

000031

CÁLCULO HIDRÁULICO

CALCULO DE APORTES EXTERNOS EN LA ZONA DE ESTUDIO "C.H. PALOMINO".

Fórmula de Manning

$$V' = \frac{R^{2/3} \times S^{1/2}}{n} \Rightarrow Q = V' \times A \Rightarrow Q = \frac{A \times R^{2/3} \times S^{1/2}}{n}$$

APORTE 1 Aporte del BE-77

APORTE 01 -BE-78

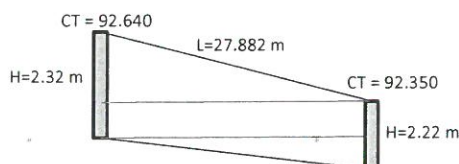
*Debido a que en el día del aforo el BE-78 estaba sellado, la medición se realizó en BE-77

HORA	TIRANTE			PROMEDIO
10:52 a. m.	4.5	3	3	3.5
1:46 p. m.	4	5	3.3	4.1
4:40 p. m.	3	4	4.4	3.8

D(m)	BZ 77			BZ 78			TUBERIA	
	COT TAPA	COT FON BZ1	H1	COT TAPA	COT FON BZ2	H2	Long. Horizontal	Pendiente (%)
0.2	92.640	90.32	2.32	92.350	90.13	2.22	28.450	0.007

Datos	
n	0.013
s	0.00700
material	concreto

Resultados					
Tirante	Radio Hidr.	Vel. (m/s)	Caudal (m3/s)	Caudal (l/s)	Q proy
4.1	0.0243	0.539	0.002436	2.436	2.878



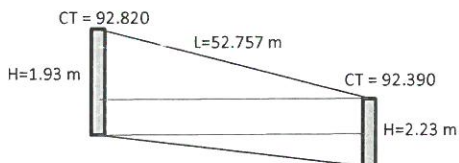
APORTE 02-BE-217

HORA	TIRANTE			PROMEDIO
11:05 a. m.	8	7	9.9	8.3
1:35 p. m.	10	11	5	8.7
4:46 p. m.	8.4	8.8	-	8.6

D(m)	BZ-217			BZ-212			TUBERIA	
	COT TAPA	COT FON BZ1	H1	COT TAPA	COT FON BZ2	H2	Long. Horizontal	Pendiente (%)
0.2	92.820	90.89	1.93	92.390	90.16	2.23	52.760	0.014

Datos	
n	0.013
s	0.01400
material	concreto

Resultados					
Tirante	Radio Hidr.	Vel. (m/s)	Caudal (m3/s)	Caudal (l/s)	Q proy
0.087	0.0455	1.1604	0.0152	15.2	17.2368



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CONSORCIO PROYECTOS LIMA

ING. ELIAS MOGOLLON ESCOBAR
DIRECTOR DE PROYECTO



DESCARGA BE-94

000033

HORA	TIRANTE			PROMEDIO
11:28 a. m.	2	1.6	1.8	1.8
1:17 p. m.	1	4	2	2.3
5:00 p. m.	2	1.9	2.3	2.1

D(m)	BZ-93			BZ-94			TUBERIA	
	COT TAPA	COT FON BZ1	H1	COT TAPA	COT FON BZ2	H2	Long. Horizontal	Pendiente (‰)
0.2	86.760	85.07	1.69	85.940	84.16	1.78	54.171	0.017

Datos	
n	0.01
s	0.01700
material	PVC

Resultados					
Tirante	Radio Hidr.	Vel. (m/s)	Caudal (m3/s)	Caudal (l/s)	Q proy
0.023	0.0145	0.7753	0.0016	1.6	1.8144

DESCARGA BE-84

HORA	TIRANTE			PROMEDIO
11:38 a. m.	6	9	10	8.3
1:27 p. m.	7	9	11	9.0
4:54 p. m.	11	13	10.05	11.35

D(m)	BZ-83			BZ-84			TUBERIA	
	COT TAPA	COT FON BZ1	H1	COT TAPA	COT FON BZ2	H2	Long. Horizontal	Pendiente (‰)
0.2	89.870	87.87	2.00	89.590	87.27	2.32	54.340	0.0110

Datos	
n	0.013
s	0.01100
material	concreto

Resultados					
Tirante	Radio Hidr.	Vel. (m/s)	Caudal (m3/s)	Caudal (l/s)	Q proy
0.113	0.0538	1.1496	0.021	21	23.814

DESCARGA BE-134

HORA	TIRANTE			PROMEDIO
11:38 a. m.	12.5	12.8	12.2	12.5
2:30 p. m.	13.6	12	-	12.8
5:18 p. m.	12	13	13.7	12.9

D(m)	BZ-93			BZ-94			TUBERIA	
	COT TAPA	COT FON BZ1	H1	COT TAPA	COT FON BZ2	H2	Long. Horizontal	Pendiente (‰)
0.3	80.750	78.12	2.63	79.910	77.26	2.65	77.070	0.0112

Datos	
n	0.013
s	0.01120
material	concreto

Resultados					
Tirante	Radio Hidr.	Vel. (m/s)	Caudal (m3/s)	Caudal (l/s)	Q proy
0.129	0.681	1.3576	0.0399	39.9	45.2466

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CAUDAL POR AREAS DE DRENAJE**AREAS DE DRENAJE**

La red de colectores de alcantarillado se dividen en áreas de drenaje que dividen la demanda establecida como lo indica los cuadros siguientes.

Área de Drenaje	Área de Influencia (m ²)	% Influencia
AD-01	281 103.76	66.86%
AD-02	47 386.93	11.27%
AD-03	83 027.24	19.75%
AD-04	8 909.60	2.12%
TOTAL	420 427.52	100.00%

AÑO 20															
Qp (lps)		33.78													
		<table><tr><th colspan="2">Qp (lps)</th></tr><tr><td>AD-01</td><td>22.59</td></tr><tr><td>AD-02</td><td>3.81</td></tr><tr><td>AD-03</td><td>6.67</td></tr><tr><td>AD-04</td><td>0.72</td></tr><tr><td>TOTAL</td><td>33.78</td></tr></table>		Qp (lps)		AD-01	22.59	AD-02	3.81	AD-03	6.67	AD-04	0.72	TOTAL	33.78
Qp (lps)															
AD-01	22.59														
AD-02	3.81														
AD-03	6.67														
AD-04	0.72														
TOTAL	33.78														
AD-01	281 103.76														
AD-02	47 386.93														
AD-03	83 027.24														
AD-04	8 909.60														
TOTAL	420 427.52														
Qunitario	8.0357E-05 lps/m2														

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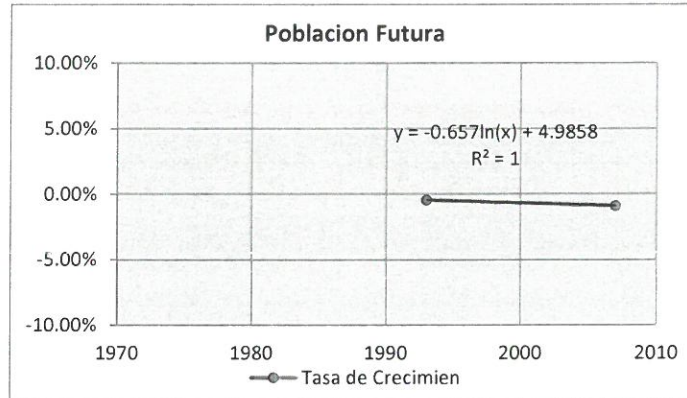
ING. ELIAS MOGOLLON ESCOBAR
DIRECTOR DE PROYECTO

TASA DE CRECIMIENTO

Distrito Cercado de Lima

Poblacion estimada y Proyectada		
Año	Cercado	Tasa de Crecimien
1981	359 397	-
1993	340 422	-0.45%
2007	299 493	-0.91%

fuelle: INEI Poblacion estimada
del 2009 al 2015



Nota: La tasa de crecimiento poblacional para el distrito de cercado es negativo según la proyección del crecimiento poblacional del INEI, por lo que se usó el criterio utilizado en el PMO de SEDAPAL en el cual se determinó las tasas de crecimiento de viviendas en función a su correspondencia con el crecimiento de las unidades de Uso del distrito.

**Estimacion de la Poblacion
para Cercado de Lima según
PMO 2014 - SEDAPAL**

Año	Poblacion	tasa
2014	326 620	--
2015	328 814	0.67%
2020	340 007	0.67%
2030	363 551	0.67%
2040	388 725	0.67%
2045	401 985	0.67%

Densidad Poblacional

Viv. Ocupadas (Unif. + Mult f.)	2754	Viv.
Densidad Poblac (viv. Unifam.)	3.97	Hab./fam.
Densidad Poblac (viv. Multifam)	12.35	Hab./fam.
Densidad Promedio	6.51	Hab./fam.
Poblacion Urbana total	17926	Hab.

Vivienda

Tipo de Usuaría	N° de Conex.	U.U.
Domest. Unifam	1 920	1 920
Domest. Multifam	268	834
Total	2 188	2 754

Factor de U.U. en Multifamiliar	3.11
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Año		Poblacion Estimada - Cercado		
		N° de Viv. Unifam.	N° de Viv. Multifam.	Población
Base	2016	1 920	834	17 926
0	2017	1 920	844	18 046
1	2018	1 920	854	18 168
2	2019	1 920	863	18 290
3	2020	1 920	873	18 413
4	2021	1 920	883	18 536
5	2022	1 920	893	18 661
6	2023	1 920	904	18 786
7	2024	1 920	914	18 912
8	2025	1 920	924	19 039
9	2026	1 920	934	19 167
10	2027	1 920	945	19 296
11	2028	1 920	955	19 426
12	2029	1 920	966	19 556
13	2030	1 920	977	19 687
14	2031	1 920	987	19 820
15	2032	1 920	998	19 953
16	2033	1 920	1 009	20 087
17	2034	1 920	1 020	20 222
18	2035	1 920	1 031	20 358
19	2036	1 920	1 042	20 494
20	2037	1 920	1 053	20 632



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DEMANDA DE AGUA

INFORMACIÓN DE CONEXIONES (2016)

CRECIMIENTO DE COBERTURA Y MEDICIÓN, Y DECREMENTO DE PÉRDIDAS

AÑO	COBERTURA DE CONEX.	MICROMEDICIÓN		PÉRDIDAS
		DOM.+MULT.	OTROS	
BASE	100.00%	100.00%	0.00%	25.09%
0	100.00%	100.00%	0.00%	25.09%
1	100.00%	100.00%	0.00%	25.09%
4	100.00%	100.00%	0.00%	24.23%
9	100.00%	100.00%	0.00%	24.22%
14	100.00%	100.00%	0.00%	24.21%
19	100.00%	100.00%	0.00%	24.20%

Fuente: PMO SEDAPAL

UNIDADES DE USO POR TIPO DE USUARIO		CONEXS	Unidades de Uso (UU)	CONS/UU (m3/mes)
Unifamiliares	T2	1920	1 920	17.52
Multifamiliar	T6	268	834	15.33
Comercial	T3	93	93	47.37
Social	T1	2	2	8.13
Estatal	T5	3	3	190.37
Industrial	T4	3	3	207.50
TOTAL		2289	2855	

Fuente: Catastro Comercial SEDAPAL

PARÁMETROS POR DISEÑO

Caudal Máximo Diario ($Q_{md} = K1 * QP$)		K1 =	1.3
Caudal Máximo Horario ($Q_{mh} = K2 * QP$)		K2 =	1.8
Crecimiento del PBI		Tpbi	3.5%

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AÑO	POBLACIÓN	N° TOTAL DE VIV. DOMEST	COBERT	POBLACIÓN SERVIDA	UNIDADES DE USO			
					DOMESTICO		NO DOMESTICO	
					UNIFAM.	MULTIFAM.	COMERCIAL	INDUSTRIAL
Base	17 926	2 754	100.00%	17 926	1 920	834	93	3
0	18 046	2 764	100.00%	18 046	1 920	844	96	3
1	18 168	2 774	100.00%	18 168	1 920	854	100	3
2	18 290	2 783	100.00%	18 290	1 920	863	103	3
3	18 413	2 793	100.00%	18 413	1 920	873	107	3
4	18 536	2 803	100.00%	18 536	1 920	883	110	4
5	18 661	2 813	100.00%	18 661	1 920	893	114	4
6	18 786	2 824	100.00%	18 786	1 920	904	118	4
7	18 912	2 834	100.00%	18 912	1 920	914	122	4
8	19 039	2 844	100.00%	19 039	1 920	924	127	4
9	19 167	2 854	100.00%	19 167	1 920	934	131	4
10	19 296	2 865	100.00%	19 296	1 920	945	136	4
11	19 426	2 875	100.00%	19 426	1 920	955	141	5
12	19 556	2 886	100.00%	19 556	1 920	966	145	5
13	19 687	2 897	100.00%	19 687	1 920	977	151	5
14	19 820	2 907	100.00%	19 820	1 920	987	156	5
15	19 953	2 918	100.00%	19 953	1 920	998	161	5
16	20 087	2 929	100.00%	20 087	1 920	1 009	167	5
17	20 222	2 940	100.00%	20 222	1 920	1 020	173	6
18	20 358	2 951	100.00%	20 358	1 920	1 031	179	6
19	20 494	2 962	100.00%	20 494	1 920	1 042	185	6
20	20 632	2 973	100.00%	20 632	1 920	1 053	192	6

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CONSORCIO PROYECTOS LIMA

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000038

"Cambio de redes de alcantarillado C.H. Palomino en el Cercado de Lima"

CONSUMO DE AGUA (l/día)						DEMANDA DE AGUA					
DOMESTICO		NO DOMESTICO				TOTAL	Qad (l/día)	Qad (l/seg)	Qad (m³/año)	Qmd (lt/seg)	Qmh (lt/seg)
UNIFAM.	MULTIFAM.	COMERCIAL	SOCIAL	ESTATAL	INDUSTRIAL						
1 121 280	426 174	146 847	542	19 037	20 750	1 734 630	2 315 619	26.80	845 201	34.84	48.24
1 121 280	431 155	151 987	546	19 165	21 476	1 745 608	2 330 274	26.97	850 550	35.06	48.55
1 121 280	436 169	157 306	549	19 294	22 228	1 756 826	2 345 248	27.14	856 016	35.29	48.86
1 121 280	441 216	162 812	553	19 423	23 006	1 768 290	2 360 553	27.32	861 602	35.52	49.18
1 121 280	446 298	168 510	557	19 554	23 811	1 780 010	2 376 198	27.50	867 312	35.75	49.50
1 121 280	451 413	174 408	560	19 685	24 644	1 791 992	2 365 041	27.37	863 240	35.59	49.27
1 121 280	456 564	180 512	564	19 817	25 507	1 804 245	2 381 212	27.56	869 142	35.83	49.61
1 121 280	461 748	186 830	568	19 950	26 400	1 816 777	2 397 752	27.75	875 180	36.08	49.95
1 121 280	466 968	193 369	572	20 084	27 324	1 829 597	2 414 672	27.95	881 355	36.33	50.31
1 121 280	472 222	200 137	576	20 219	28 280	1 842 715	2 431 985	28.15	887 674	36.59	50.67
1 121 280	477 512	207 142	580	20 355	29 270	1 856 139	2 449 378	28.35	894 023	36.85	51.03
1 121 280	482 837	214 392	583	20 492	30 294	1 869 879	2 467 510	28.56	900 641	37.13	51.41
1 121 280	488 199	221 896	587	20 630	31 355	1 883 946	2 486 073	28.77	907 417	37.41	51.79
1 121 280	493 596	229 662	591	20 768	32 452	1 898 350	2 505 080	28.99	914 354	37.69	52.19
1 121 280	499 029	237 700	595	20 908	33 588	1 913 100	2 524 545	29.22	921 459	37.99	52.59
1 121 280	504 499	246 020	599	21 048	34 763	1 928 210	2 544 148	29.45	928 614	38.28	53.00
1 121 280	510 006	254 631	603	21 189	35 980	1 943 689	2 564 572	29.68	936 069	38.59	53.43
1 121 280	515 549	263 543	607	21 332	37 240	1 959 551	2 585 500	29.92	943 708	38.90	53.86
1 121 280	521 130	272 767	611	21 475	38 543	1 975 806	2 606 949	30.17	951 536	39.22	54.31
1 121 280	526 749	282 314	616	21 619	39 892	1 992 469	2 628 934	30.43	959 561	39.56	54.77
1 121 280	532 405	292 195	620	21 765	41 288	2 009 552	2 651 124	30.68	967 660	39.89	55.23
1 121 280	538 099	302 421	624	21 911	42 733	2 027 068	2 674 232	30.95	976 095	40.24	55.71

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DIRECTOR DE PROYECTO

Consortio Proyectos Lima



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DEMANDA DE DESAGUE

AÑO	POBLACIÓN	N° TOTAL DE VIV. DOMEST	COBERT	POBLACIÓN SERVIDA	UNIDADES DE USO					
					DOMESTICO		NO DOMESTICO			
					UNIFAM.	MULTIFAM.	COMERCIAL	SOCIAL	ESTATAL	INDUSTRIAL
Base	17 926	2 754	100.00%	17925.97	1 920	834	93	2	3	3
0	18 046	2 764	100.00%	18046.39	1 920	844	96	2	3	3
1	18 168	2 774	100.00%	18167.61	1 920	854	100	2	3	3
2	18 290	2 783	100.00%	18289.65	1 920	863	103	2	3	3
3	18 413	2 793	100.00%	18412.50	1 920	873	107	2	3	3
4	18 536	2 803	100.00%	18536.18	1 920	883	110	2	3	4
5	18 661	2 813	100.00%	18660.70	1 920	893	114	2	3	4
6	18 786	2 824	100.00%	18786.05	1 920	904	118	2	3	4
7	18 912	2 834	100.00%	18912.24	1 920	914	122	2	3	4
8	19 039	2 844	100.00%	19039.28	1 920	924	127	2	3	4
9	19 167	2 854	100.00%	19167.17	1 920	934	131	2	3	4
10	19 296	2 865	100.00%	19295.92	1 920	945	136	2	3	4
11	19 426	2 875	100.00%	19425.54	1 920	955	141	2	3	5
12	19 556	2 886	100.00%	19556.02	1 920	966	145	2	3	5
13	19 687	2 897	100.00%	19687.39	1 920	977	151	2	3	5
14	19 820	2 907	100.00%	19819.63	1 920	987	156	2	3	5
15	19 953	2 918	100.00%	19952.77	1 920	998	161	2	3	5
16	20 087	2 929	100.00%	20086.80	1 920	1 009	167	2	3	5
17	20 222	2 940	100.00%	20221.72	1 920	1 020	173	2	3	6
18	20 358	2 951	100.00%	20357.56	1 920	1 031	179	2	3	6
19	20 494	2 962	100.00%	20494.31	1 920	1 042	185	2	3	6
20	20 632	2 973	100.00%	20631.97	1 920	1 053	192	2	3	6



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CONSORCIO PROYECTOS LIMA
ING. ELIAS MCGOLLON ESCOBAR
DIRECTOR DE PROYECTO

CONSUMO DE AGUA (l/día)										DEMANDA DE DESAGUE				
DOMESTICO		NO DOMESTICO					TOTAL	l/día	l/seg	m³/año	Qmd (lt/seg)	Qmh (lt/seg)		
UNIFAM.	MULTIFAM.	COMERCIAL	SOCIAL	ESTATAL	INDUSTRIAL									
1 121 280	426 174	146 847	542	19 037	20 750	1 734 630	1 387 704	16.06	506 512	20.88	28.91			
1 121 280	431 155	151 987	546	19 165	21 476	1 745 608	1 396 486	16.16	509 718	21.01	29.09			
1 121 280	436 169	157 306	549	19 294	22 228	1 756 826	1 405 460	16.27	512 993	21.15	29.28			
1 121 280	441 216	162 812	553	19 423	23 006	1 768 290	1 414 632	16.37	516 341	21.28	29.47			
1 121 280	446 298	168 510	557	19 554	23 811	1 780 010	1 424 008	16.48	519 763	21.43	29.67			
1 121 280	451 413	174 408	560	19 685	24 644	1 791 992	1 433 593	16.59	523 262	21.57	29.87			
1 121 280	456 564	180 512	564	19 817	25 507	1 804 245	1 443 396	16.71	526 839	21.72	30.07			
1 121 280	461 748	186 830	568	19 950	26 400	1 816 777	1 453 421	16.82	530 499	21.87	30.28			
1 121 280	466 968	193 369	572	20 084	27 324	1 829 597	1 463 678	16.94	534 242	22.02	30.49			
1 121 280	472 222	200 137	576	20 219	28 280	1 842 715	1 474 172	17.06	538 073	22.18	30.71			
1 121 280	477 512	207 142	580	20 355	29 270	1 856 139	1 484 911	17.19	541 993	22.34	30.94			
1 121 280	482 837	214 392	583	20 492	30 294	1 869 879	1 495 903	17.31	546 005	22.51	31.16			
1 121 280	488 199	221 896	587	20 630	31 355	1 883 946	1 507 157	17.44	550 112	22.68	31.40			
1 121 280	493 596	229 662	591	20 768	32 452	1 898 350	1 518 680	17.58	554 318	22.85	31.64			
1 121 280	499 029	237 700	595	20 908	33 588	1 913 100	1 530 480	17.71	558 625	23.03	31.89			
1 121 280	504 499	246 020	599	21 048	34 763	1 928 210	1 542 568	17.85	563 037	23.21	32.14			
1 121 280	510 006	254 631	603	21 189	35 980	1 943 689	1 554 952	18.00	567 557	23.40	32.39			
1 121 280	515 549	263 543	607	21 332	37 240	1 959 551	1 567 641	18.14	572 189	23.59	32.66			
1 121 280	521 130	272 767	611	21 475	38 543	1 975 806	1 580 645	18.29	576 935	23.78	32.93			
1 121 280	526 749	282 314	616	21 619	39 892	1 992 469	1 593 975	18.45	581 801	23.98	33.21			
1 121 280	532 405	292 195	620	21 765	41 288	2 009 552	1 607 641	18.61	586 789	24.19	33.49			
1 121 280	538 099	302 421	624	21 911	42 733	2 027 068	1 621 654	18.77	591 904	24.40	33.78			



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ING. ELIAS MOGOLLON ESCOBAR
DIRECTOR DE PROYECTO

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SIMULACIÓN HIDRÁULICA

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RED EXISTENTE

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Memoria de Cálculo

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CONSORCIO PROYECTOS LIMA

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DIRECTOR DE PROYECTO

MEMORIA DESCRIPTIVA SIMULACIÓN HIDRÁULICA

I. OBJETIVO

Evaluar las condiciones actuales de funcionamiento del sistema de alcantarillado del C.H. PALOMINO. Para identificar problemas de diseño y que éstas puedan ser resueltas para la modelación en el sistema proyectado, que deberá cumplir todas las condiciones de diseño de sistemas de alcantarillado.

II. TOPOLOGÍA

La topología considerada para la simulación para evitar confusiones es la siguiente:

Cuadro 2 – 1: Topología

ELEMENTO CONSIDERADO	TOPOLOGÍA EN LA SIMULACIÓN
TUBERÍAS Las tuberías para el sistema existente son tanto de PVC (Rehabilitadas) como de concreto (a rehabilitar).	Conduit Representan los colectores y sus características físicas de funcionamiento.
BUZONES Los buzones que se encuentran dentro de la zona de estudio, para este caso tenemos los buzones rehabilitados y a rehabilitar.	Manhole Representadas por circunferencias en cada cambio de dirección o pendiente, es donde se asignan tanto las descargas domiciliarias como los aportes.
BUZONES DE DESCARGA Buzones en los que finaliza todo el recorrido de las tuberías que provienen de un sector definido.	Out Fall Se coloca la válvula reductora de Presión bajo las mismas condiciones de la simulación original.

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III. SOFRWARE

Para realizar el modelamiento hidráulico se ha utilizado el software Bentley® SewerCAD® V8i (SELECT series 4)

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JEFE E.T.C.

IV. DATOS DE INGRESO

Los aportes

Los aportes en la simulación original muestran los siguientes datos:

	Aporte total (L/s)
CAUDAL	28.91

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El caudal proviene de la Demanda de Alcantarillado para el Año Base (2016) indicada en el Cuadro 5.3-5: Cuadro de la Demanda de Alcantarillado de la Memoria Descriptiva en la pag. 40.

El dato fue determinado tanto usando los consumos para cada tipo de usuario, como también el total de conexiones dentro de la zona de estudio, estos fueron evaluados y asignados a cada buzón dependiendo de la zona en la que se encuentre cada uno de estos. Estos caudales asignados se adjuntan al reporte de simulación hidráulica.

Elevaciones

Las elevaciones son proporcionadas por el estudio topográfico y exportado a través de las tablas flexibles que son herramientas de Sewercad, del mismo modo las profundidades de los buzones y las caídas para cada colector a la llegada a los buzones.

V. TRAMOS CRÍTICOS DE LA RED EXISTENTE

Con la información recolectado de campo como datos topográficos, características de los buzones (profundidad), tipo de material y longitud de las tuberías, más la demanda calculado en gabinete se prosiguió a realizar la simulación hidráulica. Dando como resultado tramos con tensiones tractivas y velocidades inferiores a lo indicado en el RNE, resultando estos tramos como críticos por considerarse deficiente en el arrastre de sólidos.

Se tuvo en cuenta para determinar estos valores de tensiones tractivas que el caudal mínimo de aporte en los buzones de arranque, que son los que generalmente presenta mayores problemas, sea reemplazado por 1.5 l/s para poder generar condiciones apropiadas de funcionamiento, ya que al colocar la demanda real del sistema se obtuvo tensión tractiva menor a 1 Pa en el 32 % de tuberías del sistema; para el cálculo de la tensión tractiva el programa Sewercad usa como fórmula la siguiente:

$$\tau = \gamma \cdot Rh \cdot S$$

donde:


τ = Fuerza tractiva (Kg/m²)
 γ = Peso específico del agua (Kg/m³)
 Rh = Radio hidráulico (m)
 S = Pendiente de la tubería (m/m)


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Por otra parte, la mayoría de las tuberías son de Concreto simple normalizado (CSN), tuberías que ya culminaron con su periodo de vida. Y algunas que fueron rehabilitadas tampoco cumplen con dicha condición. En la mayoría de los tramos las velocidades son inferiores a 0.6m/s, y en algunos la condición es crítica los cuales presentan problemas de arrastre hidráulico, por lo que se plantea mejorar el sistema incrementando la pendiente para un mejor arrastre hidráulico.


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Reportes

FlexTable: Conduit Table

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Length (m)	Slope (Calculated) (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
C.S.-DN 200	BE-65	88.29	BE-66	87.91	Concrete	200	4.13	91.959	1.15	9.868	12.2	4.15
C.S.-DN 200	BE-59	87.91	BE-58	88.32	Concrete	200	4.53	90.857	1.15	9.777	18.9	4.55
C.S.-DN 200	BE-18	88.72	BE-17	88.80	Concrete	200	6.08	13.495	0.59	2.235	14.7	6.08
C.S.-DN 200	BE-91	86.35	BE-92	86.12	Concrete	200	6.66	34.513	0.82	4.631	13.4	6.67
C.S.-DN 200	BE-46	87.07	BE-47	86.90	Concrete	200	8.25	20.364	0.84	4.198	23.4	8.25
C.S.-DN 200	BE-165	81.45	BE-165A	81.11	Concrete	200	8.45	40.214	0.88	5.412	17.0	8.46
C.S.-DN 200	BE-64	88.38	BE-65	88.29	Concrete	200	10.08	8.932	0.51	1.623	15.5	10.08
C.S.-DN 200	BE-30	90.87	BE-31	90.76	Concrete	200	10.11	10.975	0.55	1.901	15.1	10.11
C.S.-DN 200	BE-155	84.62	BE-156	84.49	Concrete	200	10.19	13.145	0.58	2.190	14.8	10.19
C.S.-DN 200	BE-171	78.10	BE-171A	77.69	Concrete	200	11.35	36.112	0.83	4.796	18.6	11.36
C.S.-DN 200	BE-55	89.05	BE-56	88.65	Concrete	200	11.75	34.625	0.82	4.642	13.4	11.76
C.S.-DN 200	BE-167A	80.37	BE-167	80.31	Concrete	200	11.94	5.025	0.42	1.037	18.0	11.94
C.S.-DN 200	BE-169	78.57	BE-170	78.45	Concrete	200	12.65	9.483	0.52	1.700	18.5	12.65
C.S.-DN 200	BE-BA3	85.94	BE-BA4	85.96	Concrete	200	14.72	1.155	0.25	0.329	20.1	14.72
C.S.-DN 200	BE-BA7	85.00	BE-BA15	84.85	Concrete	200	12.96	11.576	0.56	1.986	16.2	12.96
C.S.-DN 200	BE-158	83.76	BE-157	83.78	Concrete	200	13.11	1.525	0.27	0.409	19.5	13.11
C.S.-DN 200	BE-68	87.43	BE-69	87.32	Concrete	200	13.75	8.362	0.50	1.542	15.6	13.75
C.S.-DN 200	BE-17	88.80	BE-19	88.91	Concrete	200	14.95	7.492	0.48	1.416	15.8	14.95
C.S.-DN 200	BE-143	79.02	BE-139	79.53	Concrete	200	15.87	32.011	0.80	4.369	13.5	15.88
C.S.-DN 200	BE-27	92.26	BE-26	92.76	Concrete	200	16.04	31.181	0.79	4.281	17.1	16.04
C.S.-DN 200	BE-68	87.43	BE-67	88.46	Concrete	200	16.12	63.771	1.01	7.470	12.7	16.15
C.S.-DN 200	BE-151	84.81	BE-151A	84.99	Concrete	200	16.17	11.135	0.55	1.924	15.1	16.17
C.S.-DN 200	BE-61	87.02	BE-60	87.26	Concrete	200	16.59	14.467	0.74	3.217	23.2	16.59
C.S.-DN 200	BE-28	92.19	BE-27	92.26	Concrete	200	17.78	3.936	0.38	0.859	17.1	17.78
C.S.-DN 200	BE-BA13	86.97	BE-BA12	87.43	Concrete	200	17.86	25.755	0.74	3.692	13.8	17.87
C.S.-DN 200	BE-51	88.21	BE-50	88.45	Concrete	200	17.86	13.437	0.65	2.584	19.1	17.86
C.S.-DN 200	BE-34	90.58	BE-33	90.74	Concrete	200	18.11	9.056	0.51	1.640	15.4	18.11
C.S.-DN 200	BE-145	78.88	BE-143	79.02	Concrete	200	18.36	7.951	0.49	1.483	15.7	18.36
C.S.-DN 200	BE-135	77.70	BE-134	77.18	Concrete	200	18.66	27.701	0.98	5.717	50.5	18.67
C.S.-DN 200	BE-63	86.54	BE-62	86.73	Concrete	200	19.03	9.934	0.67	2.512	29.1	19.03

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ING. ELIAS MOGOLLON ESCOBAR
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FlexTable: Conduit Table

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Length (m)	Slope (Calculated) (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
C.S.N-DN 200	BE-139	79.53	BE-138	79.59	Concrete	200	19.60	3.215	0.35	0.734	17.6	19.60
C.S.N-DN 200	BE-151C	85.00	BE-151D	85.36	Concrete	200	21.62	16.649	0.63	2.629	23.9	21.63
C.S.N-DN 200	BE-151A	84.99	BE-151B	84.99	Concrete	200	21.16	0.000	0.05	0.000	23.7	21.16
C.S.N-DN 200	BE-32	90.30	BE-22	89.73	Concrete	200	21.52	26.485	0.74	3.772	16.0	21.53
C.S.N-DN 200	BE-24	93.17	BE-25	92.19	Concrete	200	22.25	44.041	0.89	5.591	25.4	22.27
C.S.N-DN 200	BE-BA15	84.85	BE-108	84.71	Concrete	200	22.31	6.142	0.45	1.213	27.5	22.31
C.S.N-DN 200	BE-147	78.51	BE-145	78.88	Concrete	200	22.96	15.940	0.62	2.543	16.3	22.96
C.S.N-DN 200	BE-62	86.73	BE-61	87.02	Concrete	200	23.53	12.283	0.72	2.934	23.8	23.53
C.S.N-DN 200	BE-53	89.98	BE-54	89.79	Concrete	200	23.62	7.960	0.49	1.484	15.7	23.62
C.S.N-DN 200	BE-90	86.92	BE-87	86.82	Concrete	200	23.67	4.139	0.39	0.892	17.0	23.67
C.S.N-DN 200	BE-151D	85.36	BE-BA8	85.64	Concrete	200	23.74	11.792	0.56	2.011	15.0	23.75
C.S.N-DN 200	BE-35B	87.88	BE-35	87.75	Concrete	200	23.76	5.598	0.43	1.128	17.2	23.76
C.S.N-DN 200	BE-109	84.92	BE-110	84.80	Concrete	200	24.83	4.833	0.41	1.006	16.7	24.83
C.S.N-DN 200	BE-194	79.78	BE-195	79.44	Concrete	200	23.93	14.124	0.60	2.315	14.7	23.93
C.S.N-DN 200	BE-210	91.22	BE-211	90.83	Concrete	200	24.01	16.118	0.63	2.564	14.5	24.01
C.S.N-DN 200	BE-87	86.82	BE-91	86.35	Concrete	200	24.10	19.501	0.67	2.971	14.2	24.11
C.S.N-DN 200	BE-22	89.73	BE-21	90.00	Concrete	200	24.21	11.071	0.55	1.915	16.0	24.21
C.S.N-DN 200	BE-88	87.97	BE-89	87.24	Concrete	200	24.58	29.784	0.78	4.131	13.6	24.59
C.S.N-DN 200	BE-32	90.30	BE-34	90.58	Concrete	200	24.61	11.214	0.55	1.935	15.0	24.61
C.S.N-DN 200	BE-76	90.71	BE-77	90.31	Concrete	200	24.90	15.946	0.62	2.543	18.1	24.90
C.S.N-DN 200	BE-211	90.83	BE-212	90.13	Concrete	200	24.96	28.001	0.76	3.939	34.5	24.97
C.S.N-DN 200	BE-23	93.19	BE-24	93.17	Concrete	200	15.55	1.287	0.26	0.359	20.0	15.55
C.S.N-DN 200	BE-161	81.98	BE-160	82.18	Concrete	200	25.13	7.959	0.49	1.484	15.7	25.13
C.S.N-DN 200	BE-BA2	86.21	BE-BA1	85.81	Concrete	200	28.75	13.912	0.60	2.289	14.7	28.75
C.S.N-DN 200	BE-52	90.26	BE-53	89.98	Concrete	200	25.53	11.085	0.55	1.917	15.1	25.53
C.S.N-DN 200	BE-BA7	85.00	BE-BA6	85.89	Concrete	200	25.62	34.739	0.82	4.654	13.4	25.63
C.S.N-DN 200	BE-122	79.69	BE-121	81.03	Concrete	200	25.65	52.248	0.95	6.381	22.7	25.68
C.S.N-DN 200	BE-203	90.16	BE-204	89.84	Concrete	200	25.70	12.412	0.57	2.099	14.9	25.70
C.S.N-DN 200	BE-207	90.78	BE-208	91.03	Concrete	200	25.96	9.401	0.52	1.689	15.4	25.96
C.S.N-DN 200	BE-151B	84.99	BE-151C	85.00	Concrete	200	24.76	0.404	0.17	0.144	31.7	24.76

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FlexTable: Conduit Table

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Length (m)	Slope (Calculated) (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
C.S.N-DN 200	BE-204	89.84	BE-205	89.53	Concrete	200	26.06	12.048	0.57	2.043	16.2	26.06
C.S.N-DN 200	BE-40	87.37	BE-43	87.25	Concrete	200	26.73	4.266	0.45	1.134	22.9	26.73
C.S.N-DN 200	BE-47	86.90	BE-45	87.50	Concrete	200	26.79	22.396	0.70	3.306	20.0	26.80
C.S.N-DN 200	BE-75	90.98	BE-76	90.71	Concrete	200	27.11	9.885	0.53	1.757	15.3	27.11
C.S.N-DN 200	BE-BA2	86.21	BE-BA13	86.97	Concrete	200	22.95	33.111	0.81	4.484	13.4	22.97
C.S.N-DN 200	BE-78	90.12	BE-79	89.74	Concrete	200	27.88	13.844	0.69	2.832	20.6	27.88
C.S.N-DN 200	BE-58	88.32	BE-56	88.65	Concrete	200	28.02	11.633	0.56	1.996	15.0	28.02
C.S.N-DN 200	BE-179	83.28	BE-180	82.91	Concrete	200	28.14	13.078	0.58	2.181	14.8	28.14
C.S.N-DN 200	BE-77	90.31	BE-78	90.12	Concrete	200	28.45	6.677	0.53	1.588	20.3	28.45
C.S.N-DN 200	BE-59	87.91	BE-51	88.21	Concrete	200	28.51	10.662	0.61	2.203	20.6	28.52
C.S.N-DN 200	BE-11	89.41	BE-12	89.14	Concrete	200	29.04	9.296	0.52	1.674	15.4	29.05
C.S.N-DN 200	BE-36A	89.42	BE-36	89.41	Concrete	200	29.36	0.341	0.16	0.126	23.2	29.36
C.S.N-DN 200	BE-85	87.89	BE-86	87.38	Concrete	200	29.53	17.268	0.64	2.705	14.3	29.54
C.S.N-DN 200	BE-43	87.25	BE-42	87.49	Concrete	200	29.78	7.824	0.49	1.464	19.5	29.78
C.S.N-DN 200	BE-163	81.60	BE-165	81.45	Concrete	200	29.87	5.022	0.43	1.076	17.3	29.87
C.S.N-DN 200	BE-169A	78.76	BE-169	78.57	Concrete	200	30.67	6.196	0.45	1.221	16.1	30.67
C.S.N-DN 200	BE-14	90.59	BE-8	90.90	Concrete	200	31.03	10.054	0.53	1.781	15.2	31.04
C.S.N-DN 200	BE-15	90.27	BE-14	90.59	Concrete	200	32.21	9.935	0.53	1.764	16.8	32.21
C.S.N-DN 200	BE-215	91.91	BE-214	91.56	Concrete	200	33.05	10.621	0.54	1.852	15.1	33.05
C.S.N-DN 200	BE-10	89.90	BE-11	89.41	Concrete	200	33.80	14.498	0.60	2.363	14.6	33.80
C.S.N-DN 200	BE-199	78.52	BE-200	78.37	Concrete	200	34.01	4.498	0.40	0.952	16.8	34.01
C.S.N-DN 200	BE-75	90.98	BE-74	91.27	Concrete	200	34.04	8.636	0.50	1.581	15.5	34.04
C.S.N-DN 200	BE-110	84.80	BE-111	84.29	Concrete	200	33.19	15.364	0.62	2.471	27.2	33.20
C.S.N-DN 200	BE-86	87.38	BE-87	86.82	Concrete	200	34.64	16.166	0.63	2.570	14.5	34.65
C.S.N-DN 200	BE-8	90.90	BE-7	91.48	Concrete	200	34.68	16.665	0.63	2.631	14.4	34.69
C.S.N-DN 200	BE-141	79.96	BE-142	79.52	Concrete	200	34.69	12.682	0.58	2.132	14.9	34.70
C.S.N-DN 200	BE-43	87.25	BE-46	87.07	Concrete	200	34.72	5.358	0.51	1.434	22.9	34.72
C.S.N-DN 200	BE-202	90.52	BE-203	90.16	Concrete	200	34.95	10.386	0.54	1.828	15.2	34.95
C.S.N-DN 200	BE-117A	81.58	BE-117	81.11	Concrete	200	35.13	13.380	0.59	2.220	21.9	35.13
C.S.N-DN 200	BE-102	83.95	BE-101	84.23	Concrete	200	35.63	7.858	0.49	1.469	15.7	35.63

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FlexTable: Conduit Table

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Length (m)	Slope (Calculated) (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
C.S.N-DN 200	BE-48	89.41	BE-22	89.73	Concrete	200	35.99	8.892	0.51	1.622	16.3	35.99
C.S.N-DN 200	BE-35	87.75	BE-40	87.37	Concrete	200	36.19	10.474	0.57	1.997	20.2	36.19
C.S.N-DN 200	BE-13	88.37	BE-20	88.17	Concrete	200	36.23	5.631	0.43	1.133	16.3	36.23
C.S.N-DN 200	BE-25	92.19	BE-28	92.19	Concrete	200	36.50	0.000	0.05	0.000	25.4	36.50
C.S.N-DN 200	BE-66	87.91	BE-68	87.43	Concrete	200	36.67	13.036	0.58	2.176	14.8	36.67
C.S.N-DN 200	BE-12	89.14	BE-13	88.37	Concrete	200	37.38	20.517	0.68	3.090	16.3	37.39
C.S.N-DN 200	BE-96	85.68	BE-97	85.22	Concrete	200	37.47	12.411	0.57	2.099	14.9	37.47
C.S.N-DN 200	BE-107	85.14	BE-106	85.63	Concrete	200	37.90	12.745	0.93	4.381	33.9	37.90
C.S.N-DN 200	BE-197	78.43	BE-198	78.02	Concrete	200	38.00	10.791	0.55	1.875	21.0	38.00
C.S.N-DN 200	BE-9	90.49	BE-10	89.90	Concrete	200	38.00	15.606	0.62	2.501	14.5	38.00
C.S.N-DN 200	BE-196	78.80	BE-197	78.43	Concrete	200	38.53	9.733	0.52	1.735	15.3	38.53
C.S.N-DN 200	BE-97	85.22	BE-98	84.56	Concrete	200	38.55	16.939	0.64	2.665	14.4	38.56
C.S.N-DN 200	BE-142	79.52	BE-143	79.02	Concrete	200	38.69	12.872	0.58	2.156	14.8	38.69
C.S.N-DN 200	BE-163	81.60	BE-162	82.86	Concrete	200	38.80	32.477	0.80	4.418	16.9	38.82
C.S.N-DN 200	BE-172	78.52	BE-171	78.10	Concrete	200	39.02	10.765	0.55	1.872	15.1	39.02
C.S.N-DN 200	BE-69	87.32	BE-70	86.86	Concrete	200	39.06	11.648	0.56	1.999	15.0	39.06
C.S.N-DN 200	BE-BA8	85.64	BE-BA3	85.94	Concrete	200	40.55	7.471	0.48	1.413	15.8	40.56
C.S.N-DN 200	BE-117	81.11	BE-118	80.28	Concrete	200	39.44	20.970	0.95	5.121	28.2	39.45
C.S.N-DN 200	BE-39	87.93	BE-40	87.37	Concrete	200	39.76	14.134	0.60	2.317	19.4	39.77
C.S.N-DN 200	BE-37	88.32	BE-38	88.05	Concrete	200	39.87	6.772	0.46	1.309	18.0	39.87
C.S.N-DN 200	BE-106	85.63	BE-72	86.07	Concrete	200	40.34	11.105	0.88	3.893	36.7	40.35
C.S.N-DN 200	BE-71	86.49	BE-72	86.07	Concrete	200	40.99	10.270	0.53	1.811	26.2	41.00
C.S.N-DN 200	BE-108	84.71	BE-107	85.14	Concrete	200	41.93	10.232	0.86	3.682	37.7	41.93
C.S.N-DN 200	BE-70	86.86	BE-71	86.49	Concrete	200	42.48	8.663	0.50	1.585	15.5	42.48
C.S.N-DN 200	BE-190	79.59	BE-188	80.06	Concrete	200	42.49	11.203	0.55	1.933	15.0	42.49
C.S.N-DN 200	BE-56	88.65	BE-57	89.19	Concrete	200	42.51	12.797	0.58	2.147	14.8	42.51
C.S.N-DN 200	BE-124	82.26	BE-123	82.46	Concrete	200	42.68	4.874	0.41	1.013	17.3	42.68
C.S.N-DN 200	BE-104	83.50	BE-102	83.95	Concrete	200	43.36	10.470	0.54	1.840	16.2	43.36
C.S.N-DN 200	BE-126	81.78	BE-125	82.01	Concrete	200	43.84	5.270	0.42	1.076	17.8	43.84
C.S.N-DN 200	BE-89	87.24	BE-90	86.92	Concrete	200	44.01	7.272	0.47	1.383	17.0	44.01

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FlexTable: Conduit Table

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Length (m)	Slope (Calculated) (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
C.S.N-DN 200	BE-38	88.05	BE-39	87.93	Concrete	200	44.73	2.683	0.33	0.636	18.0	44.73
C.S.N-DN 200	BE-120	81.55	BE-119	82.08	Concrete	200	44.90	11.961	0.57	2.032	14.9	44.90
C.S.N-DN 200	BE-203	90.16	BE-207	90.78	Concrete	200	45.02	13.816	0.59	2.276	14.7	45.02
C.S.N-DN 200	BE-121	81.03	BE-120	81.55	Concrete	200	45.05	11.565	0.56	1.984	15.0	45.05
C.S.N-DN 200	BE-200	78.37	BE-201	77.78	Concrete	200	45.09	13.195	0.58	2.197	28.1	45.10
C.S.N-DN 200	BE-113	83.69	BE-114	83.28	Concrete	200	49.91	8.215	0.49	1.521	15.6	49.91
C.S.N-DN 200	BE-73	92.12	BE-75	90.98	Concrete	200	45.86	24.945	0.73	3.601	13.8	45.87
C.S.N-DN 200	BE-50	88.45	BE-49	88.82	Concrete	200	45.86	8.111	0.52	1.617	18.1	45.86
C.S.N-DN 200	BE-49	88.82	BE-48	89.41	Concrete	200	45.89	12.770	0.59	2.219	17.0	45.89
C.S.N-DN 200	BE-209	90.28	BE-206	89.03	Concrete	200	46.00	27.172	0.75	3.848	16.7	46.02
C.S.N-DN 200	BE-47	86.90	BE-63	86.54	Concrete	200	46.05	7.732	0.61	2.071	29.2	46.05
C.S.N-DN 200	BE-BA11	85.32	BE-BA7	85.00	Concrete	200	46.17	6.931	0.47	1.333	15.9	46.17
C.S.N-DN 200	BE-122	79.69	BE-132	79.05	Concrete	200	46.36	13.761	0.84	3.868	39.2	46.37
C.S.N-DN 200	BE-31	90.76	BE-32	90.30	Concrete	200	46.40	9.893	0.53	1.758	15.3	46.40
C.S.N-DN 200	BE-145	78.88	BE-144	79.31	Concrete	200	46.74	9.221	0.51	1.663	15.4	46.75
C.S.N-DN 200	BE-118	80.28	BE-122	79.69	Concrete	200	47.05	12.710	0.81	3.546	29.1	47.05
C.S.N-DN 200	BE-178	83.79	BE-179	83.28	Concrete	200	47.06	11.007	0.55	1.906	15.1	47.06
C.S.N-DN 200	BE-206	89.03	BE-82	88.37	Concrete	200	47.07	14.084	0.63	2.508	21.4	47.08
C.S.N-DN 200	BE-158	83.76	BE-159	82.87	Concrete	200	48.08	18.511	0.66	2.854	14.2	48.09
C.S.N-DN 200	BE-138	79.59	BE-137	80.51	Concrete	200	48.29	19.052	0.67	2.918	17.6	48.30
C.S.N-DN 200	BE-104	83.50	BE-105	82.95	Concrete	200	48.40	11.260	0.56	2.000	19.9	48.41
C.S.N-DN 200	BE-205	89.53	BE-206	89.03	Concrete	200	48.47	10.274	0.54	1.857	17.0	48.48
C.S.N-DN 200	BE-28	92.19	BE-29	91.54	Concrete	200	49.95	13.013	0.58	2.173	14.8	49.95
C.S.N-DN 200	BE-125	82.01	BE-124	82.26	Concrete	200	50.00	4.880	0.41	1.014	17.2	50.00
C.S.N-DN 200	BE-184	82.04	BE-185	81.32	Concrete	200	50.05	14.484	0.60	2.361	14.6	50.06
C.S.N-DN 200	BE-95	86.54	BE-96	85.68	Concrete	200	50.10	17.247	0.64	2.702	14.3	50.10
C.S.N-DN 200	BE-82	88.37	BE-83	87.88	Concrete	200	50.42	9.719	0.68	2.585	44.3	50.42
C.S.N-DN 200	BE-137	80.51	BE-136	81.34	Concrete	200	50.79	16.341	0.63	2.592	14.4	50.80
C.S.N-DN 200	BE-159	82.87	BE-161	81.98	Concrete	200	51.84	17.168	0.64	2.693	14.4	51.85
C.S.N-DN 200	BE-42	87.49	BE-41	88.27	Concrete	200	51.96	15.070	0.61	2.435	14.6	51.96

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Julio Pacheco Ramos
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FlexTable: Conduit Table

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Length (m)	Slope (Calculated) (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
C.S.N-DN 200	BE-134	77.18	BE-173	78.17	Concrete	200	52.50	18.799	0.66	2.888	46.1	52.51
C.S.N-DN 200	BE-115	82.39	BE-116	81.68	Concrete	200	53.64	13.144	0.77	3.350	23.9	53.64
C.S.N-DN 200	BE-177	82.56	BE-182	81.93	Concrete	200	52.94	11.863	0.56	2.020	14.9	52.94
C.S.N-DN 200	BE-212	90.13	BE-217	90.86	Concrete	200	52.76	13.837	1.16	6.182	52.8	52.76
C.S.N-DN 200	BE-217	90.86	BE-216	92.19	Concrete	200	52.96	25.075	0.73	3.616	34.3	52.98
C.S.N-DN 200	BE-185	81.32	BE-183	80.79	Concrete	200	53.00	10.019	0.53	1.776	16.6	53.00
C.S.N-DN 200	BE-99	83.80	BE-105	82.95	Concrete	200	53.53	15.859	0.62	2.533	19.7	53.54
C.S.N-DN 200	BE-161	81.98	BE-163	81.60	Concrete	200	53.79	7.064	0.47	1.352	16.9	53.80
C.S.N-DN 200	BE-98	84.56	BE-99	83.80	Concrete	200	53.83	14.155	0.60	2.319	14.7	53.84
C.S.N-DN 200	BE-140	80.33	BE-141	79.96	Concrete	200	54.04	6.847	0.46	1.320	16.0	54.04
C.S.N-DN 200	BE-192	78.40	BE-193	78.22	Concrete	200	54.06	3.404	0.43	0.986	25.3	54.06
C.S.N-DN 200	BE-79	89.74	BE-80	89.34	Concrete	200	54.07	7.360	0.56	1.766	21.3	54.07
C.S.N-DN 200	BE-80	89.34	BE-81	88.87	Concrete	200	54.09	8.708	0.60	2.082	22.0	54.09
C.S.N-DN 200	BE-83	87.88	BE-84	87.24	Concrete	200	54.34	11.722	1.19	6.172	59.8	54.34
C.S.N-DN 200	BE-166	80.99	BE-167A	80.37	Concrete	200	54.57	11.361	0.55	1.959	16.6	54.58
C.S.N-DN 200	BE-117B	81.60	BE-117A	81.58	Concrete	200	54.88	0.364	0.16	0.133	23.9	54.88
C.S.N-DN 200	BE-36	89.41	BE-37	88.32	Concrete	200	54.89	19.859	0.68	3.013	16.0	54.90
C.S.N-DN 200	BE-54	89.79	BE-55	89.05	Concrete	200	55.00	13.346	0.59	2.216	14.8	55.00
C.S.N-DN 200	BE-81	88.87	BE-82	88.37	Concrete	200	55.35	9.052	0.62	2.190	23.8	55.35
C.S.N-DN 200	BE-191	78.73	BE-190	79.59	Concrete	200	55.95	15.406	0.62	2.476	19.4	55.96
C.S.N-DN 200	BE-174	84.65	BE-175	83.99	Concrete	200	56.09	11.838	0.56	2.017	15.0	56.09
C.S.N-DN 200	BE-156	84.49	BE-158	83.76	Concrete	200	56.89	12.779	0.58	2.144	14.8	56.90
C.S.N-DN 200	BE-101	84.23	BE-100	84.74	Concrete	200	57.24	8.910	0.51	1.620	15.5	57.24
C.S.N-DN 200	BE-190	79.59	BE-189	80.00	Concrete	200	57.39	7.248	0.47	1.380	15.8	57.39
C.S.N-DN 200	BE-60	87.26	BE-59	87.91	Concrete	200	57.49	11.237	0.67	2.551	22.3	57.49
C.S.N-DN 200	BE-193	78.22	BE-198	78.02	Concrete	200	57.94	3.383	0.43	0.984	25.7	57.94
C.S.N-DN 200	BE-175	83.99	BE-176	83.24	Concrete	200	58.82	12.733	0.58	2.139	14.8	58.83
C.S.N-DN 200	BE-114	83.28	BE-115	82.39	Concrete	200	59.39	15.070	0.61	2.435	21.0	59.40
C.S.N-DN 200	BE-116	81.68	BE-117	81.11	Concrete	200	59.02	9.674	0.69	2.638	26.9	59.03
C.S.N-DN 200	BE-21	90.00	BE-15	90.27	Concrete	200	59.73	4.554	0.40	0.961	16.8	59.73

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FlexTable: Conduit Table

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Length (m)	Slope (Calculated) (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
C.S.N-DN 200	BE-182	81.93	BE-183	80.79	Concrete	200	59.85	19.182	0.67	2.933	16.6	59.86
C.S.N-DN 200	BE-198	78.02	BE-201	77.78	Concrete	200	60.10	4.060	0.48	1.206	33.1	60.10
C.S.N-DN 200	BE-133	78.05	BE-147	78.51	Concrete	200	60.49	7.588	0.49	1.484	44.5	60.49
C.S.N-DN 200	BE-176	83.24	BE-177	82.56	Concrete	200	60.17	11.201	0.55	1.933	15.0	60.18
C.S.N-DN 200	BE-20	88.17	BE-35	87.75	Concrete	200	61.34	6.879	0.46	1.325	16.8	61.34
C.S.N-DN 200	BE-103	84.09	BE-104	83.50	Concrete	200	62.16	9.508	0.52	1.704	16.2	62.16
C.S.N-DN 200	BE-29	91.54	BE-30	90.87	Concrete	200	62.33	10.749	0.55	1.870	15.1	62.34
C.S.N-DN 200	BE-18	88.72	BE-20	88.17	Concrete	200	62.47	8.789	0.51	1.603	15.9	62.47
C.S.N-DN 200	BE-72	86.07	BE-63	86.54	Concrete	200	62.55	7.530	0.74	2.726	35.4	62.55
C.S.N-DN 200	BE-154	85.01	BE-155	84.62	Concrete	200	62.74	6.169	0.45	1.217	16.2	62.74
C.S.N-DN 200	BE-105	82.95	BE-115	82.39	Concrete	200	62.81	8.996	0.64	2.272	24.7	62.81
C.S.N-DN 200	BE-45	87.50	BE-44	87.96	Concrete	200	64.86	7.092	0.47	1.357	15.9	64.87
C.S.N-DN 200	BE-214	91.56	BE-213	90.90	Concrete	200	64.97	10.081	0.53	1.784	15.2	64.98
C.S.N-DN 200	BE-195	79.44	BE-196	78.80	Concrete	200	65.72	9.647	0.52	1.723	15.3	65.72
C.S.N-DN 200	BE-83	87.88	BE-218	88.99	Concrete	200	66.85	16.620	1.24	7.210	58.2	66.86
C.S.N-DN 200	BE-218	88.99	BE-212	90.13	Concrete	200	67.99	16.841	1.25	7.270	53.0	68.00
C.S.N-DN 200	BE-213	90.90	BE-77	90.31	Concrete	200	68.01	8.661	0.50	1.584	18.1	68.01
C.S.N-DN 200	BE-BA1	85.81	BE-BA11	85.32	Concrete	200	68.49	7.155	0.47	1.366	15.9	68.49
C.S.N-DN 200	BE-191	78.73	BE-192	78.40	Concrete	200	69.55	4.701	0.48	1.250	24.0	69.55
C.S.N-DN 200	BE-180	82.91	BE-182	81.93	Concrete	200	70.03	13.895	0.59	2.286	14.7	70.03
C.S.N-DN 200	BE-186	79.85	BE-191	78.73	Concrete	200	71.95	15.677	0.66	2.757	20.3	71.96
C.S.N-DN 200	BE-183	80.79	BE-186	79.85	Concrete	200	72.25	12.900	0.61	2.307	17.5	72.25
C.S.N-DN 200	BE-201	77.78	BE-135	77.70	Concrete	200	74.99	1.000	0.30	0.421	32.4	74.99
C.S.N-DN 200	BE-188	80.06	BE-187	80.84	Concrete	200	77.48	9.977	0.53	1.770	15.3	77.48
C.S.N-DN 200	BE-35B	87.88	BE-35C	87.92	Concrete	200	74.18	0.539	0.19	0.181	23.4	74.18
C.S.N-DN 200	BE-84	87.24	O-2	86.80	Concrete	200	16.98	25.798	0.86	4.630	17.7	16.98
C.S.N-DN 200	BE-216*	92.19	BE-215	91.91	Concrete	200	33.00	8.576	0.50	1.572	15.5	30.38
C.S.N-DN 200	BE-208	91.03	BE-210*	91.22	Concrete	200	24.00	8.125	0.49	1.508	15.6	22.24
C.S.N-DN 200	BE-210**	91.22	BE-209	90.28	Concrete	200	46.93	20.072	0.68	3.038	14.1	45.08
C.S.N-DN 200	BE-79*	90.74	BE-202	90.52	Concrete	200	35.05	6.077	0.44	1.203	16.2	33.30

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C.S.N-DN 200	BE-8*	90.90	BE-9	90.49	Concrete	200	36.71	11.087	0.55	1.917	15.1	33.58
C.S.N-DN 200	BE-57*	89.19	BE-64	88.38	Concrete	200	51.73	15.658	0.62	2.508	14.5	49.63
C.S.N-DN 200	BE-108*	84.71	BE-103	84.09	Concrete	200	61.40	10.195	0.53	1.801	15.2	59.43
C.S.N-DN 200	BE-BA8*	86.54	BE-BA2	86.21	Concrete	200	40.87	8.074	0.49	1.500	15.6	43.12
C.S.N-DN 200	BE-112*	84.71	BE-113	83.69	Concrete	200	49.50	20.626	0.68	3.102	14.1	46.63
C.S.N-DN 200	BE-147	78.51	BE-146*	79.07	Concrete	200	58.01	9.654	0.52	1.724	16.3	56.04
C.S.N-DN 200	BE-173	78.17	BE-172*	78.52	Concrete	200	50.43	6.940	0.47	1.334	15.9	48.70
C.S.N-DN 300	BE-132	79.05	BE-133	78.05	Concrete	300	69.28	14.377	1.17	6.345	40.4	69.28
C.S.N-DN 300	BE-133	78.05	BE-134	77.18	Concrete	300	77.07	11.262	1.32	7.166	49.5	77.08
C.S.N-DN 300	BE-132	79.05	BE-131	80.30	Concrete	300	91.47	13.709	1.02	5.102	29.5	91.48
C.S.N-DN 300	BE-134	77.18	O-3	76.80	Concrete	300	21.34	17.951	1.61	10.826	44.3	21.34
C.S.N-DN 350	BE-5	88.45	BE-6	88.16	Concrete	350	19.23	15.084	0.57	2.166	7.2	19.23
C.S.N-DN 350	BE-131	80.30	BE-130	80.78	Concrete	250	20.18	23.739	1.24	7.922	27.8	20.18
C.S.N-DN 350	BE-112	83.69	BE-111	84.29	Concrete	250	28.48	20.998	1.15	6.860	31.0	28.48
C.S.N-DN 350	BE-148	86.93	BE-149	86.24	Concrete	350	23.51	29.345	0.71	3.636	6.7	23.52
C.S.N-DN 350	BE-4	88.92	BE-5	88.45	Concrete	350	25.98	18.094	0.61	2.491	7.0	25.98
C.S.N-DN 350	BE-130	80.78	BE-129	81.46	Concrete	250	40.25	16.920	1.10	6.074	28.8	40.25
C.S.N-DN 350	BE-111	84.29	BE-108	84.71	Concrete	250	33.29	12.708	0.97	4.631	28.1	33.29
C.S.N-DN 350	BE-168	79.57	BE-167	80.31	Concrete	350	45.25	16.353	0.70	3.049	9.6	45.26
C.S.N-DN 350	BE-165A	81.11	BE-164	82.07	Concrete	350	50.00	19.199	0.62	2.607	8.9	50.01
C.S.N-DN 350	BE-170	78.45	BE-168	79.57	Concrete	350	50.96	21.979	0.78	3.842	11.4	50.97
C.S.N-DN 350	BE-150	85.63	BE-151	84.81	Concrete	350	50.96	16.091	0.58	2.276	7.1	50.97
C.S.N-DN 350	BE-167	80.31	BE-165A	81.11	Concrete	350	54.84	14.587	0.64	2.630	10.3	54.85
C.S.N-DN 350	BE-153	83.07	BE-152	83.91	Concrete	350	59.97	14.008	0.55	2.046	7.2	59.97
C.S.N-DN 350	BE-129	81.46	BE-128	82.61	Concrete	250	60.56	18.941	1.13	6.464	32.1	60.57
C.S.N-DN 350	BE-164	82.07	BE-153	83.07	Concrete	350	61.24	16.330	0.58	2.302	7.1	61.25
C.S.N-DN 350	BE-171A	77.69	BE-170	78.45	Concrete	350	61.54	12.350	0.68	2.729	12.1	61.54
C.S.N-DN 350	BE-149	86.24	BE-150	85.63	Concrete	350	62.27	9.795	0.49	1.552	7.5	62.28
C.S.N-DN 350	BE-6	88.16	BE-148	86.93	Concrete	350	65.23	18.857	0.62	2.571	7.0	65.24
C.S.N-DN 350	BE-152	83.91	BE-151	84.81	Concrete	350	66.95	13.443	0.55	1.982	7.3	66.96

Bentley SewerCAD V8i (SELECTseries 4)
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21/09/2016

PEDRO ANGEL
VEGA PRINCIPLE
INGENIERO SANITARIO
Reg. CIP N° 224319

CONSORCIO PROYECTOS LIMA

ING. ELIAS MOCILLON ESCOBAR
DIRECTOR DE PROYECTO

Julio Pacheco Ramos
F-12549



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FlexTable: Conduit Table

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Length (m)	Slope (Calculated) (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
C.S.N-DN 350	BE-128	82.61	BE-112	83.69	Concrete	250	82.77	13.097	0.98	4.793	31.4	82.78
C.S.N-DN 350	BE-3	90.48	BE-4	88.92	Concrete	350	86.55	18.025	0.61	2.483	7.0	86.56
C.S.N-DN 350	BE-3	90.48	BE-2	91.38	Concrete	350	89.97	10.004	0.49	1.578	7.5	89.97
C.S.N-DN 350	BE-171A	77.69	O-4	77.20	Concrete	350	26.43	18.542	0.79	3.776	10.7	26.43
PVC-DN 200	BE-129	81.46	BE-127	81.68	PVC	200	24.33	9.000	0.61	1.451	28.3	24.33
PVC-DN 200	BE-146	79.07	BE-169A	78.76	PVC	200	35.87	8.587	0.60	1.399	16.1	35.87
PVC-DN 200	BE-127	81.68	BE-126	81.78	PVC	200	45.70	2.188	0.37	0.483	17.2	45.70
PVC-DN 200	BE-92	86.12	BE-93	85.07	PVC	200	54.12	19.403	0.80	2.634	13.4	54.13
PVC-DN 200	BE-93	85.07	BE-94	84.16	PVC	200	54.17	16.799	0.76	2.356	13.6	54.18
PVC-DN 200	BE-16	89.73	BE-18	88.72	PVC	200	62.13	16.290	0.75	2.300	13.7	62.13
PVC-DN 200	BE-94	84.16	O-1	83.94	PVC	200	15.35	14.332	0.72	2.083	13.9	15.35
PVC-DN 200	BE-15*	90.27	BE-16	89.73	PVC	200	40.34	13.386	0.70	1.975	14.0	37.77

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Reg. CIP N° 224319

FlexTable: Manhole Table

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	X (m)	Y (m)
BE-2	93.38	93.38	91.38	2.00	274,908.92	8,666,209.88
BE-3	91.95	91.95	90.48	1.47	274,820.37	8,666,193.97
BE-4	90.52	90.52	88.92	1.60	274,736.76	8,666,171.61
BE-5	90.12	90.12	88.45	1.67	274,711.50	8,666,165.55
BE-6	89.80	89.80	88.16	1.64	274,692.82	8,666,161.01
BE-7	92.68	92.68	91.48	1.20	274,904.16	8,666,194.49
BE-8	92.45	92.45	90.90	1.55	274,910.23	8,666,160.34
BE-8*	92.45	92.45	90.90	1.55	274,907.10	8,666,160.61
BE-9	91.85	91.85	90.49	1.36	274,873.74	8,666,164.35
BE-10	91.32	91.32	89.90	1.42	274,835.96	8,666,168.47
BE-11	90.91	90.91	89.41	1.50	274,802.20	8,666,166.99
BE-12	90.79	90.79	89.14	1.65	274,773.32	8,666,163.90
BE-13	90.24	90.24	88.37	1.87	274,735.93	8,666,163.48
BE-14	92.31	92.31	90.59	1.72	274,907.82	8,666,129.40
BE-15	92.27	92.27	90.27	2.00	274,899.45	8,666,098.30
BE-15*	92.27	92.27	90.27	2.00	274,896.92	8,666,098.79
BE-16	91.73	91.73	89.73	2.00	274,859.77	8,666,105.62
BE-17	91.10	91.10	88.80	2.30	274,799.51	8,666,109.88
BE-18	90.90	90.90	88.72	2.18	274,798.50	8,666,115.87
BE-19	91.26	91.26	88.91	2.35	274,814.39	8,666,108.45
BE-20	90.12	90.12	88.17	1.95	274,737.08	8,666,127.28
BE-21	91.78	91.78	90.00	1.78	274,878.30	8,666,042.44
BE-22	91.60	91.60	89.73	1.87	274,870.03	8,666,019.69
BE-23	93.93	93.93	93.19	0.74	274,941.38	8,666,209.20
BE-24	94.34	94.34	93.17	1.17	274,956.82	8,666,207.43
BE-25	93.94	93.94	92.19	1.75	274,971.30	8,666,190.53
BE-26	93.73	93.73	92.76	0.97	274,947.97	8,666,177.17
BE-27	93.42	93.42	92.26	1.16	274,941.63	8,666,162.45
BE-28	93.79	93.79	92.19	1.60	274,958.35	8,666,156.41
BE-29	93.22	93.22	91.54	1.68	274,941.93	8,666,109.23
BE-30	92.85	92.85	90.87	1.98	274,918.35	8,666,051.53
BE-31	92.76	92.76	90.76	2.00	274,908.82	8,666,054.92
BE-32	91.95	91.95	90.30	1.65	274,890.27	8,666,012.39
BE-33	92.14	92.14	90.74	1.40	274,876.29	8,665,972.13
BE-34	92.05	92.05	90.58	1.47	274,880.86	8,665,989.65
BE-35	89.85	89.85	87.75	2.10	274,732.40	8,666,066.11
BE-35B	89.65	89.65	87.88	1.77	274,711.85	8,666,078.04
BE-35C	89.60	89.60	87.92	1.68	274,684.31	8,666,009.15
BE-36	91.67	91.67	89.41	2.26	274,850.93	8,666,022.04
BE-36A	90.77	90.77	89.42	1.35	274,842.27	8,665,993.98
BE-37	91.47	91.47	88.32	3.15	274,834.14	8,666,074.30
BE-38	90.69	90.69	88.05	2.64	274,794.28	8,666,073.61
BE-39	90.53	90.53	87.93	2.60	274,768.55	8,666,037.02
BE-40	89.67	89.67	87.37	2.30	274,729.41	8,666,030.05
BE-41	91.09	91.09	88.27	2.82	274,805.82	8,666,016.86
BE-42	90.17	90.17	87.49	2.68	274,756.69	8,665,999.95
BE-43	89.57	89.57	87.25	2.32	274,727.12	8,666,003.42
BE-44	90.26	90.26	87.96	2.30	274,799.87	8,665,929.63
BE-45	89.55	89.55	87.50	2.05	274,736.34	8,665,942.74
BE-46	89.40	89.40	87.07	2.33	274,719.22	8,665,969.62
BE-47	89.38	89.38	86.90	2.48	274,717.31	8,665,961.59
BE-48	91.31	91.31	89.41	1.90	274,858.10	8,665,985.73

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CONSORCIO PROYECTOS LIMA
ING. ELIAS MUGOLLON ESCOBAR
DIRECTOR DE PROYECTO

FlexTable: Manhole Table

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	X (m)	Y (m)
BE-49	90.82	90.82	88.82	2.00	274,840.65	8,665,943.29
BE-50	90.36	90.36	88.45	1.91	274,821.62	8,665,901.57
BE-51	90.16	90.16	88.21	1.95	274,813.11	8,665,885.87
BE-52	91.46	91.46	90.26	1.20	274,865.48	8,665,946.86
BE-53	91.18	91.18	89.98	1.21	274,865.36	8,665,921.33
BE-54	90.84	90.84	89.79	1.05	274,854.87	8,665,900.17
BE-55	90.52	90.52	89.05	1.47	274,829.38	8,665,851.44
BE-56	90.35	90.35	88.65	1.70	274,822.33	8,665,842.03
BE-57	90.44	90.44	89.19	1.25	274,798.63	8,665,806.74
BE-57*	90.44	90.44	89.19	1.25	274,798.07	8,665,804.70
BE-58	90.02	90.02	88.32	1.70	274,798.28	8,665,856.42
BE-59	89.91	89.91	87.91	2.00	274,799.57	8,665,860.77
BE-60	89.36	89.36	87.26	2.10	274,749.75	8,665,889.46
BE-61	89.22	89.22	87.02	2.20	274,735.44	8,665,897.85
BE-62	89.01	89.01	86.73	2.28	274,715.13	8,665,909.73
BE-63	88.94	88.94	86.54	2.40	274,698.77	8,665,919.45
BE-64	89.78	89.78	88.38	1.40	274,783.36	8,665,757.32
BE-65	89.84	89.84	88.29	1.55	274,787.49	8,665,748.12
BE-66	89.66	89.66	87.91	1.75	274,783.65	8,665,746.59
BE-67	89.74	89.74	88.46	1.28	274,776.09	8,665,795.86
BE-68	89.31	89.31	87.43	1.88	274,770.39	8,665,780.78
BE-69	89.22	89.22	87.32	1.90	274,765.33	8,665,793.57
BE-70	88.86	88.86	86.86	2.00	274,739.40	8,665,822.78
BE-71	88.41	88.41	86.49	1.92	274,702.81	8,665,844.35
BE-72	88.09	88.09	86.07	2.02	274,667.54	8,665,865.25
BE-73	92.94	92.94	92.12	0.82	274,935.36	8,666,061.82
BE-74	92.27	92.27	91.27	1.00	274,903.93	8,666,012.33
BE-75	92.75	92.75	90.98	1.77	274,937.77	8,666,016.02
BE-76	92.66	92.66	90.71	1.95	274,944.36	8,665,989.73
BE-77	92.63	92.63	90.31	2.32	274,955.62	8,665,967.52
BE-78	92.34	92.34	90.12	2.22	274,929.55	8,665,956.12
BE-79	92.09	92.09	89.74	2.36	274,907.80	8,665,938.67
BE-79*	92.09	92.09	90.74	1.36	274,908.64	8,665,937.13
BE-80	91.59	91.59	89.34	2.25	274,884.20	8,665,890.02
BE-81	91.12	91.12	88.87	2.25	274,862.70	8,665,840.39
BE-82	90.22	90.22	88.37	1.86	274,841.90	8,665,789.10
BE-83	89.88	89.88	87.88	2.00	274,845.07	8,665,738.78
BE-84	89.56	89.56	87.24	2.32	274,792.63	8,665,724.51
BE-85	89.10	89.10	87.89	1.21	274,752.40	8,665,712.38
BE-86	88.60	88.60	87.38	1.22	274,726.36	8,665,698.44
BE-87	88.03	88.03	86.82	1.21	274,696.92	8,665,680.18
BE-88	89.19	89.19	87.97	1.22	274,745.01	8,665,724.05
BE-89	88.84	88.84	87.24	1.60	274,720.45	8,665,724.97
BE-90	88.04	88.04	86.92	1.12	274,684.14	8,665,700.11
BE-91	87.56	87.56	86.35	1.21	274,677.70	8,665,665.64
BE-92	87.57	87.57	86.12	1.45	274,674.63	8,665,659.72
BE-93	86.76	86.76	85.07	1.69	274,634.72	8,665,623.18
BE-94	85.94	85.94	84.16	1.78	274,599.89	8,665,581.69
BE-95	88.47	88.47	86.54	1.93	274,720.93	8,665,790.68
BE-96	87.94	87.94	85.68	2.26	274,696.75	8,665,746.81
BE-97	87.32	87.32	85.22	2.10	274,671.75	8,665,718.91
BE-98	86.86	86.86	84.56	2.30	274,633.99	8,665,711.14

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CONSORCIO PROYECTOS LIMA
ING. ELIAS MCGOLLON ESCOBAR
DIRECTOR DE PROYECTO

FlexTable: Manhole Table

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	X (m)	Y (m)
BE-99	86.18	86.18	83.80	2.38	274,581.38	8,665,722.55
BE-100	87.04	87.04	84.74	2.30	274,635.25	8,665,755.17
BE-101	86.84	86.84	84.23	2.61	274,610.34	8,665,806.71
BE-102	86.31	86.31	83.95	2.36	274,577.16	8,665,793.73
BE-103	86.11	86.11	84.09	2.02	274,545.13	8,665,842.41
BE-104	85.68	85.68	83.50	2.18	274,535.71	8,665,780.98
BE-105	85.49	85.49	82.95	2.54	274,528.89	8,665,733.06
BE-106	87.53	87.53	85.63	1.91	274,630.39	8,665,880.99
BE-107	87.03	87.03	85.14	1.89	274,594.67	8,665,893.65
BE-108	86.56	86.56	84.71	1.85	274,553.84	8,665,903.19
BE-108*	86.56	86.56	84.71	1.85	274,553.52	8,665,901.24
BE-109	86.49	86.49	84.92	1.57	274,523.84	8,665,965.20
BE-110	86.40	86.40	84.80	1.60	274,521.41	8,665,940.50
BE-111	86.24	86.24	84.29	1.95	274,520.81	8,665,907.31
BE-112	85.91	85.91	83.69	2.22	274,492.37	8,665,908.79
BE-112*	85.91	85.91	84.71	1.20	274,491.25	8,665,906.03
BE-113	85.43	85.43	83.69	1.74	274,485.53	8,665,859.76
BE-114	85.02	85.02	83.28	1.74	274,478.76	8,665,810.32
BE-115	84.82	84.82	82.39	2.43	274,468.93	8,665,751.75
BE-116	84.00	84.00	81.68	2.32	274,418.03	8,665,768.68
BE-117	83.42	83.42	81.11	2.31	274,359.29	8,665,774.41
BE-117A	83.24	83.24	81.58	1.66	274,375.24	8,665,805.70
BE-117B	82.86	82.86	81.60	1.26	274,328.50	8,665,834.46
BE-118	82.78	82.78	80.28	2.50	274,320.75	8,665,782.78
BE-119	83.66	83.66	82.08	1.58	274,386.29	8,665,762.01
BE-120	82.98	82.98	81.55	1.43	274,342.09	8,665,769.89
BE-121	82.29	82.29	81.03	1.26	274,298.01	8,665,779.15
BE-122	81.87	81.87	79.69	2.19	274,274.01	8,665,788.22
BE-123	85.06	85.06	82.46	2.60	274,468.23	8,665,812.64
BE-124	85.16	85.16	82.26	2.91	274,474.30	8,665,854.88
BE-125	83.97	83.97	82.01	1.96	274,424.38	8,665,857.69
BE-126	83.71	83.71	81.78	1.93	274,380.67	8,665,861.01
BE-127	84.18	84.18	81.68	2.50	274,372.76	8,665,906.01
BE-128	84.57	84.57	82.61	1.96	274,409.61	8,665,909.97
BE-129	83.64	83.64	81.46	2.18	274,349.08	8,665,911.61
BE-130	83.06	83.06	80.78	2.28	274,316.74	8,665,887.64
BE-131	82.65	82.65	80.30	2.35	274,300.76	8,665,875.32
BE-132	81.45	81.45	79.05	2.40	274,234.42	8,665,812.34
BE-133	80.68	80.68	78.05	2.63	274,168.67	8,665,834.16
BE-134	79.83	79.83	77.18	2.65	274,096.81	8,665,862.02
BE-135	79.80	79.80	77.70	2.10	274,090.12	8,665,844.60
BE-136	83.44	83.44	81.34	2.10	274,309.98	8,665,954.76
BE-137	82.43	82.43	80.51	1.92	274,263.40	8,665,934.50
BE-138	82.09	82.09	79.59	2.50	274,223.25	8,665,907.68
BE-139	82.01	82.01	79.53	2.48	274,207.02	8,665,918.66
BE-140	82.79	82.79	80.33	2.46	274,264.52	8,665,970.87
BE-141	82.38	82.38	79.96	2.42	274,212.71	8,665,955.51
BE-142	81.96	81.96	79.52	2.44	274,179.47	8,665,945.57
BE-143	81.75	81.75	79.02	2.73	274,193.94	8,665,909.69
BE-144	81.46	81.46	79.31	2.15	274,206.08	8,665,865.76
BE-145	81.23	81.23	78.88	2.35	274,177.08	8,665,902.42
BE-146	81.07	81.07	79.07	2.00	274,141.29	8,665,949.42

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Bentley SewerCAD V8i (SELECTseries 4)
[08.11.04.54]
Page 3 of 5

PEDRO ANGEL
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Reg. CIP N° 224319

CONSORCIO PROYECTOS LIMA
ING. ELIAS MOGOLLON ESCOBAR
DIRECTOR DE PROYECTO

FlexTable: Manhole Table

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	X (m)	Y (m)
BE-146*	81.07	81.07	79.07	2.00	274,141.71	8,665,947.49
BE-147	80.89	80.89	78.51	2.38	274,156.00	8,665,893.31
BE-148	88.79	88.79	86.93	1.86	274,629.44	8,666,145.59
BE-149	88.45	88.45	86.24	2.21	274,608.72	8,666,134.49
BE-150	87.56	87.56	85.63	1.93	274,547.68	8,666,122.12
BE-151	86.80	86.80	84.81	1.99	274,497.65	8,666,112.45
BE-151A	87.04	87.04	84.99	2.05	274,505.22	8,666,098.17
BE-151B	87.09	87.09	84.99	2.10	274,519.65	8,666,082.69
BE-151C	87.64	87.64	85.00	2.64	274,543.76	8,666,077.07
BE-151D	87.81	87.81	85.36	2.45	274,553.91	8,666,057.97
BE-152	85.94	85.94	83.91	2.03	274,432.38	8,666,097.55
BE-153	85.08	85.08	83.07	2.01	274,373.98	8,666,083.92
BE-154	86.80	86.80	85.01	1.79	274,517.72	8,666,039.00
BE-155	86.37	86.37	84.62	1.75	274,479.24	8,665,989.45
BE-156	86.26	86.26	84.49	1.77	274,483.20	8,665,980.06
BE-157	85.38	85.38	83.78	1.60	274,422.23	8,665,989.88
BE-158	85.36	85.36	83.76	1.60	274,426.37	8,665,977.44
BE-159	84.80	84.80	82.87	1.93	274,379.23	8,665,986.92
BE-160	84.28	84.28	82.18	2.10	274,339.03	8,665,968.12
BE-161	84.16	84.16	81.98	2.18	274,327.51	8,665,990.45
BE-162	84.64	84.64	82.86	1.78	274,331.21	8,666,046.07
BE-163	83.83	83.83	81.60	2.23	274,294.66	8,666,033.05
BE-164	84.15	84.15	82.07	2.08	274,314.33	8,666,070.04
BE-165	83.46	83.46	81.45	2.01	274,272.23	8,666,052.77
BE-165A	83.42	83.42	81.11	2.31	274,265.75	8,666,058.21
BE-166	82.56	82.56	80.99	1.57	274,243.68	8,665,985.99
BE-167	82.58	82.58	80.31	2.27	274,212.61	8,666,044.66
BE-167A	82.64	82.64	80.37	2.27	274,219.49	8,666,034.91
BE-168	81.95	81.95	79.57	2.38	274,168.32	8,666,035.38
BE-169	81.21	81.21	78.57	2.64	274,127.23	8,666,014.45
BE-169A	81.11	81.11	78.76	2.35	274,133.35	8,665,984.40
BE-170	81.12	81.12	78.45	2.67	274,118.70	8,666,023.79
BE-171	80.30	80.30	78.10	2.20	274,065.33	8,666,000.43
BE-171A	80.24	80.24	77.69	2.55	274,058.79	8,666,009.71
BE-172	80.19	80.19	78.52	1.67	274,073.73	8,665,962.33
BE-172*	80.19	80.19	78.52	1.67	274,074.10	8,665,960.64
BE-173	79.97	79.97	78.17	1.80	274,085.09	8,665,913.20
BE-174	86.52	86.52	84.65	1.87	274,639.14	8,665,661.92
BE-175	85.54	85.54	83.99	1.56	274,584.21	8,665,673.24
BE-176	84.80	84.80	83.24	1.56	274,526.19	8,665,682.97
BE-177	84.06	84.06	82.56	1.50	274,466.48	8,665,690.39
BE-178	85.43	85.43	83.79	1.64	274,579.81	8,665,658.31
BE-179	84.98	84.98	83.28	1.70	274,555.45	8,665,618.05
BE-180	84.56	84.56	82.91	1.65	274,529.61	8,665,629.20
BE-182	83.65	83.65	81.93	1.72	274,460.12	8,665,637.83
BE-183	82.69	82.69	80.79	1.90	274,400.72	8,665,645.15
BE-184	83.69	83.69	82.04	1.65	274,411.38	8,665,747.64
BE-185	82.92	82.92	81.32	1.60	274,406.87	8,665,697.79
BE-186	81.58	81.58	79.85	1.73	274,329.03	8,665,654.08
BE-187	82.59	82.59	80.84	1.75	274,383.38	8,665,700.59
BE-188	81.69	81.69	80.06	1.63	274,306.56	8,665,710.68
BE-189	81.72	81.72	80.00	1.72	274,271.54	8,665,772.28

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CONSORCIO PROYECTOS LIMA
ING. ELIAS M. GOLLON ESCOBAR
DIRECTOR DE PROYECTO

FlexTable: Manhole Table

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	X (m)	Y (m)
BE-190	80.85	80.85	79.59	1.26	274,264.33	8,665,715.35
BE-191	80.48	80.48	78.73	1.75	274,257.31	8,665,659.84
BE-192	79.95	79.95	78.40	1.55	274,187.76	8,665,660.86
BE-193	79.57	79.57	78.22	1.36	274,133.87	8,665,656.59
BE-194	81.30	81.30	79.78	1.52	274,227.46	8,665,800.18
BE-195	80.85	80.85	79.44	1.41	274,215.56	8,665,779.42
BE-196	80.12	80.12	78.80	1.32	274,196.51	8,665,716.52
BE-197	79.69	79.69	78.43	1.26	274,158.12	8,665,719.80
BE-198	79.47	79.47	78.02	1.45	274,120.74	8,665,713.03
BE-199	80.17	80.17	78.52	1.65	274,185.19	8,665,773.99
BE-200	79.88	79.88	78.37	1.51	274,151.62	8,665,779.49
BE-201	79.48	79.48	77.78	1.71	274,107.23	8,665,771.59
BE-202	92.14	92.14	90.52	1.62	274,924.58	8,665,907.89
BE-203	91.96	91.96	90.16	1.80	274,941.00	8,665,877.04
BE-204	91.74	91.74	89.84	1.90	274,920.64	8,665,861.36
BE-205	91.55	91.55	89.53	2.02	274,908.14	8,665,838.49
BE-206	91.18	91.18	89.03	2.15	274,888.71	8,665,794.08
BE-207	92.08	92.08	90.78	1.30	274,962.71	8,665,837.60
BE-208	92.33	92.33	91.03	1.31	274,974.60	8,665,814.53
BE-209	91.88	91.88	90.28	1.60	274,934.70	8,665,795.09
BE-210	92.55	92.55	91.22	1.33	274,981.50	8,665,791.54
BE-210*	92.55	92.55	91.22	1.33	274,981.01	8,665,793.23
BE-210**	92.55	92.55	91.22	1.33	274,979.64	8,665,791.60
BE-211	92.47	92.47	90.83	1.64	274,982.74	8,665,767.56
BE-212	92.36	92.36	90.13	2.23	274,979.45	8,665,742.82
BE-213	92.60	92.60	90.90	1.70	274,985.99	8,665,906.67
BE-214	93.00	93.00	91.56	1.44	275,016.70	8,665,849.42
BE-215	93.21	93.21	91.91	1.30	275,029.75	8,665,819.06
BE-216	93.42	93.42	92.19	1.23	275,035.81	8,665,786.61
BE-216*	93.42	93.42	92.19	1.23	275,035.35	8,665,789.20
BE-217	92.79	92.79	90.86	1.93	275,031.43	8,665,733.83
BE-218	91.09	91.09	88.99	2.10	274,911.53	8,665,745.91
BE-BA1	87.76	87.76	85.81	1.95	274,589.79	8,665,990.53
BE-BA2	88.08	88.08	86.21	1.87	274,604.63	8,666,015.15
BE-BA3	88.55	88.55	85.94	2.61	274,599.43	8,666,060.25
BE-BA4	88.41	88.41	85.96	2.45	274,604.16	8,666,046.31
BE-BA6	87.09	87.09	85.89	1.20	274,575.52	8,665,949.07
BE-BA7	86.65	86.65	85.00	1.65	274,553.17	8,665,936.56
BE-BA8	87.74	87.74	85.64	2.10	274,565.88	8,666,037.47
BE-BA8*	87.74	87.74	86.54	1.20	274,567.19	8,666,036.52
BE-BA11	86.57	86.57	85.32	1.25	274,523.81	8,665,972.19
BE-BA12	88.63	88.63	87.43	1.20	274,636.62	8,666,008.30
BE-BA13	88.62	88.62	86.97	1.65	274,626.26	8,666,022.85
BE-BA15	86.70	86.70	84.85	1.85	274,558.86	8,665,924.93

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CONSORCIO PROYECTOS LIMA
ING. ELIAS MEGOLLON SUCOBAR
DIRECTOR DE PROYECTO

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RED PROYECTADA

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Memoria de Cálculo



"Renovación de red secundaria y conexión domiciliaria de alcantarillado; en el Conjunto Habitacional Palomino distrito de Lima, provincia Lima, departamento Lima" (Antes: "Cambio de redes de alcantarillado C.H. Palomino – Lima")

SIMULACIÓN
HIDRAÚLICA DEL
SISTEMA A CAMBIAR

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CONSORCIO PROYECTOS LIMA

ING. ELIAS MOGOLLON ESCOBAR
DIRECTOR DE PROYECTO

CONSORCIO PROYECTOS LIMA



"Renovación de red secundaria y conexión domiciliaria de alcantarillado; en el Conjunto Habitacional Palomino distrito de Lima, provincia Lima, departamento Lima" (Antes: "Cambio de redes de alcantarillado C.H. Palomino – Lima")

SIMULACIÓN
HIDRÁULICA DEL
SISTEMA A CAMBIAR

MEMORIA DESCRIPTIVA SIMULACIÓN HIDRÁULICA – SISTEMA A CAMBIAR

I. OBJETIVO

Determinar las condiciones finales de operación del Sistema de Alcantarillado del C.H. Palomino, a fin de que estas cumplan los parámetros establecidos por la reglamentación correspondiente (RNE).

II. TOPOLOGÍA

La topología considerada para la simulación para evitar confusiones es la siguiente:

Cuadro 2 – 1: Topología

ELEMENTO CONSIDERADO	TOPOLOGÍA EN LA SIMULACIÓN
TUBERÍAS Las tuberías para el sistema existente son tanto de PVC (Rehabilitadas) como de concreto (a rehabilitar).	Conduit Representan los colectores y sus características físicas de funcionamiento.
BUZONES Los buzones que se encuentran dentro de la zona de estudio, para este caso tenemos los buzones rehabilitados y a rehabilitar.	Manhole Representadas por circunferencias en cada cambio de dirección o pendiente, es donde se asignan tanto las descargas domiciliarias como los aportes.
BUZONES DE DESCARGA Buzones en los que finaliza todo el recorrido de las tuberías que provienen de un sector definido.	Out Fall Se coloca la válvula reductora de Presión bajo las mismas condiciones de la simulación original.

III. SOFTWARE

Para realizar el modelamiento hidráulico se ha utilizado el software Bentley® SewerCAD® V8i (SELECT series 4)

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IV. DATOS DE INGRESO

Los aportes

Los aportes en la simulación original muestran los siguientes datos:

	Aporte total (L/s)
CAUDAL	33.78



El caudal proviene de la Demanda de Alcantarillado para el Año 20 (2037) indicada en el Cuadro 5.3-5: Cuadro de la Demanda de Alcantarillado de la Memoria Descriptiva en la pag. 40. El dato fue determinado tanto usando los consumos para cada tipo de usuario, como también el total de

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conexiones dentro de la zona de estudio con una proyección de 20 años, estos fueron evaluados y asignados a cada buzón dependiendo de la zona en la que se encuentre cada uno de estos. Estos caudales asignados se adjuntan al reporte de simulación hidráulica.

Cabe resaltar que los caudales para los tramos de arranque que presentan una magnitud menor a 1.5 l/s, fue reemplazada por este valor sin alterar las condiciones de los tramos continuos.

Elevaciones

Las elevaciones son proporcionadas por el estudio topográfico y esportadas a través de las tablas flexibles que son herramientas de Sewercad, del mismo modo las profundidades de los buzones y las caídas para cada colector a la llegada a los buzones.

V. RESULTADOS DEL SISTEMA DE ALCANTARILLADO A CAMBIAR

Una vez hecho el trazado final de la red, con el listado final de buzones que se van a rehabilitar, buzones existentes que no serán cambiados y buzones a reubicar, se procedió a hacer el cálculo hidráulico de este sistema, teniendo en consideración que al ser este un proyecto de cambio únicamente, las condiciones iniciales no deben variar, o variar en lo más mínimo.

Con respecto al Sistema Existente, se modificaron ciertos tramos porque estos colectores se encuentran en las veredas teniendo vías en las cuales podrían ubicarse, esto con el fin de mejorar las condiciones operativas y de mantenimiento del sistema.

También se modificaron las profundidades de algunos buzones para permitir que se cumpla con los parámetros que especifica el RNE, en cuanto a tensión tractiva y velocidades. A fin de que estos cumplan los valores mínimos.

El programa Sewercad puede determinar estos parámetros, y expresarlos mediante tablas para su modificación. Para la determinación del parámetro más importante (Tensión Tractiva – Arrastre de sólidos) el programa usa la siguiente fórmula:

$$\tau = \gamma \cdot Rh \cdot S$$

donde:

τ = Fuerza tractiva (Kg/m²)
 γ = Peso específico del agua (Kg/m³)
 Rh = Radio hidráulico (m)
 S = Pendiente de la tubería (m/m)

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Una vez ingresados todos los tramos nuevos (Tub PVC) y también ingresadas las nuevas condiciones físicas del sistema, se procedió a modificar las profundidades de los buzones hasta hacer cumplir la primera condición ($T \geq 1Pa$), en este caso se logró hacer que todos los tramos de los colectores a cambiar cumplan con dicha condición, pero los otros parámetros no fueron cumplidos en su totalidad, teniendo en total un 3.64% de tuberías que presentan velocidades



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SIMULACIÓN
HIDRAÚLICA DEL
SISTEMA A CAMBIAR

menores a 0.6 m/s siendo la mínima velocidad hallada 0.35 m/s, y habiendo encontrado un solo tramo con velocidad máxima de 1.93 m/s ubicado entre los buzones BR-132 y BR-133 que pertenece al colector rehabilitado con diámetro de DN 315.

VI. CONCLUSIONES

- El 100% de tuberías a cambiar y/o proyectar cumplen con la primera condición que es Tensión Tractiva mayor a 1 Pascal ($T > 1\text{Pa}$).
- El 96.86% de tuberías a cambiar cumplen la condición de velocidad mayor a 0.6 m/s ($v \geq 0.6\text{ m/s}$). Sin embargo, el valor predominante es la tensión tractiva.
- No hay necesidad de modificar los diámetros de las tuberías ya que las dimensiones del sistema existente puede aguantar las condiciones futuras del proyecto y se cumple las condiciones hidráulicas requeridas.
- La mayor profundización que se hizo a los buzones fue al buzón BR-135 con 0.92 m por debajo de la cota de fondo del buzón existente.

Nota: Las conclusiones presentadas son una interpretación de lo expuesto en los reportes anexados.

VII. OBSERVACIONES

- Las tuberías de PVC-U que no serán cambiadas presentan en su mayoría tensiones tractivas mayores a 1.0 Pa que según el Artículo 9.2.4 del Reglamento de Elaboración de Proyectos de agua potable y Alcantarillado para Habilitaciones Urbanas de Lima Metropolitana y Callao de SEDAPAL es el límite mínimo para tuberías de PVC-U.

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SEDAPAL

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CONSORCIO PROYECTOS LIMA

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Reportes

FlexTable: Conduit Table

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (Unified) (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub_PVC - 1	BR-36	89.42	BP-40	89.56	PVC	192.2	1.50	10.45	13.397	0.77	1.896	14.4	10.45
Tub_PVC - 2	BP-40	89.56	BU-36A	89.92	PVC	192.2	1.50	26.92	13.375	0.77	1.894	14.4	26.92
Tub_PVC - 3	BR-167A	80.44	BP-39	80.73	PVC	192.2	1.50	30.25	9.587	0.68	1.465	14.9	30.25
Tub_PVC - 4	BP-39	80.73	BR-166	80.99	PVC	192.2	1.50	25.73	10.106	0.69	1.525	14.8	25.73
Tub_PVC - 5	BP-37	81.08	BR-136	81.34	PVC	192.2	1.50	17.30	15.026	0.79	2.077	14.2	17.31
Tub_PVC - 6	BR-137	80.51	BP-38	80.90	PVC	192.2	1.50	24.83	15.707	0.81	2.150	14.2	24.83
Tub_PVC - 7	BP-38	80.90	BP-37	81.08	PVC	192.2	1.50	11.62	15.495	0.80	2.127	14.2	11.62
Tub_PVC - 8	BU-138	80.12	BP-42	80.40	PVC	192.2	1.50	34.01	8.234	0.64	1.302	15.1	34.01
Tub_PVC - 9	BP-42	80.40	BR-137	80.51	PVC	192.2	1.50	13.03	8.442	0.65	1.327	15.1	13.03
Tub_PVC - 10	BR-145	78.88	BP-44	79.12	PVC	192.2	1.50	32.82	7.312	0.62	1.190	16.9	32.82
Tub_PVC - 11	BP-44	79.12	BP-43	79.21	PVC	192.2	1.50	13.18	6.827	0.60	1.126	15.4	13.18
Tub_PVC - 12	BP-43	79.21	BR-144	79.31	PVC	192.2	1.50	12.06	8.291	0.65	1.309	15.1	12.06
Tub_PVC - 14	BU-160	82.14	BP-3	81.54	PVC	192.2	1.87	61.72	9.722	0.73	1.639	16.6	61.72
Tub_PVC - 15	BP-3	81.54	BR-129	81.46	PVC	192.2	1.87	8.52	9.391	0.72	1.594	34.0	8.52
Tub_PVC - 16	BU-BA2	86.44	BP-15	86.07	PVC	192.2	1.50	32.09	11.532	0.73	1.689	14.6	32.09
Tub_PVC - 17	BP-12	86.30	BP-11	86.00	PVC	192.2	1.50	26.90	11.153	0.72	1.646	14.6	26.90
Tub_PVC - 18	BR-182	81.93	BR-183	80.79	PVC	192.2	1.69	59.85	19.049	0.89	2.634	18.7	59.86
Tub_PVC - 19	BR-175	83.99	BR-176	83.24	PVC	192.2	1.50	59.96	12.508	0.75	1.798	14.5	59.97
Tub_PVC - 20	BR-122	79.69	BR-132	79.05	PVC	192.2	5.48	46.36	13.804	1.13	3.458	56.5	46.37
Tub_PVC - 21	BU-133	78.10	BR-132	79.05	PVC	308.7	40.90	74.61	12.733	1.87	7.177	50.7	74.61
Tub_PVC - 22	BR-134	77.18	BU-133	78.10	PVC	308.7	42.98	71.74	12.825	1.90	7.374	52.7	71.74
Tub_PVC - 23	BR-200	78.37	BR-199	78.62	PVC	192.2	1.50	34.01	7.350	0.62	1.195	15.3	34.02
Tub_PVC - 24	BR-201	77.68	BR-200	78.37	PVC	192.2	1.50	45.09	15.302	0.80	2.106	22.4	45.10
Tub_PVC - 25	BR-135	77.40	BR-201	77.68	PVC	192.2	4.12	74.99	3.734	0.66	1.098	27.5	74.99
Tub_PVC - 26	BR-201	77.68	BR-198	77.91	PVC	192.2	3.61	60.10	3.827	0.64	1.057	27.2	60.10
Tub_PVC - 27	BR-198	77.91	BR-197	78.43	PVC	192.2	1.50	38.00	13.686	0.77	1.932	21.5	38.00
Tub_PVC - 28	BR-197	78.43	BR-196	78.80	PVC	192.2	1.50	38.53	9.603	0.68	1.466	14.9	38.53
Tub_PVC - 29	BR-196	78.80	BR-195	79.44	PVC	192.2	1.50	65.72	9.738	0.68	1.482	14.8	65.72
Tub_PVC - 30	BR-192	78.40	BR-193	78.17	PVC	192.2	3.12	54.06	4.255	0.63	1.078	24.4	54.06
Tub_PVC - 31	BR-198	77.91	BR-193	78.17	PVC	192.2	3.15	57.94	4.487	0.65	1.128	25.4	57.94
Tub_PVC - 32	BR-186	79.85	BR-191	78.73	PVC	192.2	2.15	71.95	15.566	0.90	2.510	22.1	71.96

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FlexTable: Conduit Table

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (Unified) (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub_PVC - 33	BR-188	80.06	BR-187	80.84	PVC	192.2	1.50	77.48	10.068	0.69	1.521	14.8	77.48
Tub_PVC - 34	BR-90	86.84	BU-87	86.64	PVC	192.2	1.50	27.17	7.361	0.62	1.196	15.3	27.17
Tub_PVC - 35	BE-167	80.31	BE-168	79.57	PVC	192.2	1.50	45.25	16.353	0.82	2.218	14.1	45.26
Tub_PVC - 36	BR-172	78.52	BR-171	78.10	PVC	192.2	1.50	39.02	10.765	0.71	1.602	14.7	39.02
Tub_PVC - 37	BR-171	78.10	BE-171A	77.98	PVC	192.2	1.50	11.35	10.569	0.70	1.579	14.7	11.36
Tub_PVC - 38	BR-134	77.18	BR-135	77.40	PVC	192.2	4.12	18.66	11.788	0.99	2.698	57.4	18.66
Tub_PVC - 39	BR-134	77.18	BR-173	78.17	PVC	192.2	1.50	52.50	18.856	0.86	2.476	51.8	52.51
Tub_PVC - 40	BE-168	79.57	BE-170	78.45	PVC	192.2	1.50	50.96	21.979	0.91	2.788	18.1	50.97
Tub_PVC - 41	BE-170	78.45	BE-171A	77.69	PVC	192.2	1.99	61.54	12.350	0.81	2.022	19.6	61.54
Tub_PVC - 42	BR-191	78.73	BR-192	77.40	PVC	192.2	3.04	69.55	4.745	0.65	1.160	24.2	69.55
Tub_PVC - 43	BE-94	84.16	O-1	82.89	PVC	192.2	1.50	65.90	19.271	0.87	2.518	13.9	65.92
Tub_PVC - 44	BR-84	87.24	O-2	86.20	PVC	192.2	23.01	18.12	57.392	2.84	19.599	50.5	18.15
Tub_PVC - 45	BR-190	79.55	BR-189	80.00	PVC	192.2	1.50	57.39	7.841	0.63	1.254	15.2	57.39
Tub_PVC - 46	BR-134	77.18	O-3	76.86	PVC	308.7	47.34	38.20	8.378	1.67	5.470	47.2	38.20
Tub_PVC - 47	BR-191	78.73	BR-190	79.55	PVC	192.2	1.50	55.95	14.655	0.79	2.037	20.4	55.96
Tub_PVC - 48	BE-171A	77.69	O-4	77.16	PVC	192.2	2.08	55.19	9.604	0.75	1.699	17.5	55.19
Tub_PVC - 49	BR-190	79.55	BR-188	80.06	PVC	192.2	1.50	42.49	12.004	0.74	1.742	14.5	42.49
Tub_PVC - 50	BR-173	78.17	BR-172*	78.99	PVC	192.2	1.50	50.43	16.260	0.82	2.208	14.1	48.63
Tub_PVC - 51	BR-183	80.79	BR-185	81.32	PVC	192.2	1.50	53.00	10.000	0.69	1.513	18.2	53.00
Tub_PVC - 52	BR-183	80.79	BR-186	79.85	PVC	192.2	2.04	72.25	13.011	0.83	2.129	19.9	72.25
Tub_PVC - 53	BR-185	81.32	BR-184	82.04	PVC	192.2	1.50	50.05	14.384	0.78	2.008	14.3	50.06
Tub_PVC - 54	BR-146*	79.87	BR-147	78.51	PVC	192.2	1.50	58.01	23.444	0.93	2.931	17.9	56.60
Tub_PVC - 55	BR-177	82.56	BR-176	83.24	PVC	192.2	1.50	60.17	11.301	0.72	1.663	14.6	60.18
Tub_PVC - 56	BR-182	81.93	BR-177	82.56	PVC	192.2	1.50	52.94	11.901	0.73	1.731	17.3	52.94
Tub_PVC - 57	BR-210*	91.35	BR-208	91.03	PVC	192.2	1.50	24.00	13.333	0.76	1.889	14.4	22.21
Tub_PVC - 58	BR-180	82.91	BR-182	81.93	PVC	192.2	1.50	70.03	13.995	0.77	1.966	17.3	70.03
Tub_PVC - 59	BR-180	82.91	BR-179	83.28	PVC	192.2	1.50	28.14	13.149	0.76	1.869	14.4	28.14
Tub_PVC - 60	BR-210**	91.35	BR-209	90.28	PVC	192.2	1.50	46.93	22.800	0.92	2.868	13.7	44.90
Tub_PVC - 61	BR-179	83.28	BR-178	83.79	PVC	192.2	1.50	47.06	10.837	0.71	1.610	14.7	47.06
Tub_PVC - 62	BU-174	84.90	BR-175	83.99	PVC	192.2	1.50	63.41	14.350	0.78	2.004	14.3	63.42
Tub_PVC - 63	BR-84*	88.36	BP-26	88.12	PVC	192.2	1.50	34.10	7.038	0.61	1.151	15.4	32.88

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FlexTable: Conduit Table

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (Unified) (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub_PVC - 64	BR-42	87.87	BR-43	87.17	PVC	192.2	1.50	29.78	23.507	0.93	2.937	20.9	29.79
Tub_PVC - 65	BR-147	78.51	BR-145	78.88	PVC	192.2	1.54	22.96	16.115	0.82	2.219	18.0	22.96
Tub_PVC - 66	BR-112*	84.31	BR-113	83.69	PVC	192.2	11.19	49.50	12.525	1.34	4.352	40.1	48.21
Tub_PVC - 67	BR-145	78.88	BU-143	79.09	PVC	192.2	1.50	18.58	11.301	0.72	1.663	16.9	18.58
Tub_PVC - 68	BE-164	82.07	BE-165A	81.32	PVC	192.2	1.50	50.00	14.999	0.79	2.074	14.2	50.01
Tub_PVC - 69	BE-165A	81.32	BE-167	80.31	PVC	192.2	1.50	54.84	18.416	0.85	2.431	13.9	54.85
Tub_PVC - 70	BE-167	80.31	BR-167A	80.44	PVC	192.2	1.50	11.94	10.888	0.71	1.616	14.7	11.94
Tub_PVC - 71	BR-162	82.86	BU-163	82.81	PVC	192.2	1.50	5.28	9.476	0.68	1.451	14.9	5.28
Tub_PVC - 72	BU-142	80.73	BP-2	80.64	PVC	192.2	1.50	14.37	6.263	0.58	1.056	15.6	14.37
Tub_PVC - 73	BR-195	79.44	BR-194	79.78	PVC	192.2	1.50	23.93	14.207	0.78	1.989	14.3	23.93
Tub_PVC - 74	BP-2	80.64	BU-143	80.48	PVC	192.2	1.50	23.66	6.762	0.60	1.115	15.4	23.71
Tub_PVC - 75	BR-111	84.29	BP-19	84.67	PVC	240.2	10.90	28.35	13.405	1.34	4.397	34.8	28.35
Tub_PVC - 76	BR-129	81.46	BU-130	80.94	PVC	240.2	13.81	33.16	15.680	1.51	5.511	39.7	33.17
Tub_PVC - 77	BR-107	85.14	BR-108	84.71	PVC	192.2	8.99	41.93	10.256	1.17	3.391	36.5	41.93
Tub_PVC - 78	BU-130	80.94	BR-131	80.30	PVC	240.2	14.17	27.26	23.476	1.76	7.642	31.6	27.27
Tub_PVC - 79	BR-29	91.54	BU-73	91.06	PVC	192.2	1.50	59.26	8.100	0.64	1.286	15.1	59.26
Tub_PVC - 80	BR-75	90.80	BU-73*	91.66	PVC	192.2	1.50	34.30	25.073	0.95	3.087	13.5	32.79
Tub_PVC - 81	BR-129	81.46	BR-128	82.61	PVC	240.2	11.48	60.56	18.990	1.54	5.907	37.6	60.57
Tub_PVC - 82	BR-57*	89.19	BU-56	88.64	PVC	192.2	1.50	46.07	11.938	0.76	1.846	14.4	44.29
Tub_PVC - 83	BR-126	81.88	BR-125	82.14	PVC	192.2	1.50	43.84	5.931	0.57	1.011	15.7	43.84
Tub_PVC - 84	BR-124	82.46	BR-123	83.86	PVC	192.2	1.50	42.68	32.804	1.04	3.808	13.2	42.70
Tub_PVC - 85	BR-216*	92.19	BR-215	91.91	PVC	192.2	1.50	33.00	8.485	0.65	1.333	15.1	31.89
Tub_PVC - 86	BR-125	82.14	BR-124	82.46	PVC	192.2	1.50	50.00	6.400	0.59	1.069	15.5	50.00
Tub_PVC - 87	BR-9	90.49	BR-8*	91.25	PVC	192.2	1.50	36.71	20.703	0.89	2.662	13.8	35.26
Tub_PVC - 88	BR-113	83.69	BR-114	83.28	PVC	192.2	1.50	49.91	8.215	0.64	1.300	15.1	49.91
Tub_PVC - 89	BR-72	86.07	BR-71	86.49	PVC	192.2	1.50	40.99	10.245	0.70	1.542	29.2	41.00
Tub_PVC - 90	BE-16	89.73	BR-15*	91.07	PVC	192.2	1.50	40.34	33.218	0.97	4.025	13.5	38.82
Tub_PVC - 91	BR-72	86.07	BR-106	85.63	PVC	192.2	8.79	40.34	10.907	1.19	3.526	41.9	40.35
Tub_PVC - 92	BR-63	86.54	BR-72	86.07	PVC	192.2	7.83	62.55	7.514	1.01	2.503	40.4	62.55
Tub_PVC - 93	BR-104	83.50	BR-105	82.95	PVC	192.2	1.87	48.40	11.363	0.77	1.850	22.7	48.41
Tub_PVC - 94	BR-108*	85.36	BR-103	84.09	PVC	192.2	1.50	61.40	20.684	0.89	2.660	13.8	59.75

Bentley SewerCAD V8i (SELECTseries 5)
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FlexTable: Conduit Table

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (Unified) (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub_PVC - 95	BR-103	84.09	BR-104	83.50	PVC	192.2	1.50	62.16	9.492	0.68	1.453	17.8	62.16
Tub_PVC - 96	BR-202	90.52	BR-79*	90.89	PVC	192.2	1.50	35.05	10.556	0.70	1.578	14.7	33.35
Tub_PVC - 97	BP-8	84.50	BU-156	84.30	PVC	192.2	1.50	27.44	7.288	0.61	1.187	15.3	27.44
Tub_PVC - 98	BE-150	85.63	BE-151	84.81	PVC	192.2	1.50	50.96	16.091	0.81	2.190	14.1	50.97
Tub_PVC - 99	BE-151	84.81	BE-152	83.91	PVC	192.2	1.50	66.95	13.443	0.76	1.905	14.4	66.96
Tub_PVC - 100	BR-147	78.51	BP-34	78.16	PVC	192.2	1.91	52.09	6.719	0.64	1.239	35.0	52.09
Tub_PVC - 101	BE-152	83.91	BE-153	83.07	PVC	192.2	1.50	59.97	14.008	0.78	1.967	14.3	59.97
Tub_PVC - 102	BP-34	78.16	BU-133	78.10	PVC	192.2	1.91	7.06	8.502	0.70	1.488	66.8	7.06
Tub_PVC - 103	BE-153	83.07	BE-164	82.07	PVC	192.2	1.50	61.24	16.330	0.82	2.215	14.1	61.25
Tub_PVC - 104	BU-56	88.64	BR-59	87.91	PVC	192.2	1.50	29.35	24.870	0.95	3.068	20.9	29.36
Tub_PVC - 105	BR-18	88.72	BP-35	88.22	PVC	192.2	1.50	51.87	9.639	0.68	1.471	14.9	51.87
Tub_PVC - 106	BR-128	82.61	BR-112	83.69	PVC	240.2	11.19	82.77	13.048	1.33	4.360	35.6	82.78
Tub_PVC - 107	BP-35	88.22	BR-20	88.12	PVC	192.2	1.50	10.59	9.440	0.68	1.447	14.9	10.59
Tub_PVC - 108	BR-112	83.69	BR-111	84.29	PVC	240.2	10.91	28.48	21.068	1.57	6.266	35.1	28.49
Tub_PVC - 109	BU-13	88.84	BP-35	88.22	PVC	192.2	1.50	41.29	15.016	0.79	2.076	14.2	41.29
Tub_PVC - 110	BR-114	83.28	BR-115	82.39	PVC	192.2	1.50	59.39	14.986	0.79	2.073	23.2	59.40
Tub_PVC - 111	BR-105	82.95	BR-115	82.39	PVC	192.2	3.70	62.81	8.916	0.87	2.069	28.1	62.81
Tub_PVC - 112	BU-BA3	87.08	BP-36	86.67	PVC	192.2	1.50	34.82	11.776	0.73	1.717	14.6	34.82
Tub_PVC - 113	BR-99	83.80	BR-105	82.95	PVC	192.2	1.67	53.53	15.878	0.84	2.271	22.2	53.54
Tub_PVC - 114	BP-36	86.67	BP-12	86.30	PVC	192.2	1.50	33.69	10.982	0.71	1.627	14.7	33.69
Tub_PVC - 115	BR-106	85.63	BR-107	85.14	PVC	192.2	8.99	37.90	12.930	1.27	4.072	35.6	37.90
Tub_PVC - 116	BE-151	85.30	BU-151A	85.44	PVC	192.2	1.50	13.30	10.527	0.70	1.574	14.7	13.31
Tub_PVC - 117	BU-151A	85.44	BU-151B	85.66	PVC	192.2	1.50	19.41	11.332	0.72	1.667	14.6	19.41
Tub_PVC - 118	BR-205	89.53	BR-204	89.84	PVC	192.2	1.50	26.06	11.779	0.73	1.717	17.8	26.06
Tub_PVC - 119	BR-82	88.37	BR-81	88.87	PVC	192.2	4.38	55.35	9.034	0.91	2.251	30.4	55.35
Tub_PVC - 120	BR-213	90.90	BR-77	90.31	PVC	192.2	1.50	68.01	8.676	0.66	1.356	22.9	68.01
Tub_PVC - 121	BR-214	91.56	BR-213	90.90	PVC	192.2	1.50	64.97	10.158	0.69	1.532	14.8	64.98
Tub_PVC - 122	BR-215	91.91	BR-214	91.56	PVC	192.2	1.50	33.05	10.591	0.70	1.582	14.7	33.05
Tub_PVC - 123	BR-217	90.86	BR-216	92.19	PVC	192.2	1.50	52.96	25.113	0.95	3.091	39.3	52.98
Tub_PVC - 124	BR-203	90.16	BR-202	90.52	PVC	192.2	1.50	34.95	10.300	0.70	1.548	14.8	34.95
Tub_PVC - 125	BR-89	87.24	BR-90	86.84	PVC	192.2	1.50	44.01	9.090	0.67	1.405	15.0	44.01

Bentley SewerCAD V8i (SELECTseries 5)
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FlexTable: Conduit Table

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (Unified) (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub_PVC - 126	BR-88	87.97	BR-89	87.24	PVC	192.2	1.50	24.58	29.702	1.01	3.519	13.3	24.59
Tub_PVC - 127	BR-203	90.16	BR-204	89.84	PVC	192.2	1.50	25.70	12.451	0.75	1.792	14.5	25.70
Tub_PVC - 128	BR-206	89.03	BR-82	88.37	PVC	192.2	1.50	47.07	14.021	0.78	1.968	24.3	47.08
Tub_PVC - 129	BR-209	90.28	BR-206	89.03	PVC	192.2	1.50	46.00	27.172	0.98	3.285	13.4	46.02
Tub_PVC - 130	BR-206	89.03	BR-205	89.53	PVC	192.2	1.86	48.47	10.377	0.74	1.720	16.4	48.48
Tub_PVC - 131	BR-96	85.68	BR-95	86.54	PVC	192.2	1.50	50.10	17.167	0.83	2.303	14.0	50.10
Tub_PVC - 132	BR-97	85.22	BR-96	85.68	PVC	192.2	1.50	37.47	12.278	0.74	1.773	14.5	37.47
Tub_PVC - 133	BR-98	84.56	BR-97	85.22	PVC	192.2	1.50	38.55	17.120	0.83	2.298	14.0	38.56
Tub_PVC - 134	BR-211	90.83	BR-210	91.22	PVC	192.2	1.50	24.01	16.243	0.82	2.206	14.1	24.01
Tub_PVC - 135	BR-212	90.13	BR-211	90.83	PVC	192.2	1.50	24.96	28.041	0.99	3.366	39.3	24.97
Tub_PVC - 136	BR-212	90.13	BR-217	90.86	PVC	192.2	18.74	52.76	13.837	1.60	5.821	52.1	52.76
Tub_PVC - 137	BR-218	88.99	BR-212	90.13	PVC	192.2	18.74	67.99	16.767	1.72	6.783	51.0	68.00
Tub_PVC - 138	BR-83	87.88	BR-218	88.99	PVC	192.2	18.74	66.85	16.605	1.72	6.730	65.3	66.86
Tub_PVC - 139	BR-83	87.88	BR-82	88.37	PVC	192.2	5.22	50.42	9.719	0.99	2.571	50.2	50.42
Tub_PVC - 140	BR-84	87.24	BR-83	87.88	PVC	192.2	23.01	54.34	11.778	1.59	5.535	59.3	54.34
Tub_PVC - 141	BR-78	90.12	BR-77	90.31	PVC	192.2	4.38	28.45	6.677	0.82	1.775	26.5	28.45
Tub_PVC - 142	BR-79	89.74	BR-78	90.12	PVC	192.2	4.38	27.88	13.629	1.06	3.103	24.5	27.88
Tub_PVC - 143	BR-80	89.34	BR-79	89.74	PVC	192.2	4.38	54.07	7.397	0.85	1.925	26.2	54.07
Tub_PVC - 144	BR-81	88.87	BR-80	89.34	PVC	192.2	4.38	54.09	8.689	0.90	2.184	25.7	54.09
Tub_PVC - 145	BR-207	90.78	BR-203	90.16	PVC	192.2	1.50	45.02	13.772	0.77	1.941	14.3	45.02
Tub_PVC - 146	BR-208	91.03	BR-207	90.78	PVC	192.2	1.50	25.96	9.632	0.68	1.470	14.9	25.96
Tub_PVC - 147	BR-98	84.56	BR-99	83.80	PVC	192.2	1.50	53.83	14.118	0.78	1.979	17.3	53.84
Tub_PVC - 148	BR-71	86.49	BR-70	86.86	PVC	192.2	1.50	42.48	8.710	0.66	1.360	15.0	42.48
Tub_PVC - 149	BR-70	86.86	BR-69	87.32	PVC	192.2	1.50	39.06	11.776	0.73	1.717	14.6	39.06
Tub_PVC - 150	BR-60	87.26	BR-59	87.91	PVC	192.2	3.27	57.49	11.307	0.91	2.359	25.5	57.49
Tub_PVC - 151	BR-61	87.02	BR-60	87.26	PVC	192.2	3.53	16.59	14.467	1.01	2.955	26.5	16.59
Tub_PVC - 152	BR-62	86.73	BR-61	87.02	PVC	192.2	3.81	23.53	12.326	0.98	2.703	27.2	23.53
Tub_PVC - 153	BR-63	86.54	BR-62	86.73	PVC	192.2	3.91	19.03	9.986	0.92	2.316	33.3	19.03
Tub_PVC - 154	BU-47	86.96	BR-63	86.54	PVC	192.2	3.92	44.65	9.407	0.90	2.213	33.3	44.65
Tub_PVC - 155	BR-43	87.17	BR-46	87.00	PVC	192.2	3.28	34.72	4.897	0.68	1.229	25.5	34.72
Tub_PVC - 156	BR-40	87.37	BR-43	87.17	PVC	192.2	2.37	26.73	7.483	0.71	1.482	23.1	26.73

Julio Pacheco Ramos
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Bentley SewerCAD V8i (SELECTseries 5)
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CONSORCIO PROYECTOS LIMA

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DIRECTOR DE PROYECTO

FlexTable: Conduit Table

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (Unified) (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub_PVC - 157	BR-68	87.43	BR-69	87.32	PVC	192.2	1.50	13.75	7.998	0.64	1.273	15.2	13.75
Tub_PVC - 158	BR-57	89.19	BR-64	88.38	PVC	192.2	1.50	51.73	15.657	0.81	2.144	14.2	51.74
Tub_PVC - 159	BR-53	89.98	BR-52	90.26	PVC	192.2	1.50	25.53	10.968	0.71	1.625	14.7	25.53
Tub_PVC - 160	BR-54	89.64	BR-53	89.98	PVC	192.2	1.50	23.62	14.395	0.78	2.009	14.3	23.62
Tub_PVC - 161	BR-55	89.05	BR-54	89.64	PVC	192.2	1.50	55.00	10.728	0.71	1.597	14.7	55.00
Tub_PVC - 162	BU-56	88.94	BR-55	89.05	PVC	192.2	1.50	8.20	13.413	0.76	1.902	14.4	8.21
Tub_PVC - 163	BR-48	89.40	BR-49	88.82	PVC	192.2	1.91	45.89	12.640	0.80	2.023	19.3	45.89
Tub_PVC - 164	BR-49	88.82	BR-50	88.45	PVC	192.2	2.06	45.86	8.068	0.70	1.477	20.6	45.86
Tub_PVC - 165	BR-50	88.45	BR-51	88.21	PVC	192.2	2.44	17.86	13.437	0.88	2.368	21.8	17.86
Tub_PVC - 166	BR-51	88.21	BR-59	87.91	PVC	192.2	2.56	28.51	10.521	0.82	2.000	23.5	28.52
Tub_PVC - 167	BP-26	88.12	BR-68	87.43	PVC	192.2	1.50	26.40	26.132	0.96	3.187	13.5	26.41
Tub_PVC - 168	BR-24	92.54	BR-23	92.73	PVC	192.2	1.50	15.55	12.222	0.74	1.767	14.5	15.55
Tub_PVC - 169	BR-76	90.61	BR-75	90.80	PVC	192.2	1.50	27.11	7.008	0.61	1.148	15.4	27.11
Tub_PVC - 170	BR-35	87.75	BR-40	87.37	PVC	192.2	1.62	36.19	10.501	0.72	1.627	19.3	36.19
Tub_PVC - 171	BR-20	88.12	BR-35	87.75	PVC	192.2	1.50	61.34	6.032	0.58	1.024	17.1	61.34
Tub_PVC - 172	BE-4	88.85	BE-5	88.45	PVC	192.2	1.50	25.98	15.399	0.80	2.117	14.2	25.98
Tub_PVC - 173	BE-5	88.45	BE-6	88.16	PVC	192.2	1.50	19.23	15.084	0.80	2.083	14.2	19.23
Tub_PVC - 174	BR-33	90.74	BR-34	90.58	PVC	192.2	1.50	18.11	8.835	0.66	1.375	15.0	18.11
Tub_PVC - 175	BR-27	92.22	BU-28	91.93	PVC	192.2	1.50	19.93	14.552	0.79	2.026	14.3	19.93
Tub_PVC - 176	BR-26	92.53	BR-27	92.22	PVC	192.2	1.50	16.04	19.332	0.87	2.525	13.9	16.04
Tub_PVC - 177	BU-7	91.47	BR-8	90.90	PVC	192.2	1.50	34.68	16.434	0.82	2.226	14.1	34.69
Tub_PVC - 178	BR-10	89.90	BR-9	90.49	PVC	192.2	1.50	38.00	15.527	0.80	2.130	14.2	38.00
Tub_PVC - 179	BR-11	89.41	BR-10	89.90	PVC	192.2	1.50	33.80	14.498	0.78	2.020	14.3	33.80
Tub_PVC - 180	BR-12	89.14	BR-11	89.41	PVC	192.2	1.50	29.04	9.296	0.67	1.430	14.9	29.05
Tub_PVC - 181	BE-4	88.85	BE-3	90.48	PVC	192.2	1.50	86.55	18.834	0.86	2.474	13.9	86.56
Tub_PVC - 182	BU-13	88.84	BR-12	89.14	PVC	192.2	1.50	18.39	16.310	0.82	2.213	14.1	18.40
Tub_PVC - 183	BE-148	86.93	BE-149	86.24	PVC	192.2	1.50	23.51	29.345	1.00	3.486	13.4	23.52
Tub_PVC - 184	BR-8	90.90	BR-14	90.58	PVC	192.2	1.50	31.03	10.311	0.70	1.549	14.8	31.04
Tub_PVC - 185	BR-31	90.76	BR-30	90.87	PVC	192.2	1.50	10.11	10.876	0.71	1.614	14.7	10.11
Tub_PVC - 186	BR-18	88.72	BR-17	88.80	PVC	192.2	1.50	6.08	13.166	0.76	1.871	14.4	6.08
Tub_PVC - 187	BR-17	88.80	BR-19	88.91	PVC	192.2	1.50	14.95	7.359	0.62	1.196	15.3	14.95

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CONSORCIO PROYECTOS LIMA

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FlexTable: Conduit Table

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (Unified) (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub_PVC - 188	BR-15	90.27	BR-21	89.83	PVC	192.2	1.50	59.73	7.367	0.62	1.197	15.3	59.73
Tub_PVC - 189	BR-14	90.58	BR-15	90.27	PVC	192.2	1.50	32.21	9.624	0.68	1.469	14.9	32.21
Tub_PVC - 190	BU-32	90.36	BR-31	90.76	PVC	192.2	1.50	41.78	9.574	0.68	1.463	14.9	41.78
Tub_PVC - 191	BU-22	89.67	BR-48	89.40	PVC	192.2	1.76	40.56	6.657	0.63	1.186	18.6	40.56
Tub_PVC - 192	BR-21	89.83	BU-22	89.67	PVC	192.2	1.50	19.63	8.149	0.64	1.292	17.5	19.63
Tub_PVC - 193	BU-32	90.36	BR-34	90.58	PVC	192.2	1.50	29.23	7.527	0.62	1.216	15.3	29.23
Tub_PVC - 194	BR-75	90.80	BR-74	91.07	PVC	192.2	1.50	34.04	7.931	0.64	1.265	15.2	34.04
Tub_PVC - 195	BR-77	90.31	BR-76	90.61	PVC	192.2	1.50	24.90	12.050	0.74	1.747	22.9	24.90
Tub_PVC - 196	BE-148	86.93	BE-6	88.16	PVC	192.2	1.50	65.23	18.857	0.86	2.476	13.9	65.24
Tub_PVC - 197	BR-24	92.54	BR-25	92.19	PVC	192.2	1.50	22.25	15.729	0.81	2.152	14.2	22.25
Tub_PVC - 198	BE-2	91.38	BE-3	90.48	PVC	192.2	1.50	89.97	10.004	0.69	1.514	14.8	89.97
Tub_PVC - 199	BE-149	86.24	BE-150	85.63	PVC	192.2	1.50	62.27	9.795	0.68	1.489	14.8	62.28
Tub_PVC - 200	BR-169A	78.76	BR-146	79.07	PVC	192.2	1.50	35.87	8.643	0.66	1.352	15.0	35.87
Tub_PVC - 201	BR-129	81.46	BR-127	81.61	PVC	192.2	1.50	24.33	6.165	0.58	1.042	33.0	24.33
Tub_PVC - 202	BR-127	81.61	BR-126	81.88	PVC	192.2	1.50	45.70	5.909	0.57	1.007	15.7	45.70
Tub_PVC - 203	BE-16	89.73	BR-18	88.72	PVC	192.2	1.50	62.13	16.257	0.76	2.310	14.4	62.13
Tub_PVC - 204	BE-93	85.07	BE-92	86.12	PVC	192.2	1.50	54.12	19.403	0.87	2.532	13.9	54.13
Tub_PVC - 205	BE-93	85.07	BE-94	84.16	PVC	192.2	1.50	54.17	16.799	0.83	2.264	14.1	54.18
Tub_PVC - 206	BR-169A	78.76	BR-169	78.54	PVC	192.2	1.50	30.67	7.174	0.62	1.168	15.3	30.67
Tub_PVC - 207	BR-169	78.54	BE-170	78.45	PVC	192.2	1.50	12.65	7.112	0.61	1.160	18.1	12.65
Tub_PVC - 208	BR-30	90.87	BU-73	91.06	PVC	192.2	1.50	17.66	10.758	0.71	1.601	14.7	17.66
Tub_PVC - 209	BR-46	87.00	BU-47	86.96	PVC	192.2	3.51	9.63	4.155	0.65	1.115	26.6	9.63
Tub_PVC - 210	BU-45	88.30	BU-47	88.05	PVC	192.2	1.50	36.37	6.875	0.60	1.134	15.4	36.39
Tub_PVC - 211	BP-23	88.32	BU-45	88.30	PVC	192.2	1.50	2.81	7.107	0.61	1.160	15.3	2.81
Tub_PVC - 212	BP-24	88.41	BP-23	88.32	PVC	192.2	1.50	12.87	6.995	0.61	1.146	15.4	12.87
Tub_PVC - 213	BP-25	88.56	BP-24	88.41	PVC	192.2	1.50	21.92	6.842	0.60	1.128	15.4	21.93
Tub_PVC - 214	BR-44	89.06	BP-25	88.56	PVC	192.2	1.50	31.42	15.911	0.81	2.171	14.1	31.43
Tub_PVC - 215	BR-64	88.38	BP-26	88.33	PVC	192.2	1.50	3.61	13.841	0.77	1.949	14.3	3.62
Tub_PVC - 216	BP-11	86.00	BU-151B	85.66	PVC	192.2	1.50	30.74	11.062	0.72	1.636	14.7	30.74
Tub_PVC - 217	BU-37	89.06	BU-38	88.83	PVC	192.2	1.50	34.58	6.651	0.60	1.103	15.5	34.58
Tub_PVC - 218	BP-21	89.28	BU-37	89.06	PVC	192.2	1.50	34.61	6.356	0.59	1.063	15.5	34.61

Bentley SewerCAD V8i (SELECTseries 5)
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CONSORCIO PROYECTOS LIMA

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JAVIER PAJARES RIVERA
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FlexTable: Conduit Table

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (Unified) (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub_PVC - 219	BR-36	89.42	BP-21	89.28	PVC	192.2	1.50	20.52	6.823	0.60	1.125	15.4	20.52
Tub_PVC - 220	BU-38	88.83	BR-39	87.93	PVC	192.2	1.50	51.86	17.354	0.84	2.322	14.0	51.87
Tub_PVC - 221	BR-40	87.37	BR-39	87.93	PVC	192.2	1.50	39.76	14.084	0.78	1.975	19.0	39.77
Tub_PVC - 222	BP-22	88.02	BR-42	87.87	PVC	192.2	1.50	21.52	6.969	0.61	1.143	15.4	21.52
Tub_PVC - 223	BR-41	88.27	BP-22	88.02	PVC	192.2	1.50	31.62	7.907	0.63	1.262	15.2	31.62
Tub_PVC - 224	BP-9	84.69	BP-8	84.50	PVC	192.2	1.50	25.44	7.468	0.62	1.209	15.3	25.44
Tub_PVC - 225	BP-10	84.92	BP-9	84.69	PVC	192.2	1.50	29.35	7.837	0.63	1.253	15.2	29.35
Tub_PVC - 226	BU-154	85.15	BP-10	84.92	PVC	192.2	1.50	24.30	9.467	0.68	1.450	14.9	24.30
Tub_PVC - 227	BP-7	84.13	BP-6	83.88	PVC	192.2	1.50	29.12	8.584	0.65	1.345	15.0	29.13
Tub_PVC - 228	BU-156	84.30	BP-7	84.13	PVC	192.2	1.50	22.71	7.485	0.62	1.211	15.3	22.71
Tub_PVC - 229	BP-5	83.21	BP-4	82.74	PVC	192.2	1.50	55.08	8.533	0.65	1.338	15.1	55.08
Tub_PVC - 230	BP-6	83.44	BP-5	83.21	PVC	192.2	1.50	25.54	9.005	0.66	1.395	15.0	25.54
Tub_PVC - 231	BU-160	82.14	BU-161	82.24	PVC	192.2	1.66	10.46	9.560	0.70	1.530	18.2	10.46
Tub_PVC - 232	BP-31	81.25	BP-32	81.20	PVC	192.2	1.50	6.86	7.292	0.61	1.188	15.3	6.86
Tub_PVC - 233	BP-30	81.32	BP-31	81.25	PVC	192.2	1.50	10.31	6.793	0.60	1.120	15.4	10.31
Tub_PVC - 234	BR-117B	81.41	BP-30	81.32	PVC	192.2	1.50	12.77	7.049	0.61	1.153	15.4	12.77
Tub_PVC - 235	BP-29	81.50	BR-117B	81.41	PVC	192.2	1.50	14.12	6.373	0.59	1.065	15.5	14.12
Tub_PVC - 236	BP-28	81.70	BP-29	81.50	PVC	192.2	1.50	29.39	6.806	0.60	1.122	15.4	29.39
Tub_PVC - 237	BR-117A	81.84	BP-28	81.70	PVC	192.2	1.50	19.39	7.219	0.62	1.173	15.3	19.39
Tub_PVC - 238	BP-32	81.20	BU-130	80.94	PVC	192.2	1.50	38.15	6.816	0.60	1.124	33.3	38.15
Tub_PVC - 239	BU-102	84.83	BR-104	83.50	PVC	192.2	1.50	32.17	41.343	1.13	4.544	17.8	32.20
Tub_PVC - 240	BU-101	85.47	BU-102	84.83	PVC	192.2	1.50	49.57	12.910	0.76	1.843	14.4	49.58
Tub_PVC - 241	BP-27	85.71	BU-101	85.47	PVC	192.2	1.50	30.38	7.899	0.63	1.261	15.2	30.39
Tub_PVC - 242	BU-100	85.86	BP-27	85.71	PVC	192.2	1.50	20.52	7.311	0.62	1.190	15.3	20.52
Tub_PVC - 243	BU-139	79.58	BU-138	80.12	PVC	192.2	1.50	17.79	30.352	1.02	3.579	13.3	17.80
Tub_PVC - 244	BU-143	79.09	BU-139	79.58	PVC	192.2	1.50	15.94	30.748	1.02	3.615	13.3	15.94
Tub_PVC - 245	BU-86	87.33	BU-87	86.64	PVC	192.2	1.50	34.18	20.186	0.88	2.610	13.8	34.19
Tub_PVC - 246	BU-85	87.82	BU-86	87.33	PVC	192.2	1.50	29.74	16.475	0.82	2.231	14.1	29.75
Tub_PVC - 247	BU-87	86.64	BE-92	86.12	PVC	192.2	1.50	29.85	17.418	0.84	2.329	14.0	29.86
Tub_PVC - 248	BU-117	81.51	BR-118	81.28	PVC	192.2	4.86	39.33	5.847	0.81	1.675	28.4	39.35
Tub_PVC - 249	BR-118	80.28	BR-122	79.69	PVC	192.2	5.15	47.05	12.540	1.08	3.122	32.0	47.05

Bentley SewerCAD V8i (SELECTseries 5)
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CONSORCIO PROYECTOS LIMA

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Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (Unified) (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub_PVC - 250	BR-115	82.39	BR-116	82.00	PVC	192.2	4.57	53.64	7.271	0.86	1.933	26.8	53.64
Tub_PVC - 251	BR-120	81.55	BR-119	82.08	PVC	192.2	1.50	44.90	11.805	0.73	1.720	14.6	44.90
Tub_PVC - 252	BR-121	81.03	BR-120	81.55	PVC	192.2	1.50	45.05	11.543	0.73	1.690	14.6	45.05
Tub_PVC - 253	BR-122	80.67	BR-121	81.03	PVC	192.2	1.50	25.65	14.037	0.78	1.970	14.3	25.68
Tub_PVC - 254	BU-28	91.93	BR-25	92.19	PVC	192.2	1.50	36.17	7.188	0.62	1.169	15.3	36.17
Tub_PVC - 255	BU-28	91.93	BR-29	91.54	PVC	192.2	1.50	50.32	7.750	0.63	1.242	15.2	50.33
Tub_PVC - 256	BR-BA4	87.21	BU-BA3	87.08	PVC	192.2	1.50	13.71	9.483	0.68	1.452	14.9	13.71
Tub_PVC - 257	BU-BA5	87.49	BP-20	87.30	PVC	192.2	1.50	27.85	6.822	0.60	1.125	15.4	27.85
Tub_PVC - 258	BP-20	87.30	BR-43	87.17	PVC	192.2	1.50	15.61	8.329	0.65	1.314	20.9	15.61
Tub_PVC - 259	BP-16	85.93	BP-17	85.74	PVC	192.2	1.50	21.98	8.646	0.66	1.352	15.0	21.98
Tub_PVC - 260	BP-15	86.07	BP-16	85.93	PVC	192.2	1.50	15.85	8.834	0.66	1.375	15.0	15.85
Tub_PVC - 261	BP-14	86.72	BU-BA2	86.44	PVC	192.2	1.50	24.42	11.464	0.72	1.681	14.6	24.43
Tub_PVC - 262	BP-13	86.98	BP-14	86.72	PVC	192.2	1.50	21.82	11.914	0.73	1.732	14.5	21.82
Tub_PVC - 263	BU-BA12	87.18	BP-13	86.98	PVC	192.2	1.50	17.25	11.596	0.73	1.696	14.6	17.25
Tub_PVC - 264	BU-BA7	85.30	BR-BA6	85.89	PVC	192.2	1.50	26.38	22.364	0.91	2.826	13.7	26.39
Tub_PVC - 265	BP-18	85.45	BU-BA7	85.30	PVC	192.2	1.50	16.88	8.887	0.66	1.381	15.0	16.88
Tub_PVC - 266	BP-17	85.74	BP-18	85.45	PVC	192.2	1.50	33.92	8.548	0.65	1.340	15.1	33.93
Tub_PVC - 267	BU-BA7	85.30	BU-BA13	85.13	PVC	192.2	1.50	7.32	23.226	0.93	2.910	13.6	7.32
Tub_PVC - 268	BU-BA13	85.13	BP-19	84.67	PVC	192.2	1.50	20.74	22.175	0.91	2.807	30.2	20.75
Tub_PVC - 269	BR-157	83.78	BP-6	83.44	PVC	192.2	1.50	37.07	9.171	0.67	1.415	14.9	37.08
Tub_PVC - 270	BP-4	82.74	BU-161	82.24	PVC	192.2	1.50	56.92	8.785	0.66	1.369	17.2	56.92
Tub_PVC - 271	BU-141	81.20	BU-140	81.50	PVC	192.2	1.50	48.84	6.143	0.58	1.039	15.6	48.84
Tub_PVC - 272	BP-1	80.84	BU-141	81.20	PVC	192.2	1.50	34.05	10.571	0.70	1.579	14.7	34.06
Tub_PVC - 273	BU-142	80.73	BP-1	80.84	PVC	192.2	1.50	11.50	9.569	0.68	1.462	14.9	11.50
Tub_PVC - 274	BP-19	84.67	BR-108	84.71	PVC	240.2	9.47	4.94	8.100	1.07	2.790	33.6	4.94
Tub_PVC - 275	BP-33	80.20	BR-131	80.30	PVC	308.7	14.73	45.74	2.186	0.74	1.162	30.2	45.74
Tub_PVC - 276	BR-132	80.05	BP-33	80.20	PVC	308.7	14.73	45.74	3.280	0.86	1.599	28.7	45.75
Tub_PVC - 277	BU-22	89.67	BU-32	90.36	PVC	192.2	1.50	21.81	31.637	1.03	3.698	17.5	21.82
Tub_PVC - 278	BP-41	81.86	BU-117	81.51	PVC	192.2	4.57	39.97	8.756	0.91	2.240	30.1	39.98
Tub_PVC - 279	BR-116	82.00	BP-41	81.86	PVC	192.2	4.57	20.23	6.921	0.84	1.864	27.0	20.23
Tub_PVC - 280	BR-162	82.86	BZ-3	83.58	PVC	192.2	1.50	13.60	52.935	1.24	5.496	12.7	13.62

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CONSORCIO PROYECTOS LIMA

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21/12/2016PEDRO ANGEL
VEGA PRINCIPE
INGENIERO SANITARIO
Reg. CIP N° 224319Julio Pacheco Ramos
F-12549

FlexTable: Conduit Table

Label	Start Node	Invert (Start) (m)	Stop Node	Invert (Stop) (m)	Material	Diameter (mm)	Flow (L/s)	Length (Unified) (m)	Slope (m/km)	Velocity (m/s)	Tractive Stress (Calculated) (Pascals)	Depth (Average End) / Rise (%)	Length (3D) (m)
Tub_PVC - 281	BU-BA5	87.49	BZ-2	88.20	PVC	192.2	1.50	13.07	54.327	1.25	5,606	12.7	13.09
Tub_PVC - 282	BZ-2	88.20	BZ-1	88.28	PVC	192.2	1.50	10.70	7.478	0.62	1,210	15.3	10.70
Tub_PVC - 283	BU-154	85.15	BP-45	85.32	PVC	192.2	1.50	21.91	7.760	0.63	1,244	15.2	21.91
Tub_PVC - 284	BR-157	83.78	BZ-4	84.40	PVC	192.2	1.50	12.76	48.607	1.20	5,147	12.8	12.77
Tub_PVC - 285	BU-163	82.81	BP-46	82.55	PVC	192.2	1.50	29.17	8.913	0.66	1,384	15.0	29.17
Tub_PVC - 286	BP-46	82.55	BU-161	82.24	PVC	192.2	1.50	29.17	10.627	0.71	1,586	17.2	29.17
Tub_PVC - 287	BZ-6	83.07	BP-46	82.55	PVC	192.2	1.50	13.62	38.186	1.11	4,264	13.0	13.63
Tub_PVC - 288	BZ-5	83.63	BR-162	83.59	PVC	192.2	1.50	3.54	11.288	0.72	1,661	14.6	3.63

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FlexTable: Manhole Table

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	Diameter (m)	X (m)	Y (m)
BE-2	93.38	93.38	91.38	2.00	1.2	274,908.916	8,666,209.882
BE-3	91.95	91.95	90.48	1.47	1.2	274,820.370	8,666,193.967
BE-4	90.52	90.52	88.85	1.67	1.2	274,736.759	8,666,171.614
BE-5	90.12	90.12	88.45	1.67	1.2	274,711.501	8,666,165.551
BE-6	89.80	89.80	88.16	1.64	1.2	274,692.819	8,666,161.015
BE-16	91.73	91.73	89.73	2.00	1.2	274,859.772	8,666,105.619
BE-92	87.57	87.57	86.12	1.45	1.2	274,674.633	8,665,659.724
BE-93	86.76	86.76	85.07	1.69	1.2	274,634.719	8,665,623.182
BE-94	85.94	85.94	84.16	1.78	1.2	274,599.887	8,665,581.694
BE-148	88.79	88.79	86.93	1.86	1.2	274,629.441	8,666,145.592
BE-149	88.45	88.45	86.24	2.21	1.2	274,608.716	8,666,134.487
BE-150	87.56	87.56	85.63	1.93	1.2	274,547.681	8,666,122.122
BE-151	86.80	86.80	84.81	1.99	1.2	274,497.648	8,666,112.447
BE-152	85.94	85.94	83.91	2.03	1.2	274,432.376	8,666,097.552
BE-153	85.08	85.08	83.07	2.01	1.2	274,373.980	8,666,083.918
BE-164	84.15	84.15	82.07	2.08	1.2	274,314.335	8,666,070.038
BE-165A	83.42	83.42	81.32	2.10	1.2	274,265.751	8,666,058.207
BE-167	82.58	82.58	80.31	2.27	1.2	274,212.606	8,666,044.663
BE-168	81.95	81.95	79.57	2.38	1.2	274,168.318	8,666,035.381
BE-170	81.12	81.12	78.45	2.67	1.2	274,118.696	8,666,023.791
BE-171A	80.24	80.24	77.69	2.55	1.2	274,058.791	8,666,009.715
BP-1	82.04	82.04	80.84	1.20	1.2	274,182.527	8,665,953.400
BP-2	81.92	81.92	80.64	1.28	1.2	274,183.963	8,665,929.401
BP-3	83.95	83.95	81.54	2.41	0.9	274,354.779	8,665,917.936
BP-4	84.61	84.61	82.74	1.87	1.2	274,395.232	8,666,001.993
BP-5	84.85	84.85	83.21	1.64	1.2	274,409.114	8,665,948.694
BP-6	85.14	85.14	83.44	1.70	1.2	274,433.938	8,665,954.707
BP-7	85.63	85.63	84.13	1.50	1.2	274,462.242	8,665,961.564
BP-8	86.56	86.56	84.50	2.06	1.2	274,478.110	8,666,004.008
BP-9	86.57	86.57	84.69	1.88	1.2	274,502.912	8,666,009.680
BP-10	86.72	86.72	84.92	1.80	1.2	274,504.068	8,666,039.004
BP-11	87.37	87.37	86.00	1.37	1.2	274,529.686	8,666,074.851
BP-12	87.88	87.88	86.30	1.58	1.2	274,554.683	8,666,084.786
BP-13	88.38	88.38	86.98	1.40	1.2	274,631.883	8,666,015.192
BP-14	88.20	88.20	86.72	1.48	1.2	274,611.568	8,666,023.164
BP-15	87.27	87.27	86.07	1.20	1.2	274,577.339	8,665,978.982
BP-16	87.28	87.28	85.93	1.35	1.2	274,562.268	8,665,974.079
BP-17	87.23	87.23	85.74	1.49	1.2	274,540.333	8,665,972.745
BP-18	86.75	86.75	85.45	1.30	1.2	274,541.926	8,665,938.858
BP-19	86.57	86.57	84.67	1.90	1.2	274,548.944	8,665,903.803
BP-20	89.40	89.40	87.30	2.10	1.2	274,713.540	8,666,011.123
BP-21	91.73	91.73	89.28	2.45	1.2	274,849.401	8,666,042.501
BP-22	90.52	90.52	88.02	2.50	1.2	274,778.156	8,666,001.554
BP-23	89.57	89.57	88.32	1.25	1.2	274,746.630	8,665,936.314
BP-24	89.78	89.78	88.41	1.37	1.2	274,750.576	8,665,948.561
BP-25	89.76	89.76	88.56	1.20	1.2	274,769.405	8,665,937.329
BP-26	89.57	89.57	88.12	1.45	1.2	274,779.940	8,665,756.162
BP-27	87.06	87.06	85.71	1.35	1.2	274,623.640	8,665,772.049
BP-28	83.15	83.15	81.70	1.45	1.2	274,355.882	8,665,806.799
BP-29	82.90	82.90	81.50	1.40	1.2	274,329.829	8,665,820.396
BP-30	82.89	82.89	81.32	1.57	1.2	274,331.075	8,665,846.962
BP-31	82.90	82.90	81.25	1.65	1.2	274,340.480	8,665,851.175
BP-32	83.02	83.02	81.20	1.82	1.2	274,340.032	8,665,858.018

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Bentley SewerCAD V8i (SELECTseries 5)
[08.11.05.58]
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PEDRO ANGEL
VEGA PRINCIPE
INGENIERO SANITARIO
Reg. CIP N° 224319

CONSORCIO PROYECTOS LIMA

ING. ELIAS MOGOLLON ESCOBAR
DIRECTOR DE PROYECTO

FlexTable: Manhole Table

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	Diameter (m)	X (m)	Y (m)
BP-33	82.10	82.10	80.20	1.90	1.2	274,267.590	8,665,843.833
BP-34	80.74	80.74	78.16	2.58	0.9	274,166.912	8,665,842.373
BP-35	90.25	90.25	88.22	2.03	0.9	274,747.498	8,666,125.341
BP-36	87.88	87.88	86.67	1.21	0.9	274,569.148	8,666,054.358
BP-37	83.44	83.44	81.08	2.36	0.9	274,292.690	8,665,954.018
BP-38	83.25	83.25	80.90	2.35	0.9	274,286.170	8,665,944.404
BP-39	82.48	82.48	80.73	1.75	0.9	274,227.054	8,666,005.620
BP-40	91.59	91.59	89.56	2.03	0.9	274,860.647	8,666,018.201
BP-41	83.86	83.86	81.86	2.00	1.2	274,398.036	8,665,765.617
BP-42	82.42	82.42	80.40	2.02	0.9	274,252.280	8,665,927.708
BP-43	81.30	81.30	79.21	2.09	0.9	274,197.304	8,665,874.032
BP-44	81.17	81.17	79.12	2.05	0.9	274,184.612	8,665,870.468
BP-45	87.12	87.12	85.32	1.80	0.9	274,538.690	8,666,019.715
BP-46	84.10	84.10	82.55	1.55	0.9	274,333.166	8,666,015.971
BR-8	92.45	92.45	90.90	1.55	1.2	274,910.229	8,666,160.338
BR-8*	92.45	92.45	91.25	1.20	1.2	274,908.789	8,666,160.584
BR-9	91.85	91.85	90.49	1.36	1.2	274,873.737	8,666,164.354
BR-10	91.32	91.32	89.90	1.42	1.2	274,835.962	8,666,168.470
BR-11	90.91	90.91	89.41	1.50	1.2	274,802.196	8,666,166.994
BR-12	90.79	90.79	89.14	1.65	1.2	274,773.317	8,666,163.899
BR-14	92.30	92.30	90.58	1.72	1.2	274,907.822	8,666,129.398
BR-15	92.27	92.27	90.27	2.00	1.2	274,899.446	8,666,098.296
BR-15*	92.27	92.27	91.07	1.20	1.2	274,897.890	8,666,098.378
BR-17	91.10	91.10	88.80	2.30	1.2	274,799.512	8,666,109.876
BR-18	90.90	90.90	88.72	2.18	1.2	274,798.497	8,666,115.867
BR-19	91.26	91.26	88.91	2.35	1.2	274,814.392	8,666,108.449
BR-20	90.12	90.12	88.12	2.00	1.2	274,737.083	8,666,127.276
BR-21	91.78	91.78	89.83	1.95	1.2	274,878.297	8,666,042.439
BR-23	93.93	93.93	92.73	1.20	1.2	274,941.377	8,666,209.199
BR-24	94.34	94.34	92.54	1.80	1.2	274,956.822	8,666,207.429
BR-25	93.94	93.94	92.19	1.75	1.2	274,971.297	8,666,190.529
BR-26	93.73	93.73	92.53	1.20	1.2	274,947.973	8,666,177.174
BR-27	93.42	93.42	92.22	1.20	1.2	274,941.627	8,666,162.448
BR-29	93.22	93.22	91.54	1.68	1.2	274,941.932	8,666,109.234
BR-30	92.85	92.85	90.87	1.98	1.2	274,918.347	8,666,051.535
BR-31	92.76	92.76	90.76	2.00	1.2	274,908.817	8,666,054.920
BR-33	92.14	92.14	90.74	1.40	1.2	274,876.287	8,665,972.128
BR-34	92.05	92.05	90.58	1.47	1.2	274,880.859	8,665,989.650
BR-35	89.85	89.85	87.75	2.10	1.2	274,732.395	8,666,066.113
BR-36	91.67	91.67	89.42	2.25	1.2	274,850.927	8,666,022.038
BR-39	90.53	90.53	87.93	2.60	1.2	274,768.553	8,666,037.017
BR-40	89.67	89.67	87.37	2.30	1.2	274,729.407	8,666,030.051
BR-41	91.09	91.09	88.27	2.82	1.2	274,805.819	8,666,016.862
BR-42	90.17	90.17	87.87	2.30	1.2	274,756.692	8,665,999.945
BR-43	89.57	89.57	87.17	2.40	1.2	274,727.118	8,666,003.423
BR-44	90.26	90.26	89.06	1.20	1.2	274,799.871	8,665,929.629
BR-46	89.40	89.40	87.00	2.40	1.2	274,719.218	8,665,969.618
BR-48	91.30	91.30	89.40	1.90	1.2	274,858.102	8,665,985.734
BR-49	90.82	90.82	88.82	2.00	1.2	274,840.654	8,665,943.294
BR-50	90.36	90.36	88.45	1.91	1.2	274,821.622	8,665,901.567
BR-51	90.16	90.16	88.21	1.95	1.2	274,813.106	8,665,885.867
BR-52	91.46	91.46	90.26	1.20	1.2	274,865.476	8,665,946.861
BR-53	91.18	91.18	89.98	1.20	1.2	274,865.361	8,665,921.332

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FlexTable: Manhole Table

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	Diameter (m)	X (m)	Y (m)
BR-54	90.84	90.84	89.64	1.20	1.2	274,854.874	8,665,900.169
BR-55	90.52	90.52	89.05	1.47	1.2	274,829.382	8,665,851.437
BR-57	90.44	90.44	89.19	1.25	1.2	274,798.632	8,665,806.743
BR-57*	90.44	90.44	89.19	1.25	1.2	274,799.419	8,665,808.364
BR-59	89.91	89.91	87.91	2.00	1.2	274,799.566	8,665,860.773
BR-60	89.36	89.36	87.26	2.10	1.2	274,749.746	8,665,889.456
BR-61	89.22	89.22	87.02	2.20	1.2	274,735.436	8,665,897.850
BR-62	89.01	89.01	86.73	2.28	1.2	274,715.128	8,665,909.730
BR-63	88.94	88.94	86.54	2.40	1.2	274,698.769	8,665,919.446
BR-64	89.78	89.78	88.38	1.40	1.2	274,783.363	8,665,757.315
BR-68	89.31	89.31	87.43	1.88	1.2	274,770.390	8,665,780.779
BR-69	89.22	89.22	87.32	1.90	1.2	274,765.325	8,665,793.566
BR-70	88.86	88.86	86.86	2.00	1.2	274,739.399	8,665,822.782
BR-71	88.41	88.41	86.49	1.92	1.2	274,702.805	8,665,844.353
BR-72	88.09	88.09	86.07	2.02	1.2	274,667.536	8,665,865.248
BR-74	92.27	92.27	91.07	1.20	1.2	274,903.927	8,666,012.326
BR-75	92.75	92.75	90.80	1.95	1.2	274,937.768	8,666,016.022
BR-76	92.66	92.66	90.61	2.05	1.2	274,944.360	8,665,989.725
BR-77	92.63	92.63	90.31	2.32	1.2	274,955.619	8,665,967.521
BR-78	92.34	92.34	90.12	2.22	1.2	274,929.549	8,665,956.120
BR-79	92.09	92.09	89.74	2.35	1.2	274,907.803	8,665,938.670
BR-79*	92.09	92.09	90.89	1.20	1.2	274,909.162	8,665,937.467
BR-80	91.59	91.59	89.34	2.25	1.2	274,884.195	8,665,890.023
BR-81	91.12	91.12	88.87	2.25	1.2	274,862.702	8,665,840.387
BR-82	90.22	90.22	88.37	1.85	1.2	274,841.901	8,665,789.096
BR-83	89.88	89.88	87.88	2.00	1.2	274,845.066	8,665,738.780
BR-84	89.56	89.56	87.24	2.32	1.2	274,792.633	8,665,724.508
BR-84*	89.56	89.56	88.36	1.20	1.2	274,792.337	8,665,725.712
BR-88	89.19	89.19	87.97	1.22	1.2	274,745.006	8,665,724.052
BR-89	88.84	88.84	87.24	1.60	1.2	274,720.446	8,665,724.966
BR-90	88.04	88.04	86.84	1.20	1.2	274,684.135	8,665,700.105
BR-95	88.47	88.47	86.54	1.93	1.2	274,720.930	8,665,790.685
BR-96	87.94	87.94	85.68	2.26	1.2	274,696.750	8,665,746.810
BR-97	87.32	87.32	85.22	2.10	1.2	274,671.748	8,665,718.907
BR-98	86.86	86.86	84.56	2.30	1.2	274,633.987	8,665,711.143
BR-99	86.18	86.18	83.80	2.38	1.2	274,581.377	8,665,722.546
BR-103	86.11	86.11	84.09	2.02	1.2	274,545.128	8,665,842.414
BR-104	85.68	85.68	83.50	2.18	1.2	274,535.714	8,665,780.975
BR-105	85.49	85.49	82.95	2.54	1.2	274,528.886	8,665,733.056
BR-106	87.53	87.53	85.63	1.90	1.2	274,630.389	8,665,880.987
BR-107	87.03	87.03	85.14	1.89	1.2	274,594.670	8,665,893.648
BR-108	86.56	86.56	84.71	1.85	1.2	274,553.844	8,665,903.193
BR-108*	86.56	86.56	85.36	1.20	1.2	274,553.597	8,665,901.552
BR-111	86.24	86.24	84.29	1.95	1.2	274,520.813	8,665,907.306
BR-112	85.91	85.91	83.69	2.22	1.2	274,492.373	8,665,908.791
BR-112*	85.91	85.91	84.31	1.60	1.2	274,491.948	8,665,907.544
BR-113	85.43	85.43	83.69	1.74	1.2	274,485.534	8,665,859.764
BR-114	85.02	85.02	83.28	1.74	1.2	274,478.756	8,665,810.319
BR-115	84.82	84.82	82.39	2.43	1.2	274,468.926	8,665,751.749
BR-116	84.00	84.00	82.00	2.00	1.2	274,418.031	8,665,768.681
BR-117A	83.24	83.24	81.84	1.40	1.2	274,375.245	8,665,805.703
BR-117B	82.86	82.86	81.41	1.45	1.2	274,328.501	8,665,834.456
BR-118	82.78	82.78	80.28	2.50	1.2	274,320.748	8,665,782.780

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DIRECTOR DE PROYECTO

FlexTable: Manhole Table

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	Diameter (m)	X (m)	Y (m)
BR-119	83.66	83.66	82.08	1.58	1.2	274,386.291	8,665,762.012
BR-120	82.98	82.98	81.55	1.43	1.2	274,342.092	8,665,769.893
BR-121	82.29	82.29	81.03	1.26	1.2	274,298.005	8,665,779.155
BR-122	81.87	81.87	79.69	2.18	1.2	274,274.012	8,665,788.215
BR-123	85.06	85.06	83.86	1.20	1.2	274,468.234	8,665,812.640
BR-124	85.16	85.16	82.46	2.70	1.2	274,474.299	8,665,854.885
BR-125	83.97	83.97	82.14	1.83	1.2	274,424.377	8,665,857.691
BR-126	83.71	83.71	81.88	1.83	1.2	274,380.666	8,665,861.008
BR-127	84.18	84.18	81.61	2.57	1.2	274,372.758	8,665,906.015
BR-128	84.57	84.57	82.61	1.96	1.2	274,409.612	8,665,909.969
BR-129	83.64	83.64	81.46	2.18	1.2	274,349.077	8,665,911.607
BR-131	82.65	82.65	80.30	2.35	1.2	274,300.758	8,665,875.325
BR-132	81.45	81.45	79.05	2.40	1.2	274,234.422	8,665,812.341
BR-134	79.83	79.83	77.18	2.65	1.2	274,096.811	8,665,862.024
BR-135	79.80	79.80	77.40	2.40	1.2	274,090.123	8,665,844.600
BR-136	83.44	83.44	81.34	2.10	1.2	274,309.977	8,665,954.764
BR-137	82.43	82.43	80.51	1.92	1.2	274,263.403	8,665,934.496
BR-144	81.46	81.46	79.31	2.15	1.2	274,206.079	8,665,865.757
BR-145	81.23	81.23	78.88	2.35	1.2	274,177.077	8,665,902.415
BR-146	81.07	81.07	79.07	2.00	1.2	274,141.289	8,665,949.423
BR-146*	81.07	81.07	79.87	1.20	1.2	274,141.690	8,665,948.051
BR-147	80.89	80.89	78.51	2.38	1.2	274,155.999	8,665,893.308
BR-157	85.38	85.38	83.78	1.60	1.2	274,422.230	8,665,989.884
BR-162	84.64	84.64	82.86	1.78	1.2	274,331.209	8,666,046.068
BR-166	82.56	82.56	80.99	1.57	1.2	274,243.680	8,665,985.987
BR-167A	82.64	82.64	80.44	2.20	1.2	274,219.493	8,666,034.910
BR-169	81.21	81.21	78.54	2.67	1.2	274,127.232	8,666,014.450
BR-169A	81.11	81.11	78.76	2.35	1.2	274,133.347	8,665,984.400
BR-171	80.30	80.30	78.10	2.20	1.2	274,065.329	8,666,000.433
BR-172	80.19	80.19	78.52	1.67	1.2	274,073.731	8,665,962.332
BR-172*	80.19	80.19	78.99	1.20	1.2	274,074.435	8,665,960.637
BR-173	79.97	79.97	78.17	1.80	1.2	274,085.092	8,665,913.201
BR-175	85.54	85.54	83.99	1.55	1.2	274,585.332	8,665,673.055
BR-176	84.80	84.80	83.24	1.56	1.2	274,526.195	8,665,682.969
BR-177	84.06	84.06	82.56	1.50	1.2	274,466.482	8,665,690.387
BR-178	85.43	85.43	83.79	1.64	1.2	274,579.812	8,665,658.308
BR-179	84.98	84.98	83.28	1.70	1.2	274,555.446	8,665,618.046
BR-180	84.56	84.56	82.91	1.65	1.2	274,529.611	8,665,629.197
BR-182	83.65	83.65	81.93	1.72	1.2	274,460.120	8,665,637.835
BR-183	82.69	82.69	80.79	1.90	1.2	274,400.721	8,665,645.146
BR-184	83.69	83.69	82.04	1.65	1.2	274,411.377	8,665,747.638
BR-185	82.92	82.92	81.32	1.60	1.2	274,406.866	8,665,697.788
BR-186	81.58	81.58	79.85	1.73	1.2	274,329.031	8,665,654.084
BR-187	82.59	82.59	80.84	1.75	1.2	274,383.380	8,665,700.586
BR-188	81.69	81.69	80.06	1.63	1.2	274,306.564	8,665,710.678
BR-189	81.72	81.72	80.00	1.72	1.2	274,271.535	8,665,772.284
BR-190	80.85	80.85	79.55	1.30	1.2	274,264.334	8,665,715.346
BR-191	80.48	80.48	78.73	1.75	1.2	274,257.308	8,665,659.835
BR-192	79.95	79.95	78.40	1.55	1.2	274,187.762	8,665,660.864
BR-193	79.57	79.57	78.17	1.40	1.2	274,133.871	8,665,656.590
BR-194	81.30	81.30	79.78	1.52	1.2	274,227.464	8,665,800.179
BR-195	80.85	80.85	79.44	1.41	1.2	274,215.562	8,665,779.416
BR-196	80.12	80.12	78.80	1.32	1.2	274,196.511	8,665,716.518

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CONSORCIO PROYECTOS LIMA

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FlexTable: Manhole Table

Label	Elevation (Ground) (m)	Elevation (Rim) (m)	Elevation (Invert) (m)	Depth (Structure) (m)	Diameter (m)	X (m)	Y (m)
BR-197	79.69	79.69	78.43	1.26	1.2	274,158.123	8,665,719.802
BR-198	79.47	79.47	77.91	1.56	1.2	274,120.735	8,665,713.025
BR-199	80.17	80.17	78.62	1.55	1.2	274,185.189	8,665,773.993
BR-200	79.88	79.88	78.37	1.51	1.2	274,151.621	8,665,779.488
BR-201	79.48	79.48	77.68	1.80	1.2	274,107.225	8,665,771.586
BR-202	92.14	92.14	90.52	1.62	1.2	274,924.585	8,665,907.894
BR-203	91.96	91.96	90.16	1.80	1.2	274,941.001	8,665,877.039
BR-204	91.74	91.74	89.84	1.90	1.2	274,920.637	8,665,861.360
BR-205	91.55	91.55	89.53	2.02	1.2	274,908.143	8,665,838.487
BR-206	91.18	91.18	89.03	2.15	1.2	274,888.710	8,665,794.080
BR-207	92.08	92.08	90.78	1.30	1.2	274,962.707	8,665,837.599
BR-208	92.33	92.33	91.03	1.30	1.2	274,974.600	8,665,814.528
BR-209	91.88	91.88	90.28	1.60	1.2	274,934.703	8,665,795.089
BR-210	92.55	92.55	91.22	1.33	1.2	274,981.501	8,665,791.541
BR-210*	92.55	92.55	91.35	1.20	1.2	274,981.364	8,665,793.374
BR-210**	92.55	92.55	91.35	1.20	1.2	274,979.482	8,665,791.960
BR-211	92.47	92.47	90.83	1.64	1.2	274,982.738	8,665,767.562
BR-212	92.36	92.36	90.13	2.23	1.2	274,979.448	8,665,742.817
BR-213	92.60	92.60	90.90	1.70	1.2	274,985.991	8,665,906.675
BR-214	93.00	93.00	91.56	1.44	1.2	275,016.703	8,665,849.417
BR-215	93.21	93.21	91.91	1.30	1.2	275,029.752	8,665,819.056
BR-216	93.42	93.42	92.19	1.23	1.2	275,035.809	8,665,786.615
BR-216*	93.42	93.42	92.19	1.23	1.2	275,036.116	8,665,787.812
BR-217	92.79	92.79	90.86	1.93	1.2	275,031.435	8,665,733.834
BR-218	91.09	91.09	88.99	2.10	1.2	274,911.530	8,665,745.914
BR-BA4	88.41	88.41	87.21	1.20	1.2	274,604.156	8,666,046.314
BR-BA6	87.09	87.09	85.89	1.20	1.2	274,575.525	8,665,949.074
BU-7	92.67	92.67	91.47	1.20	1.2	274,904.158	8,666,194.487
BU-13	90.71	90.71	88.84	1.87	1.2	274,755.036	8,666,165.936
BU-22	91.62	91.62	89.67	1.95	1.2	274,871.591	8,666,023.986
BU-28	93.68	93.68	91.93	1.75	1.2	274,960.488	8,666,156.013
BU-32	91.81	91.81	90.36	1.45	1.2	274,892.119	8,666,016.622
BU-36A	91.27	91.27	89.92	1.35	0.9	274,851.625	8,665,992.842
BU-37	91.46	91.46	89.06	2.40	1.2	274,835.966	8,666,074.399
BU-38	90.73	90.73	88.83	1.90	1.2	274,801.491	8,666,077.078
BU-45	89.55	89.55	88.30	1.25	1.2	274,743.829	8,665,936.041
BU-47	89.37	89.37	86.96	2.41	1.2	274,716.748	8,665,960.312
BU-56	90.34	90.34	88.64	1.70	1.2	274,824.314	8,665,844.990
BU-73	92.86	92.86	91.06	1.80	1.2	274,935.964	8,666,050.278
BU-73*	92.86	92.86	91.66	1.20	1.2	274,936.214	8,666,048.768
BU-85	89.02	89.02	87.82	1.20	1.2	274,754.332	8,665,708.626
BU-86	88.53	88.53	87.33	1.20	1.2	274,727.459	8,665,695.883
BU-87	87.94	87.94	86.64	1.30	1.2	274,698.810	8,665,677.240
BU-100	87.06	87.06	85.86	1.20	1.2	274,633.287	8,665,753.944
BU-101	86.87	86.87	85.47	1.40	1.2	274,614.528	8,665,801.036
BU-102	86.03	86.03	84.83	1.20	1.2	274,565.654	8,665,792.745
BU-117	83.36	83.36	81.51	1.85	1.2	274,358.572	8,665,771.985
BU-130	83.19	83.19	80.94	2.25	1.2	274,322.432	8,665,891.863
BU-133	80.66	80.66	78.10	2.56	1.2	274,163.695	8,665,836.092
BU-138	82.14	82.14	80.12	2.02	1.2	274,225.661	8,665,906.545
BU-139	82.07	82.07	79.58	2.49	1.2	274,209.550	8,665,914.092
BU-140	82.70	82.70	81.50	1.20	1.2	274,263.202	8,665,972.420

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FlexTable: Manhole Table

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BU-141	82.43	82.43	81.20	1.23	1.2	274,215.572	8,665,961.630
BU-142	81.93	81.93	80.73	1.20	1.2	274,178.425	8,665,942.661
BU-143	81.82	81.82	79.09	2.73	1.2	274,194.698	8,665,908.315
BU-151A	87.07	87.07	85.44	1.63	1.2	274,503.879	8,666,100.699
BU-151B	87.36	87.36	85.66	1.70	1.2	274,522.851	8,666,104.817
BU-154	87.00	87.00	85.15	1.85	1.2	274,528.364	8,666,039.037
BU-156	86.17	86.17	84.30	1.87	1.2	274,479.274	8,665,976.590
BU-160	84.14	84.14	82.14	2.00	1.2	274,338.175	8,665,977.377
BU-161	84.24	84.24	82.24	2.00	1.2	274,340.153	8,665,987.648
BU-163	84.17	84.17	82.81	1.36	1.2	274,326.235	8,666,044.308
BU-174	86.77	86.77	84.90	1.87	1.2	274,647.080	8,665,658.613
BU-BA2	87.87	87.87	86.44	1.43	1.2	274,600.094	8,666,001.602
BU-BA3	88.55	88.55	87.08	1.47	1.2	274,603.504	8,666,060.007
BU-BA5	89.17	89.17	87.49	1.68	1.2	274,685.736	8,666,012.713
BU-BA7	86.64	86.64	85.30	1.34	1.2	274,556.663	8,665,930.629
BU-BA12	88.38	88.38	87.18	1.20	1.2	274,637.200	8,665,998.785
BU-BA13	86.66	86.66	85.13	1.53	1.2	274,553.453	8,665,924.051
BZ-1	89.28	89.28	88.28	1.00	0.9	274,684.603	8,666,035.924
BZ-2	89.20	89.20	88.20	1.00	0.9	274,687.586	8,666,025.650
BZ-3	84.58	84.58	83.58	1.00	0.9	274,344.553	8,666,048.702
BZ-4	85.40	85.40	84.40	1.00	0.9	274,419.209	8,666,002.276
BZ-5	84.63	84.63	83.63	1.00	0.9	274,331.804	8,666,042.575
BZ-6	84.07	84.07	83.07	1.00	0.9	274,319.993	8,666,012.520

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