

BCA Engineering, Inc.

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BCA ENGINEERING CORP.

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**PRELIMINARY HYDROLOGY STUDY &
HYDRAULIC CALCULATIONS**

**PROPOSED RESIDENTIAL SUBDIVISION
APN 3091-141-02
SECOND AVENUE
VICTORVILLE**

PREPARED FOR

Valerie Koh
Vacationland, LLC

**Date Prepared:
October, 2014**

W.O.# 144-14

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DISCUSSION**PURPOSE**

This study was performed to determine the drainage flows that affect the proposed development of a residential subdivision so that an adequate drainage plan could be designed to conduct these flows through the site and reduce the outflows from the site.

LOCATION & DISCUSSION

This property is located on the west side of Second Avenue approximately 330 feet north of Silica Drive in Victorville. The site is approximately 5 acres and is rectangular in shape (see attached map). The site is currently vacant. There are no existing structures or improvements on the site. The entire site is pervious.

The current proposed site improvements include the construction of a ± 2.5 acre single family residential lots. On-site storm run-off will be directed away from the proposed buildings to existing storm drain facilities in the area.

OFF-SITE RUNOFF

There is no off-site runoff that affects the site. The area to the south drains to either Second Avenue or a storm drain located along the westerly property line of the site. The storm drain is an open concrete box culvert 48" wide and 24" deep. The open channel connects to a 24" diameter reinforced concrete pipe with a grated entrance. This carries the flows northerly into progressively larger storm drains.

ON -SITE RUNOFF

The on-site runoff was determined using the San Bernardino County Rational Method. Both the current land use and the proposed land use were analyzed. This information was used to determine the amount of runoff from the site.

The runoff from the existing undeveloped site was found to be 14.8 cubic feet per second. This runoff is split with approximately 5.9 cfs flowing west to the existing storm drain and 8.9 cfs flowing east to Second Avenue. The runoff from the fully developed site will be 7.1 cfs flowing

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west to the storm drain and 10.6 cfs flowing east to Second Avenue.

METHODOLOGY

The storm flow volume was determined using the Rational Method to determine the Time of Concentration for the pre-developed and fully developed sites. This information was then used in the Unit Hydrograph Method to determine the runoff volumes. The following analysis values were used:

- (a) 100 -year design storm frequency.
- (b) Hydrologic soils group "C"
- (c) Development type: Residential
- (d) 100 Year 1 hour – 1.11
- (e) SCS Curve Number – 85 existing, 4 units/acre developed

CONCLUSION

The storm run-off for a 100-year storm event created by the site in its existing undeveloped condition is 14.8 cubic feet per second. The storm run-off for the proposed developed condition is 17.7 cubic feet per second. These flows can be controlled within the existing storm drain and streets.

The development of this site will have no adverse drainage affect on this or surrounding properties.

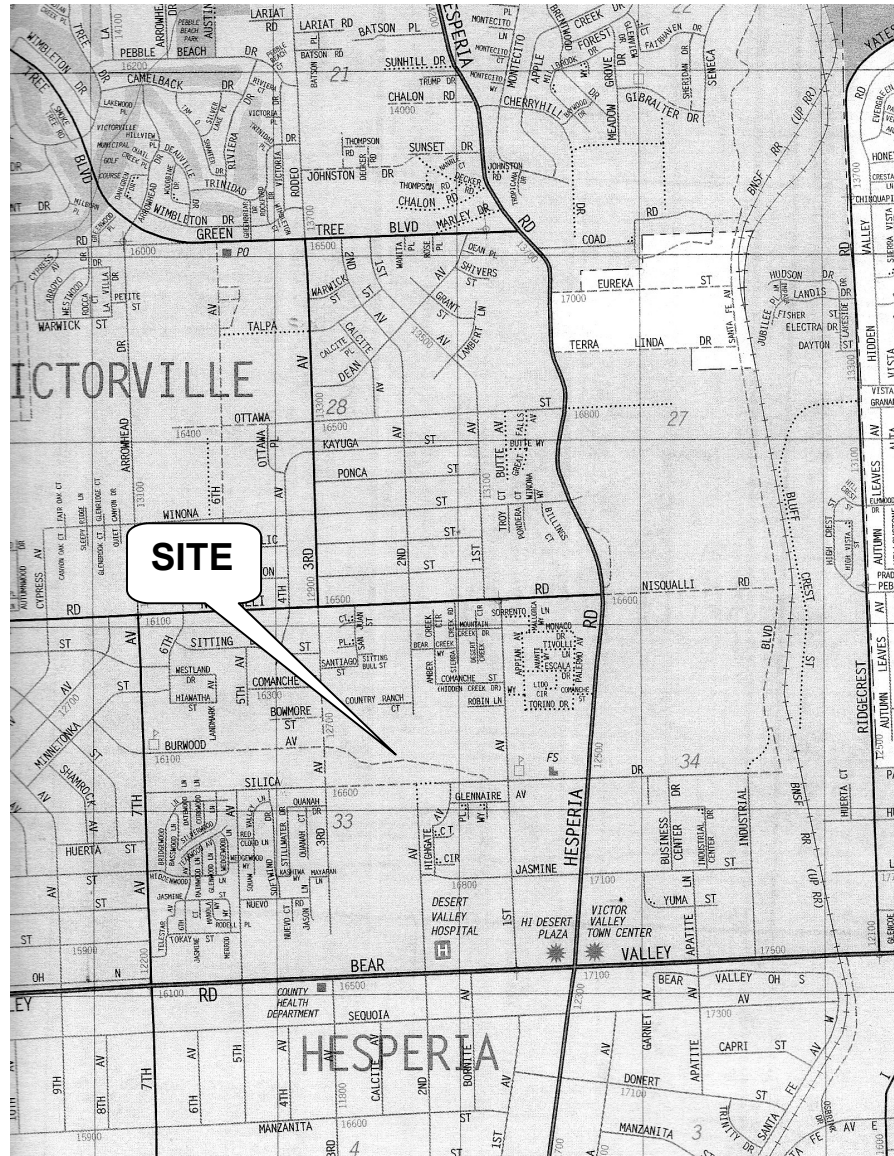
Randolph J. Coleman RCE 36293 Exp 6-30-2016

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**LOCATION MAP – WEST SIDE SECOND AVENUE SOUTH OF NISQUALLI ROAD
APPLE VALLEY**

DRAWING 1

Civil Engineering
Land Surveying & GPS
Land Planning & GIS

Biological, Native Plant & Phase I Assessments
Valuations & Marketing Studies

©

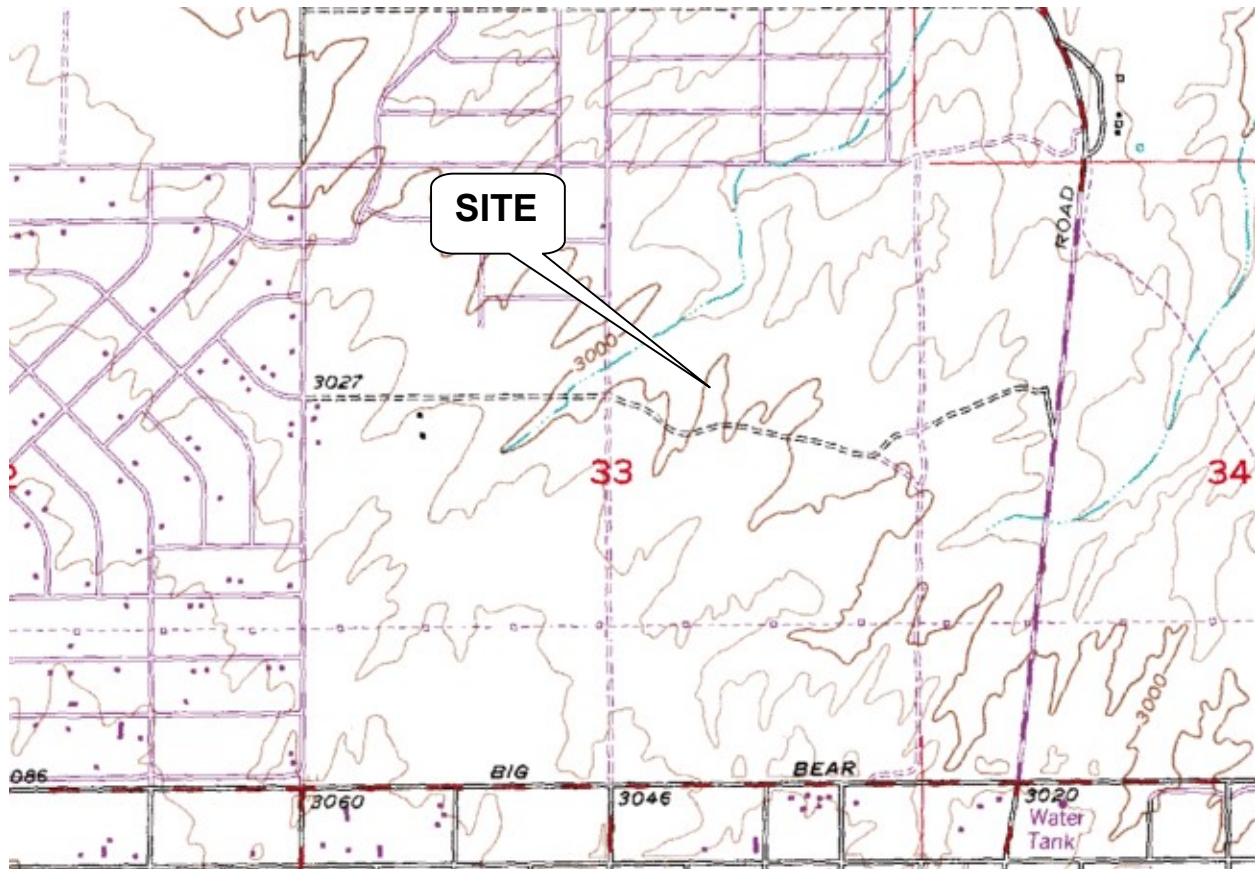
Real Estate Services
Feasibility Analysis
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USGS QUAD SHEET - VICTORVILLE

DRAWING 2

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Land Surveying & GPS
Land Planning & GIS

Biological, Native Plant & Phase I Assessments
Valuations & Marketing Studies
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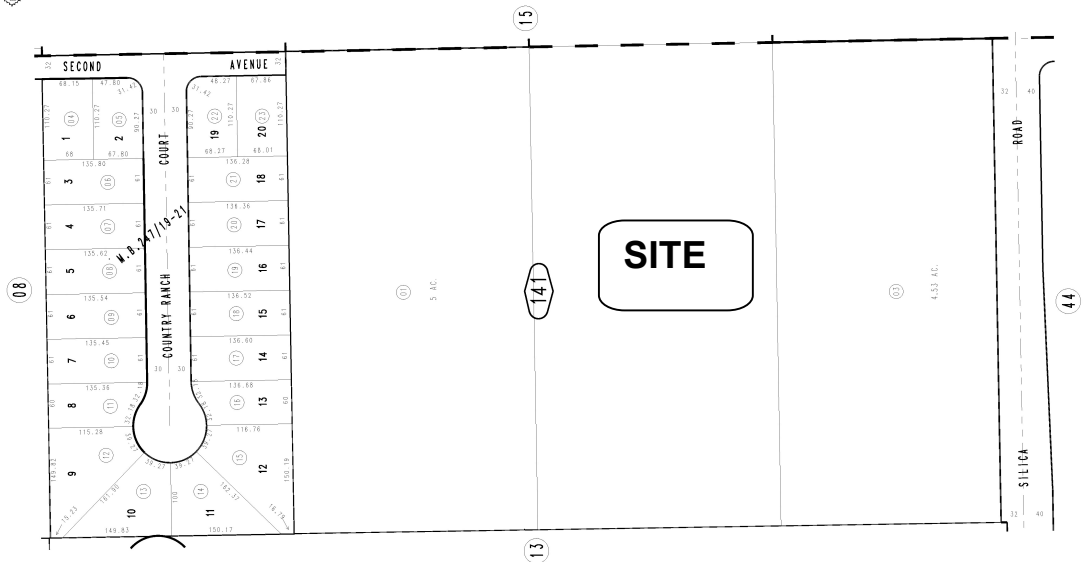
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THIS MAP IS FOR THE PURPOSE
OF AD VALOREM TAXATION ONLY.

Ptn. E.1/2, S.W.1/4, N.E.1/4 Sec. 33, T.5N.,R.4W., S.B.M.

City of Victorville
Tax Rate Area
12064

3091 - 14



OCTOBER 1993

Tract No. 14823, W.B. 247/19-21

Assessor's Map
Book 3091 Page 14
San Bernardino County

REVISED
08/03/06 GW

ASSESSOR'S MAP - APN 3091-141-02

DRAWING 3

Civil Engineering
Land Surveying & GPS
Land Planning & GIS

Biological, Native Plant & Phase I Assessments
Valuations & Marketing Studies

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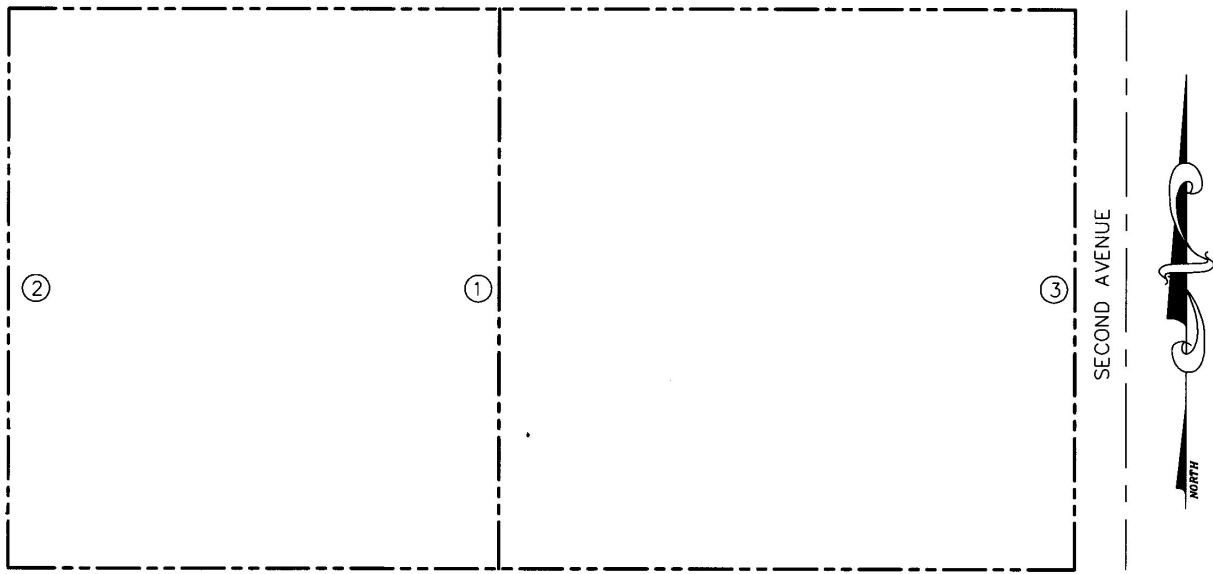
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DRAINAGE NODES - APN 3091-141-02

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AERIAL - APN 3091-141-02

DRAWING 5

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San Bernardino County Rational Hydrology Program

(Hydrology Manual Date - August 1986)

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989-2005 Version 7.1
Rational Hydrology Study Date: 10/22/14

APN 3091-141-02
Predevelopment Storm Runoff
100 Year Storm Event
14414pre.out

Program License Serial Number 6286

***** Hydrology Study Control Information *****

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.110 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

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+++++
Process from Point/Station      1.000 to Point/Station      2.000
**** INITIAL AREA EVALUATION ****
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Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 85.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.283(In/Hr)
Initial subarea data:
Initial area flow distance = 280.000(Ft.)
Top (of initial area) elevation = 3010.000(Ft.)
Bottom (of initial area) elevation = 3005.000(Ft.)
Difference in elevation = 5.000(Ft.)
Slope = 0.01786 s(%)= 1.79
TC = $k(0.529)*[(length^3)/(elevation\ change)]^{0.2}$
Initial area time of concentration = 11.273 min.
Rainfall intensity = 3.578(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.829
Subarea runoff = 5.931(CFS)
Total initial stream area = 2.000(Ac.)
Pervious area fraction = 1.000
Initial area Fm value = 0.283(In/Hr)

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+++++
Process from Point/Station 1.000 to Point/Station 3.000
**** SUBAREA FLOW ADDITION ****

Soil classification AP and SCS values input by user
USER INPUT of soil data for subarea
SCS curve number for soil(AMC 2) = 85.00
Pervious ratio(Ap) = 1.0000 Max loss rate(Fm)= 0.283(In/Hr)
Time of concentration = 11.27 min.
Rainfall intensity = 3.578(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified
rational method) (Q=KCIA) is C = 0.829
Subarea runoff = 8.896(CFS) for 3.000 (Ac.)
Total runoff = 14.827(CFS)
Effective area this stream = 5.00 (Ac.)
Total Study Area (Main Stream No. 1) = 5.00 (Ac.)
Area averaged Fm value = 0.283(In/Hr)
End of computations, Total Study Area = 5.00 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 1.000
Area averaged SCS curve number = 85.0

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Rational Hydrology Study Date: 10/22/14

APN 3091-141-02
Postdevelopment Storm Runoff
100 Year Storm Event
14414post.out

Program License Serial Number 6286

***** Hydrology Study Control Information *****

Rational hydrology study storm event year is 100.0
Computed rainfall intensity:
Storm year = 100.00 1 hour rainfall = 1.110 (In.)
Slope used for rainfall intensity curve b = 0.7000
Soil antecedent moisture condition (AMC) = 2

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+++++
Process from Point/Station 1.000 to Point/Station 2.000
**** INITIAL AREA EVALUATION ****

RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 69.00
Pervious ratio(Ap) = 0.6000 Max loss rate(Fm)= 0.329(In/Hr)
Initial subarea data:
Initial area flow distance = 280.000(Ft.)
Top (of initial area) elevation = 3010.000(Ft.)
Bottom (of initial area) elevation = 3005.000(Ft.)
Difference in elevation = 5.000(Ft.)
Slope = 0.01786 s(%)= 1.79
TC = k(0.412)*[(length^3)/(elevation change)]^0.2
Initial area time of concentration = 8.778 min.
Rainfall intensity = 4.262(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.831
Subarea runoff = 7.081(CFS)
Total initial stream area = 2.000(Ac.)
Pervious area fraction = 0.600
Initial area Fm value = 0.329(In/Hr)

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+++++
Process from Point/Station 1.000 to Point/Station 3.000
**** SUBAREA FLOW ADDITION ****

RESIDENTIAL(3 - 4 dwl/acre)
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 1.000
Decimal fraction soil group D = 0.000
SCS curve number for soil(AMC 2) = 69.00
Pervious ratio(Ap) = 0.6000 Max loss rate(Fm)= 0.329(In/Hr)
Time of concentration = 8.78 min.
Rainfall intensity = 4.262(In/Hr) for a 100.0 year storm
Effective runoff coefficient used for area, (total area with modified
rational method) (Q=KCIA) is C = 0.831
Subarea runoff = 10.621(CFS) for 3.000(Ac.)
Total runoff = 17.701(CFS)
Effective area this stream = 5.00(Ac.)
Total Study Area (Main Stream No. 1) = 5.00(Ac.)
Area averaged Fm value = 0.329(In/Hr)
End of computations, Total Study Area = 5.00 (Ac.)
The following figures may
be used for a unit hydrograph study of the same area.
Note: These figures do not consider reduced effective area
effects caused by confluences in the rational equation.

Area averaged pervious area fraction(Ap) = 0.600
Area averaged SCS curve number = 69.0