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Memorandum

TO: Ms. Connie O'Neill, North Front Range Water Quality Planning Association

FROM: Ms. Mandy Rasmussen, Stewart Environmental Consultants, Inc.

DATE: October 7, 2008

SUBJECT: Basis of the Design Flow Rate Peaking Factor for the Saddler Ridge Metropolitan District Water Reclamation Facility, Severance, Colorado

PROJECT NO: 3953.002(2)

The projected residential population and wastewater flow rates through the 20-year planning period within the SRMD Service Area, by section, is shown in the following table.

Area Description	Dwelling Units	Capita	Design Average Flow Rate, Q (gpd)	Peaking Factor	Peak Hourly Flow Rate, Q_{peak} (gpd)
South half Section 9 (Saddler Arena)	149	447	44,700	4.00	178,745
North half Section 16	35	106	10,618	4.24	44,980
Section 10	495	1486	148,646	3.68	547,376
West half of section 11	177	531	53,088	3.96	210,266
Section 15	495	1486	148,646	3.68	547,376
West half of section 14	177	531	53,088	3.96	210,266
Section 22	602	1805	180,499	3.62	653,408
Section 23	425	1274	127,411	3.73	475,206
Section 25	179	538	53,760	3.96	212,773
Section 26 Low Density	283	849	84,941	3.84	326,562
Section 26 Medium Density	358	1075	107,520	3.78	406,369
Section 27	236	707	70,673	3.89	275,072
SRMD Service Area Through the 20-year plan	**3,612**	**10,836**	**1,083,591**	**3.77**	**4,088,397**

The following peaking factor equation is the industry standard for calculating the ratio of peak hourly flow rate to design average flow rate and is recommended for communities with between 100 and 100,000 people. This equation was originally published in 1954 in "Water Supply and Waste-water Disposal" by G.M. Fair and J.C. Geyer and later included in texts by Metcalf and Eddy.

$$Peaking\ \ Factor = \frac{Q_{peak\ hourly}}{Q_{design\ average}} = \frac{18 + \sqrt{\frac{capita}{1{,}000}}}{4 + \sqrt{\frac{capita}{1{,}000}}}$$

In the above projections table, this peaking factor equation is used for each section within the SRMD service area. For example, in Section 9 with a capita of 447, the peaking factor is 4.00.

$$Section\ Peaking\ \ Factor = \frac{18 + \sqrt{\frac{447}{1{,}000}}}{4 + \sqrt{\frac{447}{1{,}000}}} = 4.00$$

The overall peaking factor value, 3.77, used for all SRMD design work is the weighted average of these section peaking factors. This is calculated as the total peak hourly flow rate divided by the total design average flow rate.

$$Peaking\ \ Factor = \frac{4{,}088{,}397}{1{,}083{,}591} = 3.77$$

The NFRWQPA recommends an alternative equation for calculating the peaking factor with the maximum value used in any assessment as 5.0.

$$Peaking\ Factor_{NFRWQPA} = \frac{3.65}{(Average\ Flow\ Rate\ in\ MGD)^{0.167}}$$

With this equation, every flow rate below 0.15 MGD results in a peaking factor greater than 5.0. It was decided that the G.M. Fair equation was more accurate for small flow rates, such as those predicted within the SRMD.

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