# Final Drainage Report
## The Glen at Widefield Filing No. 12
## El Paso County, Colorado

Prepared for:
Widefield Investment Group
3 Widefield Boulevard
Colorado Springs, Colorado 80911

Prepared by:

Kiowa
Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
Ph: (719)630-7342

Kiowa Project No. 19016

June 3, 2023

PCD Project No. SF-22-024

**TABLE OF CONTENTS**

**Table of Contents** ..... ii
**Statements and Approvals** ..... iii
**I. General Location and Description** ..... 1
**II. Major Drainage Basins and Subbasins** ..... 1
**III. Drainage Design Criteria** ..... 9
**IV. Drainage Facility Design** ..... 10
**A. Cost of Proposed Drainage Facilities** ..... 11
**B. Drainage and Bridge Fees** ..... 11
**V. Conclusions** ..... 11
**VI. References** ..... 12
**Appendix Table of Contents** ..... 13

**List of Figures and Tables (Refer to the Appendix Table of Contents)**

## STATEMENTS AND APPROVALS

### ENGINEER'S STATEMENT:

The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report.

Kiowa Engineering Corporation, 1604 South 21st Street, Colorado Springs, Colorado 80904

COLORADO LICENSED
ANDREW W. McCORD
25057
PROFESSIONAL ENGINEER

Andrew W. McCord (PE #25057) — June 8, 2023

For and on Behalf of Kiowa Engineering Corporation — Date

### DEVELOPER'S STATEMENT:

I, the Developer, have read and will comply with all of the requirements specified in this drainage report and plan.

By: _____ June 9th, 2023

Date

Print Name: J. Ryan Watson, Glen Development Company

Address: 3 Widefield Boulevard
Colorado Springs, Colorado 80911

### EL PASO COUNTY:

Filed in accordance with the requirements of the Drainage Criteria Manual, Volumes 1 & 2, El Paso County Engineering Criteria Manual, and Land Development Code, as amended.

Joshua Palmer, P.E.
El Paso County Engineer/ECM Administrator

**Approved**
**By: Gilbert LaForce, P.E.**
**Engineering Manager**
**Date: 07/28/2023 9:08:17 AM**
El Paso County Department of Public Works

## I. GENERAL LOCATION AND DESCRIPTION

The Glen at Widefield Filing No. 12 (Filing 12) subdivision will be developed as a single-family residential subdivision located in the Widefield area of El Paso County. The subject property is located to the west of Marksheffel Road and north of Mesa Ridge Parkway. The site is located in the southwest portion of Section 22, Township 15 South, Range 65 West of the 6th Principal Meridian, in El Paso County, Colorado. The site is bounded on east by Glen at Widefield Filing No. 11 and further to the east by Marksheffel Road, to the south and west by the Glen at Widefield Filing Nos. 8 thru10, and to the to the north by undeveloped raw land, currently unplatted.

Filing 12 contains 27.23 acres of single-family residential lot development for 79 planned lots. Detention and water quality is provided for the site with the extended detention basin, referred to as Detention Basin 'D' which was constructed with The Glen at Widefield Filing No. 11.

The property is currently overlot graded under grading permit to approximate finished grade conditions. Extended Detention Basin 'D' lies to the south of the site. A vicinity map of the site is shown on Figure 1 included in Appendix A.

With Filing No. 11, Detention Basin 'D' received final grading, perimeter maintenance roads, and a low-flow trickle channel. Slight modification to the outlet plate is planned with Filing 11 and is expected within the outlet structure.

With Filing No. 12, the orifice plate at the detention pond outlet structure reflects 'Ultimate Condition' which represents a full build-out condition, and which accommodates final calculated values for the tributary areas impacted by new development including Filing 11 and Filing 12.

The existing vegetative cover within the development is in poor to fair condition with minimal grasses throughout the site. The existing ground slopes within the property range from 0.2 to 25 percent. Soils within the subject site are mostly classified to be within Hydrologic Soils Group B as shown in the *El Paso County Soils Survey*. For the purposes of computing the existing and proposed hydrology for the site, Hydrologic Soil Groups B and C were used with weighted coefficients.

Existing utilities within or adjacent to the site include a pair of thirty-inch (30") Colorado Interstate Gas (CIG now Kinder-Morgan), mains that run along portions of the westerly property boundary (see maps in Appendix D).

Golden Buffs Drive will be extended west into earlier Filings 8 and 9 of The Glen at Widefield development. A dead-end barricade will be removed to complete the through connection. Roadways improvements with sidewalks and pedestrian ramps are planned to serve the subdivision and match previous work (flowline to flowline).

## II. MAJOR DRAINAGE BASINS AND SUBBASINS

The subject property limits are shown on Flood Insurance Rate Maps (FIRMs) 08041C0956G and 08041C0957G (both with effective dates of December 7, 2018) that are included in the Appendix. The FIRMs also show that the property to be developed with buildable lots is located outside of the FEMA regulated floodplain in an unshaded Zone X area, which is described as "Area of Minimal Flood Hazard."

The site lies within the West Fork Jimmy Camp Creek drainage basin. The majority of the overall site presently drains towards the south and southeast by a combination of overlot sheet flow along with curb, gutter, pipe and open channel conveyances to a minor drainage that combines with the West Fork of Jimmy Camp Creek just downstream of Mesa Ridge. The north portion of the site drains east and south within proposed roadway corridors to proposed extended Detention Basin 'D'.

The remaining portions of the site consist of rear lot margins which cannot be captured due to topography. These marginal areas are expected to consist of lawn and rear slope areas which will substantially match historic conditions. These marginal areas will achieve 60% Water Quality treatment through best practices of runoff reduction (Permanent BMP - IRF). The existing drainage patterns for the site are shown on Drainage Plan Sheet 1 provided in a map pocket at the end of this report, and developed flows are compared on Sheets H-1 & D-2 to reflect pre- and post-development impacts (See Appendix D).

The drainage reports that were reviewed in the process of preparing this drainage report are included in the References section. The Glen at Widefield East area was studied as a part of the *Master Development Drainage Plan (MDDP) for the Glen at Widefield* and the *West Fork Jimmy Camp Creek Drainage Basin Planning Study (DBPS).* A detention basin shown on the west side of the creek (DP 3101) was designed and constructed as part of the Filing No. 6 improvements. Two additional regional detention basins were identified for the site in the *MDDP*: one to serve the westerly side of the site with flows released west to the West Fork Jimmy Camp Creek (DP 3091), and the other to serve the easterly side of the site with flows released east across Marksheffel Road to a channel along the north side of Peaceful Valley Road and ultimately to the Jimmy Camp Creek main branch (DP 4021). The detention basin shown in the *MDDP* and *DBPS* at DP 3091 was designed and constructed as part of the Glen at Widefield Filing No. 7 improvements as Basin C. However, due to the proposed grading and drainage patterns north of Filing No. 7, two additional detention basins to serve the westerly side of the site were planned and constructed: one for Filing No. 8 (Basin B) and one for Filing No. 9 (Basin A), which is located just north of the Filing No. 8 area. The detention basin shown in the *MDDP* and *DBPS* at DP 4021 (Basin D) is designed to its ultimate condition herein and will be constructed to serve most of Filing 10, all of Filing 11, and most of Filing 12 within the Glen at Widefield master planned area.

Sub-Basin Names are prefixed with 'A', 'B' or 'D' depending on the detention pond they are tributary to. i.e. A for Basin 'A' (serving Filing 9 as well as other filings of The Glen), B for Basin 'B' (serving Filing 8), and D for Basin 'D' (serving Filings 10-12). The tributary basins to Basin 'D' are prefaced with the letter 'D' and numbered sequentially D1 to D24.

The Sub-basins herein are generally organized and map-labeled in the order they sit from highest elevation to lowest.

## Basin A

A very small portion of Filing 12 is tributary to EDB 'A'. This portion is located in the extreme northwest corner of the site where Golden Buffs Drive drops to meet existing grade and west of its intersection with planned Lance Leaf Drive. Filing 12 Development is anticipated in the Filing No 9 Final Drainage Reporting for these portions in the sizing and installation of the receiving downstream facilities and conveyances. No additional modification to facilities is anticipated to receive runoff from these portions.

Filing 9 Final Drainage Report[13] Excerpts for Sub-Basins A-6 through A-8 (Tributary to EDB 'A'):

The Following *Italicized* Sub-Basin Descriptions are excerpted with [bracketed] additional comment added for clarity:

*<u>Sub-basin A-6</u> is approximately 1.53 acres in area and is located east of Spring Glen Drive and north of Bittercress Place. Undeveloped runoff from this basin will sheet flow west towards Spring Glen Drive until it gutter flows south (DP 6).* [Tributary to existing EDB 'A']

*<u>Sub-basin A-7</u> is a very small portion of the site lying in the extreme northwest corner of the site. It is characterized by undisturbed raw land lying within the 100-foot-wide Colorado Interstate Gas*

*Easement. Runoff is directed west in a sheet flow manner and concentrates offsite within the Bittercress Court roadway section and is conveyed along hardened surfaces and pipe systems to* [Detention] *Basin 'A'*[13]. [Tributary to existing EDB 'A']

*<u>Sub-basin A-8</u> is a very small portion of the site lying in the extreme northwest corner of the site. It is characterized by undisturbed raw land lying within the 100-foot-wide Colorado Interstate Gas Easement. Runoff is directed west in a sheet flow manner and concentrates offsite within the Bittercress Court roadway section and is conveyed along hardened surfaces and pipe systems to* [Detention] *Basin 'A'*[13]. [Tributary to existing EDB 'A']

This Series of sub-basins is unchanged with this reporting in terms of physical boundary and Flow Prediction (Rational Method). The A-Series of sub-basins are tributary to EDB 'A'. These downstream facilities are discussed and approved with The Glen Filing No 9 and are in existing condition.

### Basin B

A very small portion of Filing 12 is tributary to Basin 'A' within the extreme northwest corner of the site., and a small portion is tributary to Basin 'B'. These portions are all located along the westerly margins of the site where Golden Buffs Drive drops to meet existing grade and just west of its intersection with planned Lance Leaf Drive. Filing 12 Development is anticipated for these portions in the sizing and installation of the receiving downstream facilities and conveyances. No additional modification to facilities is anticipated to receive runoff from these portions.

Filing 8 Final Drainage Report[16] Excerpts for Sub-Basins B-1, B-1.1, B-2, B-3, B-8, B-9, B-9.1 (Tributary to EDB 'B'):

The Following *Italicized* Sub-Basin Descriptions are excerpted with [bracketed] additional comment added for clarity:

*<u>Sub-basin B-1</u> is approximately 2.52 acres in area and is located north and west of Golden Buffs Drive and Lanceleaf Drive. Runoff from this basin will sheet flow and gutter flow south and west to Design Point (DP) 15.*

*<u>Sub-basin B-1.1</u> is approximately 2.07 acres in area and is located just west of Sub-basin B-1 and north of Golden Buffs Drive. Runoff from this basin will sheet flow south along the existing gas line easement to Golden Buffs Drive, combine with runoff from Sub-basin B-1, and gutter flow southwest to a 10' curb inlet at Peachleaf Drive (DP 15.1).*

*<u>Sub-basin B-2</u> is approximately 2.77 acres in area and is located north and east of Beebalm Place and Peachleaf Drive. Runoff from this basin will sheet flow and gutter flow west and south to a 10' curb inlet at DP 16.*

*<u>Sub-basin B-3</u> is approximately 2.65 acres in area and is located south and east of Beebalm Place and Peachleaf Drive. Runoff from this basin will sheet flow and gutter flow southwest to Peachleaf Drive, combine with carry-over flow from Sub-basin B-2, and gutter flow south to a 10' curb inlet at Golden Buffs Drive (DP 17).*

*<u>Sub-basin B-8</u> is approximately 0.77 acres in area and is located south and west of Golden Buffs Drive and Dwarf Clover Court. Runoff from this basin will sheet flow and gutter flow north and west to Peachleaf Drive (DP 22).*

*<u>Sub-basin B-9</u> is approximately 2.84 acres in area and is located east of Peachleaf Drive between its south high point and Sub-basin B-9.1. Runoff from this basin will sheet flow and gutter flow north and west to a 10' curb inlet located along Peachleaf Drive approximately 200 feet southeast of Golden Buffs Drive.*

*<u>Sub-basin B-9.1</u> is approximately 1.23 acres in area and is located east of the Golden Buffs Drive and Peachleaf Drive intersection, consisting primarily of open space area and a portion of the existing gas line easement. Runoff from this basin will sheet flow and gutter flow generally west, combine with carry over flow from Sub-basin B-9 (DP23), and combine with runoff from Sub-basin B-8 at the Golden Buffs Drive and Peachleaf Drive intersection.*

This Series of sub-basins is unchanged with this reporting in terms of physical boundary and Flow Prediction (Rational Method). The B-Series of sub-basins are tributary to EDB 'B' lying to the west. These downstream facilities are discussed and approved with The Glen Filing No 8 and are in existing condition.

### Basin D

<u>Sub-basins D-1 through D-24</u> are not all located within Filing No. 12 but are all tributary to Detention Basin 'D'. Basins D1-D24 comprise approximately 60 acres. Some edge areas are released undetained and these are accounted for in the E-Series of sub-basins as discussed in the next section.

Detained flows released from Detention Basin 'D' are ultimately conveyed to the existing roadside ditch along Marksheffel Road north of Mesa Ridge Parkway. Design Point D10-1 released flows are discharged from the outlet structure of the Extended Detention Basin 'D' within a reinforced trapezoidal channel. The channel discharges 59.6 cfs during the Major Event. Downstream Culverts have been analyzed for expected flow volume and channel capacity. Flow declarations are provided on the Developed Map Exhibits (D-1 & D-2) along both sides of Marksheffel Rd. Capacity appears to be adequate.

**Sub-basins D-1 thru D-19** have similar characteristics with a mix of street, and residential lot area. Refer to Map Sheets 2 of 3 and 3 of 3 (D-1 & D-2). The Following is a description of these sub-basins:

<u>Sub-basin D-1</u> is approximately 1.40 acres in area and is located in the northwest of the subject property (Filing 12). Runoff from this basin will sheet flow south and concentrate in the street flowline. This basin combines with Sub-basin D-2via crosspan at DP68.

<u>Sub-basin D-2</u> is approximately 1.67 acres in area and is located almost entirely within the subject property excepting a small area at the east margin where the sub-basin's downstream end terminates at existing 10' curb inlet 'E-2'. Runoff from this basin will sheet flow south and concentrate in street sections until reaching 10 ft curb inlet 'E-2' at DP69.

<u>Sub-basin D-3</u> is approximately 1.69 acres in area and is located in the northwest area of the subject property (Filing 12). Runoff from this basin will sheet flow south and concentrate in the street flowline. This basin combines with Sub-basin D-4 via crosspan at DP70.

<u>Sub-basin D-4</u> is approximately 2.07 acres in area and is located within the subject property (Filing 12) with the exception of its extreme eastern corner which is off-site. Runoff from this basin will sheet flow south and concentrate in the street flowline. It will also combine with concentrated runoff from upstream Sub-basin D-3 until reaching 10 ft curb inlet 'E-1' at DP71.

<u>Sub-basin D-5</u> is approximately 1.56 acres in area (Filing 12) with the exception of its extreme eastern corner which is off-site. Interim Inlet A-4 is converted from an interim area inlet to a closed manhole with the development of Filing No 12. Runoff from this basin will sheet flow north and concentrate in the south half of the street flowline until reaching curb inlet 'D-4' at DP82.

<u>Sub-basin D-6</u> is approximately 0.41 acres in area and off-site and east of Filing 12. Runoff from this basin will sheet flow south and concentrate in Pennycress Drive and be conveyed by curb and gutter to the south (DP73) where it will continue across a crosspan at the intersection of Lance Leaf Drive and combine with additional surface flows from Sub-basin D-7.

Sub-basin D-7 is approximately 2.98 acres in area and is located along the east margin of the subject property. Some of the northwesterly margins of this sub-basin lie within Future Filing No. 12 and consist of rear yard areas. Runoff from this basin sheet flows south and east and concentrates in Pennycress Drive and is conveyed by curb and gutter to the south to on-grade inlet E-6 at DP75. In the Major storm event, 2.0 cfs of bypass flow will continue across a crosspan at the intersection of Marsh Elder Drive and combine with additional surface flows from Sub-basin D-8.

Sub-basin D-8 is approximately 1.62 acres in area and is located along the easterly margin of the subject property. Some of the northwesterly margins of this sub-basin lie within Future Filing No. 12 consisting of rear yard areas. Runoff from this basin will sheet flow south and east and concentrate within The Marsh Elder Place cul-de-sac and within Pennycress Drive and be further conveyed by curb and gutter to the south within the Pennycress roadway corridor at DP76. In the Minor event, 2.2 cfs of bypass flow will continue south as gutter flow. In the Major storm event, 9.7 cfs of bypass flow will continue south as gutter flow (at DP 78) and combine with additional surface flows from Sub-basin D-10.

Sub-basin D-9 is approximately 2.19 acres in area and is located entirely within the subject property. Runoff from this basin will sheet flow southeast and concentrate in street flowline until captured by a new 10 ft Curb Inlet 'F-1' lying at the southeasterly edge of planned Dwarf Clover Court's cul-de-sac. This inlet will connect to a new 18" RCP pipe to convey flows to Interim Area Inlet 'F-2' described in the Filing 11 Drainage Report. This Interim Inlet consists of a manhole barrel section which will be completed with a cone section and closed lid for fully-built out conditions.

The temporary diversion ditch which terminated at Structure F-2 – and began at Structure F-1 (New 10' Curb Inlet) will be demoed at the time of Filing 12 construction (DP77).

Sub-basins D-10 through D-23 are offsite, and downstream from Filing 12. Their Sub-basin Descriptions are excerpted herein from the Filing 11 Final Drainage Report[15]:

*Sub-basin D-10 is approximately 2.52 acres in area and is located along the easterly margin of the subject property. General Runoff from this basin sheet flows south and east and concentrates within Pennycress Drive and is further conveyed by curb and gutter to the south within the Pennycress roadway corridor to a 20-foot curb inlet (Inlet H-2) at DP79. In the Minor event, 2.2 cfs of bypassed flow from upstream sub-basins D7 & D-8 will combine with flows from this sub-basin and continue south as gutter flow. In the Major storm event, 9.7 cfs of bypassed flow is received and will continue south as gutter flow to DP 79. Inlet H-2 lies in a sump condition along with a series of other inlets at this intersection which are all hydrostatically interconnected in the Major Event. These inlets collectively intercept one hundred percent (100%) of the Major Event. Hydraulic Analysis (HGL/EGL) using EPA SWMM was performed to validate the storm system's performance at this final junction in the Major Event. The SWMM Model results are included in Appendix C.*

*Sub-basin D-11 is approximately 3.96 acres in area and is located east of the subject property. Runoff from this basin sheet flows south and west and concentrates in Pennycress Drive and is conveyed by curb and gutter to the south (DP80) where it continues across a crosspan at a knuckle cul-de-sac (See Sub-basin D-12).*

*Sub-basin D-12 is approximately 1.39 in area and is located east of the subject property. Runoff from this basin sheet flows south and west and concentrates in Pennycress Drive and is combined with gutter flow from Sub-basin D-11. 4.50 cfs in the Minor event, and 13.0 cfs in the Major event combines with Sub-basin D-11 flows and these are conveyed by curb and gutter to the south to Inlet G-4 (DP81). Inlet G-4 lies in a sump condition along with a series of other inlets at this intersection which are all hydraulically connected. These inlets collectively intercept one hundred percent (100%) of the Major storm event.*

*<u>Sub-basin D-13</u> is approximately 2.06 acres in area and is located east of the subject property. Runoff from this basin sheet flows south and east and concentrates in Golden Buffs Drive and is conveyed by curb and gutter to the south to on-grade curb inlet D-4 at DP82.*

*<u>Sub-basin D-14</u> is approximately 3.30 acres in area and is located southeast of the subject property. Runoff from this basin sheet flows south and east and concentrates in Golden Buffs Drive and is conveyed by curb and gutter to the south to on-grade curb inlet G-3 at DP83. Some bypass flows (2.3 cfs) from Sub-basin D-13 combines within the street's gutter section in the Major storm event.*

*<u>Sub-basin D-15</u> is approximately 2.80 acres in area and is located entirely within the subject property (Filing 12). Runoff from this basin will sheet flow south and east and concentrate in street sections at DP84. This basin combines with Sub-basin D-16 via crosspan. New 10 ft curb inlet 'A-1' lies just past the crosspan and captures the concentrated runoff from Sub-basin D-15. Some bypass flow will continue east (0.9 cfs) to Sub-basin D-16 in the Major storm event.*

*<u>Sub-basin D-16</u> is approximately 2.27 acres in area and is located in the northeast of the subject property (Filing 12) excepting a very small portion of its easternmost edge. Runoff from this basin will sheet flow south and concentrate in street sections. This basin combines with upstream Sub-basin D-15 at the point of a planned crosspan. Combined flows continue east in the north half of the street section (Golden Buffs Drive) to the beginning of improved street Golden Buffs Drive. Combined flows continue east about another 80 feet to Inlet B-1 (DP84.1). Some bypass flow will continue east (2.6 cfs) to Sub-basin D-16.1 in the Major storm event.*

*<u>Sub-basin D-16.1</u> is approximately 2.08 acres in area and is located east of the subject property. Runoff from this basin will sheet flow southwest and concentrate within Golden Buffs Drive. Flows from this basin combine with concentrated gutter flow from upstream Sub-basin D-16 at the point of a planned crosspan (DP84.1). Combined flows continue east in the north half of Golden Buffs Drive to Mouse Ear Place cul-de-sac and the location of Inlet 'C-1' at DP85. Some bypass flow will continue southeast (1.4 cfs) to Sub-basin D-17 in the Major storm event.*

*<u>Sub-basin D-17</u> is approximately 3.45 acres in area and is located east of the subject property. Runoff from this basin sheet flow west and concentrate in Golden Buffs Drive, and within cul-de-sac gutter sections at Mouse Ear Place, and Kitten Tail Court. These flows combine at Inlet D-1 (DP86). Some bypass flows continue south; 0.1 cfs bypasses this inlet in the Minor event, and 6.0 cfs to Sub-basin D-18 in the Major storm event.*

*<u>Sub-basin D-18</u> is approximately 2.13 acres in area and is located east of the subject property. Runoff from this basin sheet flows west and concentrates in Golden Buffs Drive, and within cul-de-sac gutter sections at Horse Mint Trail. These flows combine at the east half of Golden Buffs Drive within the gutter section and ahead of an unnamed knuckle cul-de-sac at DP87. Some bypass flows continue south to Sub-basin D-19; 2.8 cfs in the Minor storm event, and 13.4 cfs in the Major event.*

*<u>Sub-basin D-19</u> is approximately 2.97 acres in area and is locate east of the subject property. Runoff from this basin sheet flows west and concentrates in Golden Buffs Drive, and within an unnamed knuckle cul-de-sac. Concentrated gutter flows combines with upstream bypassed flows from Sub-basin D-18. These combined flows will continue south to Inlet G2 at DP88. Bypassing flows from Inlet G-2 are expected to overtop to Inlet G-1 in the Minor storm event and overtop to inlet G-1 and H-1 and J-2 in the Major storm event.*

*<u>Sub-basin D-19.1</u> is approximately 0.17 acres in area and is located southeast of the subject property. Runoff from this basin will sheet flow west and concentrate in Pennycress Drive. These flows combine at Inlet G-1 (DP89). Some bypass flows will contribute to this inlet in both the Minor storm (0.1 cfs) and the Major storm event (5.7 cfs).*

**Sub-basins D20-24** have varying surface characteristics, and these are reflected in the weighted coefficients assigned to each basin through Rational methodology. These basins comprise the tributary areas inflowing to Basin 'D' from areas off-site and far to the south.

Refer to Map Sheet D-1. The Following is a description of the southerly sub-basins:

*Sub-basin D19.1, D20c & D23*[15]

*These basins are now detained as a part of Filing No 11 and are included in the Filing 10 through 12 'Ultimate Condition'. These basins consist of small portions of Pennycress Drive near EDB 'D" along with the emergency spillway structure. An inlet pair (J1-J2) captures developed flows and conveys them directly to Detention Basin 'D'.*

*Sub-Basin D20a (Modified Discharge)*

*Excerpt from Addendum to the Filing No 10 Final Drainage Report (PCD File SF1921)*[17]

*Sub-basin D20a is located along the southerly margin of Filing 10 and contains portions of residential lots, along with a portion of proposed Pennycress Drive. The basin contains 0.81 Acres. Runoff Volume is 0.9, and 2.5 cfs for the Minor and Major Storm Events, respectively.*

*A crosspan was originally planned to convey as much surface area as possible to the extended detention basin lying to the north (Detention Basin 'D'), but this pan has now been omitted to preserve the integrity of the existing roadway intersection.*

*Modified Discharging Flows are now to be conveyed via existing concrete curb & gutter at Peaceful Valley Road and then to a riprap rundown for stabilization prior to entering an existing natural channel which serves the west one-half of Marksheffel Road along with some flows entering the channel from upslope landforms adjacent to the roadway corridor. This channel is trapezoidal and is fully stabilized. Flows from Sub-Basin 20a are expected to enter the channel well ahead of Peak Discharging Flows from Detention Basin 'D'.*[17]

*Sub-basin D-20a-c contains 1.64 acres in area and is located south of the subject property. It is comprised of Pennycress Drive and some captured landscape areas. Runoff from these basins sheet flows west and concentrate in Pennycress Drive at Inlet J-1 (DP92a). These flows combine at Inlet J-2 with flows from Sub-basin D-23 and inflow directly to Detention basin 'D'. There are no bypass flows.*

*Sub-basin D-21 is approximately 4.02 acres in area and is located south of the subject property within Filing No. 10. Sub-basin D-21 has similar surface characteristics to Sub-basins D-1 thru D-19. Runoff from this basin sheet flows south and east and concentrates first within Peaceful Valley Road, and Buffalo Bur Trail, and then within Pennycress Drive existing street sections (DP90). These flows currently combine with flows from Sub-basin D-22 and are conveyed to the intersection of Pennycress Drive and Peaceful Valley Road. A crosspan conveys the flows to the northeast and directly to Basin 'D'.*

*Sub-basin D-22 is approximately 1.15 acres in area and is located south of the subject property within Filing No. 10. It is comprised of existing sections of Peaceful Valley Road and some captured overlot areas. Runoff from this basin sheet flows southwest and concentrates in Peaceful Valley Road (DP91). These flows combine with flows from Sub-basin D-21 and inflow directly to Detention Basin 'D'. There are no inlets. All flows from this sub-basin contribute to the north side gutter section of Pennycress Drive and are no longer ditch flow, but rather gutter flow within Sub-basin D-23.*

*Sub-basin D-23 is approximately 0.28 acres in area and is located south of the subject property. It is comprised of Pennycress Drive and some captured landscape areas. Runoff from this basin sheet flows east and concentrates in Pennycress Drive at Inlet J-2 (DP92b). These flows combine at Inlet J-1 with flows from Sub-basin D-23 and inflow directly to Detention basin 'D'. There are no bypass flows.*

Sub-basin D-24 is approximately 10.18 acres in area and is adjacent to and along the southwest side of the subject property. This sub-basin encompasses all of the planned detention basin area, as well as off-site flows received from the west which traverse the Colorado Interstate Gas Pipeline Easement (C.I.G. Easement). These flows will remain unchanged from historic conditions excepting roadway improvements. Flows from this sub-basin accumulate within rear lot areas north and west of the detention basin and are conveyed along shallow slopes with minimal velocity. There are no bypass flows, or inlets.

## Basin E

The E-Series 'edge area' basins are adjacent to the subject property at the extreme west margins of Sub-basin E-1, but all E-Series basins were evaluated as part of the overall IRF analysis for Filings 10 through 11 and are included herein for the sake of continuity and overall understanding of the analysis along with some narrative description of downstream conveyances.

The 'E' Series Basins are located along the easterly edge of the site between the property and Marksheffel Road. Sub-basins E-1 through E-5 drain offsite to the existing roadside ditch along Marksheffel Road.

A description of each of the 'E' Series Sub-basins is included in a reduced form from previous reports for clarity and to accurately describe the condition of downstream conveyances associated with Filings 10 through 12:

Sub-basin E-1 contains 5.27 acres and is located within Filing No 11 and Filing No 12. This basin abuts existing Marksheffel Road and is historically tributary to the west-side ditch for the roadway. The overall characteristics of these basins is unchanged from historic conditions. A narrow strip along the north margin discharges nuisance flows to an east-west drainage that ends at Marksheffel Rd. For purposes of water quality treatment, that portion of these sub-basins discharging from within the Filing No 12 Boundary was analyzed using the IRF Runoff Reduction Method. An Exhibit and MHFD Calculation Sheet (*UD-BMP_v3.07.xls*) are provided in Appendix E. Developed Runoff from this basin will sheet flow north to an existing grass swale, and then travel southeast to the existing roadside ditch along Marksheffel Road (DP 95) as it does currently. A new box culvert crossing at Poa Annua was installed with Filing No. 11 to receive and discharge ditch flows. The Poa Annua Culvert consists of a two-foot high by three-feet wide double box culvert with wingwalls at each end, and aprons with cutoff walls. The culvert passes flows from the Minor Event, and overtops some flow in the Major Event. Full Capacity ($Q_{pipe}$) is calculated to be 93.58 cfs (See Appendix C), with an additional 6.42 cfs overtopping ($Q_{overtop}$)in the Major Event

*Sub-basin E-2 contains 0.50 acres and is located within Filing No 11 along the north side of planned Poa Annua Street. This basin also partially abuts existing Marksheffel Road and is historically tributary to the west-side ditch for the roadway. The overall characteristics of these basins is unchanged from historic conditions. Runoff from this basin sheet flows southeast to the existing roadside ditch along Marksheffel Road (DP 96).*

*Sub-basin E-3 contains 1.67 acres and is located within Filing No 11 along the south side of planned Poa Annua Street. This basin also abuts existing Marksheffel Road and is historically tributary to the west-side ditch for the roadway. The overall characteristics of these basins is unchanged from historic conditions. Runoff from this basin sheet flows southeast to the existing roadside ditch along Marksheffel Road (DP 97).*

*Sub-basin E-4 contains 1.17 acres and is located within Filing No 11 and lies between planned Pennycress Drive and existing Marksheffel Rd. It is historically tributary to the west-side ditch for the*

*roadway. The overall characteristics of these basins is unchanged from historic conditions. Runoff from this basin sheet flows southeast to the existing roadside ditch along Marksheffel Road (DP 98). Sub-basin E-4 terminates at an existing six-foot wide by two-foot-high concrete box culvert with two barrels (6'x2' Double CBC) at Design Point 10-2. Just upstream a small eighteen-inch culvert crosses Marksheffel Road and connects the east and west borrow ditches hydraulically (Ref: HDR Report, Structure 'CV152'). This culvert appears to function as a transfer pipe to allow for redundant outflow.*

## III. DRAINAGE DESIGN CRITERIA

Hydrologic and hydraulic calculations for the site were performed using the methods outlined in the *El Paso County Drainage Criteria Manual*. Topography for the site was compiled using a one-foot contour interval and is presented on the Historic Conditions map. The hydrologic calculations were made for the historic and proposed site conditions. The Drainage Plan presents the drainage patterns for the site, including the 'D'-series sub-basins. The peak flow rates for the sub-basins were estimated using the Rational Method. The 5-year (Minor storm) and 100-year (Major storm) recurrence intervals were determined. The one-hour rainfall depth was determined from Table 6-2 of the *Drainage Criteria Manual*. These depths are shown in the runoff calculations spreadsheet. The peak flow data generated using the rational method was used to verify street capacities and to size inlets and storm sewers within the subdivision. The drainage basin area, time of concentration, and rainfall intensity were determined for each of the sub-basins within the property. The onsite soils were assumed to be mostly Hydrologic Soil Group B, based on the *Soil Survey* and the result of earth-moving operations. For existing conditions, runoff coefficients outside of the roughcut roadways were determined using a land use of pasture/meadow, while the rough-cut road corridors were estimated for conveyance as nearly bare ground (NBG). The land use for the proposed development will be residential land areas with a density of approximately 4 lots per acre.

The onsite hydraulic structures were sized using the methods outlined in the *El Paso County Drainage Criteria Manual*. The hydraulic capacities of the streets and curb inlets were determined using the UD-Inlet spreadsheet developed by the Urban Drainage and Flood Control District (UDFCD), considering the County criteria for the Minor (5-year) and Major (100-year) storms. Ramp curbs will be used throughout the development, except for curb returns, where a 6-inch vertical curb will be used.

The off-site Detention Basin 'D' is Extended Detention Basin (EDB) that uses Full Spectrum Detention. The UD-Detention spreadsheets created by UDFCD were used to size and design the detention basin with water quality enhancement, per the County's recommendation.

The supporting calculations associated with hydraulic functioning for this development's storm system were accepted and approved as a part of Filing 11 and have been included herein for reference in Appendix C of this report. Appendix C includes the EPA-SWMM report summaries for reference.

The system was re-analyzed in EPA-SWMM in order to demonstrate drainage performance for Filing 12 alone. Downstream impacts are noted in the form of some inlet flooding at the intersection of Pennycress Drive and Golden Buffs Drive. The Depth of Node Flooding is calculated to be 0.427' above the lowest inlets at Peak Flow ($T_{PK}$) which occurs at about 55 minutes. This demonstrates that the overall capture is theoretically 100% as Depth of Flow does not exceed the depth of the surrounding roadway corridor. The Node Flooding Value is the critical value for determination of function in this case and this value is unchanged with the development of Filing 12.

## IV. DRAINAGE FACILITY DESIGN

The drainage of the site will be accomplished through a combination of sheet flow, gutter flow and pipe conveyance systems which will outlet directly to the planned extended detention basin (Basin 'D'). A-Series Sub-Basins and B-Series Sub-Basins will receive and treat Runoff within existing extended detention basins associated with Filings No 6 through Filing 9 of The Glen. The receiving ponds are all existing and functioning properly at the time of this report.

The proposed drainage patterns for the site are shown on the Final Drainage Plan for the developed condition (Sheets D-1 and D-2) provided in the map pocket at the end of this report. The hydrologic and hydraulic calculations are provided in the Appendix. Refer to the Drainage Design Criteria section for additional information on the hydrologic and hydraulic calculations.

Evaluations related to sizing of onsite drainage improvements was carried out in accordance with the *County Storm Drainage Criteria Manual*. The capacities of the proposed onsite facilities were calculated in accordance with the *Criteria Manual* and current UDFCD supporting software.

The approved Detention Basin 'D' design included two pre-sedimentation forebays along with trickle channel to a planned three-stage outlet structure.

This detention basin is a private facility maintained by the district and is functioning properly.

Detention Basin 'D' is designed to fully accommodate water quality separation and the emergency conveyance of flow associated with Filing 10, Filing 11, and Filing 12.

The storm sewer system will provide storage and intercept most of the flows with some 100-year flows exceeding and by-passing inlets in the Major event These bypassed flows are contained within the street corridors and eventually enter the detention pond under increased hydraulic pressure associated with curb depth. The Minor event is fully intercepted by the inlet and pipe systems.

### WATER QUALITY METHODOLOGY (4-STEP PROCESS):

### STEP 1: RUNOFF REDUCTION PRACTICES

New construction will utilize existing and proposed grassed areas as buffers, allowing sediment to drop out of the storm runoff and helping to reduce runoff. The existing grassed swales along the west side of the site (Gas Mains) shall remain undisturbed. Vegetated Hillsides provide some runoff reduction benefit, along with some biofiltering. Runoff Reduction calculations and IRF Reduction Exhibit are provided in Appendix E for the zone encompassing the subject property's north margin and Sub-basin E-1. IRF reduction analysis for this zone resulted in a treatment value of at least 60% of the expected overall WQCV.

#### STEP 2: IMPLEMENT BMP'S THAT SLOWLY RELEASE THE WATER QUALITY CAPTURE VOLUME

Treatment and slow release of 40 hours of the water quality capture volume (WQCV) will be accomplished by the completed implementation of the proposed, private, Full-Spectrum, extended detention basin.

#### STEP 3: STABILIZE DRAINAGEWAYS

There are no major drainageways affected by the development. No improvements to any downstream drainageways are required or anticipated at this time. The project discharges into an existing EDB via new and existing storm pipe systems.

#### STEP 4: IMPLEMENT SITE SPECIFIC & SOURCE CONTROL BMP'S

There are no potential sources of contaminants that could be introduced to the County MS4 that will not be controlled by temporary construction BMPs. Maintenance and sweeping of parking areas is

recommended to limit sediment transport to new inlets, pipes and detention areas. Construction BMPs in the form of vehicle tracking control, concrete washout area, inlet protection, rock socks, and silt fences will be utilized during construction activities to protect receiving waters.

### WATER QUALITY

Storm water quality measures are required by the County in Volume 2 of the County's *Drainage Criteria Manual*. The water quality measures instituted for the development include:

1. Water quality enhancement of the detention basin. Existing Sedimentation Basin 'D' was operating as a temporary sedimentation basin prior to construction of the Extended Detention Basin. Final improvements at this basin impacted water quality through the addition of pre-sedimentation forebays, trickle channel, and perimeter surface treatments to serve The Glen Filing No 10 through 12.
2. Water Quality Treatment via IRF Methodology at the north and east margin of the site.
3. The outlet structure includes water quality orifice plate modification to match Ultimate (Full Build-out) Design.

### A. COST OF PROPOSED DRAINAGE FACILITIES

Table 2 presents a cost estimate for the construction of drainage improvements (Public) for The Glen at Widefield Filing No. 12 development.

### B. DRAINAGE AND BRIDGE FEES

The site lies within the West Fork Jimmy Camp Creek Drainage Basin. The current drainage basin fee associated with the West Fork Jimmy Camp Creek Drainage Basin is $14,470 per impervious acre. The current bridge fee associated with the West Fork Jimmy Camp Creek Drainage Basin is $4,281 per impervious acre. The Glen at Widefield Filing No. 12 subdivision encompasses 27.23 acres. Table 1 details the fees due as part of this development.

## V. CONCLUSIONS

The Glen at Widefield Filing No. 12 will be a single-lot family residential subdivision covering approximately 27.23 acres. Onsite drainage will include the use of surface conveyance elements such as gutter, crosspan, and inlets to route the runoff from the site to Detention Basin 'D'.

Existing Downstream Receiving Facilities (EDB A and EDB B) are functioning as designed. No adverse impacts are anticipated with Filing No 12 development.

Basin D serves Filing 10 along with northern tributary area Filing 11 and Filing 12 (see maps). Detained runoff from the site will be conveyed to the West Fork Jimmy Camp Creek. With detention serving the site and existing downstream conveyance elements in place, the development of the Glen at Widefield Filing No. 12 property will not adversely impact or deteriorate improvements or natural drainageways downstream of the property.

## VI. REFERENCES


1) Preliminary Drainage Report, The Glen at Widefield East, prepared by Kiowa Engineering Corporation, dated December 16, 2015.

2) Final Drainage Report, The Glen at Widefield Filing No. 7, prepared by Kiowa Engineering Corporation, dated January 11, 2016.

3) Amended Master Development Drainage Plan, The Glen at Widefield, prepared by Kiowa Engineering Corporation, dated June 21, 2007.

4) Final Drainage Report, The Glen at Widefield Filing No. 6, prepared by Kiowa Engineering Corporation, dated December 6, 2007.

5) Preliminary and Final Drainage Report, Mesa Ridge Parkway Final Design, prepared by Kiowa Engineering Corporation, dated November 29, 2010.

6) Mesa Ridge Parkway Roadway Design, Autumn Glen Avenue to Marksheffel Road and Widening from Powers Boulevard to Autumn Glen Avenue, prepared by Kiowa Engineering Corporation, dated December 8, 2010.

7) Master Development Drainage Plan for the Glen at Widefield, prepared by Kiowa Engineering Corporation, dated December 10, 1999.

8) West Fork Jimmy Camp Creek Drainage Basin Planning Study, prepared by Kiowa Engineering Corporation, dated October 17, 2003.

9) City of Colorado Springs and El Paso County Flood Insurance Study, prepared by the Federal Emergency Management Agency, dated March 1997.

10) El Paso County Drainage Criteria Manual (Volumes 1 and 2) and Engineering Criteria Manual, current editions.

11) Soil Survey of El Paso County Area, Colorado, prepared by United States Department of Agriculture Soil Conservation Service, dated June 1981.

12) Final Drainage Report Marksheffel Road South - Link Road to US-24, El Paso County, CO, HDR Engineering, August 2015.

13) Final Drainage Report The Glen at Widefield Filing No. 9, September 2018

14) Final Drainage Report The Glen Filing No 10 Kiowa Engineering, September 2019

15) Final Drainage Report The Glen Filing No 11 Kiowa Engineering, June 2022

16) Final Drainage Report The Glen at Widefield Filing No 8, October 3, 2016

17) Addendum to the Final Drainage Report (Crosspan Removal) The Glen at Widefield Filing No. 10 El Paso County, Colorado (PCD File SF1921), September 14, 2021

## APPENDIX TABLE OF CONTENTS

**APPENDIX A**

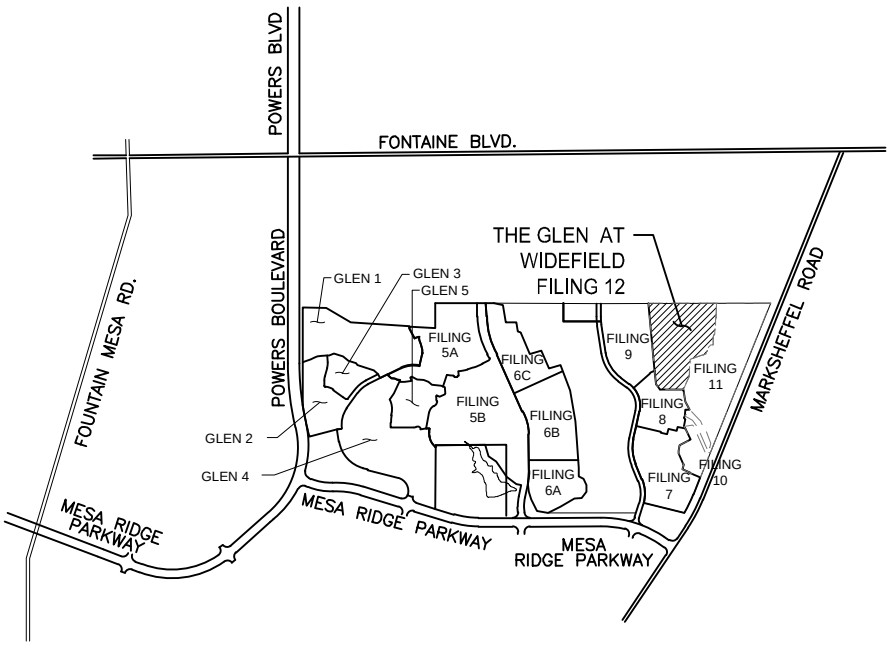
**Figure 1: Vicinity Map**

**Figure 2: Soils Map**

**FEMA Flood Insurance Rate Map (Panels 956 and 957)**

**Hepworth-Pawlak Geotechnical Report**

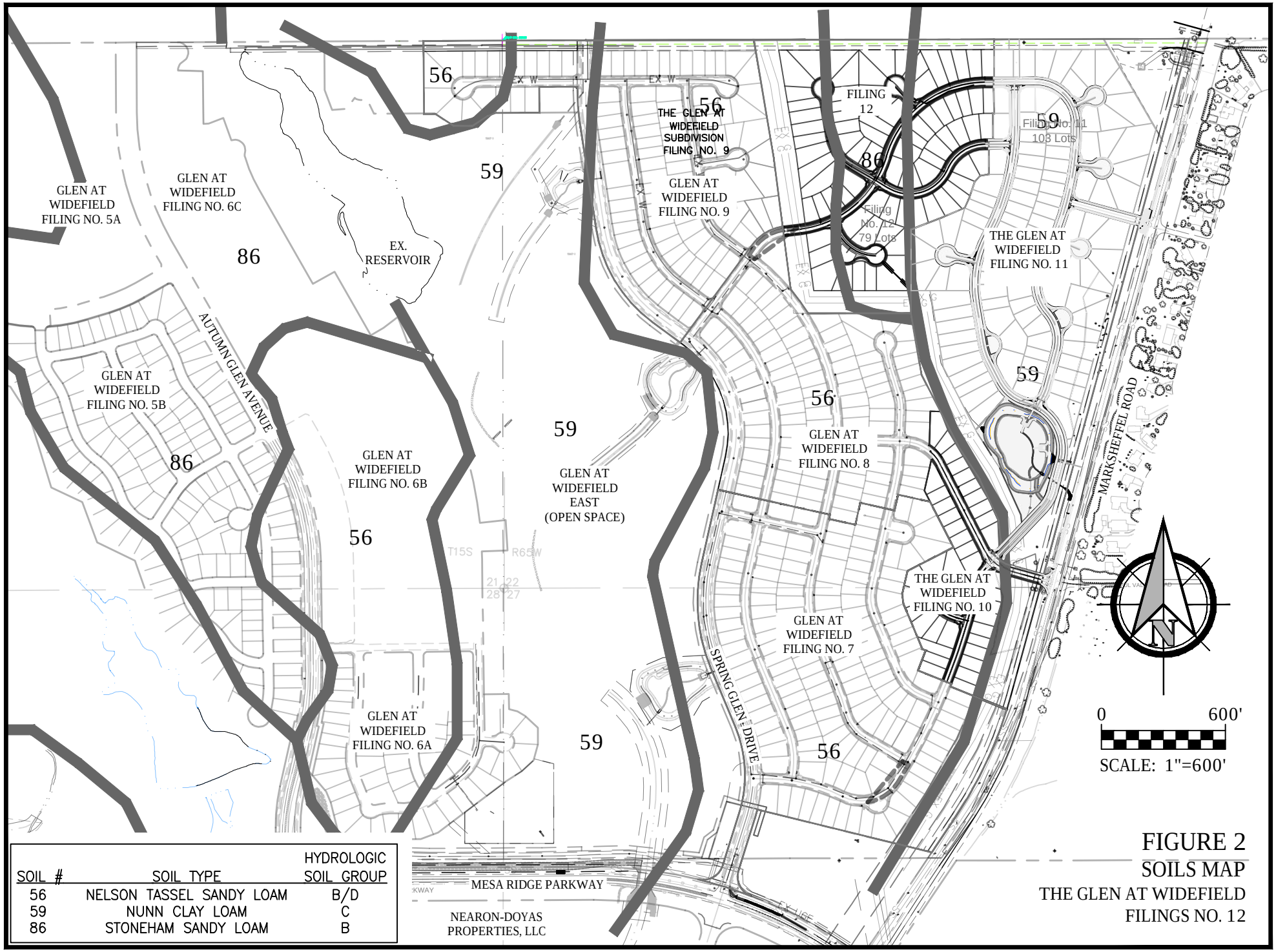
SCALE: NTS




VICINITY MAP
SCALE: N.T.S.

19016 Filing 12 – Historic Conditions.dwg/Dec 05, 2022

FIGURE 1
VICINITY MAP
THE GLEN AT WIDEFIELD FILING NO. 12




| SOIL # | SOIL TYPE | HYDROLOGIC SOIL GROUP |
|---|---|---|
| 56 | NELSON TASSEL SANDY LOAM | B/D |
| 59 | NUNN CLAY LOAM | C |
| 86 | STONEHAM SANDY LOAM | B |

FIGURE 2
SOILS MAP
THE GLEN AT WIDEFIELD
FILINGS NO. 12

Hepworth-Pawlak Geotechnical, Inc.
10302 South Progress Way
Parker, Colorado 80134
Phone: 303-841-7119
Fax: 303-841-7556
www.hpgeotech.com

# PRELIMINARY GEOTECHNICAL INVESTIGATION
# FOR PROPOSED DEVELOPMENT
# THE GLEN AT WIDEFIELD
# FILING NO. 7
# WIDEFIELD, COLORADO

Contains portions of Filing 12
Reference Boring Logs B3 and 10

JOB NUMBER: 215292A

NOVEMBER 4, 2015

PREPARED FOR:
MR. J. RYAN WATSON
WIDEFIELD INVESTMENT GROUP
3 WIDEFIELD BOULEVARD
COLORADO SPRINGS, COLORADO 80911

TABLE OF CONTENTS

PURPOSE AND SCOPE OF STUDY ..... 1
PROPOSED DEVELOPMENT ..... 2
SITE CONDITIONS ..... 2
FIELD EXPLORATION ..... 3
SUBSURFACE CONDITIONS ..... 3
General ..... 3
Sandy Clay (CL): ..... 3
Clayey Sand (SC): ..... 4
Silty Sand (SM): ..... 4
Claystone: ..... 4
Laboratory Testing: ..... 4
Groundwater: ..... 5
GEOLOGIC SITE ASSESSMENT ..... 6
Moisture Sensitive Soils ..... 6
Earthquake Considerations ..... 6
ENGINEERING ANALYSIS ..... 6
PRELIMINARY DESIGN RECOMMENDATIONS ..... 8
Site Grading ..... 8
Site Preparation: ..... 8
Suitability of On-Site Soil: ..... 9
EXCAVATIONS: ..... 9
FOUNDATIONS ..... 10
FLOOR SLABS ..... 11
DRAINAGE ..... 11
Underdrains ..... 11
SURFACE DRAINAGE AND EROSION CONTROL: ..... 11
CONTINUING SERVICES ..... 12
LIMITATIONS ..... 12

FIGURE 1 SITE LOCATION
FIGURES 2a,2b BORING LOCATIONS
FIGURE 3-4 BORING LOGS
FIGURE 5a,5b CROSS SECTIONS
FIGURE 5 LEGEND AND NOTES
FIGURE 6-13 SWELL-COMPRESSION TEST RESULTS
FIGURE 14-15 GRADATION ANALYSIS

TABLE 1 SUMMARY OF LABORATORY TEST RESULTS

## PURPOSE AND SCOPE OF STUDY

This report presents the findings of our preliminary geotechnical engineering study for the proposed residential development located at The Glen at Widefield, Filing No. 7. The site location is shown on Figure 1. The study was conducted to evaluate the potential influence of the site geology on the proposed development and to develop preliminary geotechnical engineering recommendations. The study was conducted in accordance with our agreement for professional engineering services to Widefield Investment Group dated September 9, 2015. Site specific geotechnical investigations should be conducted at each lot and within proposed roadways to determine the appropriate foundation type and construction considerations of each individual residence planned.

A review of prior geotechnical investigations conducted by Soil testing and Engineering, Inc. has been conducted. The following reports have been reviewed:

1. Preliminary Subsurface Soil Investigation, Sunrise Ridge, Phase II, Colorado Springs, Colorado, Job Number 80415, and Dated June 10, 1998
2. Preliminary Subsurface Soil Investigation, Marksheffel Road and Peaceful Valley Road, Job Number 90235, and Dated May 5, 1999
3. Preliminary Subsurface Soil Investigation, The Glen at Widefield, Filing 7, Widefield, Colorado, Job Number 060933, and dated April 16, 2007.

Additionally, the mapped geology shown in the following map was consulted:

1. Scott, G.R., Taylor, R.B., Epis, R.C., and Wobus, R.A., 1976, Geologic map of the Pueblo 1 degree x 2 degrees quadrangle, south-central Colorado: U.S. Geological Survey, Miscellaneous Field Studies Map MF-775, scale 1:187,500

In addition to the review of the available information listed above, a field exploration program consisting of a site reconnaissance and nine borings was conducted to obtain general information on subsurface conditions. Samples from the borings were tested in the laboratory to determine their engineering characteristics. The previous reports, along with the results of our geologic observations, field exploration, and laboratory testing were analyzed to develop a report on the potential geologic hazards and preliminary geotechnical recommendations. This report summarizes the data obtained during the study and presents our conclusions and preliminary recommendations.

## PROPOSED DEVELOPMENT

We understand that this project is part of a larger proposed residential development to be located in the vicinity west of Marksheffel near the intersection with Peaceful Valley Road in El Paso County, Colorado. The scope of this study is limited to the area bound by Marksheffel Road to the east, The Fountain Corporate Boundary to the North (the northern border of Section 22, Township 15 South, Range 65 West), and the rerouted gas line easement to the west and south. This portion of the project has an area of about 53.5 acres, and will potentially include about 185 single family residences and 1.6 miles of roadway. We understand that the houses in this area will be single story units with no basements. As mentioned above, site specific geotechnical studies should be conducted after final grading and platting has been established.

## SITE CONDITIONS

The project area is located to the northeast of the intersection of Marksheffel Road and Peaceful Valley Road. A detailed description of the project boundaries was given in the above section. In general, the western portion of the site is located on a ridge extending south. The ground slopes moderately to the east in this area. The eastern portion of the site (approximately 2/3 of the area) is flat with a very mild slope to the east. Based on the available USGS topographic maps, the elevation varies across the site from about 5680 to 5720 feet MSL. Jimmy camp creek is located about 1,200 feet east of the site at its nearest point.

The majority of the site was vacant at the time of our investigation, but several small well houses are located near the northwest corner, which will be outside of the considered development. Overhead power lines run along the east and north sides of the site. Vegetation on the site consists mostly of weeds and grass with some small deciduous trees, and prairie dog holes were noted throughout. A irrigation ditch was noted at the toe of the slope separating the ridge from the flatter area. Peaceful Valley Country Club Estates (Filing 1), is located just east of the project site.

## FIELD EXPLORATION

The field exploration for this project was conducted on September 23 and 24, 2015. Nine exploratory borings were drilled with an all-terrain CME 550X drill rig equipped with an automatic hammer to evaluate the subsurface conditions in the soils. The boring locations are shown in Figure 2. The exploratory borings were logged by a representative of Hepworth-Pawlak Geotechnical, Inc.

Samples of the soils were taken with a nominal 2-inch I.D. California spoon sampler and 1-3/8 inch I.D. split spoon sampler. The samplers were driven into the subsoils at various depths with blows from a 140-pound hammer falling 30 inches. This test is similar to the standard penetration test described by ASTM Method D-1586. The penetration resistance values are an indication of the relative density or consistency of the subsoils. Depths at which the samples were taken and the penetration resistance values are shown on the Boring Logs, Figure 3 and 4. The samples were returned to our laboratory for review by the project engineer and testing.

## SUBSURFACE CONDITIONS

GENERAL

Under a thin layer of topsoil up to about 1 foot thick, four major subsurface materials were identified in our investigation. These include sandy clay, clayey sand, silty sand, and claystone bedrock. Claystone was encountered at relatively shallow depths along the west side of the site, and dropped off steeply towards the east side, where it was encountered at depths of over 50 feet below the existing ground surface. A detailed discussion of each soil/bedrock type encountered follows.

<u>Sandy Clay (CL):</u>

Sandy clay was found under the topsoil in all nine borings and extended to depths of about 4 to 35 feet below the ground surface. Sandy clay cover was generally shallower at the west side of the site. The sandy clay was medium stiff to very stiff, with an average penetration resistance blow count of 15 that ranged from 6 to 38 blows required for 12 inches of sampler penetration. Swell-compression test results indicate the sandy clay has

a low to very high swell potential based on vertical expansion ranging from 0.3 to 9.1 percent under a surcharge of 1 ksf when wetted.

Clayey Sand (SC):

Clayey sand was encountered under the sandy clay in all Borings except Borings B-3 and B-4. The clayey sand was found to be loose to medium dense, with an average penetration resistance blow count of 11 that ranged from 6 to 18 blows required for 12 inches of sampler penetration. The clayey sand encountered was generally wet, and the samples tested had an in situ water content that ranged from 26.9 to 31.5 percent.

Silty Sand (SM):

Slightly silty to silty sand with some gravel was encountered below the clayey sand in all Borings except Borings B-3 and B-4. The silty sand was found to be medium dense to dense, with an average penetration resistance blow count of 26 that ranged from 13 to 42 blows required for 12 inches of sampler penetration. In situ water content ranging from 10.0 to 12.7 percent was recorded in the samples tested.

Claystone:

Claystone was found at depths as shallow as 4 feet below the ground surface at the west side of the site, and as deep as 53 feet elsewhere. It was generally hard to very hard, with an average penetration of 5½ inches after 50 blows. The sample of claystone taken at 4 feet at Boring B-4 was softer, with a blow count of 31 for 12 inches of sampler penetration.

LABORATORY TESTING:

Laboratory testing included moisture content, unit weight, Atterberg limits, sieve analysis, percent passing #200 sieve, swell-compression, and water soluble sulfate concentration. Detailed results of swell-compression testing are shown on Figures 6-13 and gradation analyses on Figures 14 and 15. Test results are shown on the boring logs, Figures 3 and 4, and are summarized in Table 1

The concentration of water-soluble sulfates in the samples tested ranged from 0.065 to 0.813 percent. According to the Portland Cement Association's publication "Design and Control of Concrete Mixtures, 14th Edition" sulfate concentrations between 0.2 and 2.0 percent represent a severe sulfate exposure to concrete. To limit the effects of sulfate attack, Type V concrete is recommended. Additionally, a water to cementitious material ratio not exceeding 0.42 is recommended.

GROUNDWATER:

Groundwater was generally found at a depth of about 20 feet below the ground surface when measured several days after drilling. The table below lists the specific depths at which ground water was encountered.

| Boring | Water Depth at time of Drilling | Water Depth Several Days After Drilling | Cave Depth |
|---|---|---|---|
| B-1 | (no water found) | 21 feet | 21.5 feet |
| B-2 | 22 feet | 20 feet | 20 feet |
| B-3 | (no water found) | (no water found) | 19 feet |
| B-4 | (no water found) | (no water found) | 14 feet |
| B-5 | (omitted from drilling program) | | |
| B-6 | 15 feet | (no water found) | 20 feet |
| B-7 | 22 feet | 22 feet | 22 feet |
| B-8 | (no water found) | 22 feet | 24 feet |
| B-9 | 44 feet | 21 feet | 22 feet |
| B-10 | (no water found) | 22 feet | 26 feet |

Our review of previous studies conducted by STE indicate that groundwater depths were significantly shallower in the past. Perched groundwater and water contained in lenses of relatively permeable sands within less permeable clays are likely to be encountered.

It is anticipated that the depth to ground water will fluctuate with time based on seasonal, climatic, and other factors including irrigation.

## GEOLOGIC SITE ASSESSMENT

The geologic formations in the vicinity of the project area include Quaternary Piney Creek Alluvium, Colluvium, and Pierre Shale below a thin layer of colluvium on the western side of the proposed development. Geologic hazards include moisture sensitive soils.

### MOISTURE SENSITIVE SOILS

Our laboratory testing shows that the clay layers and the Pierre Shale have a medium to very high expansion potential when wetted and some of the soils have a collapse potential. These conditions must be considered in the design of building foundations and road pavements. The previous reports issued by STE have noted the hazards and some of our borings have encountered them. Both compression and swell can be remediated by removal and replacement with suitable material. For the clay, replacement at moisture contents above optimum is a common method. More detailed exploration and testing is required to better define the limits and their effect on the development.

### EARTHQUAKE CONSIDERATIONS

The project area could experience earthquake related ground shaking. Modified Mercalli Intensity VI ground shaking should be expected during a reasonable exposure time for the development, but the probability for stronger ground shaking is low. Intensity VI ground shaking is felt by most people and causes general alarm, but results in negligible damage to structures of good design and construction. Occupied structures should be designed to withstand moderately strong ground shaking with little or no damage, and not to collapse under stronger ground shaking. According to the 2003 IBC and local codes, the property is considered to be Site Class C where the overburden is less than 15 feet and Site Class D where the overburden is greater than 15 feet. The Seismic Design Category is considered to be B.

## ENGINEERING ANALYSIS

Because of the relatively large area considered within the proposed development, different conditions were identified within different areas of the site. At the western portion, expansive clay over shallow expansive claystone will be the dominant subsurface materials encountered at the anticipated foundation levels. Overburden consisting of

collapsible to expansive soils will encountered throughout the remainder of the site. Though no exceedingly soft/loose areas were identified in our study, such conditions have been identified in past studies, and it is possible that areas requiring significant remediation will be identified when site specific studies are conducted. Particularly, if shallow groundwater is identified, additional fill placement may be necessary to elevate foundations to a suitable distance from the groundwater.

Generally, the moisture sensitive soils should be remediated under all roadways, utility infrastructure, paved walks, drives, and flatwork, and under foundations. This can be accomplished in large part by removing, moisture conditioning, and replacing the existing soils in controlled compacted lifts. Unsuitable material, which includes the expansive claystone bedrock and some highly expansive clay should not be used below foundations. Because of the shallow depth of the bedrock along the western portion of the site, deep foundations, such as drilled piers may be a more cost effective option than over-excavation and replacement. In areas where the existing expansive material is replaced with a more permeable granular material, a toe drain at the base of the fill will be necessary to prevent the accumulation of surface water at this interface.

Structural floors built above crawlspaces will perform the best in the moisture sensitive soils encountered, but if the increased risk of slab movement can be tolerated, on-grade slabs can be used for the garage areas provided the area below has been over-excavated and replaced with suitable material. A more detailed discussion of floor types has been provided in the *Floors* subsection of the *Preliminary Design Recommendations* section below.

We recommend that the potential homeowner be supplied with, read and follow the recommendations presented in the Colorado Geologic Survey's Special Publication 43 "Home Landscaping and Maintenance on Swelling Soil". This publication provides a thorough description of the construction of homes on expansive soil, and includes information about the additional maintenance and care required for such homes. In particular, information about surface drainage and irrigation should be reviewed.

Because high concentrations of water soluble sulfates were found, special cement will likely be necessary for concrete in contact with the native soils. Because special cement could potentially add substantial construction costs, additional testing during the site specific investigations is recommended to determine the extent of these high concentrations.

Roadways will require subgrade improvement, which could be accomplished via over-excavation and replacement, and/or the use of geogrid below the pavement section. Lime stabilization of the native soils with high sulfate concentrations is not recommended due to the potential formation of calcium-sulfate-aluminate-hydrates, and the soil heave associated with the formation of these crystalline compounds.

## PRELIMINARY DESIGN RECOMMENDATIONS

Based on the subsurface conditioned encountered, and our understanding of the proposed development, the following preliminary design recommendations have been provided.

### SITE GRADING

We anticipate relatively shallow cuts and fills. We should have the opportunity to review construction plans for consistency with our recommendations.

#### Site Preparation:

The following preliminary recommendations should be observed for site preparation.

1. Permanent cut and fill slopes should be no steeper than 3:1 (horizontal to vertical). Any man-made slopes higher than 10 feet should be evaluated for slope stability.
2. All unsuitable organic material, debris or soft soils should be removed from areas to receive fill. This applies particularly to the placement of fill on slopes. If grading creates any slope steeper than 4 horizontal to 1 vertical, the ground should be benched to provide a relatively level surface for compaction. The exposed soils should be scarified, moisture conditioned, and compacted to the same density as the overlying fill.

3. All fill and backfill should be approved by the geotechnical engineer, placed in uniform lifts with a thickness compatible with the type of compaction equipment being used, moisture conditioned within 0 to +3 percent of optimum moisture content for the clay soil, and ±2 percent of optimum for the sand soils. The soils should be compacted with the appropriate equipment for the lift thickness used. The following minimum percentages of the maximum dry density, as determined by ASTM D698 (standard Proctor), are considered suitable for the anticipated development.
    a) Below foundations……..95%
    b) Below slabs and pavements……95%
    c) Landscaped area fill……90%
    d) Retaining or Foundation Wall Backfill……..95%

Suitability of On-Site Soil:

The clay soils encountered in the borings were found to have a relatively high swell potential at their in-situ moisture content and density, and will likely be expansive when placed as fill. Moisture conditioning to optimum and above can reduce the swell potential, but will not eliminate the risk of heaving caused by expansive soils. For fills that contain these clay soils, we recommend Standard Proctor criteria (ASTM D698) as opposed to modified Proctor criteria (ASTM D1557), because its use generally yields fill at higher optimum moisture content at a lower density and hence a lower expansion potential. All soils proposed for use below slabs or foundations should be tested for suitability. Bedrock will not be suitable for placement under structures.

Borrow areas should be stripped and segregated so that the fill will be free of deleterious materials. The on-site soil should be processed so that the fill does not contain rock or soil fragments larger than 4 inches in diameter. Any soils imported to the site should be approved by the geotechnical engineer.

EXCAVATIONS:

The sandy clay overburden, and the bedrock encountered in our borings can be excavated with typical heavy duty excavation equipment. Relatively shallow excavations are

anticipated for the construction of the proposed residences, but deeper excavations may be required for utility trenches.

It is the responsibility of the Contractor to provide safe working conditions and to comply with the regulations in OSHA Standards, Excavations, 29CFS Part 1926. The on-site native clay will likely classify as "Type B" in accordance with OSHA regulations. The regulations allow slopes of 1:1 horizontal to vertical for Type B soils for temporary excavations less than 20 feet deep. Some of the hard native sandy clay and claystone or sandstone bedrock will classify as "Type A" in accordance with OSHA regulations. The regulation allows for slopes of ¾:1 for temporary excavations less than 20 feet deep. The native sands encountered below the clay will likely classify as "Type C" in accordance with OSHA regulations. The regulations allow slopes of 1½:1 horizontal to vertical (34°) for Type C soils for temporary excavations less than 20 feet deep. The presence of water, seepage, fissuring, vibrations or surcharge loads will require temporary excavation to have slopes flatter than those allowed by OSHA regulations. The Contractor's competent person should make decisions regarding cut slopes. A qualified Geotechnical engineer should observe any questionable slopes or conditions. Temporary shoring or trench boxes may be necessary. Trench cut slopes in cohesive soils and bedrock should stand at near vertical for a sufficient length of time to install any required temporary shoring unless adversely affected by groundwater seepage, vibrations or surcharge loads. Trenches cut in non-cohesive sand may not stand at a near vertical slope during the time required to install trench boxes, and these areas may require the trench to be sloped instead.

FOUNDATIONS

Considering the subsurface conditions encountered in our investigation and the nature of the proposed construction, either deep foundation systems or over-excavation and replacement should be utilized for proposed structures. Deep foundations consisting of typical drilled shaft piers will likely be suitable at the west side of the site. Helical piers bearing in the overburden materials will be necessary for areas where deep bedrock exists. Particularly in the east portion of the site, deep foundations will not likely be required if over-excavation and replacement is conducted.

These criteria are presented for preliminary planning purposes only. Actual design criteria should be established by drilling closely-spaced borings within each building footprint and performing laboratory testing.

## FLOOR SLABS

Floor slabs present a difficult problem where expansive materials are near the proposed floor slab elevation because sufficient dead load cannot be imposed on them to resist the uplift pressure generated when the materials become wet and expand. The only positive method to control floor slab movement on these soils is to construct a structural floor system above a crawl space. The evaluation of mold hazards is beyond the scope of this study and H-P Geotech does not provide recommendations regarding mold mitigation.

Garage floors are subject to the same difficult soils conditions as described above, but are difficult to construct over crawlspaces due to the relatively high live loading conditions anticipated. Slab-on-grade construction can be used for the garage floors provided that the risk of distress resulting from floor slab movement is recognized and accepted by the builder/potential homeowner. In areas with high swell potential, over-excavation of the native soils, and replacement with suitable moisture conditioned soils will be required.

## DRAINAGE

### Underdrains

Though groundwater was found at relatively low elevations compared to those of the anticipated foundations, it has been known to be significantly higher in the past. Additionally, surface water infiltration due to storm events and irrigation will change the groundwater depth. Therefore, we recommend below-grade construction, including crawlspaces be protected from excessive wetting by an underdrain system. The drain also will act to prevent buildup of hydrostatic pressures behind foundation walls.

### Surface Drainage and Erosion Control:

Moisture-sensitive and erodible subsoils were identified at this site. The satisfactory performance of foundations, floor slabs and pavements are directly related to positive surface and subsurface drainage systems to prevent subgrade wetting. Surface grades should be maintained such that irrigation, snowmelt and precipitation water will easily

run off away from the structures and pavement. A 10 percent slope adjacent to foundations is commonly used. Positive drainage away from all structures and roadways should be maintained.

Additionally, good surface drainage should be provided around all fill areas and cut slopes to direct surface runoff away from these areas. Slopes and other stripped areas should be protected against erosion by paving, re-vegetation or other means.

CONTINUING SERVICES

Two additional elements of geotechnical engineering service are important for the successful completion of this project.

1. Consultation with design professionals during the design phases. This is important so the intentions of our recommendations are properly incorporated in the design, and that any changes in the design concept properly consider geotechnical aspects. A design-level geotechnical study should be undertaken once siting and configuration of the project is final.
2. Observation and monitoring during construction. A geotechnical engineer from our firm should observe the excavation, earthwork, and foundation phases of the work to judge that subsurface conditions are compatible with those used in the analysis and design. During site grading, placement of fill should be observed and tested to confirm that the proper placement conditions have been achieved.

## LIMITATIONS

This report has been prepared in accordance with generally accepted geotechnical engineering principles and practices in this area at this time. We make no warranty either express or implied. The conclusions and recommendations submitted in this report are based upon the data obtained from widely-spaced exploratory borings drilled at the locations indicated on Figure 2, the proposed type of construction and our experience in the area, and the review of previous studies conducted in the area. Our findings are preliminary in nature and include interpolation and extrapolation of the subsurface conditions identified at the exploratory borings and variations in the subsurface

conditions may not become evident until further exploration or excavation is performed. A site specific geotechnical study should be performed for each lot.

This report has been prepared for the exclusive use by our client for preliminary design purposes. We are not responsible for technical interpretations by others of our exploratory information which has not been described or documented in this report. As the project evolves, we should provide continued consultation and field services during construction to review and monitor the implementation of our recommendations, and to verify that the recommendations have been appropriately interpreted.

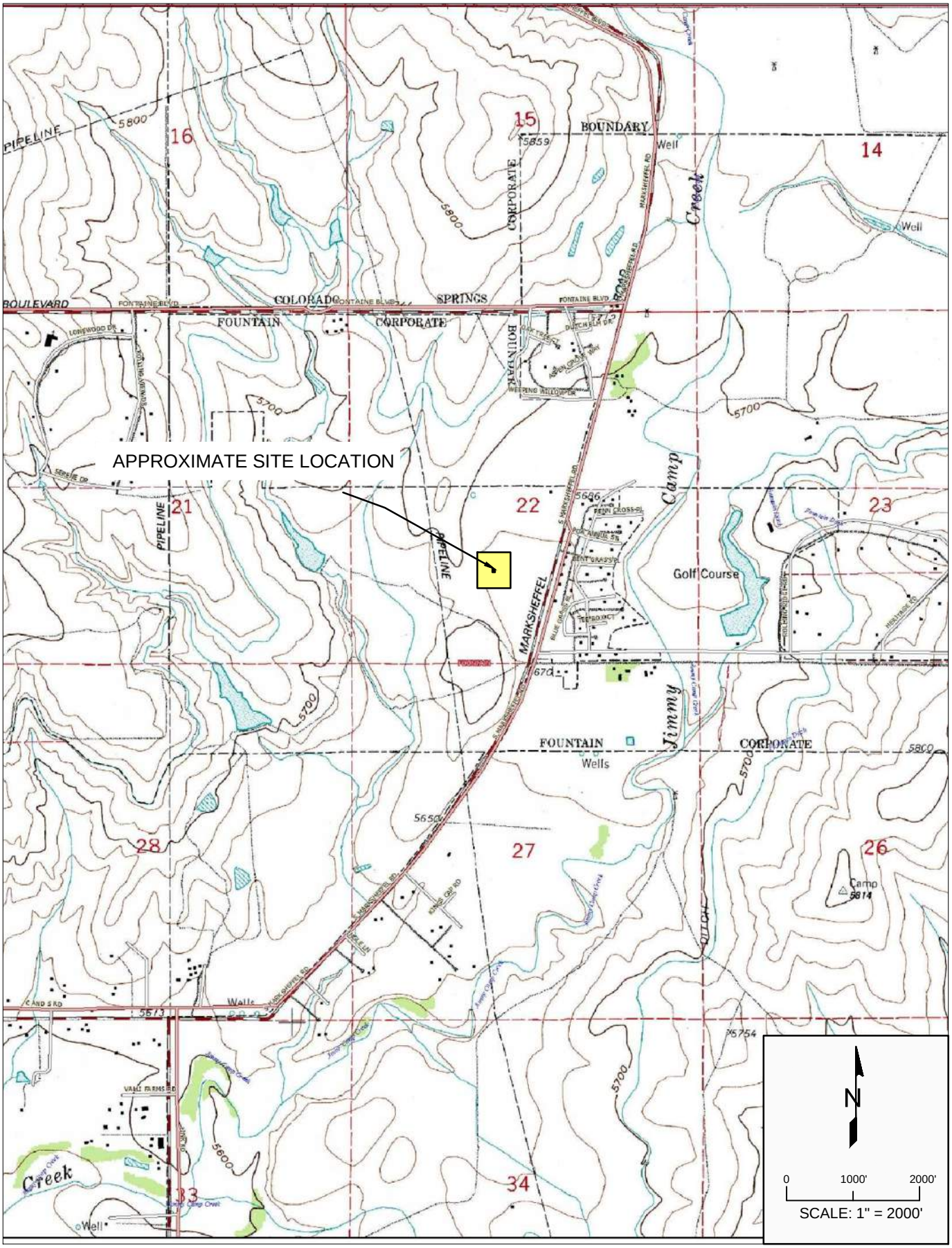
If you have any questions or if we can be of further service, please call. We appreciate the opportunity to have worked on this project.

Sincerely,
HEPWORTH - PAWLAK GEOTECHNICAL, INC.

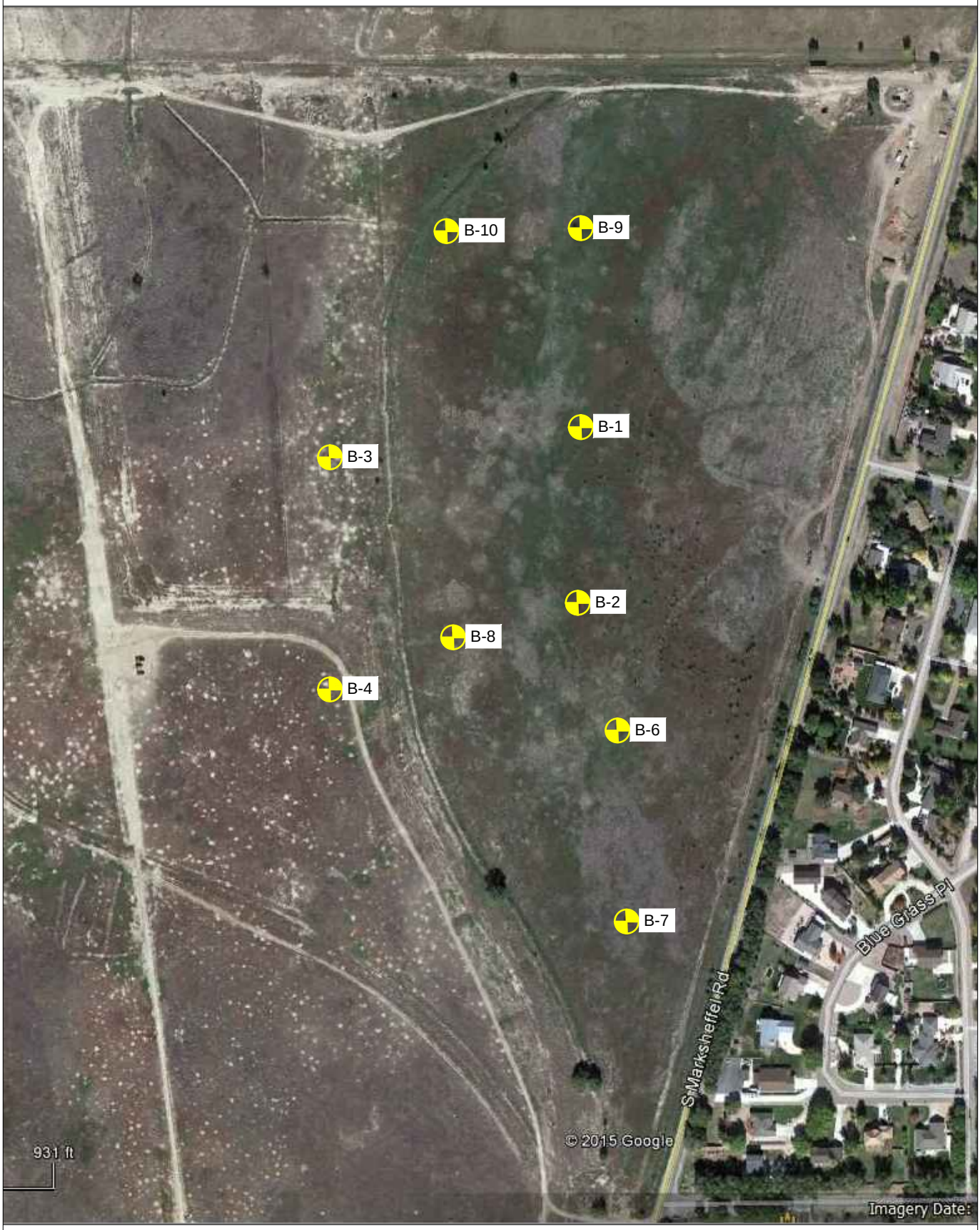
Cuong Vu, Ph.D., P.E.

and

Arben Kalaveshi, P.E.

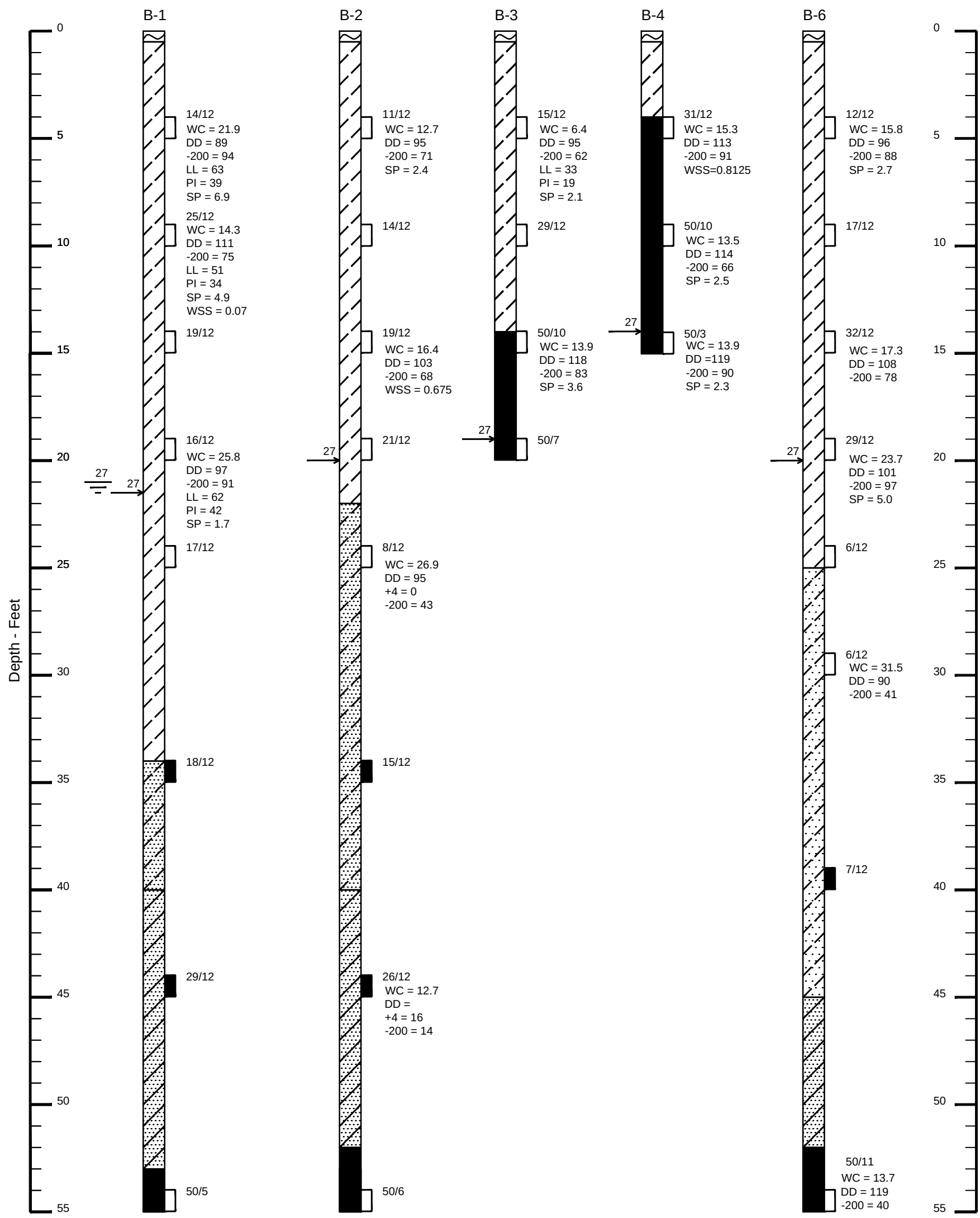



| | | | |
|---|---|---|---|
| 215292A | HEPWORTH-PAWLAK GEOTECHNICAL, Inc. | THE GLEN AT WIDEFIELD, FILING 7<br>SITE LOCATION | FIG. 1 |

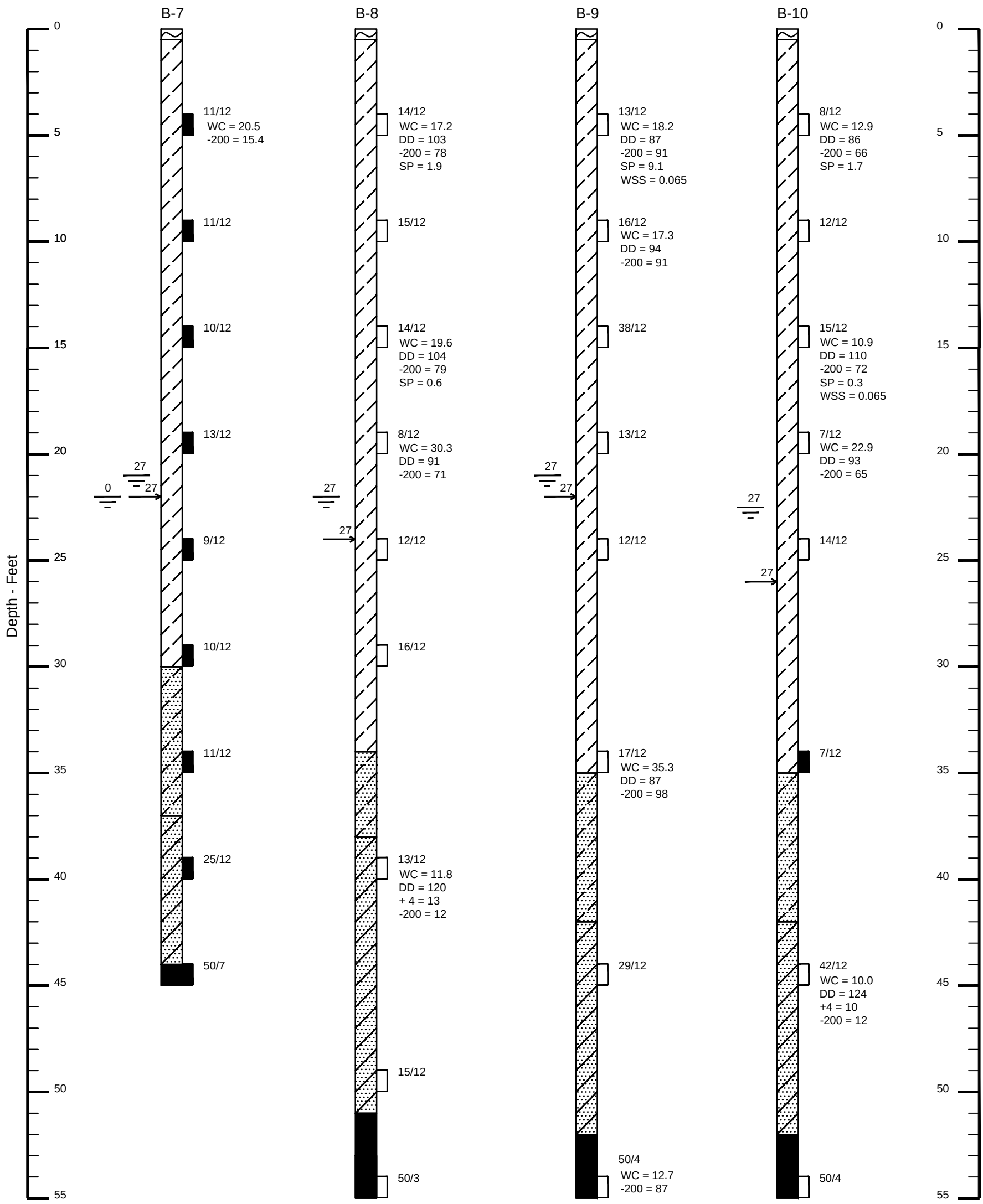



| | | | |
|---|---|---|---|
| 215292A | HEPWORTH-PAWLAK GEOTECHNICAL, Inc. | THE GLEN AT WIDEFIELD, FILING 7<br>BORING LOCATIONS | FIG. 2 |

| | | | |
|---|---|---|---|
| 215292A | HEPWORTH-PAWLAK GEOTECHNICAL, Inc. | THE GLEN AT WIDEFIELD, FILING 7<br>BORING LOCATIONS | FIG. 2a |



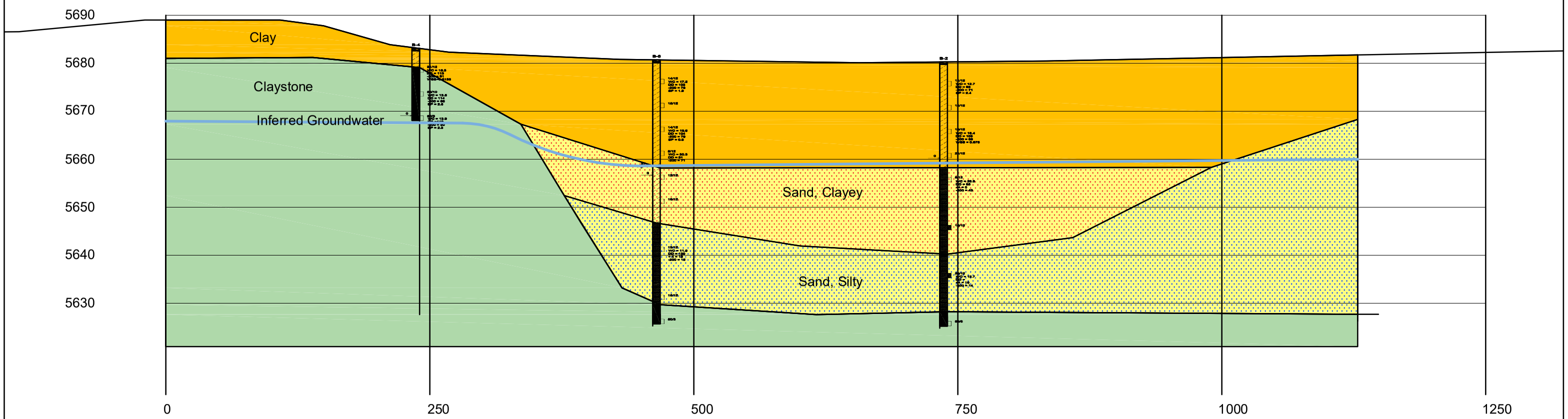

| | | | |
|---|---|---|---|
| 215292A | HEPWORTH-PAWLAK GEOTECHNICAL, Inc. | THE GLEN AT WIDEFIELD, FILING 7<br>BORING LOGS | FIG. 3 |




| | | | |
|---|---|---|---|
| 213116A | HEPWORTH-PAWLAK GEOTECHNICAL, Inc. | THE GLEN AT WIDEFIELD, FILING 7<br>BORING LOGS | FIG. 4 |

NOTES:

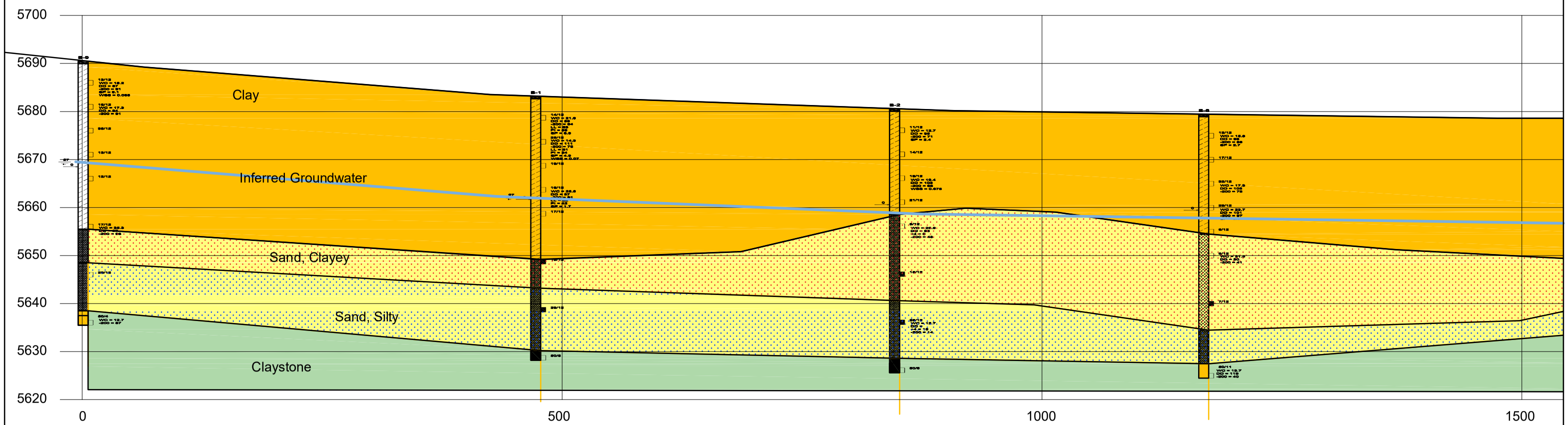
1. The materials shown and their boundaries have been inferred and interpreted from the boring data available and the surface conditions observed, and may differ from the actual subsurface conditions.
2. The surface topography end elevations are approximate.
3. The free water line shown is an extrapolation of the water level shown in boreholes when measured at least 1 day after drilling was completed.




| | | | |
|---|---|---|---|
| 215292A | HEPWORTH-PAWLAK GEOTECHNICAL, Inc. | THE GLEN AT WIDEFIELD, FILING 7<br>SOIL CROSS SECTIONS | FIG. 4A |

NOTES:

1. The materials shown and their boundaries have been inferred and interpreted from the boring data available and the surface conditions observed, and may differ from the actual subsurface conditions.
2. The surface topography end elevations are approximate.
3. The free water line shown is an extrapolation of the water level shown in boreholes when measured at least 1 day after drilling was completed.




| | | | |
|---|---|---|---|
| 215292A | HEPWORTH-PAWLAK GEOTECHNICAL, Inc. | THE GLEN AT WIDEFIELD, FILING 7<br>SOIL CROSS SECTIONS | FIG. 5 |

LEGEND

TOPSOIL: Clay (CL), sandy, slightly moist to moist, brown, with grass/weed cover.

CLAY (CL), sandy, fine to medium grained, medium stiff to very stiff, medium plasticity, moist to wet, brown.

SAND (SC), clayey, fine to coarse grained, low plasticity, loose to medium dense, very moist moist to wet, brown.

SAND (SP-SM), silty, gravelly, fine to coarse grained, medium dense, moist, brown.

Claystone, fine grained, medium hard to very hard, moist, brown to blue.

17/12 Indicates 1⅜ inch I.D. Split Spoon sampler. 17/12 indicates 17 blows of a 140-pound hammer falling 30 inches were required to drive the sampler 12 inches.

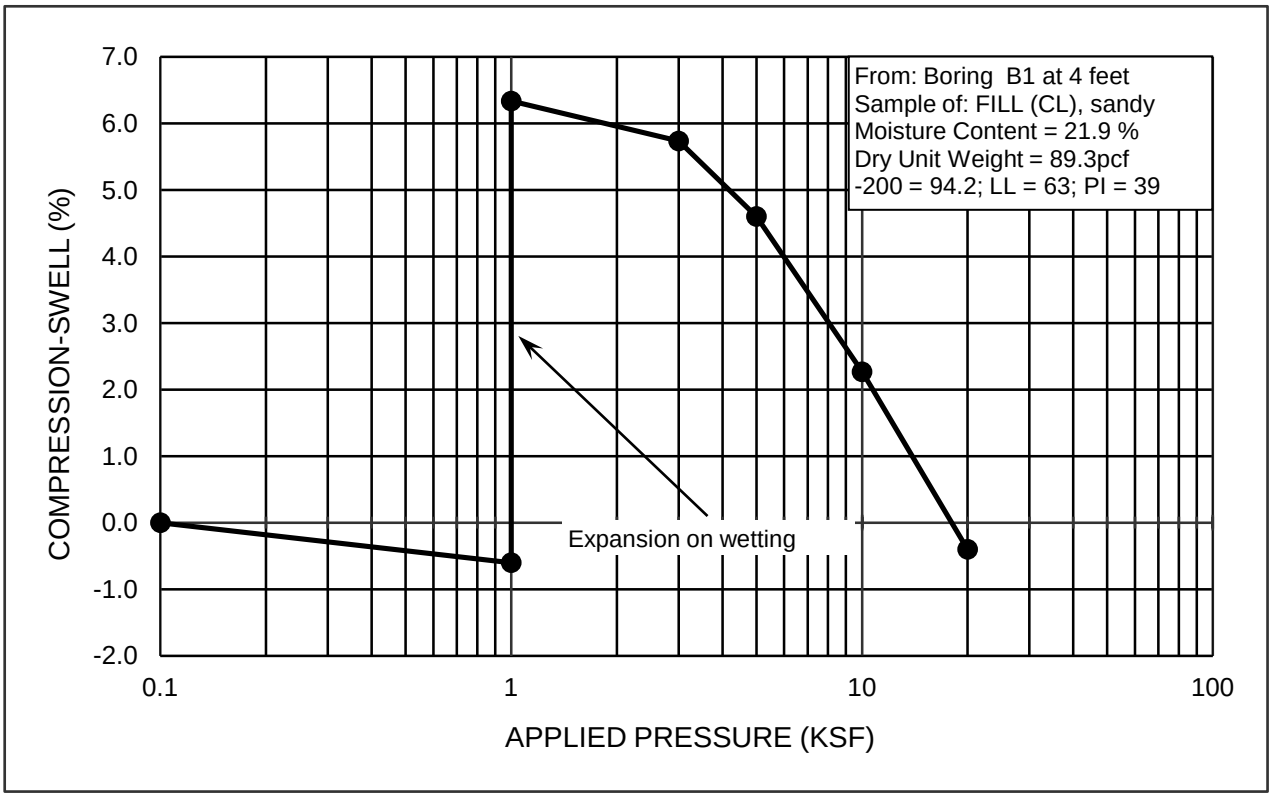
17/12 Indicates 2-inch I.D. California sampler. 17/12 indicates 17 blows of a 140-pound hammer falling 30 inches were required to drive the sampler 12 inches.

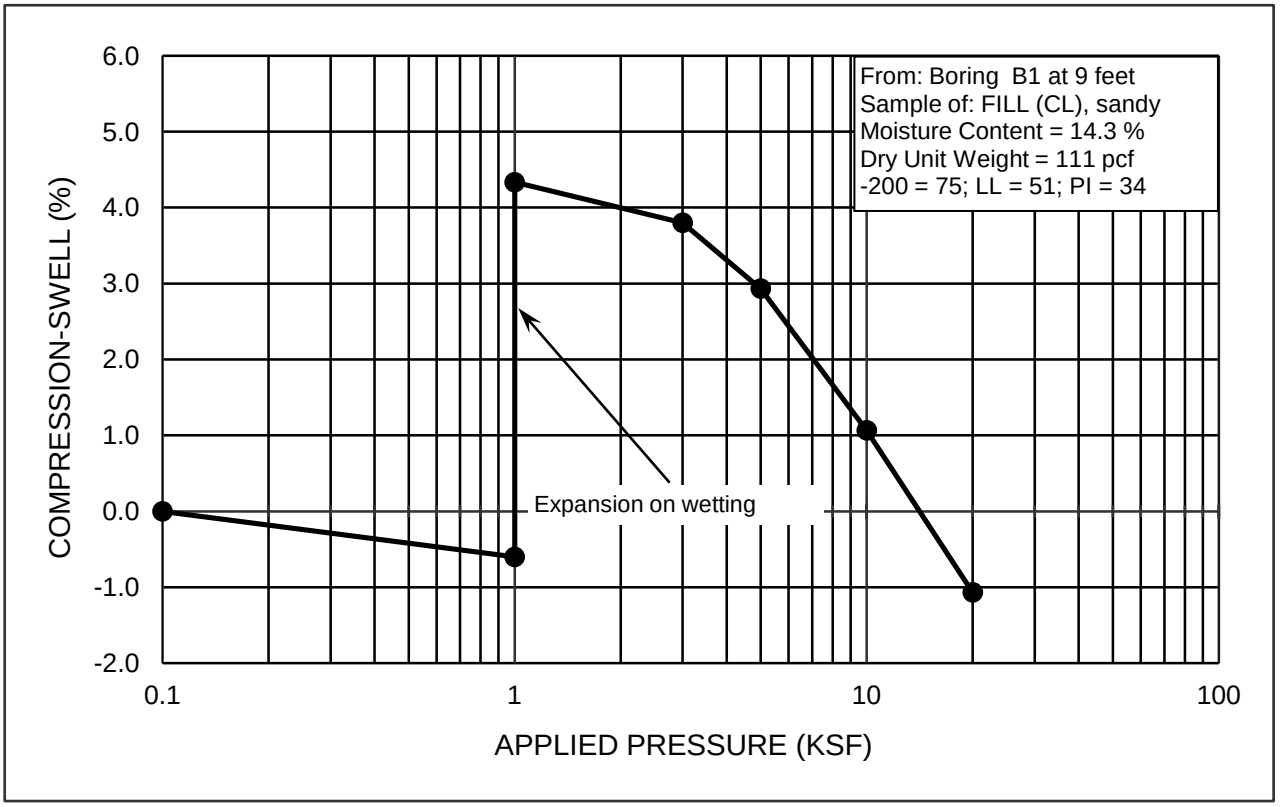
27 Indicates depth of cave and number of days after drilling measurement was made.

27 Indicates depth of free water and number of days after drilling measurement was made.

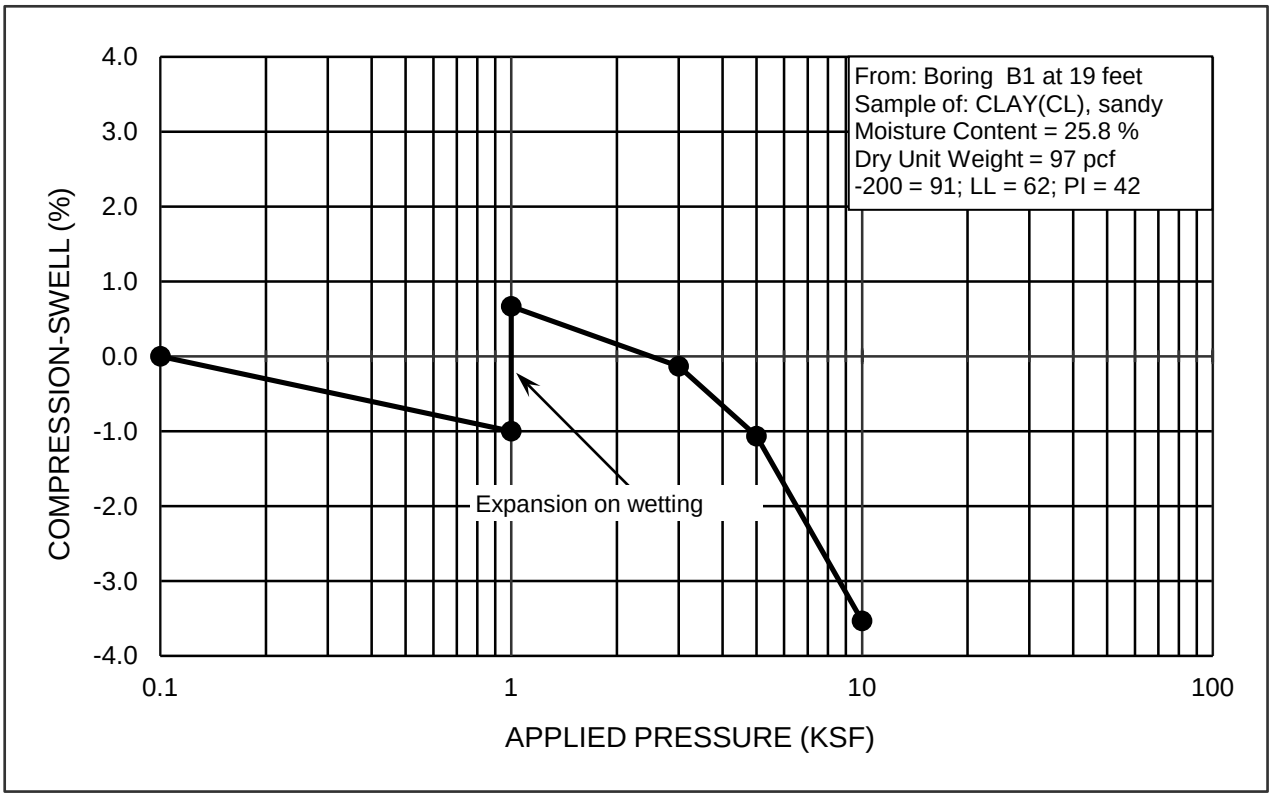
NOTES:

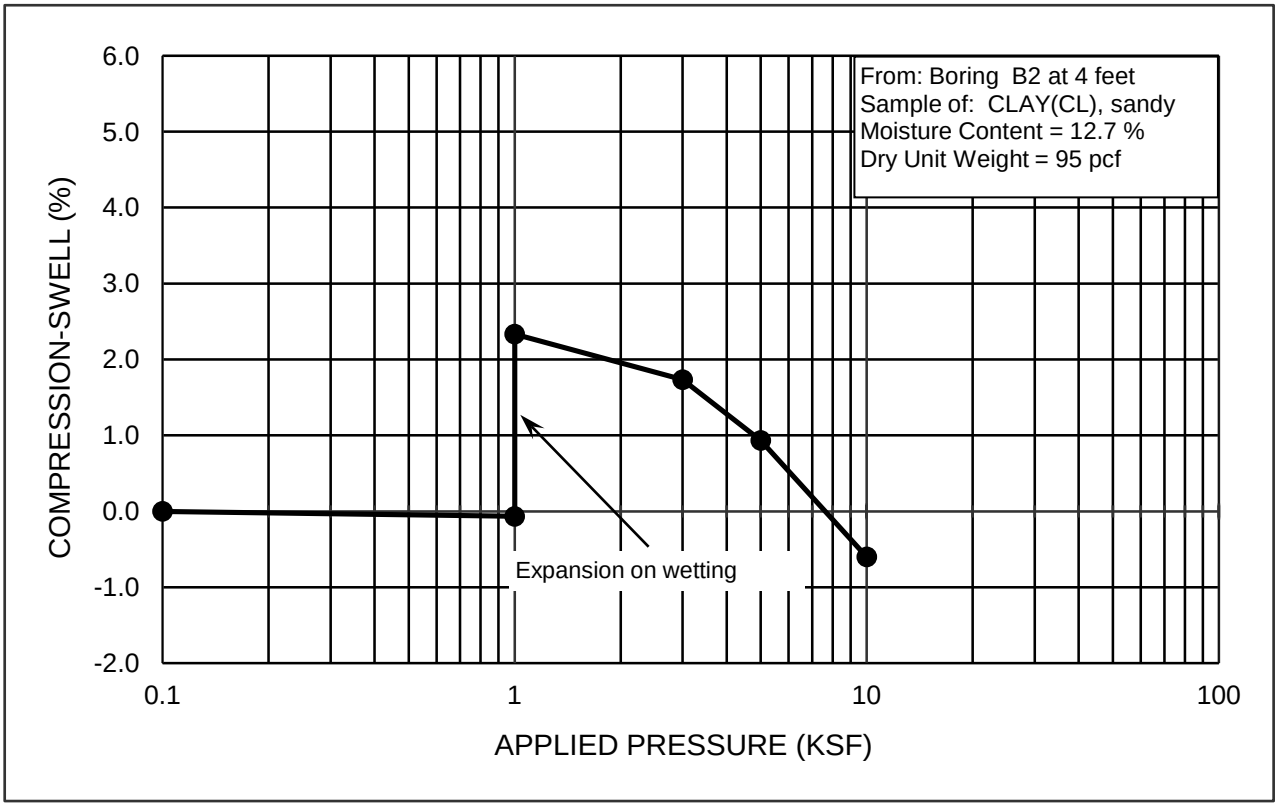
1. FIeld work was conducted on September 23 and 24, 2015. The Boring was drilled and sampled using a truck mounted CME 550X All Terrain Drill Rig.
2. Location of borings shown on Figure 2 are approximate.
3. Elevations of borings were not measured during our site visit.
4. The lines between strata represent approximate boundaries and transitions may be gradual.
5. Laboratory Testing Results:
   MC=Moisture content (%).
   DD=Dry density (pcf).
   +4 = Percent of gravel fraction
   -200 = Percent of silt and clay fraction.
   LL = Liquid limit.
   PI = Plastic index.
   SP = Percent swell under a surcharge of 1,000 psf when wetted.
   WSS = Water Soluble Sulfates in Percent.



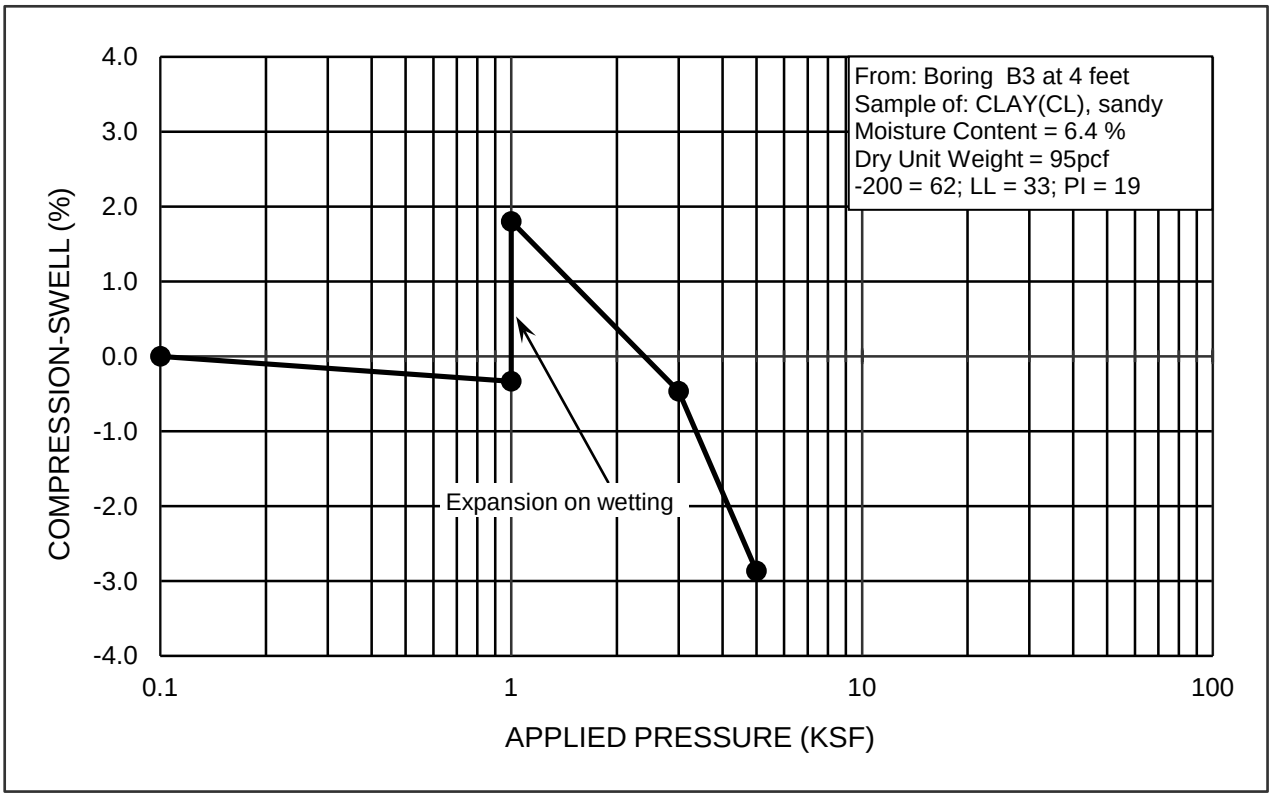



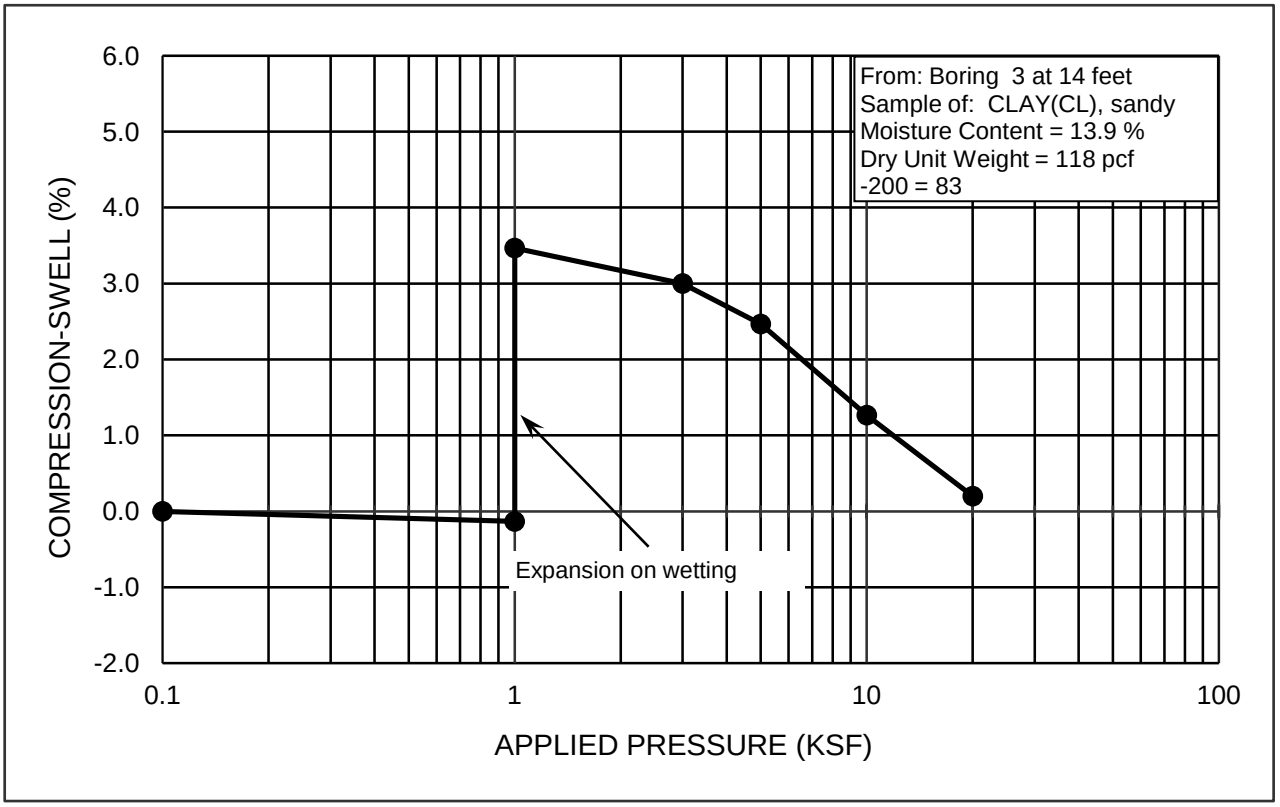

| | | | |
|---|---|---|---|
| 215292A | HEPWORTH-PAWLAK GEOTECHNICAL, INC. | WIDEFIELD<br>SWELL-COMPRESSION TEST RESULTS | FIG. 6 |



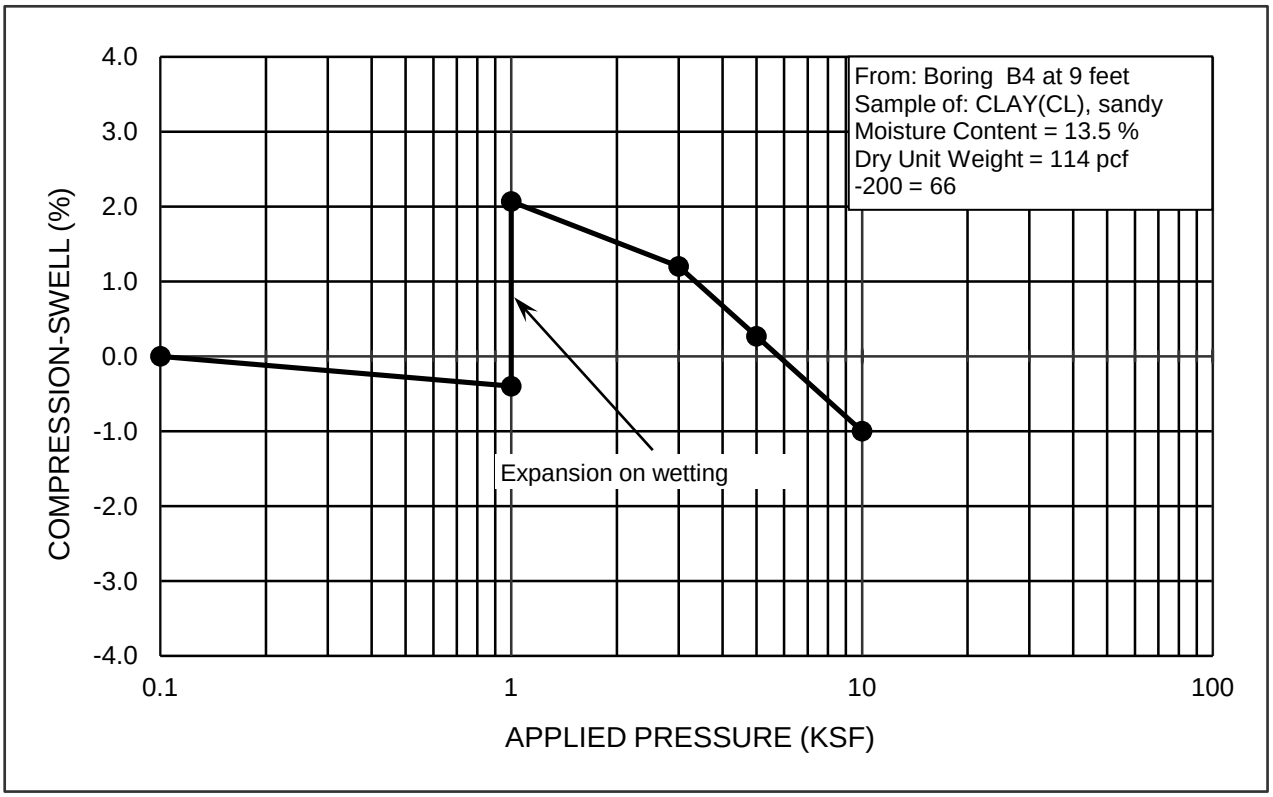



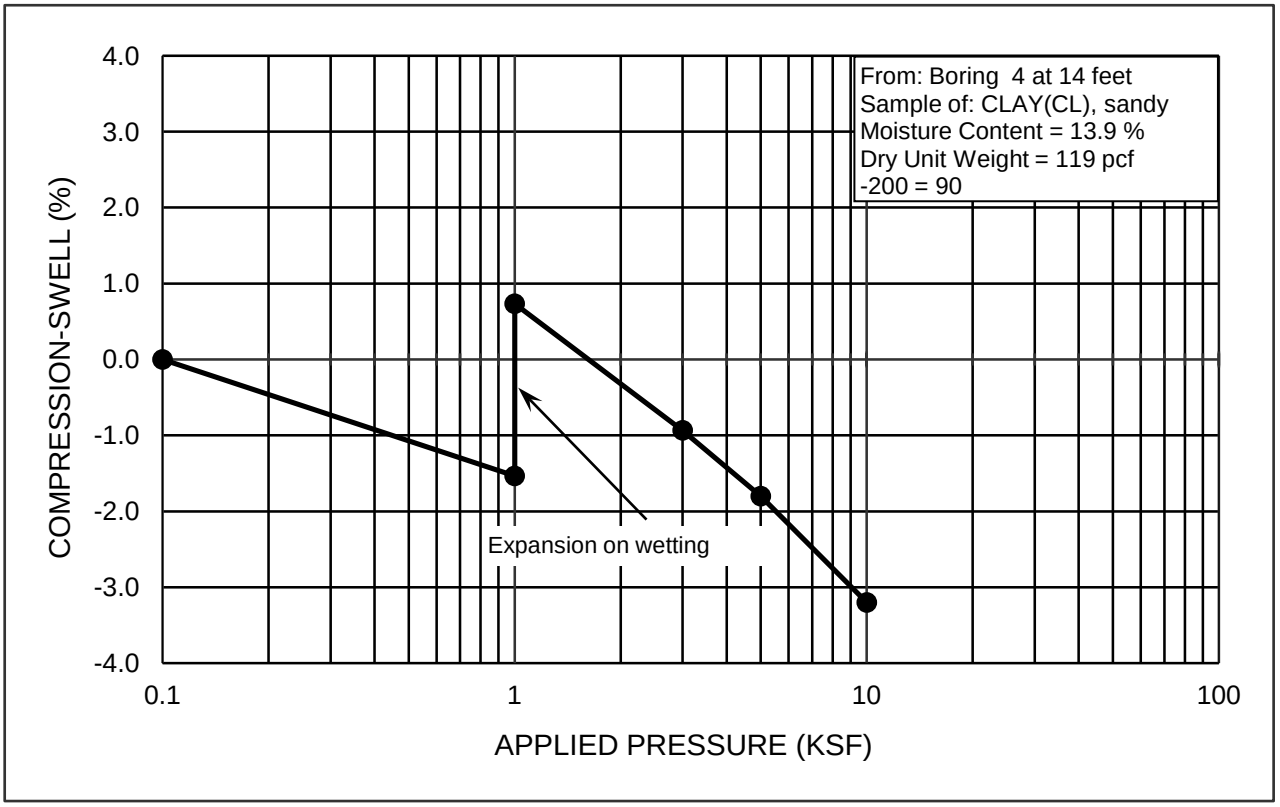

| | | | |
|---|---|---|---|
| 215292A | HEPWORTH-PAWLAK GEOTECHNICAL, INC. | WIDEFIELD<br>SWELL-COMPRESSION TEST RESULTS | FIG. 7 |



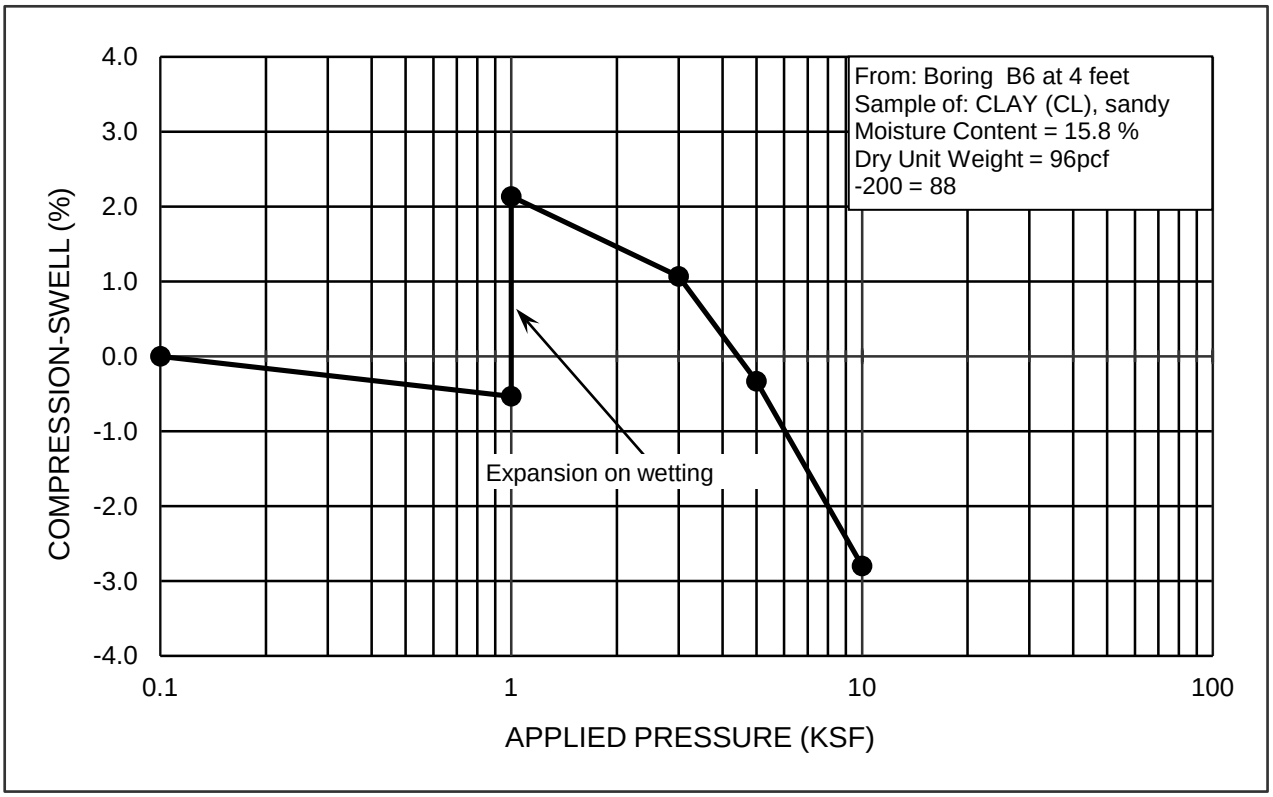



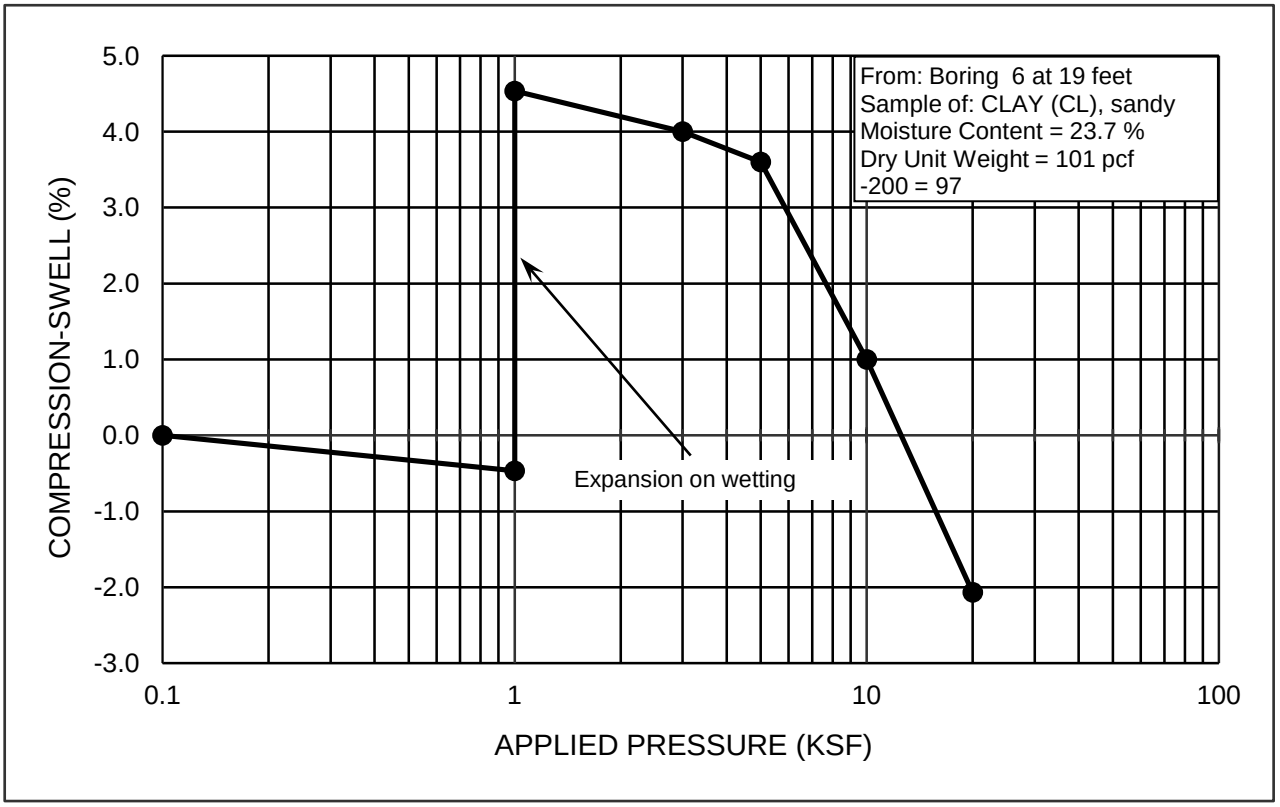

| | | | |
|---|---|---|---|
| 215292A | HEPWORTH-PAWLAK GEOTECHNICAL, INC. | WIDEFIELD<br>SWELL-COMPRESSION TEST RESULTS | FIG. 8 |



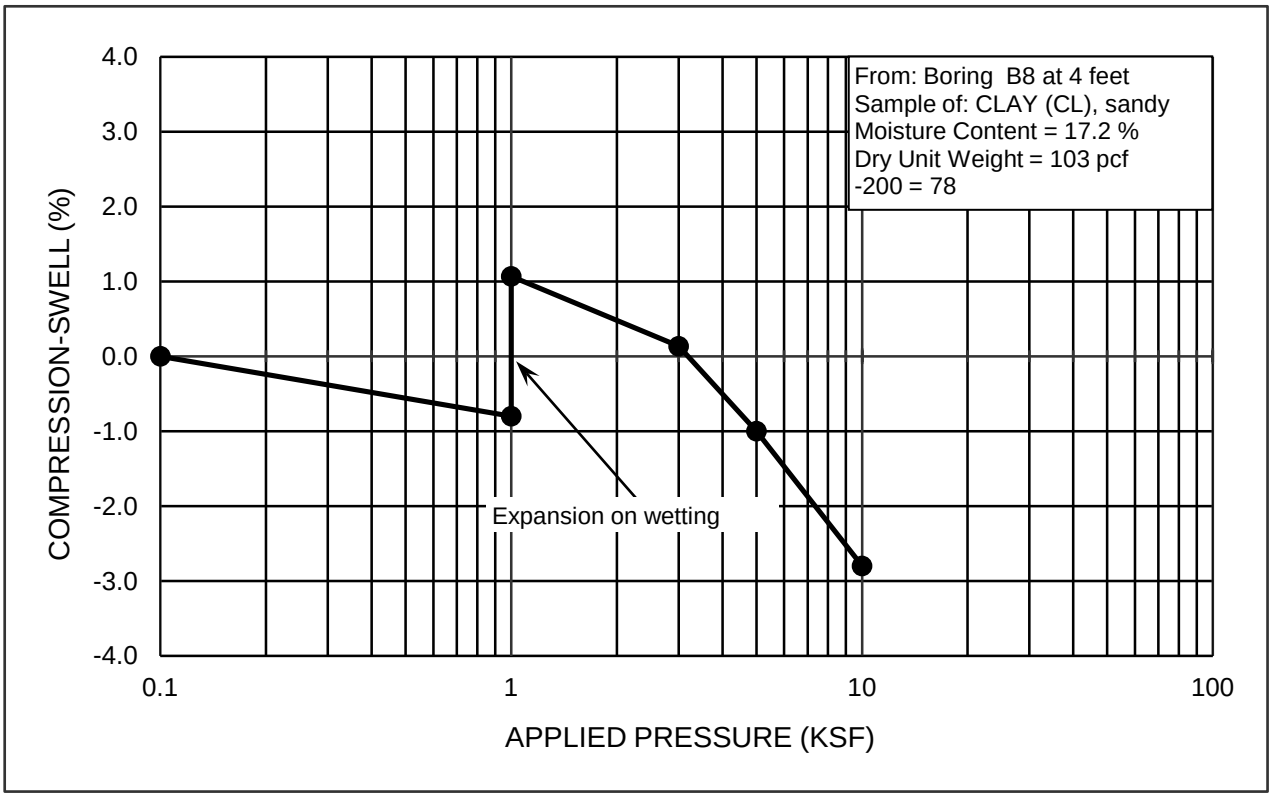



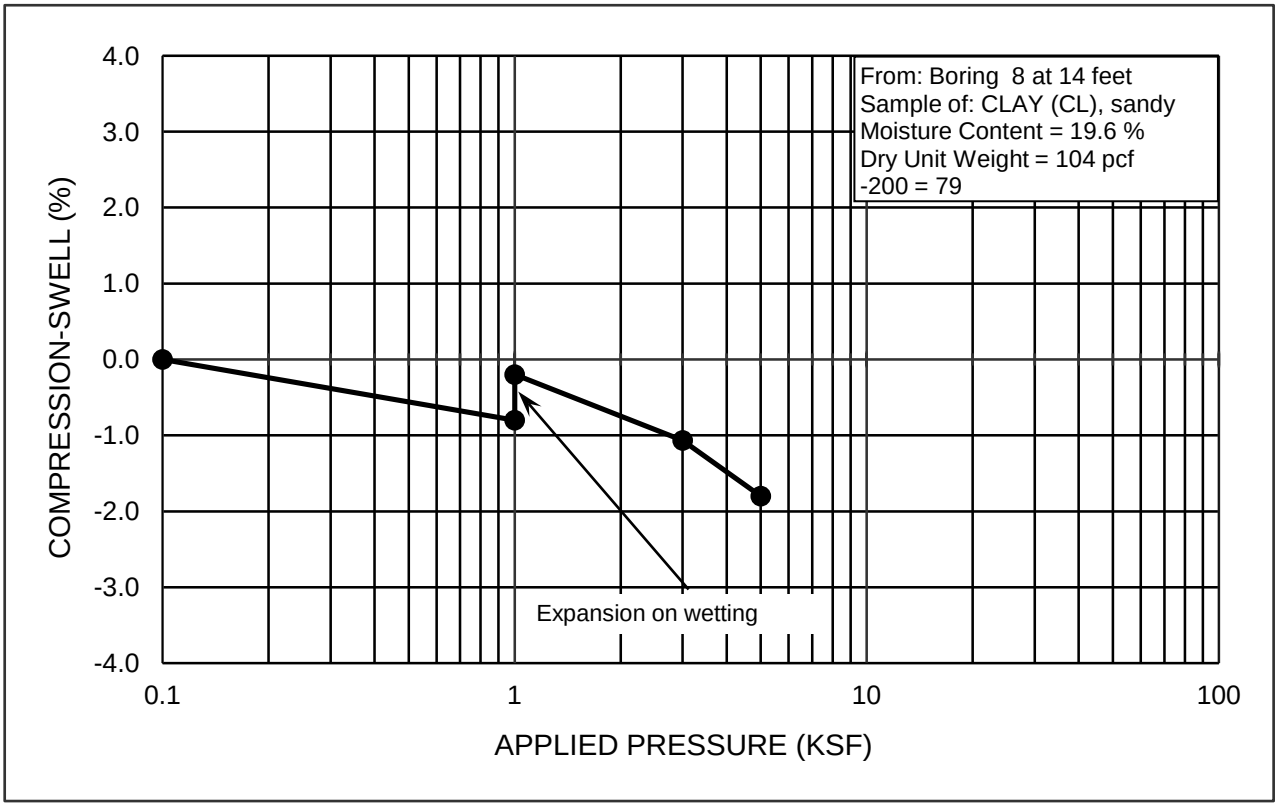

| | | | |
|---|---|---|---|
| 215292A | HEPWORTH-PAWLAK GEOTECHNICAL, INC. | WIDEFIELD<br>SWELL-COMPRESSION TEST RESULTS | FIG. 9 |



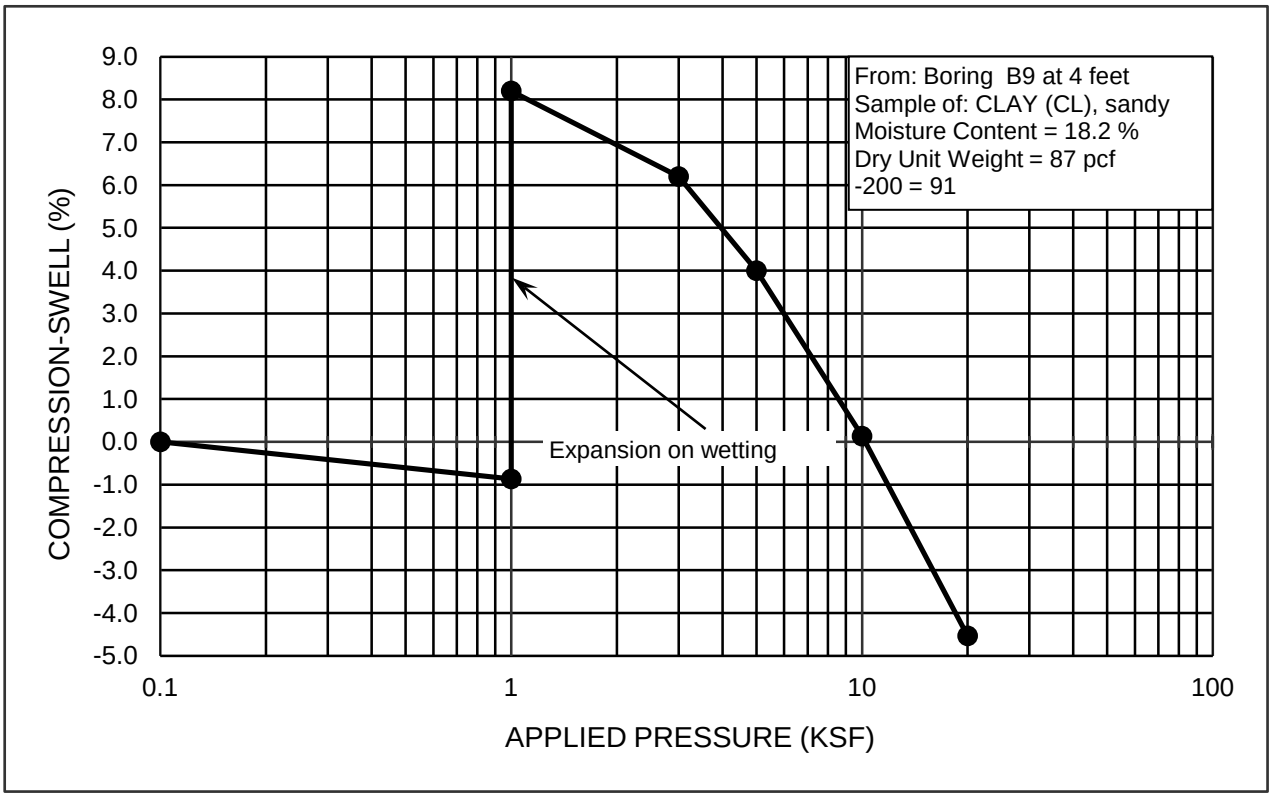



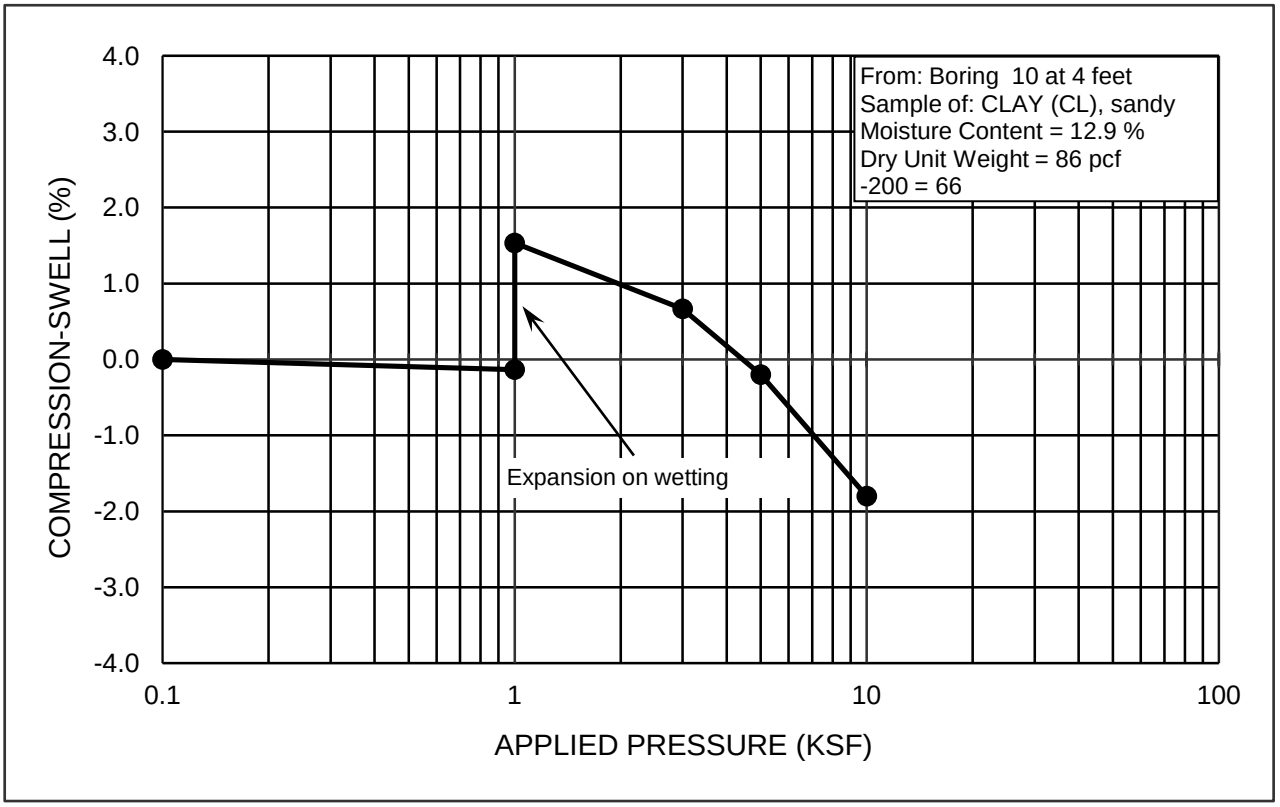

| | | | |
|---|---|---|---|
| 215292A | HEPWORTH-PAWLAK GEOTECHNICAL, INC. | WIDEFIELD SWELL-COMPRESSION TEST RESULTS | FIG. 10 |



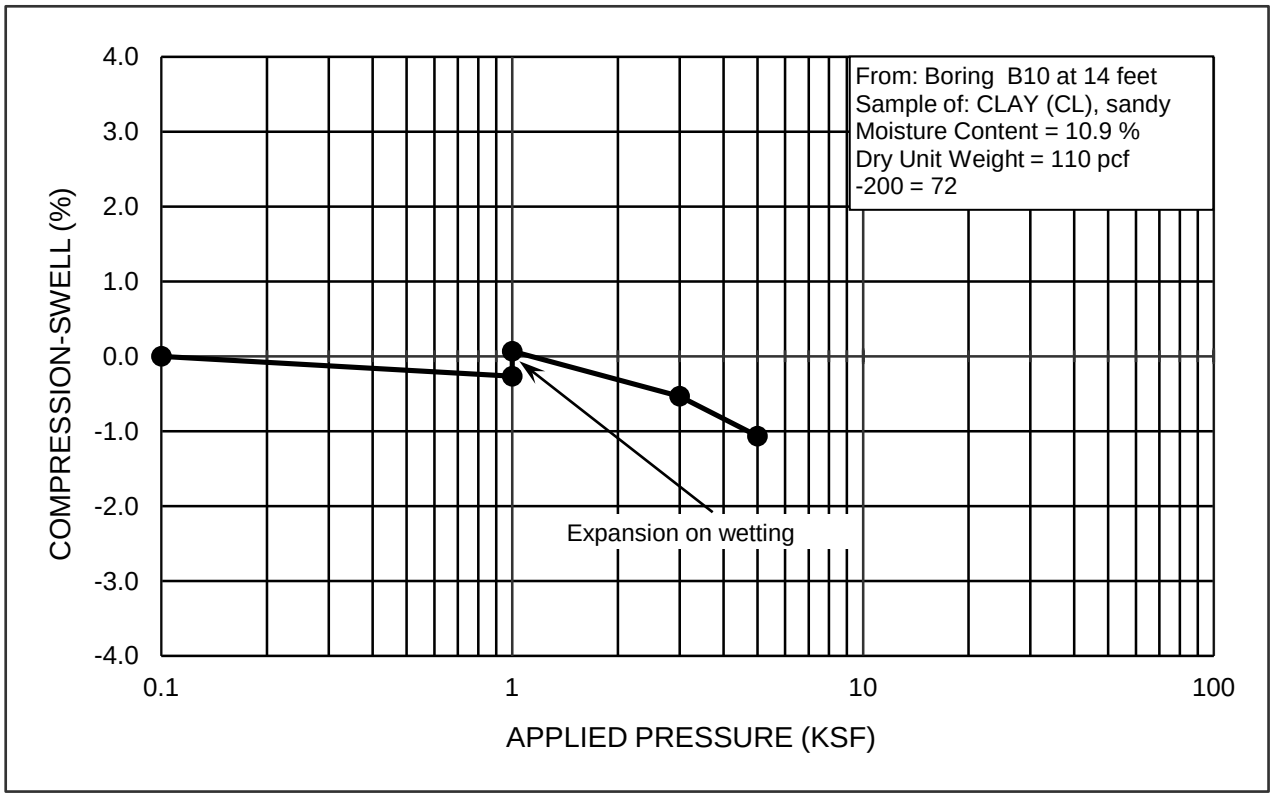




| | | | |
|---|---|---|---|
| 215292A | HEPWORTH-PAWLAK GEOTECHNICAL, INC. | WIDEFIELD<br>SWELL-COMPRESSION TEST RESULTS | FIG. 11 |

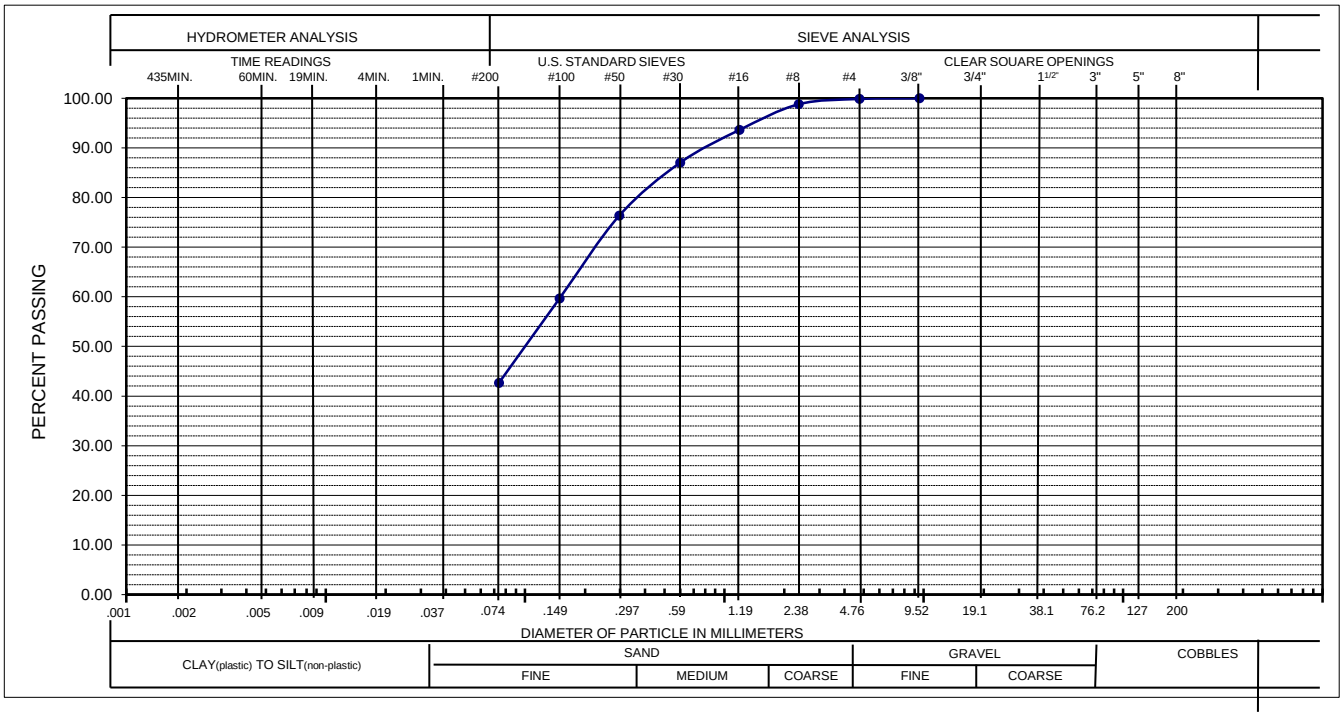


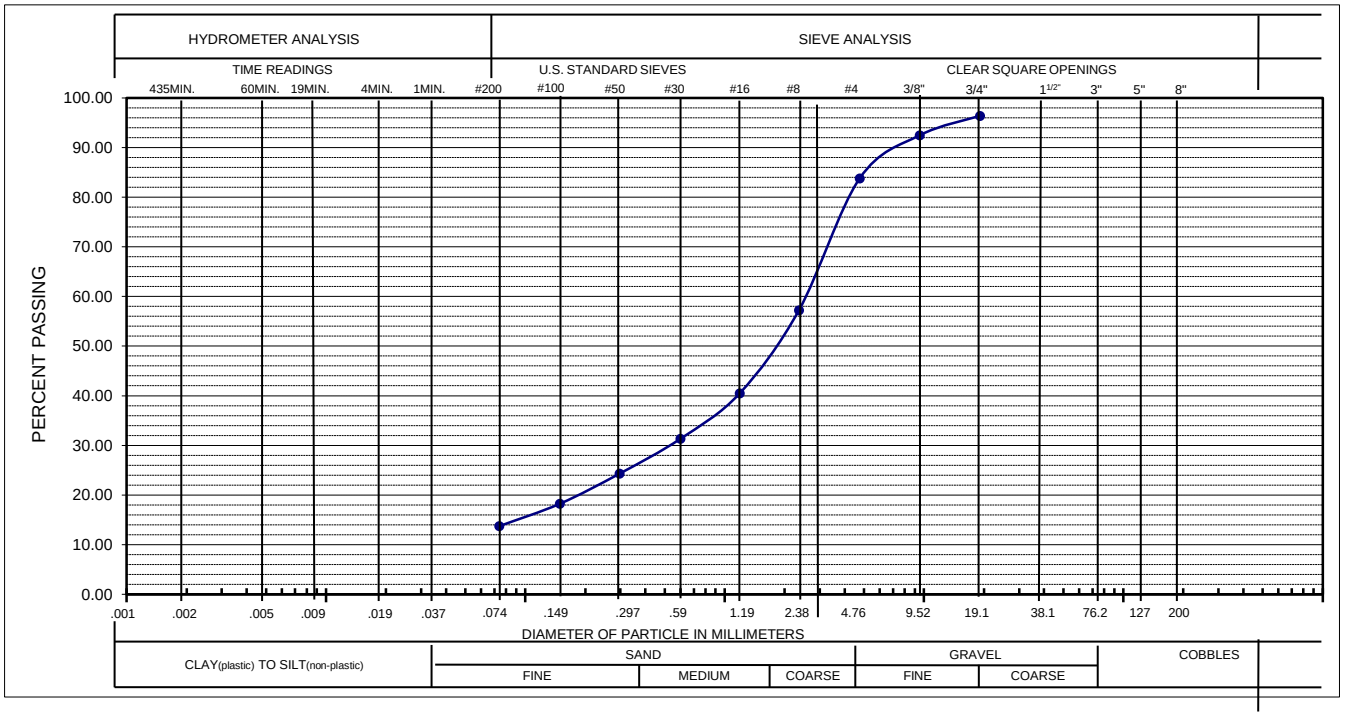

| | | | |
|---|---|---|---|
| 215292A | HEPWORTH-PAWLAK GEOTECHNICAL, INC. | WIDEFIELD<br>SWELL-COMPRESSION TEST RESULTS | FIG. 12 |




| | | | |
|---|---|---|---|
| 215292A | HEPWORTH-PAWLAK GEOTECHNICAL, INC. | WIDEFIELD SWELL-COMPRESSION TEST RESULTS | FIG. 13 |

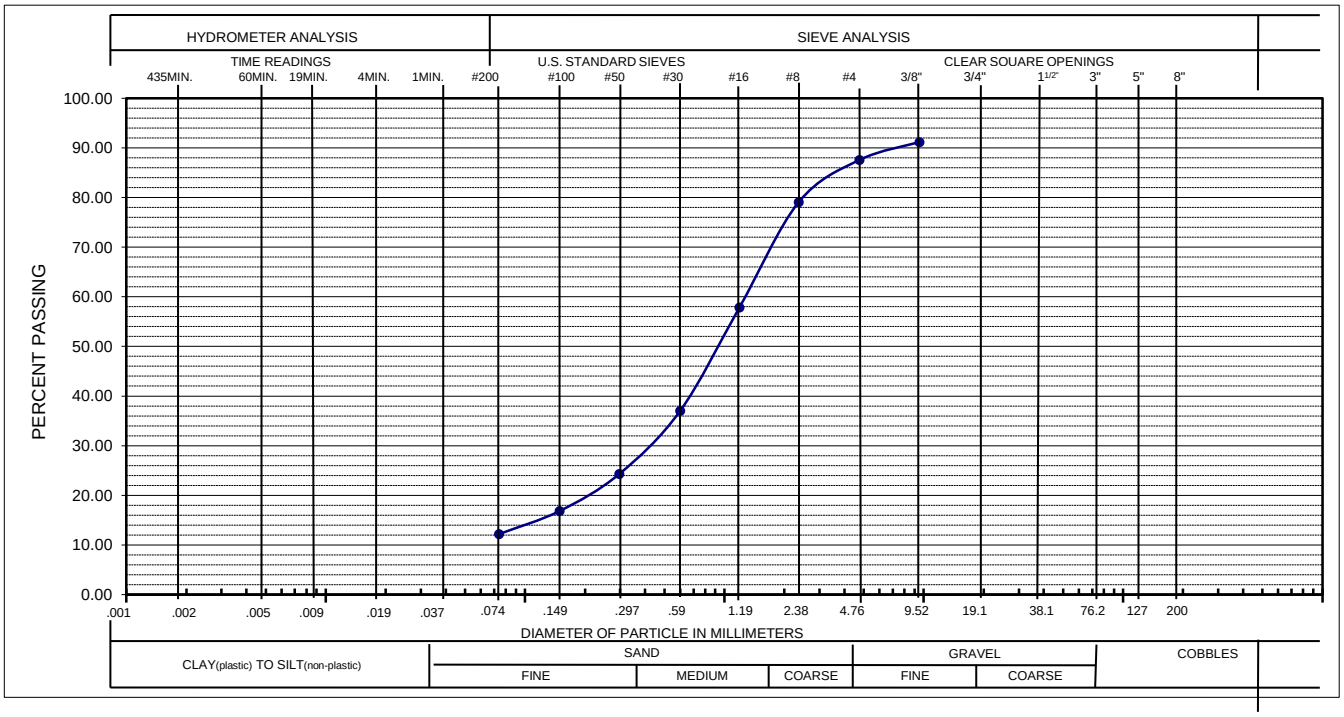



GRAVEL: 0% SAND: 57% SILT AND CLAY: 43%
LIQUID LIMIT: PLASTICITY INDEX:
SAMPLE OF: SAND (SC), clayey FROM: B2 @ 24 feet

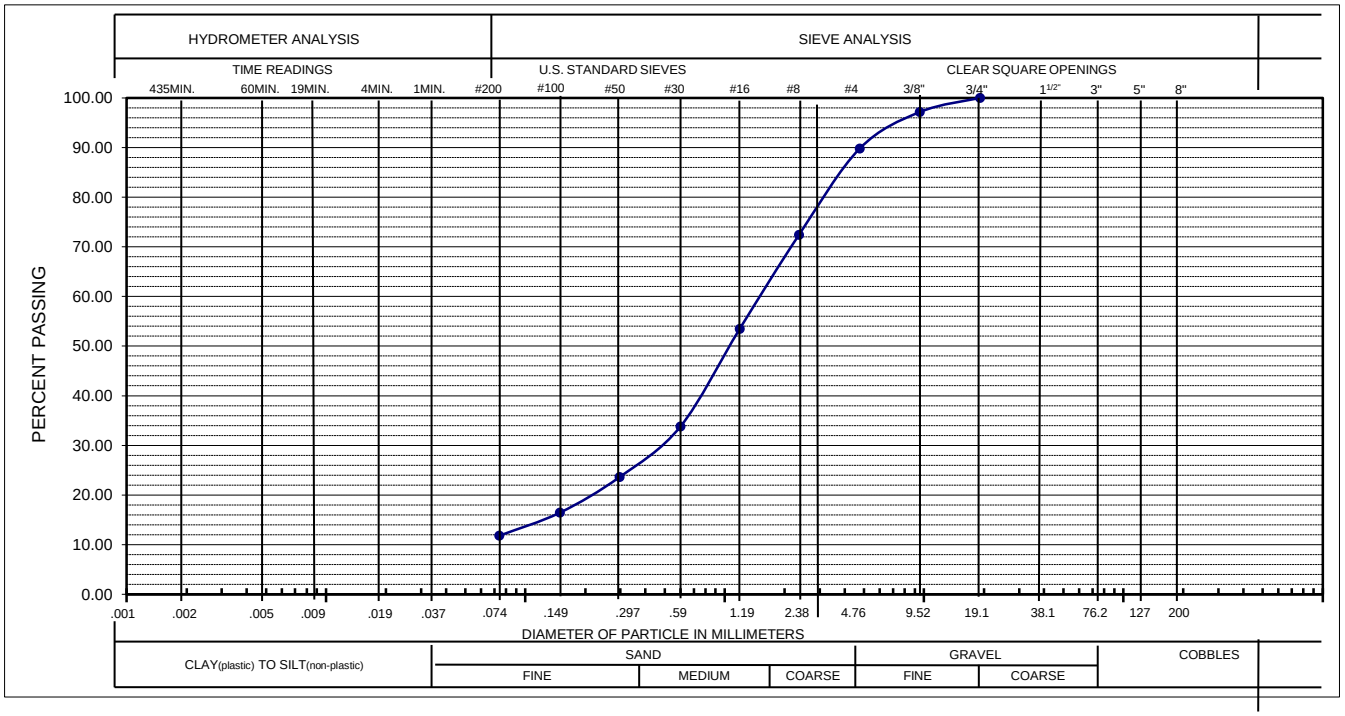



GRAVEL: 16% SAND: 70% SILT AND CLAY: 14%
LIQUID LIMIT: PLASTICITY INDEX:
SAMPLE OF: SAND (SP-SM), gravelly, silty FROM: B2 @ 44 feet

| | | | |
|---|---|---|---|
| 215292A | HEPWORTH-PAWLAK GEOTECHNICAL, INC. | WIDEFIELD GRADATION ANALYSIS | FIG. 14 |




GRAVEL: 13% SAND: 75% SILT AND CLAY: 12%
LIQUID LIMIT: PLASTICITY INDEX:
SAMPLE OF: SAND (SP-SM), gravelly, sandy FROM: B8 @ 39 feet




GRAVEL: 10% SAND: 78% SILT AND CLAY: 12%
LIQUID LIMIT: PLASTICITY INDEX:
SAMPLE OF: SAND (SP-SM), gravelly, silty FROM: B2 @ 44 feet

| | | | |
|---|---|---|---|
| 215292A | HEPWORTH-PAWLAK GEOTECHNICAL, INC. | WIDEFIELD GRADATION ANALYSIS | FIG. 15 |

## HEPWORTH-PAWLAK GEOTECHNICAL, INC.

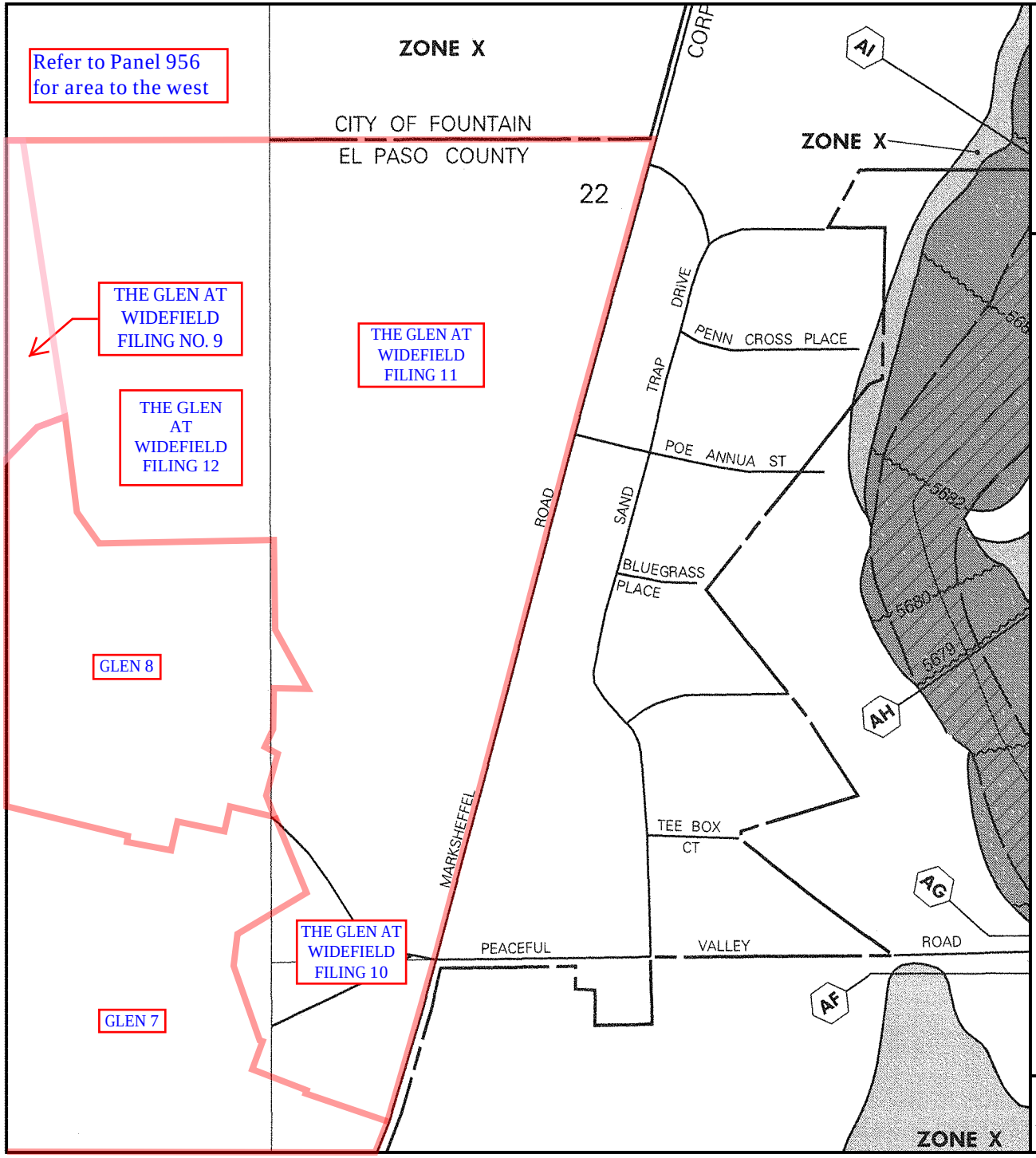
JOB NO. 215292A

PROJECT: WIDEFIELD

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

| SAMPLE LOCATION | | NATURAL MOISTURE CONTENT (%) | NATURAL DRY UNIT WEIGHT (PCF) | GRADATION | | | ATTERBERG LIMITS | | SWELL/COMP WITH 1,000 psf SURCHARGE (%) | WATER SOLUBLE SULFATES (%) | SOIL OR BEDROCK TYPE (USCS CLASSIFICATION) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| BORING | DEPTH (feet) | | | GRAVEL (%) | SAND (%) | SILT & CLAY (%) | LIQUID LIMIT (%) | PLASTIC INDEX (%) | | | |
| B-1 | 4 | 21.9 | 89 | | | 94 | 63 | 39 | 6.9 | | CLAY (CL), sandy |
| | 9 | 14.3 | 111 | | | 75 | 51 | 34 | | 0.07 | CLAY (CL), sandy |
| | 19 | 25.8 | 97 | | | 91 | 62 | 42 | 1.7 | | CLAY (CL), sandy |
| B-2 | 4 | 12.7 | 95 | | | 71 | | | 2.4 | | CLAY (CL), sandy |
| | 14 | 16.4 | 103 | | | 68 | | | | 0.675 | CLAY (CL), sandy |
| | 24 | 26.9 | 95 | 0 | 57 | 43 | | | | | SAND (SM), silty |
| | 44 | 12.7 | | 16 | 70 | 14 | | | | | SAND (SP-SM), gravelly, silty |
| B-3 | 4 | 6.4 | 95 | | | 62 | 33 | 19 | 2.1 | | CLAY (CL), sandy |
| | 14 | 13.9 | 118 | | | 83 | | | 3.6 | | CLAYSTONE |
| B-4 | 4 | 15.3 | 113 | | | 91 | | | | 0.813 | CLAYSTONE |
| | 9 | 13.5 | 114 | | | 66 | | | 2.5 | | CLAYSTONE |
| | 14 | 13.9 | 118 | | | 83 | | | 2.3 | | CLAYSTONE |
| B-6 | 4 | 15.8 | 96 | | | 88 | | | 2.7 | | CLAY (CL), sandy |
| | 14 | 17.3 | 108 | | | 78 | | | | | CLAY (CL), sandy |
| | 19 | 23.7 | 101 | | | 97 | | | 5.0 | | CLAY (CL), sandy |
| | 29 | 31.5 | 90 | | | 41 | | | | | SAND (SC), clayey |
| | 54 | 13.7 | 119 | | | 40 | | | | | CLAYSTONE |
| B-7 | 34 | 20.5 | 15 | | | | | | | | CLAY (CL), sandy |
| B-8 | 4 | 17.2 | 103 | | | 78 | | | 1.9 | | CLAY (CL), sandy |
| | 14 | 19.6 | 104 | | | 79 | | | 0.6 | | CLAY (CL), sandy |
| | 19 | 30.3 | 91 | | | 71 | | | | | CLAY (CL), sandy |
| | 39 | 11.8 | 120 | 13 | 75 | 12 | | | | | SAND (SP-SM), gravelly, silty |
| B-9 | 4 | 18.2 | 87 | | | 91 | | | 9.1 | 0.065 | CLAY (CL), sandy |
| | 9 | 17.3 | 94 | | | 91 | | | | | CLAY (CL), sandy |
| | 34 | 35.3 | 87 | | | 98 | | | | | CLAY (CL), sandy |
| | 54 | 12.7 | | | | 87 | | | | | CLAYSTONE |
| B-10 | 4 | 12.9 | 86 | | | 66 | | | 1.7 | | CLAY (CL), sandy |
| | 14 | 10.9 | 110 | | | 72 | | | 0.3 | 0.065 | CLAY (CL), sandy |
| | 19 | 22.9 | 93 | | | 65 | | | | | CLAY (CL), sandy |
| | 44 | 10.0 | 124 | 10 | 88 | 12 | | | | | SAND (SC), clayey |




APPROXIMATE SCALE IN FEET

500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

# FIRM

## FLOOD INSURANCE RATE MAP

EL PASO COUNTY, COLORADO AND INCORPORATED AREAS

**PANEL 957 OF 1300**

(SEE MAP INDEX FOR PANELS NOT PRINTED)

| CONTAINS: COMMUNITY | NUMBER | PANEL | SUFFIX |
|---|---|---|---|
| COLORADO SPRINGS, CITY OF | 080060 | 0957 | F |
| EL PASO COUNTY, UNINCORPORATED AREAS | 080059 | 0957 | F |
| FOUNTAIN, CITY OF | 080061 | 0957 | F |

**MAP NUMBER 08041C0957 F**

**EFFECTIVE DATE: MARCH 17, 1997**

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

# APPENDIX A.1

## Supporting Hydrologic Tables and Figures

## Table 1: Impervious Area and Drainage Basin & Bridge Fee Calc

## Table 2: Opinion of Cost – Drainage Facilities

**Table 1: Impervious Area and Drainage Basin & Bridge Fee Calculation**

| | |
|---|---|
| Total Lots = | 79 lots |
| Total Development Area = | 27.229 ac |
| Total Undeveloped Acres = | 5.523 ac |
| **Total Developed Area =** | **21.7 ac** |
| Building/Patio/Drive Per Lot = | 2,500 sf |
| Total Building/Patio/Drive Area = | 4.534 ac |
| Total Street/Sidewalk Area = | 4.000 ac |
| Total Impervious Area = | 8.534 ac |
| **% Impervious Area =** | **39.32 %** |

**West Fork Jimmy Camp Creek Drainage Basin**

| **Drainage Basin Fee and Bridge Fee Calculations** | | | |
|---|---|---|---|
| Drainage Basin Fee = | $14,470 / ac | **Drainage Basin Fee =** | **$ 123,486.63** |
| Bridge Fee = | $4,281 / ac | **Bridge Fee =** | **$ 36,533.95** |

| | | |
|---|---|---|
| Less Previous Drainage Fee Credit (Carry Over from Glen at Widefield Filing No. 7) | **$0.00** | $ 0.00 |
| Drainage Basin Fee Reimbursement | **$0.00** | |
| Total Drainage Basin Fee Credit Available | **$0.00** | |

| | **Drainage Basin** | **Bridge** |
|---|---|---|
| **Total Fees Due for the Glen at Widefield Filing No. 12** | **$123,486.63** | **$ 36,533.95** |

**Basin 'D' Storm Pipe Quantities -DONE/12/05/2022 -mjk**

| Mat'l. | Pipe Size | Total LF | | Unit Cost | Total |
|---|---|---|---|---|---|
| RCP | 18" | **1014.49** | LF | $72 | **$ 73,043** |
| RCP | 21" | **595.72** | LF | $84 | **$ 50,040** |
| RCP | 24" | **411.17** | LF | $96 | **$ 39,472** |
| HERCP | 24" equiv | **112.46** | LF | $105 | **$ 11,808** |
| RCP | 27" | **0.00** | LF | $105 | **$ -** |
| RCP | 30" | **504.98** | LF | $110 | **$ 55,548** |
| RCP | 36" | **1288.76** | LF | $128 | **$ 164,961** |
| RCP | 36" | **78.14** | LF | $128 | **$ 10,002** |
| RCP IV | 36" | **249.41** | LF | $142 | **$ 35,416** |
| HERCP | 48 equiv | **101.50** | LF | $140 | **$ 14,210** |
| C.B.C. | 3'x2' | **180.00** | LF | $140 | **$ 25,200** |
| | | **4536.63** | | **Grand Total:** | **$ 479,702** |

**FILING 12 ONLY - Storm Pipe Quantities -**

| Mat'l. | Pipe Size | Total LF | | Unit Cost | Total |
|---|---|---|---|---|---|
| RCP | 18" | **284.38** | LF | $72 | **$ 20,475** |
| | | **284.38** | | **Grand Total:** | **$ 20,475** |

# APPENDIX B

## Rational Calculations

**Existing Condition – Runoff Co-eff, Time of Concentration and Runoff Calcs**

**Developed Condition – Runoff Co-eff, Time of Concentration and Runoff Calcs**

# The Glen at Widefield
## Existing Condition
## Runoff Coeficient and Percent Impervious Calculation

| Filing 12 - Existing Condition | | | | | PV | Area 1 Land Use | | | LA | Area 2 Land Use | | | RS2 | Area 3 Land Use | | | RS1 | Area 4 Land Use | | | HI | Area 5 Land Use | | | | Basin Runoff Coeficient | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Basin | DP | Basin or DP Area (DP contributing basins) | | Soil Type | % Imperv | Land Use Area | % Area | Comp Land Use % Imp | % Imperv | Land Use Area | % Area | Comp Land Use % Imp | % Imperv | Land Use Area | % Area | Comp Land Use % Imp | % Imperv | Land Use Area | % Area | Comp Land Use % Imp | % Imperv | Land Use Area | % Area | Comp Land Use % Imp | Basin % Imperv | $C_2$ | $C_5$ | $C_{10}$ | $C_{25}$ | $C_{50}$ | $C_{100}$ | Notes: |
| D-1 | DP 68 | 61,148 sf | 1.40ac | B | 100% | | 0% | 0% | 0% | 1.40ac | 100% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 2% | | 0% | 0% | 0.0% | 0.02 | 0.08 | 0.15 | 0.25 | 0.30 | 0.35 | Undeveloped Condition |
| D-2 | | 72,745 sf | 1.67ac | B | 100% | | 0% | 0% | 0% | 1.67ac | 100% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 2% | | 0% | 0% | 0.0% | 0.02 | 0.08 | 0.15 | 0.25 | 0.30 | 0.35 | Undeveloped Condition |
| D-3 | DP 70 | 73,555 sf | 1.69ac | B | 100% | | 0% | 0% | 0% | 1.69ac | 100% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 2% | | 0% | 0% | 0.0% | 0.02 | 0.08 | 0.15 | 0.25 | 0.30 | 0.35 | Undeveloped Condition |
| D-4 | | 90,208 sf | 2.07ac | C | 100% | | 0% | 0% | 0% | 2.07ac | 100% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 2% | | 0% | 0% | 0.0% | 0.04 | 0.15 | 0.25 | 0.37 | 0.44 | 0.50 | Undeveloped Condition |
| D-5 | DP 72 | 68,122 sf | 1.56ac | C | 100% | | 0% | 0% | 0% | 1.56ac | 100% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 2% | | 0% | 0% | 0.0% | 0.04 | 0.15 | 0.25 | 0.37 | 0.44 | 0.50 | Undeveloped Condition |
| D-6 | DP 73 | 18,040 sf | 0.41ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 0.41ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-7 | | 130,015 sf | 2.98ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.98ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-8 | | 70,452 sf | 1.62ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 1.62ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-9 | DP 77 | 95,396 sf | 2.19ac | B | 100% | | 0% | 0% | 0% | 2.19ac | 100% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 2% | | 0% | 0% | 0.0% | 0.02 | 0.08 | 0.15 | 0.25 | 0.30 | 0.35 | Undeveloped Condition |
| D-10 | | 109,710 sf | 2.52ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.52ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-11 | DP 80 | 172,355 sf | 3.96ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 3.96ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-12 | | 60,400 sf | 1.39ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 1.39ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-13 | | 89,754 sf | 2.06ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.06ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-14 | | 143,954 sf | 3.30ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 3.30ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-15 | DP 84 | 122,155 sf | 2.80ac | B | 100% | | 0% | 0% | 0% | 2.80ac | 100% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 2% | | 0% | 0% | 0.0% | 0.02 | 0.08 | 0.15 | 0.25 | 0.30 | 0.35 | Undeveloped Condition |
| D-16 | | 98,963 sf | 2.27ac | C | 100% | | 0% | 0% | 0% | 2.27ac | 100% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 2% | | 0% | 0% | 0.0% | 0.04 | 0.15 | 0.25 | 0.37 | 0.44 | 0.50 | Undeveloped Condition |
| D-16.1 | | 90,495 sf | 2.08ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.08ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-17 | | 150,208 sf | 3.45ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 3.45ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-18 | | 92,997 sf | 2.13ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.13ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-19 | | 129,215 sf | 2.97ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.97ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-19.1 | DP89 | 7,235 sf | 0.17ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 0.17ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-20a | DP 92a | 35,151 sf | 0.81ac | C | 100% | 0.34ac | 42% | 42% | 0% | 0.37ac | 46% | 0% | 46% | | 0% | 0% | 37% | 0.10ac | 12% | 4% | 2% | | 0% | 0% | 46.6% | 0.32 | 0.38 | 0.44 | 0.52 | 0.56 | 0.60 | Developed with Filing No 10 |
| D-20b | DP 92b | 20,481 sf | 0.47ac | C | 100% | 0.40ac | 85% | 85% | 0% | 0.07ac | 15% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 2% | | 0% | 0% | 85.1% | 0.66 | 0.68 | 0.71 | 0.75 | 0.78 | 0.79 | Developed with Filing No 11 |
| D-20c | DP 92d | 15,896 sf | 0.36ac | C | 100% | 0.17ac | 47% | 47% | 0% | 0.19ac | 52% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 2% | | 0% | 0% | 46.6% | 0.32 | 0.38 | 0.44 | 0.52 | 0.56 | 0.60 | Developed with Filing No 11 |
| D-21 | DP 91 | 175,102 sf | 4.02ac | B | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 4.02ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.22 | 0.28 | 0.35 | 0.41 | 0.45 | 0.49 | Developed with Filing No 10 |
| D-22 | DP 90 | 50,194 sf | 1.15ac | B | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 1.15ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.22 | 0.28 | 0.35 | 0.41 | 0.45 | 0.49 | Developed with Filing No 10 |
| D-23 | DP92e | 12,393 sf | 0.28ac | C | 100% | 0.24ac | 84% | 84% | 0% | 0.04ac | 16% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 2% | | 0% | 0% | 84.4% | 0.65 | 0.67 | 0.71 | 0.74 | 0.77 | 0.78 | Developed with Filing No 11 |
| D-24 | | 443,273 sf | 10.18ac | C | 100% | | 0% | 0% | 0% | 8.18ac | 80% | 0% | 46% | | 0% | 0% | 37% | 2.00ac | 20% | 7% | 2% | | 0% | 0% | 7.3% | 0.09 | 0.20 | 0.29 | 0.40 | 0.47 | 0.52 | Developed with Filing No 10 |
| **Combined Design Point Summary** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | DP 69 | D1, D2 | 3.07ac | B | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 0.00ac | 0% | 0% | 2% | | 0% | 0% | 0.0% | 0.02 | 0.08 | 0.15 | 0.25 | 0.30 | 0.35 | |
| | DP 71 | D3, D4 | 3.76ac | B | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 0.00ac | 0% | 0% | 2% | | 0% | 0% | 0.0% | 0.02 | 0.08 | 0.15 | 0.25 | 0.30 | 0.35 | |
| | DP 74 | D3, D4, D6 | 4.17ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 0.41ac | 10% | 4% | 2% | | 0% | 0% | 3.7% | 0.07 | 0.17 | 0.27 | 0.39 | 0.46 | 0.51 | |
| | DP 75 | D1-D4, D6, D7 | 10.23ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 3.40ac | 33% | 12% | 2% | | 0% | 0% | 12.3% | 0.12 | 0.22 | 0.31 | 0.42 | 0.48 | 0.54 | |
| | DP 76 | D1-D4, D6-D8 | 11.85ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 5.02ac | 42% | 16% | 2% | | 0% | 0% | 15.7% | 0.15 | 0.24 | 0.33 | 0.43 | 0.49 | 0.54 | |
| | DP 78 | D1-D4, D6-D9 | 14.04ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 5.02ac | 36% | 13% | 2% | | 0% | 0% | 13.2% | 0.13 | 0.23 | 0.32 | 0.42 | 0.49 | 0.54 | |
| | DP 79 | D8, D10 | 4.14ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 4.14ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | |
| | DP 81 | D11, D12 | 5.34ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 5.34ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | |
| | DP 82 | D5, D13 | 3.62ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.06ac | 57% | 21% | 2% | | 0% | 0% | 21.0% | 0.18 | 0.26 | 0.35 | 0.45 | 0.51 | 0.55 | |
| | DP 83 | D5, D13, D14 | 6.93ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 5.37ac | 77% | 29% | 2% | | 0% | 0% | 28.6% | 0.22 | 0.30 | 0.38 | 0.47 | 0.52 | 0.57 | |
| | DP 85 | D15,D16, D16.1 | 7.15ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.08ac | 29% | 11% | 2% | | 0% | 0% | 10.7% | 0.12 | 0.21 | 0.31 | 0.42 | 0.48 | 0.53 | |
| | DP 86 | D15 - D17 | 10.60ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 5.53ac | 52% | 19% | 2% | | 0% | 0% | 19.3% | 0.17 | 0.26 | 0.34 | 0.44 | 0.50 | 0.55 | |
| | DP 87 | D15 - D18 | 12.74ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 7.66ac | 60% | 22% | 2% | | 0% | 0% | 22.3% | 0.18 | 0.27 | 0.35 | 0.45 | 0.51 | 0.56 | |
| | DP 88 | D15 - D19 | 15.70ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 10.63ac | 68% | 25% | 2% | | 0% | 0% | 25.0% | 0.20 | 0.28 | 0.36 | 0.46 | 0.52 | 0.56 | |
| | DP 92a | D20a | 0.81ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 0.81ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | |
| | DP 92b | D21,D22,D23 | 5.46ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 5.46ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | |
| | DP 93a | D1 -D19.1 | 44.70ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 44.70ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | |
| | DP 93b | D20b,D20c,D23 | 1.12ac | C | 100% | 0.56ac | 50% | 50% | 0% | 0.56ac | 50% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 2% | | 0% | 0% | 50.0% | 0.34 | 0.40 | 0.46 | 0.53 | 0.57 | 0.60 | |
| **D1-24** | **DP 94** | **Existing** | **61.97ac** | C | 100% | 1.15ac | 2% | 2% | 0% | 23.11ac | 37% | 0% | 37% | | 0% | 0% | 37% | 36.31ac | 59% | 22% | 2% | | 0% | 0% | **23.5%** | **N/A** | **0.28** | **###** | **###** | **###** | **0.56** | **Existing** |

Basin Runoff Coefficient is based on UDFCD % Imperviousness Calculation

| Runoff Coefficients and Percents Impervious | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Hydrologic Soil Type:** | **C** | | | | **Runoff Coef Calc Method** | | | **%Imp** |
| Land Use | Abb | % | $C_2$ | $C_5$ | $C_{10}$ | $C_{25}$ | $C_{50}$ | $C_{100}$ |
| Commercial Area | CO | 95% | 0.80 | 0.82 | 0.84 | 0.87 | 0.89 | 0.89 |
| Drives and Walks | DR | 90% | 0.73 | 0.75 | 0.77 | 0.80 | 0.83 | 0.83 |
| Streets - Gravel (Packed) | GR | 40% | 0.28 | 0.35 | 0.42 | 0.50 | 0.55 | 0.58 |
| Historic Flow Analysis | HI | 2% | 0.06 | 0.16 | 0.26 | 0.38 | 0.45 | 0.51 |
| Lawns | LA | 0% | 0.04 | 0.15 | 0.25 | 0.37 | 0.44 | 0.50 |
| Off-site flow-Undeveloped | OF | 45% | 0.31 | 0.37 | 0.44 | 0.51 | 0.56 | 0.59 |
| Park | PA | 7% | 0.09 | 0.19 | 0.29 | 0.40 | 0.47 | 0.52 |
| Playground | PL | 13% | 0.13 | 0.23 | 0.32 | 0.42 | 0.49 | 0.54 |
| Streets - Paved | PV | 100% | 0.89 | 0.90 | 0.92 | 0.94 | 0.96 | 0.96 |
| Roofs | RO | 90% | 0.73 | 0.75 | 0.77 | 0.80 | 0.83 | 0.83 |
| Residential: 3.7 Lots/Acre | RS1 | 37% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 |
| Residential: 1/5 Acre | RS2 | 46% | 0.31 | 0.38 | 0.44 | 0.51 | 0.56 | 0.59 |

Equations (% Impervious Calculation):

$C_A = K_A + (1.31\, i^3 - 1.44\, i^2 + 1.135\, i - 0.12)$ [Eqn RO-6]

$C_{CD} = K_{CD} + (0.858\, i^3 - 0.786\, i^2 + 0.774\, i + 0.04)$ [Eqn RO-7]

$C_B = (C_A + C_{CD}) / 2$

I = % imperviousness/100 as a decimal (See Table RO-3)

$C_A$ = Runoff coefficient for NRCS Type A Soils

$C_B$ = Runoff coefficient for NRCS Type B Soils

$C_{CD}$ = Runoff coefficient for NRCS Type C and D Soils

Correction Factors - Table RO-4

$K_A$ = For Type A Soils

$K_A$ (2-yr)= 0

$K_A$ (5-yr)= -0.08i + 0.09

$K_A$ (10-yr)= -0.14i + 0.17

$K_A$ (25-yr)= -0.19i + 0.24

$K_A$ (50-yr)= -0.22i + 0.28

$K_A$ (100-yr)= -0.25i + 0.32

$K_{CD}$=For Type C & D Soils

$K_{CD}$ (2-yr)= 0

$K_{CD}$ (5-yr)= -0.10i + 0.11

$K_{CD}$ (10-yr)= -0.18i + 0.21

$K_{CD}$ (25-yr)= -0.28i + 0.33

$K_{CD}$ (50-yr)= -0.33i + 0.40

$K_{CD}$ (100-yr)= -0.39i + 0.46

# The Glen at Widefield
## Developed Condition
## Runoff Coeficient and Percent Impervious Calculation

**Filing 12 - Developed Condition**

| Basin | DP | Basin or DP Area (DP contributing basins) | | Soil Type | PV % Imperv | PV Land Use Area | PV % Area | PV Comp Land Use % Imp | LA % Imperv | LA Land Use Area | LA % Area | LA Comp Land Use % Imp | RS2 % Imperv | RS2 Land Use Area | RS2 % Area | RS2 Comp Land Use % Imp | RS1 % Imperv | RS1 Land Use Area | RS1 % Area | RS1 Comp Land Use % Imp | Basin % Imperv | Basin Runoff Coeficient $C_5$ | Basin Runoff Coeficient $C_{100}$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| D-1 | DP 68 | 61,148 sf | 1.40ac | B | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 1.40ac | 100% | 37% | 37.0% | 0.28 | 0.49 | |
| D-2 | | 72,845 sf | 1.67ac | B | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 1.67ac | 100% | 37% | 37.0% | 0.28 | 0.49 | |
| D-3 | DP 70 | 73,555 sf | 1.69ac | B | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 1.69ac | 100% | 37% | 37.0% | 0.28 | 0.49 | |
| D-4 | | 90,208 sf | 2.07ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.07ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| D-5 | DP 72 | 68,122 sf | 1.56ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 1.56ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| D-6 | DP 73 | 18,040 sf | 0.41ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 0.41ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| D-7 | | 130,015 sf | 2.98ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.98ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| D-8 | | 70,452 sf | 1.62ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 1.62ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| D-9 | DP 77 | 95,301 sf | 2.19ac | B | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.19ac | 100% | 37% | 37.0% | 0.28 | 0.49 | |
| D-10 | | 109,710 sf | 2.52ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.52ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| D-11 | DP 80 | 172,355 sf | 3.96ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 3.96ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| D-12 | | 60,400 sf | 1.39ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 1.39ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| D-13 | | 89,754 sf | 2.06ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.06ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| D-14 | | 143,954 sf | 3.30ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 3.30ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| D-15 | DP 84 | 122,155 sf | 2.80ac | B | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.80ac | 100% | 37% | 37.0% | 0.28 | 0.49 | |
| D-16 | | 98,963 sf | 2.27ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.27ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| D-16.1 | | 90,495 sf | 2.08ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.08ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| D-17 | | 150,208 sf | 3.45ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 3.45ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| D-18 | | 92,997 sf | 2.13ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.13ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| D-19 | | 129,215 sf | 2.97ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.97ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| D-19.1 | DP89 | 7,235 sf | 0.17ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 0.17ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| D-20a | DP 92a | 35,151 sf | 0.81ac | C | 100% | 0.34ac | 42% | 42% | 0% | 0.37ac | 46% | 0% | 46% | | 0% | 0% | 37% | 0.10ac | 12% | 4% | 46.6% | 0.38 | 0.60 | |
| D-20b | DP 92b | 20,481 sf | 0.47ac | C | 100% | 0.40ac | 85% | 85% | 0% | 0.07ac | 15% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 85.1% | 0.68 | 0.79 | |
| D-20c | DP 92d | 15,896 sf | 0.36ac | C | 100% | 0.17ac | 47% | 47% | 0% | 0.19ac | 52% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 46.6% | 0.38 | 0.60 | |
| D-21 | DP 91 | 175,102 sf | 4.02ac | B | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 4.02ac | 100% | 37% | 37.0% | 0.28 | 0.49 | |
| D-22 | DP 90 | 50,194 sf | 1.15ac | B | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 1.15ac | 100% | 37% | 37.0% | 0.28 | 0.49 | |
| D-23 | DP92e | 12,393 sf | 0.28ac | C | 100% | 0.24ac | 84% | 84% | 0% | 0.04ac | 16% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 84.4% | 0.67 | 0.78 | |
| D-24 | | 443,273 sf | 10.18ac | C | 100% | | 0% | 0% | 0% | 8.18ac | 80% | 0% | 46% | | 0% | 0% | 37% | 2.00ac | 20% | 7% | 7.3% | 0.20 | 0.52 | |
| **Combined Design Point Summary** | | | | | | | | | | | | | | | | | | | | | | | | |
| | DP 69 | D1, D2 | 3.08ac | B | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 3.08ac | 100% | 37% | 37.0% | 0.28 | 0.49 | |
| | DP 71 | D3, D4 | 3.76ac | B | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 3.76ac | 100% | 37% | 37.0% | 0.28 | 0.49 | |
| | DP 74 | D3, D4, D6 | 4.17ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 4.17ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| | DP 75 | D1-D4, D6, D7 | 10.23ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 10.23ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| | DP 76 | D1-D4, D6-D8 | 11.85ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 11.85ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| | DP 78 | D1-D4, D6-D9 | 14.04ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 14.04ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| | DP 79 | D8, D10 | 4.14ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 4.14ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| | DP 81 | D11, D12 | 5.34ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 5.34ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| | DP 82 | D5, D13 | 3.62ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 3.62ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| | DP 83 | D5, D13, D14 | 6.93ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 6.93ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| | DP 85 | D15,D16, D16.1 | 7.15ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 7.15ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| | DP 86 | D15 - D17 | 10.60ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 10.60ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| | DP 87 | D15 - D18 | 12.74ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 12.74ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| | DP 88 | D15 - D19 | 15.70ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 15.70ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| | DP 92a | D20a | 0.81ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 0.81ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| | DP 92b | D21,D22,D23 | 5.46ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 5.46ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| | DP 93a | D1 -D19.1 | 44.70ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 44.70ac | 100% | 37% | 37.0% | 0.34 | 0.58 | |
| | DP 93b | D20b,D20c,D23 | 1.12ac | C | 100% | 0.56ac | 50% | 50% | 0% | 0.56ac | 50% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 50.0% | 0.40 | 0.60 | |
| **D1-24** | **DP 94** | **Developed** | **61.97ac** | C | 100% | 1.15ac | 2% | 2% | 0% | 8.85ac | 14% | 0% | 37% | | 0% | 0% | 37% | 51.97ac | 84% | 31% | **32.9%** | **0.32** | **0.57** | **Developed** |

Basin Runoff Coefficient is based on UDFCD % Imperviousness Calculation

**Runoff Coefficients and Percents Impervious**

| Hydrologic Soil Type: | C | | | | | Runoff Coef Calc Method | | %Imp |
|---|---|---|---|---|---|---|---|---|
| Land Use | Abb | % | $C_2$ | $C_5$ | $C_{10}$ | $C_{25}$ | $C_{50}$ | $C_{100}$ |
| Commercial Area | CO | 95% | 0.80 | 0.82 | 0.84 | 0.87 | 0.89 | 0.89 |
| Drives and Walks | DR | 90% | 0.73 | 0.75 | 0.77 | 0.80 | 0.83 | 0.83 |
| Streets - Gravel (Packed) | GR | 40% | 0.28 | 0.35 | 0.42 | 0.50 | 0.55 | 0.58 |
| Historic Flow Analysis | HI | 2% | 0.06 | 0.16 | 0.26 | 0.38 | 0.45 | 0.51 |
| Lawns | LA | 0% | 0.04 | 0.15 | 0.25 | 0.37 | 0.44 | 0.50 |
| Off-site flow-Undeveloped | OF | 45% | 0.31 | 0.37 | 0.44 | 0.51 | 0.56 | 0.59 |
| Park | PA | 7% | 0.09 | 0.19 | 0.29 | 0.40 | 0.47 | 0.52 |
| Playground | PL | 13% | 0.13 | 0.23 | 0.32 | 0.42 | 0.49 | 0.54 |
| Streets - Paved | PV | 100% | 0.89 | 0.90 | 0.92 | 0.94 | 0.96 | 0.96 |
| Roofs | RO | 90% | 0.73 | 0.75 | 0.77 | 0.80 | 0.83 | 0.83 |
| Residential: 3.7 Lots/Acre | RS1 | 37% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 |
| Residential: 1/5 Acre | RS2 | 46% | 0.31 | 0.38 | 0.44 | 0.51 | 0.56 | 0.59 |

Equations (% Impervious Calculation):

$C_A = K_A + (1.31\, i^3 - 1.44\, i^2 + 1.135\, i - 0.12)$ [Eqn RO-6]

$C_{CD} = K_{CD} + (0.858\, i^3 - 0.786\, i^2 + 0.774\, i + 0.04)$ [Eqn RO-7]

$C_B = (C_A + C_{CD}) / 2$

I = % imperviousness/100 as a decimal (See Table RO-3)

$C_A$ = Runoff coefficient for NRCS Type A Soils

$C_B$ = Runoff coefficient for NRCS Type B Soils

$C_{CD}$ = Runoff coefficient for NRCS Type C and D Soils

Correction Factors - Table RO-4

$K_A$ = For Type A Soils

$K_A$ (2-yr)= 0

$K_A$ (5-yr)= -0.08i + 0.09

$K_A$ (10-yr)= -0.14i + 0.17

$K_A$ (25-yr)= -0.19i + 0.24

$K_A$ (50-yr)= -0.22i + 0.28

$K_A$ (100-yr)= -0.25i + 0.32

$K_{CD}$=For Type C & D Soils

$K_{CD}$ (2-yr)= 0

$K_{CD}$ (5-yr)= -0.10i + 0.11

$K_{CD}$ (10-yr)= -0.18i + 0.21

$K_{CD}$ (25-yr)= -0.28i + 0.33

$K_{CD}$ (50-yr)= -0.33i + 0.40

$K_{CD}$ (100-yr)= -0.39i + 0.46

# The Glen at Widefield
## Existing Condition
## Time of Concentration Calculation

| Existing Sub-Basin Data | | | | | Filing 12 Existing Condition - Time of Concentration Estimate | | | | | | | | | | Min. Tc in Urban | | Final $t_c$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Initial/Overland Time ($t_i$) | | | Travel Time ($t_t$) | | | | | | Comp. | Tc Check (urban) | | | |
| Basin | Design Point | Contributing Basins | Area | $C_5$ | Length | Slope | $t_i$ | Length | Slope | Land Type | Cv | Velocity | $t_t$ | $t_c$ | Total Length | $t_c$ Check | | Notes: |
| D-1 | DP 68 | | 1.40ac | 0.08 | 100lf | 2.4% | 14.0 min. | 600lf | 3.5% | NBG | 10 | 1.9 ft/sec | 5.3 min. | 19.4 min. | 700lf | 13.9 min. | **13.9 min.** | Undeveloped Condition |
| D-2 | | | 1.67ac | 0.08 | 85lf | 1.5% | 15.1 min. | 655lf | 0.9% | NBG | 10 | 0.9 ft/sec | 11.5 min. | 26.6 min. | 740lf | 14.1 min. | **14.1 min.** | Undeveloped Condition |
| D-3 | DP 70 | | 1.69ac | 0.08 | 100lf | 2.4% | 14.0 min. | 600lf | 3.5% | NBG | 10 | 1.9 ft/sec | 5.3 min. | 19.4 min. | 700lf | 13.9 min. | **13.9 min.** | Undeveloped Condition |
| D-4 | | | 2.07ac | 0.15 | 50lf | 1.0% | 12.3 min. | 610lf | 0.9% | NBG | 10 | 0.9 ft/sec | 10.7 min. | 23.0 min. | 660lf | 13.7 min. | **13.7 min.** | Undeveloped Condition |
| D-5 | DP 72 | | 1.56ac | 0.15 | 60lf | 2.0% | 10.7 min. | 790lf | 0.5% | NBG | 10 | 0.7 ft/sec | 18.6 min. | 29.3 min. | 850lf | 14.7 min. | **14.7 min.** | Undeveloped Condition |
| D-6 | DP 73 | | 0.41ac | 0.34 | 90lf | 1.0% | 13.3 min. | 140lf | 0.8% | PV | 20 | 1.8 ft/sec | 1.3 min. | 14.6 min. | 230lf | 11.3 min. | **11.3 min.** | Developed with Filing No 11 |
| D-7 | | | 2.98ac | 0.34 | 100lf | 1.5% | 12.2 min. | 430lf | 1.3% | PV | 20 | 2.3 ft/sec | 3.1 min. | 15.4 min. | 530lf | 12.9 min. | **12.9 min.** | Developed with Filing No 11 |
| D-8 | | | 1.62ac | 0.34 | 100lf | 1.0% | 14.0 min. | 330lf | 1.5% | PV | 20 | 2.4 ft/sec | 2.2 min. | 16.2 min. | 430lf | 12.4 min. | **12.4 min.** | Developed with Filing No 11 |
| D-9 | DP 77 | | 2.19ac | 0.08 | 100lf | 2.0% | 14.9 min. | 300lf | 1.3% | PV | 20 | 2.3 ft/sec | 2.2 min. | 17.1 min. | 400lf | 12.2 min. | **12.2 min.** | Undeveloped Condition |
| D-10 | | | 2.52ac | 0.34 | 100lf | 1.5% | 12.2 min. | 660lf | 1.1% | PV | 20 | 2.1 ft/sec | 5.2 min. | 17.5 min. | 760lf | 14.2 min. | **14.2 min.** | Developed with Filing No 11 |
| D-11 | DP 80 | | 3.96ac | 0.34 | 70lf | 1.5% | 10.2 min. | 1095lf | 1.2% | PV | 20 | 2.2 ft/sec | 8.3 min. | 18.6 min. | 1165lf | 16.5 min. | **16.5 min.** | Developed with Filing No 11 |
| D-12 | | | 1.39ac | 0.34 | 100lf | 1.3% | 12.8 min. | 450lf | 1.2% | PV | 20 | 2.2 ft/sec | 3.4 min. | 16.3 min. | 550lf | 13.1 min. | **13.1 min.** | Developed with Filing No 11 |
| D-13 | | | 2.06ac | 0.34 | 55lf | 1.0% | 10.4 min. | 660lf | 0.6% | PV | 20 | 1.5 ft/sec | 7.1 min. | 17.5 min. | 715lf | 14.0 min. | **14.0 min.** | Developed with Filing No 11 |
| D-14 | | | 3.30ac | 0.34 | 100lf | 1.8% | 11.5 min. | 980lf | 1.6% | PV | 20 | 2.5 ft/sec | 6.5 min. | 18.0 min. | 1080lf | 16.0 min. | **16.0 min.** | Developed with Filing No 11 |
| D-15 | DP 84 | | 2.80ac | 0.08 | 100lf | 2.0% | 14.9 min. | 185lf | 2.0% | NBG | 10 | 1.4 ft/sec | 2.2 min. | 17.1 min. | 285lf | 11.6 min. | **17.1 min.** | Undeveloped Condition |
| D-16 | | | 2.27ac | 0.15 | 100lf | 2.0% | 13.8 min. | 660lf | 0.8% | NBG | 10 | 0.9 ft/sec | 12.3 min. | 26.1 min. | 760lf | 14.2 min. | **26.1 min.** | Undeveloped Condition |
| D-16.1 | | | 2.08ac | 0.34 | 100lf | 1.4% | 12.5 min. | 360lf | 0.8% | PV | 20 | 1.8 ft/sec | 3.4 min. | 15.9 min. | 460lf | 12.6 min. | **15.9 min.** | Backyard IRF |
| D-17 | | | 3.45ac | 0.34 | 60lf | 1.5% | 9.5 min. | 410lf | 1.5% | PV | 20 | 2.4 ft/sec | 2.8 min. | 12.3 min. | 470lf | 12.6 min. | **12.6 min.** | Backyard IRF |
| D-18 | | | 2.13ac | 0.34 | 60lf | 1.5% | 9.5 min. | 510lf | 2.2% | PV | 20 | 3.0 ft/sec | 2.9 min. | 12.3 min. | 570lf | 13.2 min. | **13.2 min.** | Backyard IRF |
| D-19 | | | 2.97ac | 0.34 | 100lf | 2.6% | 10.2 min. | 510lf | 1.1% | PV | 20 | 2.1 ft/sec | 4.1 min. | 14.2 min. | 610lf | 13.4 min. | **14.2 min.** | Backyard IRF |
| D-19.1 | DP89 | | 0.17ac | 0.34 | 45lf | 2.0% | 7.5 min. | 36lf | 1.1% | PV | 20 | 2.1 ft/sec | 0.3 min. | 7.7 min. | 81lf | 10.5 min. | **7.7 min.** | Developed with Filing No 11 |
| D-20a | DP 92a | | 0.81ac | 0.38 | 100lf | 3.3% | 8.8 min. | 1300lf | 0.8% | PV | 20 | 1.8 ft/sec | 12.1 min. | 20.9 min. | 1400lf | 17.8 min. | **17.8 min.** | Developed with Filing No 10 |
| D-20b | DP 92b | | 0.47ac | 0.68 | 100lf | 3.3% | 5.1 min. | 1300lf | 0.8% | PV | 20 | 1.8 ft/sec | 12.1 min. | 17.2 min. | 1400lf | 17.8 min. | **17.2 min.** | Developed with Filing No 11 |
| D-20c | DP 92d | | 0.36ac | 0.38 | 100lf | 3.3% | 8.8 min. | 1300lf | 0.8% | PV | 20 | 1.8 ft/sec | 12.1 min. | 20.9 min. | 1400lf | 17.8 min. | **17.8 min.** | Developed with Filing No 11 |
| D-21 | DP 91 | | 4.02ac | 0.28 | 50lf | 2.0% | 8.4 min. | 610lf | 2.1% | PV | 20 | 2.9 ft/sec | 3.5 min. | 11.9 min. | 660lf | 13.7 min. | **11.9 min.** | Developed with Filing No 10 |
| D-22 | DP 90 | | 1.15ac | 0.28 | 50lf | 2.0% | 8.4 min. | 610lf | 2.1% | PV | 20 | 2.9 ft/sec | 3.5 min. | 11.9 min. | 660lf | 13.7 min. | **11.9 min.** | Developed with Filing No 10 |
| D-23 | DP92e | | 0.28ac | 0.67 | 100lf | 2.5% | 5.7 min. | 660lf | 1.0% | PV | 20 | 2.0 ft/sec | 5.5 min. | 11.2 min. | 760lf | 14.2 min. | **11.2 min.** | Developed with Filing No 11 |
| D-24 | | | 10.18ac | 0.20 | 100lf | 4.9% | 9.8 min. | 800lf | 0.5% | GW | 15 | 1.1 ft/sec | 12.6 min. | **22.3 min.** | 900lf | 15.0 min. | **22.3 min.** | Mostly Historic |
| **Combined Design Point Summary** | | | | | | | | | | | | | | | | | | |
| | DP 69 | D1, D2 | 3.07ac | 0.08 | 100lf | 2.4% | 14.0 min. | 1385lf | 2.0% | PV | 20 | 2.8 ft/sec | 8.2 min. | 22.2 min. | 1485lf | 18.3 min. | **18.3 min.** | Undeveloped Condition |
| | DP 71 | D3, D4 | 3.76ac | 0.08 | 100lf | 2.4% | 14.0 min. | 1370lf | 2.0% | PV | 20 | 2.8 ft/sec | 8.1 min. | 22.1 min. | 1470lf | 18.2 min. | **18.2 min.** | Undeveloped Condition |
| | DP 74 | D3, D4, D6 | 4.17ac | 0.17 | 100lf | 2.4% | 12.7 min. | 1370lf | 2.0% | PV | 20 | 2.8 ft/sec | 8.1 min. | 20.7 min. | 1470lf | 18.2 min. | **18.2 min.** | Developed with Filing No 11 |
| | DP 75 | D1-D4, D6, D7 | 10.23ac | 0.22 | 100lf | 2.4% | 12.0 min. | 1970lf | 1.8% | PV | 20 | 2.7 ft/sec | 12.2 min. | 24.2 min. | 2070lf | 21.5 min. | **21.5 min.** | Developed with Filing No 11 |
| | DP 76 | D1-D4, D6-D8 | 11.85ac | 0.24 | 100lf | 2.4% | 11.8 min. | 2110lf | 1.8% | PV | 20 | 2.7 ft/sec | 13.1 min. | 24.9 min. | 2210lf | 22.3 min. | **22.3 min.** | Developed with Filing No 11 |
| | DP 78 | D1-D4, D6-D9 | 14.04ac | 0.23 | 100lf | 2.4% | 11.9 min. | 2110lf | 1.8% | PV | 20 | 2.7 ft/sec | 13.1 min. | 25.0 min. | 2210lf | 22.3 min. | **22.3 min.** | Developed with Filing No 11 |
| | DP 79 | D8, D10 | 4.14ac | 0.34 | 100lf | 2.4% | 10.5 min. | 896lf | 1.6% | PV | 20 | 2.5 ft/sec | 5.9 min. | 16.4 min. | 996lf | 15.5 min. | **15.5 min.** | Developed with Filing No 11 |
| | DP 81 | D11, D12 | 5.34ac | 0.34 | 70lf | 1.5% | 10.2 min. | 1545lf | 1.2% | PV | 20 | 2.2 ft/sec | 11.8 min. | 22.0 min. | 1615lf | 19.0 min. | **19.0 min.** | Developed with Filing No 11 |
| | DP 82 | D5, D13 | 3.62ac | 0.26 | 60lf | 2.0% | 9.4 min. | 1590lf | 0.6% | PV | 20 | 1.5 ft/sec | 17.7 min. | 27.1 min. | 1650lf | 19.2 min. | **19.2 min.** | Developed with Filing No 11 |
| | DP 83 | D5, D13, D14 | 6.93ac | 0.30 | 60lf | 2.0% | 9.0 min. | 2640lf | 0.9% | PV | 20 | 1.9 ft/sec | 23.2 min. | 32.2 min. | 2700lf | 25.0 min. | **25.0 min.** | Developed with Filing No 11 |
| | DP 85 | D15,D16, D16.1 | 7.15ac | 0.21 | 100lf | 2.0% | 12.9 min. | 847lf | 0.6% | PV | 20 | 1.5 ft/sec | 9.3 min. | 22.2 min. | 947lf | 15.3 min. | **22.2 min.** | Backyard IRF |
| | DP 86 | D15 - D17 | 10.60ac | 0.26 | 100lf | 2.0% | 12.3 min. | 1035lf | 0.8% | PV | 20 | 1.8 ft/sec | 9.6 min. | 21.9 min. | 1135lf | 16.3 min. | **21.9 min.** | Backyard IRF |
| | DP 87 | D15 - D18 | 12.74ac | 0.27 | 100lf | 2.0% | 12.1 min. | 1320lf | 0.7% | PV | 20 | 1.7 ft/sec | 13.1 min. | 25.2 min. | 1420lf | 17.9 min. | **25.2 min.** | Backyard IRF |
| | DP 88 | D15 - D19 | 15.70ac | 0.28 | 100lf | 2.0% | 11.9 min. | 2080lf | 1.0% | PV | 20 | 2.0 ft/sec | 17.3 min. | 29.2 min. | 2180lf | 22.1 min. | **29.2 min.** | Backyard IRF |
| | DP 92a | D20a | 0.81ac | 0.34 | 100lf | 2.0% | 11.1 min. | 2080lf | 1.0% | PV | 20 | 2.0 ft/sec | 17.3 min. | 28.4 min. | 2180lf | 22.1 min. | **29.2 min.** | Backyard IRF |
| | DP 92b | D21,D22,D23 | 5.46ac | 0.34 | 124lf | 2.5% | 11.5 min. | 825lf | 1.0% | PV | 20 | 2.0 ft/sec | 6.9 min. | 18.4 min. | 949lf | 15.3 min. | **15.3 min.** | Developed with Filing No 11 |
| | DP 93a | D1 -D19.1 | 44.70ac | 0.34 | 168lf | 2.5% | 13.4 min. | 2820lf | 1.0% | PV | 20 | 2.0 ft/sec | 23.5 min. | 36.9 min. | 2988lf | 26.6 min. | **26.6 min.** | Developed with Filing No 11 & 12 |
| | DP 93b | D20b,D20c,D23 | 1.12ac | 0.40 | 14lf | 2.4% | 3.6 min. | 56lf | 1.6% | PV | 20 | 2.5 ft/sec | 0.4 min. | 5.0 min. | 70lf | 10.4 min. | **5.0 min.** | |
| | **DP 94** | **Existing Condition** | **61.97ac** | 0.32 | 100lf | 2.4% | 10.7 min. | 3110lf | 1.0% | PV | 20 | 2.0 ft/sec | 25.9 min. | 36.6 min. | 3210lf | 27.8 min. | **27.8 min.** | **Final Existing $T_C$** |

Equations:

$t_i$ (Overland) = $0.395(1.1-C_5)L^{0.5}\,S^{-0.333}$

$C_5$ = Runoff coefficient for 5-year

L = Length of overland flow (ft)

S = Slope of flow path (ft/ft)

tc Check = (L/180)+10 (Developed Cond. Only)

L = Overall Length

Velocity (Travel Time) = $CvS^{0.5}$

Cv = Conveyance Coef (see Table RO-2)

S = Watercourse slope (ft/ft)

| Land Surface Type | Type | Cv |
|---|---|---|
| Grassed Waterway | GW | 15 |
| Heavy Meadow | HM | 2.5 |
| Nearly Bare Ground | NBG | 10 |
| Paved Area | PV | 20 |
| Riprap (Not Buried) | RR | 6.5 |
| Short Pasture/Lawns | SP | 7 |
| Tillage/Fields | TF | 5 |

# The Glen at Widefield
## Developed Condition
## Time of Concentration Calculation

| Developed Sub-Basin Data | | | | | Filing 12 Developed Condition - Time of Concentration Estimate | | | | | | | | | | Min. Tc in Urban | | Final $t_c$ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Initial/Overland Time ($t_i$) | | | Travel Time ($t_t$) | | | | | | Comp. | Tc Check (urban) | | | |
| Basin | Design Point | Contributing Basins | Area | $C_5$ | Length | Slope | $t_i$ | Length | Slope | Land Type | Cv | Velocity | $t_t$ | $t_c$ | Total Length | $t_c$ Check | | Notes: |
| D-1 | DP 68 | | 1.40ac | 0.28 | 100lf | 2.4% | 11.2 min. | 600lf | 3.5% | PV | 20 | 3.7 ft/sec | 2.7 min. | 13.9 min. | 700lf | 13.9 min. | **13.9 min.** | Developed with Filing No 12 |
| D-2 | | | 1.67ac | 0.28 | 85lf | 1.5% | 12.1 min. | 655lf | 0.9% | PV | 20 | 1.9 ft/sec | 5.8 min. | 17.8 min. | 740lf | 14.1 min. | **14.1 min.** | Developed with Filing No 12 |
| D-3 | DP 70 | | 1.69ac | 0.28 | 100lf | 2.4% | 11.2 min. | 600lf | 3.5% | PV | 20 | 3.7 ft/sec | 2.7 min. | 13.9 min. | 700lf | 13.9 min. | **13.9 min.** | Developed with Filing No 12 |
| D-4 | | | 2.07ac | 0.34 | 50lf | 1.0% | 9.9 min. | 610lf | 0.9% | PV | 20 | 1.9 ft/sec | 5.4 min. | 15.3 min. | 660lf | 13.7 min. | **13.7 min.** | Developed with Filing No 12 |
| D-5 | DP 72 | | 1.56ac | 0.34 | 60lf | 2.0% | 8.6 min. | 790lf | 0.5% | PV | 20 | 1.4 ft/sec | 9.3 min. | 17.9 min. | 850lf | 14.7 min. | **14.7 min.** | Developed with Filing No 12 |
| D-6 | DP 73 | | 0.41ac | 0.34 | 90lf | 1.0% | 13.3 min. | 140lf | 0.8% | PV | 20 | 1.8 ft/sec | 1.3 min. | 14.6 min. | 230lf | 11.3 min. | **11.3 min.** | Developed with Filing No 11 |
| D-7 | | | 2.98ac | 0.34 | 100lf | 1.5% | 12.2 min. | 430lf | 1.3% | PV | 20 | 2.3 ft/sec | 3.1 min. | 15.4 min. | 530lf | 12.9 min. | **12.9 min.** | Developed with Filing No 11 |
| D-8 | | | 1.62ac | 0.34 | 100lf | 1.0% | 14.0 min. | 330lf | 1.5% | PV | 20 | 2.4 ft/sec | 2.2 min. | 16.2 min. | 430lf | 12.4 min. | **12.4 min.** | Developed with Filing No 11 |
| D-9 | DP 77 | | 2.19ac | 0.28 | 100lf | 2.0% | 11.9 min. | 300lf | 1.3% | PV | 20 | 2.3 ft/sec | 2.2 min. | 14.1 min. | 400lf | 12.2 min. | **12.2 min.** | Developed with Filing No 12 |
| D-10 | | | 2.52ac | 0.34 | 100lf | 1.5% | 12.2 min. | 660lf | 1.1% | PV | 20 | 2.1 ft/sec | 5.2 min. | 17.5 min. | 760lf | 14.2 min. | **14.2 min.** | Developed with Filing No 11 |
| D-11 | DP 80 | | 3.96ac | 0.34 | 70lf | 1.5% | 10.2 min. | 1095lf | 1.2% | PV | 20 | 2.2 ft/sec | 8.3 min. | 18.6 min. | 1165lf | 16.5 min. | **16.5 min.** | Developed with Filing No 11 |
| D-12 | | | 1.39ac | 0.34 | 100lf | 1.3% | 12.8 min. | 450lf | 1.2% | PV | 20 | 2.2 ft/sec | 3.4 min. | 16.3 min. | 550lf | 13.1 min. | **13.1 min.** | Developed with Filing No 11 |
| D-13 | | | 2.06ac | 0.34 | 55lf | 1.0% | 10.4 min. | 660lf | 0.6% | PV | 20 | 1.5 ft/sec | 7.1 min. | 17.5 min. | 715lf | 14.0 min. | **14.0 min.** | Developed with Filing No 11 |
| D-14 | | | 3.30ac | 0.34 | 100lf | 1.8% | 11.5 min. | 980lf | 1.6% | PV | 20 | 2.5 ft/sec | 6.5 min. | 18.0 min. | 1080lf | 16.0 min. | **16.0 min.** | Developed with Filing No 11 |
| D-15 | DP 84 | | 2.80ac | 0.28 | 100lf | 2.0% | 11.9 min. | 185lf | 2.0% | PV | 20 | 2.8 ft/sec | 1.1 min. | 13.0 min. | 285lf | 11.6 min. | **13.0 min.** | Filing 12 - Backyard IRF |
| D-16 | | | 2.27ac | 0.34 | 100lf | 2.0% | 11.1 min. | 660lf | 0.8% | PV | 20 | 1.8 ft/sec | 6.1 min. | 17.3 min. | 760lf | 14.2 min. | **17.3 min.** | Filing 12 - Backyard IRF |
| D-16.1 | | | 2.08ac | 0.34 | 100lf | 1.4% | 12.5 min. | 360lf | 0.8% | PV | 20 | 1.8 ft/sec | 3.4 min. | 15.9 min. | 460lf | 12.6 min. | **15.9 min.** | Filing 11 - Backyard IRF |
| D-17 | | | 3.45ac | 0.34 | 60lf | 1.5% | 9.5 min. | 410lf | 1.5% | PV | 20 | 2.4 ft/sec | 2.8 min. | 12.3 min. | 470lf | 12.6 min. | **12.6 min.** | Filing 11 - Backyard IRF |
| D-18 | | | 2.13ac | 0.34 | 60lf | 1.5% | 9.5 min. | 510lf | 2.2% | PV | 20 | 3.0 ft/sec | 2.9 min. | 12.3 min. | 570lf | 13.2 min. | **13.2 min.** | Filing 11 - Backyard IRF |
| D-19 | | | 2.97ac | 0.34 | 100lf | 2.6% | 10.2 min. | 510lf | 1.1% | PV | 20 | 2.1 ft/sec | 4.1 min. | 14.2 min. | 610lf | 13.4 min. | **14.2 min.** | Filing 11 - Backyard IRF |
| D-19.1 | | | 0.17ac | 0.34 | 45lf | 2.0% | 7.5 min. | 36lf | 1.1% | PV | 20 | 2.1 ft/sec | 0.3 min. | 7.7 min. | 81lf | 10.5 min. | **7.7 min.** | Developed with Filing No 11 |
| D-20a | DP 92a | | 0.81ac | 0.38 | 100lf | 3.3% | 8.8 min. | 1300lf | 0.8% | PV | 20 | 1.8 ft/sec | 12.1 min. | 20.9 min. | 1400lf | 17.8 min. | **17.8 min.** | Developed with Filing No 10 |
| D-20b | DP 92b | | 0.47ac | 0.68 | 100lf | 3.3% | 5.1 min. | 1300lf | 0.8% | PV | 20 | 1.8 ft/sec | 12.1 min. | 17.2 min. | 1400lf | 17.8 min. | **17.2 min.** | Developed with Filing No 11 |
| D-20c | DP 92d | | 0.36ac | 0.38 | 100lf | 3.3% | 8.8 min. | 1300lf | 0.8% | PV | 20 | 1.8 ft/sec | 12.1 min. | 20.9 min. | 1400lf | 17.8 min. | **17.8 min.** | Developed with Filing No 11 |
| D-21 | DP 91 | | 4.02ac | 0.28 | 50lf | 2.0% | 8.4 min. | 610lf | 2.1% | PV | 20 | 2.9 ft/sec | 3.5 min. | 11.9 min. | 660lf | 13.7 min. | **11.9 min.** | Developed with Filing No 10 |
| D-22 | DP 90 | | 1.15ac | 0.28 | 50lf | 2.0% | 8.4 min. | 610lf | 2.1% | PV | 20 | 2.9 ft/sec | 3.5 min. | 11.9 min. | 660lf | 13.7 min. | **11.9 min.** | Developed with Filing No 10 |
| D-23 | | | 0.28ac | 0.67 | 100lf | 2.5% | 5.7 min. | 660lf | 1.0% | PV | 20 | 2.0 ft/sec | 5.5 min. | 11.2 min. | 760lf | 14.2 min. | **11.2 min.** | Developed with Filing No 11 |
| D-24 | | | 10.18ac | 0.20 | 100lf | 4.9% | 9.8 min. | 800lf | 0.5% | GW | 15 | 1.1 ft/sec | 12.6 min. | **22.3 min.** | 900lf | 15.0 min. | **22.3 min.** | Mostly Historic |
| **Combined Design Point Summary** | | | | | | | | | | | | | | | | | | |
| | DP 69 | D1, D2 | 3.08ac | 0.28 | 100lf | 2.4% | 11.2 min. | 1385lf | 2.0% | PV | 20 | 2.8 ft/sec | 8.2 min. | 19.3 min. | 1485lf | 18.3 min. | **18.3 min.** | Developed with Filing No 12 |
| | DP 71 | D3, D4 | 3.76ac | 0.28 | 100lf | 2.4% | 11.2 min. | 1370lf | 2.0% | PV | 20 | 2.8 ft/sec | 8.1 min. | 19.3 min. | 1470lf | 18.2 min. | **18.2 min.** | Developed with Filing No 12 |
| | DP 74 | D3, D4, D6 | 4.17ac | 0.34 | 100lf | 2.4% | 10.5 min. | 1370lf | 2.0% | PV | 20 | 2.8 ft/sec | 8.1 min. | 18.5 min. | 1470lf | 18.2 min. | **18.2 min.** | Developed with Filing No 11 |
| | DP 75 | D1-D4, D6, D7 | 10.23ac | 0.34 | 100lf | 2.4% | 10.5 min. | 1970lf | 1.8% | PV | 20 | 2.7 ft/sec | 12.2 min. | 22.7 min. | 2070lf | 21.5 min. | **21.5 min.** | Developed with Filing No 11 |
| | DP 76 | D1-D4, D6-D8 | 11.85ac | 0.34 | 100lf | 2.4% | 10.5 min. | 2110lf | 1.8% | PV | 20 | 2.7 ft/sec | 13.1 min. | 23.6 min. | 2210lf | 22.3 min. | **22.3 min.** | Developed with Filing No 11 |
| | DP 78 | D1-D4, D6-D9 | 14.04ac | 0.34 | 100lf | 2.4% | 10.5 min. | 2110lf | 1.8% | PV | 20 | 2.7 ft/sec | 13.1 min. | 23.6 min. | 2210lf | 22.3 min. | **22.3 min.** | Developed with Filing No 11 |
| | DP 79 | D8, D10 | 4.14ac | 0.34 | 100lf | 2.4% | 10.5 min. | 896lf | 1.6% | PV | 20 | 2.5 ft/sec | 5.9 min. | 16.4 min. | 996lf | 15.5 min. | **15.5 min.** | Developed with Filing No 11 |
| | DP 81 | D11, D12 | 5.34ac | 0.34 | 70lf | 1.5% | 10.2 min. | 1545lf | 1.2% | PV | 20 | 2.2 ft/sec | 11.8 min. | 22.0 min. | 1615lf | 19.0 min. | **19.0 min.** | Developed with Filing No 11 |
| | DP 82 | D5, D13 | 3.62ac | 0.34 | 60lf | 2.0% | 8.6 min. | 1590lf | 0.6% | PV | 20 | 1.5 ft/sec | 17.7 min. | 26.3 min. | 1650lf | 19.2 min. | **19.2 min.** | Developed with Filing No 11 |
| | DP 83 | D5, D13, D14 | 6.93ac | 0.34 | 60lf | 2.0% | 8.6 min. | 2640lf | 0.9% | PV | 20 | 1.9 ft/sec | 23.2 min. | 31.8 min. | 2700lf | 25.0 min. | **25.0 min.** | Developed with Filing No 11 |
| | DP 85 | D15,D16, D16.1 | 7.15ac | 0.34 | 100lf | 2.0% | 11.1 min. | 847lf | 0.6% | PV | 20 | 1.5 ft/sec | 9.3 min. | 20.5 min. | 947lf | 15.3 min. | **20.5 min.** | Filing 12 - Backyard IRF |
| | DP 86 | D15 - D17 | 10.60ac | 0.34 | 100lf | 2.0% | 11.1 min. | 1035lf | 0.8% | PV | 20 | 1.8 ft/sec | 9.6 min. | 20.8 min. | 1135lf | 16.3 min. | **20.8 min.** | Filing 11 - Backyard IRF |
| | DP 87 | D15 - D18 | 12.74ac | 0.34 | 100lf | 2.0% | 11.1 min. | 1320lf | 0.7% | PV | 20 | 1.7 ft/sec | 13.1 min. | 24.3 min. | 1420lf | 17.9 min. | **24.3 min.** | Filing 11 - Backyard IRF |
| | DP 88 | D15 - D19 | 15.70ac | 0.34 | 100lf | 2.0% | 11.1 min. | 2080lf | 1.0% | PV | 20 | 2.0 ft/sec | 17.3 min. | 28.4 min. | 2180lf | 22.1 min. | **28.4 min.** | Filing 11 - Backyard IRF |
| | DP 92a | D20a | 0.81ac | 0.34 | 100lf | 2.0% | 11.1 min. | 2080lf | 1.0% | PV | 20 | 2.0 ft/sec | 17.3 min. | 28.4 min. | 2180lf | 22.1 min. | **28.4 min.** | Filing 11 - Backyard IRF |
| | DP 92b | D21,D22,D23 | 5.46ac | 0.34 | 124lf | 2.5% | 11.5 min. | 825lf | 1.0% | PV | 20 | 2.0 ft/sec | 6.9 min. | 18.4 min. | 949lf | 15.3 min. | **15.3 min.** | Developed with Filing No 11 |
| | DP 93a | D1 -D19.1 | 44.70ac | 0.34 | 168lf | 2.5% | 13.4 min. | 2820lf | 1.0% | PV | 20 | 2.0 ft/sec | 23.5 min. | 36.9 min. | 2988lf | 26.6 min. | **26.6 min.** | Developed with Filing No 11 & 12 |
| | DP 93b | D20b,D20c,D23 | 1.12ac | 0.40 | 14lf | 2.4% | 3.6 min. | 56lf | 1.6% | PV | 20 | 2.5 ft/sec | 0.4 min. | 5.0 min. | 70lf | 10.4 min. | **5.0 min.** | Developed with Filing No 11 |
| | **DP 94** | **Developed** | **61.97ac** | 0.32 | 100lf | 2.4% | 10.7 min. | 3110lf | 1.0% | PV | 20 | 2.0 ft/sec | 25.9 min. | 36.6 min. | 3210lf | 27.8 min. | **27.8 min.** | **Final Developed $T_C$** |

Equations:

$t_i$ (Overland) = $0.395(1.1-C_5)L^{0.5}S^{-0.333}$

$C_5$ = Runoff coefficient for 5-year

L = Length of overland flow (ft)

S = Slope of flow path (ft/ft)

tc Check = (L/180)+10 (Developed Cond. Only)

L = Overall Length

Velocity (Travel Time) = $CvS^{0.5}$

Cv = Conveyance Coef (see Table RO-2)

S = Watercourse slope (ft/ft)

| Land Surface Type | Type | Cv |
|---|---|---|
| Grassed Waterway | GW | 15 |
| Heavy Meadow | HM | 2.5 |
| Nearly Bare Ground | NBG | 10 |
| Paved Area | PV | 20 |
| Riprap (Not Buried) | RR | 6.5 |
| Short Pasture/Lawns | SP | 7 |
| Tillage/Fields | TF | 5 |

# The Glen at Widefield
## Existing Condition
## Runoff Coeficient and Percent Impervious Calculation

| Filing 12 - Existing Condition | | | | | PV | Area 1 Land Use | | | LA | Area 2 Land Use | | | RS2 | Area 3 Land Use | | | RS1 | Area 4 Land Use | | | HI | Area 5 Land Use | | | | Basin Runoff Coeficient | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Basin | DP | Basin or DP Area (DP contributing basins) | | Soil Type | % Imperv | Land Use Area | % Area | Comp Land Use % Imp | % Imperv | Land Use Area | % Area | Comp Land Use % Imp | % Imperv | Land Use Area | % Area | Comp Land Use % Imp | % Imperv | Land Use Area | % Area | Comp Land Use % Imp | % Imperv | Land Use Area | % Area | Comp Land Use % Imp | Basin % Imperv | $C_2$ | $C_5$ | $C_{10}$ | $C_{25}$ | $C_{50}$ | $C_{100}$ | Notes: |
| D-1 | DP 68 | 61,148 sf | 1.40ac | B | 100% | | 0% | 0% | 0% | 1.40ac | 100% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 2% | | 0% | 0% | 0.0% | 0.02 | 0.08 | 0.15 | 0.25 | 0.30 | 0.35 | Undeveloped Condition |
| D-2 | | 72,745 sf | 1.67ac | B | 100% | | 0% | 0% | 0% | 1.67ac | 100% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 2% | | 0% | 0% | 0.0% | 0.02 | 0.08 | 0.15 | 0.25 | 0.30 | 0.35 | Undeveloped Condition |
| D-3 | DP 70 | 73,555 sf | 1.69ac | B | 100% | | 0% | 0% | 0% | 1.69ac | 100% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 2% | | 0% | 0% | 0.0% | 0.02 | 0.08 | 0.15 | 0.25 | 0.30 | 0.35 | Undeveloped Condition |
| D-4 | | 90,208 sf | 2.07ac | C | 100% | | 0% | 0% | 0% | 2.07ac | 100% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 2% | | 0% | 0% | 0.0% | 0.04 | 0.15 | 0.25 | 0.37 | 0.44 | 0.50 | Undeveloped Condition |
| D-5 | DP 72 | 68,122 sf | 1.56ac | C | 100% | | 0% | 0% | 0% | 1.56ac | 100% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 2% | | 0% | 0% | 0.0% | 0.04 | 0.15 | 0.25 | 0.37 | 0.44 | 0.50 | Undeveloped Condition |
| D-6 | DP 73 | 18,040 sf | 0.41ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 0.41ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-7 | | 130,015 sf | 2.98ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.98ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-8 | | 70,452 sf | 1.62ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 1.62ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-9 | DP 77 | 95,396 sf | 2.19ac | B | 100% | | 0% | 0% | 0% | 2.19ac | 100% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 2% | | 0% | 0% | 0.0% | 0.02 | 0.08 | 0.15 | 0.25 | 0.30 | 0.35 | Undeveloped Condition |
| D-10 | | 109,710 sf | 2.52ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.52ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-11 | DP 80 | 172,355 sf | 3.96ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 3.96ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-12 | | 60,400 sf | 1.39ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 1.39ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-13 | | 89,754 sf | 2.06ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.06ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-14 | | 143,954 sf | 3.30ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 3.30ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-15 | DP 84 | 122,155 sf | 2.80ac | B | 100% | | 0% | 0% | 0% | 2.80ac | 100% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 2% | | 0% | 0% | 0.0% | 0.02 | 0.08 | 0.15 | 0.25 | 0.30 | 0.35 | Undeveloped Condition |
| D-16 | | 98,963 sf | 2.27ac | C | 100% | | 0% | 0% | 0% | 2.27ac | 100% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 2% | | 0% | 0% | 0.0% | 0.04 | 0.15 | 0.25 | 0.37 | 0.44 | 0.50 | Undeveloped Condition |
| D-16.1 | | 90,495 sf | 2.08ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.08ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-17 | | 150,208 sf | 3.45ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 3.45ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-18 | | 92,997 sf | 2.13ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.13ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-19 | | 129,215 sf | 2.97ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.97ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-19.1 | DP89 | 7,235 sf | 0.17ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 0.17ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | Developed with Filing No 11 |
| D-20a | DP 92a | 35,151 sf | 0.81ac | C | 100% | 0.34ac | 42% | 42% | 0% | 0.37ac | 46% | 0% | 46% | | 0% | 0% | 37% | 0.10ac | 12% | 4% | 2% | | 0% | 0% | 46.6% | 0.32 | 0.38 | 0.44 | 0.52 | 0.56 | 0.60 | Developed with Filing No 10 |
| D-20b | DP 92b | 20,481 sf | 0.47ac | C | 100% | 0.40ac | 85% | 85% | 0% | 0.07ac | 15% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 2% | | 0% | 0% | 85.1% | 0.66 | 0.68 | 0.71 | 0.75 | 0.78 | 0.79 | Developed with Filing No 11 |
| D-20c | DP 92d | 15,896 sf | 0.36ac | C | 100% | 0.17ac | 47% | 47% | 0% | 0.19ac | 52% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 2% | | 0% | 0% | 46.6% | 0.32 | 0.38 | 0.44 | 0.52 | 0.56 | 0.60 | Developed with Filing No 11 |
| D-21 | DP 91 | 175,102 sf | 4.02ac | B | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 4.02ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.22 | 0.28 | 0.35 | 0.41 | 0.45 | 0.49 | Developed with Filing No 10 |
| D-22 | DP 90 | 50,194 sf | 1.15ac | B | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 1.15ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.22 | 0.28 | 0.35 | 0.41 | 0.45 | 0.49 | Developed with Filing No 10 |
| D-23 | DP92e | 12,393 sf | 0.28ac | C | 100% | 0.24ac | 84% | 84% | 0% | 0.04ac | 16% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 2% | | 0% | 0% | 84.4% | 0.65 | 0.67 | 0.71 | 0.74 | 0.77 | 0.78 | Developed with Filing No 11 |
| D-24 | | 443,273 sf | 10.18ac | C | 100% | | 0% | 0% | 0% | 8.18ac | 80% | 0% | 46% | | 0% | 0% | 37% | 2.00ac | 20% | 7% | 2% | | 0% | 0% | 7.3% | 0.09 | 0.20 | 0.29 | 0.40 | 0.47 | 0.52 | Developed with Filing No 10 |
| **Combined Design Point Summary** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | DP 69 | D1, D2 | 3.07ac | B | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 0.00ac | 0% | 0% | 2% | | 0% | 0% | 0.0% | 0.02 | 0.08 | 0.15 | 0.25 | 0.30 | 0.35 | |
| | DP 71 | D3, D4 | 3.76ac | B | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 0.00ac | 0% | 0% | 2% | | 0% | 0% | 0.0% | 0.02 | 0.08 | 0.15 | 0.25 | 0.30 | 0.35 | |
| | DP 74 | D3, D4, D6 | 4.17ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 0.41ac | 10% | 4% | 2% | | 0% | 0% | 3.7% | 0.07 | 0.17 | 0.27 | 0.39 | 0.46 | 0.51 | |
| | DP 75 | D1-D4, D6, D7 | 10.23ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 3.40ac | 33% | 12% | 2% | | 0% | 0% | 12.3% | 0.12 | 0.22 | 0.31 | 0.42 | 0.48 | 0.54 | |
| | DP 76 | D1-D4, D6-D8 | 11.85ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 5.02ac | 42% | 16% | 2% | | 0% | 0% | 15.7% | 0.15 | 0.24 | 0.33 | 0.43 | 0.49 | 0.54 | |
| | DP 78 | D1-D4, D6-D9 | 14.04ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 5.02ac | 36% | 13% | 2% | | 0% | 0% | 13.2% | 0.13 | 0.23 | 0.32 | 0.42 | 0.49 | 0.54 | |
| | DP 79 | D8, D10 | 4.14ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 4.14ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | |
| | DP 81 | D11, D12 | 5.34ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 5.34ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | |
| | DP 82 | D5, D13 | 3.62ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.06ac | 57% | 21% | 2% | | 0% | 0% | 21.0% | 0.18 | 0.26 | 0.35 | 0.45 | 0.51 | 0.55 | |
| | DP 83 | D5, D13, D14 | 6.93ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 5.37ac | 77% | 29% | 2% | | 0% | 0% | 28.6% | 0.22 | 0.30 | 0.38 | 0.47 | 0.52 | 0.57 | |
| | DP 85 | D15,D16, D16.1 | 7.15ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 2.08ac | 29% | 11% | 2% | | 0% | 0% | 10.7% | 0.12 | 0.21 | 0.31 | 0.42 | 0.48 | 0.53 | |
| | DP 86 | D15 - D17 | 10.60ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 5.53ac | 52% | 19% | 2% | | 0% | 0% | 19.3% | 0.17 | 0.26 | 0.34 | 0.44 | 0.50 | 0.55 | |
| | DP 87 | D15 - D18 | 12.74ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 7.66ac | 60% | 22% | 2% | | 0% | 0% | 22.3% | 0.18 | 0.27 | 0.35 | 0.45 | 0.51 | 0.56 | |
| | DP 88 | D15 - D19 | 15.70ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 10.63ac | 68% | 25% | 2% | | 0% | 0% | 25.0% | 0.20 | 0.28 | 0.36 | 0.46 | 0.52 | 0.56 | |
| | DP 92a | D20a | 0.81ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 0.81ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | |
| | DP 92b | D21,D22,D23 | 5.46ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 5.46ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | |
| | DP 93a | D1 -D19.1 | 44.70ac | C | 100% | | 0% | 0% | 0% | | 0% | 0% | 46% | | 0% | 0% | 37% | 44.70ac | 100% | 37% | 2% | | 0% | 0% | 37.0% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 | |
| | DP 93b | D20b,D20c,D23 | 1.12ac | C | 100% | 0.56ac | 50% | 50% | 0% | 0.56ac | 50% | 0% | 46% | | 0% | 0% | 37% | | 0% | 0% | 2% | | 0% | 0% | 50.0% | 0.34 | 0.40 | 0.46 | 0.53 | 0.57 | 0.60 | |
| **D1-24** | **DP 94** | **Existing** | **61.97ac** | C | 100% | 1.15ac | 2% | 2% | 0% | 23.11ac | 37% | 0% | 37% | | 0% | 0% | 37% | 36.31ac | 59% | 22% | 2% | | 0% | 0% | **23.5%** | **N/A** | **0.28** | **###** | **###** | **###** | **0.56** | **Existing** |

Basin Runoff Coefficient is based on UDFCD % Imperviousness Calculation

| Runoff Coefficients and Percents Impervious | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Hydrologic Soil Type:** | **C** | | | | **Runoff Coef Calc Method** | | | **%Imp** |
| Land Use | Abb | % | $C_2$ | $C_5$ | $C_{10}$ | $C_{25}$ | $C_{50}$ | $C_{100}$ |
| Commercial Area | CO | 95% | 0.80 | 0.82 | 0.84 | 0.87 | 0.89 | 0.89 |
| Drives and Walks | DR | 90% | 0.73 | 0.75 | 0.77 | 0.80 | 0.83 | 0.83 |
| Streets - Gravel (Packed) | GR | 40% | 0.28 | 0.35 | 0.42 | 0.50 | 0.55 | 0.58 |
| Historic Flow Analysis | HI | 2% | 0.06 | 0.16 | 0.26 | 0.38 | 0.45 | 0.51 |
| Lawns | LA | 0% | 0.04 | 0.15 | 0.25 | 0.37 | 0.44 | 0.50 |
| Off-site flow-Undeveloped | OF | 45% | 0.31 | 0.37 | 0.44 | 0.51 | 0.56 | 0.59 |
| Park | PA | 7% | 0.09 | 0.19 | 0.29 | 0.40 | 0.47 | 0.52 |
| Playground | PL | 13% | 0.13 | 0.23 | 0.32 | 0.42 | 0.49 | 0.54 |
| Streets - Paved | PV | 100% | 0.89 | 0.90 | 0.92 | 0.94 | 0.96 | 0.96 |
| Roofs | RO | 90% | 0.73 | 0.75 | 0.77 | 0.80 | 0.83 | 0.83 |
| Residential: 3.7 Lots/Acre | RS1 | 37% | 0.26 | 0.34 | 0.41 | 0.49 | 0.54 | 0.58 |
| Residential: 1/5 Acre | RS2 | 46% | 0.31 | 0.38 | 0.44 | 0.51 | 0.56 | 0.59 |

Equations (% Impervious Calculation):

$C_A = K_A + (1.31\, i^3 - 1.44\, i^2 + 1.135\, i - 0.12)$ [Eqn RO-6]

$C_{CD} = K_{CD} + (0.858\, i^3 - 0.786\, i^2 + 0.774\, i + 0.04)$ [Eqn RO-7]

$C_B = (C_A + C_{CD}) / 2$

I = % imperviousness/100 as a decimal (See Table RO-3)

$C_A$ = Runoff coefficient for NRCS Type A Soils

$C_B$ = Runoff coefficient for NRCS Type B Soils

$C_{CD}$ = Runoff coefficient for NRCS Type C and D Soils

Correction Factors - Table RO-4

$K_A$ = For Type A Soils

$K_A$ (2-yr)= 0

$K_A$ (5-yr)= -0.08i + 0.09

$K_A$ (10-yr)= -0.14i + 0.17

$K_A$ (25-yr)= -0.19i + 0.24

$K_A$ (50-yr)= -0.22i + 0.28

$K_A$ (100-yr)= -0.25i + 0.32

$K_{CD}$=For Type C & D Soils

$K_{CD}$ (2-yr)= 0

$K_{CD}$ (5-yr)= -0.10i + 0.11

$K_{CD}$ (10-yr)= -0.18i + 0.21

$K_{CD}$ (25-yr)= -0.28i + 0.33

$K_{CD}$ (50-yr)= -0.33i + 0.40

$K_{CD}$ (100-yr)= -0.39i + 0.46

# The Glen at Widefield
## Developed Condition
## Runoff Volume Calculation

| Basin | Design Point | Contributing Basins | Drainage Area | $C_5$ | $C_{100}$ | Time of Concentration | Rainfall Intensity $i_5$ | Rainfall Intensity $i_{100}$ | Runoff $Q_5$ | Runoff $Q_{100}$ | Basin / DP |
|---|---|---|---|---|---|---|---|---|---|---|---|
| D-1 | DP 68 | | 1.40 ac | 0.28 | 0.49 | 13.9 min. | 3.6 in/hr | 6.1 in/hr | **1.4 cfs** | **4.2 cfs** | D-1 |
| D-2 | | | 1.67 ac | 0.28 | 0.49 | 14.1 min. | 3.6 in/hr | 6.1 in/hr | **1.7 cfs** | **4.9 cfs** | D-2 |
| D-3 | DP 70 | | 1.69 ac | 0.28 | 0.49 | 13.9 min. | 3.6 in/hr | 6.1 in/hr | **1.7 cfs** | **5.0 cfs** | D-3 |
| D-4 | | | 2.07 ac | 0.34 | 0.58 | 13.7 min. | 3.7 in/hr | 6.1 in/hr | **2.5 cfs** | **7.4 cfs** | D-4 |
| D-5 | DP 72 | | 1.56 ac | 0.34 | 0.58 | 14.7 min. | 3.5 in/hr | 6.0 in/hr | **1.9 cfs** | **5.4 cfs** | D-5 |
| D-6 | DP 73 | | 0.41 ac | 0.34 | 0.58 | 11.3 min. | 3.9 in/hr | 6.6 in/hr | **0.5 cfs** | **1.6 cfs** | D-6 |
| D-7 | | | 2.98 ac | 0.34 | 0.58 | 12.9 min. | 3.7 in/hr | 6.3 in/hr | **3.7 cfs** | **10.8 cfs** | D-7 |
| D-8 | | | 1.62 ac | 0.34 | 0.58 | 12.4 min. | 3.8 in/hr | 6.4 in/hr | **2.1 cfs** | **6.0 cfs** | D-8 |
| D-9 | DP 77 | | 2.19 ac | 0.28 | 0.49 | 12.2 min. | 3.8 in/hr | 6.4 in/hr | **2.4 cfs** | **6.9 cfs** | D-9 |
| D-10 | | | 2.52 ac | 0.34 | 0.58 | 14.2 min. | 3.6 in/hr | 6.0 in/hr | **3.0 cfs** | **8.8 cfs** | D-10 |
| D-11 | DP 80 | | 3.96 ac | 0.34 | 0.58 | 16.5 min. | 3.4 in/hr | 5.7 in/hr | **4.5 cfs** | **13.0 cfs** | D-11 |
| D-12 | | | 1.39 ac | 0.34 | 0.58 | 13.1 min. | 3.7 in/hr | 6.3 in/hr | **1.7 cfs** | **5.0 cfs** | D-12 |
| D-13 | | | 2.06 ac | 0.34 | 0.58 | 14.0 min. | 3.6 in/hr | 6.1 in/hr | **2.5 cfs** | **7.3 cfs** | D-13 |
| D-14 | | | 3.30 ac | 0.34 | 0.58 | 16.0 min. | 3.4 in/hr | 5.7 in/hr | **3.8 cfs** | **11.0 cfs** | D-14 |
| D-15 | DP 84 | | 2.80 ac | 0.28 | 0.49 | 13.0 min. | 3.7 in/hr | 6.3 in/hr | **3.0 cfs** | **8.6 cfs** | D-15 |
| D-16 | DP84.1 | | 2.27 ac | 0.34 | 0.58 | 17.3 min. | 3.3 in/hr | 5.6 in/hr | **2.5 cfs** | **7.3 cfs** | D-16 |
| D-16.1 | | | 2.08 ac | 0.34 | 0.58 | 15.9 min. | 3.4 in/hr | 5.8 in/hr | **2.4 cfs** | **6.9 cfs** | D-16.1 |
| D-17 | | | 3.45 ac | 0.34 | 0.58 | 12.6 min. | 3.8 in/hr | 6.3 in/hr | **4.4 cfs** | **12.7 cfs** | D-17 |
| D-18 | | | 2.13 ac | 0.34 | 0.58 | 13.2 min. | 3.7 in/hr | 6.2 in/hr | **2.7 cfs** | **7.7 cfs** | D-18 |
| D-19 | | | 2.97 ac | 0.34 | 0.58 | 14.2 min. | 3.6 in/hr | 6.0 in/hr | **3.6 cfs** | **10.4 cfs** | D-19 |
| D-19.1 | DP 89 | | 0.17 ac | 0.34 | 0.58 | 7.7 min. | 4.5 in/hr | 7.6 in/hr | **0.3 cfs** | **0.7 cfs** | D-19.1 |
| D-20a | DP 92a | | 0.81 ac | 0.38 | 0.60 | 17.8 min. | 3.3 in/hr | 5.5 in/hr | **1.0 cfs** | **2.6 cfs** | D-20a |
| D-20b | DP 92b | | 0.47 ac | 0.68 | 0.79 | 17.2 min. | 3.3 in/hr | 5.6 in/hr | **1.1 cfs** | **2.1 cfs** | D-20b |
| D-20c | DP 92d | | 0.36 ac | 0.38 | 0.60 | 17.8 min. | 3.3 in/hr | 5.5 in/hr | **0.5 cfs** | **1.2 cfs** | D-20c |
| D-21 | DP 91 | | 4.02 ac | 0.28 | 0.49 | 11.9 min. | 3.9 in/hr | 6.5 in/hr | **4.4 cfs** | **12.7 cfs** | D-21 |
| D-22 | DP 90 | | 1.15 ac | 0.28 | 0.49 | 11.9 min. | 3.9 in/hr | 6.5 in/hr | **1.3 cfs** | **3.6 cfs** | D-22 |
| D-23 | | | 0.28 ac | 0.67 | 0.78 | 11.2 min. | 4.0 in/hr | 6.6 in/hr | **0.8 cfs** | **1.5 cfs** | D-23 |
| D-24 | | | 10.18 ac | 0.20 | 0.52 | 22.3 min. | 2.9 in/hr | 4.9 in/hr | **5.8 cfs** | **26.2 cfs** | D-24 |
| **Combined Design Point Summary** | | | | | | | **Direct Summation:** | | **67.0 cfs** | **201.3 cfs** | |
| | DP 69 | D1, D2 | 3.08 ac | 0.28 | 0.49 | 18.3 min. | 3.2 in/hr | 5.4 in/hr | **2.8 cfs** | **8.1 cfs** | DP 69 |
| | DP 71 | D3, D4 | 3.76 ac | 0.28 | 0.49 | 18.2 min. | 3.2 in/hr | 5.4 in/hr | **3.4 cfs** | **9.9 cfs** | DP 71 |
| | DP 74 | D3, D4, D6 | 4.17 ac | 0.34 | 0.58 | 18.2 min. | 3.2 in/hr | 5.4 in/hr | **4.5 cfs** | **13.1 cfs** | DP 74 |
| | DP 75 | D1-D4, D6, D7 | 10.23 ac | 0.34 | 0.58 | 21.5 min. | 3.0 in/hr | 5.0 in/hr | **10.2 cfs** | **29.6 cfs** | DP 75 |
| | DP 76 | D1-D4, D6-D8 | 11.85 ac | 0.34 | 0.58 | 22.3 min. | 2.9 in/hr | 4.9 in/hr | **11.6 cfs** | **33.7 cfs** | DP 76 |
| | DP 78 | D1-D4, D6-D9 | 14.04 ac | 0.34 | 0.58 | 22.3 min. | 2.9 in/hr | 4.9 in/hr | **13.8 cfs** | **39.9 cfs** | DP 78 |
| | DP 79 | D8, D10 | 4.14 ac | 0.34 | 0.58 | 15.5 min. | 3.5 in/hr | 5.8 in/hr | **4.8 cfs** | **13.9 cfs** | DP 79 |
| | DP 81 | D11, D12 | 5.34 ac | 0.34 | 0.58 | 19.0 min. | 3.2 in/hr | 5.3 in/hr | **5.7 cfs** | **16.4 cfs** | DP 81 |
| | DP 82 | D5, D13 | 3.62 ac | 0.34 | 0.58 | 19.2 min. | 3.2 in/hr | 5.3 in/hr | **3.8 cfs** | **11.1 cfs** | DP 82 |
| | DP 83 | D5, D13, D14 | 6.93 ac | 0.34 | 0.58 | 25.0 min. | 2.8 in/hr | 4.6 in/hr | **6.4 cfs** | **18.5 cfs** | DP 83 |
| | DP 85 | D15,D16, D16.1 | 7.15 ac | 0.34 | 0.58 | 20.5 min. | 3.1 in/hr | 5.1 in/hr | **7.3 cfs** | **21.2 cfs** | DP 85 |
| | DP 86 | D15 - D17 | 10.60 ac | 0.34 | 0.58 | 20.8 min. | 3.0 in/hr | 5.1 in/hr | **10.8 cfs** | **31.2 cfs** | DP 86 |
| | DP 87 | D15 - D18 | 12.74 ac | 0.34 | 0.58 | 24.3 min. | 2.8 in/hr | 4.7 in/hr | **12.0 cfs** | **34.6 cfs** | DP 87 |
| | DP 88 | D15 - D19 | 15.70 ac | 0.34 | 0.58 | 28.4 min. | 2.6 in/hr | 4.3 in/hr | **13.5 cfs** | **39.0 cfs** | DP 88 |
| | DP 92a | D20a | 0.81 ac | 0.34 | 0.58 | 28.4 min. | 2.6 in/hr | 4.3 in/hr | **0.7 cfs** | **2.0 cfs** | DP 92a |
| | DP 92b | D21,D22,D23 | 5.46 ac | 0.34 | 0.58 | 15.3 min. | 3.5 in/hr | 5.9 in/hr | **6.4 cfs** | **18.5 cfs** | DP 92b |
| | DP 93a | D1 -D19.1 | 44.70 ac | 0.34 | 0.58 | 26.6 min. | 2.7 in/hr | 4.5 in/hr | **39.9 cfs** | **115.4 cfs** | DP 93a |
| | DP 93b | D20b,D20c,D23 | 1.12 ac | 0.40 | 0.60 | 5.0 min. | 5.2 in/hr | 8.7 in/hr | **2.3 cfs** | **5.9 cfs** | DP 93b |
| | **DP94** | **Developed** | **61.97 ac** | **0.32** | **0.57** | **27.8 min.** | 2.6 in/hr | 4.4 in/hr | **51.0 cfs** | **154.3 cfs** | **Developed** |

Equations (taken from Fig 6-5, City of Colorado Springs DCM):

$i_2$=-1.19 ln($T_c$) + 6.035
$i_5$=-1.50 ln($T_c$) + 7.583
$i_{10}$=-1.75 ln($T_c$) + 8.847
$i_{25}$=-2.00 ln($T_c$) + 10.111
$i_{50}$=-2.25 ln($T_c$) + 11.375
$i_{100}$=-2.52 ln($T_c$) + 12.735

Q = CiA
Q = Peak Runoff Rate (cubic feet/second)
C = Runoff coef representing a ration of peak runoff rate to ave rainfall intensity for a duration equal to the runoff time of concentration.
i = average rainfall intensity in inches per hour
A = Drainage area in acres

| P1 | Inches |
|---|---|
| WQCV | 0.60 in |
| 2 yr | 1.19 in |
| 5 yr | 1.50 in |
| 10 yr | 1.75 in |
| 25 yr | 2.00 in |
| 50 yr | 2.25 in |
| 100 yr | 2.52 in |

# APPENDIX C

## Hydraulic Calculations

**EPA-SWMM HGL/EGL Open Channel and Pipe System Report**

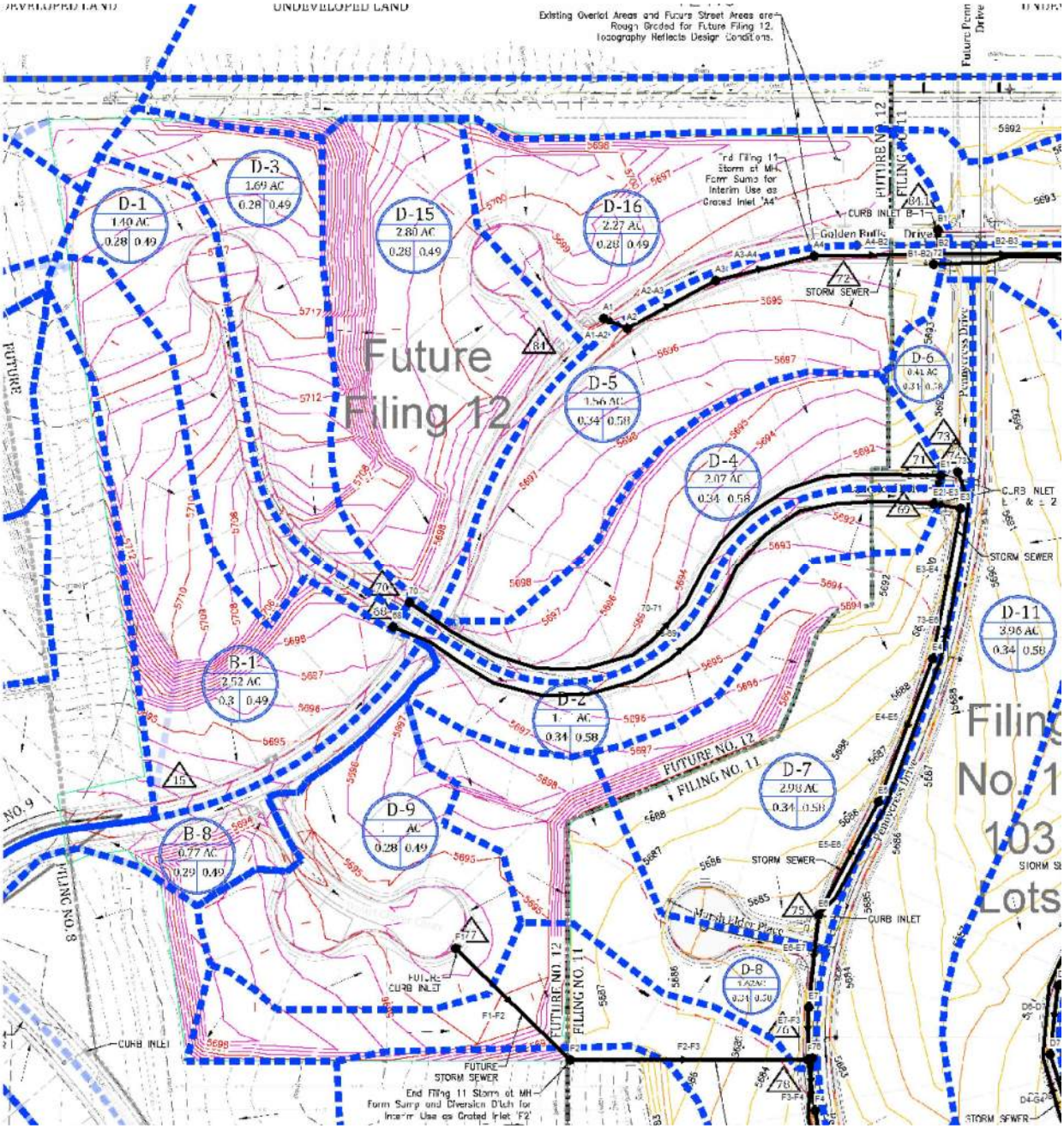
**MHFD Inlet Summaries & Calculations**

Kiowa Engineering Corporation

EPA STORM WATER MANAGEMENT MODEL - VERSION 5.1 (Build 5.1.015)

---

The Glen Filing No 12 Developed Condition 100-Year HGL/EGL Analysis



```
WARNING 10: crest elevation raised to downstream invert for regulator Link H2-HighPtS
WARNING 02: maximum depth increased for Node HighPtN
WARNING 02: maximum depth increased for Node 68
WARNING 02: maximum depth increased for Node 73
WARNING 02: maximum depth increased for Node 76
WARNING 02: maximum depth increased for Node 87
WARNING 02: maximum depth increased for Node 80
WARNING 02: maximum depth increased for Node 72

*********************************************************
NOTE: The summary statistics displayed in this report are
based on results found at every computational time step,
not just on results from each reporting time step.
*********************************************************

****************
Analysis Options
****************
Flow Units ............... CFS
Process Models:
  Rainfall/Runoff ........ YES
  RDII ................... NO
  Snowmelt ............... NO
  Groundwater ............ NO
  Flow Routing ........... YES
  Ponding Allowed ........ YES
  Water Quality .......... NO
Flow Routing Method ...... DYNWAVE
Surcharge Method ......... EXTRAN
Starting Date ............ 03/16/2021 00:00:00
Ending Date .............. 03/16/2021 03:00:00
Antecedent Dry Days ...... 0.0
Report Time Step ......... 00:05:00
```

```
Routing Time Step ........ 30.00 sec
Variable Time Step ....... YES
Maximum Trials ........... 8
Number of Threads ........ 1
Head Tolerance ........... 0.005000 ft


**************************        Volume         Volume
Flow Routing Continuity        acre-feet       10^6 gal
**************************     ---------      ---------
Dry Weather Inflow .......         0.000          0.000
Wet Weather Inflow .......         0.000          0.000
Groundwater Inflow .......         0.000          0.000
RDII Inflow ..............         0.000          0.000
External Inflow ..........        63.195         20.593
External Outflow .........        34.244         11.159
Flooding Loss ............        25.516          8.315
Evaporation Loss .........         0.000          0.000
Exfiltration Loss ........         0.000          0.000
Initial Stored Volume ....         0.001          0.000
Final Stored Volume ......         0.429          0.140
Continuity Error (%) .....         4.758


*************************
Highest Continuity Errors
*************************
Node G1 (30.44%)
Node F6 (9.79%)
Node F7 (6.27%)
Node F5 (2.77%)
Node D4 (-2.70%)
```

```
**************************
Time-Step Critical Elements
**************************
Link D10-D11 (3369.31%)
Link G4-H1 (82.10%)
Link H2-H3 (11.00%)
Link H1-H2 (2.56%)
Link G2-H1 (1.79%)

*******************************
Highest Flow Instability Indexes
*******************************
Link H2-G3-Overtopping (13)
Link G4-H1 (11)
Link G4-G3-Gutter (9)
Link G2-H1 (6)
Link G3-G4 (6)

************************
Routing Time Step Summary
************************
Minimum Time Step           :     0.21 sec
Average Time Step           :     0.67 sec
Maximum Time Step           :     1.74 sec
Percent in Steady State     :    97.57
Average Iterations per Step :     2.67
Percent Not Converging      :     5.63
Time Step Frequencies       :
   30.000 - 13.228 sec      :     0.00 %
   13.228 -  5.833 sec      :     0.00 %
    5.833 -  2.572 sec      :     0.00 %
    2.572 -  1.134 sec      :    15.42 %
    1.134 -  0.500 sec      :    84.58 %
```

**********

Node Depth Summary

**********

| Node | Type | Average Depth Feet | Maximum Depth Feet | Maximum HGL Feet | Time of Max Occurrence days hr:min | Reported Max Depth Feet |
|---|---|---|---|---|---|---|
| H2 | JUNCTION | 3.42 | 3.46 | 5676.05 | 0 00:04 | 3.46 |
| H1 | JUNCTION | 3.65 | 3.69 | 5676.60 | 0 00:04 | 3.69 |
| F7 | JUNCTION | 3.05 | 3.79 | 5676.92 | 0 00:03 | 3.09 |
| D12 | JUNCTION | 3.27 | 3.73 | 5677.18 | 0 00:02 | 3.31 |
| D11 | JUNCTION | 3.05 | 3.10 | 5677.27 | 0 00:04 | 3.10 |
| D10 | JUNCTION | 2.94 | 2.99 | 5677.57 | 0 00:04 | 2.99 |
| D9 | JUNCTION | 2.62 | 2.67 | 5677.99 | 0 00:04 | 2.67 |
| D8 | JUNCTION | 2.04 | 2.08 | 5678.36 | 0 00:04 | 2.08 |
| D7 | JUNCTION | 1.90 | 1.93 | 5679.02 | 0 00:04 | 1.93 |
| D6 | JUNCTION | 1.88 | 1.91 | 5679.87 | 0 00:04 | 1.91 |
| D5 | JUNCTION | 1.76 | 1.79 | 5682.23 | 0 00:04 | 1.79 |
| D4 | JUNCTION | 1.96 | 2.01 | 5683.84 | 0 00:03 | 1.98 |
| D2 | JUNCTION | 1.75 | 1.86 | 5685.11 | 0 00:03 | 1.76 |
| D1 | JUNCTION | 0.95 | 1.12 | 5685.45 | 0 00:00 | 0.95 |
| C3 | JUNCTION | 1.38 | 1.50 | 5685.94 | 0 00:03 | 1.40 |
| C2 | JUNCTION | 1.54 | 1.61 | 5686.70 | 0 00:02 | 1.55 |
| B4 | JUNCTION | 1.41 | 1.49 | 5687.40 | 0 00:02 | 1.42 |
| B3 | JUNCTION | 1.46 | 1.52 | 5688.07 | 0 00:02 | 1.47 |
| B2 | JUNCTION | 1.44 | 1.49 | 5689.32 | 0 00:02 | 1.44 |
| B1 | JUNCTION | 1.17 | 1.50 | 5689.88 | 0 00:00 | 1.17 |
| A4 | JUNCTION | 1.06 | 1.21 | 5690.21 | 0 00:01 | 1.07 |
| A3 | JUNCTION | 1.05 | 1.14 | 5690.99 | 0 00:01 | 1.05 |
| A2 | JUNCTION | 1.05 | 1.11 | 5691.81 | 0 00:00 | 1.05 |
| A1 | JUNCTION | 0.99 | 1.20 | 5692.24 | 0 00:00 | 0.99 |
| E1 | JUNCTION | 1.06 | 1.31 | 5687.02 | 0 00:00 | 1.06 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| E2 | JUNCTION | 1.31 | 1.59 | 5686.86 | 0 | 00:00 | 1.31 |
| E3 | JUNCTION | 1.17 | 1.54 | 5686.35 | 0 | 00:00 | 1.17 |
| E4 | JUNCTION | 1.16 | 1.21 | 5684.12 | 0 | 00:01 | 1.17 |
| E5 | JUNCTION | 1.11 | 1.20 | 5682.12 | 0 | 00:01 | 1.12 |
| E6 | JUNCTION | 1.59 | 1.68 | 5680.30 | 0 | 00:02 | 1.60 |
| E7 | JUNCTION | 1.55 | 1.64 | 5679.28 | 0 | 00:02 | 1.56 |
| F3 | JUNCTION | 1.58 | 1.69 | 5678.69 | 0 | 00:02 | 1.59 |
| F2 | JUNCTION | 1.10 | 1.11 | 5680.19 | 0 | 00:03 | 1.11 |
| F1 | JUNCTION | 0.59 | 0.59 | 5688.12 | 0 | 00:00 | 0.59 |
| F4 | JUNCTION | 1.62 | 1.80 | 5678.19 | 0 | 00:02 | 1.64 |
| F5 | JUNCTION | 2.31 | 2.34 | 5676.63 | 0 | 00:04 | 2.34 |
| F6 | JUNCTION | 2.76 | 3.19 | 5676.62 | 0 | 00:03 | 2.80 |
| G3 | JUNCTION | 2.57 | 2.60 | 5676.70 | 0 | 00:04 | 2.60 |
| G4 | JUNCTION | 2.97 | 3.00 | 5676.66 | 0 | 00:04 | 3.00 |
| G2 | JUNCTION | 3.05 | 3.08 | 5676.68 | 0 | 00:04 | 3.08 |
| G1 | JUNCTION | 2.45 | 2.47 | 5676.70 | 0 | 00:04 | 2.47 |
| C1 | JUNCTION | 0.74 | 0.77 | 5686.95 | 0 | 00:02 | 0.75 |
| J2 | JUNCTION | 0.68 | 0.99 | 5673.76 | 0 | 00:00 | 0.68 |
| J1 | JUNCTION | 0.98 | 1.12 | 5673.61 | 0 | 00:00 | 0.98 |
| PA1 | JUNCTION | 1.81 | 2.00 | 5679.81 | 0 | 00:00 | 1.81 |
| PA2 | JUNCTION | 2.00 | 2.00 | 5679.36 | 0 | 00:00 | 2.00 |
| HighPtN | JUNCTION | 0.00 | 0.00 | 5677.88 | 0 | 00:00 | 0.00 |
| HighPtS | JUNCTION | 0.00 | 0.00 | 5677.88 | 0 | 00:00 | 0.00 |
| 68 | JUNCTION | 0.00 | 0.00 | 5698.00 | 0 | 00:00 | 0.00 |
| 70 | JUNCTION | 0.00 | 0.00 | 5698.00 | 0 | 00:00 | 0.00 |
| 73 | JUNCTION | 0.00 | 0.00 | 5690.25 | 0 | 00:00 | 0.00 |
| 76 | JUNCTION | 0.00 | 0.00 | 5682.75 | 0 | 00:00 | 0.00 |
| 87 | JUNCTION | 0.00 | 0.00 | 5682.00 | 0 | 00:00 | 0.00 |
| 80 | JUNCTION | 0.00 | 0.00 | 5680.75 | 0 | 00:00 | 0.00 |
| 72 | JUNCTION | 0.00 | 0.00 | 5692.00 | 0 | 00:00 | 0.00 |
| Forebay-H | OUTFALL | 2.43 | 2.45 | 5674.70 | 0 | 00:04 | 2.45 |
| Forebay-J | OUTFALL | 0.00 | 0.00 | 5671.61 | 0 | 00:00 | 0.00 |

**********

Node Inflow Summary

**********

| Node | Type | Maximum Lateral Inflow CFS | Maximum Total Inflow CFS | Time of Max Occurrence days hr:min | Lateral Inflow Volume 10^6 gal | Total Inflow Volume 10^6 gal | Flow Balance Error Percent |
|---|---|---|---|---|---|---|---|
| H2 | JUNCTION | 13.70 | 127.42 | 0 00:04 | 1.11 | 10.2 | 0.412 |
| H1 | JUNCTION | 0.00 | 76.59 | 0 00:02 | 0 | 6.11 | 0.114 |
| F7 | JUNCTION | 0.00 | 36.58 | 0 00:03 | 0 | 2.36 | 6.685 |
| D12 | JUNCTION | 0.00 | 38.08 | 0 00:04 | 0 | 3.03 | 0.354 |
| D11 | JUNCTION | 0.00 | 39.23 | 0 00:04 | 0 | 3.13 | 0.349 |
| D10 | JUNCTION | 0.00 | 39.78 | 0 00:04 | 0 | 3.17 | 1.521 |
| D9 | JUNCTION | 0.00 | 40.61 | 0 00:04 | 0 | 3.23 | 1.861 |
| D8 | JUNCTION | 0.00 | 41.18 | 0 00:04 | 0 | 3.29 | 1.791 |
| D7 | JUNCTION | 0.00 | 41.41 | 0 00:04 | 0 | 3.31 | 0.585 |
| D6 | JUNCTION | 0.00 | 41.76 | 0 00:04 | 0 | 3.34 | 0.948 |
| D5 | JUNCTION | 0.00 | 41.64 | 0 00:04 | 0 | 3.31 | -0.704 |
| D4 | JUNCTION | 9.90 | 41.98 | 0 00:03 | 0.8 | 3.23 | -2.632 |
| D2 | JUNCTION | 0.00 | 32.35 | 0 00:03 | 0 | 2.41 | -0.502 |
| D1 | JUNCTION | 8.10 | 8.10 | 0 00:00 | 0.654 | 0.654 | 0.033 |
| C3 | JUNCTION | 0.00 | 23.40 | 0 00:03 | 0 | 1.79 | 1.432 |
| C2 | JUNCTION | 0.00 | 23.14 | 0 00:02 | 0 | 1.79 | 0.216 |
| B4 | JUNCTION | 0.00 | 17.18 | 0 00:02 | 0 | 1.32 | 0.122 |
| B3 | JUNCTION | 0.00 | 16.99 | 0 00:02 | 0 | 1.32 | 0.140 |
| B2 | JUNCTION | 0.00 | 17.19 | 0 00:01 | 0 | 1.33 | 0.320 |
| B1 | JUNCTION | 9.60 | 9.60 | 0 00:00 | 0.776 | 0.776 | 0.048 |
| A4 | JUNCTION | 0.00 | 7.40 | 0 00:01 | 0 | 0.555 | 0.124 |
| A3 | JUNCTION | 0.00 | 7.24 | 0 00:01 | 0 | 0.556 | 0.229 |
| A2 | JUNCTION | 0.00 | 7.93 | 0 00:00 | 0 | 0.557 | 0.225 |
| A1 | JUNCTION | 6.90 | 6.90 | 0 00:00 | 0.557 | 0.557 | 0.060 |
| E1 | JUNCTION | 8.50 | 8.50 | 0 00:00 | 0.687 | 0.687 | 0.047 |
| E2 | JUNCTION | 6.10 | 15.87 | 0 00:00 | 0.493 | 1.18 | 0.052 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| E3 | JUNCTION | 0.00 | 17.10 | 0 | 00:00 | 0 | 1.18 | 0.104 | |
| E4 | JUNCTION | 0.00 | 18.22 | 0 | 00:00 | 0 | 1.18 | 0.359 | |
| E5 | JUNCTION | 0.00 | 15.10 | 0 | 00:01 | 0 | 1.17 | 0.124 | |
| E6 | JUNCTION | 11.60 | 27.23 | 0 | 00:01 | 0.937 | 2.11 | 0.189 | |
| E7 | JUNCTION | 0.00 | 27.69 | 0 | 00:02 | 0 | 2.1 | 0.094 | |
| F3 | JUNCTION | 0.00 | 34.84 | 0 | 00:02 | 0 | 2.66 | 0.176 | |
| F2 | JUNCTION | 0.00 | 6.95 | 0 | 00:00 | 0 | 0.556 | 0.436 | |
| F1 | JUNCTION | 6.90 | 6.90 | 0 | 00:00 | 0.557 | 0.557 | 0.175 | |
| F4 | JUNCTION | 0.00 | 35.19 | 0 | 00:02 | 0 | 2.65 | -0.982 | |
| F5 | JUNCTION | 0.00 | 36.96 | 0 | 00:02 | 0 | 2.68 | 2.849 | |
| F6 | JUNCTION | 0.00 | 37.52 | 0 | 00:03 | 0 | 2.61 | 10.857 | |
| G3 | JUNCTION | 16.40 | 16.43 | 0 | 00:02 | 1.32 | 1.32 | 1.093 | |
| G4 | JUNCTION | 7.10 | 24.85 | 0 | 00:00 | 0.574 | 1.5 | -0.214 | |
| G2 | JUNCTION | 13.60 | 32.51 | 0 | 00:00 | 1.1 | 1.6 | 0.452 | |
| G1 | JUNCTION | 16.30 | 16.30 | 0 | 00:00 | 1.32 | 1.32 | 43.758 | |
| C1 | JUNCTION | 5.80 | 5.80 | 0 | 00:00 | 0.469 | 0.469 | 0.003 | |
| J2 | JUNCTION | 3.70 | 3.70 | 0 | 00:00 | 0.299 | 0.299 | 1.142 | |
| J1 | JUNCTION | 8.70 | 13.82 | 0 | 00:00 | 0.703 | 0.998 | -0.191 | |
| PA1 | JUNCTION | 102.00 | 102.00 | 0 | 00:00 | 8.24 | 8.24 | 0.192 | |
| PA2 | JUNCTION | 0.00 | 107.99 | 0 | 00:00 | 0 | 8.22 | 0.000 | |
| HighPtN | JUNCTION | 0.00 | 0.00 | 0 | 00:00 | 0 | 0 | 0.000 | gal |
| HighPtS | JUNCTION | 0.00 | 0.00 | 0 | 00:00 | 0 | 0 | 0.000 | gal |
| 68 | JUNCTION | 0.00 | 0.00 | 0 | 00:00 | 0 | 0 | 0.000 | gal |
| 70 | JUNCTION | 0.00 | 0.00 | 0 | 00:00 | 0 | 0 | 0.000 | gal |
| 73 | JUNCTION | 0.00 | 0.00 | 0 | 00:00 | 0 | 0 | 0.000 | gal |
| 76 | JUNCTION | 0.00 | 0.00 | 0 | 00:00 | 0 | 0 | 0.000 | gal |
| 87 | JUNCTION | 0.00 | 0.00 | 0 | 00:00 | 0 | 0 | 0.000 | gal |
| 80 | JUNCTION | 0.00 | 0.00 | 0 | 00:00 | 0 | 0 | 0.000 | gal |
| 72 | JUNCTION | 0.00 | 0.00 | 0 | 00:00 | 0 | 0 | 0.000 | gal |
| Forebay-H | OUTFALL | 0.00 | 126.96 | 0 | 00:04 | 0 | 10.2 | 0.000 | |
| Forebay-J | OUTFALL | 0.00 | 13.59 | 0 | 00:01 | 0 | 1 | 0.000 | |

**********

Node Surcharge Summary

**********

Surcharging occurs when water rises above the top of the highest conduit.

| Node | Type | Hours Surcharged | Max. Height Above Crown Feet | Min. Depth Below Rim Feet |
|---|---|---|---|---|
| H1 | JUNCTION | 2.95 | 0.522 | 1.551 |
| F7 | JUNCTION | 0.01 | 0.694 | 0.466 |
| D12 | JUNCTION | 2.94 | 0.628 | 0.412 |
| D11 | JUNCTION | 2.93 | 0.000 | 0.000 |
| B1 | JUNCTION | 0.01 | 0.000 | 0.000 |
| F6 | JUNCTION | 0.01 | 0.088 | 1.202 |
| PA1 | JUNCTION | 0.01 | 0.000 | 0.000 |
| PA2 | JUNCTION | 3.00 | 0.000 | 0.000 |

**********

Node Flooding Summary

**********

Flooding refers to all water that overflows a node, whether it ponds or not.

| Node | Hours Flooded | Maximum Rate CFS | Time of Max Occurrence days hr:min | Total Flood Volume 10^6 gal | Maximum Ponded Depth Feet |
|---|---|---|---|---|---|
| D11 | 2.93 | 1.14 | 0 00:04 | 0.090 | 0.000 |
| B1 | 0.01 | 0.28 | 0 00:00 | 0.000 | 0.000 |
| G1 | 2.95 | 13.75 | 0 00:03 | 0.420 | 0.470 |
| PA1 | 0.01 | 87.31 | 0 00:00 | 0.007 | 0.000 |
| PA2 | 3.00 | 107.99 | 0 00:00 | 8.217 | 0.000 |

(PA*n* = Poa Annua Box Culvert)

**********

Outfall Loading Summary

**********

| Outfall Node | Flow Freq Pcnt | Avg Flow CFS | Max Flow CFS | Total Volume 10^6 gal |
|---|---|---|---|---|
| Forebay-H | 100.00 | 125.16 | 126.96 | 10.158 |
| Forebay-J | 100.00 | 12.38 | 13.59 | 1.000 |
| System | 100.00 | 137.53 | 139.37 | 11.158 |

**********

Link Flow Summary

**********

| Link | Type | Maximum \|Flow\| CFS | Time of Max Occurrence days | hr:min | Maximum \|Veloc\| ft/sec | Max/ Full Flow | Max/ Full Depth |
|---|---|---|---|---|---|---|---|
| A1-A2 | CONDUIT | 7.93 | 0 | 00:00 | 5.84 | 0.89 | 0.75 |
| A2-A3 | CONDUIT | 7.24 | 0 | 00:01 | 5.41 | 0.89 | 0.71 |
| A3-A4 | CONDUIT | 7.40 | 0 | 00:01 | 5.32 | 0.91 | 0.74 |
| A4-B2 | CONDUIT | 7.69 | 0 | 00:01 | 5.15 | 0.95 | 0.79 |
| B1-B2 | CONDUIT | 11.11 | 0 | 00:00 | 7.07 | 1.05 | 0.90 |
| B2-B3 | CONDUIT | 16.99 | 0 | 00:02 | 6.83 | 0.90 | 0.74 |
| B3-B4 | CONDUIT | 17.18 | 0 | 00:02 | 6.80 | 0.93 | 0.75 |
| B4-C2 | CONDUIT | 17.33 | 0 | 00:02 | 6.98 | 0.90 | 0.74 |
| C1-C2 | CONDUIT | 5.87 | 0 | 00:00 | 8.16 | 0.39 | 0.62 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| C2-C3 | CONDUIT | 23.40 | 0 | 00:03 | 7.09 | 0.74 | 0.64 |
| C3-D2 | CONDUIT | 24.25 | 0 | 00:03 | 7.41 | 0.59 | 0.64 |
| D10-D11 | CONDUIT | 39.23 | 0 | 00:04 | 5.55 | 0.93 | 1.00 |
| D11-D12 | CONDUIT | 38.08 | 0 | 00:04 | 5.39 | 0.90 | 1.00 |
| D12-H1 | CONDUIT | 38.07 | 0 | 00:04 | 5.82 | 0.69 | 1.00 |
| D1-D2 | CONDUIT | 10.51 | 0 | 00:00 | 9.76 | 0.71 | 0.77 |
| D2-D4 | CONDUIT | 32.08 | 0 | 00:03 | 7.57 | 0.78 | 0.67 |
| D4-D5 | CONDUIT | 41.64 | 0 | 00:04 | 9.01 | 0.88 | 0.73 |
| D5-D6 | CONDUIT | 41.76 | 0 | 00:04 | 10.15 | 0.75 | 0.65 |
| D6-D7 | CONDUIT | 41.41 | 0 | 00:04 | 9.43 | 0.82 | 0.69 |
| D7-D8 | CONDUIT | 41.18 | 0 | 00:04 | 9.07 | 0.77 | 0.73 |
| D8-D9 | CONDUIT | 40.61 | 0 | 00:04 | 8.49 | 0.77 | 0.84 |
| D9-D10 | CONDUIT | 39.78 | 0 | 00:04 | 6.96 | 0.84 | 0.99 |
| E1-E2 | CONDUIT | 9.77 | 0 | 00:00 | 5.48 | 0.65 | 0.74 |
| E2-E3 | CONDUIT | 17.10 | 0 | 00:00 | 7.04 | 0.90 | 0.75 |
| E3-E4 | CONDUIT | 18.22 | 0 | 00:00 | 10.82 | 0.80 | 0.59 |
| E4-E5 | CONDUIT | 15.10 | 0 | 00:01 | 7.72 | 0.67 | 0.60 |
| E5-E6 | CONDUIT | 15.63 | 0 | 00:01 | 8.15 | 0.64 | 0.59 |
| E6-E7 | CONDUIT | 27.69 | 0 | 00:02 | 8.04 | 0.78 | 0.67 |
| E7-F3 | CONDUIT | 27.96 | 0 | 00:02 | 8.29 | 0.76 | 0.65 |
| F1-F2 | CONDUIT | 6.95 | 0 | 00:00 | 10.69 | 0.33 | 0.40 |
| F2-F3 | CONDUIT | 6.91 | 0 | 00:03 | 4.99 | 0.89 | 0.76 |
| F3-F4 | CONDUIT | 35.19 | 0 | 00:02 | 8.78 | 0.59 | 0.57 |
| F4-F5 | CONDUIT | 36.96 | 0 | 00:02 | 7.85 | 0.62 | 0.65 |
| F5-F6 | CONDUIT | 37.52 | 0 | 00:03 | 6.17 | 0.89 | 0.86 |
| F6-F7 | CONDUIT | 36.58 | 0 | 00:03 | 5.48 | 1.06 | 1.00 |
| F7-H2 | CONDUIT | 34.89 | 0 | 00:03 | 4.94 | 0.74 | 1.00 |
| G1-G2 | CONDUIT | 18.91 | 0 | 00:00 | 7.10 | 1.22 | 1.00 |
| G2-H1 | CONDUIT | 35.33 | 0 | 00:00 | 9.09 | 0.89 | 1.00 |
| G3-G4 | CONDUIT | 17.75 | 0 | 00:00 | 6.60 | 0.83 | 1.00 |
| G4-H1 | CONDUIT | 26.76 | 0 | 00:00 | 8.95 | 1.26 | 1.00 |
| H1-H2 | CONDUIT | 76.51 | 0 | 00:03 | 9.71 | 1.40 | 1.00 |
| H2-H3 | CONDUIT | 126.96 | 0 | 00:04 | 10.47 | 1.02 | 0.89 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| J1-EDB | CONDUIT | 13.59 | 0 | 00:01 | 5.76 | 0.82 | 0.66 |
| J2-J1 | CONDUIT | 5.12 | 0 | 00:00 | 3.12 | 0.29 | 0.62 |
| PA1-PA2 | CONDUIT | 107.99 | 0 | 00:00 | 9.46 | 0.74 | 1.00 |
| 68-69 | CHANNEL | 0.00 | 0 | 00:00 | 0.00 | 0.00 | 0.00 |
| 70-71 | CHANNEL | 0.00 | 0 | 00:00 | 0.00 | 0.00 | 0.00 |
| 80-G3 | CHANNEL | 0.00 | 0 | 00:00 | 0.00 | 0.00 | 0.00 |
| H2-HighPtS | WEIR | 0.00 | 0 | 00:00 | | | 0.00 |
| 87-G2 | WEIR | 0.00 | 0 | 00:00 | | | 0.00 |
| HighPtN-J2 | WEIR | 0.00 | 0 | 00:00 | | | 0.00 |
| D4-G4 | WEIR | 0.00 | 0 | 00:00 | | | 0.00 |
| H2-G1-Overtopping | WEIR | 5.16 | 0 | 00:04 | | | 0.18 |
| H2-G3-Overtopping | WEIR | 5.06 | 0 | 00:04 | | | 0.18 |
| 73-E6 | WEIR | 0.00 | 0 | 00:00 | | | 0.00 |
| 76-H2 | WEIR | 0.00 | 0 | 00:00 | | | 0.00 |
| HighPtS-J1 | WEIR | 0.00 | 0 | 00:00 | | | 0.00 |
| 72-D4 | WEIR | 0.00 | 0 | 00:00 | | | 0.00 |
| G4-G3-Gutter | WEIR | 0.82 | 0 | 00:04 | | | 0.06 |
| G2-G1-Gutter | WEIR | 2.10 | 0 | 00:04 | | | 0.17 |
| HighPtN-G1 | WEIR | 0.00 | 0 | 00:00 | | | 0.00 |

**********

Flow Classification Summary

**********

| | Adjusted | ---------- Fraction of Time in Flow Class ---------- | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | /Actual | | Up | Down | Sub | Sup | Up | Down | Norm | Inlet |
| Conduit | Length | Dry | Dry | Dry | Crit | Crit | Crit | Crit | Ltd | Ctrl |
| A1-A2 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 |
| A2-A3 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 |
| A3-A4 | 1.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.99 | 0.00 | 0.00 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| A4-B2 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| B1-B2 | 1.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.98 | 0.00 | 0.02 | 0.00 | 0.00 |
| B2-B3 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 |
| B3-B4 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 |
| B4-C2 | 1.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.99 | 0.00 | 0.00 |
| C1-C2 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.99 | 0.00 | 0.01 | 0.00 | 0.00 |
| C2-C3 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 |
| C3-D2 | 1.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.98 | 0.00 | 0.00 | 0.00 | 0.00 |
| D10-D11 | 1.00 | 0.00 | 0.00 | 0.00 | 0.99 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| D11-D12 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| D12-H1 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| D1-D2 | 1.00 | 0.00 | 0.00 | 0.00 | 0.98 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 |
| D2-D4 | 1.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.98 | 0.00 | 0.00 | 0.00 | 0.00 |
| D4-D5 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 |
| D5-D6 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.98 | 0.00 | 0.02 | 0.00 | 0.00 |
| D6-D7 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 |
| D7-D8 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| D8-D9 | 1.00 | 0.00 | 0.00 | 0.00 | 0.97 | 0.01 | 0.00 | 0.02 | 0.00 | 0.00 |
| D9-D10 | 1.00 | 0.00 | 0.00 | 0.00 | 0.99 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| E1-E2 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| E2-E3 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 |
| E3-E4 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| E4-E5 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 |
| E5-E6 | 1.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.98 | 0.01 | 0.00 |
| E6-E7 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 |
| E7-F3 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 |
| F1-F2 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.98 | 0.00 | 0.02 | 0.99 | 0.00 |
| F2-F3 | 1.00 | 0.00 | 0.00 | 0.00 | 0.99 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| F3-F4 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.99 | 0.00 | 0.00 |
| F4-F5 | 1.00 | 0.00 | 0.00 | 0.00 | 0.97 | 0.01 | 0.00 | 0.02 | 0.00 | 0.00 |
| F5-F6 | 1.00 | 0.00 | 0.00 | 0.00 | 0.99 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| F6-F7 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| F7-H2 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| G1-G2 | 1.00 | 0.00 | 0.00 | 0.00 | 0.98 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 |
| G2-H1 | 1.00 | 0.00 | 0.00 | 0.00 | 0.99 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 |
| G3-G4 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| G4-H1 | 1.00 | 0.00 | 0.00 | 0.00 | 0.98 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 |
| H1-H2 | 1.00 | 0.00 | 0.00 | 0.00 | 0.98 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 |
| H2-H3 | 1.00 | 0.00 | 0.00 | 0.00 | 0.98 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 |
| J1-EDB | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 |
| J2-J1 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PA1-PA2 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 68-69 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 70-71 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 80-G3 | 1.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

**********

Conduit Surcharge Summary

**********

| Conduit | Hours Full: Both Ends | Hours Full: Upstream | Hours Full: Dnstream | Hours Above Full Normal Flow | Hours Capacity Limited |
|---|---|---|---|---|---|
| B1-B2 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| D10-D11 | 0.01 | 0.01 | 2.93 | 0.01 | 0.01 |
| **D11-D12** | **2.94** | **2.94** | **2.94** | **0.01** | **0.01** |
| **D12-H1** | **2.95** | **2.95** | **2.95** | 0.01 | 0.01 |
| D9-D10 | 0.01 | 0.01 | 2.94 | 0.01 | 0.01 |
| F5-F6 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| F6-F7 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| F7-H2 | 2.94 | 2.94 | 2.95 | 0.01 | 0.01 |
| G1-G2 | 2.95 | 2.95 | 2.95 | 0.04 | 0.01 |
| G2-H1 | 2.95 | 2.95 | 2.95 | 0.01 | 0.01 |
| G3-G4 | 2.95 | 2.95 | 2.95 | 0.01 | 0.01 |
| G4-H1 | 2.95 | 2.95 | 2.95 | 0.06 | 0.01 |
| H1-H2 | 2.95 | 2.95 | 2.95 | 2.96 | 2.95 |
| H2-H3 | 0.01 | 2.95 | 0.01 | 2.93 | 0.01 |
| PA1-PA2 | 0.01 | 0.01 | 3.00 | 0.01 | 0.01 |

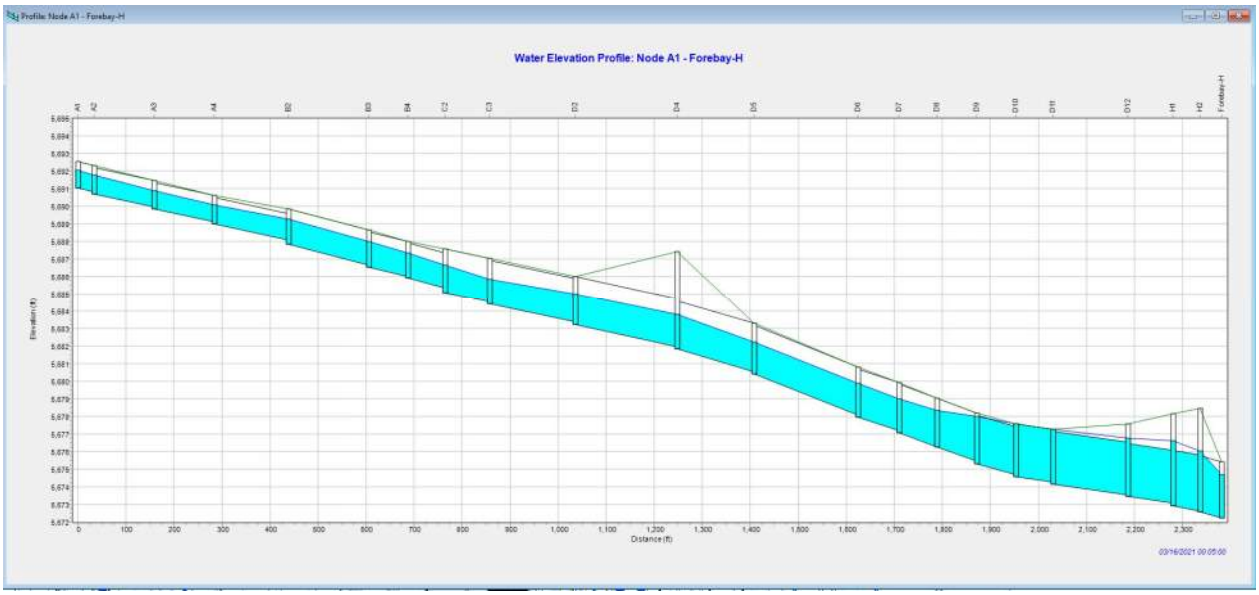
Analysis begun on: Thu Mar 30 14:37:18 2023

Analysis ended on: Thu Mar 30 14:37:18 2023

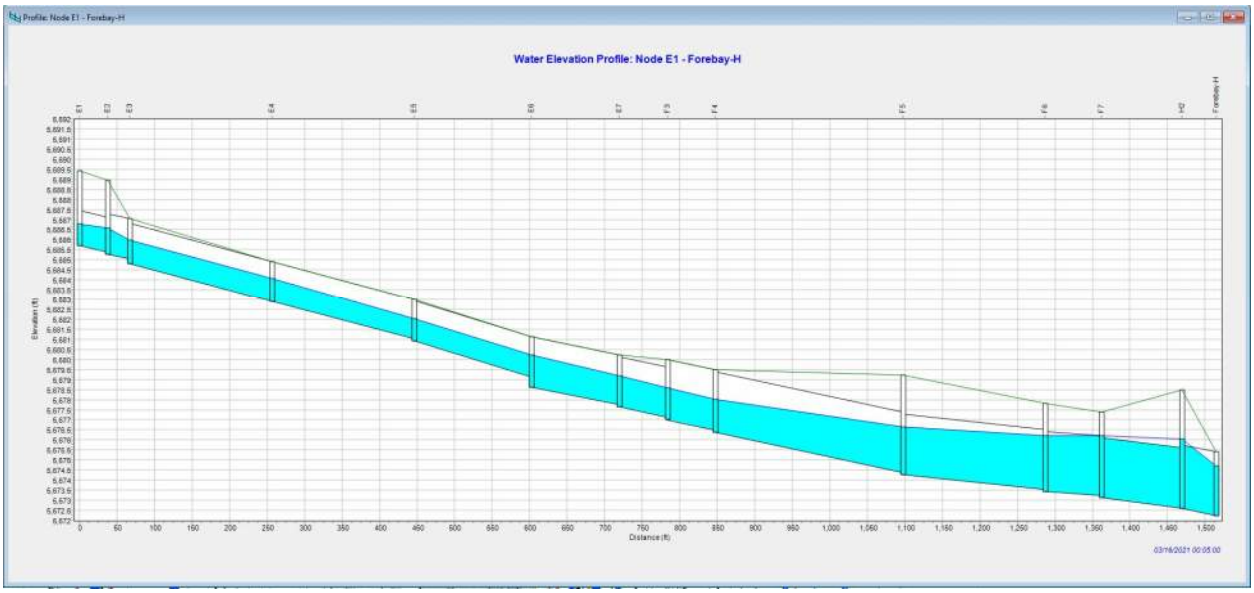
Total elapsed time: < 1 sec

Note: Node Flooding Resolves at the inlet complex G1 through G4 along with Inlets J1 and J2 to intercept 100% of the Major Event at a depth 0.47’.

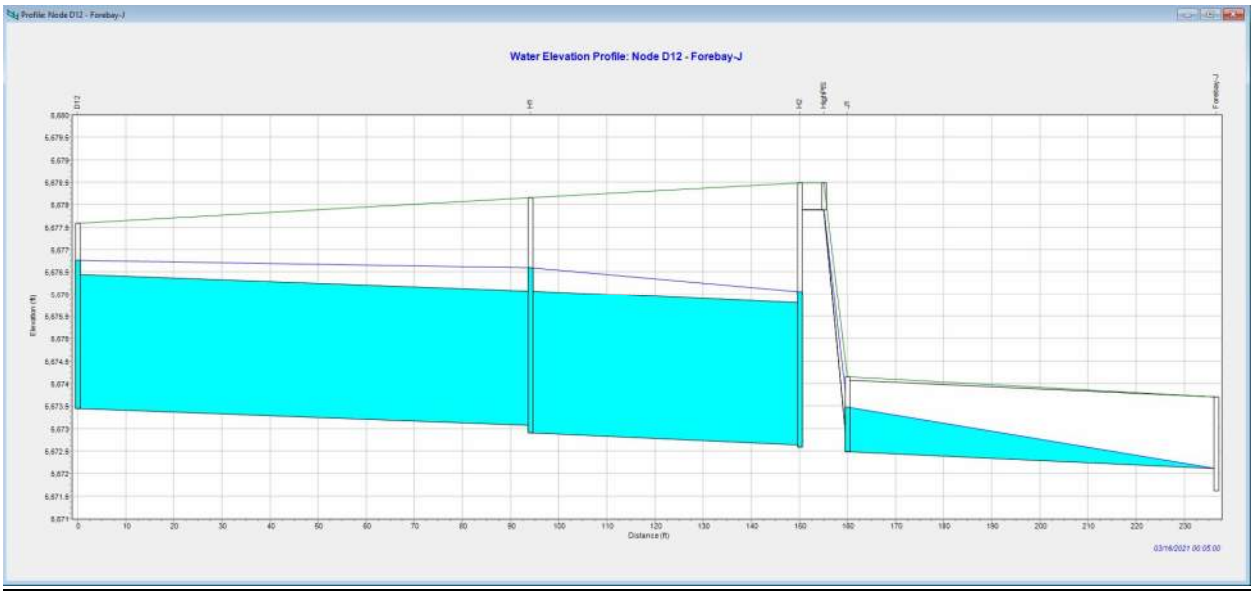
Inlet A-1 to Forebay H Major Event Profile (Golden Buffs Drive Trunkline))



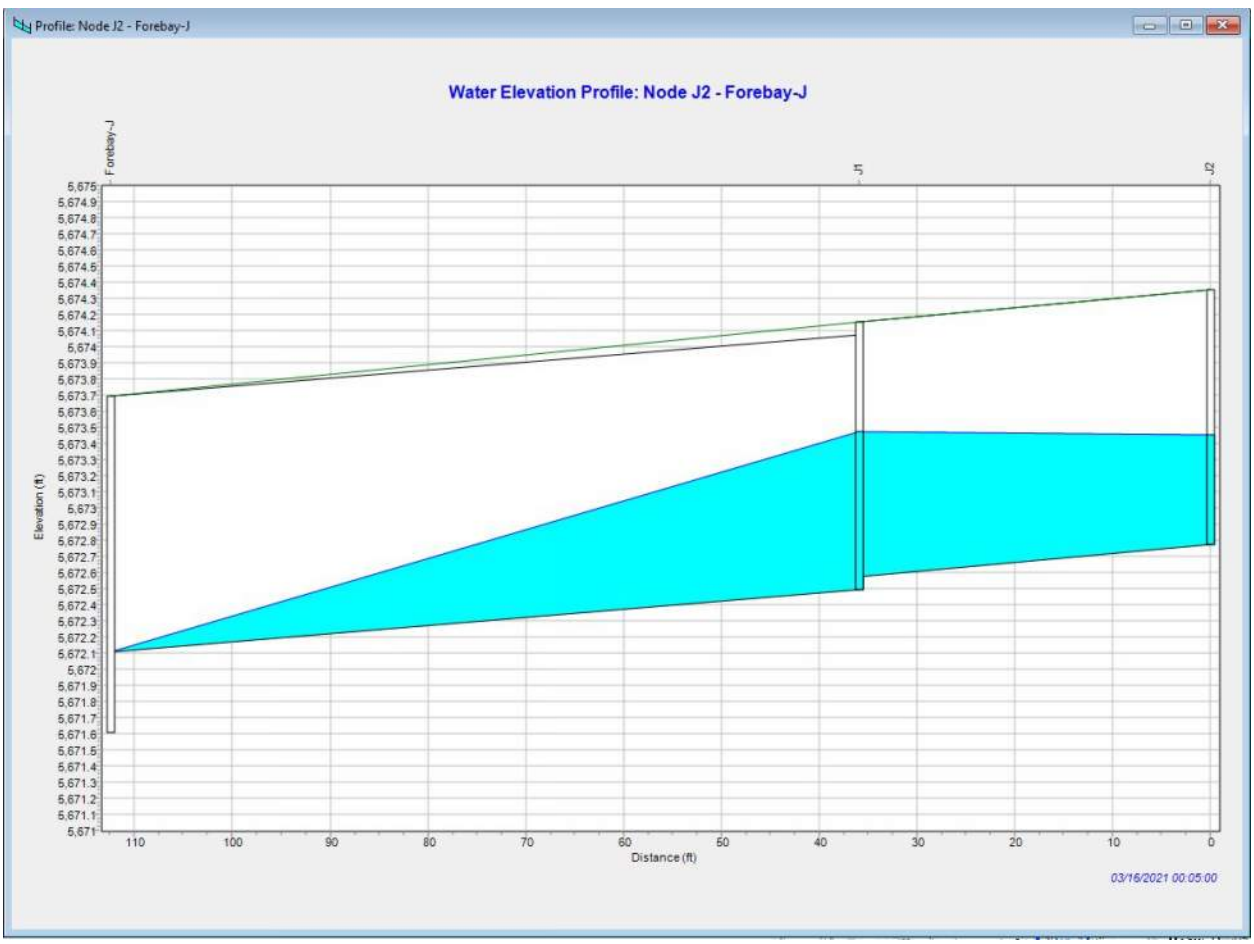

Inlet E-1 to Forebay H Major Event Profile (Pennycress Drive Trunkline)



Overtopping Characteristics at Inlets G1-G4 (Near Detention Basin ‘D’)




Inlets J1-J2 Major Event to Forebay J



Version 4.05 Released March 2017

# INLET MANAGEMENT

Worksheet Protected

| INLET NAME | B-1 | C-1 | D-1 | D-4 |
|---|---|---|---|---|
| Site Type (Urban or Rural) | URBAN | URBAN | URBAN | URBAN |
| Inlet Application (Street or Area) | STREET | STREET | STREET | STREET |
| Hydraulic Condition | On Grade | On Grade | On Grade | On Grade |
| Inlet Type | CDOT Type R Curb Opening | CDOT Type R Curb Opening | CDOT Type R Curb Opening | CDOT Type R Curb Opening |

## USER-DEFINED INPUT

**User-Defined Design Flows**

| | | | | |
|---|---|---|---|---|
| Minor $Q_{Known}$ (cfs) | 2.5 | 2.4 | 4.4 | 3.8 |
| Major $Q_{Known}$ (cfs) | 7.3 | 6.9 | 12.7 | 11.1 |

**Bypass (Carry-Over) Flow from Upstream**

| | | | | |
|---|---|---|---|---|
| Receive Bypass Flow from: | User-Defined | No Bypass Flow Received | User-Defined | No Bypass Flow Received |
| Minor Bypass Flow Received, $Q_b$ (cfs) | 0.0 | 0.0 | 0.0 | 0.0 |
| Major Bypass Flow Received, $Q_b$ (cfs) | 1.7 | 0.0 | 1.1 | 0.0 |

**Watershed Characteristics**

| | | | | |
|---|---|---|---|---|
| Subcatchment Area (acres) | | | | |
| Percent Impervious | | | | |
| NRCS Soil Type | C | C | C | C |

**Watershed Profile**

| | | | | |
|---|---|---|---|---|
| Overland Slope (ft/ft) | | | | |
| Overland Length (ft) | | | | |
| Channel Slope (ft/ft) | | | | |
| Channel Length (ft) | | | | |

**Minor Storm Rainfall Input**

| | | | | |
|---|---|---|---|---|
| Design Storm Return Period, $T_r$ (years) | | | | |
| One-Hour Precipitation, $P_1$ (inches) | | | | |
| $C_1$ | | | | |
| $C_2$ | | | | |
| $C_3$ | | | | |
| User-defined C | | | | |
| User-defined 5-yr $C_5$ | | | | |
| User-defined $T_c$ | | | | |

**Major Storm Rainfall Input**

| | | | | |
|---|---|---|---|---|
| Design Storm Return Period, $T_r$ (years) | | | | |
| One-Hour Precipitation, $P_1$ (inches) | | | | |
| $C_1$ | | | | |
| $C_2$ | | | | |
| $C_3$ | | | | |
| User-defined C | | | | |
| User-defined 5-yr $C_5$ | | | | |
| User-defined $T_c$ | | | | |

## CALCULATED OUTPUT

| | | | | |
|---|---|---|---|---|
| **Minor Total Design Peak Flow, Q (cfs)** | **2.5** | **2.4** | **4.4** | **3.8** |
| **Major Total Design Peak Flow, Q (cfs)** | **9.0** | **6.9** | **13.8** | **11.1** |
| Minor Flow Bypassed Downstream, $Q_b$ (cfs) | 0.0 | 0.0 | 0.1 | 0.0 |
| Major Flow Bypassed Downstream, $Q_b$ (cfs) | 2.3 | 1.1 | 5.4 | 1.2 |

Version 4.05 Released March 2017

# INLET MANAGEMENT

Worksheet Protected

| INLET NAME | G-1 | G-2 | E-1 | E-2 |
|---|---|---|---|---|
| Site Type (Urban or Rural) | URBAN | URBAN | URBAN | URBAN |
| Inlet Application (Street or Area) | STREET | STREET | STREET | STREET |
| Hydraulic Condition | In Sump | On Grade | On Grade | On Grade |
| Inlet Type | CDOT Type R Curb Opening | CDOT Type R Curb Opening | CDOT Type R Curb Opening | CDOT Type R Curb Opening |

## USER-DEFINED INPUT

**User-Defined Design Flows**

| | | | | |
|---|---|---|---|---|
| Minor $Q_{Known}$ (cfs) | 0.3 | 6.2 | 3.4 | 2.8 |
| Major $Q_{Known}$ (cfs) | 0.7 | 14.5 | 9.9 | 8.1 |

**Bypass (Carry-Over) Flow from Upstream**

| | | | | |
|---|---|---|---|---|
| Receive Bypass Flow from: | No Bypass Flow Received | D-1 | No Bypass Flow Received | No Bypass Flow Received |
| Minor Bypass Flow Received, $Q_b$ (cfs) | 0.0 | 0.1 | 0.0 | 0.0 |
| Major Bypass Flow Received, $Q_b$ (cfs) | 0.0 | 5.4 | 0.0 | 0.0 |

**Watershed Characteristics**

| | | | | |
|---|---|---|---|---|
| Subcatchment Area (acres) | | | | |
| Percent Impervious | | | | |
| NRCS Soil Type | C | C | C | C |

**Watershed Profile**

| | | | | |
|---|---|---|---|---|
| Overland Slope (ft/ft) | | | | |
| Overland Length (ft) | | | | |
| Channel Slope (ft/ft) | | | | |
| Channel Length (ft) | | | | |

**Minor Storm Rainfall Input**

| | | | | |
|---|---|---|---|---|
| Design Storm Return Period, $T_r$ (years) | | | | |
| One-Hour Precipitation, $P_1$ (inches) | | | | |
| $C_1$ | | | | |
| $C_2$ | | | | |
| $C_3$ | | | | |
| User-defined C | | | | |
| User-defined 5-yr $C_5$ | | | | |
| User-defined $T_c$ | | | | |

**Major Storm Rainfall Input**

| | | | | |
|---|---|---|---|---|
| Design Storm Return Period, $T_r$ (years) | | | | |
| One-Hour Precipitation, $P_1$ (inches) | | | | |
| $C_1$ | | | | |
| $C_2$ | | | | |
| $C_3$ | | | | |
| User-defined C | | | | |
| User-defined 5-yr $C_5$ | | | | |
| User-defined $T_c$ | | | | |

## CALCULATED OUTPUT

| | | | | |
|---|---|---|---|---|
| **Minor Total Design Peak Flow, Q (cfs)** | **0.3** | **6.3** | **3.4** | **2.8** |
| **Major Total Design Peak Flow, Q (cfs)** | **0.7** | **19.9** | **9.9** | **8.1** |
| Minor Flow Bypassed Downstream, $Q_b$ (cfs) | N/A | 0.0 | 0.0 | 0.0 |
| Major Flow Bypassed Downstream, $Q_b$ (cfs) | N/A | 6.1 | 2.8 | 1.7 |

Version 4.05 Released March 2017

# INLET MANAGEMENT

Worksheet Protected

| INLET NAME | E-6 | H-2 | J-1 | J-2 |
|---|---|---|---|---|
| Site Type (Urban or Rural) | URBAN | URBAN | URBAN | URBAN |
| Inlet Application (Street or Area) | STREET | STREET | STREET | STREET |
| Hydraulic Condition | On Grade | In Sump | In Sump | In Sump |
| Inlet Type | CDOT Type R Curb Opening | CDOT Type R Curb Opening | CDOT Type R Curb Opening | CDOT Type R Curb Opening |

## USER-DEFINED INPUT

**User-Defined Design Flows**

| | | | | |
|---|---|---|---|---|
| Minor $Q_{Known}$ (cfs) | 3.7 | 15.1 | 1.0 | 0.8 |
| Major $Q_{Known}$ (cfs) | 10.8 | 43.8 | 2.6 | 1.5 |

**Bypass (Carry-Over) Flow from Upstream**

| | | | | |
|---|---|---|---|---|
| Receive Bypass Flow from: | User-Defined | User-Defined | User-Defined | User-Defined |
| Minor Bypass Flow Received, $Q_b$ (cfs) | 0.2 | 0.0 | | |
| Major Bypass Flow Received, $Q_b$ (cfs) | 3.5 | 2.7 | 8.2 | 9.5 |

**Watershed Characteristics**

| | | | | |
|---|---|---|---|---|
| Subcatchment Area (acres) | | | | |
| Percent Impervious | | | | |
| NRCS Soil Type | C | C | C | C |

**Watershed Profile**

| | | | | |
|---|---|---|---|---|
| Overland Slope (ft/ft) | | | | |
| Overland Length (ft) | | | | |
| Channel Slope (ft/ft) | | | | |
| Channel Length (ft) | | | | |

**Minor Storm Rainfall Input**

| | | | | |
|---|---|---|---|---|
| Design Storm Return Period, $T_r$ (years) | | | | |
| One-Hour Precipitation, $P_1$ (inches) | | | | |
| $C_1$ | | | | |
| $C_2$ | | | | |
| $C_3$ | | | | |
| User-defined C | | | | |
| User-defined 5-yr $C_5$ | | | | |
| User-defined $T_c$ | | | | |

**Major Storm Rainfall Input**

| | | | | |
|---|---|---|---|---|
| Design Storm Return Period, $T_r$ (years) | | | | |
| One-Hour Precipitation, $P_1$ (inches) | | | | |
| $C_1$ | | | | |
| $C_2$ | | | | |
| $C_3$ | | | | |
| User-defined C | | | | |
| User-defined 5-yr $C_5$ | | | | |
| User-defined $T_c$ | | | | |

## CALCULATED OUTPUT

| | | | | |
|---|---|---|---|---|
| **Minor Total Design Peak Flow, Q (cfs)** | **3.9** | **15.1** | **1.0** | **0.8** |
| **Major Total Design Peak Flow, Q (cfs)** | **14.3** | **46.5** | **10.8** | **11.0** |
| Minor Flow Bypassed Downstream, $Q_b$ (cfs) | 0.0 | N/A | N/A | N/A |
| Major Flow Bypassed Downstream, $Q_b$ (cfs) | 2.7 | N/A | N/A | N/A |

Version 4.05 Released March 2017

# INLET MANAGEMENT

Worksheet Protected

| INLET NAME | F-1 | A-1 | G-3 | G-4 ON GRADE |
|---|---|---|---|---|
| Site Type (Urban or Rural) | URBAN | URBAN | URBAN | URBAN |
| Inlet Application (Street or Area) | STREET | STREET | STREET | STREET |
| Hydraulic Condition | In Sump | On Grade | In Sump | On Grade |
| Inlet Type | CDOT Type R Curb Opening | CDOT Type R Curb Opening | CDOT Type R Curb Opening | CDOT Type R Curb Opening |

## USER-DEFINED INPUT

**User-Defined Design Flows**

| | | | | |
|---|---|---|---|---|
| Minor $Q_{Known}$ (cfs) | 2.4 | 3.0 | 5.7 | 3.8 |
| Major $Q_{Known}$ (cfs) | 6.9 | 8.6 | 16.4 | 12.2 |

**Bypass (Carry-Over) Flow from Upstream**

| | | | | |
|---|---|---|---|---|
| Receive Bypass Flow from: | No Bypass Flow Received | User-Defined | No Bypass Flow Received | User-Defined |
| Minor Bypass Flow Received, $Q_b$ (cfs) | 0.0 | 0.0 | | 0.0 |
| Major Bypass Flow Received, $Q_b$ (cfs) | 0.0 | 0.0 | | 1.2 |

**Watershed Characteristics**

| | | | | |
|---|---|---|---|---|
| Subcatchment Area (acres) | | | | |
| Percent Impervious | | | | |
| NRCS Soil Type | C | C | C | C |

**Watershed Profile**

| | | | | |
|---|---|---|---|---|
| Overland Slope (ft/ft) | | | | |
| Overland Length (ft) | | | | |
| Channel Slope (ft/ft) | | | | |
| Channel Length (ft) | | | | |

**Minor Storm Rainfall Input**

| | | | | |
|---|---|---|---|---|
| Design Storm Return Period, $T_r$ (years) | | | | |
| One-Hour Precipitation, $P_1$ (inches) | | | | |
| $C_1$ | | | | |
| $C_2$ | | | | |
| $C_3$ | | | | |
| User-defined C | | | | |
| User-defined 5-yr $C_5$ | | | | |
| User-defined $T_c$ | | | | |

**Major Storm Rainfall Input**

| | | | | |
|---|---|---|---|---|
| Design Storm Return Period, $T_r$ (years) | | | | |
| One-Hour Precipitation, $P_1$ (inches) | | | | |
| $C_1$ | | | | |
| $C_2$ | | | | |
| $C_3$ | | | | |
| User-defined C | | | | |
| User-defined 5-yr $C_5$ | | | | |
| User-defined $T_c$ | | | | |

## CALCULATED OUTPUT

| | | | | |
|---|---|---|---|---|
| **Minor Total Design Peak Flow, Q (cfs)** | **2.4** | **3.0** | **5.7** | **3.8** |
| **Major Total Design Peak Flow, Q (cfs)** | **6.9** | **8.6** | **16.4** | **13.4** |
| Minor Flow Bypassed Downstream, $Q_b$ (cfs) | N/A | 0.0 | N/A | 0.0 |
| Major Flow Bypassed Downstream, $Q_b$ (cfs) | N/A | 2.0 | N/A | 2.3 |

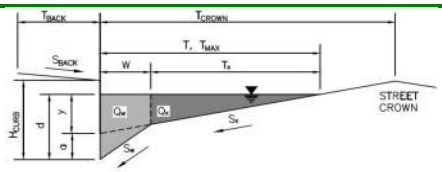
Version 4.05 Released March 2017

# ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

**Project:** **The Glen at Widefield Filing No 11**

**Inlet ID:** **B-1**




**Gutter Geometry (Enter data in the blue cells)**

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 8.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.017 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 17.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | **0.0057** | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | **17.0** | **17.0** | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 6.2 | inches |
| Allow Flow Depth at Street Crown (leave blank for no) | | ☐ | ☑ | check = yes |

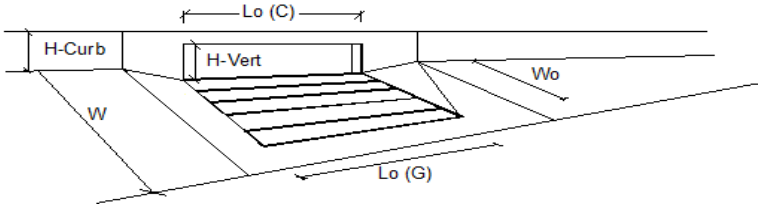
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Spread Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Depth Criterion** | **$Q_{allow}$ =** | **8.2** | **11.3** | **cfs** |

**Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

**Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

**Version 4.05 Released March 2017**




| **Design Information (Input)** | CDOT Type R Curb Opening | | MINOR | MAJOR | |
|---|---|---|---|---|---|
| Type of Inlet | | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a') | | $a_{LOCAL}$ = | 3.0 | 3.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | | No = | 2 | 2 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | | $L_o$ = | 5.00 | 5.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | | $W_o$ = | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | | $C_f$-G = | N/A | N/A | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | | $C_f$-C = | 0.10 | 0.10 | |

| **Street Hydraulics: OK - Q < Allowable Street Capacity'** | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Total Inlet Interception Capacity** | **Q =** | **2.5** | **6.7** | **cfs** |
| **Total Inlet Carry-Over Flow (flow bypassing inlet)** | **$Q_b$ =** | **0.0** | **2.3** | **cfs** |
| **Capture Percentage = $Q_a/Q_o$ =** | **C% =** | **100** | **75** | **%** |

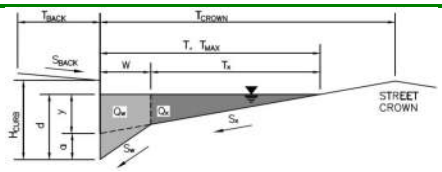
Version 4.05 Released March 2017

# ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

**Project:** **The Glen at Widefield Filing No 11**

**Inlet ID:** **C-1**




**Gutter Geometry (Enter data in the blue cells)**

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 8.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.017 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 17.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | **0.006** | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 17.0 | 17.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 6.2 | inches |
| Allow Flow Depth at Street Crown (leave blank for no) | | ☐ | ☑ | check = yes |

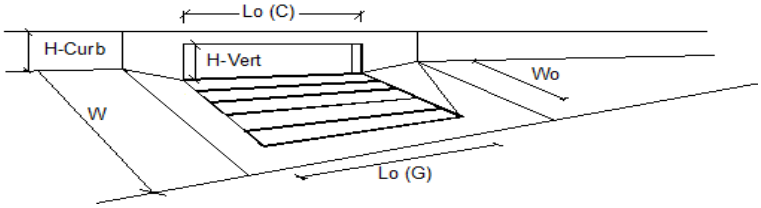
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Spread Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Depth Criterion** | **$Q_{allow}$ =** | **8.2** | **11.3** | **cfs** |

**Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

**Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

**Version 4.05 Released March 2017**




| **Design Information (Input)** | CDOT Type R Curb Opening | | MINOR | MAJOR | |
|---|---|---|---|---|---|
| Type of Inlet | | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a') | | $a_{LOCAL}$ = | 3.0 | 3.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | | No = | 2 | 2 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | | $L_o$ = | 5.00 | 5.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | | $W_o$ = | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | | $C_f$-G = | N/A | N/A | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | | $C_f$-C = | 0.10 | 0.10 | |

| **Street Hydraulics: OK - Q < Allowable Street Capacity'** | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Total Inlet Interception Capacity** | **Q =** | **2.4** | **5.8** | **cfs** |
| **Total Inlet Carry-Over Flow (flow bypassing inlet)** | **$Q_b$ =** | **0.0** | **1.1** | **cfs** |
| **Capture Percentage = $Q_a/Q_o$ =** | **C% =** | **100** | **84** | **%** |

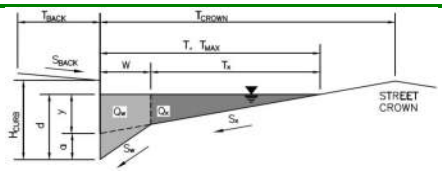
Version 4.05 Released March 2017

# ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

**Project:** **The Glen at Widefield Filing No 11**

**Inlet ID:** **D-1**




**Gutter Geometry (Enter data in the blue cells)**

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 8.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.017 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 17.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | **0.009** | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 17.0 | 17.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 6.2 | inches |
| Allow Flow Depth at Street Crown (leave blank for no) | | ☐ | ☑ | check = yes |

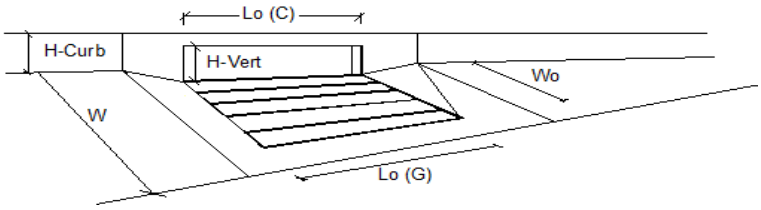
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Spread Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Depth Criterion** | **$Q_{allow}$ =** | **10.3** | **14.2** | **cfs** |

**Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

**Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

**Version 4.05 Released March 2017**




| **Design Information (Input)** | CDOT Type R Curb Opening | | MINOR | MAJOR | |
|---|---|---|---|---|---|
| Type of Inlet | | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a') | | $a_{LOCAL}$ = | 3.0 | 3.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | | No = | 2 | 2 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | | $L_o$ = | 5.00 | 5.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | | $W_o$ = | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | | $C_f$-G = | N/A | N/A | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | | $C_f$-C = | 0.10 | 0.10 | |

| **Street Hydraulics: OK - Q < Allowable Street Capacity'** | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Total Inlet Interception Capacity** | **Q =** | **4.3** | **8.4** | **cfs** |
| **Total Inlet Carry-Over Flow (flow bypassing inlet)** | **$Q_b$ =** | **0.1** | **5.4** | **cfs** |
| **Capture Percentage = $Q_a/Q_o$ =** | **C% =** | **97** | **61** | **%** |

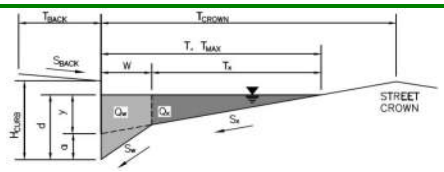
Version 4.05 Released March 2017

# ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

**Project:** **The Glen at Widefield Filing No 11**

**Inlet ID:** **D-4**




**Gutter Geometry (Enter data in the blue cells)**

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 8.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.017 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 17.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.006 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 17.0 | 17.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 6.2 | inches |
| Allow Flow Depth at Street Crown (leave blank for no) | | ☐ | ☑ | check = yes |

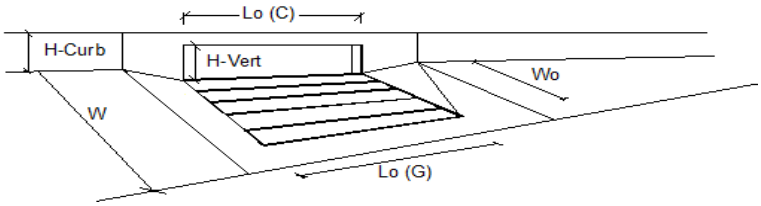
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Spread Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Depth Criterion** | **$Q_{allow}$ =** | **8.2** | **11.3** | **cfs** |

**Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

**Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

**Version 4.05 Released March 2017**




| **Design Information (Input)** | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet (CDOT Type R Curb Opening) | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a') | $a_{LOCAL}$ = | 3.0 | 3.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | No = | 3 | 3 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | $L_o$ = | 5.00 | 5.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | $W_o$ = | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | $C_f$-G = | N/A | N/A | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | $C_f$-C = | 0.10 | 0.10 | |

| **Street Hydraulics: OK - Q < Allowable Street Capacity'** | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Total Inlet Interception Capacity** | **Q =** | **3.8** | **9.9** | **cfs** |
| **Total Inlet Carry-Over Flow (flow bypassing inlet)** | **$Q_b$ =** | **0.0** | **1.2** | **cfs** |
| **Capture Percentage = $Q_a/Q_o$ =** | **C% =** | **100** | **89** | **%** |

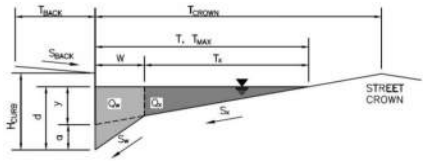
Version 4.05 Released March 2017

# ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

**Project:** **The Glen at Widefield Filing No 11**

**Inlet ID:** **G-1**




**Gutter Geometry (Enter data in the blue cells)**

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 8.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.017 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 17.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | **0.000** | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 17.0 | 17.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 6.2 | inches |
| Check boxes are not applicable in SUMP conditions | | ☐ | ☐ | |

**Maximum Capacity for 1/2 Street based On Allowable Spread**

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Water Depth without Gutter Depression (Eq. ST-2) | y = | 4.08 | 4.08 | inches |
| Vertical Depth between Gutter Lip and Gutter Flowline (usually 2") | $d_C$ = | 2.0 | 2.0 | inches |
| Gutter Depression ($d_C$ - (W * $S_x$ * 12)) | a = | 1.51 | 1.51 | inches |
| Water Depth at Gutter Flowline | d = | 5.59 | 5.59 | inches |
| Allowable Spread for Discharge outside the Gutter Section W (T - W) | $T_X$ = | 15.0 | 15.0 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) | $E_O$ = | 0.350 | 0.350 | |
| Discharge outside the Gutter Section W, carried in Section $T_X$ | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section W ($Q_T$ - $Q_X$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| **Maximum Flow Based On Allowable Spread** | **$Q_T$ =** | **SUMP** | **SUMP** | **cfs** |
| Flow Velocity within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |

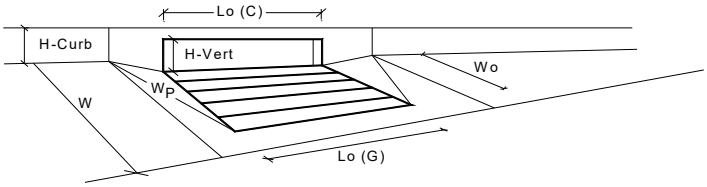
**Maximum Capacity for 1/2 Street based on Allowable Depth**

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Theoretical Water Spread | $T_{TH}$ = | 18.7 | 19.4 | ft |
| Theoretical Spread for Discharge outside the Gutter Section W (T - W) | $T_{X\,TH}$ = | 16.7 | 17.4 | ft |
| Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7) | $E_O$ = | 0.318 | 0.306 | |
| Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$ | $Q_{X\,TH}$ = | 0.0 | 0.0 | cfs |
| Actual Discharge outside the Gutter Section W, (limited by distance $T_{CROWN}$) | $Q_X$ = | 0.0 | 0.0 | cfs |
| Discharge within the Gutter Section W ($Q_d$ - $Q_X$) | $Q_W$ = | 0.0 | 0.0 | cfs |
| Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns) | $Q_{BACK}$ = | 0.0 | 0.0 | cfs |
| Total Discharge for Major & Minor Storm (Pre-Safety Factor) | Q = | 0.0 | 0.0 | cfs |
| Average Flow Velocity Within the Gutter Section | V = | 0.0 | 0.0 | fps |
| V*d Product: Flow Velocity Times Gutter Flowline Depth | V*d = | 0.0 | 0.0 | |
| Slope-Based Depth Safety Reduction Factor for Major & Minor (d $\geq$ 6") Storm | R = | SUMP | SUMP | |
| **Max Flow Based on Allowable Depth (Safety Factor Applied)** | **$Q_d$ =** | **SUMP** | **SUMP** | **cfs** |
| Resultant Flow Depth at Gutter Flowline (Safety Factor Applied) | d = | | | inches |
| Resultant Flow Depth at Street Crown (Safety Factor Applied) | $d_{CROWN}$ = | | | inches |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Depth Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Depth Criterion** | **$Q_{allow}$ =** | **SUMP** | **SUMP** | **cfs** |

# INLET IN A SUMP OR SAG LOCATION

**Version 4.05 Released March 2017**




| | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Design Information (Input)** CDOT Type R Curb Opening | | | | |
| Type of Inlet | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | $a_{local}$ = | 3.00 | 3.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | No = | 4 | 4 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 5.0 | 6.2 | inches |
| **Grate Information** | | MINOR | MAJOR | ☑ Override Depths |
| Length of a Unit Grate | $L_o$ (G) = | N/A | N/A | feet |
| Width of a Unit Grate | $W_o$ = | N/A | N/A | feet |
| Area Opening Ratio for a Grate (typical values 0.15-0.90) | $A_{ratio}$ = | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | $C_f$ (G) = | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | $C_w$ (G) = | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | $C_o$ (G) = | N/A | N/A | |
| **Curb Opening Information** | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | $L_o$ (C) = | 5.00 | 5.00 | feet |
| Height of Vertical Curb Opening in Inches | $H_{vert}$ = | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | $H_{throat}$ = | 6.00 | 6.00 | inches |
| Angle of Throat (see USDCM Figure ST-5) | Theta = | 63.40 | 63.40 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | $W_p$ = | 2.00 | 2.00 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | $C_f$ (C) = | 0.10 | 0.10 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | $C_w$ (C) = | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | $C_o$ (C) = | 0.67 | 0.67 | |
| **Low Head Performance Reduction (Calculated)** | | MINOR | MAJOR | |
| Depth for Grate Midwidth | $d_{Grate}$ = | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.25 | 0.35 | ft |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | 0.47 | 0.58 | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | 0.72 | 0.80 | |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | N/A | N/A | |
| | | MINOR | MAJOR | |
| **Total Inlet Interception Capacity (assumes clogged condition)** | **$Q_a$ =** | **10.8** | **19.9** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)** | $Q_{PEAK\ REQUIRED}$ = | 0.3 | 0.7 | cfs |

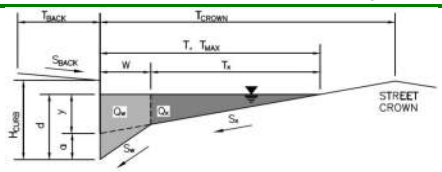
Version 4.05 Released March 2017

# ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

**Project:** **The Glen at Widefield Filing No 11**

**Inlet ID:** **G-2**




**Gutter Geometry (Enter data in the blue cells)**

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 8.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.017 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 17.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | **0.005** | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 17.0 | 17.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 6.2 | inches |
| Allow Flow Depth at Street Crown (leave blank for no) | | ☐ | ☑ | check = yes |

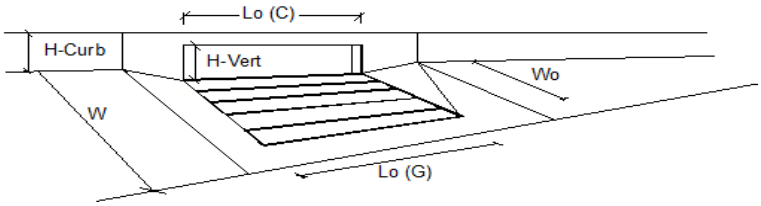
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Spread Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Depth Criterion** | $Q_{allow}$ = | **7.7** | **10.6** | **cfs** |

**Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

**WARNING: MAJOR STORM max. allowable capacity is less than the design flow given on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

**Version 4.05 Released March 2017**




| **Design Information (Input)** | CDOT Type R Curb Opening | | MINOR | MAJOR | |
|---|---|---|---|---|---|
| Type of Inlet | | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a') | | $a_{LOCAL}$ = | 3.0 | 3.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | | No = | 3 | 3 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | | $L_o$ = | 5.00 | 5.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | | $W_o$ = | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | | $C_f$-G = | N/A | N/A | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | | $C_f$-C = | 0.10 | 0.10 | |

| **Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MAJOR STORM** | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Total Inlet Interception Capacity** | **Q =** | **6.3** | **13.8** | **cfs** |
| **Total Inlet Carry-Over Flow (flow bypassing inlet)** | **$Q_b$ =** | **0.0** | **6.1** | **cfs** |
| **Capture Percentage = $Q_a/Q_o$ =** | **C% =** | **100** | **70** | **%** |

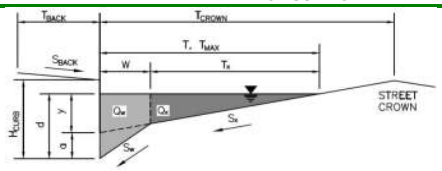
Version 4.05 Released March 2017

# ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

**Project:** **The Glen at Widefield Filing No 11**

**Inlet ID:** **NOT USED GLITCH CAN'T ERASE**




**Gutter Geometry (Enter data in the blue cells)**

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | | ft |
| Gutter Width | W = | | ft |
| Street Transverse Slope | $S_X$ = | | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | | | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | | | inches |
| Allow Flow Depth at Street Crown (leave blank for no) | | ☐ | ☐ | check = yes |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Depth Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Depth Criterion** | $Q_{allow}$ = | | | **cfs** |

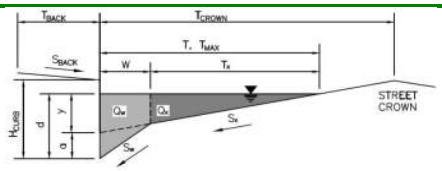
Version 4.05 Released March 2017

# ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

**Project:** **The Glen at Widefield Filing No 11**

**Inlet ID:** **E-1**




**Gutter Geometry (Enter data in the blue cells)**

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 8.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.017 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 17.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | **0.009** | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 17.0 | 17.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 6.2 | inches |
| Allow Flow Depth at Street Crown (leave blank for no) | | ☐ | ☑ | check = yes |

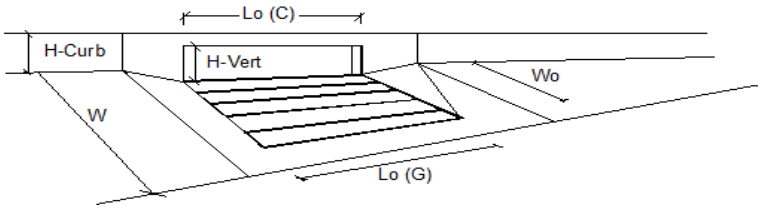
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Spread Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Depth Criterion** | **$Q_{allow}$ =** | **10.2** | **14.1** | **cfs** |

**Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

**Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

**Version 4.05 Released March 2017**




| **Design Information (Input)** | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet (CDOT Type R Curb Opening) | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a') | $a_{LOCAL}$ = | 3.0 | 3.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | No = | 2 | 2 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | $L_o$ = | 5.00 | 5.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | $W_o$ = | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | $C_f$-G = | N/A | N/A | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | $C_f$-C = | 0.10 | 0.10 | |

| **Street Hydraulics: OK - Q < Allowable Street Capacity'** | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Total Inlet Interception Capacity** | **Q =** | **3.4** | **7.1** | **cfs** |
| **Total Inlet Carry-Over Flow (flow bypassing inlet)** | **$Q_b$ =** | **0.0** | **2.8** | **cfs** |
| **Capture Percentage = $Q_a/Q_o$ =** | **C% =** | **100** | **72** | **%** |

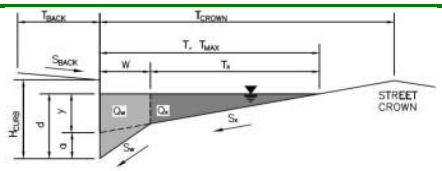
Version 4.05 Released March 2017

# ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

**Project:** **The Glen at Widefield Filing No 11**

**Inlet ID:** **E-2**




**Gutter Geometry (Enter data in the blue cells)**

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 8.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.017 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 17.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | **0.009** | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 17.0 | 17.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 6.2 | inches |
| Allow Flow Depth at Street Crown (leave blank for no) | | ☐ | ☑ | check = yes |

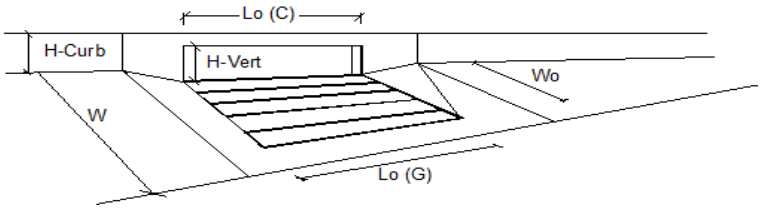
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Spread Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Depth Criterion** | $Q_{allow}$ = | **10.2** | **14.1** | **cfs** |

**Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

**Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

**Version 4.05 Released March 2017**




| **Design Information (Input)** | | MINOR | MAJOR | |
|---|---|---|---|---|
| Type of Inlet (CDOT Type R Curb Opening) | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a') | $a_{LOCAL}$ = | 3.0 | 3.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | No = | 2 | 2 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | $L_o$ = | 5.00 | 5.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | $W_o$ = | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | $C_f$-G = | N/A | N/A | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | $C_f$-C = | 0.10 | 0.10 | |

| **Street Hydraulics: OK - Q < Allowable Street Capacity'** | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Total Inlet Interception Capacity** | **Q =** | **2.8** | **6.4** | **cfs** |
| **Total Inlet Carry-Over Flow (flow bypassing inlet)** | **$Q_b$ =** | **0.0** | **1.7** | **cfs** |
| **Capture Percentage = $Q_a/Q_o$ =** | **C% =** | **100** | **79** | **%** |

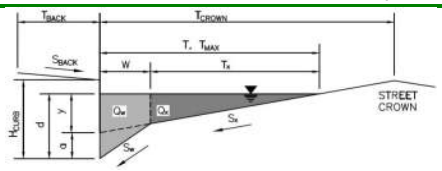
Version 4.05 Released March 2017

# ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

**Project:** **The Glen at Widefield Filing No 11**

**Inlet ID:** **E-6**




**Gutter Geometry (Enter data in the blue cells)**

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 8.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.017 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 17.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | **0.011** | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 17.0 | 17.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 6.2 | inches |
| Allow Flow Depth at Street Crown (leave blank for no) | | ☐ | ☑ | check = yes |

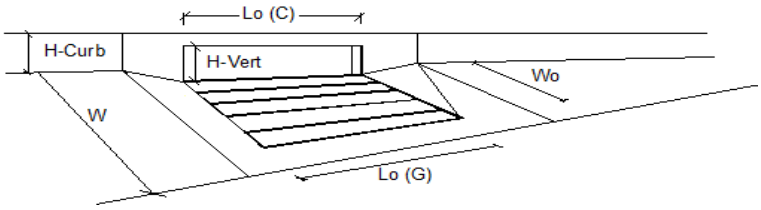
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Spread Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Depth Criterion** | $Q_{allow}$ = | **11.6** | **16.0** | **cfs** |

**Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

**Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

**Version 4.05 Released March 2017**




| **Design Information (Input)** | CDOT Type R Curb Opening | | MINOR | MAJOR | |
|---|---|---|---|---|---|
| Type of Inlet | | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a') | | $a_{LOCAL}$ = | 3.0 | 3.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | | No = | 3 | 3 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | | $L_o$ = | 5.00 | 5.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | | $W_o$ = | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | | $C_f$-G = | N/A | N/A | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | | $C_f$-C = | 0.10 | 0.10 | |

| **Street Hydraulics: OK - Q < Allowable Street Capacity'** | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Total Inlet Interception Capacity** | **Q =** | **3.9** | **11.6** | **cfs** |
| **Total Inlet Carry-Over Flow (flow bypassing inlet)** | **$Q_b$ =** | **0.0** | **2.7** | **cfs** |
| **Capture Percentage = $Q_a/Q_o$ =** | **C% =** | **100** | **81** | **%** |

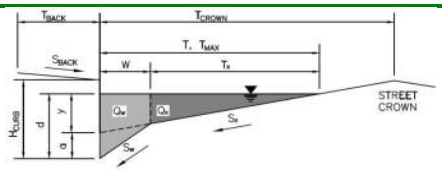
Version 4.05 Released March 2017

# ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

**Project:** **The Glen at Widefield Filing No 11**

**Inlet ID:** **H-2**




**Gutter Geometry (Enter data in the blue cells)**

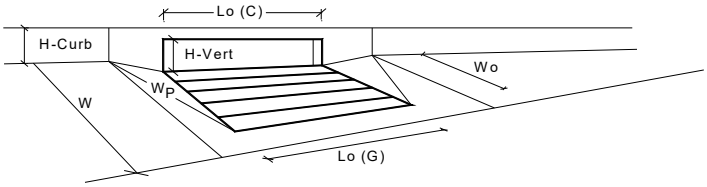
| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 8.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.017 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 17.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | **0.000** | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 17.0 | 17.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 6.2 | inches |
| Check boxes are not applicable in SUMP conditions | | ☐ | ☐ | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Depth Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Depth Criterion** | $Q_{allow}$ = | **SUMP** | **SUMP** | **cfs** |

# INLET IN A SUMP OR SAG LOCATION

**Version 4.05 Released March 2017**




| | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Design Information (Input)** | | | | |
| Type of Inlet (CDOT Type R Curb Opening) | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | $a_{local}$ = | 3.00 | 3.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | No = | 4 | 4 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 6.0 | 6.2 | inches |
| **Grate Information** | | MINOR | MAJOR | ☑ Override Depths |
| Length of a Unit Grate | $L_o$ (G) = | N/A | N/A | feet |
| Width of a Unit Grate | $W_o$ = | N/A | N/A | feet |
| Area Opening Ratio for a Grate (typical values 0.15-0.90) | $A_{ratio}$ = | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | $C_f$ (G) = | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | $C_w$ (G) = | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | $C_o$ (G) = | N/A | N/A | |
| **Curb Opening Information** | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | $L_o$ (C) = | 5.00 | 5.00 | feet |
| Height of Vertical Curb Opening in Inches | $H_{vert}$ = | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | $H_{throat}$ = | 6.00 | 6.00 | inches |
| Angle of Throat (see USDCM Figure ST-5) | Theta = | 63.40 | 63.40 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | $W_p$ = | 2.00 | 2.00 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | $C_f$ (C) = | 0.10 | 0.10 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | $C_w$ (C) = | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | $C_o$ (C) = | 0.67 | 0.67 | |
| **Low Head Performance Reduction (Calculated)** | | MINOR | MAJOR | |
| Depth for Grate Midwidth | $d_{Grate}$ = | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.33 | 0.35 | ft |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | 0.57 | 0.58 | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | 0.79 | 0.80 | |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | N/A | N/A | |
| | | MINOR | MAJOR | |
| **Total Inlet Interception Capacity (assumes clogged condition)** | **$Q_a$ =** | **18.2** | **19.9** | **cfs** |
| **WARNING: Inlet Capacity less than Q Peak for Major Storm** | $Q_{PEAK\ REQUIRED}$ = | 15.1 | 46.5 | cfs |

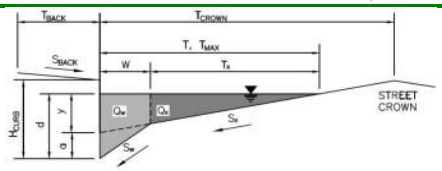
Version 4.05 Released March 2017

# ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

**Project:** **The Glen at Widefield Filing No 11**

**Inlet ID:** **J-1**




**Gutter Geometry (Enter data in the blue cells)**

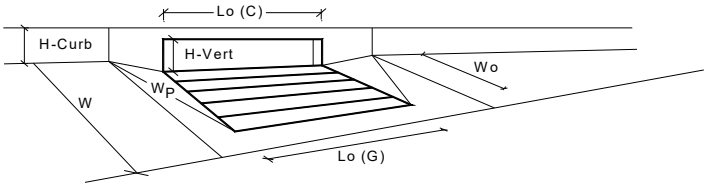
| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 8.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.017 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 17.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | **0.000** | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 17.0 | 17.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 6.2 | inches |
| Check boxes are not applicable in SUMP conditions | | ☐ | ☐ | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Depth Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Depth Criterion** | $Q_{allow}$ = | **SUMP** | **SUMP** | **cfs** |

# INLET IN A SUMP OR SAG LOCATION

**Version 4.05 Released March 2017**




| | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Design Information (Input)** | | | | |
| Type of Inlet (CDOT Type R Curb Opening) | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | $a_{local}$ = | 3.00 | 3.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | No = | 2 | 2 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 5.6 | 5.6 | inches |
| **Grate Information** | | MINOR | MAJOR | ☐ Override Depths |
| Length of a Unit Grate | $L_o$ (G) = | N/A | N/A | feet |
| Width of a Unit Grate | $W_o$ = | N/A | N/A | feet |
| Area Opening Ratio for a Grate (typical values 0.15-0.90) | $A_{ratio}$ = | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | $C_f$ (G) = | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | $C_w$ (G) = | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | $C_o$ (G) = | N/A | N/A | |
| **Curb Opening Information** | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | $L_o$ (C) = | 5.00 | 5.00 | feet |
| Height of Vertical Curb Opening in Inches | $H_{vert}$ = | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | $H_{throat}$ = | 6.00 | 6.00 | inches |
| Angle of Throat (see USDCM Figure ST-5) | Theta = | 63.40 | 63.40 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | $W_p$ = | 2.00 | 2.00 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | $C_f$ (C) = | 0.10 | 0.10 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | $C_w$ (C) = | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | $C_o$ (C) = | 0.67 | 0.67 | |
| **Low Head Performance Reduction (Calculated)** | | MINOR | MAJOR | |
| Depth for Grate Midwidth | $d_{Grate}$ = | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.30 | 0.30 | ft |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | 0.53 | 0.53 | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | 0.91 | 0.91 | |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | N/A | N/A | |
| | | MINOR | MAJOR | |
| **Total Inlet Interception Capacity (assumes clogged condition)** | **$Q_a$ =** | **8.7** | **8.7** | **cfs** |
| **WARNING: Inlet Capacity less than Q Peak for Major Storm** | $Q_{PEAK\ REQUIRED}$ = | 1.0 | 10.8 | cfs |

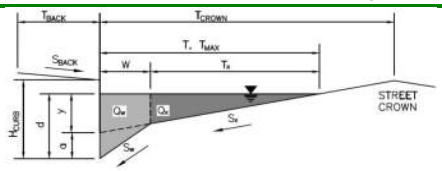
Version 4.05 Released March 2017

# ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

**Project:** **The Glen at Widefield Filing No 11**

**Inlet ID:** **J-2**




**Gutter Geometry (Enter data in the blue cells)**

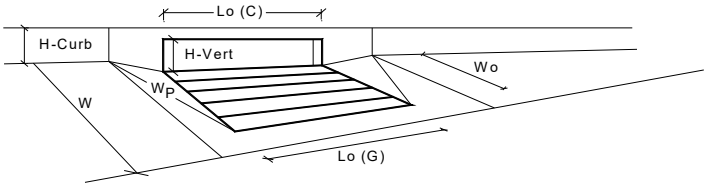
| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 8.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.017 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 17.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | **0.000** | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 17.0 | 17.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 6.2 | inches |
| Check boxes are not applicable in SUMP conditions | | ☐ | ☐ | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Depth Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Depth Criterion** | $Q_{allow}$ = | **SUMP** | **SUMP** | **cfs** |

# INLET IN A SUMP OR SAG LOCATION

**Version 4.05 Released March 2017**




| | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Design Information (Input)** | | | | |
| Type of Inlet (CDOT Type R Curb Opening) | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | $a_{local}$ = | 3.00 | 3.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | No = | 2 | 2 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 5.6 | 5.6 | inches |
| **Grate Information** | | MINOR | MAJOR | ☐ Override Depths |
| Length of a Unit Grate | $L_o$ (G) = | N/A | N/A | feet |
| Width of a Unit Grate | $W_o$ = | N/A | N/A | feet |
| Area Opening Ratio for a Grate (typical values 0.15-0.90) | $A_{ratio}$ = | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | $C_f$ (G) = | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | $C_w$ (G) = | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | $C_o$ (G) = | N/A | N/A | |
| **Curb Opening Information** | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | $L_o$ (C) = | 5.00 | 5.00 | feet |
| Height of Vertical Curb Opening in Inches | $H_{vert}$ = | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | $H_{throat}$ = | 6.00 | 6.00 | inches |
| Angle of Throat (see USDCM Figure ST-5) | Theta = | 63.40 | 63.40 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | $W_p$ = | 2.00 | 2.00 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | $C_f$ (C) = | 0.10 | 0.10 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | $C_w$ (C) = | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | $C_o$ (C) = | 0.67 | 0.67 | |
| **Low Head Performance Reduction (Calculated)** | | MINOR | MAJOR | |
| Depth for Grate Midwidth | $d_{Grate}$ = | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.30 | 0.30 | ft |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | 0.53 | 0.53 | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | 0.91 | 0.91 | |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | N/A | N/A | |
| | | MINOR | MAJOR | |
| **Total Inlet Interception Capacity (assumes clogged condition)** | **$Q_a$ =** | **8.7** | **8.7** | **cfs** |
| **WARNING: Inlet Capacity less than Q Peak for Major Storm** | $Q_{PEAK\ REQUIRED}$ = | 0.8 | 11.0 | cfs |

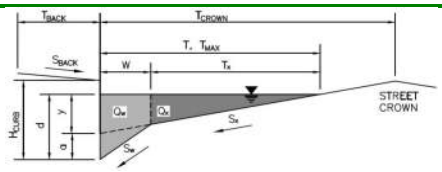
Version 4.05 Released March 2017

# ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

**Project:** **The Glen at Widefield Filing No 11**

**Inlet ID:** **F-1**




**Gutter Geometry (Enter data in the blue cells)**

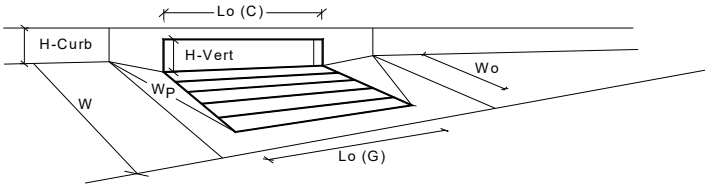
| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 8.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.017 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 20.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | **0.000** | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 17.0 | 17.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 6.2 | inches |
| Check boxes are not applicable in SUMP conditions | | ☐ | ☐ | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Depth Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Depth Criterion** | $Q_{allow}$ = | **SUMP** | **SUMP** | **cfs** |

# INLET IN A SUMP OR SAG LOCATION

**Version 4.05 Released March 2017**




| | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Design Information (Input)** | | | | |
| Type of Inlet (CDOT Type R Curb Opening) | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | $a_{local}$ = | 3.00 | 3.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | No = | 2 | 2 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 5.6 | 6.2 | inches |
| **Grate Information** | | MINOR | MAJOR | ☑ Override Depths |
| Length of a Unit Grate | $L_o$ (G) = | N/A | N/A | feet |
| Width of a Unit Grate | $W_o$ = | N/A | N/A | feet |
| Area Opening Ratio for a Grate (typical values 0.15-0.90) | $A_{ratio}$ = | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | $C_f$ (G) = | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | $C_w$ (G) = | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | $C_o$ (G) = | N/A | N/A | |
| **Curb Opening Information** | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | $L_o$ (C) = | 5.00 | 5.00 | feet |
| Height of Vertical Curb Opening in Inches | $H_{vert}$ = | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | $H_{throat}$ = | 6.00 | 6.00 | inches |
| Angle of Throat (see USDCM Figure ST-5) | Theta = | 63.40 | 63.40 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | $W_p$ = | 2.00 | 2.00 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | $C_f$ (C) = | 0.10 | 0.10 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | $C_w$ (C) = | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | $C_o$ (C) = | 0.67 | 0.67 | |
| **Low Head Performance Reduction (Calculated)** | | MINOR | MAJOR | |
| Depth for Grate Midwidth | $d_{Grate}$ = | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.30 | 0.35 | ft |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | 0.53 | 0.58 | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | 0.91 | 0.94 | |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | N/A | N/A | |
| | | MINOR | MAJOR | |
| **Total Inlet Interception Capacity (assumes clogged condition)** | **$Q_a$ =** | **8.7** | **11.2** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)** | $Q_{PEAK\ REQUIRED}$ = | 2.4 | 6.9 | cfs |

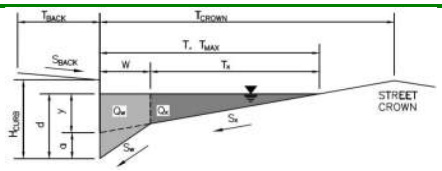
Version 4.05 Released March 2017

# ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

**Project:** **The Glen at Widefield Filing No 11**

**Inlet ID:** **A-1**




**Gutter Geometry (Enter data in the blue cells)**

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 8.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.017 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 17.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | **0.006** | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 17.0 | 17.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 6.2 | inches |
| Allow Flow Depth at Street Crown (leave blank for no) | | ☐ | ☑ | check = yes |

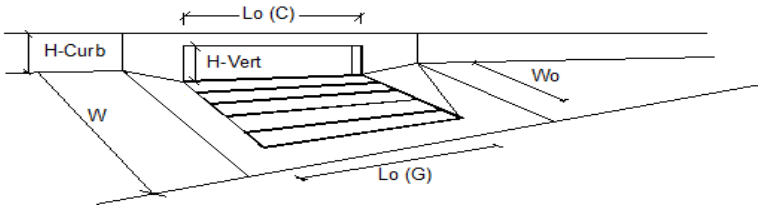
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Spread Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Depth Criterion** | $Q_{allow}$ = | **8.2** | **11.3** | **cfs** |

**Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

**Major storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

**Version 4.05 Released March 2017**




| **Design Information (Input)** | CDOT Type R Curb Opening | | MINOR | MAJOR | |
|---|---|---|---|---|---|
| Type of Inlet | | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a') | | $a_{LOCAL}$ = | 3.0 | 3.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | | No = | 2 | 2 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | | $L_o$ = | 5.00 | 5.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | | $W_o$ = | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | | $C_f$-G = | N/A | N/A | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | | $C_f$-C = | 0.10 | 0.10 | |

| **Street Hydraulics: OK - Q < Allowable Street Capacity'** | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Total Inlet Interception Capacity** | **Q =** | **3.0** | **6.6** | **cfs** |
| **Total Inlet Carry-Over Flow (flow bypassing inlet)** | **$Q_b$ =** | **0.0** | **2.0** | **cfs** |
| **Capture Percentage = $Q_a/Q_o$ =** | **C% =** | **100** | **76** | **%** |

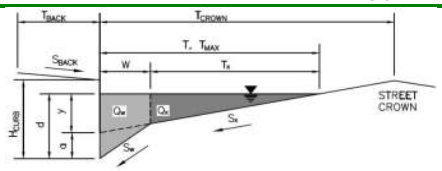
Version 4.05 Released March 2017

# ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

**Project:** **The Glen at Widefield Filing No 11**

**Inlet ID:** **G-3**




**Gutter Geometry (Enter data in the blue cells)**

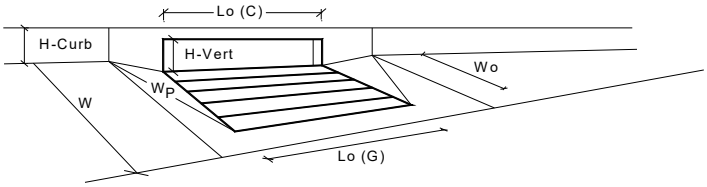
| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 8.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.017 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 17.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | 0.000 | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 17.0 | 17.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 6.2 | inches |
| Check boxes are not applicable in SUMP conditions | | ☐ | ☐ | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Depth Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Depth Criterion** | **$Q_{allow}$ =** | **SUMP** | **SUMP** | **cfs** |

# INLET IN A SUMP OR SAG LOCATION

**Version 4.05 Released March 2017**




| | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Design Information (Input)** | | | | |
| Type of Inlet (CDOT Type R Curb Opening) | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a' from above) | $a_{local}$ = | 3.00 | 3.00 | inches |
| Number of Unit Inlets (Grate or Curb Opening) | No = | 4 | 4 | |
| Water Depth at Flowline (outside of local depression) | Ponding Depth = | 5.0 | 6.2 | inches |
| **Grate Information** | | MINOR | MAJOR | ☑ Override Depths |
| Length of a Unit Grate | $L_o$ (G) = | N/A | N/A | feet |
| Width of a Unit Grate | $W_o$ = | N/A | N/A | feet |
| Area Opening Ratio for a Grate (typical values 0.15-0.90) | $A_{ratio}$ = | N/A | N/A | |
| Clogging Factor for a Single Grate (typical value 0.50 - 0.70) | $C_f$ (G) = | N/A | N/A | |
| Grate Weir Coefficient (typical value 2.15 - 3.60) | $C_w$ (G) = | N/A | N/A | |
| Grate Orifice Coefficient (typical value 0.60 - 0.80) | $C_o$ (G) = | N/A | N/A | |
| **Curb Opening Information** | | MINOR | MAJOR | |
| Length of a Unit Curb Opening | $L_o$ (C) = | 5.00 | 5.00 | feet |
| Height of Vertical Curb Opening in Inches | $H_{vert}$ = | 6.00 | 6.00 | inches |
| Height of Curb Orifice Throat in Inches | $H_{throat}$ = | 6.00 | 6.00 | inches |
| Angle of Throat (see USDCM Figure ST-5) | Theta = | 63.40 | 63.40 | degrees |
| Side Width for Depression Pan (typically the gutter width of 2 feet) | $W_p$ = | 2.00 | 2.00 | feet |
| Clogging Factor for a Single Curb Opening (typical value 0.10) | $C_f$ (C) = | 0.10 | 0.10 | |
| Curb Opening Weir Coefficient (typical value 2.3-3.7) | $C_w$ (C) = | 3.60 | 3.60 | |
| Curb Opening Orifice Coefficient (typical value 0.60 - 0.70) | $C_o$ (C) = | 0.67 | 0.67 | |
| **Low Head Performance Reduction (Calculated)** | | MINOR | MAJOR | |
| Depth for Grate Midwidth | $d_{Grate}$ = | N/A | N/A | ft |
| Depth for Curb Opening Weir Equation | $d_{Curb}$ = | 0.25 | 0.35 | ft |
| Combination Inlet Performance Reduction Factor for Long Inlets | $RF_{Combination}$ = | 0.47 | 0.58 | |
| Curb Opening Performance Reduction Factor for Long Inlets | $RF_{Curb}$ = | 0.72 | 0.80 | |
| Grated Inlet Performance Reduction Factor for Long Inlets | $RF_{Grate}$ = | N/A | N/A | |
| | | MINOR | MAJOR | |
| **Total Inlet Interception Capacity (assumes clogged condition)** | **$Q_a$ =** | **10.8** | **19.9** | **cfs** |
| **Inlet Capacity IS GOOD for Minor and Major Storms(>Q PEAK)** | $Q_{PEAK\ REQUIRED}$ = | 5.7 | 16.4 | cfs |

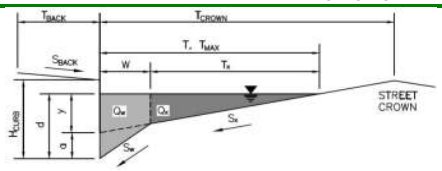
Version 4.05 Released March 2017

# ALLOWABLE CAPACITY FOR ONE-HALF OF STREET (Minor & Major Storm)

**(Based on Regulated Criteria for Maximum Allowable Flow Depth and Spread)**

**Project:** **The Glen at Widefield Filing No 11**

**Inlet ID:** **G-4 ON GRADE**




**Gutter Geometry (Enter data in the blue cells)**

| | | | |
|---|---|---|---|
| Maximum Allowable Width for Spread Behind Curb | $T_{BACK}$ = | 8.0 | ft |
| Side Slope Behind Curb (leave blank for no conveyance credit behind curb) | $S_{BACK}$ = | 0.020 | ft/ft |
| Manning's Roughness Behind Curb (typically between 0.012 and 0.020) | $n_{BACK}$ = | 0.017 | |
| Height of Curb at Gutter Flow Line | $H_{CURB}$ = | 6.00 | inches |
| Distance from Curb Face to Street Crown | $T_{CROWN}$ = | 17.0 | ft |
| Gutter Width | W = | 2.00 | ft |
| Street Transverse Slope | $S_X$ = | 0.020 | ft/ft |
| Gutter Cross Slope (typically 2 inches over 24 inches or 0.083 ft/ft) | $S_W$ = | 0.083 | ft/ft |
| Street Longitudinal Slope - Enter 0 for sump condition | $S_O$ = | **0.005** | ft/ft |
| Manning's Roughness for Street Section (typically between 0.012 and 0.020) | $n_{STREET}$ = | 0.016 | |

| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| Max. Allowable Spread for Minor & Major Storm | $T_{MAX}$ = | 17.0 | 17.0 | ft |
| Max. Allowable Depth at Gutter Flowline for Minor & Major Storm | $d_{MAX}$ = | 6.0 | 6.2 | inches |
| Allow Flow Depth at Street Crown (leave blank for no) | | ☐ | ☑ | check = yes |

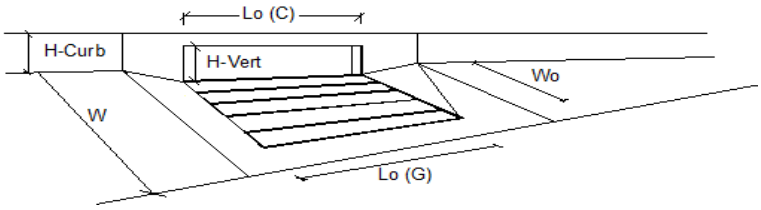
| | | Minor Storm | Major Storm | |
|---|---|---|---|---|
| **MINOR STORM Allowable Capacity is based on Spread Criterion** | | | | |
| **MAJOR STORM Allowable Capacity is based on Depth Criterion** | $Q_{allow}$ = | **7.7** | **10.8** | **cfs** |

**Minor storm max. allowable capacity GOOD - greater than the design flow given on sheet 'Inlet Management'**

**WARNING: MAJOR STORM max. allowable capacity is less than the design flow given on sheet 'Inlet Management'**

# INLET ON A CONTINUOUS GRADE

**Version 4.05 Released March 2017**



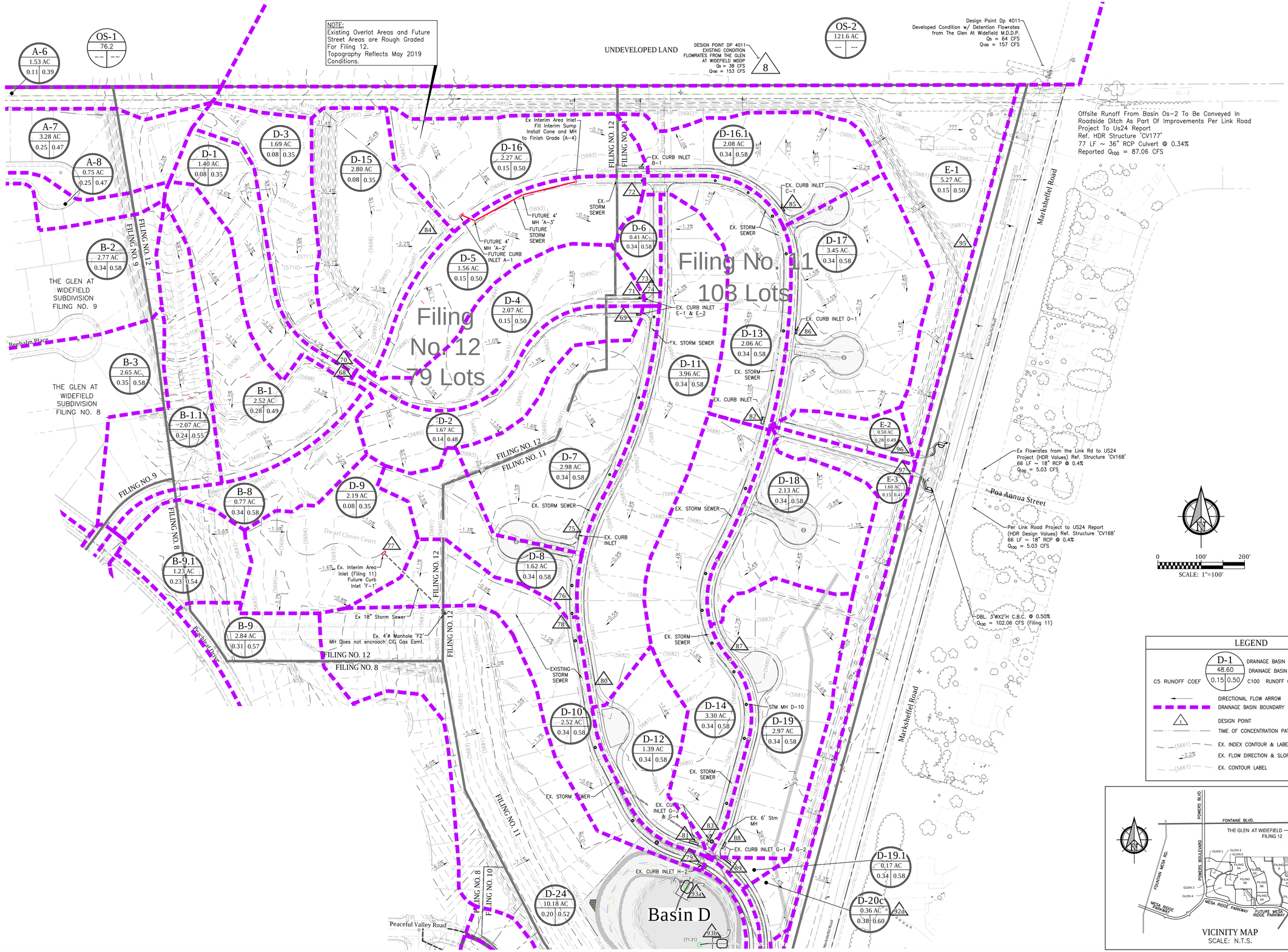

| **Design Information (Input)** | CDOT Type R Curb Opening | | MINOR | MAJOR | |
|---|---|---|---|---|---|
| Type of Inlet | | Type = | CDOT Type R Curb Opening | | |
| Local Depression (additional to continuous gutter depression 'a') | | $a_{LOCAL}$ = | 3.0 | 3.0 | inches |
| Total Number of Units in the Inlet (Grate or Curb Opening) | | No = | 3 | 3 | |
| Length of a Single Unit Inlet (Grate or Curb Opening) | | $L_o$ = | 5.00 | 5.00 | ft |
| Width of a Unit Grate (cannot be greater than W, Gutter Width) | | $W_o$ = | N/A | N/A | ft |
| Clogging Factor for a Single Unit Grate (typical min. value = 0.5) | | $C_f$-G = | N/A | N/A | |
| Clogging Factor for a Single Unit Curb Opening (typical min. value = 0.1) | | $C_f$-C = | 0.10 | 0.10 | |

| **Street Hydraulics: WARNING: Q > ALLOWABLE Q FOR MAJOR STORM** | | MINOR | MAJOR | |
|---|---|---|---|---|
| **Total Inlet Interception Capacity** | **Q =** | **3.8** | **11.1** | **cfs** |
| **Total Inlet Carry-Over Flow (flow bypassing inlet)** | **$Q_b$ =** | **0.0** | **2.3** | **cfs** |
| **Capture Percentage = $Q_a/Q_o$ =** | **C% =** | **100** | **83** | **%** |

# APPENDIX D

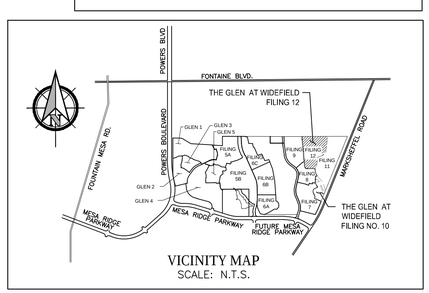
## Existing and Proposed Drainage Plans

**H-1 – Historic Conditions (Overall)**
**D-1 - Developed Conditions Onsite (South)**
**D-2 – Developed Conditions Onsite (North)**




## LEGEND

| | |
|---|---|
| D-1 | DRAINAGE BASIN 'D-n' TRIBUTARY |
| 48.60 | DRAINAGE BASIN ACRES |
| C5 RUNOFF COEF | C100 RUNOFF COEFFICIENT |
| | DIRECTIONAL FLOW ARROW |
| | DRAINAGE BASIN BOUNDARY |
| 1 | DESIGN POINT |
| | TIME OF CONCENTRATION PATH |
| (5661) | EX. INDEX CONTOUR & LABEL |
| 2.2% | EX. FLOW DIRECTION & SLOPE |
| (5661) | EX. CONTOUR LABEL |




VICINITY MAP
SCALE: N.T.S.

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
(719) 630-7342

WIDEFIELD Investment Group

# THE GLEN AT WIDEFIELD
## FILING NO. 12
## HISTORIC DRAINAGE BASINS (WITH CURRENT CONDITIONS)
El Paso, County, Colorado

| | |
|---|---|
| Project No.: | 19016 |
| Date: | Mar 30, 2023 |
| Design: | MJK |
| Drawn: | MJK |
| Check: | AMcC |
| Revisions: | |

SHEET
H-1
1 of 3 Sheets

MATCHLINE SEE SHEET D-2
MATCHLINE SEE SHEET D-1

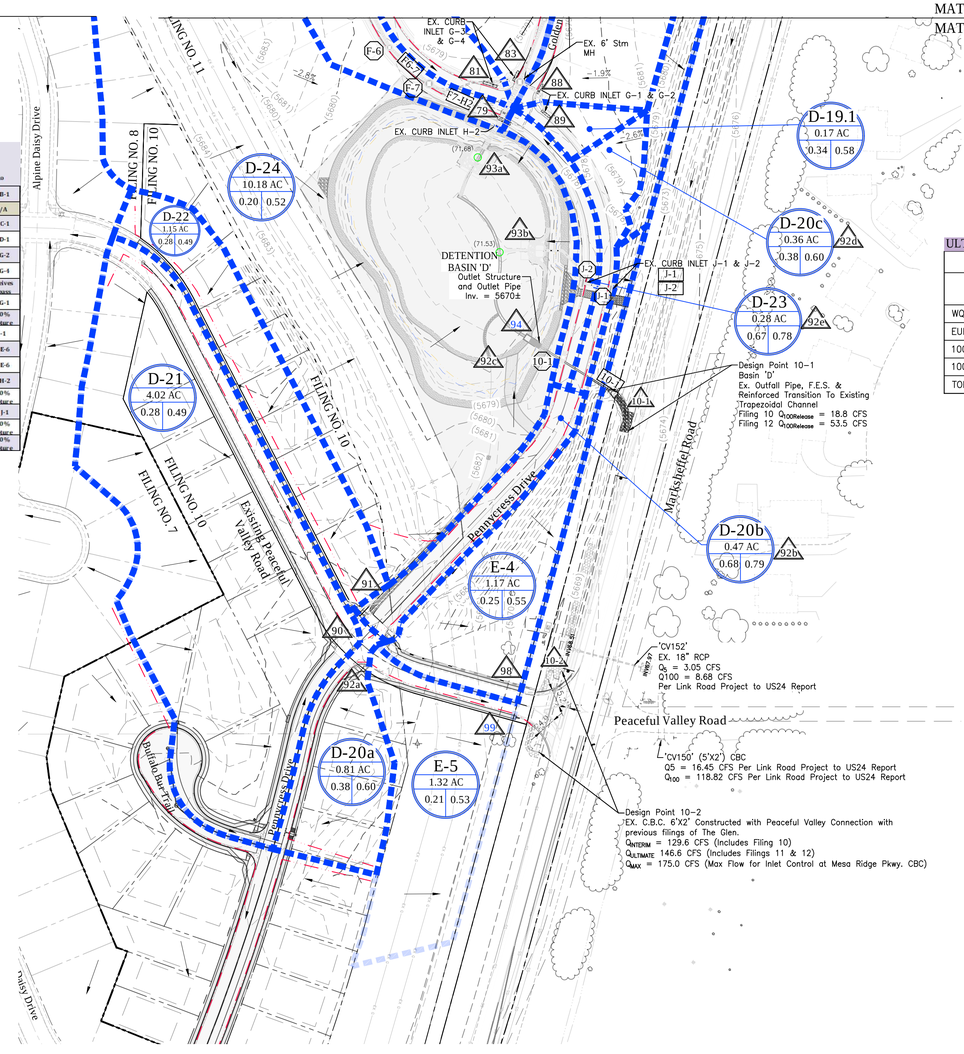
INLET IDENTIFIER (B-1)

| Inlet ID | Design Flow (Basin or DP) | Flow to Inlet 2yr | 5yr | 100yr | Upstream Inlet(s) | Carry Over Flow 5yr | 100yr | Flow to Inlet including Carry Over 5yr | 100yr | Street Flow Depth 5yr | 100yr | Street Section Capacity 5yr | 100yr | Inlet Type | Inlet Condition | Inlet Capacity 5yr | 100yr | Flow Not Captured by Inlet 5yr | 100yr | to |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A-1 | DP 84 | | 3.0cfs | 8.6cfs | None | 0.0cfs | 2.6cfs | 3.0cfs | 8.6cfs | 6.0in | 6.2in | 8.2cfs | 13.3cfs | 10' Type R | On Grade | 3.0 cfs | 6.9 cfs | 0.0cfs | 1.7cfs | to B-1 |
| A-4 | DP 71 (Interim Inlet) | | | | | | | | | | | | | BECOMES MANHOLE | IN PIPE | | | | | N/A |
| B-1 | Sub-Basin D-16 | | 2.5cfs | 7.3cfs | A-1 | 0.0cfs | 1.7cfs | 2.5cfs | 9.0cfs | 6.0in | 6.2in | 8.2cfs | 13.3cfs | 10' Type R | On Grade | 5.0 cfs | 9.6 cfs | 0.0cfs | 0.0cfs | to C-1 |
| C-1 | DP 85 | | 2.4cfs | 6.9cfs | A-1, B-1 | 0.0cfs | 0.0cfs | 2.4cfs | 6.9cfs | 6.0in | 6.2in | 8.2cfs | 13.3cfs | 10' Type R | On Grade | 2.4 cfs | 5.8 cfs | 0.0cfs | 1.1cfs | to D-1 |
| D-1 | DP 86 | | 4.4cfs | 12.7cfs | A-1, B-1, C-1 | 0.0cfs | 1.1cfs | 4.4cfs | 13.8cfs | 6.0in | 6.2in | 10.3cfs | 14.2cfs | 10' Type R | On Grade | 4.3 cfs | 8.1 cfs | 0.1cfs | 5.7cfs | to G-2 |
| D-4 | DP 82 | | 3.8cfs | 11.1cfs | A-1, B-1, C-1 | 0.0cfs | 0.0cfs | 3.8cfs | 11.1cfs | 6.0in | 6.2in | 8.2cfs | 13.3cfs | 15' Type R | On Grade | 3.8 cfs | 9.9 cfs | 0.0cfs | 1.2cfs | to G-4 |
| G-1 | DP 89 | | 0.3cfs | 0.7cfs | None | 0.0cfs | 15.5cfs | 0.3cfs | 16.3cfs | 6.0in | 6.2in | 11.1cfs | 13.1cfs | 20' Type R | In Sump | 10.8 cfs | 19.9 cfs | 0.0cfs | 0.0cfs | Receives Bypass |
| G-2 | DP 88 | | 6.2cfs | 18.1cfs | A-1 thru D-1 | 0.1cfs | 5.7cfs | 6.3cfs | 23.7cfs | 6.0in | 6.2in | 7.7cfs | 10.6cfs | 15' Type R | On Grade | 6.3 cfs | 13.6 cfs | 0.0cfs | 10.1cfs | to G-1 |
| G-3 | DP 81 | | 5.7cfs | 16.4cfs | None | 0.0cfs | 0.0cfs | 5.7cfs | 16.4cfs | 6.0in | 6.2in | 11.1cfs | 13.1cfs | 20' Type R | In Sump | 10.8 cfs | 19.9 cfs | 0.0cfs | 0.0cfs | 100% Capture |
| G-4 | DP 83 | | 3.8cfs | 11.0cfs | D-4 | 0.0cfs | 1.2cfs | 3.8cfs | 12.2cfs | 6.0in | 6.2in | 9.1cfs | 12.8cfs | 15' Type R | On Grade | 3.8 cfs | 7.1 cfs | 0.0cfs | 5.1cfs | G-1 |
| E-1 | DP 71 | | 3.4cfs | 9.9cfs | None | 0.0cfs | 0.0cfs | 3.4cfs | 9.9cfs | 6.0in | 6.2in | 10.2cfs | 14.1cfs | 10' Type R | On Grade | 3.4 cfs | 8.5 cfs | 0.0cfs | 1.4cfs | to E-6 |
| E-2 | DP 69 | | 2.8cfs | 8.1cfs | None | 0.0cfs | 0.0cfs | 2.8cfs | 8.1cfs | 6.0in | 6.2in | 10.2cfs | 14.1cfs | 10' Type R | On Grade | 2.6 cfs | 6.1 cfs | 0.2cfs | 2.0cfs | to E-6 |
| E-6 | DP 75 | | 3.7cfs | 10.8cfs | E-1, E-2 | 0.2cfs | 3.5cfs | 4.0cfs | 14.3cfs | 6.0in | 6.2in | 11.6cfs | 16.0cfs | 15' Type R | On Grade | 3.9 cfs | 11.6 cfs | 0.1cfs | 2.7cfs | to H-2 |
| F-1 | DP 77 | | 2.4cfs | 6.9cfs | None | 0.0cfs | 0.0cfs | 2.4cfs | 6.9cfs | 6.0in | 6.2in | 11.1cfs | 13.1cfs | 10' Type R | In Sump | 8.7 cfs | 11.2 cfs | 0.0cfs | 0.0cfs | 100% Capture |
| H-2 | DP 79 | | 4.8cfs | 13.9cfs | A thru H | 0.1cfs | 6.2cfs | 4.9cfs | 20.1cfs | 6.0in | 6.2in | 11.1cfs | 13.1cfs | 20' Type R | In Sump | 18.2 cfs | 19.9 cfs | 0.0cfs | 0.2cfs | to J-1 |
| J-1 | DP 92a | | 1.0cfs | 2.6cfs | DP 2.0 Only + Overtopping | 0.0cfs | 5.1cfs | 1.0cfs | 7.7cfs | 6.0in | 6.2in | 11.1cfs | 13.1cfs | 10' Type R | In Sump | 8.7 cfs | 8.7 cfs | 0.0cfs | 0.0cfs | 100% Capture |
| J-2 | DP 92b | | 0.8cfs | 1.5cfs | DP 2.0 Only + Overtopping | 0.0cfs | 0.2cfs | 0.8cfs | 1.7cfs | 6.0in | 6.2in | 11.1cfs | 13.1cfs | 10' Type R | In Sump | 8.7 cfs | 8.7 cfs | 0.0cfs | 0.0cfs | 100% Capture |

Note: Storm Manholes A-4 and F-1 will serve as interim inlets pending development of Future Filing No. 12.
Note: Street Capacity Exceeded at Pennycress / Golden Buffs Intersection (DP 79) in Major Storm. Flows in excess of 5" depth will overtop asphalt and feed surrounding inlets G-1 & G-4, then J-1 & J-2.

PIPE IDENTIFIER (B1-B2)

| Pipe # | 5yr Rat'l | 100yr Rat'l | Pipe Slope | Pipe Equiv. Dia. | Mannings Pipe Capacity | 2D Length (Center-to-Center) | Pipe Material |
|---|---|---|---|---|---|---|---|
| **Golden Buffs Drive Trunkline** | | | | Equivalent | | | |
| A1-A2 | 3.0 cfs | 8.6 cfs | 0.70% | 18-inch | 8.8 cfs | 33.67 | 18" RCP |
| A2-A3 | 3.0 cfs | 8.6 cfs | 0.60% | 18-inch | 8.2 cfs | 124.91 | 18" RCP |
| A3-A4 | 3.0 cfs | 8.6 cfs | 0.60% | 18-inch | 8.2 cfs | 125.80 | 18" RCP |
| A4-B2 | 3.0 cfs | 8.6 cfs | 0.60% | 18-inch | 8.2 cfs | 153.59 | 18" RCP |
| B1-B2 | 2.5 cfs | 7.3 cfs | 1.00% | 18-inch | 10.5 cfs | 29.70 | 18" RCP |
| B2-B3 | 7.3 cfs | 21.2 cfs | 0.70% | 24-inch | 19.0 cfs | 168.24 | 24" RCP |
| B3-B4 | 7.3 cfs | 21.2 cfs | 0.70% | 24-inch | 19.0 cfs | 80.62 | 24" RCP |
| B4-C2 | 7.3 cfs | 21.2 cfs | 0.70% | 24-inch | 19.0 cfs | 77.97 | 24" RCP |
| C1-C2 | 7.3 cfs | 21.2 cfs | 2.00% | 18-inch | 14.9 cfs | 29.14 | 18" RCP |
| C2-C3 | 10.8 cfs | 31.2 cfs | 0.60% | 30-inch | 31.9 cfs | 92.14 | 30" RCP |
| C3-D2 | 10.8 cfs | 31.2 cfs | 0.60% | 30-inch | 31.9 cfs | 177.80 | 30" RCP |
| D1-D2 | 1.4 cfs | 4.2 cfs | 2.00% | 18-inch | 14.9 cfs | 27.71 | 18" RCP |
| D2-D4 | 12.0 cfs | 34.6 cfs | 0.60% | 36-inch | 51.8 cfs | 212.13 | 36" RCP |
| D4-D5 | 15.8 cfs | 45.7 cfs | 0.80% | 36-inch | 59.8 cfs | 161.24 | 36" RCP |
| D5-D6 | 15.8 cfs | 45.7 cfs | 1.10% | 36-inch | 70.1 cfs | 216.49 | 36" RCP |
| D6-D7 | 15.8 cfs | 45.7 cfs | 0.90% | 36-inch | 63.4 cfs | 85.26 | 36" RCP |
| D7-D8 | 15.8 cfs | 45.7 cfs | 0.90% | 36-inch | 63.4 cfs | 78.72 | 36" RCP |
| D8-D9 | 15.8 cfs | 45.7 cfs | 1.00% | 36-inch | 66.9 cfs | 83.20 | 36" RCP |
| D9-D10 | 15.8 cfs | 45.7 cfs | 0.80% | 36-inch | 59.8 cfs | 80.51 | 36" RCP |
| D10-D11 | 15.8 cfs | 45.7 cfs | 0.40% | 36-inch | 42.3 cfs | 78.14 | 36" RCP |
| D11-D12 | 15.8 cfs | 45.7 cfs | 0.40% | 36-inch | 42.3 cfs | 155.35 | 36" RCP |
| D12-H1 | 15.8 cfs | 45.7 cfs | 0.40% | 36-inch | 42.3 cfs | 94.06 | 36" RCP |
| H1-H2 | 30.1 cfs | 74.0 cfs | 0.50% | 48-inch | 101.8 cfs | 55.96 | HERCP |
| | | | | | | | |
| **PennyCress Drive Trunkline** | | | | Equivalent | | | |
| E1-E2 | 4.5 cfs | 13.1 cfs | 0.60% | 21-inch | 12.3 cfs | 37.39 | 24" RCP |
| E2-E3 | 7.3 cfs | 21.2 cfs | 0.90% | 21-inch | 15.1 cfs | 29.61 | 24" RCP |
| E3-E4 | 7.3 cfs | 21.2 cfs | 1.00% | 21-inch | 15.9 cfs | 189.40 | 24" RCP |
| E4-E5 | 7.3 cfs | 21.2 cfs | 1.00% | 21-inch | 15.9 cfs | 189.25 | 24" RCP |
| E5-E6 | 7.3 cfs | 21.2 cfs | 1.20% | 21-inch | 17.4 cfs | 150.07 | 24" RCP |
| E6-E7 | 10.2 cfs | 29.6 cfs | 0.80% | 30-inch | 36.8 cfs | 100.41 | 30" RCP |
| F1-F2 | 2.4 cfs | 6.9 cfs | 4.00% | 18-inch | 21.1 cfs | 197.94 | 18" RCP |
| F2-F3 | 2.4 cfs | 6.9 cfs | 0.50% | 18-inch | 7.4 cfs | 292.03 | 18" RCP |
| E7-F3 | 10.2 cfs | 29.6 cfs | 0.80% | 30-inch | 36.8 cfs | 64.32 | 30" RCP |
| F3-F4 | 13.8 cfs | 39.9 cfs | 0.80% | 36-inch | 59.8 cfs | 63.47 | 36" RCP |
| F4-F5 | 4.8 cfs | 39.9 cfs | 0.80% | 36-inch | 59.8 cfs | 250.09 | 36" RCP |
| F5-F6 | 4.8 cfs | 39.9 cfs | 0.40% | 36-inch | 42.3 cfs | 189.19 | 36" RCP |
| F6-F7 | 4.8 cfs | 39.9 cfs | 0.40% | 36-inch | 42.3 cfs | 75.03 | 36" RCP |
| F7-H2 | 4.8 cfs | 13.9 cfs | 0.40% | 36-inch | 42.3 cfs | 106.99 | 36" RCP |
| G1-G2 | 0.3 cfs | 0.7 cfs | 0.60% | 24-inch | 17.6 cfs | 36.18 | 24" RCP |
| G2-H1 | 6.2 cfs | 18.1 cfs | 1.00% | 30-inch | 41.1 cfs | 29.60 | 30" RCP |
| G3-G4 | 3.8 cfs | 12.8 cfs | 1.10% | 24-inch | 23.8 cfs | 10.28 | 24" RCP |
| G4-H1 | 5.7 cfs | 16.4 cfs | 1.10% | 24-inch | 23.8 cfs | 37.88 | 24" RCP |
| H2-H3 | 45.8 cfs | 115.4 cfs | 0.60% | 48-inch | 111.6 cfs | 45.54 | HERCP |
| | | | | | | | |
| **Pair at Inflow 'J'** | | | | Equivalent | | | |
| J2-J1 | 1.0 cfs | 2.6 cfs | 0.50% | 24-inch | 16.0 cfs | 35.87 | HERCP |
| J1-End | 1.8 cfs | 4.1 cfs | 0.60% | 24-inch | 17.6 cfs | 76.59 | HERCP |
| | | | | | | | |
| **Box Culvert Poa Annua Street** | | | | Equivalent | | | |
| PA1-PA2 | | 102.1 cfs | 0.50% | 50-inch | 113.6 cfs | 97.06 | C.B.C. |




ULTIMATE CONDITION (FILINGS 10-12)

| DETENTION BASIN 'D' DATA | | |
|---|---|---|
| | REQUIRED VOLUME | RELEASE RATE |
| WQCV | 0.827 AC-FT | 1.4 CFS |
| EURV | 1.035 AC-FT | 1.5 CFS |
| 100-YR | 2.414 AC-FT | 53.5 CFS |
| 100-YR + ½ WQCV | 2.828 AC-FT | 53.5 CFS |
| TOP OF EMBANKMENT ELEVATION: 5679.14 | | |

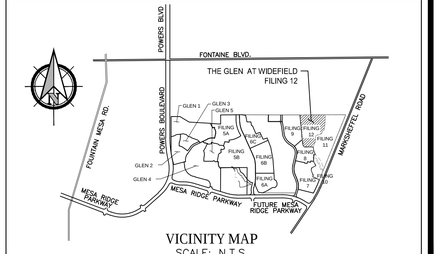
LEGEND

- D-1 / 48.60 / 0.15 0.50 — DRAINAGE BASIN 'D-n' TRIBUTARY; DRAINAGE BASIN ACRES; C5 RUNOFF COEF; C100 RUNOFF COEFFICIENT
- 2.2 cfs / 4.3 cfs — 5-YEAR RUNOFF; 100-YEAR RUNOFF
- ~2.0% — DIRECTIONAL FLOW ARROW AND SLOPE
- DRAINAGE BASIN BOUNDARY
- 1 — DESIGN POINT
- TIME OF CONCENTRATION PATH
- 10 — HYDRAULIC STRUCTURE IDENTIFIER
- S10 — STORM SEWER IDENTIFIER
- PROPOSED STORM SEWER PIPE
- PROPOSED STORM SEWER MANHOLE
- PROPOSED STORM DRAINAGE CURB INLET
- (6020) — EXISTING CONTOURS
- SANITARY LINE & STRUCTURE
- WATER LINE & FITTINGS
- EX. STORM LINE & STRUCTURE

DESIGN POINT FLOWS

| | 5-YEAR | 100-YEAR | | 5-YEAR | 100-YEAR |
|---|---|---|---|---|---|
| 68 | 1.4 cfs | 4.2 cfs | 83 | 6.4 cfs | 18.5 cfs |
| 69 | 2.8 cfs | 8.1 cfs | 84 | 3.0 cfs | 8.6 cfs |
| 70 | 1.7 cfs | 5.0 cfs | 84.1 | 2.5 cfs | 7.3 cfs |
| 71 | 3.4 cfs | 9.9 cfs | 85 | 7.3 cfs | 21.2 cfs |
| 72 | 1.9 cfs | 5.4 cfs | 86 | 10.8 cfs | 31.2 cfs |
| 73 | 0.5 cfs | 1.6 cfs | 87 | 12.0 cfs | 34.6 cfs |
| 74 | 4.5 cfs | 13.1 cfs | 88 | 13.5 cfs | 39.0 cfs |
| 75 | 10.2 cfs | 29.6 cfs | 89 | 0.3 cfs | 0.7 cfs |
| 76 | 11.6 cfs | 33.7 cfs | 90 | 1.3 cfs | 3.6 cfs |
| 77 | 2.4 cfs | 6.9 cfs | 91 | 4.4 cfs | 12.7 cfs |
| 78 | 13.8 cfs | 39.9 cfs | 92a | 0.7 cfs | 2.0 cfs |
| 79 | 4.8 cfs | 13.9 cfs | 92b | 6.4 cfs | 18.5 cfs |
| 80 | 4.5 cfs | 13.0 cfs | 93a | 32.5 cfs | 94.1 cfs |
| 81 | 5.7 cfs | 16.4 cfs | 93b | 2.3 cfs | 5.9 cfs |
| 82 | 3.8 cfs | 11.1 cfs | 94 | 51.3 cfs | 154.8 cfs |
| | | | 10-1 | 4.0 cfs | 41.8 cfs |
| | | | 98 | 0.9 cfs | 3.8 cfs |
| | | | 99 | 1.1 cfs | 4.6 cfs |
| | | | 10-2 | | 146.6 cfs |

0 100' 200'
SCALE: 1"=100'




VICINITY MAP
SCALE: N.T.S.

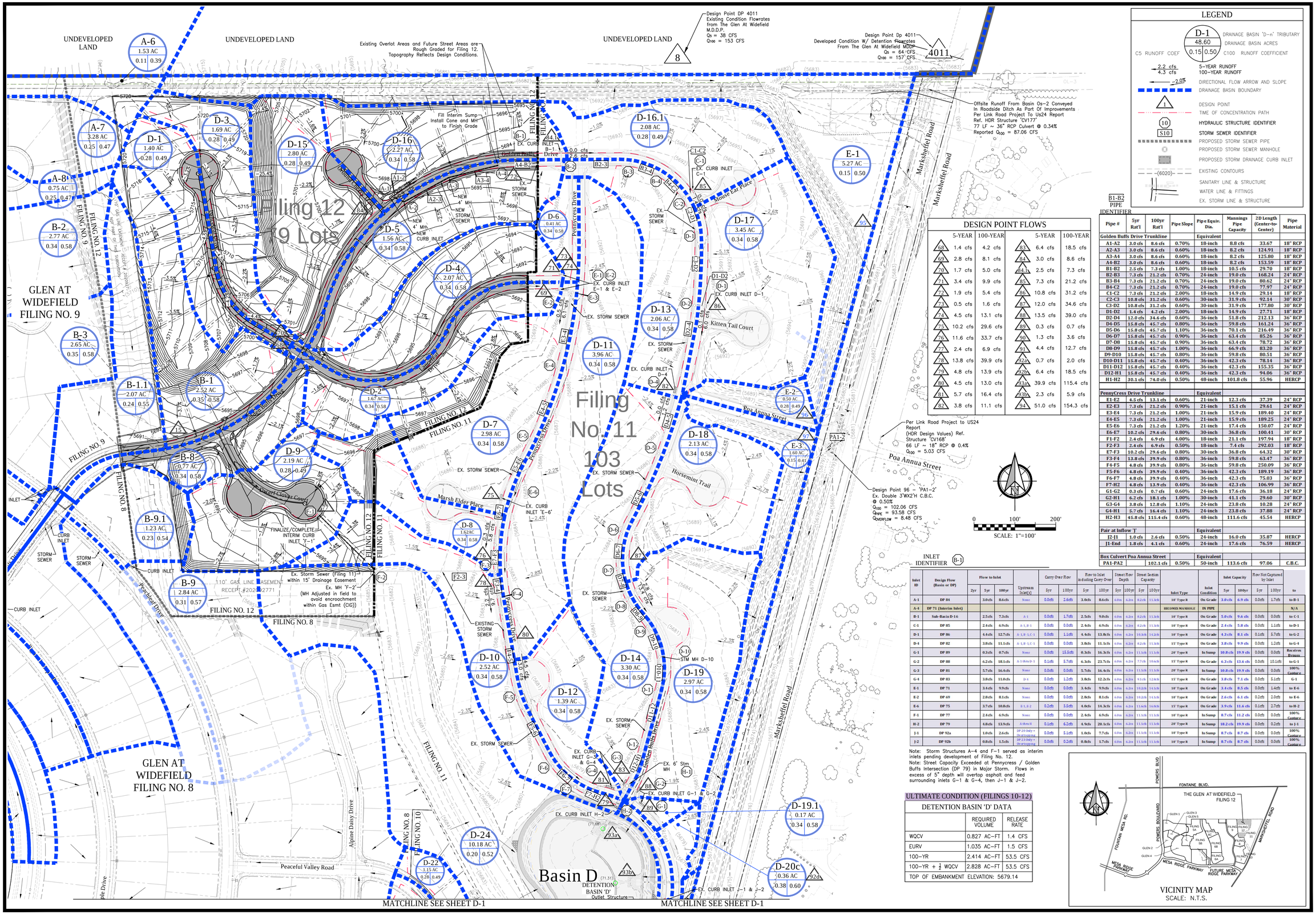

Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
(719) 630-7342


WIDEFIELD Investment Group

# THE GLEN AT WIDEFIELD
## FILING NO. 12
## DEVELOPED DRAINAGE BASINS (OFF-SITE AREA)
El Paso, County, Colorado

| | |
|---|---|
| Project No.: | 19016 |
| Date: | June 7th, 2023 |
| Design: | MJK |
| Drawn: | MJK |
| Check: | AMcC |
| Revisions: | |

SHEET
D-1
2 of 3 Sheets




## LEGEND

- D-1 / 48.60 / 0.15 / 0.50 — DRAINAGE BASIN 'D-n' TRIBUTARY; DRAINAGE BASIN ACRES; C5 RUNOFF COEF; C100 RUNOFF COEFFICIENT
- 2.2 cfs / 4.3 cfs — 5-YEAR RUNOFF; 100-YEAR RUNOFF
- 2.0% — DIRECTIONAL FLOW ARROW AND SLOPE
- DRAINAGE BASIN BOUNDARY
- 1 — DESIGN POINT
- TIME OF CONCENTRATION PATH
- 10 — HYDRAULIC STRUCTURE IDENTIFIER
- S10 — STORM SEWER IDENTIFIER
- PROPOSED STORM SEWER PIPE
- PROPOSED STORM SEWER MANHOLE
- PROPOSED STORM DRAINAGE CURB INLET
- (6020) — EXISTING CONTOURS
- SANITARY LINE & STRUCTURE
- WATER LINE & FITTINGS
- EX. STORM LINE & STRUCTURE

B1-B2 — PIPE IDENTIFIER

## DESIGN POINT FLOWS

| | 5-YEAR | 100-YEAR | | 5-YEAR | 100-YEAR |
|---|---|---|---|---|---|
| 68 | 1.4 cfs | 4.2 cfs | 83 | 6.4 cfs | 18.5 cfs |
| 69 | 2.8 cfs | 8.1 cfs | 84 | 3.0 cfs | 8.6 cfs |
| 70 | 1.7 cfs | 5.0 cfs | 84.1 | 2.5 cfs | 7.3 cfs |
| 71 | 3.4 cfs | 9.9 cfs | 85 | 7.3 cfs | 21.2 cfs |
| 72 | 1.9 cfs | 5.4 cfs | 86 | 10.8 cfs | 31.2 cfs |
| 73 | 0.5 cfs | 1.6 cfs | 87 | 12.0 cfs | 34.6 cfs |
| 74 | 4.5 cfs | 13.1 cfs | 88 | 13.5 cfs | 39.0 cfs |
| 75 | 10.2 cfs | 29.6 cfs | 89 | 0.3 cfs | 0.7 cfs |
| 76 | 11.6 cfs | 33.7 cfs | 90 | 1.3 cfs | 3.6 cfs |
| 77 | 2.4 cfs | 6.9 cfs | 91 | 4.4 cfs | 12.7 cfs |
| 78 | 13.8 cfs | 39.9 cfs | 92a | 0.7 cfs | 2.0 cfs |
| 79 | 4.8 cfs | 13.9 cfs | 92b | 6.4 cfs | 18.5 cfs |
| 80 | 4.5 cfs | 13.0 cfs | 93a | 39.9 cfs | 115.4 cfs |
| 81 | 5.7 cfs | 16.4 cfs | 93b | 2.3 cfs | 5.9 cfs |
| 82 | 3.8 cfs | 11.1 cfs | 94 | 51.0 cfs | 154.3 cfs |

| Pipe # | 5yr Rat'l | 100yr Rat'l | Pipe Slope | Pipe Equiv. Dia. | Mannings Pipe Capacity | 2D Length (Center-to-Center) | Pipe Material |
|---|---|---|---|---|---|---|---|
| **Golden Buffs Drive Trunkline** | | | | **Equivalent** | | | |
| A1-A2 | 3.0 cfs | 8.6 cfs | 0.70% | 18-inch | 8.8 cfs | 33.67 | 18" RCP |
| A2-A3 | 3.0 cfs | 8.6 cfs | 0.60% | 18-inch | 8.2 cfs | 124.91 | 18" RCP |
| A3-A4 | 3.0 cfs | 8.6 cfs | 0.60% | 18-inch | 8.2 cfs | 125.80 | 18" RCP |
| A4-B2 | 3.0 cfs | 8.6 cfs | 0.60% | 18-inch | 8.2 cfs | 153.59 | 18" RCP |
| B1-B2 | 2.5 cfs | 7.3 cfs | 1.00% | 18-inch | 10.5 cfs | 29.70 | 18" RCP |
| B2-B3 | 7.3 cfs | 21.2 cfs | 0.70% | 24-inch | 19.0 cfs | 168.24 | 24" RCP |
| B3-B4 | 7.3 cfs | 21.2 cfs | 0.70% | 24-inch | 19.0 cfs | 80.62 | 24" RCP |
| B4-C2 | 7.3 cfs | 21.2 cfs | 0.70% | 24-inch | 19.0 cfs | 77.97 | 24" RCP |
| C1-C2 | 7.3 cfs | 21.2 cfs | 2.00% | 18-inch | 14.9 cfs | 29.14 | 18" RCP |
| C2-C3 | 10.8 cfs | 31.2 cfs | 0.60% | 30-inch | 31.9 cfs | 92.14 | 30" RCP |
| C3-D2 | 10.8 cfs | 31.2 cfs | 0.60% | 30-inch | 31.9 cfs | 177.80 | 30" RCP |
| D1-D2 | 1.4 cfs | 4.2 cfs | 2.00% | 18-inch | 14.9 cfs | 27.71 | 18" RCP |
| D2-D4 | 12.0 cfs | 34.6 cfs | 0.60% | 36-inch | 51.8 cfs | 212.13 | 36" RCP |
| D4-D5 | 15.8 cfs | 45.7 cfs | 0.80% | 36-inch | 59.8 cfs | 161.24 | 36" RCP |
| D5-D6 | 15.8 cfs | 45.7 cfs | 1.10% | 36-inch | 70.1 cfs | 216.49 | 36" RCP |
| D6-D7 | 15.8 cfs | 45.7 cfs | 0.90% | 36-inch | 63.4 cfs | 85.26 | 36" RCP |
| D7-D8 | 15.8 cfs | 45.7 cfs | 0.90% | 36-inch | 63.4 cfs | 78.72 | 36" RCP |
| D8-D9 | 15.8 cfs | 45.7 cfs | 1.00% | 36-inch | 66.9 cfs | 83.20 | 36" RCP |
| D9-D10 | 15.8 cfs | 45.7 cfs | 0.80% | 36-inch | 59.8 cfs | 80.51 | 36" RCP |
| D10-D11 | 15.8 cfs | 45.7 cfs | 0.40% | 36-inch | 42.3 cfs | 78.14 | 36" RCP |
| D11-D12 | 15.8 cfs | 45.7 cfs | 0.40% | 36-inch | 42.3 cfs | 155.35 | 36" RCP |
| D12-H1 | 15.8 cfs | 45.7 cfs | 0.40% | 36-inch | 42.3 cfs | 94.06 | 36" RCP |
| H1-H2 | 30.1 cfs | 74.0 cfs | 0.50% | 48-inch | 101.8 cfs | 55.96 | HERCP |
| **PennyCress Drive Trunkline** | | | | **Equivalent** | | | |
| E1-E2 | 4.5 cfs | 13.1 cfs | 0.60% | 21-inch | 12.3 cfs | 37.39 | 24" RCP |
| E2-E3 | 7.3 cfs | 21.2 cfs | 0.90% | 21-inch | 15.1 cfs | 29.61 | 24" RCP |
| E3-E4 | 7.3 cfs | 21.2 cfs | 1.00% | 21-inch | 15.9 cfs | 189.40 | 24" RCP |
| E4-E5 | 7.3 cfs | 21.2 cfs | 1.00% | 21-inch | 15.9 cfs | 189.25 | 24" RCP |
| E5-E6 | 7.3 cfs | 21.2 cfs | 1.20% | 21-inch | 17.4 cfs | 150.07 | 24" RCP |
| E6-E7 | 10.2 cfs | 29.6 cfs | 0.80% | 30-inch | 36.8 cfs | 100.41 | 30" RCP |
| F1-F2 | 2.4 cfs | 6.9 cfs | 4.00% | 18-inch | 21.1 cfs | 197.94 | 18" RCP |
| F2-F3 | 2.4 cfs | 6.9 cfs | 0.50% | 18-inch | 7.4 cfs | 292.03 | 18" RCP |
| E7-F3 | 10.2 cfs | 29.6 cfs | 0.80% | 30-inch | 36.8 cfs | 64.32 | 30" RCP |
| F3-F4 | 13.8 cfs | 39.9 cfs | 0.80% | 36-inch | 59.8 cfs | 63.47 | 36" RCP |
| F4-F5 | 4.8 cfs | 39.9 cfs | 0.80% | 36-inch | 59.8 cfs | 250.09 | 36" RCP |
| F5-F6 | 4.8 cfs | 39.9 cfs | 0.40% | 36-inch | 42.3 cfs | 189.19 | 36" RCP |
| F6-F7 | 4.8 cfs | 39.9 cfs | 0.40% | 36-inch | 42.3 cfs | 75.03 | 36" RCP |
| F7-H2 | 4.8 cfs | 13.9 cfs | 0.40% | 36-inch | 42.3 cfs | 106.99 | 36" RCP |
| G1-G2 | 0.3 cfs | 0.7 cfs | 0.60% | 24-inch | 17.6 cfs | 36.18 | 24" RCP |
| G2-H1 | 6.2 cfs | 18.1 cfs | 1.00% | 30-inch | 41.1 cfs | 29.60 | 30" RCP |
| G3-G4 | 3.8 cfs | 12.8 cfs | 1.10% | 24-inch | 23.8 cfs | 10.28 | 24" RCP |
| G4-H1 | 5.7 cfs | 16.4 cfs | 1.10% | 24-inch | 23.8 cfs | 37.88 | 24" RCP |
| H2-H3 | 45.8 cfs | 115.4 cfs | 0.60% | 48-inch | 111.6 cfs | 45.54 | HERCP |
| **Pair at Inflow 'J'** | | | | **Equivalent** | | | |
| J2-J1 | 1.0 cfs | 2.6 cfs | 0.50% | 24-inch | 16.0 cfs | 35.87 | HERCP |
| J1-End | 1.8 cfs | 4.1 cfs | 0.60% | 24-inch | 17.6 cfs | 76.59 | HERCP |
| **Box Culvert Poa Annua Street** | | | | **Equivalent** | | | |
| PA1-PA2 | | 102.1 cfs | 0.50% | 50-inch | 113.6 cfs | 97.06 | C.B.C. |

INLET IDENTIFIER B-1

| Inlet ID | Design Flow (Basin or DP) | Flow to Inlet 2yr | Flow to Inlet 5yr | Flow to Inlet 100yr | Upstream Inlet(s) | Carry Over Flow 5yr | Carry Over Flow 100yr | Flow to Inlet including Carry Over 5yr | Flow to Inlet including Carry Over 100yr | Street Flow Depth 5yr | Street Flow Depth 100yr | Street Section Capacity 5yr | Street Section Capacity 100yr | Inlet Type | Inlet Condition | Inlet Capacity 5yr | Inlet Capacity 100yr | Flow Not Captured by Inlet 5yr | Flow Not Captured by Inlet 100yr | to |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A-1 | DP 84 | | 3.0cfs | 8.6cfs | None | 0.0cfs | 2.6cfs | 3.0cfs | 8.6cfs | 6.0in | 6.2in | 8.2cfs | 11.3cfs | 10' Type R | On Grade | 3.0 cfs | 6.9 cfs | 0.0cfs | 1.7cfs | to B-1 |
| A-4 | DP 71 (Interim Inlet) | | | | | | | | | | | | | BECOMES MA MHOLE | IN PIPE | | | | | N/A |
| B-1 | Sub-Basin D-16 | | 2.5cfs | 7.3cfs | A-1 | 0.0cfs | 1.7cfs | 2.5cfs | 9.0cfs | 6.0in | 6.2in | 8.2cfs | 11.3cfs | 10' Type R | On Grade | 2.4 cfs | 5.8 cfs | 0.0cfs | 1.1cfs | to C-1 |
| C-1 | DP 85 | | 2.4cfs | 6.9cfs | A-1, B-1 | 0.0cfs | 0.0cfs | 2.4cfs | 6.9cfs | 6.0in | 6.2in | 8.2cfs | 11.3cfs | 10' Type R | On Grade | 2.4 cfs | 5.8 cfs | 0.0cfs | 1.1cfs | to D-1 |
| D-1 | DP 86 | | 4.4cfs | 12.7cfs | A-1, B-1, C-1 | 0.0cfs | 1.1cfs | 4.4cfs | 13.8cfs | 6.0in | 6.2in | 10.3cfs | 14.2cfs | 10' Type R | On Grade | 4.3 cfs | 8.1 cfs | 0.1cfs | 5.7cfs | to G-2 |
| D-4 | DP 82 | | 3.8cfs | 11.1cfs | A-1, B-1, C-1 | 0.0cfs | 0.0cfs | 3.8cfs | 11.1cfs | 6.0in | 6.2in | 8.2cfs | 11.3cfs | 15' Type R | On Grade | 3.8 cfs | 9.9 cfs | 0.0cfs | 1.2cfs | to G-4 |
| G-1 | DP 89 | | 0.3cfs | 0.7cfs | None | 0.0cfs | 15.5cfs | 0.3cfs | 16.3cfs | 6.0in | 6.2in | 11.3cfs | 11.3cfs | 20' Type R | In Sump | 10.8 cfs | 19.9 cfs | 0.0cfs | 0.0cfs | Receives Bypass |
| G-2 | DP 88 | | 6.2cfs | 18.1cfs | A-1 thru D-1 | 0.1cfs | 5.7cfs | 6.3cfs | 23.7cfs | 6.0in | 6.2in | 7.7cfs | 10.6cfs | 15' Type R | On Grade | 6.3 cfs | 13.6 cfs | 0.0cfs | 10.1cfs | to G-1 |
| G-3 | DP 81 | | 5.7cfs | 16.4cfs | None | 0.0cfs | 0.0cfs | 5.7cfs | 16.4cfs | 6.0in | 6.2in | 11.3cfs | 11.3cfs | 20' Type R | In Sump | 10.8 cfs | 19.9 cfs | 0.0cfs | 0.0cfs | 100% Capture |
| G-4 | DP 83 | | 3.8cfs | 11.0cfs | D-4 | 0.0cfs | 1.2cfs | 3.8cfs | 12.2cfs | 6.0in | 6.2in | 9.1cfs | 12.8cfs | 15' Type R | On Grade | 3.8 cfs | 7.1 cfs | 0.0cfs | 5.1cfs | G-1 |
| E-1 | DP 71 | | 3.4cfs | 9.9cfs | None | 0.0cfs | 0.0cfs | 3.4cfs | 9.9cfs | 6.0in | 6.2in | 10.2cfs | 14.1cfs | 10' Type R | On Grade | 3.4 cfs | 8.5 cfs | 0.0cfs | 1.4cfs | to E-6 |
| E-2 | DP 69 | | 2.8cfs | 8.1cfs | None | 0.0cfs | 0.0cfs | 2.8cfs | 8.1cfs | 6.0in | 6.2in | 10.2cfs | 14.1cfs | 10' Type R | On Grade | 2.6 cfs | 6.1 cfs | 0.2cfs | 2.0cfs | to E-6 |
| E-6 | DP 75 | | 3.7cfs | 10.8cfs | E-1, E-2 | 0.2cfs | 3.5cfs | 4.0cfs | 14.3cfs | 6.0in | 6.2in | 11.6cfs | 16.0cfs | 15' Type R | On Grade | 3.9 cfs | 11.6 cfs | 0.1cfs | 2.7cfs | to H-2 |
| F-1 | DP 77 | | 2.4cfs | 6.9cfs | None | 0.0cfs | 0.0cfs | 2.4cfs | 6.9cfs | 6.0in | 6.2in | 11.3cfs | 11.3cfs | 10' Type R | In Sump | 8.7 cfs | 11.2 cfs | 0.0cfs | 0.0cfs | 100% Capture |
| H-2 | DP 79 | | 4.8cfs | 13.9cfs | A thru H | 0.1cfs | 6.2cfs | 4.9cfs | 20.1cfs | 6.0in | 6.2in | 11.3cfs | 11.3cfs | 20' Type R | In Sump | 10.2 cfs | 19.9 cfs | 0.0cfs | 0.2cfs | to J-1 |
| J-1 | DP 92a | | 1.0cfs | 2.6cfs | DP 20 Only + Overtopping | 0.0cfs | 5.1cfs | 1.0cfs | 7.7cfs | 6.0in | 6.2in | 11.3cfs | 11.3cfs | 10' Type R | In Sump | 8.7 cfs | 8.7 cfs | 0.0cfs | 0.0cfs | 100% Capture |
| J-2 | DP 92b | | 0.8cfs | 1.5cfs | DP 23 Only + Overtopping | 0.0cfs | 0.2cfs | 0.8cfs | 1.7cfs | 6.0in | 6.2in | 11.3cfs | 11.3cfs | 10' Type R | In Sump | 8.7 cfs | 8.7 cfs | 0.0cfs | 0.0cfs | 100% Capture |

Note: Storm Structures A-4 and F-1 served as interim inlets pending development of Filing No. 12.
Note: Street Capacity Exceeded at Pennycress / Golden Buffs Intersection (DP 79) in Major Storm. Flows in excess of 5" depth will overtop asphalt and feed surrounding inlets G-1 & G-4, then J-1 & J-2.

## ULTIMATE CONDITION (FILINGS 10-12)

### DETENTION BASIN 'D' DATA

| | REQUIRED VOLUME | RELEASE RATE |
|---|---|---|
| WQCV | 0.827 AC-FT | 1.4 CFS |
| EURV | 1.035 AC-FT | 1.5 CFS |
| 100-YR | 2.414 AC-FT | 53.5 CFS |
| 100-YR + ½ WQCV | 2.828 AC-FT | 53.5 CFS |
| TOP OF EMBANKMENT ELEVATION: 5679.14 | | |




VICINITY MAP
SCALE: N.T.S.


Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
(719) 630-7342


WIDEFIELD Investment Group

# THE GLEN AT WIDEFIELD
## FILING NO. 12
## DEVELOPED DRAINAGE BASINS (FULL BUILD-OUT)
El Paso, County, Colorado

| | |
|---|---|
| Project No.: | 19016 |
| Date: | March 30, 2023 |
| Design: | MJK |
| Drawn: | MJK |
| Check: | AMcC |
| Revisions: | |

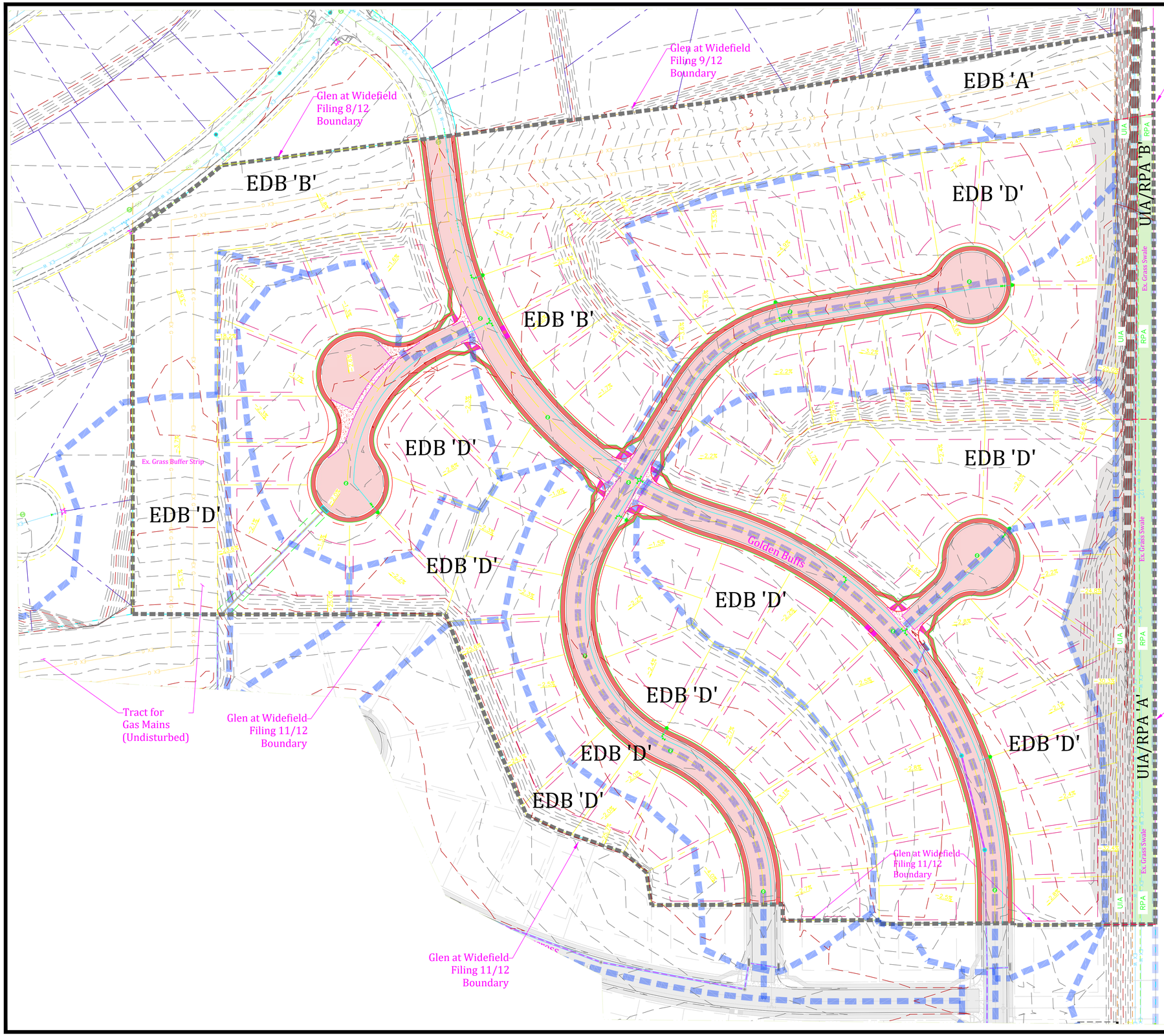
SHEET

D-2

# APPENDIX E

## IRF Reduction Calculations and Exhibits

**IRF Zones A & B (UIA/RPA)**
**IRF UD_BMP Spreadsheet Results**




0 60' 120'

SCALE: 1" = 60'

## LEGEND

- EDB 'D' — Detention Basin Designation
- Drainage Basin Boundary
- Flow Direction
- UIA 'A' — UIA (Unconnected Impervious Area)
- UIA/RPA interface
- RPA 'B' — RPA (Receiving Pervious Area)
- IRF Zone Designation
- DCIA — DCIA (Directly-Connected Impervious Area)
- Flowline

**IRF REDUCTION AREA SUMMARY**

| | UIA | RPA | SPA | DCIA | Exempt |
|---|---|---|---|---|---|
| A | 38539.4814 | 17719.0123 | 0 | 0 | 0 |
| B | 20177.5042 | 8604.9995 | 0 | 0 | 0 |
| Summ: | 58716.9856 | 26324.0118 | 0 | 0 | 0 |
| Acreage: | 1.35 | 0.60 | 0.00 | 0.00 | 0.00 |


Kiowa Engineering Corporation
1604 South 21st Street
Colorado Springs, Colorado 80904
(719) 630-7342


WIDEFIELD Investment Group

# GLEN AT WIDEFIELD NO. 12

## IR Exhibit

All On-Site Areas

EL PASO, COUNTY, COLORADO

| | |
|---|---|
| Project No.: | 19016 |
| Date: | June 7th, 2023 |
| Design: | MK |
| Drawn: | MJK |
| Check: | AWMc |
| Revisions: | |

SHEET

IRF-1

1 of 1 Sheets

## Design Procedure Form: Runoff Reduction

UD-BMP (Version 3.07, March 2018)



| | |
|---|---|
| **Designer:** | **AWMc** |
| **Company:** | **Kiowa Engineering Corporation** |
| **Date:** | **May 7, 2020** |
| **Project:** | **The Glen Filing No 10 & 11 - 'Runoff Reduction' 53676** |
| **Location:** | **Widefield, CO** |

### SITE INFORMATION (User Input in Blue Cells)

| | | |
|---|---|---|
| WQCV Rainfall Depth | 0.60 | inches |
| Depth of Average Runoff Producing Storm, $d_6$ = | 0.43 | inches (for Watersheds Outside of the Denver Region, Figure 3-1 in USDCM Vol. 3) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Area Type | UIA:RPA | | UIA:RPA | UIA:RPA | UIA:RPA | UIA:RPA | | | | | | |
| Area ID | 1 | | 3 | 4 | 5 | 2 | | | | | | |
| Downstream Design Point ID | 1 | | 3 | 4 | 5 | 2 | | | | | | |
| Downstream BMP Type | None | | None | None | None | None | | | | | | |
| DCIA ($ft^2$) | -- | | -- | -- | -- | -- | | | | | | |
| UIA ($ft^2$) | 13,193 | | 28,509 | 23,724 | 16,086 | 15,564 | | | | | | |
| RPA ($ft^2$) | 27,826 | | 16,858 | 13,992 | 29,565 | 23,737 | | | | | | |
| SPA ($ft^2$) | -- | | -- | -- | -- | -- | | | | | | |
| HSG A (%) | 0% | | 0% | 0% | 0% | 0% | | | | | | |
| HSG B (%) | 0% | | 0% | 0% | 0% | 0% | | | | | | |
| HSG C/D (%) | 100% | | 100% | 100% | 100% | 100% | | | | | | |
| Average Slope of RPA (ft/ft) | 0.250 | | 0.250 | 0.250 | 0.150 | 0.150 | | | | | | |
| UIA:RPA Interface Width (ft) | 62.80 | | 80.00 | 80.00 | 80.00 | 80.00 | | | | | | |

### CALCULATED RUNOFF RESULTS

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Area ID | 1 | | 3 | 4 | 5 | 2 | | | | | | |
| UIA:RPA Area ($ft^2$) | 41,020 | #REF! | 45,367 | 37,716 | 45,651 | 39,301 | | | | | | |
| L / W Ratio | 10.40 | #REF! | 7.09 | 5.89 | 7.13 | 6.14 | | | | | | |
| UIA / Area | 0.3216 | #REF! | 0.6284 | 0.6290 | 0.3524 | 0.3960 | | | | | | |
| Runoff (in) | 0.00 | | 0.07 | 0.08 | 0.00 | 0.00 | | | | | | |
| Runoff ($ft^3$) | 0 | | 268 | 237 | 0 | 0 | | | | | | |
| Runoff Reduction ($ft^3$) | 550 | | 920 | 751 | 670 | 649 | | | | | | |

### CALCULATED WQCV RESULTS

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Area ID | 1 | | 3 | 4 | 5 | 2 | | | | | | |
| WQCV ($ft^3$) | 550 | | 1188 | 989 | 670 | 649 | | | | | | |
| WQCV Reduction ($ft^3$) | 550 | | 920 | 751 | 670 | 649 | | | | | | |
| WQCV Reduction (%) | 100% | | 77% | 76% | 100% | 100% | | | | | | |
| Untreated WQCV ($ft^3$) | 0 | | 268 | 237 | 0 | 0 | | | | | | |

### CALCULATED DESIGN POINT RESULTS (sums results from all columns with the same Downstream Design Point ID)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Downstream Design Point ID | 1 | 3 | 4 | 5 | 2 | | | | | | | |
| DCIA ($ft^2$) | 0 | 0 | 0 | 0 | 0 | | | | | | | |
| UIA ($ft^2$) | 13,193 | 28,509 | 23,724 | 16,086 | 15,564 | | | | | | | |
| RPA ($ft^2$) | 27,826 | 16,858 | 13,992 | 29,565 | 23,737 | | | | | | | |
| SPA ($ft^2$) | 0 | 0 | 0 | 0 | 0 | | | | | | | |
| Total Area ($ft^2$) | 41,020 | 45,367 | 37,716 | 45,651 | 39,301 | | | | | | | |
| Total Impervious Area ($ft^2$) | 13,193 | 28,509 | 23,724 | 16,086 | 15,564 | | | | | | | |
| WQCV ($ft^3$) | 550 | 1,188 | 989 | 670 | 649 | | | | | | | |
| WQCV Reduction ($ft^3$) | 550 | 920 | 751 | 670 | 649 | | | | | | | |
| WQCV Reduction (%) | 100% | 77% | 76% | 100% | 100% | | | | | | | |
| Untreated WQCV ($ft^3$) | 0 | 268 | 237 | 0 | 0 | | | | | | | |

### CALCULATED SITE RESULTS (sums results from all columns in worksheet)

| | |
|---|---|
| Total Area ($ft^2$) | 209,054 |
| Total Impervious Area ($ft^2$) | 97,076 |
| WQCV ($ft^3$) | 4,045 |
| WQCV Reduction ($ft^3$) | 3,540 |
| WQCV Reduction (%) | 88% |
| Untreated WQCV ($ft^3$) | 505 |