DRAINAGE REPORT
FOR
MESA DEL SOL
RESIDENTIAL
MONTAGE UNIT 3 AND 4

JANUARY 2019

Prepared for:

MESA DEL SOL, LLC
5700 UNIVERSITY BLVD WEST SE - SUITE 310
ALBUQUERQUE, NM 87106

Prepared by:

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Prepared By:

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Design Engineer	Project Manager

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APPENDICES

EXHIBITS

I. PURPOSE

This drainage report is for Mesa del Sol Residential Montage Unit 3 and 4. The proposed development consists of approximately 277 single family detached and attached residential lots on approximately 67 acres which will be developed in two units (Unit 3 and 4). This project is located within Mesa del Sol, in southeast Albuquerque south of the intersection of Bobby Foster Road and University Blvd. The Mesa del Sol Residential Montage Unit 3 and 4 is part of a larger phase of residential development which will occur in the future; however, the fully developed drainage for the ultimate future condition as well as the interim developed conditions are addressed by this report. This report is submitted in support of grading approval and preliminary plat approval by the DRB.

II. CONCEPTS AND METHODOLOGIES

Drainage conditions were analyzed utilizing the 100-year, 6-hour storm event in accordance with the City of Albuquerque Drainage Ordinance and the *Development Process Manual (DPM), Volume 2 Design Criteria, Section 22.2, Hydrology, The City of Albuquerque*, January 2002. Basins, as referenced later in this report are less than 40 acres, therefore Part A of the DPM, Section 22.2, which provides a simplified procedure for projects with sub-basins smaller than 40 acres, was used. The results are included in Appendices A through C. Street capacity and storm drain inlet calculations supporting this study are located in Appendix B.

The overall drainage concept for this project will be onsite and offsite ponding of storm water in the developed conditions. Onsite runoff will be captured by retention ponds, which are designed to retain and infiltrate approximately the 2-year storm volume, as well as the 100-year 10-day storm volume. These ponds will be owned and maintained by Mesa del Sol with agreement and covenants with the City of Albuquerque.

In Albuquerque, approximately 90% of the annual runoff is generated by rainfall events that are 1 inch or less, which equates to approximately the 2-year storm; therefore, this was the basis for sizing the infiltration basins within the retention ponds. The infiltration time utilizing the infiltration basins as well as the surrounding ponding area, will be 96 hours or less. Offsite flows affecting this project from the west will be captured by temporary retention ponds until development to the west occurs.

The following document was referenced in the preparation of this report:

- *Technical Appendices for the Level B Plan for Mesa del Sol*, prepared by Calthorpe Associates, dated October 2006.

The Level B Plan contains a conceptual Drainage Management Plan (DMP), which outlines both existing and developed drainage conditions. Retention ponding of the 10-day developed storm volume is proposed by this report both by proposed ponding areas as well as the existing playa area located to the south within Zone 'A' as designated by FEMA, which has historically captured and retained storm water from the Mesa del Sol area. In addition, the Level B DMP states a volume capacity of the existing playa of 2,300 ac-ft., which is far in excess of the developed runoff volume of 480 ac-ft. for the entire Mesa del Sol development; therefore, the DMP demonstrates adequate downstream capacity. The Level B DMP also allows for a modified approach for regional ponding area, which consists of infiltrating the volumes smaller than the 10-day storm volume and bleeding off the remaining volume through a storm drain pipe, which will ultimately discharge into the existing playa. Therefore, the proposed concept for this report is in conformance with the Level B DMP.

- *Drainage Report for Mesa del Sol Residential Montage Unit 1 and 2*, prepared by Bohannan Huston, Inc., dated January 2011. COA Record # R16D0034

This drainage report provides drainage analysis for Units 1 and 2, which is located just north of Units 3 and 4. This report provides detailed analysis for the retention ponds that will accept flows from this development.

III. SITE LOCATION AND CHARACTERISTICS

Mesa del Sol Residential Montage Unit 3 and 4 will be developed in two units, Unit 3 and 4. Unit 3 will consist of the eastern portion of the project and the Unit 4 will comprise the remaining western half. Access to both units will be from University Blvd. SE.

The site has been previously graded with relatively flat slopes and generally slopes from west to east at an average grade of about 0.5%.

IV. EXISTING HYDRAULIC AND HYDROLOGIC CONDITIONS

The land comprising Mesa del Sol Residential Montage Unit 3 and 4 is currently undeveloped, but was graded several years ago. Ponds 2A, 2B, 3 and 4 are currently graded and accept developed runoff from existing Units 1 and 2, as well as undeveloped runoff to the west of these ponds. Runoff generated by the project site in its present state

drains toward the existing ponding areas. The existing playa represents the historic runoff capture point for the project site as well as the surrounding areas, and again, this flow has been historically retained and infiltrated within the existing playa.

V. DEVELOPED HYDRAULIC AND HYDROLOGIC CONDITIONS

A. PERMANENT STORM WATER DETENTION PONDS

Originally, Ponds 1, 2A, 2B, and 3 were anticipated to be constructed as detention ponds in the future. However, it is now proposed that these ponds function as retention ponds for this project and in the future, which is consistent with the drainage concept throughout the Mesa del Sol area, both commercial and residential. Existing ponds 2B and 3 will be upsized to accept developed runoff from this project. Existing Pond 4 will remain in its current configuration, and certified as part of the Financial Guaranty Release for this project. However, it is likely that Pond 4 will be reconfigured at some time in the future to accommodate the future adjacent improvements and will need upsizing based upon future plans. Again, all permanent retention ponds (Ponds 2A, 2B, and 3) will be designed to evacuate storm water through infiltration within 96 hours, and the infiltration basins serve to infiltrate the more frequent 2-yr (90^{th} percentile) storms.

Ponds 2B and 3 were originally designed to assist in accommodating flows from Montage Units 1 and 2 with the intent to upgrade and increase the capacity of the ponds, as needed, when further development of the Mesa Del Sol area is completed. The original pond size estimates for 2B and 3 were 3.45 ac-ft and 4.30 ac-ft, respectively *(Approved Drainage Report Mesa del Sol Residential Montage Unit 1 and 2, by Bohannan Huston Inc dated 01/14/2011, COA Record Number R16D003A).* The proposed drainage design for Montage Units 3 and 4 increases the required capacity of the ponds. The needed composite volume required for Ponds 2B and 3 is 16.36 ac-ft. The updated design of the ponds as part of this project is 19.71 ac-ft.

POND	REQUIRED POND VOLUME FOR EXISTING CONDITIONS (AC-FT)	REQUIRED POND VOLUME FOR PROPOSED CONDITIONS (AC-FT)**	CALCULATED DESIGN POND VOLUME (AC-FT)
2B*	3.45	7.82	6.84
3*	4.30	8.54	12.87

*Pond 2B and 3 operate as a single pond with a 54" pipe that connects the two beneath Strand Loop.

** Required Volume includes Units 1, 2, 3 and 4.

The permanent storm ponds (Ponds 1-4) will each consist of a forebay, primary storage zone, infiltration basin, and pond outlet (please see Exhibit 9). The forebay will be located at the pipe inlet into the pond and its purpose is to dissipate energy and deposit sediment from the storm water. The infiltration basin consisting of a bed of gravel and/or rip-rap will assist in infiltrating the 2-year storm volume, and in concert with infiltration occurring in the remaining earthen portions of the pond, has been designed to drain the 100-year, 10-day storm water volume in 96 hours or less. The infiltration basins will be located a sufficient distance from the forebays in order to minimize the amount of silt entering the infiltration basins. Only Ponds 2A, 2B, and 3 are proposed to be graded to their near final configuration which will exclude constructing infiltration basins and forebays. These improvements will be provided at a later date with a separate grading submittal.

Infiltration calculations were based on an average of percolation test results performed by Geo-Test, Inc. on a permanent pond immediately north of Albuquerque Studios Mesa del Sol, New Mexico dated May 17, 2007, File No. 1-61211 (see summary tables below). A percolation rate of 0.3 in/hr. was recorded for 24" above ground surface, which was neglected for our average in our infiltration calculations. This was based on the assumption that the ponds would be cleaned and maintained before the point of virtually no infiltration was reached. A factor of safety of 1.1 was then used for the infiltration basin and a factor of safety of 2.0 was used for the remaining area of the pond to determine the time to infiltrate the required storm water volume, which is approximately the 2-year storm water volume in **Equation 1.**

Equation 1. $T_{Drain} = Vol_{req} / ((i\ pond(A_{eff})) + (i\ infiltration\ basin\ (A_{eff})))$

Where: Vol_{req} = Storm Volume (cf)

$i\ pond$ = Pond Infiltration rate = i/2.0 (in/hr)

$i\ infiltration\ basin$ = Infiltration basin rate= i/1.1 (in/hr)

Infiltration basin = Area Infiltration Basin (sf)

A_{eff} = Avg Pond Area Minus Infiltration basin (sf)

POND INFILTRATION SUMMARY

POND	100-YR 10-DAY RETENTION VOLUME (AC-FT)	2-YR RETENTION VOLUME (AC-FT)	AREA OF INFILTRATION BASIN (SF)	AVG AREA OF POND (SF)	TIME TO INFILTRATE 100-YR 10-DAY VOLUME (HR)	TIME TO INFILTRATE 2-YR VOLUME (HR)
1 (Future)	N/A	N/A	N/A	N/A	N/A	N/A
2A	5.50	2.39	1500	100000	33	14
2B	7.82	3.39	1500	50000	92	40
3	8.54	3.71	1500	70000	72	31
4*	19.04	8.26	5000	130000	85	37

*denotes possible future configuration

B. ONSITE DEVELOPED BASINS

1. OUTFALL 'A'

Outfall 'A' consists of Basins A-1, A-2, A-3, A-4, A-5 and A-6, as well as a portion of Future Basin 1, as shown on the Developed Conditions Basin Map. These flows will enter proposed storm drain inlets within these basins and ultimately discharge into Pond 3. Ponds 2B and 3 are interconnected with a 54" pipe beneath Strand Loop. This pipe was constructed as part of the Unit 1 project to the north. Therefore, these ponds act as a single pond with the water surfaces equilibrating. See Appendix B for street hydraulics and storm drain inlet analysis.

2. OUTFALL 'B'

Outfall 'B' consists of Basins B-1, B-2, B-3, B4, B-5, B-6, B-7, Future Basin 2 and Future Basin 3, as well as a portion of Future Basin 1, as shown on the Developed Conditions Basin Map. These flows will enter proposed storm drain inlets within these basins and ultimately discharge into Pond 4. See Appendix B for street hydraulics and storm drain inlet analysis.

The proposed pond system as well as the storm drain system has been designed to accommodate the future developed condition of this project. The existing playa will accept runoff leaving the site under the future developed conditions scenario in conformance with the Level B Drainage Management Plan.

3. OUTFALL TO UNIVERSITY BLVD.

This outfall consists of Basin M. Previously approved drainage reports allowed all of Existing Basin M to drain into University Blvd. This plan cuts this basin approximately in

half; therefore, much less flow will be directed into University Blvd. from this basin than was previously permitted.

VI. CONCLUSION

Onsite developed runoff generated by the site will be conveyed to retention ponds utilizing surface street flows in conjunction with underground public storm drain pipe networks. The drainage concept outlined by this report consists of retention ponding of developed runoff consistent with existing development throughout Mesa del Sol, and in conformance with previously approved Level A and Level B Master Plan drainage concepts. These ponds will hold water for 96 hours or less utilizing infiltration, also consistent with existing development plans throughout Mesa del Sol.

APPENDICES

APPENDIX A: BASIN CALCULATIONS

APPENDIX B: STREET HYDRAULICS, STORM DRAIN INLET ANALYSIS AND ALLEY HYDRAULICS

APPENDIX C: INROADS STORM DRAIN OUTPUT FILES

APPENDIX D: INFILTRATION CALCULATIONS

APPENDIX E: POND VOLUME CALCULATIONS

APPENDIX A

BASIN CALCULATIONS

BASIN SUMMARY FOR MDS UNITS 3 and 4

BASIN SUMMARY												
BASIN	AREA	UNITS		% LAND TREATMENT					DISCHARGE (CFS)		STORMWATER VOLUME	
I.D.	(AC)	#		A	B	C	D		10 YR	100YR	100 YR 6HR	100 YR 10-DAY
HYRDOLOGICAL VOLUMETRIC & DISCHARGE DATA (EXISTING CALCULATED)												
A	16.00									50.31	0.71	0.71
B	30.64									96.38	1.35	1.35
H	7.17									19.31	0.32	0.32
I	5.53									14.83	0.24	0.24
L	2.01									6.31	0.09	0.09
M	3.32									10.42	0.15	0.15
OFFSITE 1	95.65									155.97	4.22	4.22
OFFSITE 2	64.46									105.92	2.85	2.85
TOTAL	**224.78**								**0.00**	**459.45**	**9.93**	**9.93**
* EXISTING BASINS CALCULATIONS WERE CALCULATED IN THE DMP FOR MESA DEL SOL UNITS 1 AND 2												
HYRDOLOGICAL VOLUMETRIC & DISCHARGE DATA (DEVELOPED CALCULATED)												
Basin A-1	5.8	32		0.0%	23.0%	24.0%	53.0%		13.29	21.83	0.76	1.17
Basin A-2	4.7	21		0.0%	27.0%	27.0%	46.0%		10.16	17.01	0.58	0.87
Basin A-3	4.4	17		0.0%	29.5%	29.5%	41.0%		9.11	15.49	0.53	0.77
Basin A-4	5.2	24		0.0%	26.5%	26.5%	47.0%		11.33	18.92	0.65	0.98
Basin A-5	4.4	15		0.0%	31.0%	31.0%	38.0%		8.87	15.22	0.51	0.74
Basin A-6	3.2	9		0.0%	33.5%	33.5%	33.0%		6.16	10.75	0.36	0.50
Basin B-1	9.3	43		0.0%	26.5%	26.5%	47.0%		20.27	33.85	1.16	1.75
Basin B-2	2.2	10		0.0%	27.0%	27.0%	46.0%		4.75	7.96	0.27	0.41
Basin B-3	4.5	27		0.0%	21.5%	21.5%	57.0%		10.62	17.27	0.61	0.95
Basin B-4	4.6	24		0.0%	24.5%	24.5%	51.0%		10.36	17.11	0.59	0.91
Basin B-5	6.6	29		0.0%	27.5%	27.5%	45.0%		14.15	23.76	0.81	1.21
Basin B-6	3.7	9		0.0%	35.0%	35.0%	30.0%		6.93	12.21	0.40	0.55
Basin B-7	2.9	10		0.0%	31.0%	31.0%	38.0%		5.85	10.03	0.34	0.48
Basin C	0.8	3		0.0%	30.0%	30.0%	40.0%		1.64	2.80	0.09	0.14
Basin M	2.2	4		0.0%	35.0%	40.0%	25.0%		3.96	7.09	0.23	0.30
Future Basin 1	8.8	n/a		0.0%	24.5%	24.5%	51.0%		19.81	32.73	1.14	1.73
Future Basin 2	7.7	n/a		0.0%	24.5%	24.5%	51.0%		17.34	28.64	0.99	1.52
Future Basin 3	10.3	n/a		0.0%	24.5%	24.5%	51.0%		23.19	38.31	1.33	2.03
Future Basin 4	13.1	n/a		0.0%	24.5%	24.5%	51.0%		29.50	48.72	1.69	2.58
Future Basin 5	61.1	n/a		0.0%	24.5%	24.5%	51.0%		137.57	227.24	7.89	12.04
Future Basin 6	36.6			0.0%	12.5%	12.5%	75.0%		98.28	153.64	5.58	9.24
TOTAL	**202.1**	277							**463.15**	**760.57**	26.52	40.86

APPENDIX E

POND VOLUME CALCULATIONS

POND 2A

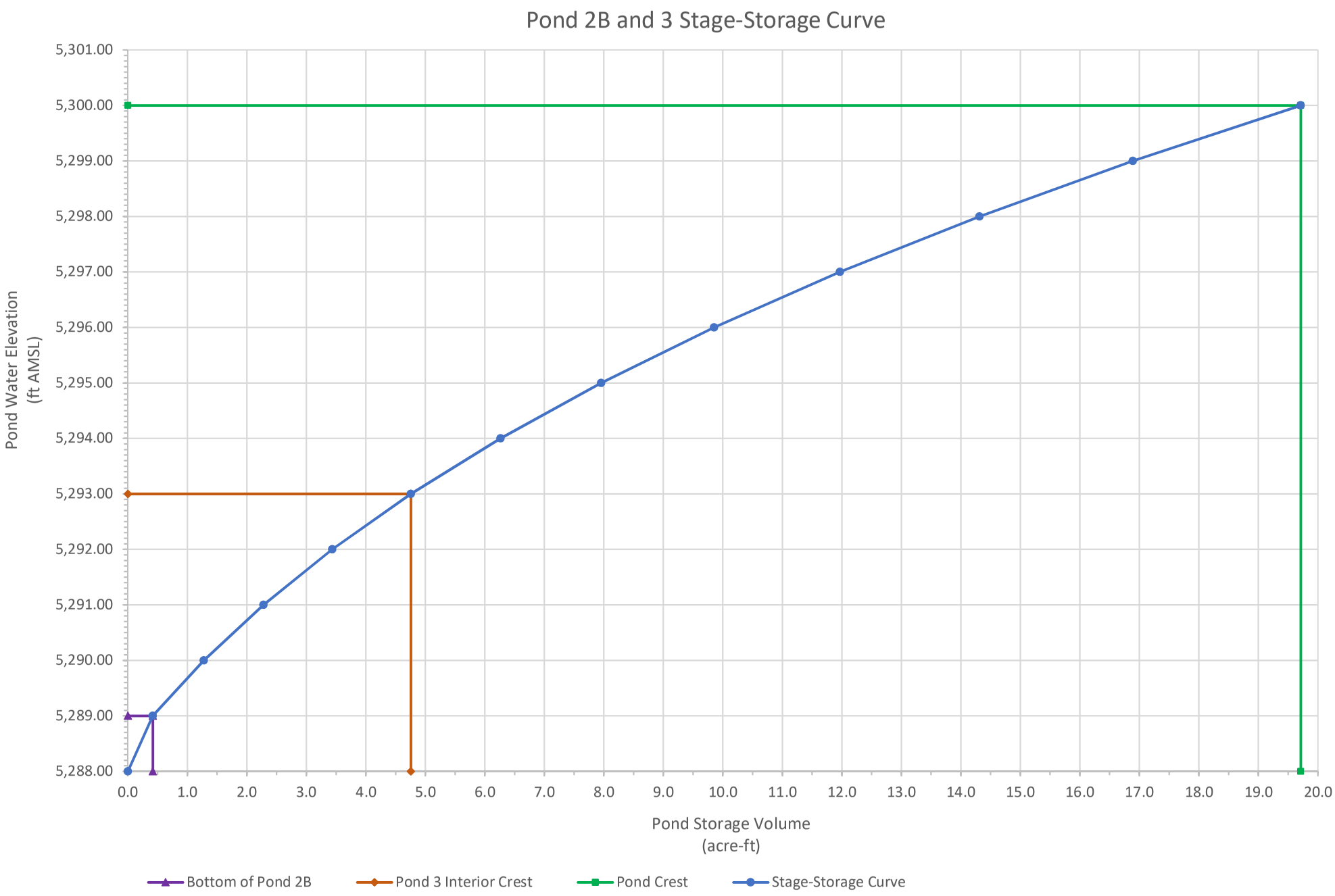
Elevation	Incremental Volume cu ft	Cumulative Volume cu ft	Acre-Feet	Surface Area sq ft
5294.5000	973.3054	973.3054	0.0223	4386.6135
5295.0000	2650.5057	3623.8111	0.0832	6676.3677
5295.5000	4251.2300	7875.0411	0.1808	10487.5991
5296.0000	6264.7455	14139.7866	0.3246	14468.7852
5296.5000	8153.2609	22293.0475	0.5118	18228.0361
5297.0000	10278.3327	32571.3802	0.7477	23069.8801
5297.5000	13033.2289	45604.6092	1.0469	29498.4812
5298.0000	16873.2582	62477.8674	1.4343	38587.8213
5298.5000	21443.9508	83921.8182	1.9266	47009.6335
5299.0000	25860.2969	109782.1151	2.5203	56317.1985
5299.5000	31251.7437	141033.8589	3.2377	68406.4902
5300.0000	37877.7953	178911.6541	4.1072	82482.1196
5300.5000	43900.3594	222812.0135	5.1151	92752.3987
5301.0000	49037.9908	271850.0043	6.2408	104391.3594

Hydraulic Analysis for Ponds 2B & 3 Using AutoCAD Civil 3D

Project Name: **Mesa Del Sol Neighborhood Montage Units 3 & 4**
Project No.: **20190195**
Prepared By: **P. Carrillo**
Date: **12/26/2018**

Contour Elevation (ft AMSL)	Contour Area (sq. ft)	Contour Area (acres)	Depth (ft)	Incremental Volume (Conic) (cu. yds)	Incremental Volume (Conic) (ac-ft)	Cumulative Volume (Conic) (cu. yds)	Cumulative Volume (Conic) (ac-ft)
5,288.00	16,403.47	0.38	0.00	0.00	0.00	0.00	0.00
5,289.00	34,244.60	0.79	1.00	678.03	0.42	1,236.32	0.42
5,290.00	40,445.36	0.93	1.00	1,382.28	0.86	2,699.01	1.28
5,291.00	46,982.87	1.08	1.00	1,618.00	1.00	4,400.91	2.28
5,292.00	53,889.71	1.24	1.00	1,867.25	1.16	6,354.29	3.44
5,293.00	61,132.66	1.40	1.00	2,128.96	1.32	8,571.85	4.76
5,294.00	69,674.67	1.60	1.00	2,430.23	1.51	11,093.59	6.26
5,295.00	77,894.90	1.79	1.00	2,731.59	1.69	13,919.63	7.96
5,296.00	87,308.77	2.00	1.00	3,059.03	1.90	17,075.85	9.85
5,297.00	97,061.16	2.23	1.00	3,414.42	2.12	20,590.35	11.97
5,298.00	107,132.94	2.46	1.00	3,780.56	2.34	24,473.91	14.31
5,299.00	117,501.05	2.70	1.00	4,159.49	2.58	28,742.04	16.89
5,300.00	128,714.69	2.95	1.00	4,554.45	2.82	20,769.71	19.71

REVISED


Pond 2B and 3 Stage-Storage Curve
Pond Water Elevation (ft AMSL)
5,301.00
5,300.00
5,299.00
5,298.00
5,297.00
5,296.00
5,295.00
5,294.00
5,293.00
5,292.00
5,291.00
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0.0
1.0
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10.0
11.0
12.0
13.0
14.0
15.0
16.0
17.0
18.0
19.0
20.0
Pond Storage Volume (acre-ft)
Bottom of Pond 2B
Pond 3 Interior Crest
Pond Crest
Stage-Storage Curve

POND 4

Elevation	Incremental Volume cu ft	Cumulative Volume cu ft	Acre-Feet	Surface Area sq ft
5283.5000	11351.7866	11351.7866	0.2606	23333.3008
5284.0000	11985.6638	23337.4504	0.5358	24613.5002
5284.5000	12631.9855	35969.4358	0.8257	25918.5918
5285.0000	13290.7516	49260.1874	1.1309	27248.5674
5285.5000	13961.9622	63222.1496	1.4514	28603.4265
5286.0000	14645.6172	77867.7668	1.7876	29983.1870
5286.5000	15341.7166	93209.4834	2.1398	31387.8311
5287.0000	16050.2605	109259.7439	2.5083	32817.3608
5287.5000	16771.2489	126030.9928	2.8933	34271.7832
5288.0000	17504.6816	143535.6744	3.2951	35751.0930
5288.5000	18250.5589	161786.2333	3.7141	37255.2876
5289.0000	19008.8806	180795.1138	4.1505	38784.3804
5289.5000	19779.6467	200574.7605	4.6046	40338.3560
5290.0000	20562.8572	221137.6178	5.0766	41917.2249
5290.5000	21358.5123	242496.1300	5.5669	43520.9766
5291.0000	22166.6117	264662.7417	6.0758	45149.6140
5291.5000	22987.1556	287649.8973	6.6035	46803.1526
5292.0000	23820.1439	311470.0413	7.1504	48481.5723
5292.5000	24665.5767	336135.6180	7.7166	50184.8809
5293.0000	25523.4540	361659.0720	8.3025	51913.0803
5293.5000	26393.7756	388052.8476	8.9085	53666.1692
5294.0000	27276.5418	415329.3894	9.5347	55444.1462
5294.5000	28171.7523	443501.1417	10.1814	57247.0088
5295.0000	0.0000	443501.1417	0.0000	0.0000