# POND 1 DETENTION & OUTFALL CALCULATIONS

## Graphical Hydrograph Method for Stormwater Detention
**Mansions Family - Rockwall, Texas**
**2 Year Detention Calculations**

**Purpose:** Use the graphical hydrograph method to determine the volume of stormwater storage needed to compensate for increased runoff due to development.

**Method:** Use the Rational Method to determine maximum rate of runoff

Q = c*I*A  Where: c = Runoff Coefficient; I = Rainfall Intensity (in/hr); A = Drainage Area (acres)

**Assumptions:** Rainfall Intensity determined from attached graph given Time of Concentration (Tc) or Duration and the Return Period of the storm.

**For Existing Conditions:** Allowable release rate is based upon 20 minute, 2 year storm event for undeveloped flows where c = 0.30, I = 0.60 in./hr.

**For Proposed Conditions:** Use c = 0.75 for multi-family development

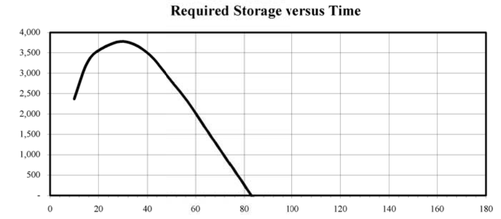
**I. Determination of Allowable Release Rate - Existing Site**

| | | |
|---|---|---|
| Total site area | 2.25 | acres |
| Detained Time of Concentration ($T_c$) | 20 | minutes |
| Rainfall intensity for two year storm ($T_c$=20 min) | 3.59 | inches/hr |
| Detained runoff coefficient | 0.35 | |
| **Max. Allowable release rate** | **2.07** | cfs |
| Area of site draining through detention pond | 2.25 | acres |
| Area of site draining undetained | 0.00 | acres |
| Undetained Time of Concentration ($T_c$) | 10 | minutes |
| Rainfall intensity for two year storm ($T_c$=10 min) | 6.74 | inches/hr |
| Runoff coefficient for developed conditions | 0.75 | |
| **Runoff from undetained area** | **0.00** | cfs |
| Total off-site area passed through | 0.00 | acres |
| Time of Concentration ($T_c$) | 20 | minutes |
| Rainfall intensity for two year storm ($T_c$=20 min) | 3.59 | inches/hr |
| Runoff coefficient | 0.30 | |
| **Off-site pass-through rate** | **0.00** | cfs |
| **Total release rate from detention pond** | **2.07** | cfs |
| **Metered release rate from detention pond** | **4.82** | cfs |

**II. Required Storage Calculations, Return Period = 2 years**

| Duration (hours) | Duration (min) | Rainfall Intensity (in/hr) | Inflow Rate (cfs) | Inflow Volume (cf) | Outflow Rate (cfs) | Outflow Volume (cf) | Inflow - Outflow Volume (cf) | Required Storage (ac-ft) |
|---|---|---|---|---|---|---|---|---|
| 0.17 | 10 | 5.20 | 8.8 | 5,265 | 4.82 | 2,893 | 2,372 | 0.054 |
| 0.25 | 15 | 4.40 | 7.6 | 6,834 | 4.82 | 3,616 | 3,218 | 0.074 |
| 0.33 | 20 | 3.90 | 6.6 | 7,898 | 4.82 | 4,339 | 3,558 | 0.082 |
| **0.50** | **30** | **3.15** | **5.3** | **9,568** | **4.82** | **5,786** | **3,783** | **0.087** |
| 0.67 | 40 | 2.65 | 4.5 | 10,710 | 4.82 | 7,232 | 3,501 | 0.080 |
| 0.83 | 50 | 2.27 | 3.8 | 11,492 | 4.82 | 8,678 | 2,814 | 0.065 |
| 1.00 | 60 | 2.00 | 3.4 | 12,150 | 4.82 | 10,125 | 2,025 | 0.046 |
| 2.00 | 120 | 1.25 | 2.1 | 15,188 | 4.82 | 18,803 | -3,615 | -0.083 |
| 3.00 | 180 | 0.88 | 1.5 | 16,038 | 4.82 | 27,481 | -11,443 | -0.263 |
| 4.00 | 240 | 0.71 | 1.2 | 17,253 | 4.82 | 36,159 | -18,906 | -0.434 |
| 5.00 | 300 | 0.60 | 1.0 | 18,225 | 4.82 | 44,838 | -26,613 | -0.611 |
| 6.00 | 360 | 0.52 | 0.9 | 18,954 | 4.82 | 53,516 | -34,562 | -0.793 |
| 12.00 | 720 | 0.30 | 0.5 | 21,870 | 4.82 | 105,585 | -83,715 | -1.922 |

**Stormwater Detention Calculations**
**Required Storage versus Time**




## Graphical Hydrograph Method for Stormwater Detention
**Mansions Family - Rockwall, Texas**
**10 Year Detention Calculations**

**Purpose:** Use the graphical hydrograph method to determine the volume of stormwater storage needed to compensate for increased runoff due to development.

**Method:** Use the Rational Method to determine maximum rate of runoff

Q = c*I*A  Where: c = Runoff Coefficient; I = Rainfall Intensity (in/hr); A = Drainage Area (acres)

**Assumptions:** Rainfall Intensity determined from attached graph given Time of Concentration (Tc) or Duration and the Return Period of the storm.

**For Existing Conditions:** Allowable release rate is based upon 20 minute, 10 year storm event for undeveloped flows where c = 0.30, I = 7.20 in./hr.

**For Proposed Conditions:** Use c = 0.75 for multi-family development

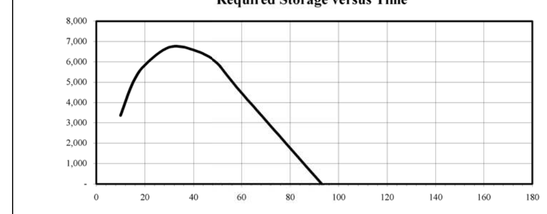
**I. Determination of Allowable Release Rate - Existing Site**

| | | |
|---|---|---|
| Total site area | 2.25 | acres |
| Detained Time of Concentration ($T_c$) | 20 | minutes |
| Rainfall intensity for ten year storm ($T_c$=20 min) | 4.84 | inches/hr |
| Detained runoff coefficient | 0.35 | |
| **Max. Allowable release rate** | **4.57** | cfs |
| Area of site draining through detention pond | 2.25 | acres |
| Area of site draining undetained | 0.00 | acres |
| Undetained Time of Concentration ($T_c$) | 10 | minutes |
| Rainfall intensity for ten year storm ($T_c$=10 min) | 9.08 | inches/hr |
| Runoff coefficient for developed conditions | 0.75 | |
| **Runoff from undetained area** | **0.00** | cfs |
| Total off-site area passed through | 0.00 | acres |
| Time of Concentration ($T_c$) | 20 | minutes |
| Rainfall intensity for ten year storm ($T_c$=20 min) | 4.84 | inches/hr |
| Runoff coefficient | 0.30 | |
| **Off-site pass-through rate** | **0.00** | cfs |
| **Total release rate from detention pond** | **4.57** | cfs |
| **Metered release rate from detention pond** | **6.55** | cfs |

**II. Required Storage Calculations, Return Period = 10 years**

| Duration (hours) | Duration (min) | Rainfall Intensity (in/hr) | Inflow Rate (cfs) | Inflow Volume (cf) | Outflow Rate (cfs) | Outflow Volume (cf) | Inflow - Outflow Volume (cf) | Required Storage (ac-ft) |
|---|---|---|---|---|---|---|---|---|
| 0.17 | 10 | 7.20 | 12.2 | 7,290 | 6.55 | 3,929 | 3,362 | 0.077 |
| 0.25 | 15 | 6.00 | 11.0 | 9,872 | 6.55 | 5,893 | 3,979 | 0.091 |
| 0.33 | 20 | 5.00 | 9.8 | 11,745 | 6.55 | 7,858 | 3,852 | 0.134 |
| **0.50** | **30** | **4.00** | **8.1** | **14,580** | **6.55** | **7,857** | **6,723** | **0.154** |
| 0.67 | 40 | 4.05 | 6.8 | 16,403 | 6.55 | 9,821 | 6,581 | 0.151 |
| 0.83 | 50 | 3.50 | 5.9 | 17,719 | 6.55 | 11,786 | 5,933 | 0.136 |
| 1.00 | 60 | 3.00 | 5.1 | 18,225 | 6.55 | 13,750 | 4,475 | 0.103 |
| 2.00 | 120 | 1.80 | 3.0 | 21,870 | 6.55 | 25,515 | -3,645 | -0.084 |
| 3.00 | 180 | 1.40 | 2.4 | 25,515 | 6.55 | 37,321 | -11,806 | -0.271 |
| 4.00 | 240 | 1.15 | 1.9 | 27,945 | 6.55 | 49,106 | -21,161 | -0.486 |
| 5.00 | 300 | 0.93 | 1.6 | 28,249 | 6.55 | 60,892 | -32,643 | -0.749 |
| 6.00 | 360 | 0.80 | 1.4 | 29,160 | 6.55 | 72,677 | -43,517 | -0.999 |
| 12.00 | 720 | 0.47 | 0.8 | 34,263 | 6.55 | 143,390 | -109,127 | -2.505 |

**Stormwater Detention Calculations**
**Required Storage versus Time**




## Graphical Hydrograph Method for Stormwater Detention
**Mansions Family - Rockwall, Texas**
**25 Year Detention Calculations**

**Purpose:** Use the graphical hydrograph method to determine the volume of stormwater storage needed to compensate for increased runoff due to development.

**Method:** Use the Rational Method to determine maximum rate of runoff

Q = c*I*A  Where: c = Runoff Coefficient; I = Rainfall Intensity (in/hr); A = Drainage Area (acres)

**Assumptions:** Rainfall Intensity determined from attached graph given Time of Concentration (Tc) or Duration and the Return Period of the storm.

**For Existing Conditions:** Allowable release rate is based upon 20 minute, 25 year storm event for undeveloped flows where c = 0.30, I = 6.75 in./hr.

**For Proposed Conditions:** Use c = 0.75 for multi-family development

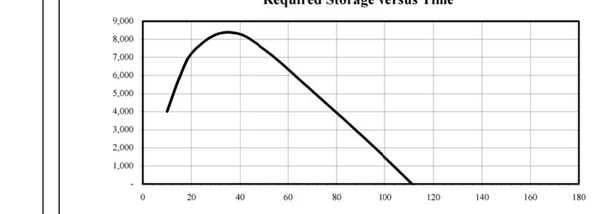
**I. Determination of Allowable Release Rate - Existing Site**

| | | |
|---|---|---|
| Total site area | 2.25 | acres |
| Detained Time of Concentration ($T_c$) | 20 | minutes |
| Rainfall intensity for twenty-five year storm ($T_c$=20 min) | 6.75 | inches/hr |
| Detained runoff coefficient | 0.35 | |
| **Max. Allowable release rate** | **5.32** | cfs |
| Area of site draining through detention pond | 2.25 | acres |
| Area of site draining undetained | 0.00 | acres |
| Undetained Time of Concentration ($T_c$) | 10 | minutes |
| Rainfall intensity for twenty-five year storm ($T_c$=10 min) | 8.50 | inches/hr |
| Runoff coefficient for developed conditions | 0.75 | |
| **Runoff from undetained area** | **0.00** | cfs |
| Total off-site area passed through | 0.00 | acres |
| Time of Concentration ($T_c$) | 20 | minutes |
| Rainfall intensity for twenty-five year storm ($T_c$=20 min) | 6.75 | inches/hr |
| Runoff coefficient | 0.30 | |
| **Off-site pass-through rate** | **0.00** | cfs |
| **Total release rate from detention pond** | **5.32** | cfs |
| **Metered release rate from detention pond** | **7.17** | cfs |

**II. Required Storage Calculations, Return Period = 25 years**

| Duration (hours) | Duration (min) | Rainfall Intensity (in/hr) | Inflow Rate (cfs) | Inflow Volume (cf) | Outflow Rate (cfs) | Outflow Volume (cf) | Inflow - Outflow Volume (cf) | Required Storage (ac-ft) |
|---|---|---|---|---|---|---|---|---|
| 0.17 | 10 | 8.20 | 13.8 | 8,303 | 7.17 | 4,299 | 4,003 | 0.092 |
| 0.25 | 15 | 7.40 | 12.5 | 11,239 | 7.17 | 5,374 | 5,865 | 0.135 |
| 0.33 | 20 | 6.75 | 11.4 | 13,669 | 7.17 | 6,449 | 7,220 | 0.166 |
| 0.50 | 30 | 5.55 | 9.4 | 16,858 | 7.17 | 8,599 | 8,259 | 0.190 |
| **0.67** | **40** | **4.75** | **7.9** | **19,035** | **7.17** | **10,748** | **8,287** | **0.190** |
| 0.83 | 50 | 4.02 | 6.8 | 20,351 | 7.17 | 12,898 | 7,453 | 0.171 |
| 1.00 | 60 | 3.52 | 5.9 | 21,384 | 7.17 | 15,048 | 6,336 | 0.145 |
| 2.00 | 120 | 2.20 | 3.7 | 26,730 | 7.17 | 27,946 | -1,216 | -0.028 |
| 3.00 | 180 | 1.65 | 2.8 | 30,031 | 7.17 | 40,844 | -10,773 | -0.247 |
| 4.00 | 240 | 1.35 | 2.3 | 32,805 | 7.17 | 53,742 | -20,937 | -0.481 |
| 5.00 | 300 | 1.15 | 1.9 | 34,931 | 7.17 | 66,640 | -31,709 | -0.728 |
| 6.00 | 360 | 0.96 | 1.6 | 34,992 | 7.17 | 79,538 | -44,546 | -1.023 |
| 12.00 | 720 | 0.55 | 0.9 | 40,095 | 7.17 | 156,927 | -116,832 | -2.682 |

**Stormwater Detention Calculations**
**Required Storage versus Time**




## Graphical Hydrograph Method for Stormwater Detention
**Mansions Family - Rockwall, Texas**
**50 Year Detention Calculations**

**Purpose:** Use the graphical hydrograph method to determine the volume of stormwater storage needed to compensate for increased runoff due to development.

**Method:** Use the Rational Method to determine maximum rate of runoff

Q = c*I*A  Where: c = Runoff Coefficient; I = Rainfall Intensity (in/hr); A = Drainage Area (acres)

**Assumptions:** Rainfall Intensity determined from attached graph given Time of Concentration (Tc) or Duration and the Return Period of the storm.

**For Existing Conditions:** Allowable release rate is based upon 20 minute, 50 year storm event for undeveloped flows where c = 0.30, I = 7.40 in./hr.

**For Proposed Conditions:** Use c = 0.75 for multi-family development

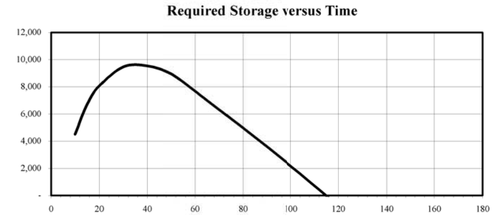
**I. Determination of Allowable Release Rate - Existing Site**

| | | |
|---|---|---|
| Total site area | 2.25 | acres |
| Detained Time of Concentration ($T_c$) | 20 | minutes |
| Rainfall intensity for fifty year storm ($T_c$=20 min) | 7.40 | inches/hr |
| Detained runoff coefficient | 0.35 | |
| **Max. Allowable release rate** | **5.83** | cfs |
| Area of site draining through detention pond | 2.25 | acres |
| Area of site draining undetained | 0.00 | acres |
| Undetained Time of Concentration ($T_c$) | 10 | minutes |
| Rainfall intensity for fifty year storm ($T_c$=10 min) | 9.30 | inches/hr |
| Runoff coefficient for developed conditions | 0.75 | |
| **Runoff from undetained area** | **0.00** | cfs |
| Total off-site area passed through | 0.00 | acres |
| Time of Concentration ($T_c$) | 20 | minutes |
| Rainfall intensity for fifty year storm ($T_c$=20 min) | 7.40 | inches/hr |
| Runoff coefficient | 0.30 | |
| **Off-site pass-through rate** | **0.00** | cfs |
| **Total release rate from detention pond** | **5.83** | cfs |
| **Metered release rate from detention pond** | **7.68** | cfs |

**II. Required Storage Calculations, Return Period = 50 years**

| Duration (hours) | Duration (min) | Rainfall Intensity (in/hr) | Inflow Rate (cfs) | Inflow Volume (cf) | Outflow Rate (cfs) | Outflow Volume (cf) | Inflow - Outflow Volume (cf) | Required Storage (ac-ft) |
|---|---|---|---|---|---|---|---|---|
| 0.17 | 10 | 9.00 | 13.2 | 8,910 | 7.68 | 4,607 | 4,306 | 0.103 |
| 0.25 | 15 | 8.00 | 13.8 | 12,454 | 7.68 | 5,758 | 6,696 | 0.154 |
| 0.33 | 20 | 7.40 | 12.5 | 14,985 | 7.68 | 6,910 | 8,075 | 0.185 |
| 0.50 | 30 | 6.15 | 10.4 | 18,681 | 7.68 | 9,213 | 9,468 | 0.217 |
| **0.67** | **40** | **5.20** | **8.8** | **21,060** | **7.68** | **11,516** | **9,544** | **0.219** |
| 0.83 | 50 | 4.50 | 7.6 | 22,781 | 7.68 | 13,820 | 8,962 | 0.206 |
| 1.00 | 60 | 3.92 | 6.6 | 23,814 | 7.68 | 16,123 | 7,691 | 0.177 |
| 2.00 | 120 | 2.40 | 4.1 | 29,160 | 7.68 | 29,942 | -782 | -0.018 |
| 3.00 | 180 | 1.80 | 3.0 | 32,805 | 7.68 | 43,762 | -10,957 | -0.252 |
| 4.00 | 240 | 1.45 | 2.4 | 35,235 | 7.68 | 57,581 | -22,346 | -0.513 |
| 5.00 | 300 | 1.30 | 2.2 | 39,488 | 7.68 | 71,401 | -31,913 | -0.733 |
| 6.00 | 360 | 1.15 | 1.9 | 41,918 | 7.68 | 85,220 | -43,303 | -0.994 |
| 12.00 | 720 | 0.63 | 1.1 | 45,927 | 7.68 | 168,137 | -122,210 | -2.806 |

**Stormwater Detention Calculations**
**Required Storage versus Time**




## Graphical Hydrograph Method for Stormwater Detention
**Seniors - Rockwall, Texas**
**100 Year Detention Calculations - Pond 1**

**Purpose:** Use the graphical hydrograph method to determine the volume of stormwater storage needed to compensate for increased runoff due to development.

**Method:** Use the Rational Method to determine maximum rate of runoff

Q = c*I*A  Where: c = Runoff Coefficient; I = Rainfall Intensity (in/hr); A = Drainage Area (acres)

**Assumptions:** Rainfall Intensity determined from attached graph given Time of Concentration (Tc) or Duration and the Return Period of the storm.

**For Existing Conditions:** Allowable release rate is based upon 20 minute, 100 year storm event for undeveloped flows where c = 0.35, I = 8.30 in./hr.

**For Proposed Conditions:** Use c = 0.75 for multi-family development

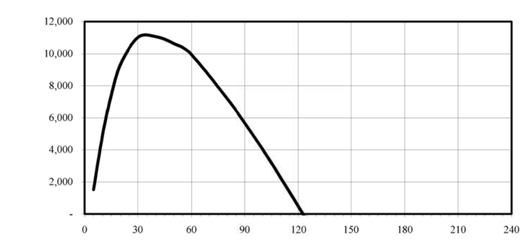
**I. Determination of Allowable Release Rate - Existing Site**

| | | |
|---|---|---|
| Total site area | 2.25 | acres |
| Detained Time of Concentration ($T_c$) | 20 | minutes |
| Rainfall intensity for one-hundred year storm ($T_c$=20 min) | 8.30 | inches/hr |
| Detained runoff coefficient | 0.35 | |
| **Max. Allowable release rate** | **6.54** | cfs |
| Area of site draining through detention pond 1 | 2.25 | acres |
| Area of site draining undetained | 0.00 | acres |
| Undetained Time of Concentration ($T_c$) | 10 | minutes |
| Rainfall intensity for one-hundred year storm ($T_c$=10 min) | 9.80 | inches/hr |
| Runoff coefficient for developed conditions | 0.75 | |
| **Runoff from undetained area** | **0.00** | cfs |
| Total off-site area passed through | 0.00 | acres |
| Time of Concentration ($T_c$) | 20 | minutes |
| Rainfall intensity for one-hundred year storm ($T_c$=20 min) | 8.30 | inches/hr |
| Runoff coefficient | 0.35 | |
| **Off-site pass-through rate** | **0.00** | cfs |
| **Total allowable release rate from detention pond** | **6.54** | cfs |
| **Metered release rate from detention pond** | **8.29** | cfs |
| **Release from Pond 1 to be accounted for in Pond 2** | **1.75** | cfs |

**II. Required Storage Calculations, Return Period = 100 years**

| Duration (hours) | Duration (min) | Rainfall Intensity (in/hr) | Inflow Rate (cfs) | Inflow Volume (cf) | Outflow Rate (cfs) | Outflow Volume (cf) | Inflow - Outflow Volume (cf) | Required Storage (ac-ft) |
|---|---|---|---|---|---|---|---|---|
| 0.08 | 5 | 10.37 | 17.3 | 5,250 | 8.29 | 2,731 | 1,519 | 0.035 |
| 0.17 | 10 | 9.80 | 16.5 | 9,923 | 8.29 | 4,974 | 4,949 | 0.114 |
| 0.25 | 15 | 9.00 | 15.2 | 13,669 | 8.29 | 6,218 | 7,451 | 0.171 |
| 0.33 | 20 | 8.30 | 14.0 | 16,808 | 8.29 | 7,461 | 9,347 | 0.215 |
| 0.50 | 30 | 6.90 | 11.6 | 20,959 | 8.29 | 9,948 | 11,011 | 0.253 |
| **0.67** | **40** | **5.80** | **9.8** | **23,490** | **8.29** | **12,435** | **11,055** | **0.254** |
| 0.83 | 50 | 5.05 | 8.5 | 25,566 | 8.29 | 14,922 | 10,644 | 0.244 |
| 1.00 | 60 | 4.50 | 7.6 | 27,338 | 8.29 | 17,409 | 9,929 | 0.228 |
| 1.50 | 90 | 3.35 | 5.7 | 30,527 | 8.29 | 24,870 | 5,657 | 0.130 |
| 2.00 | 120 | 2.70 | 4.6 | 32,805 | 8.29 | 32,331 | 474 | 0.011 |
| 3.00 | 180 | 2.00 | 3.4 | 36,450 | 8.29 | 47,253 | -10,803 | -0.248 |
| 4.00 | 240 | 1.65 | 2.8 | 40,095 | 8.29 | 62,175 | -22,080 | -0.507 |

**Stormwater Detention Calculations - Pond 1**
**Required Storage versus Time**




## Pond #1 Outfall Calculations

**Purpose:** Provide metered flow that meets multiple storm event release rate restrictions.

**Method:** Use multiple plate openings and utilize weir flow and orifice flow calculations to determine total outflow as a product of pond depth.

**Goal:** Water surface elevation based upon volume required

| | | | |
|---|---|---|---|
| 2-yr storm requires | *3,783* | sf storage, which occurs at elev | 544.88 |
| 10-yr storm requires | *6,723* | sf storage, which occurs at elev | 545.42 |
| 25-yr storm requires | *8,287* | sf storage, which occurs at elev | 545.70 |
| 50-yr storm requires | *9,544* | sf storage, which occurs at elev | 545.90 |
| 100-yr storm requires | *11,055* | sf storage, which occurs at elev | 546.09 |

**Where:** Use weir equation to determine flow until opening is submerged.
Q = C*b*H^(3/2)
C = discharge coefficient = 2.68
b = weir base width
H = water level height above base of weir

Use orifice equation to determine flow once opening is submerged.
Q = A*C*(2g*h)^(1/2)
A = area of opening  1st Orifice 2nd Orifice 3rd Orifice
C = discharge coefficient = 0.8 0.6 0.6
h = water level height above center of opening

| Opening 1 | Opening 2 | Opening 3 |
|---|---|---|
| b = 1.00 ft | b = 1.145 ft | b = 0 ft |
| Height = 0.500 ft | Height = 0.500 ft | Height = 0.000 ft |
| A = 0.50 SF | A = 0.57 SF | A = 0.00 SF |
| Invert= 543.50 ft | Invert= 544.50 ft | se elev = 547.00 ft |

| WSEL | Weir H1 | Weir Q1 | Orifice h1 | Orifice Q1 | Weir H2 | Weir Q2 | Orifice h2 | Orifice Q2 | Qtotal | Event | Q allow | Qtotal |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 543.50 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| 543.55 | 0.05 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | | | |
| 543.60 | 0.10 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | | | |
| 543.70 | 0.20 | 0.24 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.24 | | | |
| 543.80 | 0.30 | 0.44 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.44 | | | |
| 543.90 | 0.40 | 0.68 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.68 | | | |
| 544.00 | 0.50 | 0.95 | 0.25 | 1.60 | 0.00 | 0.00 | 0.00 | 0.00 | 1.60 | | | |
| 544.10 | 0.60 | 0.96 | 0.35 | 1.90 | 0.00 | 0.00 | 0.00 | 0.00 | 1.90 | | | |
| 544.20 | 0.70 | 0.96 | 0.45 | 2.15 | 0.00 | 0.00 | 0.00 | 0.00 | 2.15 | | | |
| 544.30 | 0.80 | 0.96 | 0.55 | 2.38 | 0.00 | 0.00 | 0.00 | 0.00 | 2.38 | | | |
| 544.40 | 0.90 | 0.96 | 0.65 | 2.59 | 0.00 | 0.00 | 0.00 | 0.00 | 2.59 | | | |
| 544.50 | 1.00 | 0.96 | 0.75 | 2.78 | 0.00 | 0.00 | 0.00 | 0.00 | 2.78 | | | |
| 544.60 | 1.10 | 0.96 | 0.85 | 2.96 | 0.10 | 0.10 | 0.00 | 0.00 | 3.06 | | | |
| 544.70 | 1.20 | 0.96 | 0.95 | 3.13 | 0.20 | 0.27 | 0.00 | 0.00 | 3.40 | | | |
| 544.80 | 1.30 | 0.96 | 1.05 | 3.29 | 0.30 | 0.50 | 0.00 | 0.00 | 3.79 | | | |
| 544.85 | 1.35 | 0.96 | 1.10 | 3.37 | 0.35 | 0.64 | 0.00 | 0.00 | 4.00 | | | |
| 544.90 | 0.00 | 0.00 | 1.15 | 3.44 | 0.40 | 0.78 | 0.00 | 0.00 | 4.22 | 2-Year | 4.82 | 4.22 |
| 545.00 | 0.00 | 0.00 | 1.25 | 3.59 | 0.00 | 0.00 | 0.25 | 1.38 | 4.97 | | | |
| 545.10 | 0.00 | 0.00 | 1.35 | 3.73 | 0.00 | 0.00 | 0.35 | 1.63 | 5.36 | | | |
| 545.20 | 0.00 | 0.00 | 1.45 | 3.87 | 0.00 | 0.00 | 0.45 | 1.85 | 5.71 | | | |
| 545.30 | 0.00 | 0.00 | 1.55 | 4.00 | 0.00 | 0.00 | 0.55 | 2.04 | 6.04 | | | |
| 545.40 | 0.00 | 0.00 | 1.65 | 4.12 | 0.00 | 0.00 | 0.65 | 2.22 | 6.35 | 10-Year | 6.55 | 6.35 |
| 545.50 | 0.00 | 0.00 | 1.75 | 4.25 | 0.00 | 0.00 | 0.75 | 2.39 | 6.63 | | | |
| 545.60 | 0.00 | 0.00 | 1.85 | 4.37 | 0.00 | 0.00 | 0.85 | 2.54 | 6.91 | | | |
| 545.70 | 0.00 | 0.00 | 1.95 | 4.48 | 0.00 | 0.00 | 0.95 | 2.69 | 7.17 | 25-Year | 7.17 | 7.17 |
| 545.80 | 0.00 | 0.00 | 2.05 | 4.60 | 0.00 | 0.00 | 1.05 | 2.82 | 7.42 | | | |
| 545.90 | 0.00 | 0.00 | 2.15 | 4.71 | 0.00 | 0.00 | 1.15 | 2.96 | 7.66 | 50-Year | 7.68 | 7.66 |
| 545.95 | 0.00 | 0.00 | 2.20 | 4.76 | 0.00 | 0.00 | 1.20 | 3.02 | 7.78 | | | |
| 546.00 | 0.00 | 0.00 | 2.25 | 4.81 | 0.00 | 0.00 | 1.25 | 3.08 | 7.90 | | | |
| 546.10 | 0.00 | 0.00 | 2.35 | 4.92 | 0.00 | 0.00 | 1.35 | 3.20 | 8.12 | 100-Year | 8.29 | 8.12 |
| 546.20 | 0.00 | 0.00 | 2.45 | 5.02 | 0.00 | 0.00 | 1.45 | 3.32 | 8.34 | | | |
| 546.30 | 0.00 | 0.00 | 2.55 | 5.13 | 0.00 | 0.00 | 1.55 | 3.43 | 8.56 | | | |
| 546.40 | 0.00 | 0.00 | 2.65 | 5.23 | 0.00 | 0.00 | 1.65 | 3.54 | 8.77 | | | |
| 546.50 | 0.00 | 0.00 | 2.75 | 5.32 | 0.00 | 0.00 | 1.75 | 3.65 | 8.97 | | | |
| 546.60 | 0.00 | 0.00 | 2.85 | 5.42 | 0.00 | 0.00 | 1.85 | 3.75 | 9.17 | | | |
| 546.70 | 0.00 | 0.00 | 2.95 | 5.51 | 0.00 | 0.00 | 1.95 | 3.85 | 9.36 | | | |
| 546.80 | 0.00 | 0.00 | 3.05 | 5.61 | 0.00 | 0.00 | 2.05 | 3.95 | 9.55 | | | |
| 546.90 | 0.00 | 0.00 | 3.15 | 5.70 | 0.00 | 0.00 | 2.15 | 4.04 | 9.74 | | | |
| 547.00 | 0.00 | 0.00 | 3.25 | 5.79 | 0.00 | 0.00 | 2.25 | 4.13 | 9.92 | | | |

## Pond 1 Volume Calculations

**Method:** Use the average-end area method to determine volume of storage of the pond and determine the 100-year storm high water level

**Where:** Volume = (1/2)*(Area of top contour + Area of bottom contour)*depth increment

| | | |
|---|---|---|
| High Water Elevation | 546.09 | feet |
| High Water Elevation + 1' freeboard | 547.09 | feet |
| Invert elevation of outlet structure | 543.50 | feet |
| 100 Year WSEL of Creek | 543.50 | |

**Goal:** Required 100-yr storage 11,055 cubic feet

**Calculations:**

| Elevation (feet) | Area (sq. ft.) | Incremental Volume (cubic ft.) | Incremental Volume (ac. ft.) | Total Volume (ac. ft.) | Total Volume (cubic ft.) |
|---|---|---|---|---|---|
| 543.0 | 0.0 | 0.0 | 0.000 | 0.000 | 0 |
| 543.5 | 971.7 | 242.9 | 0.006 | 0.006 | 243 |
| 544.0 | 1,943.4 | 728.8 | 0.017 | 0.022 | 972 |
| 544.5 | 3,306.2 | 1,312.4 | 0.030 | 0.052 | 2,284 |
| 545.0 | 4,669.0 | 1,993.8 | 0.046 | 0.098 | 4,278 |
| 545.5 | 6,028.0 | 2,674.2 | 0.061 | 0.160 | 6,952 |
| **546.0** | **7,386.9** | **3,353.7** | **0.077** | **0.237** | **10,306** |
| 546.5 | 10,085.1 | 4,368.0 | 0.100 | 0.337 | 14,674 |
| 547.0 | 12,783.3 | 5,717.1 | 0.131 | 0.468 | 20,391 |

**RECORD DRAWING**
**RECORD INFORMATION PROVIDED BY CONASTER CONSTRUCTION, FORT WORTH, TEXAS ELEVATION VERIFICATION PERFORMED BY SURVEY CONSULTANTS, INC., PLANO, TEXAS**

STATE OF TEXAS
ROBERT K. MANAOIS
86508
LICENSED
PROFESSIONAL ENGINEER

| REV. | DATE | REMARKS | BY |
|---|---|---|---|

# DETENTION POND CALCULATIONS

**MANSIONS SENIOR**

**CITY of ROCKWALL, TEXAS**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| RKM | JRY | JRY | 1026-005 | 02/18/09 | N/A | 8a OF 20 |

MANSIONS SENIOR, RKMCE PROJECT # 1026-005