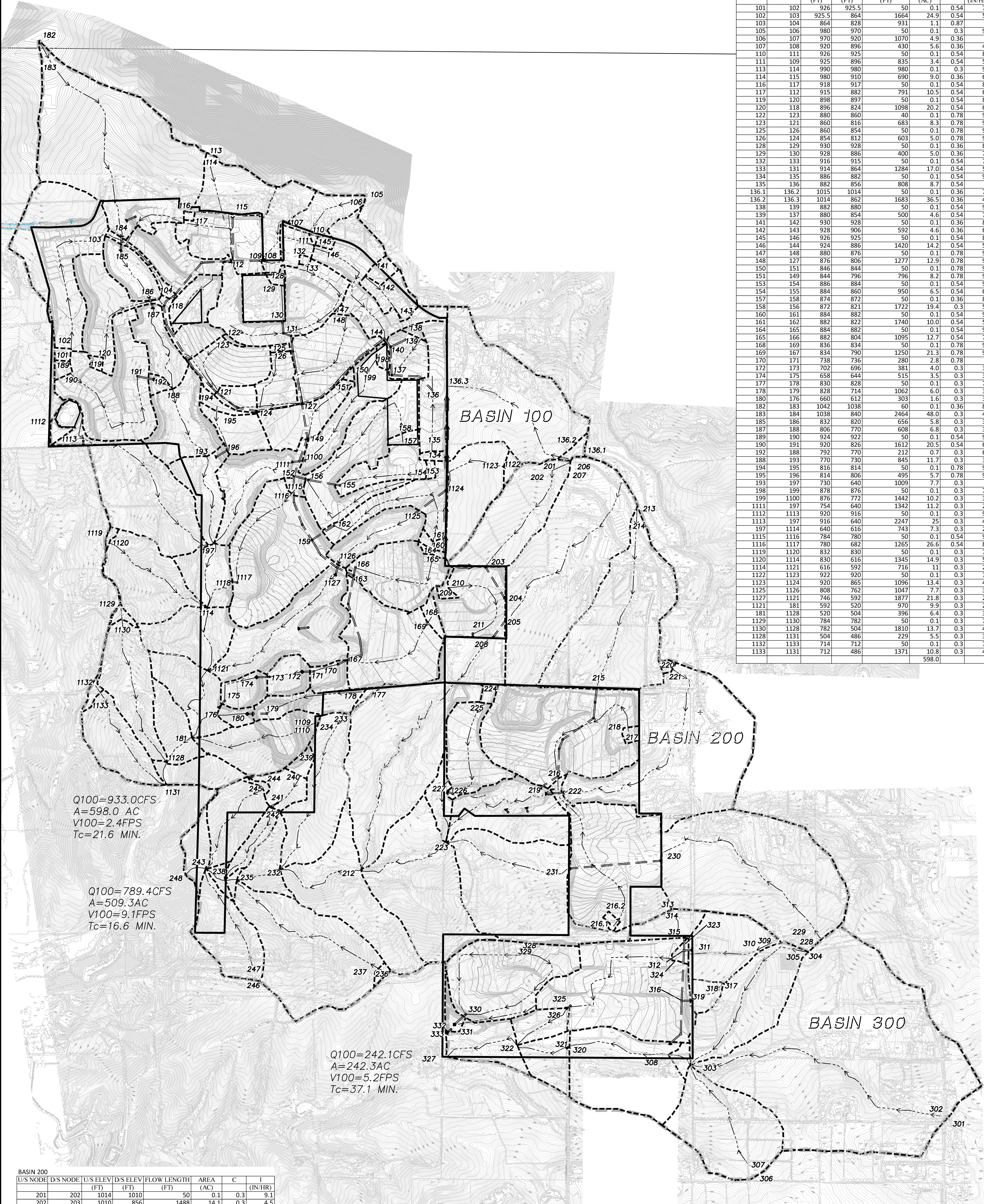


POST-DEVELOPMENT HYDROLOGY MAP
LILAC HILLS RANCH
TM-5572 RPL-1



BASIN 100								
U/S NODE	D/S NODE	U/S ELEV (FT)	D/S ELEV (FT)	FLOW LENGTH (FT)	AREA (AC)	C	I (IN/HR)	
101	102	926	925.5	50	0.1	0.54	7.3	
102	103	925.5	864	1664	24.9	0.54	5.5	
103	104	864	828	931	1.1	0.87	5	
105	106	980	970	50	0.1	0.3	9.2	
106	107	970	920	1070	4.9	0.36	5	
107	108	920	896	430	5.6	0.36	4.4	
110	111	926	925	50	0.1	0.54	8.5	
111	109	925	896	835	3.4	0.54	5.9	
113	114	990	980	980	0.1	0.3	9.2	
114	115	980	910	690	9.0	0.36	6.2	
116	117	918	917	50	0.1	0.54	8.5	
117	112	915	882	791	10.5	0.54	6.8	
119	120	898	897	50	0.1	0.54	8.5	
120	118	896	824	1098	20.2	0.54	6.9	
122	123	860	860	40	0.1	0.78	9.2	
123	121	860	816	683	8.3	0.78	9.2	
125	126	860	854	50	0.1	0.78	9.2	
126	124	854	812	603	5.0	0.78	9.2	
128	129	930	928	50	0.1	0.36	8.2	
129	130	928	886	400	5.0	0.36	7.1	
132	133	916	915	50	0.1	0.54	7.3	
133	131	914	864	1284	17.0	0.54	5.7	
134	135	885	882	50	0.1	0.54	9.2	
135	136	882	856	808	8.7	0.54	8	
136.1	136.2	1015	1014	50	0.1	0.36	7.1	
136.2	136.3	1014	862	1683	36.5	0.36	4.1	
138	139	882	880	50	0.1	0.54	9.2	
139	137	880	854	500	4.6	0.54	7.9	
141	142	930	928	50	0.1	0.36	8.2	
142	143	928	906	592	4.6	0.36	6.3	
145	146	926	925	50	0.1	0.54	8.5	
146	144	924	886	1420	14.2	0.54	5.8	
147	148	880	876	50	0.1	0.78	9.2	
148	127	876	806	1277	12.9	0.78	9.2	
150	151	846	844	50	0.1	0.78	9.2	
151	149	844	796	796	8.2	0.78	9.2	
153	154	886	884	50	0.1	0.54	9.2	
154	155	884	860	950	6.5	0.54	6.6	
157	158	874	872	50	0.1	0.36	8.2	
158	156	872	821	1722	19.4	0.3	5.2	
160	161	884	882	50	0.1	0.54	9.2	
161	162	882	822	1740	10.0	0.54	5.8	
164	165	884	882	50	0.1	0.54	9.2	
165	166	882	804	1095	12.7	0.54	7.4	
168	169	836	834	50	0.1	0.78	9.2	
169	167	834	790	1250	21.3	0.78	9.2	
170	171	738	736	280	2.8	0.78	4	
172	173	702	696	381	4.0	0.3	3.9	
174	175	658	644	515	3.5	0.3	3.8	
177	178	830	828	50	0.1	0.3	7.8	
178	179	828	714	1062	6.0	0.3	3.9	
180	176	660	612	303	1.6	0.3	3.7	
182	183	1042	1038	60	0.1	0.36	8.7	
183	184	1038	840	2464	48.0	0.3	4.2	
185	186	832	820	656	5.8	0.3	3.7	
187	188	806	770	608	6.8	0.3	3.4	
189	190	924	922	50	0.1	0.54	9.2	
190	191	920	826	1612	20.5	0.54	6.9	
192	188	792	770	212	0.7	0.3	6.6	
188	193	770	730	845	11.7	0.3	3.1	
194	195	816	814	50	0.1	0.78	9.2	
195	196	814	806	495	5.7	0.78	9.2	
193	197	730	640	1009	7.7	0.3	3	
198	199	878	876	50	0.1	0.3	7.8	
199	1100	876	772	1442	10.2	0.3	3.4	
1111	197	754	640	1342	11.2	0.3	2.7	
1112	1113	920	916	50	0.1	0.3	9.1	
1113	197	916	640	2247	25	0.3	4.5	
197	1114	640	616	743	7.3	0.3	2.8	
1115	1116	784	780	50	0.1	0.54	9.2	
1116	1117	780	682	1265	26.6	0.54	8.6	
1119	1120	832	830	50	0.1	0.3	7.8	
1120	1114	830	616	1345	14.9	0.3	5.3	
1114	1121	616	592	716	11	0.3	2.7	
1122	1123	922	920	50	0.1	0.3	7.8	
1123	1124	920	865	1096	13.4	0.3	4.5	
1125	1126	808	762	1047	7.7	0.3	3.7	
1127	1121	746	592	1877	21.8	0.3	2.9	
1121	181	592	520	970	9.9	0.3	2.6	
181	1128	520	504	396	6.4	0.3	5.6	
1129	1130	784	782	50	0.1	0.3	7.8	
1130	1128	782	504	1810	13.7	0.3	4.6	
1128	1131	504	486	229	5.5	0.3	3.6	
1132	1133	714	712	50	0.1	0.3	7.8	
1133	1131	712	486	1371	10.8	0.3	4.4	
					598.0			

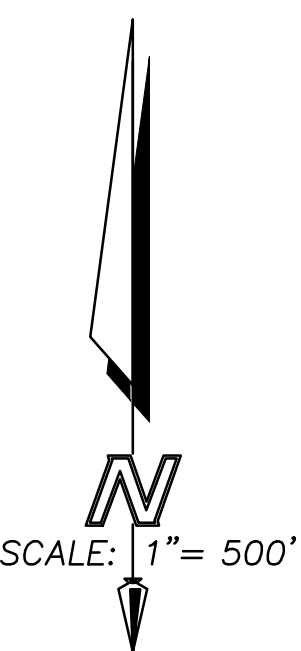
BASIN 200								
U/S NODE	D/S NODE	U/S ELEV (FT)	D/S ELEV (FT)	FLOW LENGTH (FT)	AREA (AC)	C	I (IN/HR)	
201	202	1014	1010	50	0.1	0.3	9.1	
202	203	1010	856	1488	14.1	0.3	4.5	
206	207	998	996	50	0.1	0.36	8.2	
207	205	996	820	2010	44.9	0.3	3.9	
209	210	866	864	50	0.1	0.54	9.2	
210	211	864	828	1084	11.8	0.54	7	
208	212	806	644	2232	45	0.3	3.1	
213	214	992	990	50	0.1	0.36	8.2	
214	215	990	832	2032	34.1	0.3	3.9	
217	218	872	870	50	0.1	0.54	9.2	
218	216	870	798	1499	35	0.54	7.4	
216.1	216.2	914	912	50	0.1	0.54	9.2	
216.2	216	912	798	1893	29.5	0.54	6.9	
220	221	921	920	50	0.1	0.36	7.1	
221	222	920	778	2501	46.2	0.3	3.2	
219	223	768	696	1523	15.9	0.3	5.5	
224	225	840	838	50	0.1	0.78	9.2	
225	226	838	760	1181	10.4	0.78	9.2	
227	223	750	696	726	3.3	0.3	7.1	
228	229	1076	1074	50	0.1	0.36	8.2	
229	230	1074	858	2289	48.7	0.3	3.4	
231	223	828	696	1431	31.7	0.3	2.8	
223	212	696	644	1040	28.1	0.3	5	
212	232	644	582	1041	21.3	0.3	4.5	
233	234	820	816	50	0.1	0.36	9.2	
234	232	816	582	1931	17.1	0.3	4.3	
232	235	582	534	474	5.6	0.3	4.4	
236	237	858	854	50	0.1	0.3	9.1	
237	235	854	534	1938	30.6	0.3	5.2	
235	238	534	526	125	0.6	0.3	4.4	
239	240	748	740	100	0.5	0.78	9.2	
240	241	740	700	407	4.2	0.78	9.2	
242	238	690	526	993	3	0.3	7.2	
238	243	526	482	262	1.1	0.3	4.3	
244	245	708	700	50	0.1	0.3	9.2	
245	243	700	482	1156	9.3	0.3	4.9	
246	247	750	746	50	0.1	0.54	9.2	
247	243	746	482	1189	12.0	0.3	5.5	
243	248	482	470	250	4.0	0.3	4.2	
					509.3			

BASIN 300								
U/S NODE	D/S NODE	U/S ELEV (FT)	D/S ELEV (FT)	FLOW LENGTH (FT)	AREA (AC)	C	I (IN/HR)	
301	302	1072	1071	50	0.1	0.36	7.1	
302	303	1071	880	3039	89.9	0.3	3.5	
304	305	1073	1071	50	0.1	0.36	8.2	
305	303	1071	880	1937	19.1	0.3	4.1	
306	307	1016	1014	50	0.1	0.3	7.8	
307	303	1014	880	1283	20.2	0.3	5.4	
303	308	880	872	280	1.1	0.3	3.3	
309	310	1024	1022	50	0.1	0.36	8.2	
310	311	1022	912	916	11.5	0.3	5.5	
313	314	944	942	50	0.1	0.36	8.2	
314	315	942	908	312	4.4	0.3	6.7	
317	318	984	982	50	0.1	0.3	7.8	
318	319	982	936	383	2.2	0.3	5.9	
308	320	872	846	1088	22.6	0.3	2.9	
321	322	845	825	556	5.6	0.3	2.7	
323	324	906	904	50	0.1	0.54	9.2	
324	325	904	856	1547	31	0.54	6.9	
326	322	848	825	659	4.1	0.3	5.9	
322	327	825	786	847	7.4	0.3	2.5	
328	329	912	910	50	0.1	0.54	9.2	
329	330	910	830	1432	21	0.54	7.2	
331	332	810	809.5	90	1.4	0.3	6.7	
					242.3			

LEGEND

- MAJOR BASIN BOUNDARY
TRIBUTARY AREA BOUNDARY
FLOW PATH
NODE NUMBER

101



ADDENDUM

Even though this Master TM does not proposed any paved roads and building construction, the post-development condition hydrology analysis took into consideration the future built-out conditions of the project in determination of the post-development runoff rate and volume and subsequently the sizing the proposed detention basins.

ALTERNATIVE TO DETENTION BASINS

The developer has proposed a few alternative measures to augment or enhance the storm water runoff volume attenuation methods. In recent years, new technologies have become available to better retain and store excess runoff volume such as rain barrels, bio-retention and permeable pavers. These rain capturing measures will not only reduce the project's hydrologic and subsequent development footprint but they will also reduce the water demand of this project since the captured runoff could be used for irrigation. With these alternative runoff volume attenuation measures, the project could eliminate the proposed large detention basins and possibly to reduce the overall project disturbance footprint

ASSUMPTIONS:

Bio-retention:

- Average lot size = 4500 sf
- Average impervious coverage per lot = 1500 sf roof + 300 sf walkways and driveway = 1800 sf
- Typical pervious coverage (bio-retention) per lot = 1000 sf with the top 12" layer providing a minimum of 5"/hour infiltration rate.
- Typical void ratio of engineered infiltration material = 0.55

Rain barrels:

- Typical home rain gutter down spout location = 4
- Typical rain barrel capacity = 50 gal.

Permeable pavers (see page 195 for typical section):

- Typical permeable paver section: 2" bedding+4" no. 57 stone base + 24" no.2 stone subbase
- Average permeable paver base void ratio = 0.4
- Average storage volume under each square foot of pavers = 1.0 cf

Project design:

- Proposed residential units = 1746

ANALYSIS:

Typical Lot rainwater capturing/retention calculations:

Bio-retention volume per typical home: $1000 \text{ sf} \times 12''/12 \times 0.55 \text{ void ratio} = 550 \text{ cf}$.

Total bio-retention vol. = $550 \text{ cf} \times 1746 \text{ residential units} = 960300 \text{ cf} = \mathbf{22.0 \text{ Ac-Ft}}$.

Rain barrel capacity = $4 \times 50 \text{ gal} = 200 \text{ gal} = 27 \text{ cf}$

Total rain barrel capturing capacity = $27 \text{ cf} \times 1746 \text{ residential units} = 47140 \text{ cf} = \mathbf{1.1 \text{ Ac-Ft}}$.

Total lot rain capturing capacity for the development = $22.0 + 1.1 = \mathbf{23.1 \text{ Ac-Ft}}$.

Permeable Pavers:

The developer proposes to install a total of 23 acres of permeable pavers throughout the entire project that will provide 23 Ac-Ft of storage space. The project will need a total of 36.0 Ac-Ft of storage space for 100-year runoff volume attenuation.

Total alternative storage capacity = rain barrels + bio-retention + permeable pavers = $23.1 + 23 = \mathbf{46.1 \text{ Ac-Ft}}$.

CONCLUSION:

These permeable pavers, bio-retention and rain barrels offer a great alternative to the proposed detention basins for 100-year runoff volume attenuation.

The project developers projected a total of 23 acres of pavers throughout the project. Per the calculations presented in this report, the proposed rain barrels, bio-retention areas and permeable pavers will provide adequate storage capacity to eliminate the required detention basin for 100-year storm water runoff volume attenuation purposes. It is possible to eliminate the proposed large detention basins and reduce the project foot print with the deployment of these alternative methods. Additionally, the captured rainwater in the bio-retention areas and rain barrels will offset the irrigation water demand of the project to make it a more sustainable development.

