DRAINAGE REPORT

CASHIN'S FIELD AFFORDABLE HOUSING

NEVADA CITY

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1. Project Description

The area included in this report is the Cashin'S Field Property located along the north side of Ridge Road between Searls Avenue and Zion Street. (See Figure 1).

The site is composed of primarily undeveloped land. There are existing concrete sidewalks at the property lines along Searls Avenue, Ridge Road and Zion Street. The sidewalk along Zion Street is supported by a sloping rock-faced retaining wall. Inconsistent fencing runs the length of the north property line. Access to the site is a driveway entrance with a rock-faced retaining wall at Ridge road near to the intersection of Zion Street and Ridge Road. The land is comprised of a large open area in the central to west side. There are many coniferous trees (350-360) and a variety of deciduous trees (20-30) ranging in sizes from 6 to 60" in diameter. The highest elevation of the property is at the West corner near the Zion Street and Ridge Road intersection. Contours shed from there toward the North Eastern side of the property and then follows the North property line easterly toward Searls Avenue. The average slope is around five percent downward. There is one 18" concrete pipe culvert at the south-easterly corner of the property crossing under Searls Avenue into the California Transportation (CalTrans) right of way.

2. Existing Conditions

2.1 Existing Land Uses

The land is currently undeveloped. Only foot traffic occurs through the site via sidewalks lining Searls Avenue, Ridge Road and Zion Street.

2.2 Existing Site Drainage

The Site Drainage is almost entirely by sheet flow from the highest elevation near the corner of Ridge Road and Zion Street to the lowest elevation along Searls Avenue. Along the Ridge Road property line a steep slope intersects the existing sidewalk shedding water onto the road. From there it flows east to the CalTrans right-of-way. Besides the sidewalk at the corner of Ridge Road and Zion Street, the remaining flow is directed North Easterly. Once flow reaches the North property line, a natural occurring flow line follows the fencing Easterly. The lowest elevation of the property occurs on the east property line adjacent to Searls Avenue. There, a natural flow line exists toward the South-Eastern corner where an 18" concrete pipe culvert crosses under Searls Avenue in the CalTrans right-of-way. From there a steep hillside daylights flow into a concrete lined ditch which it then flows into a larger 36" concrete culvert under highway 20/49 toward Deer Creek.

2.3 Existing Hydraulics

There are no existing hydraulics besides the one 18" concrete pipe culvert at the low elevation point of the property. Since no net flow will be added to the site, no calculations are necessary on this culvert.

2.4 Existing Soils Data

Location on site	Perc Test #	Min Field Infiltration Rate (in/hr)*	Min Field Infiltration Rate (Gal/hr/SF)*	MAX DESIGN Infiltration (in/hr) **	MAX DESIGN Infiltration Rate (Gal/day/SF) **
SW PL corner	P-A	2.3	0.3	0.8	0.09
NW PL corner	P-B	3.0	0.4	1.0	0.12
PL adjacent to H&K office	P-C	18.3	2.2	6.1	0.75
East slope towards Searls	P-D	4.0	0.5	1.3	0.16

*** = No Factor of Safety or Mounding Analysis**

****= 3.0 F.O.S.**

2.5 Groundwater

Geotechnical investigation revealed no groundwater seepage into test trenches. Groundwater was not encountered.

3. Proposed Conditions

3.1 Proposed Land Uses

The land is to be used for the purpose of Affordable Housing. This will include a community building, four building groupings and a central recreation area. Concrete sidewalks will connect the buildings and recreational areas. Parking will be provided on asphalt pavement and/or concrete. Due to the sloping nature of the site, grading will be required for the development.

3.2 Proposed Site Drainage

Drainage of the proposed site will result in no net additional outflow. Pre-treatment and infiltration will be provided prior to discharge at the existing 18" concrete pipe culvert. Improvement to the existing sheet flow will be provided by splitting the developed area of drainage into two zones.

The first zone will move storm water from the community building and the first group of buildings adjacent to Ridge Road along the south-easterly ridge line. Inlets will be provided at all low points transferring water to an underground pipeline. The pipeline will daylight east of the development into a rock-lined ditch. Infiltration will occur along the ditch until it reaches a retaining pond for pre-treatment. The outlet will again be a rock-lined ditch to the existing 18" concrete pipe culvert where it will exit the site.

The second zone will move storm water northward along the driveway passed the first building group and community building. Along both sides of the crowned drive will be rock-lined ditches moving any storm water outside of the first zone to area drains. These drains will be connected by underground pipes. The impervious sidewalks and parking at the north side of the property will all sheet flow into low-point drain inlets along curbing and gutter. Piping from the area drains will be connected to piping from the low-point

drain inlets. Similarly, the recreational area and impervious areas at the north-east part of the development will have area drains and drain inlets connected to the same piping system. Outflow of this zone will occur east of the parking near the north side of the property. Daylight will be into a rock-lined ditch for infiltration. Again, pre-treatment will be at a retention pond within the forested area east of the development. From there another rock-lined ditch will carry runoff to the existing 18" concrete pipe culvert exiting the site.

Besides these two zones, the Ridge Road and Zion Street corner sidewalk shed remains unchanged. The same is true of the Ridge Road sidewalk and the slope it intersects. No changes occur at these locations, therefore; it is left out of the analysis. Only the development area is analyzed.

4. Hydrologic and Hydraulic Calculations

4.1 Methodology

Hydrology calculations for the project site are provided herein per the Nevada County Design Standards. Pre- and Post-Development hydrology analyses include calculation of impervious surfaces for the purpose of determining impacts of the proposed development. Peak flows were determined for 10- and 100-year storm events.

The post-development rate and volume will be reduced to or below the pre-development rate and volume with infiltration, retention facilities and BMP's identified herein. Onsite retention facilities will reduce the post-development flow by attenuating the peak flow. Post-Mitigated (after retention) Flow calculation is based on Federal Highway Administration Hydraulic Design of Highway Culverts. Hydraulic Design Series No. 5 (HDS-5).

4.2 Existing Conditions and Results

The existing conditions of the site drainage are intact. The only storm drain on the site, located at the east side of the property, is in good condition. There are no signs of back flow or deficiencies in the size and location. Pre-development flow calculations (Plate 1) are based on 4.82 acres with sheet flow over 740 feet at an average slope of 5 percent. With natural runoff and the site slope, permeability, vegetation, and surface type, 10-year flow rates are 2.28 cubic feet per second. 100-year flow is 4.82 cubic feet per second.

4.3 Proposed Conditions and Results

The proposed drainage will be split into two zones as mentioned above. The first zone, A-2, represents 1.04 acres of the development. Impervious surfaces will be from the building roofs, sidewalks, asphalt pavement and concrete flatwork. This represents 0.72 acres, with the remaining area being landscaped or natural surface. Channel flow will occur in a concrete valley gutter in two locations. The first area is located at the west parking area for a length of 128 feet at 1.0 percent. The second area is located at the entrance to the site along the east side of the driveway for a length of 50 feet at 5.0 percent. The rest of the parking will sheet flow to one of four drain inlets. Underground piping will then convey drainage in high density polyethylene piping to daylight into a rock-lined drainage ditch. The drainage ditch flows roughly 100 feet into a retention pond. The retention pond is sized to retain 2200 cubic feet of storm water. Outflow of the pond again flows into a rock-lined ditch roughly 130 feet to the existing drainpipe.

The second zone, A-3, represents 3.78 acres of the development. Impervious surfaces will be from the building roofs, sidewalks, asphalt pavement and concrete flatwork. This represents 0.84 acres, with the remaining area being landscaped or natural surface. Channel flow will occur in a concrete valley gutters located at various locations between parking islands. Each gutter is sloping at 1.0 percent for a combined 354 feet. The rest of the parking will sheet flow to one of four drain inlets. Underground piping will then convey drainage in high density polyethylene piping to daylight into a rock-lined drainage ditch. The drainage ditch

flows roughly 160 feet into a retention pond. The retention pond is sized to retain 1500 cubic feet of storm water. Outflow of the pond again flows into a rock-lined ditch roughly 150 feet to the existing drainpipe.

We have determined the difference between pre- and post-development flows, as required by county standards and the rational method. We have designed all culverts, storm drain, and outlet structures in conformance with these guidelines. A summary of the flows is included in Tables 3 and 4 of this report. The 10-year and 100-year events have been analyzed based on county rainfall intensity (D11, D12). Analysis of pre- and post-development hydrology indicates that downstream facilities will not be affected by the development.

It has been determined peak post-development flows are higher than pre-development flows. This is due to the large increase in impervious surfaces and is expected. To mitigate the additional flow, retention facilities are sized to result in no net additional flow to the existing outflow from the property. Retention facilities reduce the outflow compared to pre-development. Primarily this is accomplished through infiltration trenches and retention ponds. The retention facilities provide water quality treatment, recharge natural groundwater and attenuate peak flows thus reducing runoff volume and rate of discharge. This post-mitigated flow is based on storage routing calculations provided in the summary of this report (Table 5).

5. Water Quality Management

Storm drainage from impervious areas (roads, walks, roofs) is collected and routed through water quality treatment facilities for removal of potential pollutants. A description of each treatment facility being used for this project is provided below. This consists of a Multiple Treatment System which includes the following Best Management Practices (BMP's) in series prior to discharge of flow to existing drainage facilities.

BMP #	
TC-10	Infiltration trenches will be installed at roof downspouts for both retention of storm water runoff and for capturing pollutants prior to entering the natural drainage course. Runoff is stored in the void space between the stones and infiltrates into surrounding soil.
TC-11	Infiltration basins will be installed at the end of the biofiltration swales for stormwater runoff storage and exfiltration into the underlying soil. Pollutant removal occurs through the infiltration of runoff and the absorption of pollutants into the soil and vegetation.
TC-30	Vegetated biofiltration swales will be provided at the discharge of the underground storm water piping. The swale will trap particulate pollutants, promote infiltration, reduce flow velocity, and increase time of concentration of stormwater runoff.

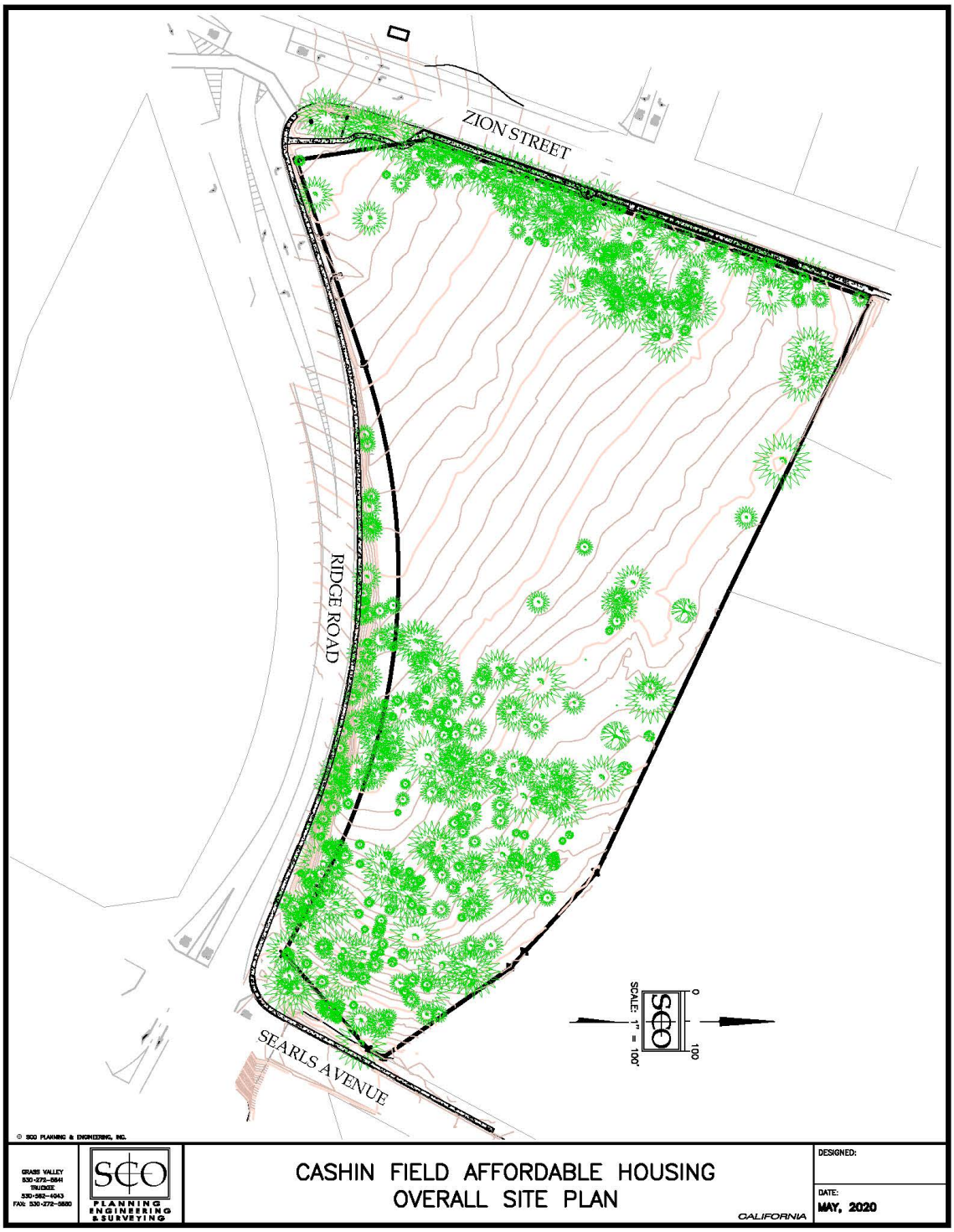
During construction, additional BMP's including temporary erosion control facilities shall be implemented to control pollutants that have a potential to affect the quality of storm water discharges from the construction site. Implementation of BMP's for Construction Activities will be in accordance with California State Water Resources Control Board (SWRCB) requirements.

6. References

Standard Drawings, 1994, County of Nevada Department of Transportation: 34-43 p.
Road Standards.

List of Figures

Figure 1: Project Location Map



List of Analysis

1: Rainfall Parameters used in Calculations (D11, D12)

NEVADA COUNTY DESIGN STORM (INTENSITY)
10 YEAR STORM DURATION IN MINUTES FOR NEVADA COUNTY

MEAN ANNUAL PRECIPITATION	5	10	15	30	60	120	180	360	720	1440
					1 HR	2 HR	3 HR	6 HR	12 HR	24 HR
INCHES	INTENSITY IN INCHES PER HOUR									
20	1.57	1.15	0.96	0.70	0.51	0.38	0.31	0.23	0.17	0.12
22	1.68	1.23	1.03	0.75	0.55	0.40	0.34	0.25	0.18	0.13
24	1.80	1.31	1.10	0.80	0.59	0.43	0.36	0.26	0.19	0.14
26	1.91	1.4	1.17	0.85	0.62	0.46	0.38	0.28	0.20	0.15
28	2.02	1.48	1.23	0.90	0.66	0.48	0.40	0.30	0.22	0.16
30	2.14	1.57	1.30	0.95	0.70	0.51	0.43	0.31	0.23	0.17
32	2.25	1.65	1.37	1.01	0.74	0.54	0.45	0.33	0.24	0.18
34	2.37	1.73	1.44	1.06	0.77	0.57	0.47	0.35	0.25	0.19
36	2.48	1.82	1.51	1.11	0.81	0.59	0.49	0.36	0.27	0.19
38	2.59	1.9	1.58	1.16	0.85	0.62	0.52	0.38	0.28	0.20
40	2.71	1.98	1.65	1.21	0.89	0.65	0.54	0.40	0.29	0.21
42	2.81	2.07	1.72	1.26	0.92	0.68	0.56	0.41	0.30	0.22
44	2.94	2.15	1.79	1.31	0.96	0.70	0.59	0.43	0.31	0.23
46	3.05	2.23	1.86	1.36	1.00	0.73	0.61	0.45	0.33	0.24
48	3.17	2.32	1.93	1.41	1.03	0.76	0.63	0.46	0.34	0.25
50	3.28	2.4	2.00	1.46	1.07	0.78	0.65	0.48	0.35	0.26
52	3.39	2.48	2.07	1.52	1.11	0.81	0.68	0.50	0.36	0.27
54	3.51	2.57	2.14	1.57	1.15	0.84	0.70	0.51	0.37	0.27
56	3.62	2.65	2.21	1.62	1.18	0.87	0.72	0.53	0.39	0.28
58	3.74	2.73	2.28	1.67	1.22	0.89	0.74	0.55	0.40	0.29
60	3.85	2.82	2.35	1.72	1.26	0.92	0.77	0.56	0.41	0.30
62	3.96	2.9	2.42	1.77	1.30	0.95	0.79	0.58	0.42	0.31
64	4.08	2.98	2.49	1.82	1.33	0.98	0.81	0.60	0.44	0.32
66	4.19	3.07	2.56	1.87	1.37	1.00	0.84	0.61	0.45	0.33
68	4.31	3.15	2.63	1.92	1.41	1.03	0.86	0.63	0.46	0.34
70	4.41	3.24	2.70	1.97	1.44	1.06	0.88	0.65	0.47	0.35
72	4.53	3.32	2.77	2.02	1.48	1.08	0.90	0.66	0.48	0.35
74	4.65	3.4	2.84	2.08	1.52	1.11	0.93	0.68	0.50	0.36
76	4.76	3.49	2.90	2.13	1.56	1.14	0.95	0.70	0.51	0.37
78	4.88	3.57	2.97	2.18	1.59	1.17	0.97	0.71	0.52	0.38
80	4.99	3.65	3.04	2.23	1.63	1.19	0.99	0.73	0.53	0.39

46	3.05	2.23	1.86	1.36	1	0.73	0.61	0.45	0.33	0.24

ZONE	Tcl	Tc	Tch	IL	I	IH
A-1	15	21.85	30	1.86	1.63	1.36
A-2	10	13.22	15	2.23	1.99	1.86
A-3	10	14.41	15	2.23	1.90	1.86

D11

NEVADA COUNTY DESIGN STORM (INTENSITY)

100 YEAR STORM DURATION IN MINUTES FOR NEVADA COUNTY

MEAN ANNUAL PRECIPITATION	5	10	15	30	60	120	180	360	720	1440
					1 HR	2 HR	3 HR	6 HR	12 HR	24 HR
INCHES	INTENSITY IN INCHES PER HOUR									
20	2.22	1.63	1.36	0.99	0.73	0.53	0.44	0.32	0.24	0.17
22	2.39	1.75	1.46	1.07	0.78	0.57	0.48	0.35	0.25	0.19
24	2.55	1.86	1.55	1.14	0.83	0.61	0.51	0.37	0.27	0.20
26	2.71	1.98	1..65	1.21	0.89	0.65	0.54	0.40	0.29	0.21
28	2.87	2.10	1.75	1.28	0.94	0.69	0.57	0.42	0.31	0.22
30	3.03	2.22	1.85	1.35	0.99	0.73	0.60	0.44	0.32	0.24
32	3.19	2.34	1.95	1.43	1.04	0.76	0.64	0.47	0.34	0.25
34	3.36	2.46	2.05	1.50	1.10	0.80	0.67	0.49	0.36	0.26
36	3.52	2.58	2.15	1.57	1.15	0.84	0.70	0.51	0.38	0.28
38	3.68	2.69	2.24	1.64	1.20	0.88	0.73	0.54	0.39	0.29
40	3.84	2.81	2.34	1.72	1.26	0.92	0.77	0.56	0.41	0.30
42	4.00	2.93	2.44	1.79	1.31	0.96	0.80	0.58	0.43	0.31
44	4.17	3.05	2.54	1.86	1.36	1.00	0.83	0.61	0.45	0.33
46	4.33	3.17	2.64	1.93	1.41	1.04	0.86	0.63	0.46	0.34
48	4.49	3.29	2.74	2.00	1.47	1.07	0.89	0.66	0.48	0.35
50	4.65	3.40	2.84	2.08	1.52	1.11	0.93	0.68	0.50	0.36
52	4.81	3.52	2.94	2.15	1.57	1.15	0.96	0.70	0.51	0.38
54	4.97	3.64	3.03	2.22	1.63	1.19	0.99	0.73	0.53	0.39
56	5.14	3.76	3.13	2.29	1.68	1.23	1.02	0.75	0.55	0.40
58	5.30	3.88	3.23	2.37	1.73	1.27	1.06	0.77	0.57	0.41
60	5.46	4.00	3.33	2.44	1.78	1.31	1.09	0.80	0.58	0.43
62	5.62	4.12	3.43	2.51	1.84	1.35	1.12	0.82	0.60	0.44
64	5.78	4.23	3.53	2.58	1.89	1.38	1.15	0.84	0.62	0.45
66	5.94	4.35	3.63	2.65	1.94	1.42	1.19	0.87	0.64	0.46
68	6.11	4.47	3.72	2.73	2.00	1.46	1.22	0.89	0.65	0.48
70	6.27	4.59	3.82	2.80	2.05	1.50	1.25	0.91	0.67	0.49
72	6.43	4.71	3.92	2.87	2.10	1.54	1.28	0.94	0.69	0.50
74	6.59	4.83	4.02	2.94	2.15	1.58	1.31	0.96	0.70	0.52
76	6.75	4.94	4.12	3.02	2.21	1.62	1.35	0.99	0.72	0.53
78	6.92	5.06	4.22	3.09	2.26	1.65	1.38	1.01	0.74	0.54
80	7.08	5.18	4.32	3.16	2.31	1.69	1.41	1.03	0.76	0.55

46	4.33	3.17	2.64	1.93	1.41	1.04	0.86	0.63	0.46	0.34

ZONE	Tcl	Tc	Tch	IL	I	IH
A-1	15	21.85	30	2.64	2.32	1.93
A-2	10	13.22	15	3.17	2.83	2.64
A-3	10	14.41	15	3.17	2.70	2.64

D12

2: Existing Conditions Hydrologic Model Parameters (D10, D15)

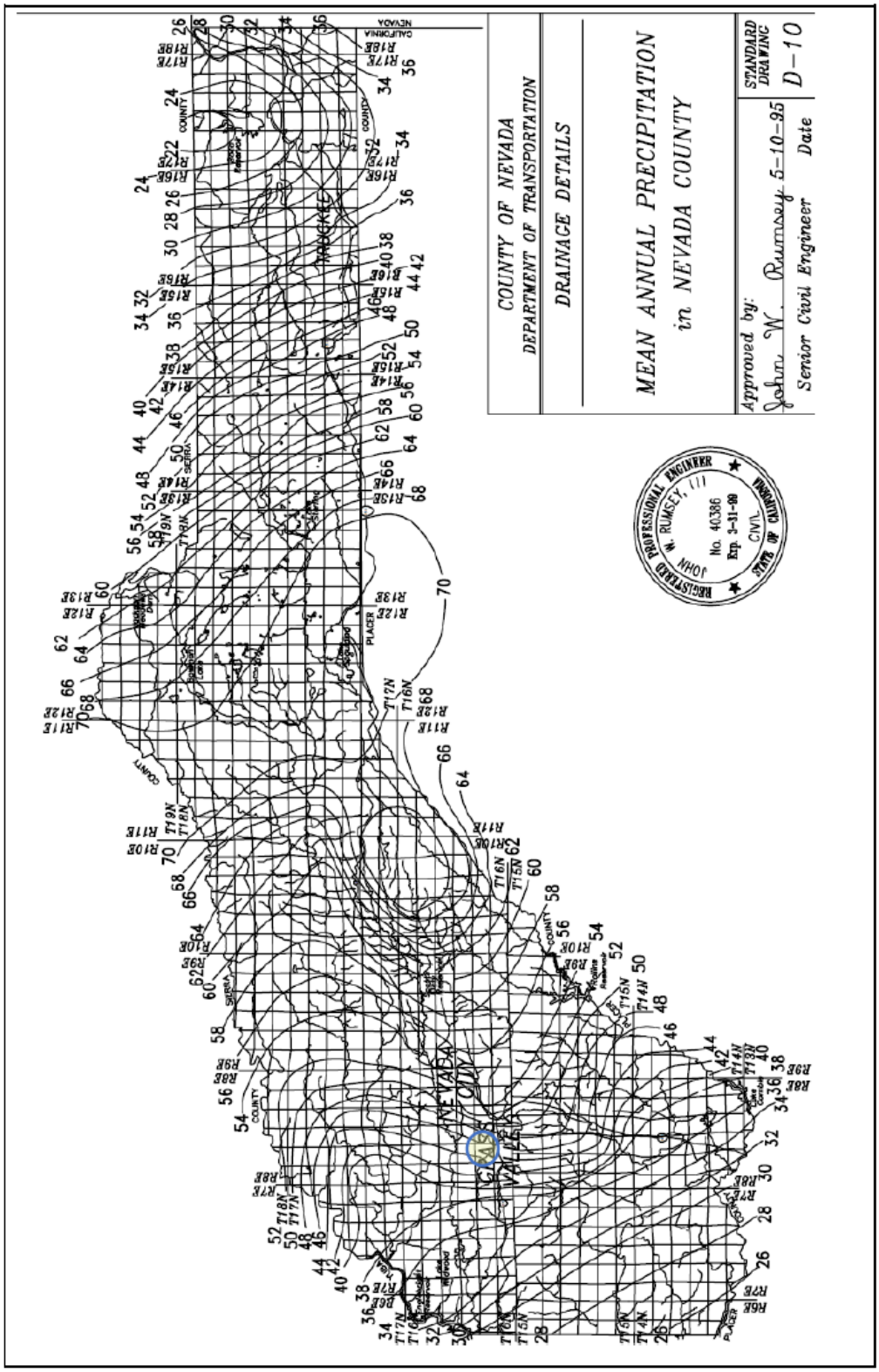


TABLE FOR ESTIMATING "C" IN RATIONAL FORMULA

UNIMPROVED AREAS

CONDITION	EXTREME		HIGH		MODERATE		LOW	
C =	0.36	0.28	0.28	0.15	0.15	0.10	0.10	0.05
SLOPE	ABOVE	30%	30%	10%	10%	5%	5%	0%
C =	0.20	0.15	0.15	0.07	0.07	0.04		0.03
SURFACE PERMEABILITY	BARE ROCK OR VERY THIN SOIL		IMPERVIOUS CLAYS SHALLOW SOILS		DEEP PERVIOUS LOAM, SANDY LOAM		DEEP SAND VOLCANIC ASH	
C =	0.20	0.15	0.15	0.07	0.07	0.04		0.03
VEGETATION	NONE OR VERY SPARSE		LESS THAN 20% COVERED WITH SUBSTANTIAL GROWTH		ABOUT 50% COVERED WITH HEAVY GROWTH		90% COVERED WITH HEAVY GROWTH, DEE HUMMS LAYER	
C =	0.20	0.15	0.15	0.07	0.07	0.04		0.03
SURFACE	SMOOTH SOIL, SLICK ROCK DRAINAGE FLOW CONTINUOUS		ROUGHENED SOIL OR ROCKS		DRAINAGE FLOW INTERRUPTED MANY PONDS, LAKES &		DEEP SAND VOLCANIC ASH	

IMPROVED AREAS

SURFACE	C
ROOF SURFACES	0.95
A.C. OR P.C.C. PAVEMENT, PATIOS, DRIVEWAYS, STREETS, SIDEWALKS	0.90
LANDSCAPED AREAS	0.25
GRAVEL WALKS, ROADWAYS	0.30

D15

3: Existing Conditions Calculations (A-1)

STORM FLOW, Q = CIA

RUNOFF COEFFICIENT, C

RUNOFF COEFFICIENT, C				
ROOF	=	0.00	AC	0.95
PAVEMENT	=	0.00	AC	0.90
GRAVEL	=	0.00	AC	0.25
LANDSCAPED	=	0.00	AC	0.30
NATURAL	=	4.82	AC	
TOTAL	=	4.82	AC	

PARAMETERS			
SLOPE	=	0.10	MODERATE
PERMEABILITY	=	0.07	THIN
VEGETATION	=	0.05	60%
SURFACE	=	0.07	OPEN/FOREST
NATURAL C	=	0.29	

COMPOSITE RUNOFF, C		
C (10 YEAR)	=	0.29
C (100 YEAR)	=	0.43

INTENSITY, I

ANNUAL PRECIPITATION	=	46

SHEET FLOW, Ti			
LENGTH, L	=	740.0	FT
SLOPE, S	=	5.0%	
Ti	=	21.9	MIN

$$T_i = \frac{0.355(CL)^{0.6}}{S^{0.3}}$$

(SEE D-11/12)

TIME OF CONCENTRATION			
TOTAL (Ti+Tt)	=	21.9	MIN
Tc	=	21.9	MIN

CHANNEL FLOW, Tt			
LENGTH, L	=	0.0	FT
SLOPE, S	=	0.0%	
VELOCITY, V	=	1.0	F/S
Tt	=	0.0	MIN

$$T_t = \frac{L}{V}$$

STORM INTENSITY			
I (10 YEAR)	=	1.63	IN/HR
I (100 YEAR)	=	2.32	IN/HR

ZONE, 1

AREA, A-1	=	4.82	AC

DRAINAGE FLOW, Q

FLOW, Q	=	CIA	
Q (10 YEAR)	=	2.28	CFS
Q (100 YEAR)	=	4.82	CFS

4: Proposed Conditions Calculations (A-2, A-3)

STORM FLOW, Q = CIA

RUNOFF COEFFICIENT, C

RUNOFF COEFFICIENT, C

ROOF	=	0.21	AC	0.95
PAVEMENT	=	0.39	AC	0.90
GRAVEL	=	0.00	AC	0.25
LANDSCAPED	=	0.20	AC	0.30
NATURAL	=	0.24	AC	
TOTAL	=	1.04	AC	

PARAMETERS

SLOPE	=	0.10	MODERATE
PERMEABILITY	=	0.07	THIN
VEGETATION	=	0.05	60%
SURFACE	=	0.07	OPEN/FOREST
NATURAL C	=	0.29	

COMPOSITE RUNOFF, C

C (10 YEAR)	=	0.65
C (100 YEAR)	=	0.72

INTENSITY, I

ANNUAL PRECIPITATION = 46

SHEET FLOW, Ti

LENGTH, L	=	100.0	FT
SLOPE, S	=	1.0%	
Ti	=	10.7	MIN

$$T_i = \frac{0.355(CL)^{0.6}}{S^{0.3}}$$

(SEE D-11/12)

TIME OF CONCENTRATION

TOTAL (Ti+Tt)	=	13.2	MIN
Tc	=	13.2	MIN

CHANNEL FLOW, Tt

CHANNEL NO.		1		2
LENGTH, L	=	128.0	FT	52.0
SLOPE, S	=	1.0%		5.0%
VELOCITY, V	=	1.0	F/S	2.0
Tt	=	2.1	MIN	0.4

$$T_t = \frac{L}{V}$$

STORM INTENSITY

I (10 YEAR)	=	1.99	IN/HR
I (100 YEAR)	=	2.83	IN/HR

ZONE, 1

AREA, A-2	=	1.04	AC

DRAINAGE FLOW, Q

FLOW, Q	=	CIA	
Q (10 YEAR)	=	1.36	CFS
Q (100 YEAR)	=	2.13	CFS

STORM FLOW, Q = CIA

RUNOFF COEFFICIENT, C

RUNOFF COEFFICIENT, C

ROOF	=	0.43	AC	0.95
PAVEMENT	=	0.84	AC	0.90
GRAVEL	=	0.00	AC	0.25
LANDSCAPED	=	0.50	AC	0.30
NATURAL	=	2.01	AC	
TOTAL	=	3.78	AC	

PARAMETERS

SLOPE	=	0.10	MODERATE
PERMEABILITY	=	0.07	THIN
VEGETATION	=	0.05	60%
SURFACE	=	0.07	OPEN/FOREST
NATURAL C	=	0.29	

COMPOSITE RUNOFF, C

C (10 YEAR)	=	0.50
C (100 YEAR)	=	0.60

INTENSITY, I

ANNUAL PRECIPITATION = 46

SHEET FLOW, Ti

LENGTH, L	=	75.0	FT
SLOPE, S	=	1.0%	
Ti	=	9.0	MIN

$$T_i = \frac{0.355(CL)^{0.6}}{S^{0.3}}$$

(SEE D-11/12)

TIME OF CONCENTRATION

TOTAL (Ti+Tt)	=	14.4	MIN
Tc	=	14.4	MIN

CHANNEL FLOW, Tt

CHANNEL NO.		1		2
LENGTH, L	=	272.0	FT	82.0
SLOPE, S	=	1.0%		3.0%
VELOCITY, V	=	1.0	F/S	1.5
Tt	=	4.5	MIN	0.9

$$T_t = \frac{L}{V}$$

STORM INTENSITY

I (10 YEAR)	=	1.90	IN/HR
I (100 YEAR)	=	2.70	IN/HR

ZONE, 1

AREA, A-3	=	3.78	AC

DRAINAGE FLOW, Q

FLOW, Q	=	CIA	
Q (10 YEAR)	=	3.61	CFS
Q (100 YEAR)	=	6.14	CFS

	Developed Areas		Total	*Recommended* 0.7"	Vegitation Buffer		Water	Infiltration Trench		Retention	*Actual* Retention
AREA	Asph/Conc (sf)	Roof (sf)	Imp. Area (sf)	Retention (cf)	Area (sf)	Storage (cf)	Inlets (cf)	Length (lf)	Storage (cf)	Pond (cf)	Provided (cf)
A-2	16940	9240	26180	1527	300	24	12	103	515	2123	2674
A-3	36297	18528	54825	3198	300	24	12	140	700	1488	2224
TOTAL	53237	27768	81005	4725							4898

RETENTION = 96%

A-2 RETENTION POND				
ELEVATION	AREA	CONTOUR INTERVAL	VOLUME	VOLUME
ft	sq ft	ft	cf	gal
2679	1534			
		1	1534	11474
2678	589			
		1	589	4406
		Total Volume =	2123	15880

A-3 RETENTION POND				
ELEVATION	AREA	CONTOUR	VOLUME	VOLUME
ft	sq ft	ft	cf	gal
2679	1112			
		1	1112	8318
2678	376			
		1	376	2812
		Total Volume =	1488	11130

Typical Infiltration Trench			
Depth	Width	Vol Factor	Volume (cf/lf)
2	5	0.50	5.00

6: Summary of Peak Flows

SUMMARY OF PEAK FLOWS (RATIONAL METHOD)						
	Drainage Basin	Area (AC)	Response Time (min)	10-YR (cfs)	100-YR (cfs)	Onsite Retention (cf)
Pre-Development	A-1	4.82	21.85	2.28	4.82	
	Total	4.82		2.28	4.82	
Post-Dev Q's (not including onsite retention*)						
Post-Development	A-2	1.04	13.22	1.36	2.13	2674.00
	A-3	3.78	14.41	3.61	6.14	2224.00
	Total	4.82		4.96	8.27	
Post-Dev Q's (including onsite retention**)						
Post-Mitigated Flow	O-2 + A-2			-1.17	-0.40	
Post-Mitigated Flow	O-3 + A-3			1.68	4.21	
	Total Post-Mitigated Flow			0.51	3.81	

Notes:

* The post-development flow is more than pre-development flow as a result of an increase in impervious surfaces.

**The Post-Mitigated Flow includes the effect of attenuation from onsite retention facilities.

Retention facilities for this project is a vegetative buffer strip, drainage inlet sumps and roof downspout infiltration trenches

Post-Mitigated Flow calculation is based on Federal Highway Administration Hydraulic Design

Qr = Qp - S / 80tp Qp - Peak Flow (cfs) without onsite retention
S - Available Onsite Storage/Retention
tp - Time to Peak (min)

As described in FHWA's HDS-5, this calculation method is a 'quick, direct solution for the reduced outflow'. If further confirmationor analysis is needed, the full routing calculation with Stage-Storage calculations and Inflow/Outflow Hydrographs should be used.

List of Plates

Plate 1. Pre-Project Drainage Map

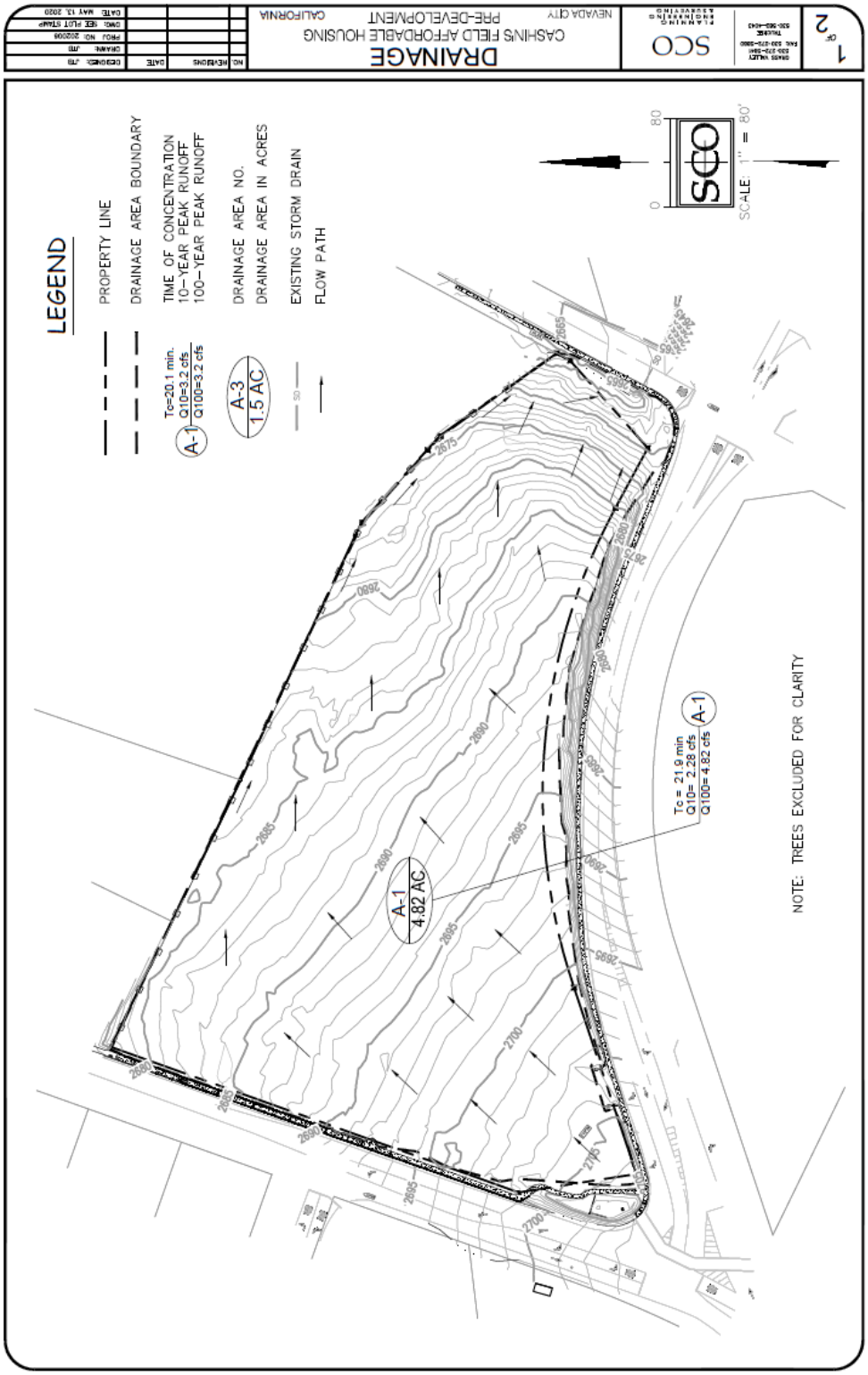
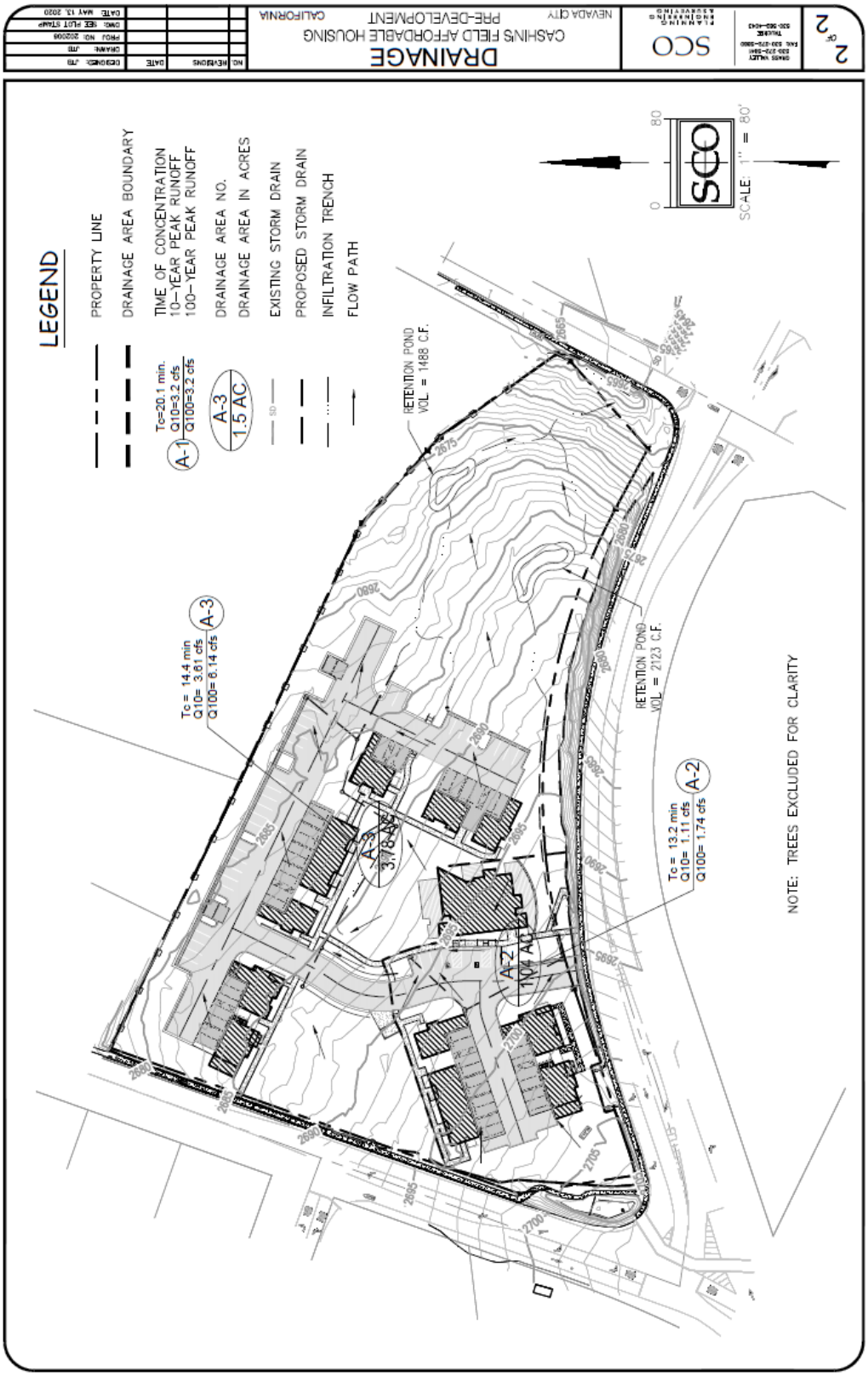



Plate 2. Post-Project Drainage Map