APPENDIX K

SEWER MASTER PLAN

Sanitary Sewer Master Plan

STONE BEETLAND
SACRAMENTO, CALIFORNIA

OCTOBER 2022

CARLSON, BARBEE & GIBSON, Inc.
CIVIL ENGINEERS • SURVEYORS • PLANNERS

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I. BACKGROUND

The Stone Beetland property ("Project") is located directly east of the Delta Shores master-planned community. The Project is approximately 141 acres and is bound by Cosumnes River Boulevard to the south, Delta Shores and the future 24th Street extension to the west, City of Sacramento property and the Detroit Boulevard Neighborhood to the north and the Sacramento Regional Transit Blue Line light rail line and station, and Morrison Creek to the east. See Figure 1 depicting the Project Location. The proposed Project includes the development of a mixed-use community with a range of residential densities that transition from similar housing types as the surrounding communities to higher densities surrounding the Light Rail station, promoting transit-oriented development. The current land uses within the Project include approximately 1,160 residential units, 6.2 acres of commercial uses and 33 acres of trails, open space and integrated drainage facilities. See Figure 2 depicting the proposed Project Land Use Plan.

The proposed Project was considered as a future development site within the Delta Shores Sewer Master Plan, dated July 2014. Accordingly, the infrastructure downstream of the Project and within the Sump 53 Sewer Shed has been planned to provide capacity for the Project.

II. EXISTING AND PLANNED SANITARY SEWER FACILITIES

The Project site is within the existing Sump 53 Sewershed. The existing Sump 53 is located at the northwest corner of the Project. From this facility, there is an existing force main that conveys sanitary sewer to the existing sewer pipeline system located in 24th Street to the north of Delta Shores. This system of pipelines eventually connects to the existing 96" City Interceptor that is located along Interstate 5 and conveys flows to the wastewater treatment plant.

The Delta Shores Sewer Master Plan identified that the 96" City Interceptor has capacity for 1.283 MGD of flow from the Delta Shores / Stone Beetland / City of Sacramento projects. Once the flows from these developments exceed this capacity, a new Sump 53 pump station is planned to be constructed south of the 24th Street / Cosumnes River Blvd intersection. Sanitary sewer flows from the North and South Sheds of Delta Shores and all of the Stone Beetland and City of Sacramento properties will be directed to the new Sump 53. The new Sump 53 will discharge to a force main that will be located along the Cosumnes River Blvd corridor, conveying flows approximately 10,000

linear feet in distance, and eventually connecting to the existing SRCSD Central Interceptor pipeline located near Franklin Boulevard.

There is also an existing sanitary sewer collection pipeline within the Project site. This pipeline is located along the northern boundary and conveys sanitary sewer from the portions of Detroit Boulevard Neighborhood to the existing Sump 53.

III. PROPOSED SANITARY SEWER FLOWS

The sanitary sewer flows to be generated by the proposed development of the Project have been estimated based upon the criteria identified in the County of Sacramento Improvement Standards and Sacramento Area Sewer Design Standards, which are summarized below.

FLOW GENERATION	LAND USES			MODIFIERS
	Single-Family Residential	Multiple-Family Residential	Commercial / Industrial	Minimum plan density shall be RD-6
310 gpd/ESD	ESD's per acre shall be either the number of units per acre per land use zone, or per the proposed development agreement, or 6, whichever is greatest.	ESD is 232 gpd (Multiply the ESD's/Acre by 0.75)	6 ESD's per acre	Rainfall Dependent I/I: New Development Areas – 1,000 gpd/acre

The estimated sanitary sewer design flows generated from Stone Beetland are as follows and further detailed in Appendix :

- Q_{peak} = PWWF = PDWF + I/I
- Peaking Factor = $3.5 - 1.8Q^{0.05}$

  Q = ADWF

  Minimum shall be 1.2
- Q_{avg} = 189 SFD(ESD) x 310 gpd/ESD = 58,590 gpd

  971 MFR(ESD) x 232 gpd/ESD = 225,272 gpd

  6.2 Acre Comm. x 6 ESD x 310 gpd/ESD = 11,532 gpd

  Q_{avg} = 295,394 gpd

- Peaking Factor = $3.5 - 1.8Q_{avg}^{0.05}$
  = $3.5 - 1.8\ (0.2959)^{0.05}$
  = 1.8
- I/I = 1,000 gpd/acre x 141 acres (Includes RT and Roadways) = 141,000 gpd
- Q_{peak} = 295,394 gpd x 1.8 peaking factor + 141,000 gpd
  = 672,709 gpd
  = 0.673 MGD

The approved Delta Shores Sewer Master Plan had assumed a design flow from the Stone Beetland property of 0.76 MGD, which exceeds the current estimated flows of 0.67 MGD. See the original estimated sanitary sewer flows for the Stone Beetland property highlighted in Appendix B. The reduction in estimated flow is related to the original assumed land uses within the Project have transitioned since the Delta Shore Sewer Master Plan was completed. The current proposed land uses now include more multi-family units within the Project to focus on transit-oriented development near the Light Rail station, and therefore less total ESDs associated with the Project. Accordingly, the downstream systems that have been planned and or constructed to date have adequate capacity assumed for the Project site.

IV. PROPOSED SANITARY SEWER SYSTEM IMPROVEMENTS

The Project will install a system of sanitary sewer collection pipelines, ranging from 8" to 15" in diameter, within the proposed street framework. The pipelines will collect and convey sanitary sewer flows generated by the Project from east to west. The existing pipeline from the Detroit Boulevard Neighborhood will be removed and those flows will be intercepted by the new system of collection pipelines. Also, future flows from the City of Sacramento site have been planned to be connected to the downstream portions of the proposed system. The proposed collection pipelines will ultimately connect into the planned 24" trunk line in 24th Street. The 24" trunk line will convey flows southerly, across Cosumnes River Blvd, and to the planned new Sump 53.

Depending on the status of adjacent development within Delta Shores, there may be an opportunity to connect initial phases of development to the existing Sump 53 and utilize the remaining capacity

within the 96” City Interceptor Line. This will require more detailed analysis to determine if this interim condition is feasible at the time of final design.

See Figure 3 depicting the proposed sanitary sewer system within the Project and surrounding existing and planned sewer facilities. See the sewer pipeline hydraulic calculations in Appendix C demonstrating the proposed system meets the required minimum pipeline velocities and capacity criteria.

FIGURES

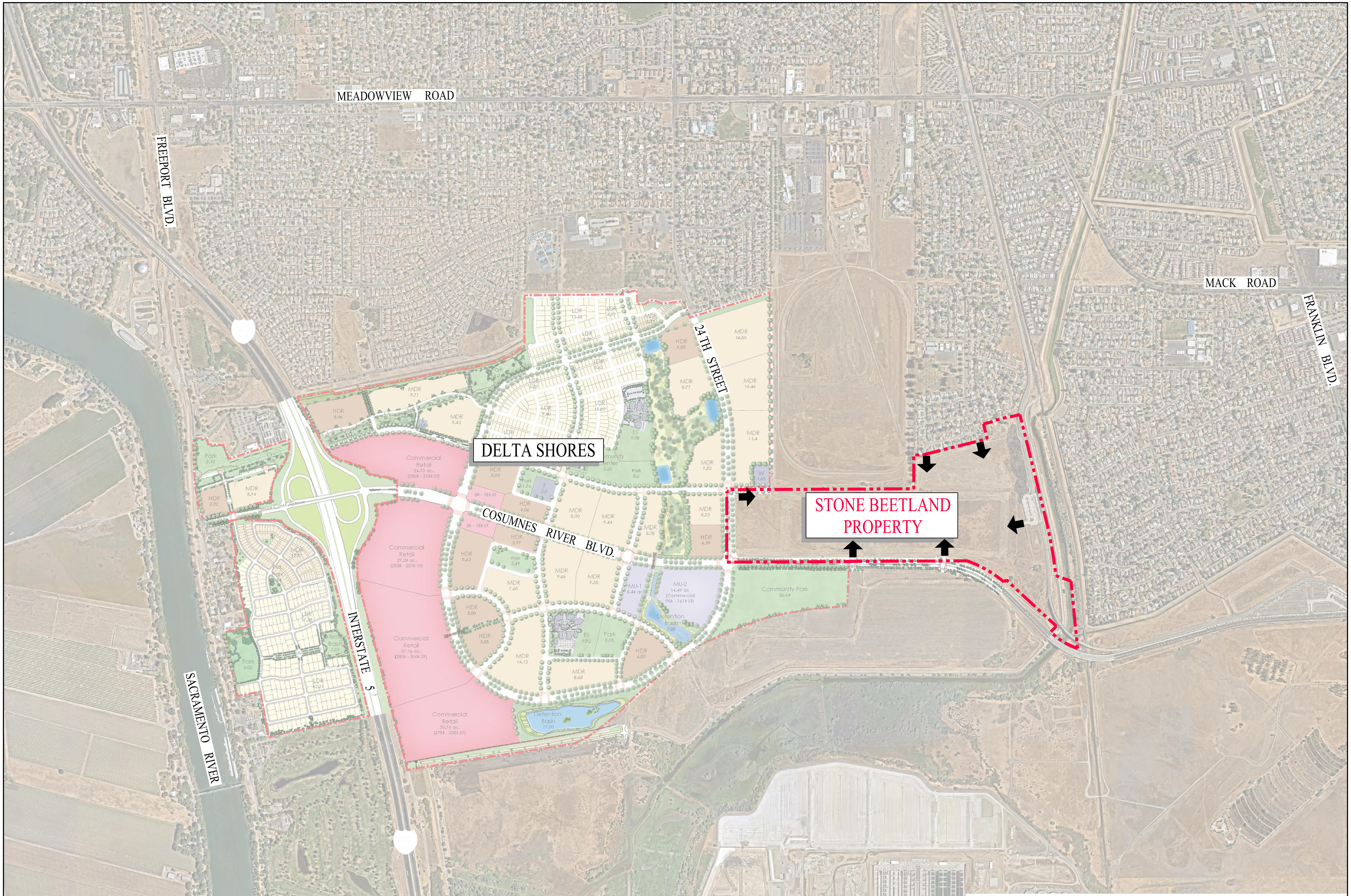

FIGURE 1
CONTEXTUAL REGIONAL MAP
STONE BEETLAND

CITY OF SACRAMENTO SACRAMENTO COUNTY CALIFORNIA

SCALE:1"=400' DATE: NOVEMBER, 2021

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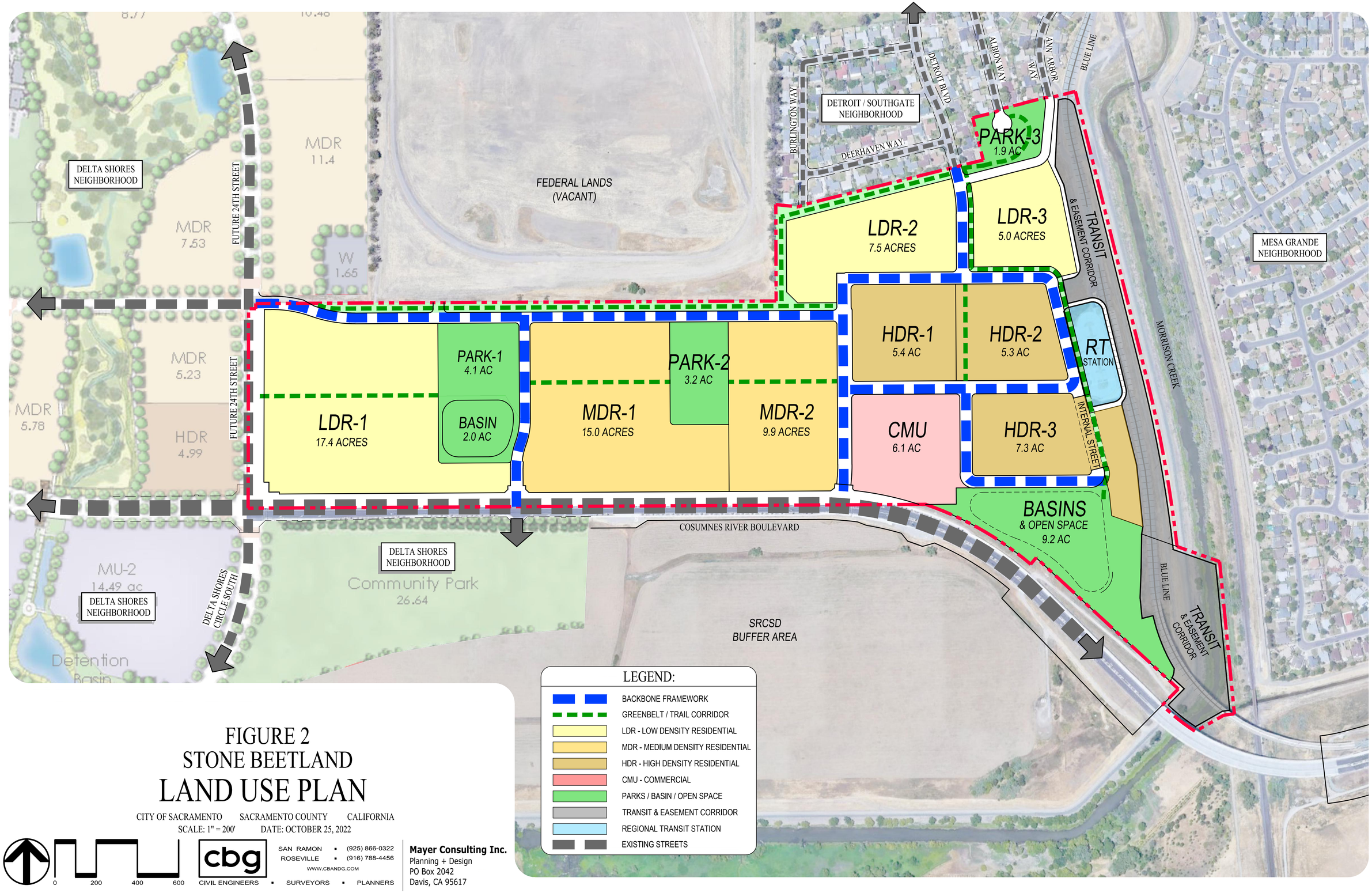

FIGURE 2
STONE BEETLAND
LAND USE PLAN

CITY OF SACRAMENTO SACRAMENTO COUNTY CALIFORNIA

SCALE: 1" = 200' DATE: OCTOBER 25, 2022

0 200 400 600

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Mayer Consulting Inc.
Planning + Design
PO Box 2042
Davis, CA 95617

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FIGURE 3
SANITARY SEWER MASTER PLAN
STONE BEETLAND

CITY OF SACRAMENTO SACRAMENTO COUNTY CALIFORNIA

SCALE: 1" = 150' DATE: OCTOBER 25, 2022

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APPENDICES

APPENDIX A –
Stone Beetland Estimated Sanitary Sewer Flows

APPENDIX A
Stone Beetland Sewer Master Plan
Project Sewer Flows

October 2022

Node	LDR ac	LDR ESD's	MDR ac	MDR ESD's	HDR ac	HDR ESD's	School ac	School ESD's	Mixed ac	Mixed ESD's	Comm ac	Comm ESD's	Public ac	Public ESD's	Park ac	Park ESD's	OS ac	OS ESD's	Major Road ac	Major Road ESD's	Total Area ac	Total Total ESD's	Flow Calculations Flow Gen gpd/ESD	Qave mgd	Qinf mgd	Peaking Factor	Q Peak DWF mgd	Q Peak PWWF mgd	Q Peak PWWF cfs	Diam in	Slope ft/ft	Flow Depth in	d/D ratio	Velocity fps
LDR-1	17.40	100	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	17.40	100	310	0.031	0.017	1.80	0.056	0.073	0.11	-	-	-		-
LDR-2	7.50	55	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	7.50	55	310	0.017	0.008	1.80	0.031	0.038	0.06	-	-	-		-
LDR-3	4.80	31	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	4.80	31	310	0.010	0.005	1.80	0.017	0.022	0.03	-	-	-		-
MDR-1	0.00	0	15.00	151	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	15.00	151	232.5	0.035	0.015	1.80	0.063	0.078	0.12	-	-	-		-
MDR-2	0.00	0	9.90	111	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	9.90	111	232.5	0.026	0.010	1.80	0.046	0.056	0.09	-	-	-		-
HDR-1	0.00	0	0.00	0	5.40	241	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	5.40	241	232.5	0.056	0.005	1.80	0.101	0.106	0.16	-	-	-		-
HDR-2	0.00	0	0.00	0	5.30	198	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	5.30	198	232.5	0.046	0.005	1.80	0.083	0.088	0.14	-	-	-		-
HDR-3	0.00	0	0.00	0	7.30	272	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	7.30	272	232.5	0.063	0.007	1.80	0.114	0.121	0.19	-	-	-		-
CMU	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	6.10	37	0.00	0	0.00	0	0.00	0	0.00	0	6.10	37	310	0.011	0.006	1.80	0.021	0.027	0.04	-	-	-		-
PQP-RT	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	10.30	0	0.00	0	0.00	0	0.00	0	10.30	0	310	0.000	0.010	1.80	0.000	0.010	0.02	-	-	-		-
P	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	9.30	0	0.00	0	0.00	0	9.30	0	310	0.000	0.009	1.80	0.000	0.009	0.01	-	-	-		-
OS-G	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	12.70	0	0.00	0	12.70	0	310	0.000	0.013	1.80	0.000	0.013	0.02	-	-	-		-
OS-B	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	11.20	0	0.00	0	11.20	0	310	0.000	0.011	1.80	0.000	0.011	0.02	-	-	-		-
RW-EXT	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	4.70	0	4.70	0	310	0.000	0.005	1.80	0.000	0.005	0.01	-	-	-		-
RW-INT	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	13.80	0	13.80	0	310	0.000	0.014	1.80	0.000	0.014	0.02	-	-	-		-
Stone	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**0.672**	**1.040**	-	-	-		-
Detroit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**0.127**	**0.197**	-	-	-		-
Corps	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**0.685**	**1.060**	-	-	-		-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1.484**	**2.297**	15"	0.0020	10.1"	0.67	2.61
Totals:	29.70	186	24.90	262	18.00	711	0.00	0	0.00	0	6.10	37	10.30	0	9.30	0	23.90	0	18.50	0	140.70	1196					Total:	1.484	2.297					

Commercial = 6 ESD's per Acre
RT Station, Parks & Roadways = No ESD's
I / I = 1,000 GPD / Acre
Peaking Factor = 1.80 Typical

APPENDIX B –
2014 Delta Shores Sewer Master Plan
(Assumed Flow from Stone Beetland Property)

APPENDIX B

EXHIBIT G
Delta Shores Sewer Master Plan
Phase 3 Sewer Flows (Ultimate Build Out)

May 29, 2014

Node	LDR ac	LDR ESD's	MDR ac	MDR ESD's	HDR ac	HDR ESD's	School ac	School ESD's	Mixed ac	Mixed ESD's	Comm ac	Comm ESD's	Public ac	Public ESD's	Park ac	Park ESD's	OS ac	OS ESD's	Major Road ac	Major Road ESD's	Total Area ac	Total ESD's	Cumulative Area ac	Cumulative ESD's	Qave mgd	Qinf mgd	Peak Factor	Q Peak DWF mgd	Q Peak PWWF mgd	Q Peak PWWF cfs	Diam in	Slope ft/ft	Flow Depth in	Velocity fps
W1	0.00	0	5.74	81	3.92	80	0.00	0	0.00	0	0.00	0	0.00	0	3.10	19	7.78	47	1.47	0	22.01	227	22.01	227	0.070	0.026	1.92	0.135	0.162	0.25	8	0.0035	3.3	1.88
W2	23.29	103	17.87	110	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.54	4	0.00	0	0.41	0	42.11	217	64.12	444	0.138	0.077	1.87	0.257	0.334	0.52	10	0.0025	4.9	1.99
W3	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	30.00	180	0.00	0	0.00	0	0.00	0	0.00	0	30.00	180	30.00	180	0.056	0.036	1.94	0.108	0.144	0.22	8	0.0035	3.1	1.82
W4	29.30	109	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	6.02	37	0.00	0	0.60	0	35.92	146	130.04	770	0.239	0.156	1.82	0.435	0.592	0.92	12	0.0020	6.6	2.11
W5	7.00	26	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	2.57	0	0.17	0	9.74	26	139.78	796	0.247	0.168	1.82	0.450	0.617	0.96	12	0.0020	6.7	2.12
S2	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	97.03	583	0.00	0	0.00	0	4.16	0	5.87	0	107.06	583	246.84	1379	0.427	0.296	1.77	0.759	1.055	1.63	15	0.0015	8.9	2.18
S3	0.00	0	0.00	0	20.28	412	0.00	0	0.00	0	2.71	17	0.00	0	0.00	0	0.00	0	5.98	0	28.97	429	275.81	1808	0.560	0.331	1.75	0.982	1.313	2.03	15	0.0015	10.3	2.27
S4	0.00	0	10.87	153	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	2.99	0	13.86	153	289.67	1961	0.608	0.348	1.74	1.060	1.408	2.18	15	0.0015	10.9	2.30
S5	0.00	0	29.17	410	3.99	81	9.92	60	0.00	0	0.00	0	0.00	0	3.49	21	19.66	0	14.15	0	80.38	572	370.05	2533	0.785	0.444	1.72	1.352	1.796	2.78	18	0.0012	11.8	2.27
S6	0.00	0	9.35	131	6.83	139	0.00	0	5.44	33	0.00	0	0.00	0	5.05	31	7.28	0	7.86	0	41.81	334	411.86	2867	0.889	0.494	1.71	1.520	2.015	3.12	18	0.0012	12.9	2.32
N2	0.00	0	13.57	190	8.46	119	0.00	0	0.00	0	24.27	146	0.54	4	1.32	8	5.87	36	6.62	0	60.65	503	60.65	503	0.156	0.073	1.86	0.290	0.363	0.56	10	0.0025	5.1	2.03
N3	12.04	73	5.57	78	0.00	0	0.00	0	0.00	0	3.15	20	0.00	0	0.00	0	0.76	5	3.63	0	25.15	176	85.80	679	0.210	0.103	1.83	0.386	0.489	0.76	10	0.0025	6.1	2.17
N4	26.71	112	3.77	26	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	5.30	32	1.20	8	2.97	0	39.95	178	39.95	178	0.055	0.048	1.94	0.107	0.155	0.24	8	0.0035	3.2	1.85
N5	38.55	212	0.00	0	0.00	0	9.98	60	0.00	0	0.00	0	2.60	16	0.00	0	0.48	3	5.33	0	56.94	291	96.89	469	0.145	0.116	1.87	0.271	0.387	0.60	8	0.0157	3.5	4.09
N6	0.00	0	4.45	62	10.01	204	0.00	0	0.00	0	0.00	0	2.00	12	1.76	11	0.52	4	6.57	0	25.31	293	208.00	1441	0.447	0.250	1.77	0.791	1.041	1.61	15	0.0015	8.8	2.17
N7	0.00	0	19.67	279	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	8.60	52	0.00	0	4.76	0	33.03	331	241.03	1772	0.549	0.289	1.75	0.963	1.252	1.94	15	0.0015	10.0	2.26
N8	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	30.89	0	1.74	0	32.63	0	273.66	1772	0.549	0.328	1.75	0.963	1.291	2.00	15	0.0157	10.2	2.27
N9	0.00	0	8.99	127	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	1.54	0	10.53	127	284.19	1899	0.589	0.341	1.75	1.028	1.370	2.12	15	0.0015	10.6	2.29
N10	0.00	0	23.27	326	5.88	120	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	1.50	9	2.71	0	33.36	455	33.36	455	0.141	0.040	1.87	0.263	0.304	0.47	8	0.0035	4.7	2.18
N11	0.00	0	10.46	147	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.67	0	11.13	147	44.49	602	0.187	0.053	1.84	0.344	0.398	0.62	10	0.0025	5.4	2.07
N12	0.00	0	15.17	213	0.00	0	0.00	0	0.00	0	0.00	0	1.65	10	0.00	0	0.00	0	2.57	0	19.39	223	63.88	825	0.256	0.077	1.82	0.465	0.542	0.84	10	0.0025	6.6	2.22
Detroit	32.00	146	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	32.00	146	32.00	146	0.045	0.038	1.96	0.089	0.127	0.20	8	0.0035	2.9	1.76
Stone	32.00	192	31.00	310	44.50	484	0.00	0	0.00	0	5.00	30	0.00	0	14.00	84	0.00	0	0.00	0	126.50	1100	126.50	1100	0.341	0.152	1.79	0.612	0.764	1.18	12	0.0020	7.7	2.22
Corps	150.00	900	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	150.00	900	150.00	900	0.279	0.180	1.81	0.505	0.685	1.06	12	0.0020	7.2	2.18
N13	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	308.50	2146	0.665	0.370	1.74	1.155	1.525	2.36	15	0.0015	11.7	2.38
N14	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	656.57	4870	1.510	0.788	1.66	2.510	3.298	5.10	24	0.0008	16.2	2.26
N15	0.00	0	0.00	0	4.99	102	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	1.26	0	6.25	102	662.82	4972	1.541	0.795	1.66	2.560	3.355	5.19	24	0.0008	16.4	2.27
N16	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	26.56	160	0.00	0	4.22	0	30.78	160	693.60	5132	1.591	0.832	1.66	2.637	3.470	5.37	24	0.0008	16.9	2.28
S7	0.00	0	0.00	0	0.00	0	0.00	0	14.49	87	0.00	0	0.00	0	0.00	0	0.00	0	2.36	0	16.85	87	1122.31	8086	2.507	1.347	1.62	4.049	5.396	8.35	27	0.0008	21.1	2.51
S8	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.08	0	0.00	0	0.00	0	0.00	0	0.08	0	1122.39	8086	2.507	1.347	1.62	4.049	5.396	8.35	27	0.0008	21.1	2.51
Totals	350.89	1873	208.92	2643	108.86	1741	19.90	120	19.93	120	162.16	976	6.87	42	75.74	459	82.67	112	86.45	0	1122.39	8086	1122.39	8086	2.507	1.347		4.049	5.396					

APPENDIX C –
Sanitary Sewer Pipeline Hydraulic Analysis

APPENDIX C
Stone Beetland Sewer Master Plan
Project Sewer Flows

October 2022

Node	LDR ac	LDR ESD's	MDR ac	MDR ESD's	HDR ac	HDR ESD's	School ac	School ESD's	Mixed ac	Mixed ESD's	Comm ac	Comm ESD's	Public ac	Public ESD's	Park ac	Park ESD's	OS ac	OS ESD's	Major Road ac	Major Road ESD's	Total Area ac	Total Total ESD's	Flow Calculations Flow Gen gpd/ESD	Qave mgd	Qave cfs	Qinf mgd	Peaking Factor	Q Peak DWF mgd	Q Peak PWWF mgd	Q Peak PWWF cfs	Diam in	Slope ft/ft	Flow Depth in	d/D ratio	Avg Velocity fps	Peak Velocity fps
Node 1																																				
HDR-2	0.00	0	0.00	0	1.76	66	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	1.76	66	232.5	0.015	0.02	0.002	1.80	0.028	0.029	0.05	-	-	-		-	-
PQP-RT	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	5.15	0	0.00	0	0.00	0	0.00	0	5.15	0	310	0.000	0.00	0.005	1.80	0.000	0.005	0.01	-	-	-		-	-
OS-G	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.30	0	0.00	0	0.30	0	310	0.000	0.00	0.000	1.80	0.000	0.000	0.00						
																												Node 1 Peak:		**0.05**	8	0.0050	1.3	0.16	-	1.32
																							Node 1 Average:		**0.02**						8	0.0050	0.8	0.11	1.01	-
Node 2																																				
Node 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	0.05	-	-	-			-
LDR-3	0.70	5	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.70	5	310	0.002	0.002	0.001	1.80	0.003	0.003	0.01	-	-	-			-
P	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	1.90	0	0.00	0	0.00	0	1.90	0	310	0.000	0.00	0.002	1.80	0.000	0.002	0.00	-	-	-			-
																												Node 2 Peak:		**0.06**	8	0.0100	1.3	0.16	-	1.58
																							Node 2 Average:		**0.002**						8	0.0100	0.2	0.03	0.64	-
Node 3																																				
Node 2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.002	-	-	-	-	0.06	-	-	-		-	-
LDR-2	1.00	9	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	1.00	9	310	0.003	0.00	0.001	1.80	0.005	0.006	0.01	-	-	-		-	-
LDR-3	4.10	26	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	4.10	26	310	0.008	0.01	0.004	1.80	0.015	0.019	0.03	-	-	-		-	-
HDR-2	0.00	0	0.00	0	1.76	66	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	1.76	66	232.5	0.015	0.02	0.002	1.80	0.028	0.029	0.05	-	-	-		-	-
OS-G	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.50	0	0.00	0	0.50	0	232.5	0.000	0.00	0.001	1.80	0.000	0.001	0.00	-	-	-		-	-
																												Node 3 Peak:		**0.15**	8	0.0035	2.5	0.31	-	1.60
																							Node 3 Average:		**0.04**						8	0.0035	1.3	0.16	1.06	-
Node 4																																				
Node 3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.04	-	-	-	-	0.15	-	-	-		-	-
LDR-2	6.50	46	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	6.50	46	310	0.014	0.02	0.007	1.80	0.026	0.032	0.05	-	-	-		-	-
HDR-1	0.00	0	0.00	0	2.70	121	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	2.70	121	232.5	0.028	0.04	0.003	1.80	0.051	0.053	0.08	-	-	-		-	-
OS-G	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	1.60	0	0.00	0	1.60	0	310	0.000	0.00	0.002	1.80	0.000	0.002	0.00	-	-	-		-	-
																												Node 4 Peak:		**0.28**	8	0.0035	3.5	0.44	-	1.90
																							Node 4 Average:		**0.11**						8	0.0035	2.2	0.28	1.44	-
Node 5																																				
HDR-3	0.00	0	0.00	0	1.83	68	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	1.83	68	232.5	0.016	0.02	0.002	1.80	0.028	0.030	0.05	-	-	-		-	-
OS-B	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	4.60	0	0.00	0	4.60	0	310	0.000	0.00	0.005	1.80	0.000	0.005	0.01	-	-	-		-	-
OS-G	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	6.60	0	0.00	0	6.60	0	310	0.000	0.00	0.007	1.80	0.000	0.007	0.01	-	-	-		-	-
																												Node 5 Peak:		**0.06**	8	0.0050	1.4	0.18		1.40
																							Node 5 Average:		**0.02**						8	0.0050	0.8	0.11	1.01	
Node 6																																				
Node 5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.024	-	-	-	-	0.06	-	-	-		-	-
HDR-3	0.00	0	0.00	0	1.83	68	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	1.83	68	232.5	0.016	0.02	0.002	1.80	0.028	0.030	0.05	-	-	-		-	-
PQP-RT	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	5.15	0	0.00	0	0.00	0	0.00	0	5.15	0	310	0.000	0.00	0.005	1.80	0.000	0.005	0.01	-	-	-		-	-
																												Node 6 Peak:		**0.12**	8	0.0035	2.3	0.29	-	1.45
																							Node 6 Average:		**0.05**						8	0.0035	1.4	0.18	1.16	-

Notes: These calculations utilize a roughness coefficient of n=0.013 per current city standards.
There is insufficient flow at Node 2 to achieve a minimum average velocity of 1 ft/s.

cbg

APPENDIX C
Stone Beetland Sewer Master Plan
Project Sewer Flows

October 2022

Node	LDR ac	LDR ESD's	MDR ac	MDR ESD's	HDR ac	HDR ESD's	School ac	School ESD's	Mixed ac	Mixed ESD's	Comm ac	Comm ESD's	Public ac	Public ESD's	Park ac	Park ESD's	OS ac	OS ESD's	Major Road ac	Major Road ESD's	Total Area ac	Total ESD's	Flow Gen gpd/ESD	Qave mgd	Qave cfs	Qinf mgd	Peaking Factor	Q Peak DWF mgd	Q Peak PWWF mgd	Q Peak PWWF cfs	Diam in	Slope ft/ft	Flow Depth in	d/D ratio	Avg Velocity fps	Peak Velocity fps
Node 7																																				
HDR-3	0.00	0	0.00	0	1.83	68	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	1.83	68	232.5	0.016	0.02	0.002	1.80	0.028	0.030	0.05	-	-	-		-	-
CMU	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	2.00	12	0.00	0	0.00	0	0.00	0	0.00	0	2.00	12	310	0.004	0.01	0.002	1.80	0.007	0.009	0.01	-	-	-		-	-
OS-B	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	4.60	0	0.00	0	4.60	0	310	0.000	0.00	0.005	1.80	0.000	0.005	0.01	-	-	-		-	-
																												Node 7 Peak:		**0.07**	8	0.0050	1.5	0.19	-	1.44
																							Node 7 Average:		**0.03**						8	0.0050	1.1	0.14	1.04	-
Node 8																																				
Node 6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.05	-	-	-	-	0.12	-	-	-		-	-
Node 7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.03	-	-	-	-	0.07	-	-	-		-	-
HDR-2	0.00	0	0.00	0	1.77	66	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	1.77	66	232.5	0.015	0.02	0.002	1.80	0.028	0.029	0.05	-	-	-		-	-
HDR-3	0.00	0	0.00	0	1.82	68	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	1.82	68	232.5	0.016	0.02	0.002	1.80	0.028	0.030	0.05	-	-	-		-	-
																												Node 8 Peak:		**0.28**	8	0.0035	3.5	0.44	-	1.90
																							Node 8 Average:		**0.13**						8	0.0035	2.4	0.30	1.46	-
Node 9																																				
CMU	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	2.00	12	0.00	0	0.00	0	0.00	0	0.00	0	2.00	12	310	0.004	0.01	0.002	1.80	0.007	0.009	0.01	-	-	-		-	-
																												Node 9 Peak:		**0.01**	8	0.0150	0.6	0.08	-	1.16
																							Node 9 Average:		**0.01**						8	0.0150	0.5	0.06	1.16	-
Node 10																																				
Node 8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.13	-	-	-	-	0.28	-	-	-		-	-
Node 9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01	-	-	-	-	0.01	-	-	-		-	-
HDR-1	0.00	0	0.00	0	2.70	120	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	2.70	120	232.5	0.028	0.04	0.003	1.80	0.050	0.053	0.08	-	-	-		-	-
CMU	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	2.10	13	0.00	0	0.00	0	0.00	0	0.00	0	2.10	13	310	0.004	0.01	0.002	1.80	0.007	0.009	0.01	-	-	-		-	-
																												Node 10 Peak:		**0.39**	8	0.0035	4.2	0.53	-	2.08
																							Node 10 Average:		**0.18**						8	0.0035	2.8	0.35	1.67	-
Node 11																																				
Node 4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.11	-	-	-	-	0.28	-	-	-		-	-
Node 10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.18	-	-	-	-	0.39	-	-	-		-	-
																												Node 11 Peak:		**0.67**	10	0.0025	5.8	0.58	-	2.06
																							Node 11 Average:		**0.29**						10	0.0025	3.6	0.36	1.63	-
Node 12																																				
Node 11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.29	-	-	-	-	0.67	-	-	-		-	-
Detroit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.05	-	-	-	0.127	0.197	-	-	-		-	-
OS-G	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.25	0	0.00	0	0.25	0	310	0.000	0.00	0.000	1.80	0.000	0.000	0.00	-	-	-		-	-
																												Node 12 Peak:		**0.87**	10	0.0025	6.8	0.68	-	2.22
																							Node 12 Average:		**0.34**						10	0.0025	3.8	0.38	1.77	-
Node 13																																				
Node 12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.34	-	-	-	-	0.87	-	-	-		-	-
MDR-2	0.00	0	9.90	111	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	9.90	111	232.5	0.026	0.04	0.010	1.80	0.046	0.056	0.09	-	-	-		-	-
OS-G	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.20	0	0.00	0	0.20	0	310	0.000	0.00	0.000	1.80	0.000	0.000	0.00	-	-	-		-	-
																												Node 13 Peak:		**0.95**	12	0.0020	6.7	0.56	-	2.09
																							Node 13 Average:		**0.38**						12	0.0020	4.1	0.34	1.60	-

cbg

APPENDIX C
Stone Beetland Sewer Master Plan
Project Sewer Flows

October 2022

Node	LDR ac	LDR ESD's	MDR ac	MDR ESD's	HDR ac	HDR ESD's	School ac	School ESD's	Mixed ac	Mixed ESD's	Comm ac	Comm ESD's	Public ac	Public ESD's	Park ac	Park ESD's	OS ac	OS ESD's	Major Road ac	Major Road ESD's	Total Area ac	Total Total ESD's	Flow Calculations Flow Gen gpd/ESD	Qave mgd	Qave cfs	Qinf mgd	Peaking Factor	Q Peak DWF mgd	Q Peak PWWF mgd	Q Peak PWWF cfs	Diam in	Slope ft/ft	Flow Depth in	d/D ratio	Avg Velocity fps	Peak Velocity fps
Node 14																																				
Node 13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.38	-	-	-	-	0.95	-	-	-		-	-
MDR-1	0.00	0	3.10	26	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	3.10	26	232.5	0.006	0.01	0.003	1.80	0.011	0.014	0.02	-	-	-		-	-
P	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	3.20	0	0.00	0	0.00	0	3.20	0	310	0.000	0.00	0.003	1.80	0.000	0.003	0.00	-	-	-		-	-
OS-G	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.35	0	0.00	0	0.35	0	310	0.000	0.00	0.000	1.80	0.000	0.000	0.00	-	-	-		-	-
																												Node 14 Peak:		**0.98**	15	0.0020	6.1	0.41	-	2.07
																							Node 14 Average:		**0.39**						15	0.0020	3.7	0.25	1.63	-
Node 15																																				
Node 14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.39	-	-	-	-	0.98	-	-	-		-	-
Corps	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.28	-	-	-	0.685	1.060					-	-
MDR-1	0.00	0	11.90	125	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	11.90	125	232.5	0.029	0.04	0.012	1.80	0.052	0.064	0.10	8	0.0035	2.0	0.25	-	1.41
OS-G	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.75	0	0.00	0	0.75	0	310	0.000	0.00	0.001	1.80	0.000	0.001	0.00	-	-	-		-	-
OS-B	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	2.00	0	0.00	0	2.00	0	310	0.000	0.00	0.002	1.80	0.000	0.002	0.00	-	-	-		-	-
																												Node 15 Peak:		**2.14**	15	0.0020	9.7	0.65	-	2.55
																							Node 15 Average:		**0.71**						15	0.0020	5.2	0.35	1.89	-
Node 16																																				
Node 15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.71	-	-	-	-	2.14	-	-	-		-	-
LDR-1	6.50	34	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	6.50	34	310	0.011	0.02	0.007	1.80	0.019	0.025	0.04	-	-	-		-	-
P	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	4.10	0	0.00	0	0.00	0	4.10	0	310	0.000	0.00	0.004	1.80	0.000	0.004	0.01	-	-	-		-	-
OS-G	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.60	0	0.00	0	0.60	0	310	0.000	0.00	0.001	1.80	0.000	0.001	0.00	-	-	-		-	-
																												Node 16 Peak:		**2.19**	15	0.0020	9.8	0.65	-	2.56
																							Node 16 Average:		**0.73**						15	0.0020	5.2	0.35	1.95	-
Node 17																																				
Node 16	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.73	-	-	-	-	2.19	-	-	-		-	-
LDR-1	10.90	66	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	10.90	66	310	0.020	0.03	0.011	1.80	0.037	0.048	0.07	-	-	-		-	-
OS-G	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	1.65	0	0.00	0	1.65	0	310	0.000	0.00	0.002	1.80	0.000	0.002	0.00	-	-	-		-	-
RW-EXT	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	4.70	0	4.70	0	310	0.000	0.00	0.005	1.80	0.000	0.005	0.01	-	-	-		-	-
RW-INT	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	13.80	0	13.80	0	310	0.000	0.00	0.014	1.80	0.000	0.014	0.02	-	-	-		-	-
																												Node 17 Peak:		**2.296**	15	0.0020	10.2	0.68	-	2.58
																							Node 17 Average:		**0.76**						15	0.0020	5.3	0.35	1.95	-
Totals:	29.70	186	24.90	262	18.00	711	0.00	0	0.00	0	6.10	37	10.30	0	9.20	0	24.00	0	18.50	0	140.70	1,196														

cbg

APPENDIX C
Stone Beetland Sewer Master Plan
Project Sewer Flows

October 2022

Node	LDR ac	LDR ESD's	MDR ac	MDR ESD's	HDR ac	HDR ESD's	School ac	School ESD's	Mixed ac	Mixed ESD's	Comm ac	Comm ESD's	Public ac	Public ESD's	Park ac	Park ESD's	OS ac	OS ESD's	Major Road ac	Major Road ESD's	Total Area ac	Total ESD's	Flow Gen gpd/ESD	Qave mgd	Qave cfs	Qinf mgd	Peaking Factor	Q Peak DWF mgd	Q Peak PWWF mgd	Q Peak PWWF cfs	Diam in	Slope ft/ft	Flow Depth in	d/D ratio	Avg Velocity fps	Peak Velocity fps
LDR-1	17.40	100	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	17.40	100	310	0.031		0.017	1.80	0.056	0.073	0.11	-	-	-			-
LDR-2	7.50	54	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	7.50	54	310	0.017		0.008	1.80	0.030	0.038	0.06	-	-	-			-
LDR-3	4.80	31	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	4.80	31	310	0.010		0.005	1.80	0.017	0.022	0.03	-	-	-			-
MDR-1	0.00	0	15.00	151	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	15.00	151	232.5	0.035		0.015	1.80	0.063	0.078	0.12	-	-	-			-
MDR-2	0.00	0	9.90	111	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	9.90	111	232.5	0.026		0.010	1.80	0.046	0.056	0.09	-	-	-			-
HDR-1	0.00	0	0.00	0	5.40	241	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	5.40	241	232.5	0.056		0.005	1.80	0.101	0.106	0.16	-	-	-			-
HDR-2	0.00	0	0.00	0	5.30	198	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	5.30	198	232.5	0.046		0.005	1.80	0.083	0.088	0.14	-	-	-			-
HDR-3	0.00	0	0.00	0	7.30	272	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	7.30	272	232.5	0.063		0.007	1.80	0.114	0.121	0.19	-	-	-			-
CMU	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	6.10	37	0.00	0	0.00	0	0.00	0	0.00	0	6.10	37	310	0.011		0.006	1.80	0.021	0.027	0.04	-	-	-			-
PQP-RT	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	10.30	0	0.00	0	0.00	0	0.00	0	10.30	0	310	0.000		0.010	1.80	0.000	0.010	0.02	-	-	-			-
P	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	9.30	0	0.00	0	0.00	0	9.30	0	310	0.000		0.009	1.80	0.000	0.009	0.01	-	-	-			-
OS-G	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	12.70	0	0.00	0	12.70	0	310	0.000		0.013	1.80	0.000	0.013	0.02	-	-	-			-
OS-B	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	11.20	0	0.00	0	11.20	0	310	0.000		0.011	1.80	0.000	0.011	0.02	-	-	-			-
RW-EXT	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	4.70	0	4.70	0	310	0.000		0.005	1.80	0.000	0.005	0.01	-	-	-			-
RW-INT	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	13.80	0	13.80	0	310	0.000		0.014	1.80	0.000	0.014	0.02	-	-	-			-
Stone	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	**0.672**	**1.039**	-	-	-			-
Detroit	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	**0.127**	**0.197**	-	-	-			-
Corps	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	**0.685**	**1.060**	-	-	-			-
Total:	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	**1.484**	**2.296**	15"	0.0020	10.2"	0.68		2.58
Totals:	29.70	185	24.90	262	18.00	711	0.00	0	0.00	0	6.10	37	10.30	0	9.30	0	23.90	0	18.50	0	140.70	1,195						Total:	1.484	2.296						