Appendix F

Stormwater Management Data
SUSTIN SAND FILTER DESIGN

*FOR DESIGN, REFER TO WATER & LAND DEVELOPMENT MANUAL, SECTION 2.8

1) WQV = 0.75 x C x (A/12)
   C = 0.9 - ASSUME ALL HARD SURFACE
   A = DRAINAGE AREA (ACRES)
   A = 1786.43 - SF

   WQV = 0.75 x 0.9 x (1786.43/12) = 4459.46 CF

   SEDIMENT STORAGE VOLUME = 0.2 x WQV = 891.89 CF

   DRAINAGE AREA IS 9.1 AC. SINCE THIS IS REDEVELOPMENT, TREAT 20% FOR POST CONSTRUCTION QUALITY.

2) SEDIMENTATION CHAMBER DESIGN

   *FOR THIS DESIGN, A 60 INCH PIPE DIAMETER IS ASSUMED

   CHAMBER VOLUME = 5351.35 CF

   *EQUATION IS NOT APPLICABLE DUE TO USE OF CIRCULAR PIPE SYSTEM

   NOTE: THE 60 INCH DIAMETER UNDERGROUND PIPING SYSTEM IS USED TO PROVIDE THE SEDIMENTATION BASIN AND STORM WATER MANAGEMENT (PRE VS POST CONSTRUCTION).

   THE STORMWATER MANAGEMENT VOLUME (VOLUME DETAINED) IS:

   THIS PLUS THE SEDIMENTATION VOLUME = 5351 CF

   STEAM WATER IS DETAINED IN EXISTING DETENTION BASIN.

   AREA OF 60" PIPE = n x (60)^2 = 19.63 SF

   LENGTH OF 60" PIPE REQUIRED = 275 LF

3) FILTRATION CHAMBER DESIGN

   A = (WQV, + d) / (k x h) + d = 318.53 SF

   WQV = 4459.46 CF

   d = 3.5 FT - SAND FILTER BED DEPTH

   k = 3.5 FT/DAY - GIVEN

   h = 4.50 (2/3 MAX ALLOWABLE WATER COVER OVER FILTER [3 FT])

   318.53 / 186.7 = 1.706194

   t = 1 DAYS - GIVEN

   NUMBER OF FILTER UNITS = 2 FILTER UNITS
FILTRATION CHAMBER DESIGN

\[ A_f = \left( \frac{MQ}{V} \right) / \left( h_i + d_f \right) \times d_u = \]

\[ = 186.7 \text{ SF} \]

\[ \frac{6386.15}{386.7} = 34.21632 \]

\[ \frac{V}{M} = 59434.13 \text{ CF} \]

\[ h_i = 1.5 \text{ FT FOR SAND FILTER BED DEPTH} \]

\[ k = 3.5 \text{ FT/DAY} \] \(-\) \text{ GIVEN} \)

\[ h = 4.50 \text{ 1/2 MAX ALLOWABLE WATER DEPTH COVER OVER FILTER (5 FT)} \)

\[ \text{1 DAY} \] \(-\) \text{ GIVEN} \)

\[ \frac{34.21632}{3.5} = 9.776 \]

\[ \text{NUMBER OF FILTER UNITS} = 83 \]

\[ \text{FILTER UNITS} \]

\[ 35 \text{ PRECAST UNITS} - 10' \times 20' \text{ EACH} \]

\[ \text{WITH 9 FT HEAD WATER DEPTH} \]

\[ \text{CONSIDER CAST-IN-PLACE UNITS} \]

\[ \text{TOTAL REQ'D FILTER AREA} = 6386.15 \text{ SF} \]

\[ \text{TICK 3 UNITS} \rightarrow 6386.15 / 3 = 2130 \text{ SF EACH} \]

\[ \text{TICK} \ 75' \times 30' = 2250 \text{ SF} \]

\[ > 2130 \text{ SF} \] \(-\) \text{ ACCEPTABLE} \)

\[ 75' \times 20' \times 20' = 115' \]

\[ (30 \times 3) + (20 \times 4) = 170' \]

\[ \text{TOTAL AREA} = 115' \times 170' \]

30 AC AVIATION DEVELOPMENT (A1)
PLUS PART OF WEST SIDE PARALLEL TARIWAY
**JUSTIN SAND FILTER DESIGN**

**FOR DESIGN, REFER TO BANKE WATER & LAND DEVELOPMENT MANUAL, SECTION 2.0**

<table>
<thead>
<tr>
<th>WQV = 0.75 x C x (A/12)</th>
<th>C = 0.9 - ASSUME HARD SURFACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>A = DRAINAGE AREA (ACRES)</td>
<td>A = 178634.23 SF</td>
</tr>
<tr>
<td>3.76875 AC-FT</td>
<td>154166.75 CF</td>
</tr>
</tbody>
</table>

**SEDIMENTATION CHAMBER DESIGN**

**FOR THIS DESIGN, A 60 INCH PIPE DIAMETER IS ASSUMED**

**CHAMBER VOLUME = 197000 CF**

**EQUATION IS NOT APPLICABLE DUE TO USE OF CIRCULAR PIPE SYSTEM**

**NOTE:** THE 60 INCH DIAMETER UNDERGROUND PIPELINE SYSTEM IS USED TO PROVIDE THE SEDIMENTATION BASIN AND STORMWATER MANAGEMENT (PRE VS POST CONSTRUCTION).

THE STORMWATER MANAGEMENT VOLUME (VOLUME DETAINED) IS:

**235720 CF**

**THIS PLUS THE SEDIMENTATION VOLUME: 157000 CF**

**AREA OF 60" PIPE = π x (6/2)^2 = 19.63 SF**

**LENGTH OF 60" PIPE REQUIRED = 22010 LF**

**FILTRATION CHAMBER DESIGN**

**WQ, = 164166.75 CF**

<table>
<thead>
<tr>
<th>A = (WQ, / 10) / (h x h x 12) =</th>
<th>11726.20 SF</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 x 18.67                      =</td>
<td>186.7 SF</td>
</tr>
<tr>
<td>11726.20</td>
<td>62.807694</td>
</tr>
</tbody>
</table>

**NUMBER OF FILTER UNITS = 43 FILTER UNITS**

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**PIPE REQ'D**

432170 ÷ 19.63 = 22016 UF - 60" PIPE

432170 ÷ 28.27 = 15287 UF - 72" PIPE

USE 60" PIPE - ESTIMATE 18 ROWS

22016 ÷ 18 = 1224 UF PER ROW

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**FILTERS REQ'D**

63 PRECAST UNITS AT 10' x 20' EACH, W/9' HEAD, WATER TRY CAST-IN-PLACE FILTERS

**REQ'D FILTER AREA = 11727 SF**

**TRY 5 FILTERS 11727 / 5 = 2346 SF - OK**

**TRY 80' x 50' = 4000 SF > 2346 SF - OK**

80' x 20' = 1600

80 x 30 + 80 x 20 = 2720
1) WQV = 0.75 x C x [A/12]  
C = 0.9 - ASSUME ALL HARD SURFACE  
A = DRAINAGE AREA (ACRES)  
Diameter (FT) = 5 (60" PIPE)  
WQV = 0.3056.25 AC-FT  
SEDIMENT STORAGE VOLUME = 0.2 x WQV  
= 115.33 CF

3) SEDIMENTATION CHAMBER DESIGN  
*FOR THIS DESIGN, A 60 INCH PIPE DIAMETER IS ASSUMED*  
CHAMBER VOLUME = 19111.95 CF  
A₀ = (1.2 x WQV) / db = FREEBOARD  
*EQUATION IS NOT APPLICABLE DUE TO USE OF CIRCULAR PIPE SYSTEM*  
NOTE: THE 60 INCH DIAMETER UNDERGROUND PIPING SYSTEM IS USED TO PROVIDE THE SEDIMENTATION BASIN AND STORM WATER MANAGEMENT (PRE VS POST CONSTRUCTION).  
The Stormwater Management Volume (Volume Detained) is: 22815 CF  
This Plus the Sedimentation Volume: 19112 CF  
Gives a Total Required Volume in the 60 Inch Pipe System of: 41927 CF  
Area of 60" Pipe = π x r² = 19.63 SF  
LENGTH OF 60" PIPE REQUIRED = 2135 FT

Portion of west side parallel taxiway
1) WQV = 0.75 x C x (A/12)
   C = 0.9 - ASSUME ALL HARD SURFACE
   A = DRAINS AREA (ACRES)

   \[
   \text{WQV} = 1.6875 \text{ AC-FT} = 73507.50 \text{ CF}
   \]

   \[
   \text{SEDIMENT STORAGE VOLUME} = 0.2 \times \text{WQV} = 14701.50 \text{ CF}
   \]

2) SEDIMENTATION CHAMBER DESIGN

   \[
   \text{CHAMBER VOLUME} = 88209.00 \text{ CF}
   \]

   \[
   A_3 = \frac{1.1 \times \text{WQV}}{0.1 + \text{FREEBOARD}}
   \]

   *EQUATION IS NOT APPLICABLE DUE TO USE OF CIRCULAR PIPE SYSTEM

NOTE: THE 60 INCH DIA UNDERGROUN PIPES SYSTEM IS USED TO PROVIDE THE SEDIMENTATION BASIN AND STORM WATER MANAGEMENT (PRE VS POST CONSTRUCTION).

THE STORMWATER MANAGEMENT VOLUME (VOLUME DETAINED) IS GIVES A TOTAL REQUIRED VOLUME IN THE 60 INCH PIPE SYSTEM OF:

\[
105300 \text{ CF}
\]

\[
88209 \text{ CF}
\]

\[
193509 \text{ CF}
\]

\[
\text{AREA OF 60" PIPE} = \pi \times \text{d}^2 = 19.63 \text{ SF}
\]

\[
\text{LENGTH OF 60" PIPE REQUIRED} = 985.3 \text{ FT}
\]

\[
965.3 \text{ FT}
\]
WESTIN SAND FILTER DESIGN

*FOR DESIGN, REFER TO "RAINWATER & LAND DEVELOPMENT MANUAL" SECTION 2.3

\[
\text{WQV} = 0.75 \times C \times x (A/12)
\]

C = 0.9
A = 0.9
AC

\[
\text{Diameter (ft)} = 5 \times (60^\circ \text{ PIPE})
\]

\[
\text{WQV} = 2.025 \text{ AC-FT} = \frac{88209.00 \text{ CF}}{17643.80 \text{ CF}}
\]

\[
\text{Sedimentation Chamber Design}
\]

*FOR THIS DESIGN, A SQUARE PIPE DIAMETER IS ASSUMED

\[
\text{Chamber Volume} = 10585.00 \text{ CF}
\]

\[
A_z = \frac{3.2 \times \text{WQV}}{d_z + \text{FREEBOARD}}
\]

EQUATION IS NOT APPLICABLE DUE TO USE OF CIRCULAR PIPE SYSTEM

NOTE: THE 60 INCH DIAMETER UNDERGROUND PIPING SYSTEM IS USED TO PROVIDE THE SEDIMENTATION BASIN AND STORM WATER MANAGEMENT (PRE VS POST CONSTRUCTION).

THE STORMWATER MANAGEMENT VOLUME (VOLUME DETAINED) IS:

\[
128260.00 \text{ CF}
\]

THIS PLUS THE SEDIMENTATION VOLUME:

\[
10585.00 \text{ CF}
\]

GIVES A TOTAL REQUIRED VOLUME IN THE 60 INCH PIPE SYSTEM OF:

\[
234115.00 \text{ CF}
\]

\[
\text{Area of 60'' Pipe} = \pi \times (60^2) = 19.63 \text{ SF}
\]

\[
\text{Length of 60'' Pipe Required} = 11640 \text{ SF}
\]

\[
\text{Filtration Chamber Design}
\]

\[
A_z = \frac{(WQV + d_z)}{h_z (h_z + d_z)} = 6300.64 \text{ SF}
\]

\[
WQV = \frac{88209.00 \text{ CF}}{18.67} = 18.7 \text{ SF}
\]

\[
d_z = 1.5 \text{ FT FOR SAND FILTER BED DEPTH}
\]

\[
k_z = 3.5 \text{ FT/DAY - GIVEN}
\]

\[
h_z = 4.5 \text{ 1/2 MAX ALLOWABLE WATER DEPTH OVER FILTER (3 FT)}
\]

\[
t_z = 1 \text{ DAYS - GIVEN}
\]

\[
\text{Number of Filter Units} = 14 \text{ FILTER UNITS}
\]

PIPER REM'D
PRINT REMOVED 4.2 AC
4.2/30 = 0.117

0.117 x 126250 = 14742
126250 - 14742 = 111508
111508 + 105651 = 217160 CF

217160 / 19.63 = 11039 UF - 60', OR
217160 / 26.27 = 7693 UF - 72'
USE 60'' PIPE
11029 / 100 = 114 ROASTS
14 x 60 = 112' WIDE

FILTERS REM'D

34, PRECAST UNITS - 10' x 20' EA W/ 9' HEADWATER
CONSIDER CAST-IN-PLACE UNITS

RENEW'D FILTER AREA = 6501 SF

TRY 5 FILTERS AT 6501/3 = 2166.3 SF EACH

TRY 85' x 25' = 1225 SF > 2100.3 SF - OK

20
25
25
85'

(20 x 4)+ (20 x 5) = 155'
TOTAL AREA = 125' x 155'
1) WQV = 0.75 x C x (A/12)  
C = 0.9 - ASSUME ALL HARD SURFACE  
A = DRAINAGE AREA (ACRES)  
A = 1.78604 02 SF  
WQV = 0.45785 AC-FT  
SEDIMENT STORAGE VOLUME = 0.2 x WQV  
19111.95 CF  
1822.39 CF

3) SEDIMENTATION CHAMBER DESIGN  
FOR THE DESIGN, A ROUND PIPE DIAMETER IS ASSUMED  
CHAMBER VOLUME = 22934.4 CF  
A = (1.2 x WQV) / d + FREEBOARD  
EQUATION IS NOT APPLICABLE DUE TO USE OF CIRCULAR PIPE SYSTEM  
NOTE: THE 60 INCH DIAMETER UNDERGROUND PIPING SYSTEM IS USED TO PROVIDE THE SEDIMENTATION BASIN AND STORM WATER MANAGEMENT (PRE VS POST CONSTRUCTION).  
THE STORMWATER MANAGEMENT VOLUME (VOLUME DETAINED) IS:  
GIVES A TOTAL REQUIRED VOLUME IN THE 60 INCH PIPE SYSTEM OF:  
27378 CF  
THIS PLUS THE SEDIMENTATION VOLUME:  
50112 CF  
AREA OF 60" PIPE = n x 81 = 19.65 FS  
LENGTH OF 60" PIPE REQUIRED = 2562 FT

6) FILTRATION CHAMBER DESIGN  
A = (WQ x d) / (h x d x e) = 1365.14 SF  
WQ = 19111.95 CF  
A = 3.5 FT FOR SAND FILTER BED DEPTGH  
h = 3.5 FT/DAY - GIVEN  
h = 4.50/1 1/2 MAX ALLOWABLE WATER DEPTH COVER OVER FILTER (9 FT)  
1365.14 / 186.7 = 7.313405  
NUMBER OF FILTER UNITS = FILTER UNITS

FILTERS BEG'D  
8 PRECAST UNITS 10'X20' EACH W/ 9' HEADWATER 
TRY CAST IN PLACE  
TOTAL REQ'D FILTER AREA = 13660 SF  
ESTIMATE 2 UNITS -- 13660 / 2 = 683 SF  
TRY 50'X15' FILTER = 750 SF > 683 SF -- OK  
USE 2 UNITS AT 50'X15'  
50' X 15' (50 X 15) X 150' = 90'  
USE 90'X90' ARENA
WQV = 0.75 \times \frac{A}{C} = 4.12

\begin{align*}
C &= 0.9 - \text{ASSUME ALL HARD SURFACE} \\
A &= \text{DRAINAGE AREA (ACRES)} \\
A &= 178634.25 \text{ SF}
\end{align*}

WQV = 0.2925 \text{ AC FT} = 1274.30 \text{ CF}

\text{SEDIMENT STORAGE VOLUME} = 0.2 \times \text{WQV} = 2548.60 \text{ CF}

\text{SEDIMENTATION CHAMBER DESIGN}

*FOR THIS DESIGN, ALL 60 INCH PIPE DIAMETER IS ASSUMED

\text{CHAMBER VOLUME} = 15290.56 \text{ CF}

A_v = (1.2 \times \text{WQV}) / ds + \text{FREEBOARD}

\text{*EQUATION IS NOT APPLICABLE DUE TO USE OF CIRCULAR PIPE SYSTEM}

\text{NOTE: THE 60 INCH DIAMETER UNDERGROUND PIPING SYSTEM IS USED TO PROVIDE THE SEDIMENTATION BASIN AND STORM WATER MANAGEMENT (PRE VS POST CONSTRUCTION). THE STORMWATER MANAGEMENT VOLUME (VOLUME DETAINED) IS: 18252 CF THIS PLUS THE SEDIMENTATION VOLUME: 15290 CF GIVES A TOTAL REQUIRED VOLUME IN THE 60 INCH PIPE SYSTEM OF: 33542 CF}

\text{AREA OF 60" PIPE} = \pi \times (0.5)^2 = 19.63 \text{ SF}

\text{LENGTH OF 60" PIPE REQUIRED} = 3108 \text{ LF}

\text{USE 3 ROLLS OF 60" PIPE, 570 LF EACH}

\text{FILTRATION CHAMBER DESIGN}

A_v = (WQV \times \text{d}) / (h \times (h + \text{d}) \times 3.3)

\begin{align*}
WQV &= 12741.30 \text{ CF} \\
A_v &= 3.5 \text{ FT FOR SAND FILTER BED DEPTH} \\
k &= 3.5 \text{ FT/DAY - GIVEN} \\
h &= 6.50 \text{ 1/2 MAX ALLOWABLE WATER DEPTH COVER OVER FILTER (9 FT)} \\
l_1 &= 1 \text{ DAYS - GIVEN}
\end{align*}

\text{NUMBERS OF FILTER UNITS: 1 FILTER UNIT USD}

\text{FOOTPRINT} = 110' \times 40'
JUSTIN SAND FILTER DESIGN

WQV = 0.75 x C x (A/12)

C = 0.9 - ASSUME ALL HARD SURFACE
A = DRAINAGE AREA (ACRES)

A = 178634.23 SF

C = 0.9

WQV = 0.75 x 0.9 x (178634.23/12) = 12251.25 CF

CHAMBER (FT) = 5 (60" PIPE)

SEDIMENT STORAGE VOLUME = 0.2 x WQV = 2450.25 CF

SEDIMENTATION CHAMBER DESIGN

*FOR THIS DESIGN, A MINIMUM PIPE DIAMETER IS ASSUMED

CHAMBER VOLUME = 14701.50 CF

A = (1.2 x WQV) / dh = FREEBOARD

EQUATION IS NOT APPLICABLE DUE TO USE OF CIRCULAR PIPE SYSTEM

NOTE: THE 60 INCH DIAMETER UNDERGROUND PIPING SYSTEM IS USED TO PROVIDE THE SEDIMENTATION BASIN AND STORM WATER MANAGEMENT (PRE VS POST CONSTRUCTION).

THE STORMWATER MANAGEMENT VOLUME [VOLUME DETAINED] IS:

17750 CF

THIS PLUS THE SEDIMENTATION VOLUME = 14702 CF

AREA OF 60" PIPE = πr² = 19.63 SF

LENGTH OF 60" PIPE REQUIRED = 1644 ft

FOR 3 ROWS OF 60" PIPE, USE 5430 LF PIPE ROW

FILTRATION CHAMBER DESIGN

A = (WQD x d) / (x x h x d) = 875.09 SF

WQD = 12513.25 CF

d = 1.5 FT FOR SAND FILTER BED DEPTH

k = 2.5 FT/DAY - GIVEN

h = 4.50 1/2 MAX ALLOWABLE WATER DEPTH COVER OVER FILTER (9 FT)

t = 1 DAYS - GIVEN

NUMBER OF FILTER UNITS = 3 FILTER UNITS
JUSTIN SAND FILTER DESIGN

WQV = 0.75 x C x (A/12)
WQV = 0.14625 AC-FT = 6370.65 CF

SEDIMENTATION CHAMBER DESIGN
CHAMBER VOLUME = 7644.78 CF

FILTRATION CHAMBER DESIGN

For 60" pipe: Use 2 Pools @ 430 CF each
For Filters: Use 3 Precast Units, 10' x 20' each