Storm Drain Maser Plan indicates the engineer is not aware of proposed drainage improvements within the project area.



SECTION 5: FEMA FLOODPLAIN

Sienna Canyon is located within Area of Minimum Flood Hazard as indicated by the FEMA flood map included in Appendix D of this report.

SECTION 6: OTHER DRAINAGE STUDIES

Other than the City of St. George Storm Drain Master Plan, the engineer is not aware of other drainage studies applicable to this site.

SECTION 7: PROPOSED DRAINAGE FACILITIES

7.1 Grading:

The overall grading plan consists of typical residential grading; draining lot runoff into adjacent streets or drainage easements until it is intercepted by curb and gutter or catch basins. The project site generally drains to four (4) discharge locations. The first is at the southeast area near the low-point in the proposed Road B. Runoff is discharged from detention basin DB-1 and into the existing wash to match existing condition flow patterns. The second is at the northwest corner of the site, just south of Apparation Court and discharges runoff from DB-2A into Apparation Court. The third discharge location is located at the norther of the site, just south of the drainage easement that drains into DB-2B and then through the drainage easement to Summit Ridge Drive. The fourth discharge location is located at the norther of the site, just south of the drainage easement that drains into DB-3 and then through the drainage easement to Summit Ridge Drive.

7.2 Roadway Improvements:

Roadway improvements will include asphalt residential driveways, Hillrise Avenue, Road A and Road B. Hillrise Avenue will be a 30' wide street with normal crown, curb and gutter and sidewalks on either side of the street. Road A and Road B will also be 30' wide roadways with curb and gutter and sidewalks on either side of the street. Road A and Road B include cul-de-sac where they terminate.

7.3 Conveyance Improvements:

The overall storm water management approach for this project is based on conveying the 10-year storm through inlets and pipes and the 100-year storm flows in streets. Inlets will be placed at strategic locations as shown in the Drainage Control Plans and pipes will be used to convey both on-site and off-site storm drain runoff.

7.4 Detention Facilities:

It is proposed that onsite, local detention basin facilities will be required to reduce the post-developed discharge rate to less than or equal to the pre-developed discharge or 0.20 cfs per acre, whichever is greater. This report includes a hydrologic analysis, which is used to compare the pre and post developed peak runoff. The post-development HEC-1 models include the minimum detention basin volumes and discharge pipe sizes that meet the criteria per the City of St. George Drainage Manual (Hereinafter referred to as "The Manual"). However, the final grading of the proposed detention basins may vary while providing the minimum capacity and volumes as shown in the report. The locations as shown on Figure C.3.5 and as described in the report above.

SECTION 8: COMPLIANCE WITH FEMA REQUIREMENTS

Not applicable, there are no FEMA mapped floodplains within the project boundary.



SECTION 9: DESIGN RUNOFF COMPUTATIONS

9.1 Selection of Hydrological Model:

The hydrological analysis completed for this project is based on the SCS curve number method and is modeled using HEC-1. Similar to HEC-HMS, HEC-1 is commonly used for hydrologic analysis of both simple and complex drainage basins and can be used to model runoff from various design storm events including detention basin routing. The design storm frequency and distribution used in this analysis is based on the City of St. George Drainage Manual and summarized below

- 10-year, 24-hour (Type II)
- 100-year, 24-hour (Type II)
- 100-year, 3-hour (Farmer Fletcher)

Both pre and post developed site conditions were modeled using the design storm noted. See Figures C.3.4 and C.3.5 in Appendix A and Appendix C for HEC-1 Summary Tables. Complete HEC-1 reports for each site condition and design storm are provided in Appendix C.

9.2 Hydrological Model Input Parameters:

HEC-1 requires the following inputs and parameters to model and compute peak flows for each drainage basin/sub-area.

- Drainage Area (acre)
- SCS Curve Number (weighted)
- Time of Concentration (min)
- Rainfall Depth (inches)
- Storm Distribution

Hydrological model inputs noted above are described in more detail under Sections 9.3 to 9.7 below.

9.3 Watershed Area:

Watershed areas for both pre and post-developed conditions are shown in Appendix A and summarized in Tables 9.4.1 and 9.4.2 below.

9.4 Curve Number:

Soil data obtained from USDA Web Soil Survey shows the site consists of primarily Hobog-Rock Land Association (HG) soils with Hydrologic Soil Group (HSG) "D". Refer to Appendix D for additional Web Soil Survey figures and data.

SCS runoff curve numbers obtained from TR-55 Table 2-2a and 2-2d based on soil type, hydrologic soil group and land cover. The resulting curve numbers for both pre and post developed site conditions are provide in Tables 9.4.1 and 9.4.2 respectively.



Table 9.4.1: Pre-Developed Runoff Curve Number

Basin	Soil Type	HSG	Cover Description	CN	Area (acre)
PRE-1	HG (Hobog-Rock)	D	Desert shrub-Fair	86	42.38
PRE-2	HG (Hobog-Rock)	D	Desert shrub-Fair	86	41.40
PRE-3	HG (Hobog-Rock)	D	Desert shrub-Fair	86	7.77

Table 9.4.2: Post-Developed Runoff Curve Number

Basin	Soil Type	HSG	Cover Description	CN	Area (acre)
OFF-1	HG (Hobog-Rock)	D	Desert shrub-Fair	86	11.59
OFF-2	HG (Hobog-Rock)	D	Desert shrub-Fair	86	10.74
POST-1	HG (Hobog-Rock)	D	Western desert urban area	88	43.46
POST-2A	HG (Hobog-Rock)	D	Western desert urban area	88	8.50
POST-2B	HG (Hobog-Rock)	D	Western desert urban area	88	9.70
Post-3	HG (Hobog-Rock)	D	Western desert urban area	88	7.77

9.5 Lag Time:

For drainage areas less than 2,000 acres, the lag time can be calculated using the following equation:

$$L = \frac{l^{0.8} \left(\frac{1000}{CN} - 9 \right)^{0.7}}{1900(S)^{0.5}}$$

Where:

L = Lag Time (hour)

l = longest length of subarea (ft.)

CN = SCS Curve Number

S = average slope along longest length (%)

Resulting lag times for both pre and post-developed site conditions are summarized in Table 9.5.1 and 9.5.2 respectively.

Table 9.5.1: Pre-Developed Watershed Inputs

Basin ID	CN	Length (ft)	Slope (%)	Lag Time (hrs)
PRE-1	86	1931	11.19%	0.132
PRE-2	86	2538	16.00%	0.137
PRE-3	86	705	13.88%	0.053



Table 9.5.2: Post-Developed Watershed Inputs				
Basin ID	CN	Length (ft)	Slope (%)	Lag Time (hrs)
OFF-1	86	870	19.43%	0.053
OFF-2	86	1855	16.2%	0.106
POST-1	88	1785	10.03%	0.121
POST-2A	88	1250	14.4%	0.076
POST-2B	88	1184	15.71%	0.07
POST-3	88	1083	8.86%	0.086

9.6 Rainfall Depth:

Rainfall depths used in the hydrological model were obtained from the NOAA Atlas 14 and are summarized in Table 9.6.1.

Table 9.6.1: NOAA Rainfall Data		
Storm Event	3-Hour (in)	24-Hour (in)
10-Year	0.99	1.57
100-Year	1.64	2.31

9.7 Hydrological Model Output

The worst-case results of the HEC-1 are summarized in Table 9.7.1. Complete hydrograph output reports can be reviewed in Appendix C.

Table 9.7.1: Hydrograph Results - Worse Case					
Design Storm	Storm Distribution	Pre-Developed Peak Flow (cfs)	Post-Developed Peak Flow (cfs)	Peak Discharge Increase (cfs)	Discharge Location
100-Year, 3-Hour	Farmer-Fletcher	42	69	27	DB-1 or CD2
10-Year, 24-Hour	Type II	7.8	6	-1.8	DB-2A
100-Year, 3-Hour	Farmer-Fletcher	25P	26	1	DB-2B or CD1
100-Year, 3-Hour	Farmer-Fletcher	9	10	1	DB-3

As previously discussed under Section 7.4, the project will need to include a detention facility capable of reducing the post-developed peak discharge by at least amounts shown in table 9.7.1 in order to be less than or equal to the pre-developed peak discharge.



SECTION 10: DRAINAGE FACILITY DESIGN

In accordance with the City of St. George Drainage Manual, the HEC-1 peak flows are prorated and used to design drainage collection facilities for the 10-year flood. The methodology for the HEC-1 models is described above. The prorate calculations are performed by calculating the cfs/acre for the basin calculated using the HEC-1 models, then using the prorate areas of the basins to determine the peak flows at points of interest. The prorated subbasins are delineated and the resulting peak flows calculations are summarized on Figure C.3.5 in Appendix A.

10.1 Summary Tables

Basin Peak Flowrates Summary				
PRE-DEVELOPED CONDITION 24 HOUR EVENT				
Basin	Area (acres)	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)	Discharge location
PRE-1	42.38	21	43	DB-1
PRE-2	41.40	12.2	25	DB-2B
		7.8	16	DB-2A
PRE-3	7.77	4	9	DB-3
PRE-DEVELOPED CONDITION 3 HOUR EVENT				
PRE-1	42.38	13	42	DB-1
PRE-2	41.40	7.3	25	DB-2B
		4.7	16	DB-2A
PRE-3	7.77	3	9	DB-3

Basin Peak Flowrates Summary			
POST-DEVELOPED CONDITION 24 HOUR EVENT			
Basin	Area (acres)	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)
CD1 ¹	-	12	23
CD2 ²	-	32	62
OFF-1	11.59	7	13
OFF-2	10.74	6	12
POST-1	43.45	26	50
POST-2A	8.48	6	12
POST-2B	9.70	6	10
POST-3	7.77	5	9

¹CD1 = POST-2B + OFF-2

²CD2 = POST-1 + OFF-1



POST-DEVELOPED CONDITION 3 HOUR EVENT			
CD1	-	8	26
CD2	-	22	69
OFF-1	11.59	4	14
OFF-2	10.74	4	14
POST-1	43.45	18	55
POST-2A	8.48	5	13
POST-2B	9.70	4	12
POST-3	7.77	4	10

¹CD1 = POST-2B + OFF-2

²CD2 = POST-1 + OFF-1

10.2 Prorate Summary Tables

PRORATE FLOW SUMMARY FOR POST DEVELOPED CONDITION FARMER-FLETCHER-100YR			
Basin	Area (acres)	Q ₁₀₀ (cfs)	CFS/AC
OFF-1	11.6	14	1.21
POST-1	43.4	55	1.27
POST2A-(a)	8.5	13	1.53
POST-3	7.8	10	1.28
Sub-basin ID	Area (Acres)	Q100 (cfs)	100-yr unit flow (cfs/acre)
OFF-1(a)	7.3	8.8	1.21
OFF-1(b)	3.2	3.9	1.21
OFF-1(c)	1.1	1.3	1.21
Total	11.6	14	
Sub-basin ID	Area (Acres)	Q100 (cfs)	100-yr unit flow (cfs/acre)
POST-1(a)	5.2	6.6	1.27
POST-1(b)	2.7	3.4	1.27
POST-1(c)	3.4	4.3	1.27
POST-1(d)	20.4	25.9	1.27
POST-1(e)	5.5	7.0	1.27
POST-1(f)	0.6	0.8	1.27
Other	5.6	7.1	1.27
Total	43.5	55	
Sub-basin ID	Area (Acres)	Q100 (cfs)	100-yr unit flow (cfs/acre)
POST-2A(a)	3.3	5	1.53
Other	5.2	8	1.53



Total	8.5	13	
Sub-basin ID	Area (Acres)	Q100 (cfs)	100-yr unit flow (cfs/acre)
POST-3(a)	2.4	3	1.28
POST-3(b)	0.8	1	1.28
POST-3(b)	0.2	0.3	1.28
Other	4.4	5.7	1.28
Total	7.8	10	

SECTION 11: DRAINAGE EASEMENTS

All proposed storm drain improvements are contained within the individual lots and drain to proposed roadways or to proposed and/or existing easements. See the proposed drainage easements on Figure C.3.5 in Appendix A.

SECTION 12: FEMA FLOODPLAIN CALCULATIONS

Not applicable, there are no FEMA mapped floodplains within the project boundary.

SECTION 13: CONCLUSIONS

13.1 Concluding Statement:

The proposed storm drain improvements presented herein, and on the accompanying Drainage Control Plans, are designed to comply with all City of St. George drainage requirements. It is determined by Horrocks Engineers that the proposed drainage infrastructure proposed for the Summit Estates at Webb Hill will effectively convey storm water runoff through the site, and reduce developed flows to or below peak flows in the pre-developed condition. All hydraulic and hydrologic computations used to develop this drainage study were performed using the current standard of care and engineering best management practices.

Upon approval of the hillside, and other necessary entitlements/permits, detailed construction plans will be completed and supplemental revisions to this original report, if any, will be submitted to the City for final review.



APPENDICES

A. FIGURES AND DRAWINGS

- A.1 Figure C.3.4 - Pre-Developed Drainage Basins
- A.2 Figure C.3.5 - Post-Developed Drainage Basins

B. HYDRAULIC COMPUTATIONS

- B.1 Street Normal Depth Calculations
- B.2 Drop Inlet Calculations
- B.3 Storm Drain Normal Depth Calculations

C. HYDROLOGIC COMPUTATIONS

- C.1 HEC-1 Parameters Summary
- C.2 HEC-1 - Pre-Developed Farmer-Fletcher
- C.3 HEC-1 - Pre-Developed Type II
- C.4 HEC-1 - Post-Developed Farmer-Fletcher
- C.5 HEC-1 - Post-Developed Type II

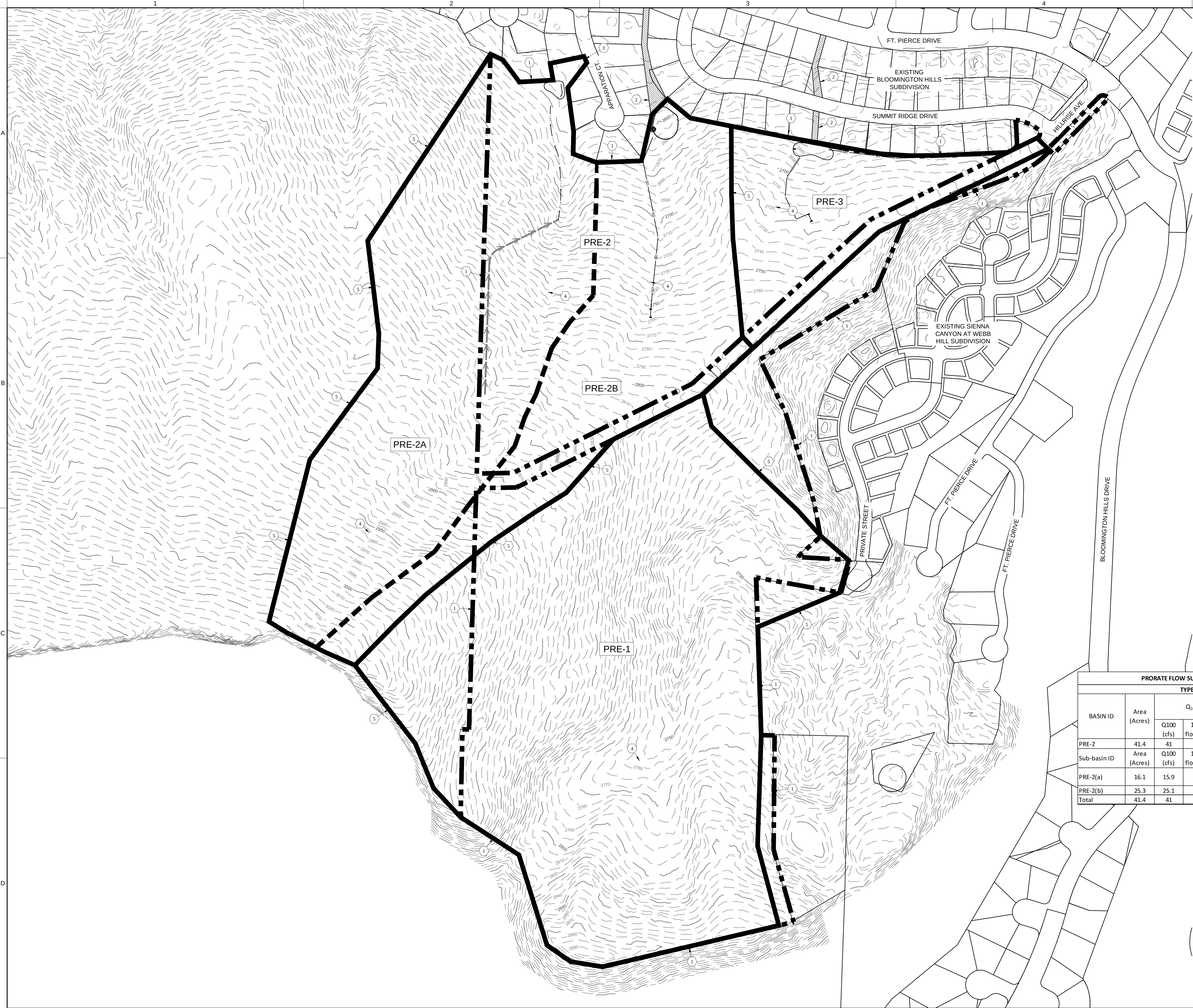
D. REFERENCES/RESOURCES

- D.1 NOAA Atlas 14 Rainfall Data
- D.2 USDA Web Soil Map
- D.3 USDA Hydrologic Soil Group
- D.4 FEMA Floodplain Boundary Map



APPENDIX A: FIGURES AND DRAWINGS





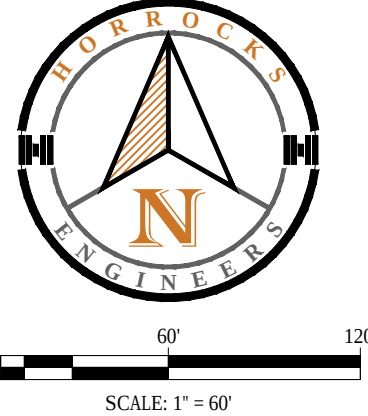
Basin Peak Flowrates Summary				
PRE-DEVELOPED CONDITION 24 HOUR EVENT				
Basin	Area (acres)	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)	Discharge location
PRE-1	42.38	21	43	DB-1
PRE-2	41.40	12.2	25	DB-2B
PRE-3	7.77	7.8	16	DB-2A
PRE-3	7.77	4	9	DB-3

PRE-DEVELOPED CONDITION 3 HOUR EVENT				
PRE-1	42.38	13	42	DB-1
PRE-2	41.40	7.3	25	DB-2B
PRE-2		4.7	16	DB-2A
PRE-3	7.77	3	9	DB-3

PRORATE FLOW SUMMARY FOR PRE-DEVELOPED CONDITION							
TYPE II						FARMER-FLETCHER	
BASIN ID	Area (Acres)	Q ₁₀₀		Q ₁₀		Q ₁₀	
		Q100 (cfs)	100-yr unit flow (cfs/acre)	Q10 (cfs)	10-yr unit flow (cfs/acre)	Q100 (cfs)	100-yr unit flow (cfs/acre)
PRE-2	41.4	41	0.99	20	0.48	41	0.99
Sub-basin ID	Area (Acres)	Q100 (cfs)	100-yr unit flow (cfs/acre)	Q10 (cfs)	10-yr unit flow (cfs/acre)	Q100 (cfs)	100-yr unit flow (cfs/acre)
PRE-2(a)	16.1	15.9	0.99	7.8	0.48	15.9	0.99
PRE-2(b)	25.3	25.1	0.99	12.2	0.48	25.1	0.99
Total	41.4	41		20		41	

KEY:

- POST-1 BASIN NAME
- BASIN BOUNDARY
- PRORATE BASIN BOUNDARY



- DRAINAGE CONTROL PLAN KEY NOTES:
- 1 SUMMIT ESTATES PROPERTY LINE
 - 2 EXISTING DRAINAGE/MUNICIPAL EASEMENT
 - 3 EXISTING STORM DRAIN CULVERT
 - 4 EXISTING PRE-DEVELOPED FLOW PATH
 - 5 PRE-DEVELOPED DRAINAGE BASIN BOUNDARY

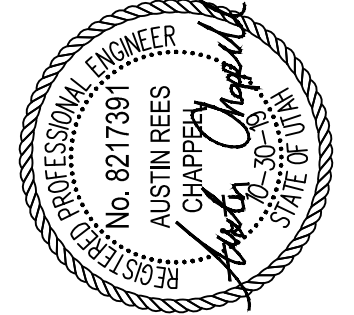
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CHECKED	AC		
PROJECT	UT-1570-1901		



SUMMIT ESTATES

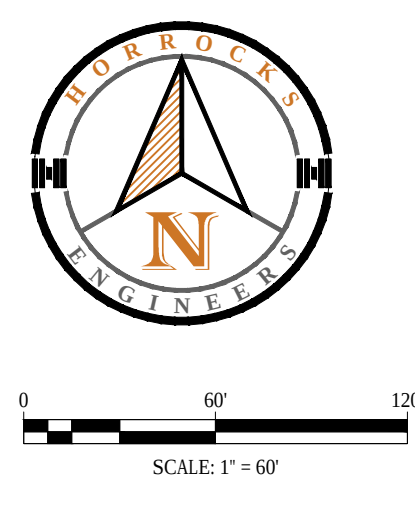
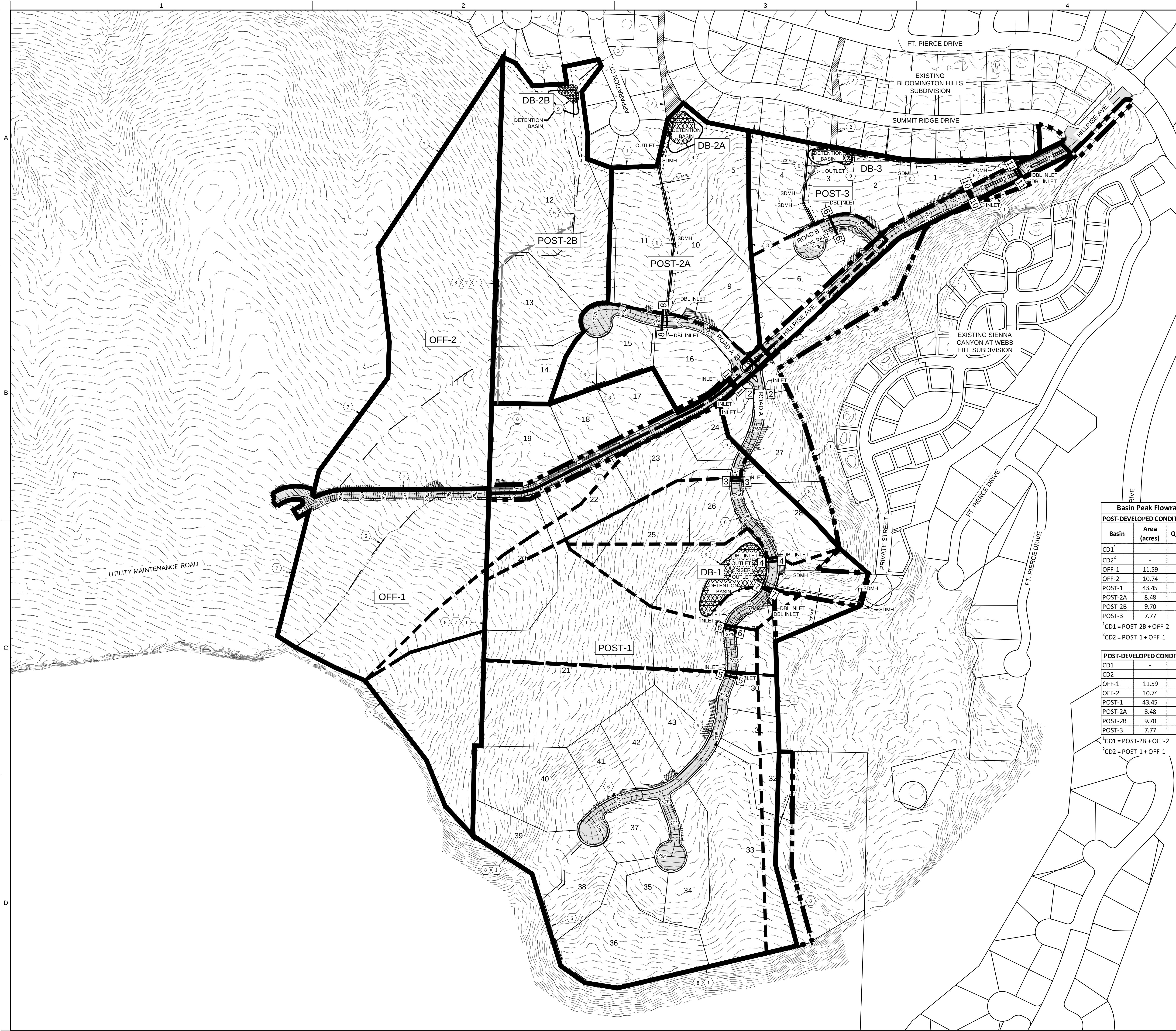
ST. GEORGE, UTAH

DRAINAGE CONTROL PLAN

PRE-DEVELOPED CONDITION



C.3.4



POST DEVELOPED SUMMARY			
Basin	Area (acre)	Length (ft)	Slope (%)
OFF-1	11.59	870	19.43%
OFF-2	10.74	1855	16.20%
POST-1	43.46	1785	10.03%
POST-2A	8.5	1250	14.40%
POST-2B	9.7	1184	15.71%
POST-3	7.77	1083	8.86%

- GENERAL NOTES:**
- SEE SHEET C.2.1 FOR PROPOSED UTILITIES INCLUDING STORM DRAIN FACILITIES AND EASEMENTS.
 - SEE "SUMMIT ESTATES DRAINAGE CONTROL REPORT" FOR ADDITIONAL DRAINAGE INFORMATION.

- DRAINAGE CONTROL PLAN KEY NOTES:**
- 1 SUMMIT ESTATES PROPERTY LINE
 - 2 EXISTING DRAINAGE/MUNICIPAL EASEMENT
 - 3 EXISTING STORM DRAIN CULVERT
 - 4 EXISTING PRE-DEVELOPED FLOW PATH
 - 5 PRE-DEVELOPED DRAINAGE BASIN BOUNDARY
 - 6 POST-DEVELOPED FLOW PATH
 - 7 OFF-SITE DRAINAGE BASIN BOUNDARY
 - 8 POST-DEVELOPED DRAINAGE BASIN BOUNDARY
 - 9 PROPOSED DETENTION BASIN

POST DEVELOPED CONDITION CROSS SECTION SUMMARY						
Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
Section-13-Hour 100-YR	C11	15.4	12.00	0.27	7.37	1.99
Section-33-Hour 100-YR	C11	14.1	6.25	0.29	5.61	1.63
Section-43-Hour 100-YR	C11	13.5	11.40	0.26	7.04	1.83
Section-53-Hour 100-YR	C11	29.7	4.00	0.39	5.86	2.29
Section-63-Hour 100-YR	C12-19	31	11.20	0.34	8.43	2.87
Section-73-Hour 100-YR	C12-35	26.3	11.20	0.33	8.13	2.68
Section-83-Hour 100-YR	C12-19	5	2.80	0.25	3.27	0.82
Section-93-Hour 100-YR	C12-35	3	5.60	0.19	3.92	0.74
Section-103-Hour 100-YR	C13	1	7.30	0.12	4.58	0.55
Section-113-Hour 100-YR	ON-D3	0.3	12.00	0.07	4.08	0.29

Basin Peak Flowrates Summary			
POST-DEVELOPED CONDITION 24 HOUR EVENT			
Basin	Area (acres)	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)
CD1 ¹	-	12	23
CD2 ²	-	32	62
OFF-1	11.59	7	13
OFF-2	10.74	6	12
POST-1	43.45	26	50
POST-2A	8.48	6	12
POST-2B	9.70	6	10
POST-3	7.77	5	9

¹CD1 = POST-2B + OFF-2
²CD2 = POST-1 + OFF-1

POST-DEVELOPED CONDITION 3 HOUR EVENT			
Basin	Area (acres)	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)
CD1	-	8	26
CD2	-	22	69
OFF-1	11.59	4	14
OFF-2	10.74	4	14
POST-1	43.45	18	55
POST-2A	8.48	5	13
POST-2B	9.70	4	12
POST-3	7.77	4	10

¹CD1 = POST-2B + OFF-2
²CD2 = POST-1 + OFF-1

PRORATE FLOW SUMMARY FOR POST DEVELOPED CONDITION FARMER-FLETCHER-100YR			
Basin	Area (acres)	Q ₁₀₀ (cfs)	CFS/AC
OFF-1	11.6	14	1.21
POST-1	43.4	55	1.27
POST2A-(a)	8.5	13	1.53
POST-3	7.8	10	1.28
Sub-basin ID			
		Q100 (cfs)	100-yr unit flow
OFF-1(a)	7.3	8.8	1.21
OFF-1(b)	3.2	3.9	1.21
OFF-1(c)	1.1	1.3	1.21
Total	11.6	14	
Sub-basin ID			
		Q100 (cfs)	100-yr unit flow
POST-1(a)	5.2	6.6	1.27
POST-1(b)	2.7	3.4	1.27
POST-1(c)	3.4	4.3	1.27
POST-1(d)	20.4	25.9	1.27
POST-1(e)	5.5	7.0	1.27
POST-1(f)	0.6	0.8	1.27
Other	5.6	7.1	1.27
Total	43.5	55	
Sub-basin ID			
		Q100 (cfs)	100-yr unit flow
POST-2A(a)	3.3	5	1.53
Other	5.2	8	1.53
Total	8.5	13	
Sub-basin ID			
		Q100 (cfs)	100-yr unit flow
POST-3(a)	2.4	3	1.28
POST-3(b)	0.8	1	1.28
POST-3(b)	0.2	0.3	1.28
Other	4.4	5.7	1.28
Total	7.8	10	

KEY:

- POST-1 BASIN NAME
- 4-4 CROSS SECTION
- BASIN BOUNDARY
- PRORATE BASIN BOUNDARY

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CHECKED	AC
PROJECT	UT-1570-1901

REGISTERED PROFESSIONAL ENGINEER

NO. 8271391

AUSTIN REES

CHAPTER 1

ST. GEORGE, UTAH

SUMMIT ESTATES

ST. GEORGE, UTAH

DRAINAGE CONTROL PLAN

POST-DEVELOPED CONDITION

APPENDIX B: HYDRAULIC COMPUTATIONS



Section-1 3-Hour 100-YR

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Channel Slope	12.000 %
Discharge	15.40 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.50
0+04	0.41
0+05	0.41
0+06	0.00
0+07	0.12
0+20	0.37
0+33	0.12
0+34	0.00
0+35	0.41
0+36	0.41
0+40	0.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.50)	(0+07, 0.12)	0.013
(0+07, 0.12)	(0+33, 0.12)	0.016
(0+33, 0.12)	(0+40, 0.50)	0.013

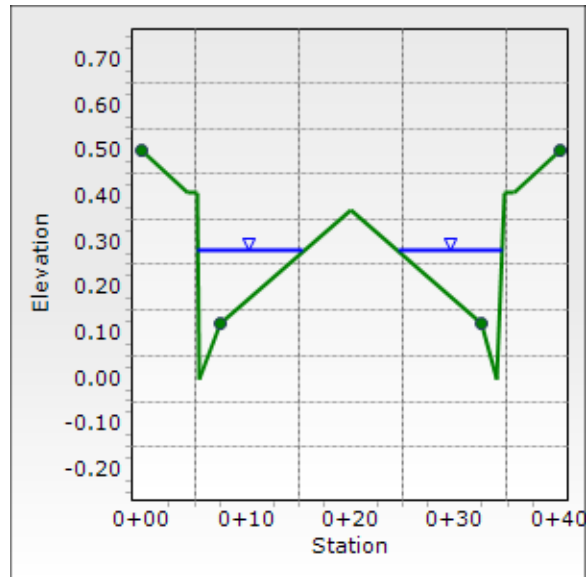
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.28 ft
Elevation Range	0.0 to 0.5 ft
Flow Area	2.1 ft ²
Wetted Perimeter	20.14 ft
Hydraulic Radius	0.10 ft
Top Width	19.92 ft
Normal Depth	0.28 ft
Critical Depth	0.43 ft
Critical Slope	0.610 %

Results	
Velocity	7.37 ft/s
Velocity Head	0.84 ft
Specific Energy	1.12 ft
Froude Number	4.013
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.28 ft
Critical Depth	0.43 ft
Channel Slope	12.000 %
Critical Slope	0.610 %

Cross Section for Section-1 3-Hour 100-YR

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	12.000 %
Normal Depth	0.28 ft
Discharge	15.40 cfs



Section-3 3-Hour 100-YR

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Channel Slope	6.250 %
Discharge	14.10 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.50
0+04	0.41
0+05	0.41
0+06	0.00
0+07	0.12
0+20	0.37
0+33	0.12
0+34	0.00
0+35	0.41
0+36	0.41
0+40	0.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.50)	(0+07, 0.12)	0.013
(0+07, 0.12)	(0+33, 0.12)	0.016
(0+33, 0.12)	(0+40, 0.50)	0.013

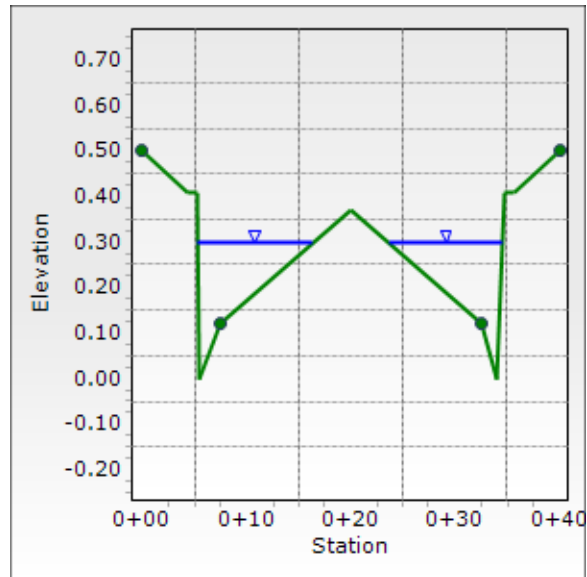
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.30 ft
Elevation Range	0.0 to 0.5 ft
Flow Area	2.5 ft ²
Wetted Perimeter	22.22 ft
Hydraulic Radius	0.11 ft
Top Width	21.99 ft
Normal Depth	0.30 ft
Critical Depth	0.42 ft
Critical Slope	0.621 %

Results	
Velocity	5.61 ft/s
Velocity Head	0.49 ft
Specific Energy	0.79 ft
Froude Number	2.929
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.30 ft
Critical Depth	0.42 ft
Channel Slope	6.250 %
Critical Slope	0.621 %

Cross Section for Section-3 3-Hour 100-YR

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	6.250 %
Normal Depth	0.30 ft
Discharge	14.10 cfs



Section-5 3-Hour 100-YR

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Channel Slope	4.000 %
Discharge	29.70 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.50
0+04	0.41
0+05	0.41
0+06	0.00
0+07	0.12
0+20	0.37
0+33	0.12
0+34	0.00
0+35	0.41
0+36	0.41
0+40	0.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.50)	(0+07, 0.12)	0.013
(0+07, 0.12)	(0+33, 0.12)	0.016
(0+33, 0.12)	(0+40, 0.50)	0.013

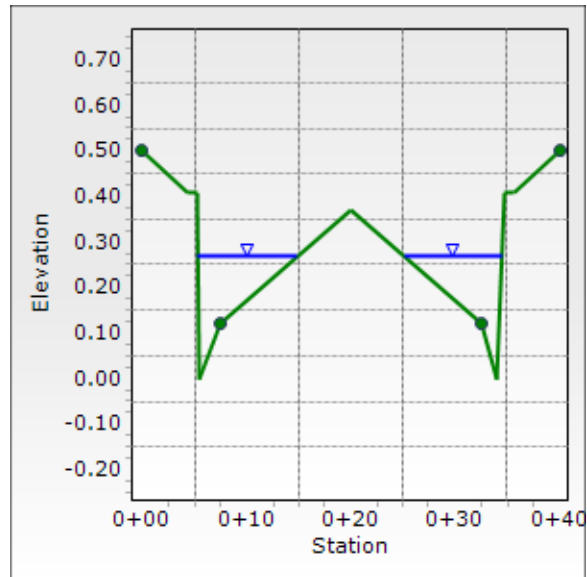
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.39 ft
Elevation Range	0.0 to 0.5 ft
Flow Area	5.1 ft ²
Wetted Perimeter	29.86 ft
Hydraulic Radius	0.17 ft
Top Width	29.55 ft
Normal Depth	0.39 ft
Critical Depth	0.54 ft
Critical Slope	0.561 %

Results	
Velocity	5.86 ft/s
Velocity Head	0.53 ft
Specific Energy	0.93 ft
Froude Number	2.495
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.39 ft
Critical Depth	0.54 ft
Channel Slope	4.000 %
Critical Slope	0.561 %

Cross Section for Section-4 3-Hour 100-YR

Project Description	
Friction Method	Manning
Solve For	Formula Normal Depth
Input Data	
Channel Slope	11.400 %
Normal Depth	0.27 ft
Discharge	13.50 cfs



Section-6 3-Hour 100-YR

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Channel Slope	11.200 %
Discharge	31.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.50
0+04	0.41
0+05	0.41
0+06	0.00
0+07	0.12
0+20	0.37
0+33	0.12
0+34	0.00
0+35	0.41
0+36	0.41
0+40	0.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.50)	(0+07, 0.12)	0.013
(0+07, 0.12)	(0+33, 0.12)	0.016
(0+33, 0.12)	(0+40, 0.50)	0.013

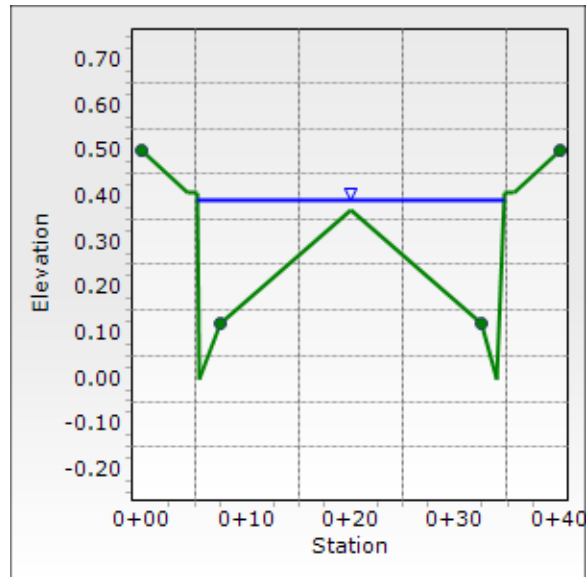
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.34 ft
Elevation Range	0.0 to 0.5 ft
Flow Area	3.7 ft ²
Wetted Perimeter	27.17 ft
Hydraulic Radius	0.14 ft
Top Width	26.89 ft
Normal Depth	0.34 ft
Critical Depth	0.55 ft
Critical Slope	0.554 %

Results	
Velocity	8.43 ft/s
Velocity Head	1.10 ft
Specific Energy	1.45 ft
Froude Number	4.017
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.34 ft
Critical Depth	0.55 ft
Channel Slope	11.200 %
Critical Slope	0.554 %

Cross Section for Section-5 3-Hour 100-YR

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	4.000 %
Normal Depth	0.39 ft
Discharge	29.70 cfs



Section-7 3-Hour 100-YR

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Channel Slope	11.200 %
Discharge	26.30 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.50
0+04	0.41
0+05	0.41
0+06	0.00
0+07	0.12
0+20	0.37
0+33	0.12
0+34	0.00
0+35	0.41
0+36	0.41
0+40	0.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.50)	(0+07, 0.12)	0.013
(0+07, 0.12)	(0+33, 0.12)	0.016
(0+33, 0.12)	(0+40, 0.50)	0.013

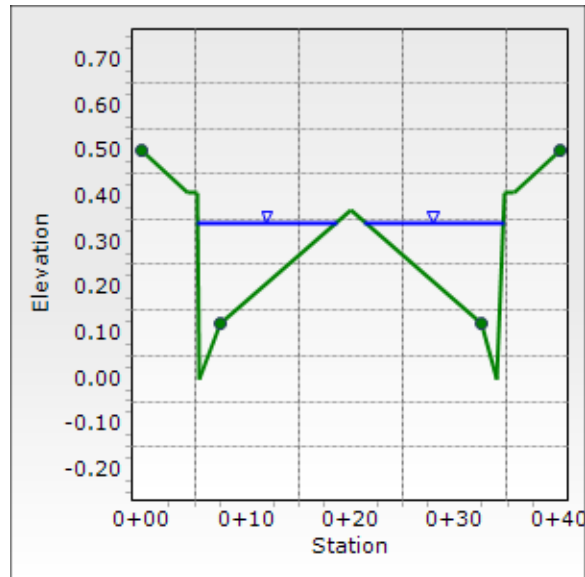
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.33 ft
Elevation Range	0.0 to 0.5 ft
Flow Area	3.2 ft ²
Wetted Perimeter	25.40 ft
Hydraulic Radius	0.13 ft
Top Width	25.14 ft
Normal Depth	0.33 ft
Critical Depth	0.52 ft
Critical Slope	0.572 %

Results	
Velocity	8.13 ft/s
Velocity Head	1.03 ft
Specific Energy	1.36 ft
Froude Number	3.998
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.33 ft
Critical Depth	0.52 ft
Channel Slope	11.200 %
Critical Slope	0.572 %

Cross Section for Section-6 3-Hour 100-YR

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	11.200 %
Normal Depth	0.34 ft
Discharge	31.00 cfs



Section-8 3-Hour 100-YR

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Channel Slope	2.800 %
Discharge	5.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.50
0+04	0.41
0+05	0.41
0+06	0.00
0+07	0.12
0+20	0.37
0+33	0.12
0+34	0.00
0+35	0.41
0+36	0.41
0+40	0.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.50)	(0+07, 0.12)	0.013
(0+07, 0.12)	(0+33, 0.12)	0.016
(0+33, 0.12)	(0+40, 0.50)	0.013

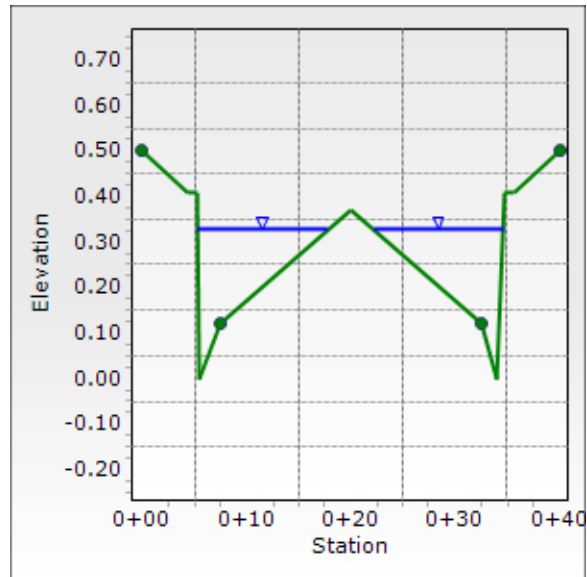
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.25 ft
Elevation Range	0.0 to 0.5 ft
Flow Area	1.5 ft ²
Wetted Perimeter	16.97 ft
Hydraulic Radius	0.09 ft
Top Width	16.77 ft
Normal Depth	0.25 ft
Critical Depth	0.30 ft
Critical Slope	0.708 %

Results	
Velocity	3.27 ft/s
Velocity Head	0.17 ft
Specific Energy	0.41 ft
Froude Number	1.913
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.25 ft
Critical Depth	0.30 ft
Channel Slope	2.800 %
Critical Slope	0.708 %

Cross Section for Section-7 3-Hour 100-YR

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	11.200 %
Normal Depth	0.33 ft
Discharge	26.30 cfs



Section-9 3-Hour 100-YR

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Channel Slope	5.600 %
Discharge	3.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.50
0+04	0.41
0+05	0.41
0+06	0.00
0+07	0.12
0+20	0.37
0+33	0.12
0+34	0.00
0+35	0.41
0+36	0.41
0+40	0.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.50)	(0+07, 0.12)	0.013
(0+07, 0.12)	(0+33, 0.12)	0.016
(0+33, 0.12)	(0+40, 0.50)	0.013

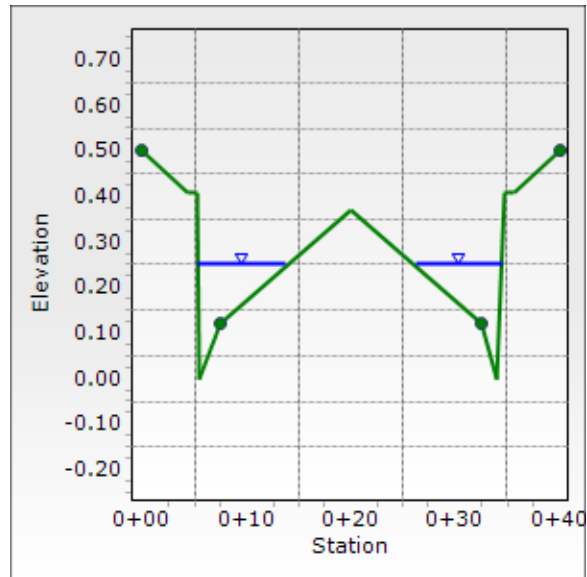
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.19 ft
Elevation Range	0.0 to 0.5 ft
Flow Area	0.8 ft ²
Wetted Perimeter	11.33 ft
Hydraulic Radius	0.07 ft
Top Width	11.18 ft
Normal Depth	0.19 ft
Critical Depth	0.26 ft
Critical Slope	0.725 %

Results	
Velocity	3.92 ft/s
Velocity Head	0.24 ft
Specific Energy	0.43 ft
Froude Number	2.637
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.19 ft
Critical Depth	0.26 ft
Channel Slope	5.600 %
Critical Slope	0.725 %

Cross Section for Section-8 3-Hour 100-YR

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	2.800 %
Normal Depth	0.25 ft
Discharge	5.00 cfs



Section-10 3-Hour 100-YR

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Channel Slope	7.300 %
Discharge	1.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.50
0+04	0.41
0+05	0.41
0+06	0.00
0+07	0.12
0+20	0.37
0+33	0.12
0+34	0.00
0+35	0.41
0+36	0.41
0+40	0.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.50)	(0+07, 0.12)	0.013
(0+07, 0.12)	(0+33, 0.12)	0.016
(0+33, 0.12)	(0+40, 0.50)	0.013

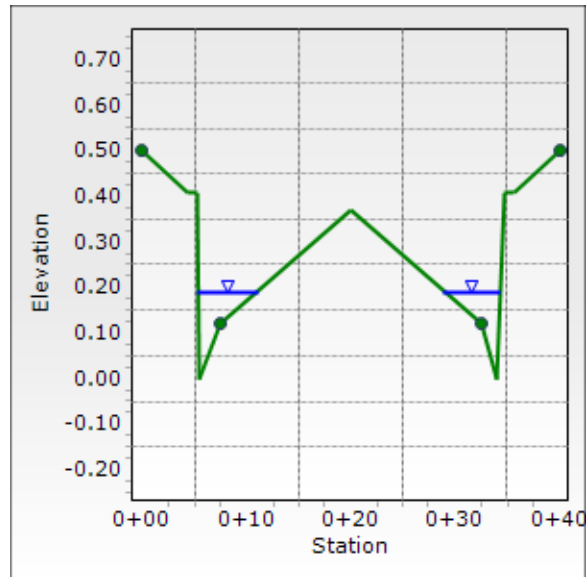
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.12 ft
Elevation Range	0.0 to 0.5 ft
Flow Area	0.2 ft ²
Wetted Perimeter	3.82 ft
Hydraulic Radius	0.06 ft
Top Width	3.72 ft
Normal Depth	0.12 ft
Critical Depth	0.18 ft
Critical Slope	0.621 %

Results	
Velocity	4.58 ft/s
Velocity Head	0.33 ft
Specific Energy	0.44 ft
Froude Number	3.337
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.12 ft
Critical Depth	0.18 ft
Channel Slope	7.300 %
Critical Slope	0.621 %

Cross Section for Section-9 3-Hour 100-YR

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	5.600 %
Normal Depth	0.19 ft
Discharge	3.00 cfs



Section-11 3-Hour 100-YR

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Channel Slope	12.000 %
Discharge	0.30 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.50
0+04	0.41
0+05	0.41
0+06	0.00
0+07	0.12
0+20	0.37
0+33	0.12
0+34	0.00
0+35	0.41
0+36	0.41
0+40	0.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.50)	(0+07, 0.12)	0.013
(0+07, 0.12)	(0+33, 0.12)	0.016
(0+33, 0.12)	(0+40, 0.50)	0.013

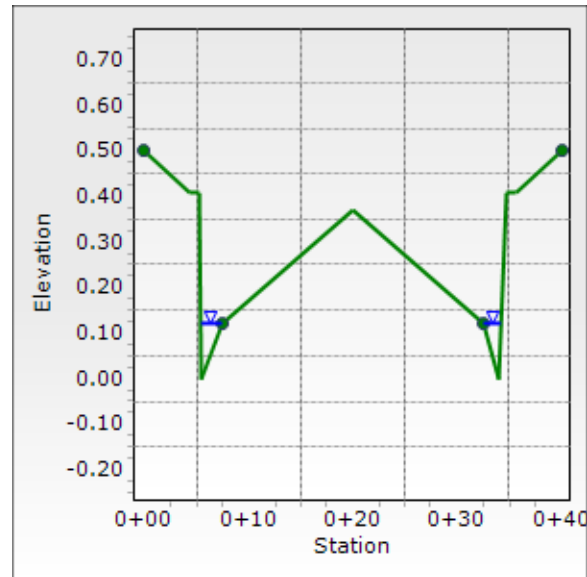
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.07 ft
Elevation Range	0.0 to 0.5 ft
Flow Area	0.1 ft ²
Wetted Perimeter	2.22 ft
Hydraulic Radius	0.03 ft
Top Width	2.16 ft
Normal Depth	0.07 ft
Critical Depth	0.12 ft
Critical Slope	0.656 %

Results	
Velocity	4.08 ft/s
Velocity Head	0.26 ft
Specific Energy	0.33 ft
Froude Number	3.901
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.07 ft
Critical Depth	0.12 ft
Channel Slope	12.000 %
Critical Slope	0.656 %

Cross Section for Section-10 3-Hour 100-YR

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	7.300 %
Normal Depth	0.12 ft
Discharge	1.00 cfs



Section-4 3-Hour 100-YR

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Channel Slope	11.400 %
Discharge	13.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.50
0+04	0.41
0+05	0.41
0+06	0.00
0+07	0.12
0+20	0.37
0+33	0.12
0+34	0.00
0+35	0.41
0+36	0.41
0+40	0.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.50)	(0+07, 0.12)	0.013
(0+07, 0.12)	(0+33, 0.12)	0.016
(0+33, 0.12)	(0+40, 0.50)	0.013

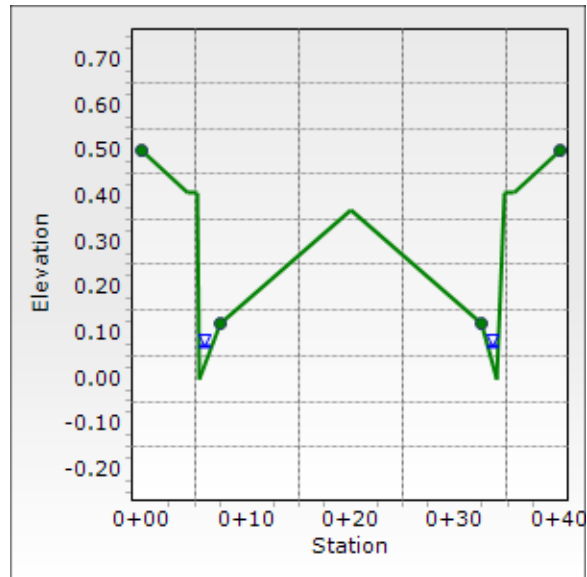
Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results	
Normal Depth	0.27 ft
Elevation Range	0.0 to 0.5 ft
Flow Area	1.9 ft ²
Wetted Perimeter	19.23 ft
Hydraulic Radius	0.10 ft
Top Width	19.02 ft
Normal Depth	0.27 ft
Critical Depth	0.41 ft
Critical Slope	0.611 %

Results	
Velocity	7.04 ft/s
Velocity Head	0.77 ft
Specific Energy	1.04 ft
Froude Number	3.907
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.27 ft
Critical Depth	0.41 ft
Channel Slope	11.400 %
Critical Slope	0.611 %

Cross Section for Section-11 3-Hour 100-YR

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Channel Slope	12.000 %
Normal Depth	0.07 ft
Discharge	0.30 cfs



DI#1_5'_3-Hour 100-YR

Project Description	
Solve For	Efficiency
Input Data	
Discharge	15.40 cfs
Slope	12.000 %
Gutter Width	1.50 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.016
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Width	1.50 ft
Grate Length	1.25 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	0.0 %
Curb Opening Length	2.50 ft
Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None
Results	
Efficiency	28.94 %
Intercepted Flow	4.46 cfs
Bypass Flow	10.94 cfs
Spread	12.13 ft
Depth	0.34 ft
Flow Area	1.5 ft ²
Gutter Depression	1.1 in
Total Depression	3.1 in
Velocity	9.98 ft/s
Splash Over Velocity	6.35 ft/s
Frontal Flow Factor	0.674
Side Flow Factor	0.004
Grate Flow Ratio	0.368
Equivalent Cross Slope	8.426 %
Active Grate Length	1.25 ft
Length Factor	0.024
Total Interception Length	52.82 ft
Messages	

Messages	
Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5- 4.5 ft / 0.15- 1.35 m).

DI#3_5'_3-Hour 100-YR

Project Description	
Solve For	Efficiency
Input Data	
Discharge	14.10 cfs
Slope	6.250 %
Gutter Width	1.50 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.016
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Width	1.50 ft
Grate Length	1.25 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	0.0 %
Curb Opening Length	2.50 ft
Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None
Results	
Efficiency	34.49 %
Intercepted Flow	4.86 cfs
Bypass Flow	9.24 cfs
Spread	13.36 ft
Depth	0.36 ft
Flow Area	1.9 ft ²
Gutter Depression	1.1 in
Total Depression	3.1 in
Velocity	7.60 ft/s
Splash Over Velocity	6.35 ft/s
Frontal Flow Factor	0.888
Side Flow Factor	0.006
Grate Flow Ratio	0.334
Equivalent Cross Slope	7.831 %
Active Grate Length	1.25 ft
Length Factor	0.029
Total Interception Length	43.74 ft
Messages	

Messages	
Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5- 4.5 ft / 0.15- 1.35 m).

DI#5_5'_3-Hour 100-YR

Project Description	
Solve For	Efficiency
Input Data	
Discharge	29.70 cfs
Slope	4.000 %
Gutter Width	1.50 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.016
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Width	1.50 ft
Grate Length	1.25 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	0.0 %
Curb Opening Length	2.50 ft
Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None
Results	
Efficiency	23.65 %
Intercepted Flow	7.02 cfs
Bypass Flow	22.68 cfs
Spread	19.54 ft
Depth	0.49 ft
Flow Area	3.9 ft ²
Gutter Depression	1.1 in
Total Depression	3.1 in
Velocity	7.64 ft/s
Splash Over Velocity	6.35 ft/s
Frontal Flow Factor	0.884
Side Flow Factor	0.006
Grate Flow Ratio	0.225
Equivalent Cross Slope	5.927 %
Active Grate Length	1.25 ft
Length Factor	0.020
Total Interception Length	61.82 ft
Messages	

Messages	
Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5- 4.5 ft / 0.15- 1.35 m).

DI#6_5'_3-Hour 100-YR

Project Description	
Solve For	Efficiency
Input Data	
Discharge	31.00 cfs
Slope	11.200 %
Gutter Width	1.50 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.016
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Width	1.50 ft
Grate Length	1.25 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	0.0 %
Curb Opening Length	2.50 ft
Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None
Results	
Efficiency	17.80 %
Intercepted Flow	5.52 cfs
Bypass Flow	25.48 cfs
Spread	16.26 ft
Depth	0.42 ft
Flow Area	2.7 ft ²
Gutter Depression	1.1 in
Total Depression	3.1 in
Velocity	11.42 ft/s
Splash Over Velocity	6.35 ft/s
Frontal Flow Factor	0.544
Side Flow Factor	0.003
Grate Flow Ratio	0.273
Equivalent Cross Slope	6.760 %
Active Grate Length	1.25 ft
Length Factor	0.016
Total Interception Length	79.22 ft
Messages	

Messages	
Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5- 4.5 ft / 0.15- 1.35 m).

DI#8_5'_3-Hour 100-YR

Project Description	
Solve For	Efficiency
Input Data	
Discharge	5.00 cfs
Slope	2.800 %
Gutter Width	1.50 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.016
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Width	1.50 ft
Grate Length	1.25 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	0.0 %
Curb Opening Length	2.50 ft
Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None
Results	
Efficiency	52.25 %
Intercepted Flow	2.61 cfs
Bypass Flow	2.39 cfs
Spread	10.30 ft
Depth	0.30 ft
Flow Area	1.1 ft ²
Gutter Depression	1.1 in
Total Depression	3.1 in
Velocity	4.42 ft/s
Splash Over Velocity	6.35 ft/s
Frontal Flow Factor	1.000
Side Flow Factor	0.015
Grate Flow Ratio	0.433
Equivalent Cross Slope	9.553 %
Active Grate Length	1.25 ft
Length Factor	0.063
Total Interception Length	19.74 ft
Messages	

Messages	
Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5- 4.5 ft / 0.15- 1.35 m).

DI#9_5'_3-Hour 100-YR

Project Description	
Solve For	Efficiency
Input Data	
Discharge	3.00 cfs
Slope	5.600 %
Gutter Width	1.50 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.016
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Width	1.50 ft
Grate Length	1.25 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	0.0 %
Curb Opening Length	2.50 ft
Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None
Results	
Efficiency	69.18 %
Intercepted Flow	2.08 cfs
Bypass Flow	0.92 cfs
Spread	7.06 ft
Depth	0.24 ft
Flow Area	0.6 ft ²
Gutter Depression	1.1 in
Total Depression	3.1 in
Velocity	5.27 ft/s
Splash Over Velocity	6.35 ft/s
Frontal Flow Factor	1.000
Side Flow Factor	0.011
Grate Flow Ratio	0.608
Equivalent Cross Slope	12.601 %
Active Grate Length	1.25 ft
Length Factor	0.075
Total Interception Length	16.61 ft
Messages	

Messages	
Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5- 4.5 ft / 0.15- 1.35 m).

DI#10_5'_3-Hour 100-YR

Project Description	
Solve For	Efficiency
Input Data	
Discharge	1.00 cfs
Slope	7.300 %
Gutter Width	1.50 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.016
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Width	1.50 ft
Grate Length	1.25 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	0.0 %
Curb Opening Length	2.50 ft
Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None
Results	
Efficiency	96.88 %
Intercepted Flow	0.97 cfs
Bypass Flow	0.03 cfs
Spread	3.53 ft
Depth	0.17 ft
Flow Area	0.2 ft ²
Gutter Depression	1.1 in
Total Depression	3.1 in
Velocity	5.11 ft/s
Splash Over Velocity	6.35 ft/s
Frontal Flow Factor	1.000
Side Flow Factor	0.012
Grate Flow Ratio	0.909
Equivalent Cross Slope	17.854 %
Active Grate Length	1.25 ft
Length Factor	0.136
Total Interception Length	9.20 ft
Messages	

Messages	
Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5- 4.5 ft / 0.15- 1.35 m).

DI#11_5'_3-Hour 100-YR

Project Description	
Solve For	Efficiency
Input Data	
Discharge	0.30 cfs
Slope	12.000 %
Gutter Width	1.50 ft
Gutter Cross Slope	8.330 %
Road Cross Slope	2.000 %
Roughness Coefficient	0.016
Local Depression	2.0 in
Local Depression Width	18.0 in
Grate Width	1.50 ft
Grate Length	1.25 ft
Grate Type	P-50 mm (P-1 -7/8")
Clogging	0.0 %
Curb Opening Length	2.50 ft
Options	
Calculation Option	Use Both
Grate Flow Option	Exclude None
Results	
Efficiency	100.00 %
Intercepted Flow	0.30 cfs
Bypass Flow	0.00 cfs
Spread	1.18 ft
Depth	0.10 ft
Flow Area	0.1 ft ²
Gutter Depression	1.1 in
Total Depression	3.1 in
Velocity	5.14 ft/s
Splash Over Velocity	6.35 ft/s
Frontal Flow Factor	1.000
Side Flow Factor	0.012
Grate Flow Ratio	1.000
Equivalent Cross Slope	19.441 %
Active Grate Length	1.25 ft
Length Factor	0.204
Total Interception Length	6.12 ft
Messages	

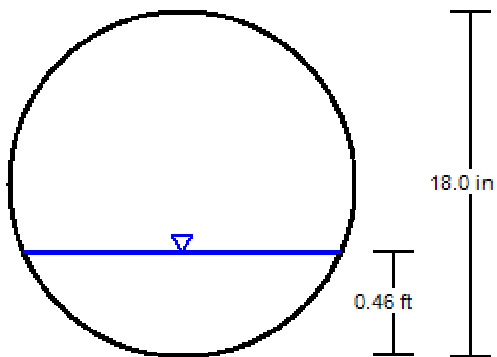
Messages	
Messages	Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5- 4.5 ft / 0.15- 1.35 m).

SD1 Section1

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Roughness Coefficient	0.016
Channel Slope	6.900 %
Diameter	18.0 in
Discharge	4.50 cfs
Results	
Normal Depth	0.46 ft
Flow Area	0.5 ft ²
Wetted Perimeter	1.75 ft
Hydraulic Radius	0.26 ft
Top Width	1.38 ft
Critical Depth	0.81 ft
Percent Full	30.4 %
Critical Slope	0.846 %
Velocity	9.92 ft/s
Velocity Head	1.53 ft
Specific Energy	1.98 ft
Froude Number	3.048
Maximum Discharge	24.11 cfs
Discharge Full	22.42 cfs
Slope Full	0.278 %
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	30.4 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.46 ft
Critical Depth	0.81 ft
Channel Slope	6.900 %
Critical Slope	0.846 %

Cross Section for SD1 Section1

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.016
Channel Slope	6.900 %
Normal Depth	0.46 ft
Diameter	18.0 in
Discharge	4.50 cfs



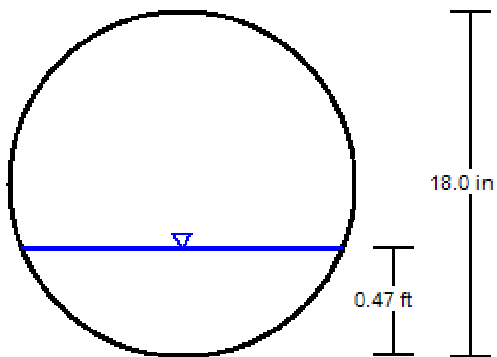
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SD2 Section2

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.016
Channel Slope	6.100 %
Diameter	18.0 in
Discharge	4.50 cfs
Results	
Normal Depth	0.47 ft
Flow Area	0.5 ft ²
Wetted Perimeter	1.78 ft
Hydraulic Radius	0.27 ft
Top Width	1.39 ft
Critical Depth	0.81 ft
Percent Full	31.4 %
Critical Slope	0.845 %
Velocity	9.49 ft/s
Velocity Head	1.40 ft
Specific Energy	1.87 ft
Froude Number	2.865
Maximum Discharge	22.67 cfs
Discharge Full	21.08 cfs
Slope Full	0.278 %
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	31.4 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.47 ft
Critical Depth	0.81 ft
Channel Slope	6.100 %
Critical Slope	0.845 %

Cross Section for SD2 Section2

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.016
Channel Slope	6.100 %
Normal Depth	0.47 ft
Diameter	18.0 in
Discharge	4.50 cfs



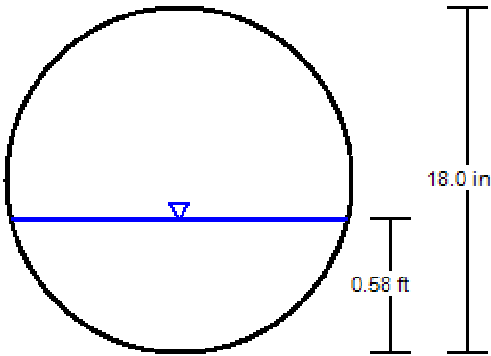
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SD3 Section3

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.016
Channel Slope	12.100 %
Diameter	18.0 in
Discharge	9.40 cfs
Results	
Normal Depth	0.58 ft
Flow Area	0.6 ft ²
Wetted Perimeter	2.01 ft
Hydraulic Radius	0.31 ft
Top Width	1.46 ft
Critical Depth	1.18 ft
Percent Full	38.7 %
Critical Slope	1.303 %
Velocity	14.90 ft/s
Velocity Head	3.45 ft
Specific Energy	4.03 ft
Froude Number	3.998
Maximum Discharge	31.93 cfs
Discharge Full	29.69 cfs
Slope Full	1.213 %
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	38.7 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.58 ft
Critical Depth	1.18 ft
Channel Slope	12.100 %
Critical Slope	1.303 %

Cross Section for SD3 Section3

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.016
Channel Slope	12.100 %
Normal Depth	0.58 ft
Diameter	18.0 in
Discharge	9.40 cfs



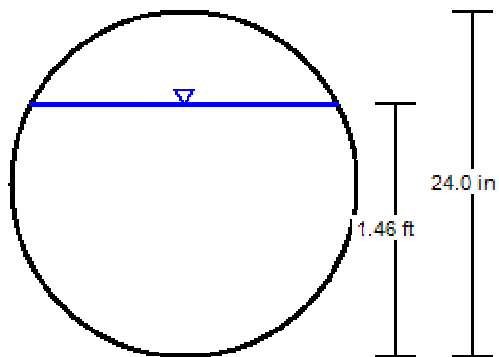
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Worksheet for SD4 Section4

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.016
Channel Slope	2.000 %
Diameter	24.0 in
Discharge	22.90 cfs
Results	
Normal Depth	1.46 ft
Flow Area	2.5 ft ²
Wetted Perimeter	4.09 ft
Hydraulic Radius	0.60 ft
Top Width	1.78 ft
Critical Depth	1.70 ft
Percent Full	72.9 %
Critical Slope	1.458 %
Velocity	9.34 ft/s
Velocity Head	1.35 ft
Specific Energy	2.81 ft
Froude Number	1.402
Maximum Discharge	27.96 cfs
Discharge Full	25.99 cfs
Slope Full	1.552 %
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	72.9 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.46 ft
Critical Depth	1.70 ft
Channel Slope	2.000 %
Critical Slope	1.458 %

Cross Section for SD4 Section4

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.016
Channel Slope	2.000 %
Normal Depth	1.46 ft
Diameter	24.0 in
Discharge	22.90 cfs



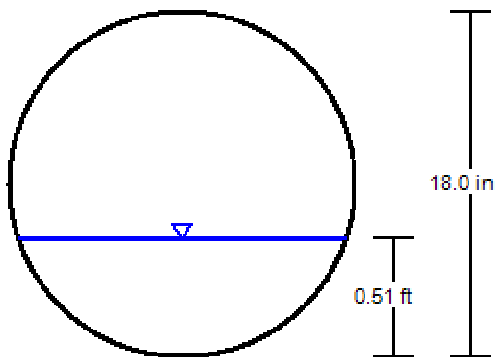
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SD5 Section5

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Roughness Coefficient	0.016
Channel Slope	10.700 %
Diameter	18.0 in
Discharge	7.00 cfs
Results	
Normal Depth	0.51 ft
Flow Area	0.5 ft ²
Wetted Perimeter	1.87 ft
Hydraulic Radius	0.28 ft
Top Width	1.42 ft
Critical Depth	1.02 ft
Percent Full	34.1 %
Critical Slope	1.024 %
Velocity	13.14 ft/s
Velocity Head	2.68 ft
Specific Energy	3.20 ft
Froude Number	3.786
Maximum Discharge	30.03 cfs
Discharge Full	27.92 cfs
Slope Full	0.673 %
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	34.1 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.51 ft
Critical Depth	1.02 ft
Channel Slope	10.700 %
Critical Slope	1.024 %

Cross Section for SD5 Section5

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.016
Channel Slope	10.700 %
Normal Depth	0.51 ft
Diameter	18.0 in
Discharge	7.00 cfs



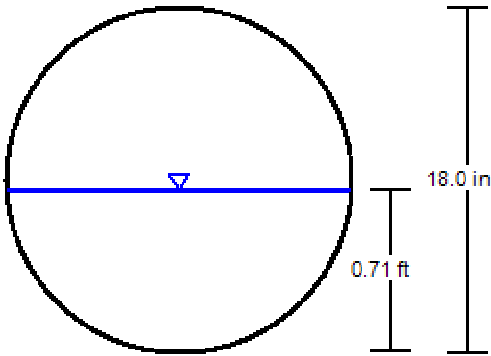
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SD6 Section6

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.016
Channel Slope	10.500 %
Diameter	18.0 in
Discharge	12.50 cfs
Results	
Normal Depth	0.71 ft
Flow Area	0.8 ft ²
Wetted Perimeter	2.27 ft
Hydraulic Radius	0.36 ft
Top Width	1.50 ft
Critical Depth	1.33 ft
Percent Full	47.1 %
Critical Slope	1.909 %
Velocity	15.26 ft/s
Velocity Head	3.62 ft
Specific Energy	4.32 ft
Froude Number	3.636
Maximum Discharge	29.75 cfs
Discharge Full	27.65 cfs
Slope Full	2.145 %
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	47.1 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.71 ft
Critical Depth	1.33 ft
Channel Slope	10.500 %
Critical Slope	1.909 %

Cross Section for SD6 Section6

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.016
Channel Slope	10.500 %
Normal Depth	0.71 ft
Diameter	18.0 in
Discharge	12.50 cfs



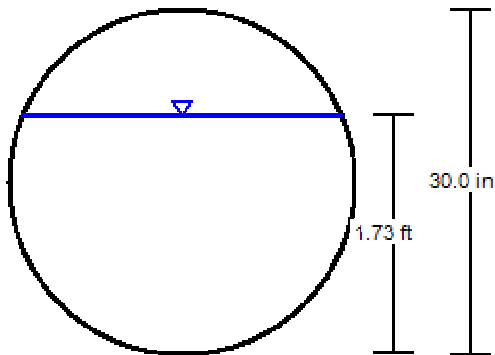
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Worksheet for SD7 Section7

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.016
Channel Slope	2.000 %
Diameter	30.0 in
Discharge	38.80 cfs
Results	
Normal Depth	1.73 ft
Flow Area	3.6 ft ²
Wetted Perimeter	4.91 ft
Hydraulic Radius	0.74 ft
Top Width	2.31 ft
Critical Depth	2.10 ft
Percent Full	69.1 %
Critical Slope	1.298 %
Velocity	10.72 ft/s
Velocity Head	1.79 ft
Specific Energy	3.51 ft
Froude Number	1.510
Maximum Discharge	50.70 cfs
Discharge Full	47.13 cfs
Slope Full	1.356 %
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	69.1 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	1.73 ft
Critical Depth	2.10 ft
Channel Slope	2.000 %
Critical Slope	1.298 %

Cross Section for SD7 Section7

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.016
Channel Slope	2.000 %
Normal Depth	1.73 ft
Diameter	30.0 in
Discharge	38.80 cfs



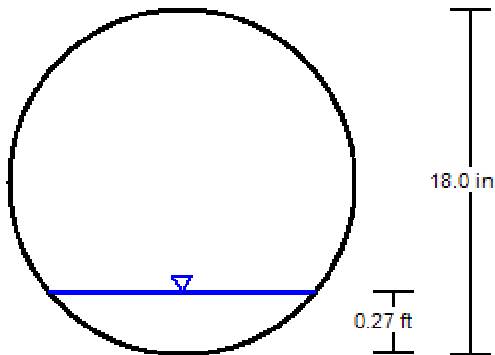
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SD8 Section 8

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.016
Channel Slope	17.500 %
Diameter	18.0 in
Discharge	2.60 cfs
Results	
Normal Depth	0.27 ft
Flow Area	0.2 ft ²
Wetted Perimeter	1.32 ft
Hydraulic Radius	0.17 ft
Top Width	1.16 ft
Critical Depth	0.61 ft
Percent Full	18.3 %
Critical Slope	0.763 %
Velocity	11.77 ft/s
Velocity Head	2.15 ft
Specific Energy	2.43 ft
Froude Number	4.754
Maximum Discharge	38.40 cfs
Discharge Full	35.70 cfs
Slope Full	0.093 %
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	18.3 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.27 ft
Critical Depth	0.61 ft
Channel Slope	17.500 %
Critical Slope	0.763 %

Cross Section for SD8 Section 8

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.016
Channel Slope	17.500 %
Normal Depth	0.27 ft
Diameter	18.0 in
Discharge	2.60 cfs



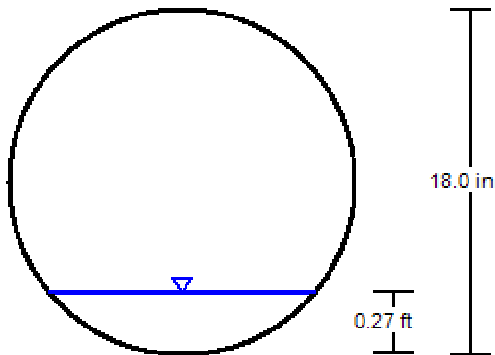
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SD9 Section 9

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.016
Channel Slope	12.300 %
Diameter	18.0 in
Discharge	2.10 cfs
Results	
Normal Depth	0.27 ft
Flow Area	0.2 ft ²
Wetted Perimeter	1.31 ft
Hydraulic Radius	0.16 ft
Top Width	1.15 ft
Critical Depth	0.55 ft
Percent Full	17.9 %
Critical Slope	0.750 %
Velocity	9.76 ft/s
Velocity Head	1.48 ft
Specific Energy	1.75 ft
Froude Number	3.980
Maximum Discharge	32.20 cfs
Discharge Full	29.93 cfs
Slope Full	0.061 %
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	17.9 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.27 ft
Critical Depth	0.55 ft
Channel Slope	12.300 %
Critical Slope	0.750 %

Cross Section for SD9 Section 9

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.016
Channel Slope	12.300 %
Normal Depth	0.27 ft
Diameter	18.0 in
Discharge	2.10 cfs



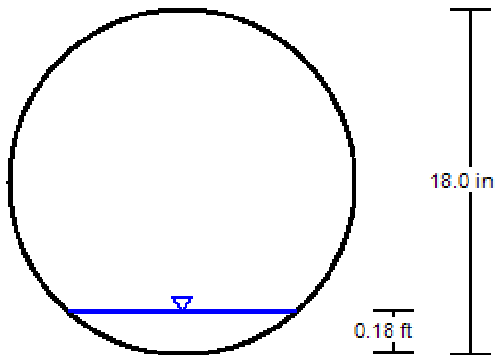
V: 1 
H: 1

SD10 Section 10

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.016
Channel Slope	13.200 %
Diameter	18.0 in
Discharge	1.00 cfs
Results	
Normal Depth	0.18 ft
Flow Area	0.1 ft ²
Wetted Perimeter	1.07 ft
Hydraulic Radius	0.12 ft
Top Width	0.99 ft
Critical Depth	0.37 ft
Percent Full	12.3 %
Critical Slope	0.746 %
Velocity	8.04 ft/s
Velocity Head	1.00 ft
Specific Energy	1.19 ft
Froude Number	3.987
Maximum Discharge	33.35 cfs
Discharge Full	31.01 cfs
Slope Full	0.014 %
Flow Type	Supercritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	12.3 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.18 ft
Critical Depth	0.37 ft
Channel Slope	13.200 %
Critical Slope	0.746 %

Cross Section for SD10 Section 10

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.016
Channel Slope	13.200 %
Normal Depth	0.18 ft
Diameter	18.0 in
Discharge	1.00 cfs



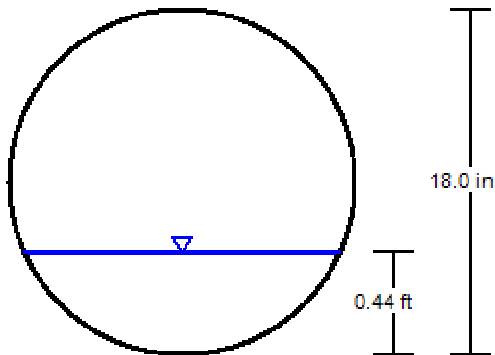
V: 1
H: 1

SD11 Section 11

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Roughness Coefficient	0.016
Channel Slope	0.640 %
Diameter	18.0 in
Discharge	1.30 cfs
Results	
Normal Depth	0.44 ft
Flow Area	0.4 ft ²
Wetted Perimeter	1.72 ft
Hydraulic Radius	0.25 ft
Top Width	1.37 ft
Critical Depth	0.43 ft
Percent Full	29.6 %
Critical Slope	0.742 %
Velocity	2.97 ft/s
Velocity Head	0.14 ft
Specific Energy	0.58 ft
Froude Number	0.928
Maximum Discharge	7.34 cfs
Discharge Full	6.83 cfs
Slope Full	0.023 %
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Average End Depth Over Rise	0.0 %
Normal Depth Over Rise	14.0 %
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.44 ft
Critical Depth	0.43 ft
Channel Slope	0.640 %
Critical Slope	0.742 %

Cross Section for SD11 Section 11

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Roughness Coefficient	0.016
Channel Slope	0.640 %
Normal Depth	0.44 ft
Diameter	18.0 in
Discharge	1.30 cfs



V: 1
H: 1

APPENDIX C: HYDROLOGIC COMPUTATIONS



U.S. ARMY CORPS OF ENGINEERS
HYDROLOGIC ENGINEERING CENTER
609 SECOND STREET
DAVIS, CALIFORNIA 95616
(916) 756-1104

```

X      X  XXXXXXXX  XXXXXX      X
X      X  X      X      X      XX
X      X  X      X      X      X
XXXXXXXXX XXXXX  X      XXXXXX  X
X      X  X      X      X      X
X      X  X      X      X      X
X      X  XXXXXXXX  XXXXXX  XXXX

```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY, DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1

HEC-1 INPUT

PAGE 1

LINE	ID	1	2	3	4	5	6	7	8	9	10
------	----	---	---	---	---	---	---	---	---	---	----

```

1      ID
2      ID
3      ID
4      ID
5      ID
6      ID
7      ID
8      ID
9      ID
10     ID
11     ID
12     ID
13     ID
14     ID
15     ID
16     ID
17     ID
18     ID
19     ID
20     ID
21     IT      5
22     IO      5
23     IN      30
24     JR      PREC      0.68      1.00
      *
25     KK      PRE-1
26     BA      .0662
27     PB      2.31
28     PC      .008      .005      .011      .016      .022      .028      .035      .041      .048      .055
29     PC      .063      .071      .079      .088      .098      .108      .120      .132      .146      .162
30     PC      .181      .204      .235      .283      .664      .735      .773      .800      .820      .839
31     PC      .855      .868      .881      .892      .902      .912      .921      .929      .937      .945
32     PC      .952      .959      .965      .972      .978      .984      .989      .995      1.000
33     LS      0      86
34     UD      .132
      *
35     KK      PRE-2
36     BA      .0647
37     LS      0      86
38     UD      0.137
      *
39     KK      PRE-3
40     BA      .0121
41     LS      0      86
42     UD      .053
      *
43     ZZ

```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
*****
*
*   U.S. ARMY CORPS OF ENGINEERS
*   HYDROLOGIC ENGINEERING CENTER
*   609 SECOND STREET
*   DAVIS, CALIFORNIA 95616
*   (916) 756-1104
*
*****
```

HORROCKS ENGINEERING
PRE-DEVELOPED CONDITION
FILE: Sienna_Pre_Post.DAT
PROJECT No: UT-1570-1901
DATE: NOV 2019

```

22 IO      OUTPUT CONTROL VARIABLES
           IPRT      5  PRINT CONTROL
           IPLOT     0  PLOT CONTROL
           QSCAL     0.  HYDROGRAPH PLOT SCALE

IT         HYDROGRAPH TIME DATA
           NMIN      5  MINUTES IN COMPUTATION INTERVAL
           IDATE     1  0  STARTING DATE
           ITIME     0000 STARTING TIME
           NQ        330 NUMBER OF HYDROGRAPH ORDINATES
           NDDATE    2  0  ENDING DATE
           NDTIME    0325 ENDING TIME
           ICENT     19  CENTURY MARK

           COMPUTATION INTERVAL .08 HOURS
           TOTAL TIME BASE     27.42 HOURS

ENGLISH UNITS
DRAINAGE AREA      SQUARE MILES
PRECIPITATION DEPTH INCHES
LENGTH, ELEVATION FEET
FLOW               CUBIC FEET PER SECOND
STORAGE VOLUME     ACRE-FEET
SURFACE AREA       ACRES
TEMPERATURE        DEGREES FAHRENHEIT

JP         MULTI-PLAN OPTION
           NPLAN      1  NUMBER OF PLANS

JR         MULTI-RATIO OPTION
           RATIOS OF PRECIPITATION
           .68      1.00

```

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1	RATIO 2
				.68	1.00

HYDROGRAPH AT						
+	PRE-1	.07	1	FLOW	21.	43.
				TIME	12.00	12.00

HYDROGRAPH AT						
+	PRE-2	.06	1	FLOW	20.	41.
				TIME	12.00	12.00

HYDROGRAPH AT						
+	PRE-3	.01	1	FLOW	4.	9.
				TIME	12.00	12.00

*** NORMAL END OF HEC-1 ***

U.S. ARMY CORPS OF ENGINEERS
HYDROLOGIC ENGINEERING CENTER
609 SECOND STREET
DAVIS, CALIFORNIA 95616
(916) 756-1104

```

X      X  XXXXXXXX  XXXXXX      X
X      X  X        X      X      XX
X      X  X        X      X      X
XXXXXXX XXXXX      X      XXXXXX  X
X      X  X        X      X      X
X      X  X        X      X      X
X      X  XXXXXXXX  XXXXXX  XXXX

```

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE, SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY, DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

PAGE 1

```

1      ID
2      ID
3      ID          <><><><><><><><><><><><><><><>
4      ID          SIENNA CANYON AT WEBB HILL
5      ID          HYDROLOGIC MODEL
6      ID          -----
7      ID          PRE AND POST DEVELOPMENT
8      ID          10 AND 100-YR STORM EVENT
9      ID          TYPE II DISTRICTUPTION
10     ID
11     ID          -----
12     ID          HORROCKS ENGINEERING
13     ID          POST-DEVELOPED CONDITION
14     ID          FILE: Sienna_Post.DAT
15     ID          PROJECT No: UT-1570-1901
16     ID          DATE: NOV 2019
17     ID          <><><><><><><><><><><><><><><>
18     ID
19     ID          --> 24-HOUR / TYPE II <---
20     ID
21     IT           5             0             0             660
22     IO           5
23     IN           30
24     JR    PREC   0.68       1.00
25     *
26     KK    POST-3
27     BA     .0121
28     PB     2.31
29     PC     .000     .005     .011     .016     .022     .028     .035     .041     .048     .055
30     PC     .063     .071     .079     .088     .098     .108     .120     .132     .146     .162
31     PC     .181     .204     .235     .283     .664     .735     .773     .800     .820     .839
32     PC     .855     .868     .881     .892     .902     .912     .921     .929     .937     .945
33     PC     .952     .959     .965     .972     .978     .984     .989     .995     1.000
34     LS           0            88
35     UD     .086
36     *
37     KK    DB-3
38     KM    LOCAL DETENTION BASIN FOR DISCHARGE AT BASIN POST3
39     RS           1
40     SA     0.0     0.06     0.08     0.10     0.12
41     SE     10     10.01     11     12     13
42     SL     10     1.77     0.62     0.5
43     SS     12.99     25     3     1.5
44     *
45     KK    POST2A
46     BA     .0152
47     LS           0            88
48     UD     0.076

```


LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

```

46      KK  DB-2A
47      KM  LOCAL DETENTION BASIN FOR DISCHARGE AT BASIN POST2A
48      RS   1
49      SA   0.0   0.11   0.13   0.15   0.17
50      SE  10  10.01  11    12    13
51      SL  10   1.77   0.62   0.5
52      SS 12.99   25     3     1.5
      *

53      KK  POST2B
54      BA  .0133
55      LS   0      88
56      UD  .070
      *

57      KK  OFF-2
58      BA  .0168
59      LS   0      86
60      UD  .0106
      *

61      KK  CD1
62      KM  COMBINES POST2B AND OFF-2
63      HC   2
      *

64      KK  DB-2B
65      KM  LOCAL DETENTION BASIN FOR DISCHARGE AT BASIN POST2B AND OFF-2
66      RS   1
67      SA   0.0   0.04   0.05   0.07   0.08
68      SE  10  10.01  11    12    13
69      SL  10   3.14   0.62   0.5
70      SS 12.99   25     3     1.5
      *

71      KK  POST1
72      BA  .0679
73      LS   0      88
74      UD  .121
      *

75      KK  OFF-1
76      BA  .0181
77      LS   0      86
78      UD  .053
      *

79      KK  RTE1
80      KM  ROUTE OFF-1 THROUGH ROAD SIDE DRAIN
81      RD 1670   .005   .013   TRAP
      *

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

```

82      KK  CD2
83      KM  COMBINES POST 1 AND OFF-1
84      HC   2
      *

85      KK  DB-1
86      KM  LOCAL DETENTION BASIN FOR DISCHARGE AT BASIN POST1 AND OFF-1
87      RS   1
88      SA   0.0   0.55   0.57   0.64   0.69
89      SE  10  10.01  11    12    13
90      SL  10   4.91   0.62   0.5
91      SS 12.99   25     3     1.5
      *

92      ZZ

```

SCHEMATIC DIAGRAM OF STREAM NETWORK

```

INPUT
LINE  (V) ROUTING      (--->) DIVERSION OR PUMP FLOW
NO.    (.) CONNECTOR  (<---) RETURN OF DIVERTED OR PUMPED FLOW

25     POST-3
      V
      V
35     DB-3
      .
      .
42     POST2A
      .
      .
      V
      V

```


JP MULTI-PLAN OPTION
 NPLAN 1 NUMBER OF PLANS

 JR MULTI-RATIO OPTION
 RATIOS OF PRECIPITATION
 .68 1.00

1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
 FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
 TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1 .68	RATIO 2 1.00
HYDROGRAPH AT					
+	POST-3	.01	1 FLOW TIME	5. 12.00	9. 12.00
ROUTED TO					
+	DB-3	.01	1 FLOW TIME	4. 12.00	8. 12.00
			** PEAK STAGES IN FEET **		
			1 STAGE TIME	10.38 12.00	10.84 12.00
HYDROGRAPH AT					
+	POST2A	.02	1 FLOW TIME	6. 12.00	12. 12.00
ROUTED TO					
+	DB-2A	.02	1 FLOW TIME	5. 12.08	9. 12.08
			** PEAK STAGES IN FEET **		
			1 STAGE TIME	10.46 12.08	11.05 12.08
HYDROGRAPH AT					
+	POST2B	.01	1 FLOW TIME	6. 12.00	10. 12.00
HYDROGRAPH AT					
+	OFF-2	.02	1 FLOW TIME	6. 12.00	12. 12.00
2 COMBINED AT					
+	CD1	.03	1 FLOW TIME	12. 12.00	23. 12.00
ROUTED TO					
+	DB-2B	.03	1 FLOW TIME	11. 12.00	20. 12.00
			** PEAK STAGES IN FEET **		
			1 STAGE TIME	10.67 12.00	11.72 12.00
HYDROGRAPH AT					
+	POST1	.07	1 FLOW TIME	26. 12.00	50. 12.00
HYDROGRAPH AT					
+	OFF-1	.02	1 FLOW TIME	7. 12.00	13. 12.00
ROUTED TO					
+	RTE1	.02	1 FLOW TIME	6. 12.08	12. 12.00
2 COMBINED AT					
+	CD2	.09	1 FLOW TIME	32. 12.00	62. 12.00
ROUTED TO					
+	DB-1	.09	1 FLOW TIME	21. 12.17	34. 12.17
			** PEAK STAGES IN FEET **		
			1 STAGE TIME	10.87 12.17	11.99 12.17

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
 (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	DT	INTERPOLATED TO COMPUTATION INTERVAL		VOLUME
							PEAK	TIME TO PEAK	

	(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
FOR PLAN = 1	RATIO= .00							
RTE1	MANE	4.50	6.20	724.50	.54	5.00	6.03	725.00
								.54

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5227E+00 EXCESS= .0000E+00 OUTFLOW= .5228E+00 BASIN STORAGE= .5850E-03 PERCENT ERROR= -.1

FOR PLAN = 1	RATIO= .00							
RTE1	MANE	4.57	12.12	722.34	1.09	5.00	11.96	720.00
								1.09

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1051E+01 EXCESS= .0000E+00 OUTFLOW= .1052E+01 BASIN STORAGE= .7754E-03 PERCENT ERROR= -.1

*** NORMAL END OF HEC-1 ***

U.S. ARMY CORPS OF ENGINEERS
HYDROLOGIC ENGINEERING CENTER
609 SECOND STREET
DAVIS, CALIFORNIA 95616
(916) 756-1104

```

X      X XXXXXXXX XXXXXX      X
X      X X      X      X      XX
X      X X      X      X      X
XXXXXXXX XXXXX X      XXXXXX
X      X X      X      X      X
X      X X      X      X      X
X      X XXXXXXXX XXXXXX      XX

```

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -AMSK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE, SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY, DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

1 SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

U.S. ARMY CORPS OF ENGINEERS
HYDROLOGIC ENGINEERING CENTER
609 SECOND STREET
DAVIS, CALIFORNIA 95616
(916) 756-1104

HORROCKS ENGINEERING
PRE-DEVELOPED CONDITION
FILE: Sienna_Pre_Post.DAT
PROJECT No: UT-1570-1901
DATE: NOV 2019

---> 03-HOUR / Farmer-Fletcher <---

ENGLISH UNITS	
DRAINAGE AREA	SQUARE MILES
PRECIPITATION DEPTH	INCHES
LENGTH, ELEVATION	FEET
FLOW	CUBIC FEET PER SECOND
STORAGE VOLUME	ACRE-Feet
SURFACE AREA	ACRES
TEMPERATURE	DEGREES FAHRENHEIT

JR MULTI-RATIO OPTION
 RATIOS OF PRECIPITATION
 .60 1.00

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1	RATIO 2
				.60	1.00

HYDROGRAPH AT						
+	PRE-1	.07	1	FLOW	13.	42.
				TIME	.92	.83

HYDROGRAPH AT						
+	PRE-2	.06	1	FLOW	12.	41.
				TIME	.92	.92

HYDROGRAPH AT						
+	PRE-3	.01	1	FLOW	3.	9.
				TIME	.83	.75

*** NORMAL END OF HEC-1 ***

U.S. ARMY CORPS OF ENGINEERS
HYDROLOGIC ENGINEERING CENTER
609 SECOND STREET
DAVIS, CALIFORNIA 95616
(916) 756-1104

PAGE 2

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

45 KK DB-2A
46 KM LOCAL DETENTION BASIN FOR DISCHARGE AT BASIN POST2A
47 RS 1
48 SA 0.0 0.11 0.13 0.15 0.17
49 SE 10 10.01 11 12 13
50 SL 10 1.77 0.62 0.5
51 SS 12.99 25 3 1.5
*

52 KK POST2B
53 BA .0133
54 LS 0 88
55 UD .070
*

56 KK OFF-2
57 BA .0168
58 LS 0 86
59 UD .0106
*

60 KK CD1
61 KM COMBINES POST2B AND OFF-2
62 HC 2
*

63 KK DB-2B
64 KM LOCAL DETENTION BASIN FOR DISCHARGE AT BASIN POST2B AND OFF-2
65 RS 1
66 SA 0.0 0.04 0.05 0.07 0.08
67 SE 10 10.01 11 12 13
68 SL 10 3.14 0.62 0.5
69 SS 12.99 25 3 1.5
*

70 KK POST1
71 BA .0679
72 LS 0 88
73 UD .121
*

74 KK OFF-1
75 BA .0181
76 LS 0 86
77 UD .053
*

78 KK RTE1
79 KM ROUTE OFF-1 THROUGH ROAD SIDE DRAIN
80 RD 1670 .005 .013 TRAP
*

1

HEC-1 INPUT

PAGE 3

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

81 KK CD2
82 KM COMBINES POST 1 AND OFF-1
83 HC 2
*

84 KK DB-1
85 KM LOCAL DETENTION BASIN FOR DISCHARGE AT BASIN POST1 AND OFF-1
86 RS 1
87 SA 0.0 0.55 0.57 0.64 0.69
88 SE 10 10.01 11 12 13
89 SL 10 4.91 0.62 0.5
90 SS 12.99 25 3 1.5
*

91 ZZ

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT
LINE (V) ROUTING (--->) DIVERSION OR PUMP FLOW
NO. (.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW
25 POST-3
V
V
34 DB-3
.
.
41 POST2A
V
V
45 DB-2A

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

U.S. ARMY CORPS OF ENGINEERS
HYDROLOGIC ENGINEERING CENTER
609 SECOND STREET
DAVIS, CALIFORNIA 95616
(916) 756-1104

```

22 10      OUTPUT CONTROL VARIABLES
           IPRT      5      PRINT CONTROL
           IPLOT     0      PLOT CONTROL
           QSCAL     0.     HYDROGRAPH PLOT SCALE

IT         HYDROGRAPH TIME DATA
           NMN       5      MINUTES IN COMPUTATION INTERVAL
           IDATE     1  0    STARTING DATE
           ITIME     0000    STARTING TIME
           NQ        30     NUMBER OF HYDROGRAPH ORDINATES
           NDDATE    1  0    ENDING DATE
           NDTIME     0225    ENDING TIME
           ICENT      19     CENTURY MARK

           COMPUTATION INTERVAL      .08 HOURS
           TOTAL TIME BASE      2.42 HOURS

ENGLISH UNITS
DRAINAGE AREA      SQUARE MILES
PRECIPITATION DEPTH INCHES
LENGTH, ELEVATION FEET
FLOW              CUBIC FEET PER SECOND
STORAGE VOLUME    ACRE-FEET
SURFACE AREA      ACRES
TEMPERATURE       DEGREES FAHRENHEIT

JP         MULTI-PLAN OPTION

```

NPLAN 1 NUMBER OF PLANS

OR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
.60 1.00

1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1 .60	RATIO 2 1.00
HYDROGRAPH AT					
+	POST-3	.01	1 FLOW TIME	4. .83	10. .83
ROUTED TO					
+	DB-3	.01	1 FLOW TIME	3. .92	9. .92
** PEAK STAGES IN FEET **					
			1 STAGE TIME	10.25 .92	10.95 .92
HYDROGRAPH AT					
+	POST2A	.02	1 FLOW TIME	5. .83	13. .75
ROUTED TO					
+	DB-2A	.02	1 FLOW TIME	3. 1.00	9. .92
** PEAK STAGES IN FEET **					
			1 STAGE TIME	10.28 1.00	11.05 .92
HYDROGRAPH AT					
+	POST2B	.01	1 FLOW TIME	4. .83	12. .75
HYDROGRAPH AT					
+	OFF-2	.02	1 FLOW TIME	4. .83	14. .75
2 COMBINED AT					
+	CD1	.03	1 FLOW TIME	8. .83	26. .75
ROUTED TO					
+	DB-2B	.03	1 FLOW TIME	8. .83	22. .83
** PEAK STAGES IN FEET **					
			1 STAGE TIME	10.43 .83	11.97 .83
HYDROGRAPH AT					
+	POST1	.07	1 FLOW TIME	18. .92	55. .83
HYDROGRAPH AT					
+	OFF-1	.02	1 FLOW TIME	4. .83	14. .75
ROUTED TO					
+	RTE1	.02	1 FLOW TIME	4. .92	14. .83
2 COMBINED AT					
+	CD2	.09	1 FLOW TIME	22. .92	69. .83
ROUTED TO					
+	DB-1	.09	1 FLOW TIME	14. 1.17	33. 1.17
** PEAK STAGES IN FEET **					
			1 STAGE TIME	10.52 1.17	11.86 1.17

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	DT	INTERPOLATED TO COMPUTATION INTERVAL		VOLUME
							PEAK	TIME TO PEAK	

	(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
FOR PLAN = 1 RATIO= .00								
RTE1 MANE .75	4.10	54.75	.18	5.00	4.10	55.00	.18	

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1816E+00 EXCESS= .0000E+00 OUTFLOW= .1777E+00 BASIN STORAGE= .4513E-02 PERCENT ERROR= -.3

FOR PLAN = 1 RATIO= .00								
RTE1 MANE .75	14.07	49.50	.58	5.00	14.03	50.00	.57	

CONTINUITY SUMMARY (AC-FT) - INFLOW= .5635E+00 EXCESS= .0000E+00 OUTFLOW= .5565E+00 BASIN STORAGE= .8689E-02 PERCENT ERROR= -.3

*** NORMAL END OF HEC-1 ***

Basin Peak Flowrates Summary				
PRE-DEVELOPED CONDITION 24 HOUR EVENT				
Basin	Area (acres)	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)	Discharge location
PRE-1	42.38	21	43	DB-1
PRE-2	41.40	12.2	25	DB-2B
		7.8	16	DB-2A
PRE-3	7.77	4	9	DB-3
PRE-DEVELOPED CONDITION 3 HOUR EVENT				
PRE-1	42.38	13	42	DB-1
PRE-2	41.40	7.3	25	DB-2B
		4.7	16	DB-2A
PRE-3	7.77	3	9	DB-3

Basin Peak Flowrates Summary			
POST-DEVELOPED CONDITION 24 HOUR EVENT			
Basin	Area (acres)	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)
CD1 ¹	-	12	23
CD2 ²	-	32	62
OFF-1	11.59	7	13
OFF-2	10.74	6	12
POST-1	43.45	26	50
POST-2A	8.48	6	12
POST-2B	9.70	6	10
POST-3	7.77	5	9

¹CD1 = POST-2B + OFF-2

²CD2 = POST-1 + OFF-1

POST-DEVELOPED CONDITION 3 HOUR EVENT			
CD1	-	8	26
CD2	-	22	69
OFF-1	11.59	4	14
OFF-2	10.74	4	14
POST-1	43.45	18	55
POST-2A	8.48	5	13
POST-2B	9.70	4	12
POST-3	7.77	4	10

¹CD1 = POST-2B + OFF-2

²CD2 = POST-1 + OFF-1

APPENDIX D: REFERENCES/RESOURCES



Soil Map—Washington County Area, Utah



MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils



Soil Map Unit Polygons



Soil Map Unit Lines



Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Washington County Area, Utah

Survey Area Data: Version 13, Sep 16, 2019

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jun 1, 2018—Aug 1, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BA	Badland	8.8	3.0%
BB	Badland, very steep	108.7	36.7%
FA	Fluvaquents and torrifluvents, sandy	2.1	0.7%
HG	Hobog-Rock land association	146.4	49.5%
IAF	Isom cobbly sandy loam, 3 to 30 percent slopes	2.4	0.8%
LeB	Leeds silty clay loam, 1 to 2 percent slopes	3.0	1.0%
NkC	Nikey sandy loam, 1 to 3 percent slopes	3.8	1.3%
Tc	Tobler fine sandy loam	17.3	5.9%
VFD	Vekol sandy loam, 2 to 10 percent slopes	2.8	0.9%
W	Water	0.6	0.2%
Totals for Area of Interest		295.9	100.0%

National Flood Hazard Layer FIRMette



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
		Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
		17.5
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
		Coastal Transect Baseline
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped

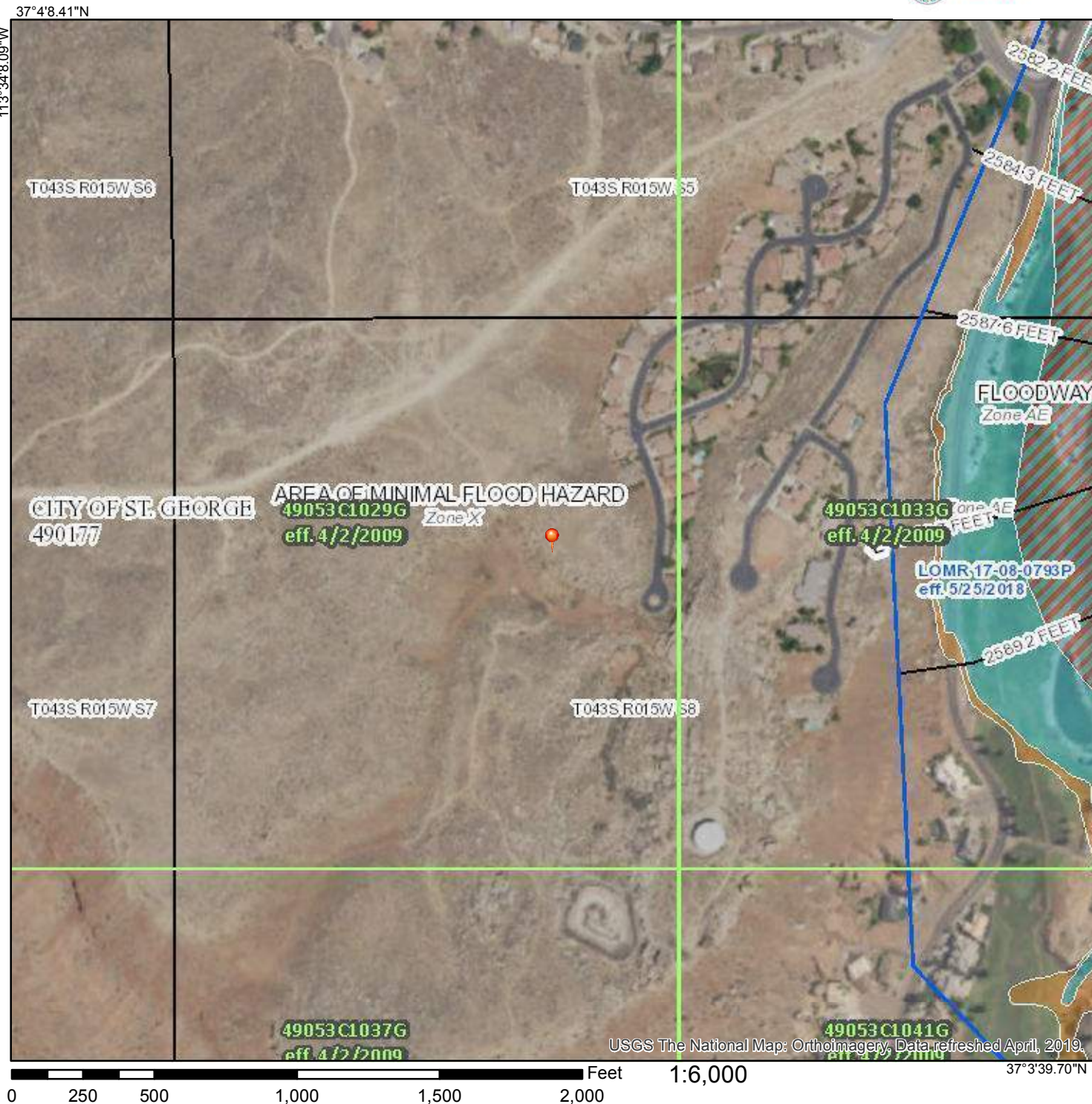


The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **10/30/2019 at 5:05:31 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.



USGS The National Map: Orthoimagery, Data refreshed April, 2019



NOAA Atlas 14, Volume 1, Version 5
Location name: Saint George, Utah, USA*
Latitude: 37.067°, Longitude: -113.5651°
Elevation: 2758.09 ft**
* source: ESRI Maps
** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps_&_aerials](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.123 (0.106-0.144)	0.158 (0.137-0.185)	0.213 (0.184-0.249)	0.262 (0.225-0.307)	0.338 (0.285-0.394)	0.404 (0.336-0.472)	0.481 (0.390-0.565)	0.566 (0.446-0.668)	0.698 (0.529-0.839)	0.812 (0.598-0.983)
10-min	0.187 (0.161-0.219)	0.240 (0.209-0.281)	0.324 (0.279-0.378)	0.399 (0.341-0.468)	0.515 (0.434-0.600)	0.615 (0.511-0.719)	0.732 (0.594-0.860)	0.862 (0.680-1.02)	1.06 (0.805-1.28)	1.24 (0.909-1.50)
15-min	0.231 (0.200-0.271)	0.297 (0.259-0.349)	0.402 (0.346-0.469)	0.494 (0.423-0.579)	0.639 (0.538-0.744)	0.763 (0.634-0.891)	0.908 (0.736-1.07)	1.07 (0.843-1.26)	1.32 (0.998-1.58)	1.53 (1.13-1.86)
30-min	0.312 (0.269-0.365)	0.401 (0.348-0.470)	0.542 (0.467-0.632)	0.666 (0.570-0.780)	0.860 (0.725-1.00)	1.03 (0.853-1.20)	1.22 (0.991-1.44)	1.44 (1.14-1.70)	1.77 (1.34-2.13)	2.06 (1.52-2.50)
60-min	0.386 (0.333-0.452)	0.496 (0.431-0.582)	0.670 (0.578-0.782)	0.824 (0.706-0.966)	1.06 (0.897-1.24)	1.27 (1.06-1.49)	1.51 (1.23-1.78)	1.78 (1.41-2.10)	2.19 (1.66-2.64)	2.55 (1.88-3.09)
2-hr	0.468 (0.414-0.537)	0.582 (0.517-0.671)	0.761 (0.674-0.872)	0.920 (0.809-1.06)	1.17 (1.01-1.33)	1.37 (1.17-1.57)	1.61 (1.34-1.85)	1.87 (1.52-2.18)	2.27 (1.78-2.68)	2.62 (1.99-3.12)
3-hr	0.519 (0.464-0.587)	0.646 (0.581-0.735)	0.830 (0.745-0.942)	0.987 (0.880-1.11)	1.22 (1.08-1.38)	1.42 (1.23-1.61)	1.64 (1.39-1.87)	1.88 (1.57-2.20)	2.29 (1.83-2.71)	2.64 (2.06-3.15)
6-hr	0.644 (0.579-0.724)	0.805 (0.729-0.907)	1.02 (0.922-1.15)	1.21 (1.08-1.36)	1.47 (1.30-1.65)	1.69 (1.47-1.91)	1.93 (1.65-2.19)	2.19 (1.84-2.52)	2.59 (2.11-3.03)	2.93 (2.33-3.46)
12-hr	0.771 (0.699-0.858)	0.968 (0.874-1.08)	1.22 (1.09-1.35)	1.42 (1.27-1.58)	1.70 (1.51-1.89)	1.91 (1.68-2.14)	2.14 (1.86-2.41)	2.38 (2.04-2.70)	2.71 (2.27-3.11)	3.00 (2.47-3.49)
24-hr	0.874 (0.813-0.935)	1.09 (1.02-1.17)	1.36 (1.27-1.45)	1.57 (1.47-1.67)	1.86 (1.73-1.98)	2.08 (1.93-2.22)	2.31 (2.13-2.46)	2.54 (2.33-2.72)	2.84 (2.58-3.14)	3.08 (2.78-3.52)
2-day	0.946 (0.893-1.01)	1.18 (1.11-1.26)	1.46 (1.38-1.55)	1.68 (1.59-1.78)	1.98 (1.86-2.10)	2.20 (2.07-2.34)	2.43 (2.27-2.58)	2.66 (2.47-2.83)	2.96 (2.73-3.18)	3.19 (2.92-3.56)
3-day	1.00 (0.947-1.06)	1.25 (1.18-1.32)	1.54 (1.46-1.63)	1.77 (1.67-1.86)	2.07 (1.96-2.18)	2.31 (2.17-2.43)	2.54 (2.38-2.68)	2.78 (2.59-2.93)	3.08 (2.86-3.28)	3.32 (3.05-3.60)
4-day	1.06 (1.00-1.12)	1.31 (1.24-1.39)	1.62 (1.53-1.70)	1.85 (1.76-1.94)	2.17 (2.06-2.26)	2.41 (2.28-2.52)	2.65 (2.50-2.78)	2.89 (2.71-3.03)	3.20 (2.98-3.38)	3.44 (3.18-3.64)
7-day	1.20 (1.13-1.27)	1.48 (1.40-1.57)	1.82 (1.73-1.92)	2.08 (1.97-2.18)	2.41 (2.29-2.53)	2.66 (2.52-2.78)	2.90 (2.74-3.03)	3.13 (2.95-3.28)	3.42 (3.22-3.60)	3.62 (3.39-3.82)
10-day	1.32 (1.24-1.40)	1.64 (1.55-1.75)	2.02 (1.92-2.14)	2.31 (2.19-2.44)	2.69 (2.55-2.83)	2.97 (2.81-3.12)	3.24 (3.05-3.41)	3.49 (3.29-3.69)	3.82 (3.58-4.04)	4.05 (3.78-4.30)
20-day	1.63 (1.53-1.73)	2.03 (1.91-2.16)	2.48 (2.35-2.64)	2.81 (2.66-2.97)	3.22 (3.04-3.39)	3.49 (3.30-3.69)	3.75 (3.54-3.96)	3.99 (3.75-4.21)	4.26 (4.00-4.51)	4.42 (4.16-4.69)
30-day	1.92 (1.80-2.05)	2.39 (2.25-2.54)	2.93 (2.76-3.11)	3.32 (3.13-3.51)	3.81 (3.59-4.02)	4.14 (3.90-4.37)	4.46 (4.20-4.71)	4.75 (4.46-5.03)	5.09 (4.77-5.39)	5.32 (4.97-5.65)
45-day	2.30 (2.14-2.46)	2.86 (2.67-3.07)	3.53 (3.31-3.76)	4.01 (3.76-4.26)	4.60 (4.32-4.87)	5.02 (4.71-5.30)	5.40 (5.07-5.71)	5.74 (5.39-6.08)	6.12 (5.76-6.48)	6.34 (5.98-6.73)
60-day	2.59 (2.41-2.77)	3.23 (3.01-3.46)	3.97 (3.70-4.24)	4.51 (4.21-4.80)	5.18 (4.83-5.50)	5.64 (5.26-5.99)	6.07 (5.66-6.45)	6.45 (6.01-6.86)	6.89 (6.42-7.35)	7.15 (6.66-7.65)

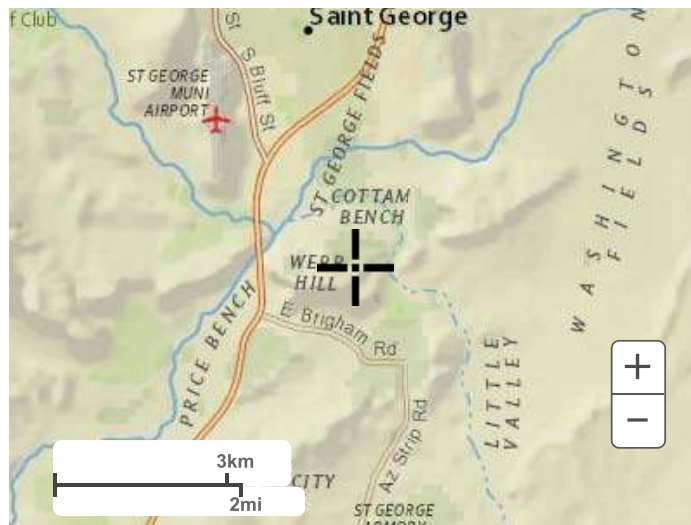
¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

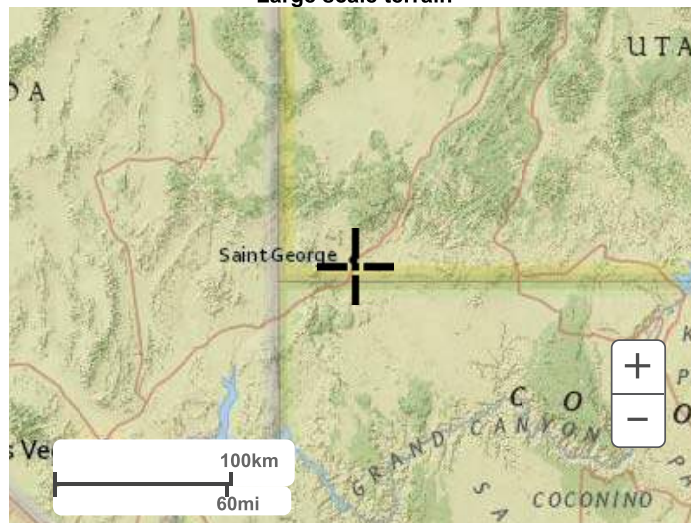
Please refer to NOAA Atlas 14 document for more information.

[Back to Top](#)

PF graphical



Large scale terrain



Large scale map



Large scale aerial

Geotechnical Report



**GEOTECHNICAL INVESTIGATION
& HILLSIDE EVALUATION
SUMMIT ESTATES**

ST. GEORGE, UTAH

PREPARED FOR:

**V.E. MANAGEMENT
1240 EAST 100 SOUTH #12
S. GEORGE, UTAH 84790**

ATTENTION: JOBE VENUTI

PROJECT NO. 2182014

OCTOBER 23, 2019

SUMMARY

1. AGEC has conducted a Geologic Hillside Evaluation and a preliminary geotechnical study for the property shown on Figures 1 and 2. The study included a geologic review of available literature, a site reconnaissance, field exploration of the subsurface conditions, and preparation of this report.
2. The study has concluded the following:
 - a. The geologic hazards identified as a potential risk and were evaluated include:
 - Expansive Soil/Rock
 - Hard Rock
 - b. Of lesser concern, the following items were identified through literature review and further evaluated during the site study and exploration:
 - Drainage or Erosion (civil engineer will provide a drainage study and plan)
 - Rock Fall (site has a low rock fall concern)
 - Landslide
 - c. AGEC observed the drilling of 11 borings at the approximate locations shown on Figure 2.
3. The proposed development will be a single family residential development with relatively large lots. The development will include grading and development of roadways and individual lots will be graded during construction of the residences. The proposed grading for the roadways is shown on Figure 2A. Cuts and fills are anticipated to be less than 10 feet with the majority of cuts and fill less than 5 feet.
4. The bedrock on the site varies from shale from the Upper Red Member of the Moenkopi Formation to siltstone and sandstone from the Shinarump Member of the Chinle Formation. The shale and siltstone were found to have zones that were slightly plastic and may exhibit low expansion characteristics. Due to the slight potential, we recommend each lot be evaluated on an individual basis. The geologic map and hazard maps are shown on Figures 3, 3A, 3B, 3C and 3D. The boring logs are shown on Figures 4 and 5 with the legend shown on Figure 6. Photos of the core samples from the borings are shown in Appendix A.
5. Groundwater was not encountered in the borings drilled to the maximum depth investigated approximately 24 feet. Fluctuations in groundwater may occur over time. An evaluation of such fluctuations was beyond the scope of this report. Springs or seepages were not observed on the site. We do not anticipate excavations or grading will expose groundwater concerns.

6. The topography of the site consists of a moderately sloping hillside with a ridge along the south and northeast portions of the site. Rock fall was not found to affect the lots on this site. During the grading of the roadway along the north end of the site, care should be taken to avoid creating rock fall on the development below the site.
7. Slopes should be graded along the roadways within the fill zone no steeper than 2:1 (Horizontal:Vertical). Cut slopes in the bedrock may be graded as steep as $\frac{1}{2}$:1.
8. We anticipate that the proposed residences may be supported on conventional spread footings bearing on bedrock or properly compacted structural fill. Each lot should be verified with additional exploration prior to design and construction.
9. Grading recommendations for site grading and roadway/public improvements are included in the report.
10. We anticipate that portions of the bedrock will require blasting and heavy duty excavation equipment. Portions of the sandstone rock are anticipated to be suitable for use for rock stacked walls, rip rap or processed for granular fill.

SCOPE

This report presents the results of a geotechnical investigation and hillside evaluation for the proposed Summit Estates subdivision to be located in St. George, Utah, as shown in Figure 1. This report presents the subsurface conditions encountered and recommendations for the project.

Field exploration was conducted to obtain information on the subsurface conditions and to obtain samples for laboratory testing. Information obtained from the field and laboratory was used to define conditions at the site and to develop recommendations for the proposed development. The laboratory testing is currently in progress and will be used to assist in individual lot evaluation.

This report has been prepared to summarize the data obtained during the study and to present our conclusions and recommendations based on the proposed construction and the subsurface conditions encountered. The report has been prepared to provide a geologic hazard and preliminary design. Grading recommendations for the development including public improvements are included within the report.

SITE CONDITIONS

The subject site is south of the Bloomington Hill North Residential Development and southwest of the Sienna Canyon Development in St. George, Utah as shown on Figure 1. The majority of the site is covered with sparse vegetation consisting of desert brush and weeds. Bedrock is exposed through the majority of the property. The site slopes down moderately from the south to the north with a rim along the center of the site and a bowl or valley area within the eastern portion of the site. This area slopes down generally to the north and northeast. There is vacant property to the west with a water tank at the top of the ridge/hillside to the southwest. The Sienna Canyon development is located adjacent and generally below the property to the east along the northern portion of the site. There is an additional water tank and pond adjacent to the east to southeast portion of the site. At the

south end of the property is the crest of the hillside and a steep slope down towards the adjacent the property to the south.

FIELD STUDY

On January 10, 11 and 14, 2019 an engineer from AGECE visited the site and observed the drilling of 11 borings. The location of the explorations are shown on Figure 2. The borings were drilled utilizing a truck mount drilled rig equipped with 8-inch hollow stem augers. The borings were advanced into bedrock using a 2 ½ inch HQ core barrel with a diamond bit using compressed air to remove cuttings. The subsurface soil profile was logged and soil samples were obtained at this time for laboratory testing. Continuous samples were obtained during coring.

GEOLOGIC AND SEISMOTECTONIC SETTING

A. Regional Geology

This area is part of the St. George Basin which is bound on the north by the Pine Valley Mountains, on the east by the Hurricane Cliffs, on the west by the Beaver Dam Mountains, and on the south by the Mount Trumbull area.

Bedrock in the St. George basin mainly consists of Upper Permian and Lower Jurassic sandstone, shale, siltstone, limestone, gypsum, and conglomerate. These beds are folded to the southeast into the northeast trending Virgin anticline. Several north-trending faults are present within the St. George Basin, the most prominent of which is the Washington Fault (Christensen and Deen, 1983).

The St. George Basin is characterized by basalt capped buttes and cuestas that were once stream channels along which lava flowed. Erosion of the surrounding softer sedimentary rocks over time has resulted in an inverted topography of old stream channel becoming resistant basalt ridges such as the Middleton Black Ridge and the West Black Ridge (Christenson and Deen, 1983).

The geologic structure within the basin is dominated by the Virgin anticline which trends northeast south and east of the site. The Virgin anticline is a broad, generally symmetrical fold with maximum flank dips of 25 to 30 degrees to the northwest and southeast (Christenson and Deen, 1983).

The geologic conditions at the site were evaluated based on a review of geologic literature, test pit exploration and a reconnaissance of the site. Figure 3 indicates the most recent geologic mapping for the site.

B. Tectonic Setting

The site is located on the north side of the flank of the Virgin River Anticline as shown on Figure 3 (Higgins and Willis, 2011). Several north/south trending faults can be found in the vicinity, including the Washington Fault and the Hurricane Fault. Also, the St. George Fault is located north and east of the property.

The Washington Fault is located approximately 4.4 miles west of the site. The sense of displacement on this high angle normal fault is down to the west (Higgins, 1998). The Washington Fault is thought to bifurcate into several smaller faults creating a wide fault zone north of the city of Washington (Christenson and Deen, 1983; Willis and Higgins, 1995). The Washington Fault is considered to be active due to evidence for late Quaternary offset of both the Washington basalt flow and late Pleistocene sediments (Willis and Higgins, 1995; Higgins, 1998).

The Hurricane Fault is located approximately 14 miles east of the site. The sense of displacement on this high angle normal fault is down to the west (Biek, 2003b). The Hurricane Fault is considered to be active due to evidence for displacement of Quaternary basaltic flows, fault scarps in alluvium, as well as recent seismic activity, including the 1992 St. George earthquake (Christenson, 1995; Black et al., 2003; Biek, 2003a).

Based on previous work by Christenson and Deen (1983), Lund and others (2008), the mapped location of the St. George fault extends in a north-south direction approximately ½ mile to the east of the property. Based on previous conversations with Lund and others, the St. George Fault is not considered an active fault.

C. Stratigraphy

The stratigraphy of the area consists of Jurassic-aged bedrock of the Chinle and Moenkopi Formations. Quaternary-aged alluvial deposits cover the gently sloping area on the west (Figure 3).

Upper Red Member of the Moenkopi Formation (T_{Rmu}) (Triassic aged): This bedrock consists of moderate reddish-brown, thin bedded siltstone and sandstone with some gypsum beds and abundant discordant gypsum stringers; locally contains a few thick to massive bedded, ledge forming, channel sandstones; 500 feet thick.

Shinarump Conglomerate Member of the Chinle Formation (T_{Rcs}) (Jurassic aged): This bedrock varies from grayish-orange to moderate-yellowish-brown, medium to coarse-grained sandstone with locally well-developed limonite bands to a moderate to dark-reddish-brown, chert pebble conglomerate. It forms a very resistant cuesta ledge; deposited in stream channels and locally has hummocky surface where involved in gravity slumping. It ranges from 50 to 200 feet thick.

The geologic conditions of the site and vicinity are shown on Figure 3.

GEOLOGIC HAZARDS

Based on review of geologic literature and site reconnaissance, the following hazards were reviewed as a part of the evaluation.

- Landslide Hazard (Figure 3A)
- Rockfall Hazard (Figure 3B)
- Expansive Soil and Rock Susceptibility (Figure 3C)
- Shallow Bedrock Susceptibility (Figure 3D)

AGEC has reviewed the Geologic Hazard Study for the St. George-Hurricane Metropolitan Area, Washington County, Utah, UGS Special Study 127, 2007 by Lund et al. Maps of the site that identify each of the items above are included as noted.

Based on our review of these maps and further site evaluation, the following geologic hazards were identified:

A. Expansive Soil/Bedrock

The presence of potentially low to moderate expansive layers of bedrock is identified by the geologic mapping hazard by Lund and others, 2008 as shown on Figure 3C. The expansive bedrock is mapped as Chinle Formation and the Moenkopi Formation. Our subsurface investigation (11 borings) and laboratory testing (in progress) by AGECEC and our experience in the area also indicate that there is a potential for low expansion within the siltstone and shale bedrock within the area. We recommend that each lot be verified during the design and construction phases.

B. Shallow Bedrock

The majority of the site contains a moderate amount of hard sandstone bedrock. In addition, the shale bedrock was soft to moderately hard (see Figure 3D). The hard bedrock consists of sandstone and will likely result in the need for blasting. The recommendations for grading these materials is address in the grading section of this report.

There were several other hazards that the literature identified and were evaluated by AGEC and found not to be of concern. These include the Rockfall (Figure 3B), and the rockfall (Figure 3B, and the landslide (Figure 3A).

SUBSURFACE CONDITIONS

Following our geologic review, the site was evaluated by drilling 11 borings at the locations shown on Figure 2. The locations and elevations of the borings were measured by a hand held GPS and correlated to the existing topography map provided by Horrocks Engineering.

The subsurface conditions vary at the site with sandstone and siltstone along the majority of the site with a zone of shale bedrock through the center of the site.

Shale Bedrock: The shale bedrock was encountered within Borings B-6, B-7, B-9, B-10 and B-11. The shale is part of the Upper Red Member of the Moenkopi Formation and is low plastic, moderately weathered, dry to slightly moist and light brown to red in color.

Sandstone Bedrock: The sandstone bedrock was encountered through the majority of the property in the remaining borings. The sandstone is part of the Shinarump Member of the Chinle Formation and consists of fine to coarse/gravel material. Portions of the Shinarump consist of a conglomerate type material of highly cemented sand and gravel. The sandstone was generally slightly fractured and contains layers of siltstone. The sandstone is moderately hard to hard, dry and light brown to yellow in color.

Siltstone Bedrock: - The siltstone bedrock was encountered within the sandstone as layers or zones. The siltstone varied from non to low to medium plastic. The material is weathered, blocky and moderately hard. The bedrock is dry and grey with yellow streaks.

The Logs of Exploratory Borings are shown on Figures 4-5. The Legend and Notes of Exploratory Borings are shown on Figure 6.

PROPOSED CONSTRUCTION

The property is proposed to be developed into 43 lots varying in size as shown on Figure 2. The roadways will be graded as a part of the development and individual lots will be graded at the time of the residential construction. A cut and fill map for the roadways is shown on Figure 2A.

For design purposes, we have utilized a Traffic Indexes (TI) of 5 for the roadways according to St. George City Standards.

Details of proposed residences are not known at this time. Once those details are known, AGECE should be requested to provide detailed recommendations for the proposed construction.

RECOMMENDATIONS

Based on our experience in the area, the subsurface conditions encountered, our engineering analysis, the proposed construction, and the proposed grading provided by Horrocks Engineering the following recommendations are provided:

A. Site Grading

1. Subgrade Preparation

Prior to placing fill, the site should be grubbed to remove vegetation and soil containing roots and organics. Generally the surface is bedrock and the vegetation is sparse.

Prior to placing fill over bedrock, if soil exists, the soil should be scarified, moisture conditioned and properly compacted. In bedrock areas, the scarification process is not necessary.

2. Excavation/Slopes

Permanent cut slopes excavated into the bedrock may be cut as steep as $\frac{1}{2}$:1 (horizontal to vertical).

Fill slopes constructed with on-site granular soils should be constructed no steeper than 2:1. Fill slopes should be constructed by overbuilding the slope and then cutting back the slope face to the desired grade to provide a properly compacted slope face. Fill placed on existing slopes steeper than 3:1 should be keyed into the existing slope using a benching procedure. Benches should be of sufficient width to allow for operation of compaction equipment.

Water should be directed around slopes using drainage swales to reduce potential erosion in accordance with a site specific drainage plan. Soil slopes may also be protected from erosion with an appropriate geotextile or riprap underlain with filter fabric. More detailed recommendations for riprap erosion control can be provided if requested. A lot specific drainage study should be conducted on lots adjacent to the hillside.

Utility trenches excavated in the on-site soils should be excavated in accordance with OSHA requirements using a Soil Class A ($\frac{1}{2}$:1) for trenches excavated into the bedrock. Steeper trenches may require the use of shoring or a trench box to provide as safe work environment. Safe trench excavation is the responsibility of the contractor.

3. Materials

Import materials should be non-expansive, non-gypsiferous, granular soil. Listed below are the materials recommended for imported fill.

Area	Fill Type	Recommendations
Roadways	Site grading/ structural fill	-200 < 50%, LL < 30% Maximum size: 4 inches Solubility < 1%
Roadways	Base course	CBR > 50%, 200 < 12% Maximum size: $\frac{3}{4}$ inch

-200 = Percent Passing the No. 200 Sieve
LL = Liquid Limit

The onsite bedrock may be used as site grading fill. It will require processing such that the maximum particle size is 4 inches and at least 60 percent of the material passes the No. 4 sieve. This may require crushing of the sandstone materials.

4. Compaction

Compaction of fill materials placed at the site should equal or exceed the following percentages when compared to the maximum dry density as determined by ASTM D-1557:

Area	Percent Compaction ASTM D-1557
Subgrade	90
Utility trench backfill (Structural Areas)	95

Fill should be placed in lifts which do not exceed the capability of the equipment used. Generally 6 to 8 inch lifts are adequate for heavy rubber tire equipment. Lift thicknesses should be reduced to 4 inches for hand compaction equipment. Fill placed at the site should be properly moisture conditioned prior to placement and should be tested to verify proper compaction. The fill should be moisture conditioned to within 2 percentage points of the optimum moisture content as determined by ASTM D-1557.

5. Drainage

The following drainage recommendations should be implemented:

- Positive site drainage should be maintained during the course of construction

B. **Soil Corrosion**

Our experience has shown that portions of the on-site soil/bedrock or imported soils may contain sulfates in sufficient concentration to be corrosive to concrete. Therefore, we recommend concrete elements that will be exposed to the on-site soils be designed in accordance with provisions provided in the American Concrete Institute Manual of Concrete Practice (ACI) 318-14. Tables 19.3.1.1 and 19.3.2.1 of ACI 318-14 should be referenced for design of concrete elements utilizing a Sulfate Exposure Class of S2.

Consideration should also be given to cathodic protection of buried metal pipes. We recommend utilizing PVC pipes where local building codes allow.

C. Pavement

Based on the subsoil conditions encountered and the laboratory test results, the following recommendations are given:

1. Analysis

Asphaltic Concrete: The flexible pavement analysis is based on UDOT and AASHTO design methods and a 20 year design life. The following parameters were considered for our analysis:

- Base course that meets specifications which would correspond to a Structural Coefficient (a_2) of at least 0.12. Asphalt that provides a Structural Coefficient (a_1) of at least 0.40.
- Drainage Coefficient = 1.0.
- The subgrade support soils will consist of processed sandstone, siltstone, and shale bedrock. A M_R value of 15,000 pounds per square inch (psi) was used for the subgrade based upon an estimated CBR value of 10 percent and the relationship between CBR and Resilient Modulus (M_R).
- Serviceability Index: $P_o = 4.2$, $P_t = 2.5$.
- Reliability of 90 percent.
- Standard Deviation (S_o) = 0.45.

2. Subgrade Support

We anticipate the subgrade materials will consist of compacted on-site bedrock or processed bedrock. Our design assumes a properly compacted subgrade. Prior to placing base course or pavement area grading fill, the subgrade should be prepared as recommended in the Subgrade Preparation section of this report.

3. Pavement Thickness

Based on the anticipated traffic, a 20 year design life, PCC and AASHTO design methods, the following pavement sections are recommended.

Area	Flexible Pavement	
	Asphaltic concrete (inches)	Base Course (inches)
Interior roadways	2½	6

4. Pavement Materials

The pavement materials should meet AASHTO and St. George City Specifications for gradation and quality. The pavement thicknesses indicated above assume that the base course is high quality material with a CBR of at least 60 percent. Asphalt material should have a Marshall stability of at least 1,800 pounds.

5. Drainage

The collection and diversion of drainage away from the pavement surface is extremely important to the satisfactory performance of the pavement section. Proper drainage should be provided. We further recommend a yearly maintenance program including crack sealing and a surface treatment such as a slurry seal to extend the pavement life and reduce water infiltration into the subsurface soils.

D. **Construction Testing and Observations**

We recommend testing fill, concrete, and asphalt materials at a frequency which meets or exceeds St. George City minimum testing frequency requirements for city improvements. We also recommend the following testing and observations be done as a minimum:

1. Verify the subgrade is properly prepared/compacted in accordance with the recommendations provided in the Subgrade Preparation section of this report.
2. Conduct compaction testing on fill placed in roadways. We recommend testing each foot of fill placed.
3. Conduct construction materials testing of soils, concrete and asphalt materials required for the proposed construction by St. George City.

E. Geotechnical Recommendation Review

The client should familiarize themselves with the information contained in this report. If specific questions arise or if the client does not fully understand the conclusions/recommendations provided, AGECC should be contacted to provide clarification.

LIMITATIONS

This report has been prepared in accordance with generally accepted soil and foundation engineering practices in the area for the use of the client for design purposes. The conclusions and recommendations included within the report are based on the information obtained from the borings, and our experience in the area. Variations in the subsurface conditions may not become evident until excavation is conducted. If the subsurface conditions or groundwater level are found to be significantly different from those described above, we should be notified to reevaluate our recommendations.

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.

G. Wayne Rogers, P.E.

Reviewed by: Jon Russell Hanson, P.E.

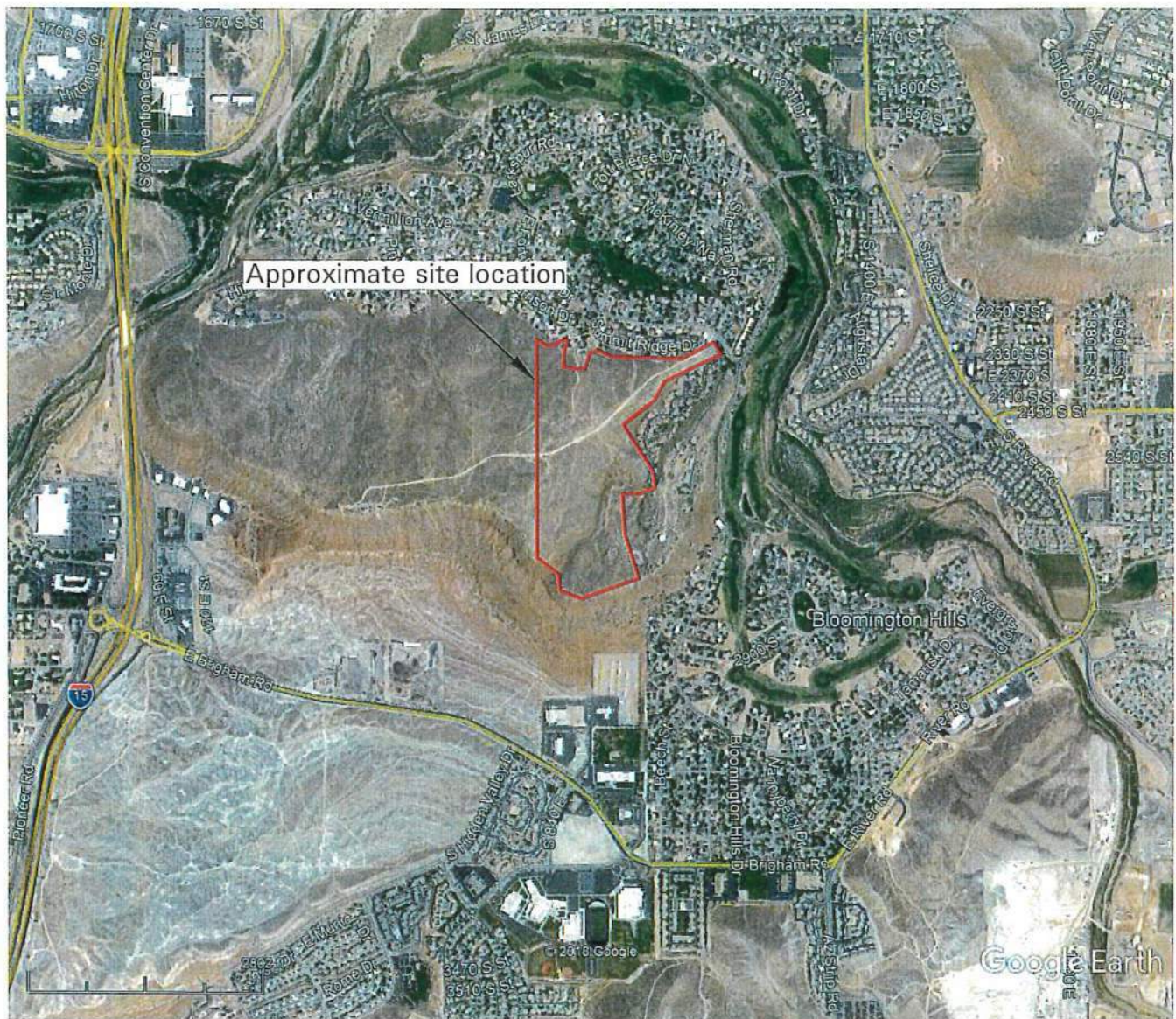
P:\2018 Project Files\2182000\2182014 - Webb Hill 70 Acres\Geologic Hillside Report.wpd



REFERENCES:

Christenson, G.E. and Deen, R.D., 1983, Engineering Geology of the St. George area Washington County, Utah: Utah Geological and Mineral Survey Special Studies 58, 32 p., scale 1:24,000.

Lund, W.R., Knudsen, T.R., Vice, G.S., and Shaw, L.M., 2008, Geologic hazards and adverse construction conditions, St. George-Hurricane Metropolitan Area, Washington County, Utah, Utah Geological Survey Special Study 127, 14 plates, scale 1:24,000.



SUMMIT ESTATES
ST. GEORGE, UTAH

Not to Scale

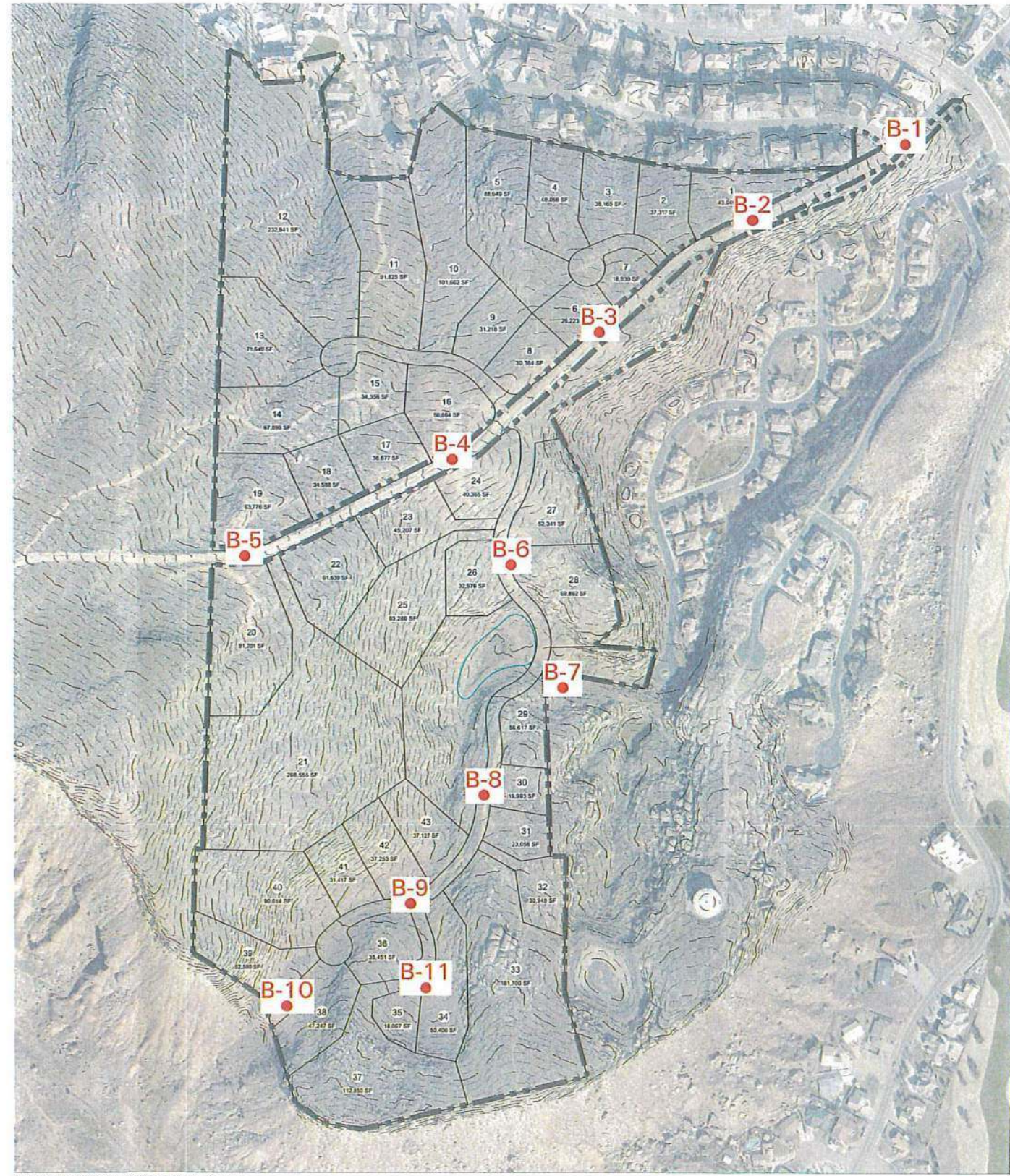
SUMMIT ESTATES
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• Approximate boring location



0 400 800 feet

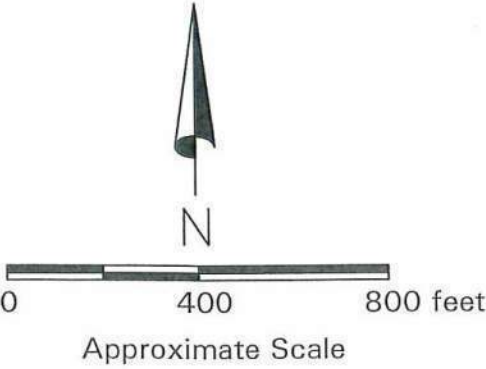
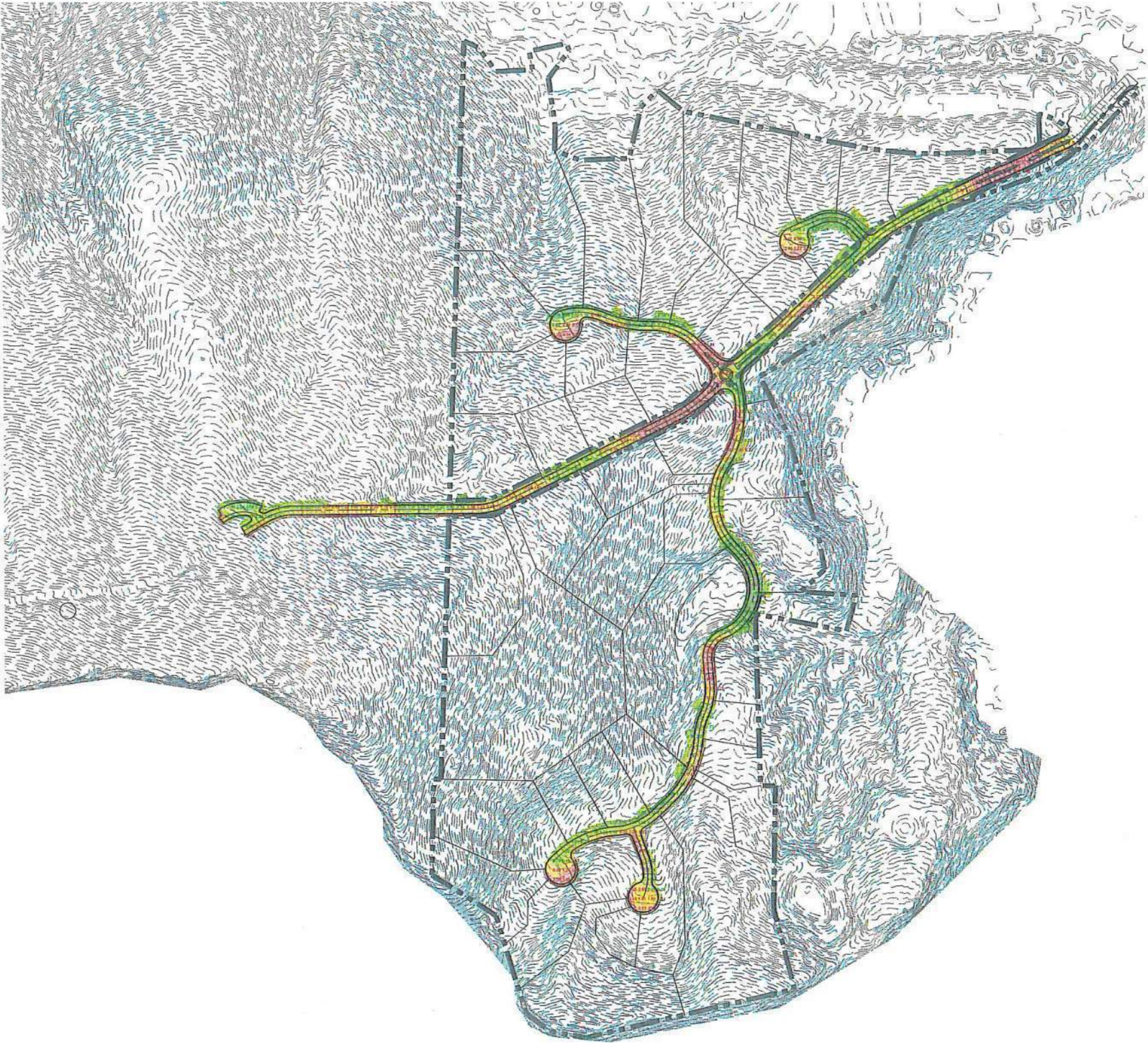
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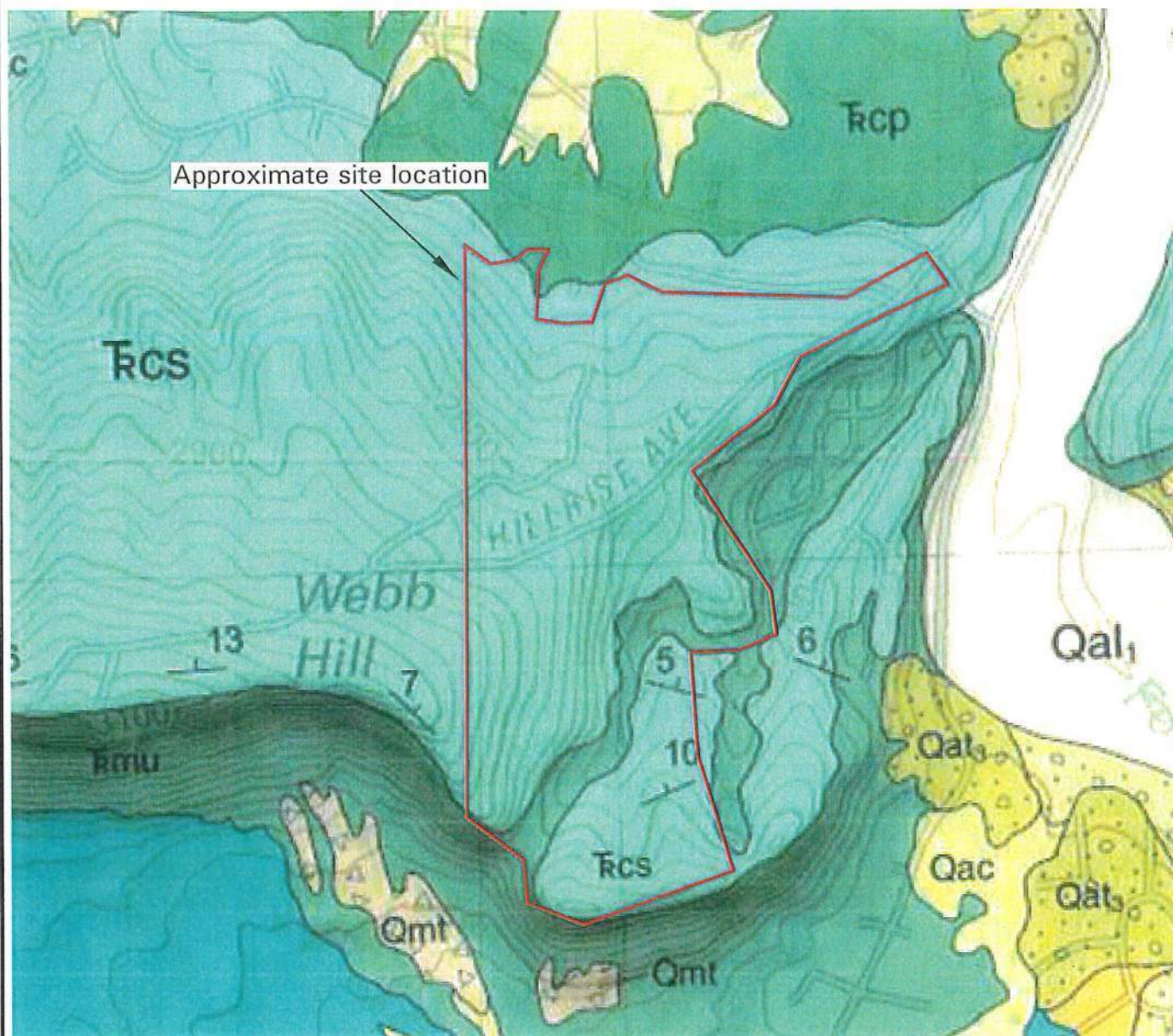


SUMMIT ESTATES
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ELEVATIONS TABLE				
NUMBER	MINIMUM ELEVATION	MAXIMUM ELEVATION	AREA	COLOR
1	-15.00	-12.00	860.66	Dark Red
2	-12.00	-9.00	5511.95	Red
3	-9.00	-6.00	10509.26	Red
4	-6.00	-3.00	40484.69	Red
5	-3.00	0.00	97038.11	Yellow
6	0.00	3.00	121002.75	Light Green
7	3.00	6.00	34949.71	Green
8	6.00	9.00	14797.00	Green
9	9.00	12.00	5254.56	Green
10	12.00	15.00	1852.62	Green
11	15.00	18.00	1421.73	Green

CUT / FILL SUMMARY						
NAME	CUT FACTOR	FILL FACTOR	2D AREA (FT²)	CUT (YD³)	FILL (YD³)	NET (YD³)
SUMMIT ESTATES ROADWAY DESIGN VS. FLOWN EXISTING GROUND	1.00	1.00	333,683	16,804	18,987	2,183





Geologic Map for the St. George-Hurricane Metropolitan Area, Washington County, Utah, UGS Special Study 127 2008, W.R. Lund, T.R. Knudson, G.S. Vice and L.M. Shaw

TRmu: Upper red member of Moenkopi Formation

Moderate-reddish-brown to moderate-reddish-orange, thin- to medium-bedded siltstone and very fine grained sandstone with some thin gypsum beds and abundant discordant gypsum stringers; ripple marks common in the siltstone; locally includes 20-foot-thick (6 m) fine-grained, resistant sandstone near base; where the basal sandstone is thickened, the weathering and slope retreat of overlying units is slowed, creating resistant points on the cuestas that form Webb and Bloomington Hills

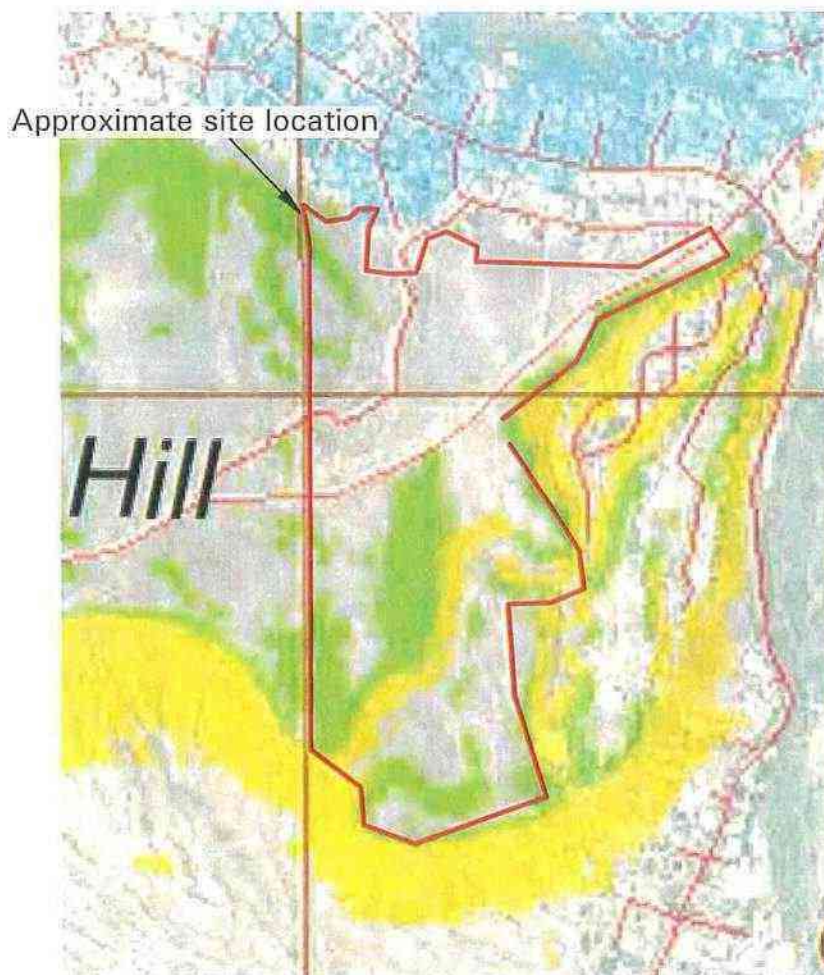
TRcs: Shinarump Conglomerate Member of Chinle Formation

Grayish-orange to moderate-yellowish-brown, medium- to coarse-grained sandstone with locally well-developed limonite bands ("picture stone" or "landscape rock"), grading to moderate-brown, pebbly conglomerate with subrounded clasts of quartz, quartzite, and chert; conglomerate well developed in the southeast corner of the quadrangle;



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Landslide-Hazard Map for the St. George-Hurricane Metropolitan Area, Washington County, Utah, UGS Special Study 127 2008, W.R. Lund, T.R. Knudson, G.S. Vice and L.M. Shaw

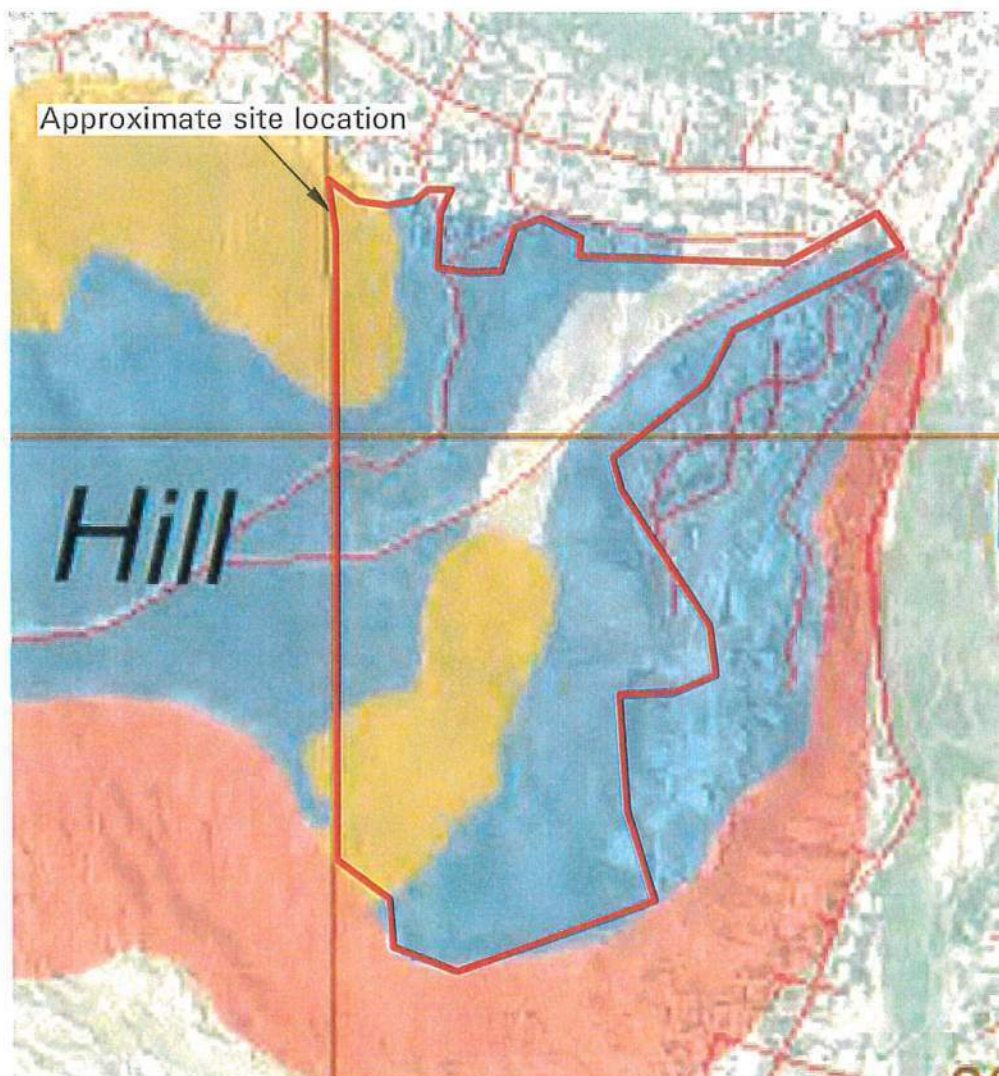
EXPLANATION

VH	Very High: Existing landslides (Category A).
H	High: Areas where Category B geologic units crop out on slopes greater than 15 percent (8.5°).
M _C	Moderate C: Areas where Category C geologic units crop out on slopes greater than 20 percent (11.3°).
M _B	Moderate B: Areas where Category B geologic units crop out on slopes less than 15 percent (8.5°).
L	Low: Areas where Category D geologic units crop out on slopes greater than 30 percent (16.7°).



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Rock-Fall-Hazard Map for the St. George-Hurricane Metropolitan Area, Washington County, Utah, UGS Special Study 127 2008, W.R. Lund, T.R. Knudson, G.S. Vice and L.M. Shaw

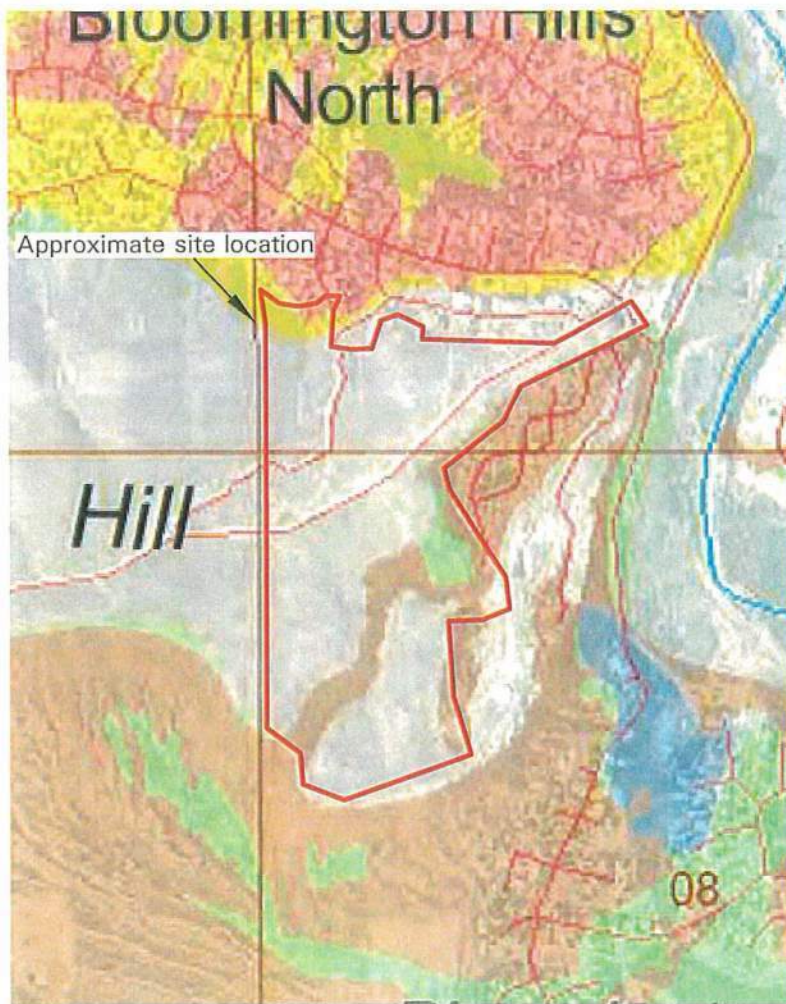
EXPLANATION

- | | |
|--|--|
| <div style="background-color: #f08080; border: 1px solid black; width: 20px; height: 20px; display: flex; align-items: center; justify-content: center; margin-bottom: 10px;">H</div> <div style="background-color: #f0e68c; border: 1px solid black; width: 20px; height: 20px; display: flex; align-items: center; justify-content: center; margin-bottom: 10px;">M</div> <div style="background-color: #add8e6; border: 1px solid black; width: 20px; height: 20px; display: flex; align-items: center; justify-content: center;">L</div> | <p>H High rock-fall-hazard areas include steep slopes below resistant cliff-forming units where the acceleration and runout zones are littered with abundant rock-fall boulders greater than 1.5 feet in diameter. Such large boulders can do significant damage to property and threaten lives. Rock units in high rock-fall-hazard areas chiefly include the Shinarump Member of the Chinle Formation, upper Kayenta Formation, Springdale Sandstone Member of the Kayenta Formation, Navajo Sandstone, Virgin Limestone Member of the Moenkopi Formation, Kaibab Formation, Toroweap Formation, and Tertiary-Quaternary basalt flows. Where jointed or fractured, outcrops of these rock units can produce large, angular boulders.</p> <p>M Moderate rock-fall-hazard areas are present where slopes provide sufficient relief to create an acceleration zone, but where only sparse rock-fall debris is present on slopes or in the runout zone at the base of the slope. Typically rock units in moderate-hazard areas crop out in the slope instead of forming a capping unit, or where a capping unit is present, the resulting rock-fall debris is typically less than 1.5 feet in diameter. Rock units in moderate rock-fall-hazard areas include the Kayenta Formation, Moenave Formation, and portions of the Kaibab Formation and Navajo Sandstone.</p> <p>L Low rock-fall-hazard areas are present where fine-grained, comparatively soft rock units such as mudstone and shale crop out on steep slopes, or where rock units typical of moderate- or high-hazard categories crop out in areas of low to moderate relief. Low rock-fall-hazard areas typically contain sparse rock sources of limited extent. Low rock-fall hazard is most common adjacent to low relief outcrops of Navajo Sandstone and basalt.</p> |
|--|--|



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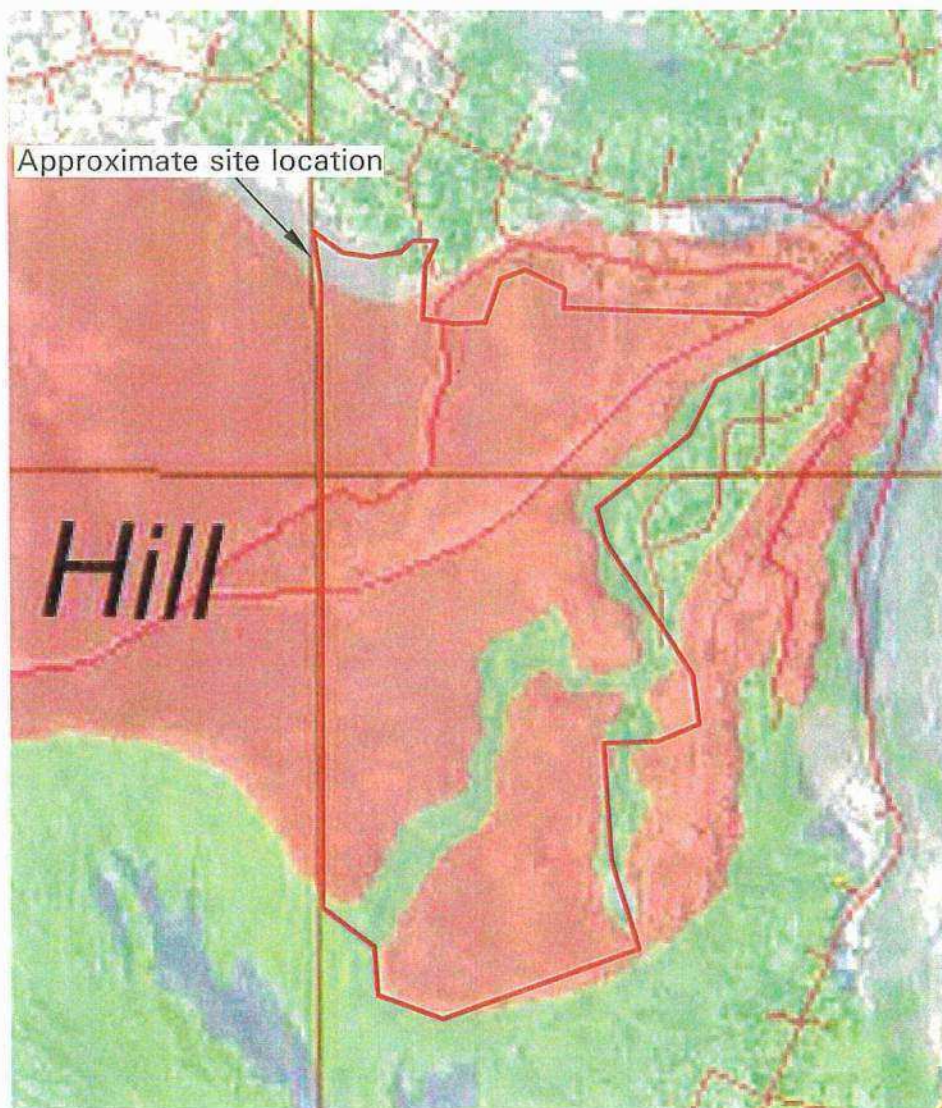
Expansive-Soil- and Rock-Susceptibility Map for the St. George-Hurricane Metropolitan Area, Washington County, Utah, UGS Special Study 127 2008, W.R. Lund, T.R. Knudson, G.S. Vice and L.M. Shaw

EXPLANATION	
SOIL	
ESH	Soils with high susceptibility for volumetric change are typically clay rich and have a liquid limit (LL) ≥ 45 , a plasticity index (PI) ≥ 20 , and/or a swell/shrinkage test (SCT) value of 23 percent swell. Soils with these characteristics are of limited areal extent at the surface in the study area, but are frequently found at depth as shown by the geotechnical database (see GEOTECHNICAL DATA EVALUATION section in accompanying text). This phenomenon reflects the fact that most of the geotechnical data available for the study area come from the municipalities of St. George, Santa Clara, Alva, and Washington, portions of which are underlain at shallow depth (typically <20 feet) by bedrock with high or moderate susceptibility for volumetric change. The influence of this shallow, often clay-rich source rock on overlying soils is apparent in the geotechnical data collected from below a depth of 60 inches.
ESM	Soils classified by the Natural Resources Conservation Service (NRCS) as having moderate susceptibility for volumetric change (LL from 20 to 50, and PI from nonplastic (NP) to 30). These values overlap at their upper ends with soils in the high susceptibility category. Chen (1988) recognized that while PI is an indicator of expansive potential, other factors also exert an influence, and therefore reported a range of PI values when categorizing soils' capacity to shrink or swell.
ESL	Soils classified by the NRCS as having low susceptibility for volumetric change (LL from 0-30, and PI from NP-15). These values overlap at their upper ends with soils in the moderate susceptibility category. However, the low category includes soils with highly variable potential for volumetric change that do not fit easily into the moderate or high categories.
ROCK	
ERH	Bedrock units with high shrink/swell susceptibility include claystone horizons in the Virgin Limestone Member of the Moenkapi Formation; the Petrified Forest Member of the Chinle Formation, known locally as the "Blue Clay;" the lower red beds of the Dinosaur Canyon Member and the Whitmore Point Member of the Moenave Formation; the Iron Springs Formation, which contains abundant clay-rich strata in its lower part; and a thin interval (maximum thickness 10 feet) of non-mottled clay that lies between the Carnall Formation and the overlying Iron Springs Formation. Landslides mapped within these rock units were also included in the high-susceptibility category. These bedrock units contain an abundance of expansive clay minerals and are commonly associated with expansive rock problems in the study area.
ERW	Bedrock units with moderate shrink/swell susceptibility include the Shinarump and lower, middle, and upper red members of the Moenkapi Formation; the Co-up Creek and Crystal Creek Members of the Carnall Formation; and the Temple Cap Formation. These rock units are chiefly fine grained and contain alternating strata of shale, claystone, mudstone, siltstone, sandstone, and limestone. Not all or necessarily the majority of these strata contain expansive clay minerals, but past experience in the study area has shown that a sufficiently high percentage of strata do contain expansive clays that foundation problems are often associated with these rock units. Where mapped as undivided, we assigned a moderate susceptibility to the Moenkapi Formation, Carnall Formation, and grouped Tertiary, Triassic/Jurassic, and Jurassic/Cretaceous rocks. Landslides mapped within moderate-susceptibility units are also included in this category.
ERL	Bedrock units with low shrink/swell susceptibility include the Timpanog Member of the Moenkapi Formation and the Kayenta Formation. Although we consider these units to have a low susceptibility relative to the bedrock units identified above, they contain some fine-grained, clay-rich strata that may cause shrink/swell problems locally.
CONCEALED	
CHESR	Area of highly expansive soil or rock (≥ 5 percent swell) in the shallow subsurface (<20 feet), but with little or no evidence of such material at the ground surface. Based on past engineering experience, such highly expansive soil or rock can cause differential displacements of the ground surface even when overlain by as much as 20 feet of nonexpansive material, and these areas are considered to have a high potential for expansive soil and rock problems.

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Not to Scale



Shallow-Bedrock-Susceptibility Map for the St. George-Hurricane Metropolitan Area, Washington County, Utah, UGS Special Study 127 2008, W.R. Lund, T.R. Knudson, G.S. Vice and L.M. Shaw

EXPLANATION



Hard: Areas where generally hard and resistant bedrock crops out at the ground surface. These bedrock units typically require blasting to excavate.



Soft: Areas where less resistant bedrock crops out at the ground surface. Even when fresh, these bedrock units typically can be excavated without blasting, although some blasting may be required locally. Some rock units may contain expansive clay minerals and may be deeply weathered.



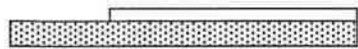
Buried: Areas where depth to bedrock is ≤ 10 feet beneath soil cover. In most areas the identity and degree of weathering of the underlying bedrock is unknown. However, many basalt flows in the study area, which consist of very hard and durable rock, are covered with a thin veneer of soil and fall into this category.



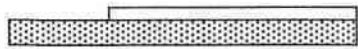
SUMMIT ESTATES
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B-1
Elev. 2657.0'



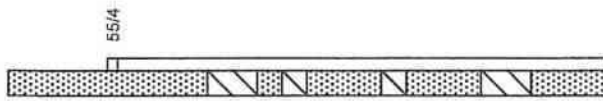
B-2
Elev. 2717.0'



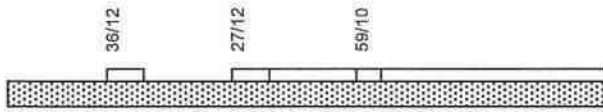
B-3
Elev. 2754.6'



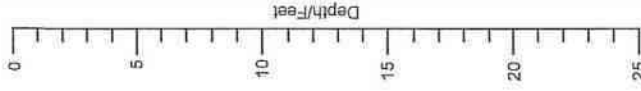
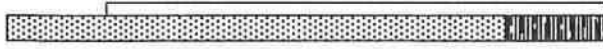
B-4
Elev. 2795.8'



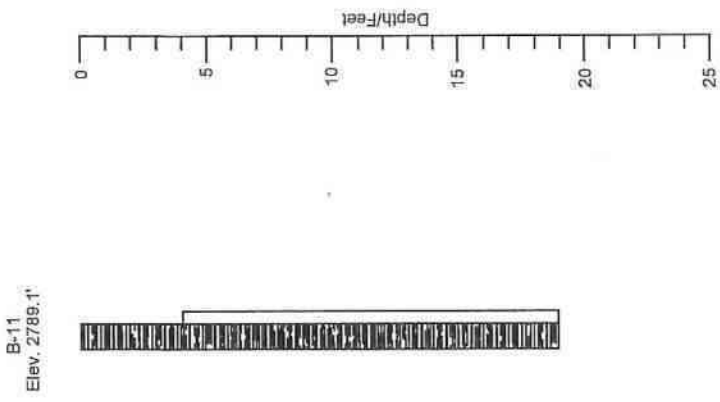
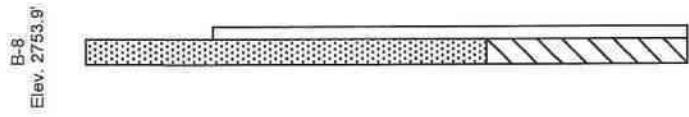
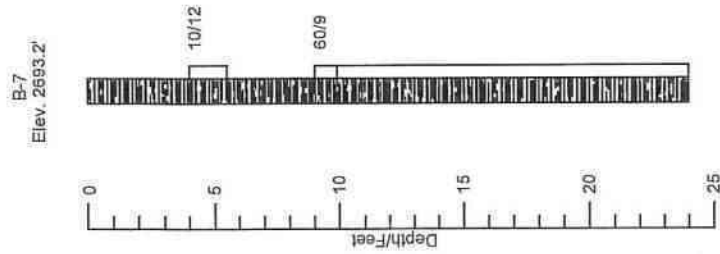
B-5
Elev. 2875.4'



B-6
Elev. 2736.8'



See Figure 6 for Legend and Notes



See Figure 6 for Legend and Notes

LEGEND:



Sandstone Bedrock; moderately hard to hard, some coarse pebbles, conglomerate, yellow light brown



Shale Bedrock; soft to moderately hard, weathered, dry to slightly moist, low to medium plastic, red to light brown



Siltstone Bedrock; weathered, highly fractured in upper zone, low to medium plastic, light brown to grey to brown

10/12



California drive sample taken. The symbol 10/12 indicates that 10 blows from a 140 pound hammer falling 30 inches were required to drive the sampler 12 inches.



Indicates core sample taken.

NOTES:

1. The borings were drilled on January 10, 11, and 14, 2019 with a truck mounted drill rig equipped with 8-inch hollow-stem augers. The bedrock was cored using an HQ 2 1/2" core barrel with a diamond bit using air to remove cuttings.
2. The location of the borings were measured by a hand held GPS as shown on Figure 2.
3. The elevation of the borings were determined by Horrocks Engineering using the hand held GPS data.
4. The boring locations and elevations should be considered accurate only to the degree implied by the method used.
5. The lines between the materials shown on the boring logs represent the approximate boundaries between material types and the transitions may be gradual.
6. Free water was not encountered in the borings at the time of drilling.

Appendix A

Core Sample Photos

Borings B-1 to B-11



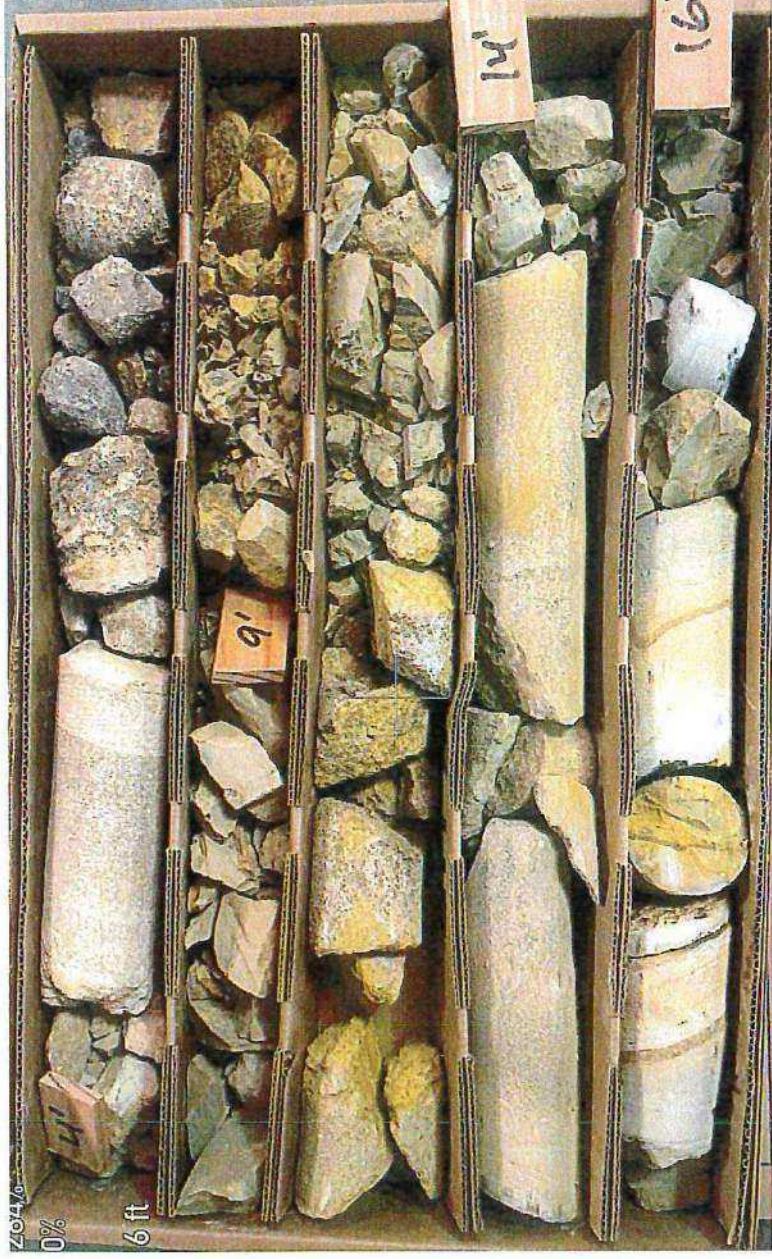
Boring B-1 @ 4-14 ft.



Boring B-2 @ 4-14 ft.



Boring B-3@ 4-14 ft.



Boring B-4 @ 4-16 ft.



Boring B-4 @ 16-24 ft.



Boring B-5@ 14-24 ft.



Boring B-6 @ 4-19 ft.



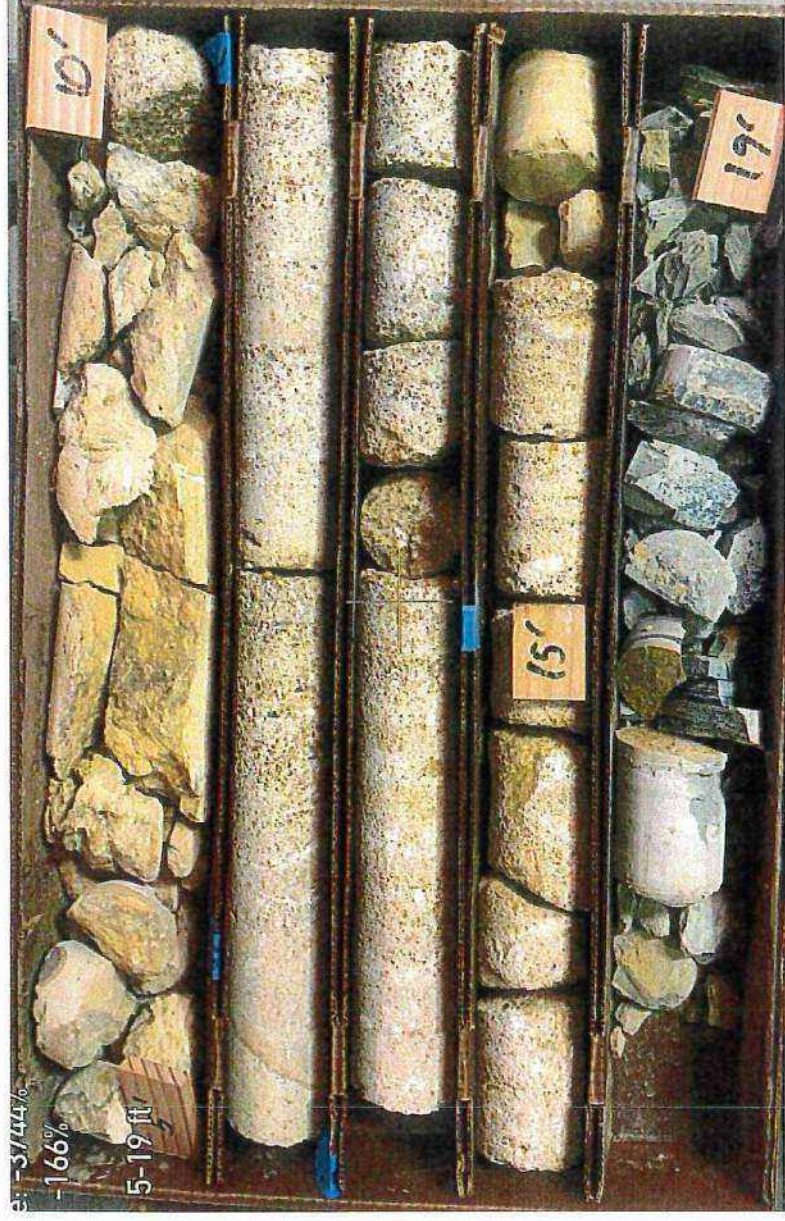
Boring B-6@ 19-24 ft.



Boring B-7 @ 9-23 ft.



Boring B-7 @ 23-24 ft



Boring B-8@ 5-19 ft.



Boring B-8@ 19-24 ft.

AGEC

Applied GeoTech

Summit Estates - AGEC Project 2182014



Boring B-9@ 4-14 ft.



Boring B-9@ 14-19 ft.



Boring B-10@ 4-19 ft.



Boring B-11 @ 4-16.5 ft.



Boring B-11 @ 16.5-19 ft.

Vibration Report



July 14, 2020

VE Management and Investment Co., L.C.
1240 East 100 South #12
St. George, Utah 84790

Attention: Joby Venuti
EMAIL: joby@netutah.com

Subject: Summit Estates
Hillrise Circle
St George, Utah
Project No. 2182014

Gentlemen:

Applied Geotechnical Engineering Consultants, Inc. (AGEC) was requested to provide our professional opinion on ways to reduce the risk of rock falling on existing improvements within the Sienna Canyon Development during construction of the proposed subdivision on Webb Hill in St George, Utah.

AGEC previously conducted a rockfall run-out evaluation for the Sienna Canyon Development, specifically along the property boundary between Sienna Canyon Development and Webb Hill. We presented our findings in a report dated February 10, 2020 under Project No. 2182014.

FINDINGS

Based on the investigation conducted, it is our professional opinion that:

- There are a number of locations along the hill located along the west side of the Sienna Canyon subdivision where large rock could roll off of the slope and damage and possibly result in loss of life or injury to the residents below the hill.
- Should hydraulic driven rock breakers be needed to excavate below the existing ground surface for utility and/or roadway construction, we recommend that the magnitude of vibration be limited by size of equipment and that the distance away from potential rockfall be kept as large as possible.
- Based on our current evaluation, it appears that hydraulic rock breakers should be no closer than 160 feet from the rock on the slope and that rock trenchers be operated no closer than 75 feet from the slope.

- We recommend that these distances be verified once the actual equipment has been identified by on-site evaluation at the time of construction.
- We recommend that the vibrations generated during construction, that is performed close to the slope, be monitored.

LITERATURE STUDY

A review of available literature was conducted in order to determine the findings from earlier studies on the potential adverse impact of vibration. From our research we were able to find levels of ground shaking that could be considered to reduce potential damage. We were also able to find typical distances and their associated ground vibration that could be induced by various types of construction equipment.

Based on the information obtained, we suggest that a peak particle velocity be limited to a maximum value of less than 0.08 inches per second. This is the criteria used for "ruins and ancient monuments" as presented in "A Survey of Traffic-induced Vibrations" by Whiffin and Leonard, Transport and Research Laboratory, RRL Report LR418, Crowthorne, Berkshire, England, 1971.

ON-SITE INVESTIGATION

Our field investigation included three steps. The first step was to visit the rock slope and assess the potential for rock to move and/or become dislodged from the slope, which could then roll down and adversely impact the improvements below.

The second step of the field investigation included measuring actual ground motions resulting from impact at various distances away from a vibration measuring device.

The third step of the field investigation included measuring actual ground motions resulting from vibration generated in the ground from two potential pieces of construction equipment, a CAT H140E hydraulic breaker, and a Vermeer T855 trencher.

A. Rock Slope Evaluation

Based on our observations, the following rockfall related conditions were observed:

1. Ground slopes were measured to range from 26 to 40 degrees.
2. Specific rock surfaces that were sloping downslope were found to be as steep as 65 degrees to near vertical.
3. Rocks were observed to be in a condition that could result in future movement by:

- a. sliding down slope
 - b. becoming dislodged from an overhang
 - c. dislodge from a wedge
 - d. fall from a precarious stack
4. It appears that many rocks could be loosened and/or freed from their current position by very small efforts of ground shaking, erosion or impact.
5. The rocks were found to be predominantly sandstone and could be considered a weak rock.

B. Vibration

We were able to measure the velocity and acceleration at distances varying from 2 to 160 feet using a falling weight that imposed an energy of approximately 100-foot pounds to the rock. From this information we were able to plot the measured vibration versus distance.

Based on the energy imposed and the response, it appears that the on-site ground motions were larger than what the literature would indicate.

With this condition, we conducted on-site testing to further define the site response of the energy imposed by potential construction equipment to excavate the rock.

On April 28, 2020 a hydraulic breaker (CAT H140E) and a trencher (Vemeer T855) were operated on site to measure the induced vibration on the ground surface at a number of distances away from the equipment. The measurements obtained are presented on Figure 2.

LABORATORY TESTING

Samples of the rock were taken to the laboratory to determine the approximate strength and sliding resistance that the rock may have. Based on our testing, the friction angle between rocks was measured to vary from 30 degrees to 61 degrees. Similar results were obtained when the rock was wet.

From this study we anticipate that the larger friction values are a result of the asperities of the rock and therefore have not been incorporated in our analysis. The average value of the interface friction angle is 39 degrees.

ANALYSIS AND FINDINGS

Based on the existing condition of the hillside along with the relatively weak strength of the rock, it is our professional opinion that the rockfall hazard for the improvements at the bottom of the slope should be considered significant even without construction on the neighboring site. From our evaluation, it is apparent that a number of rocks are in a position that could dislodge with very small amounts of ground motion, erosion of supporting materials and/or wetting.

Ideally, the development should have followed the recommendations presented in the original geotechnical report for the proposed Webb Canyon Development (currently known as the Sienna Canyon Subdivision) provided by Black, Miller & Associates, Inc. dated May 8, 1996 under Project No. 96-1191-01.

Using the information obtained from our on-site measurements, a plot of ground vibration resulting from use of the equipment at various distances has been plotted. These measurements are presented on Figure 2.

The literature indicates that vibration inducted by equipment typically follows a linear relationship in a log-log scale. This linear approximation has been applied to the vibrations measured by the T855 trencher and the H140E hydraulic hammer. These results are presented on Figure 2.

Also presented on Figure 2 is what historically been measured as vibration from truck traffic.

Assuming that trucks have traveled on the existing road, that closely parallels the steep slope, some of the rockfall hazard areas may have experienced ground shaking higher than we are recommending to be considered as the threshold for future activities.

The proposed road alignment and grading plan prepared by Horrocks Engineers, dated June 12, 2020, incorporates many of the recommendations that were previously provided to the developer for consideration and development of the area.

The following conditions pertaining to the vibration hazard have been incorporated in the design.

- a. The entrance roadway has been located west of and farther away from the area of rockfall hazard.
- b. The proposed alignment of the entry roadway results in cuts of 3 feet or less in the first 200 feet of the roadway. We understand that deeper cuts would have been considered if the existing road alignment was used to access the development.

- c. It appears that the buildable areas have been restricted to be west of the entry road until after the intersection of Hillside Drive and "Road A." Lots 25 and 26 are the only two buildable areas that are on the east side of the road. We understand that the grading plan (prepared by Horrocks Engineers) indicates that fill will be placed on Lots 25 and 26 to achieve the desired grade. This effort would result in less vibration than if the final grade required cuts.
- d. The grading plan indicates that water that is collected west of the roadway will drain towards the north away from the slope of concern. This is also an improvement compared to the existing drainage condition.

RECOMMENDATIONS

1. With these conditions, we recommend that positive measures be taken in order to reduce the potential of unacceptable performance of the rocks during construction on Webb Hill. This can be accomplished by:
 - a. using equipment that would minimize vibration in the ground.
 - b. maintaining sufficient distances away from the slope of concern with vibration inducing equipment.
2. The minimum distance away from the slope for equipment should be considered based on a criteria that is included in the literature to prevent damage to "ruins and ancient monuments". This criteria (maximum particle velocity of 0.08 inches per second) was obtained from, "A Survey of Traffic-Induced Vibrations" by Whiffin and Leonard, Transport and Research Laboratory, RRL Report LR418 Crow thorn Berkshire, England, 1971.
3. Human beings have the capability of becoming aware of vibration well below the level when damage may occur. In fact, there will likely be concern long before there is a potential for vibration induced hazard. With this condition, we recommend that contractors consider using equipment that induces vibration in the ground use as little vibration that will still accomplish the task at hand. Vibrations on the order of 0.006 to 0.019 inches/second within the literature can be perceived. Keeping the energy of the equipment and/or operating farther away from the slope will help to limit the perception by others.
4. Based on the field measurements of the hydraulic hammer and trencher, and using the criteria of 0.08 inches per second peak particle velocity, the hydraulic hammer should be operated no closer than 160 feet and the trencher no closer than 75 feet of the area of concern. These setbacks are presented on Figure 1.

5. The induced vibration of the equipment proposed for excavation into rock should be measured before proceeding. Any modification to the criteria developed by this study could then be made if needed. These evaluations would help reduce the potential for rockfall to occur.
6. Ground motions should be measured during construction to verify that the threshold selected is not being exceeded.
7. The criteria presented in this letter should be followed by contractors working on site.
8. Blasting should not be allowed on site.
9. The improvements on the building lots within the 160-foot setback should follow the same criteria indicated within this letter. If vibrations, larger than the ones generated for this study, are contemplated, beyond the 160 feet setback, we should be consulted in order to establish energy limits and/or the appropriate set back to reduce the potential for potentially damaging vibration.

LIMITATIONS

This letter has been prepared in accordance with generally accepted geotechnical engineering practices in the area for the use of the client. The conclusions and recommendations included in the letter are based on conditions observed during our field study. If conditions are significantly different from those described in this letter, we should be notified to reevaluate our conclusions and recommendations.

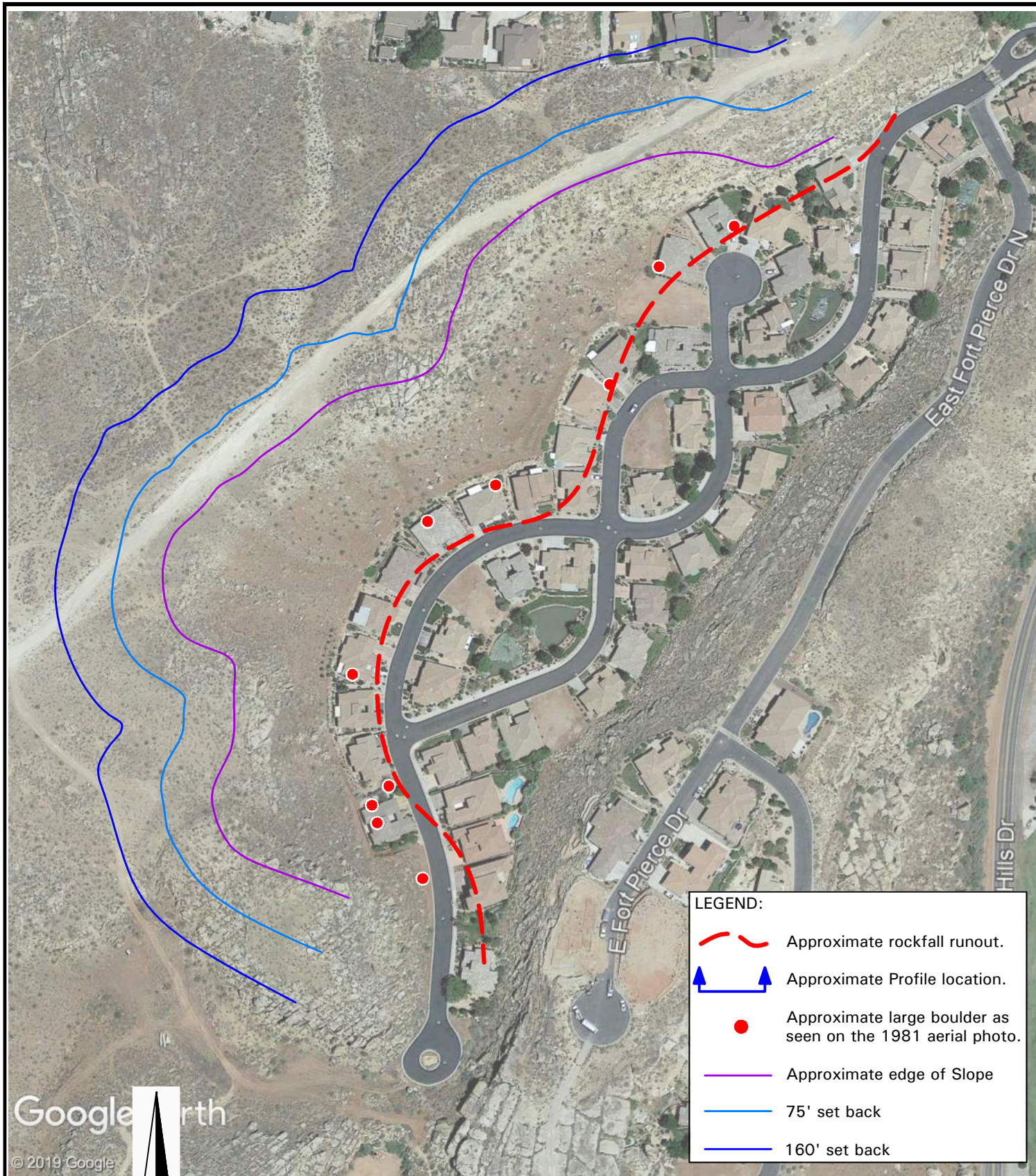
If you have questions or if we can be of further service, please call.

Sincerely,

APPLIED GEOTECHNICAL ENGINEERING CONSULTANTS, INC.

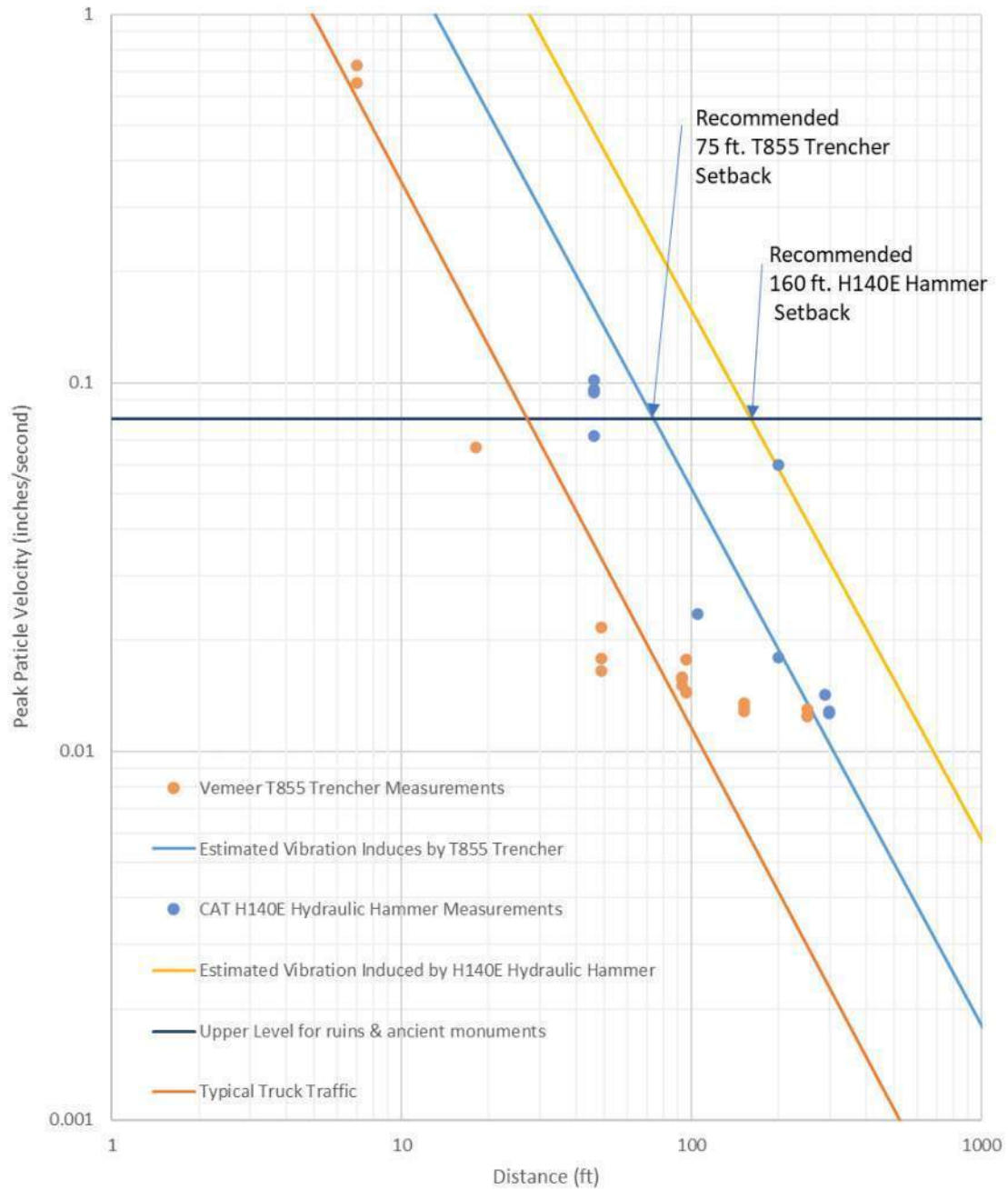


James E. Nordquist, P.E., D.G.E.
JEN/rs



ROCKFALL HAZARD ASSESSMENT
SUMMIT ESTATES
HILLSIDE CIRCLE
ST. GEORGE, UTAH

Measured and Estimated Vibration Based on Equipment Used and Distance



ZONE CHANGE AMENDMENT

PLANNING COMMISSION AGENDA REPORT: 10/13/2020

Zone Change

Summit Estates

Case No. 2020-ZCA-037

Request: Consider a Zone Change Amendment to the Webb Hill PD-R (Planned Development Residential) zone to reconfigure the layout of the conceptual plat found in the development agreement.

Applicant: Superior Development

Area: 70.78 acres

Location: The site is generally located on Hillrise Drive, south of Summit Ridge Drive.

Current Zone: PD-R (Planned Development Residential)

General Plan: OS (Open Space)



Background

The subject property has a long history including real estate exchanges which culminated in a development agreement between the City of St. George, Bureau of Land Management (BLM), and Leucadia Financial Corporation in July of 1998. In the development agreement, the City agreed to allow the construction of Sienna Canyon, Sienna Ridge and the remaining property on Webb Hill (the subject property). Between Sienna Ridge (13 lots) and Sienna Canyon (55 lots), 68 units have been platted. Out of 118 total units allowed by the development agreement, this leaves a total of 50 lots left to be developed. The applicant is proposing 42 new lots.

The location does fall within the Hillside Development Zone, and the applicant has received a positive recommendation by the Hillside Review Board and is currently under review by the Planning Commission in conjunction with this application (Please refer to case 2019-HS-008).

The proposed development will contain 70.78 acres. The plan is to add approximately 42 lots. Access will be through Hillrise Drive, which is currently a gravel, unimproved road. As a Planned Development, this new expansion will be required to adhere to the planned development regulations. The table below depicts these regulations.

STANDARD	REQUIREMENT	PROPOSAL
Density: up to 1.4 du/ac	No more than 50 dwelling units	43 units (0.6 upa)
Landscaping: 30% of site area	Minimum of 21.23 acres	21.21 acres (30%)
Amenities: 1,000 sq ft for lots 1-5, 200 square feet per unit beyond	8,400 square feet for 42 dwelling units	Approx. 22,000 sf

With 42 units, the applicant will not exceed the density requirement at 0.6 units per acre. The applicant is requesting that the Planning Commission consider the natural terrain and vegetation fulfil the requirement for 30% landscaping. They have set aside the 30% required by code for open space. Their argument is that the point of the hillside is to preserve the sensitive nature of the hillside to the greatest extent possible. They feel that by disturbing it and formally landscaping the hillside, it will do more harm than good. As far as amenities, they are requesting approval of the 10' trail that will run adjacent to Copper Ridge Drive (currently known as Hillrise Drive) through the development. The code doesn't necessarily anticipate this type of development (large, hillside) when it calls for a perimeter trail system. By creating this trail through the development on a public street, it will allow for access to Kentucky Lucky Chicken trail. Staff estimates the ten-foot-wide trail will provide approximately 22,000 sq ft of amenity to the site.

The applicant is proposing a large range in lot sizes. The smallest lot, lot 214, is proposed to be 18,067 square feet or 0.41 acres. The largest lot, lot 211, is proposed to be 141,570 square feet or 3.25 acres. The applicant is proposing design guidelines which will give all landscaping, architecture, signage, and other features a cohesive feel. The guidelines are attached to the staff report.

Staff has reviewed the proposed zone change amendment and recommends that the Planning Commission carefully consider all factors outlined in this report in making a recommendation to

the City Council. If the Planning Commission feels that the open space and recreation areas are sufficient, staff recommends approval of the application.

Alternatives:

1. Recommend approval of this Zone Change Amendment to the Webb Hill PD-R (Planned Development Residential) zone to develop the property with 42 new single-family lots.
2. Recommend approval with conditions of this Zone Change Amendment to the Webb Hill PD-R (Planned Development Residential) zone to develop the property with 42 new single-family lots.
3. Recommend denial of the Zone Change Amendment.
4. Table the proposed Zone Change Amendment to a specific date.

Applicant's Narrative

To: St. George Planning Staff

From: Ben Willits, Project Manager

Date: October 8, 2020

Subject: Summit Estates PD Secondary Zone Change Narrative



Site Statistics:

Parcel Size: 70.83 ac *Assessor's Parcel ID:* SG-5-3-5-32001

Location: Intersection of Hillrise & Summit Ridge Dr. St. George, UT

Existing Site Use: Undeveloped with a City ROW access road to the Webb Hill Comm. Towers and Kentucky Lucky Chicken Trail (City trail).

Zoning and Entitlements:

Currently the site is zoned PD-R as part of the original Sienna Canyon Master Plan and per the Webb Hill Land Exchange Development Agreement, July 1998. The parcel is entitled for 54 lots per said agreement. No variances to this are being requested at this time.

Proposed Project Land Use Planning:

The developers are proposing a low impact, high-end custom residential parcels ranging from 0.5 ac. to over 3.2 ac. in size. Over 45% of the site will be left in open space with 30% as common area. The lot and home placement will be carefully selected so as to minimize cuts and fills to the site with a lot count of 42 units and a density of 0.6 du/ac. A new 10' paved trail will connect the existing Bloomington Hills area to the relocated Kentucky Lucky TH via the newly paved public roadway. The project has been approved with Hillside committee. Very strict design guidelines and CC&R's will be placed on the plat and will deed restrict the manner in which the homes and landscape will be built. This will include lot grading with cuts and fills, building heights, roof pitches and materials used in order to maintain a minimal visual impact to the surrounding areas. The site will incorporate low lighting design criteria in order to maintain dark night sky levels while maintaining public safety. See attached Design Guidelines booklet for more detail.

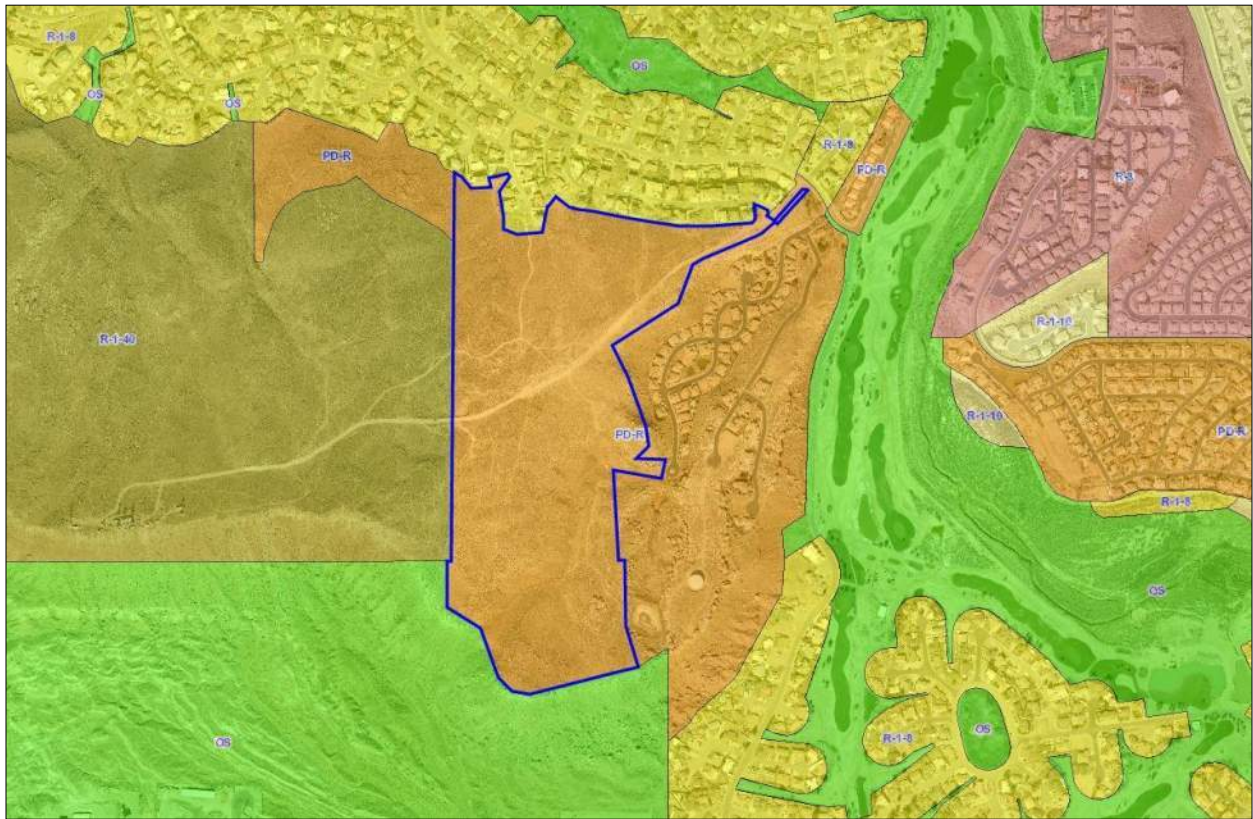
LAND USE TABULATION	
PRIVATE DEVELOPMENT AREA	49.62 AC (70.0%)
COMMON OPEN SPACE	21.21 AC (30.0%)
TOTAL	70.83 AC

TOTAL SITE AREA	70.83 AC
DEVELOPABLE AREA	29.38 AC
TOTAL UNITS	42 UNITS (0.5 - 3.2 AC)
DENSITY	0.6 DU/AC

Proposed Project Phasing:

The project will be built in two phases. The first phase will all improvements on Copper Ridge Dr. including the new water tank to serve lots 101-120 to the north. The second phase will include all improvements for lots 201-222 on the south side of the project.

Zoning Map



Letters from Public

My wife and I decided to move our family to St George one year ago. We purchased a home in the Bloomington Hills North area. I work as a nurse and as a result I can pretty much move to any city in the US that has a hospital. We chose to move to St George because of all the great outdoor activities and the family friendly atmosphere. This city has a large reputation for its year around recreations. I live less than one minute from the Kentucky Lucky Chicken trail that will be affected by this zone change. I assume the zone change will eliminate this trail. This will affect my family. I have 3 small kids. I try to spend as much time as I can with my family. The proximity of this trail helps me have a good balance with my family life. I will ride my bike up to the trail head, around the Kentucky Lucky Chicken trail and back home in about 50 minutes. If I load my bike and drive to another trail it adds quite a bit on to my time. I usually spend over 2 hours total when going to other trails here in St George. This may seem insignificant, but this is a big deal to my weakly joy and drive to be a good father. I enjoy my morning rides a couple times a week. I also take my wife and kids hiking on the trail a couple times a month. It is a safe trail for them to go on and we love the proximity to our house. If St George would rather build homes and business over having recreational activities than my family and I will have to eventually find another place to live if this continues. I know you may say, well this is just one trail. In response I would have to say where does it stop? It is just Kentucky Lucky Chicken because we will make a lot of money as a city selling this property. Well what about Gooseberry Mesa, Bearclow Poppy or the Zen trail? If there is enough money offered or expansion continues than these trails will also fall to new home development. Will the rezoning of the property go into my pocketbook or the communities? Will our health improve? Will we make traffic more of an issue than it already is as a large community now must commute every time, we want to enjoy a hike or a mountain bike ride. I am guessing that the reason for the rezoning proposal is due to the lack of value of that area if kept the way it is currently. The city wouldn't want to tear down the public swimming pool because the benefit is too large to keep it there. This local trail is a large benefit to this community. I know of many, many people that ride and hike that trail almost daily from my neighborhood. I hope they speak up too. Please reconsider rezoning this area.

Thank you,

-Joshua Lundin

Development of Webb Hill

1 message

Earthlink [REDACTED]

Fri, Oct 9, 2020 at 12:00 PM

To: daniel.boles@sgcity.org

Dear Dan,

As residents of North Bloomington Hills, we are very aware of the wonderful benefits of what we assumed Webb Hill to be - Public Open Area. For a year or more we had been made aware of the details for development on the area adjoining Siena Canyon. We wondered how that could be?

Besides being a difficult area to develop, the loss of use to the city and its citizens would be heartbreaking to the many who use it - often daily. A land swap for property that could be more easily developed by the owners should makes sense to all.

Please know that none of us in this area are in favor of such development.

Thanks, Dave & Jeanne Macdonald

Rezoning of Web Hill (home of Kentucky Lucky Chicken Trail)

1 message

MAllen [REDACTED]
To: daniel.boles@sgcity.org

Fri, Oct 9, 2020 at 10:12 AM

Hey Daniel,

I just heard there is a request to rezone Web Hill. I live on Twin Circle just a half mile from that area. One of the reasons I chose that area was because of the trail system in the backyard and the open space on the hill. I ride up there a lot and see a lot of people riding, walking, etc. It is hard to find open space these days close to where one lives and I have loved how I don't need to drive to get to a trail.

Between the additional people and traffic (it is already very busy in that area) and the potential loss of open space and a very fun trail and area that I know people recreate on a lot, I would highly encourage you to not rezone this area and to preserve it as open space. It isn't a bad thing to have some open space in an area littered by homes and people, let's keep things a bit raw and preserve the dirt.

Thanks for listening to me out and best regards,
Millard

[REDACTED]

Webb Hill- Keep it Wild

1 message

Nathan Clements [REDACTED]
To: daniel.boles@sgcity.org

Fri, Oct 9, 2020 at 11:35 AM

Dear Mr. Boles,

My name is Nate Clements and I am a St. George/Bloomington Hills native. My parents have been at the base of Web Hill since 1982. The area is one of the few small areas for kids, families and other to hike, bike and explore.

I understand the tremendous growth and pressures to build build build but at what expense? To develop one of the last remaining hills in the city?

It is time to preserve some of our open lands for recreation and the health and well-being of the citizens of St. George.

Best,

Nate Clements

Please don't rezone Webb Hill!

1 message

Fri, Oct 9, 2020 at 11:55 AM

To: daniel.boles@sgcity.org

Good morning Daniel,

I am writing to share my feelings on the possible rezoning of Webb Hill by the City of St George. Please do not add more homes to yet another hill in St. George. Webb Hill should be kept as it is and not allowed for further high end, overpriced development. As a St. George native, it kills me to see more and more of our beautiful hillsides being sold off to the highest bidder for more residential and commercial development.

Thank you for your consideration,

Tom Picklesimer

Webb Hill

1 message

Skylar Topham [REDACTED]

Fri, Oct 9, 2020 at 11:29 AM

To: daniel.boles@sgcity.org

Hi Dan,

I wanted to simply let you know that myself (and many others) in the North Bloomington Hills are sick about this development.

It's the talk of the community.

I hope enough people find out about this rezoning meeting to stop it.

We've been trying to figure out how to make our voices heard so I'm glad i was able to track you down.

Webb Hill is a treasure in so many ways.

Thanks,

--



Skylar Topham

CEO at [Smartcare.io](https://smartcare.io)

[REDACTED]
Hey, Smartcare made the [slack blog](#)!

Keep Webb Hill Wild

1 message

Travis Topham [REDACTED]
To: daniel.boles@sgcity.org

Fri, Oct 9, 2020 at 11:27 AM

To whom it may concern,

I'm not a fan of rezoning more of Webb Hill for residential housing.

Having grown up here for the past 40 years, I've watched every mountain within eye-shot of the temple get developed.

It's no secret that our vistas have become a major selling point for new residents from out of town. While this rezoning would make a handful of developers wealthy, it would ultimately hurt more than it would help.

I know St George is growing (for obvious reasons), and we need to develop land in order to accommodate, but we don't need to develop all the land, we don't need to develop this land.

Thanks for your consideration of my opinion in this matter,

Travis Topham

Webb Hill

1 message

Skyler Almquist [REDACTED]

Fri, Oct 9, 2020 at 11:15 AM

To: daniel.boles@sgcity.org

Daniel,

I hope this email finds you well. I have been a resident of Bloomington Hills my entire life. I have recently moved back to STG from NYC and I completely understand the need to find housing and attractive housing options. I better than most understand that STG is the ideal place to live. What makes it so amazing is the proximity to nature and the ability to quickly escape the world.

Webb Hill has been that escape for me my entire life. In fact most of the trails up there were created by myself, my friends, and my dogs. I run up there most days and having a sanctuary so close in the city has made life during this pandemic more bearable.

I am appalled that we would want to take away the one gem we have left in the city. Webb hill is truly a beacon and gem. If you don't believe me, go to Dixie Rock and imagine homes all the way up just like the other hills. Trust me, you will not want to go to Dixie Rock again. St. George is a big city with a small heart and believe it or not running homes up the hill will make it look just like another overgrown mess.

There are more than enough attractive places to develop and we need not take away the last small sanctuary many in this city love.

Now as you may have gathered by now, I am very strongly opposed to the development of Webb Hill.

If you would like to discuss further, please respond or call me at [REDACTED]

Best,
Skyler Almquist

Webb hill development.

1 message

Matthew Clements [REDACTED]

Fri, Oct 9, 2020 at 11:25 AM

To: daniel.boles@sgcity.org

Daniel,

I will be a part of the zoom meeting regarding the RE zoning of parts of Webb hill. I am completely against this as I have lived right at the base of the hill my entire life. I look forward to this meeting to let city officials know the citizens that have lived and loved Webb Hill for 35 years are against this.

Thanks

Matt Clements

Sent from my iPhone

October 9, 2020

Mr. Dan Boles
AICP Senior Planner
175 East 200 North
City of St. George, UT 84770

cc: daniel.boles@sgcity.org

RE: Objection to Proposed 13 OCT 2020 Mtg. for Rezoning of Webb Hill
Case No. 2020-ZCA-037

Dear Mr. Boles,

I am an adjoining land owner to the subject land, and have been a full-time resident and property tax payer, here, for over 22 years. I purchased my home site exactly where it is for the precise reason that it abutted a natural area. It was represented to me that the adjoining land would never be developed. My objections to the meeting itself and the idea of the meeting are several,

To Wit:

Defective Notice

- The form letter I received is dated September 30th, but I only received it a couple days ago. I would expect that such a notice should be publicized at least a full 15 working days in advance without two weekends including intervening religious celebrations (Roman Catholic, Jewish and LDS) spanning the time frame, in order to give the public adequate notice of the same, and to provide those temporarily, out-of-towners, interested, adequate time to make intelligent preparations for comment.
- The Notice itself, I believe, is further defective because it did not state what type of rezoning may be imposed, thus leaving it to the reader to infer it may involve heavy construction for residential or commercial development.
- Concerning the magnitude and location of the property in question, details of the proposal should have been noticed in the Spectrum on at least two separate occasions contemporaneously with said letter and on the radio. I suspect the letter was only sent to a few dozen home owners similarly situated along the boundary, and therefore the general public and other neighbors in North Bloomington Hills (even just one or two streets away) were/are not apprised of this undertaking.
- Your letter did not cite who was proposing the rezoning, nor to whom, or to what other agencies it was being sent. For the aforesaid reasons I believe the meeting to be illegal and must be postponed particularly if any decision to approve the zoning change is intended to be taken by the commissioners.
- Furthermore, invitations to participate are overly restrictive in that it appears that no one is allowed to attend in person. Many of us are senior citizens (may not be entirely computer literate), and our reasonable, oral comments will go unheard. I hereby request that my letter be read into the record in

its entirety, should the meeting be held anyway, so that at least those few participants via Zoom may be apprised of the balance of the issues one could feel, in fairness need to be disclosed, as set forth hereinafter. What is the urgency to hold this meeting? Let's wait till after COVID-19 is over so people may congregate in a civilized, rather than nerdy fashion.

Anthropology/Archaeology

- Within the aerial photo depicted on the back of the scant written information is a rock formation where several petroglyphs occur. A number of these are being sent to you electronically. Development of the area will only contribute to their degradation if not total destruction.
- It is unclear how many other ancient Native American relics, undiscovered to date, will forever disappear from this area absent an intensive exploration and documentation of the same, grid by grid. Those "writings" mentioned above appear to be signs of a burial close-by.

Ecology

- On Webb Hill at least two protected reptile species are hanging on in spite of historical encroachment, e.g., the Gila Monster and Chuckwalla, both indigenous to the area. Nearly every late Spring / early Summer one or more (*Heloderma suspectum*) are attracted to the garden premises of adjacent residents and have to be "rescued" by the Red Cliffs Reserve or other authority. Destruction of habit (if not annihilating this endangered species) will provoke those lucky escapees to invade the neighborhood until being run over by automobiles or removed by ethical, authorized personnel.
- My back yard has benefitted from visits by four species of snakes and at least five species of lizards, much to my personal enjoyment, including the Collared Lizard which is typically only found in rocky, hilly areas within our region. On more than one occasion neighbors have brought me lizards mauled by cats (including one newly hatched Chuckwalla nearly two decades ago) to try to rehabilitate and release when recovered. More housing means more domesticated animals with predatory instincts to continue to decimate the native fauna. Besides the reptile, what will happen to the abundant quail and dove that inhabit Webb Hill and visit our gardens for water and refuge?

Construction costs/efficacy/resources

- Webb Hill is very rocky. It is not a cost-effective area upon which to build. Just putting in a swimming pool towards the base of the hill incurs several thousand extra dollars in track hoe time to dig through the near-solid rock formation or boulders. I know.
- The severe downhill grade makes for difficult (particularly, Winter) navigation. Slippery Ice accumulates for often days on our driveways several hundred feet below the proposed area. Imagine how much worse it will be the farther up the hill one goes. What about runaway vehicles including children on bicycles?

- Has anyone seriously considered the sewer and fresh water issues? Besides the expensive trenching, the concern of dust flying everywhere, dynamiting, and added traffic to our ingress and egress points, both during years of construction and afterwards, I'd like to see a study on what happens to homes downhill when somebody uphill flushes a toilet and there is any kind of a clog. What is the velocity of and force of what is discharged, gallon per gallon?
- Obviously culinary water will have to be pumped uphill. More trenching, no?
- What about runaway boulders during the process or after construction is complete. I am not real excited about seeing tons of accumulated boulders artificially stacked up hill for landscaping purposes just waiting for a little tremor to send them tumbling downhill onto my garage, smashing through my fence, or worse, visiting me in my bedroom while asleep at night when the next earthquake hits.
- Where is all the water coming from to take care of more and more residents. The proposed Colorado pipeline is folly, if for no other reason than there is a much closer point of diversion than the one being promoted. If the Colorado River has insufficient water, what good will the pipeline do? Our aquifers may already be operating beyond their capacity to sustain continuous, indefinite water flow. Hasn't anybody noticed the drought we have been in the last several months? It takes eons for ancient water to accumulate underground. Once streets are put in on the hill that will only mean more accumulation of water in certain channels to cause severe flood damage in unanticipated areas. Look how many times the dams have had to be rebuilt and Flood Street re-engineered. Water, besides gravity moves the aforementioned boulders. Just what we need, more residents driving up the price of water!

Aesthetics

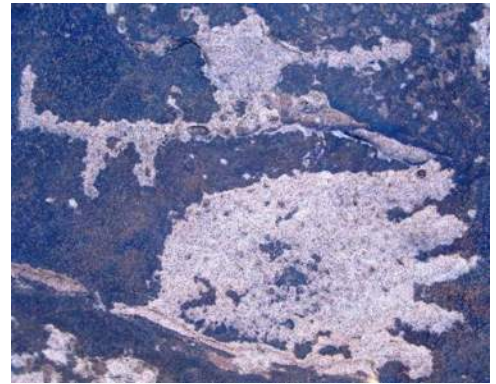
I return to what brought me to Saint George. The home I purchased was already constructed by someone else. It was refreshing to have some open area behind the house for hiking without more obstructive, noisy or trashy impediments to my ability to enjoy the beautiful view (if one even walks just a few meters up the hill to peer toward downtown. St. George is growing much too fast and seems to be out of control. Too much traffic, too much garbage, no thorough efficient recycling plan intact. Do the old-time residents want this to become another Las Vegas with all of its social problems? Allowing builders to go right up into the Red Cliffs and endangered habitats is taking away part of the attraction of Washington County. I would not let out of town special interest, builders come in here and rape the land to garner big profits then take their money elsewhere. We need to know more about the agenda before holding a meeting. Please advise.

Sincerely,

R. Joseph Collet JD



cc: Inter alia: KJUL Radio, Cherry Creek Radio, Spectrum, Mayor of St. George, County Commissioners, City Councilmen, Paul Van Dam, Paiute Nation, City attorney, law firms and North Bloomington Hills neighbors . . .



Proposed Design Standards



SUMMIT ESTATES

design and aesthetic standards

The development and design standards for the Summit Estates development are to provide property owners, and their designers with detailed development and design criteria that are intended to establish a unique community, which preserves the natural beauty and site integrity of individual homesites, while allowing diversity in individual residences. To ensure that Summit Estates is developed and maintained to the highest practical aesthetic standards, the Summit Estates homeowners have established an Architectural Review Committee (ARC) that has established the Architectural Rules & Design Guidelines contained in this document.

Summit Estates has a very distinct architectural theme which is desert contemporary and as such, all of the buildings and landscapes within Summit Estates are expected to adhere to these high standards. High standards for design and construction will ensure architecture and landscapes that are considerate to the site and to surrounding buildings. The Architectural Standards section specifically addresses design and architectural objectives.

The information in this book is intended to help you, your designer, architect, builder, contractor and/or landscape professional to understand these rules and guidelines regarding home design and landscaping, as well as acquaint you with the necessary approval process that each submittal entails. The ARC wants to ensure that the design review and approval process is administered fairly and effectively for the benefit of individual property owners and for all residents. These Development Standards and Design Guidelines shall apply to all properties located within the Summit Estates at Webb Hill Development area.

COVER

PURPOSE: 2

COLOR AND TEXTURE PALLETTE: 5-6

PLANT PALLETTE: 7

STREET SIGNAGE: 9-10

DRIVEWAY GATES: 11-13

ENTRY MONUMENT: 14-15

ROUND-A-BOUT PAVING: 16-18

FENCING: 19-22

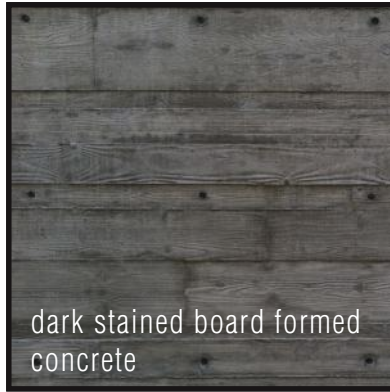
TYPICAL LOT LAYOUTS: 24-25

PARKSTRIP AND ROADSIDE
LANDSCAPING 26-29

design palette



corten steel



dark stained board formed
concrete



belgard madria slab pavers



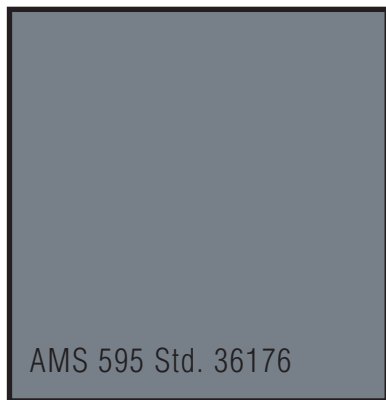
stainless steel
(for sign lettering)



dark black ledgerstone
imitation



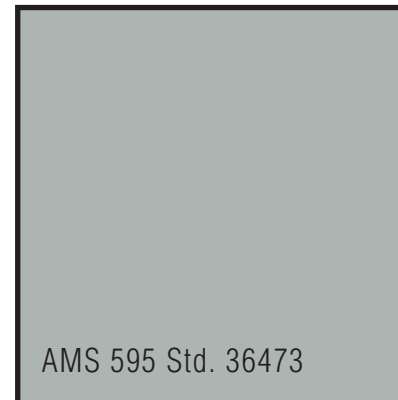
light exposed aggregate
concrete (for driveways only)



AMS 595 Std. 36176



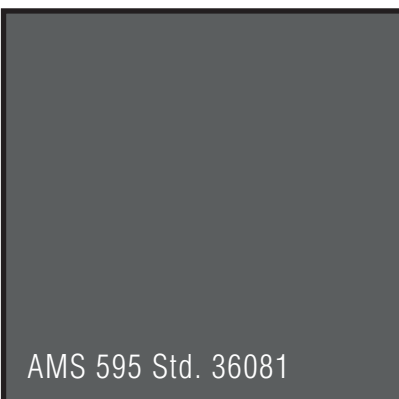
AMS 595 Std. 36440



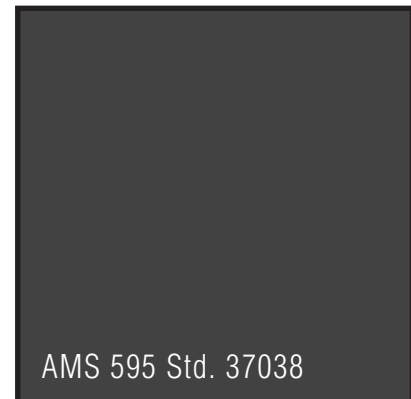
AMS 595 Std. 36473



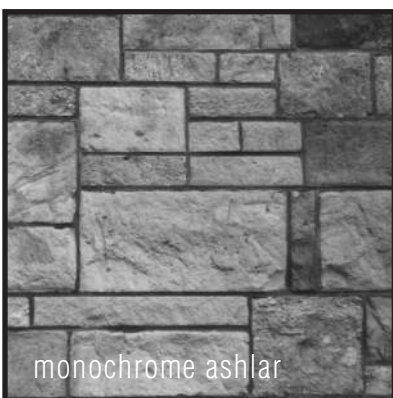
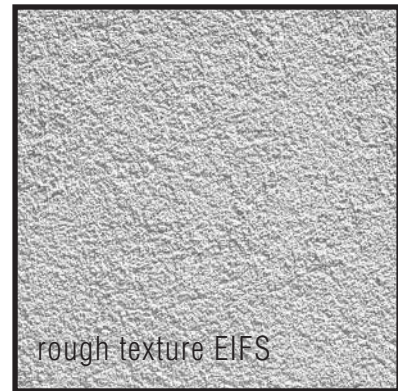
AMS 595 Std. 36270



AMS 595 Std. 36081

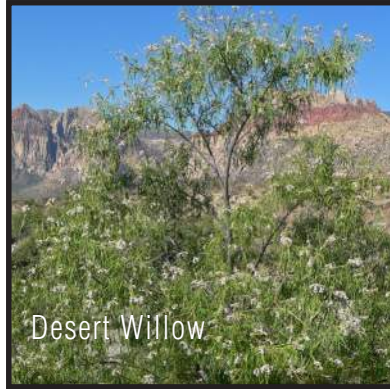


AMS 595 Std. 37038





Palo Verde



Desert Willow



Agave



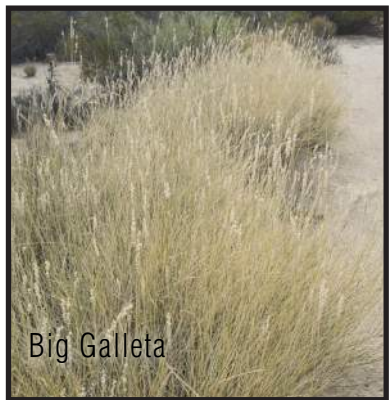
Pink Muhly Grass



Brittlebush



Barometer Bush



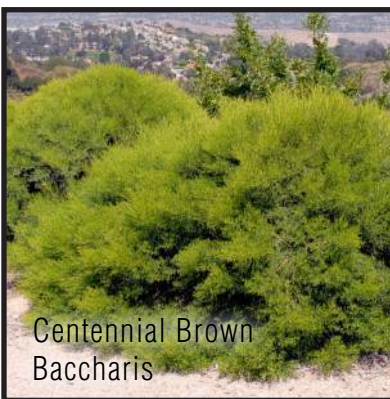
Big Galleta



Blue Switch Grass



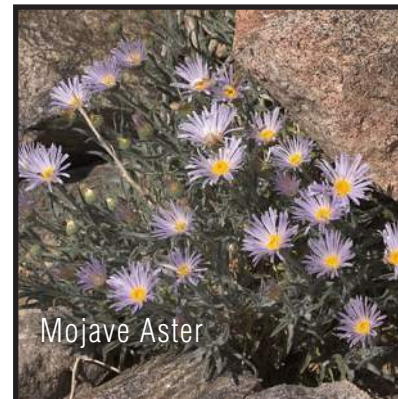
Red Desert Spoon



Centennial Brown
Baccharis



Dorr Sage

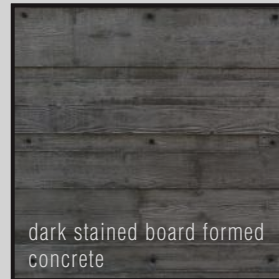


Mojave Aster

site elements



Elevation View (No Plants)



Elevation View (Plants)

1. Dark stained board
formed concrete post.
(18" x 18").

2. Corten steel plates with
stainless steel letters
(backlit).



3. Accent Trees (palo
verde)

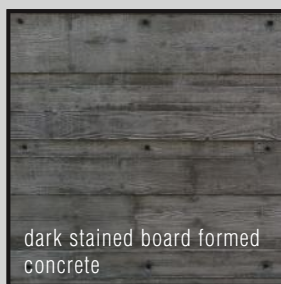
4. Low growing natural
plantings.



Elevation View (No Plants)



corten steel



dark stained board formed
concrete



belgard madria slab pavers



cultured stone



palo verde



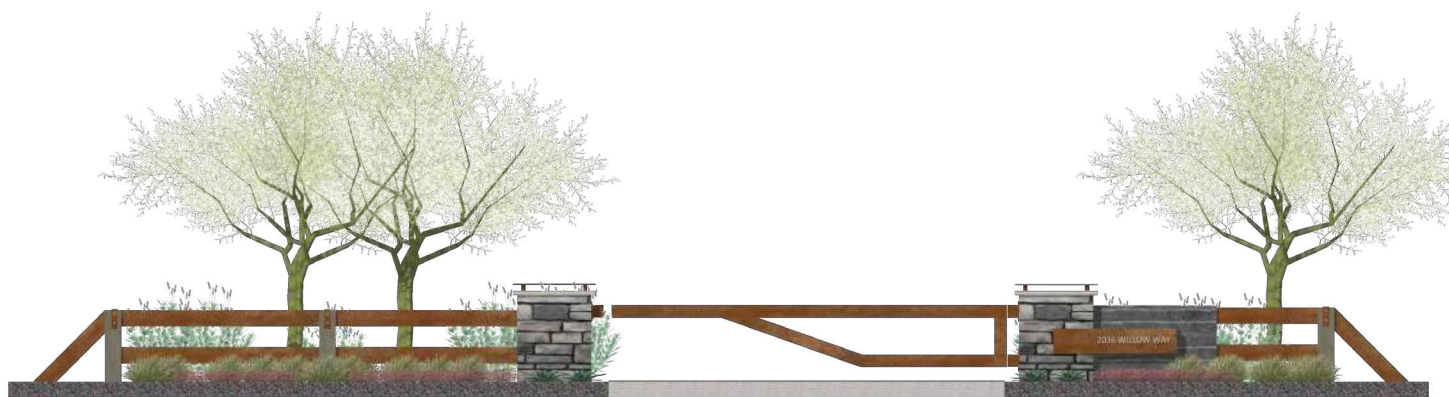
russian sage



dragons blood sedum



muhly grasses



Elevation View (Plants)

1. Single piece, single pivot, 16' wide gate.

2. 4' H x 3' W x 2'D cultured stone pillars.

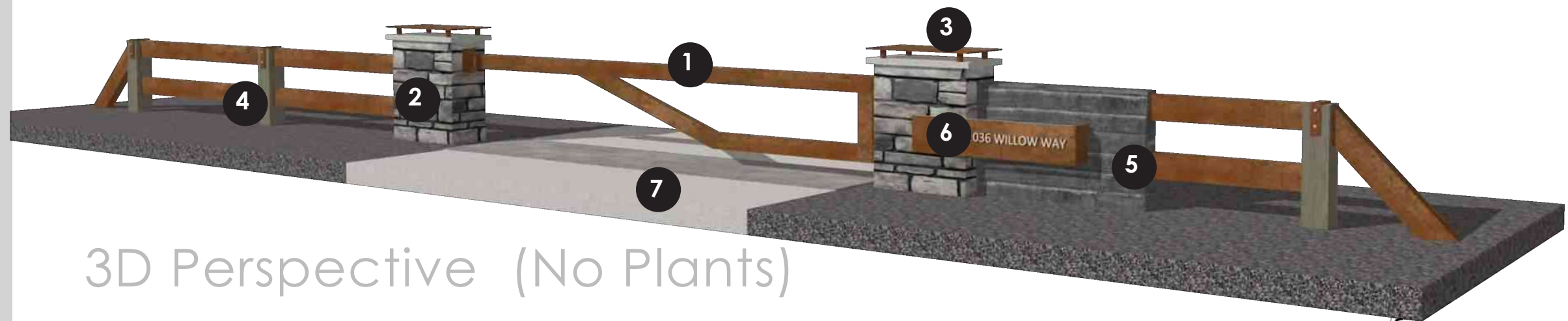
3. Corten steel caps to cover lighting.

4. 6" x 6" cedar post with corten cap corten rails.

5. Board formed concrete wall. 3' H x 5' W x 6" D with dark stain.

6. Corten steel panel for address with backlighting.

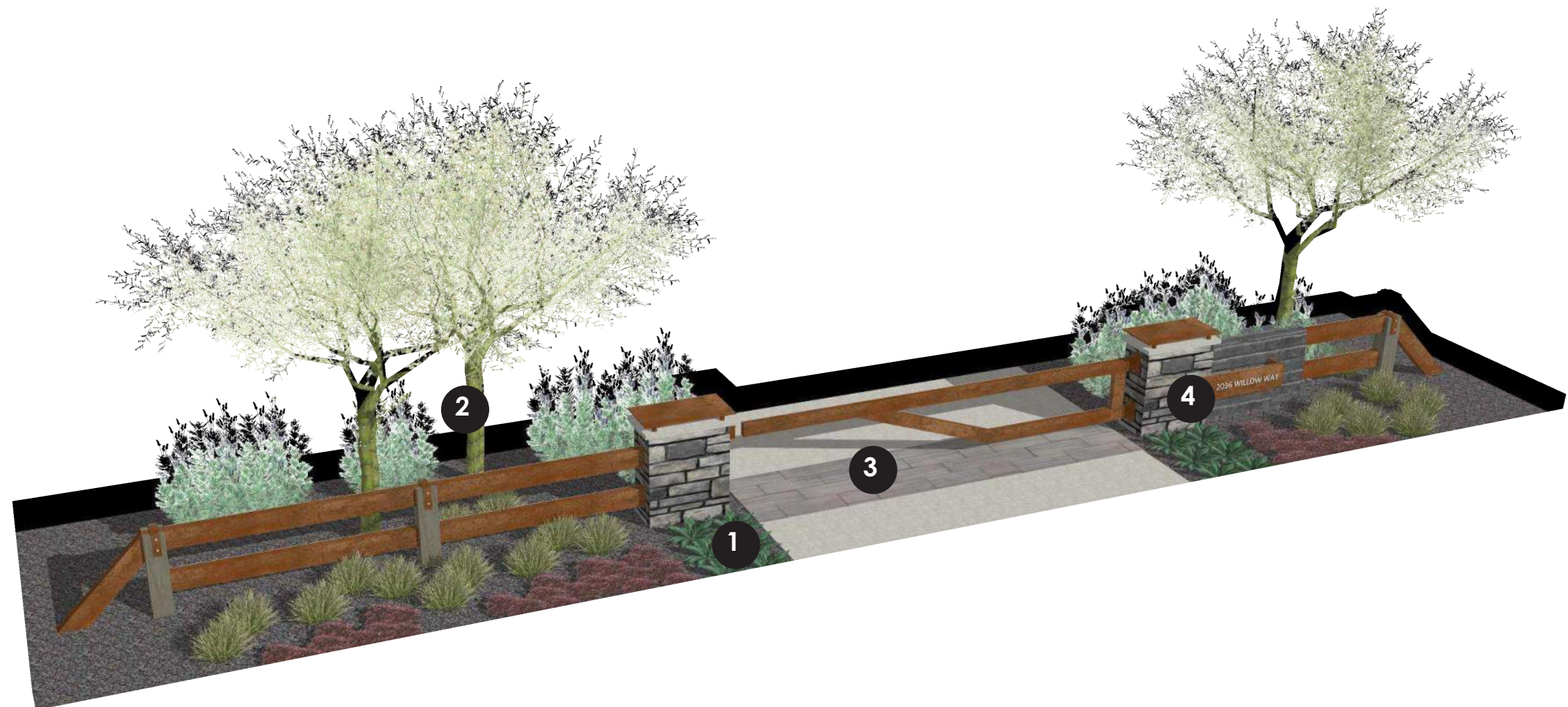
7. Exposed aggregate concrete driveway.



1. Agave or other bold planting to line driveway.
2. Tree groupings to frame entry on either side of monument.
3. Paver band between columns under gate.
4. Laser cut stainless steel letters for address or house number.



3D Perspective (No Plants)



3D Perspective (Plants)

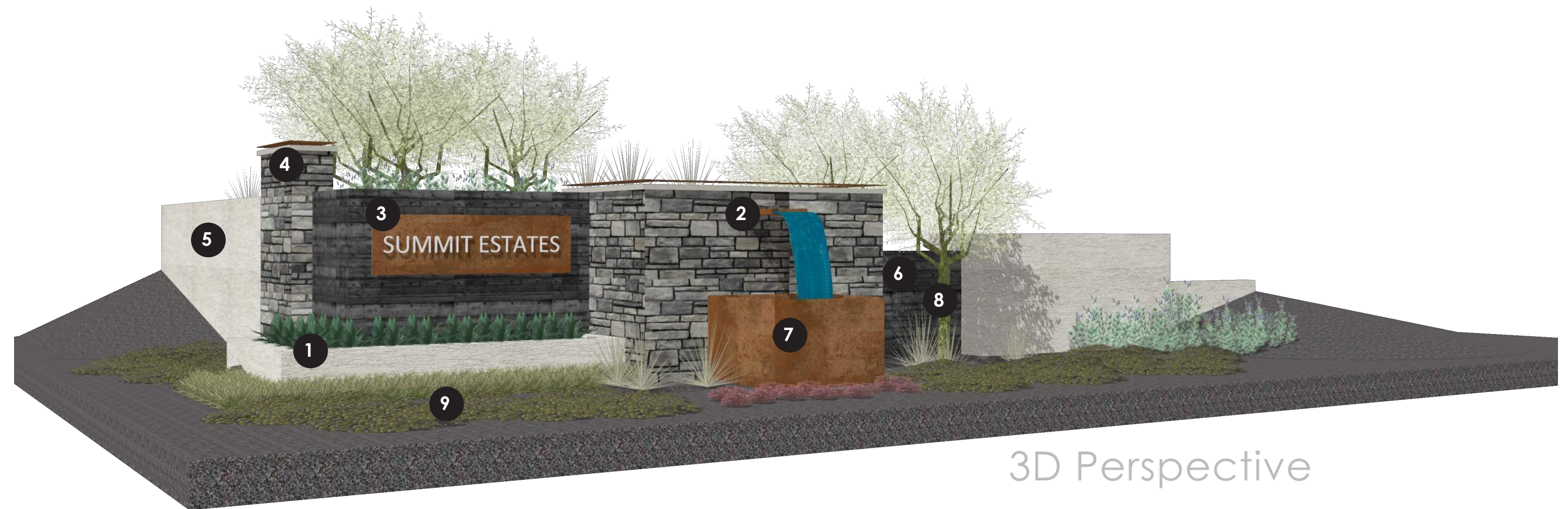
1. Raised planter with agave or other ornamental succulent.

2. Basic water flume feature.

3. Corten steel panel with stainless steel (backlit) letters.

4. Cultured stone wall with concrete cap and corten lighting panel.

5. Rough texture, light colored stucco retaining wall.



3D Perspective

6. Dark stained board formed concrete wall.

7. Corten steel catch basin for water flume.

8. Accent trees (palo verde).

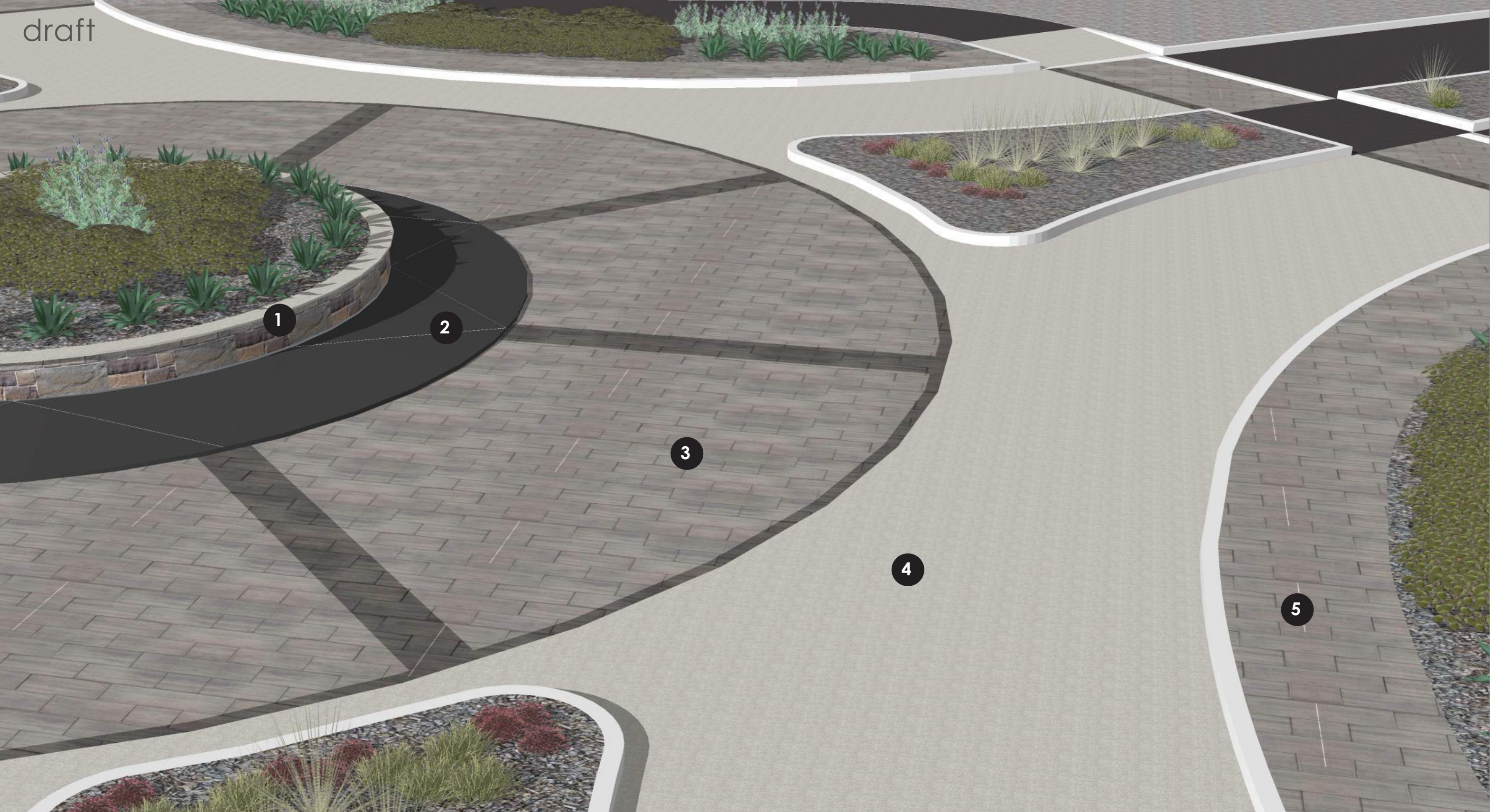
9. Low growing grasses and ground covers.



Side Elevation



1. Raised Center Island with plantings and potential monument.
2. Planted islands/medians.
3. Paver band with patterning in center of roundabout.
4. Exposed aggregate or colored concrete in roundabout
5. Paver band behind curb.
6. Typical asphalt pavement.
7. Tree groupings on outskirts of landscape areas.
8. Formal landscape adjacent to roundabout.
9. Trail and crossings, with pavers matching paver band in roundabout (if applicable)



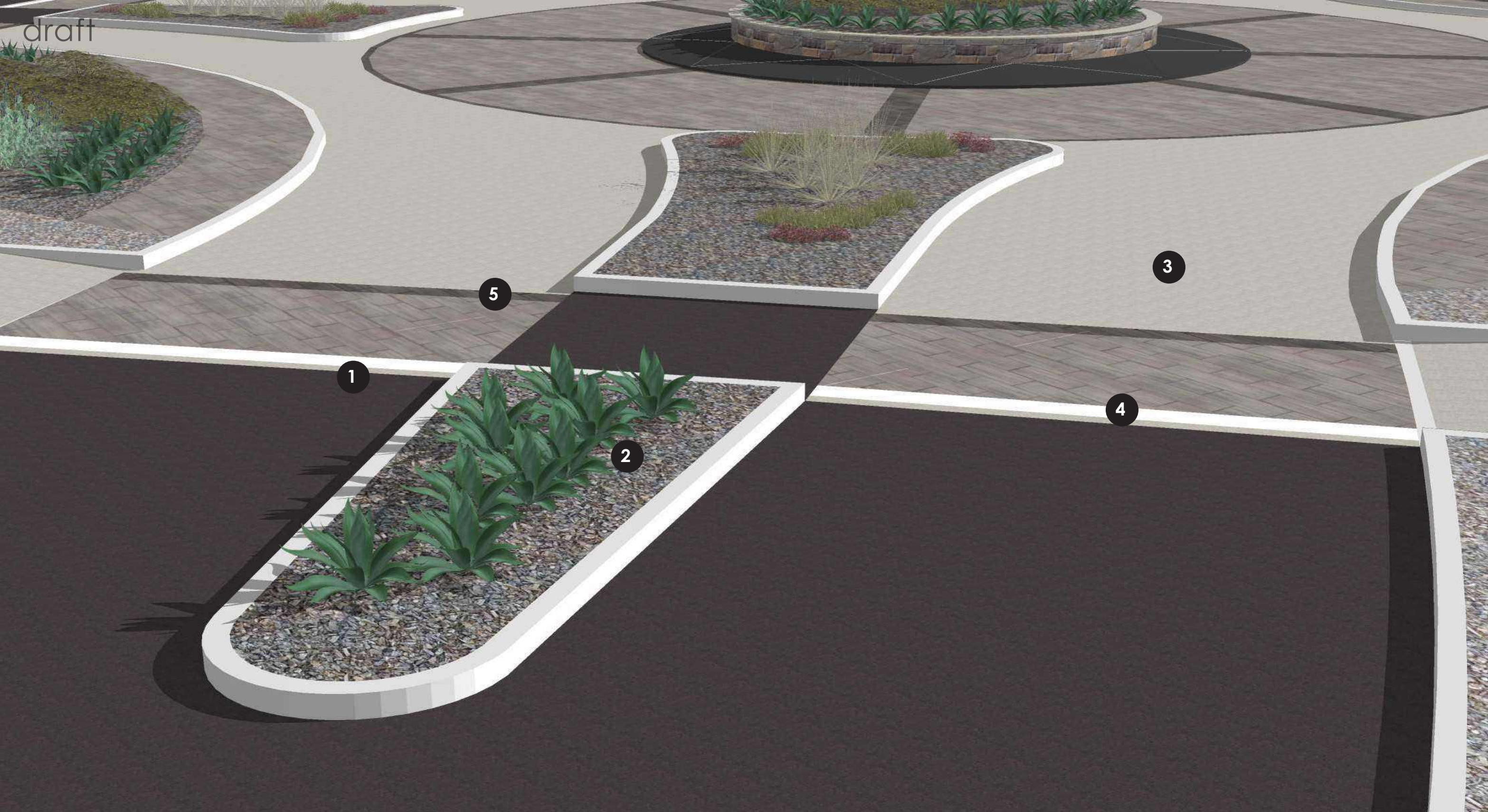
1. Raised Center Island with plantings and potential monument,

2. Colored apron around raised center island.

3. Paver band with patterning in center of roundabout.

4. Exposed aggregate or colored concrete in roundabout

5. Paver band behind curb.



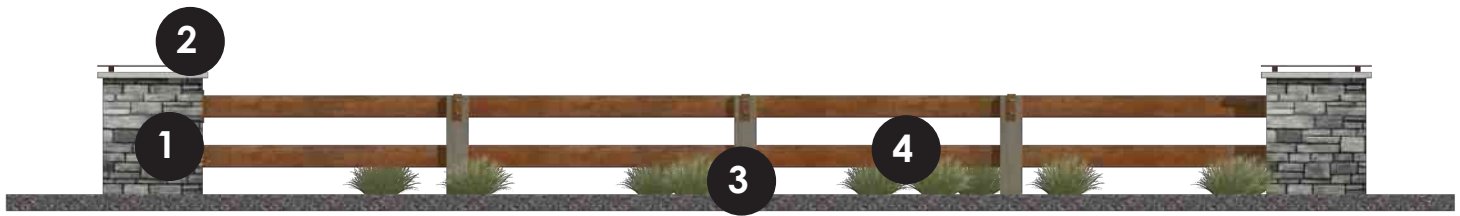
1. Distinct change in pavement at pedestrian crossings.

2. Formal plantings in raised medians/islands.

3. Exposed aggregate or colored concrete pavement.

4. Thermoplastic paint/stripping.

5. Colored concrete band.



Elevation View (double rail option)

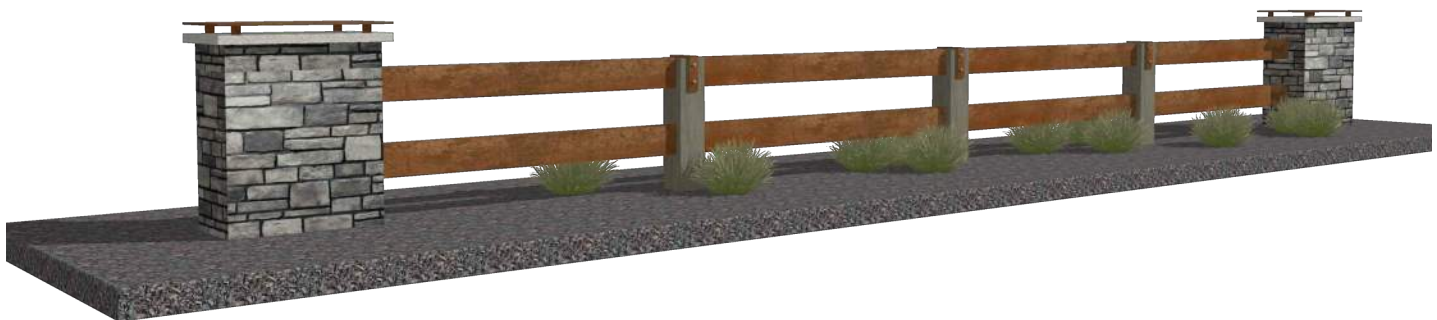
1. Pillar with stone veneer.

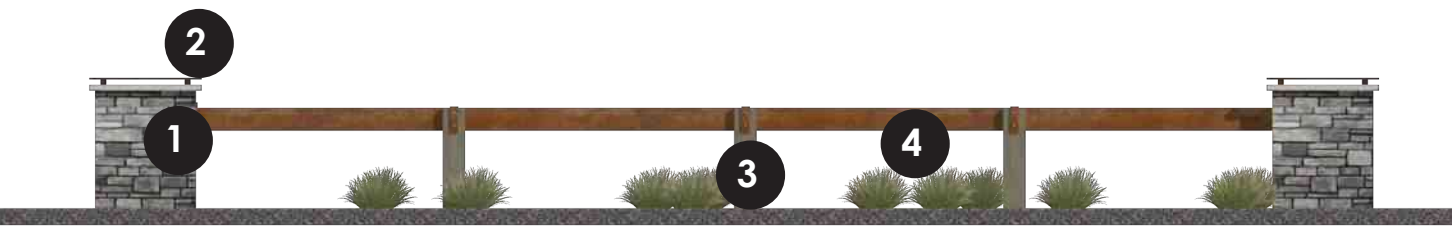
2. Corten cap to accomodate low profile lighting.

3. Cedar posts with corten brackets and galvanized hardware.

4. Corten steel rails.

Perspective View (double rail option)





Elevation View (single rail option)

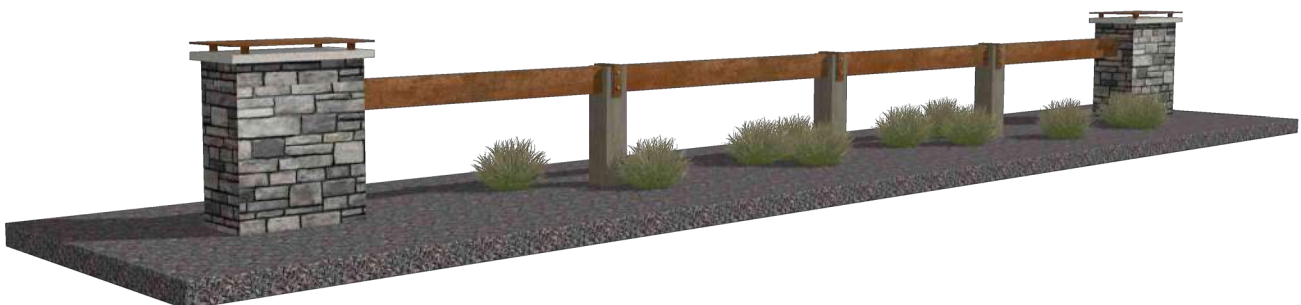
1. Pillar with stone veneer.

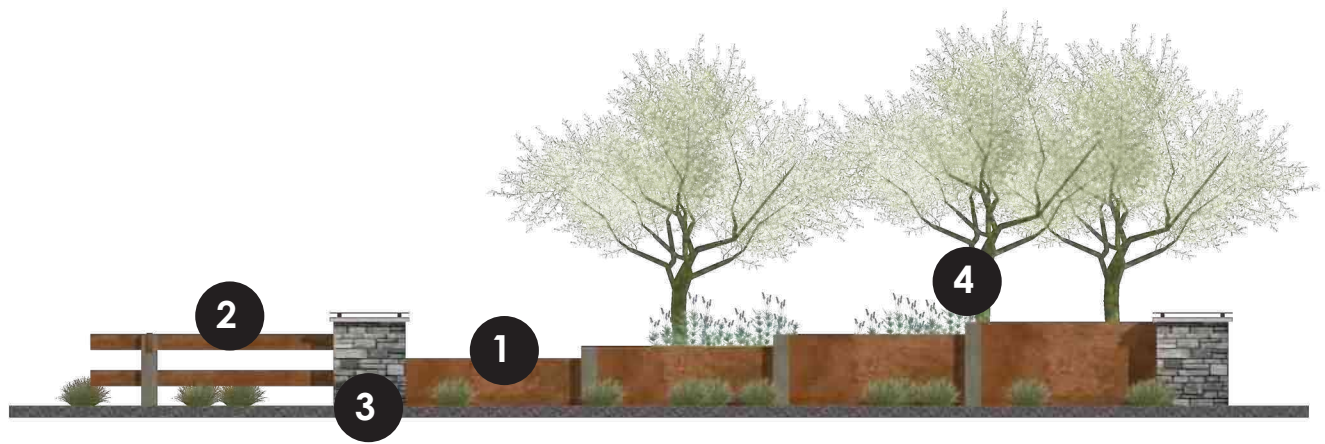
2. Corten cap to accomodate low profile lighting.

3. Cedar posts with corten brackets and galvanized hardware.

4. Corten steel rails.

Perspective View (single rail option)





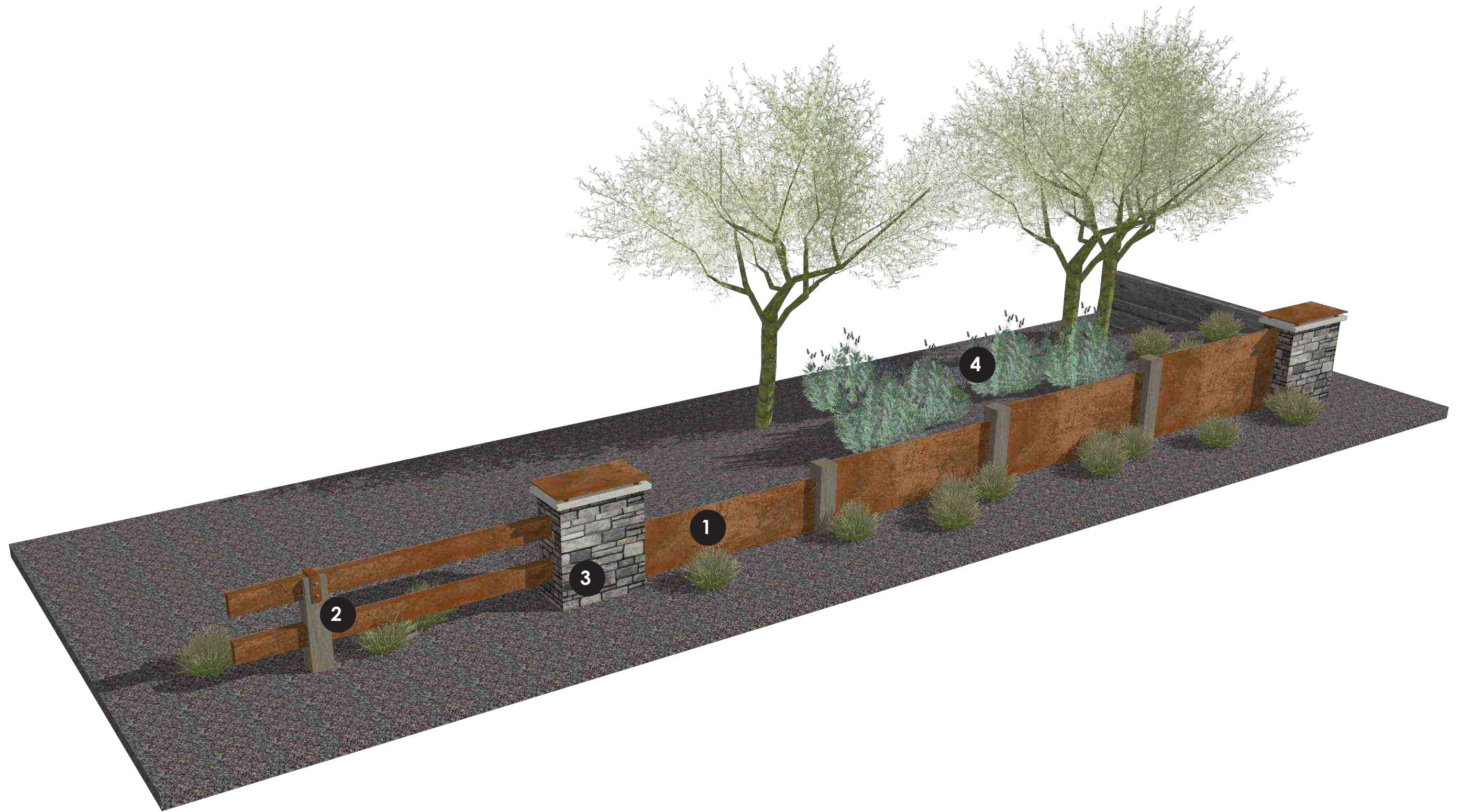
1. Small corten steel retaining walls (1'-4' maximum) as needed.

2. Cedar posts with corten rail fence.

3. Decorative pillar with stone veneer.

4. Plantings on berm behind wall.





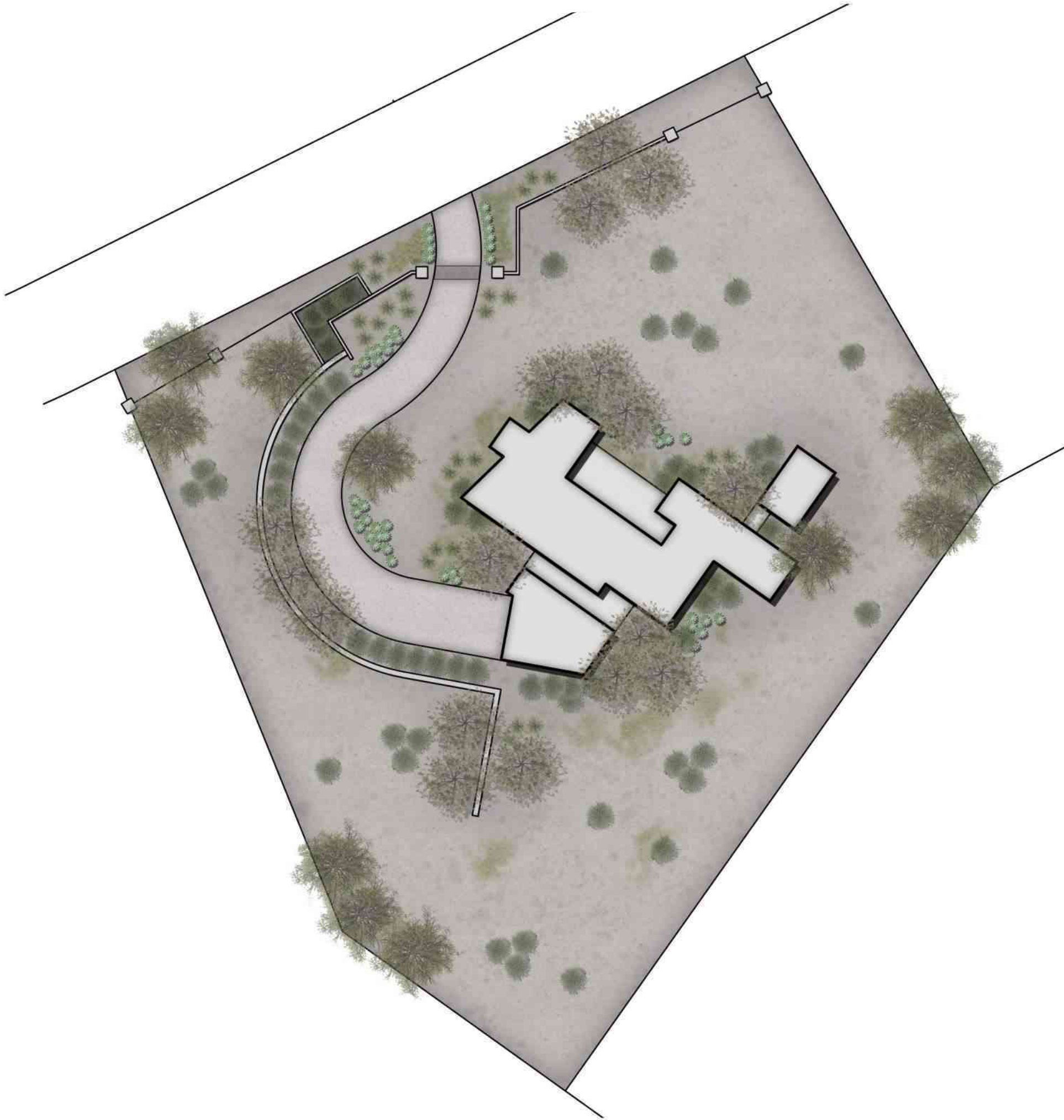
1. Small corten steel retaining walls (1'-4' maximum) as needed.

2. Cedar posts with corten rail fence.

3. Decorative pillar with stone veneer.

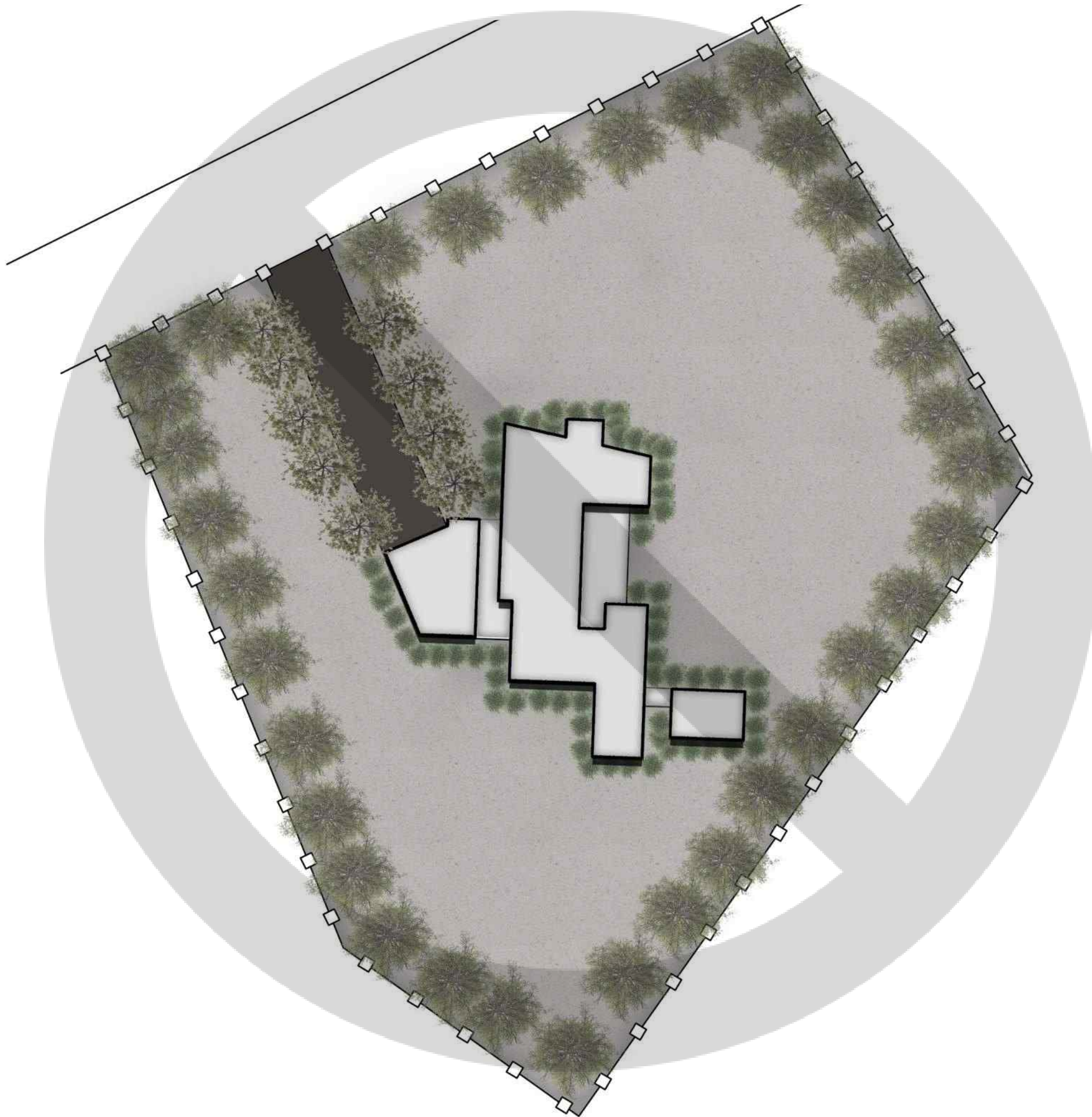
4. Plantings on berm behind wall.

standards



Correct Design Standards

1. Variety of fencing, walls, and railing is used along roadway frontage.
2. Gate is centered along the lot frontage.
3. Driveway is curved and does not create a "tunnel effect" towards the home.
4. Specific areas are chosen for focal plantings. Other plantings are natural groupings.
5. Trees and large vegetation is used to frame the home and transitions back to native vegetation throughout the property.
6. Different wall types and raised planters are used for retaining.
7. Small groupings of trees are used to frame property corners or edges but no solid fence is used on property lines.
8. Home is generally centered on the lot and allows for sufficient buffer between neighboring homes.
9. Driveway is a natural colored pavement such as exposed aggregate concrete rather than asphalt.

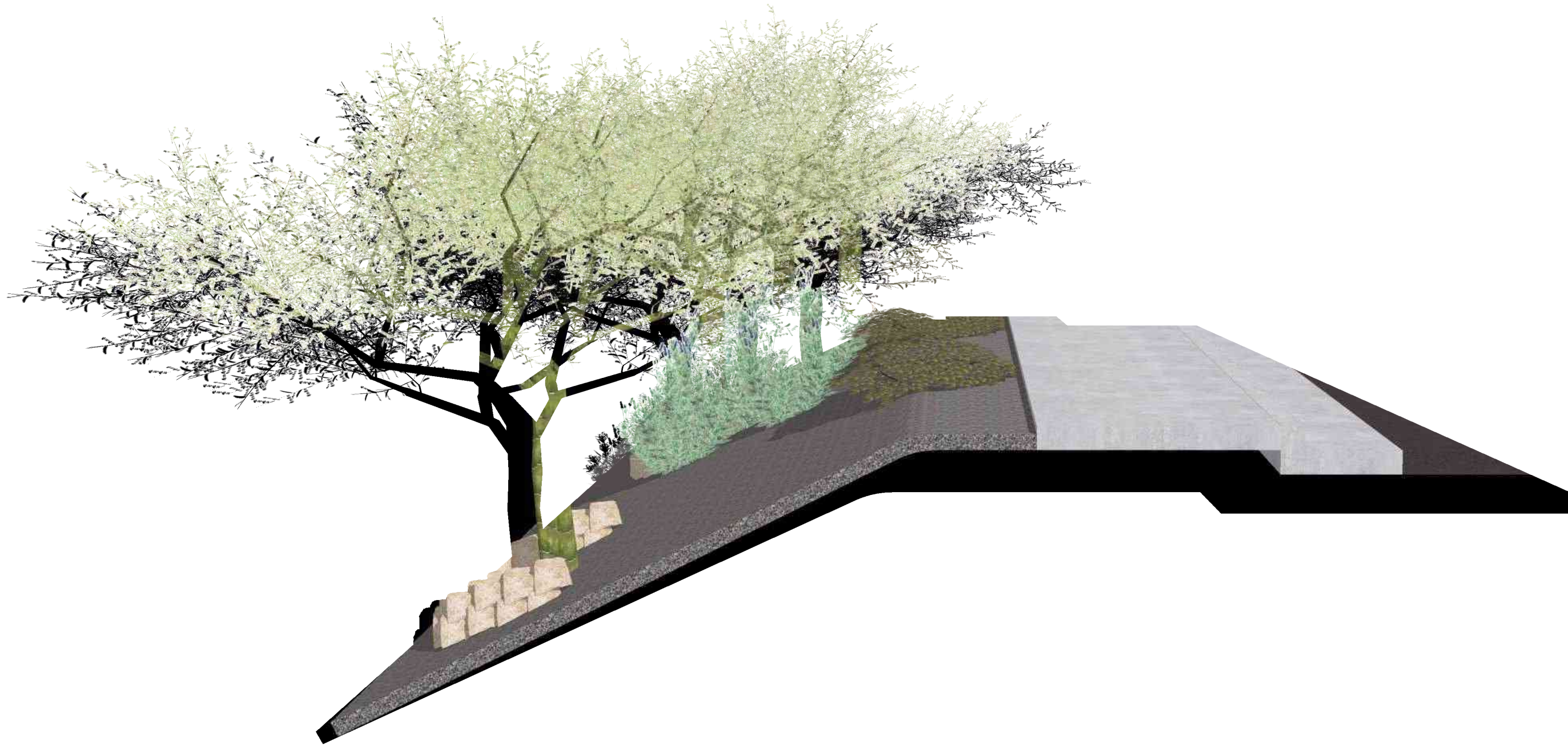


Incorrect Design Standards

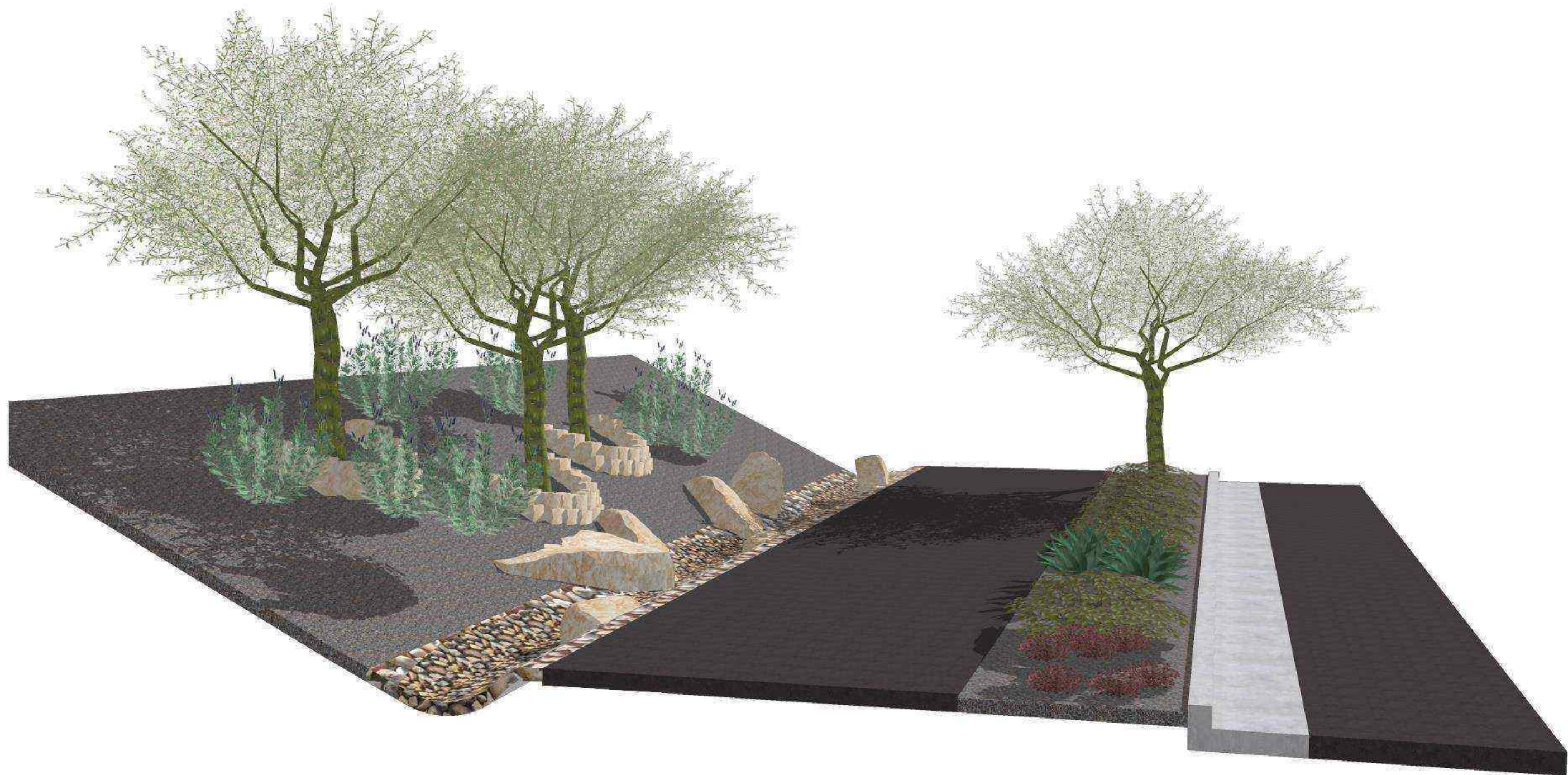
1. Driveway is perpendicular to the roadway and leads straight to the home.
2. A solid fence is used along the entire property line.
3. Non-native vegetation is used as a barrier along the driveway and property lines.
4. Gate standards with paver band have not been implemented.
5. Planting around the home is uniform, unnatural, and does not highlight the architecture or frame views.
6. There is no transition to from tall non-native to low growing native vegetation.
7. Asphalt driveway stands out and does not match natural colors in the area.



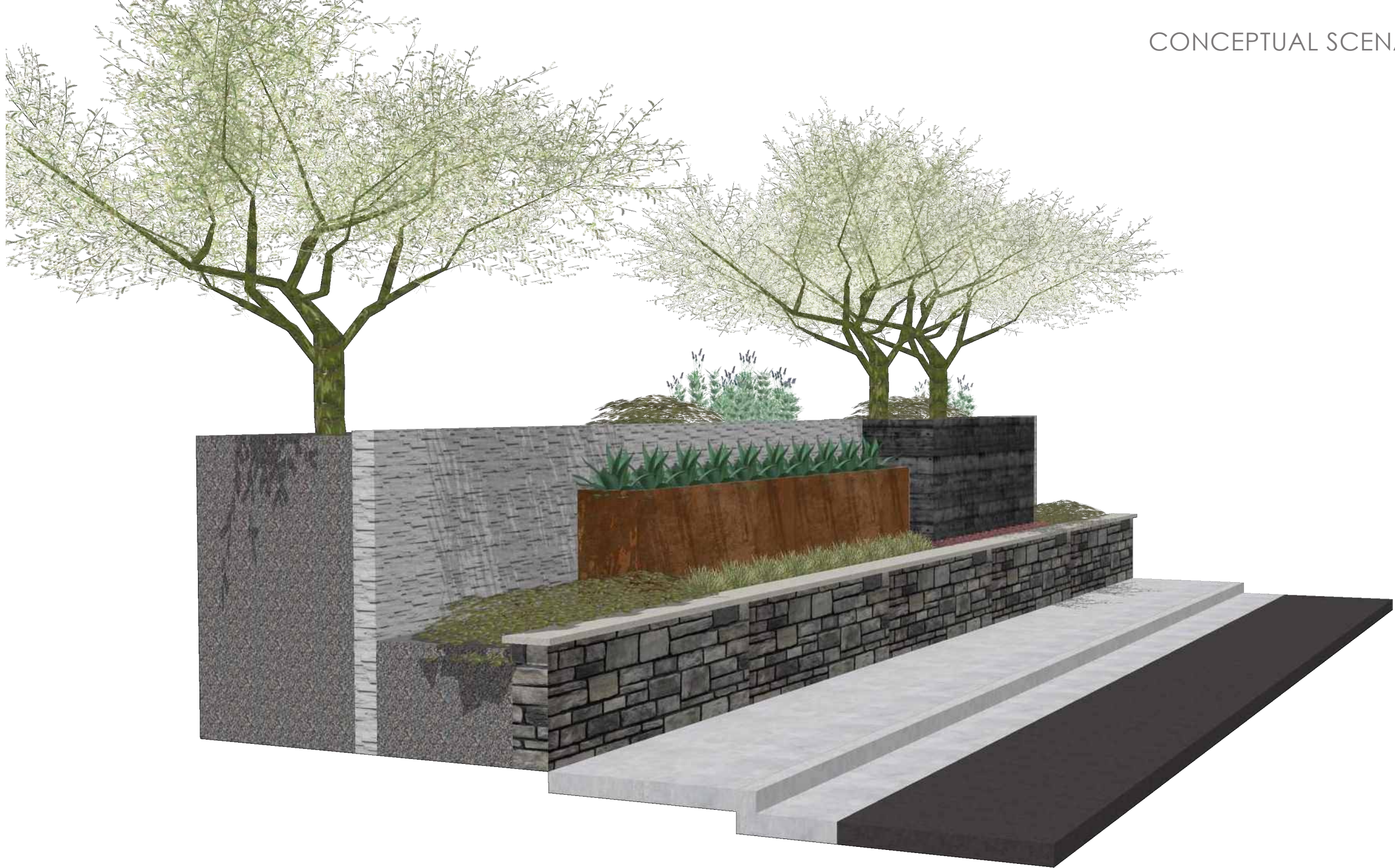
In scenarios with a parkstrip and sidewalk/trail the park strip should vary between groupings of dense formal plantings and natural open plantings. Retaining walls adjacent to sidewalks/trails that have parkstrips can be taller with fewer terraces.



Cut/fill slopes adjacent to curb back sidewalks/trails should be include natural groupings of low density plantings.



In scenarios with a curb back sidewalk and no parkstrip where retaining walls are present, the walls should be terraced so the corridor feels more open. Plantings should be dense and formal on middle levels and natural and open in areas above the wall.



In scenarios with a curb back sidewalk and no parkstrip where retaining walls are present, the walls should be terraced so the corridor feels more open. Plantings should be dense and formal on middle levels and natural and open in areas above the wall.

Proposed Conceptual Site Plan

Presentation

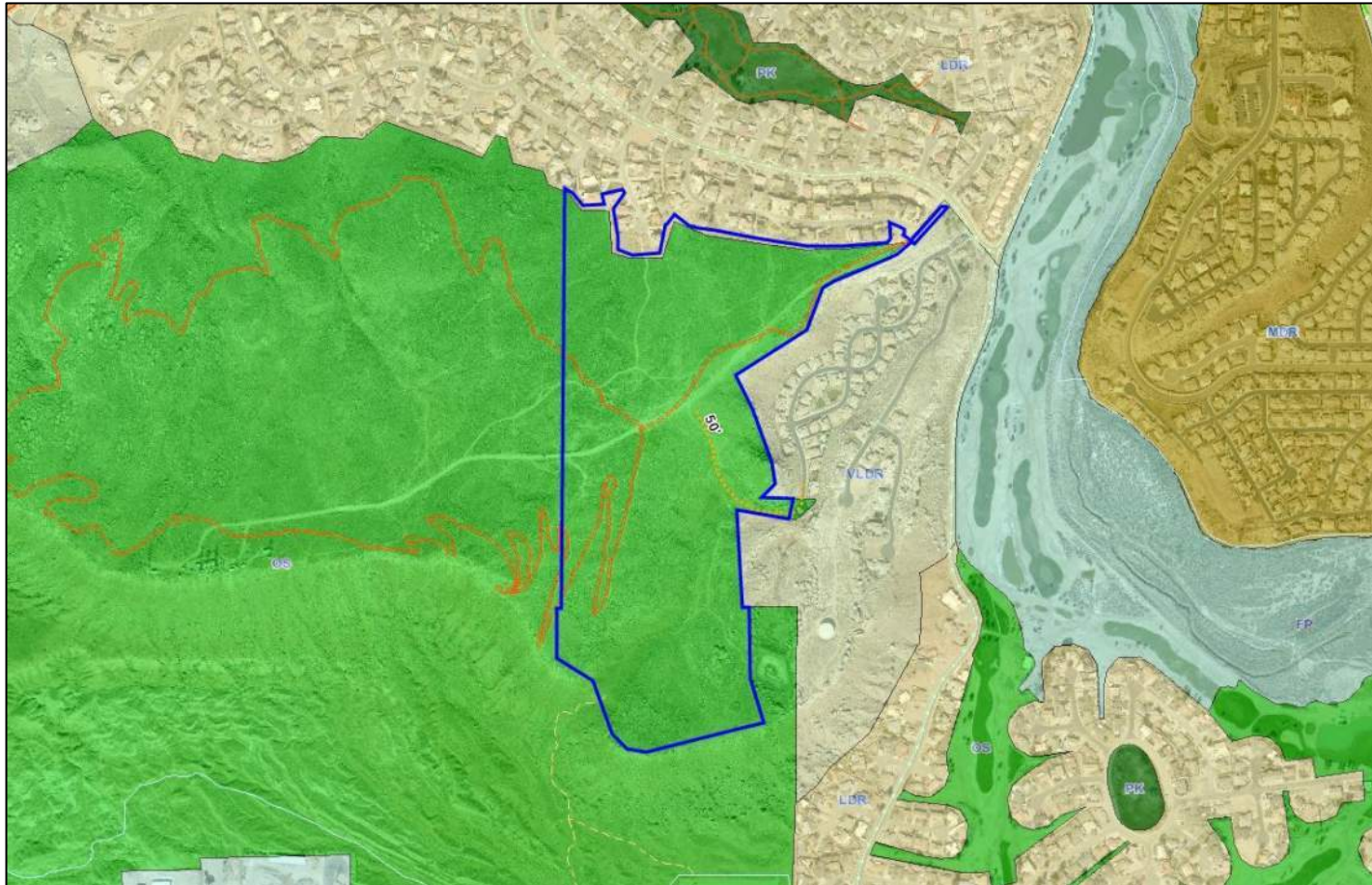
Summit Estates Zone Change Amendment

2020-ZCA-037

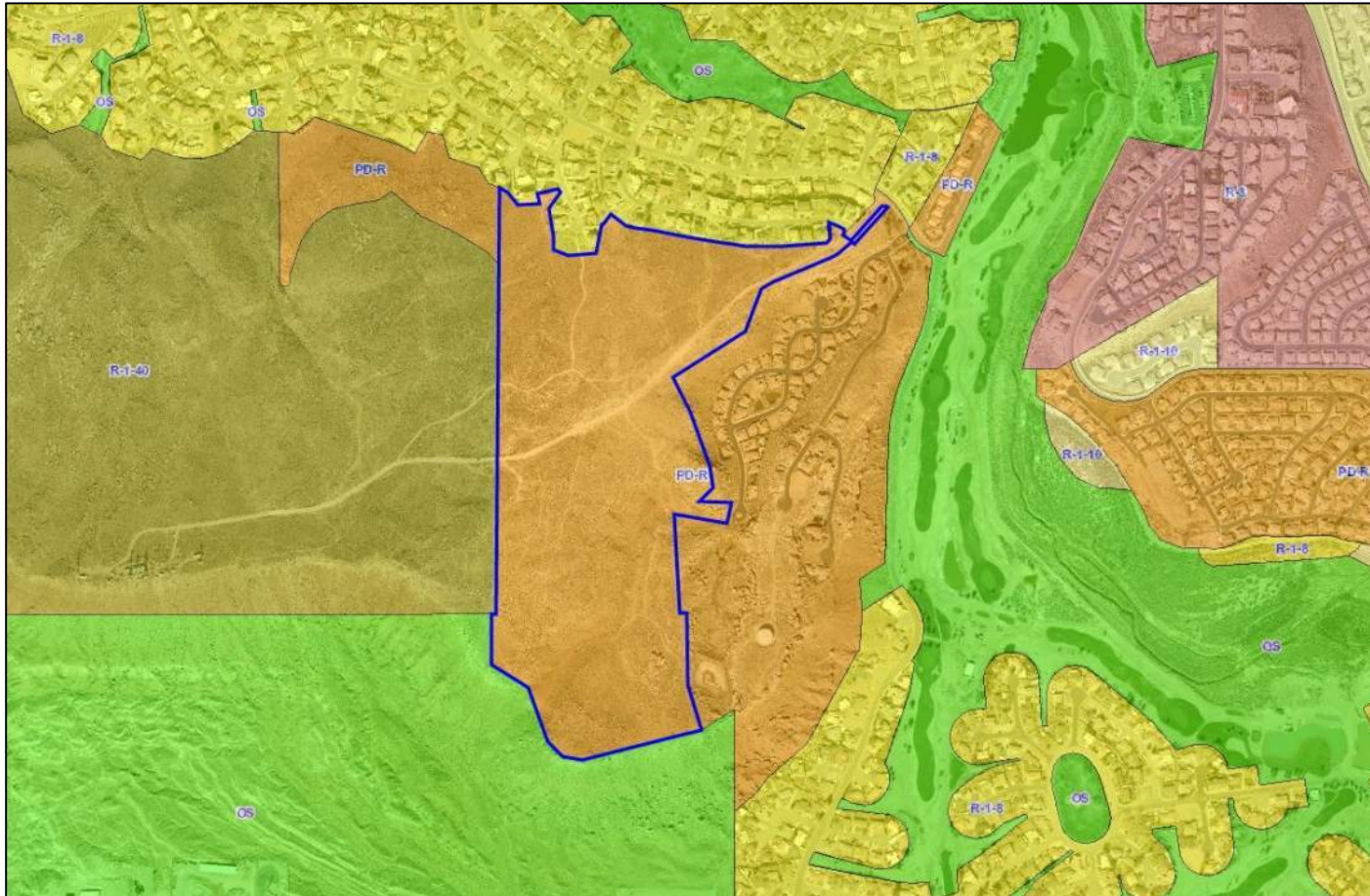
Vicinity Map



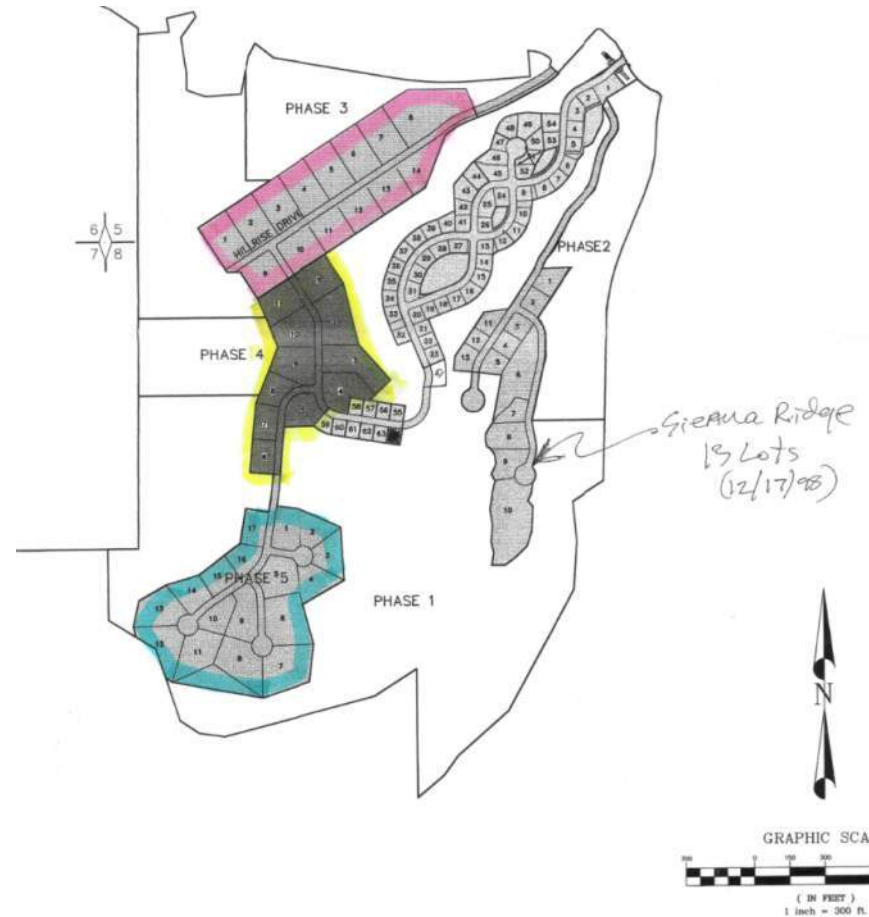
Land Use Map



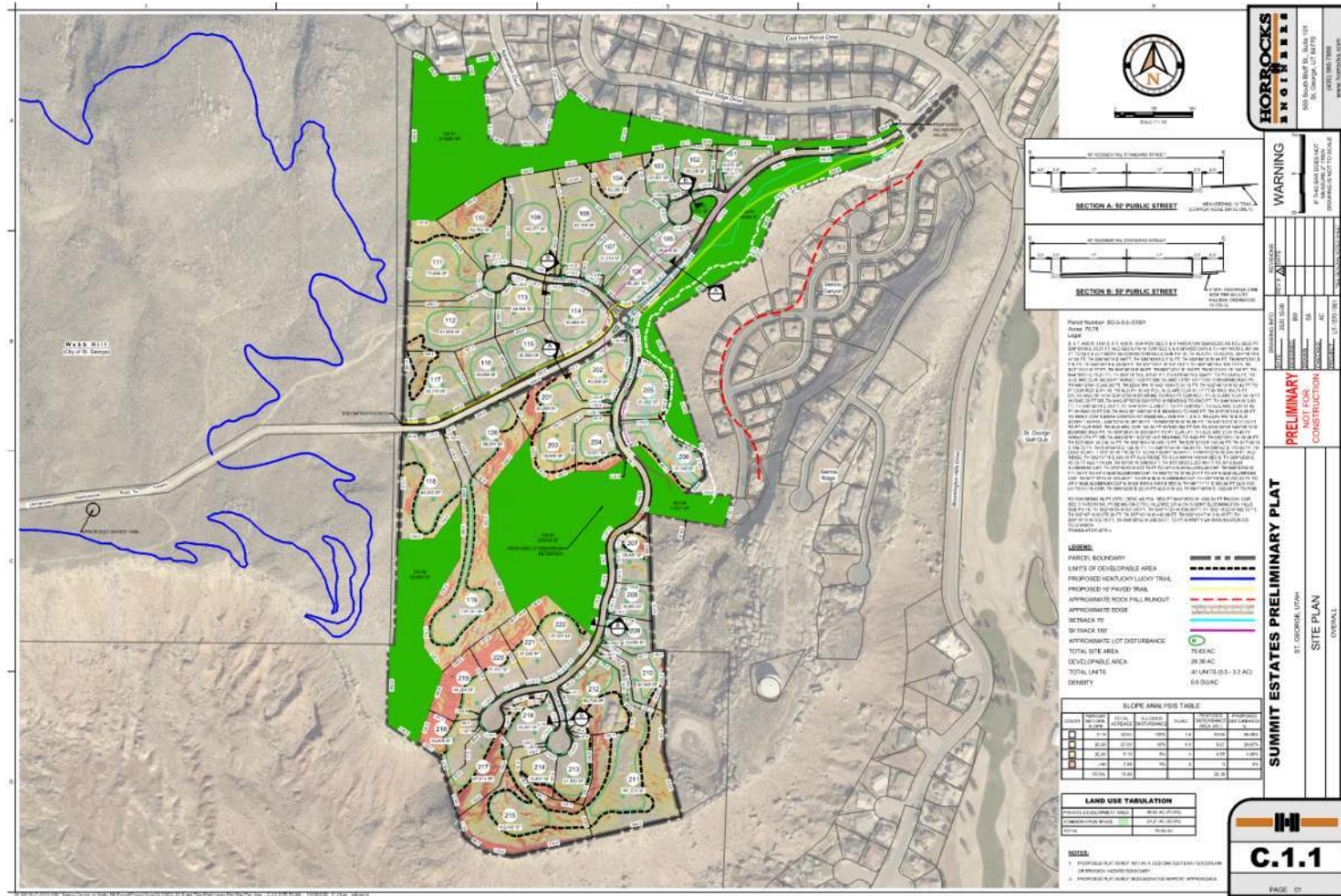
Zoning Map



1998 Agreement Layout



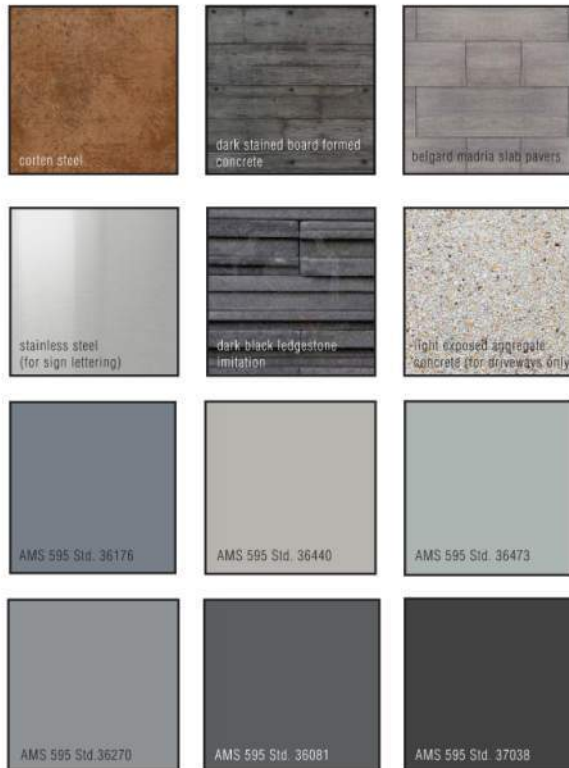
Conceptual Layout



Standards



Standards



5 color and texture palette



6 color and texture palette

Standards



Correct Design Standards

1. Variety of fencing, walls, and railing is used along roadway frontage.
2. Gate is centered along the lot frontage.
3. Driveway is curved and does not create a "tunnel effect" towards the home.
4. Specific areas are chosen for focal plantings. Other plantings are natural groupings.
5. Trees and large vegetation is used to frame the home and transitions back to native vegetation throughout the property.
6. Different wall types and raised planters are used for retaining.
7. Small groupings of trees are used to frame property corners or edges but no solid fence is used on property lines.
8. Home is generally centered on the lot and allows for sufficient buffer between neighboring homes.
9. Driveway is a natural colored pavement such as exposed aggregate concrete rather than asphalt.

Standards



PLANNING COMMISSION AGENDA REPORT: 10/13/2020

Zone Change

River Trail Townhomes PD Zone Change

Case No. 2020-ZCA-033

Request: Consider a Zone Change Amendment to the River Trails PD-R (Planned Development Residential) in order to move the road to the south, add a unit and make small adjustments to the site.

Applicant: Feller Ventures LLC

Representative: Todd Gardner, Alpha Engineering

Area: 4.86 Acres

Proposed Density: 8.64 Units per acre (up from 8.44 UPA)

Location: The property is generally located at 1400 East Riverside Drive.



Current Zone: PD-R (Planned Development Residential)

General Plan: MDR (Medium Density Residential)

Background:

In August of 2019, the City Council heard a request by the applicant to change the land use designation of the general plan on the subject property from LDR (Low Density Residential) to MDR (Medium Density Residential) in anticipation of this project. The City Council approved the application to change the general plan.

On June 23rd of this year, the Planning Commission heard a request to change the zoning to a PD-R which would allow 41 units on the subject property. The Planning Commission recommended approval of the application on a 7-0 vote. On July 9, 2020, the City Council approved the application as proposed.

The plan that was approved showed the access road from the future 1450 East would straddle the subject property and the property to the north. The applicant has been unable to secure an easement or purchase the property to the north for the access road and therefore needs to amend the site to show the property entirely on the site. This application does that. In so doing other small changes were made to the number of units (increased by one), amenities areas (slightly increased), density (increased from 8.44 to 8.64 units per acre) and the general layout. A zone change amendment is required to make these changes.

Proposed Site Details:

The site is currently vacant though the applicant has been preparing the property for future development. The floodplain has traditionally occupied a portion of the site. Recently, FEMA granted approval of a CLOMR that gives conditional approval to remove the floodplain from the property.

The city has plans to construct a road (1450 East) to the east of the subject property that will connect Riverside Drive to Foremaster Drive to the north. This road will give the proposed development the access it needs without having to access Riverside Drive directly. The road will be constructed in conjunction with this project if the project is approved. There will not be any connection to the development adjacent to the west.

The proposed revised site plan depicts three four-plex and ten three-plex buildings on a 4.86 acre site. This will yield a total of 42 total units which is an increase of one from the approved site plan. This is a density of 8.64 units per acre (medium density residential allows up to nine units per acre).

Parking: Under section 10-19-4(A)(4) of the St. George zoning code, each unit is required to provide two parking stalls, one of which must be covered, plus one stall for every three units for guest parking. With 42 units, this yields a total requirement of 84 stalls plus 14 stalls for guest parking. Each unit will have a two-car garage which will satisfy the requirements for each unit as

well as room in front of the unit to park two cars. Additionally, the site has been designed with 14 guest parking stalls.

Elevations: As previously discussed, the site depicts three four-plex buildings and ten three plex buildings. They will all be two stories at approximately 28' tall. The materials to be used are EIFS (stucco), and stone. The applicant is proposing two colors, tan and brown. Each unit will have its own two car garage.

Landscaping/Amenities: The site is required to maintain a minimum of 30% landscaping. The site has been designed with 36% landscaping (down from 38%). Additionally, a PD-R must provide usable recreation areas, in this case at least 8,200 sq ft. The site depicts two pavilions and a playground in two separate areas equaling 8,735 sq ft which will fulfill that requirement.

Recommendation:

Staff recommends approval of this Zone Change and PD plan as proposed.

Alternatives:

1. Recommend approval as presented.
2. Recommend approval with conditions.
3. Recommend denial.
4. Table the proposed zone change amendment to a specific date.

Possible Motion:

The Planning Commission recommends approval of the Zone Change for the River Trails Townhomes Planned Development.

Findings for Approval:

1. The proposed amendment meets the requirements of section 10-7F of the zoning code.
2. There will be adequate parking to facilitate the development.
3. The applicant is providing the appropriate amenities as required by the zoning code.

EXHIBIT A
PD-R ZONING NARATIVE

PD Written Text

In compliance with Section 10-8-4 of the Zoning Ordinance, the City of St George requires a written text to be submitted with a PD-R (Planned Development Residential) zone change application. The following is the written text for the **Riverwalk Townhomes** project:

- A. Use of Land: The projected use of land, including percentages of land devoted to various types of land use, such as building coverage, parking area, landscaped area, etc.:

It is proposed to develop townhomes on approximately 4.86 acres near approximately 1400 East Riverside Drive. Approximately 23% of land will be devoted to building coverage, with 36% dedicated to landscape and 41% will consist of asphalt and pavement.

- B. Height and Elevations: The text shall indicate the type, character and proposed height of all buildings. The plot plan, elevations and perspective drawings may be prepared as necessary by the applicant to help the planning commission and city council to better understand the proposal.

General elevations and a materials board are attached with the PD-R application. Pictures of the same building that were constructed in another municipality of Washington County have also been included

- C. Density: The density in terms of dwelling units per gross acre of land shall be indicated.

There are 42 total dwelling units on 4.86 acres of land, for a density of 8.64 dwelling units per acre.

- D. Schools, Churches And Open Spaces: The location of any proposed school sites, churches, parks or other common or open spaces shall be identified.

There are no school sites or churches planned with this project. Common spaces include the publicly owned roadways, driveways, continuation of a city asphalt trail, and landscaping. There is a total of 3.8 acres devoted to common space.

- E. Phasing Plan: A phasing plan, if the development is proposed to be developed in phases, shall be submitted.

N/A - The property will not be developed in multiple phases.

- F. Topography: Topography at contour intervals of two feet (2') shall be submitted unless waived by the planning staff.

The drawings contain 2-foot existing contours obtained from a drone flight. A preliminary rough finish grade has also been provided and is shown with 2-foot contours. More detailed topographical information will be provided with the construction drawing grading plan. The entire site slopes east into Rimrock wash.

- G. Landscape Plan: A landscape plan showing the general location of lawn area and trees shall be submitted (this may be a part of the site or plot plan).

A preliminary landscape plan has been provided as part of the site plan. All landscaping shall comply with Title 10 Chapter 25 "Landscaping" of the St George Zoning Ordinance, and will be coordinated with the City for the construction drawings.

- H. Area Reserved for Landscaping: The amount of land area reserved for landscaping shall be indicated.

Area reserved for landscaping is shown on the site plan. Detailed landscape drawings will be provided with construction drawings after the preliminary plat is approved. Based on the current design, approximately 1.7 acres of landscaping is anticipated.

- I. Utilities: All utilities shall be underground unless otherwise approved by the city council and upon recommendation of the water and power director. Transformer equipment shall be screened from streets and from adjacent properties.

All utilities will be coordinated with the respective entities through the Joint Utility Committee process as per the standards and recommendations of each entity. It is anticipated that all new utilities will be underground but are subject to the direction of each entity.

- J. Refuse Storage Areas: Refuse storage areas shall be screened so that materials stored within these areas shall not be visible from access streets, freeways and adjacent properties.

Individual garbage collection will be used throughout the site.

- K. Lighting Plan: The plans submitted shall include a general lighting plan indicating location of lights to be installed on the site.

A photometric plan has been submitted with the zone change application.

- L. Turning Space: Safe and convenient turning space shall be provided for cars, sewer vehicles, refuse collection vehicles, firefighting equipment, etc., at the end of private drives and dead-end streets. (1998 Document § 17-4; amd. 2003 Code)

Traffic circulation details will be provided as a part of the SPR (Site Plan Review) application. Safe and convenient turning space shall be demonstrated for cars, trucks, sewer vehicles, refuse collection vehicles, firefighting equipment, etc.

- M. Signs: Overall sign program if proposed signage differs from what is allowed as outlined in the sign ordinance set forth in [title 9, chapter 13](#) of this code. (Ord. 1-3-2000, 1-20-2000)

All signs shall follow the sign ordinance, be coordinated with the City as part of the SPR application, and be shown on subsequent site plans.

[illegible]

[illegible]

[illegible]





EXIHIBIT E
POWERPOINT PRESENTATION

River Trail Townhomes PD Zone Change Amendment

Approximately 1400 East Riverside Drive
2020-ZCA-033

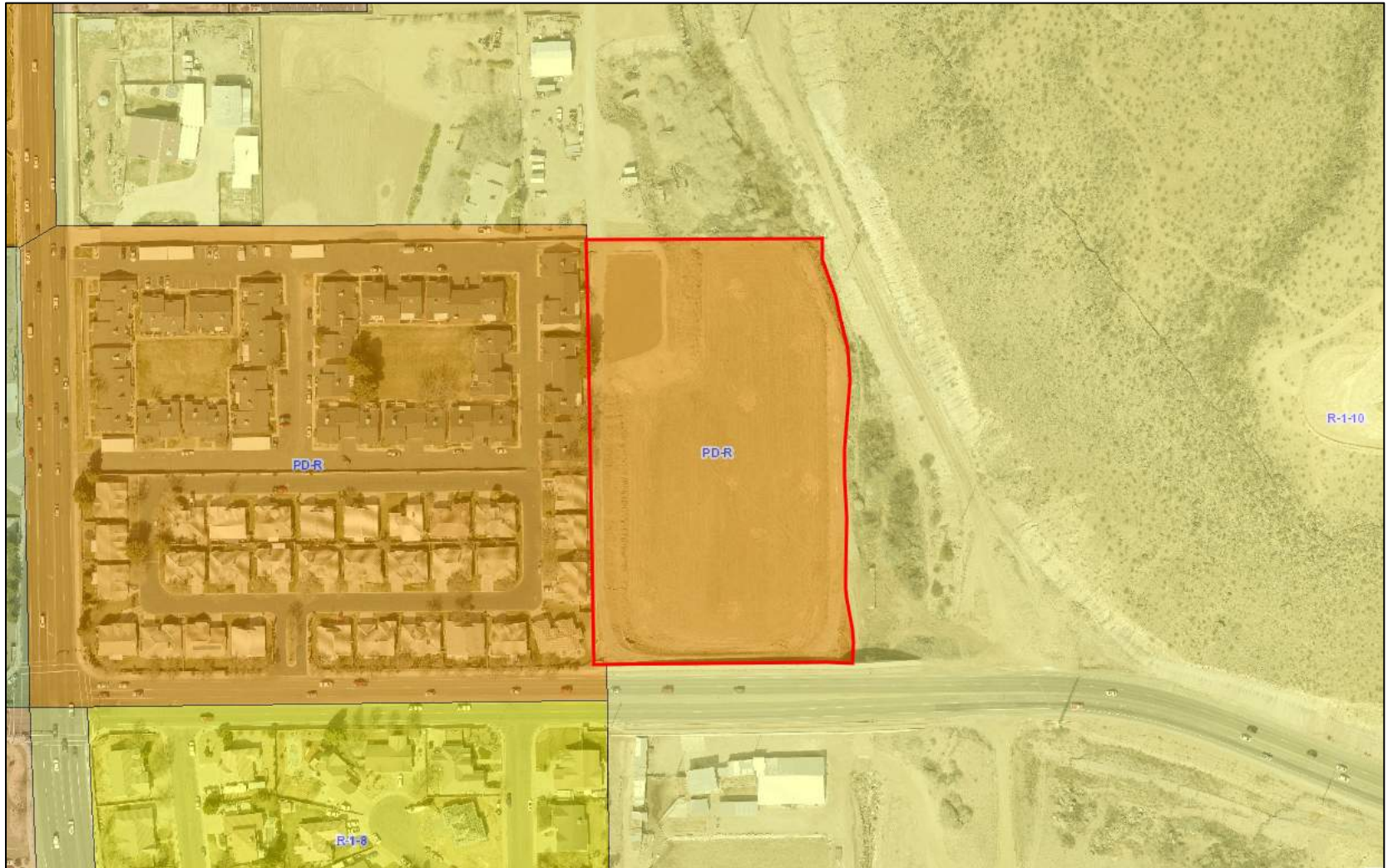
Vicinity Map



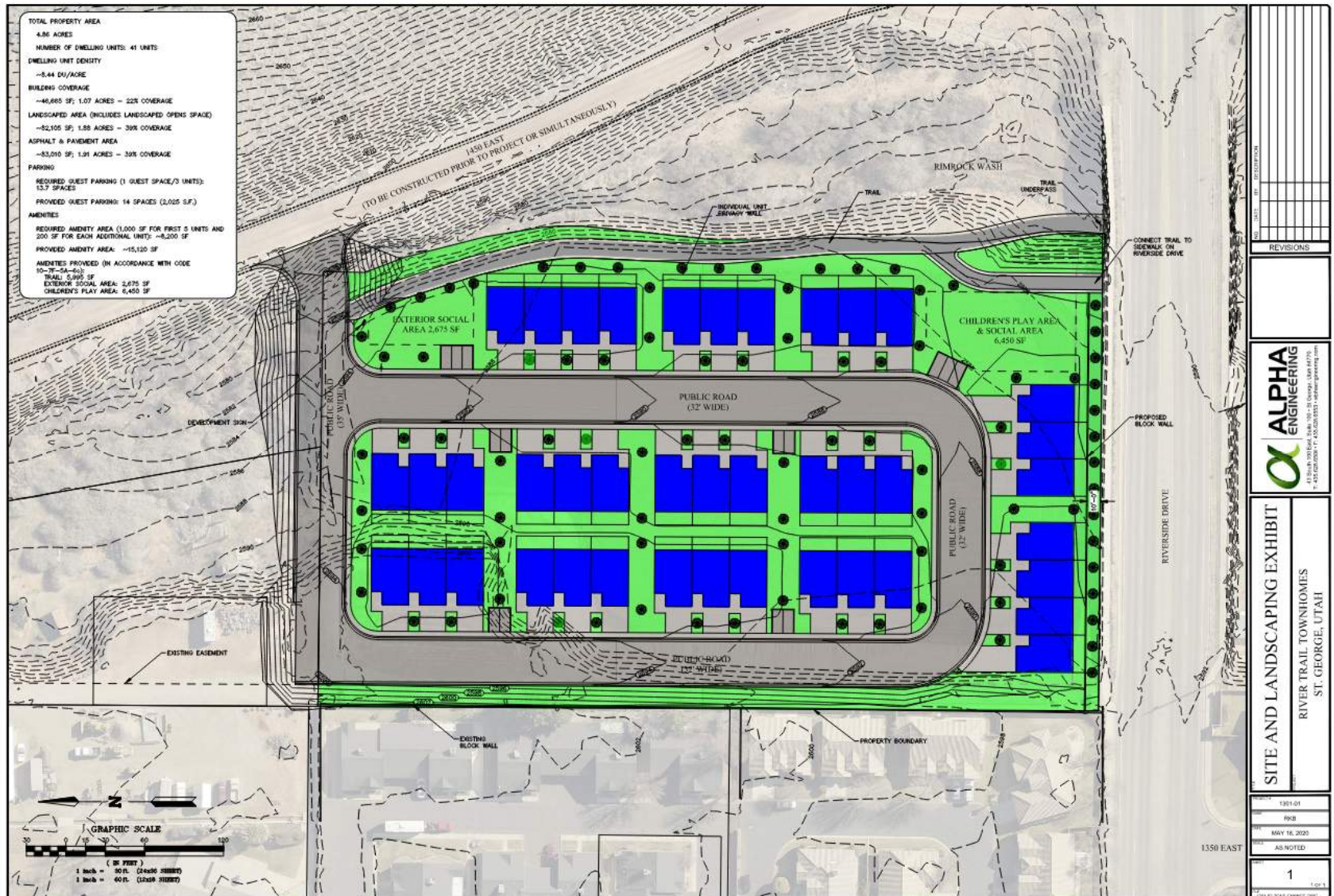
General Plan Map



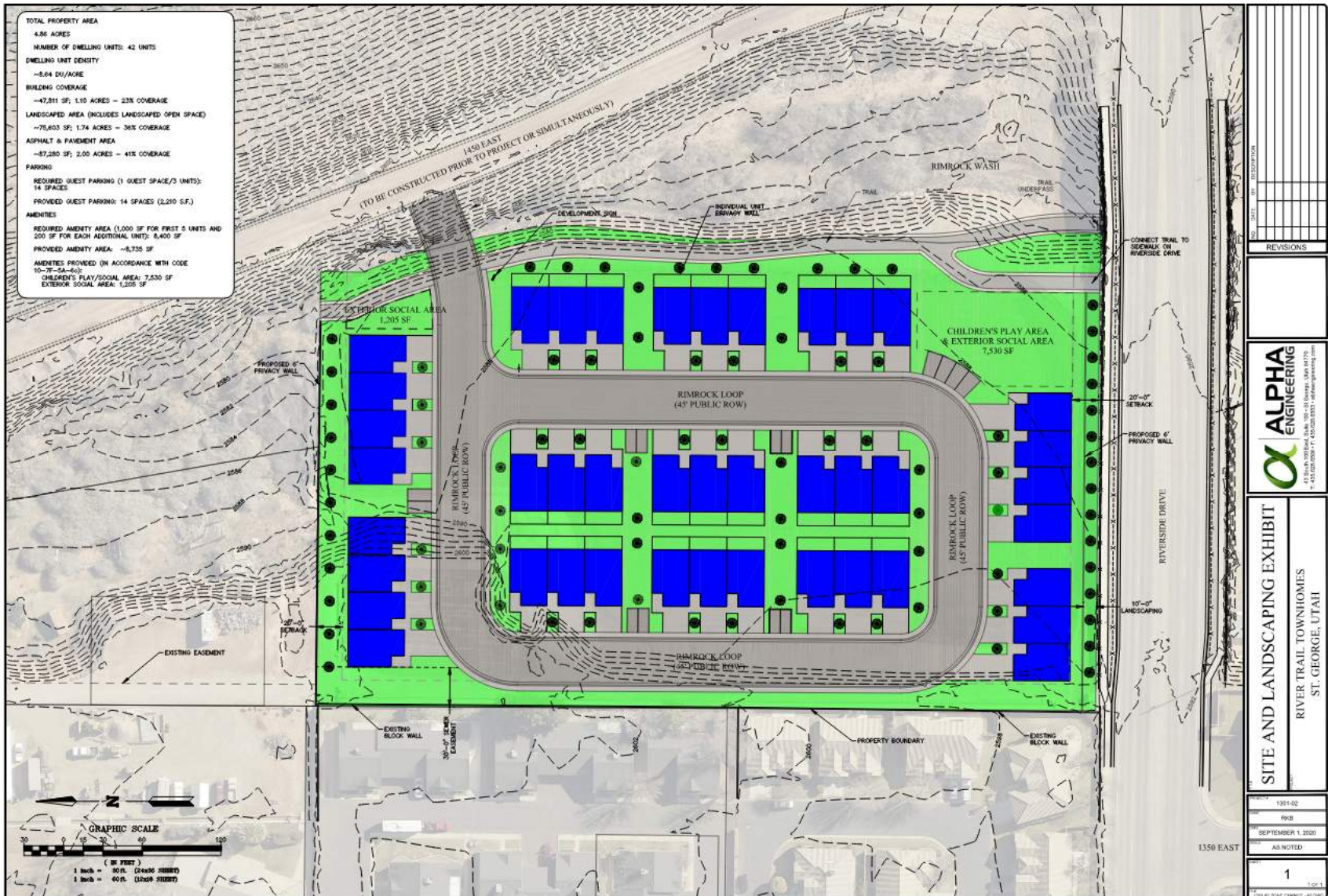
Zoning Map



Current Site Plan



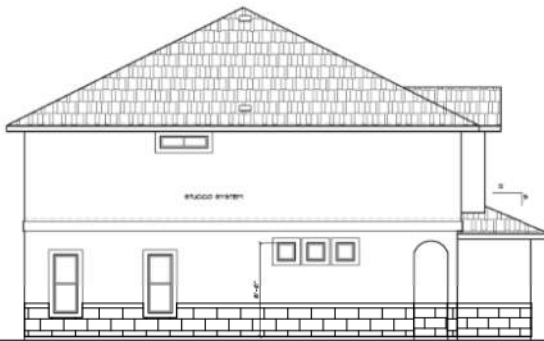
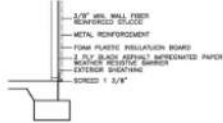
Proposed Site Plan



Building Elevations

STUCCO NOTES:

Install stucco system/finish as per manufacturer specifications and use the following guidelines: 2" min. to finish concrete, at least 1/2" clearance under eaves, if no clearance to finish, stucco must be applied to the exterior wall. If any conditions are not met, weather barrier on all exterior walls to be a two (2) mil mineral impregnated paper or equivalent.



LEFT ELEVATION
SCALE 1/4"

GENERAL NOTES:

All exterior doors shall have a floor of landing or entry area of the door. The floor or landing of the door shall not be more than 1/2" below the top of the threshold. If the door is set 2" or more, the landing shall not exceed 2" from the top of the threshold. All landings shall not be less than 36" wide, measured in the direction of travel.

GENERAL NOTES:

Connections with rods and washers securing the roof shall be made and approved by the general contractor. The general contractor shall verify all existing conditions and dimensions before the construction. Note that all window dimensions take precedence over manufacturer specifications for installation of materials and be verified.

ATTIC VENTILATION NOTES:

The net free ventilation area shall not be less than 1/300th of the total volume of the attic space. The net free ventilation area shall be verified in the upper portion of the space to be ventilated. The other 2/3 shall be provided by a central intake system or attic located in the lower portion of the roof.

EXCAVATION NOTES:

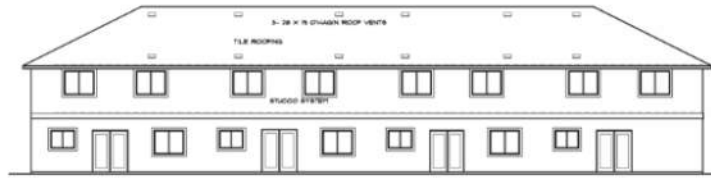
All footings shall have a minimum 12" of compacted fill or an equivalent material to be placed around the footing. The footing shall be placed on a minimum 4" of compacted fill. A minimum edge of 24" shall be maintained for the foot 12" x 12" with 1/2" slope transfer to adjacent drainage area.

WINDOW NOTES:

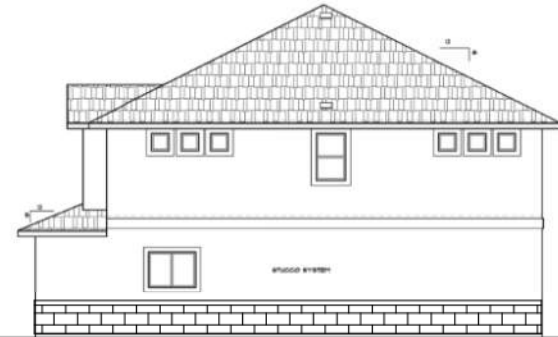
Window frames are to have a finished sill height max of 48" from the ground. Windows to have 24" min. clear width and 24" min. clear height. Window frames are to be a min. of 6.5 sq. ft. Windows to be set at 1/12th of the sill to the frame and 1/20th of the sill to the frame. Windows within 18" of the floor to be of tempered glass.

ROOF VENTILATION CALC:

100 x 100 ft. ROOF AREA
100 x 100 ft. ROOF AREA
3- 28 x 18 CHIMNEY ROOF VENTS
1 ROOF TOPPING VENT
3 28 x 18 CHIMNEY ROOF VENTS
1 ROOF TOPPING VENT



REAR ELEVATION
SCALE 1/8"



RIGHT ELEVATION
SCALE 1/8"



FRONT ELEVATION
SCALE 1/4"

PLAN #
4Plex

SCOTT D. HUGHES
1304 W PROVINCE WAY
ST. GEORGE, UT 84770
435-566-9012

PARADISE
SCENE DESIGN

DATE: 10/20/2024
SHEET: 1

Building Photograph



Building Photograph



Materials Board





PLANNING COMMISSION AGENDA REPORT: 10/13/2020

ZONE CHANGE: PUBLIC HEARING

Big Shots Golf

Case No. 2020-ZCA-036

Request: Consider a zone change amendment for the Desert Color Zone Plan to amend the “Big Shots” Golf Center (Driving Range).

Use: The use is an approved use under the Desert Color Zone Plan

Representative: Mr. Bob Hermandson, Bush & Gudgell, Inc.

Background: This is a request to amend the approved conceptual site plan, landscape plan, elevations, renderings, and the colors, and materials board for Big Shots a golfing destination facility. The original PD-C was approved on January 04, 2018. Several modifications are being proposed with this amendment. The elevations are being modified, height is being reduced, building size is slightly smaller, and adjustments have been made to the site plan.

Area: Approx. 10.65 acres

Property: This property is generally located at the intersection of the I-15 Freeway and the Southern Corridor.

Zoning: PD-C (Planned Development Commercial)

General Plan: TC (Town Center) [*Desert Color Master Plan*]

Building: 32,272 sq. ft.

Height: Approved - 45’-3”
Proposed - 36’

Setbacks: The required PD-C setbacks are:
F = 25 ft., Street Side = 25 ft., Side = 10 ft., and R = 10 ft.
Note: The project appears to meet and exceed the required setbacks and this will be verified during the SPR (Site Plan Review) process.

Parking: The proposed site plan meets the parking requirement and will be verified at SPR.

PARKING	STALL COUNT
RESTAURANT AREA - 4,000 SQ FT	40
RESTAURANT OUTDOOR AREA - 2,200	22
TEE BOXES- 52 TOTAL	104
TOTAL REQUIRED	166
TOTAL PROVIDED	215
ADA REQUIRED	7
ADA PROVIDED	8

Landscaping: Per Section 10-23 of the City of St. George Municipal Code, a landscape strip outside the public right of way along the front of the public streets, not less than 6 ft. and an average of at least 15 ft. wide shall be landscaped.

As presented, the landscaping appears to meet the requirements and staff will verify this during the SPR process.

Colors & Materials: The building materials and colors will be:
(As represented in the renderings and material samples provided)

Synthetic Stucco – Colors & textures

1. Sahara Finish – Revere #3102 – Senergy – BASF Corp.
2. Sahara Finish – Whale Gray #872 – Senergy – BASF Corp.

Cultured Stone

1. Eldorado Stone – Mountain Ledge Panels - Silverton

Metal Wall Panel

1. Standing Seam Metal Panels – Nucor Pearl Gray IR.47. SRI 54

Options: The Planning Commission has several options:

1. Deny the zone change amendment
2. Approve the zone change amendment as presented
3. Approve the zone change amendment with additional conditions
4. Table the zone change amendment to allow for additional information to be provided as determined.

EXAMPLE

Motion to Approve: Note: A motion to approve this planned development zone change amendment would need to include:

The Planning Commission recommends approval of the zone change amendment to amend the PD-C (Planned Development Commercial) zone on approximately 10.65 acres to develop “Big Shots Golf” as presented and recommends the following conditions and comments:

1. Zoning - Approve the PD-C zone change amendment on approx. 10.65 acres
2. Uses – This use is in harmony with the previously approved ‘Desert Color Master Plan.’
3. Site Plan – The conceptual layout(s) as presented is recommended for approval.
4. Colors & Materials – As presented the colors and materials are recommended for approval.
5. Setbacks – Setbacks shall meet the Zoning Ordinance (*staff will confirm during the SPR process*).
6. Landscaping – The applicant shall provide landscaping in compliance with the Landscape Ordinance (10-25).
7. Lighting - The applicant shall provide a photometric plan in compliance with the Lighting Ordinance (10-14)
8. SPR – Upon approval of the zone change amendment, the applicant shall submit an application for a SPR (Site Plan Review) along with the required civil engineering plan set which may include but not be limited to: cover sheet, site plan, grading plan, erosion control plan, utility plan, landscape plan, irrigation plan, and photometric plan.



Narrative



October 6, 2020

St George City
Community Development Department
175 North 200 East
St George, UT

Re: PD Zone Change 2nd Amendment

To whom it may concern:

We are submitting the 2nd Amendment to the PD Zone change for Big Shots due to the Following Reasons:

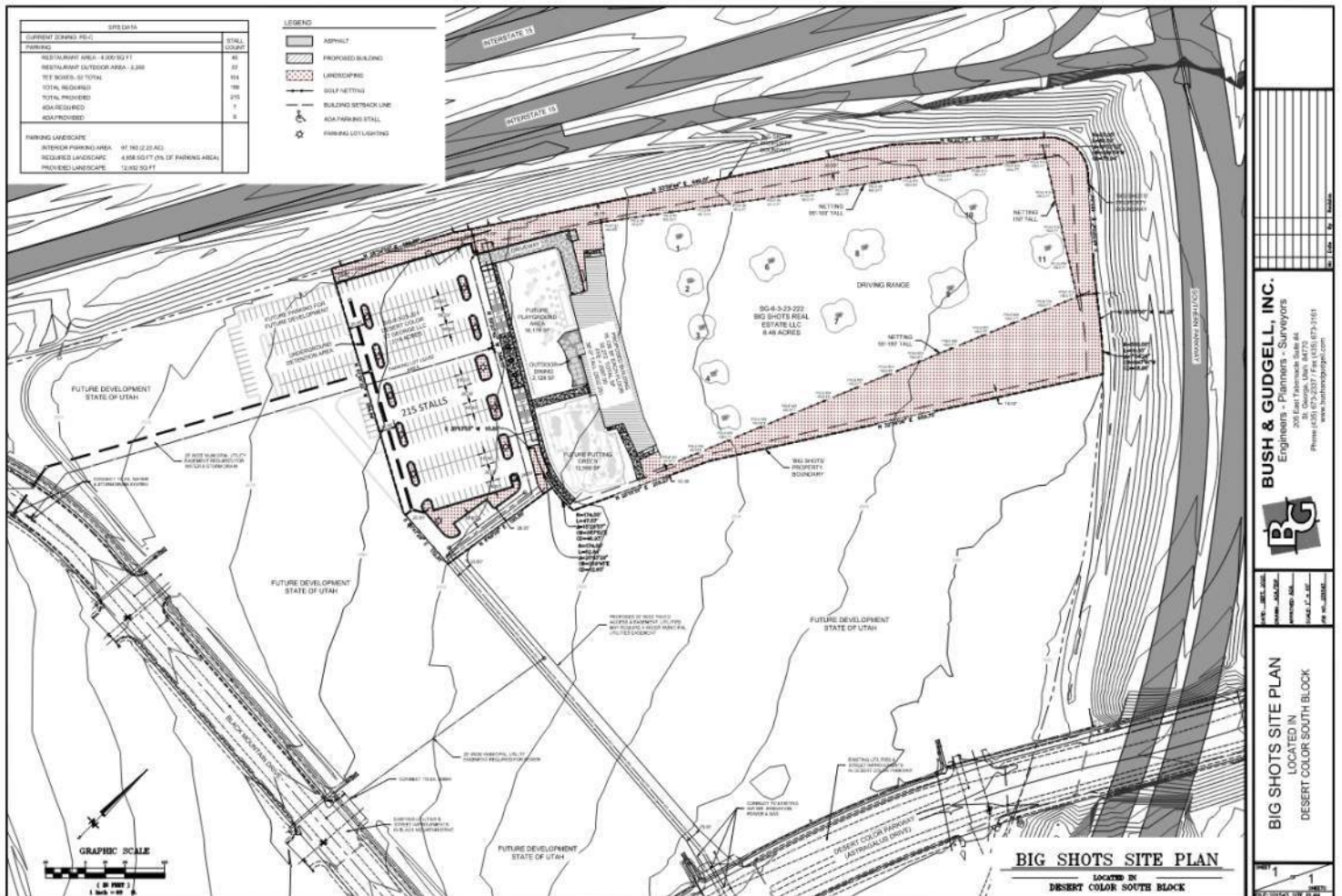
- 1-The building has been updated to the newest Generation 3 Big Shots Model, thereby changing its look
- 2-The building has been Pushed back to provide for more amenities and Landscaping out front of the building
- 3-The Parking Lot orientation has changed.

We appreciate your consideration on this item.

Sincerely,
Bush and Gudgell, Inc.

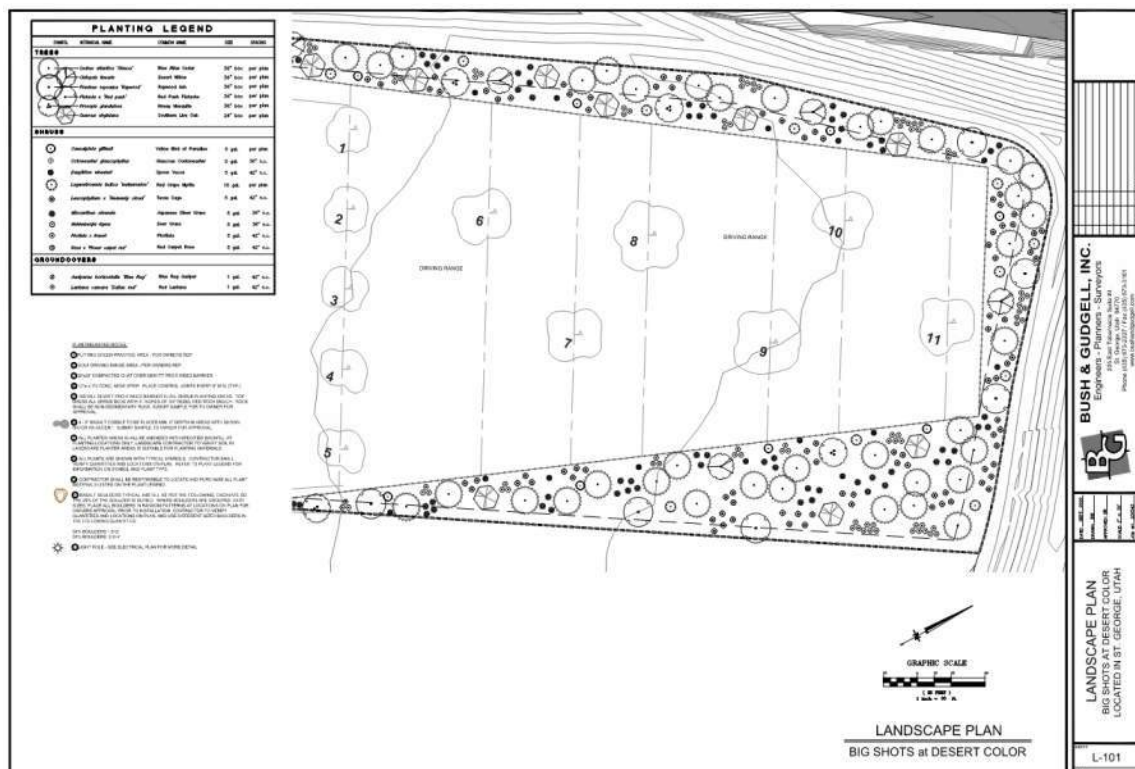
Adam Allen, PLS
Operations Manager

Concept Site Plan

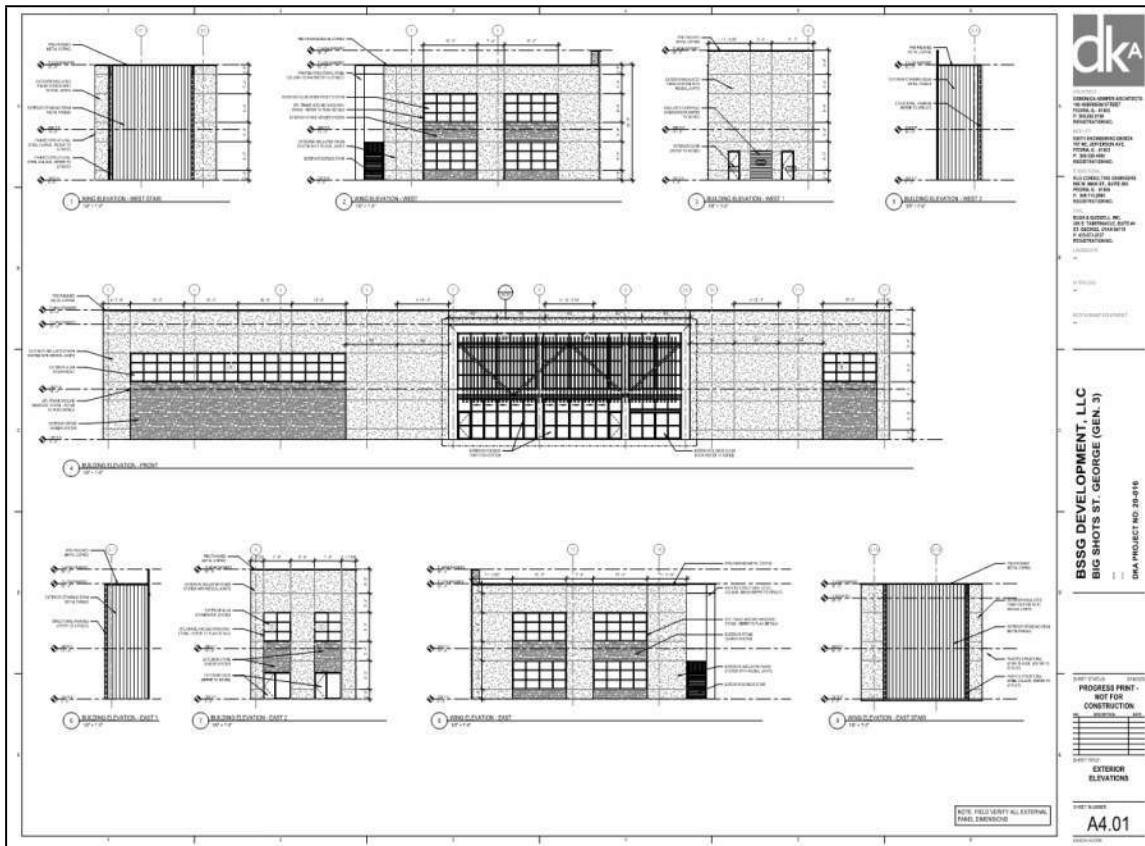


PLANTING LEGEND

TREES	SYMBOL	SYMBOL NAME	COUNTY NAME	SIZE	QUANTITY
1		Silver Cholla (Yucca elata)	10'	10'	10'
2		Desert Willow (Quercus agrifolia)	10'	10'	10'
3		Silver Cholla (Yucca elata)	10'	10'	10'
4		Silver Cholla (Yucca elata)	10'	10'	10'
5		Silver Cholla (Yucca elata)	10'	10'	10'
6		Silver Cholla (Yucca elata)	10'	10'	10'
7		Silver Cholla (Yucca elata)	10'	10'	10'
8		Silver Cholla (Yucca elata)	10'	10'	10'
9		Silver Cholla (Yucca elata)	10'	10'	10'
10		Silver Cholla (Yucca elata)	10'	10'	10'
11		Silver Cholla (Yucca elata)	10'	10'	10'
12		Silver Cholla (Yucca elata)	10'	10'	10'
13		Silver Cholla (Yucca elata)	10'	10'	10'
14		Silver Cholla (Yucca elata)	10'	10'	10'
15		Silver Cholla (Yucca elata)	10'	10'	10'
16		Silver Cholla (Yucca elata)	10'	10'	10'
17		Silver Cholla (Yucca elata)	10'	10'	10'
18		Silver Cholla (Yucca elata)	10'	10'	10'
19		Silver Cholla (Yucca elata)	10'	10'	10'
20		Silver Cholla (Yucca elata)	10'	10'	10'
21		Silver Cholla (Yucca elata)	10'	10'	10'
22		Silver Cholla (Yucca elata)	10'	10'	10'
23		Silver Cholla (Yucca elata)	10'	10'	10'
24		Silver Cholla (Yucca elata)	10'	10'	10'
25		Silver Cholla (Yucca elata)	10'	10'	10'
26		Silver Cholla (Yucca elata)	10'	10'	10'
27		Silver Cholla (Yucca elata)	10'	10'	10'
28		Silver Cholla (Yucca elata)	10'	10'	10'
29		Silver Cholla (Yucca elata)	10'	10'	10'
30		Silver Cholla (Yucca elata)	10'	10'	10'
31		Silver Cholla (Yucca elata)	10'	10'	10'
32		Silver Cholla (Yucca elata)	10'	10'	10'
33		Silver Cholla (Yucca elata)	10'	10'	10'
34		Silver Cholla (Yucca elata)	10'	10'	10'
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38		Silver Cholla (Yucca elata)	10'	10'	10'
39		Silver Cholla (Yucca elata)	10'	10'	10'
40		Silver Cholla (Yucca elata)	10'	10'	10'
41		Silver Cholla (Yucca elata)	10'	10'	10'
42		Silver Cholla (Yucca elata)	10'	10'	10'
43		Silver Cholla (Yucca elata)	10'	10'	10'
44		Silver Cholla (Yucca elata)	10'	10'	10'
45		Silver Cholla (Yucca elata)	10'	10'	10'
46		Silver Cholla (Yucca elata)	10'	10'	10'
47		Silver Cholla (Yucca elata)	10'	10'	10'
48		Silver Cholla (Yucca elata)	10'	10'	10'
49		Silver Cholla (Yucca elata)	10'	10'	10'
50		Silver Cholla (Yucca elata)	10'	10'	10'
51		Silver Cholla (Yucca elata)	10'	10'	10'
52		Silver Cholla (Yucca elata)	10'	10'	10'
53		Silver Cholla (Yucca elata)	10'	10'	10'</



Elevations



Renderings



Renderings (Continued)



Renderings (Continued)



Previous Rendering (2017)



Power Point Presentation

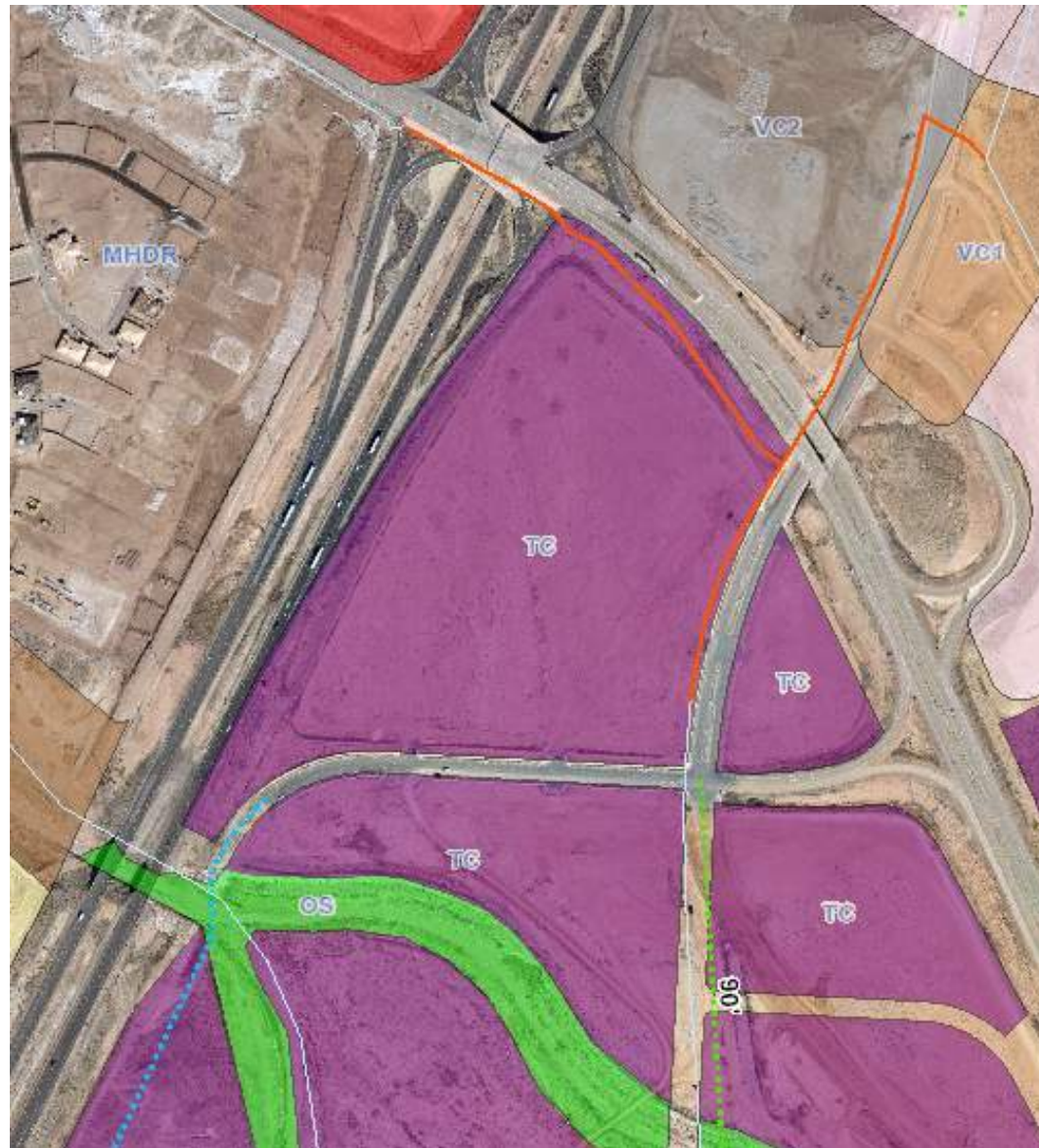
Big Shots PD-C Amendment

2020-ZCA-036

Zoning

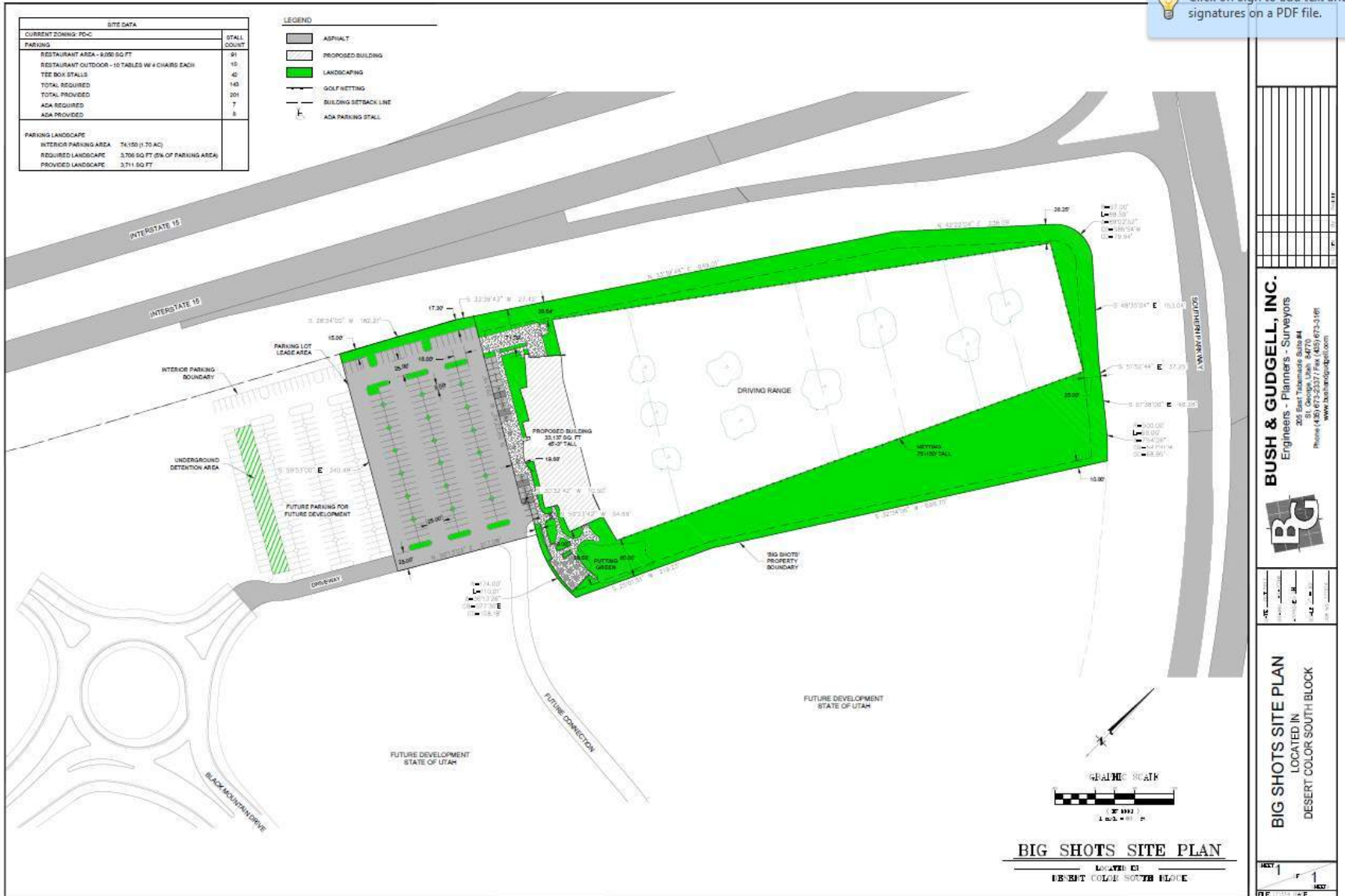


General Plan

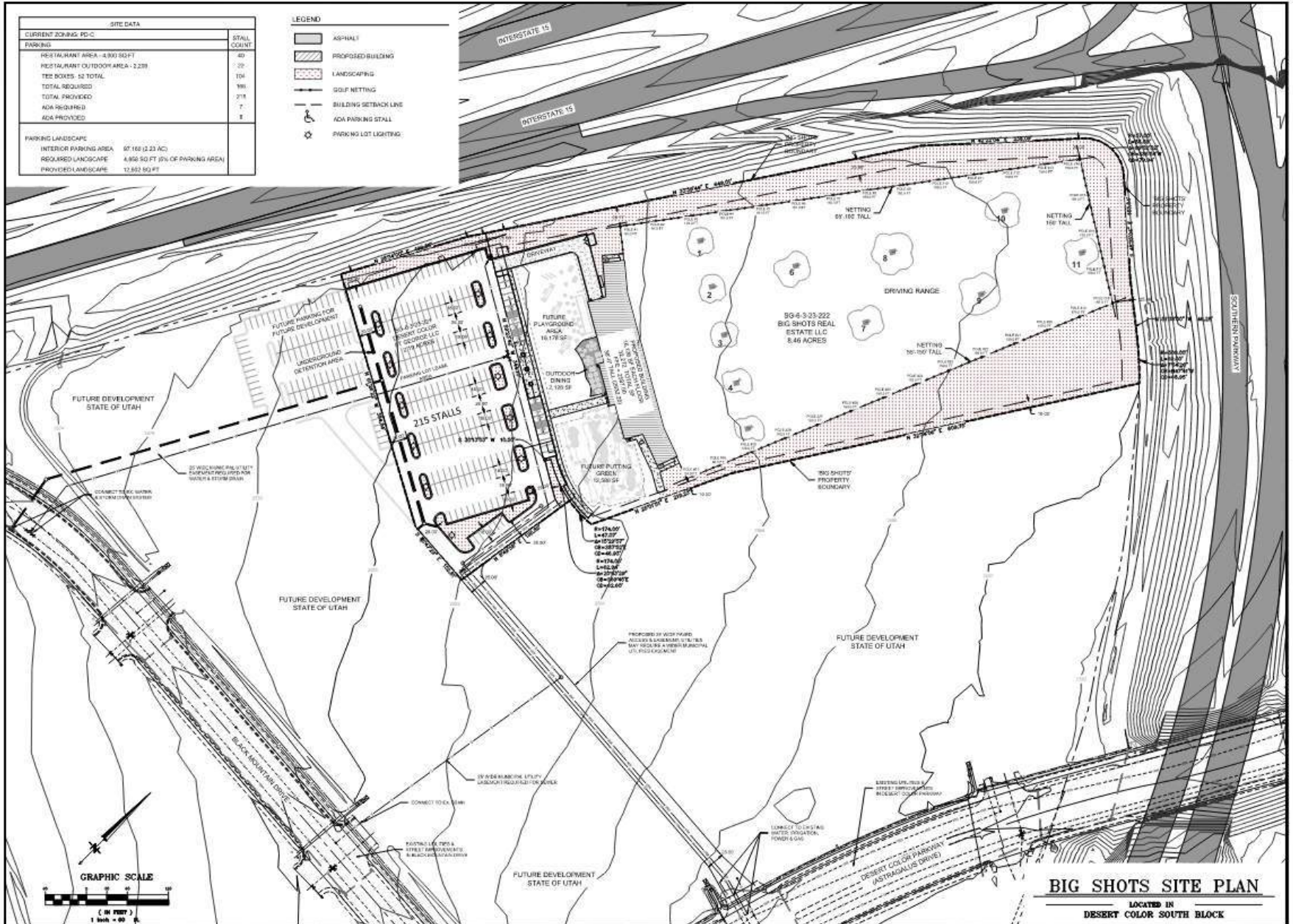


Approved Site Plan

Click on Sign to add text and signatures on a PDF file.



Proposed Site Plan

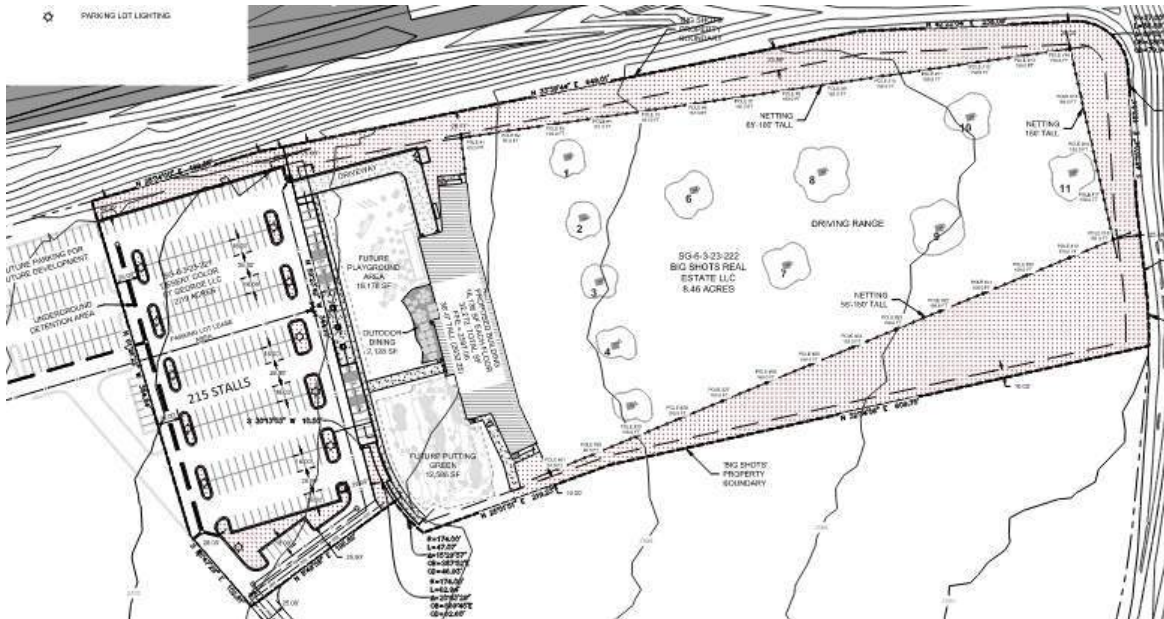


Proposed Site Plan

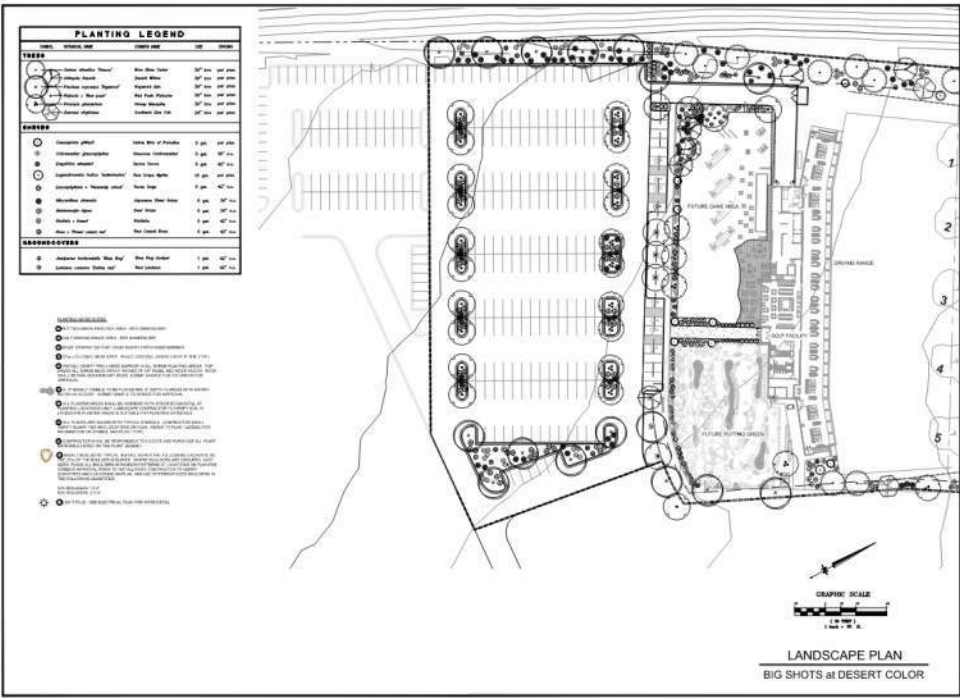
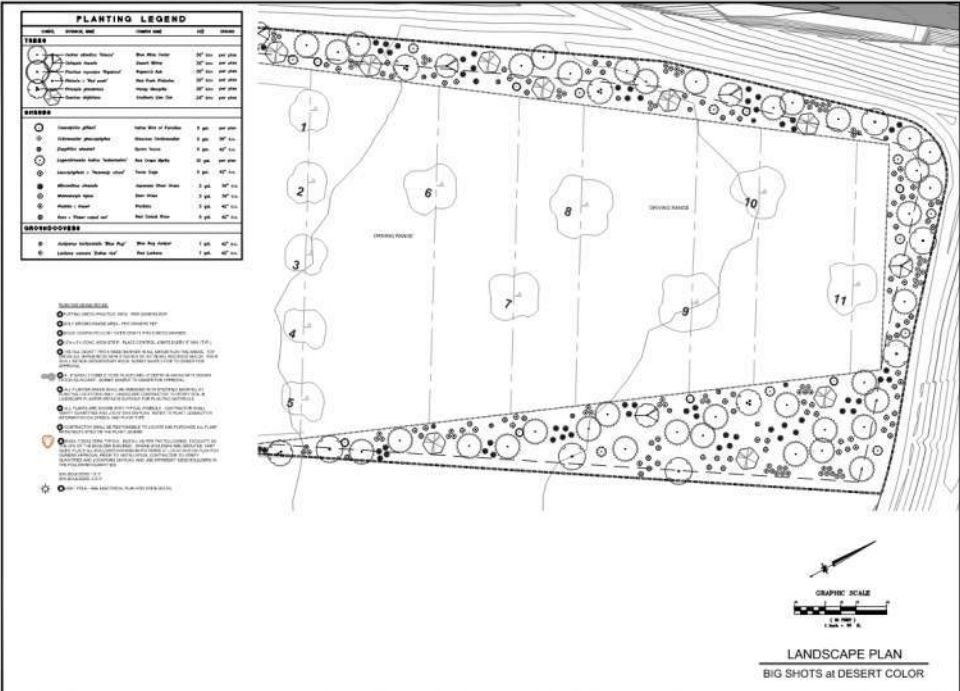
Approved



Proposed



Landscape Plan

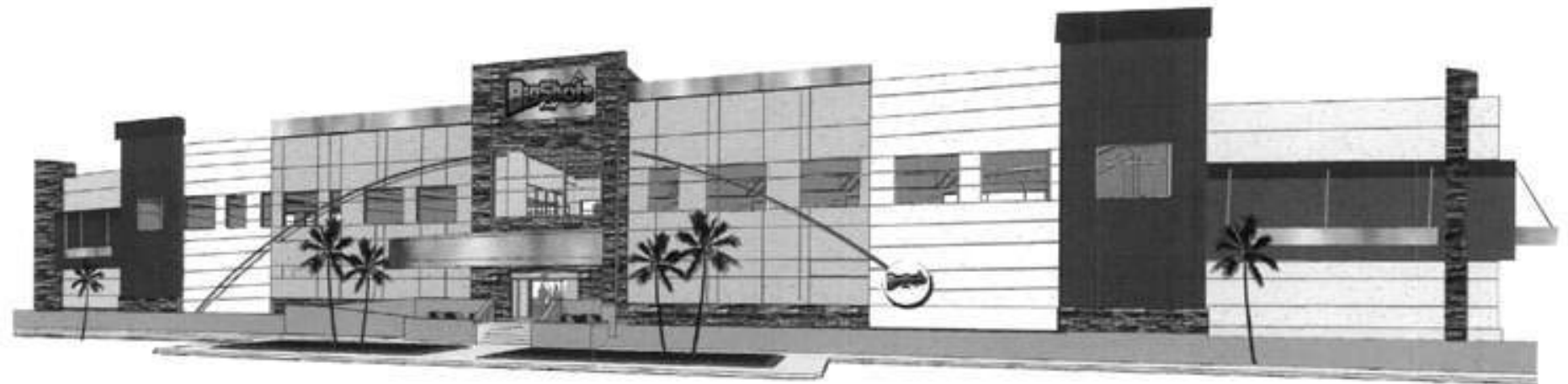


Approved Elevations



Approved Elevations

Elevation – Front



Approved Elevations

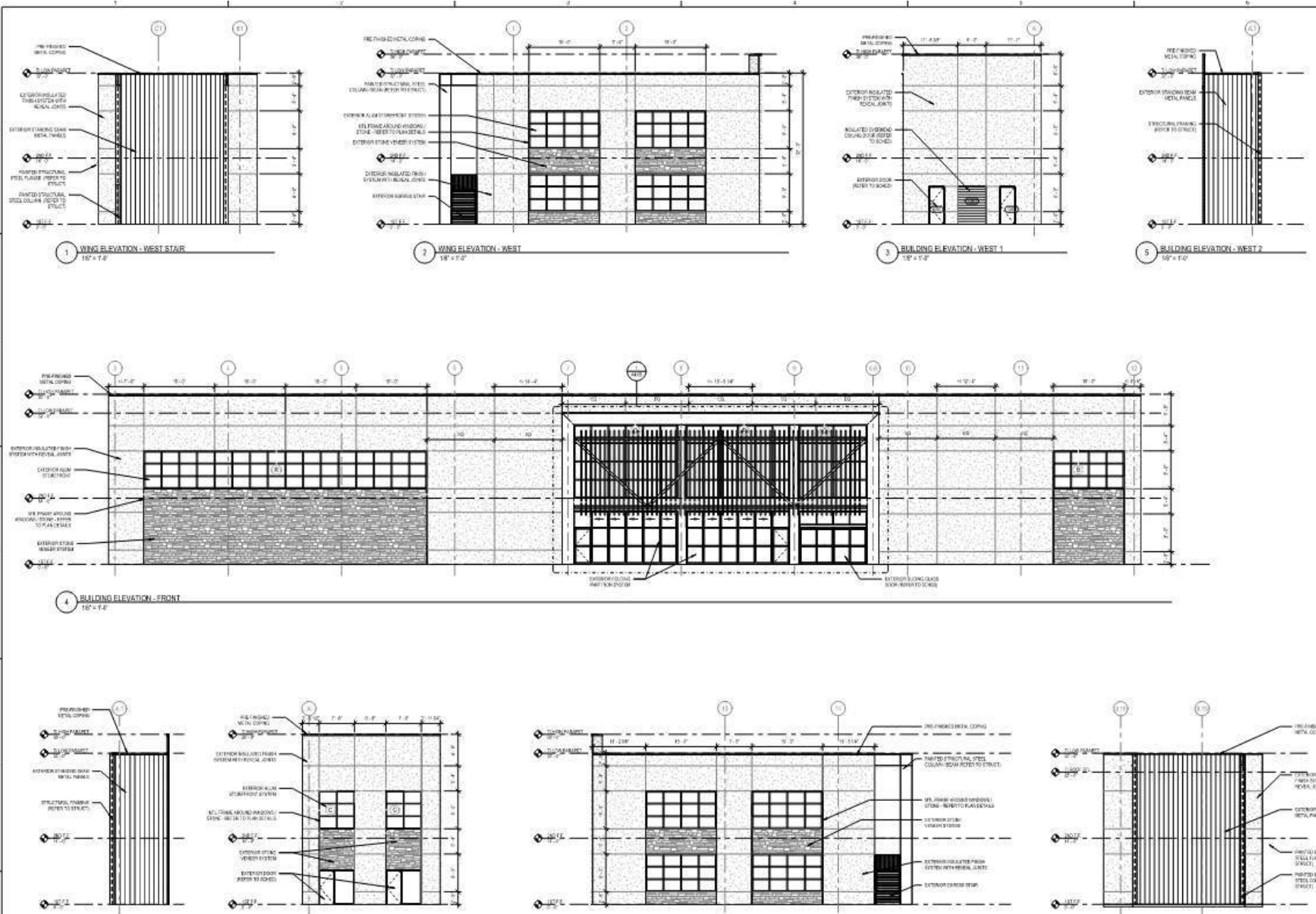
WEST SIDE



EAST SIDE



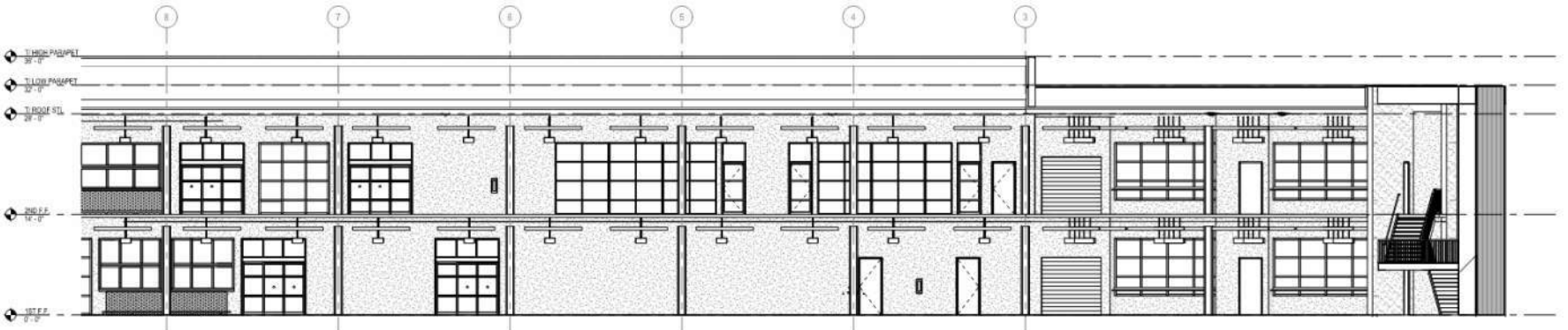
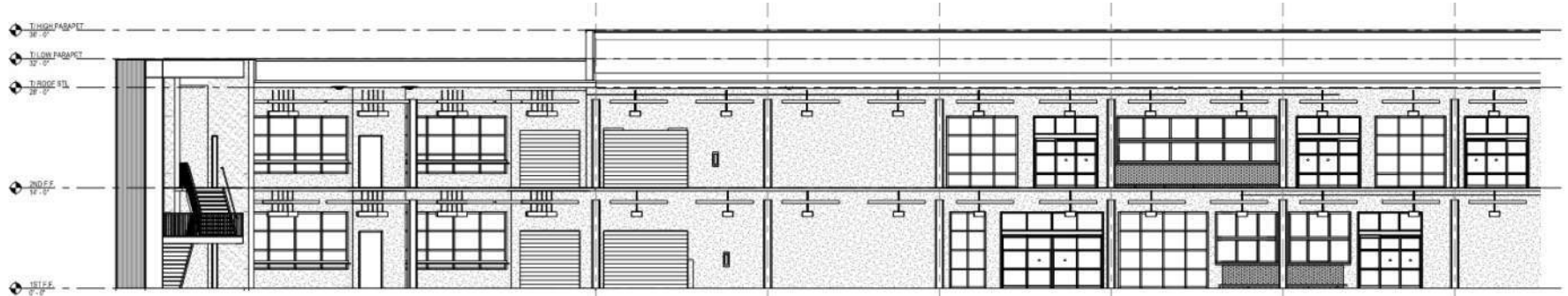
Proposed Elevations



Approved Materials



Proposed Elevations



Proposed Elevations

Legend

- 160' Range Pole Height
*Determined by Pole Layout
Plan and Trajectory Study*
- Updated rear pole
and netting height
line
- 1 Sengery Fine Finish
Whale Grey #872
- 2 Sengery Sahara Finish
Revere #3102
- 3 Eldorado Stone –
Mountain Ledge Panels
Silverton
All stone areas
- 4 Standing Seam Metal
Panels – Nucor Pearl
Gray IR.47.SRI 54
*Used on exterior stairwell and entry
sides*



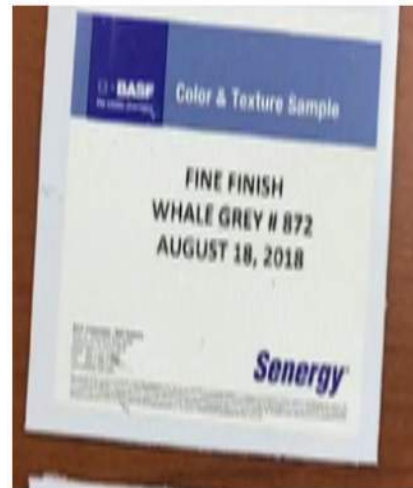
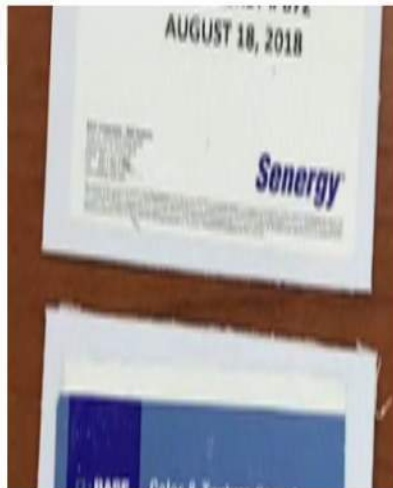
Proposed Materials

BSSG Development, LLC – Exterior Wall Material Sample Sheet
Desert Color, St. George, UT



Eldorado Stone – Mountain
Ledge Panels - Silverton

Product Link:
<https://www.eldoradostone.com/products/mountain-ledge-panels/silverton/>



PVDF Cool Coatings

PVDF utilizes a two-coat system featuring high resistant color, including durability, and environmentally friendly "cool" technology.

Pearl Gray **

IR .47 SRI 54

REVEAL WALL PANELS

MATERIALS
25 mil aluminum
20 gauge steel

SPRUE
1/2" x 1/2" x 1/2" SL
1" High

REVEAL PANEL

REVEAL PANEL W/ CLIP (OPTIONAL)

PRODUCT FEATURES

- Available in 10 colors
- Available with up to 100 additional panels
- Powder coated finish for protection
- 25 mil aluminum (20 gauge steel)
- 1/2" x 1/2" x 1/2" SL
- 1" High
- 25 mil aluminum (20 gauge steel)
- 1/2" x 1/2" x 1/2" SL
- 1" High
- 25 mil aluminum (20 gauge steel)
- 1/2" x 1/2" x 1/2" SL
- 1" High

FLORIDA BUILDING PRODUCT APPROVALS
These items are pre-approved for use in Florida. For specific product approval, contact the Florida Building Department.

PLANNING COMMISSION AGENDA REPORT: 10/13/2020Zone Change**Small Town Capital**

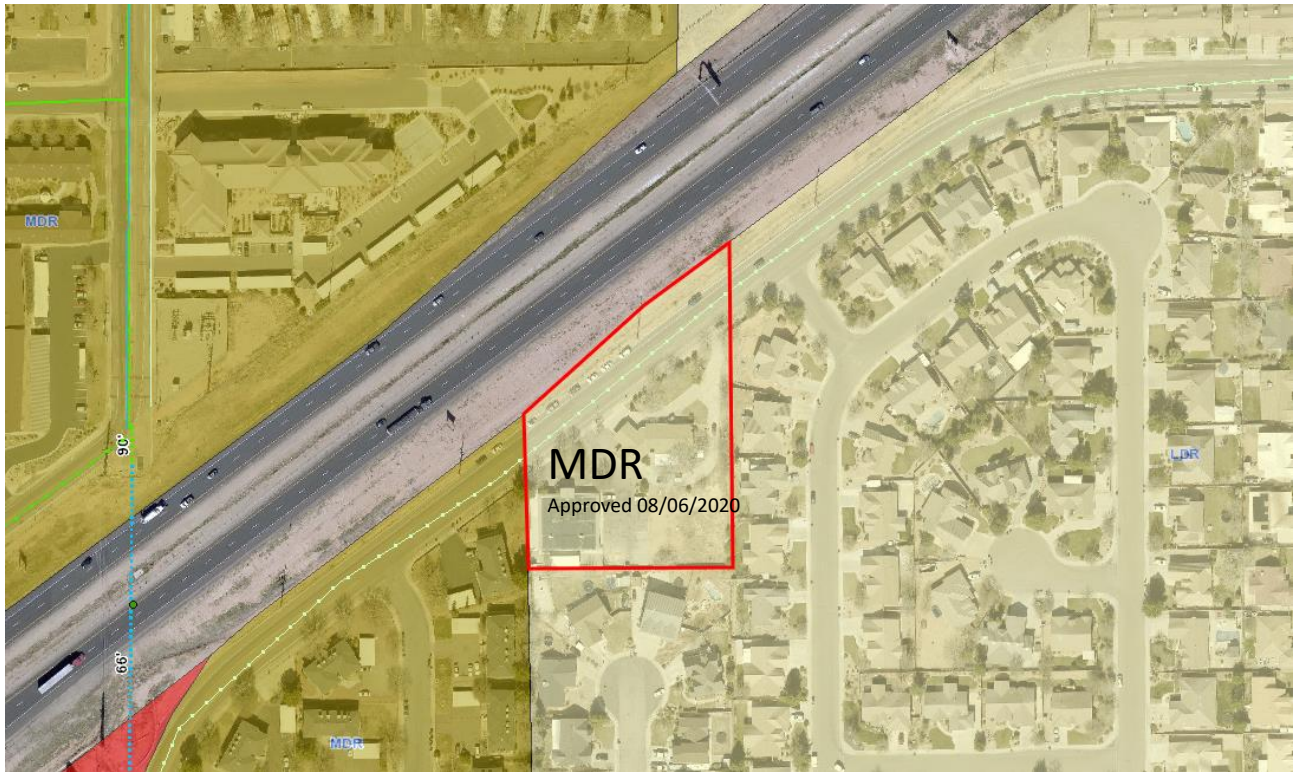
Case No. 2020-ZC-035

- Request:** Consider a zone change from R-1-8 (Single-Family 8,000 sq. ft min) to R-2 (Multiple Family / Duplex).
- Representatives:** Jared West with JW West Homes.
- Area:** Approximately 0.49 acres
- Location:** The property is generally located southwest of the freeway on 900 South at approximately 510 East.
- Parcel(s):** SG-5-2-31-1241
- Current Zone:** R-1-8 (Single-Family 8,000 sq. ft min)
Current zoning on the property is split between R-2 and R-1-8. The applicant would like to construct a duplex on the vacant lot.
- General Plan:** MDR (Medium Density Residential). On August 6, 2020, the City Council approved a General Plan Amendment from LDR to MDR on this property.

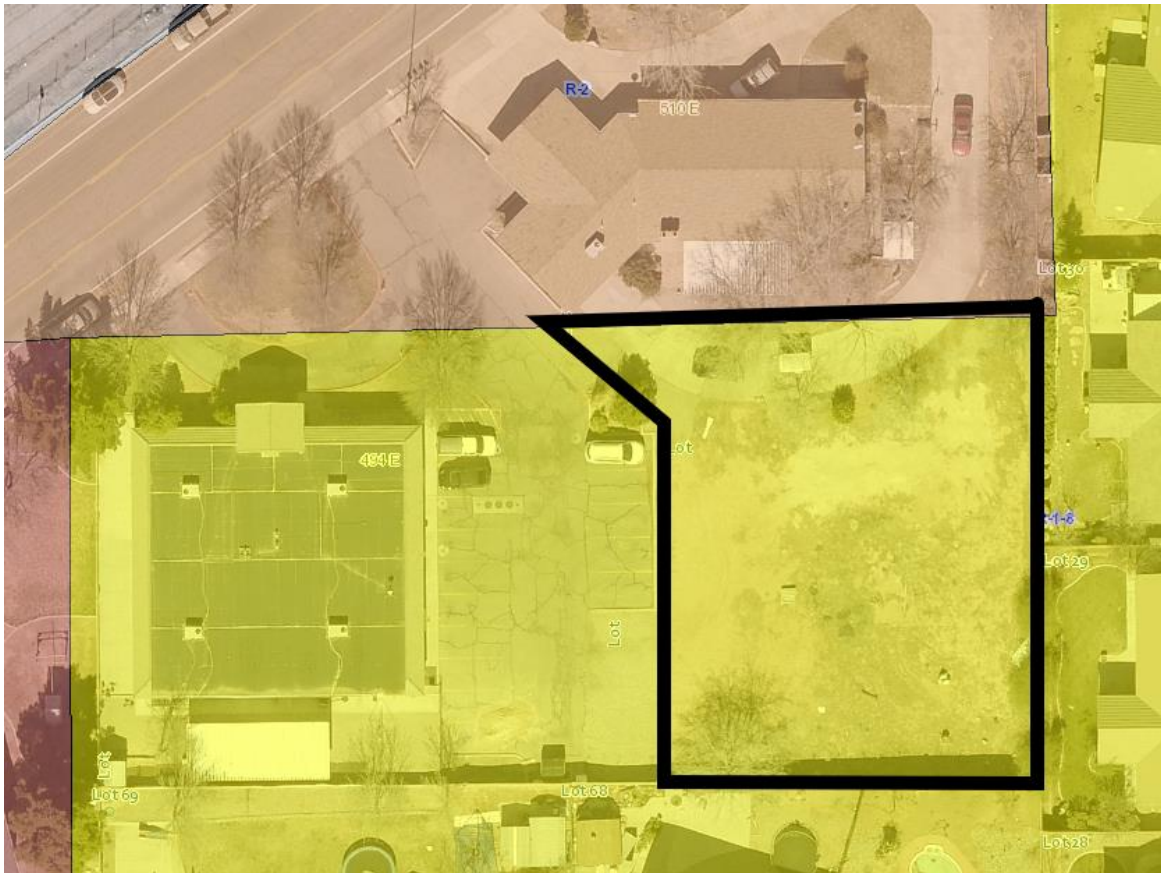
General Plan Category	Possible Zoning Categories
MDR (Medium Density Residential)	R-1-6 R-1-7 R-2 R-3 PD-R (Requires 4 units min) MH-6

- Staff Comments:** Staff recommends approval of this Zone Change. The R-2 zoning will be an extension of the existing R-2, which is located along the public street. Typically, staff would recommend a PD-R, but City Ordinance (10-7F-4:A) requires a minimum of 15,000 square feet and four (4) units for a PD-R application. The project does not meet the minimum four (4) units required. Therefore, the applicant is requesting R-2. The underlying MDR will support an R-2 zone and appears to be in character with the area.

Land Use Map



Zoning Map



Existing Site



Small Town Capital 2020-ZC-035

Zone Change



1



Land Use Map

2



Zoning Map

3



Existing Site

4



PLANNING COMMISSION AGENDA REPORT: 10/13/2020

General Plan Amendment

1450 South Property

Case No. 2020-GPA-015

Request: A request to change a portion of FP (Flood Plain) land use designations to COM (Commercial)

Background: Typically, the General Plan may be amended by a GPA (General Plan Amendment) four (4) times a year (in January, April, July, & October). This application fits within the required time period.

Location: The property is generally located on the north side of 1450 South at approximately 1600 East.

Applicant/Representative: Dream On, LLC, Nick McKinlay - representative

Area: Area to be amended is approximately 12 acres

Current Zoning: Current zoning on the property is R-1-10 (Single Family Residential).

Current General Plan: The General Plan currently designates this property as FP (Flood Plain).

Request: Within the past several years, the property underwent a series of changes to its designation with FEMA being adjacent to the river. FEMA has removed the property from the floodway which would prevent construction but have not removed it from the floodplain which has requirements but still allows construction. In the past, the City has been opposed to construction of residential buildings in the floodplain but has allowed commercial as long as federal guidelines have been met.

The applicant is asking that the land use designation on the property be changed to Commercial. This would allow the property owner to pursue a zone change to a commercial designation but the change in land use designation does not vest the property or give them any other rights beyond the R-1-10, residential zoning that is in place on the property. If this general plan amendment is approved, a zone change would be required.

General Plan Category	Possible Zoning Categories
COM (Commercial)	C-2 C-3 Planned Development Commercial
FP (Flood Plain)	No Corresponding Zoning

Recommendation:

There will be additional processes to go through such as zone changes and hillside reviews before anything will be constructed on the site. Because of that, staff is comfortable with a commercial land use designation in the area and is recommending approval of the General Plan Amendment.

Alternatives:

1. Recommend approval of this General Plan Amendment as proposed by the applicant.
2. Recommend denial of this General Plan Amendment.
3. Table the proposed General Plan Amendment to a specific date.

Possible Motion:

The Planning Commission recommends approval of the General Plan Amendment to change from a FP (Flood Plain) land use designations to COM (Commercial) as recommended by staff.

Findings for approval:

1. The amendment is harmonious with other land uses in the area.
2. The land use amendment will not be harmful to the health, safety and general welfare of residences and businesses in the area.
3. There are other steps to go through prior to any development on the property.

EXHIBIT A
AREA PROPOSED TO BE CHANGED



EXHIBIT B NARRATIVE

Brief Narrative of the proposed change on the 1450 property.

In December 2017, the Letter of Map Revision for the 1450 Property, prepared by Rosenberg Engineering, was approved by the City. The 1450 Property is currently zoned R-1-10 and we have had several developers approach us/make us offers on the property wanting to build multi-family/residential. We have been working with the City for some time and have had several meetings with the heads of the city, staff and others. We have been told consistently that the City doesn't want to see multi-family/residential on the property, and that commercial, office or other use makes much more sense to the City. We have close to 12 acres of developable property that we would like to develop as such.

As the City does not want to have multi-family/residential on the property, and has expressed it would much rather see commercial, office or something else that is not housing, we are requesting the proposed change of the General Plan from Flood plane (residential zoning) to commercial. Thereafter, we will work hand in hand with the City on a planned development (PD-C or other zoning) for the specific use.

We are also working with Rosenberg Engineering to do the erosion control (erosion hazard) along the entire property just as Maverick, Jiffy Lube and others have done in many parts of the city (by the river) so our property and whatever is developed on it is protected. We are requesting the City approve the change of the General Plan to commercial.

Thank you so much

DreamOn LLC
Nick Mckinlay
435-862-4158

EXHIBIT C
POWER POINT PRESENTATION

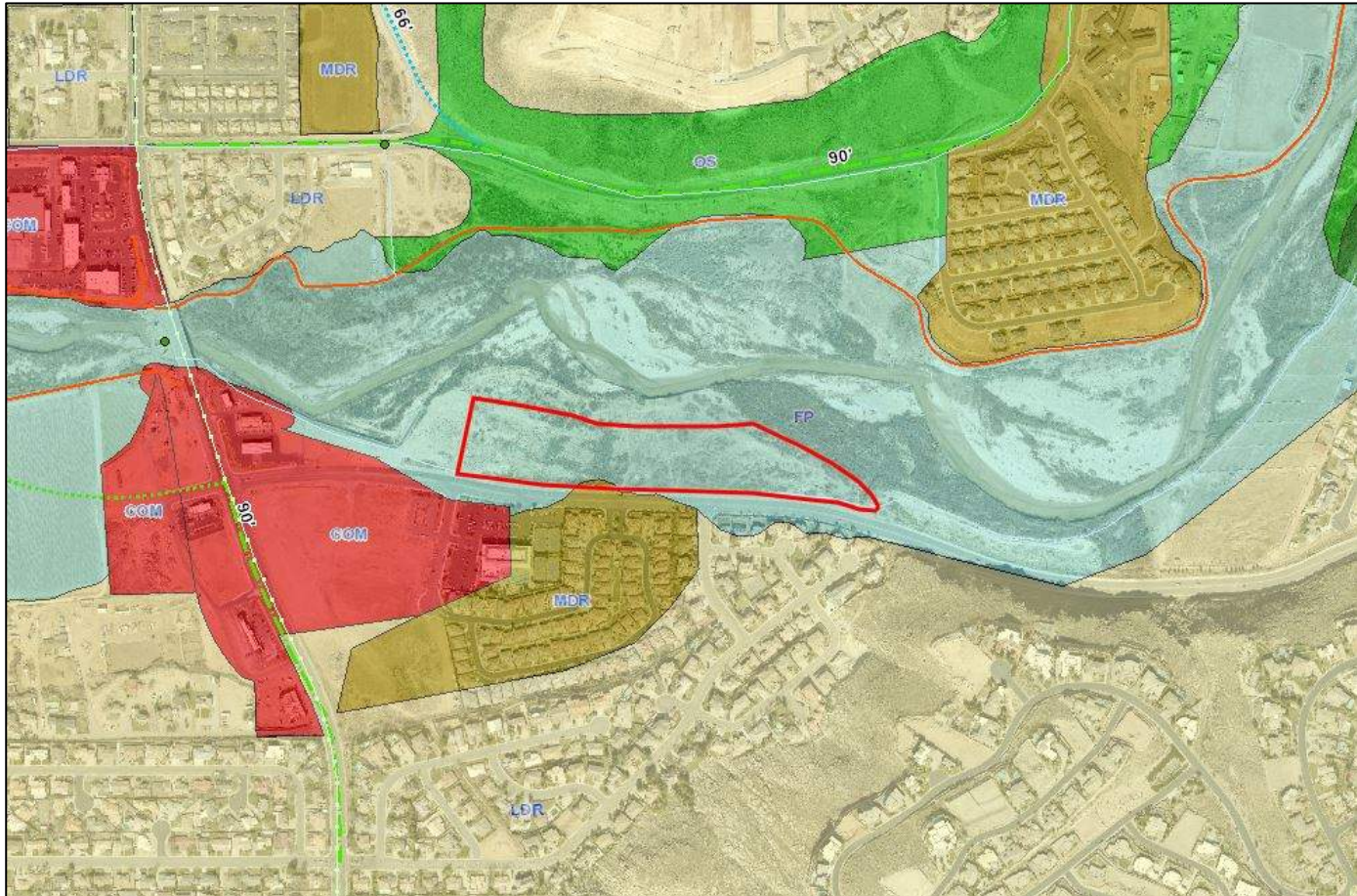
1450 South Property General Plan Amendment

2020-GPA-015

Vicinity Map



Current General Plan Map



Current Zoning Map

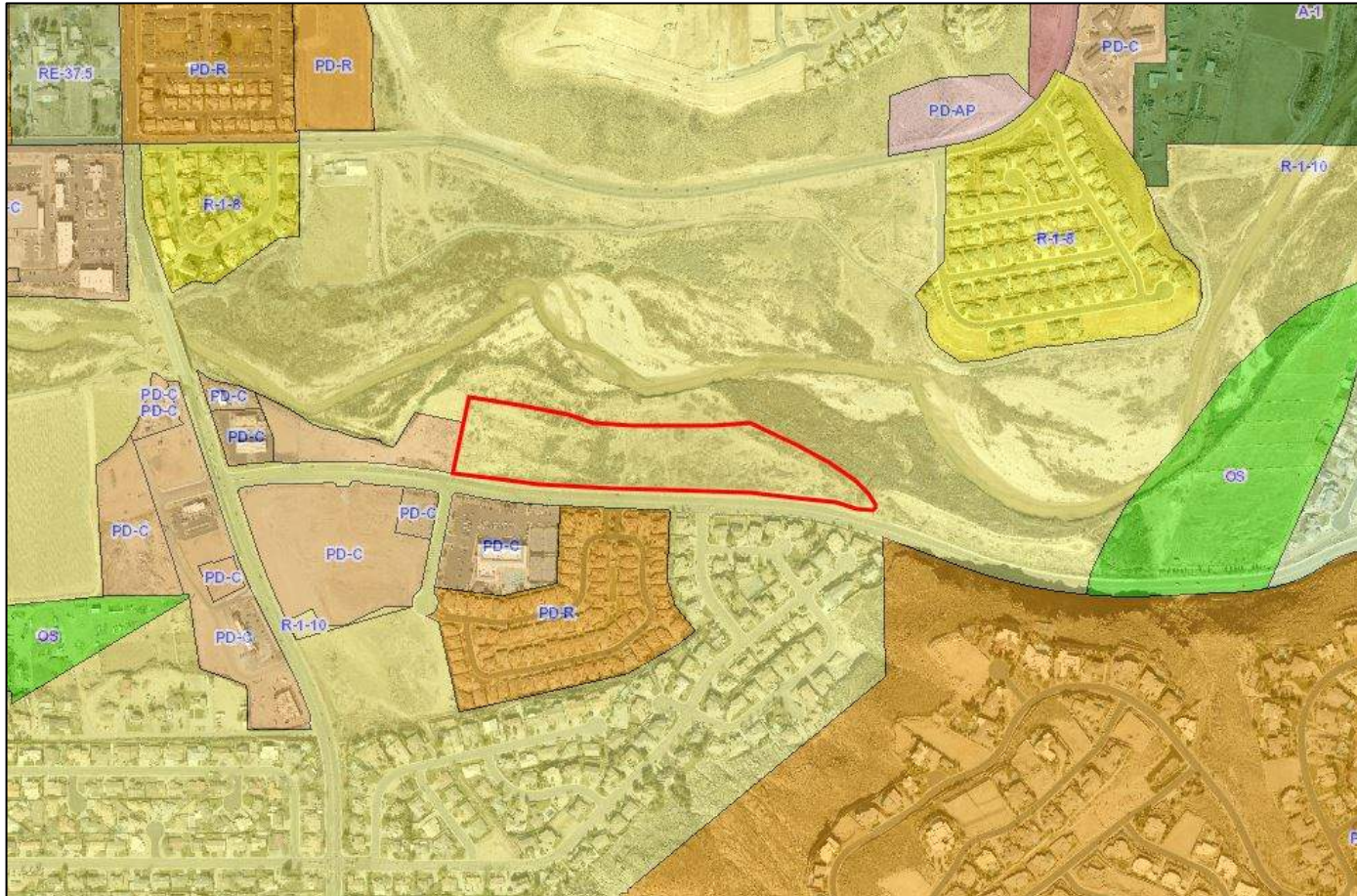


Photo of site



Photo of site



PLANNING COMMISSION AGENDA REPORT: 10/13/2020General Plan Amendment**High Point Storage**

Case No. 2020-GPA-013

Request:	Consider a request to change the general plan from LDR (Low Density Residential) to COM (Commercial) on approximately 14.75 acres generally located at 910 West 4700 North
Location:	The property is generally located east of SR-18 following the natural extension of Pocket Mesa Drive at approximately 910 West 4700 North.
Parcel(s):	SG-7270-B-SA, SG-7270-A-1
Background:	Typically, the City's General Plan may be amended by a GPA (General Plan Amendment) four (4) times a year (January, April, July, & October). This application fits within the required time period.
Applicant:	Ledges at Snow Canyon, LLC
Representative:	Stacy Young, Development Solutions Co
Area:	Approximately 14.75 over 2 parcels
Current Zoning:	M&G (Mining & Grazing)
Current General Plan:	LDR (Low Density Residential)
Requested General Plan:	COM (Commercial)
Staff Comments:	The proposed commercial area is inside a mined-out cinder cone which may provide a natural enclosure for potential commercial development. Existing development to the north of the proposal is the Lava Bluffs equestrian center. The proposed commercial area will not be located on a major street. The proposed commercial area is surrounded by LDR, however, the surrounding land is undeveloped. There may be some commercial uses that make sense in this area. A zone change will be required before any commercial development may occur.

Possible Motions:

1. Recommend approval of this General Plan Amendment as proposed by the applicant.
2. Recommend approval with changes proposed by the Planning Commission.
3. Recommend denial of this General Plan Amendment.
4. Table the proposed General Plan Amendment to a specific date.

Findings for approval:

1. The amendment is harmonious with other land uses in the area.
2. The land use amendment will not be harmful to the health, safety and general welfare of residences and businesses in the area.
3. There are other steps to go through prior to any development on the property.

Existing General Plan



Proposed General Plan



Existing Zoning



General Plan Amendment (GPA) High Point Storage

SG-7270-B-SA, SG-7270-A-1

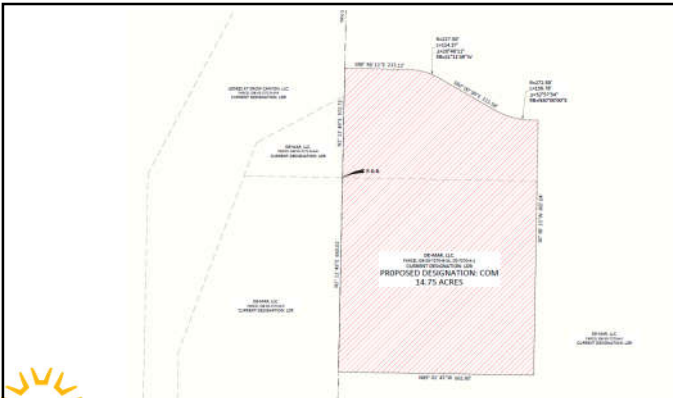


1



Existing General Plan

2



Proposed General Plan

3



Existing Zoning

4



PLANNING COMMISSION AGENDA REPORT: 10/13/2020

General Plan Amendment

The Cove

Case No. 2020-GPA-017

Request: A request to change a portion of COM (Commercial) land use designations to HDR (High Density Residential)

Background: Typically, the General Plan may be amended by a GPA (General Plan Amendment) four (4) times a year (in January, April, July, & October). This application fits within the required time period.

Location: The property is generally located west of Bluff Street at approximately 300 West and 900 South.

Representative: Josh Lyon Wasatch Commercial Builders, LLC and Adam Allen w/ Bush and Gudgeon, Inc.

Area: Area to be amended is approximately 1.7 acres

Current Zoning: Current zoning on the property is C-2 (Commercial).

Current General Plan: The General Plan currently designates this property has COM (Commercial).

Requested General Plan: On May 5, 2020, the City Council approved a portion of the property located to the west as HDR (High Density Residential) and OS (Open Space). The applicant is now requesting to extend the approved HDR for these two areas. This would increase the HDR to approximately 8 acres.

The applicant submitted a slope analysis as part of the original application and it appears to be slopes that are greater than 20% on each of the properties. The property lies in the hillside overlay and is therefore subject to the hillside ordinance. This may render some of the property undevelopable, but the applicant, if this land use change is approved, will be subject to those requirements and processes.

General Plan Category	Possible Zoning Categories
COM (Commercial)	C-2 C-3 Planned Development Commercial
HDR (High Density Residential)	R-3 R-4 Planned Development Residential

Recommendation:

There will be additional processes to go through such as zone changes and hillside reviews before anything will be constructed on the site. Because of that, staff is comfortable with high density residential in the area and is recommending approval of the General Plan Amendment.

Alternatives:

1. Recommend approval of this General Plan Amendment as proposed by the applicant.
2. Recommend denial of this General Plan Amendment.
3. Table the proposed General Plan Amendment to a specific date.

Possible Motion:

The Planning Commission recommends approval of the General Plan Amendment to change from COM (Commercial) land use designations to HDR (High Density Residential) as recommended by staff.

Findings for approval:

1. The amendment is harmonious with other land uses in the area.
2. The land use amendment will not be harmful to the health, safety and general welfare of residences and businesses in the area.
3. There are other steps to go through prior to any development on the property.

[illegible]

EXHIBIT B
POWER POINT PRESENTATION

2020-GPA-017

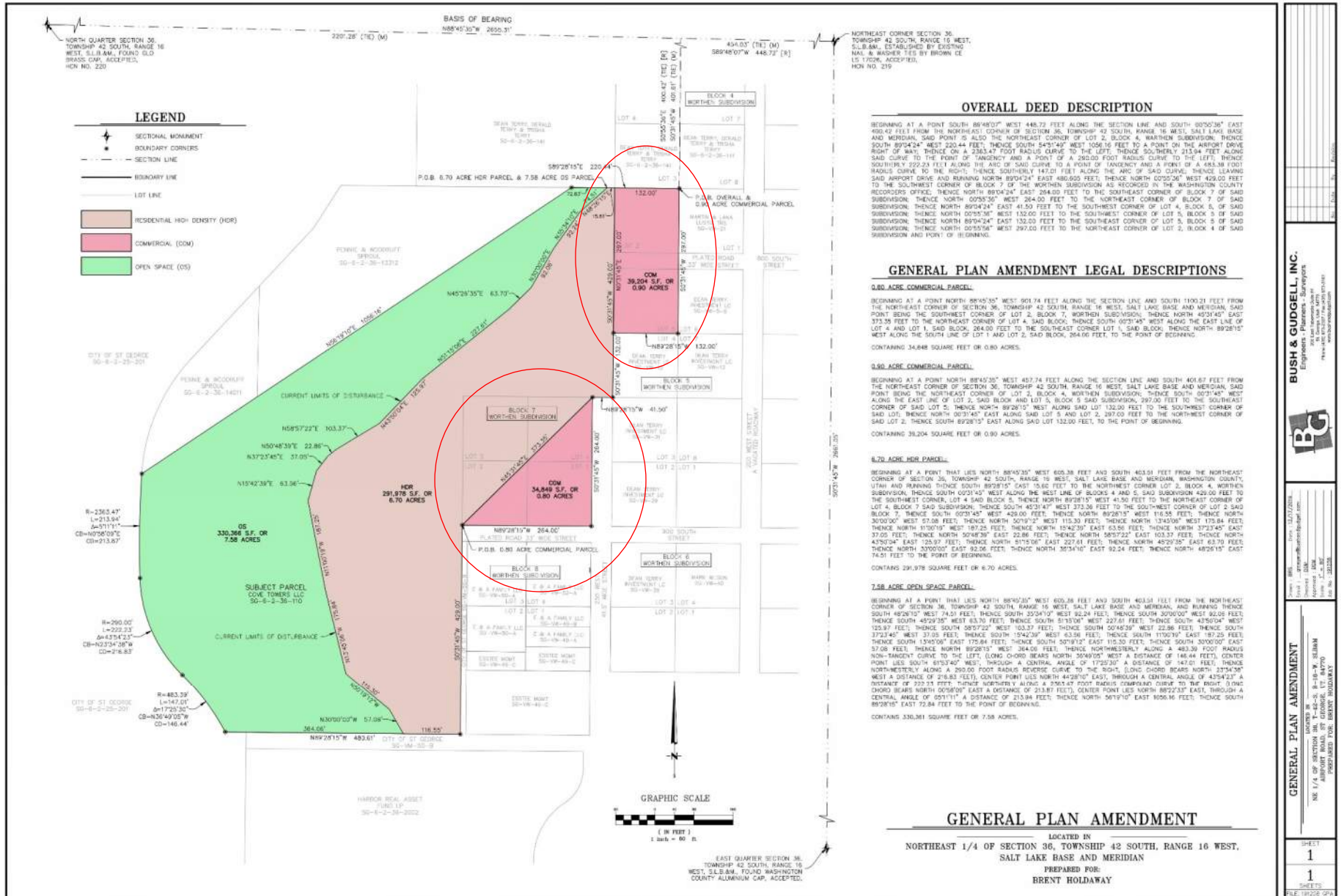
The Cove General Plan Amendment

Located Generally west of Bluff Street at
approximately 300 West and 900 South

Vicinity Map



Land Use Map



Zoning- Existing



LEGEND



SECTIONAL MONUMENT



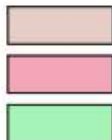
BOUNDARY CORNERS



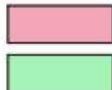
• BOUNDARY LINE



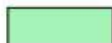
LOT LINE



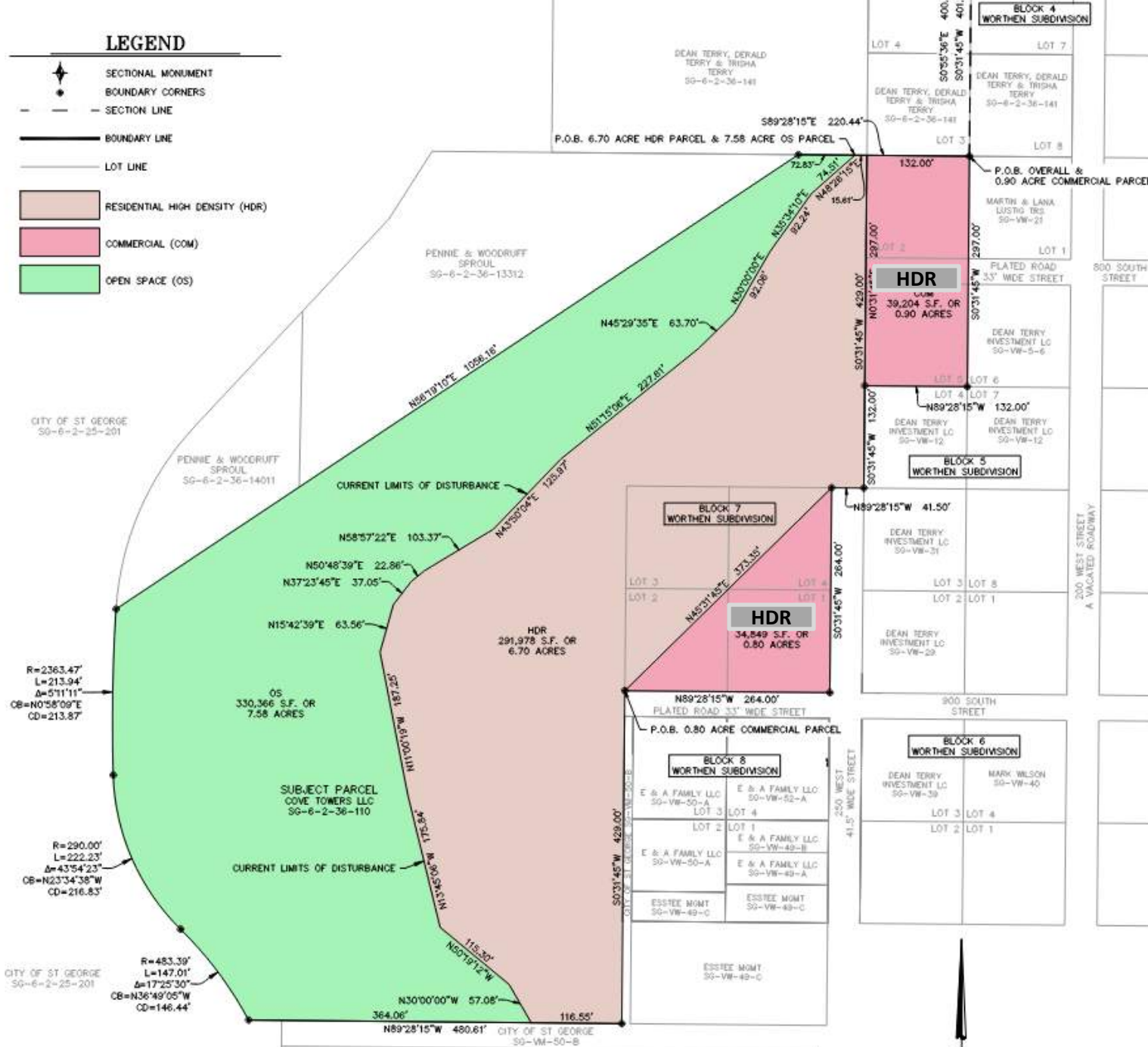
RESIDENTIAL HIGH DENSITY (HDR)



COMMERCIAL (COM)



OPEN SPACE (OS)

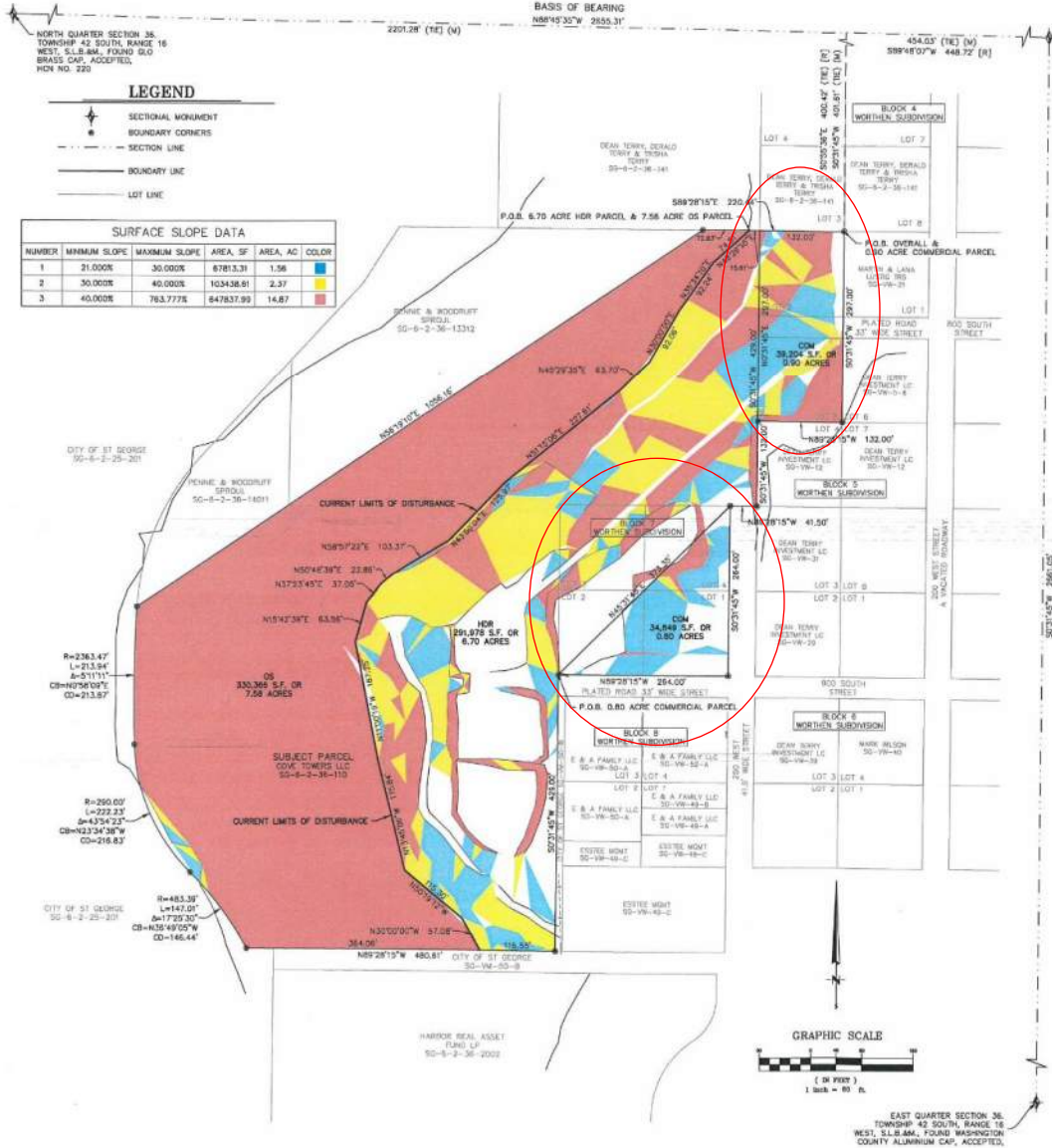


NORTH QUARTER SECTION 36,
TOWNSHIP 42 SOUTH, RANGE 16
WEST, S.L.B.M., FOUND G.D.
BRASS CAP, ACCEPTED,
HCN NO. 220

LEGEND

- SECTIONAL MONUMENT
- BOUNDARY CORNERS
- SECTION LINE
- BOUNDARY LINE
- LOT LINE

SURFACE SLOPE DATA					
NUMBER	MINIMUM SLOPE	MAXIMUM SLOPE	AREA, SF	AREA, AC	COLOR
1	21.000%	30.000%	87813.31	1.56	
2	30.000%	40.000%	103436.81	2.37	
3	40.000%	763.777%	647837.99	14.87	



NORTH QUARTER SECTION 36,
TOWNSHIP 42 SOUTH, RANGE 16 WEST,
S.L.B.M., ESTABLISHED BY EXISTING
RAIL WASHNER TIES BY SHOWN CL,
LS 17028, ACCEPTED,
HCN NO. 218

OVERALL DEED DESCRIPTION

BEGINNING AT A POINT SOUTH 89°40'07" WEST 448.72 FEET ALONG THE SECTION LINE AND SOUTH 00°55'34" EAST 404.42 FEET FROM THE NORTHEAST CORNER OF SECTION 36, TOWNSHIP 42 SOUTH, RANGE 16 WEST, SALT LAKE BASE AND MERIDIAN, SAID POINT IS ALSO THE NORTHEAST CORNER OF LOT 2, BLOCK 4, NORTHERN SUBDIVISION, THENCE SOUTH 89°04'24" WEST 220.44 FEET, THENCE SOUTH 54°31'49" WEST 1008.18 FEET TO A POINT ON THE AIRPORT DRIVE RIGHT OF WAY, THENCE ON 2364.47 FOOT RADIUS CURVE TO THE LEFT, THENCE SOUTH 21°04'18 FEET ALONG SAID CURVE, TO THE POINT OF TANGENCY AND A POINT OF A 290.00 FOOT RADIUS CURVE TO THE LEFT, THENCE SOUTH 22°22.23 FEET ALONG THE ARC OF SAID CURVE TO A POINT OF TANGENCY AND A POINT OF A 483.36 FOOT RADIUS CURVE TO THE RIGHT, THENCE SOUTHWESTLY 147.01 FEET ALONG THE ARC OF SAID CURVE, THENCE LEAVING SAID AIRPORT DRIVE AND RUNNING NORTH 89°04'24" EAST 480.80 FEET, THENCE NORTH 07°55'34" WEST 426.00 FEET TO THE SOUTHWEST CORNER OF BLOCK 7 OF THE NORTHERN SUBDIVISION AS RECORDED IN THE WASHINGTON COUNTY RECORDERS OFFICE, THENCE NORTH 89°04'24" EAST 284.00 FEET TO THE SOUTHEAST CORNER OF BLOCK 7 OF SAID SUBDIVISION, THENCE NORTH 07°55'34" WEST 284.00 FEET TO THE NORTHEAST CORNER OF BLOCK 7 OF SAID SUBDIVISION, THENCE NORTH 89°04'24" EAST 415.00 FEET TO THE SOUTHWEST CORNER OF LOT 4, BLOCK 5, OF SAID SUBDIVISION, THENCE NORTH 07°55'34" WEST 132.00 FEET TO THE SOUTHWEST CORNER OF LOT 5, BLOCK 5, OF SAID SUBDIVISION, THENCE NORTH 89°04'24" EAST 132.00 FEET TO THE SOUTHWEST CORNER OF LOT 4, BLOCK 5, OF SAID SUBDIVISION, THENCE NORTH 07°55'34" WEST 297.00 FEET TO THE NORTHEAST CORNER OF LOT 2, BLOCK 4 OF SAID SUBDIVISION AND POINT OF BEGINNING.

GENERAL PLAN AMENDMENT LEGAL DESCRIPTIONS

0.80 ACRE COMMERCIAL PARCEL.
BEGINNING AT A POINT NORTH 89°45'35" WEST 801.74 FEET ALONG THE SECTION LINE AND SOUTH 1100.31 FEET FROM THE NORTHEAST CORNER OF SECTION 36, TOWNSHIP 42 SOUTH, RANGE 16 WEST, SALT LAKE BASE AND MERIDIAN, SAID POINT BEING THE NORTHEAST CORNER OF LOT 2, BLOCK 7, NORTHERN SUBDIVISION, THENCE NORTH 49°14'45" EAST 373.35 FEET TO THE NORTHEAST CORNER OF LOT 4, SAID BLOCK, THENCE SOUTH 02°14'45" WEST ALONG THE EAST LINE OF LOT 4 AND LOT 1, SAID BLOCK, 284.00 FEET TO THE SOUTHWEST CORNER OF LOT 1, SAID BLOCK, THENCE NORTH 89°15'15" WEST ALONG THE SOUTH LINE OF LOT 1 AND LOT 2, SAID BLOCK, 284.00 FEET, TO THE POINT OF BEGINNING.
CONTAINING 34,848 SQUARE FEET OR 0.80 ACRES.

0.80 ACRE COMMERCIAL PARCEL.
BEGINNING AT A POINT NORTH 89°45'35" WEST 457.74 FEET ALONG THE SECTION LINE AND SOUTH 420.87 FEET FROM THE NORTHEAST CORNER OF SECTION 36, TOWNSHIP 42 SOUTH, RANGE 16 WEST, SALT LAKE BASE AND MERIDIAN, SAID POINT BEING THE NORTHEAST CORNER OF LOT 2, BLOCK 7, NORTHERN SUBDIVISION, THENCE NORTH 49°14'45" EAST 373.35 FEET TO THE NORTHEAST CORNER OF LOT 4, SAID BLOCK, THENCE SOUTH 02°14'45" WEST ALONG THE EAST LINE OF LOT 4 AND LOT 1, SAID BLOCK, 284.00 FEET TO THE SOUTHWEST CORNER OF LOT 1, SAID BLOCK, THENCE NORTH 89°15'15" WEST ALONG THE SOUTH LINE OF LOT 1 AND LOT 2, SAID BLOCK, 284.00 FEET, TO THE POINT OF BEGINNING.
CONTAINING 34,848 SQUARE FEET OR 0.80 ACRES.

6.70 ACRE HOR. PARCEL.
BEGINNING AT A POINT THAT LIES NORTH 89°45'25" WEST 820.38 FEET AND SOUTH 403.51 FEET FROM THE NORTHEAST CORNER OF SECTION 36, TOWNSHIP 42 SOUTH, RANGE 16 WEST, SALT LAKE BASE AND MERIDIAN, WASHINGTON COUNTY, UTAH AND RUNNING THENCE NORTH 89°28'15" EAST 15.00 FEET TO THE NORTHEAST CORNER OF LOT 3, BLOCK 4, NORTHERN SUBDIVISION, THENCE SOUTH 02°14'45" WEST ALONG THE WEST LINE OF BLOCKS 4 AND 5, SAID SUBDIVISION 428.00 FEET TO THE SOUTHWEST CORNER OF LOT 4, SAID BLOCK 5, THENCE NORTH 89°15'15" WEST 41.00 FEET TO THE NORTHEAST CORNER OF LOT 4, BLOCK 7 SAID SUBDIVISION, THENCE SOUTH 45°31'49" WEST 373.36 FEET TO THE SOUTHWEST CORNER OF LOT 2 SAID BLOCK 7, THENCE SOUTH 02°14'45" WEST 428.00 FEET, THENCE NORTH 89°28'15" WEST 118.65 FEET, THENCE NORTH 30°07'00" WEST 57.08 FEET, THENCE NORTH 50°19'14" WEST 115.34 FEET, THENCE NORTH 13°45'04" WEST 175.84 FEET, THENCE NORTH 11°07'10" WEST 187.25 FEET, THENCE NORTH 10°42'30" EAST 83.56 FEET, THENCE NORTH 37°23'45" EAST 37.08 FEET, THENCE NORTH 80°46'30" EAST 22.88 FEET, THENCE NORTH 89°28'15" EAST 103.33 FEET, THENCE NORTH 43°50'04" EAST 125.97 FEET, THENCE NORTH 51°55'06" EAST 227.81 FEET, THENCE NORTH 40°59'25" EAST 63.70 FEET, THENCE NORTH 30°07'00" EAST 80.08 FEET, THENCE NORTH 30°54'10" EAST 92.24 FEET, THENCE NORTH 46°25'10" EAST 74.51 FEET TO THE POINT OF BEGINNING.
CONTAINS 291,878 SQUARE FEET OR 6.70 ACRES.

7.58 ACRE OPEN SPACE PARCEL.
BEGINNING AT A POINT THAT LIES NORTH 89°45'35" WEST 820.38 FEET AND SOUTH 403.51 FEET FROM THE NORTHEAST CORNER OF SECTION 36, TOWNSHIP 42 SOUTH, RANGE 16 WEST, SALT LAKE BASE AND MERIDIAN, AND RUNNING THENCE SOUTH 46°25'10" WEST 74.51 FEET, THENCE SOUTH 35°34'10" WEST 93.24 FEET, THENCE SOUTH 30°07'00" WEST 92.08 FEET, THENCE SOUTH 47°59'25" WEST 63.70 FEET, THENCE SOUTH 51°55'06" WEST 227.81 FEET, THENCE NORTH 43°50'04" WEST 125.97 FEET, THENCE SOUTH 58°57'24" WEST 103.33 FEET, THENCE SOUTH 50°46'30" WEST 22.88 FEET, THENCE SOUTH 13°45'04" WEST 175.84 FEET, THENCE SOUTH 11°07'10" WEST 187.25 FEET, THENCE NORTH 10°42'30" EAST 83.56 FEET, THENCE NORTH 37°23'45" EAST 37.08 FEET, THENCE NORTH 80°46'30" EAST 22.88 FEET, THENCE NORTH 89°28'15" EAST 103.33 FEET, THENCE NORTH 43°50'04" EAST 125.97 FEET, THENCE NORTH 51°55'06" EAST 227.81 FEET, THENCE NORTH 40°59'25" EAST 63.70 FEET, THENCE NORTH 30°07'00" EAST 80.08 FEET, THENCE NORTH 30°54'10" EAST 92.24 FEET, THENCE NORTH 46°25'10" EAST 74.51 FEET TO THE POINT OF BEGINNING.
CONTAINS 330,361 SQUARE FEET OR 7.58 ACRES.

GENERAL PLAN AMENDMENT

LOCATED IN
NORTHEAST 1/4 OF SECTION 36, TOWNSHIP 42 SOUTH, RANGE 16 WEST,
SALT LAKE BASE AND MERIDIAN
PREPARED FOR:
BRENT HOLLOWAY

BUSH & GUDGELL, INC.
Engineers - Planners - Surveyors
1800 West 1000 South, Suite 200
Salt Lake City, UT 84119
Phone: 313.766.6666
Fax: 313.766.6667
www.bushgudgell.com



Drawn: [Name]
Checked: [Name]
Reviewed: [Name]
Scale: 1" = 60'
Date: 10/1/2020

GENERAL PLAN AMENDMENT
SEE 1/4 OF SECTION 36, TOWNSHIP 42 SOUTH, RANGE 16 WEST, S.L.B.M., FOUND WASHINGTON COUNTY ALUMINUM CAP, ACCEPTED, PREPARED FOR: BRENT HOLLOWAY

SHEET
1
SHEETS
FILE: 19/208 GPA







PLANNING COMMISSION AGENDA REPORT: 10/13/2020

PRELIMINARY PLAT

Hidden Valley Phase 10

Case No. 2020-PP-028

Request:	To approve a preliminary plat for sixty-three (63) lot residential subdivision
Location:	The site is located at approximately West Hidden Valley Drive
Property:	13.19 acres
Number of Lots:	63
Density:	4.78 DU/AC
Zoning:	PD-R
Adjacent zones:	This plat is surrounded by the following zones: North – PD-R South – PD-R East – PD-R West – PD-R
General Plan:	PD-R
Applicant:	Bush & Gudgell
Representative:	Bob Hermandson
Comments:	Per the development agreement, the neighborhood park property will need to be dedicated to the City prior to 400 certificates of occupancy being issued. This plat brings the total number of units very close to 400.

Preliminary Plats

October 13, 2020



1



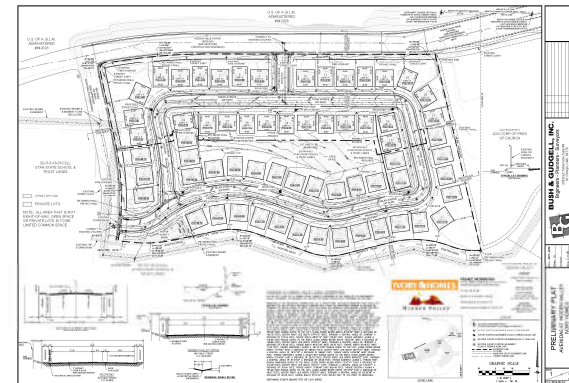
Preliminary Plat – Hidden Valley Phase 10

2



Preliminary Plat – Hidden Valley Phase 10

3



Preliminary Plat – Hidden Valley Phase 10

4



PLANNING COMMISSION AGENDA REPORT: 10/13/2020

PRELIMINARY PLAT

Red Cliffs Estates

Case No. 2020-PP-029

Request: To approve a preliminary plat for twenty-eight (28) lot residential subdivision.

Location: The site is located between 3210 East and 3430 East at approximately 2300 South.

Property: 31.23 acres

Number of Lots: 28

Density: 0.90 DU/AC

Zoning: A-1

Adjacent zones: This plat is surrounded by the following zones:
North – A-1
South – A-1
East – A-1, RE-37.5
West – A-1

General Plan: LDR

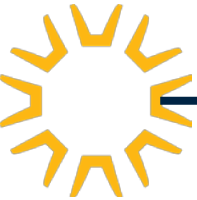
Applicant: Rosenberg Associates

Representative: Jason Ward

Comments:

Preliminary Plats

October 13, 2020



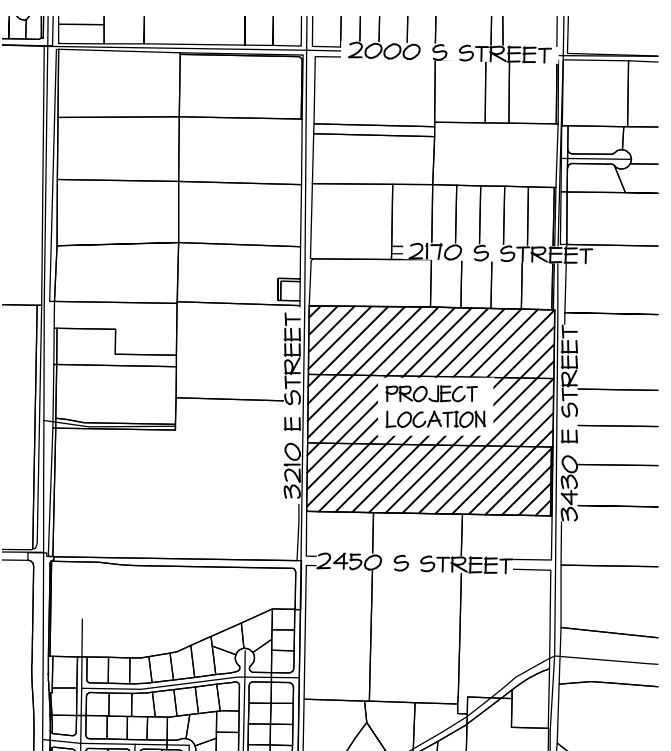
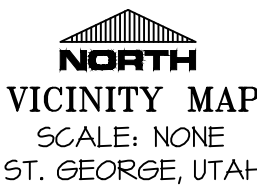
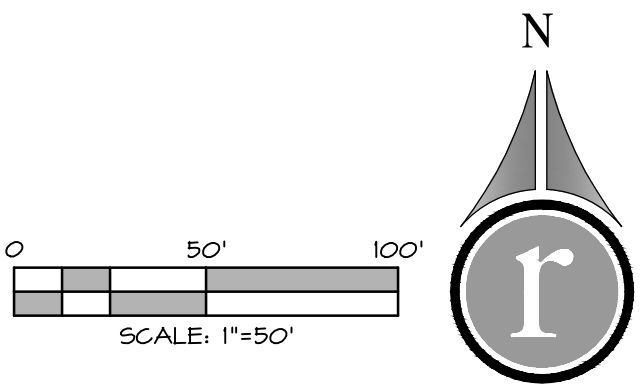




Preliminary Plat – Red Cliffs Estates

PRELIMINARY PLAT
RED CLIFFS ESTATES

A 28 LOT RESIDENTIAL DEVELOPMENT
IN SECTION 3, TOWNSHIP 43 SOUTH, RANGE 15 WEST OF THE
SALT LAKE BASE AND MERIDIAN
CITY OF ST. GEORGE, WASHINGTON COUNTY, UTAH.



LEGEND

- | | | | |
|-----------|---------------------------|-------------|-------------------------|
| — 2546 — | EXISTING 1' CONTOUR | — H — 8" — | EXISTING WATER |
| — — — | EXISTING 5' CONTOUR | — SS — 8" — | EXISTING SANITARY SEWER |
| — 2546 — | PROPOSED 1' CONTOUR | — H — 8" — | PROPOSED WATER |
| — — — | PROPOSED 5' CONTOUR | — SS — 8" — | PROPOSED SANITARY SEWER |
| [Pattern] | EXISTING ASPHALT PAVEMENT | ⊙ | PROPOSED SEWER MANHOLE |
| [Pattern] | PROPOSED ASPHALT PAVEMENT | ⊙ | PROPOSED FIRE HYDRANT |
| | | — — — | PROPOSED DRAINAGE DITCH |

PROJECT ENGINEER

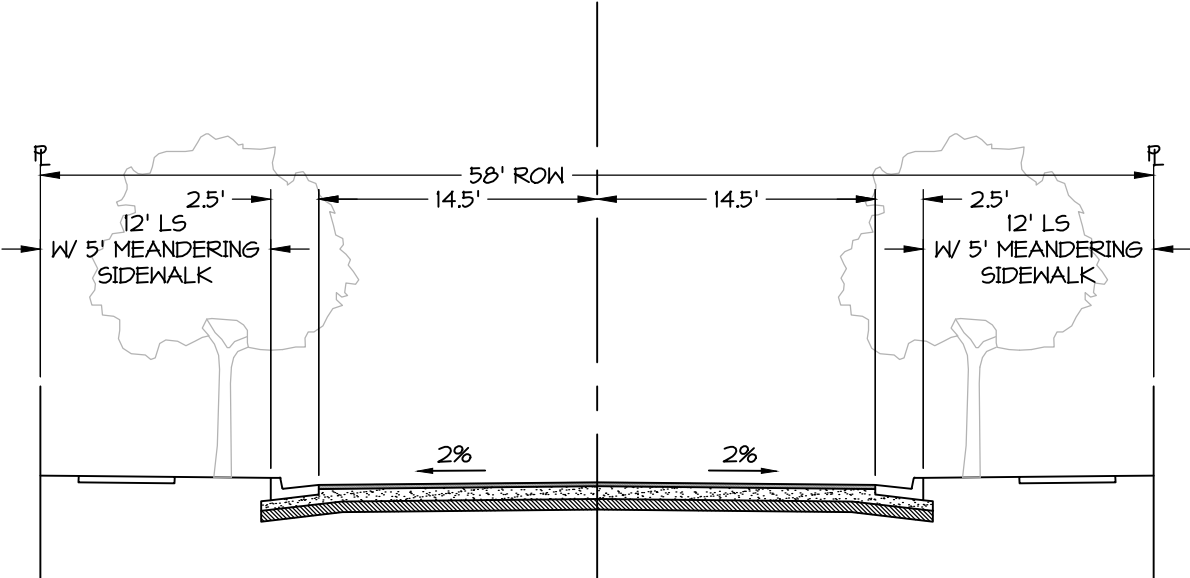
ROSENBERG ASSOCIATES
352 EAST RIVERSIDE DRIVE, SUITE A-2
ST. GEORGE, UT 84740
CONTACT: JASON WARD
(435) 673-8586

PROJECT OWNER/ DEVELOPER

CLR DEVELOPMENT, LLC
3481 EAST 2040 SOUTH CIRCLE
ST. GEORGE, UT 84740
CONTACT: JEFF ANDRUS
(435) 461-2484

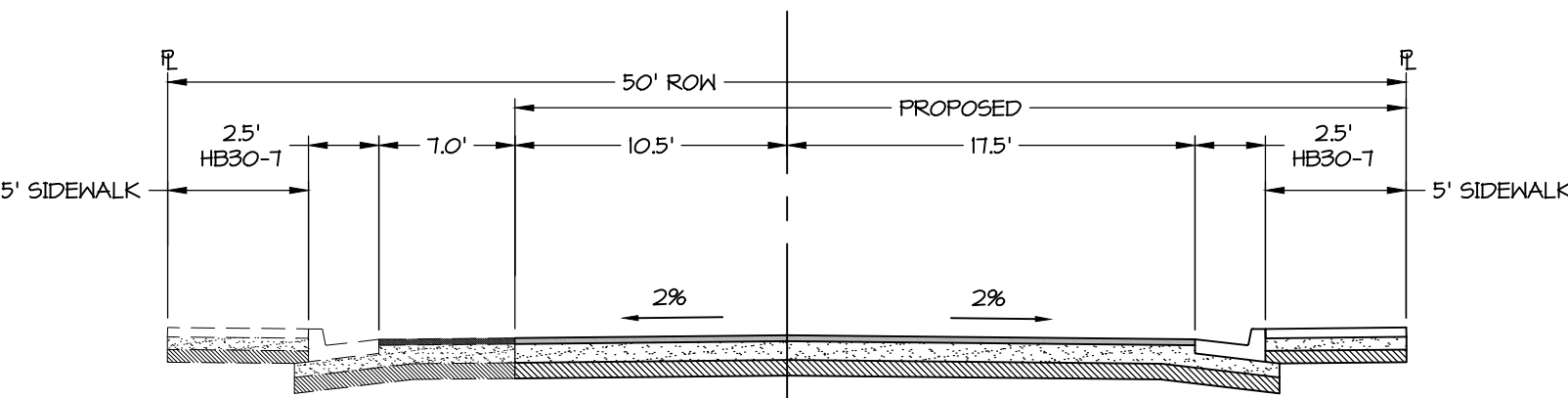
SITE DATA

CURRENT ZONING: A-1
PROJECT LAND USE: RESIDENTIAL
TOTAL AREA: 1,360,548 SQ FT
31.23 ACRES



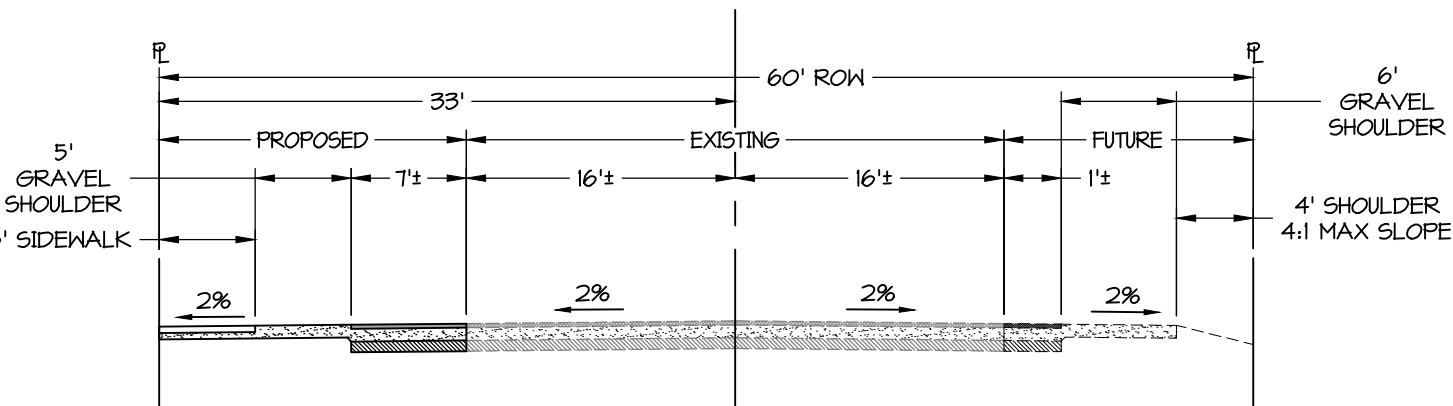
TYP RESIDENTIAL STREET CROSS SECTION

SCALE: NTS



3210 EAST TYP CROSS SECTION

SCALE: NTS



TYP 60' RURAL STREET SECTION

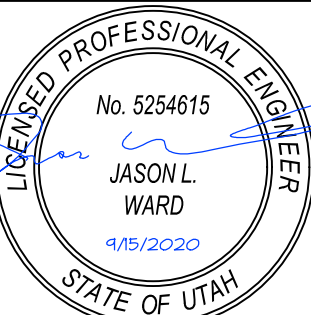
SCALE: NTS

DATE:	1/28/2020
JOB NO.:	5155-20
DESIGNED BY:	JLM
CHECKED BY:	JSS
DWG.:	Pre Plat
DATE:	
REVISIONS:	

ROSENBERG
ASSOCIATES
CIVIL ENGINEERS • LAND SURVEYORS

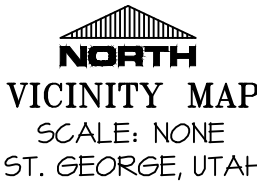
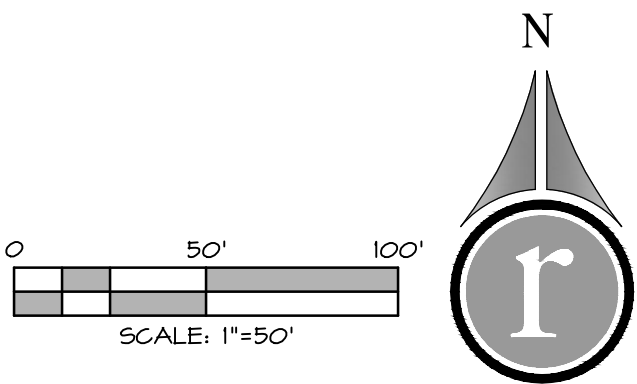
352 East Riverside Drive, Suite A-2
St. George, Utah 84740
Ph (435) 673-8586; Fx (435) 673-8397
www.rscivil.com

Preliminary Plat
FOR
Red Cliffs Estates
CLR Development, LLC
St. George, Utah



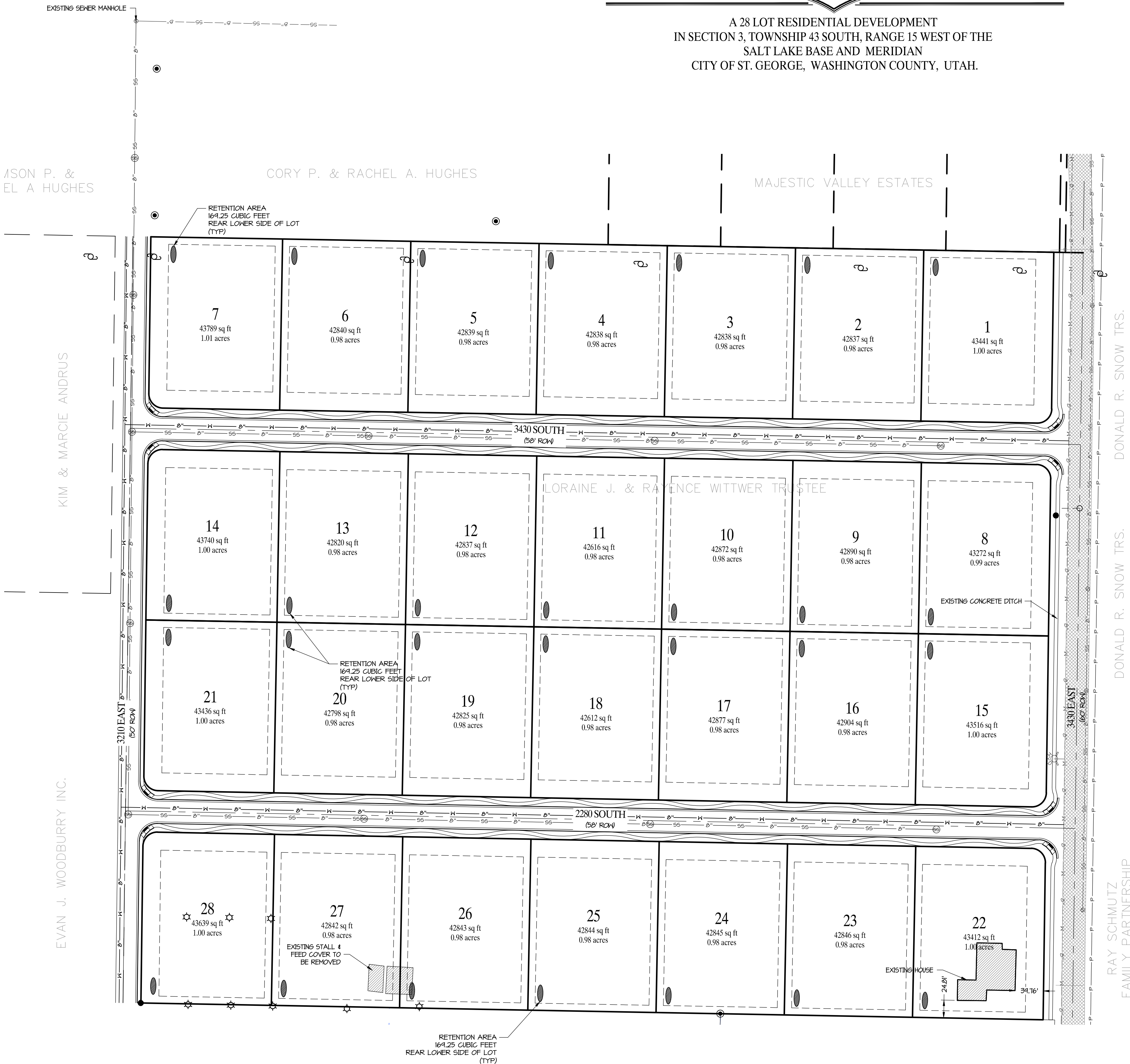
PRELIMINARY PLAT
RED CLIFFS ESTATES

A 28 LOT RESIDENTIAL DEVELOPMENT
IN SECTION 3, TOWNSHIP 43 SOUTH, RANGE 15 WEST OF THE
SALT LAKE BASE AND MERIDIAN
CITY OF ST. GEORGE, WASHINGTON COUNTY, UTAH.

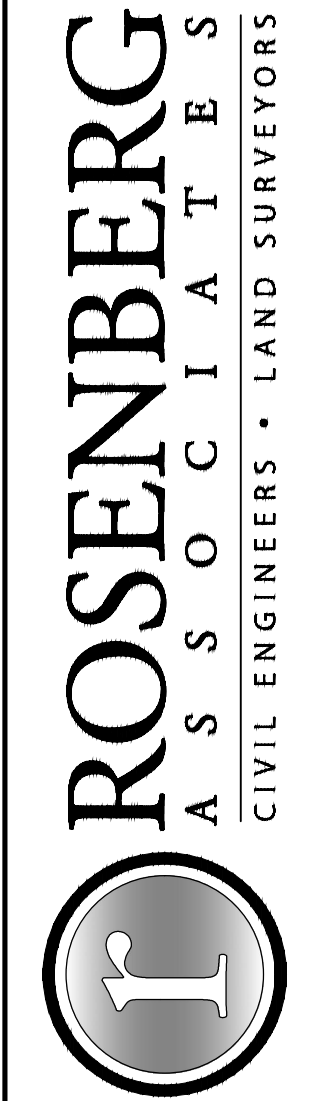


LEGEND

- | | | | |
|-----------|---------------------------|-------------|-------------------------|
| — 2546 — | EXISTING 1' CONTOUR | — H — 8" — | EXISTING WATER |
| — — — | EXISTING 5' CONTOUR | — SS — 8" — | EXISTING SANITARY SEWER |
| — 2546 — | PROPOSED 1' CONTOUR | — H — 8" — | PROPOSED WATER |
| — 2546 — | PROPOSED 5' CONTOUR | — SS — 8" — | PROPOSED SANITARY SEWER |
| [Pattern] | EXISTING ASPHALT PAVEMENT | [Symbol] | PROPOSED SEWER MANHOLE |
| [Pattern] | PROPOSED ASPHALT PAVEMENT | [Symbol] | PROPOSED FIRE HYDRANT |
| [Symbol] | PROPOSED RETENTION AREA | | |



DATE:	1/28/2020
JOB NO.:	5155-20
DESIGNED BY:	JLM
CHECKED BY:	JSS
DWG.:	Pre Plat
DATE:	
REVISIONS:	



352 East Riverside Drive, Suite A-2
St. George, Utah 84790
Ph (435) 673-8888; Fx (435) 673-8397
www.rscivil.com

Preliminary Plat LID
FOR
Red Cliffs Estates
CLR Development, LLC
St. George, Utah

