Appendix H: Hydrology - Murrieta Canyon Academy

Hydrology – Murrieta Canyon Academy

The Murrieta Canyon Academy located at 24150 Hayes Avenue, Murrieta, California, is a fully functioning adult education school campus constructed during various phases. The proposed buildings are generally located within the existing softball fields located immediately north of the existing campus and south of Thompson Middle School. The existing Murrieta Canyon Academy buildings are to be demolished and new parking/landscape to be constructed. The goal of this study is to see if the 36" pipe out letting the on-site run-off will be able to handle the added run-off from the proposed improvements from Murrieta Canyon Academy and the existing run-off from Thompson Middle School. 100-year storm flows were modelled.

Area A

Area A starts at node 100, on the north portion of Thompson Middle School, run-off flows into a CB at node 101. The CB at 101 is connected to the pipe, node 102, that flows from Thompson Middle School, which is primarily impervious due to Thompson Middle School being an active public school. The run-off is conveyed through an existing 18" storm drain pipe to node 103, a 27" storm drain pipe. The "Q" at node 104 is 20.05 cfs.

Area B

Area B starts at node 200, on the north side of the existing field at Thompson Middle School. This flow drains into the south into an existing catch basin, node 201. The flow is then routed through the existing catch basin and into an existing storm drain pipe for 581' and connects to the existing 27" storm drain pipe, node 203. The "Q" at node 203 is 10.22 cfs.

Flow from Area A and Area B are then confluenced at node 300. The flow from Area A and Area B then flow through a 36" pipe for 133' until node 301. The "Q" at node 301 if 24.43 cfs.

Area C

Area C starts at node 400, on the north side of the existing field at Thompson Middle School. This flow drains south and into a drop inlet CB, node 401. The CB at 401 is connected to a proposed 6" storm drain pipe, node 402, that flows from the CB to the proposed basin, which has subsurface 6" perforated pipes. The perforated pipes are then confluence with 301, at node 403. The "Q" at node 403 is 15.60 cfs.

Area D

Area D starts at Node 600, on the north side of the parking lot at Thompson Middle School. This flow drains south into a drop inlet CB, node 601. The CB at 601 is connected to an existing storm drain pipe, node 602, which conveys the run-off from Thompson Middle School to node 603 via an existing 18" storm drain pipe. The run-off is conveyed through an existing 18" storm drain pipe to node 603. The "Q" at node 603 is 8.70 cfs.

Area E

Area E starts at Node 700, on the north side of the southern parking lot at Thompson Middle School. This flow drains south into a drop inlet CB, node 701. The CB at 701 is connected to an existing storm drain pipe, node 702, which conveys the run-off from Thompson Middle School to node 703 via an existing 18" storm drain pipe. The run-off is conveyed through an existing 18" storm drain pipe to node 703. The "Q" at node 703 is 7.75 cfs. In conclusion, the 36" pipe out letting the on-site run-off will be able to handle the added run-off from the proposed improvements from Murrieta Canyon Academy and the existing run-off from Thompson Middle School in a 100-year storm.

Riverside County Rational Hydrology Program

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CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989 - 2014 Version 9.0 Rational Hydrology Study Date: 01/08/20 File:MCARAT100ABC.out MURRIETA CANYON ACADEMY AREA A / AREA B / AREA C RATIONAL METHOD STUDY TDM / SRU 01/08/2020 ******** Hydrology Study Control Information ********* English (in-1b) Units used in input data file Program License Serial Number 6386 Rational Method Hydrology Program based on Riverside County Flood Control & Water Conservation District 1978 hydrology manual Storm event (year) = 100.00 Antecedent Moisture Condition = 3 Standard intensity-duration curves data (Plate D-4.1) For the [Murrieta, Tmc, Rnch CaNorco] area used. 10 year storm 10 minute intensity = 2.360(In/Hr) 10 year storm 60 minute intensity = 0.880(In/Hr) 100 year storm 10 minute intensity = 3.480(In/Hr)
100 year storm 60 minute intensity = 1.300(In/Hr) Storm event year = 100.0 Calculated rainfall intensity data: 1 hour intensity = 1.300(In/Hr) Slope of intensity duration curve = 0.5500 Process from Point/Station 100.000 to Point/Station 101.000 **** INITIAL AREA EVALUATION **** Initial area flow distance = 95.000(Ft.) Top (of initial area) elevation = 39.890(Ft.) Bottom (of initial area) elevation = 35.650(Ft.) Difference in elevation = 4.240(Ft.) Slope = 0.04463 s(percent) = 4.46 $TC = k(0.336)*[(length^3)/(elevation change))^{0.2}$ Warning: TC computed to be less than 5 min.; program is assuming the time of concentration is 5 minutes. Initial area time of concentration = 5.000 min. 5.099(In/Hr) for a 100.0 year storm Rainfall intensity = MOBILE HOME PARK subarea type Runoff Coefficient = 0.890 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 RI index for soil(AMC 3) = 84.40Pervious area fraction = 0.250; Impervious fraction = 0.750 Initial subarea runoff = 20.050(CFS) Total initial stream area = 4.420(Ac.) Pervious area fraction = 0.250 Process from Point/Station 102.000 to Point/Station 103.000 **** PIPEFLOW TRAVEL TIME (User specified size) **** Upstream point/station elevation = 32.650(Ft.) Downstream point/station elevation = 27.720(Ft.) Pipe length = 606.00(Ft.) Manning's N = 0.013 No, of pipes = 1 Required pipe flow = 20.050(CFS)

Given pipe size = 12.00(In.) NOTE: Normal flow is pressure flow in user selected pipe size. The approximate hydraulic grade line above the pipe invert is 202.113(Ft.) at the headworks or inlet of the pipe(s) Pipe friction loss = 191.863(Ft.) Minor friction loss = 15.180(Ft.) Pipe flow velocity = 25.53(Ft/s) 15.180(Ft.) K-factor = 1.50Travel time through pipe = 0.40 min. Time of concentration (TC) = 5.40 m 5.40 min. Process from Point/Station 103.000 to Point/Station 104.000 **** PIPEFLOW TRAVEL TIME (User specified size) **** Upstream point/station elevation = 27.720(Ft.) Downstream point/station elevation = 21.320(Ft.) Pipe length = 462.00(Ft.) Manning's N = 0.013 No. of pipes = 1 Required pipe flow = 20.050(CFS) Given pipe size = 27.00(In.) Calculated individual pipe flow = 20.050(CFS) Normal flow depth in pipe = 14.30(In.) Flow top width inside pipe = 26.95(In.) Critical Depth = 18.79(In.) Pipe flow velocity = 9.39(Ft/s) Travel time through pipe = 0.82 min. Time of concentration (TC) = 6.22 m 6.22 min. **** CONFLUENCE OF MINOR STREAMS **** Along Main Stream number: 1 in normal stream number 1 Stream flow area = 4.420(Ac.) Runoff from this stream = 20.050(CFS) Time of concentration = 6.22 min. Rainfall intensity = 4.524(In/Hr) Process from Point/Station 200.000 to Point/Station 201.000 **** INITIAL AREA EVALUATION **** Initial area flow distance = 184.000 (Ft.) Top (of initial area) elevation = 40.700(Ft.) Bottom (of initial area) elevation = 31.400(Ft.) Difference in elevation = 9.300(Ft.) Slope = 0.05054 s(percent) = 5.05 TC = k(0.940) * [(length^3) / (elevation change)]^0.2 Initial area time of concentration = 13.751 min. Rainfall intensity = 2.923(In/Hr) for a 100.0 year storm UNDEVELOPED (good cover) subarea Runoff Coefficient = 0.844 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 = 0.000RI index for soil(AMC 3) = 87.40 Pervious area fraction = 1.000; Impervious fraction = 0.000 Initial subarea runoff = 10.220(CFS) Total initial stream area = 4.140 (Ac.) Pervious area fraction = 1.000 Process from Point/Station 202.000 to Point/Station 203.000 **** PIPEFLOW TRAVEL TIME (User specified size) **** Upstream point/station elevation = 29.900(Ft.) Downstream point/station elevation = 21.320(Ft.) Pipe length = 581.00(Ft.) Manning's N = 0.013 No. of pipes = 1 Required pipe flow = 10.220 (CFS) Given pipe size = 12.00(In.) NOTE: Normal flow is pressure flow in user selected pipe size. The approximate hydraulic grade line above the pipe invert is 43.151(Ft.) at the headworks or inlet of the pipe(s) Pipe friction loss = 47.788(Ft.)

Minor friction loss = 3.944(Ft.) Pipe flow velocity = 13.01(Ft/s) K-factor = 1.50Travel time through pipe = 0.74 min. Time of concentration (TC) = 14.49 min. Process from Point/Station 104.000 to Point/Station 203.000 **** CONFLUENCE OF MINOR STREAMS **** Along Main Stream number: 1 in normal stream number 2 Stream flow area = 4.140 (Ac.) Runoff from this stream = 10.220 (CFS) Time of concentration = 14.49 min. Rainfall intensity = 2.840(In/Hr) Summary of stream data: Rainfall Intensity Stream Flow rate TC (min) (CES) No. (In/Hr) 20.050 6.22 10.220 14.49 1 4.524 2 2.840 Largest stream flow has longer or shorter time of concentration Qp = 20.050 + sum of Qa Tb/Ta 10.220 * 0.429 = 4.383 Qp = 24.433 Total of 2 streams to confluence: Flow rates before confluence point: 20.050 10.220 Area of streams before confluence: 4.420 4.140 Results of confluence: Total flow rate = 24.433(CFS) Time of concentration = 6.216 min. Effective stream area after confluence = 8.560(Ac.) ***** Process from Point/Station 300.000 to Point/Station 301.000 **** PIPEFLOW TRAVEL TIME (User specified size) **** Upstream point/station elevation = 21.320(Ft.) Downstream point/station elevation = 17.120(Ft.) Pipe length = 133.00(Ft.) Manning's N = 0.013 No. of pipes = 1 Required pipe flow = 24.433(CFS) Given pipe size = 36.00(In.) Calculated individual pipe flow = 24.433(CFS) Normal flow depth in pipe = 11.09(In.) Flow top width inside pipe = 33.24(In.) Critical Depth = 19.12(In.) Pipe flow velocity = 13.20 (Ft/s) Travel time through pipe = 0.17 min. Time of concentration (TC) = 6.38 m 6.38 min. **** CONFLUENCE OF MINOR STREAMS **** Along Main Stream number: 1 in normal stream number 1 Stream flow area = 8.560(Ac.) Runoff from this stream = 24.433(CFS) Time of concentration = 6.38 min. Rainfall intensity = 4.458(In/Hr) ***** Process from Point/Station 400.000 to Point/Station 401,000 **** INITIAL AREA EVALUATION **** Initial area flow distance = 353.000(Ft.) Top (of initial area) elevation = 33.310(Ft.) Bottom (of initial area) elevation = 28.330(Ft.) Difference in elevation = 4.980(Ft.)

Slope = 0.01411 s(percent) = 1.41

 $TC = k(0.480)*[(length^3)/(elevation change)]^{0.2}$ Initial area time of concentration = 11.761 min. Rainfall intensity = 3.185(In/Hr) for a 100.0 year storm SINGLE FAMILY (1 Acre Lot) Runoff Coefficient = 0.861 Decimal fraction soil group A = 0.000 Decimal fraction soil group B = 0.000 Decimal fraction soil group C = 0.000Decimal fraction soil group D = 1.000 RI index for soil (AMC 3) = 88.00Pervious area fraction = 0.800; Impervious fraction = 0.200 Initial subarea runoff = 15.608(CFS) Total initial stream area = 5.690 (Ac.) Pervious area fraction = 0.800 ****************** Process from Point/Station 402.000 to Point/Station 403.000 **** PIPEFLOW TRAVEL TIME (User specified size) **** Upstream point/station elevation = 26.830(Ft.) Downstream point/station elevation = 17.120(Ft.) Pipe length = 291.00(Ft.) Manning's N = 0.013 No. of pipes = 1 Required pipe flow = 15.608(CFS) Given pipe size = 6.00(In.) NOTE: Normal flow is pressure flow in user selected pipe size. The approximate hydraulic grade line above the pipe invert is 2388.394(Ft.) at the headworks or inlet of the pipe(s) Pipe friction loss = 2250.925(Ft.) Minor friction loss = 147.180(Ft.) Pipe flow velocity = 79.49(Ft/s) K-factor = 1.50Travel time through pipe = 0.06 min. Time of concentration (TC) = 11.82 min. Process from Point/Station 301.000 to Point/Station 403.000 **** CONFLUENCE OF MINOR STREAMS **** Along Main Stream number: 1 in normal stream number 2 Stream flow area = 5.690 (Ac.) Runoff from this stream = 15.608(CFS) Time of concentration = 11.82 min. Rainfall intensity = 3.176(In/Hr) Summary of stream data: Stream Flow rate TC No. (CFS) (min) Rainfall Intensity (In/Hr) 24.433 6.38 15.608 11.82 6.38 4.458 1 2 3.176 Largest stream flow has longer or shorter time of concentration 24.433 + sum of Qp = Qa Tb/Ta 15.608 * 0.540 = 8.428 32.861 0p = Total of 2 streams to confluence: Flow rates before confluence point: 24.433 15.608 Area of streams before confluence: 8.560 5.690 Results of confluence: Total flow rate = 32.861(CFS) Time of concentration = 6.384 min. Effective stream area after confluence = 14.250(Ac.) Process from Point/Station 500.000 to Point/Station 501.000 **** PIPEFLOW TRAVEL TIME (User specified size) **** Upstream point/station elevation = 17.120(Ft.) Downstream point/station elevation = 16.270(Ft.) Pipe length = 177.00(Ft.) Manning's N = 0.013 No. of pipes = 1 Required pipe flow = 32.861(CFS) Given pipe size = 36.00(In.)

Calculated individual pipe flow = 32.861(CFS) Normal flow depth in pipe = 22.43(In.) Flow top width inside pipe = 34.89(In.) Critical Depth = 22.30(In.) Pipe flow velocity = 7.10(Ft/s) Travel time through pipe = 0.42 min. Time of concentration (TC) = 6.80 min. End of computations, total study area = 14.25 (Ac.) The following figures may be used for a unit hydrograph study of the same area.

Area averaged pervious area fraction (Ap) = 0.688Area averaged RI index number = 72.8

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Riverside County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software, (c) 1989 - 2014 Version 9.0 Rational Hydrology Study Date: 02/21/20 File:MCARAT100D.out _____ ------MURRIETA CANYON ACADEMY AREA D & AREA E 100YR RATIONAL STUDY TDM / SRU 2/21/2020 -----********* Hydrology Study Control Information ********** English (in-lb) Units used in input data file Program License Serial Number 6386 Rational Method Hydrology Program based on Riverside County Flood Control & Water Conservation District 1978 hydrology manual Storm event (year) = 100.00 Antecedent Moisture Condition = 3 Standard intensity-duration curves data (Plate D-4.1) For the [Murrieta, Tmc, Rnch CaNorco] area used. 10 year storm 10 minute intensity = 2.360(In/Hr) 10 year storm 60 minute intensity = 0.880(In/Hr) 100 year storm 10 minute intensity = 3.480(In/Hr) 100 year storm 60 minute intensity = 1.300(In/Hr) Storm event year = 100.0 Calculated rainfall intensity data: 1 hour intensity = 1.300(In/Hr) Slope of intensity duration curve = 0.5500 Process from Point/Station 600,000 to Point/Station 601.000 **** INITIAL AREA EVALUATION **** Initial area flow distance = 344.000(Ft.) Top (of initial area) elevation = 39.590 (Ft.) Bottom (of initial area) elevation = 36.000 (Ft.) Difference in elevation = 3.590(Ft.) Slope = 0.01044 s(percent) = 1.04 $TC = k(0.323)*[(length^3)/(elevation change)]^{0.2}$ Initial area time of concentration = 8.320 min. Rainfall intensity = 3.854(In/Hr) for a 100.0 year storm APARTMENT subarea type Runoff Coefficient = 0.892 Decimal fraction soil group A = 0.000Decimal fraction soil group B = 0.000 Decimal fraction soil group C = 0.000 Decimal fraction soil group D = 1.000 RI index for soil (AMC 3) = 88.00Pervious area fraction = 0.200; Impervious fraction = 0.800 Initial subarea runoff = 8.695(CFS) Total initial stream area = 2.530(Ac.) Pervious area fraction = 0.200 ********* Process from Point/Station 602.000 to Point/Station 603.000 **** PIPEFLOW TRAVEL TIME (User specified size) **** Upstream point/station elevation = 33.000(Ft.) Downstream point/station elevation = 31.670(Ft.) Pipe length = 270.00(Ft.) Manning's N = 0.013 No. of pipes = 1 Required pipe flow = 8.695(CFS) Given pipe size = 18.00(In.) NOTE: Normal flow is pressure flow in user selected pipe size. The approximate hydraulic grade line above the pipe invert is

1.084(Ft.) at the headworks or inlet of the pipe(s) Pipe friction loss = 1.850(Ft.) Minor friction loss = 0.564(Ft.) K-factor = 1.50 Pipe flow velocity = 4.92(Ft/s) Travel time through pipe = 0.91 min. Time of concentration (TC) = 9.23 min. Process from Point/Station 700.000 to Point/Station **** SUBAREA FLOW ADDITION **** 701.000 APARTMENT subarea type Runoff Coefficient = 0.891 Decimal fraction soil group A = 0.000 Decimal fraction soil group B = 0.000 Decimal fraction soil group C = 0.000Decimal fraction soil group D = 1.000 RI index for soil(AMC 3) = 88.00 Pervious area fraction = 0.200; Impervious fraction = 0.800 Time of concentration = 9.23 min. Rainfall intensity = 3.639(In/Hr) for a 100.0 year storm Subarea runoff = 7.752(CFS) for 2.390(Ac.)Total runoff = 16.448(CFS) Total area = 4.920(A)4.920 (Ac.) Process from Point/Station 702.000 to Point/Station 703.000 **** PIPEFLOW TRAVEL TIME (User specified size) **** Upstream point/station elevation = 31.670(Ft.) Downstream point/station elevation = 16.270(Ft.) Pipe length = 778.00(Ft.) Manning's N = 0.013 No. of pipes = 1 Required pipe flow = 16.448(CFS) Given pipe size = 18.00(In.) NOTE: Normal flow is pressure flow in user selected pipe size. The approximate hydraulic grade line above the pipe invert is 5.686(Ft.) at the headworks or inlet of the pipe(s) Pipe friction loss = 19.069(Ft.) Minor friction loss = 2.018(Ft Pipe flow velocity = 9.31(Ft/s) K-factor = 1.50 2.018(Ft.) Travel time through pipe = 1.39 min. Time of concentration (TC) = 10.63 min. End of computations, total study area = 4.92 (Ac.) The following figures may be used for a unit hydrograph study of the same area. Area averaged pervious area fraction(Ap) = 0.200 Area averaged RI index number = 75.0

