Preliminary

03/03/2025 3:50:02 PM

NORTH CAROLINA PROFESSIONAL SEAL 36128 ENGINEER JAKOB P. KLEIN

Digitally signed by Jakob Klein
Date: 2025.03.03 15:50:17-05'00'

KALAS 5 SITE

This digital Flood Insurance Rate Map (FIRM) was produced through a unique cooperative partnership between the State of North Carolina and the Federal Emergency Management Agency (FEMA). The State of North Carolina has implemented a long term approach to floodplain management to decrease the costs associated with flooding. This is demonstrated by the State's commitment to map flood hazard areas at the local level. As a part of this effort, the State of North Carolina has joined in a Cooperating Technical State agreement with FEMA to produce and maintain this digital FIRM.

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR ZONE DESCRIPTIONS AND INDEX MAP FOR FIRM PANEL LAYOUT

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTPS://FRIS.NC.GOV/FRIS

HTTPS://MSC.FEMA.GOV

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A,V, A99* With BFE or Depth *Zone AE, AO, AH, VE, AR*
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% Annual Chance Flood with Average Depth Less Than One Foot or With Drainage Areas of Less Than One Square Mile *Zone X*
	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	Area with Reduced Flood Risk due to Levee See Notes *Zone X*
OTHER AREAS	Areas Determined to be Outside the 0.2% Annual Chance Floodplain *Zone X*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
	012 18.2 Cross Sections with 1% Annual Chance Water Surface Elevation (BFE)
	8 Coastal Transect
	Coastal Transect Baseline
OTHER FEATURES	Profile Baseline
	Hydrographic Feature
	Limit of Study
	Jurisdiction Boundary

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at https://msc.fema.gov. An accompanying Flood Insurance Study report, Letter of Map Revision (LOMR) or Letter of Map Amendment (LOMA) revising portions of this panel, and digital versions of this FIRM may be available. Visit the North Carolina Floodplain Mapping Program website at https://flood.nc.gov/ncflood, or contact the FEMA Map Service Center.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in the community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Flood Insurance Study (FIS) means an examination, evaluation, and determination of flood hazards, corresponding water surface elevations, flood hazard risk zones, and other flood data in a community issued by the North Carolina Floodplain Mapping Program (NCFMP). The Flood Insurance Study (FIS) is comprised of the following products used together: the Digital Flood Hazard Database, the Water Surface Elevation Rasters, the digitally derived, autogenerated Flood Insurance Rate Map and the Flood Insurance Survey Report. A Flood Insurance Survey is a compilation and presentation of flood risk data for specific watercourses, lakes, and coastal flood hazard areas within a community. This report contains detailed flood elevation data, data tables and FIRM indices. When a flood study is completed for the NFIP, the digital information, reports and maps are assembled into an FIS. Information shown on this FIRM is provided in digital format by the NCFMP. Base map information shown on this FIRM was provided in digital format by the NCFMP. The source of this information can be determined from the metadata available in the digital FLOOD database and in the Technical Support Data Notebook (TSDN).

ACCREDITED LEVEE NOTES TO USERS: If an accredited levee note appears on this panel check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at https://www.fema.gov/national-flood-insurance-program.

PROVISIONALLY ACCREDITED LEVEE NOTES TO USERS: If a Provisionally Accredited Levee (PAL) note appears on this panel, check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To maintain accreditation, the levee owner or community is required to submit the data and documentation necessary to comply with Section 65.10 of the NFIP regulations. If the community or owner does not provide the necessary data and documentation or if the data and documentation provided indicate the levee system does not comply with Section 65.10 requirements, FEMA will revise the flood hazard and risk information for this area to reflect de-accreditation of the levee system. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at https://www.fema.gov/national-flood-insurance-program.

LIMIT OF MODERATE WAVE ACTION NOTES TO USERS: For some coastal flooding zones the AE Zone category has been divided by a Limit of Moderate Wave Action (LiMWA). The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. The effects of wave hazards between the VE Zone and the LiMWA (or between the shoreline and the LiMWA for areas where VE Zones are not identified) will be similar to, but less severe than those in the VE Zone.

Limit of Moderate Wave Action (LiMWA)

SCALE

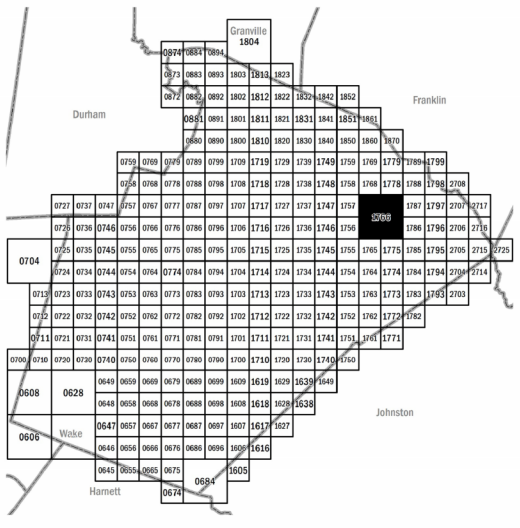
Map Projection:
North Carolina State Plane Projection Feet (Zone 3200)
Datum: NAD 1983 (Horizontal), NAVD 1988 (Vertical)

1 inch = 1,000 feet 1:12,000

0 500 1,000 2,000 Feet

0 150 300 600 Meters

PANEL LOCATOR



FEMA National Flood Insurance Program

NORTH CAROLINA FLOODPLAIN MAPPING PROGRAM
NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

NORTH CAROLINA

PANEL 1766

FEMA

Panel Contains:

COMMUNITY	CID	PANEL	SUFFIX
ROLESVILLE, TOWN OF	370468	1766	K
WAKE COUNTY	370368	1766	K

VERSION NUMBER
2.3.3.2

MAP NUMBER
3720176600K

MAP REVISED
July 19, 2022

NOAA Atlas 14, Volume 2, Version 3
Location name: Wake Forest, North Carolina, USA*
Latitude: 35.8876°, Longitude: -78.4479°
Elevation: 396 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**4.85** (4.44-5.30)	**5.63** (5.16-6.14)	**6.41** (5.87-7.00)	**7.20** (6.59-7.86)	**7.99** (7.28-8.72)	**8.64** (7.82-9.41)	**9.20** (8.29-10.0)	**9.71** (8.70-10.6)	**10.3** (9.12-11.2)	**10.8** (9.49-11.8)
10-min	**3.87** (3.55-4.24)	**4.50** (4.12-4.91)	**5.13** (4.70-5.60)	**5.76** (5.27-6.28)	**6.37** (5.80-6.95)	**6.88** (6.23-7.49)	**7.31** (6.59-7.97)	**7.69** (6.89-8.39)	**8.12** (7.22-8.87)	**8.48** (7.48-9.29)
15-min	**3.22** (2.95-3.53)	**3.77** (3.46-4.12)	**4.33** (3.96-4.72)	**4.86** (4.44-5.30)	**5.38** (4.90-5.87)	**5.80** (5.26-6.33)	**6.16** (5.55-6.71)	**6.47** (5.80-7.06)	**6.81** (6.06-7.44)	**7.10** (6.26-7.77)
30-min	**2.21** (2.02-2.42)	**2.60** (2.39-2.85)	**3.07** (2.82-3.35)	**3.52** (3.22-3.84)	**3.99** (3.63-4.35)	**4.37** (3.96-4.76)	**4.72** (4.25-5.14)	**5.04** (4.51-5.50)	**5.42** (4.82-5.92)	**5.75** (5.07-6.29)
60-min	**1.38** (1.26-1.51)	**1.63** (1.50-1.78)	**1.97** (1.80-2.15)	**2.29** (2.10-2.50)	**2.66** (2.42-2.90)	**2.96** (2.68-3.23)	**3.25** (2.93-3.54)	**3.53** (3.16-3.86)	**3.89** (3.46-4.25)	**4.20** (3.70-4.59)
2-hr	**0.805** (0.732-0.889)	**0.958** (0.874-1.05)	**1.17** (1.06-1.28)	**1.38** (1.25-1.51)	**1.62** (1.46-1.77)	**1.83** (1.65-2.00)	**2.04** (1.82-2.23)	**2.25** (2.00-2.46)	**2.53** (2.22-2.77)	**2.78** (2.41-3.04)
3-hr	**0.568** (0.516-0.630)	**0.676** (0.617-0.746)	**0.828** (0.753-0.913)	**0.981** (0.890-1.08)	**1.17** (1.05-1.28)	**1.33** (1.19-1.46)	**1.50** (1.33-1.64)	**1.67** (1.47-1.83)	**1.90** (1.66-2.09)	**2.12** (1.82-2.32)
6-hr	**0.341** (0.311-0.377)	**0.407** (0.372-0.448)	**0.498** (0.454-0.548)	**0.591** (0.538-0.649)	**0.706** (0.638-0.773)	**0.810** (0.727-0.885)	**0.914** (0.814-0.998)	**1.02** (0.903-1.12)	**1.17** (1.02-1.28)	**1.31** (1.13-1.43)
12-hr	**0.200** (0.183-0.220)	**0.238** (0.219-0.261)	**0.293** (0.268-0.322)	**0.350** (0.319-0.383)	**0.420** (0.381-0.459)	**0.486** (0.436-0.529)	**0.552** (0.491-0.600)	**0.623** (0.548-0.677)	**0.721** (0.624-0.784)	**0.813** (0.693-0.884)
24-hr	**0.119** (0.110-0.128)	**0.144** (0.134-0.155)	**0.181** (0.168-0.195)	**0.211** (0.195-0.227)	**0.251** (0.232-0.271)	**0.284** (0.262-0.306)	**0.318** (0.292-0.343)	**0.353** (0.323-0.381)	**0.402** (0.365-0.434)	**0.441** (0.399-0.478)
2-day	**0.069** (0.064-0.074)	**0.083** (0.077-0.089)	**0.103** (0.096-0.111)	**0.120** (0.111-0.129)	**0.142** (0.132-0.153)	**0.160** (0.148-0.173)	**0.179** (0.164-0.193)	**0.198** (0.181-0.214)	**0.225** (0.204-0.243)	**0.246** (0.222-0.266)
3-day	**0.048** (0.045-0.052)	**0.058** (0.054-0.063)	**0.073** (0.068-0.078)	**0.084** (0.078-0.090)	**0.099** (0.092-0.107)	**0.112** (0.103-0.120)	**0.125** (0.115-0.134)	**0.138** (0.126-0.148)	**0.156** (0.142-0.168)	**0.171** (0.154-0.184)
4-day	**0.038** (0.036-0.041)	**0.046** (0.043-0.049)	**0.057** (0.053-0.061)	**0.066** (0.061-0.070)	**0.078** (0.072-0.083)	**0.087** (0.081-0.094)	**0.097** (0.090-0.104)	**0.108** (0.099-0.115)	**0.122** (0.111-0.131)	**0.133** (0.121-0.143)
7-day	**0.025** (0.024-0.027)	**0.030** (0.028-0.032)	**0.037** (0.035-0.040)	**0.042** (0.040-0.045)	**0.050** (0.046-0.053)	**0.056** (0.052-0.060)	**0.062** (0.057-0.066)	**0.068** (0.063-0.073)	**0.077** (0.070-0.083)	**0.084** (0.076-0.090)
10-day	**0.020** (0.019-0.021)	**0.024** (0.022-0.025)	**0.029** (0.027-0.031)	**0.033** (0.031-0.035)	**0.038** (0.036-0.041)	**0.042** (0.039-0.045)	**0.047** (0.043-0.050)	**0.051** (0.047-0.055)	**0.057** (0.052-0.061)	**0.062** (0.056-0.066)
20-day	**0.013** (0.012-0.014)	**0.016** (0.015-0.017)	**0.019** (0.018-0.020)	**0.021** (0.020-0.023)	**0.024** (0.023-0.026)	**0.027** (0.025-0.029)	**0.029** (0.027-0.031)	**0.032** (0.030-0.034)	**0.036** (0.033-0.038)	**0.038** (0.035-0.041)
30-day	**0.011** (0.010-0.012)	**0.013** (0.012-0.014)	**0.015** (0.014-0.016)	**0.017** (0.016-0.018)	**0.019** (0.018-0.020)	**0.021** (0.020-0.022)	**0.023** (0.021-0.024)	**0.024** (0.023-0.026)	**0.027** (0.025-0.029)	**0.029** (0.026-0.031)
45-day	**0.009** (0.009-0.010)	**0.011** (0.010-0.011)	**0.012** (0.012-0.013)	**0.014** (0.013-0.015)	**0.015** (0.015-0.016)	**0.017** (0.016-0.018)	**0.018** (0.017-0.019)	**0.019** (0.018-0.020)	**0.021** (0.019-0.022)	**0.022** (0.021-0.023)
60-day	**0.008** (0.008-0.009)	**0.010** (0.009-0.010)	**0.011** (0.010-0.012)	**0.012** (0.011-0.013)	**0.013** (0.013-0.014)	**0.014** (0.014-0.015)	**0.015** (0.015-0.016)	**0.016** (0.015-0.017)	**0.018** (0.017-0.019)	**0.019** (0.017-0.020)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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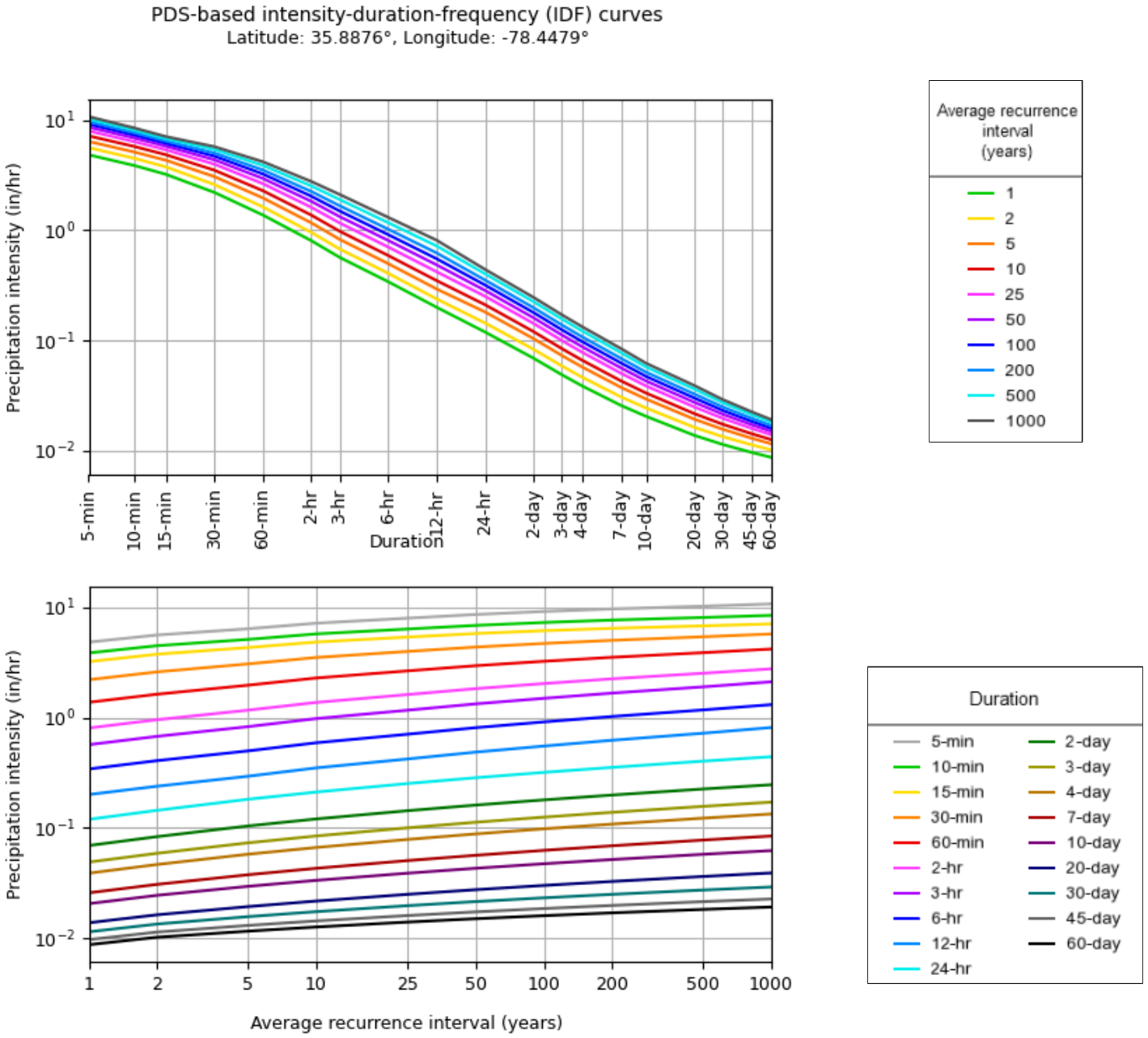
PF graphical



NOAA Atlas 14, Volume 2, Version 3

Created (GMT): Tue Nov 12 22:22:08 2024

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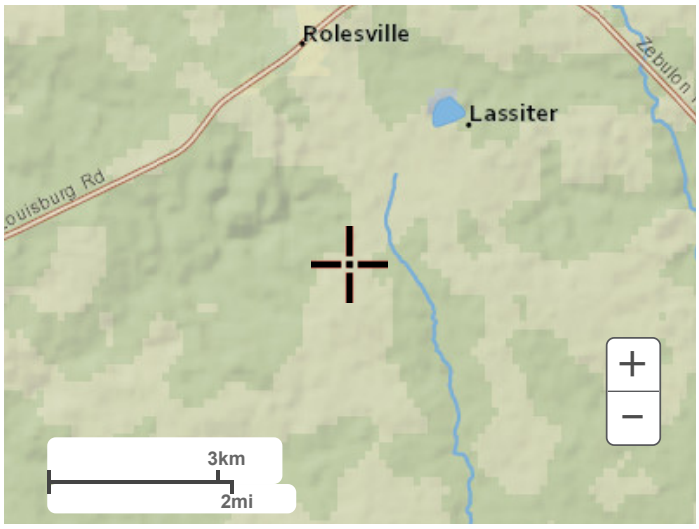
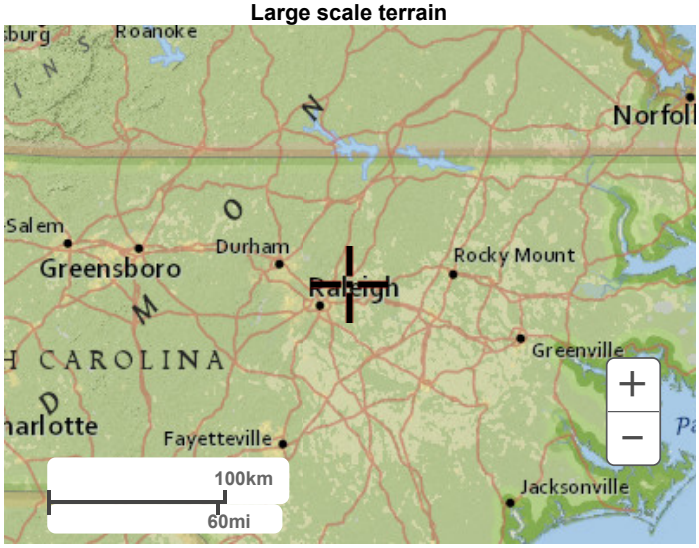
Maps & aerials

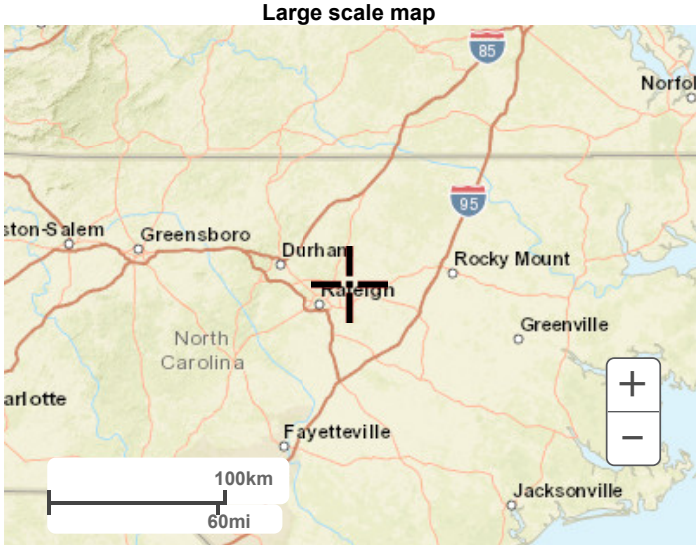
Small scale terrain



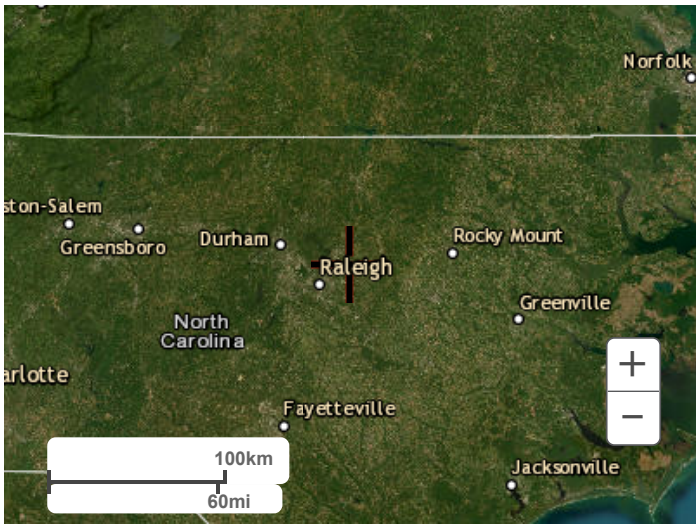
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

NOAA Atlas 14, Volume 2, Version 3
Location name: Wake Forest, North Carolina, USA*
Latitude: 35.9793°, Longitude: -78.5093°
Elevation: 377 ft**
* source: ESRI Maps
** source: USGS

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.403** (0.370-0.440)	**0.469** (0.430-0.512)	**0.535** (0.491-0.583)	**0.599** (0.549-0.653)	**0.664** (0.605-0.723)	**0.715** (0.648-0.778)	**0.760** (0.685-0.826)	**0.799** (0.716-0.871)	**0.843** (0.749-0.919)	**0.880** (0.776-0.962)
10-min	**0.644** (0.591-0.702)	**0.750** (0.688-0.818)	**0.858** (0.786-0.934)	**0.959** (0.877-1.04)	**1.06** (0.965-1.15)	**1.14** (1.03-1.24)	**1.21** (1.09-1.31)	**1.27** (1.14-1.38)	**1.33** (1.18-1.45)	**1.39** (1.22-1.52)
15-min	**0.804** (0.739-0.878)	**0.942** (0.865-1.03)	**1.08** (0.995-1.18)	**1.21** (1.11-1.32)	**1.34** (1.22-1.46)	**1.44** (1.31-1.57)	**1.53** (1.38-1.66)	**1.60** (1.43-1.74)	**1.68** (1.49-1.83)	**1.74** (1.54-1.90)
30-min	**1.10** (1.01-1.20)	**1.30** (1.20-1.42)	**1.54** (1.41-1.68)	**1.76** (1.61-1.91)	**1.99** (1.81-2.16)	**2.17** (1.97-2.36)	**2.34** (2.11-2.54)	**2.49** (2.23-2.71)	**2.67** (2.37-2.91)	**2.82** (2.48-3.08)
60-min	**1.38** (1.26-1.50)	**1.63** (1.50-1.78)	**1.98** (1.81-2.15)	**2.29** (2.09-2.49)	**2.65** (2.41-2.88)	**2.94** (2.67-3.20)	**3.22** (2.90-3.50)	**3.49** (3.13-3.80)	**3.83** (3.40-4.18)	**4.11** (3.63-4.50)
2-hr	**1.61** (1.47-1.77)	**1.92** (1.75-2.10)	**2.34** (2.14-2.57)	**2.74** (2.49-3.00)	**3.22** (2.90-3.51)	**3.63** (3.26-3.96)	**4.02** (3.59-4.38)	**4.42** (3.92-4.82)	**4.93** (4.33-5.38)	**5.38** (4.68-5.88)
3-hr	**1.71** (1.55-1.89)	**2.04** (1.86-2.24)	**2.50** (2.27-2.75)	**2.94** (2.67-3.23)	**3.48** (3.14-3.82)	**3.96** (3.55-4.35)	**4.43** (3.94-4.86)	**4.92** (4.34-5.39)	**5.58** (4.86-6.10)	**6.16** (5.31-6.76)
6-hr	**2.05** (1.87-2.26)	**2.44** (2.24-2.69)	**3.00** (2.73-3.30)	**3.54** (3.22-3.88)	**4.21** (3.80-4.61)	**4.81** (4.32-5.25)	**5.40** (4.81-5.90)	**6.03** (5.31-6.57)	**6.87** (5.98-7.49)	**7.63** (6.55-8.34)
12-hr	**2.42** (2.22-2.66)	**2.88** (2.65-3.16)	**3.56** (3.26-3.90)	**4.22** (3.85-4.62)	**5.06** (4.59-5.52)	**5.81** (5.23-6.32)	**6.58** (5.86-7.14)	**7.40** (6.51-8.02)	**8.52** (7.39-9.24)	**9.54** (8.15-10.4)
24-hr	**2.86** (2.67-3.08)	**3.45** (3.23-3.72)	**4.33** (4.04-4.65)	**5.02** (4.67-5.38)	**5.95** (5.52-6.38)	**6.69** (6.19-7.17)	**7.44** (6.87-7.99)	**8.22** (7.56-8.82)	**9.28** (8.50-9.97)	**10.1** (9.23-10.9)
2-day	**3.32** (3.10-3.57)	**4.00** (3.74-4.30)	**4.97** (4.64-5.34)	**5.73** (5.34-6.15)	**6.76** (6.27-7.26)	**7.56** (7.01-8.12)	**8.39** (7.75-9.01)	**9.23** (8.50-9.93)	**10.4** (9.51-11.2)	**11.3** (10.3-12.2)
3-day	**3.52** (3.29-3.77)	**4.23** (3.96-4.53)	**5.23** (4.89-5.60)	**6.02** (5.62-6.44)	**7.09** (6.59-7.59)	**7.94** (7.36-8.50)	**8.80** (8.13-9.43)	**9.68** (8.92-10.4)	**10.9** (9.98-11.7)	**11.8** (10.8-12.7)
4-day	**3.72** (3.48-3.97)	**4.46** (4.18-4.76)	**5.49** (5.14-5.86)	**6.31** (5.90-6.73)	**7.42** (6.91-7.93)	**8.31** (7.72-8.88)	**9.20** (8.52-9.84)	**10.1** (9.34-10.8)	**11.4** (10.4-12.2)	**12.4** (11.3-13.3)
7-day	**4.31** (4.04-4.60)	**5.14** (4.82-5.48)	**6.26** (5.86-6.67)	**7.14** (6.68-7.62)	**8.35** (7.79-8.90)	**9.31** (8.66-9.93)	**10.3** (9.54-11.0)	**11.3** (10.4-12.1)	**12.7** (11.6-13.6)	**13.7** (12.6-14.8)
10-day	**4.90** (4.60-5.22)	**5.83** (5.47-6.21)	**7.01** (6.57-7.46)	**7.93** (7.43-8.44)	**9.17** (8.57-9.77)	**10.1** (9.47-10.8)	**11.1** (10.4-11.9)	**12.1** (11.3-13.0)	**13.5** (12.5-14.5)	**14.5** (13.4-15.6)
20-day	**6.57** (6.19-6.99)	**7.76** (7.31-8.25)	**9.16** (8.63-9.74)	**10.3** (9.66-10.9)	**11.8** (11.1-12.5)	**13.0** (12.1-13.8)	**14.2** (13.2-15.1)	**15.4** (14.3-16.4)	**17.0** (15.8-18.2)	**18.3** (16.9-19.6)
30-day	**8.16** (7.71-8.65)	**9.60** (9.06-10.2)	**11.2** (10.5-11.8)	**12.4** (11.7-13.1)	**14.0** (13.1-14.8)	**15.2** (14.3-16.1)	**16.4** (15.4-17.5)	**17.6** (16.5-18.8)	**19.3** (17.9-20.5)	**20.5** (19.0-21.9)
45-day	**10.4** (9.88-10.9)	**12.2** (11.6-12.8)	**13.9** (13.2-14.7)	**15.3** (14.5-16.1)	**17.1** (16.1-18.0)	**18.4** (17.4-19.4)	**19.7** (18.6-20.8)	**21.0** (19.7-22.2)	**22.7** (21.2-24.0)	**24.0** (22.4-25.4)
60-day	**12.5** (11.9-13.1)	**14.6** (13.8-15.3)	**16.4** (15.6-17.3)	**17.9** (17.0-18.8)	**19.8** (18.8-20.8)	**21.2** (20.1-22.3)	**22.6** (21.3-23.8)	**23.9** (22.5-25.2)	**25.6** (24.1-27.0)	**26.9** (25.2-28.4)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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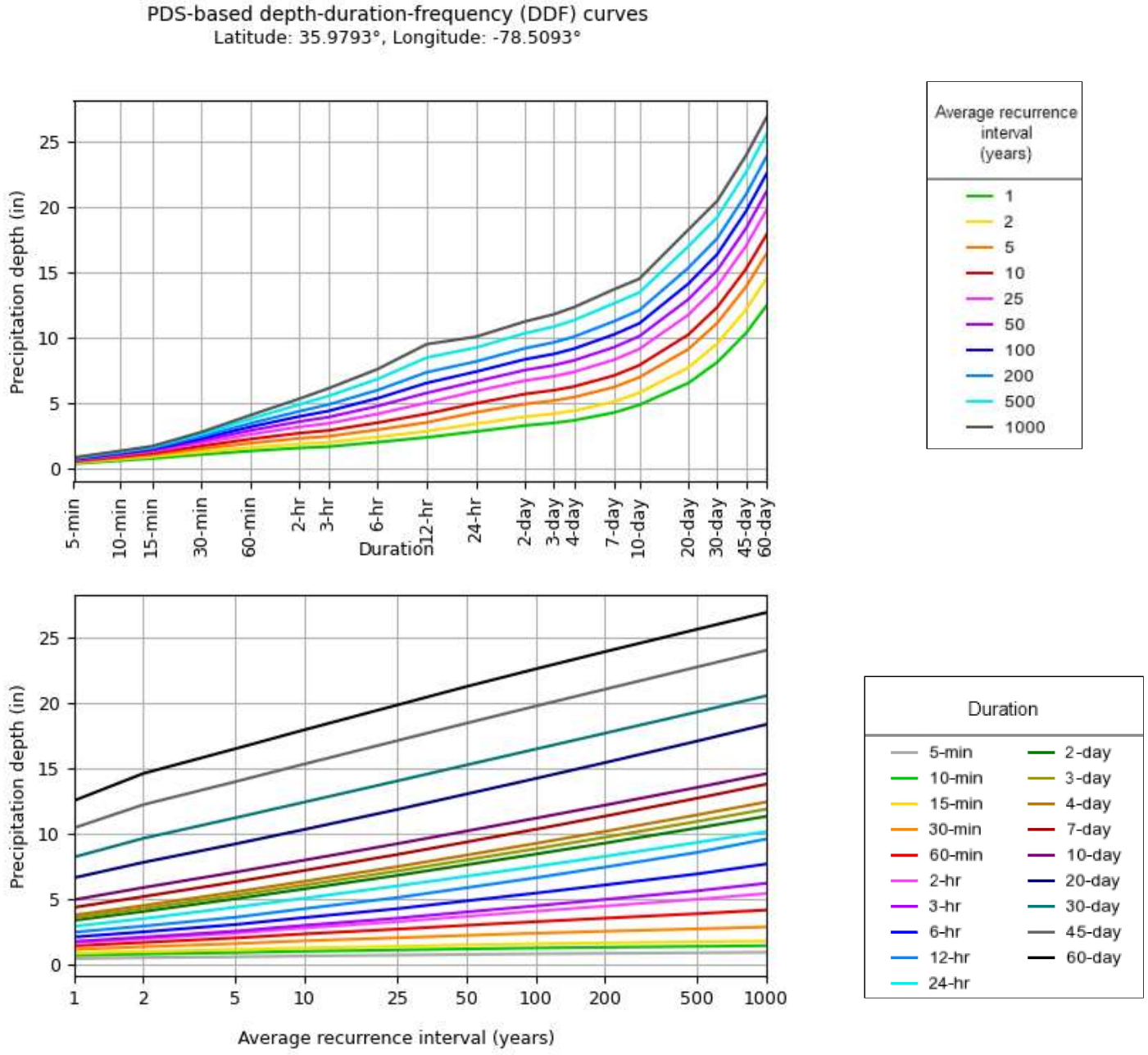
PF graphical



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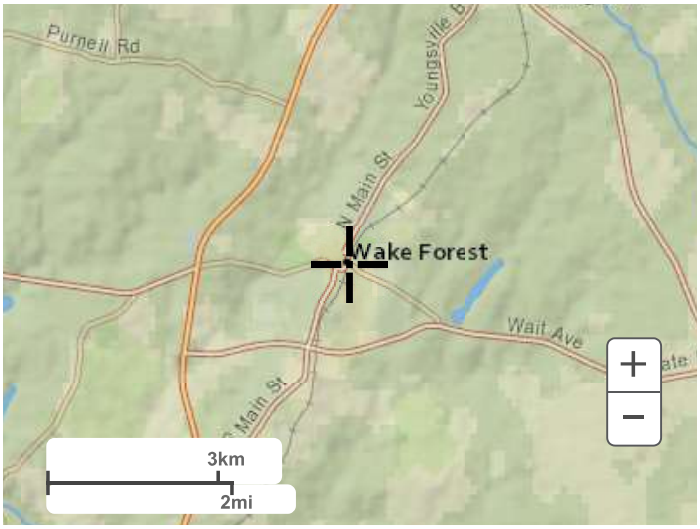
Maps & aerials

Small scale terrain



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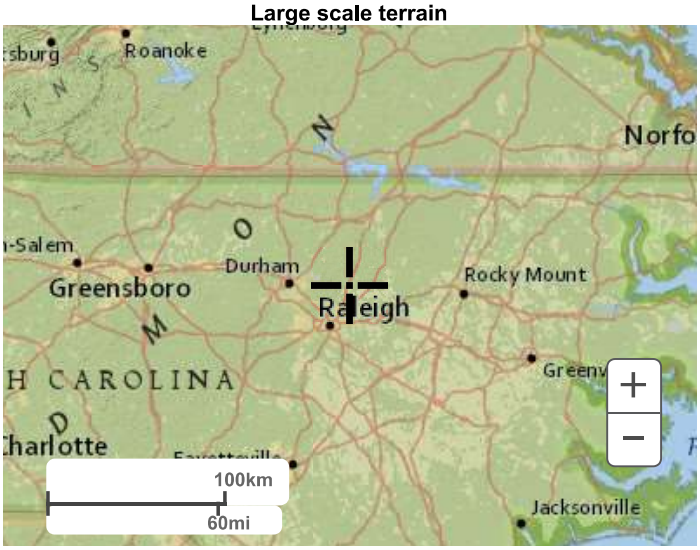

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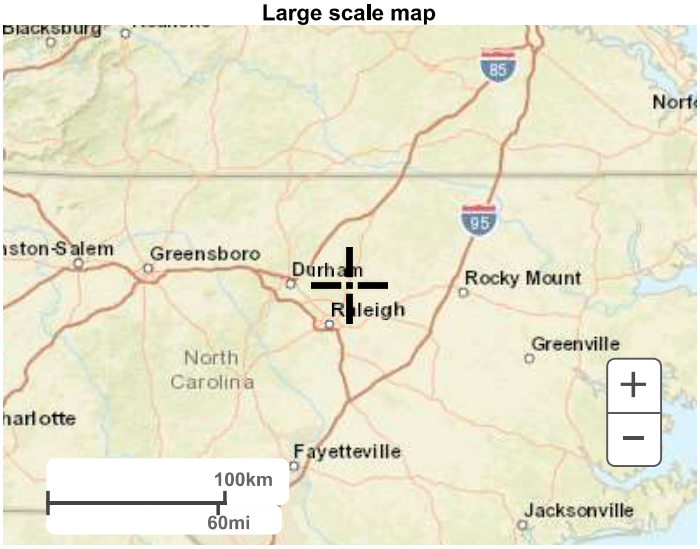
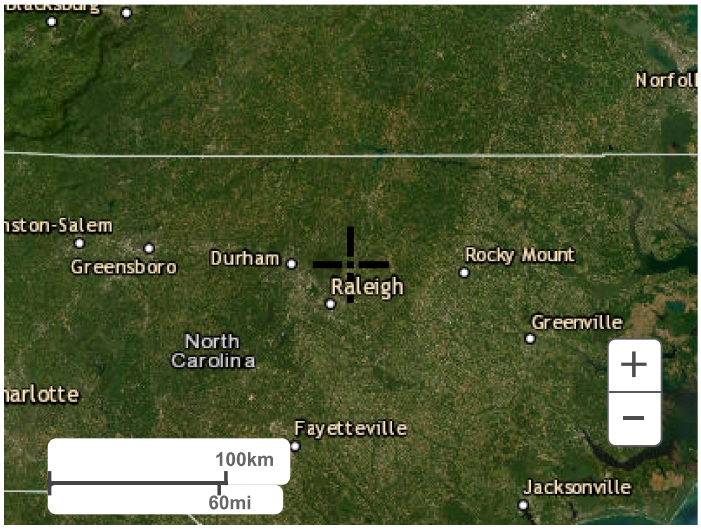


Large scale aerial



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Disclaimer

ECS Southeast, LLP

Preliminary Geotechnical Engineering Report

Kalas Falls Residential Development

1832 Rolesville Road
Rolesville, North Carolina

ECS Project Number 06:24735

March 11, 2022

ECS SOUTHEAST, LLP
"Setting the Standard for Service"
Geotechnical • Construction Materials • Environmental • Facilities

March 11, 2022

Ms. Julie Spencer
D.R. Horton
2000 Aerial Center Parkway
Suite 110-A
Morrisville, North Carolina 27560

ECS Project No. 06:24735

Reference: Preliminary Geotechnical Engineering Report
Kalas Falls Residential Development
1832 Rolesville Road
Rolesville, North Carolina

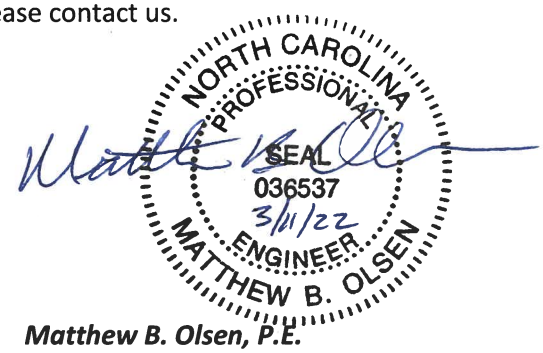
Dear Ms. Spencer:

ECS Southeast, LLP (ECS) has completed the preliminary subsurface exploration, laboratory testing, and geotechnical engineering analyses for the above-referenced project. Our services were performed in general accordance with our agreed to scope of work. This report presents our understanding of the geotechnical aspects of the project, the results of the field exploration conducted, and our preliminary geotechnical design and construction recommendations for the project.

It has been our pleasure to be of service to you during this phase of this project. We would appreciate the opportunity to remain involved during the continuation of the design phase, and we would like to provide our services during construction phase operations as well to verify subsurface conditions assumed for this report. Should you have any questions concerning the information contained in this report, or if we can be of further assistance to you, please contact us.

Respectfully submitted,

ECS Southeast, LLP



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- Subsurface Exploration Procedure: Standard Penetration Testing (SPT)
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- Moisture-Density Relationship Curves
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EXECUTIVE SUMMARY

This executive summary is intended as a very brief overview of the primary geotechnical conditions that are expected to affect design and construction. Information gleaned from the executive summary should not be utilized in lieu of reading the entire geotechnical report.

- Elastic SILT (MH) and Fat CLAY (CH) are present at the site in localized areas. These are potentially expansive soils per the current North Carolina Building Code and local practice. Based on laboratory testing and our experience, these soils have a medium to high potential for expansion (i.e., shrink-swell) and are considered to be expansive. We recommend that the mitigation measures given in this report be implemented to reduce the potential for structure or pavement distress (cracking, excessive deformation) as a result of volumetric changes in potentially expansive soils due to variations in its moisture content. Mitigation options include a 1 foot separation distance under footings, floor slabs and pavements and chemical (lime) stabilization. Additional soil sampling and laboratory testing should be performed during the design phase of the project to further evaluate the potentially expansive soils.

- The site is underlain by foliated to massive intrusive granitic rock in a geologic area known for shallow partially weathered rock (WR) and hard competent rock.

- Most of the borings (29 of 53) encountered PWR and/or hard competent rock at depths of 1 to 10 feet below the existing ground surface.

- Based upon the assumed grades, we anticipate that ripping, hammering, and/or blasting of partially weathered rock and rock will be required across the majority of the site to achieve design site, foundation, and underground utility grades.

- Existing fill was encountered in Boring B-08. The SPT boring N-values indicate that the existing fill was probably not thoroughly and adequately compacted. The existing fill should be evaluated at the time of construction by proofrolling, excavation of test pits, hand auger borings, and/or construction excavations. If the existing fill is very soft to soft and/or contains excessive inert debris or excessive organic materials, it should not be used to support foundations, floor slabs, or pavements, and it should be undercut and replaced with engineered fill consisting of suitable materials.

- Based on 14 of the soil test borings, we anticipate undercutting of very soft to soft or very loose near-surface natural soils could be necessary in numerous areas across the site during mass grading, depending on design grades. If site earthwork is performed during the typically cooler, wetter months of the year, additional undercutting is anticipated due to excessively wet unstable soils.

- We anticipate that most of the soils encountered in the borings within the anticipated excavation depths will be suitable for use as engineered fill. For areas with ripped or blasted rock, these materials can be included in engineered fills in accordance with report recommendations.

- Most of the borings were dry to their termination depths. Some of the borings encountered groundwater at depths between 3 and 16 feet. The Web Soil Survey Report indicates that the seasonal high water table is generally more than 6 feet deep in the upland areas, which make up the majority of the site. The seasonal high water table is as shallow as 1 to 2 feet in the lower areas of the site near the drainage features. Once a preliminary grading plan has been prepared, it should be provided to ECS for review and comment regarding the potential need for temporary and/or permanent dewatering of the groundwater at the site.

- Lightly loaded 1- to 3-story wood-framed residential structures (column loads less than 50 kips and wall loads less than 5 kips per foot) can be supported by shallow foundations and floor slabs bearing on undisturbed natural soils or new engineered fill.

- Additional subsurface explorations consisting of additional seismic refraction testing, soil test borings, and/or test pits should be performed to obtain additional data to estimate quantities of rip rock, mass blast rock, and trench blast rock for the proposed site grading.

- This is a preliminary report, and it should not be used for final design or for construction.

1.0 INTRODUCTION

The purpose of this study was to provide preliminary geotechnical information for the design and construction of a new subdivision with 455 single-family homes, streets, stormwater control measures, and underground utilities, including an off-site sanitary sewer outfall line for D.R. Horton. The recommendations developed for this report are based on project information supplied by Ms. Julie Spencer with D.R. Horton.

Our services were provided in accordance with our Proposal No. 06:22970, dated November 22, 2021, as authorized by Jonathan Cooper with D.R. Horton on November 30, 2021, which includes our Terms and Conditions of Service.

This report contains the procedures and results of our subsurface exploration and laboratory testing programs, review of existing site conditions, engineering analyses, and preliminary recommendations for development of the project.

2.0 PROJECT INFORMATION

This report is based on the following sources of information:

- Emails between Ms. Julie Spencer and Mr. Jonathan Cooper with D.R. Horton and Mr. Santhosh Mahavadi with ECS between November 5 and November 8, 2021.
- General site plans titled “Development Essentials Brochure” prepared by American Engineering dated April 21, 2020.
- Overall Phase Plan for Kalas Falls, prepared by American Engineering, dated September 19, 2019.
- Kalas Property Traffic Impact Analysis Report, prepared by Stantec, prepare for Mitchel Mill Road Investors, LLC, dated January 16, 2016.
- Report of Subsurface Exploration, Dam @ Rolesville Road ant Mitchel Mill Road, prepared by GeoTechnologies, prepared for Withers & Ravenel, dated April 28, 2016.
- Report titled “Difficult Excavation Potential, Kalas Tract Sewer”, prepared by GeoTechnologies, prepared for Mitchell Mill Investors, LLC, dated July 12, 2016.
- Report titled “Difficult Excavation Potential & Dam Embankment Impact, Kalas Tract Sewer MH-1 to MH-3”, prepared by GeoTechnologies, prepared for Mitchell Mill Investors, LLC, dated November 8, 2016.
- Drawings titled “Construction Phase 1 for Kalas Falls”, prepared by American Engineering, dated June 28, 2021.
- Drawings titled “Construction Phase 2 for Kalas Falls”, prepared by American Engineering, dated July 22, 2021.
- Drawings titled “Construction Phase 3 for Kalas Falls”, prepared by American Engineering, dated August 17, 2021.
- Preliminary site plan drawings prepared by American Engineering, dated September 19, 2019.
- Google Earth aerial photos dated between December 1985 and March 2021.
- Site and topographic information obtained from the Wake County GIS website.
- United States Geologic Survey Quadrangle Map (Google Earth overlay .kmz file).

2.1 SITE INFORMATION

The site is located at 1832 Rolesville Road in Rolesville, North Carolina, at the approximate location shown in the following figure.

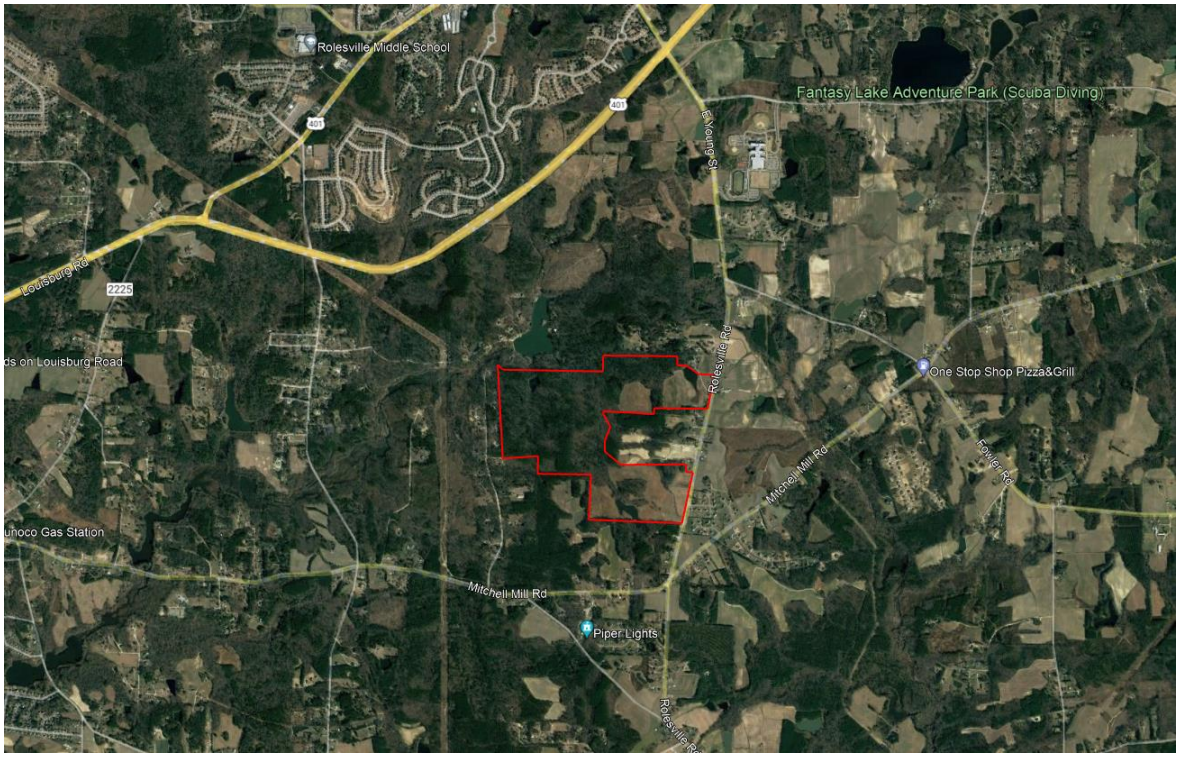


Figure 2.1.1. Site Location

The property is currently undeveloped and mostly wooded, with some open fields. The site generally slopes downward to the north and to the south from the central portion of the site. Four ponds and numerous creeks were observed on site. Numerous rock outcrops and boulders were found in the western portion of the site. A stream was observed in the central portion of the site leading to an approximate 10-foot-tall waterfall northwestern portion of the site.

2.2 PROPOSED CONSTRUCTION

The project involves constructing a new subdivision with 455 single-family homes, streets, stormwater control measures, and underground utilities, included an off-site sanitary sewer outfall line.

We assume that the proposed houses will be 2 to 3-story, wood-framed structures with slab-on-grade ground floors or crawl spaces. Design foundation loads have not been provided to us. We assume maximum unfactored loads will be less than or equal to the following:

- Maximum Wall Load = 3 kips per foot
- Maximum Ground Floor Slab Load = 150 pounds per square foot (psf)

The structural engineer should verify these assumptions and notify ECS if the actual unfactored foundation design loads exceed or are significantly less than this assumed value.

The grading plans provided to us indicates that maximum cuts in the pavement areas will be approximately 10 feet, with maximum cuts of approximately 15 feet in some of the SCM areas. Maximum fill depths will be approximately 10 feet. Water lines will be approximately 4 feet below the finished grades along the streets and sanitary sewer lines will be approximately 10 to 15 feet below the finished grades along the streets.

3.0 FIELD EXPLORATION AND LABORATORY TESTING

Our exploration procedures are explained in greater detail in Appendix B including the insert titled Subsurface Exploration Procedure: Standard Penetration Testing (SPT). Our scope of work included drilling 50 borings. Our borings were located with a handheld GPS unit and their approximate locations are shown on the Boring Location Diagram in Appendix A.

3.1 SUBSURFACE CHARACTERIZATION

The subsurface conditions encountered were generally consistent with published geological mapping. The following sections provide generalized characterizations of the soil and rock strata. Please refer to the boring logs in Appendix B.

The site is located within the Piedmont physiographic province. The Piedmont is characterized by residual overburden soils weathered in place from the underlying igneous and metamorphic rock. The topography and relief of the Piedmont uplands have developed from differential weathering of the bedrock. Because of the continued chemical and physical weathering, the bedrock in the Piedmont is now generally covered with a mantle of soil that has weathered in place from the parent bedrock. These soils have variable thicknesses and are referred to as residuum or residual soils. The residuum is typically finer grained and has higher clay content near the surface because of the advanced weathering. Similarly, the soils typically become coarser grained with increasing depth because of decreased weathering. As the degree of weathering decreases, the residual soils generally retain the overall appearance, texture, gradation and foliations of the parent rock.

The boundary between soil and rock in the Piedmont is not sharply defined. A transitional zone termed “partially weathered rock” is normally found overlying the parent bedrock. Partially weathered rock (WR) is defined for engineering purposes as residual material with Standard Penetration Resistances (N-values) exceeding 100 blows per foot. The transition between hard/dense residual soils and partially weathered rock occurs at irregular depths due to variations in degree of weathering. Also, it is not unusual to find lenses and boulders of hard rock and/or zones of partially weathered rock within the soil mantel well above the general bedrock level.

According to the *1985 Geologic Map of North Carolina* the site is underlain by foliated to massive granitic rock of Permian to Pennsylvanian age (PPmg).

It is important to note that the natural geology within portions of the site has been modified in the past that included the placement of fill materials. The quality of man-made fills can vary significantly, and it is often difficult to assess the engineering properties of existing fills.

The following sections provide additional information about the soil and rock strata encountered during our subsurface exploration.

Surficial Material: A surficial layer of topsoil, ranging from approximately 4 to 12 inches in thickness, was encountered at most boring locations.

Existing Fill: Existing fill/possible fill soils consisting of Silty SAND (SM) and Silty Clayey SAND (SC-SM) were encountered below the topsoil and extended to approximate depths of 8 feet below existing grade at Boring B-8.

Residuum: The natural soils encountered below the fill and/or topsoil generally consisted of Silty SAND (SM), Clayey SAND (SC), Silty Clayey SAND (SC-SM), Sandy with SILT (SP-SM), Sandy SILT (ML), Sandy Elastic SILT (MH), Sandy Lean CLAY (CL) and Sandy Fat CLAY (CH). The SPT N-values within the sands ranged from 1 to 79 bpf, indicating a relative density of very loose to very dense. The SPT N-values within the silts and clays ranged from 2 to 50 bpf, indicating a consistency varying from very soft to very hard.

Weathered Rock: Weathered Rock (WR), which is classified as material with SPT blow counts greater than 50 blows per 6 inches of penetration, was encountered in the majority of borings. The depths of the top of weathered rock are given in the following table:

Weathered Rock (WR)

Boring	Depth to WR (ft)
B-1	3.5
B-2	0.5
B-3	3.0
B-4	0.5
B-5	3.0
B-6	3.5
B-7	5.5*, 17.5
B-8	12
B-9	3.0
B-10	3.0
B-12	0.6
B-14	8.0
B-15	0.5
B-16	3.0
B-17	0.5
B-18	3.0
B-19	13.0
B-20	0.3
B-24	3.0
B-28	3.0

Boring	Depth to WR (ft)
B-29	8.0
B-30	5.5
SCM-01	3.0
SCM-04	0.5
SCM-05	12.5
SCM-07	5.5
SCM-09	8.0
SCM-10	0.6
SCM-11	3.0
SCM-12	0.3
SCM-13	3.0
SCM-14	0.5

* - Lens of PWR encountered between depths of about 5.5 feet to 8 feet within location B-7

Competent Rock: Competent Rock, classified as auger refusal material, was encountered in the majority of borings. The depths of the top of weathered rock are given in the following table:

Competent Rock

Boring	Depth to Rock (ft)
B-1	3.5
B-2	1.1
B-3	3.0
B-4	2.0
B-5	3.0
B-6	3.5
B-7	17.5
B-8	13.7
B-9	3.5
B-10	3.0
B-12	3.6
B-14	8.7
B-15	0.5
B-16	3.6
B-17	2.5
B-18	4.2
B-19	13.0
B-20	1.6
B-24	5.5
B-28	5.5

Boring	Depth to Rock (ft)
B-29	12.5
B-30	6.0
SCM-01	5.5
SCM-04	1.0
SCM-05	12.5
SCM-07	6.0
SCM-09	9.5
SCM-10	2.0
SCM-11	3.7
SCM-12	0.5
SCM-13	3.0
SCM-14	1.2

3.2 GROUNDWATER OBSERVATIONS

Water levels were measured and are given on the boring logs in Appendix B. Most borings were observed dry after drilling with cave-in at various depths. Groundwater was observed in some borings at the completion of drilling and were measured at depths ranging from 3.5 to 12.5 feet below the ground surface. As stated in the ECS Seasonal High Water Table Estimation Report dated February 7, 2022 (ECS Project No. 49:16341), the SHWTs were estimated to range from 12 inches below the existing ground surface at location SCM-18 to as much as 122 inches (10 feet) deep at location SCM-15. Variations in the long-term water table may occur as a result of changes in precipitation, evaporation, surface water runoff, construction activities, and other factors.

3.3 LABORATORY TESTING

Each sample was visually classified on the basis of texture and plasticity in accordance with ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedures).

The laboratory testing consisted of selected tests performed on samples obtained during our field exploration operations. Classification and index property tests were performed on representative soil samples in accordance with ASTM D2487 Standard Practice for Classification for Engineering Purposes. Additionally, standard Proctor and California Bearing Ratio (CBR) tests were performed on representative samples.

After identification and classification, the samples were grouped in the major zones noted on the boring logs in Appendix B. The group symbols for each soil type are indicated in parentheses along with the soil descriptions. The stratification lines between strata on the logs are approximate; in situ, the transitions may be gradual.

4.0 PRELIMINARY RECOMMENDATIONS

4.1 BUILDING/STRUCTURE DESIGN

Lightly loaded 1- to 3-story structures (column loads less than 50 kips and wall loads less than 6 kips per foot) can be supported by shallow foundations and ground supported slabs bearing on undisturbed residual soils, new engineered fill, or approved existing fill.

For preliminary design purposes, the footings can be sized using a presumptive allowable bearing pressure of 2,000 psf. A higher bearing pressure could be achieved, depending on the results of the recommended design-phase geotechnical borings and engineering analysis.

4.2 SUBGRADE PREPARATION

4.2.1 Stripping and Grubbing

The subgrade preparation should consist of stripping all vegetation, rootmat, topsoil, and any other soft or unsuitable materials from the proposed construction areas. The borings generally encountered 4 to 12 inches of topsoil. Deeper topsoil or organic laden soils are likely present in wet, low-lying, and poorly drained areas. In the wooded areas, the rootmat may extend as deep as about 1 to 2 feet and will require additional localized stripping and grubbing depth to completely remove the organics. In agricultural fields, organics within the cultivated soil are anticipated primarily to a depth of about 6 inches. The topsoil encountered in the borings was not analyzed for its suitability for reuse in landscaping areas. ECS should be called on to verify that topsoil and unsuitable surficial materials have been completely removed prior to the placement of engineered fill or construction of structures and pavements.

We anticipate average stripping depths of 12 inches to remove the cultivated soil from the existing agricultural fields, 6 inches to remove topsoil and rootmat from areas that are currently grass-, weed- or brush-covered, and 12 inches to remove the topsoil and rootmat from areas that are currently wooded. We recommend that these average stripping depths be used for quantity approximations for earthwork design and construction cost estimating.

4.2.2 Proofrolling

After removing all unsuitable surface materials, cutting to the proposed grade, and prior to the placement of any engineered fill or other construction materials, the exposed subgrade should be examined by the geotechnical engineer or authorized representative. The exposed subgrade should be thoroughly densified in place using a 10-ton, self-propelled, vibratory smooth drum roller due to the very loose to loose sands encountered in the borings at the anticipated subgrade elevations. The exposed subgrade should then be proofrolled with previously approved construction equipment having a minimum axle load of 10 tons (e.g. fully loaded tandem-axle dump truck). The areas subject to proofrolling should be traversed by the equipment in two perpendicular (orthogonal) directions with overlapping passes of the vehicle under the observation of the geotechnical engineer or authorized representative. This procedure is intended to assist in identifying any localized yielding materials.

In the event that unstable or "pumping" subgrade is identified by the proofrolling, those areas should be marked for repair prior to the placement of any subsequent engineered fill or other construction materials. Methods of repair of unstable subgrade, such as undercutting or moisture conditioning or chemical stabilization, should be discussed with the geotechnical engineer to determine the appropriate procedure with regard to the existing conditions causing the instability. Test pits and/or hand auger borings may be excavated to explore the shallow subsurface materials in the area of the instability to help in determining the cause of the observed unstable materials and to assist in the evaluation of the appropriate remedial action to stabilize the subgrade.

Based on the soil test borings, we anticipate undercutting of existing fill and very soft to soft or very loose near-surface natural soils will be necessary in numerous areas across the site. If site earthwork is performed during the typically cooler, wetter months of the year, additional undercutting in other areas of the site is anticipated due to potentially excessively wet unstable soils. Undercut excavations should be backfilled with properly placed and engineered fill. Use of geotextiles and select granular fill may be recommended by ECS during construction to reduce the required undercut depths and/or aid in stabilization of subgrades. We recommend that unsuitable/unstable soil undercut allowance quantities be determined by the design team for inclusion in a classified earthwork contract, and bidders should provide unit prices for the following:

- Excavation of, disposal of (either off-site or on-site, depending on available space and owner's preference), and replacement of unsuitable/unstable soils with engineered fill (per cubic yard).
- Excavation of, disposal of (either off-site or on-site, depending on available space and owner's preference), and replacement of unsuitable/unstable soils with NCDOT Class II, Type 1 Select Material (per cubic yard).
- Installation of woven geotextile, Mirafi HP270 or equivalent (per square yard)

4.3 EARTHWORK OPERATIONS

4.3.1 Engineered Fill Materials

Materials suitable for use as engineered fill should consist of inorganic soils classified as CL, ML, SM, SC, SW, SP, GW, GM and GC, or a combination of these group symbols, per ASTM D 2487. The materials should be free of organic matter and debris. The fill should exhibit a maximum dry density of at least 90 pounds per cubic foot, as determined by a Standard Proctor compaction test (ASTM D 698).

Engineered fill should be placed in maximum 8-inch loose lifts. In confined areas such as utility trenches, portable compaction equipment and thin lifts of 4 inches to 6 inches may be required to achieve specified degrees of compaction.Engineered fill should be moisture conditioned as necessary to within -3 and +3 % of the soil's optimum moisture content. Moisture conditioning options include spraying and mixing in water to excessively dry soils, scarifying and drying of excessively wet soils, and adding lime to excessively wet soils.Engineered fill should be compacted with suitable equipment to a dry density of at least 95% of the Standard Proctor maximum dry density (ASTM D698) more than 12 inches below the finish subgrade elevation and to a least 98% in the upper 12 inches. ECS should be retained to observe and test the placement and compaction of engineered fill.

Product Submittals: At least one week prior to placement of engineered fill, representative bulk samples (about 50 pounds) of on-site and/or off-site borrow should be submitted to ECS for laboratory testing, which will include Atterberg limits, natural moisture content, grain-size distribution, and moisture-density relationships for compaction. Import materials should be tested prior to being hauled to the site to determine if they meet project specifications.

Suitable Engineered Fill Materials: Materials suitable for use as engineered fill should consist of inorganic soils classified as CL, ML, SM, SC, SW, SP, GW, GM and GC, or a combination of these group symbols, per ASTM D 2487. The materials should be free of organic matter and debris. The fill should exhibit a maximum dry density of at least 90 pounds per cubic foot, as determined by a Standard Proctor compaction test (ASTM D 698). On-site Fat CLAY (CH) and Elastic SILT (MH) may be placed as engineered fill for mass grading, provided the previously recommended separation distance is achieved or lime stabilization is implemented. Rock fragments should generally be less than 3 inches in maximum dimension and should be blended with soil.

For sites with ripped or blasted rock, these materials can be included in engineered fills in accordance with the following table:

Loose Lifts and Rock Fragment Sizes

Engineered fill Depth Below Finish Subgrade Elevation	Maximum Loose Lift (in.)	Maximum Particle (Rock Fragment) Size (in.)
0 to 5 ft	8	3
5 to 10 ft	12	6
>10 ft	24	18

If ripped or blast rock is used as engineered fill, and it is not thoroughly blended to avoid the formation of voids within the fill, then the ripped/blast rock fill should be covered with a 2-feet-thick layer of well-graded “choke stone” material to prevent the migration of fines downward from the upper soil fill into the ripped/blast rock fill voids.

Unsuitable Materials: Unsuitable fill materials include materials which do not satisfy the requirements for suitable materials, such as topsoil, organic materials, debris, and debris-laden fill.

On-Site Borrow Suitability: The on-site soils meeting the classifications for recommended suitable engineered fill, plus meeting the restrictions on separation distances, organic content, and debris, may be used as engineered fill. We anticipate that most of the soils encountered in the borings within the anticipated excavation depths will be suitable for use as engineered fill.

The on-site Elastic SILT (MH) and Fat CLAY (CH) may be used as engineered fill for mass grading, as long as the previously recommended foundation bearing depths and vertical separation distance between floor slab subgrade and pavement subgrade elevations are achieved. However, these soils should not be used as retaining wall backfill. Please note that these soils are very moisture sensitive, can be relatively weak and compressible, and may be difficult to properly moisture condition and compact.

On-site soils used as engineered fill will require careful moisture control in order to achieve compaction and stability. Any soils excavated from below the water table will require significant drying to achieve the recommended moisture content and minimum compaction. Soils above the water table may also be relatively dry at the time of construction and require wetting to achieve the recommended moisture content and minimum compaction.

The gradation of partially weathered rock and rock removed by ripping or blasting will probably be quite varied. Crushing of boulder-sized rock fragments may be required to meet the maximum particle sizes given in the previous table if ripped or blasted rock is to be used as engineered fill.

4.3.2 Existing Fill

Based on the relative strength and stiffness of the existing fill/possible fill soils indicated by the SPT N-values from the soil test borings, in addition to the organics and construction debris encountered in Borings B-8, it appears that some of the existing fill was placed in an uncontrolled manner without consistent compaction. As we have not been provided fill placement construction field testing reports, we interpret the existing fill to also be undocumented.

Uncontrolled and/or undocumented fill poses risks associated with under-compacted soil, undetected deleterious inclusions within the fill, and/or deleterious materials at the virgin ground fill interface that are covered by the fill. ECS does not recommend supporting building foundations and pavements on under-compacted existing fill or existing fill with excessive organics or excessive inert debris. Therefore, we recommend that these conditions be addressed by on-site engineering evaluation by ECS during construction, including proofrolling and test pits, if recommended. Under-compacted fill indicated by Boring B-8, and potentially in other localized areas, should be over-excavated and replaced with engineered fill. Undercutting and replacement of existing fill should be anticipated for this project and could be addressed contractually through allowances and unit prices.

4.3.3 Expansive Soil

Elastic SILT (MH) and Fat CLAY (CH) are present at the site. These are potentially expansive soils per the current North Carolina Building Code and local practice. Based on laboratory testing and our experience, these soils have a low to medium potential for expansion (i.e., shrink-swell) and are considered to be expansive. We recommend that the mitigation measures given in this report be implemented to reduce the potential for structure or pavement distress (cracking, excessive deformation) as a result of volumetric changes in potentially expansive soils due to variations in its moisture content. Mitigation options include a 1-foot separation distance or chemical (lime) stabilization.

We recommend that if and where the expansive soils are present at the footing bearing elevations, they should be undercut to a depth of 1 foot below bottom of footing and replaced with engineered fill, compacted ABC, flowable fill, or lean concrete. We also recommend that a minimum separation distance of 1 foot be maintained between slab subgrade and pavement subgrade elevations and expansive soil (CH, MH) to reduce the potential for structure or pavement distress (cracking, excessive deformation) as a result of volumetric changes in the soil due to variations in its moisture content. Based on the borings and anticipated design grades, we anticipate that this separation

distance may be required in the areas represented by Borings B-6, B-11, B-13, B-14, B-18, B-19, B-23, B-28, B-31, and SCM-08, in addition to other localized areas at the site.

The minimum separation distance should be achieved by undercutting the undisturbed natural expansive soil and replacing it with low-plasticity engineered fill. This will require overexavation and replacement of 1 foot of expansive soil where present in the cut-fill transition.

Alternatively, the recommended separation distance could be achieved by treating the expansive soil with lime. With a 1-foot separation distance, the soil could be treated in situ with lime.

It may be possible to reduce the separation distance and the amount of undercutting/replacement or lime stabilization required with additional soil sampling, advanced laboratory testing (Expansion Index and Swell Potential), and detailed structural dead-load analysis. If lime stabilization is selected, additional laboratory testing is recommended to determine the percentage of lime required. ECS can provide a proposal for these additional services/analyses upon request.

Even though the Elastic SILT (MH) and Fat CLAY (CH) can be used as fill below the recommended separation distance elevations, they are very moisture sensitive and can be relatively weak and compressible. The moisture contents will require careful control and must be within +/- 3% of the soil's standard Proctor optimum moisture content to provide stability and to prevent excessive swell heave, shrinkage settlement, or collapse settlement upon wetting.

4.3.4 Compaction

Fill Compaction: Engineered fill should be placed in maximum 8-inch loose lifts. In confined areas such as utility trenches, portable compaction equipment and thin lifts of 4 inches to 6 inches may be required to achieve specified degrees of compaction.

Engineered fill should be moisture conditioned as necessary to within -3 and +3 % of the soil's optimum moisture content. Moisture conditioning options include spraying and mixing in water to excessively dry soils, scarifying and drying of excessively wet soils, and adding lime to excessively wet soils.

Engineered fill should be compacted with suitable equipment to a dry density of at least 95% of the Standard Proctor maximum dry density (ASTM D698) more than 12 inches below the finish subgrade elevation and to a least 98% in the upper 12 inches.

ECS should be retained to observe and test the placement and compaction of engineered fill.

Moisture Conditioning: The on-site soils are moisture sensitive and can be difficult to work. Problems include softening of exposed subgrade soils, excessive rutting or deflection under construction traffic, and the inability to adequately dry and compact wet soil.

Drying and compaction of wet soils is typically difficult during typically cooler, wetter months of the year (typically November through March). During the cooler and wetter periods of the year, delays and additional costs should be anticipated. At these times, reduction of soil moisture may need to be accomplished by a combination of mechanical manipulation and the use of chemical additives,

such as lime or cement, in order to lower moisture contents to levels appropriate for compaction. Alternatively, removal and replacement with drier, off-site materials may be necessary.

4.4 PAVEMENTS

4.4.1 Pavement Sections

Undisturbed low-plasticity soils or newly placed engineered fill can provide adequate support for a pavement structure designed for appropriate subgrade strength and traffic characteristics.

Based on the results of our soil test borings, it appears that the soils that will be exposed as pavement subgrades, exposed in cuts and placed as fill, will consist mainly of Silty Sand (SM), Sandy Lean CLAY (CL), Sandy SILT (ML), and Clayey SAND (SC). A California Bearing Ratio (CBR) of 5 should be used for preliminary pavement section thickness design, until design phase CBR laboratory testing is performed.

Fat CLAY (CH) and Elastic SILT (MH) should not be left in place in cut areas or placed as fill immediately below the pavements. A minimum separation of 1 foot should be maintained between the pavement subgrade elevation and Elastic SILT (MH) or Fat CLAY (CH), or lime stabilization should be implemented. This will require undercutting of Elastic SILT (MH) and Fat CLAY (CH) at cut fill transitions and the placement of low-plasticity soil in the upper 1 foot of engineered fill.

5.0 ADDITIONAL GEOTECHNICAL SERVICES

Once final grades, building locations, and pavement locations measure locations have been determined, we recommend that additional soil test borings and laboratory testing be performed to develop final geotechnical design and construction recommendations. Additional laboratory testing should include Expansion Index and Swell Pressure testing of the highly plastic soil encountered in the preliminary borings.

If site retaining walls 5 feet or more in height are needed to achieve design grades, we recommend that additional soil test borings and laboratory testing be performed to evaluate the foundation bearing conditions along the wall alignments and to test the on-site soils for potential use as retaining wall backfill. ECS would be pleased to provide a proposal for these additional services, including site retaining wall design, upon request.

6.0 CLOSING

ECS has prepared this report of findings, evaluations, and preliminary recommendations to guide geotechnical-related aspects of the project. These recommendations are not intended for final design and construction. Additional exploration and/or analysis will be required to develop final commendations.

The description of the proposed project is based on information provided to ECS. If any of this information is inaccurate, either due to our interpretation of the documents provided or site or design changes that may occur later, ECS should be contacted immediately in order that we can

review the report in light of the changes and provide additional or alternate recommendations as may be required to reflect the proposed construction.

We recommend that ECS be retained to develop design and construction recommendations once the project's plans have been developed.

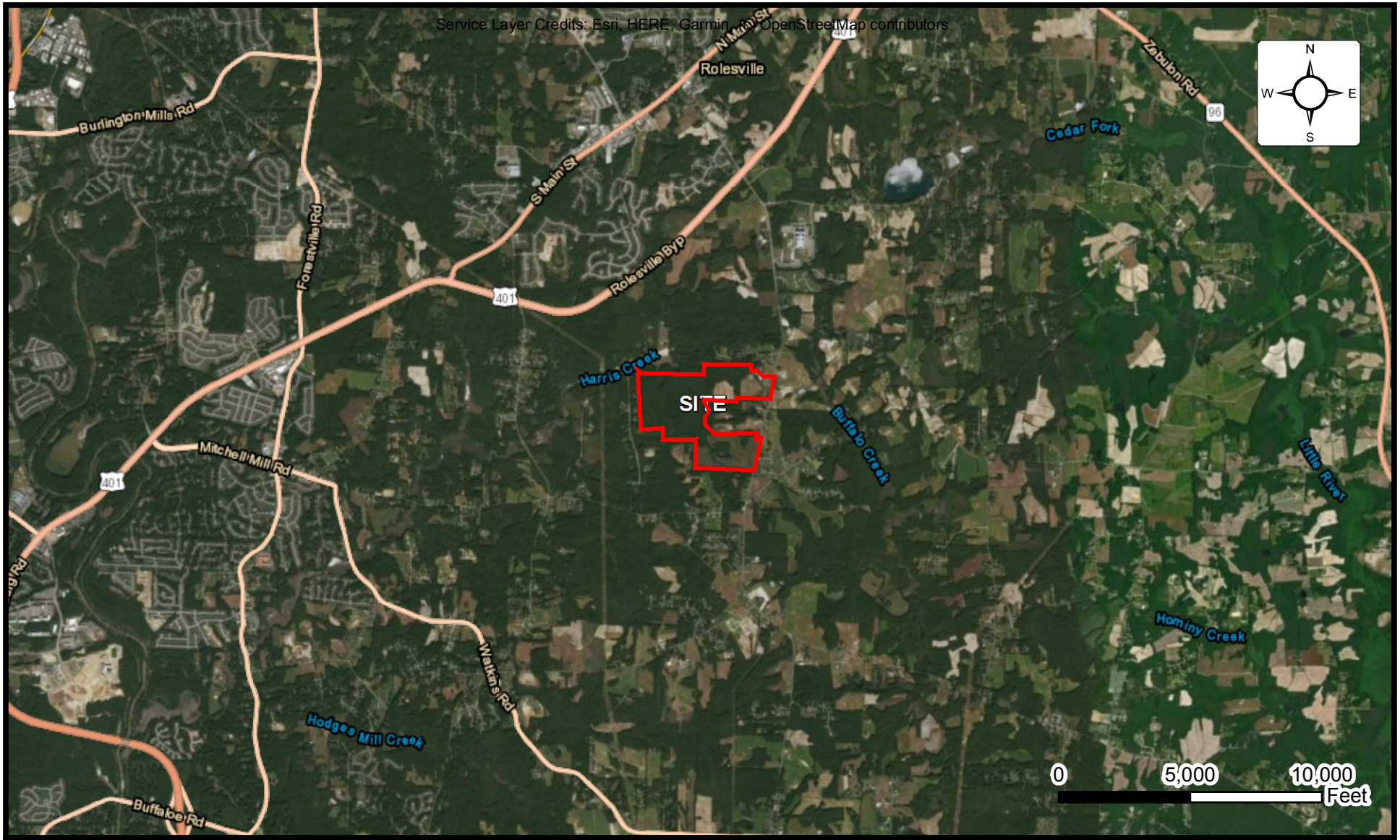
Field observations, monitoring, and quality assurance testing during earthwork and foundation installation are an extension of and integral to the geotechnical design recommendation. We recommend that the owner retain these quality assurance services and that ECS be allowed to continue our involvement throughout these critical phases of construction to provide general consultation as issues arise.

ECS is not responsible for the conclusions, opinions, or recommendations of others based on the data in this report.

Appendix A - Drawings and Reports

Site Location Diagram

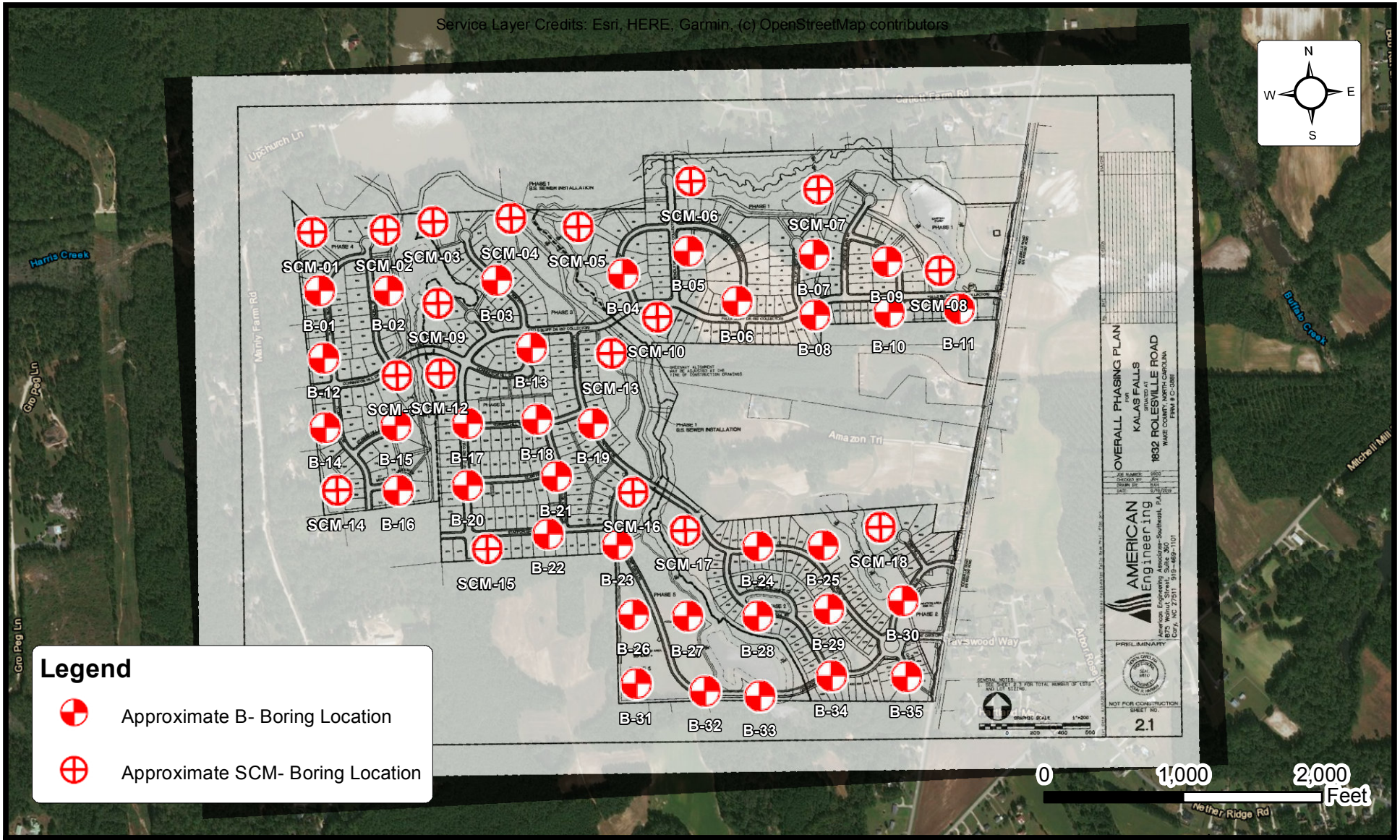
Boring Location Diagram(s)



SITE LOCATION DIAGRAM
KALAS FALLS RESIDENTIAL DEVELOPMENT

1832 ROLESVILLE ROAD, ROLESVILLE, NORTH CAROLINA
D.R. HORTON

ENGINEER	TMS4
SCALE	AS NOTED
PROJECT NO.	06:24735
SHEET	1
DATE	2/17/2022



BORING LOCATION DIAGRAM
KALAS FALLS RESIDENTIAL DEVELOPMENT

1832 ROLESVILLE ROAD, ROLESVILLE, NORTH CAROLINA
D.R. HORTON

ENGINEER	TMS4
SCALE	AS NOTED
PROJECT NO.	06:24735
SHEET	2
DATE	2/17/2022

Appendix B – Field Operations

Reference Notes

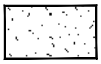
Subsurface Exploration Procedures

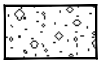
Boring Logs

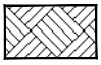
REFERENCE NOTES FOR BORING LOGS

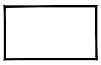
MATERIAL[1,2]

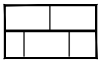

ASPHALT


CONCRETE


GRAVEL

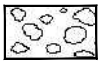

TOPSOIL

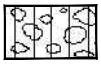

VOID


BRICK

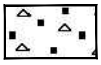

AGGREGATE BASE COURSE

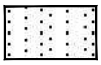

GW **WELL-GRADED GRAVEL**
gravel-sand mixtures, little or no fines

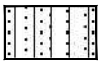

GP **POORLY-GRADED GRAVEL**
gravel-sand mixtures, little or no fines


GM **SILTY GRAVEL**
gravel-sand-silt mixtures

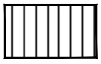

GC **CLAYEY GRAVEL**
gravel-sand-clay mixtures

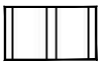

SW **WELL-GRADED SAND**
gravelly sand, little or no fines

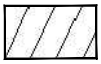

SP **POORLY-GRADED SAND**
gravelly sand, little or no fines


SM **SILTY SAND**
sand-silt mixtures

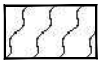

SC **CLAYEY SAND**
sand-clay mixtures

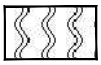

ML **SILT**
non-plastic to medium plasticity

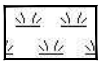

MH **ELASTIC SILT**
high plasticity


CL **LEAN CLAY**
low to medium plasticity


CH **FAT CLAY**
high plasticity


OL **ORGANIC SILT or CLAY**
non-plastic to low plasticity


OH **ORGANIC SILT or CLAY**
high plasticity


PT **PEAT**
highly organic soils

DRILLING SAMPLING SYMBOLS & ABBREVIATIONS

SS	Split Spoon Sampler	PM	Pressuremeter Test
ST	Shelby Tube Sampler	RD	Rock Bit Drilling
WS	Wash Sample	RC	Rock Core, NX, BX, AX
BS	Bulk Sample of Cuttings	REC	Rock Sample Recovery %
PA	Power Auger (no sample)	RQD	Rock Quality Designation %
HSA	Hollow Stem Auger		

PARTICLE SIZE IDENTIFICATION

DESIGNATION		PARTICLE SIZES
Boulders		12 inches (300 mm) or larger
Cobbles		3 inches to 12 inches (75 mm to 300 mm)
Gravel:	Coarse	¾ inch to 3 inches (19 mm to 75 mm)
	Fine	4.75 mm to 19 mm (No. 4 sieve to ¾ inch)
Sand:	Coarse	2.00 mm to 4.75 mm (No. 10 to No. 4 sieve)
	Medium	0.425 mm to 2.00 mm (No. 40 to No. 10 sieve)
	Fine	0.074 mm to 0.425 mm (No. 200 to No. 40 sieve)
Silt & Clay ("Fines")		<0.074 mm (smaller than a No. 200 sieve)

COHESIVE SILTS & CLAYS

UNCONFINED COMPRESSIVE STRENGTH, Q_P[4]	SPT[5] (BPF)	CONSISTENCY[7] (COHESIVE)
<0.25	<2	Very Soft
0.25 - <0.50	2 - 4	Soft
0.50 - <1.00	5 - 8	Firm
1.00 - <2.00	9 - 15	Stiff
2.00 - <4.00	16 - 30	Very Stiff
4.00 - 8.00	31 - 50	Hard
>8.00	>50	Very Hard

GRAVELS, SANDS & NON-COHESIVE SILTS

SPT[5]	DENSITY
<5	Very Loose
5 - 10	Loose
11 - 30	Medium Dense
31 - 50	Dense
>50	Very Dense

RELATIVE AMOUNT[7]	COARSE GRAINED (%)[8]	FINE GRAINED (%)[8]
Trace	≤5	≤5
With	10 - 20	10 - 25
Adjective *(ex: "Silty")*	25 - 45	30 - 45

WATER LEVELS[6]

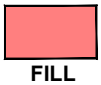

WL (First Encountered)


WL (Completion)


WL (Seasonal High Water)


WL (Stabilized)

FILL AND ROCK


FILL


POSSIBLE FILL


PROBABLE FILL


ROCK

[1]Classifications and symbols per ASTM D 2488-17 (Visual-Manual Procedure) unless noted otherwise.

[2]To be consistent with general practice, "POORLY GRADED" has been removed from GP, GP-GM, GP-GC, SP, SP-SM, SP-SC soil types on the boring logs.

[3]Non-ASTM designations are included in soil descriptions and symbols along with ASTM symbol [Ex: (SM-FILL)].

[4]Typically estimated via pocket penetrometer or Torvane shear test and expressed in tons per square foot (tsf).

[5]Standard Penetration Test (SPT) refers to the number of hammer blows (blow count) of a 140 lb. hammer falling 30 inches on a 2 inch OD split spoon sampler required to drive the sampler 12 inches (ASTM D 1586). "N-value" is another term for "blow count" and is expressed in blows per foot (bpf). SPT correlations per 7.4.2 Method B and need to be corrected if using an auto hammer.

[6]The water levels are those levels actually measured in the borehole at the times indicated by the symbol. The measurements are relatively reliable when augering, without adding fluids, in granular soils. In clay and cohesive silts, the determination of water levels may require several days for the water level to stabilize. In such cases, additional methods of measurement are generally employed.

[7]Minor deviation from ASTM D 2488-17 Note 14.

[8]Percentages are estimated to the nearest 5% per ASTM D 2488-17.

SUBSURFACE EXPLORATION PROCEDURE: STANDARD PENETRATION TESTING (SPT) ASTM D 1586 Split-Barrel Sampling

Standard Penetration Testing, or **SPT**, is the most frequently used subsurface exploration test performed worldwide. This test provides samples for identification purposes, as well as a measure of penetration resistance, or N-value. The N-Value, or blow counts, when corrected and correlated, can approximate engineering properties of soils used for geotechnical design and engineering purposes.

SPT Procedure:

- Involves driving a hollow tube (split-spoon) into the ground by dropping a 140-lb hammer a height of 30-inches at desired depth
- Recording the number of hammer blows required to drive split-spoon a distance of 12 inches (in 3 or 4 Increments of 6 inches each)
- Auger is advanced* and an additional SPT is performed
- One SPT typically performed for every two to five feet
- Obtain 1.5-inch diameter soil sample

**Drilling Methods May Vary*— The predominant drilling methods used for SPT are open hole fluid rotary drilling and hollow-stem auger drilling.

ECS provides Boring Location Diagrams and Boring Logs for each project!

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-01**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0	S-1	SS	18	18	Topsoil Thickness[7.00"] (SM) Residuum, SILTY MEDIUM SAND, pink and tan, moist, medium dense		0	2-5-11 (16)
					AUGER REFUSAL AT 3.5 FT			
5							-5	
10							-10	
15							-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

⊗16

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 03 2022**		CAVE IN DEPTH:
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 03 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-02**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0	S-1	SS	1	1	Topsoil Thickness[7.00"] (WR) PARTIALLY WEATHERED ROCK SAMPLED AS, No recovery [Weathered ROCK] **AUGER REFUSAL AT 1.1 FT**		0	50/1" (50/1")
5							-5	
10							-10	
15							-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

⊗ 50/1"

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 09 2022**		CAVE IN DEPTH:
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 09 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-03**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0	S-1	SS	18	18	Topsoil Thickness[6.00"] (SM) Residuum, SILTY FINE SAND, brown, moist, very loose		0	1-1-1 (2)
					AUGER REFUSAL AT 3 FT			
5							-5	
10							-10	
15							-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 09 2022**		CAVE IN DEPTH: **2.00**
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 09 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-04**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0	S-1	SS	6	6	Topsoil Thickness[6.00"] (WR) PARTIALLY WEATHERED ROCK SAMPLED AS SILTY FINE TO MEDIUM SAND, pink, tan and gray, moist [Weathered ROCK] Refusal encountered at 2.0 feet. **END OF DRILLING AT 2.0 FT**		0	50/6 (50/6")
5							-5	
10							-10	
15							-15	
20							-20	
25							-25	
30								

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

⊗ 50/6"

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 08 2022**	CAVE IN DEPTH: **1.00**	
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 08 2022**	HAMMER TYPE: **Auto**	
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-05**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION: **367.00**	BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	Plastic Limit Water Content Liquid Limit (X—●—△) ⊗ STANDARD PENETRATION BLOWS/FT; ROCK QUALITY DESIGNATION & RECOVERY; RQD; REC; ○ CALIBRATED PENETROMETER TON/SF; [FINES CONTENT] %
					Topsoil Thickness[6.00"]				
	S-1	SS	18	18	(SC) Residuum, CLAYEY MEDIUM SAND, brown and orange, moist, loose			3-3-4 (7)	⊗7
					AUGER REFUSAL AT 3 FT				
5							-5		
10							-10		
15							-15		
20							-20		
25							-25		
30							-30		

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 08 2022**		CAVE IN DEPTH: **2.00**
▼ WL (Completion) **DRY**	BORING COMPLETED: **Feb 08 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV CME550**	LOGGED BY: **CAR3**	DRILLING METHOD: **2.25 HSA**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-06**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[8.00"]			
	S-1	SS	18	18	(SM) Residuum, SILTY FINE TO MEDIUM SAND, dark yellowish brown, moist, medium dense			1-3-8 (11)
					AUGER REFUSAL AT 3.5 FT			
5							-5	
10							-10	
15							-15	
20							-20	
25							-25	
30							-30	

⊗11 13.7 [19.6%]

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 08 2022**		CAVE IN DEPTH:
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 08 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-07**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[4.00"]		0	
	S-1	SS	18	18	(ML) Residuum, SANDY SILT, orange, moist, firm			1-2-3 (5)
	S-2	SS	18	18	(SM) Residuum, SILTY MEDIUM TO COARSE SAND, gray and white, moist, medium dense		-5	11-13-11 (24)
5	S-3	SS	6	6	(WR) PARTIALLY WEATHERED ROCK SAMPLED AS SILTY FINE SAND, orange, moist [Weathered ROCK]			50/6 (50/6")
	S-4	SS	18	18	(SM) Residuum, SILTY FINE SAND, orange, moist, medium dense to loose		-10	6-6-7 (13)
10								
	S-5	SS	18	18				3-4-5 (9)
15							-15	
					Refusal encountered at 17.5 feet.			
					END OF DRILLING AT 17.5 FT			
20							-20	
25							-25	
30								

Plastic Limit Water Content Liquid Limit

STANDARD PENETRATION BLOWS/FT

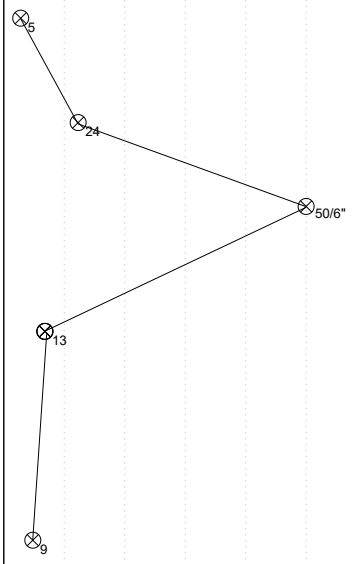
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

WL (First Encountered)	BORING STARTED: **Feb 03 2022**		CAVE IN DEPTH:
WL (Completion) **Dry**	BORING COMPLETED: **Feb 03 2022**		HAMMER TYPE: **Auto**
WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-08**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[12.00"]		0	
	S-1	SS	18	18	(SM FILL) FILL, SILTY MEDIUM SAND, gray and brown, moist			2-3-2 (5)
	S-2	SS	18	18	(SC-SM FILL) FILL, SILTY CLAYEY MEDIUM SAND, orange, moist			2-3-5 (8)
5	S-3	SS	18	18			-5	2-4-5 (9)
	S-4	SS	18	18	(SM) Residuum, SILTY FINE TO MEDIUM SAND, orange, moist, medium dense			6-8-9 (17)
10							-10	
	S-5	SS	2	2	(WR) PARTIALLY WEATHERED ROCK SAMPLED AS SILTY MEDIUM TO COARSE SAND, pink and white, moist [Weathered ROCK]			50/2" (50/2")
15					**AUGER REFUSAL AT 13.7 FT**		-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

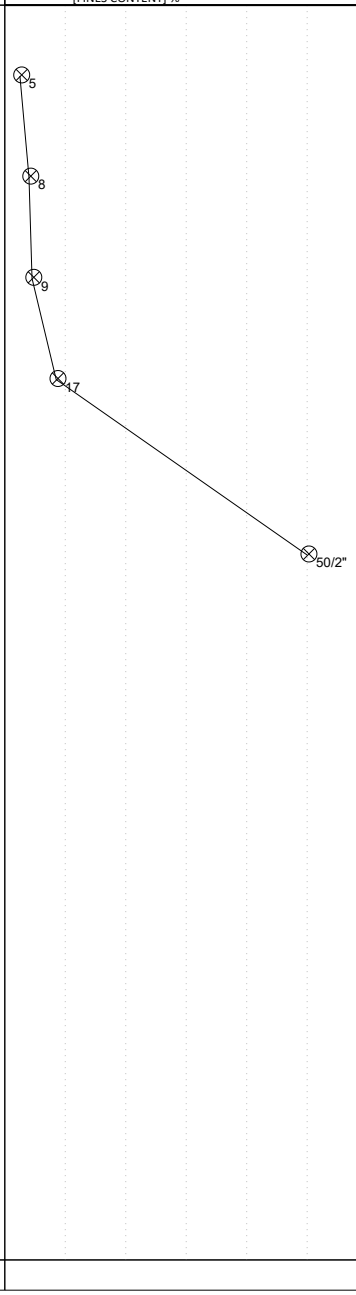
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 03 2022**		CAVE IN DEPTH:
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 03 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-09**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit

STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness[2.00"]			
	S-1	SS	18	18	(SM) Residuum, SILTY MEDIUM SAND, orange, moist, loose			WOH-1-6 (7)
5	~~S-2~~	~~SS~~	~~0~~	~~0~~	(WR) PARTIALLY WEATHERED ROCK SAMPLED AS, No recovery [Weathered ROCK]		-5	50/0" (50/0")
					AUGER REFUSAL AT 3.5 FT			
10							-10	
15							-15	
20							-20	
25							-25	
30							-30	

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 02 2022**	CAVE IN DEPTH: **3.00**	
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 02 2022**	HAMMER TYPE: **Auto**	
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-10**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[6.00"]			
	S-1	SS	18	18	(SM) Residuum, SILTY MEDIUM TO COARSE SAND, gray and tan, moist, medium dense			5-5-17 (22)
					AUGER REFUSAL AT 3 FT			
5							-5	
10							-10	
15							-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

⊗22

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 03 2022**		CAVE IN DEPTH:
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 03 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-11**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness[4.00"]			
	S-1	SS	18	18	(CH) Residuum, SANDY FAT CLAY, brownish yellow, moist, firm			1-2-4 (6)
	S-2	SS	18	18	(SM) Residuum, SILTY FINE TO MEDIUM SAND, tan and pink, moist, very loose to loose			1-1-3 (4)
5	S-3	SS	18	18			-5	2-2-4 (6)
	S-4	SS	18	18				1-1-4 (5)
10							-10	
	S-5	SS	18	18				2-3-5 (8)
15							-15	
	S-6	SS	18	18	(SM) Residuum, SILTY FINE SAND, pink and tan, moist, medium dense			3-4-7 (11)
20					**END OF BORING AT 20 FT**		-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

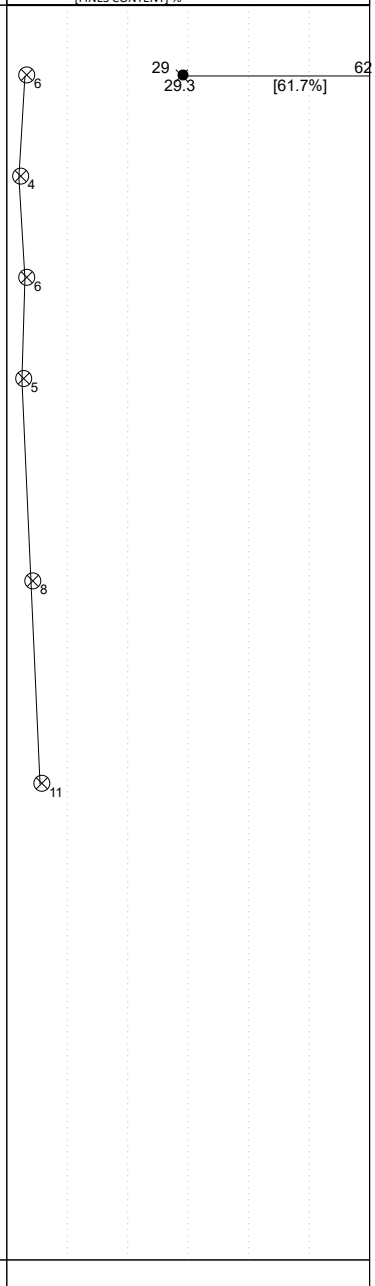
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered) **dry**	BORING STARTED: **Jan 24 2022**		CAVE IN DEPTH:
▼ WL (Completion)	BORING COMPLETED: **Jan 24 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **Truck 55 Trailer/2013 F350**	LOGGED BY: **CAR3**	DRILLING METHOD: **2.25 HSA**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-12**	**1 of 1**
PROJECT NAME: **Kalas Falls Residential Development**	DRILLER/CONTRACTOR: **Bridger Drilling Inc.**		
SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**			LOSS OF CIRCULATION
NORTHING:	EASTING:	STATION:	SURFACE ELEVATION: / BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[8.00"]		0	
	S-1	SS	16	16	(WR) PARTIALLY WEATHERED ROCK SAMPLED AS SILTY MEDIUM TO COARSE SAND, orange, brown and gray, moist			4-5-50/4" (55/10")
	~~S-2~~	~~SS~~	~~1~~	~~1~~	[Weathered ROCK]			50/1" (50/1")
					AUGER REFUSAL AT 3.6 FT			
5							-5	
10							-10	
15							-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

55/10"

50/1"

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 11 2022**		CAVE IN DEPTH: **2.00**
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 11 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-13**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[6.00"]		0	
	S-1	SS	18	18	(SC) Residuum, CLAYEY FINE TO MEDIUM SAND, brown, moist to wet, very loose			WOH-1-1 (2)
	S-2	SS	18	18	(CL) Residuum, SANDY LEAN CLAY, trace silt, red and brown, moist, stiff			4-6-7 (13)
5	S-3	SS	18	18	(SM) Residuum, SILTY FINE TO MEDIUM SAND, pink and gray, moist, loose to medium dense		-5	5-5-3 (8)
	S-4	SS	18	18				4-4-5 (9)
10							-10	
	S-5	SS	18	18				6-7-10 (17)
15							-15	
	S-6	SS	18	18				9-12-16 (28)
20					**END OF BORING AT 20 FT**		-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

STANDARD PENETRATION BLOWS/FT

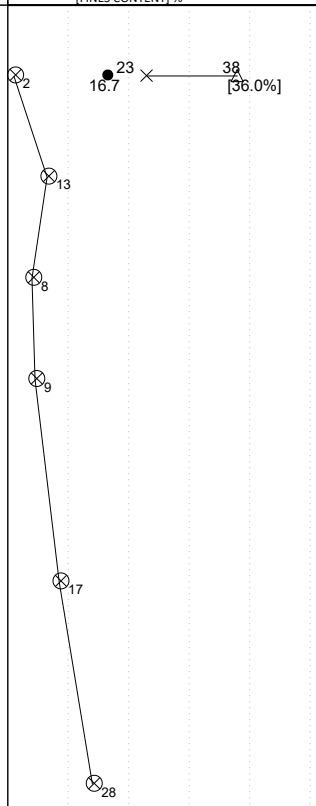
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 09 2022**	CAVE IN DEPTH: **16.90**	
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 09 2022**	HAMMER TYPE: **Auto**	
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-14**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[6.00"]		0	
	S-1	SS	18	18	(ML) Residuum, SANDY SILT, light yellowish brown, moist, firm to stiff			2-3-3 (6)
	S-2	SS	18	18				4-6-7 (13)
5							-5	
	S-3	SS	18	18	(SM) Residuum, SILTY FINE SAND, gray and tan, moist, dense			9-17-29 (46)
	S-4	SS	2	2	(WR) PARTIALLY WEATHERED ROCK SAMPLED AS FINE SAND WITH SILT, gray and tan, moist [Weathered ROCK]			50/2" (50/2")
10					**AUGER REFUSAL AT 8.7 FT**		-10	
15							-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

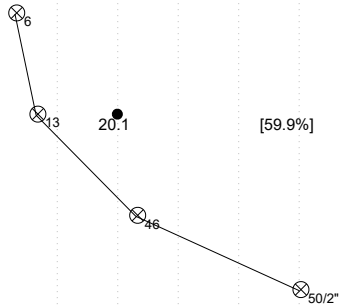
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 11 2022**	CAVE IN DEPTH: **8.00**	
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 11 2022**	HAMMER TYPE: **Auto**	
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-15**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0	S-1	SS	0	0	Topsoil Thickness[5.00"] (WR) PARTIALLY WEATHERED ROCK SAMPLED AS, No recovery [Weathered ROCK] **AUGER REFUSAL AT 0.5 FT**		0 -5	50/0" (50/0")

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

⊗ 50/0"

5 -5
10 -10
15 -15
20 -20
25 -25
30 -30

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Jan 19 2022**		CAVE IN DEPTH:
▼ WL (Completion) **Dry**	BORING COMPLETED: **Jan 25 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-16**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

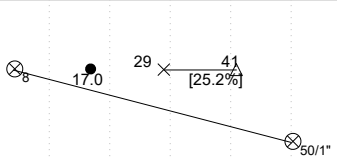
RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness[8.00"]			
	S-1	SS	18	18	(SM) Residuum, SILTY MEDIUM SAND, brown, moist, loose			2-3-5 (8)
	~~S-2~~	~~SS~~	~~1~~	~~1~~	(WR) PARTIALLY WEATHERED ROCK SAMPLED AS SILTY FINE TO MEDIUM SAND, tan and gray, moist [Weathered ROCK]			50/1" (50/1")
5					**AUGER REFUSAL AT 3.6 FT**		-5	
10							-10	
15							-15	
20							-20	
25							-25	
30							-30	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 11 2022**		CAVE IN DEPTH:
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 11 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-17**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[6.00"]		0	
	S-1	SS	16	16	(WR) PARTIALLY WEATHERED ROCK SAMPLED AS SILTY MEDIUM SAND, brown, moist [Weathered ROCK]			3-4-50/4" (54/10")
					AUGER REFUSAL AT 2.5 FT			
5							-5	
10							-10	
15							-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

⊗ **STANDARD PENETRATION BLOWS/FT**

ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ **CALIBRATED PENETROMETER TON/SF**

[FINES CONTENT] %

54/10"

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Jan 19 2022**	CAVE IN DEPTH: **2.50**	
▼ WL (Completion) **Dry**	BORING COMPLETED: **Jan 25 2022**	HAMMER TYPE: **Auto**	
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-18**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[6.00"]		0	
	S-1	SS	18	18	(CH) Residuum, SANDY FAT CLAY, yellowish brown, moist, firm			2-3-3 (6)
	S-2	SS	8	8	(WR) PARTIALLY WEATHERED ROCK SAMPLED AS SILTY MEDIUM SAND, orange and brown, moist [Weathered ROCK]			6-50/2" (50/2")
5					**AUGER REFUSAL AT 4.2 FT**		-5	
10							-10	
15							-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

⊗ **STANDARD PENETRATION BLOWS/FT**

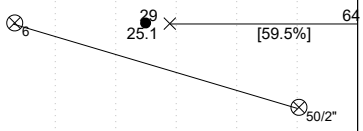
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ **CALIBRATED PENETROMETER TON/SF**

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 10 2022**	CAVE IN DEPTH: **4.00**	
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 10 2022**	HAMMER TYPE: **Auto**	
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-19**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[4.00"]		0	
	S-1	SS	18	18	(MH) Residuum, SANDY ELASTIC SILT, brown, moist, stiff			3-4-5 (9)
	S-2	SS	18	18	(SM) Residuum, SILTY FINE SAND, orange and gray, moist, loose to medium dense			3-4-6 (10)
5	S-3	SS	18	18			-5	3-4-4 (8)
	S-4	SS	18	18				4-5-6 (11)
10							-10	
					AUGER REFUSAL AT 13 FT			
15							-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

STANDARD PENETRATION BLOWS/FT

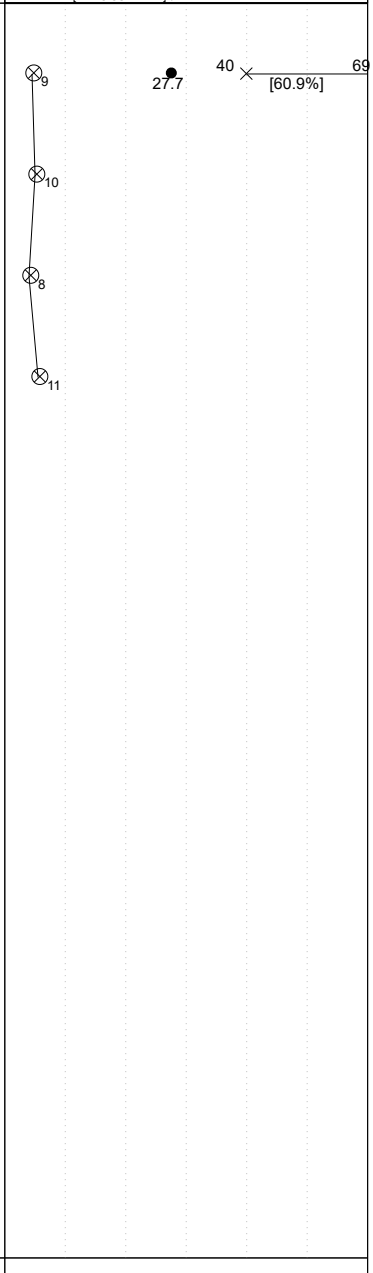
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 10 2022**	CAVE IN DEPTH: **12.10**	
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 10 2022**	HAMMER TYPE: **Auto**	
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-20**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[3.00"]			
	S-1	SS	7	7	(WR) PARTIALLY WEATHERED ROCK SAMPLED AS SILTY MEDIUM SAND, tan and gray, moist [Weathered ROCK]			5-50/1" (50/1")
					AUGER REFUSAL AT 1.6 FT			
5							-5	
10							-10	
15							-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

X———●———△

⊗ **STANDARD PENETRATION BLOWS/FT**

ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ **CALIBRATED PENETROMETER TON/SF**

[FINES CONTENT] %

⊗50/1"

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 11 2022**		CAVE IN DEPTH:
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 11 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-21**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness[7.00"]			
	S-1	SS	18	18	(CL) Residuum, SANDY LEAN CLAY, tan and pink, moist, firm to stiff			2-2-4 (6)
	S-2	SS	18	18				4-6-6 (12)
5							-5	
	S-3	SS	18	18	(SC-SM) Residuum, SILTY CLAYEY FINE TO MEDIUM SAND, pink and gray, moist, loose to medium dense			4-5-5 (10)
	S-4	SS	18	18				3-4-6 (10)
10							-10	
	S-5	SS	18	18				4-6-6 (12)
15							-15	
	S-6	SS	18	18				6-7-9 (16)
20					**END OF BORING AT 20 FT**		-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

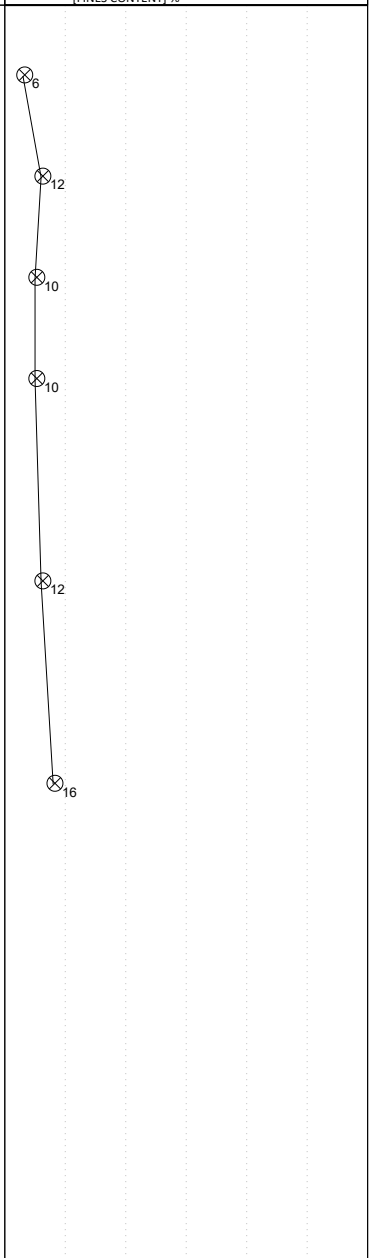
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 10 2022**		CAVE IN DEPTH: **12.30**
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 10 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-22**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

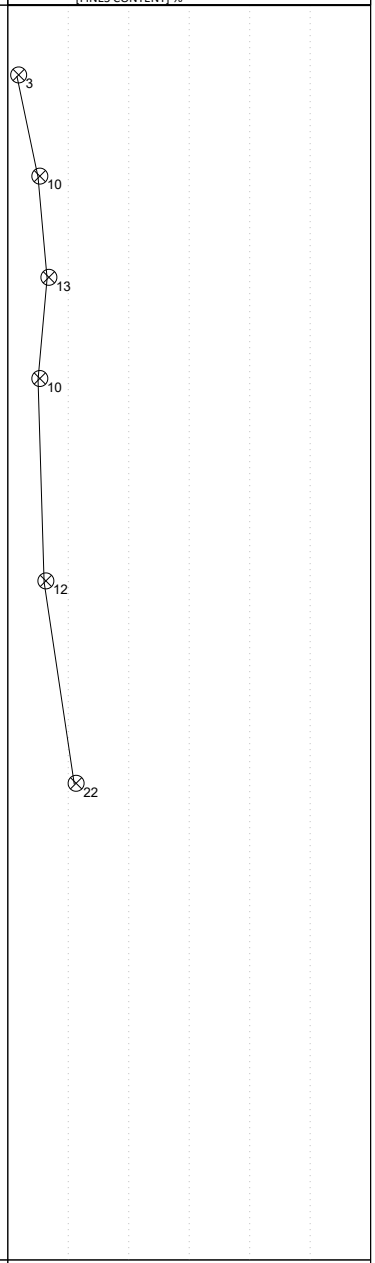
RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness[6.00"]			
	S-1	SS	18	18	(CL) Residuum, SANDY LEAN CLAY, trace silt, orange, moist, soft			1-1-2 (3)
	S-2	SS	18	18	(SC) Residuum, CLAYEY FINE TO MEDIUM SAND, orange, moist, loose			3-5-5 (10)
5	S-3	SS	18	18	(SM) Residuum, SILTY FINE TO MEDIUM SAND, pink and gray, moist, loose to medium dense		-5	4-6-7 (13)
	S-4	SS	18	18				4-5-5 (10)
10							-10	
	S-5	SS	18	18				3-5-7 (12)
15							-15	
	S-6	SS	18	18				7-10-12 (22)
20					**END OF BORING AT 20 FT**		-20	
25							-25	
30							-30	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 10 2022**		CAVE IN DEPTH: **12.90**
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 10 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-23**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[6.00"]		0	
	S-1	SS	18	18	(SC) Alluvium, CLAYEY FINE TO MEDIUM SAND, grayish brown, saturated, very loose, no recovery at 3.5 feet, obstruction			1-1-1 (2)
	S-2	SS	18	18		▼		2-2-3 (5)
5							-5	
	S-3	SS	18	18	(SM) Residuum, SILTY FINE TO MEDIUM SAND, gray and brown, saturated, very loose			1-1-2 (3)
	S-4	SS	18	18				1-1-2 (3)
10							-10	
	S-5	SS	18	18				1-2-1 (3)
15							-15	
	S-6	SS	18	18	(SM) Residuum, SILTY FINE TO MEDIUM SAND, orange and brown, saturated, medium dense			5-7-9 (16)
20					**END OF BORING AT 20 FT**		-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

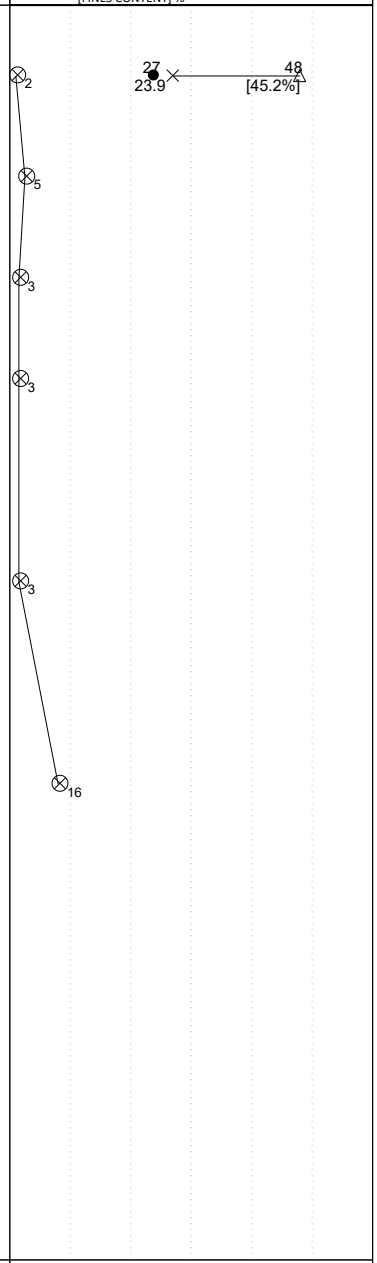
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 12 2022**	CAVE IN DEPTH: **13.00**	
▼ WL (Completion) **5.00**	BORING COMPLETED: **Feb 12 2022**	HAMMER TYPE: **Auto**	
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-24**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness[6.00"]			
	S-1	SS	18	18	(CL) Residuum, SANDY LEAN CLAY, brown, moist, stiff			3-4-7 (11)
	S-2	SS	13	13	(WR) PARTIALLY WEATHERED ROCK SAMPLED AS SILTY FINE SAND, orange and gray, moist [Weathered ROCK]			10-20-50/1" (70/7")
5					**AUGER REFUSAL AT 5.5 FT**		-5	
10							-10	
15							-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

X———●———△

⊗ **STANDARD PENETRATION BLOWS/FT**

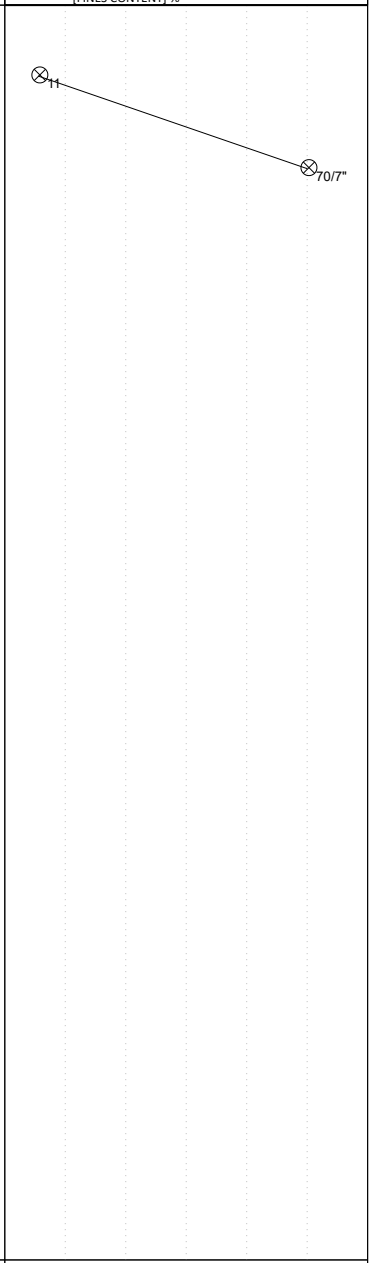
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ **CALIBRATED PENETROMETER TON/SF**

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Jan 19 2022**		CAVE IN DEPTH: **4.00**
▼ WL (Completion) **Dry**	BORING COMPLETED: **Jan 25 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-25**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[6.00"]		0	
	S-1	SS	18	18	(SM) Residuum, SILTY FINE SAND, reddish yellow, moist, loose			2-3-5 (8)
	S-2	SS	18	18				1-4-5 (9)
5	S-3	SS	18	18			-5	3-3-4 (7)
	S-4	SS	18	18				2-2-4 (6)
10					(SC) Residuum, CLAYEY FINE SAND, gray, brown, moist, loose	▽	-10	
	S-5	SS	18	18				2-2-3 (5)
15							-15	
					(SM) Residuum, SILTY FINE TO MEDIUM SAND, gray, moist, medium dense			
	S-6	SS	18	18				10-14-16 (30)
20					**END OF BORING AT 20 FT**		-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

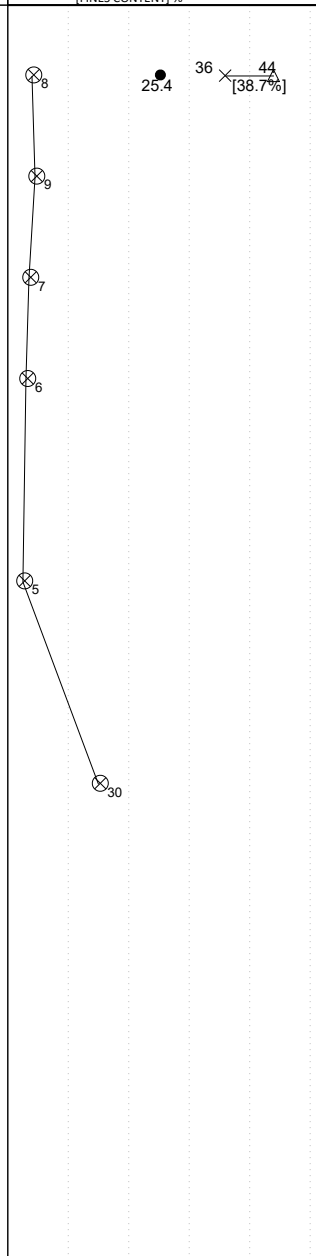
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered) **12.50**	BORING STARTED: **Jan 20 2022**	CAVE IN DEPTH: **14.00**	
▼ WL (Completion)	BORING COMPLETED: **Jan 20 2022**	HAMMER TYPE: **Auto**	
▼ WL (Seasonal High Water)	EQUIPMENT: **Truck 55 Trailer/2013 F350**	LOGGED BY: **CAR3**	DRILLING METHOD: **2.25 HSA**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-26**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness[6.00"]			
	S-1	SS	18	18	(ML) Residuum, SILT, tan and brown, moist, stiff			2-4-5 (9)
	S-2	SS	18	18				1-6-9 (15)
5							-5	
	S-3	SS	18	18	(SM) Residuum, SILTY FINE SAND, tan and gray, moist to wet, loose			3-2-4 (6)
	S-4	SS	18	18		▽		2-2-3 (5)
10							-10	
	S-5	SS	18	18				2-2-3 (5)
15							-15	
	S-6	SS	18	18				3-3-6 (9)
20					**END OF BORING AT 20 FT**		-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

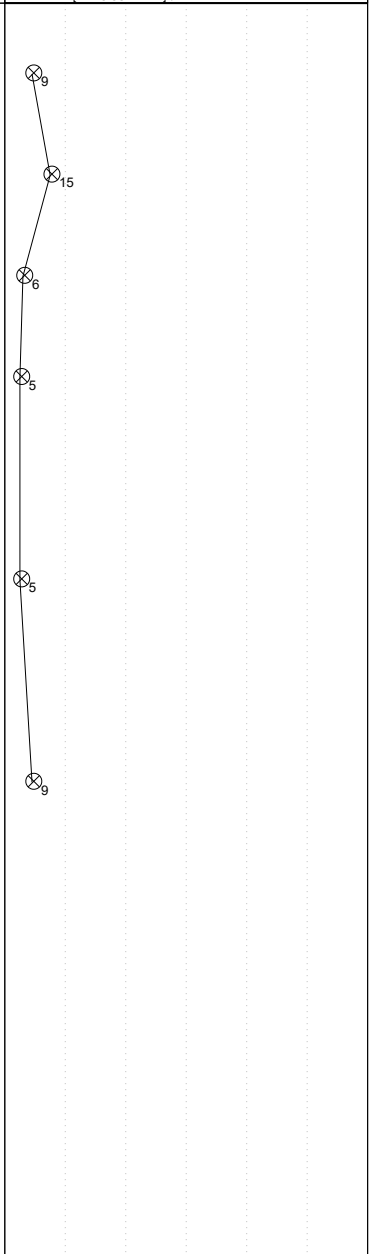
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered) **10.50**	BORING STARTED: **Jan 19 2022**		CAVE IN DEPTH: **12.00**
▼ WL (Completion)	BORING COMPLETED: **Jan 19 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **Truck 55 Trailer/2013 F350**	LOGGED BY: **CAR3**	DRILLING METHOD: **2.25 HSA**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-27**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness[6.00"]			
	S-1	SS	18	18	(SC) Residuum, CLAYEY SAND, tannish brown, moist, loose to medium dense			1-3-5 (8)
	S-2	SS	18	18				2-5-7 (12)
5							-5	
	S-3	SS	18	18	(SM) Residuum, SILTY SAND, gray and brown, moist, loose to medium dense			3-4-4 (8)
	S-4	SS	18	18				3-3-4 (7)
10						▽	-10	
	S-5	SS	18	18				2-5-3 (8)
15							-15	
	S-6	SS	18	18				4-6-10 (16)
20					**END OF BORING AT 20 FT**		-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

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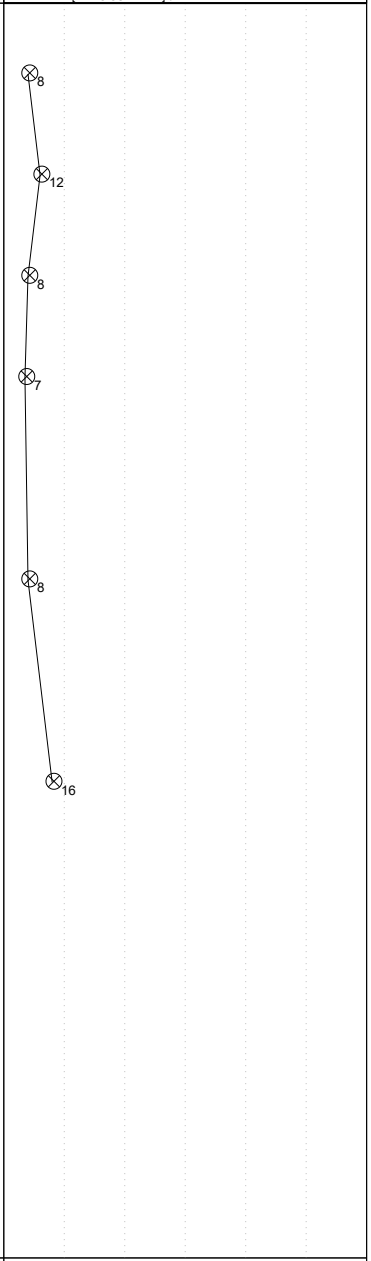


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered) **11.00**	BORING STARTED: **Jan 20 2022**	CAVE IN DEPTH: **12.00**	
▼ WL (Completion)	BORING COMPLETED: **Jan 20 2022**	HAMMER TYPE: **Auto**	
▽ WL (Seasonal High Water)	EQUIPMENT: **Truck 55 Trailer/2013 F350**	LOGGED BY: **CAR3**	DRILLING METHOD: **2.25 HSA**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-28**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[6.00"]		0	
	S-1	SS	18	18	(SP-SM) Residuum, SAND WITH SILT, dark brown, moist, loose			1-2-3 (5)
	S-2	SS	4	4	(WR) PARTIALLY WEATHERED ROCK SAMPLED AS SILTY SAND, white and gray, moist [Weathered ROCK]			50/4" (50/4")
5					**AUGER REFUSAL AT 5.5 FT**		-5	
10							-10	
15							-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

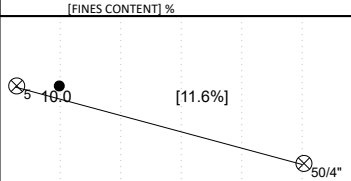
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	**dry**	BORING STARTED:	**Jan 20 2022**	CAVE IN DEPTH:	**5.50**
▼ WL (Completion)		BORING COMPLETED:	**Jan 20 2022**	HAMMER TYPE:	**Auto**
▼ WL (Seasonal High Water)		EQUIPMENT: **Truck 55 Trailer/2013 F350**	LOGGED BY: **CAR3**	DRILLING METHOD:	**2.25 HSA**
▽ WL (Stabilized)					

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-29**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[5.00"]		0	
	S-1	SS	18	18	(SM) Residuum, SILTY SAND, tannish brown, moist, loose			1-2-4 (6)
	S-2	SS	18	18	(ML) Residuum, SILT, trace sand, tannish brown, moist, stiff			4-5-7 (12)
5	S-3	SS	18	18			-5	3-5-6 (11)
	S-4	SS	15	15	(WR) PARTIALLY WEATHERED ROCK SAMPLED AS SILTY FINE TO MEDIUM SAND, gray and tan, moist [Weathered ROCK]			2-7-50/3" (57/9")
10					**AUGER REFUSAL AT 12.5 FT**		-10	
15							-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

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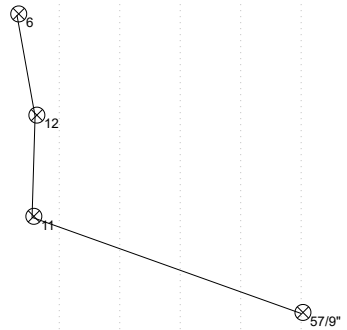


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered) **dry**	BORING STARTED: **Jan 19 2022**		CAVE IN DEPTH: **12.50**
▼ WL (Completion)	BORING COMPLETED: **Jan 19 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **Truck 55Trailer/2013 F350**	LOGGED BY: **CAR3**	DRILLING METHOD: **2.25 HSA**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-30**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness[12.00"]			
	S-1	SS	18	18	(CL) Residuum, SANDY LEAN CLAY, gray and tan, moist, firm			1-2-3 (5)
	S-2	SS	18	18	(SM) Residuum, SILTY FINE TO MEDIUM SAND, gray, moist to wet, loose	▼		11-3-2 (5)
5	S-3	SS	0	0	(WR) PARTIALLY WEATHERED ROCK SAMPLED AS, No recovery [Weathered ROCK]		-5	50/0" (50/0")
					AUGER REFUSAL AT 6 FT			
10							-10	
15							-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

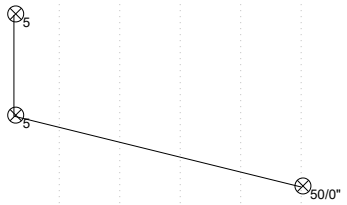
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 12 2022**		CAVE IN DEPTH: **6.00**
▼ WL (Completion) **5.00**	BORING COMPLETED: **Feb 12 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-31**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness[6.00"]			
	S-1	SS	18	18	(CH) Residuum, SANDY FAT CLAY, brownish yellow, moist, soft			2-2-2 (4)
	S-2	SS	18	18	(SM) Residuum, SILTY FINE SAND, orangish brown and gray, moist to wet, loose to medium dense			1-3-4 (7)
5	S-3	SS	18	18			-5	1-2-4 (6)
	S-4	SS	18	18				1-3-5 (8)
10	S-5	SS	18	18		▽	-10	7-9-14 (23)
15	S-6	SS	18	18	(SM) Residuum, SILTY FINE SAND, orangish brown and gray, moist to wet, very dense		-15	15-21-41 (62)
20					**END OF BORING AT 20 FT**		-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

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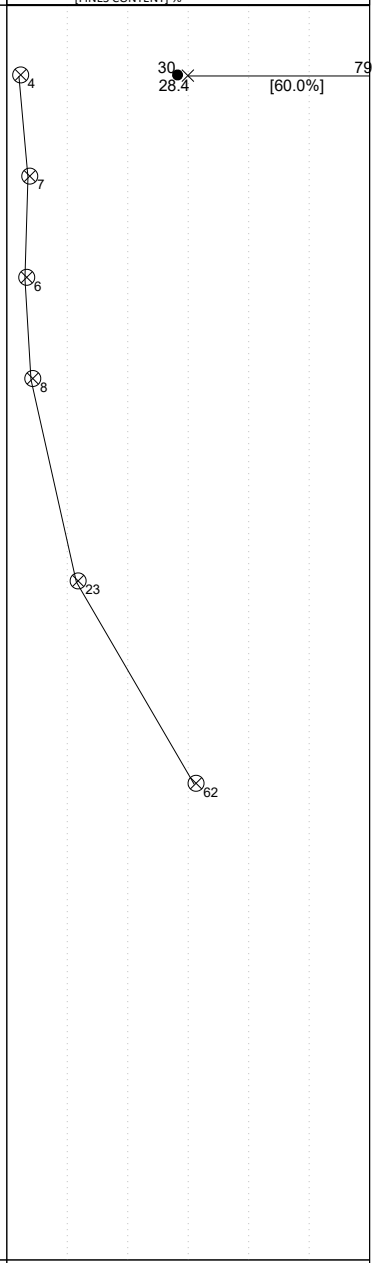


THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered) **16.00**	BORING STARTED: **Jan 19 2022**	CAVE IN DEPTH: **17.50**	
▼ WL (Completion)	BORING COMPLETED: **Jan 19 2022**	HAMMER TYPE: **Auto**	
▽ WL (Seasonal High Water)	EQUIPMENT: **Truck 55Trailer/2013 F350**	LOGGED BY: **CAR3**	DRILLING METHOD: **2.25 HSA**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-32**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[6.00"]		0	
	S-1	SS	18	18	(SM) Residuum, SILTY FINE SAND, contains mica, tannish brown and orange, moist, medium dense to loose			2-5-7 (12)
	S-2	SS	18	18				2-4-5 (9)
5	S-3	SS	18	18			-5	2-3-3 (6)
	S-4	SS	18	18				2-3-4 (7)
10					(ML) Residuum, SANDY SILT, tan and gray, moist to wet, firm		-10	
	S-5	SS	18	18		▽		2-3-4 (7)
15							-15	
	S-6	SS	18	18	(ML) Residuum, SANDY SILT, tan and gray, wet, very stiff			5-10-11 (21)
20					**END OF BORING AT 20 FT**		-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

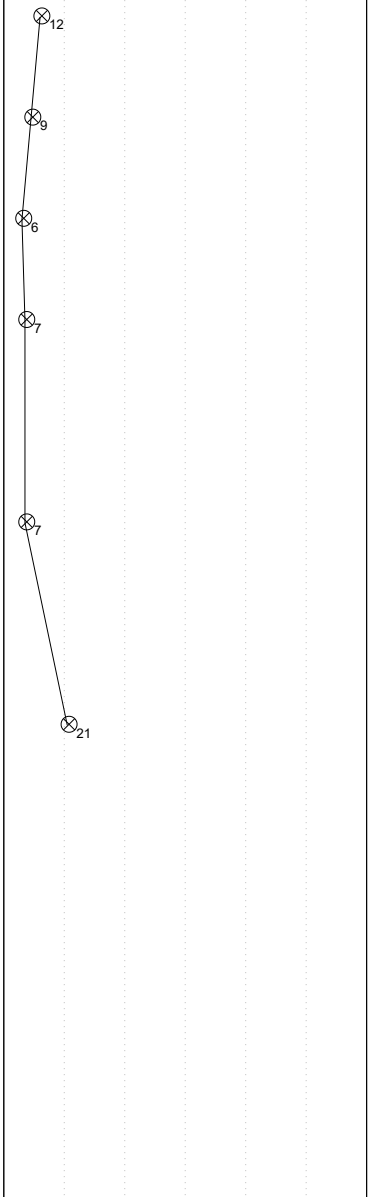
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	**14.50**	BORING STARTED:	**Jan 19 2022**	CAVE IN DEPTH:	**17.00**
▼ WL (Completion)		BORING COMPLETED:	**Jan 19 2022**	HAMMER TYPE:	**Auto**
▽ WL (Seasonal High Water)		EQUIPMENT:	**Truck 55Trailer/2013 F350**	LOGGED BY: **CAR3**	DRILLING METHOD: **2.25 HSA**
▽ WL (Stabilized)					

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-33**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness[6.00"]			
	S-1	SS	18	18	(SM) Residuum, SILTY FINE SAND, tan, gray and brown, moist to wet, medium dense to loose	▽		3-5-6 (11)
	S-2	SS	18	18				1-3-3 (6)
5	S-3	SS	18	18	(ML) Residuum, SILT, white, orange and gray, wet, very soft		-5	2-1-1 (2)
	S-4	SS	18	18	(ML) Residuum, SILT, white, orange and gray, moist, firm			2-3-3 (6)
10							-10	
	S-5	SS	18	18				1-2-4 (6)
15							-15	
	S-6	SS	18	18	(ML) Residuum, SILT, white, orange and gray, moist, hard			7-12-38 (50)
20					**END OF BORING AT 20 FT**		-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

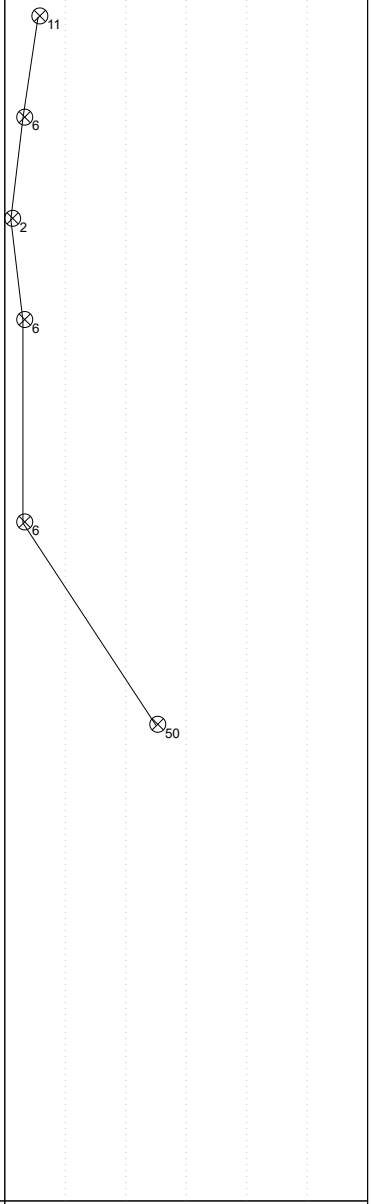
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered) **3.50**	BORING STARTED: **Jan 20 2022**	CAVE IN DEPTH: **10.00**	
▼ WL (Completion)	BORING COMPLETED: **Jan 20 2022**	HAMMER TYPE: **Auto**	
▼ WL (Seasonal High Water)	EQUIPMENT: **Truck 55Trailer/2013 F350**	LOGGED BY: **CAR3**	DRILLING METHOD: **2.25 HSA**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-34**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

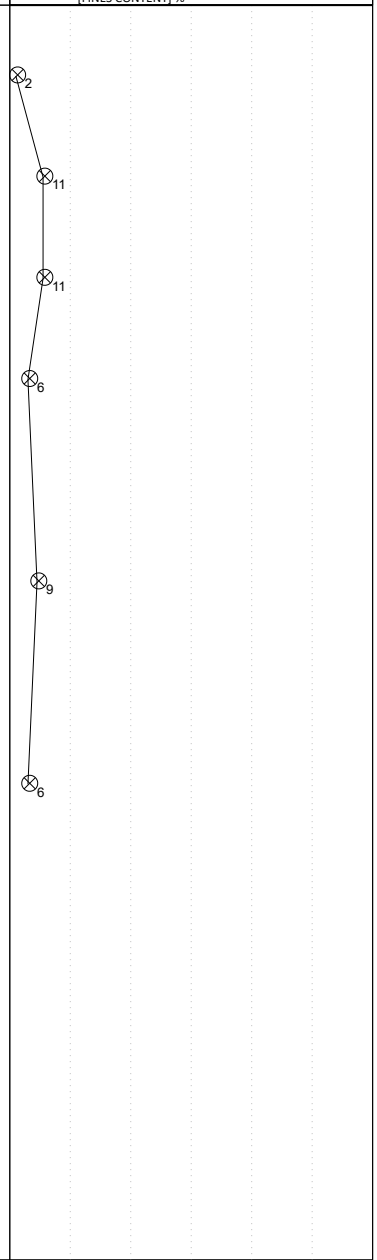
RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness[6.00"]			
	S-1	SS	18	18	(SM) Residuum, SILTY FINE SAND, gray and orange, moist, very loose			1-1-1 (2)
	S-2	SS	18	18	(SM) Residuum, SILTY FINE SAND, gray and orange, moist, medium dense to loose			2-5-6 (11)
5	S-3	SS	18	18			-5	4-5-6 (11)
	S-4	SS	18	18				4-3-3 (6)
10							-10	
	S-5	SS	18	18				4-4-5 (9)
15							-15	
	S-6	SS	18	18				1-3-3 (6)
20					**END OF BORING AT 20 FT**		-20	
25							-25	
30							-30	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered) **dry**	BORING STARTED: **Jan 19 2022**	CAVE IN DEPTH: **18.00**	
▼ WL (Completion)	BORING COMPLETED: **Jan 19 2022**	HAMMER TYPE: **Auto**	
▼ WL (Seasonal High Water)	EQUIPMENT: **Truck 55 Trailer/2013 F350**	LOGGED BY: **CAR3**	DRILLING METHOD: **2.25 HSA**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**B-35**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0	S-1	SS	18	18	(SM) Residuum, SILTY FINE SAND, light gray and dark brown, moist to wet, very loose to loose	▽	0	1-1-1 (2)
	S-2	SS	18	18				1-1-2 (3)
5	S-3	SS	18	18			-5	1-1-1 (2)
	S-4	SS	18	18				2-3-5 (8)
10	S-5	SS	18	18			-10	4-4-3 (7)
15	S-6	SS	18	18	(SM) Residuum, SILTY FINE SAND, gray and white and orange, wet, dense		-15	14-18-16 (34)
20					**END OF BORING AT 20 FT**		-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

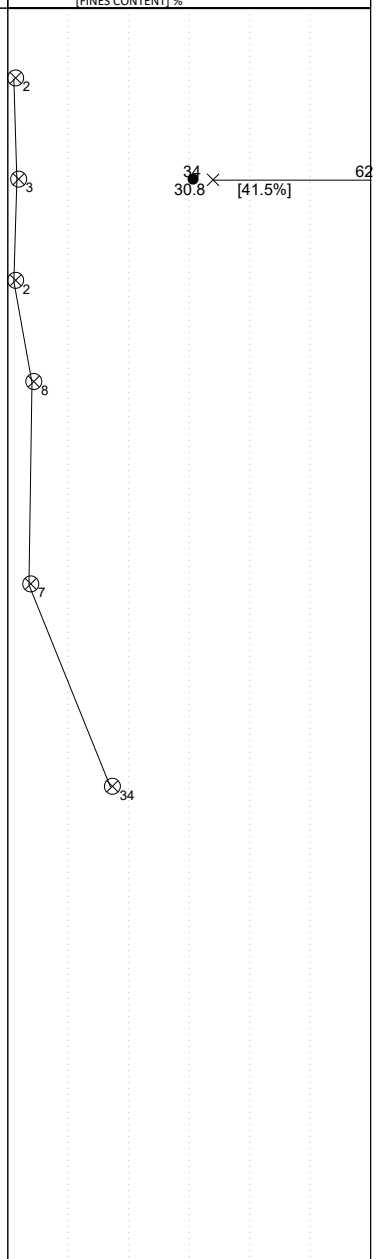
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered) **6.00**	BORING STARTED: **Jan 19 2022**	CAVE IN DEPTH: **11.50**	
▼ WL (Completion)	BORING COMPLETED: **Jan 25 2022**	HAMMER TYPE: **Auto**	
▽ WL (Seasonal High Water)	EQUIPMENT: **Truck 55 Trailer/2013 F350**	LOGGED BY: **CAR3**	DRILLING METHOD: **2.25 HSA**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**SCM-01**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[10.00"]		0	
	S-1	SS	18	18	(SM) Residuum, SILTY MEDIUM SAND, tan, moist, very loose			WOH-1-2 (3)
	S-2	SS	18	18	(WR) PARTIALLY WEATHERED ROCK SAMPLED AS SILTY MEDIUM TO COARSE SAND, orange, moist [Weathered ROCK]		-5	5-8-50 (58)
5					**AUGER REFUSAL AT 5.5 FT**			
10							-10	
15							-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

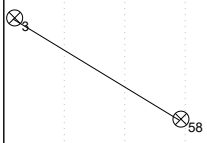
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 11 2022**	CAVE IN DEPTH: **4.00**	
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 11 2022**	HAMMER TYPE: **Auto**	
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**SCM-02**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[6.00"]		0	
	S-1	SS	18	18	(SC) Residuum, CLAYEY FINE SAND, yellowish brown, moist, loose			2-3-4 (7)
	S-2	SS	18	18	(SM) Residuum, SILTY MEDIUM SAND, tan, moist, medium dense to loose			4-5-6 (11)
5	S-3	SS	18	18			-5	3-4-6 (10)
	S-4	SS	18	18				5-4-5 (9)
10							-10	
	S-5	SS	18	18				3-4-4 (8)
15					**END OF BORING AT 15 FT**		-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

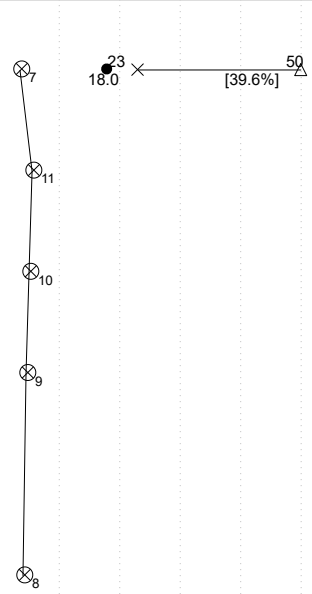
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 09 2022**	CAVE IN DEPTH: **12.00**	
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 09 2022**	HAMMER TYPE: **Auto**	
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**SCM-03**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness[7.00"]			
	S-1	SS	18	18	(SC-SM) Residuum, SILTY CLAYEY FINE TO MEDIUM SAND, gray and tan, moist, very loose			1-1-2 (3)
	S-2	SS	18	18	(SM) Residuum, SILTY MEDIUM TO COARSE SAND, orange and gray, moist, medium dense			3-5-7 (12)
5	S-3	SS	18	18			-5	6-9-13 (22)
	S-4	SS	18	18				7-10-9 (19)
10							-10	
	S-5	SS	18	18				9-12-16 (28)
15					**END OF BORING AT 15 FT**		-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

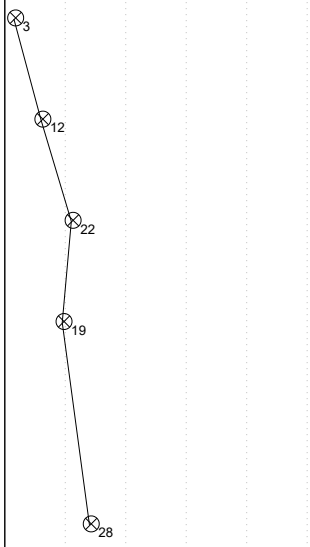
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 09 2022**		CAVE IN DEPTH: **12.40**
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 09 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**SCM-04**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0	S-1	SS	0	0	Topsoil Thickness[6.00"] (WR) PARTIALLY WEATHERED ROCK SAMPLED AS, No recovery [Weathered ROCK] **AUGER REFUSAL AT 1 FT**		0	50/0" (50/0")
5							-5	
10							-10	
15							-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit
X——●——△

⊗ **STANDARD PENETRATION BLOWS/FT**

ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ **CALIBRATED PENETROMETER TON/SF**

[FINES CONTENT] %

⊗ 50/0"

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 09 2022**		CAVE IN DEPTH: **1.00**
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 09 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**SCM-05**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[9.00"]		0	
	S-1	SS	18	18	(SM) Residuum, SILTY MEDIUM SAND, light greenish brown, moist, medium dense			2-7-11 (18)
	S-2	SS	18	18				4-6-7 (13)
5	S-3	SS	18	18			-5	6-9-12 (21)
	S-4	SS	18	18				6-7-9 (16)
10							-10	
					AUGER REFUSAL AT 12.5 FT			
15							-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

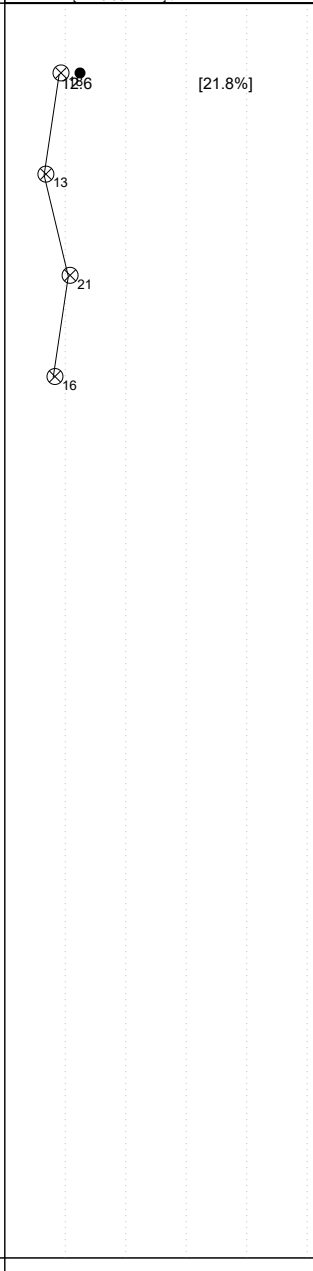
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 08 2022**	CAVE IN DEPTH: **11.50**	
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 08 2022**	HAMMER TYPE: **Auto**	
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**SCM-06**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[8.00"]		0	
	S-1	SS	18	18	(SM) Residuum, SILTY MEDIUM SAND, brown, moist, loose			2-3-6 (9)
	S-2	SS	18	18	(ML) Residuum, SANDY SILT, trace clay, gray, moist to wet, very stiff to stiff		-5	7-10-10 (20)
5	S-3	SS	18	18				6-8-7 (15)
	S-4	SS	18	18	(SM) Residuum, SILTY FINE TO MEDIUM SAND, gray and orange, moist to wet, loose	▼	-10	3-4-4 (8)
10								
	S-5	SS	18	18				2-3-4 (7)
15					**END OF BORING AT 15 FT**		-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

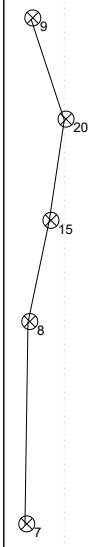
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 08 2022**	CAVE IN DEPTH: **12.30**	
▼ WL (Completion) **12.00**	BORING COMPLETED: **Feb 08 2022**	HAMMER TYPE: **Auto**	
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**SCM-07**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION: **336.00**	BOTTOM OF CASING

Plastic Limit Water Content Liquid Limit

STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

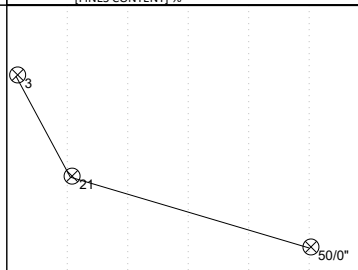
RQD

REC

CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness[10.00"]			
	S-1	SS	18	18	(ML) Residuum, SANDY SILT, tan, moist, soft			1-1-2 (3)
	S-2	SS	18	18	(SM) Residuum, SILTY MEDIUM SAND, tan, moist, medium dense			6-8-13 (21)
5	S-3	SS	0	0	(WR) PARTIALLY WEATHERED ROCK SAMPLED AS, No recovery [Weathered ROCK]		-5	50/0" (50/0")
					AUGER REFUSAL AT 6 FT			
10							-10	
15							-15	
20							-20	
25							-25	
30							-30	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 08 2022**	CAVE IN DEPTH: **4.70**	
▼ WL (Completion) **DRY**	BORING COMPLETED: **Feb 08 2022**	HAMMER TYPE: **Auto**	
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV CME550**	LOGGED BY: **CAR3**	DRILLING METHOD: **2.25 HSA**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**SCM-08**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION: **378.00**

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[12.00"]		0	
	S-1	SS	18	18	(CH) Residuum, FAT CLAY WITH SAND, brownish yellow, moist, firm			2-2-3 (5)
5	S-2	SS	18	18	(SM) Residuum, SILTY MEDIUM SAND, pink and brown, moist to wet, loose to medium dense		-5	2-2-4 (6)
	S-3	SS	18	18		▽		2-3-5 (8)
	S-4	SS	18	18				2-4-7 (11)
10							-10	
	S-5	SS	18	18				3-3-6 (9)
15					**END OF BORING AT 15 FT**		-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

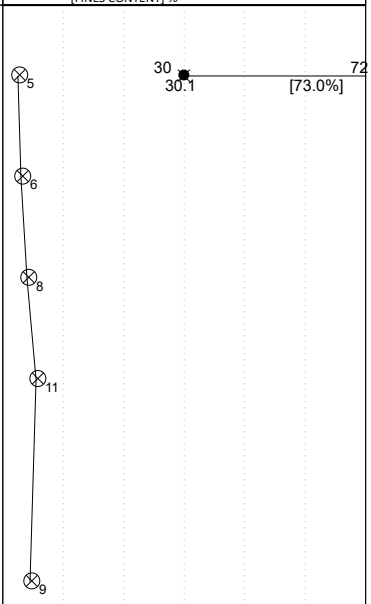
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered) **7.00**	BORING STARTED: **Feb 08 2022**		CAVE IN DEPTH: **12.00**
▼ WL (Completion)	BORING COMPLETED: **Feb 08 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **CAR3**	DRILLING METHOD:
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**SCM-09**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0					Topsoil Thickness[8.00"]		0	
	S-1	SS	18	18	(SM) Residuum, SILTY FINE TO MEDIUM SAND, gray and brown, moist, loose to medium dense			2-3-4 (7)
	S-2	SS	18	18				5-10-24 (34)
5							-5	
	S-3	SS	18	18	(SM) Residuum, SILTY FINE TO MEDIUM SAND, gray and brown, moist, very dense			17-29-50 (79)
	S-4	SS	8	8	(WR) PARTIALLY WEATHERED ROCK SAMPLED AS SILTY FINE TO MEDIUM SAND, orange and gray, moist to wet [Weathered ROCK]	▼		35-50/2" (50/2")
10					**AUGER REFUSAL AT 9.5 FT**		-10	
15							-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

X———●———△

⊗ STANDARD PENETRATION BLOWS/FT

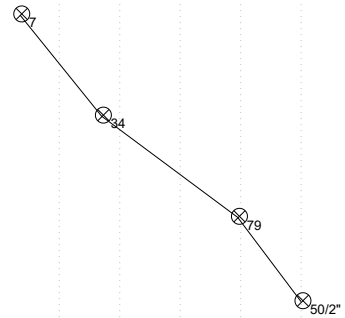
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Jan 19 2022**		CAVE IN DEPTH: **9.50**
▼ WL (Completion) **9.40**	BORING COMPLETED: **Jan 25 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**SCM-10**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0	S-1	SS	3	3	Topsoil Thickness[8.00"] (WR) PARTIALLY WEATHERED ROCK SAMPLED AS SILTY MEDIUM SAND, gray, moist [Weathered ROCK] **AUGER REFUSAL AT 2 FT**		0	50/3" (50/3")
5							-5	
10							-10	
15							-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

⊗ 50/3"

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Jan 19 2022**		CAVE IN DEPTH: **1.00**
▼ WL (Completion) **Dry**	BORING COMPLETED: **Jan 25 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**SCM-11**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness[12.00"]			
	S-1	SS	18	18	(SM) Residuum, SILTY FINE SAND, brown, moist, very loose			1-1-WOH (1)
	~~S-2~~	~~SS~~	~~1~~	~~1~~	(WR) PARTIALLY WEATHERED ROCK SAMPLED AS, No recovery [Weathered ROCK]			50/1" (50/1")
					AUGER REFUSAL AT 3.7 FT			

Plastic Limit Water Content Liquid Limit

STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 11 2022**		CAVE IN DEPTH:
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 11 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**SCM-12**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0	S-1	SS	0	0	Topsoil Thickness[4.00"] (WR) PARTIALLY WEATHERED ROCK SAMPLED AS, No recovery [Weathered ROCK] **AUGER REFUSAL AT 0.5 FT**		0	50/0" (50/0")
5							-5	
10							-10	
15							-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit
X———●———△

⊗ **STANDARD PENETRATION BLOWS/FT**

ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ **CALIBRATED PENETROMETER TON/SF**

[FINES CONTENT] %

⊗ 50/0"

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 11 2022**		CAVE IN DEPTH: **0.50**
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 11 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**SCM-13**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"	Plastic Limit Water Content Liquid Limit X——●——△ ⊗ STANDARD PENETRATION BLOWS/FT; ROCK QUALITY DESIGNATION & RECOVERY; RQD; REC; ○ CALIBRATED PENETROMETER TON/SF; [FINES CONTENT] %
					Topsoil Thickness[7.00"]				
	S-1	SS	18	18	(SM) Residuum, SILTY MEDIUM SAND, tan, moist, medium dense			1-7-10 (17)	⊗17
					AUGER REFUSAL AT 3 FT				
5							-5		
10							-10		
15							-15		
20							-20		
25							-25		
30							-30		

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 09 2022**	CAVE IN DEPTH: **3.00**	
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 09 2022**	HAMMER TYPE: **Auto**	
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**SCM-14**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
0	S-1	SS	2	2	Topsoil Thickness[6.00"] (WR) PARTIALLY WEATHERED ROCK SAMPLED AS SILTY MEDIUM TO COARSE SAND, brown, moist [Weathered ROCK] **AUGER REFUSAL AT 1.2 FT**		0	50/2" (50/2")
5							-5	
10							-10	
15							-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

⊗ STANDARD PENETRATION BLOWS/FT

ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ CALIBRATED PENETROMETER TON/SF

[FINES CONTENT] %

⊗ 50/2"

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 11 2022**	CAVE IN DEPTH: **1.20**	
▼ WL (Completion) **Dry**	BORING COMPLETED: **Feb 11 2022**	HAMMER TYPE: **Auto**	
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

CLIENT:	PROJECT NO.:	BORING NO.:	SHEET:
D.R. Horton	**06:24735**	**SCM-15**	**1 of 1**

PROJECT NAME:	DRILLER/CONTRACTOR:
Kalas Falls Residential Development	**Bridger Drilling Inc.**

SITE LOCATION: **1832 Rolesville Road, Rolesville, North Carolina 27587**

LOSS OF CIRCULATION

NORTHING:	EASTING:	STATION:	SURFACE ELEVATION:

BOTTOM OF CASING

DEPTH (FT)	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DIST. (IN)	RECOVERY (IN)	DESCRIPTION OF MATERIAL	WATER LEVELS	ELEVATION (FT)	BLOWS/6"
					Topsoil Thickness[4.00"]			
	S-1	SS	18	18	(CL) Residuum, SANDY LEAN CLAY, brown, moist, soft			1-1-2 (3)
	S-2	SS	18	18	(ML) Residuum, SANDY SILT, trace clay, trace gravel, orange and brown, moist to wet, stiff			3-6-6 (12)
5	S-3	SS	18	18			-5	4-4-5 (9)
	S-4	SS	18	18				3-4-6 (10)
10						▼	-10	
	S-5	SS	18	18				3-6-4 (10)
15					**END OF BORING AT 15 FT**		-15	
20							-20	
25							-25	
30							-30	

Plastic Limit Water Content Liquid Limit

X———●———△

⊗ **STANDARD PENETRATION BLOWS/FT**

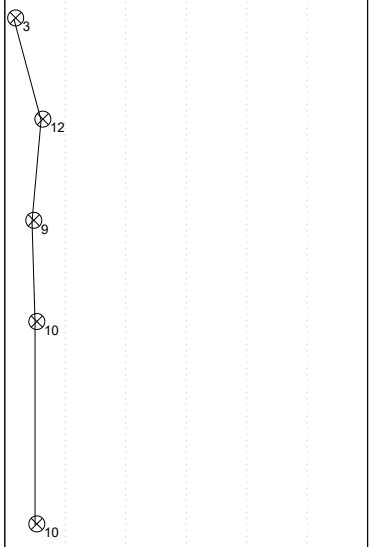
ROCK QUALITY DESIGNATION & RECOVERY

RQD

REC

○ **CALIBRATED PENETROMETER TON/SF**

[FINES CONTENT] %



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES. IN-SITU THE TRANSITION MAY BE GRADUAL

▽ WL (First Encountered)	BORING STARTED: **Feb 10 2022**		CAVE IN DEPTH: **13.00**
▼ WL (Completion) **12.10**	BORING COMPLETED: **Feb 10 2022**		HAMMER TYPE: **Auto**
▼ WL (Seasonal High Water)	EQUIPMENT: **ATV**	LOGGED BY: **GHG**	DRILLING METHOD: **2-1/4" H.S.A.**
▽ WL (Stabilized)			

GEOTECHNICAL BOREHOLE LOG

Appendix C – Laboratory Testing

Laboratory Testing Summary

Plasticity Chart(s)

Moisture-Density Relationship Curve(s)

CBR Test Results

Laboratory Testing Summary

Sample Source	Sample Number	Start Depth (feet)	End Depth (feet)	Sample Distance (feet)	MC[1] (%)	Soil Type[2]	Atterberg Limits[3]			Percent Passing No. 200 Sieve[4]	Moisture - Density (Corr.)[5]		CBR Value[6]	Organic Content
							LL	PL	PI		Maximum Density (pcf)	Optimum Moisture (%)		
B-06	S-1	1.0	2.5	1.5	13.7	SM		NP		19.6	111.7	11.5	20	
B-11	S-1	1.0	2.5	1.5	29.3	CH	62	29	33	61.7				
B-13	S-1	1.0	2.5	1.5	16.7	SC	38	23	15	36.0	100.7	14.2	10	
B-14	S-2	3.5	5.0	1.5	20.1	ML		NP		59.9				
B-16	S-1	1.0	2.5	1.5	17.0	SM	41	29	12	25.2				
B-18	S-1	1.0	2.5	1.5	25.1	CH	64	29	35	59.5				
B-19	S-1	1.0	2.5	1.5	27.7	MH	69	40	29	60.9				
B-23	S-1	1.0	2.5	1.5	23.9	SC	48	27	21	45.2				
B-25	S-1	1.0	2.5	1.5	25.4	SM	44	36	8	38.7				
B-28	S-1	1.0	2.5	1.5	10.0	SP-SM		NP		11.6	118.4	11.2	17	
B-31	S-1	1.0	2.5	1.5	28.4	CH	79	30	49	60.0				
B-35	S-2	3.5	5.0	1.5	30.8	SM	62	34	28	41.5				
SCM-02	S-1	1.0	2.5	1.5	18.0	SC	50	23	27	39.6				
SCM-05	S-1	1.0	2.5	1.5	12.6	SM		NP		21.8				
SCM-08	S-1	1.0	2.5	1.5	30.1	CH	72	30	42	73.0				

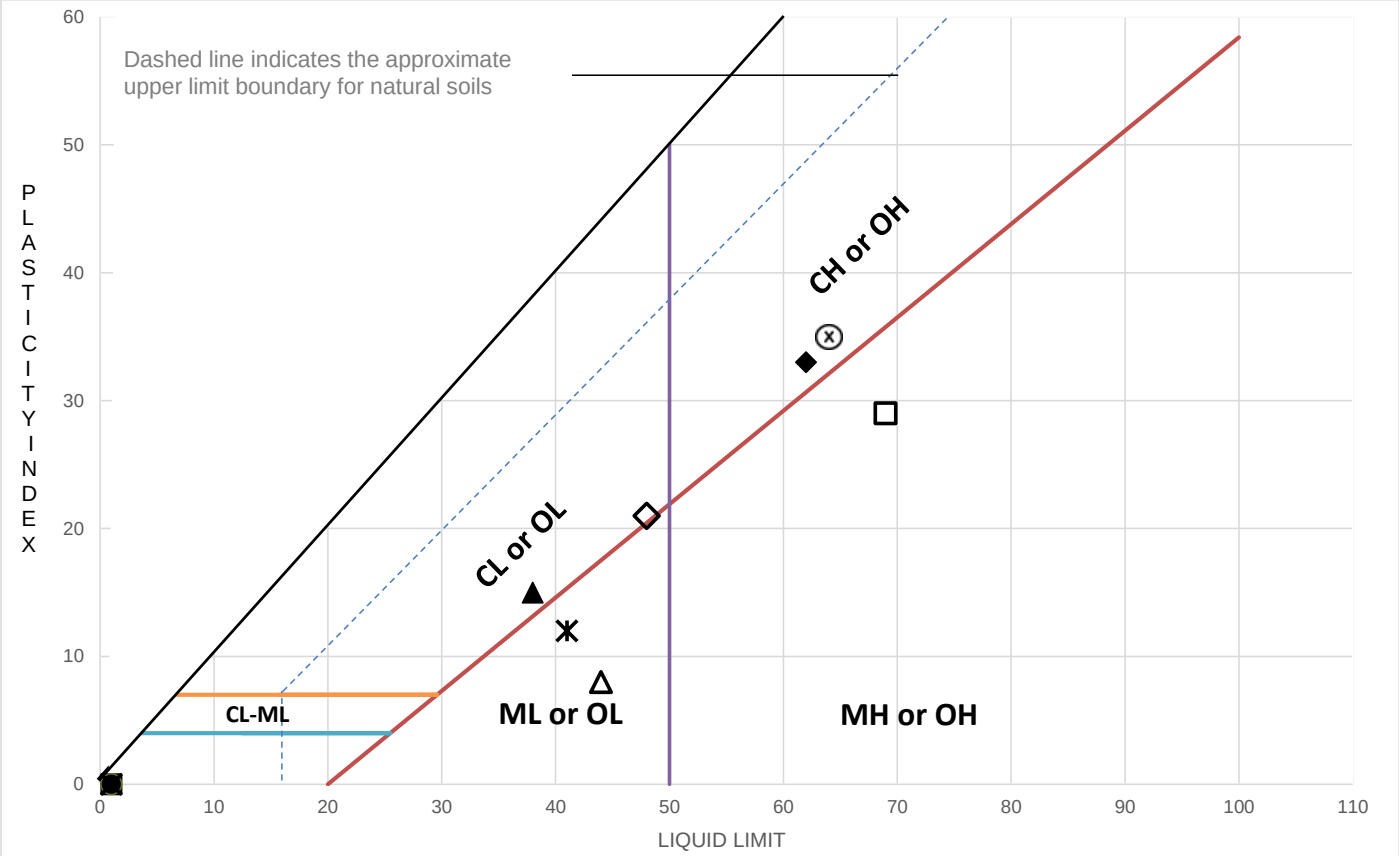
Notes: 1. ASTM D 2216, 2. ASTM D 2487, 3. ASTM D 4318, 4. ASTM D 1140, 5. See test reports for test method, 6. See test reports for test method

Definitions: MC: Moisture Content, Soil Type: USCS (Unified Soil Classification System), LL: Liquid Limit, PL: Plastic Limit, PI: Plasticity Index, CBR: California Bearing Ration, OC: Organic Content (ASTM D 2974)

Project No. 06:24735
Project Name: Kalas Falls Residential Development
PM: Gunnar Goslin
PE: Thomas Schipporeit
Printed On: March 7, 2022

ECS Southeast, LLP - Raleigh
9001 Glenwood Avenue
Raleigh, NC 27617-7505
Phone: 919-861-9910
Fax: 919-861-9911

LIQUID AND PLASTIC LIMITS TEST REPORT



TEST RESULTS (ASTM D4318-10 (MULTIPOINT TEST))

	Sample Location	Sample Number	Sample Depth (ft)	LL	PL	PI	%<#40	%<#200	AASHTO	USCS	Material Description
■	B-06	S-1	1-2.5	NP	NP	NP		19.6			(SM) SILTY SAND, Dark Yellowish-Brown
◆	B-11	S-1	1-2.5	62	29	33		61.7			(CH) SANDY FAT CLAY, Brownish-Yellow
▲	B-13	S-1	1-2.5	38	23	15		36.0			(SC) CLAYEY SAND, Strong Brown
●	B-14	S-2	3.5-5	NP	NP	NP		59.9			(ML) SANDY SILT, Light Yellowish-Brown
✳	B-16	S-1	1-2.5	41	29	12		25.2			(SM) SILTY SAND, Brown
⊗	B-18	S-1	1-2.5	64	29	35		59.5			(CH) SANDY FAT CLAY, Yellowish-Brown
□	B-19	S-1	1-2.5	69	40	29		60.9			(MH) SANDY ELASTIC SILT, Strong Brown
◇	B-23	S-1	1-2.5	48	27	21		45.2			(SC) CLAYEY SAND, Grayish-Brown
△	B-25	S-1	1-2.5	44	36	8		38.7			(SM) SILTY SAND, Reddish-Yellow
×	B-28	S-1	1-2.5	NP	NP	NP		11.6			(SP-SM) POORLY GRADED SAND w/ SILT, Dark Brown

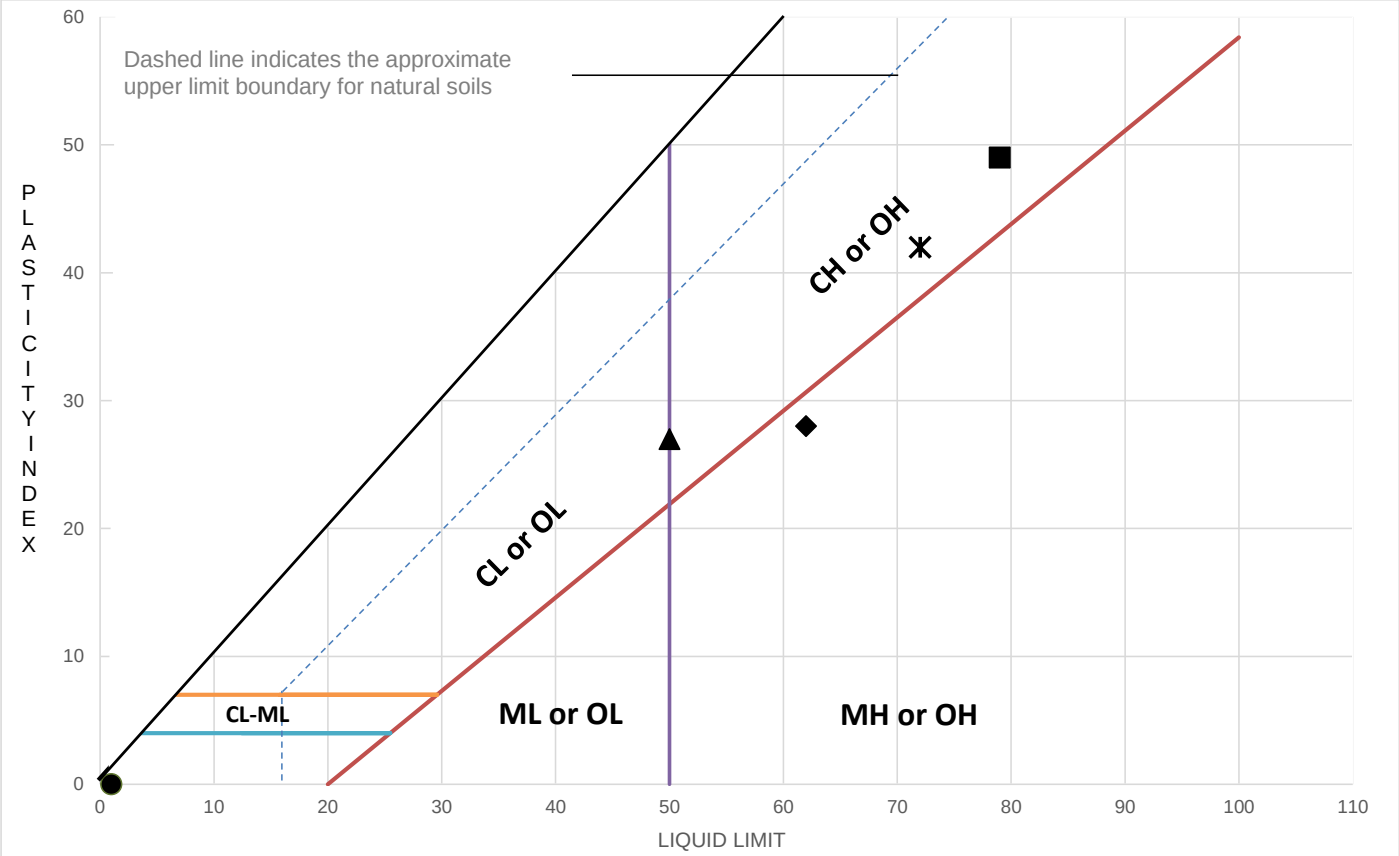
Project: Kalas Falls Residential Development
Client: D.R. Horton

Project No.: 06:24735
Date Reported: 3/2/2022

Office / Lab	Address	Office Number / Fax
ECS Southeast LLP - Raleigh	5260 Greens Dairy Road Raleigh, NC 27616	(919)861-9910 (919)861-9911

Tested by	Checked by	Approved by	Date Received
acreech	ssisell2	ssisell2	2/22/2022

LIQUID AND PLASTIC LIMITS TEST REPORT



TEST RESULTS (ASTM D4318-10 (MULTIPOINT TEST))

	Sample Location	Sample Number	Sample Depth (ft)	LL	PL	PI	%<#40	%<#200	AASHTO	USCS	Material Description
■	B-31	S-1	1-2.5	79	30	49		60.0			(CH) SANDY FAT CLAY, Brownish-Yellow
◆	B-35	S-2	3.5-5	62	34	28		41.5			(SM) SILTY SAND, Light Gray
▲	SCM-02	S-1	1-2.5	50	23	27		39.6			(SC) CLAYEY SAND, Yellowish-Brown
●	SCM-05	S-1	1-2.5	NP	NP	NP		21.8			(SM) SILTY SAND, Light Olive Brown
✳	SCM-08	S-1	1-2.5	72	30	42		73.0			(CH) FAT CLAY w/ SAND, Brownish-Yellow

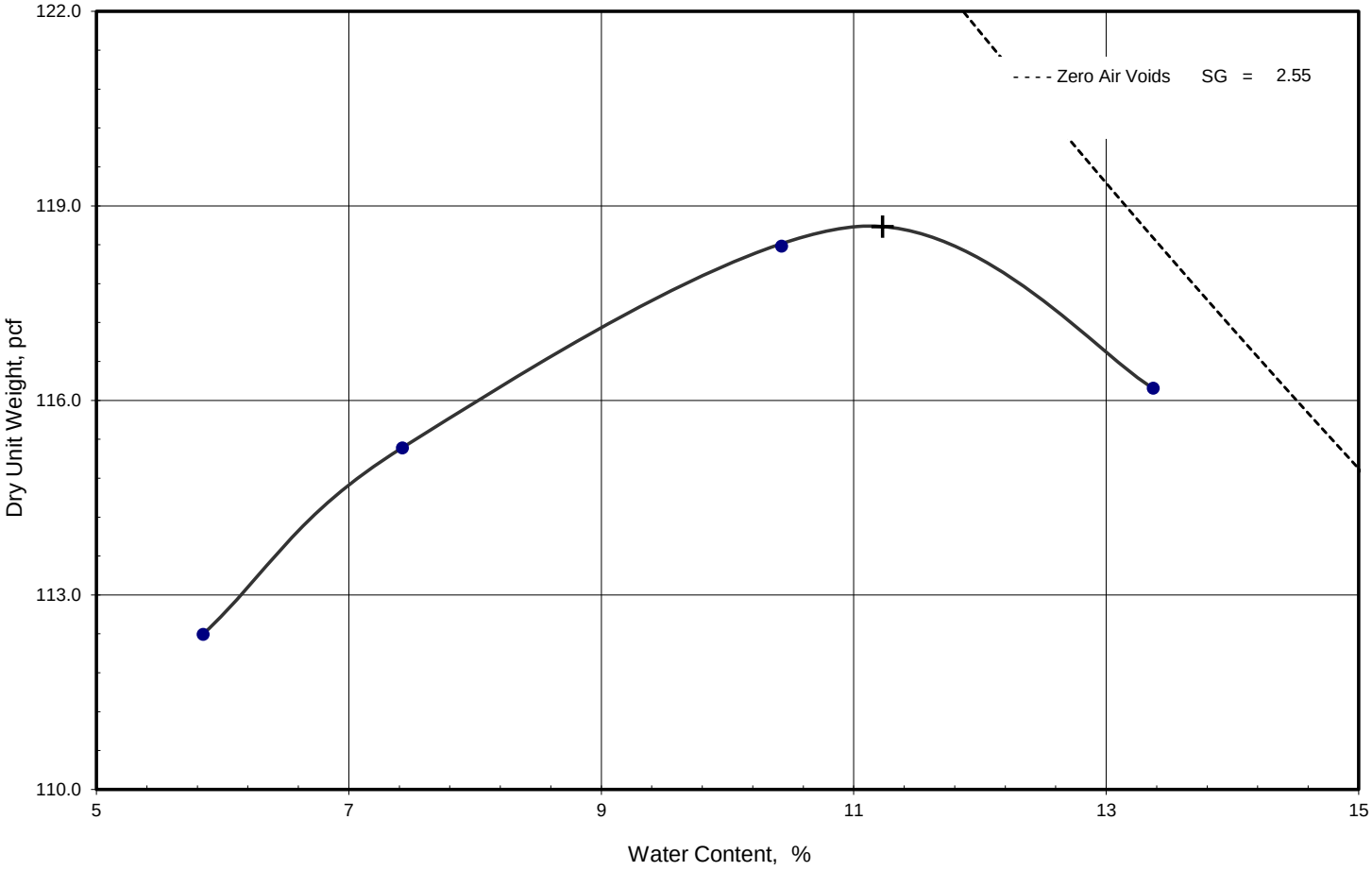
Project: Kalas Falls Residential Development
Client: D.R. Horton

Project No.: 06:24735
Date Reported: 3/2/2022

Office / Lab	Address	Office Number / Fax
ECS Southeast LLP - Raleigh	5260 Greens Dairy Road Raleigh, NC 27616	(919)861-9910 (919)861-9911

Tested by	Checked by	Approved by	Date Received
acreech	ssisell2	ssisell2	2/22/2022

Laboratory Compaction Characteristics of Soil
Using Standard Effort



Optimum Moisture Content		**11.2**	%
Maximum Dry Unit Weight		**118.7**	pcf
Cumulative material retained on:	3/4 in. sieve	2.3	%
	3/8 in. sieve	4.6	%
	#4 sieve	10.4	%

Preparation	ASTM dry preparation method	
Type of rammer	Mechanical - sector face	
Test Specfication / Method	ASTM D698-12e2-method C	
Specific gravity - D854 water pycnometer	2.55	Historical
Coarse Aggregate Specific Gravity -		

Soil Description	Nat. Moist. %	Liquid Limit	Plasticity Index	%< #200	USCS	AASHTO
(SP-SM) POORLY GRADED SAND w/ SILT, Dark Brown	10.0	NP	NP	11.6		

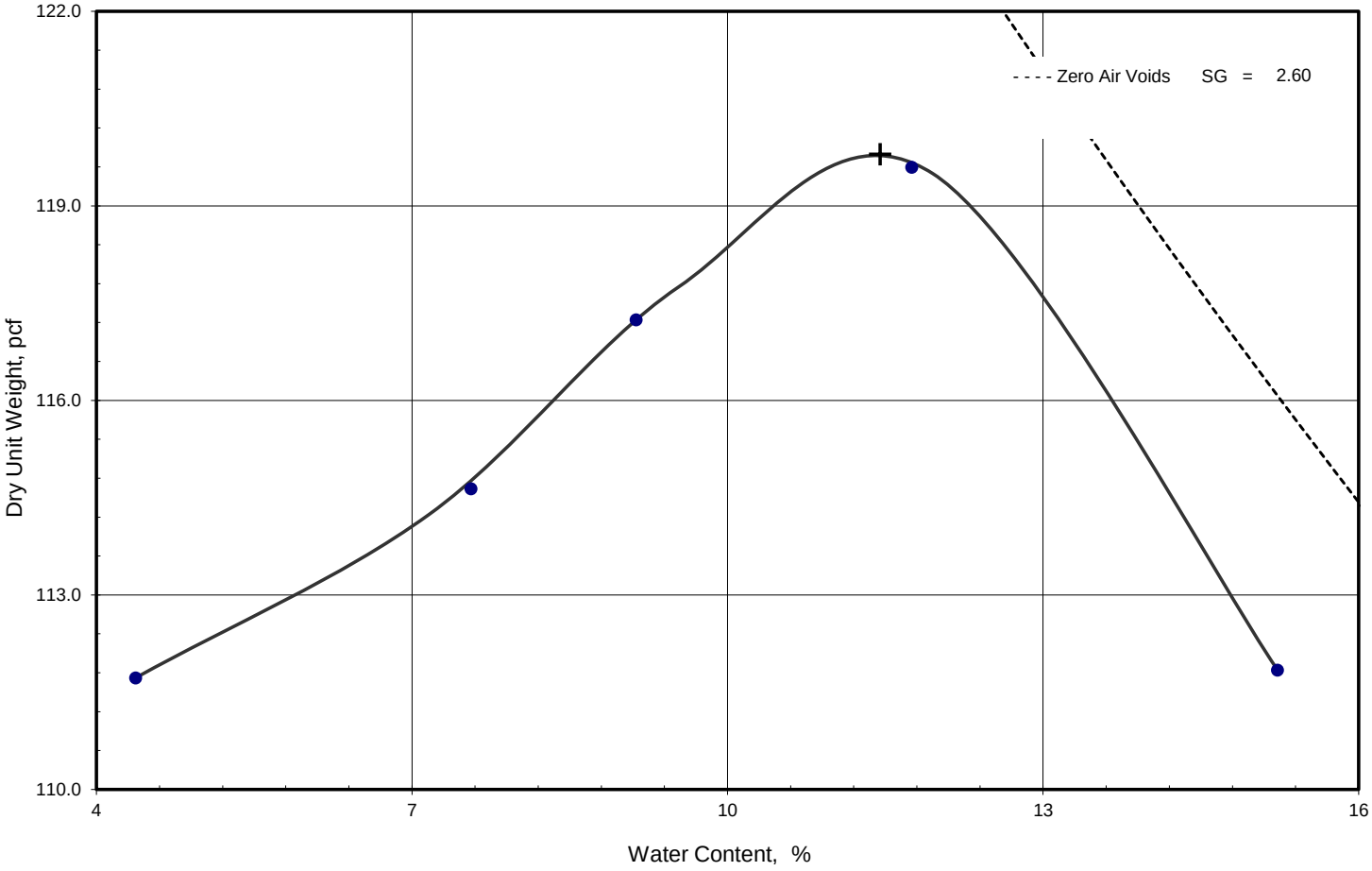
Project: Kalas Falls Residential Development
Client: D.R. Horton
Sample / Source B-28
Test Reference/No.:

Project No.: 06:24735
Depth (ft.): 1 - 2.5
Sample No.: S-1
Date Reported: 3/4/2022

Office / Lab	Address	Office Number / Fax
ECS Southeast LLP - Raleigh	5260 Greens Dairy Road Raleigh, NC 27616	(919)861-9910 (919)861-9911

Tested by	Checked by	Approved by	Date Received	Remarks
acreech	ssisell2	ssisell2	2/22/2022	

Laboratory Compaction Characteristics of Soil
Using Standard Effort



Optimum Moisture Content		**11.5**	%
Maximum Dry Unit Weight		**119.8**	pcf
Cumulative material retained on:	3/4 in. sieve	0.2	%
	3/8 in. sieve	0.8	%
	#4 sieve	3.7	%

Preparation	ASTM dry preparation method	
Type of rammer	Mechanical - circular face	
Test Specfication / Method	ASTM D698-12e2-method B	
Specific gravity - D854 water pycnometer	2.60	Historical
Coarse Aggregate Specific Gravity -		

Soil Description	Nat. Moist. %	Liquid Limit	Plasticity Index	%< #200	USCS	AASHTO
(SM) SILTY SAND, Dark Yellowish-Brown	13.7	NP	NP	19.6		

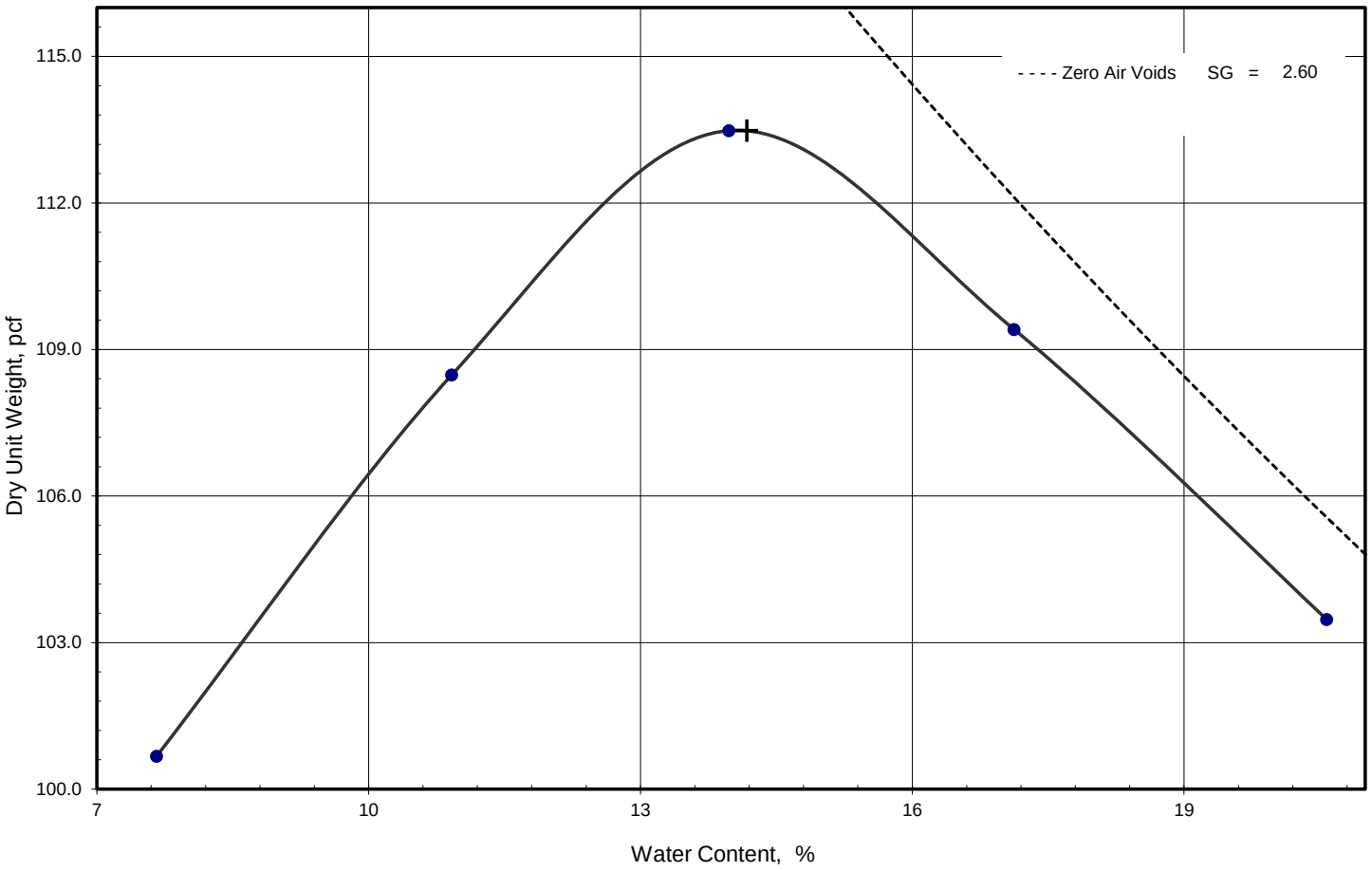
Project: Kalas Falls Residential Development
Client: D.R. Horton
Sample / Source B-06
Test Reference/No.:

Project No.: 06:24735
Depth (ft.): 1 - 2.5
Sample No.: S-1
Date Reported: 3/4/2022

Office / Lab	Address	Office Number / Fax
ECS Southeast LLP - Raleigh	5260 Greens Dairy Road Raleigh, NC 27616	(919)861-9910 (919)861-9911

Tested by	Checked by	Approved by	Date Received	Remarks
acreech	ssisell2	ssisell2	2/22/2022	

Laboratory Compaction Characteristics of Soil
Using Standard Effort



Optimum Moisture Content		**14.2**	%
Maximum Dry Unit Weight		**113.5**	pcf
Cumulative material retained on:	3/4 in. sieve	0.0	%
	3/8 in. sieve	0.0	%
	#4 sieve	0.0	%

Preparation	ASTM dry preparation method	
Type of rammer	Mechanical - circular face	
Test Specfication / Method	ASTM D698-12e2-method A	
Specific gravity - D854 water pycnometer	2.60	Historical
Coarse Aggregate Specific Gravity -		

Soil Description	Nat. Moist. %	Liquid Limit	Plasticity Index	%< #200	USCS	AASHTO
(SC) CLAYEY SAND, Strong Brown	16.7	38	15	36.0		

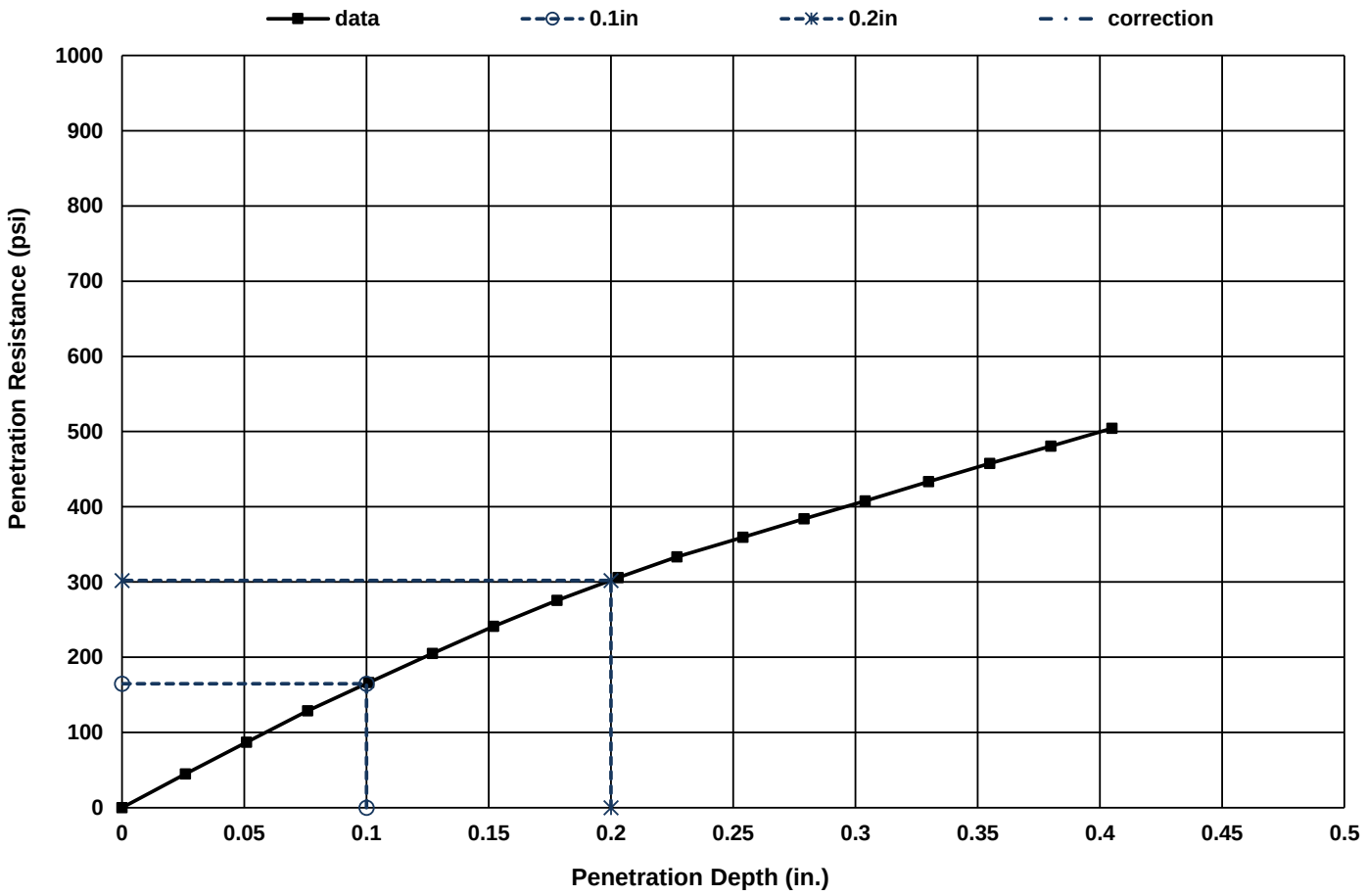
Project: Kalas Falls Residential Development
Client: D.R. Horton
Sample / Source B-13
Test Reference/No.:

Project No.: 06:24735
Depth (ft.): 1 - 2.5
Sample No.: S-1
Date Reported: 3/4/2022

Office / Lab	Address	Office Number / Fax
ECS Southeast LLP - Raleigh	5260 Greens Dairy Road Raleigh, NC 27616	(919)861-9910 (919)861-9911

Tested by	Checked by	Approved by	Date Received	Remarks
	ssisell2	ssisell2	2/22/2022	

California Bearing Ratios (CBR) of Laboratory-Compacted Soils



TEST RESULTS (ASTM D1883-16)

Molded			Soaked			CBR (%)		Linearty Correction (in.)	Surcharge (lbs.)		Swell (%)	
Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.1 in.	0.2 in.					
114.4	96.4	10.1	110.4	93.0	14.1	16.5	20.1	0.00	10		0.02	
Material Description				AASHTO	USCS	MAX. Dens. (pcf)	Optimum Moisture (%)	LL	PI	% Fines	% Gravel	
(SP-SM) POORLY GRADED SAND w/ SILT, Dark Brown						118.7	11.2	NP	NP			

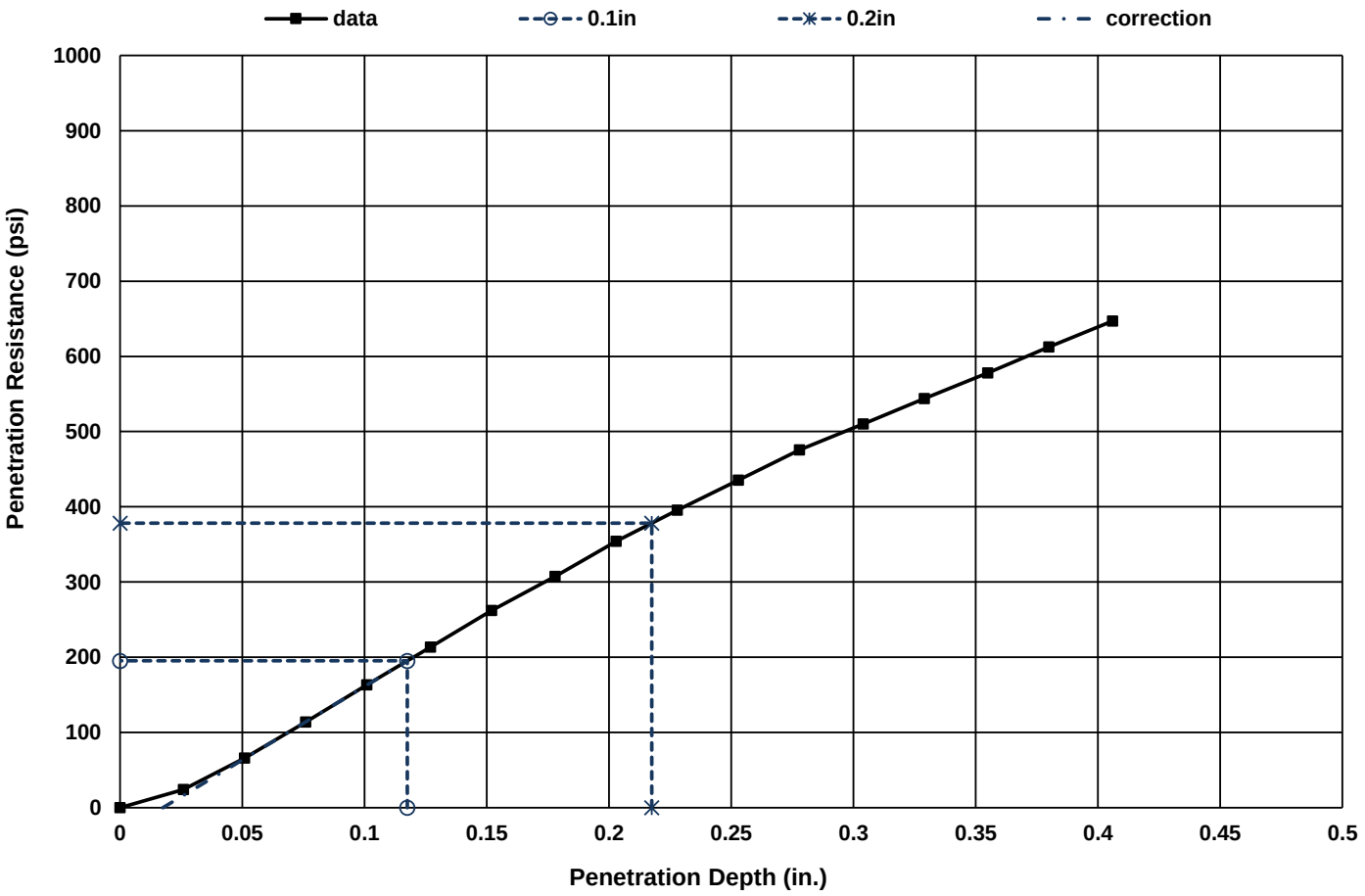
Project: Kalas Falls Residential Development
Client: D.R. Horton
Sample / Source B-28
Test Reference/No.: 1

Project No.: 06:24735
Depth (ft.): 1 - 2.5
Sample No.: S-1
Date Reported: 3/4/2022

Office / Lab	Address	Office Number / Fax
ECS Southeast LLP - Raleigh	5260 Greens Dairy Road Raleigh, NC 27616	(919)861-9910 (919)861-9911

Tested by	Checked by	Approved by	Date Received	Remarks
acreech	ssisell2	ssisell2	2/22/2022	

California Bearing Ratios (CBR) of Laboratory-Compacted Soils



TEST RESULTS (ASTM D1883-16)

Molded			Soaked			CBR (%)		Linearty Correction (in.)	Surcharge (lbs.)		Swell (%)	
Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.1 in.	0.2 in.					
116.2	97.0	11.3	114.7	95.7	12.7	19.5	25.2	0.02	10		0.00	

Material Description	AASHTO	USCS	MAX. Dens. (pcf)	Optimum Moisture (%)	LL	PI	% Fines	% Gravel
(SM) SILTY SAND, Dark Yellowish-Brown			119.8	11.5	NP	NP		

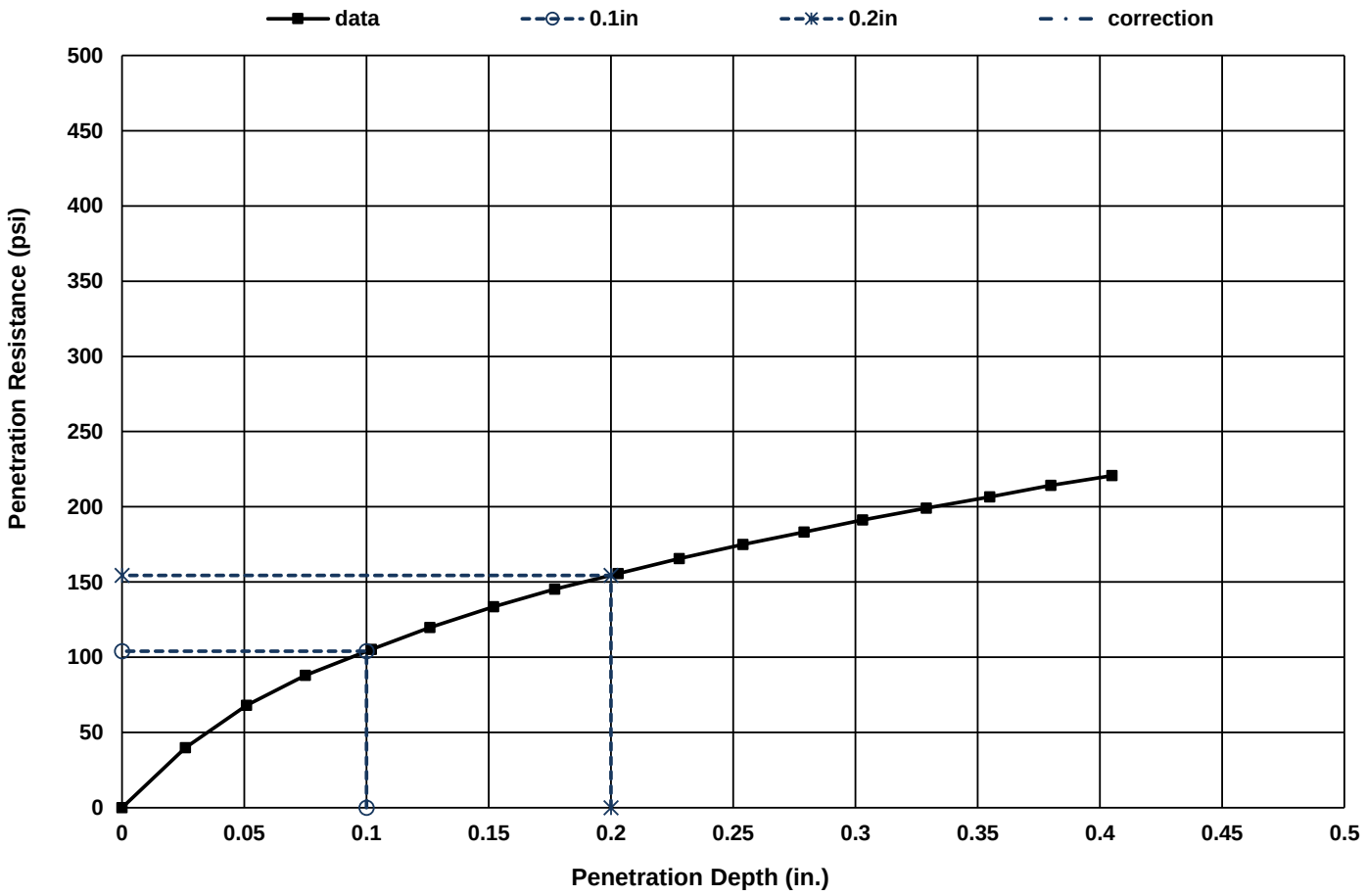
Project: Kalas Falls Residential Development
Client: D.R. Horton
Sample / Source B-06
Test Reference/No.: 1

Project No.: 06:24735
Depth (ft.): 1 - 2.5
Sample No.: S-1
Date Reported: 3/4/2022

Office / Lab	Address	Office Number / Fax
ECS Southeast LLP - Raleigh	5260 Greens Dairy Road Raleigh, NC 27616	(919)861-9910 (919)861-9911

Tested by	Checked by	Approved by	Date Received	Remarks
acreech	ssisell2	ssisell2	2/22/2022	

California Bearing Ratios (CBR) of Laboratory-Compacted Soils



TEST RESULTS (ASTM D1883-16)

Molded			Soaked			CBR (%)		Linearty Correction (in.)	Surcharge (lbs.)		Swell (%)	
Density (pcf)	Percent of Max. Dens.	Moisture (%)	Density (pcf)	Percent of Max. Dens.	Moisture (%)	0.1 in.	0.2 in.					
106.8	94.1	14.3	101.3	89.3	19.8	10.4	10.3	0.00	10		0.52	

Material Description	AASHTO	USCS	MAX. Dens. (pcf)	Optimum Moisture (%)	LL	PI	% Fines	% Gravel
(SC) CLAYEY SAND, Strong Brown			113.5	14.2	38	15		

Project: Kalas Falls Residential Development
Client: D.R. Horton
Sample / Source B-13
Test Reference/No.: 1

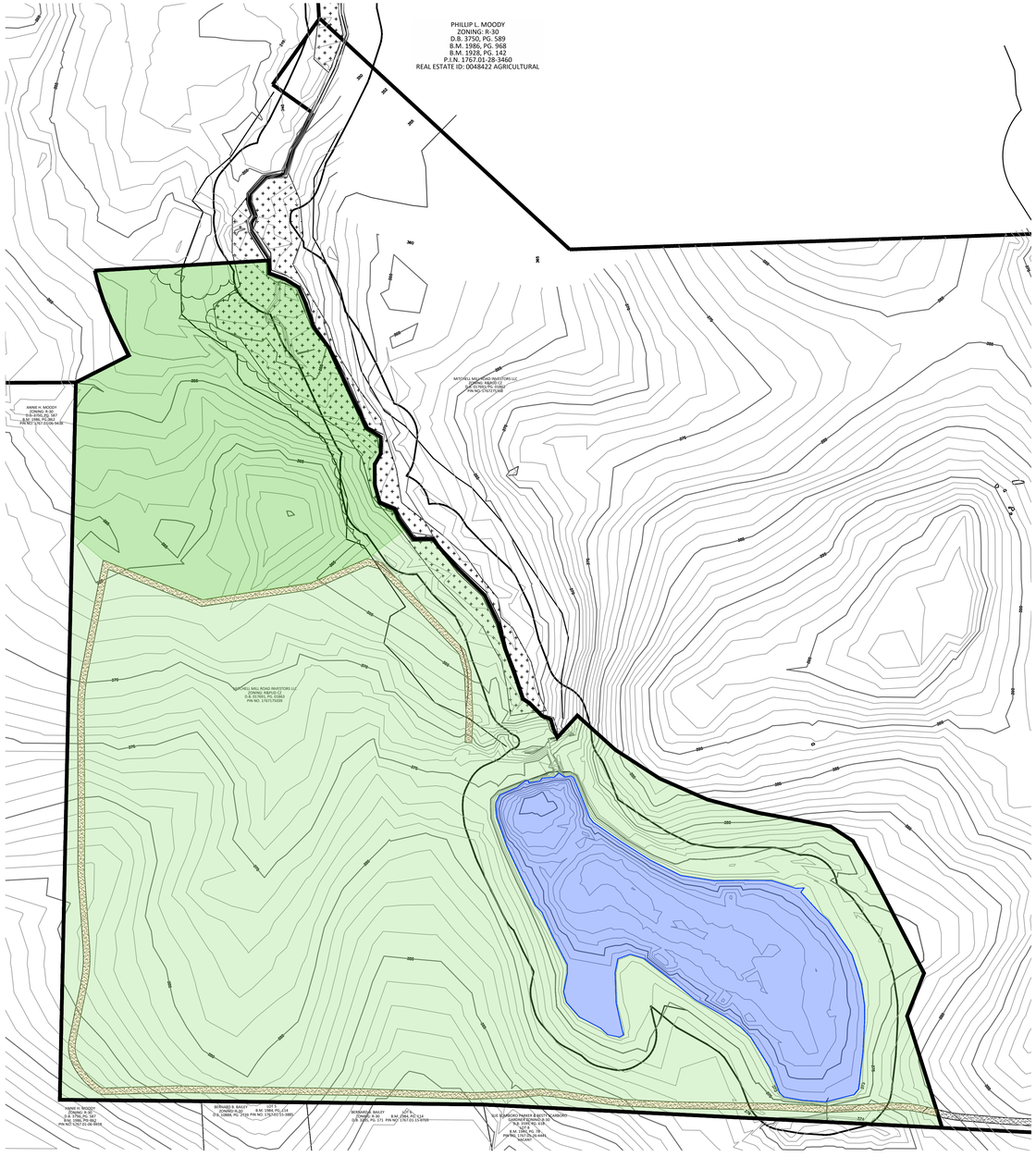
Project No.: 06:24735
Depth (ft.): 1 - 2.5
Sample No.: S-1
Date Reported: 3/4/2022

Office / Lab	Address	Office Number / Fax
ECS Southeast LLP - Raleigh	5260 Greens Dairy Road Raleigh, NC 27616	(919)861-9910 (919)861-9911

Tested by	Checked by	Approved by	Date Received	Remarks
	ssisell2	ssisell2	2/22/2022	

APPENDIX B

DRAINAGE AREA MAPS



Land Use Impervious Calculations									
Type	Total Area (Ac)	Water Body (Ac)	BMP (Ac)	Roadway (Ac)	Sidewalk (Ac)	Roof (Ac)	Driveways (Ac)	Woods/Open Space (Ac)	Total Impervious (Ac)
Pre-Development	23.55	2.87	0.00	0.00	0.65	0.00	0.00	20.03	3.52

LEGEND	
PASTURE	
WOODS/WETLANDS	
OPEN WATER	
SIDEWALK	
PARCEL BOUNDARY	

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100ft

NOT FOR CONSTRUCTION. THIS PLAN IS PRELIMINARY AND SUBJECT TO CHANGE

PRE-DEVELOPMENT LAND USE MAP

AMERICAN Engineering

RALEIGH NC | CHARLOTTE NC | CHESAPEAKE VA

PROJECT # 220020

WAKE COUNTY, NC

KALAS FALLS PHASE 5

MARCH 3rd, 2025

LEGEND	
WOODS	
OPEN SPACE	
SIDEWALK	
ROADWAY	
DRIVEWAYS	
ROOF	
OPEN WATER	
PARCEL BOUNDARY	

Land Use Impervious Calculations

Type	Total Area (Ac)	Water Body (Ac)	BMP (Ac)	Roadway (Ac)	Sidewalk (Ac)	Roof (Ac)	Driveways (Ac)	Woods/Open Space (Ac)	Total Impervious (Ac)
Pre-Development	23.55	2.87	0.00	0.00	0.65	0.00	0.00	20.03	3.52
Post Development	23.55	2.68	0.00	2.33	1.04	2.62	0.65	14.30	9.31
								Net (positive)	**5.79**

0 100 200 300

NOT FOR CONSTRUCTION. THIS PLAN IS PRELIMINARY AND SUBJECT TO CHANGE

POST-DEVELOPMENT LAND USE MAP

AMERICAN Engineering

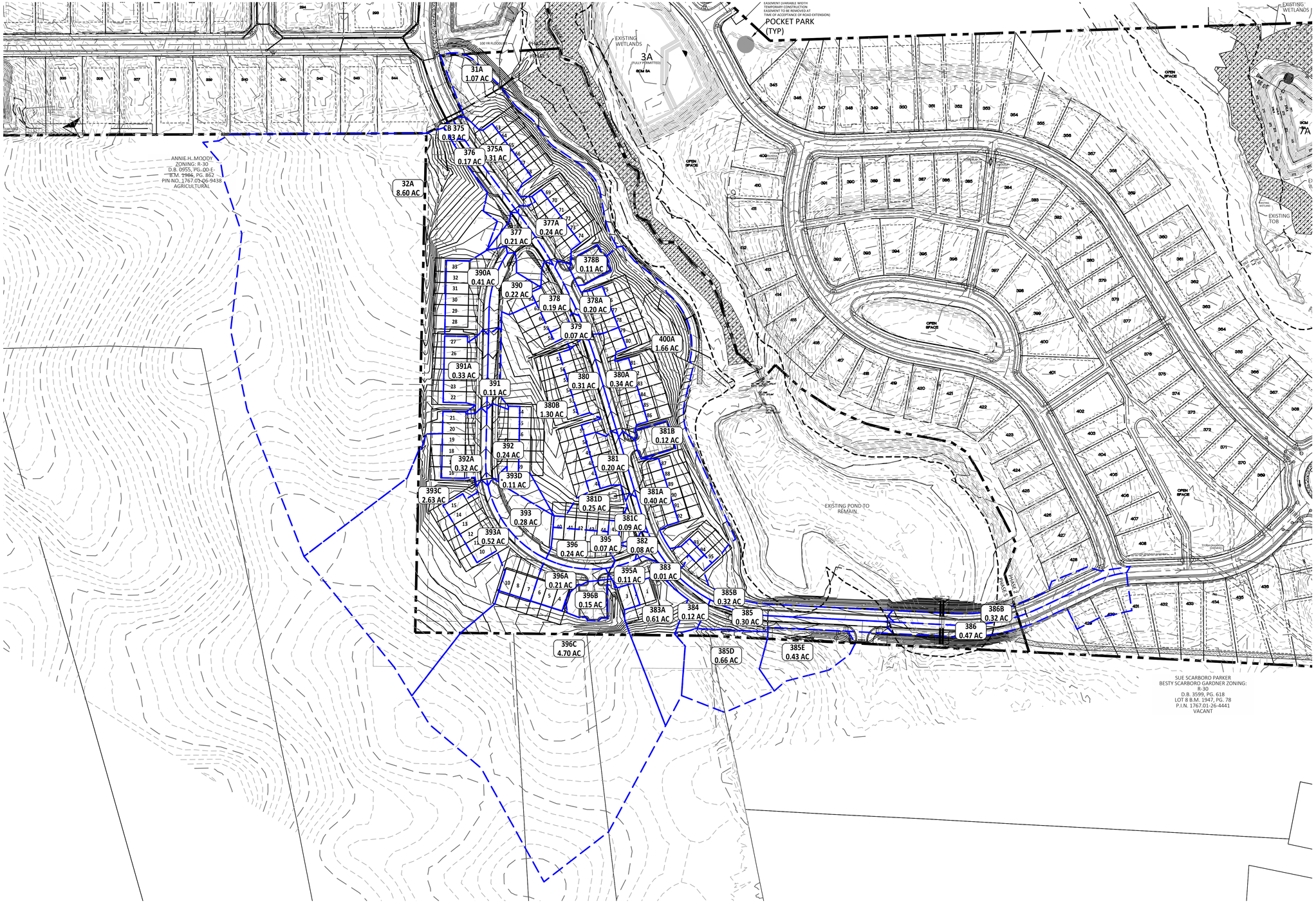
RALEIGH NC | CHARLOTTE NC | CHESAPEAKE VA

PROJECT # 220020

WAKE COUNTY, NC

KALAS FALLS PHASE 5

March 3rd, 2025



NOTE: THIS EXHIBIT IS TO BE USED IN TANDEM WITH HYDRAFLOW STORM SEWERS MODELING FOR CONVEYANCE CALCULATIONS.

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft

POST-DEVELOPMENT INLET AREAS

AMERICAN Engineering

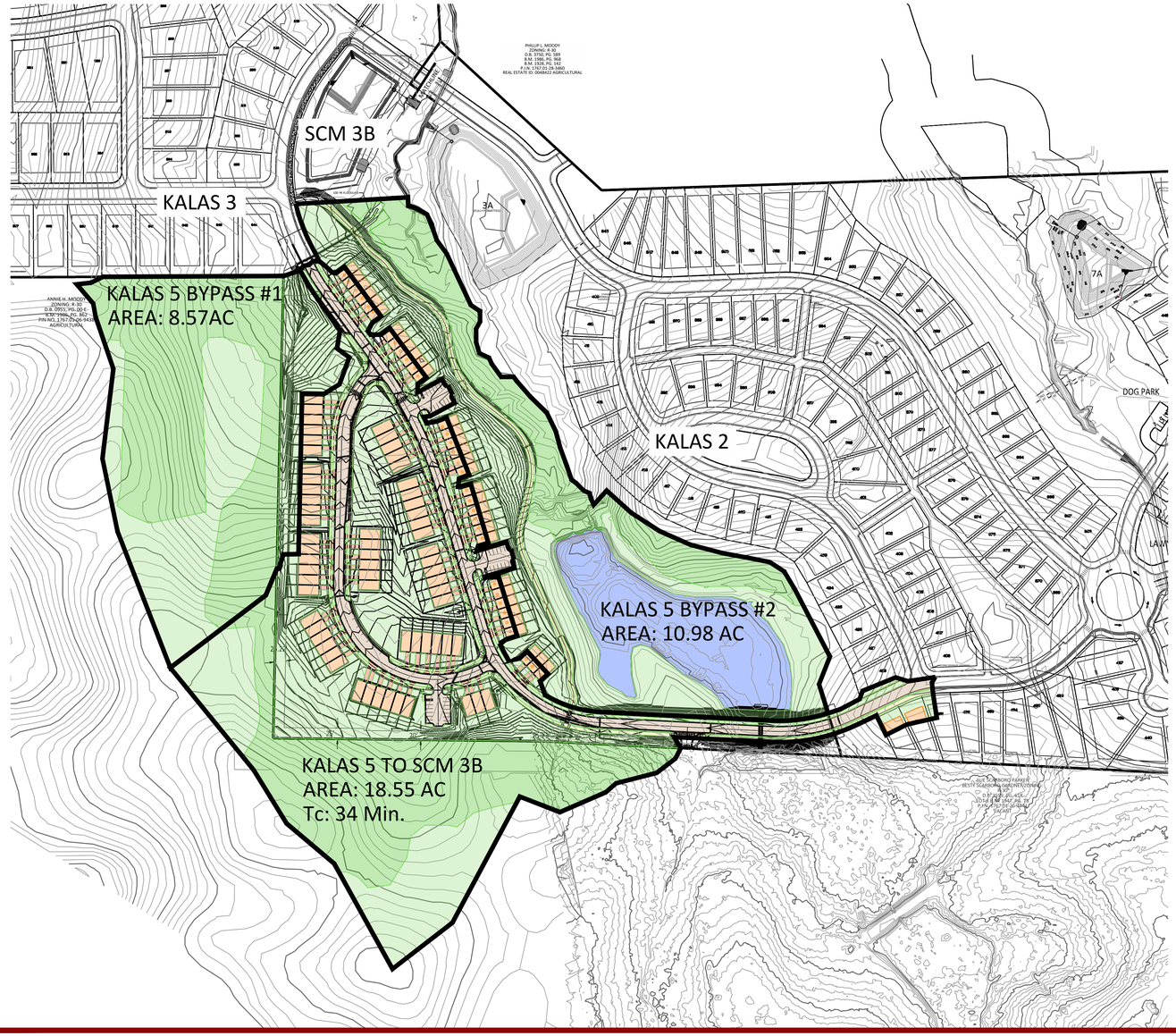
RALEIGH NC | CHARLOTTE NC | CHESAPEAKE VA

PROJECT # 220020

KALAS FALLS PHASE 5

ROLESVILLE, NC | WAKE COUNTY

March 3, 2025



Rational C-Value Calculations - Post-Development POD's (For Storm Sewers Modeling)

Area ID	Drainage Area (ac)	Wooded Area (ac)	Roadway (ac)	Water Body (ac)	Roof (ac)	Sidewalk (ac)	Open Space (ac)	Impervious C	Wooded Area C	Open Space C	Composite C Value
BYPASS #1	8.57	4.70	0.00	0.00	0.00	0.00	3.87	0.95	0.15	0.20	**0.17**
BYPASS #2	10.98	2.65	0.00	2.68	0.45	0.32	4.88	0.95	0.15	0.20	**0.42**
SCM 3B	18.55	4.61	3.12	0.00	2.22	0.79	7.80	0.95	0.15	0.20	**0.44**

Post-Dev For Municipal Tool (Rolesville)

Area ID	Total Drainage Area (ac)	Woods, Good Condition (ac)	Open Space, Good Condition (ac)	Impervious (ac)
BYPASS #1	8.57	4.70	3.87	0.00
BYPASS #2	10.98	2.65	4.88	3.45
SCM 3B	18.55	4.61	7.80	6.14

Post-Dev For Hydrograph Modeling

Area ID	Total Drainage Area (ac)	SCS CN Value
BYPASS #1	8.57	59
BYPASS #2	10.98	71
SCM 3B	18.55	72

LEGEND	
WOODS	
OPEN SPACE	
SIDEWALK	
ROADWAY	
ROOF	
OPEN WATER	
PARCEL BOUNDARY	

NOTE: THIS EXHIBIT IS TO REPORT KEY STORMWATER DATA THAT IS BEING CONVEYED FROM KALAS PHSE 5 (UPSTREAM) TO SCM 3B WHICH IS LOCATED ON KALAS PHASE 3 (DOWNSTREAM).

0 150 300 450

NOT FOR CONSTRUCTION. THIS PLAN IS PRELIMINARY AND SUBJECT TO CHANGE

KALAS PHASE 5 POST-DEVELOPMENT DRAINAGE MAP (DOCUMENTATION FOR KALAS 3 MASTER STORMWATER PERMIT)

AMERICAN Engineering

RALEIGH NC | CHARLOTTE NC | CHESAPEAKE VA

PROJECT # 220020

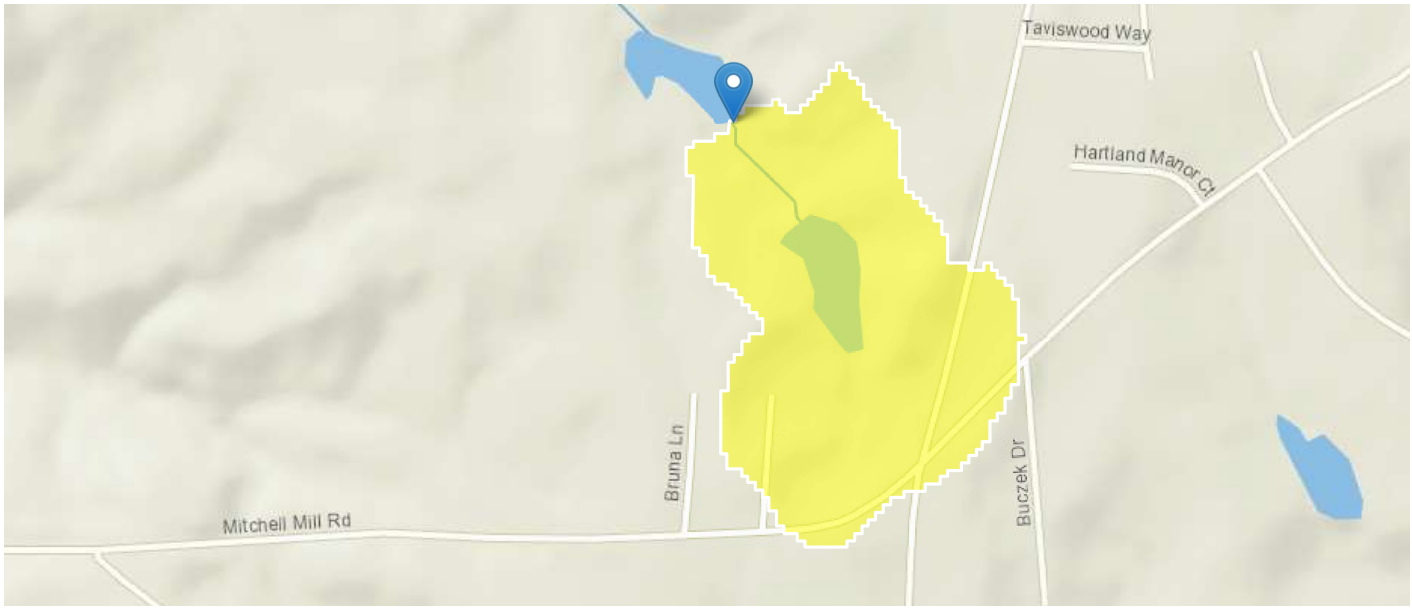
WAKE COUNTY, NC

KALAS FALLS PHASE 5

MARCH 3rd, 2025

Kalas Phase 5 - Graymont Oaks Dr. 48" Culvert Crossing Drainage Area

Region ID: NC
Workspace ID: NC20250303151307501000
Clicked Point (Latitude, Longitude): 35.88269, -78.45243
Time: 2025-03-03 10:13:34 -0500



This area was delineated to determine peak flow rates for the point of interest located at the Graymont Oaks Drive dual 48" culvert crossing to allow for additional modeling evaluation.

Collapse All

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	0.0644	square miles
LC06IMP	Percentage of impervious area determined from NLCD 2006 impervious dataset	2.39	percent
PCTREG1	Percentage of drainage area located in Region 1 - Piedmont / Ridge and Valley	100	percent
PCTREG2	Percentage of drainage area located in Region 2 - Blue Ridge	0	percent
PCTREG3	Percentage of drainage area located in Region 3 - Sandhills	0	percent
PCTREG4	Percentage of drainage area located in Region 4 - Coastal Plains	0	percent
PCTREG5	Percentage of drainage area located in Region 5 - Lower Tifton Uplands	0	percent

Peak-Flow Statistics

Peak-Flow Statistics Parameters [Region 1 Piedmont rural under 1 sqmi 2014 5030]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.0644	square miles	0.1	1

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
LC06IMP	Percent Impervious NLCD2006	2.39	percent	0	47.9

Peak-Flow Statistics Parameters [Peak Southeast US NC 2023 5006]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.0644	square miles	0.08	8902
PCTREG1	Percent Area in Region 1 - Piedmont / Ridge and Valley	100	percent	0	100
PCTREG2	Percent Area in Region 2 - Blue Ridge	0	percent	0	100
PCTREG3	Percent Area in Region 3 - Sandhills	0	percent	0	100
PCTREG4	Percent Area in Region 4 - Coastal Plains	0	percent	0	100
PCTREG5	Percent Area in Region 5 - Lower Tifton Uplands	0	percent	0	100

Peak-Flow Statistics Disclaimers [Region 1 Piedmont rural under 1 sqmi 2014 5030]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Peak-Flow Statistics Flow Report [Region 1 Piedmont rural under 1 sqmi 2014 5030]

Statistic	Value	Unit
50-percent AEP flood	25.1	ft^3/s
20-percent AEP flood	39.9	ft^3/s
10-percent AEP flood	50.3	ft^3/s
4-percent AEP flood	63.6	ft^3/s
2-percent AEP flood	73.8	ft^3/s
1-percent AEP flood	84.2	ft^3/s
0.5-percent AEP flood	94.3	ft^3/s
0.2-percent AEP flood	111	ft^3/s

Peak-Flow Statistics Disclaimers [Peak Southeast US NC 2023 5006]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Peak-Flow Statistics Flow Report [Peak Southeast US NC 2023 5006]

Statistic	Value	Unit
50-percent AEP flood	25.4	ft^3/s
20-percent AEP flood	47.3	ft^3/s
10-percent AEP flood	65.5	ft^3/s
4-percent AEP flood	90.9	ft^3/s
2-percent AEP flood	114	ft^3/s
1-percent AEP flood	137	ft^3/s
0.5-percent AEP flood	161	ft^3/s
0.2-percent AEP flood	194	ft^3/s

Peak-Flow Statistics Citations

Feaster, T.D., Gotvald, A.J., and Weaver, J.C.,2014, Methods for estimating the magnitude and frequency of floods for urban and small, rural streams in Georgia, South Carolina, and North Carolina, 2011 (ver. 1.1, March 2014): U.S. Geological Survey Scientific Investigations Report 2014–5030, 104 p. (http://pubs.usgs.gov/sir/2014/5030/)

Feaster, T.D., Gotvald, A.J., Musser, J.W., Weaver, J.C, Kolb, K.R., Veilleux, A.G., and Wagner, D.M.2023, Magnitude and frequency of floods for rural streams in Georgia, South Carolina, and North Carolina, 2017—Results: U.S. Geological Survey Scientific Investigations Report 2023-5006, 75 p. (https://pubs.er.usgs.gov/publication/sir20235006)

Application Version: 4.28.0
StreamStats Services Version: 1.2.22
NSS Services Version: 2.2.1

APPENDIX C

STORM CONVEYANCE CALCULATIONS

AMERICAN Engineering

4020 Westchase Boulevard Suite 450 Raleigh, NC 27607
OFFICE: 919.469.1101 | **AMERICAN-EA.COM**

Project Name:	**Kalas Falls PH5**
Project Number:	**R180115**
Date:	**3/3/2025**
Calculated By:	**RSC**
Checked By:	**JK**

Input data in blue boxes

Rational C-Value Calculations for Inlet Areas

Area ID	Drainage Area (ac)	Roof (ac)	Roadway (ac)	Sidewalk (ac)	Open Space (ac)	Wooded (ac)	Impervious C	Open Space C	Wooded C	Composite C Value
Onsite	12.88	2.22	3.12	0.79	6.74	0.00	0.95	0.2	0.15	**0.56**
Offsite	8.57	0.00	0.00	0.00	3.87	4.70	0.95	0.2	0.15	**0.17**

AMERICAN Engineering

4020 Westchase Boulevard Suite 450 Raleigh, NC 27607
OFFICE: 919.469.1101 | **AMERICAN-EA.COM**

Project Name:	**Kalas Falls Phase 5**
Project Number:	**180115**
Date:	**3/3/2025**
Calculated By:	**SM**
Checked By:	**JK**

Rip Rap Dissipater Calculations 10-Year Storm

Outlet ID	Pipe Diameter (in)	Pipe Velocity (fps)	Stone Class	Stone Depth (in)	Stone Material (tons)	Geo-Textile (SY)	Start Width (ft)	End Width (ft)	Length (ft)
FES 10 (TEMP)	12	0.25	B	12	1	4	2	6	4
FES 11 (TEMP)	12	0.17	B	12	1	4	2	6	4
FES 20 (TEMP)	36	3.71	B	12	7	22	6	18	12
FES 30B	36	4.17	B	12	7	22	6	18	12
FES 400A	18	3.25	B	12	2	7	3	9	6

Calculations were determined from NCDOT Detail 876.02 *Guide for Rip Rap at Pipe Outlets*
Values shown in table above are minimum quantities and dimensions

Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Mar 3 2025

Graymont Oaks Culvert - 10-Year

Invert Elev Dn (ft)	=	369.00
Pipe Length (ft)	=	94.00
Slope (%)	=	1.00
Invert Elev Up (ft)	=	369.94
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	2
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0018, 2, 0.0292, 0.74, 0.2

Embankment

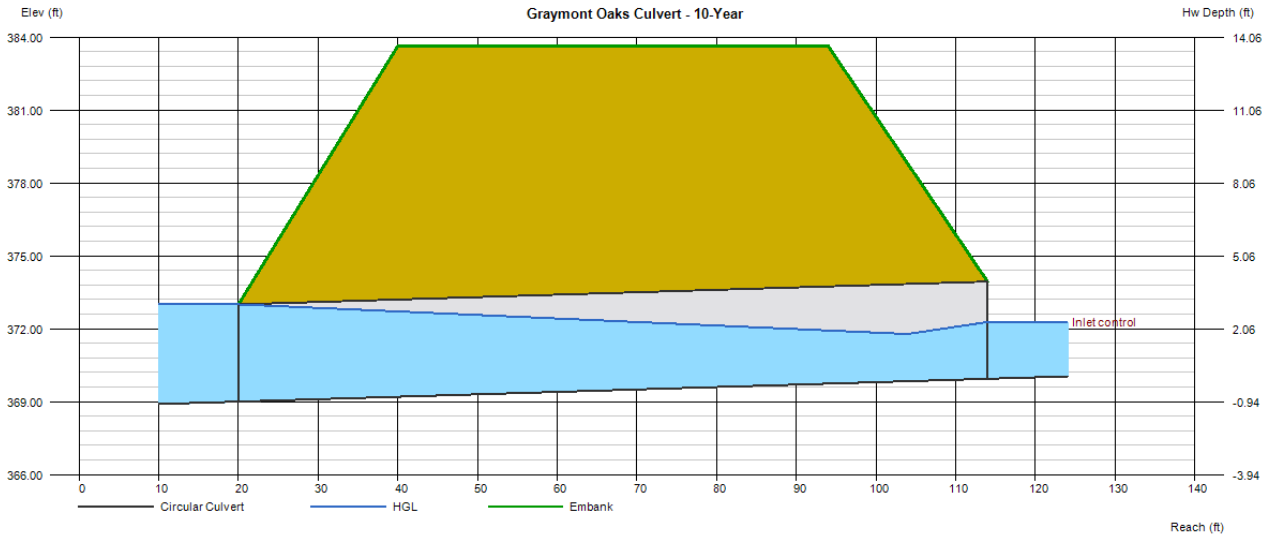
Top Elevation (ft)	=	383.63
Top Width (ft)	=	54.00
Crest Width (ft)	=	94.00

Calculations

Qmin (cfs)	=	65.50
Qmax (cfs)	=	65.50
Tailwater Elev (ft)	=	Crown

Highlighted

Qtotal (cfs)	=	65.50
Qpipe (cfs)	=	65.50
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	2.61
Veloc Up (ft/s)	=	6.44
HGL Dn (ft)	=	373.00
HGL Up (ft)	=	371.64
Hw Elev (ft)	=	372.28
Hw/D (ft)	=	0.58
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Mar 3 2025

Graymont Oaks Culvert - 25-Year

Invert Elev Dn (ft)	=	369.00
Pipe Length (ft)	=	94.00
Slope (%)	=	1.00
Invert Elev Up (ft)	=	369.94
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	2
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0018, 2, 0.0292, 0.74, 0.2

Embankment

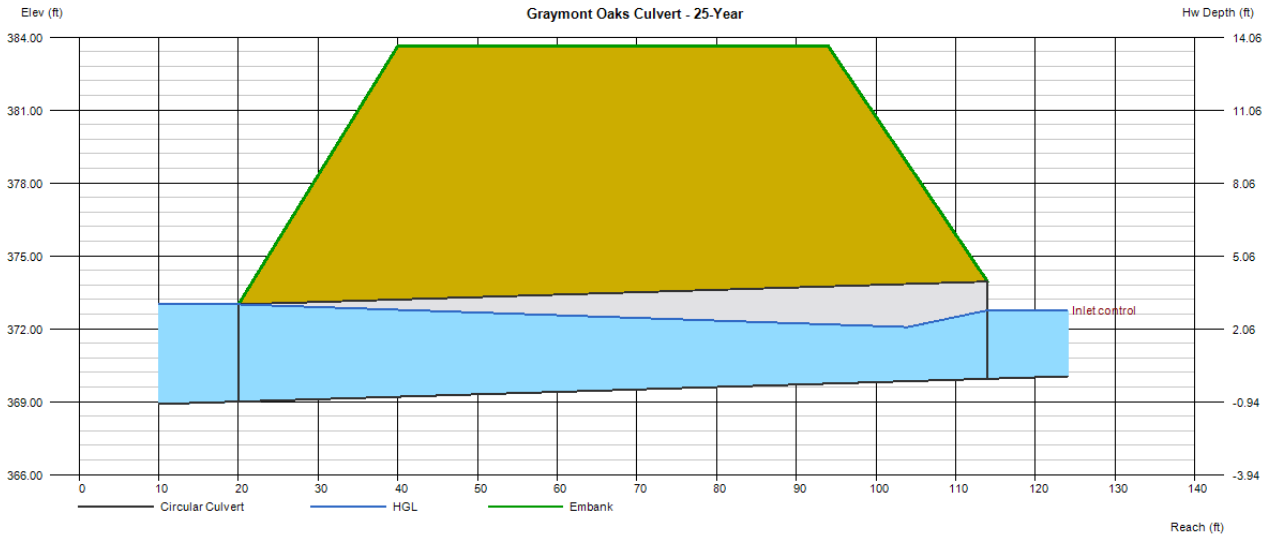
Top Elevation (ft)	=	383.63
Top Width (ft)	=	54.00
Crest Width (ft)	=	94.00

Calculations

Qmin (cfs)	=	90.90
Qmax (cfs)	=	90.90
Tailwater Elev (ft)	=	Crown

Highlighted

Qtotal (cfs)	=	90.90
Qpipe (cfs)	=	90.90
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	3.62
Veloc Up (ft/s)	=	7.16
HGL Dn (ft)	=	373.00
HGL Up (ft)	=	371.96
Hw Elev (ft)	=	372.76
Hw/D (ft)	=	0.70
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Mar 3 2025

Graymont Oaks Culvert - 100-Year

Invert Elev Dn (ft)	=	369.00
Pipe Length (ft)	=	94.00
Slope (%)	=	1.00
Invert Elev Up (ft)	=	369.94
Rise (in)	=	48.0
Shape	=	Circular
Span (in)	=	48.0
No. Barrels	=	2
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end w/headwall (C)
Coeff. K,M,c,Y,k	=	0.0018, 2, 0.0292, 0.74, 0.2

Embankment

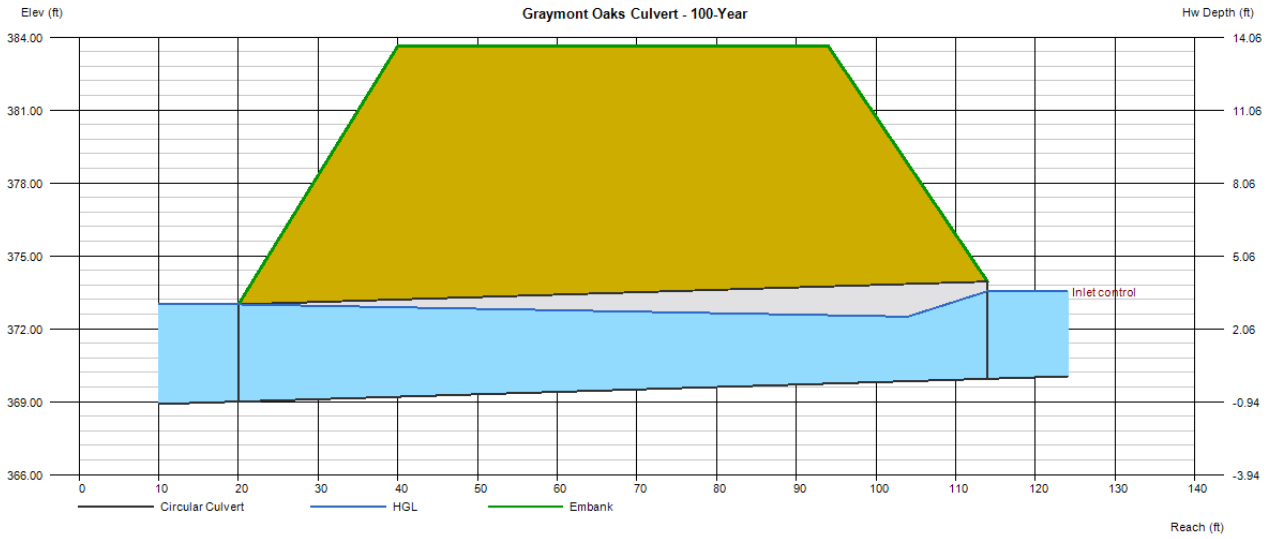
Top Elevation (ft)	=	383.63
Top Width (ft)	=	54.00
Crest Width (ft)	=	94.00

Calculations

Qmin (cfs)	=	137.00
Qmax (cfs)	=	137.00
Tailwater Elev (ft)	=	Crown

Highlighted

Qtotal (cfs)	=	137.00
Qpipe (cfs)	=	137.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.45
Veloc Up (ft/s)	=	8.30
HGL Dn (ft)	=	373.00
HGL Up (ft)	=	372.44
Hw Elev (ft)	=	373.54
Hw/D (ft)	=	0.90
Flow Regime	=	Inlet Control



Hydrology Report

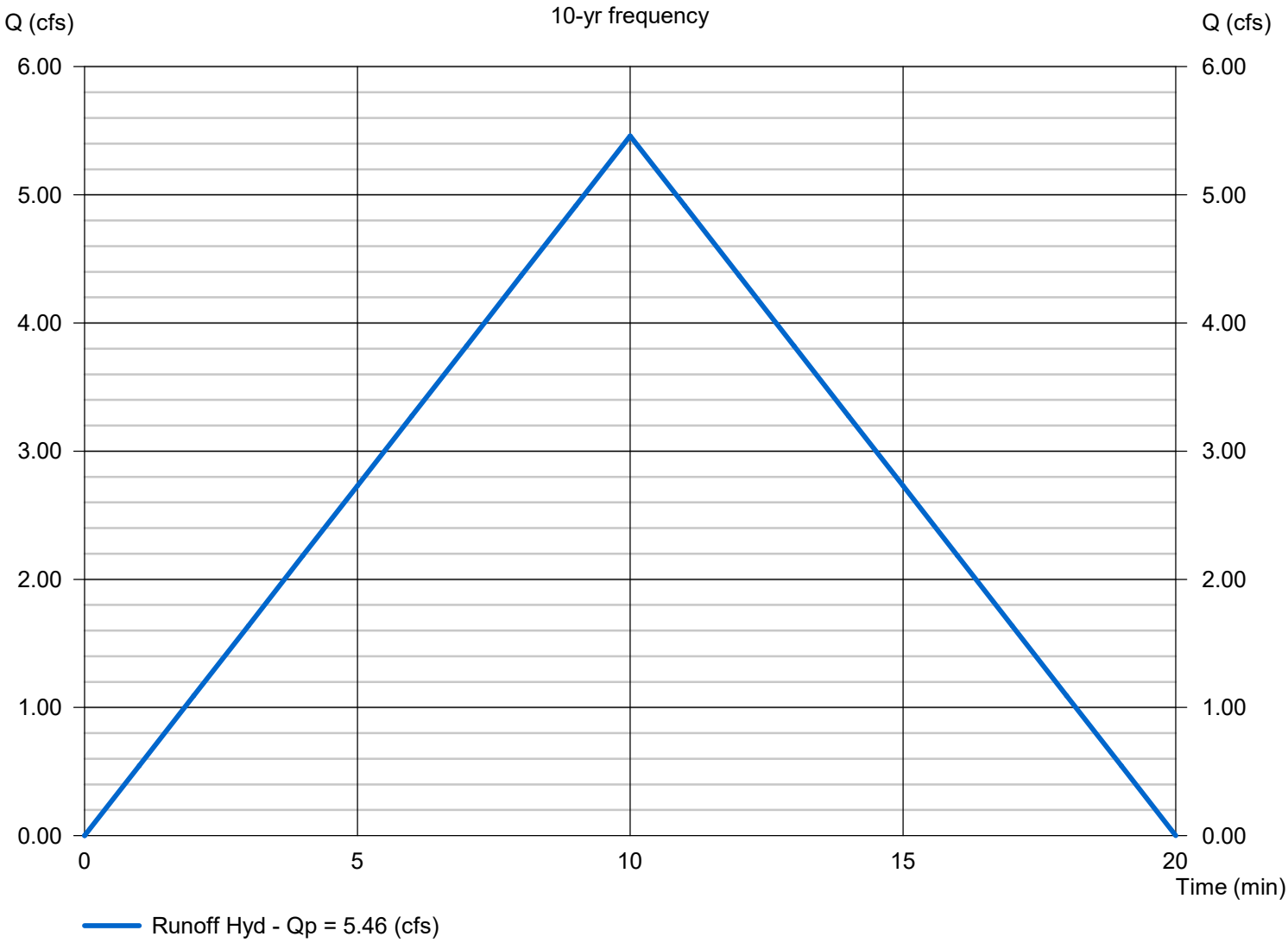
Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Mar 3 2025

Greenway Culvert - 10-Year Report

Hydrograph type	= Rational	Peak discharge (cfs)	= 5.460
Storm frequency (yrs)	= 10	Time interval (min)	= 1
Drainage area (ac)	= 1.660	Runoff coeff. (C)	= 0.56
Rainfall Inten (in/hr)	= 5.873	Tc by User (min)	= 10
IDF Curve	= 20241113 Kalas 5.IDF	Rec limb factor	= 1.00

Hydrograph Volume = 3,276 (cuft); 0.075 (acft)

Runoff Hydrograph



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Mar 3 2025

Greenway Culvert - 10-Year Report

Invert Elev Dn (ft)	=	363.30
Pipe Length (ft)	=	25.00
Slope (%)	=	2.80
Invert Elev Up (ft)	=	364.00
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

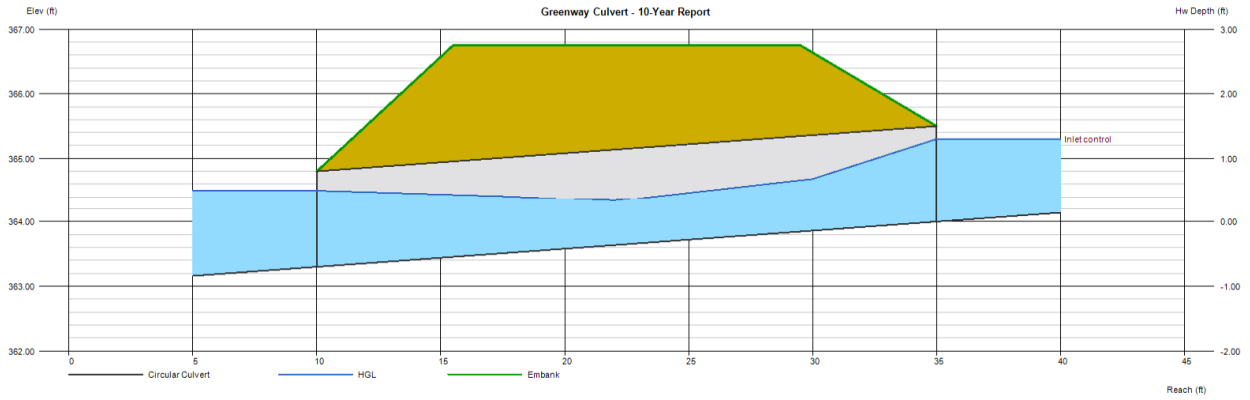
Top Elevation (ft)	=	366.75
Top Width (ft)	=	14.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	5.46
Qmax (cfs)	=	5.46
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	5.46
Qpipe (cfs)	=	5.46
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	3.60
Veloc Up (ft/s)	=	4.93
HGL Dn (ft)	=	364.50
HGL Up (ft)	=	364.90
Hw Elev (ft)	=	365.30
Hw/D (ft)	=	0.87
Flow Regime	=	Inlet Control



Hydrology Report

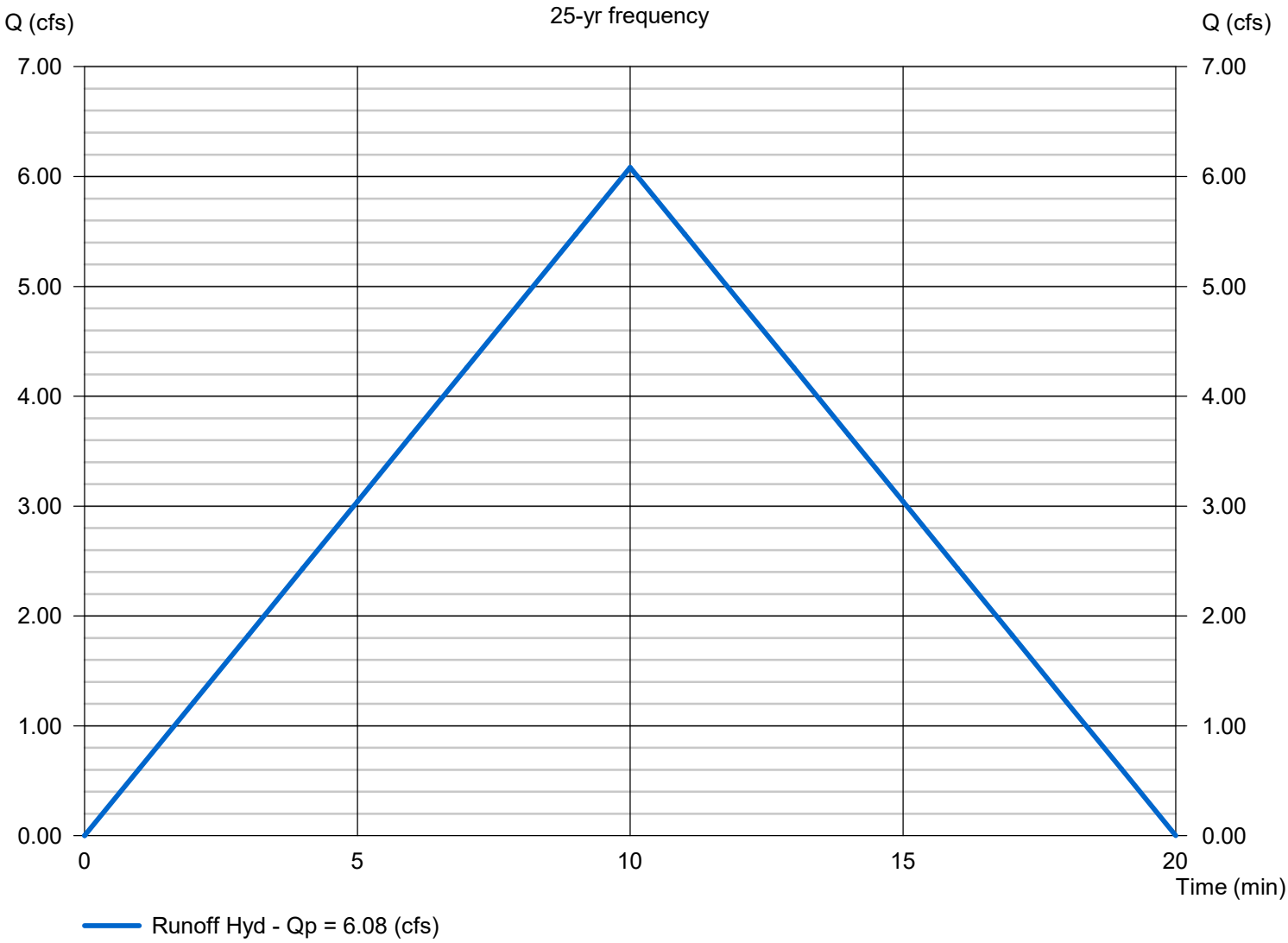
Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Mar 3 2025

Greenway Culvert - 25-Year

Hydrograph type	= Rational	Peak discharge (cfs)	= 6.083
Storm frequency (yrs)	= 25	Time interval (min)	= 1
Drainage area (ac)	= 1.660	Runoff coeff. (C)	= 0.56
Rainfall Inten (in/hr)	= 6.544	Tc by User (min)	= 10
IDF Curve	= 20241113 Kalas 5.IDF	Rec limb factor	= 1.00

Hydrograph Volume = 3,650 (cuft); 0.084 (acft)

Runoff Hydrograph



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Mar 3 2025

Greenway Culvert - 25-Year

Invert Elev Dn (ft)	=	363.30
Pipe Length (ft)	=	25.00
Slope (%)	=	2.80
Invert Elev Up (ft)	=	364.00
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

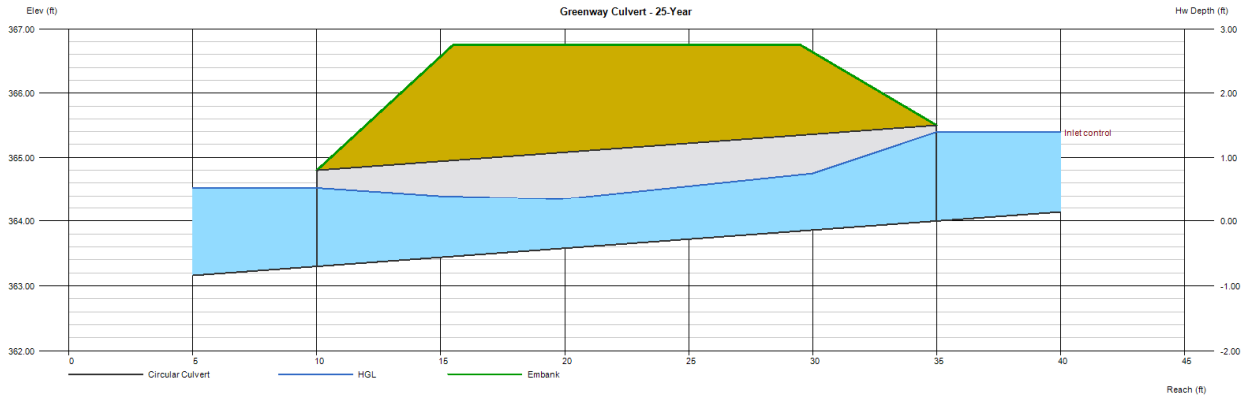
Top Elevation (ft)	=	366.75
Top Width (ft)	=	14.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	6.08
Qmax (cfs)	=	6.08
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	6.08
Qpipe (cfs)	=	6.08
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	3.93
Veloc Up (ft/s)	=	5.14
HGL Dn (ft)	=	364.53
HGL Up (ft)	=	364.95
Hw Elev (ft)	=	365.40
Hw/D (ft)	=	0.93
Flow Regime	=	Inlet Control



Hydrology Report

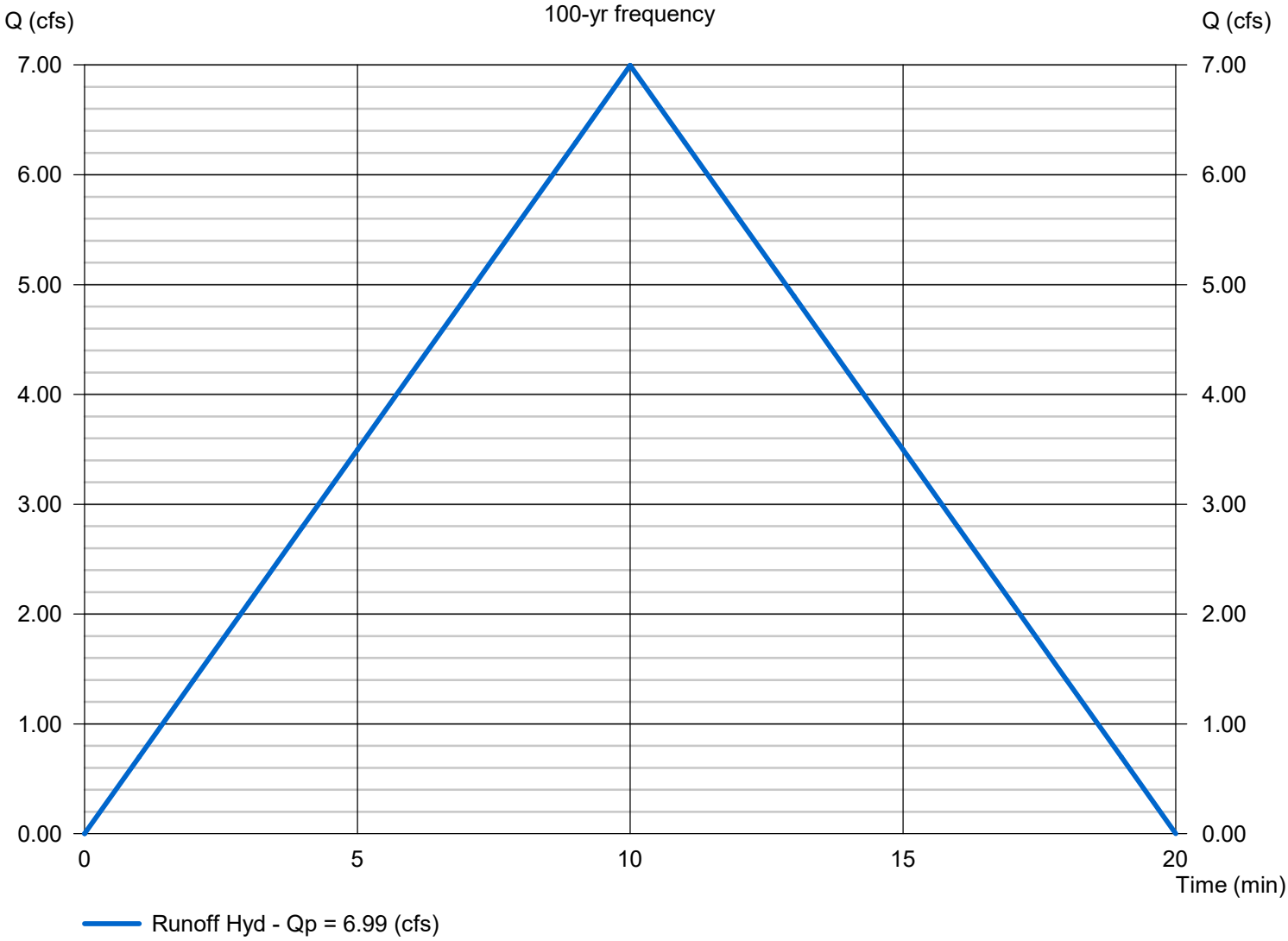
Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Mar 3 2025

Greenway Culvert - 100-Year

Hydrograph type	= Rational	Peak discharge (cfs)	= 6.995
Storm frequency (yrs)	= 100	Time interval (min)	= 1
Drainage area (ac)	= 1.660	Runoff coeff. (C)	= 0.56
Rainfall Inten (in/hr)	= 7.525	Tc by User (min)	= 10
IDF Curve	= 20241113 Kalas 5.IDF	Rec limb factor	= 1.00

Hydrograph Volume = 4,197 (cuft); 0.096 (acft)

Runoff Hydrograph



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Mar 3 2025

Greenway Culvert - 100-Year

Invert Elev Dn (ft)	=	363.30
Pipe Length (ft)	=	25.00
Slope (%)	=	2.80
Invert Elev Up (ft)	=	364.00
Rise (in)	=	18.0
Shape	=	Circular
Span (in)	=	18.0
No. Barrels	=	1
n-Value	=	0.012
Culvert Type	=	Circular Concrete
Culvert Entrance	=	Groove end projecting (C)
Coeff. K,M,c,Y,k	=	0.0045, 2, 0.0317, 0.69, 0.2

Embankment

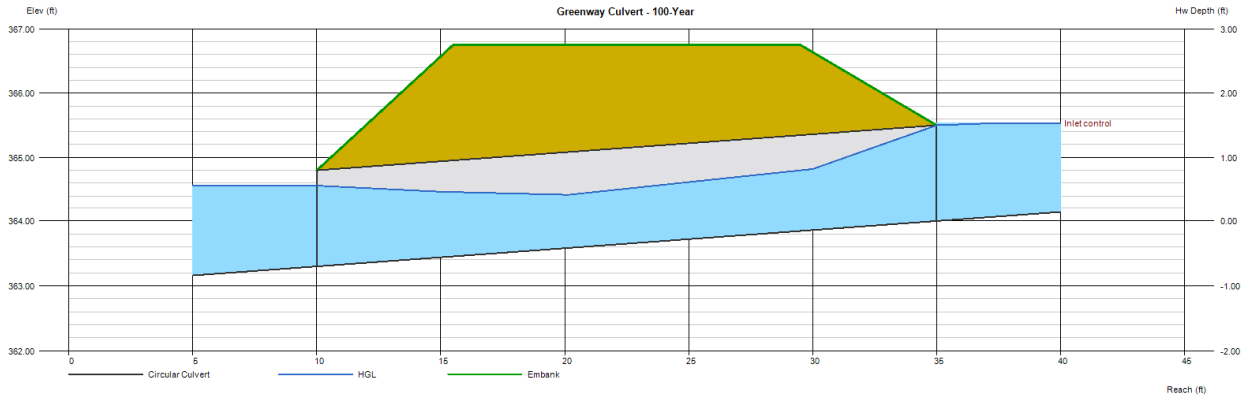
Top Elevation (ft)	=	366.75
Top Width (ft)	=	14.00
Crest Width (ft)	=	20.00

Calculations

Qmin (cfs)	=	7.00
Qmax (cfs)	=	7.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

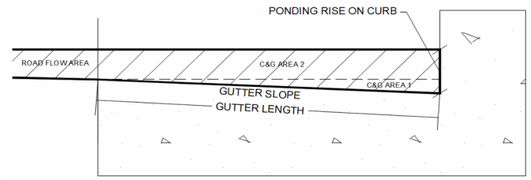
Qtotal (cfs)	=	7.00
Qpipe (cfs)	=	7.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	4.41
Veloc Up (ft/s)	=	5.45
HGL Dn (ft)	=	364.56
HGL Up (ft)	=	365.02
Hw Elev (ft)	=	365.53
Hw/D (ft)	=	1.02
Flow Regime	=	Inlet Control



Gutter Spread by Limited Area

Determine maximum area to on-grade inlet using input factors as shown below.

Project: **Kalas Falls PH5** Road: **Armfield Creek Place (27' B-B)** Date: 3/3/25



Inlet No. **1** Allowable Spread=Pvm't + Gutter Width: 7.5 ft

Compute "C" Factor: One Half R/W Width: 25 One Half B/B Width: 13.5 S/W Width 5

Paved Area "C": 0.95 Grass Area 0.2

0.70 0.05

Gutter Width= 2.00 ft.

Total Allow. Spread = 7.50 ft. Manning's n = 0.015 Weir C = 3.33

Inlet Type 1 Inlet Types 1 NCDOT Std. 840.03

Composite Rational C = 0.76 I (2yr.) = 4.00 iph

Roadway X-slope = 0.02 Varies Manual Input

Standard Curb and Gutter Profile (see diagram above)

Gutter Length (ft)	2
Gutter Slope (ft/ft)	0.04
Ponding Rise on Curb (ft)	0.19

Max Flow for Limited Spread

C.B. NUMBER	Long. Slope	ROAD X-SLOPE	E. O. P. Depth	Weir Depth	C&G Flow Area 1	C&G Flow Area 2	C&G WP	Road Flow Area	Road WP	Total Flow A	Total WP	MAX Q FOR SPREAD, CFS	On-Grade Spread	Max Drainage Area (S.F.)	Actual Drainage Area (S.F.)	Actual Drainage Area (ACRE)	Check	
390A-CB	0.019	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.54**	7.50	20455	18052	0.41	GOOD	
390-CB	0.019	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.54**	7.50	20455	9666	0.22	GOOD	
391A-CB	0.019	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.54**	7.50	20455	14478	0.33	GOOD	
391-CB	0.019	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.54**	7.50	20455	4809	0.11	GOOD	
392A-CB	0.019	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.54**	7.50	20455	13982	0.32	GOOD	
392-CB	0.019	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.54**	7.50	20455	10647	0.24	GOOD	
393A/393B-CB	0.019	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.54**	7.50	40909	22658	0.52	GOOD	*Double
393-CB	0.019	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.54**	7.50	20455	12130	0.28	GOOD	
395A-CB	0.008	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.01**	7.50	13460	4586	0.11	GOOD	
395-CB	0.008	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.01**	7.50	13460	3179	0.07	GOOD	
396A-CB	0.008	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.01**	7.50	13460	9273	0.21	GOOD	
396B-CB	0.008	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.01**	7.50	13460	6744	0.15	GOOD	
396-CB	0.008	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.01**	7.50	13460	10609	0.24	GOOD	

E. O. P. - Edge of Pavement
C&G - Curb and gutter
WP - Wetted Perimeter (ft.)

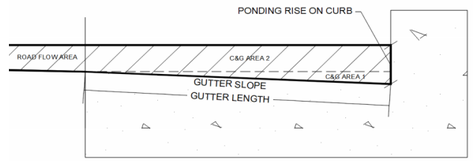
A - Area (s. f.)
V - Velocity (fps)

Note: Program uses Manning's formula for open channel flow.

Gutter Spread by Limited Area

Determine maximum area to on-grade inlet using input factors as shown below.

Project: **Kalas Falls PH5** Road: **Graymont Oaks Dr. (27' B-B)** Date: 3/3/25



Inlet No. **1** Allowable Spread=Pvm't + Gutter Width: 7.5 ft

Compute "C" Factor: One Half R/W Width: 25 One Half B/B Width: 13.5 S/W Width 5

Paved Area "C": 0.95 Grass Area 0.2

0.70 0.05

Gutter Width= 2.00 ft.

Total Allow. Spread = 7.50 ft. Manning's n = 0.015 Weir C = 3.33

Inlet Type 1 Inlet Types 1 NCDOT Std. 840.03

Composite Rational C = 0.76 I (2yr.) = 4.00 iph

Roadway X-slope = 0.02 Varies Manual Input

Standard Curb and Gutter Profile (see diagram above)

Gutter Length (ft)	2
Gutter Slope (ft/ft)	0.04
Ponding Rise on Curb (ft)	0.19

Max Flow for Limited Spread

C.B. NUMBER	Long. Slope	ROAD X-SLOPE	E. O. P. Depth	Weir Depth	C&G Flow Area 1	C&G Flow Area 2	C&G WP	Road Flow Area	Road WP	Total Flow A	Total WP	MAX Q FOR SPREAD, CFS	On-Grade Spread	Max Drainage Area (S.F.)	ctual Drainage Ar Area (S.F.)	al Drainage Area (ACRE)	Check	
375A-CB	0.017	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.43**	7.50	19091	13291	0.31	GOOD	
376-CB	0.017	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.43**	7.50	19091	7896	0.18	GOOD	
377A-CB	0.017	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.43**	7.50	19091	10439	0.24	GOOD	
377-CB	0.017	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.43**	7.50	19091	9361	0.21	GOOD	
378A-CB	0.017	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.43**	7.50	19091	8896	0.20	GOOD	
378B-CB	0.017	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.43**	7.50	19091	4939	0.11	GOOD	
378-CB	0.017	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.43**	7.50	19091	8137	0.19	GOOD	
379-CB	0.017	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.43**	7.50	19091	3059	0.07	GOOD	
380A-CB	0.017	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.43**	7.50	19091	15026	0.34	GOOD	
380-CB	0.017	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.43**	7.50	19091	13389	0.31	GOOD	
381A-CB	0.017	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.43**	7.50	19091	17358	0.40	GOOD	
381B-CB	0.017	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.43**	7.50	19091	5036	0.12	GOOD	
381-CB	0.017	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.43**	7.50	19091	8877	0.20	GOOD	
381C-CB	0.017	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.43**	7.50	19091	3965	0.09	GOOD	
382-CB	0.017	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.43**	7.50	19091	3553	0.08	GOOD	
383-CB	0.005	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**0.78**	7.50	10384	281	0.01	GOOD	
384-CB	0.005	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**0.78**	7.50	10384	5116	0.12	GOOD	
385/385A-CB	0.005	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**0.78**	7.50	20769	13125	0.30	GOOD	*Double
385B/385C-CB	0.005	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**0.78**	7.50	20769	13958	0.32	GOOD	*Double
386/386A-CB	0.005	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**0.78**	7.50	20769	20662	0.47	GOOD	*Double
386B/386C-CB	0.005	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**0.78**	7.50	20769	14052	0.32	GOOD	*Double
EX. 375-CB	0.017	0.020	0.11	0.11	0.08	0.22	2.19	0.30	5.50	0.61	7.69	**1.43**	7.50	19091	1103	0.03	GOOD	

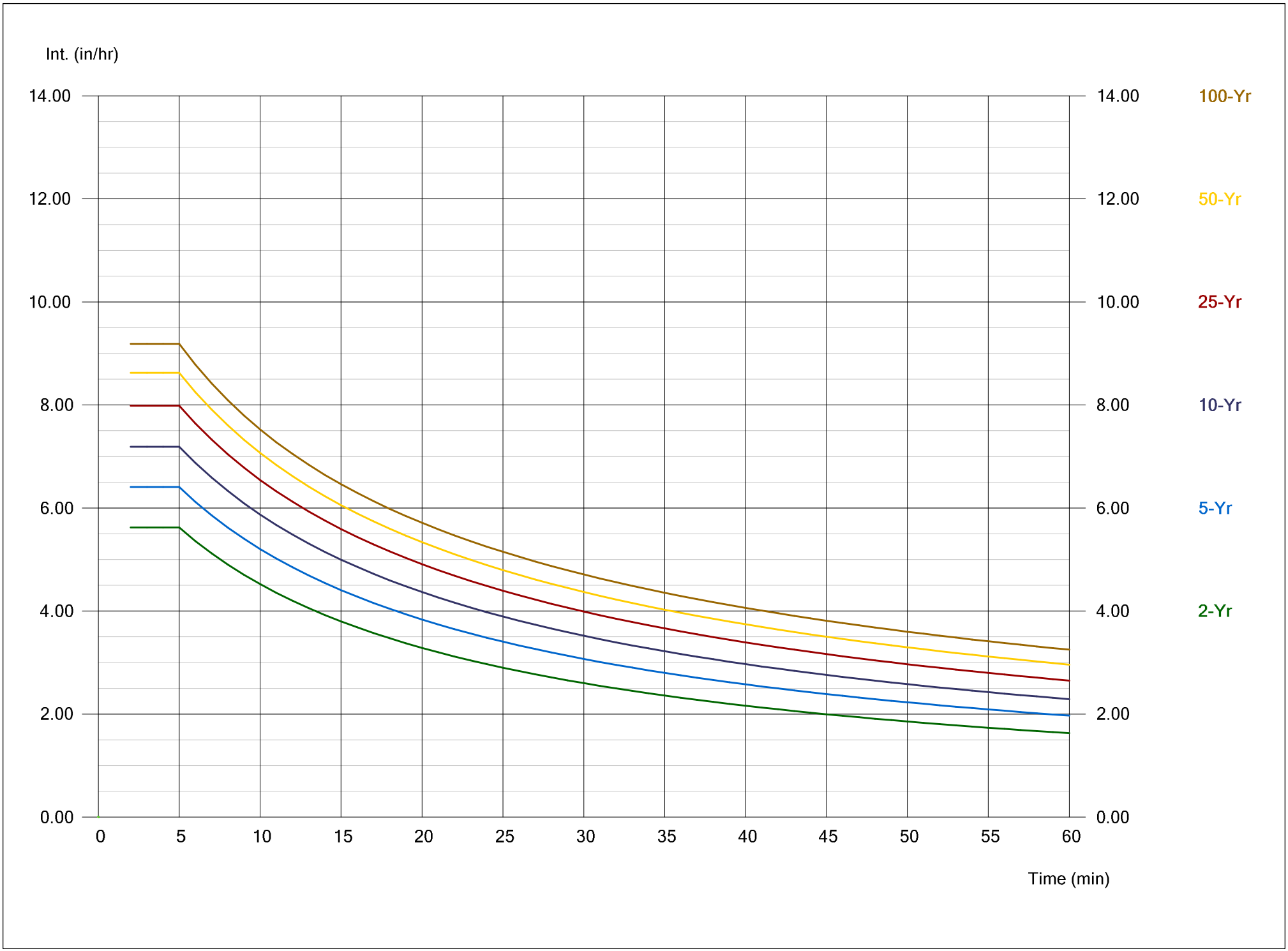
E. O. P. - Edge of Pavement
C&G - Curb and gutter
WP - Wetted Perimeter (ft.)

A - Area (s. f.)
V - Velocity (fps)

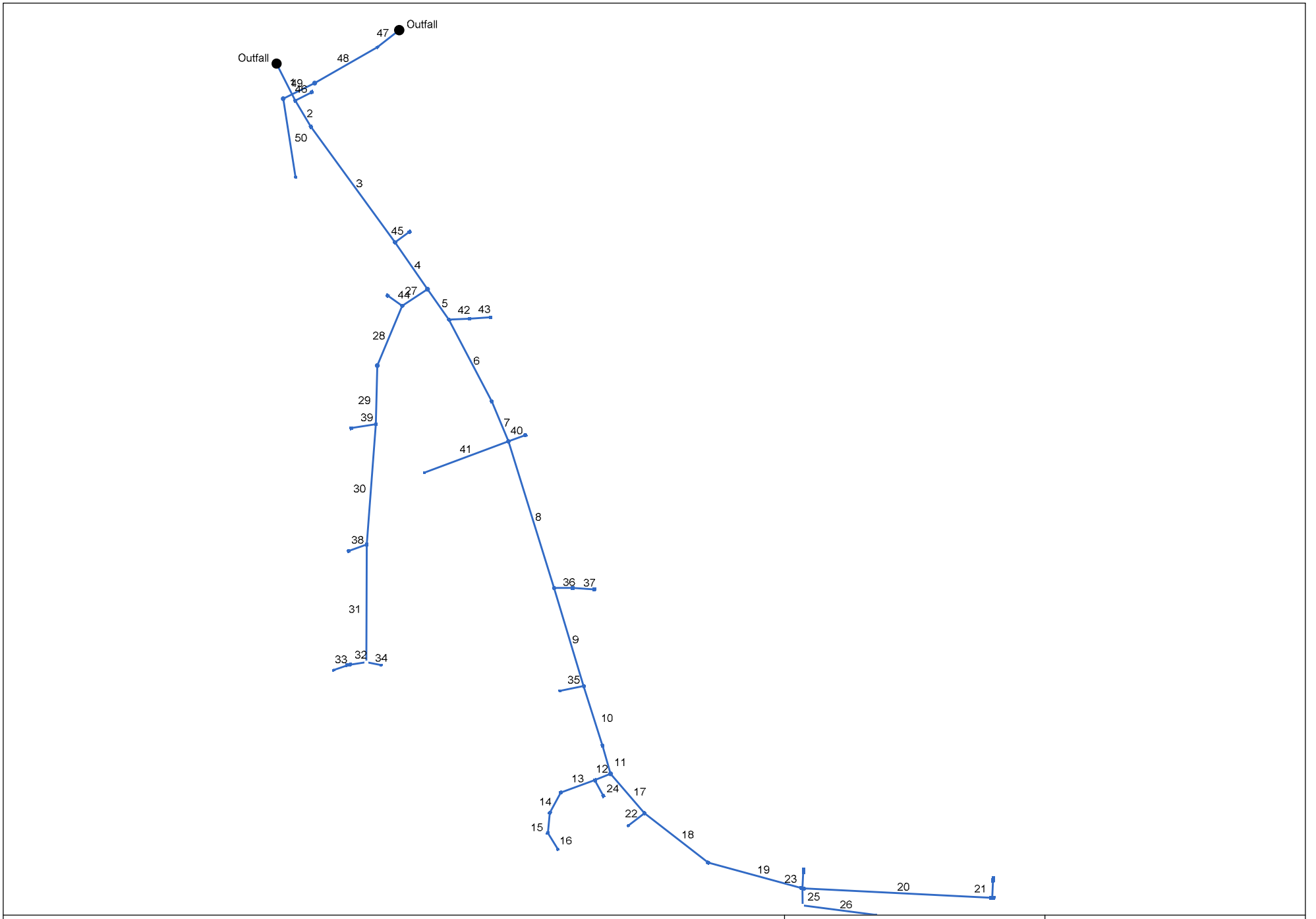
Note: Program uses Manning's formula for open channel flow.

Storm Sewer IDF Curves

IDF file: 20241113 Kalas 5.IDF



Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan KALAS 5 10-YEAR REPORT



Project File: Outfall #1.stm	Number of lines: 50	Date: 3/3/2025

Storm Sewer Inventory Report

KALAS 5 10-YEAR REPORT

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	57.000	63.252	Comb	0.00	0.01	0.56	10.0	357.90	0.68	358.29	36	Cir	0.013	1.50	364.82	Ex. 375 Out
2	1	41.866	-4.047	Comb	0.00	0.17	0.56	10.0	358.64	0.50	358.85	36	Cir	0.013	0.50	365.27	Pipe - (20)
3	2	196.394	-5.160	Comb	0.00	0.21	0.56	10.0	358.95	1.64	362.17	36	Cir	0.013	1.50	368.56	Pipe - (19)
4	3	78.359	1.332	MH	0.00	0.01	0.56	10.0	362.27	1.57	363.50	36	Cir	0.013	1.00	370.06	Pipe - (18)
5	4	51.000	-0.352	Comb	0.00	0.19	0.56	10.0	364.00	1.06	364.54	30	Cir	0.013	1.30	370.73	Pipe - (16)
6	5	126.897	7.290	Comb	0.00	0.07	0.56	10.0	364.64	1.42	366.44	30	Cir	0.013	0.50	372.89	Pipe - (15)
7	6	59.532	5.165	Comb	0.00	0.31	0.56	10.0	366.65	1.72	367.68	30	Cir	0.013	1.50	373.89	Pipe - (14)
8	7	210.964	5.328	Comb	0.00	0.20	0.56	10.0	367.78	1.54	371.03	30	Cir	0.013	1.44	377.52	Pipe - (13)
9	8	140.875	0.547	Comb	0.00	0.09	0.56	10.0	371.43	0.65	372.35	30	Cir	0.013	1.50	379.89	Pipe - (12) (1)
10	9	86.180	-0.829	Comb	0.00	0.08	0.56	10.0	373.07	0.61	373.60	30	Cir	0.013	0.50	381.39	Pipe - (12)
11	10	40.124	1.547	MH	0.00	0.01	0.56	10.0	373.70	0.75	374.00	30	Cir	0.013	1.00	381.95	Pipe - (51)
12	11	23.025	83.735	Comb	0.00	0.07	0.56	10.0	375.27	0.50	375.38	24	Cir	0.013	1.50	382.14	Pipe - (50) (1)
13	12	49.905	2.092	Comb	0.00	0.24	0.56	10.0	375.48	0.50	375.73	24	Cir	0.013	1.07	382.55	Pipe - (50)
14	13	31.516	-41.901	Comb	0.00	0.21	0.56	10.0	375.83	0.50	375.99	24	Cir	0.013	0.65	382.87	Pipe - (49)
15	14	27.860	-22.271	Comb	0.00	0.15	0.56	10.0	376.09	0.50	376.23	24	Cir	0.013	0.99	382.23	Pipe - (48)
16	15	25.968	-37.432	DrGrt	0.00	4.70	0.17	10.0	376.73	0.89	376.96	18	Cir	0.013	1.00	379.55	Pipe - (58)
17	11	71.389	-24.767	Comb	0.00	0.01	0.56	10.0	374.10	0.53	374.48	24	Cir	0.013	1.50	382.72	Pipe - (11)
18	17	110.816	-11.425	Comb	0.00	0.12	0.56	10.0	374.58	0.50	375.13	24	Cir	0.013	0.66	382.29	Pipe - (10)
19	18	133.897	-22.601	Comb	0.00	0.30	0.56	10.0	375.23	0.50	375.90	24	Cir	0.013	2.18	381.56	Pipe - (9)
20	19	260.141	-12.381	Comb	0.00	0.47	0.56	10.0	376.02	0.49	377.30	18	Cir	0.013	1.50	382.86	Pipe - (8)
21	20	25.751	-90.000	Comb	0.00	0.32	0.56	10.0	377.55	0.66	377.72	15	Cir	0.013	1.00	382.92	Pipe - (7)
22	17	28.157	93.178	DrGrt	0.00	0.61	0.17	10.0	376.03	2.24	376.66	15	Cir	0.013	1.00	380.41	Pipe - (59)
23	19	24.491	-102.382	Comb	0.00	0.32	0.56	10.0	376.45	0.53	376.58	15	Cir	0.013	1.00	381.56	Pipe - (55)

Project File: Outfall #1.stm | Number of lines: 50 | Date: 3/3/2025

Storm Sewer Inventory Report

KALAS 5 10-YEAR REPORT

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
24	12	24.507	-95.925	Comb	0.00	0.11	0.56	10.0	376.87	0.73	377.05	15	Cir	0.013	1.00	382.14	Pipe - (70)
25	19	23.549	74.368	DrGrt	0.00	0.66	0.17	10.0	376.05	0.72	376.22	15	Cir	0.013	1.49	381.51	Pipe - (60)
26	25	101.000	-82.180	DrGrt	0.00	0.43	0.17	10.0	376.32	0.52	376.85	15	Cir	0.013	1.00	377.88	Pipe - (71)
27	4	41.676	91.283	Comb	0.00	0.22	0.56	10.0	364.00	0.84	364.35	24	Cir	0.013	1.42	370.22	Pipe - (57)
28	27	88.898	-34.214	MH	0.00	0.01	0.56	10.0	364.57	2.00	366.35	24	Cir	0.013	0.41	372.10	Pipe - (56)
29	28	80.422	-21.032	Comb	0.00	0.11	0.56	10.0	366.55	2.00	368.16	24	Cir	0.013	1.48	373.82	Pipe - (39)
30	29	166.115	2.964	Comb	0.00	0.24	0.56	10.0	368.68	1.80	371.67	18	Cir	0.013	1.39	376.92	Pipe - (37)
31	30	161.824	-4.236	Comb	0.00	0.28	0.56	10.0	371.77	1.93	374.90	18	Cir	0.013	2.22	380.04	Pipe - (36)
32	31	24.500	81.321	Comb	0.00	0.52	0.56	10.0	375.00	0.49	375.12	18	Cir	0.013	0.50	380.20	Pipe - (42)
33	32	22.252	-10.400	DrGrt	0.00	2.63	0.17	10.0	375.42	0.99	375.64	15	Cir	0.013	1.00	378.27	Pipe - (61)
34	31	20.817	-78.889	DrGrt	0.00	0.11	0.56	10.0	375.15	0.72	375.30	15	Cir	0.013	1.00	379.93	Pipe - (62)
35	9	32.881	95.114	DrGrt	0.00	0.25	0.56	10.0	374.07	1.09	374.43	18	Cir	0.013	1.00	377.38	Pipe - (69)
36	8	25.642	-72.321	Comb	0.00	0.40	0.56	10.0	372.50	0.70	372.68	15	Cir	0.013	0.50	377.65	Pipe - (54)
37	36	29.330	3.216	Comb	0.00	0.12	0.56	10.0	372.80	3.00	373.68	15	Cir	0.013	1.00	378.77	Pipe - (22)
38	30	26.271	65.734	Comb	0.00	0.32	0.56	10.0	371.92	1.45	372.30	15	Cir	0.013	1.00	377.11	Pipe - (41)
39	29	34.056	79.521	Comb	0.00	0.33	0.56	10.0	368.81	0.65	369.03	15	Cir	0.013	1.00	373.82	Pipe - (40)
40	7	24.427	-88.012	Comb	0.00	0.34	0.56	10.0	368.75	1.06	369.01	15	Cir	0.013	1.00	374.05	Pipe - (43)
41	7	123.325	91.973	DrGrt	0.00	1.30	0.56	10.0	368.30	0.54	368.97	18	Cir	0.013	1.00	372.49	Pipe - (63)
42	5	28.012	-57.519	Comb	0.00	0.20	0.56	10.0	365.72	1.36	366.10	15	Cir	0.013	0.50	371.06	Pipe - (24)
43	42	29.509	-1.479	Comb	0.00	0.11	0.56	10.0	366.20	0.51	366.35	15	Cir	0.013	1.00	371.27	Pipe - (53)
44	27	24.451	69.302	Comb	0.00	0.41	0.56	10.0	364.85	1.02	365.10	18	Cir	0.013	1.00	370.23	Pipe - (17)
45	3	24.503	-90.507	Comb	0.00	0.24	0.56	10.0	363.42	0.94	363.65	15	Cir	0.013	1.00	368.56	Pipe - (28)
46	1	25.748	-90.230	Comb	0.00	0.31	0.56	10.0	360.76	-0.50	360.63	18	Cir	0.013	1.00	364.57	Pipe - (26)

Project File: Outfall #1.stm | Number of lines: 50 | Date: 3/3/2025

Storm Sewer Inventory Report

KALAS 5 10-YEAR REPORT

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
47	End	38.074	141.899	DrGrt	0.00	1.07	0.56	10.0	352.90	0.50	353.09	36	Cir	0.013	0.50	359.06	Pipe - (67)
48	47	98.975	8.202	MH	0.00	0.01	0.56	10.0	353.19	0.50	353.69	30	Cir	0.013	0.15	364.91	Pipe - (66)
49	48	48.268	3.525	MH	0.00	0.01	0.56	10.0	353.79	0.50	354.03	30	Cir	0.013	0.96	364.48	Pipe - (65)
50	49	109.030	-72.571	DrGrt	0.00	8.60	0.17	10.0	355.35	2.20	357.75	24	Cir	0.013	1.00	360.04	Pipe - (29)

Project File: Outfall #1.stm | Number of lines: 50 | Date: 3/3/2025

Structure Report

KALAS 5 10-YEAR REPORT

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	EX. CB 375	Combination	364.82	Rect	4.00	4.00	36	Cir	358.29	36 18	Cir Cir	358.64 360.76
2	376	Combination	365.27	Rect	4.00	4.00	36	Cir	358.85	36	Cir	358.95
3	377	Combination	368.56	Rect	4.00	4.00	36	Cir	362.17	36 15	Cir Cir	362.27 363.42
4	377B	Manhole	370.06	Cir	4.00	4.00	36	Cir	363.50	30 24	Cir Cir	364.00 364.00
5	378	Combination	370.73	Rect	4.00	4.00	30	Cir	364.54	30 15	Cir Cir	364.64 365.72
6	379	Combination	372.89	Rect	4.00	4.00	30	Cir	366.44	30	Cir	366.65
7	380	Combination	373.89	Rect	4.00	4.00	30	Cir	367.68	30 15 18	Cir Cir Cir	367.78 368.75 368.30
8	381	Combination	377.52	Rect	4.00	4.00	30	Cir	371.03	30 15	Cir Cir	371.43 372.50
9	381C	Combination	379.89	Rect	4.00	4.00	30	Cir	372.35	30 18	Cir Cir	373.07 374.07
10	382	Combination	381.39	Rect	4.00	4.00	30	Cir	373.60	30	Cir	373.70
11	382A	Manhole	381.95	Cir	4.00	4.00	30	Cir	374.00	24 24	Cir Cir	375.27 374.10
12	395	Combination	382.14	Rect	4.00	4.00	24	Cir	375.38	24 15	Cir Cir	375.48 376.87
13	396	Combination	382.55	Rect	4.00	4.00	24	Cir	375.73	24	Cir	375.83
14	396A	Combination	382.87	Rect	4.00	4.00	24	Cir	375.99	24	Cir	376.09
15	396B	Combination	382.23	Rect	4.00	4.00	24	Cir	376.23	18	Cir	376.73
16	396C	DropGrate	379.55	Rect	3.00	3.00	18	Cir	376.96			
17	383	Combination	382.72	Rect	4.00	4.00	24	Cir	374.48	24 15	Cir Cir	374.58 376.03

Project File: Outfall #1.stm | Number of Structures: 50 | Run Date: 3/3/2025

Structure Report

KALAS 5 10-YEAR REPORT

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
18	384	Combination	382.29	Rect	4.00	4.00	24	Cir	375.13	24	Cir	375.23
19	385	Combination	381.56	Rect	8.00	4.00	24	Cir	375.90	18 15 15	Cir Cir Cir	376.02 376.45 376.05
20	386	Combination	382.86	Rect	8.00	4.00	18	Cir	377.30	15	Cir	377.55
21	386A	Combination	382.92	Rect	8.00	4.00	15	Cir	377.72			
22	383A	DropGrate	380.41	Rect	3.00	3.00	15	Cir	376.66			
23	385A	Combination	381.56	Rect	8.00	4.00	15	Cir	376.58			
24	395A	Combination	382.14	Rect	4.00	4.00	15	Cir	377.05			
25	385B	DropGrate	381.51	Rect	3.00	3.00	15	Cir	376.22	15	Cir	376.32
26	385C	DropGrate	377.88	Rect	3.00	3.00	15	Cir	376.85			
27	390	Combination	370.22	Rect	4.00	4.00	24	Cir	364.35	24 18	Cir Cir	364.57 364.85
28	390B	Manhole	372.10	Cir	4.00	4.00	24	Cir	366.35	24	Cir	366.55
29	391	Combination	373.82	Rect	4.00	4.00	24	Cir	368.16	18 15	Cir Cir	368.68 368.81
30	392	Combination	376.92	Rect	4.00	4.00	18	Cir	371.67	18 15	Cir Cir	371.77 371.92
31	393	Combination	380.04	Rect	4.00	4.00	18	Cir	374.90	18 15	Cir Cir	375.00 375.15
32	393A	Combination	380.20	Rect	8.00	4.00	18	Cir	375.12	15	Cir	375.42
33	393B	DropGrate	378.27	Rect	3.00	3.00	15	Cir	375.64			
34	393C	DropGrate	379.93	Rect	3.00	3.00	15	Cir	375.30			
35	381D	DropGrate	377.38	Rect	3.00	3.00	18	Cir	374.43			
36	381A	Combination	377.65	Rect	4.00	4.00	15	Cir	372.68	15	Cir	372.80
37	381B	Combination	378.77	Rect	4.00	4.00	15	Cir	373.68			

Project File: Outfall #1.stm | Number of Structures: 50 | Run Date: 3/3/2025

Structure Report

KALAS 5 10-YEAR REPORT

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
38	392A	Combination	377.11	Rect	4.00	4.00	15	Cir	372.30			
39	391A	Combination	373.82	Rect	4.00	4.00	15	Cir	369.03			
40	380A	Combination	374.05	Rect	4.00	4.00	15	Cir	369.01			
41	380B	DropGrate	372.49	Rect	3.00	3.00	18	Cir	368.97			
42	378A	Combination	371.06	Rect	4.00	4.00	15	Cir	366.10	15	Cir	366.20
43	378B	Combination	371.27	Rect	4.00	4.00	15	Cir	366.35			
44	390A	Combination	370.23	Rect	4.00	4.00	18	Cir	365.10			
45	377A	Combination	368.56	Rect	4.00	4.00	15	Cir	363.65			
46	375A	Combination	364.57	Rect	4.00	4.00	18	Cir	360.63			
47	31A	DropGrate	359.06	Rect	3.00	3.00	36	Cir	353.09	30	Cir	353.19
48	EX. 31	Manhole	364.91	Cir	4.00	4.00	30	Cir	353.69	30	Cir	353.79
49	EX. 32	Manhole	364.48	Cir	4.00	4.00	30	Cir	354.03	24	Cir	355.35
50	32A	DropGrate	360.04	Rect	3.00	3.00	24	Cir	357.75			

Project File: Outfall #1.stm | Number of Structures: 50 | Run Date: 3/3/2025

Storm Sewer Summary Report

KALAS 5 10-YEAR REPORT

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	Ex. 375 Out	34.00	36	Cir	57.000	357.90	358.29	0.684	360.90	361.00	0.60	361.60	End	Combination
2	Pipe - (20)	33.23	36	Cir	41.866	358.64	358.85	0.502	361.60	360.72	0.40	360.72	1	Combination
3	Pipe - (19)	33.18	36	Cir	196.394	358.95	362.17	1.640	360.72	364.04	1.20	364.04	2	Combination
4	Pipe - (18)	32.08	36	Cir	78.359	362.27	363.50	1.570	364.04	365.34	0.78	365.34	3	Manhole
5	Pipe - (16)	22.61	30	Cir	51.000	364.00	364.54	1.059	365.34	366.16	0.92	366.16	4	Combination
6	Pipe - (15)	21.39	30	Cir	126.897	364.64	366.44	1.418	366.16	368.01	0.34	368.01	5	Combination
7	Pipe - (14)	21.28	30	Cir	59.532	366.65	367.68	1.723	368.01	369.25	n/a	369.25	6	Combination
8	Pipe - (13)	15.95	30	Cir	210.964	367.78	371.03	1.539	369.25	372.38	n/a	372.38 j	7	Combination
9	Pipe - (12) (1)	14.00	30	Cir	140.875	371.43	372.35	0.653	372.56	373.61	0.75	373.61	8	Combination
10	Pipe - (12)	13.08	30	Cir	86.180	373.07	373.60	0.615	374.18	374.81	n/a	374.81	9	Combination
11	Pipe - (51)	12.89	30	Cir	40.124	373.70	374.00	0.748	374.81	375.21	n/a	375.21	10	Manhole
12	Pipe - (50) (1)	7.14	24	Cir	23.025	375.27	375.38	0.499	376.20	376.33	0.55	376.33	11	Combination
13	Pipe - (50)	6.59	24	Cir	49.905	375.48	375.73	0.501	376.37	376.64	n/a	376.64	12	Combination
14	Pipe - (49)	5.84	24	Cir	31.516	375.83	375.99	0.501	376.67	376.84	n/a	376.84	13	Combination
15	Pipe - (48)	5.17	24	Cir	27.860	376.09	376.23	0.499	376.88	377.03	n/a	377.03	14	Combination
16	Pipe - (58)	4.69	18	Cir	25.968	376.73	376.96	0.886	377.46	377.79	n/a	377.79	15	DropGrate
17	Pipe - (11)	6.26	24	Cir	71.389	374.10	374.48	0.532	375.21	375.37	n/a	375.37 j	11	Combination
18	Pipe - (10)	5.74	24	Cir	110.816	374.58	375.13	0.496	375.41	375.98	n/a	375.98	17	Combination
19	Pipe - (9)	5.46	24	Cir	133.897	375.23	375.90	0.500	376.04	376.72	0.68	376.72	18	Combination
20	Pipe - (8)	2.59	18	Cir	260.141	376.02	377.30	0.491	376.72	377.91	n/a	377.91	19	Combination
21	Pipe - (7)	1.05	15	Cir	25.751	377.55	377.72	0.660	377.93	378.12	0.15	378.12	20	Combination
22	Pipe - (59)	0.61	15	Cir	28.157	376.03	376.66	2.237	376.24	376.96	0.11	376.96	17	DropGrate
23	Pipe - (55)	1.05	15	Cir	24.491	376.45	376.58	0.531	376.85	376.98	0.15	376.98	19	Combination
24	Pipe - (70)	0.36	15	Cir	24.507	376.87	377.05	0.734	377.09	377.28	0.08	377.28	12	Combination

Project File: Outfall #1.stm | Number of lines: 50 | Run Date: 3/3/2025

NOTES: Return period = 10 Yrs. ; j - Line contains hyd. jump.

Storm Sewer Summary Report

KALAS 5 10-YEAR REPORT

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
25	Pipe - (60)	1.06	15	Cir	23.549	376.05	376.22	0.722	376.72	376.62	n/a	376.62	19	DropGrate
26	Pipe - (71)	0.43	15	Cir	101.000	376.32	376.85	0.525	376.62	377.10	n/a	377.10	25	DropGrate
27	Pipe - (57)	10.39	24	Cir	41.676	364.00	364.35	0.840	365.34	365.50	n/a	365.50 j	4	Combination
28	Pipe - (56)	8.51	24	Cir	88.898	364.57	366.35	2.002	365.50	367.39	n/a	367.39	27	Manhole
29	Pipe - (39)	8.54	24	Cir	80.422	366.55	368.16	2.001	367.39	369.20	0.61	369.20	28	Combination
30	Pipe - (37)	7.25	18	Cir	166.115	368.68	371.67	1.800	369.44	372.71	0.66	372.71	29	Combination
31	Pipe - (36)	5.57	18	Cir	161.824	371.77	374.90	1.934	372.71	375.81	n/a	375.81 j	30	Combination
32	Pipe - (42)	4.32	18	Cir	24.500	375.00	375.12	0.490	375.83	375.95	0.15	376.09	31	Combination
33	Pipe - (61)	2.63	15	Cir	22.252	375.42	375.64	0.989	376.09	376.29	n/a	376.29 j	32	DropGrate
34	Pipe - (62)	0.36	15	Cir	20.817	375.15	375.30	0.721	375.81	375.53	0.08	375.53	31	DropGrate
35	Pipe - (69)	0.82	18	Cir	32.881	374.07	374.43	1.095	374.35	374.77	0.12	374.77	9	DropGrate
36	Pipe - (54)	1.69	15	Cir	25.642	372.50	372.68	0.702	372.98	373.20	n/a	373.20	8	Combination
37	Pipe - (22)	0.39	15	Cir	29.330	372.80	373.68	3.000	373.20	373.92	n/a	373.92 j	36	Combination
38	Pipe - (41)	1.05	15	Cir	26.271	371.92	372.30	1.446	372.71	372.70	n/a	372.70 j	30	Combination
39	Pipe - (40)	1.09	15	Cir	34.056	368.81	369.03	0.646	369.20	369.44	0.15	369.44	29	Combination
40	Pipe - (43)	1.12	15	Cir	24.427	368.75	369.01	1.064	369.25	369.43	n/a	369.43 j	7	Combination
41	Pipe - (63)	4.28	18	Cir	123.325	368.30	368.97	0.543	369.25	369.76	0.32	369.76	7	DropGrate
42	Pipe - (24)	1.01	15	Cir	28.012	365.72	366.10	1.357	366.16	366.49	n/a	366.49 j	5	Combination
43	Pipe - (53)	0.36	15	Cir	29.509	366.20	366.35	0.508	366.49	366.59	0.08	366.66	42	Combination
44	Pipe - (17)	1.35	18	Cir	24.451	364.85	365.10	1.022	365.50	365.53	n/a	365.53 j	27	Combination
45	Pipe - (28)	0.79	15	Cir	24.503	363.42	363.65	0.939	364.04	364.00	n/a	364.00 j	3	Combination
46	Pipe - (26)	1.02	18	Cir	25.748	360.76	360.63	-0.505	361.60	361.61	0.01	361.62	1	Combination
47	Pipe - (67)	11.85	36	Cir	38.074	352.90	353.09	0.499	354.95	354.18	n/a	354.18	End	DropGrate
48	Pipe - (66)	8.52	30	Cir	98.975	353.19	353.69	0.500	354.18	354.66	n/a	354.66 j	47	Manhole

Project File: Outfall #1.stm | Number of lines: 50 | Run Date: 3/3/2025

NOTES: Return period = 10 Yrs. ; j - Line contains hyd. jump.

Storm Sewer Summary Report

KALAS 5 10-YEAR REPORT

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
49	Pipe - (65)	8.54	30	Cir	48.268	353.79	354.03	0.497	354.72	355.00	n/a	355.00	48	Manhole
50	Pipe - (29)	8.59	24	Cir	109.030	355.35	357.75	2.201	356.04	358.79	0.42	358.79	49	DropGrate

Project File: Outfall #1.stm

Number of lines: 50

Run Date: 3/3/2025

NOTES: Return period = 10 Yrs. ; j - Line contains hyd. jump.

Inlet Report

KALAS 5 10-YEAR REPORT

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	EX. CB 375	0.03	0.00	0.03	0.00	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.06	1.06	0.00	0.00	0.0	Off
2	376	0.56	0.00	0.51	0.05	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.18	4.90	0.07	1.22	0.0	Off
3	377	0.69	0.00	0.61	0.08	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.19	5.51	0.09	1.49	0.0	Off
4	377B	0.03	0.00	0.00	0.03	MH	0.0	0.00	0.00	0.00	0.00	Sag	2.00	0.060	0.020	0.013	0.00	0.00	0.00	0.00	0.0	Off
5	378	0.62	0.00	0.56	0.06	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.18	5.22	0.08	1.36	0.0	Off
6	379	0.23	0.00	0.23	0.00	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.13	2.61	0.01	0.22	0.0	Off
7	380	1.02	0.00	0.84	0.18	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.21	6.71	0.12	2.08	0.0	Off
8	381	0.66	0.00	0.59	0.07	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.19	5.36	0.09	1.42	0.0	Off
9	381C	0.30	0.00	0.29	0.00	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.14	3.22	0.03	0.49	0.0	Off
10	382	0.26	0.00	0.26	0.00	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.14	2.93	0.02	0.38	0.0	Off
11	382A	0.03	0.00	0.00	0.03	MH	0.0	0.00	0.00	0.00	0.00	Sag	2.00	0.060	0.020	0.013	0.00	0.00	0.00	0.00	0.0	Off
12	395	0.23	0.00	0.23	0.00	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.13	2.61	0.01	0.22	0.0	Off
13	396	0.79	0.00	0.68	0.11	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.20	5.91	0.10	1.66	0.0	Off
14	396A	0.69	0.00	0.61	0.08	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.19	5.51	0.09	1.49	0.0	Off
15	396B	0.49	0.00	0.46	0.03	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.17	4.55	0.06	1.07	0.0	Off
16	396C	4.69	0.00	4.69	0.00	DrGrt	0.0	0.00	4.00	2.00	2.00	Sag	2.00	0.010	0.010	0.013	0.34	69.34	0.34	69.34	0.0	Off
17	383	0.03	0.00	0.03	0.00	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.06	1.06	0.00	0.00	0.0	Off
18	384	0.39	0.00	0.38	0.02	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.16	3.96	0.05	0.81	0.0	Off
19	385	0.99	0.00	0.91	0.07	Comb	6.0	1.50	0.00	6.00	2.50	0.005	2.00	0.060	0.020	0.013	0.21	6.61	0.09	1.44	0.0	Off
20	386	1.55	0.00	1.37	0.18	Comb	6.0	1.50	0.00	6.00	2.50	0.005	2.00	0.060	0.020	0.013	0.24	8.15	0.12	2.00	0.0	Off
21	386A	1.05	0.00	0.97	0.08	Comb	6.0	1.50	0.00	6.00	2.50	0.005	2.00	0.060	0.020	0.013	0.22	6.82	0.09	1.51	0.0	Off
22	383A	0.61	0.00	0.61	0.00	DrGrt	0.0	0.00	4.00	2.00	2.00	Sag	2.00	0.010	0.010	0.013	0.09	19.25	0.09	19.25	0.0	Off
23	385A	1.05	0.00	0.97	0.08	Comb	6.0	1.50	0.00	6.00	2.50	0.005	2.00	0.060	0.020	0.013	0.22	6.82	0.09	1.51	0.0	Off

Project File: Outfall #1.stm | Number of lines: 50 | Run Date: 3/3/2025

NOTES: Inlet N-Values = 0.016; Intensity = 72.00 / (Inlet time + 12.50) ^ 0.80; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

Inlet Report

KALAS 5 10-YEAR REPORT

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
24	395A	0.36	0.00	0.35	0.01	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.15	3.73	0.04	0.71	0.0	Off
25	385B	0.66	0.00	0.66	0.00	DrGrt	0.0	0.00	4.00	2.00	2.00	Sag	2.00	0.010	0.010	0.013	0.09	20.18	0.09	20.18	0.0	Off
26	385C	0.43	0.00	0.43	0.00	DrGrt	0.0	0.00	4.00	2.00	2.00	Sag	2.00	0.020	0.020	0.013	0.07	8.83	0.07	8.83	0.0	Off
27	390	0.72	0.00	0.63	0.09	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.19	5.64	0.09	1.55	0.0	Off
28	390B	0.03	0.00	0.00	0.03	MH	0.0	0.00	0.00	0.00	0.00	Sag	2.00	0.060	0.020	0.013	0.00	0.00	0.00	0.00	0.0	Off
29	391	0.36	0.00	0.35	0.01	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.15	3.73	0.04	0.71	0.0	Off
30	392	0.79	0.00	0.68	0.11	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.20	5.91	0.10	1.66	0.0	Off
31	393	0.92	0.00	0.77	0.15	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.21	6.39	0.11	1.88	0.0	Off
32	393A	1.71	0.00	1.50	0.21	Comb	6.0	1.50	0.00	6.00	2.50	0.005	2.00	0.060	0.020	0.013	0.25	8.53	0.13	2.43	0.0	Off
33	393B	2.63	0.00	2.63	0.00	DrGrt	0.0	0.00	4.00	2.00	2.00	Sag	2.00	0.010	0.010	0.013	0.23	47.72	0.23	47.72	0.0	Off
34	393C	0.36	0.00	0.36	0.00	DrGrt	0.0	0.00	4.00	2.00	2.00	Sag	2.00	0.010	0.010	0.013	0.06	14.19	0.06	14.19	0.0	Off
35	381D	0.82	0.00	0.82	0.00	DrGrt	0.0	0.00	4.00	2.00	2.00	Sag	2.00	0.010	0.010	0.013	0.11	23.07	0.11	23.07	0.0	Off
36	381A	1.32	0.00	1.02	0.30	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.23	7.57	0.14	3.23	0.0	Off
37	381B	0.39	0.00	0.38	0.02	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.16	3.96	0.05	0.81	0.0	Off
38	392A	1.05	0.00	0.86	0.20	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.22	6.82	0.12	2.22	0.0	Off
39	391A	1.09	0.00	0.88	0.21	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.22	6.92	0.13	2.36	0.0	Off
40	380A	1.12	0.00	0.90	0.22	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.22	7.02	0.13	2.50	0.0	Off
41	380B	4.28	0.00	4.28	0.00	DrGrt	0.0	0.00	4.00	2.00	2.00	Sag	2.00	0.010	0.010	0.013	0.32	65.29	0.32	65.29	0.0	Off
42	378A	0.66	0.00	0.59	0.07	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.19	5.36	0.09	1.42	0.0	Off
43	378B	0.36	0.00	0.35	0.01	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.15	3.73	0.04	0.71	0.0	Off
44	390A	1.35	0.00	1.04	0.31	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.23	7.66	0.15	3.34	0.0	Off
45	377A	0.79	0.00	0.68	0.11	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.20	5.91	0.10	1.66	0.0	Off
46	375A	1.02	0.00	0.84	0.18	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.21	6.71	0.12	2.08	0.0	Off

Project File: Outfall #1.stm | Number of lines: 50 | Run Date: 3/3/2025

NOTES: Inlet N-Values = 0.016; Intensity = 72.00 / (Inlet time + 12.50) ^ 0.80; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

Inlet Report

KALAS 5 10-YEAR REPORT

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
47	31A	3.52	0.00	3.52	0.00	DrGrt	0.0	0.00	4.00	2.00	2.00	Sag	2.00	0.010	0.010	0.013	0.28	57.58	0.28	57.58	0.0	Off
48	EX. 31	0.03	0.00	0.00	0.03	MH	0.0	0.00	0.00	0.00	0.00	Sag	2.00	0.060	0.020	0.013	0.00	0.00	0.00	0.00	0.0	Off
49	EX. 32	0.03	0.00	0.00	0.03	MH	0.0	0.00	0.00	0.00	0.00	Sag	2.00	0.060	0.020	0.013	0.00	0.00	0.00	0.00	0.0	Off
50	32A	8.59	0.00	8.59	0.00	DrGrt	0.0	0.00	4.00	2.00	2.00	Sag	2.00	0.010	0.010	0.013	0.50	102.76	0.50	102.76	0.0	Off

Project File: Outfall #1.stm | Number of lines: 50 | Run Date: 3/3/2025

NOTES: Inlet N-Values = 0.016; Intensity = 72.00 / (Inlet time + 12.50) ^ 0.80; Return period = 10 Yrs. ; * Indicates Known Q added. All curb inlets are throat.

Hydraulic Grade Line Computations

KALAS 5 10-YEAR REPORT

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
1	36	34.00	357.90	360.90	3.00	7.07	4.81	0.36	361.26	0.260	57.000	358.29	361.00	2.71	6.72	5.06	0.40	361.40	0.228	0.244	0.139	1.50	0.60
2	36	33.23	358.64	361.60	2.96	4.63	4.71	0.80	362.40	0.000	41.866	358.85	360.72	1.87**	4.63	7.17	0.80	361.52	0.000	0.000	n/a	0.50	0.40
3	36	33.18	358.95	360.72	1.77	4.34	7.65	0.80	361.52	0.000	196.394	362.17	364.04	1.87**	4.63	7.17	0.80	364.84	0.000	0.000	n/a	1.50	1.20
4	36	32.08	362.27	364.04	1.77	4.34	7.40	0.78	364.82	0.000	78.359	363.50	365.34	1.84**	4.53	7.08	0.78	366.11	0.000	0.000	n/a	1.00	0.78
5	30	22.61	364.00	365.34	1.34	2.67	8.48	0.71	366.04	0.000	51.000	364.54	366.16	1.62**	3.36	6.74	0.71	366.86	0.000	0.000	n/a	1.30	0.92
6	30	21.39	364.64	366.16	1.52	3.12	6.87	0.67	366.83	0.000	126.897	366.44	368.01	1.57**	3.25	6.59	0.67	368.69	0.000	0.000	n/a	0.50	0.34
7	30	21.28	366.65	368.01	1.36	2.72	7.82	0.67	368.68	0.000	59.532	367.68	369.25	1.57**	3.24	6.58	0.67	369.92	0.000	0.000	n/a	1.50	n/a
8	30	15.95	367.78	369.25	1.46	2.70	5.35	0.54	369.79	0.000	210.964	371.03	372.38 j	1.35**	2.70	5.91	0.54	372.92	0.000	0.000	n/a	1.44	0.78
9	30	14.00	371.43	372.56	1.13*	2.17	6.46	0.50	373.06	0.000	140.875	372.35	373.61	1.26**	2.48	5.65	0.50	374.11	0.000	0.000	n/a	1.50	0.75
10	30	13.08	373.07	374.18	1.11*	2.11	6.21	0.48	374.66	0.000	86.180	373.60	374.81	1.21**	2.37	5.53	0.48	375.29	0.000	0.000	n/a	0.50	n/a
11	30	12.89	373.70	374.81	1.11	2.12	6.09	0.47	375.29	0.000	40.124	374.00	375.21	1.21**	2.34	5.50	0.47	375.68	0.000	0.000	n/a	1.00	n/a
12	24	7.14	375.27	376.20	0.94*	1.44	4.94	0.37	376.57	0.000	23.025	375.38	376.33	0.95**	1.47	4.87	0.37	376.70	0.000	0.000	n/a	1.50	0.55
13	24	6.59	375.48	376.37	0.89*	1.36	4.85	0.35	376.73	0.000	49.905	375.73	376.64	0.91**	1.39	4.75	0.35	376.99	0.000	0.000	n/a	1.07	n/a
14	24	5.84	375.83	376.67	0.84*	1.24	4.70	0.32	376.99	0.000	31.516	375.99	376.84	0.85**	1.28	4.57	0.32	377.17	0.000	0.000	n/a	0.65	n/a
15	24	5.17	376.09	376.88	0.78*	1.14	4.54	0.30	377.18	0.000	27.860	376.23	377.03	0.80**	1.18	4.40	0.30	377.33	0.000	0.000	n/a	0.99	n/a
16	18	4.69	376.73	377.46	0.73*	0.85	5.52	0.34	377.80	0.000	25.968	376.96	377.79	0.83**	1.01	4.67	0.34	378.13	0.000	0.000	n/a	1.00	n/a
17	24	6.26	374.10	375.21	1.11	1.34	3.52	0.34	375.54	0.000	71.389	374.48	375.37 j	0.88**	1.34	4.67	0.34	375.70	0.000	0.000	n/a	1.50	0.51
18	24	5.74	374.58	375.41	0.83*	1.23	4.66	0.32	375.73	0.000	110.816	375.13	375.98	0.85**	1.26	4.54	0.32	376.30	0.000	0.000	n/a	0.66	n/a
19	24	5.46	375.23	376.04	0.81*	1.19	4.61	0.31	376.35	0.000	133.897	375.90	376.72	0.82**	1.22	4.47	0.31	377.04	0.000	0.000	n/a	2.18	0.68
20	18	2.59	376.02	376.72	0.70	0.67	3.19	0.16	376.88	0.306	260.141	377.30	377.91	0.61**	0.67	3.84	0.23	378.14	0.506	0.406	n/a	1.50	n/a
21	15	1.05	377.55	377.93	0.38*	0.32	3.34	0.15	378.08	0.000	25.751	377.72	378.12	0.40**	0.34	3.07	0.15	378.27	0.000	0.000	n/a	1.00	0.15
22	15	0.61	376.03	376.24	0.21*	0.14	4.39	0.11	376.35	0.000	28.157	376.66	376.96	0.30**	0.23	2.64	0.11	377.07	0.000	0.000	n/a	1.00	0.11

Project File: Outfall #1.stm | Number of lines: 50 | Run Date: 3/3/2025

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

Hydraulic Grade Line Computations

KALAS 5 10-YEAR REPORT

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
23	15	1.05	376.45	376.85	0.40*	0.34	3.09	0.15	377.00	0.000	24.491	376.58	376.98	0.40**	0.34	3.07	0.15	377.13	0.000	0.000	n/a	1.00	0.15
24	15	0.36	376.87	377.09	0.22*	0.14	2.54	0.08	377.17	0.000	24.507	377.05	377.28	0.23**	0.16	2.29	0.08	377.36	0.000	0.000	n/a	1.00	0.08
25	15	1.06	376.05	376.72	0.67	0.34	1.57	0.15	376.87	0.000	23.549	376.22	376.62	0.40**	0.34	3.08	0.15	376.77	0.000	0.000	n/a	1.49	n/a
26	15	0.43	376.32	376.62	0.30	0.18	1.86	0.05	376.68	0.262	101.000	376.85	377.10	0.25**	0.18	2.40	0.09	377.19	0.538	0.400	n/a	1.00	n/a
27	24	10.39	364.00	365.34	1.34	1.88	4.66	0.48	365.81	0.000	41.676	364.35	365.50 j	1.15**	1.88	5.54	0.48	365.98	0.000	0.000	n/a	1.42	0.68
28	24	8.51	364.57	365.50	0.93	1.44	5.92	0.41	365.92	0.000	88.898	366.35	367.39	1.04**	1.65	5.16	0.41	367.80	0.000	0.000	n/a	0.41	n/a
29	24	8.54	366.55	367.39	0.84	1.25	6.85	0.42	367.80	0.000	80.422	368.16	369.20	1.04**	1.65	5.17	0.42	369.62	0.000	0.000	n/a	1.48	0.61
30	18	7.25	368.68	369.44	0.76*	0.90	8.03	0.48	369.92	0.000	166.115	371.67	372.71	1.04**	1.31	5.54	0.48	373.19	0.000	0.000	n/a	1.39	0.66
31	18	5.57	371.77	372.71	0.94	1.12	4.77	0.38	373.10	0.000	161.824	374.90	375.81 j	0.91**	1.12	4.97	0.38	376.19	0.000	0.000	n/a	2.22	n/a
32	18	4.32	375.00	375.83	0.83*	1.00	4.33	0.29	376.12	0.489	24.500	375.12	375.95	0.83	1.00	4.33	0.29	376.24	0.491	0.490	0.120	0.50	0.15
33	15	2.63	375.42	376.09	0.67	0.64	3.90	0.26	376.35	0.000	22.252	375.64	376.29 j	0.65**	0.64	4.08	0.26	376.55	0.000	0.000	n/a	1.00	0.26
34	15	0.36	375.15	375.81	0.66	0.16	0.55	0.08	375.89	0.000	20.817	375.30	375.53	0.23**	0.16	2.29	0.08	375.61	0.000	0.000	n/a	1.00	0.08
35	18	0.82	374.07	374.35	0.28*	0.23	3.65	0.12	374.47	0.000	32.881	374.43	374.77	0.34**	0.30	2.77	0.12	374.89	0.000	0.000	n/a	1.00	0.12
36	15	1.69	372.50	372.98	0.48*	0.43	3.90	0.20	373.18	0.000	25.642	372.68	373.20	0.52**	0.48	3.54	0.20	373.39	0.000	0.000	n/a	0.50	n/a
37	15	0.39	372.80	373.20	0.40	0.17	1.18	0.09	373.28	0.000	29.330	373.68	373.92 j	0.24**	0.17	2.34	0.09	374.01	0.000	0.000	n/a	1.00	0.09
38	15	1.05	371.92	372.71	0.79	0.34	1.28	0.15	372.86	0.000	26.271	372.30	372.70 j	0.40**	0.34	3.07	0.15	372.85	0.000	0.000	n/a	1.00	0.15
39	15	1.09	368.81	369.20	0.39	0.33	3.31	0.15	369.35	0.000	34.056	369.03	369.44	0.41**	0.35	3.10	0.15	369.59	0.000	0.000	n/a	1.00	0.15
40	15	1.12	368.75	369.25	0.50	0.36	2.47	0.15	369.40	0.000	24.427	369.01	369.43 j	0.42**	0.36	3.13	0.15	369.58	0.000	0.000	n/a	1.00	0.15
41	18	4.28	368.30	369.25	0.95	0.95	3.64	0.21	369.45	0.316	123.325	368.97	369.76	0.79**	0.95	4.52	0.32	370.08	0.552	0.434	n/a	1.00	0.32
42	15	1.01	365.72	366.16	0.44	0.33	2.65	0.14	366.30	0.000	28.012	366.10	366.49 j	0.39**	0.33	3.04	0.14	366.64	0.000	0.000	n/a	0.50	n/a
43	15	0.36	366.20	366.49	0.29	0.16	1.64	0.04	366.54	0.211	29.509	366.35	366.59	0.24**	0.16	2.26	0.08	366.66	0.522	0.367	0.108	1.00	0.08
44	18	1.35	364.85	365.50	0.65	0.43	1.83	0.16	365.66	0.000	24.451	365.10	365.53 j	0.43**	0.43	3.17	0.16	365.69	0.000	0.000	n/a	1.00	n/a

Project File: Outfall #1.stm | Number of lines: 50 | Run Date: 3/3/2025

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

Hydraulic Grade Line Computations

KALAS 5 10-YEAR REPORT

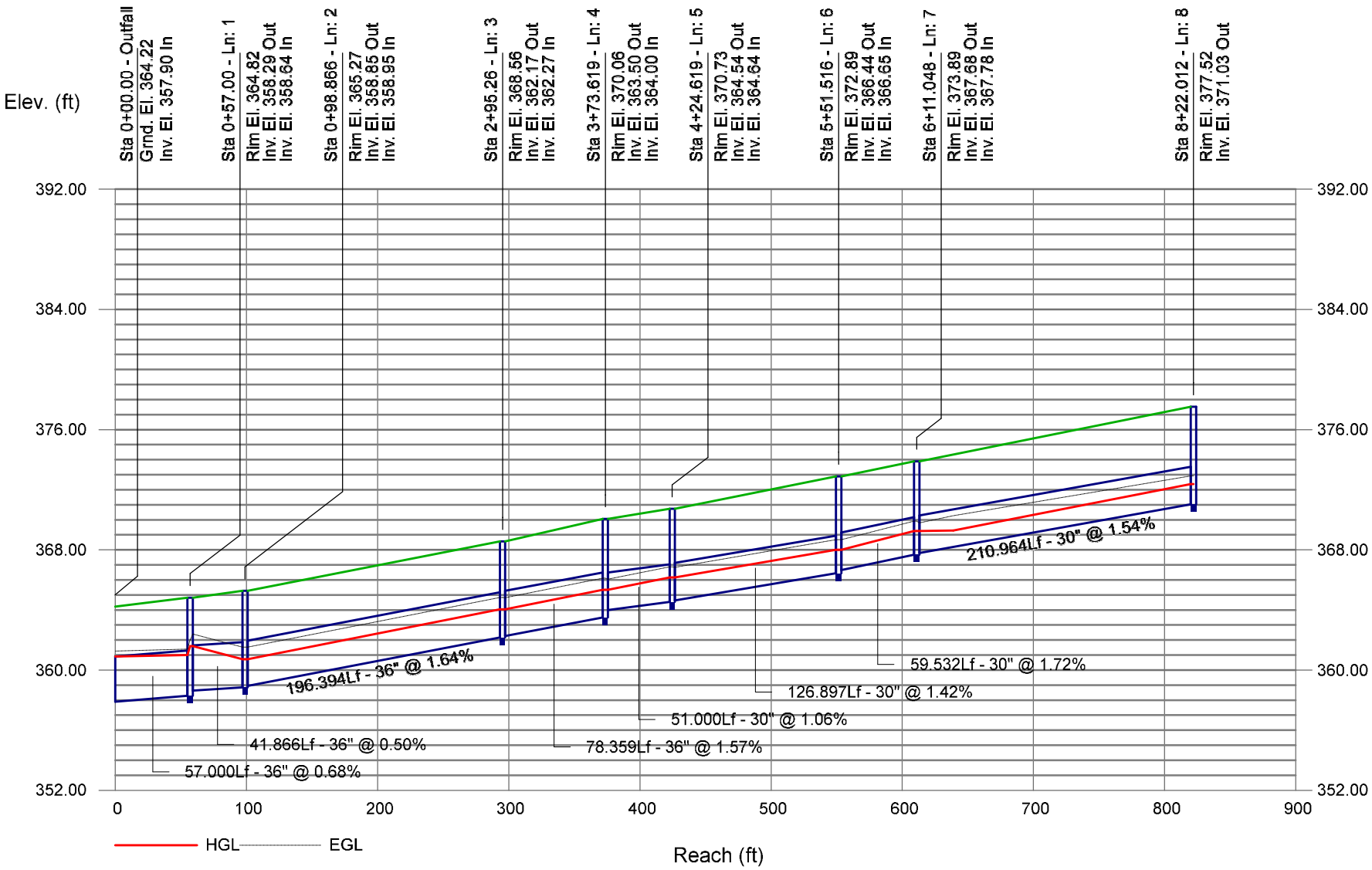
Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
45	15	0.79	363.42	364.04	0.62	0.28	1.30	0.12	364.16	0.000	24.503	363.65	364.00 j	0.35**	0.28	2.83	0.12	364.12	0.000	0.000	n/a	1.00	0.12
46	18	1.02	360.76	361.60	0.84	1.02	1.00	0.02	361.61	0.026	25.748	360.63	361.61	0.98	1.22	0.84	0.01	361.62	0.016	0.021	0.005	1.00	0.01
47	36	11.85	352.90	354.95	2.05	2.32	2.31	0.40	355.35	0.000	38.074	353.09	354.18	1.09**	2.32	5.10	0.40	354.59	0.000	0.000	n/a	0.50	n/a
48	30	8.52	353.19	354.18	0.99	1.76	4.70	0.36	354.54	0.000	98.975	353.69	354.66 j	0.97**	1.76	4.83	0.36	355.02	0.000	0.000	n/a	0.15	n/a
49	30	8.54	353.79	354.72	0.93*	1.67	5.13	0.36	355.08	0.000	48.268	354.03	355.00	0.97**	1.77	4.83	0.36	355.37	0.000	0.000	n/a	0.96	n/a
50	24	8.59	355.35	356.04	0.69*	0.96	8.93	0.42	356.46	0.000	109.030	357.75	358.79	1.04**	1.66	5.18	0.42	359.21	0.000	0.000	n/a	1.00	0.42

Project File: Outfall #1.stm | Number of lines: 50 | Run Date: 3/3/2025

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

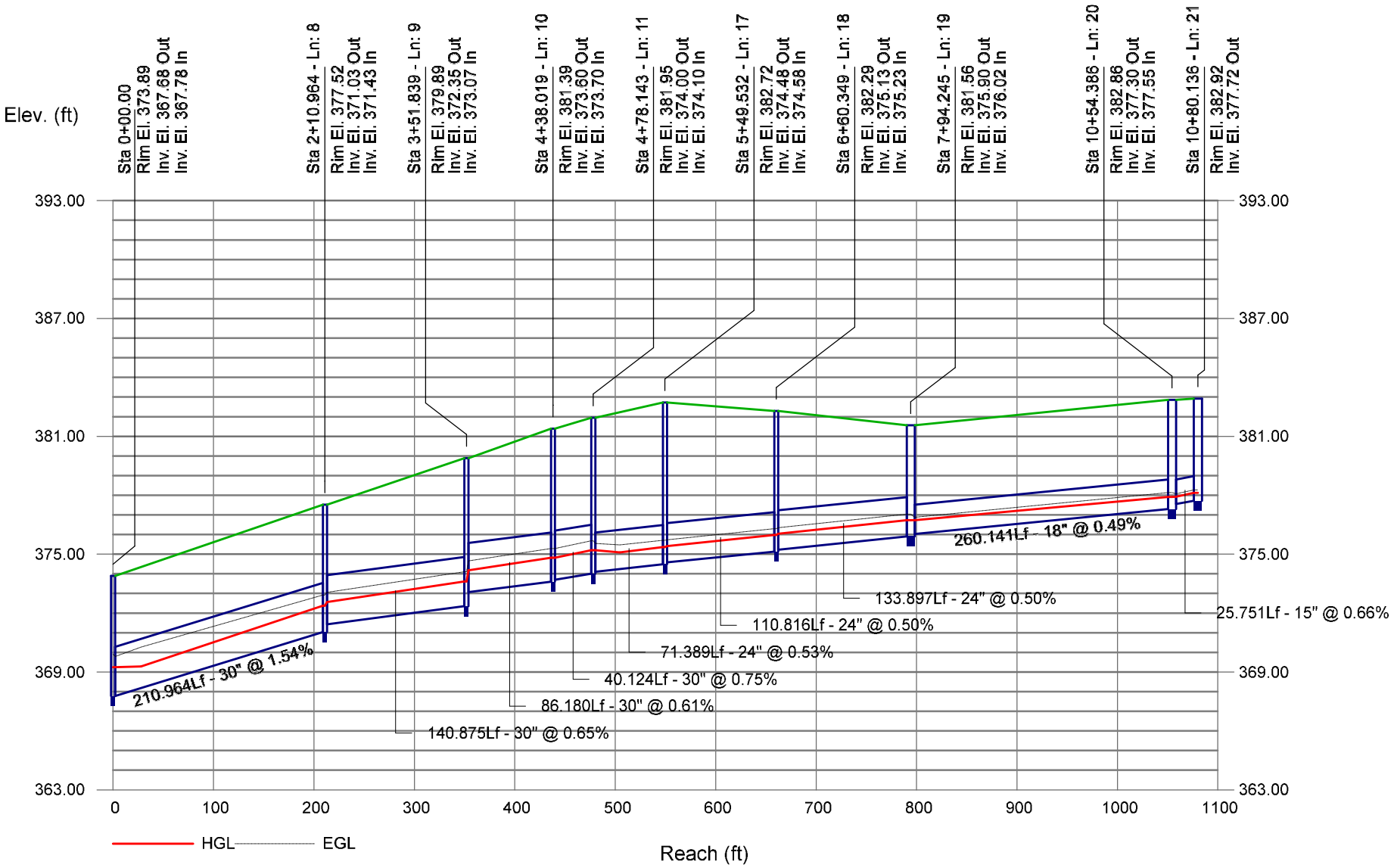
Storm Sewer Profile

KALAS 5 10-YEAR PROFILE 1-8 Proj. file: Outfall #1.stm



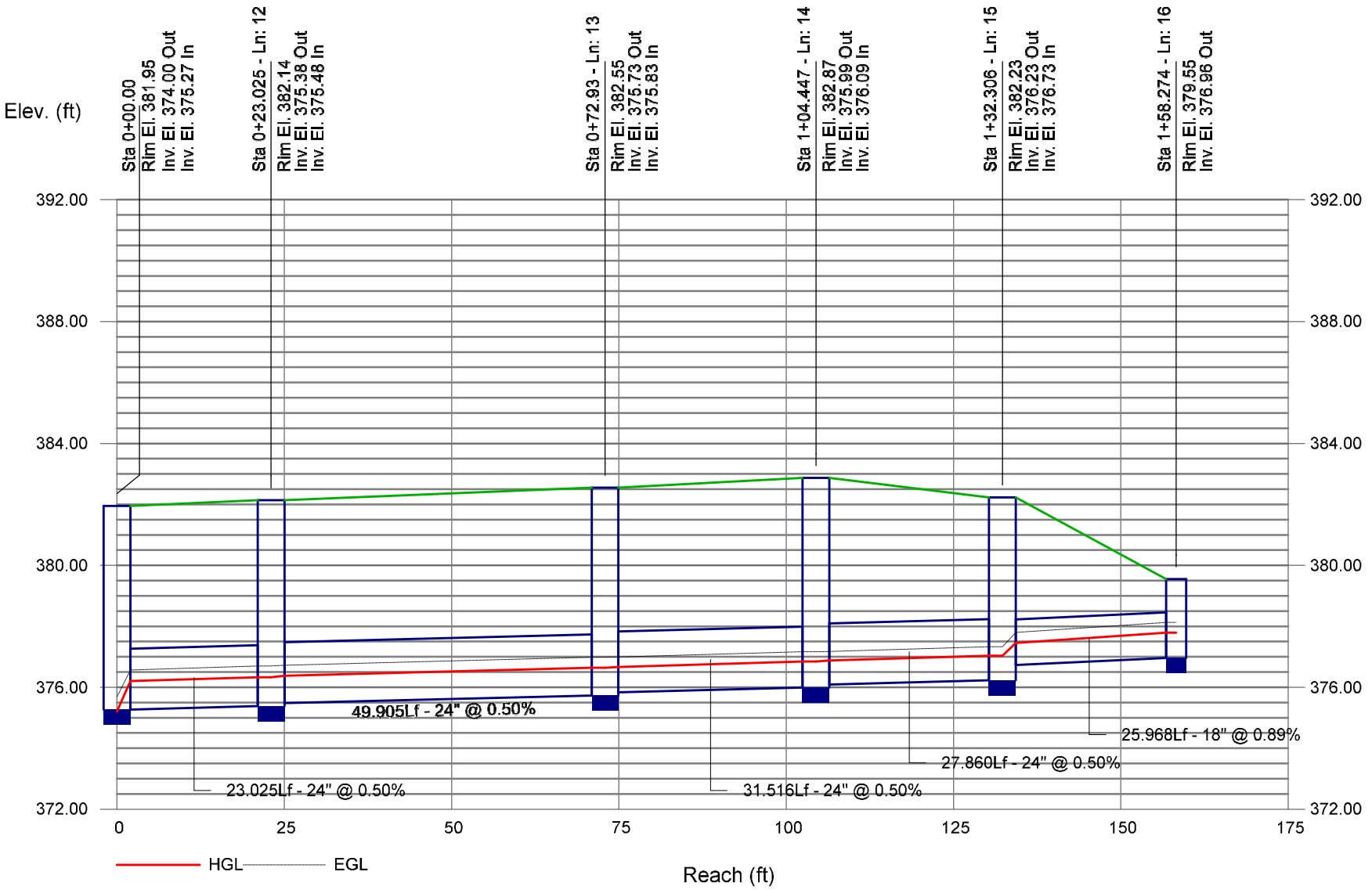
Storm Sewer Profile

KALAS 5 10-YEAR PROFILE 8-21 Proj. file: Outfall #1.stm



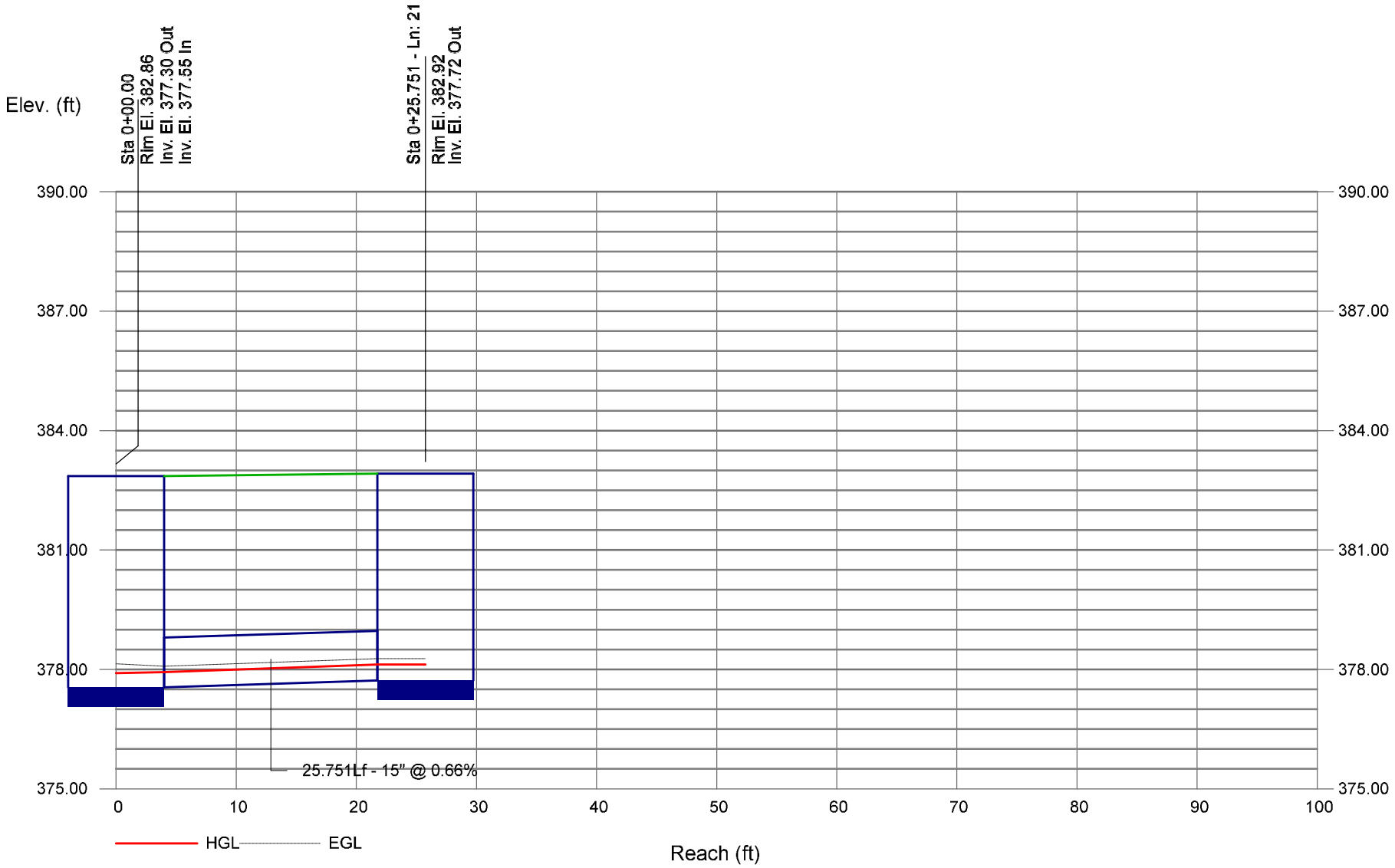
Storm Sewer Profile

KALAS 5 10-YEAR PROFILE 12-16Proj. file: Outfall #1.stm



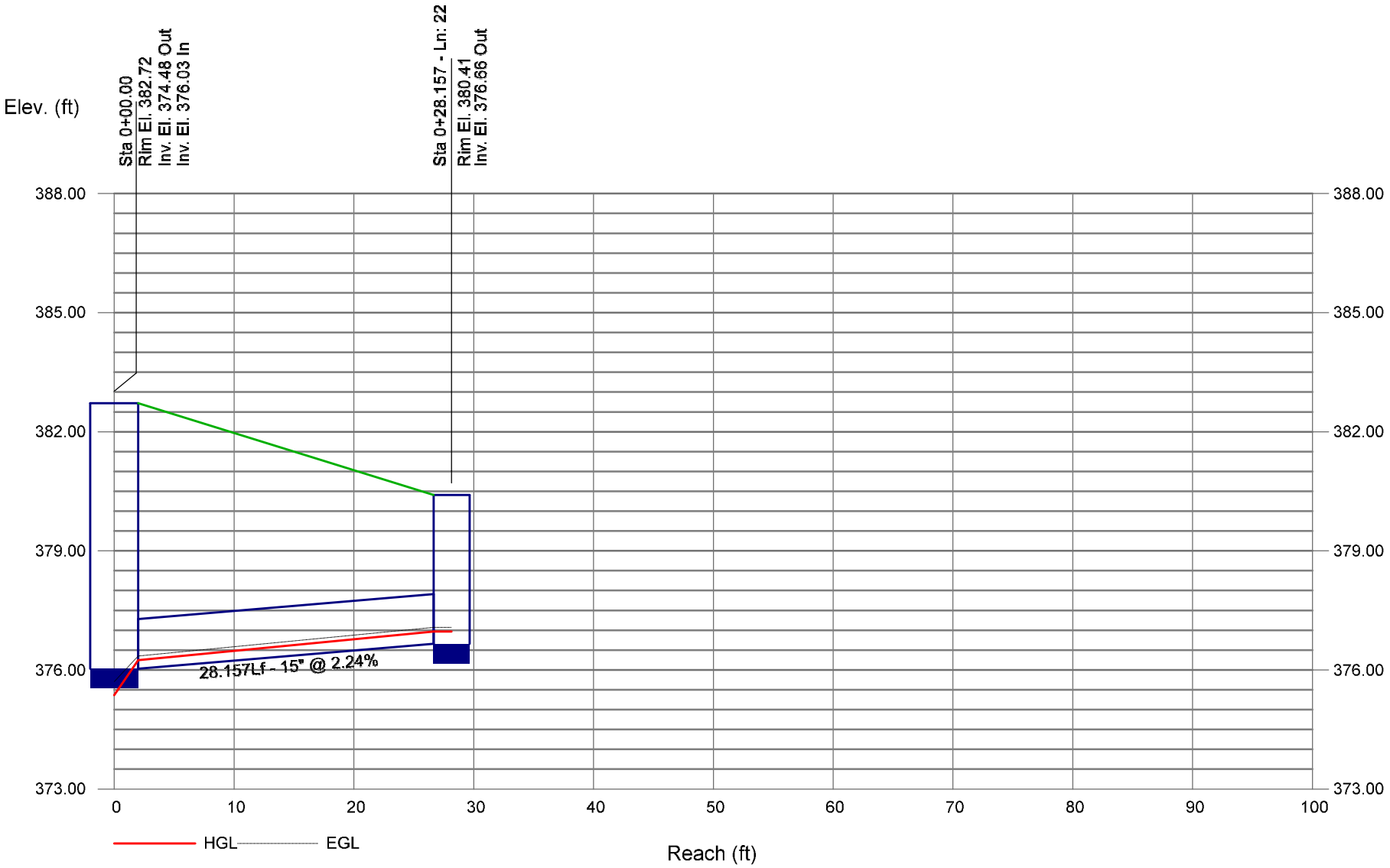
Storm Sewer Profile

KALAS 5 10-YEAR PROFILE 21-21 Proj. file: Outfall #1.stm



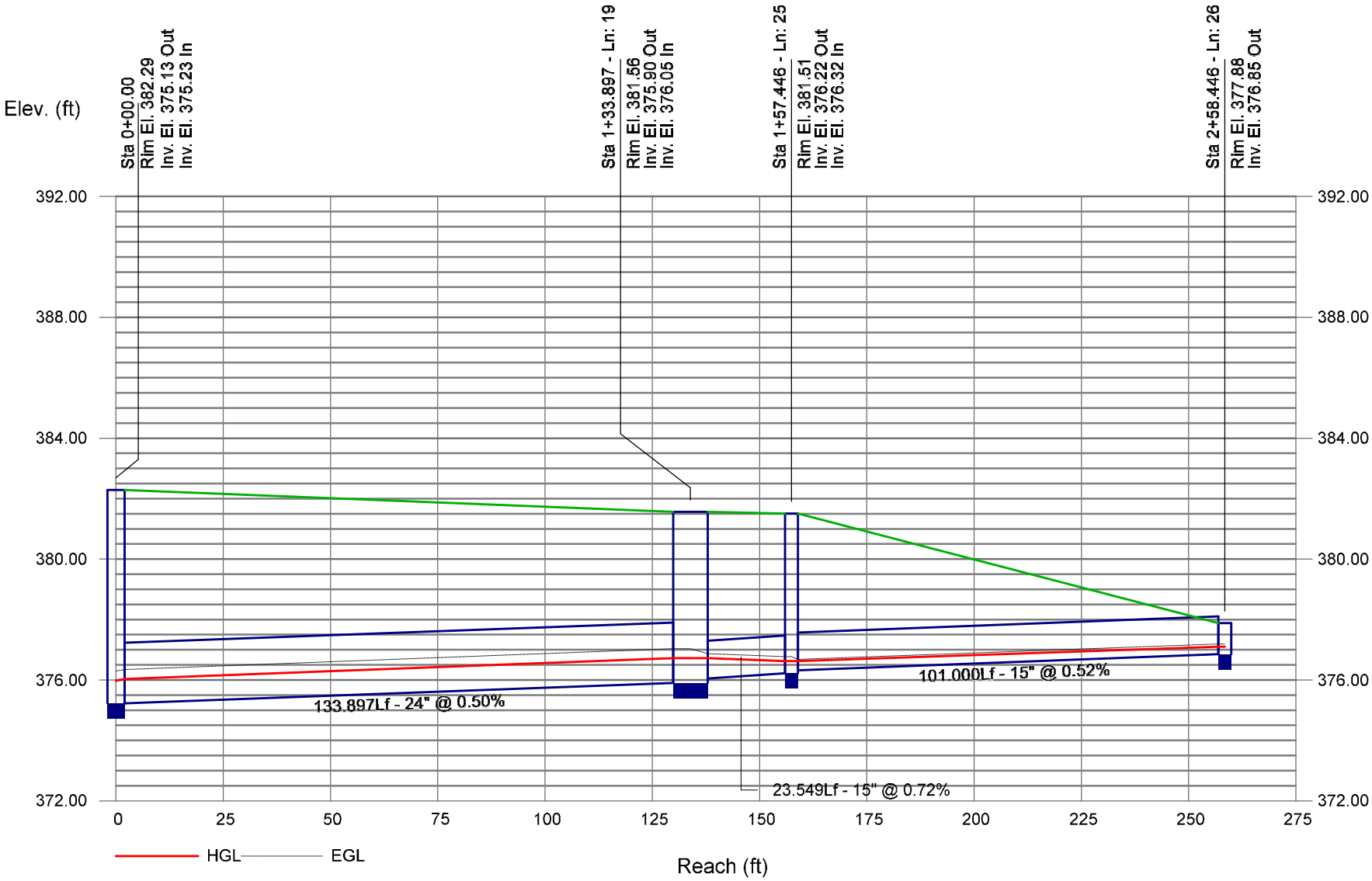
Storm Sewer Profile

KALAS 5 10-YEAR PROFILE 22-22 Proj. file: Outfall #1.stm



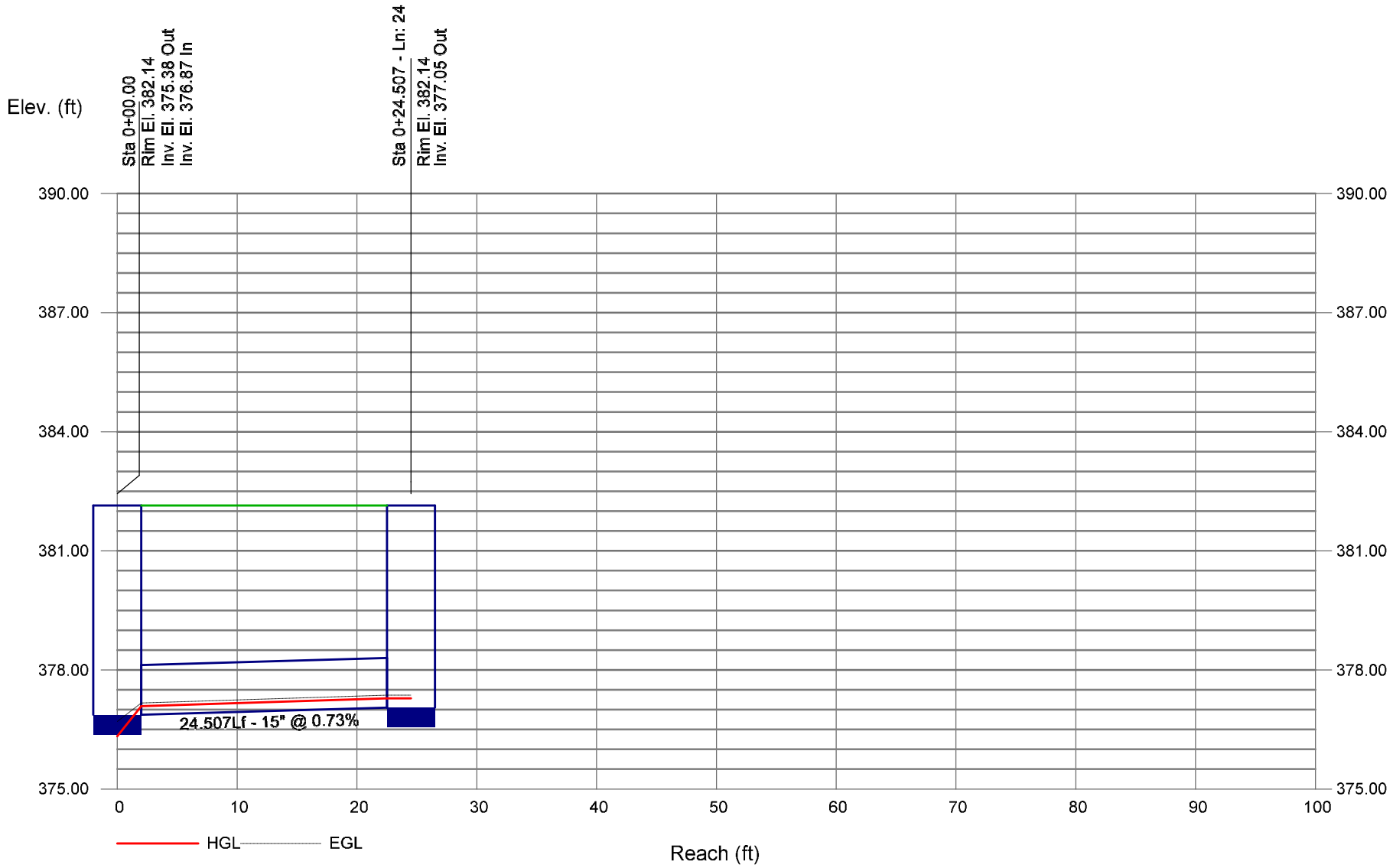
Storm Sewer Profile

KALAS 5 10-YEAR PROFILE 23-26 Proj. file: Outfall #1.stm



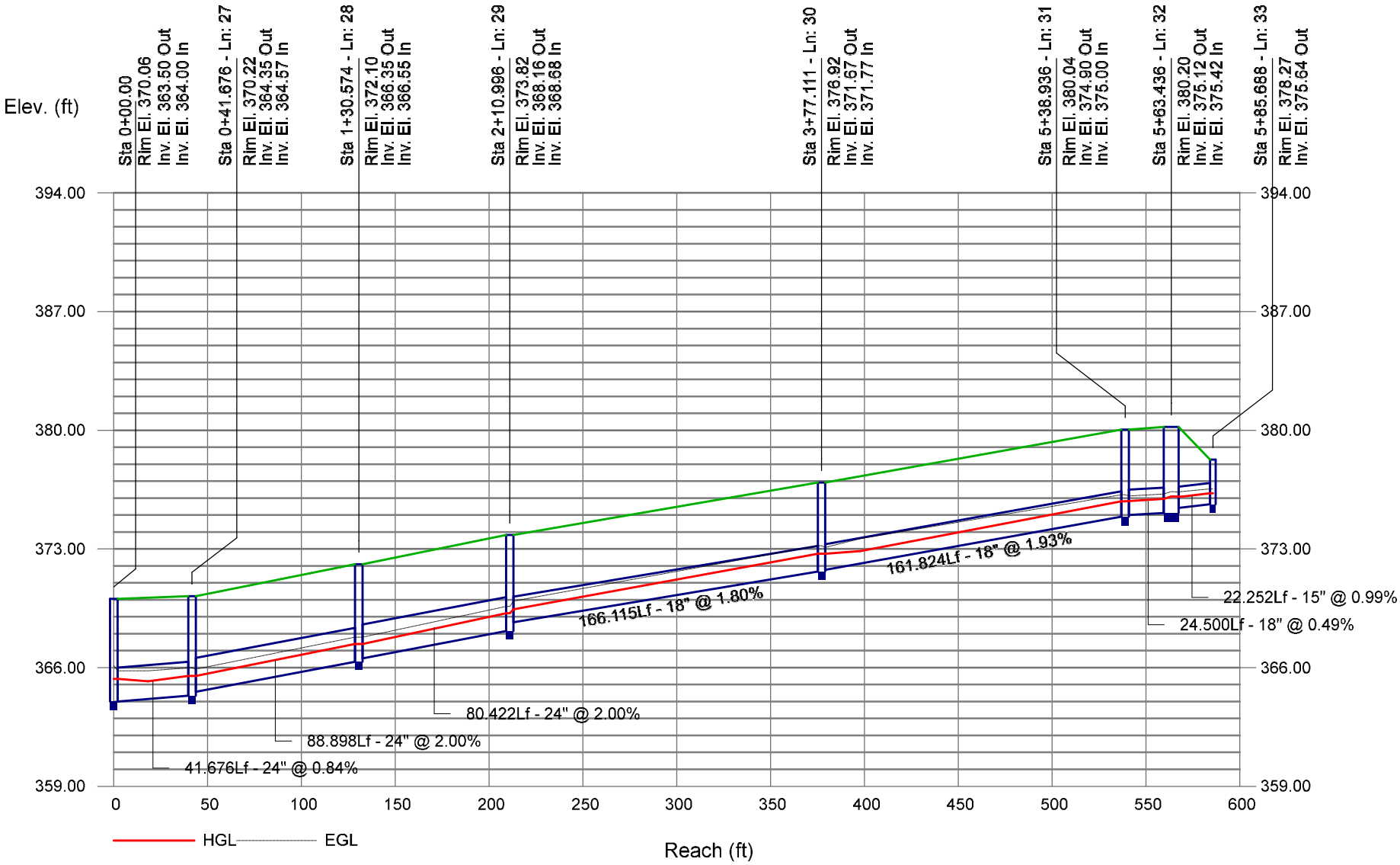
Storm Sewer Profile

KALAS 5 10-YEAR PROFILE 24-24 Proj. file: Outfall #1.stm



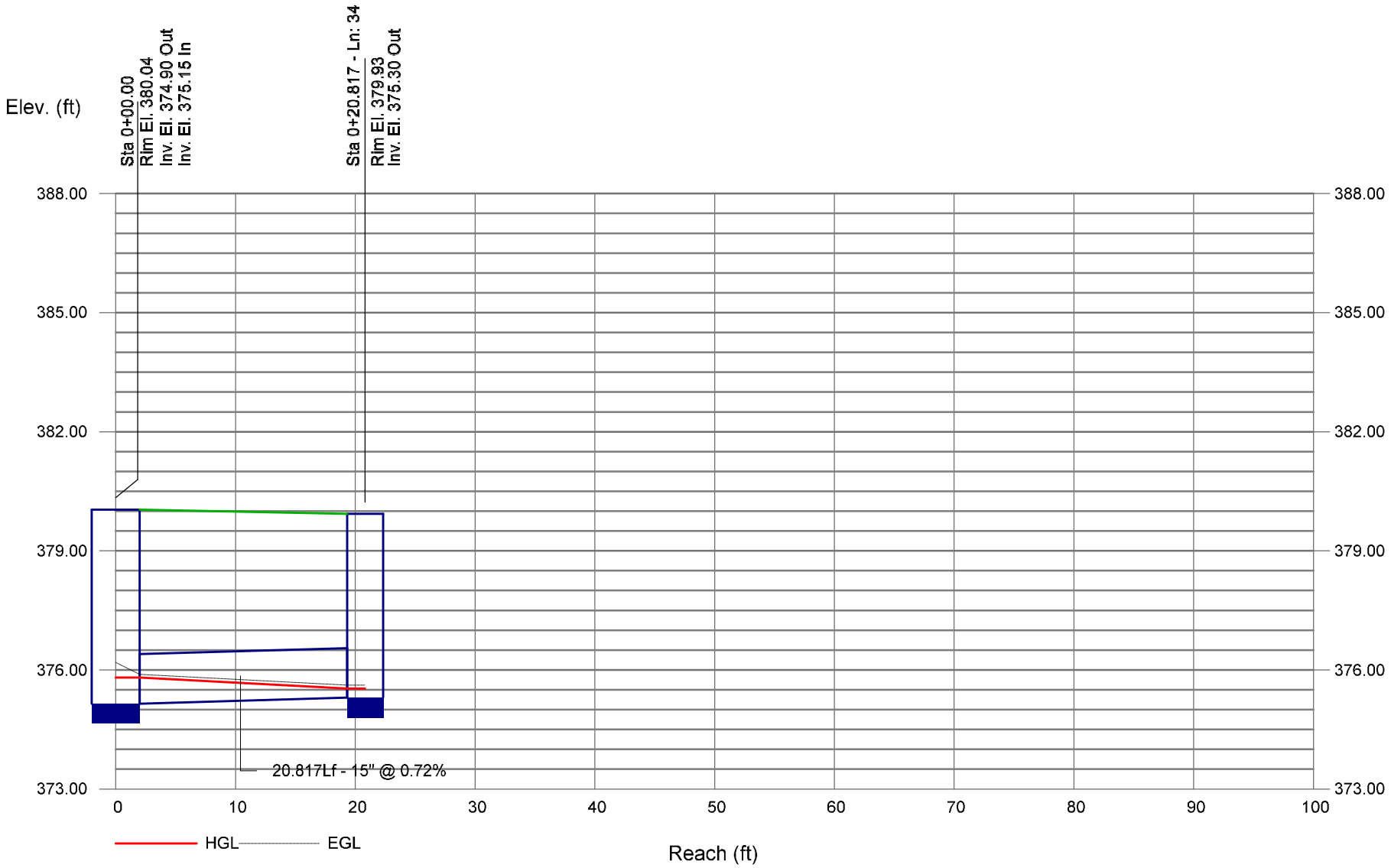
Storm Sewer Profile

KALAS 5 10-YEAR PROFILE 27-33 Proj. file: Outfall #1.stm



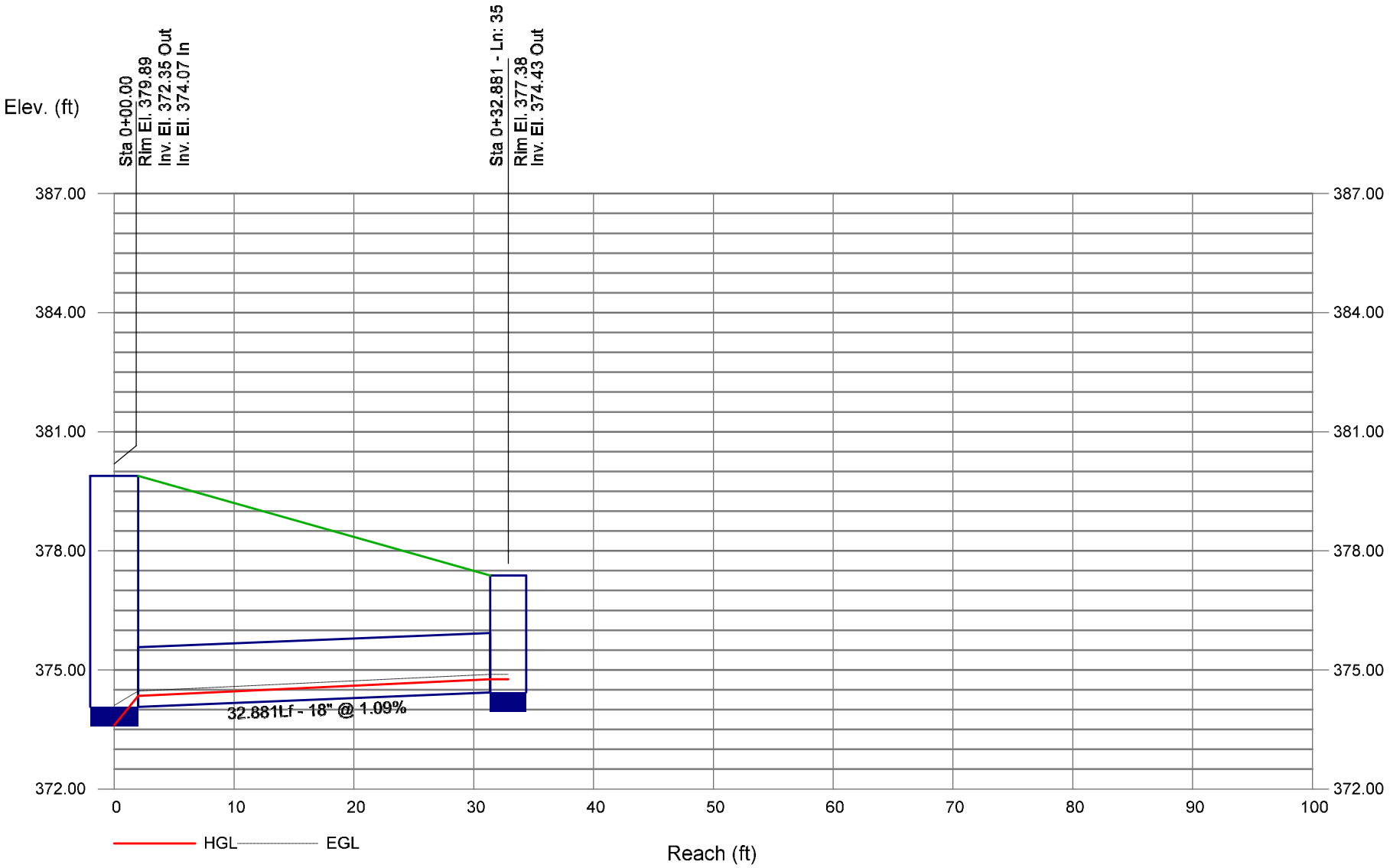
Storm Sewer Profile

KALAS 5 10-YEAR PROFILE 34-34 Proj. file: Outfall #1.stm



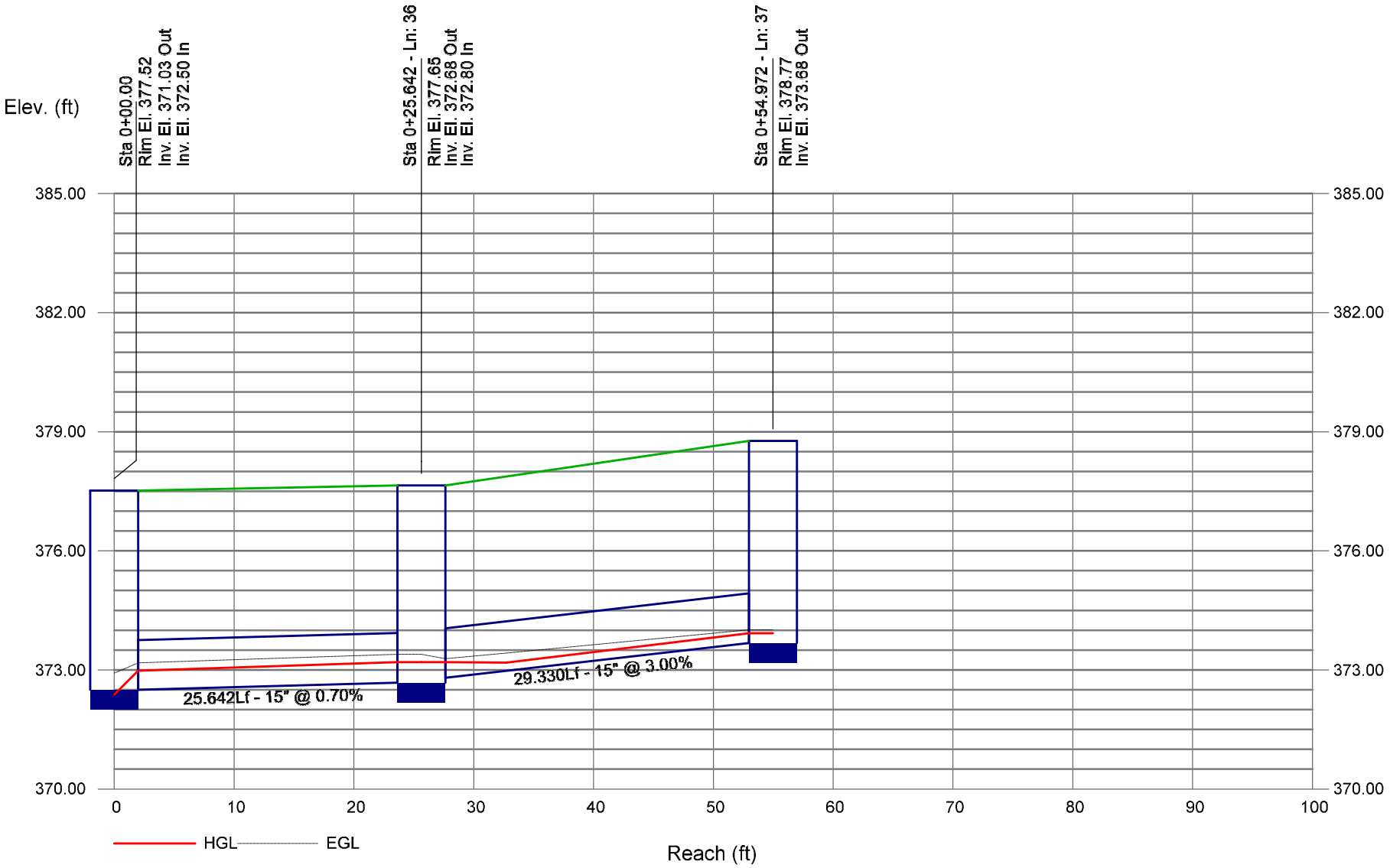
Storm Sewer Profile

KALAS 5 10-YEAR PROFILE 35-35 Proj. file: Outfall #1.stm



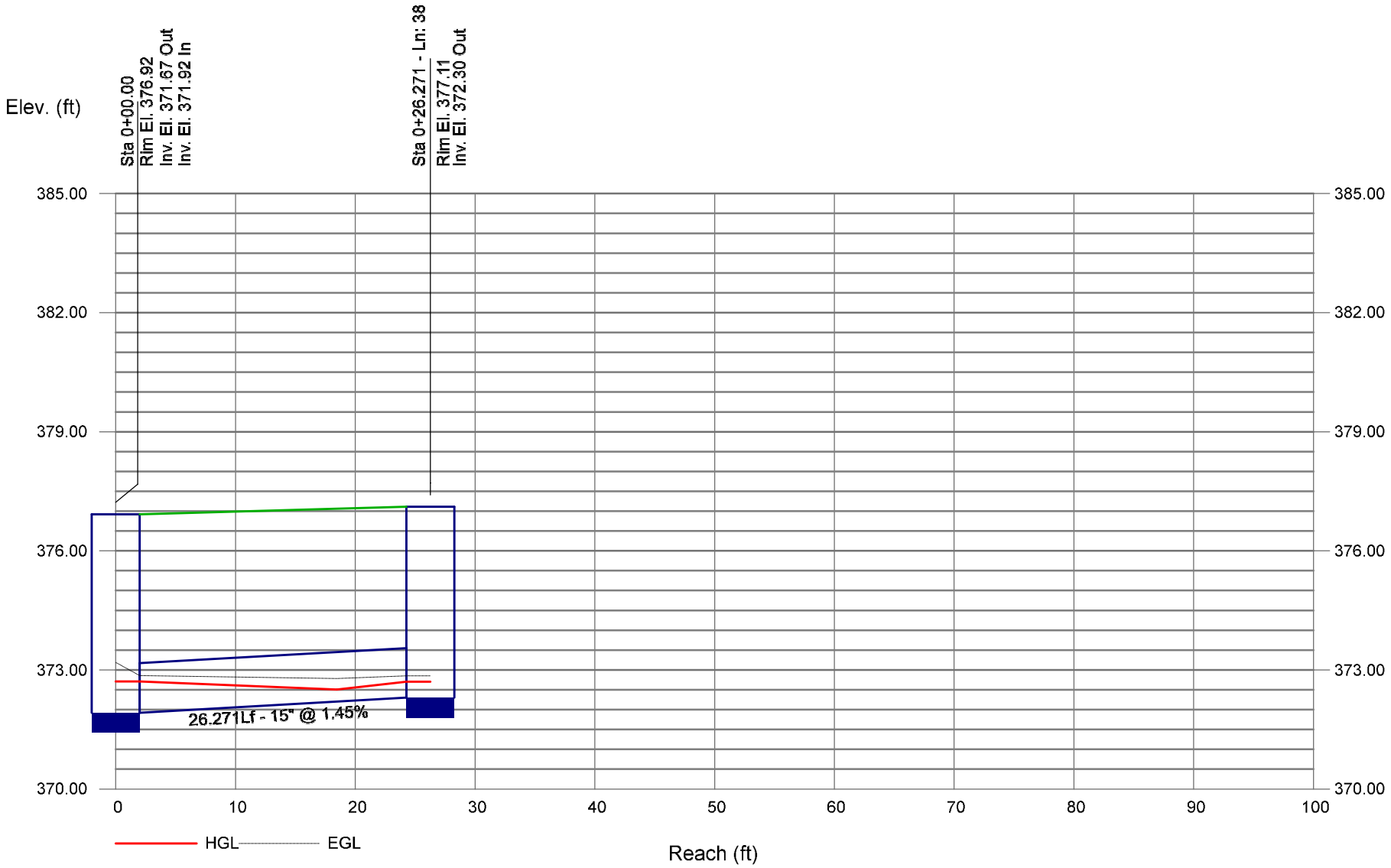
Storm Sewer Profile

KALAS 5 10-YEAR PROFILE 36-37 Proj. file: Outfall #1.stm



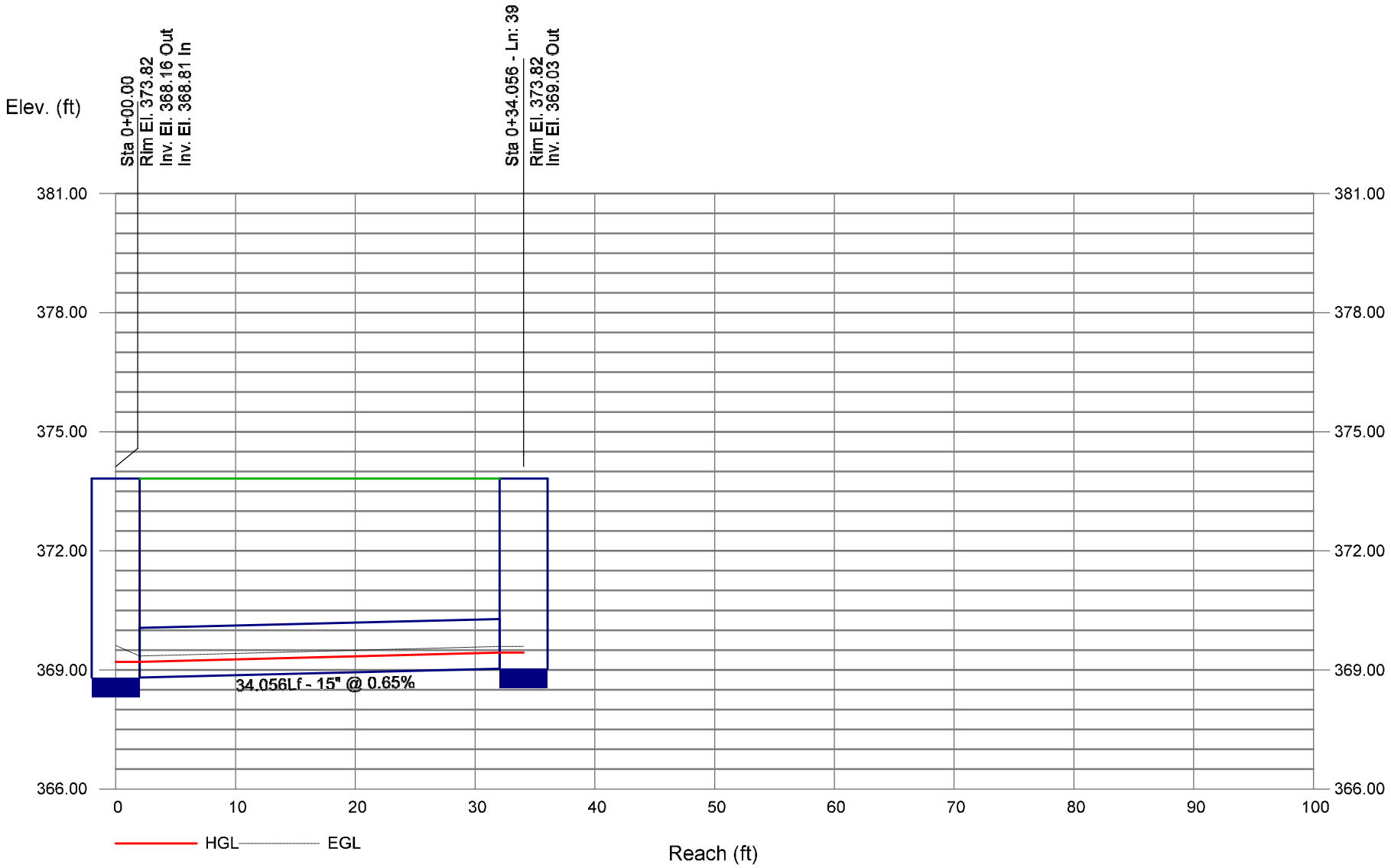
Storm Sewer Profile

KALAS 5 10-YEAR PROFILE 38-38 Proj. file: Outfall #1.stm



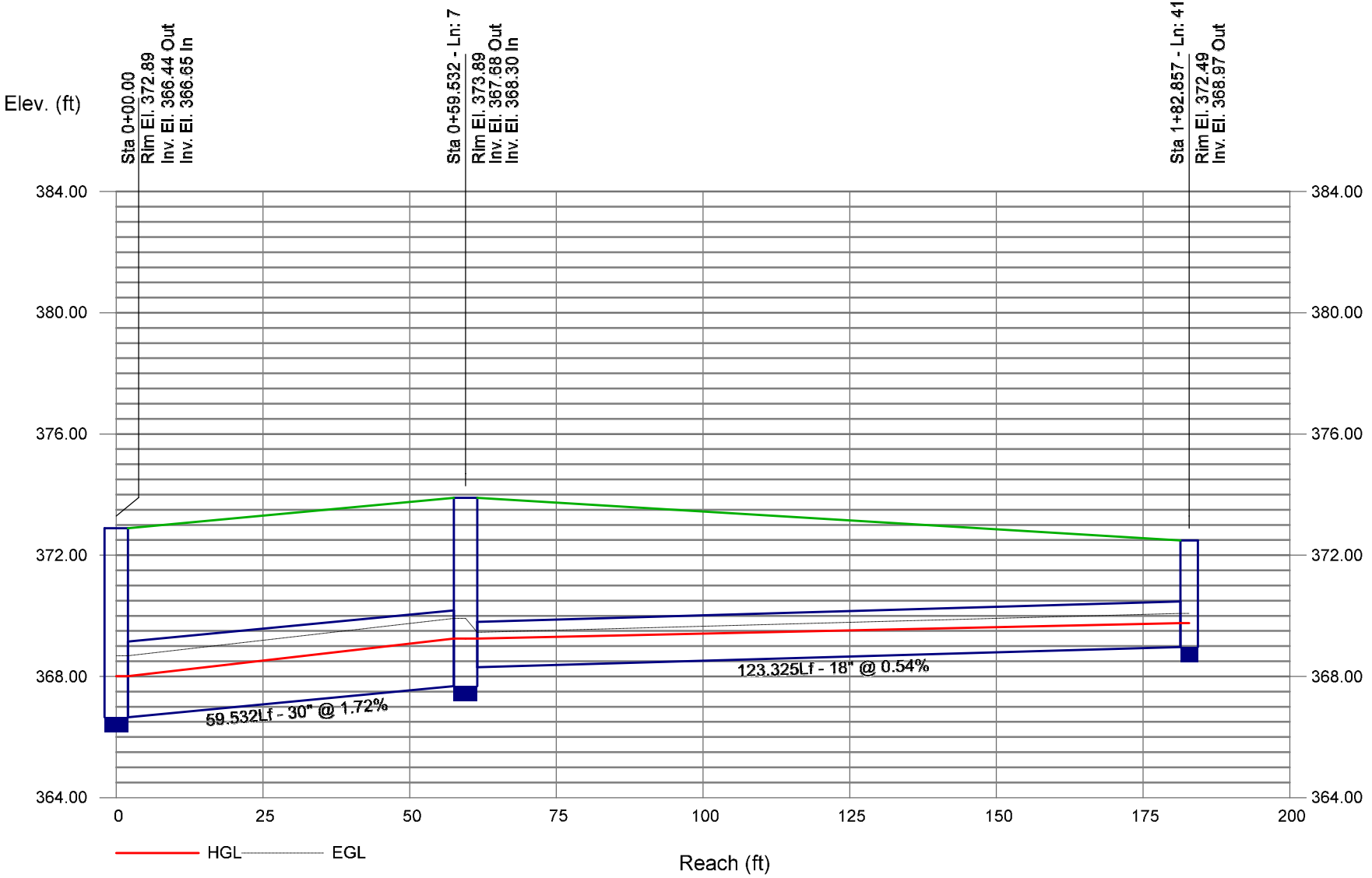
Storm Sewer Profile

KALAS 5 10-YEAR PROFILE 39-39 Proj. file: Outfall #1.stm



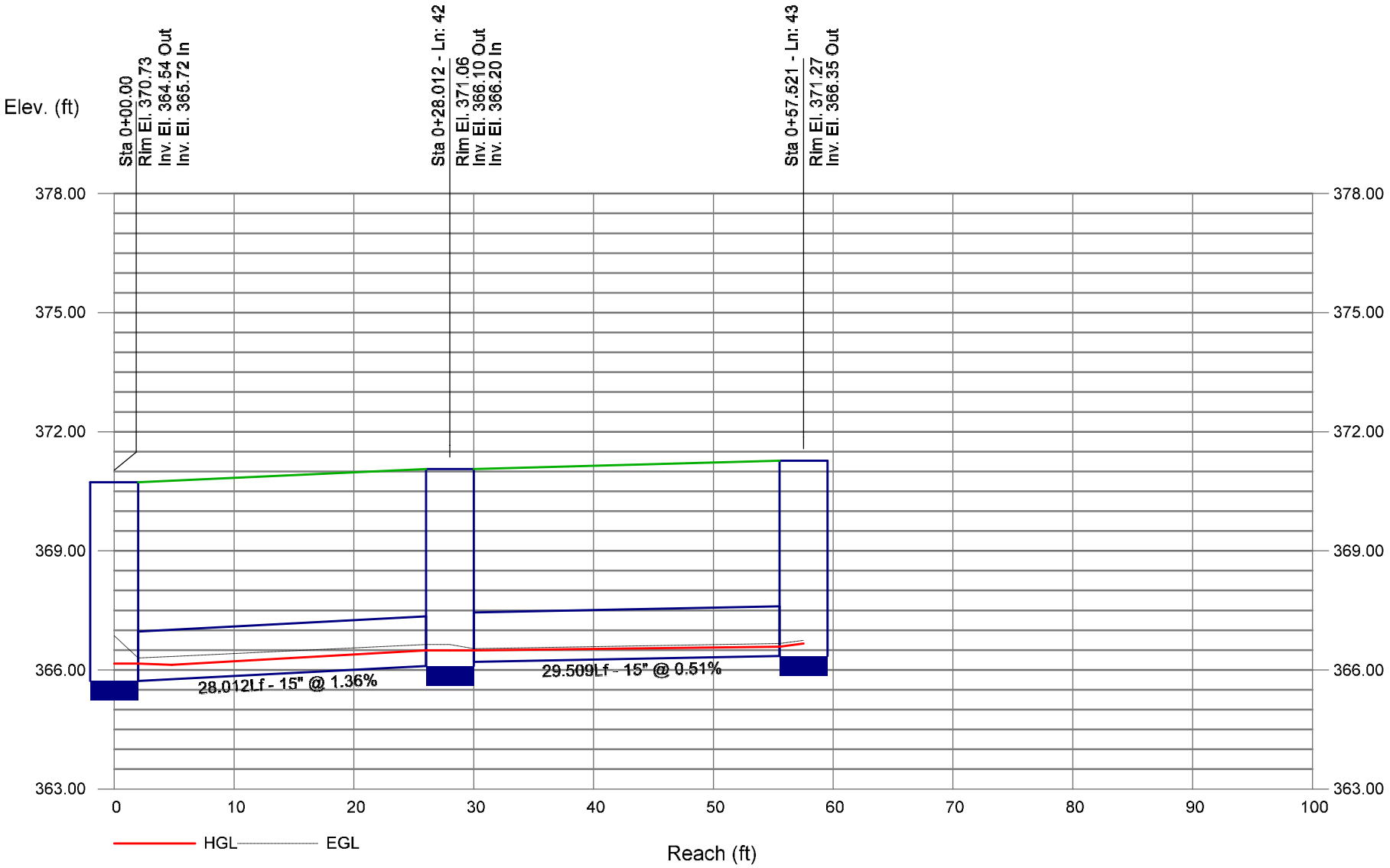
Storm Sewer Profile

KALAS 5 10-YEAR PROFILE 40-41 Proj. file: Outfall #1.stm



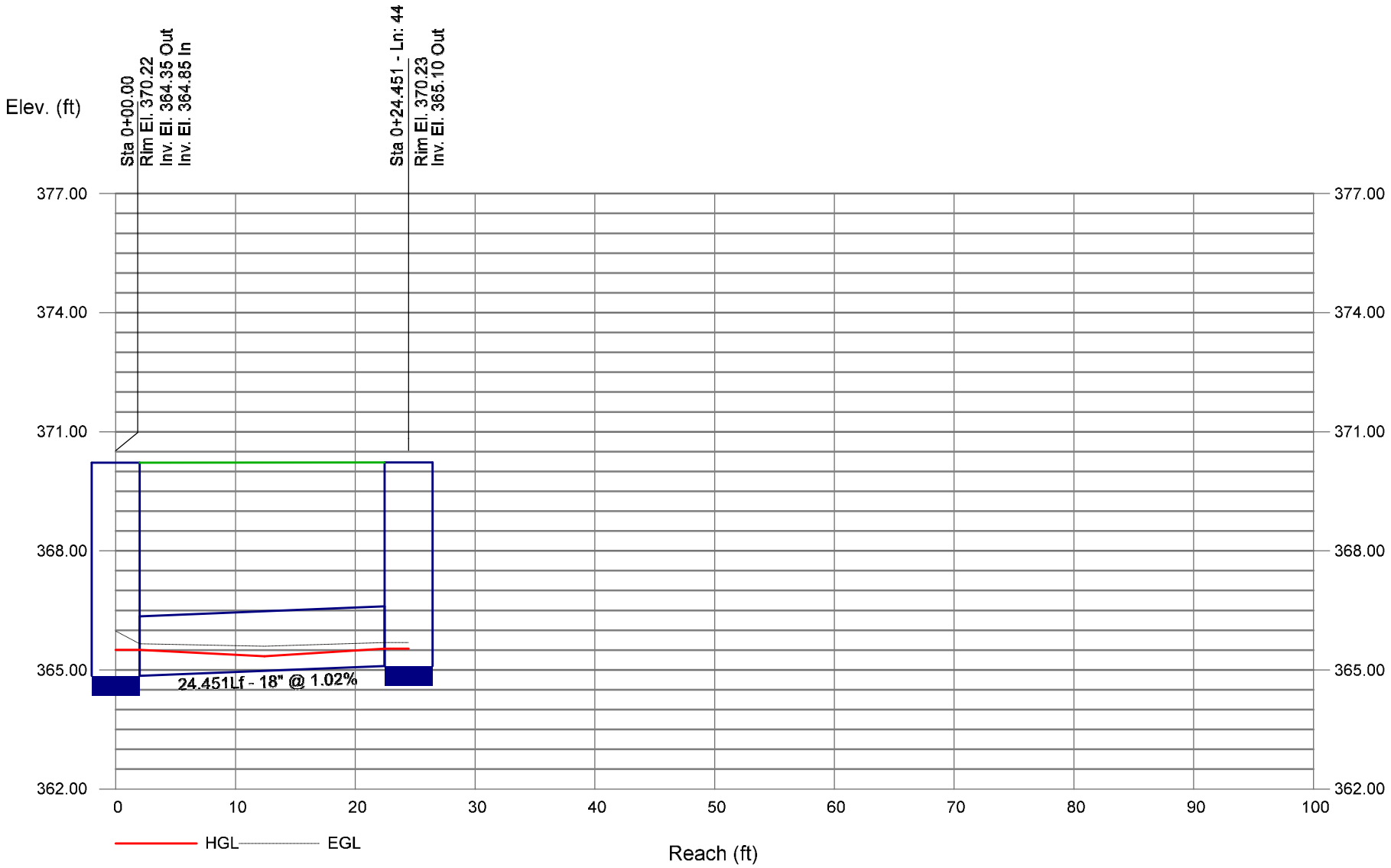
Storm Sewer Profile

KALAS 5 10-YEAR PROFILE 42-43 Proj. file: Outfall #1.stm



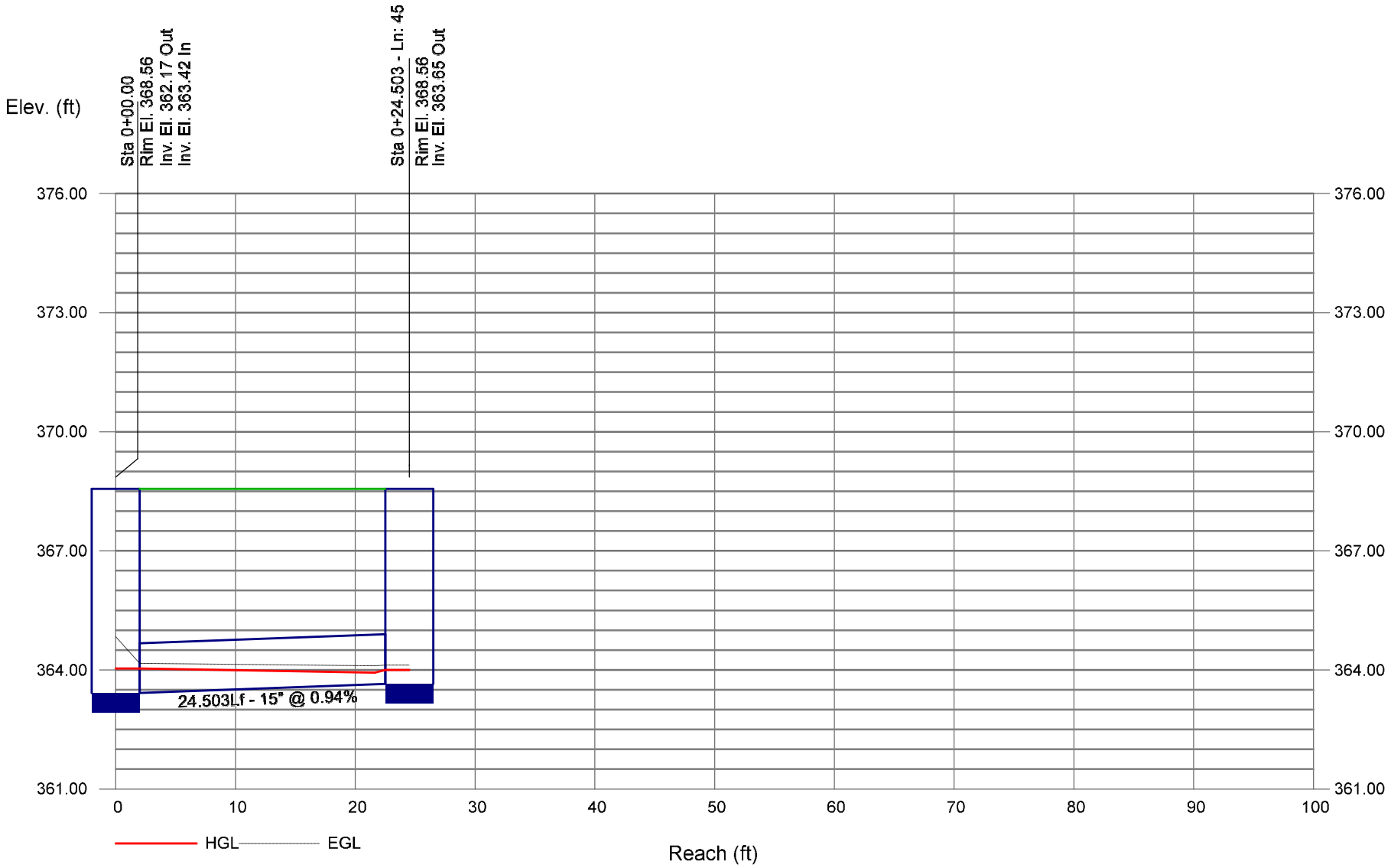
Storm Sewer Profile

KALAS 5 10-YEAR PROFILE 44-44 Proj. file: Outfall #1.stm



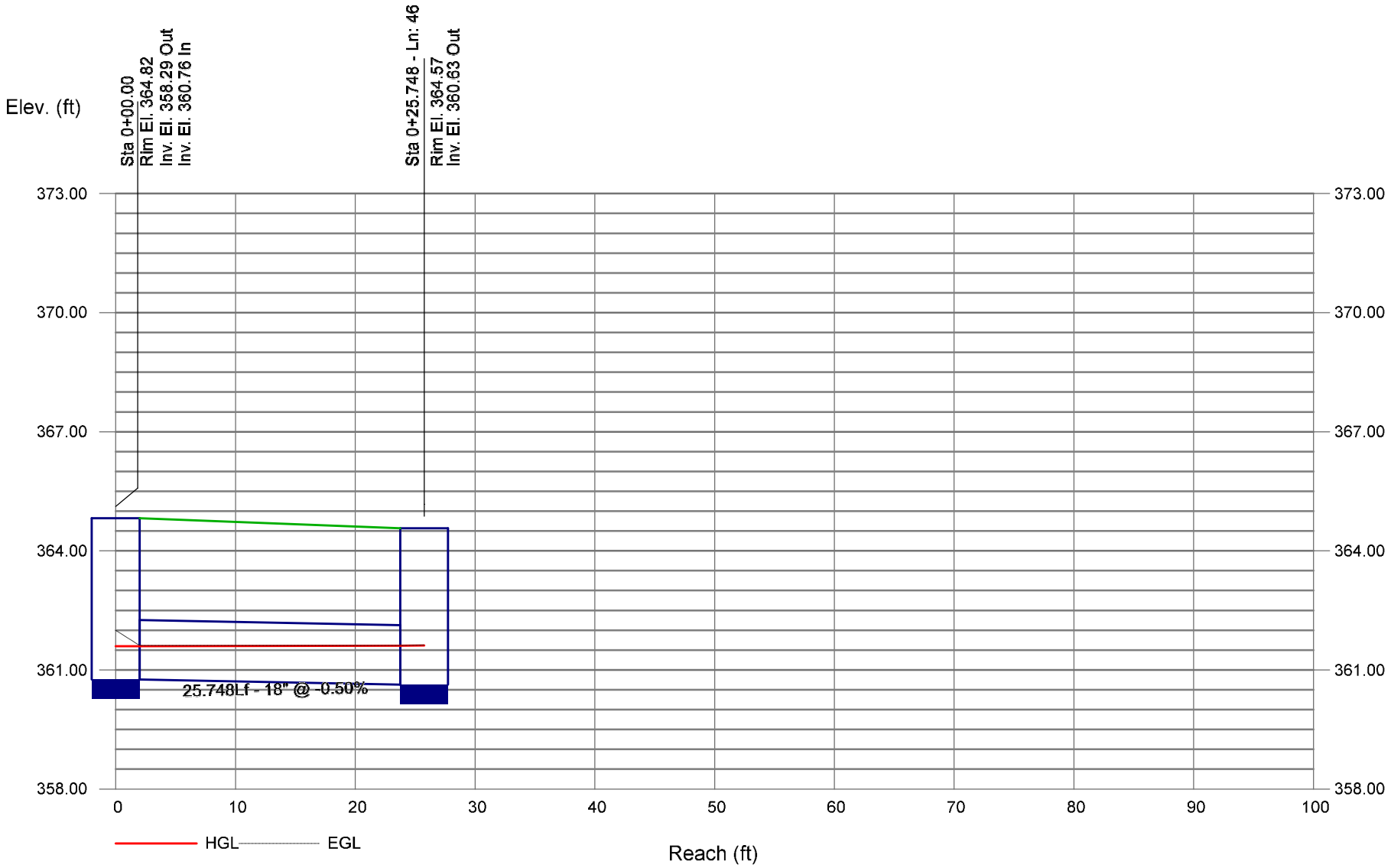
Storm Sewer Profile

KALAS 5 10-YEAR PROFILE 45-45 Proj. file: Outfall #1.stm



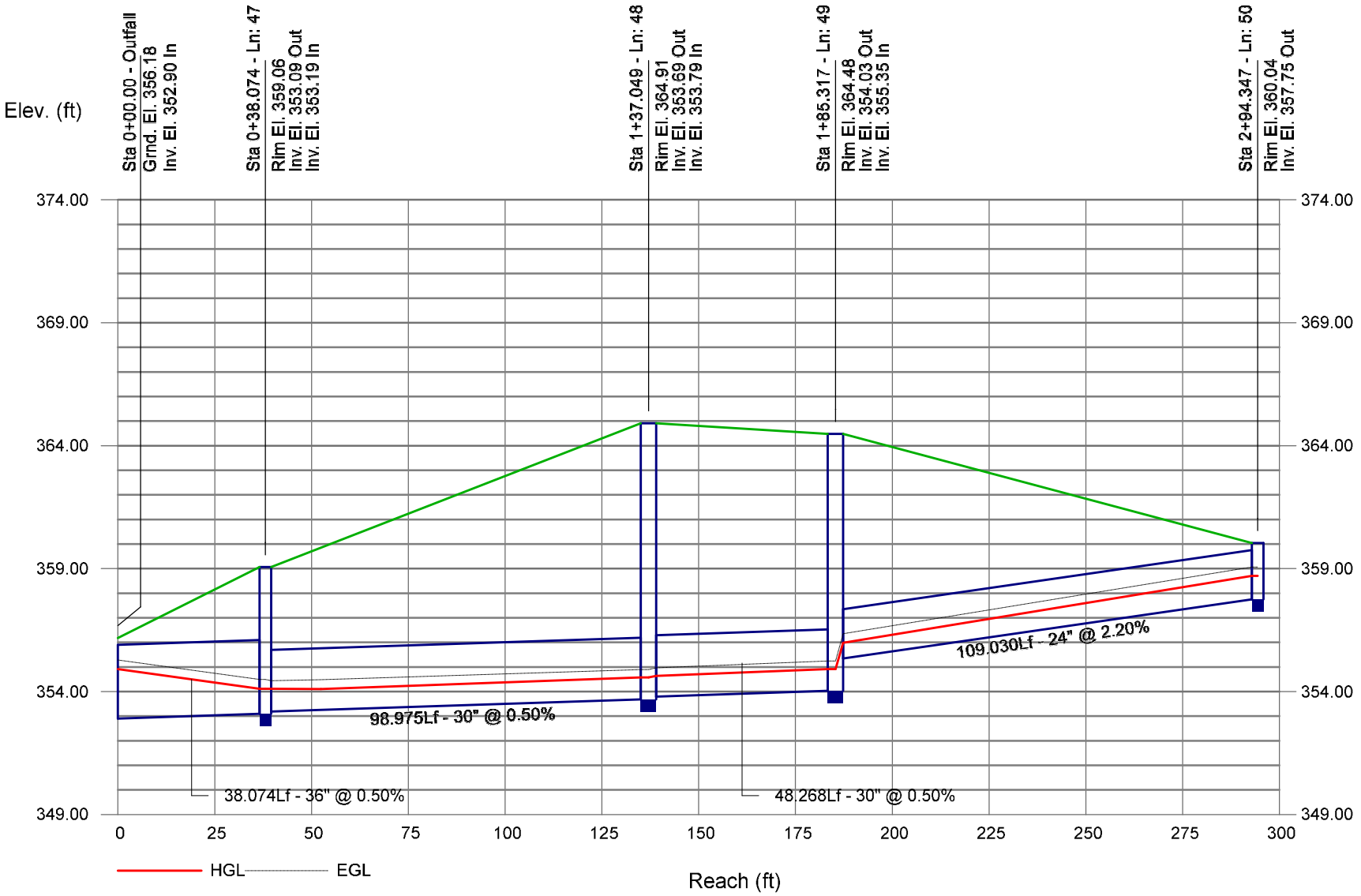
Storm Sewer Profile

KALAS 5 10-YEAR PROFILE 46-46 Proj. file: Outfall #1.stm

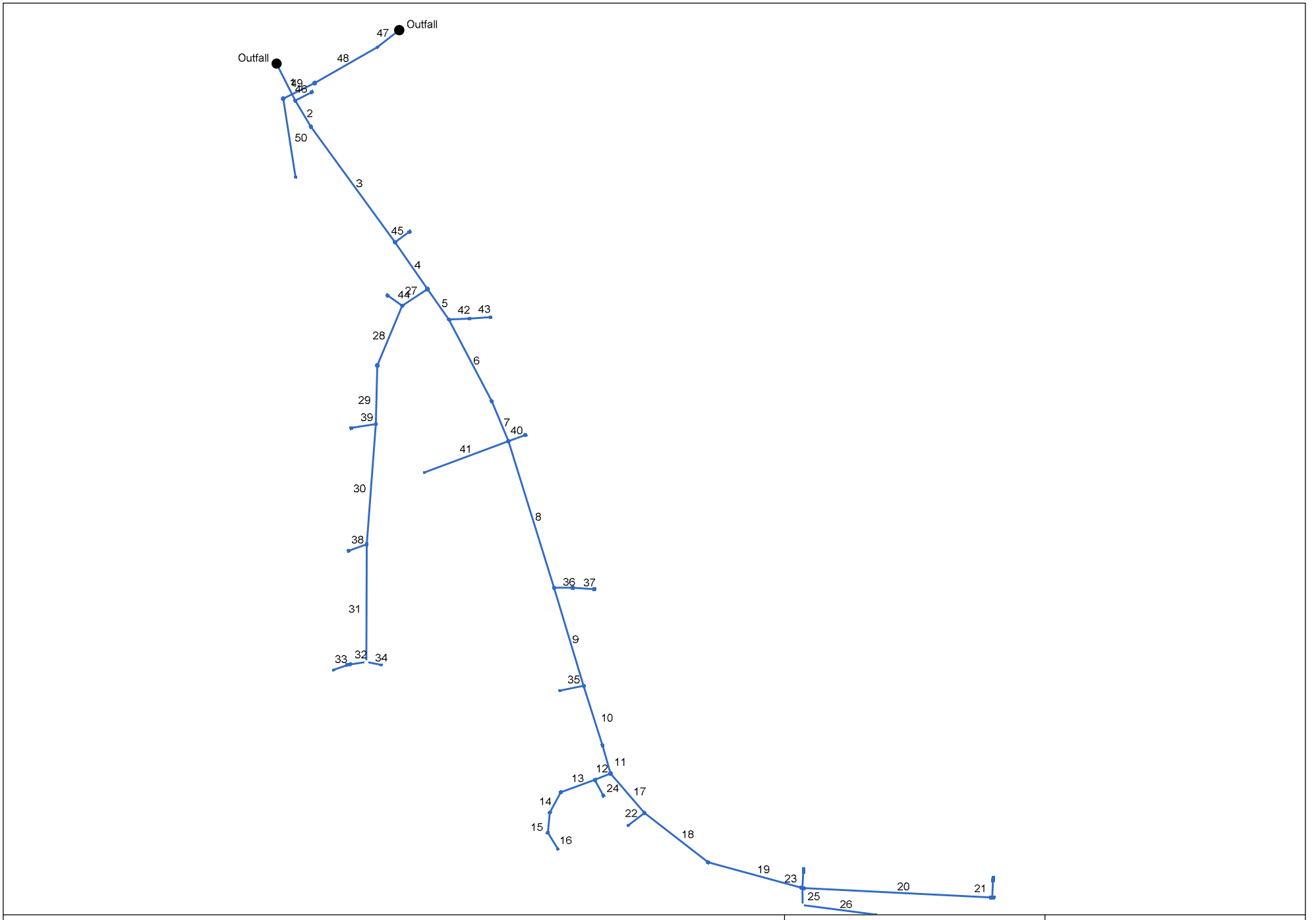


Storm Sewer Profile

KALAS 5 10-YEAR PROFILE 47-50 Proj. file: Outfall #1.stm



Hydraflow Storm Sewers Extension for Autodesk® Civil 3D® Plan KALAS 5 25-YEAR REPORT



Project File: Outfall #1.stm	Number of lines: 50	Date: 3/3/2025

Storm Sewer Inventory Report

KALAS 5 25-YEAR REPORT

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
1	End	57.000	63.252	Comb	0.00	0.01	0.56	10.0	357.90	0.68	358.29	36	Cir	0.013	1.50	364.82	Ex. 375 Out
2	1	41.866	-4.047	Comb	0.00	0.17	0.56	10.0	358.64	0.50	358.85	36	Cir	0.013	0.50	365.27	Pipe - (20)
3	2	196.394	-5.160	Comb	0.00	0.21	0.56	10.0	358.95	1.64	362.17	36	Cir	0.013	1.50	368.56	Pipe - (19)
4	3	78.359	1.332	MH	0.00	0.01	0.56	10.0	362.27	1.57	363.50	36	Cir	0.013	1.00	370.06	Pipe - (18)
5	4	51.000	-0.352	Comb	0.00	0.19	0.56	10.0	364.00	1.06	364.54	30	Cir	0.013	1.30	370.73	Pipe - (16)
6	5	126.897	7.290	Comb	0.00	0.07	0.56	10.0	364.64	1.42	366.44	30	Cir	0.013	0.50	372.89	Pipe - (15)
7	6	59.532	5.165	Comb	0.00	0.31	0.56	10.0	366.65	1.72	367.68	30	Cir	0.013	1.50	373.89	Pipe - (14)
8	7	210.964	5.328	Comb	0.00	0.20	0.56	10.0	367.78	1.54	371.03	30	Cir	0.013	1.44	377.52	Pipe - (13)
9	8	140.875	0.547	Comb	0.00	0.09	0.56	10.0	371.43	0.65	372.35	30	Cir	0.013	1.50	379.89	Pipe - (12) (1)
10	9	86.180	-0.829	Comb	0.00	0.08	0.56	10.0	373.07	0.61	373.60	30	Cir	0.013	0.50	381.39	Pipe - (12)
11	10	40.124	1.547	MH	0.00	0.01	0.56	10.0	373.70	0.75	374.00	30	Cir	0.013	1.00	381.95	Pipe - (51)
12	11	23.025	83.735	Comb	0.00	0.07	0.56	10.0	375.27	0.50	375.38	24	Cir	0.013	1.50	382.14	Pipe - (50) (1)
13	12	49.905	2.092	Comb	0.00	0.24	0.56	10.0	375.48	0.50	375.73	24	Cir	0.013	1.07	382.55	Pipe - (50)
14	13	31.516	-41.901	Comb	0.00	0.21	0.56	10.0	375.83	0.50	375.99	24	Cir	0.013	0.65	382.87	Pipe - (49)
15	14	27.860	-22.271	Comb	0.00	0.15	0.56	10.0	376.09	0.50	376.23	24	Cir	0.013	0.99	382.23	Pipe - (48)
16	15	25.968	-37.432	DrGrt	0.00	4.70	0.17	10.0	376.73	0.89	376.96	18	Cir	0.013	1.00	379.55	Pipe - (58)
17	11	71.389	-24.767	Comb	0.00	0.01	0.56	10.0	374.10	0.53	374.48	24	Cir	0.013	1.50	382.72	Pipe - (11)
18	17	110.816	-11.425	Comb	0.00	0.12	0.56	10.0	374.58	0.50	375.13	24	Cir	0.013	0.66	382.29	Pipe - (10)
19	18	133.897	-22.601	Comb	0.00	0.30	0.56	10.0	375.23	0.50	375.90	24	Cir	0.013	2.18	381.56	Pipe - (9)
20	19	260.141	-12.381	Comb	0.00	0.47	0.56	10.0	376.02	0.49	377.30	18	Cir	0.013	1.50	382.86	Pipe - (8)
21	20	25.751	-90.000	Comb	0.00	0.32	0.56	10.0	377.55	0.66	377.72	15	Cir	0.013	1.00	382.92	Pipe - (7)
22	17	28.157	93.178	DrGrt	0.00	0.61	0.17	10.0	376.03	2.24	376.66	15	Cir	0.013	1.00	380.41	Pipe - (59)
23	19	24.491	-102.382	Comb	0.00	0.32	0.56	10.0	376.45	0.53	376.58	15	Cir	0.013	1.00	381.56	Pipe - (55)

Project File: Outfall #1.stm | Number of lines: 50 | Date: 3/3/2025

Storm Sewer Inventory Report

KALAS 5 25-YEAR REPORT

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
24	12	24.507	-95.925	Comb	0.00	0.11	0.56	10.0	376.87	0.73	377.05	15	Cir	0.013	1.00	382.14	Pipe - (70)
25	19	23.549	74.368	DrGrt	0.00	0.66	0.17	10.0	376.05	0.72	376.22	15	Cir	0.013	1.49	381.51	Pipe - (60)
26	25	101.000	-82.180	DrGrt	0.00	0.43	0.17	10.0	376.32	0.52	376.85	15	Cir	0.013	1.00	377.88	Pipe - (71)
27	4	41.676	91.283	Comb	0.00	0.22	0.56	10.0	364.00	0.84	364.35	24	Cir	0.013	1.42	370.22	Pipe - (57)
28	27	88.898	-34.214	MH	0.00	0.01	0.56	10.0	364.57	2.00	366.35	24	Cir	0.013	0.41	372.10	Pipe - (56)
29	28	80.422	-21.032	Comb	0.00	0.11	0.56	10.0	366.55	2.00	368.16	24	Cir	0.013	1.48	373.82	Pipe - (39)
30	29	166.115	2.964	Comb	0.00	0.24	0.56	10.0	368.68	1.80	371.67	18	Cir	0.013	1.39	376.92	Pipe - (37)
31	30	161.824	-4.236	Comb	0.00	0.28	0.56	10.0	371.77	1.93	374.90	18	Cir	0.013	2.22	380.04	Pipe - (36)
32	31	24.500	81.321	Comb	0.00	0.52	0.56	10.0	375.00	0.49	375.12	18	Cir	0.013	0.50	380.20	Pipe - (42)
33	32	22.252	-10.400	DrGrt	0.00	2.63	0.17	10.0	375.42	0.99	375.64	15	Cir	0.013	1.00	378.27	Pipe - (61)
34	31	20.817	-78.889	DrGrt	0.00	0.11	0.56	10.0	375.15	0.72	375.30	15	Cir	0.013	1.00	379.93	Pipe - (62)
35	9	32.881	95.114	DrGrt	0.00	0.25	0.56	10.0	374.07	1.09	374.43	18	Cir	0.013	1.00	377.38	Pipe - (69)
36	8	25.642	-72.321	Comb	0.00	0.40	0.56	10.0	372.50	0.70	372.68	15	Cir	0.013	0.50	377.65	Pipe - (54)
37	36	29.330	3.216	Comb	0.00	0.12	0.56	10.0	372.80	3.00	373.68	15	Cir	0.013	1.00	378.77	Pipe - (22)
38	30	26.271	65.734	Comb	0.00	0.32	0.56	10.0	371.92	1.45	372.30	15	Cir	0.013	1.00	377.11	Pipe - (41)
39	29	34.056	79.521	Comb	0.00	0.33	0.56	10.0	368.81	0.65	369.03	15	Cir	0.013	1.00	373.82	Pipe - (40)
40	7	24.427	-88.012	Comb	0.00	0.34	0.56	10.0	368.75	1.06	369.01	15	Cir	0.013	1.00	374.05	Pipe - (43)
41	7	123.325	91.973	DrGrt	0.00	1.30	0.56	10.0	368.30	0.54	368.97	18	Cir	0.013	1.00	372.49	Pipe - (63)
42	5	28.012	-57.519	Comb	0.00	0.20	0.56	10.0	365.72	1.36	366.10	15	Cir	0.013	0.50	371.06	Pipe - (24)
43	42	29.509	-1.479	Comb	0.00	0.11	0.56	10.0	366.20	0.51	366.35	15	Cir	0.013	1.00	371.27	Pipe - (53)
44	27	24.451	69.302	Comb	0.00	0.41	0.56	10.0	364.85	1.02	365.10	18	Cir	0.013	1.00	370.23	Pipe - (17)
45	3	24.503	-90.507	Comb	0.00	0.24	0.56	10.0	363.42	0.94	363.65	15	Cir	0.013	1.00	368.56	Pipe - (28)
46	1	25.748	-90.230	Comb	0.00	0.31	0.56	10.0	360.76	-0.50	360.63	18	Cir	0.013	1.00	364.57	Pipe - (26)

Project File: Outfall #1.stm | Number of lines: 50 | Date: 3/3/2025

Storm Sewer Inventory Report

KALAS 5 25-YEAR REPORT

Line No.	Alignment				Flow Data				Physical Data								Line ID
	Dnstr Line No.	Line Length (ft)	Defl angle (deg)	Junc Type	Known Q (cfs)	Drng Area (ac)	Runoff Coeff (C)	Inlet Time (min)	Invert El Dn (ft)	Line Slope (%)	Invert El Up (ft)	Line Size (in)	Line Shape	N Value (n)	J-Loss Coeff (K)	Inlet/ Rim El (ft)	
47	End	38.074	141.899	DrGrt	0.00	1.07	0.56	10.0	352.90	0.50	353.09	36	Cir	0.013	0.50	359.06	Pipe - (67)
48	47	98.975	8.202	MH	0.00	0.01	0.56	10.0	353.19	0.50	353.69	30	Cir	0.013	0.15	364.91	Pipe - (66)
49	48	48.268	3.525	MH	0.00	0.01	0.56	10.0	353.79	0.50	354.03	30	Cir	0.013	0.96	364.48	Pipe - (65)
50	49	109.030	-72.571	DrGrt	0.00	8.60	0.17	10.0	355.35	2.20	357.75	24	Cir	0.013	1.00	360.04	Pipe - (29)

Project File: Outfall #1.stm | Number of lines: 50 | Date: 3/3/2025

Structure Report

KALAS 5 25-YEAR REPORT

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
1	EX. CB 375	Combination	364.82	Rect	4.00	4.00	36	Cir	358.29	36 18	Cir Cir	358.64 360.76
2	376	Combination	365.27	Rect	4.00	4.00	36	Cir	358.85	36	Cir	358.95
3	377	Combination	368.56	Rect	4.00	4.00	36	Cir	362.17	36 15	Cir Cir	362.27 363.42
4	377B	Manhole	370.06	Cir	4.00	4.00	36	Cir	363.50	30 24	Cir Cir	364.00 364.00
5	378	Combination	370.73	Rect	4.00	4.00	30	Cir	364.54	30 15	Cir Cir	364.64 365.72
6	379	Combination	372.89	Rect	4.00	4.00	30	Cir	366.44	30	Cir	366.65
7	380	Combination	373.89	Rect	4.00	4.00	30	Cir	367.68	30 15 18	Cir Cir Cir	367.78 368.75 368.30
8	381	Combination	377.52	Rect	4.00	4.00	30	Cir	371.03	30 15	Cir Cir	371.43 372.50
9	381C	Combination	379.89	Rect	4.00	4.00	30	Cir	372.35	30 18	Cir Cir	373.07 374.07
10	382	Combination	381.39	Rect	4.00	4.00	30	Cir	373.60	30	Cir	373.70
11	382A	Manhole	381.95	Cir	4.00	4.00	30	Cir	374.00	24 24	Cir Cir	375.27 374.10
12	395	Combination	382.14	Rect	4.00	4.00	24	Cir	375.38	24 15	Cir Cir	375.48 376.87
13	396	Combination	382.55	Rect	4.00	4.00	24	Cir	375.73	24	Cir	375.83
14	396A	Combination	382.87	Rect	4.00	4.00	24	Cir	375.99	24	Cir	376.09
15	396B	Combination	382.23	Rect	4.00	4.00	24	Cir	376.23	18	Cir	376.73
16	396C	DropGrate	379.55	Rect	3.00	3.00	18	Cir	376.96			
17	383	Combination	382.72	Rect	4.00	4.00	24	Cir	374.48	24 15	Cir Cir	374.58 376.03

Project File: Outfall #1.stm | Number of Structures: 50 | Run Date: 3/3/2025

Structure Report

KALAS 5 25-YEAR REPORT

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
18	384	Combination	382.29	Rect	4.00	4.00	24	Cir	375.13	24	Cir	375.23
19	385	Combination	381.56	Rect	8.00	4.00	24	Cir	375.90	18 15 15	Cir Cir Cir	376.02 376.45 376.05
20	386	Combination	382.86	Rect	8.00	4.00	18	Cir	377.30	15	Cir	377.55
21	386A	Combination	382.92	Rect	8.00	4.00	15	Cir	377.72			
22	383A	DropGrate	380.41	Rect	3.00	3.00	15	Cir	376.66			
23	385A	Combination	381.56	Rect	8.00	4.00	15	Cir	376.58			
24	395A	Combination	382.14	Rect	4.00	4.00	15	Cir	377.05			
25	385B	DropGrate	381.51	Rect	3.00	3.00	15	Cir	376.22	15	Cir	376.32
26	385C	DropGrate	377.88	Rect	3.00	3.00	15	Cir	376.85			
27	390	Combination	370.22	Rect	4.00	4.00	24	Cir	364.35	24 18	Cir Cir	364.57 364.85
28	390B	Manhole	372.10	Cir	4.00	4.00	24	Cir	366.35	24	Cir	366.55
29	391	Combination	373.82	Rect	4.00	4.00	24	Cir	368.16	18 15	Cir Cir	368.68 368.81
30	392	Combination	376.92	Rect	4.00	4.00	18	Cir	371.67	18 15	Cir Cir	371.77 371.92
31	393	Combination	380.04	Rect	4.00	4.00	18	Cir	374.90	18 15	Cir Cir	375.00 375.15
32	393A	Combination	380.20	Rect	8.00	4.00	18	Cir	375.12	15	Cir	375.42
33	393B	DropGrate	378.27	Rect	3.00	3.00	15	Cir	375.64			
34	393C	DropGrate	379.93	Rect	3.00	3.00	15	Cir	375.30			
35	381D	DropGrate	377.38	Rect	3.00	3.00	18	Cir	374.43			
36	381A	Combination	377.65	Rect	4.00	4.00	15	Cir	372.68	15	Cir	372.80
37	381B	Combination	378.77	Rect	4.00	4.00	15	Cir	373.68			

Project File: Outfall #1.stm | Number of Structures: 50 | Run Date: 3/3/2025

Structure Report

KALAS 5 25-YEAR REPORT

Struct No.	Structure ID	Junction Type	Rim Elev (ft)	Structure			Line Out			Line In		
				Shape	Length (ft)	Width (ft)	Size (in)	Shape	Invert (ft)	Size (in)	Shape	Invert (ft)
38	392A	Combination	377.11	Rect	4.00	4.00	15	Cir	372.30			
39	391A	Combination	373.82	Rect	4.00	4.00	15	Cir	369.03			
40	380A	Combination	374.05	Rect	4.00	4.00	15	Cir	369.01			
41	380B	DropGrate	372.49	Rect	3.00	3.00	18	Cir	368.97			
42	378A	Combination	371.06	Rect	4.00	4.00	15	Cir	366.10	15	Cir	366.20
43	378B	Combination	371.27	Rect	4.00	4.00	15	Cir	366.35			
44	390A	Combination	370.23	Rect	4.00	4.00	18	Cir	365.10			
45	377A	Combination	368.56	Rect	4.00	4.00	15	Cir	363.65			
46	375A	Combination	364.57	Rect	4.00	4.00	18	Cir	360.63			
47	31A	DropGrate	359.06	Rect	3.00	3.00	36	Cir	353.09	30	Cir	353.19
48	EX. 31	Manhole	364.91	Cir	4.00	4.00	30	Cir	353.69	30	Cir	353.79
49	EX. 32	Manhole	364.48	Cir	4.00	4.00	30	Cir	354.03	24	Cir	355.35
50	32A	DropGrate	360.04	Rect	3.00	3.00	24	Cir	357.75			

Project File: Outfall #1.stm | Number of Structures: 50 | Run Date: 3/3/2025

Storm Sewer Summary Report

KALAS 5 25-YEAR REPORT

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
1	Ex. 375 Out	38.13	36	Cir	57.000	357.90	358.29	0.684	360.90	361.04	0.74	361.77	End	Combination
2	Pipe - (20)	37.27	36	Cir	41.866	358.64	358.85	0.502	361.77*	361.90*	0.22	362.12	1	Combination
3	Pipe - (19)	37.28	36	Cir	196.394	358.95	362.17	1.640	362.12	364.15	n/a	364.15 j	2	Combination
4	Pipe - (18)	36.03	36	Cir	78.359	362.27	363.50	1.570	364.15	365.45	n/a	365.45	3	Manhole
5	Pipe - (16)	25.39	30	Cir	51.000	364.00	364.54	1.059	365.45	366.26	1.01	366.26	4	Combination
6	Pipe - (15)	24.01	30	Cir	126.897	364.64	366.44	1.418	366.26	368.11	0.37	368.11	5	Combination
7	Pipe - (14)	23.87	30	Cir	59.532	366.65	367.68	1.723	368.11	369.34	n/a	369.34	6	Combination
8	Pipe - (13)	17.87	30	Cir	210.964	367.78	371.03	1.539	369.34	372.46	n/a	372.46 j	7	Combination
9	Pipe - (12) (1)	15.67	30	Cir	140.875	371.43	372.35	0.653	372.64	373.69	n/a	373.69	8	Combination
10	Pipe - (12)	14.64	30	Cir	86.180	373.07	373.60	0.615	374.25	374.89	n/a	374.89	9	Combination
11	Pipe - (51)	14.43	30	Cir	40.124	373.70	374.00	0.748	374.89	375.28	0.51	375.28	10	Manhole
12	Pipe - (50) (1)	7.96	24	Cir	23.025	375.27	375.38	0.499	376.26	376.38	n/a	376.38	11	Combination
13	Pipe - (50)	7.35	24	Cir	49.905	375.48	375.73	0.501	376.43	376.69	n/a	376.69	12	Combination
14	Pipe - (49)	6.51	24	Cir	31.516	375.83	375.99	0.501	376.72	376.89	n/a	376.89	13	Combination
15	Pipe - (48)	5.76	24	Cir	27.860	376.09	376.23	0.499	376.92	377.08	n/a	377.08	14	Combination
16	Pipe - (58)	5.23	18	Cir	25.968	376.73	376.96	0.886	377.51	377.84	0.37	377.84	15	DropGrate
17	Pipe - (11)	7.00	24	Cir	71.389	374.10	374.48	0.532	375.28	375.42	0.55	375.42	11	Combination
18	Pipe - (10)	6.42	24	Cir	110.816	374.58	375.13	0.496	375.46	376.03	n/a	376.03	17	Combination
19	Pipe - (9)	6.10	24	Cir	133.897	375.23	375.90	0.500	376.09	376.77	0.73	376.77	18	Combination
20	Pipe - (8)	2.88	18	Cir	260.141	376.02	377.30	0.491	376.77	377.94	0.37	377.94	19	Combination
21	Pipe - (7)	1.17	15	Cir	25.751	377.55	377.72	0.660	377.95	378.15	0.16	378.15	20	Combination
22	Pipe - (59)	0.68	15	Cir	28.157	376.03	376.66	2.237	376.25	376.98	0.11	376.98	17	DropGrate
23	Pipe - (55)	1.17	15	Cir	24.491	376.45	376.58	0.531	376.88	377.01	0.16	377.01	19	Combination
24	Pipe - (70)	0.40	15	Cir	24.507	376.87	377.05	0.734	377.10	377.30	n/a	377.30	12	Combination

Project File: Outfall #1.stm

Number of lines: 50

Run Date: 3/3/2025

NOTES: Return period = 25 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Summary Report

KALAS 5 25-YEAR REPORT

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
25	Pipe - (60)	1.18	15	Cir	23.549	376.05	376.22	0.722	376.77	376.65	n/a	376.65	19	DropGrate
26	Pipe - (71)	0.48	15	Cir	101.000	376.32	376.85	0.525	376.65	377.12	n/a	377.12	25	DropGrate
27	Pipe - (57)	11.61	24	Cir	41.676	364.00	364.35	0.840	365.45	365.57	n/a	365.57 j	4	Combination
28	Pipe - (56)	9.51	24	Cir	88.898	364.57	366.35	2.002	365.57	367.45	0.18	367.45	27	Manhole
29	Pipe - (39)	9.54	24	Cir	80.422	366.55	368.16	2.001	367.45	369.26	0.66	369.26	28	Combination
30	Pipe - (37)	8.10	18	Cir	166.115	368.68	371.67	1.800	369.50	372.77	n/a	372.77	29	Combination
31	Pipe - (36)	6.21	18	Cir	161.824	371.77	374.90	1.934	372.77	375.86	n/a	375.86 j	30	Combination
32	Pipe - (42)	4.82	18	Cir	24.500	375.00	375.12	0.490	375.89	376.00	0.15	376.16	31	Combination
33	Pipe - (61)	2.93	15	Cir	22.252	375.42	375.64	0.989	376.16	376.33	n/a	376.33 j	32	DropGrate
34	Pipe - (62)	0.40	15	Cir	20.817	375.15	375.30	0.721	375.86	375.55	n/a	375.55	31	DropGrate
35	Pipe - (69)	0.92	18	Cir	32.881	374.07	374.43	1.095	374.36	374.79	n/a	374.79	9	DropGrate
36	Pipe - (54)	1.89	15	Cir	25.642	372.50	372.68	0.702	373.01	373.23	n/a	373.23	8	Combination
37	Pipe - (22)	0.44	15	Cir	29.330	372.80	373.68	3.000	373.23	373.94	n/a	373.94 j	36	Combination
38	Pipe - (41)	1.17	15	Cir	26.271	371.92	372.30	1.446	372.77	372.73	n/a	372.73 j	30	Combination
39	Pipe - (40)	1.21	15	Cir	34.056	368.81	369.03	0.646	369.26	369.46	n/a	369.46 j	29	Combination
40	Pipe - (43)	1.25	15	Cir	24.427	368.75	369.01	1.064	369.34	369.45	n/a	369.45 j	7	Combination
41	Pipe - (63)	4.76	18	Cir	123.325	368.30	368.97	0.543	369.34	369.81	n/a	369.81	7	DropGrate
42	Pipe - (24)	1.13	15	Cir	28.012	365.72	366.10	1.357	366.26	366.52	n/a	366.52 j	5	Combination
43	Pipe - (53)	0.40	15	Cir	29.509	366.20	366.35	0.508	366.52	366.60	n/a	366.68 j	42	Combination
44	Pipe - (17)	1.50	18	Cir	24.451	364.85	365.10	1.022	365.57	365.56	n/a	365.56 j	27	Combination
45	Pipe - (28)	0.88	15	Cir	24.503	363.42	363.65	0.939	364.15	364.02	0.13	364.02	3	Combination
46	Pipe - (26)	1.14	18	Cir	25.748	360.76	360.63	-0.505	361.77	361.78	0.01	361.79	1	Combination
47	Pipe - (67)	13.22	36	Cir	38.074	352.90	353.09	0.499	354.95	354.25	n/a	354.25	End	DropGrate
48	Pipe - (66)	9.51	30	Cir	98.975	353.19	353.69	0.500	354.25	354.71	n/a	354.71 j	47	Manhole

Project File: Outfall #1.stm | Number of lines: 50 | Run Date: 3/3/2025

NOTES: Return period = 25 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Storm Sewer Summary Report

KALAS 5 25-YEAR REPORT

Line No.	Line ID	Flow rate (cfs)	Line Size (in)	Line shape	Line length (ft)	Invert EL Dn (ft)	Invert EL Up (ft)	Line Slope (%)	HGL Down (ft)	HGL Up (ft)	Minor loss (ft)	HGL Junct (ft)	Dns Line No.	Junction Type
49	Pipe - (65)	9.52	30	Cir	48.268	353.79	354.03	0.497	354.78	355.06	n/a	355.06	48	Manhole
50	Pipe - (29)	9.57	24	Cir	109.030	355.35	357.75	2.201	356.08	358.85	0.45	358.85	49	DropGrate

Project File: Outfall #1.stm | Number of lines: 50 | Run Date: 3/3/2025

NOTES: Return period = 25 Yrs. ; *Surcharged (HGL above crown). ; j - Line contains hyd. jump.

Inlet Report

KALAS 5 25-YEAR REPORT

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
1	EX. CB 375	0.04	0.00	0.04	0.00	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.07	1.11	0.00	0.00	0.0	Off
2	376	0.62	0.00	0.56	0.06	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.18	5.21	0.08	1.35	0.0	Off
3	377	0.77	0.00	0.67	0.10	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.20	5.83	0.10	1.63	0.0	Off
4	377B	0.04	0.00	0.00	0.04	MH	0.0	0.00	0.00	0.00	0.00	Sag	2.00	0.060	0.020	0.013	0.00	0.00	0.00	0.00	0.0	Off
5	378	0.70	0.00	0.61	0.08	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.19	5.53	0.09	1.49	0.0	Off
6	379	0.26	0.00	0.25	0.00	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.14	2.87	0.02	0.34	0.0	Off
7	380	1.14	0.00	0.91	0.23	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.22	7.07	0.13	2.57	0.0	Off
8	381	0.73	0.00	0.64	0.09	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.19	5.68	0.09	1.56	0.0	Off
9	381C	0.33	0.00	0.32	0.01	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.15	3.49	0.04	0.61	0.0	Off
10	382	0.29	0.00	0.29	0.00	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.14	3.20	0.03	0.48	0.0	Off
11	382A	0.04	0.00	0.00	0.04	MH	0.0	0.00	0.00	0.00	0.00	Sag	2.00	0.060	0.020	0.013	0.00	0.00	0.00	0.00	0.0	Off
12	395	0.26	0.00	0.25	0.00	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.14	2.87	0.02	0.34	0.0	Off
13	396	0.88	0.00	0.74	0.14	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.20	6.24	0.11	1.81	0.0	Off
14	396A	0.77	0.00	0.67	0.10	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.20	5.83	0.10	1.63	0.0	Off
15	396B	0.55	0.00	0.50	0.05	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.18	4.85	0.07	1.20	0.0	Off
16	396C	5.23	0.00	5.23	0.00	DrGrt	0.0	0.00	4.00	2.00	2.00	Sag	2.00	0.010	0.010	0.013	0.36	74.37	0.36	74.37	0.0	Off
17	383	0.04	0.00	0.04	0.00	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.07	1.11	0.00	0.00	0.0	Off
18	384	0.44	0.00	0.42	0.02	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.16	4.24	0.06	0.93	0.0	Off
19	385	1.10	0.00	1.01	0.09	Comb	6.0	1.50	0.00	6.00	2.50	0.005	2.00	0.060	0.020	0.013	0.22	6.96	0.09	1.56	0.0	Off
20	386	1.72	0.00	1.51	0.22	Comb	6.0	1.50	0.00	6.00	2.50	0.005	2.00	0.060	0.020	0.013	0.25	8.56	0.13	2.45	0.0	Off
21	386A	1.17	0.00	1.07	0.10	Comb	6.0	1.50	0.00	6.00	2.50	0.005	2.00	0.060	0.020	0.013	0.22	7.18	0.10	1.64	0.0	Off
22	383A	0.68	0.00	0.68	0.00	DrGrt	0.0	0.00	4.00	2.00	2.00	Sag	2.00	0.010	0.010	0.013	0.09	20.54	0.09	20.54	0.0	Off
23	385A	1.17	0.00	1.07	0.10	Comb	6.0	1.50	0.00	6.00	2.50	0.005	2.00	0.060	0.020	0.013	0.22	7.18	0.10	1.64	0.0	Off

Project File: Outfall #1.stm | Number of lines: 50 | Run Date: 3/3/2025

NOTES: Inlet N-Values = 0.016; Intensity = 65.79 / (Inlet time + 11.50) ^ 0.75; Return period = 25 Yrs. ; * Indicates Known Q added.All curb inlets are throat.

Inlet Report

KALAS 5 25-YEAR REPORT

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
24	395A	0.40	0.00	0.39	0.02	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.16	4.01	0.05	0.83	0.0	Off
25	385B	0.73	0.00	0.73	0.00	DrGrt	0.0	0.00	4.00	2.00	2.00	Sag	2.00	0.010	0.010	0.013	0.10	21.54	0.10	21.54	0.0	Off
26	385C	0.48	0.00	0.48	0.00	DrGrt	0.0	0.00	4.00	2.00	2.00	Sag	2.00	0.020	0.020	0.013	0.07	9.34	0.07	9.34	0.0	Off
27	390	0.81	0.00	0.69	0.11	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.20	5.97	0.10	1.69	0.0	Off
28	390B	0.04	0.00	0.00	0.04	MH	0.0	0.00	0.00	0.00	0.00	Sag	2.00	0.060	0.020	0.013	0.00	0.00	0.00	0.00	0.0	Off
29	391	0.40	0.00	0.39	0.02	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.16	4.01	0.05	0.83	0.0	Off
30	392	0.88	0.00	0.74	0.14	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.20	6.24	0.11	1.81	0.0	Off
31	393	1.03	0.00	0.84	0.19	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.21	6.73	0.12	2.11	0.0	Off
32	393A	1.91	0.00	1.65	0.26	Comb	6.0	1.50	0.00	6.00	2.50	0.005	2.00	0.060	0.020	0.013	0.26	8.95	0.14	2.88	0.0	Off
33	393B	2.93	0.00	2.93	0.00	DrGrt	0.0	0.00	4.00	2.00	2.00	Sag	2.00	0.010	0.010	0.013	0.25	51.14	0.25	51.14	0.0	Off
34	393C	0.40	0.00	0.40	0.00	DrGrt	0.0	0.00	4.00	2.00	2.00	Sag	2.00	0.010	0.010	0.013	0.07	15.10	0.07	15.10	0.0	Off
35	381D	0.92	0.00	0.92	0.00	DrGrt	0.0	0.00	4.00	2.00	2.00	Sag	2.00	0.010	0.010	0.013	0.11	24.65	0.11	24.65	0.0	Off
36	381A	1.47	0.00	1.11	0.36	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.24	7.96	0.15	3.71	0.0	Off
37	381B	0.44	0.00	0.42	0.02	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.16	4.24	0.06	0.93	0.0	Off
38	392A	1.17	0.00	0.93	0.24	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.22	7.18	0.13	2.71	0.0	Off
39	391A	1.21	0.00	0.95	0.25	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.23	7.28	0.14	2.85	0.0	Off
40	380A	1.25	0.00	0.98	0.27	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.23	7.38	0.14	2.98	0.0	Off
41	380B	4.76	0.00	4.76	0.00	DrGrt	0.0	0.00	4.00	2.00	2.00	Sag	2.00	0.010	0.010	0.013	0.34	70.02	0.34	70.02	0.0	Off
42	378A	0.73	0.00	0.64	0.09	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.19	5.68	0.09	1.56	0.0	Off
43	378B	0.40	0.00	0.39	0.02	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.16	4.01	0.05	0.83	0.0	Off
44	390A	1.50	0.00	1.13	0.37	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.24	8.05	0.16	3.82	0.0	Off
45	377A	0.88	0.00	0.74	0.14	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.20	6.24	0.11	1.81	0.0	Off
46	375A	1.14	0.00	0.91	0.23	Comb	6.0	1.50	0.00	3.00	2.50	0.005	2.00	0.060	0.020	0.013	0.22	7.07	0.13	2.57	0.0	Off

Project File: Outfall #1.stm | Number of lines: 50 | Run Date: 3/3/2025

NOTES: Inlet N-Values = 0.016; Intensity = 65.79 / (Inlet time + 11.50) ^ 0.75; Return period = 25 Yrs. ; * Indicates Known Q added.All curb inlets are throat.

Inlet Report

KALAS 5 25-YEAR REPORT

Line No	Inlet ID	Q = CIA (cfs)	Q carry (cfs)	Q capt (cfs)	Q Byp (cfs)	Junc Type	Curb Inlet		Grate Inlet			Gutter							Inlet			Byp Line No
							Ht (in)	L (ft)	Area (sqft)	L (ft)	W (ft)	So (ft/ft)	W (ft)	Sw (ft/ft)	Sx (ft/ft)	n	Depth (ft)	Spread (ft)	Depth (ft)	Spread (ft)	Depr (in)	
47	31A	3.92	0.00	3.92	0.00	DrGrt	0.0	0.00	4.00	2.00	2.00	Sag	2.00	0.010	0.010	0.013	0.30	61.73	0.30	61.73	0.0	Off
48	EX. 31	0.04	0.00	0.00	0.04	MH	0.0	0.00	0.00	0.00	0.00	Sag	2.00	0.060	0.020	0.013	0.00	0.00	0.00	0.00	0.0	Off
49	EX. 32	0.04	0.00	0.00	0.04	MH	0.0	0.00	0.00	0.00	0.00	Sag	2.00	0.060	0.020	0.013	0.00	0.00	0.00	0.00	0.0	Off
50	32A	9.57	0.00	9.57	0.00	DrGrt	0.0	0.00	4.00	2.00	2.00	Sag	2.00	0.010	0.010	0.013	0.54	110.29	0.54	110.29	0.0	Off

Project File: Outfall #1.stm | Number of lines: 50 | Run Date: 3/3/2025

NOTES: Inlet N-Values = 0.016; Intensity = 65.79 / (Inlet time + 11.50) ^ 0.75; Return period = 25 Yrs. ; * Indicates Known Q added.All curb inlets are throat.

Hydraulic Grade Line Computations

KALAS 5 25-YEAR REPORT

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
1	36	38.13	357.90	360.90	3.00	7.07	5.39	0.45	361.35	0.327	57.000	358.29	361.04	2.75	6.78	5.62	0.49	361.53	0.284	0.306	0.174	1.50	0.74
2	36	37.27	358.64	361.77	3.00	7.07	5.27	0.43	362.21	0.312	41.866	358.85	361.90	3.00	7.07	5.27	0.43	362.34	0.312	0.312	0.131	0.50	0.22
3	36	37.28	358.95	362.12	3.00	4.96	5.28	0.43	362.55	0.313	196.394	362.17	364.15 j	1.98**	4.96	7.51	0.88	365.03	0.520	0.416	n/a	1.50	1.32
4	36	36.03	362.27	364.15	1.88	4.67	7.71	0.85	365.01	0.000	78.359	363.50	365.45	1.95**	4.86	7.41	0.85	366.30	0.000	0.000	n/a	1.00	n/a
5	30	25.39	364.00	365.45	1.45	2.95	8.60	0.78	366.23	0.000	51.000	364.54	366.26	1.72**	3.59	7.07	0.78	367.03	0.000	0.000	n/a	1.30	1.01
6	30	24.01	364.64	366.26	1.62	3.36	7.16	0.74	367.00	0.000	126.897	366.44	368.11	1.67**	3.48	6.90	0.74	368.85	0.000	0.000	n/a	0.50	0.37
7	30	23.87	366.65	368.11	1.45	2.96	8.07	0.74	368.84	0.000	59.532	367.68	369.34	1.66**	3.47	6.89	0.74	370.08	0.000	0.000	n/a	1.50	n/a
8	30	17.87	367.78	369.34	1.56	2.90	5.55	0.59	369.93	0.000	210.964	371.03	372.46 j	1.43**	2.90	6.16	0.59	373.05	0.000	0.000	n/a	1.44	n/a
9	30	15.67	371.43	372.64	1.21*	2.35	6.66	0.54	373.18	0.000	140.875	372.35	373.69	1.34**	2.67	5.88	0.54	374.22	0.000	0.000	n/a	1.50	n/a
10	30	14.64	373.07	374.25	1.18*	2.29	6.40	0.51	374.77	0.000	86.180	373.60	374.89	1.29**	2.55	5.74	0.51	375.40	0.000	0.000	n/a	0.50	n/a
11	30	14.43	373.70	374.89	1.19	2.30	6.27	0.51	375.40	0.000	40.124	374.00	375.28	1.28**	2.53	5.71	0.51	375.79	0.000	0.000	n/a	1.00	0.51
12	24	7.96	375.27	376.26	1.00*	1.57	5.08	0.40	376.66	0.000	23.025	375.38	376.38	1.00**	1.58	5.05	0.40	376.78	0.000	0.000	n/a	1.50	n/a
13	24	7.35	375.48	376.43	0.95*	1.47	4.99	0.38	376.81	0.000	49.905	375.73	376.69	0.96**	1.50	4.92	0.38	377.07	0.000	0.000	n/a	1.07	n/a
14	24	6.51	375.83	376.72	0.89*	1.35	4.83	0.35	377.07	0.000	31.516	375.99	376.89	0.90**	1.38	4.73	0.35	377.24	0.000	0.000	n/a	0.65	n/a
15	24	5.76	376.09	376.92	0.83*	1.23	4.67	0.32	377.25	0.000	27.860	376.23	377.08	0.85**	1.27	4.55	0.32	377.40	0.000	0.000	n/a	0.99	n/a
16	18	5.23	376.73	377.51	0.78*	0.92	5.67	0.37	377.87	0.000	25.968	376.96	377.84	0.88**	1.08	4.85	0.37	378.21	0.000	0.000	n/a	1.00	0.37
17	24	7.00	374.10	375.28	1.18	1.45	3.64	0.36	375.64	0.000	71.389	374.48	375.42	0.94**	1.45	4.84	0.36	375.78	0.000	0.000	n/a	1.50	0.55
18	24	6.42	374.58	375.46	0.88*	1.34	4.80	0.34	375.81	0.000	110.816	375.13	376.03	0.90**	1.36	4.71	0.34	376.37	0.000	0.000	n/a	0.66	n/a
19	24	6.10	375.23	376.09	0.86*	1.29	4.75	0.33	376.42	0.000	133.897	375.90	376.77	0.87**	1.32	4.63	0.33	377.11	0.000	0.000	n/a	2.18	0.73
20	18	2.88	376.02	376.77	0.75	0.73	3.26	0.17	376.94	0.301	260.141	377.30	377.94	0.64**	0.73	3.97	0.25	378.19	0.512	0.407	n/a	1.50	0.37
21	15	1.17	377.55	377.95	0.40*	0.34	3.44	0.16	378.11	0.000	25.751	377.72	378.15	0.43**	0.37	3.17	0.16	378.30	0.000	0.000	n/a	1.00	0.16
22	15	0.68	376.03	376.25	0.22*	0.15	4.54	0.11	376.37	0.000	28.157	376.66	376.98	0.32**	0.25	2.72	0.11	377.10	0.000	0.000	n/a	1.00	0.11

Project File: Outfall #1.stm | Number of lines: 50 | Run Date: 3/3/2025

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

Hydraulic Grade Line Computations

KALAS 5 25-YEAR REPORT

Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
23	15	1.17	376.45	376.88	0.43*	0.37	3.18	0.16	377.03	0.000	24.491	376.58	377.01	0.43**	0.37	3.17	0.16	377.16	0.000	0.000	n/a	1.00	0.16
24	15	0.40	376.87	377.10	0.23*	0.15	2.62	0.09	377.18	0.000	24.507	377.05	377.30	0.25**	0.17	2.36	0.09	377.38	0.000	0.000	n/a	1.00	n/a
25	15	1.18	376.05	376.77	0.72	0.37	1.60	0.16	376.93	0.000	23.549	376.22	376.65	0.43**	0.37	3.18	0.16	376.81	0.000	0.000	n/a	1.49	n/a
26	15	0.48	376.32	376.65	0.33	0.19	1.86	0.05	376.70	0.242	101.000	376.85	377.12	0.27**	0.19	2.47	0.09	377.21	0.534	0.388	n/a	1.00	n/a
27	24	11.61	364.00	365.45	1.45	2.01	4.76	0.52	365.97	0.000	41.676	364.35	365.57 j	1.22**	2.01	5.77	0.52	366.09	0.000	0.000	n/a	1.42	n/a
28	24	9.51	364.57	365.57	1.00	1.58	6.03	0.45	366.02	0.000	88.898	366.35	367.45	1.10**	1.77	5.36	0.45	367.90	0.000	0.000	n/a	0.41	0.18
29	24	9.54	366.55	367.45	0.90	1.37	6.96	0.45	367.90	0.000	80.422	368.16	369.26	1.10**	1.78	5.37	0.45	369.71	0.000	0.000	n/a	1.48	0.66
30	18	8.10	368.68	369.50	0.82*	0.98	8.24	0.53	370.02	0.000	166.115	371.67	372.77	1.10**	1.39	5.82	0.53	373.30	0.000	0.000	n/a	1.39	n/a
31	18	6.21	371.77	372.77	1.00	1.20	4.95	0.42	373.19	0.000	161.824	374.90	375.86 j	0.96**	1.20	5.19	0.42	376.28	0.000	0.000	n/a	2.22	0.93
32	18	4.82	375.00	375.89	0.89*	1.09	4.43	0.31	376.19	0.489	24.500	375.12	376.00	0.88	1.08	4.45	0.31	376.31	0.493	0.491	0.120	0.50	0.15
33	15	2.93	375.42	376.16	0.74	0.69	3.88	0.28	376.44	0.000	22.252	375.64	376.33 j	0.69**	0.69	4.24	0.28	376.61	0.000	0.000	n/a	1.00	0.28
34	15	0.40	375.15	375.86	0.71	0.17	0.56	0.09	375.95	0.000	20.817	375.30	375.55	0.25**	0.17	2.36	0.09	375.63	0.000	0.000	n/a	1.00	n/a
35	18	0.92	374.07	374.36	0.29*	0.24	3.77	0.13	374.49	0.000	32.881	374.43	374.79	0.36**	0.32	2.85	0.13	374.91	0.000	0.000	n/a	1.00	n/a
36	15	1.89	372.50	373.01	0.51*	0.47	4.01	0.21	373.22	0.000	25.642	372.68	373.23	0.55**	0.52	3.66	0.21	373.43	0.000	0.000	n/a	0.50	n/a
37	15	0.44	372.80	373.23	0.43	0.18	1.19	0.09	373.32	0.000	29.330	373.68	373.94 j	0.26**	0.18	2.41	0.09	374.03	0.000	0.000	n/a	1.00	0.09
38	15	1.17	371.92	372.77	0.85	0.37	1.32	0.16	372.93	0.000	26.271	372.30	372.73 j	0.43**	0.37	3.17	0.16	372.88	0.000	0.000	n/a	1.00	0.16
39	15	1.21	368.81	369.26	0.45	0.38	3.01	0.16	369.42	0.000	34.056	369.03	369.46 j	0.43**	0.38	3.20	0.16	369.62	0.000	0.000	n/a	1.00	n/a
40	15	1.25	368.75	369.34	0.59	0.39	2.18	0.16	369.50	0.000	24.427	369.01	369.45 j	0.44**	0.39	3.23	0.16	369.61	0.000	0.000	n/a	1.00	0.16
41	18	4.76	368.30	369.34	1.04	1.02	3.63	0.21	369.55	0.299	123.325	368.97	369.81	0.84**	1.02	4.69	0.34	370.15	0.570	0.435	n/a	1.00	n/a
42	15	1.13	365.72	366.26	0.54	0.36	2.24	0.15	366.41	0.000	28.012	366.10	366.52 j	0.42**	0.36	3.14	0.15	366.67	0.000	0.000	n/a	0.50	n/a
43	15	0.40	366.20	366.52	0.32	0.17	1.64	0.04	366.56	0.195	29.509	366.35	366.60 j	0.25**	0.17	2.32	0.08	366.68	0.518	0.356	0.105	1.00	0.08
44	18	1.50	364.85	365.57	0.72	0.46	1.78	0.17	365.74	0.000	24.451	365.10	365.56 j	0.46**	0.46	3.27	0.17	365.73	0.000	0.000	n/a	1.00	0.17

Project File: Outfall #1.stm | Number of lines: 50 | Run Date: 3/3/2025

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

Hydraulic Grade Line Computations

KALAS 5 25-YEAR REPORT

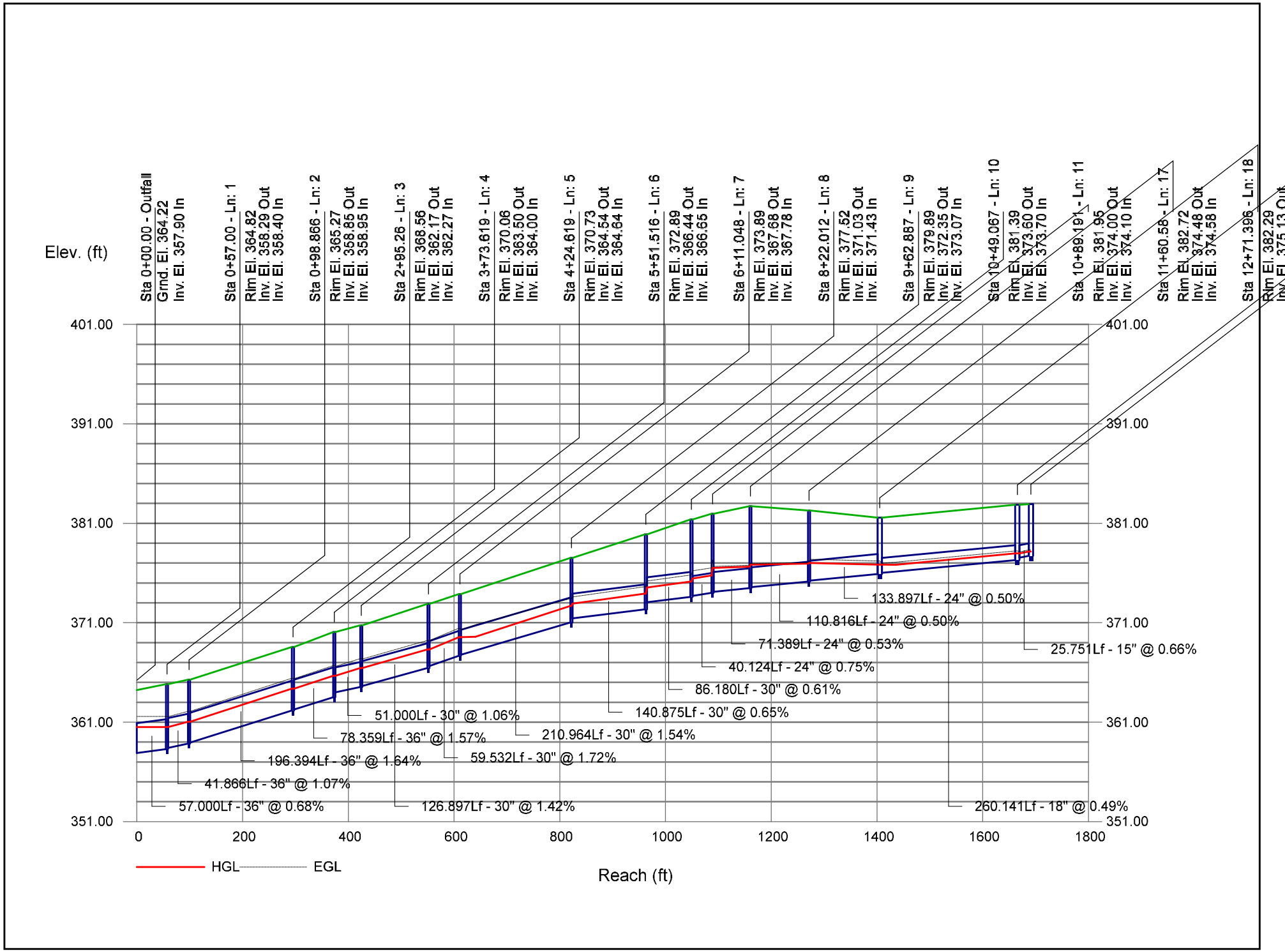
Line	Size	Q	Downstream								Len	Upstream								Check		JL coeff	Minor loss
			Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf		Invert elev	HGL elev	Depth	Area	Vel	Vel head	EGL elev	Sf	Ave Sf	Enrgy loss		
	(in)	(cfs)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(sqft)	(ft/s)	(ft)	(ft)	(%)	(%)	(ft)	(K)	(ft)
45	15	0.88	363.42	364.15	0.73	0.30	1.17	0.13	364.29	0.000	24.503	363.65	364.02	0.37**	0.30	2.92	0.13	364.15	0.000	0.000	n/a	1.00	0.13
46	18	1.14	360.76	361.77	1.01	1.27	0.89	0.01	361.79	0.018	25.748	360.63	361.78	1.15	1.45	0.78	0.01	361.79	0.013	0.016	0.004	1.00	0.01
47	36	13.22	352.90	354.95	2.05	2.51	2.57	0.43	355.38	0.000	38.074	353.09	354.25	1.16**	2.51	5.27	0.43	354.68	0.000	0.000	n/a	0.50	n/a
48	30	9.51	353.19	354.25	1.06	1.90	4.83	0.39	354.63	0.000	98.975	353.69	354.71 j	1.03**	1.90	5.00	0.39	355.10	0.000	0.000	n/a	0.15	n/a
49	30	9.52	353.79	354.78	0.99*	1.80	5.28	0.39	355.17	0.000	48.268	354.03	355.06	1.03**	1.90	5.00	0.39	355.45	0.000	0.000	n/a	0.96	n/a
50	24	9.57	355.35	356.08	0.73*	1.04	9.20	0.45	356.53	0.000	109.030	357.75	358.85	1.10**	1.78	5.38	0.45	359.30	0.000	0.000	n/a	1.00	0.45

Project File: Outfall #1.stm | Number of lines: 50 | Run Date: 3/3/2025

Notes: * depth assumed; ** Critical depth.; j-Line contains hyd. jump ; c = cir e = ellip b = box

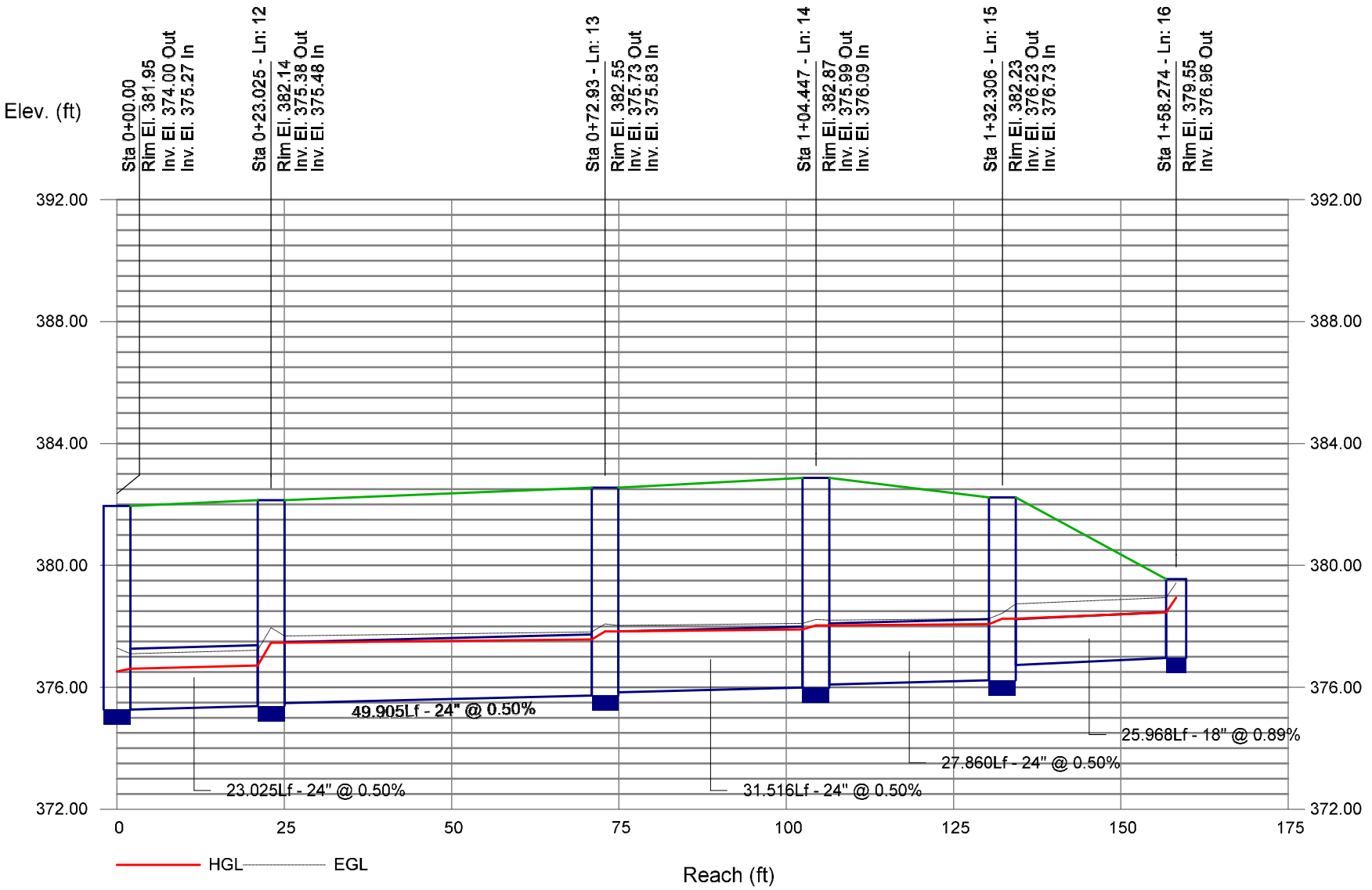
Storm Sewer Profile

25-Year: 1-21 Profile Proj. file: Outfall #1.stm



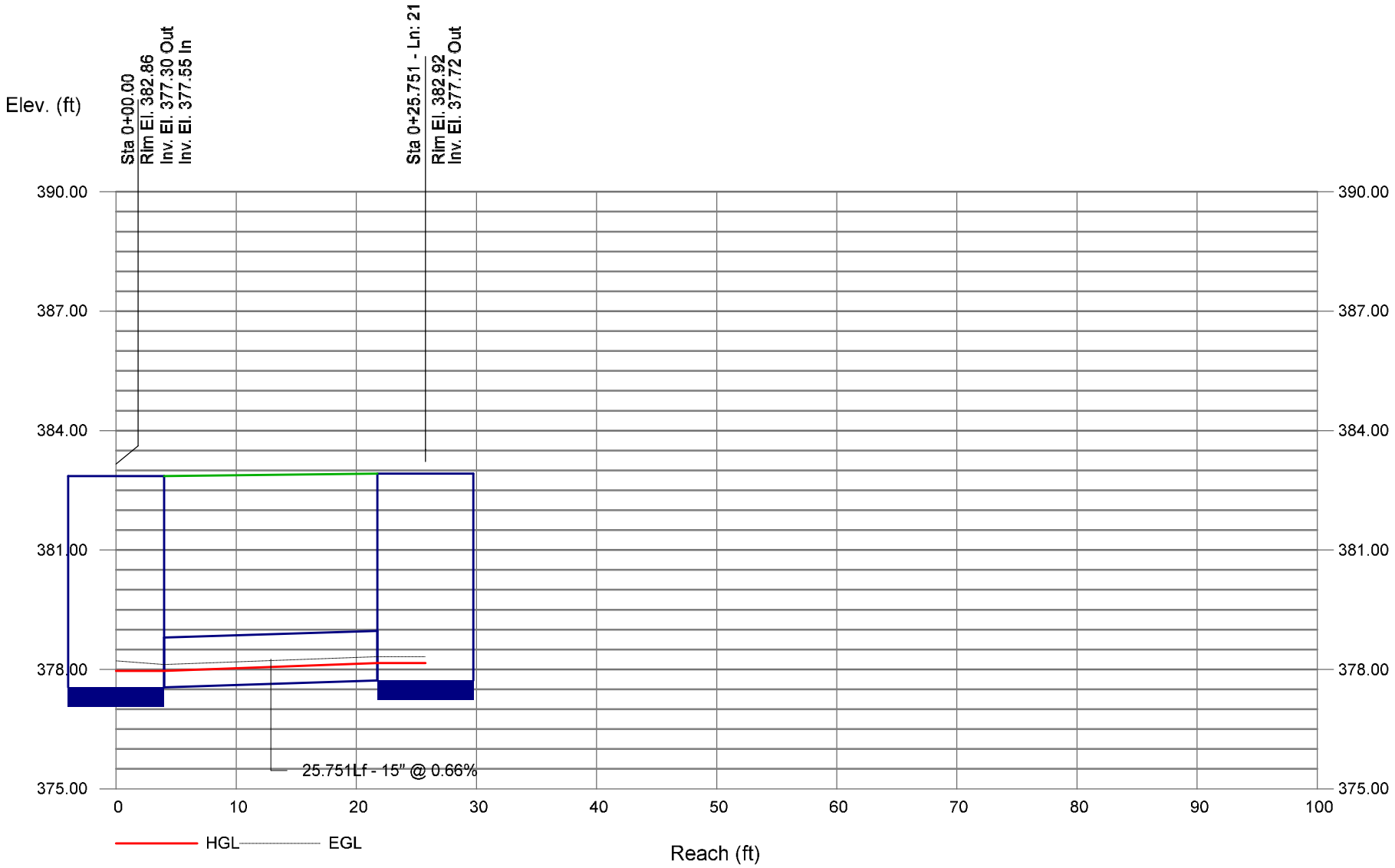
Storm Sewer Profile

25-Year: 12-16 Profile Proj. file: Outfall #1.stm



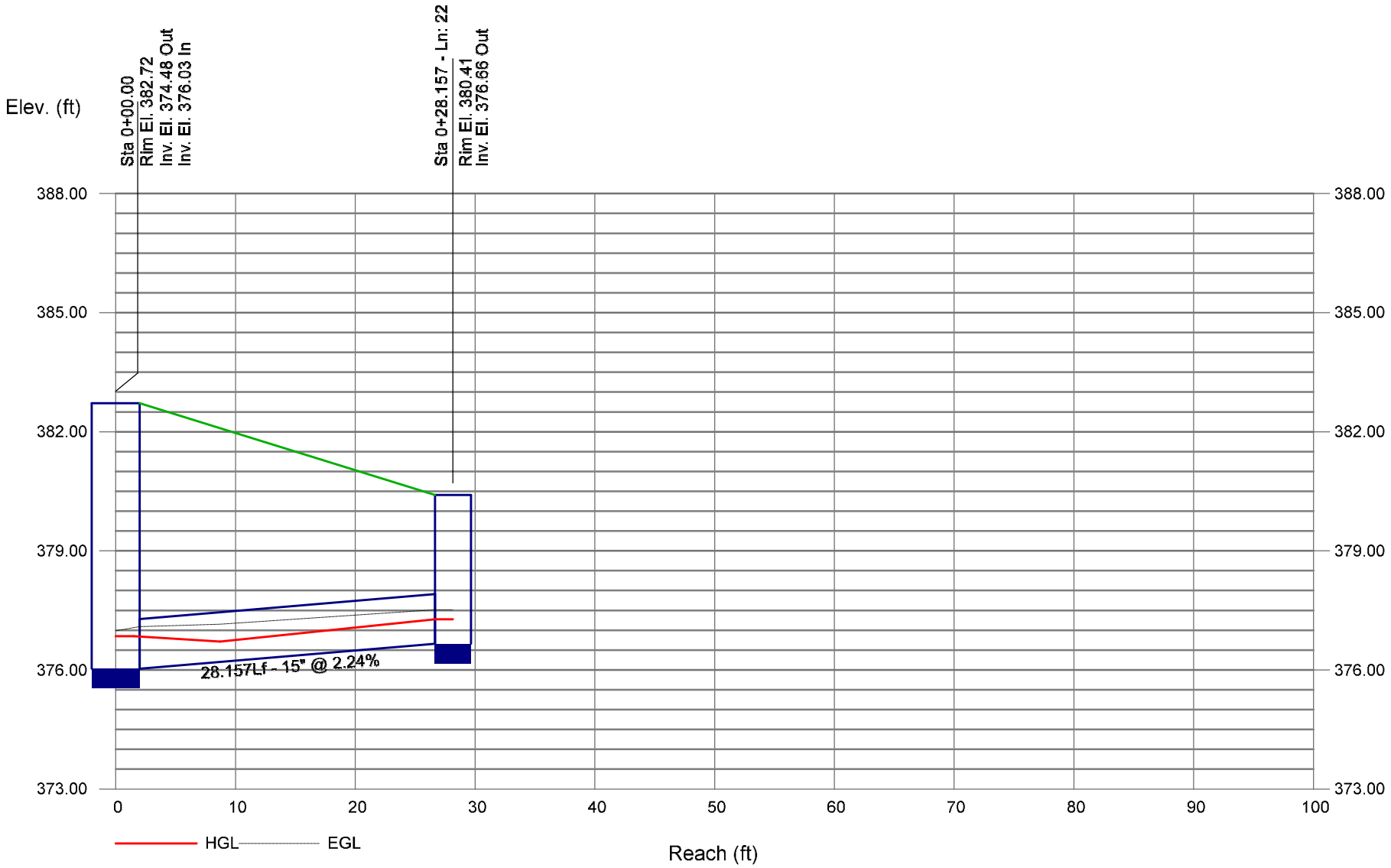
Storm Sewer Profile

25-Year: 21-21 Profile Proj. file: Outfall #1.stm



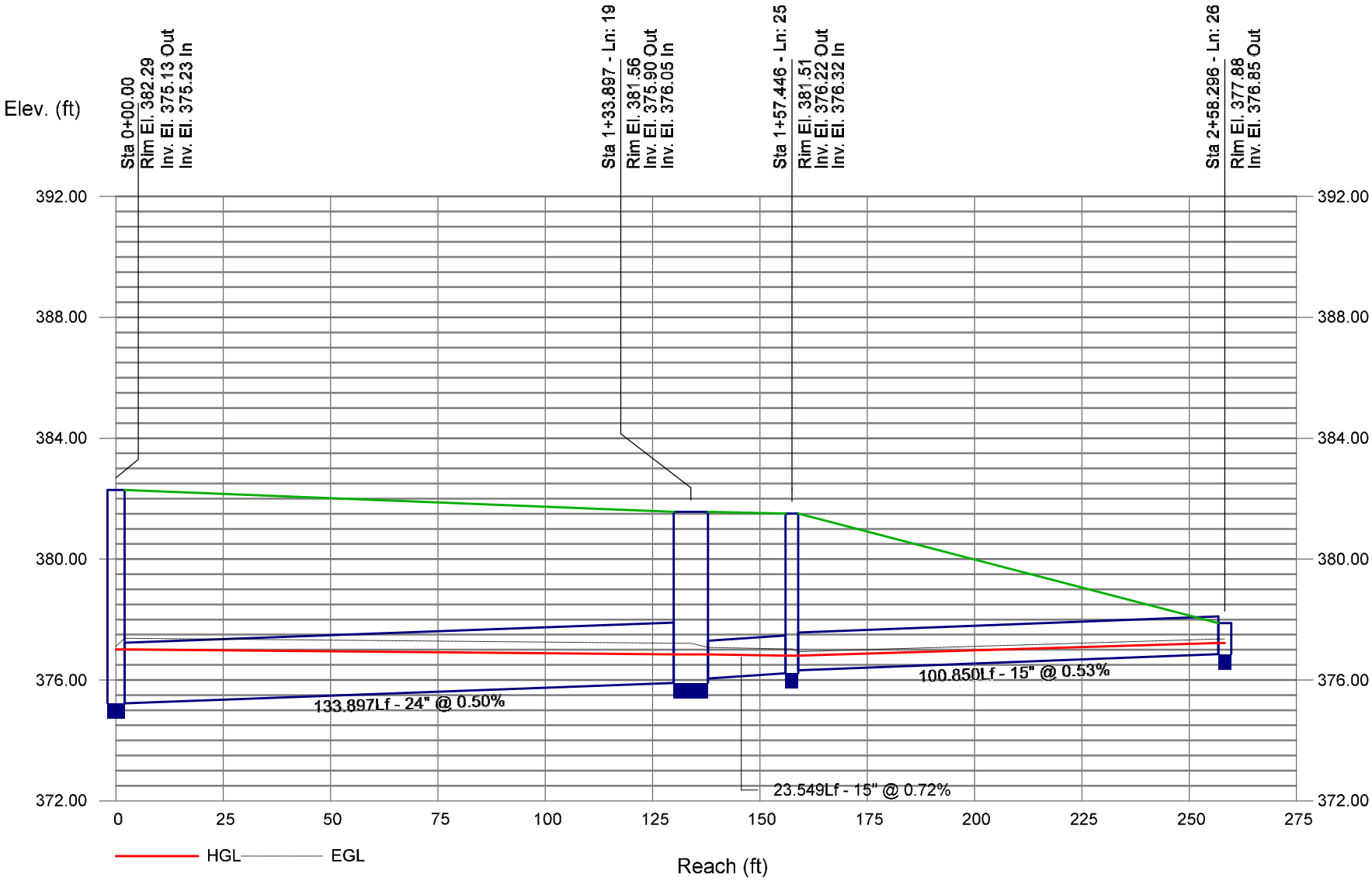
Storm Sewer Profile

25-Year: 22-22 Profile Proj. file: Outfall #1.stm



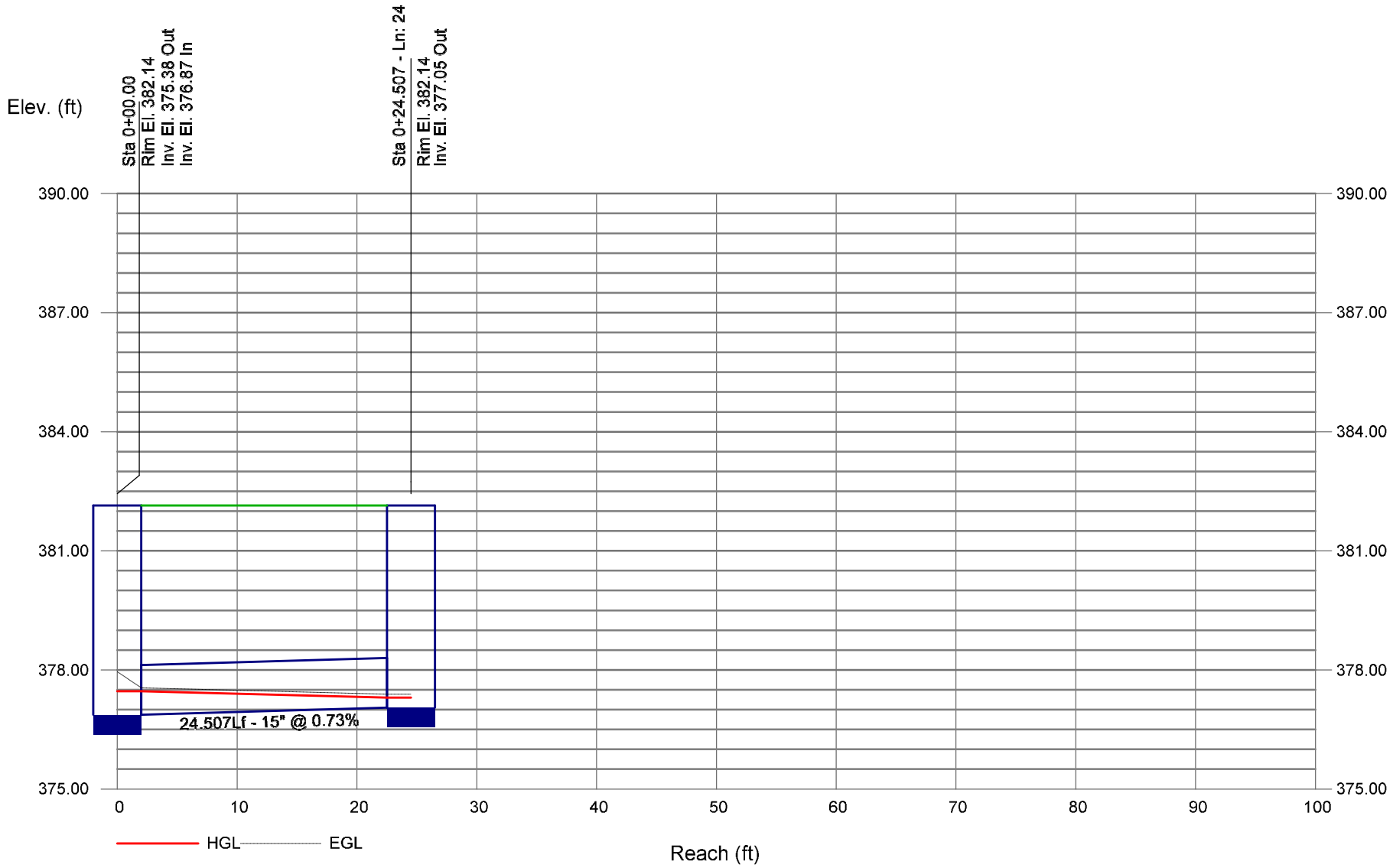
Storm Sewer Profile

25-Year: 23-26 Profile Proj. file: Outfall #1.stm



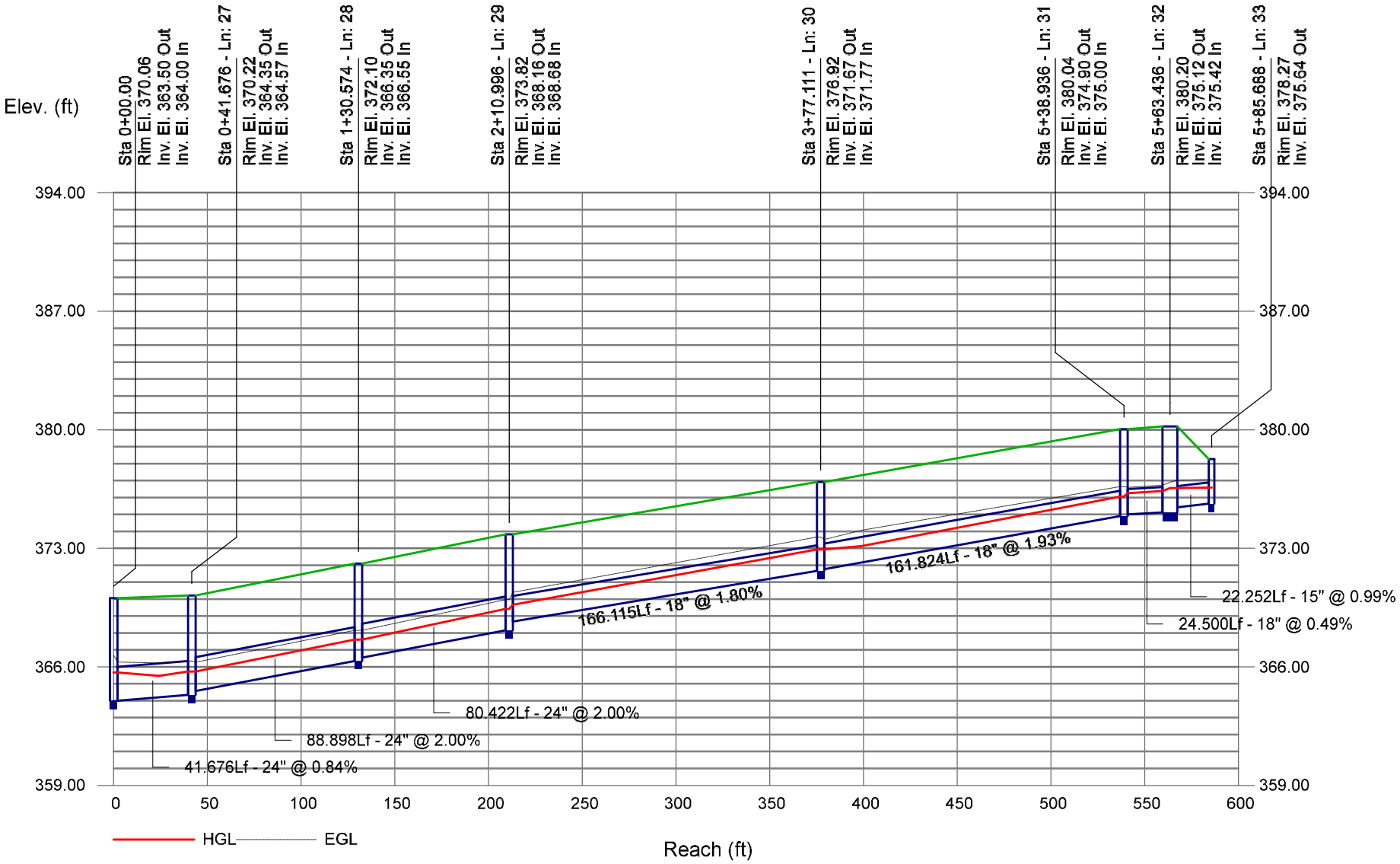
Storm Sewer Profile

25-Year: 24-24 Profile Proj. file: Outfall #1.stm



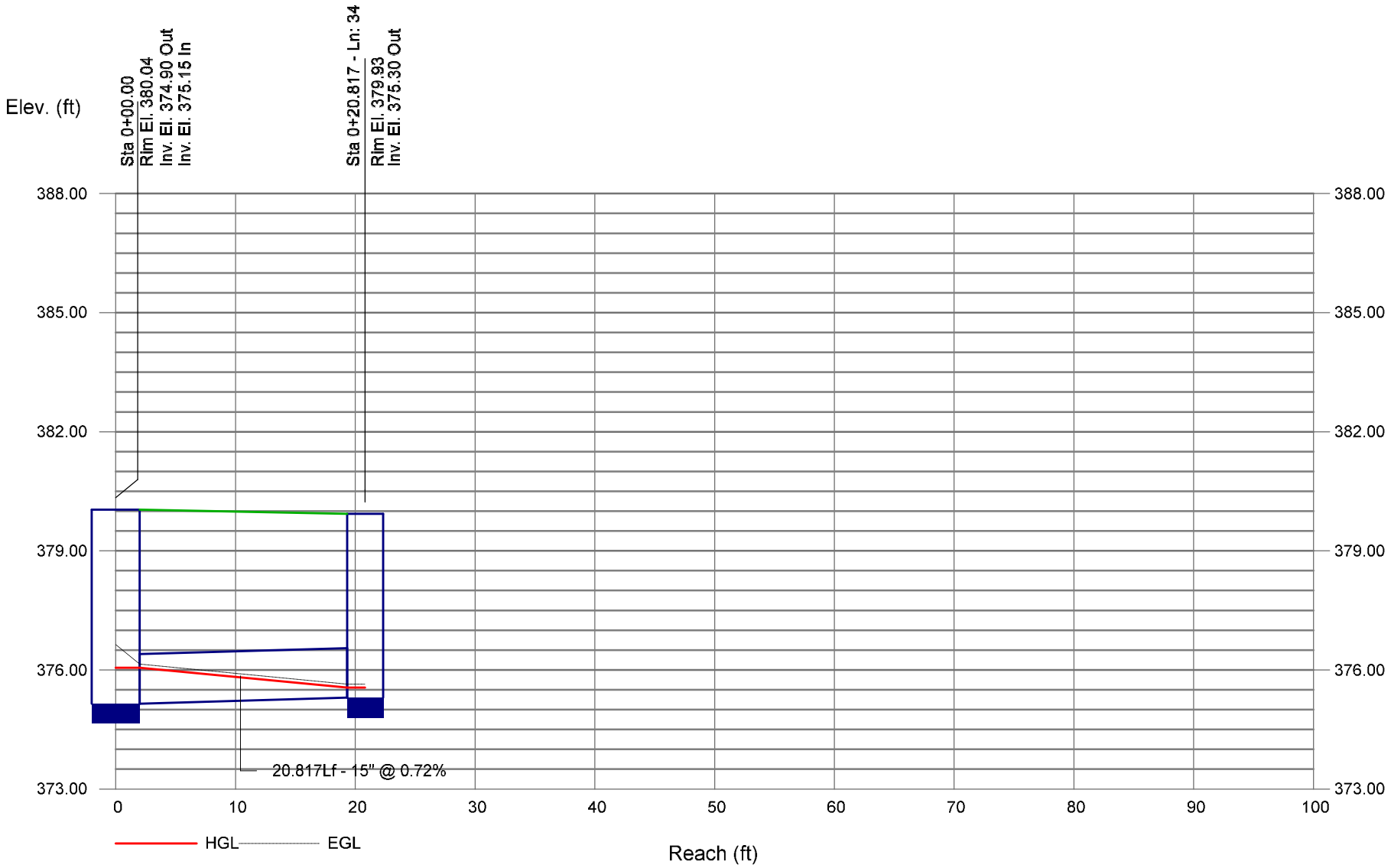
Storm Sewer Profile

25-Year: 27-33 Profile Proj. file: Outfall #1.stm



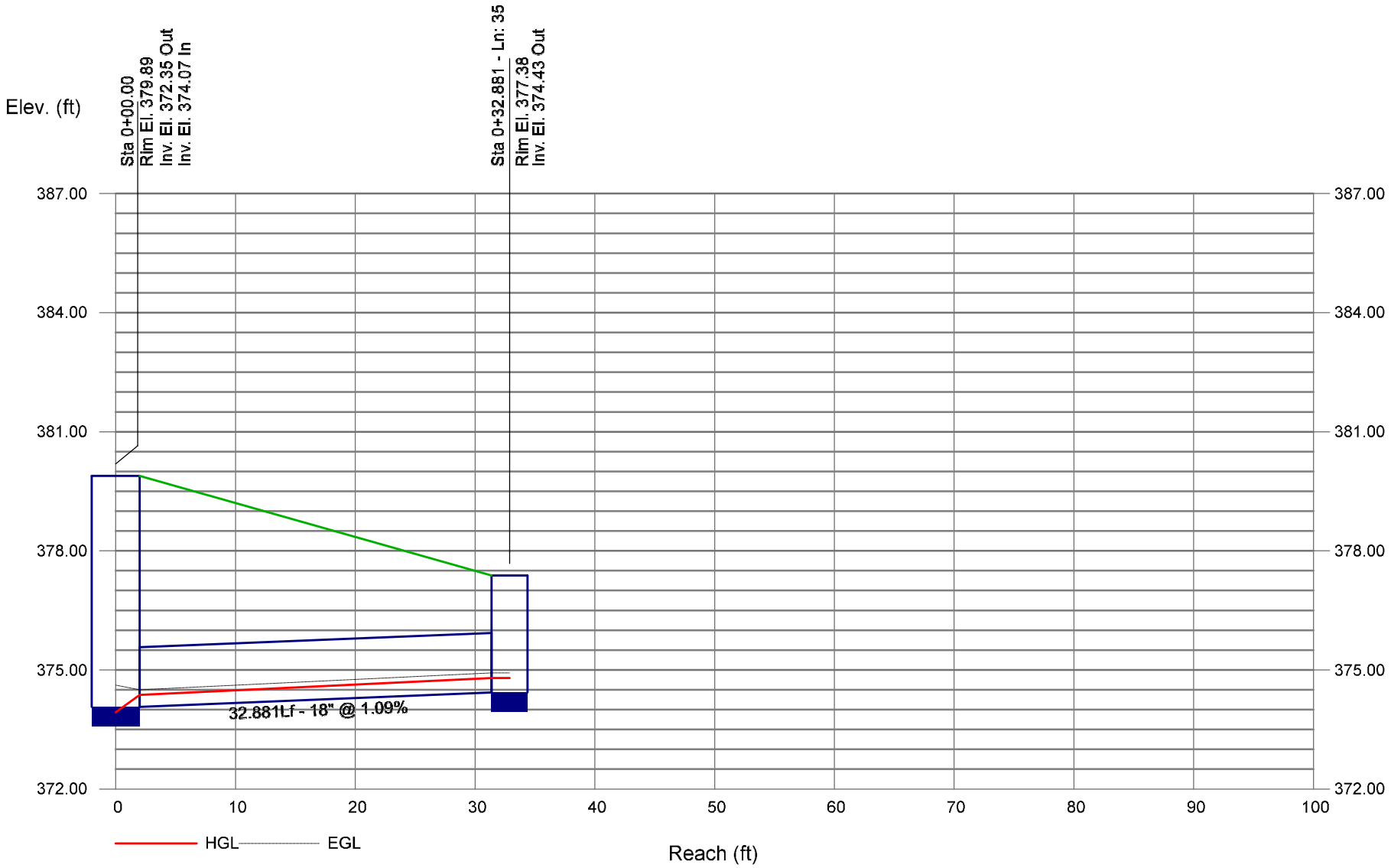
Storm Sewer Profile

25-Year: 34-34 Profile Proj. file: Outfall #1.stm



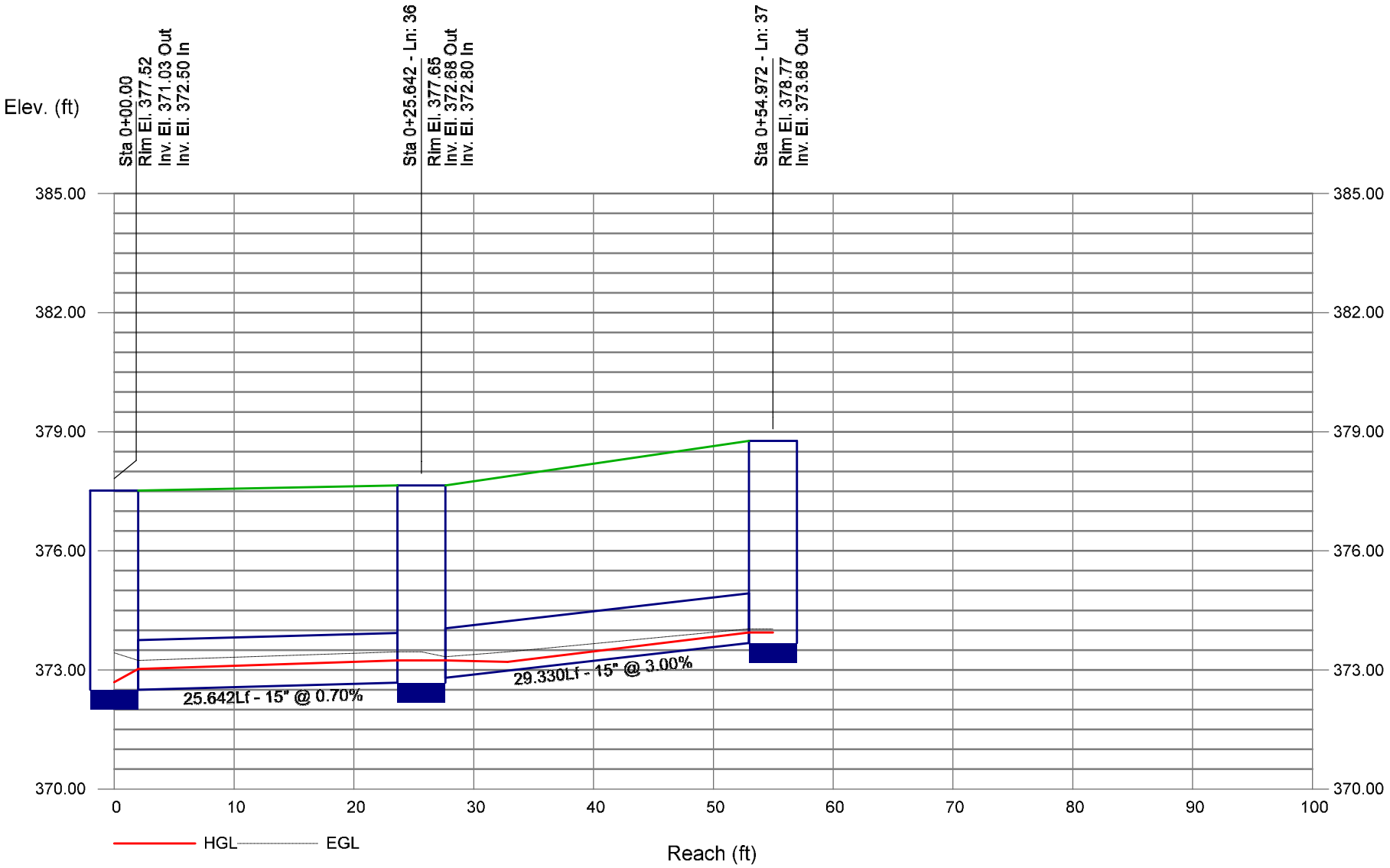
Storm Sewer Profile

25-Year: 35-35 Profile Proj. file: Outfall #1.stm



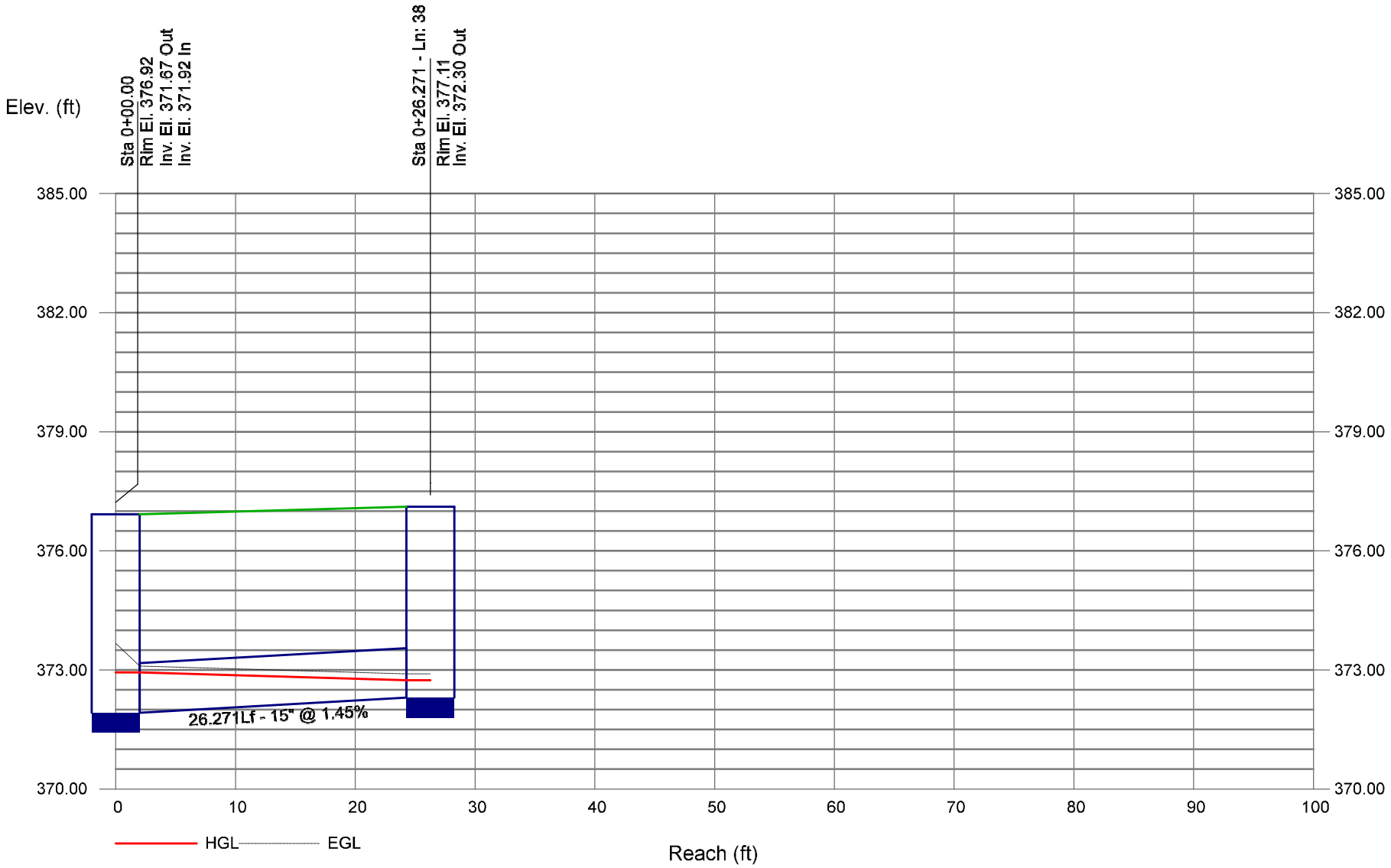
Storm Sewer Profile

25-Year: 36-37 Profile Proj. file: Outfall #1.stm



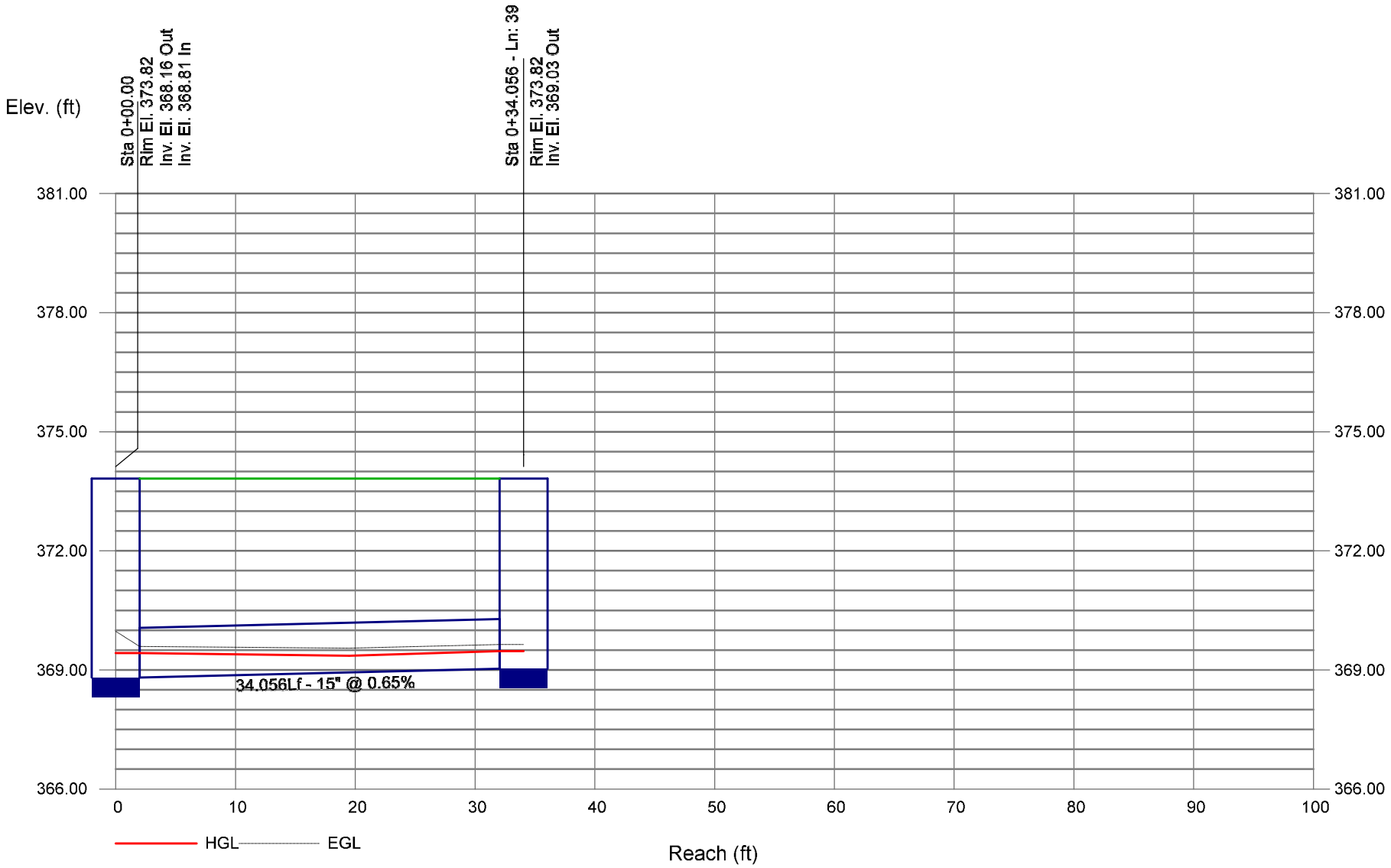
Storm Sewer Profile

25-Year: 38-38 Profile Proj. file: Outfall #1.stm



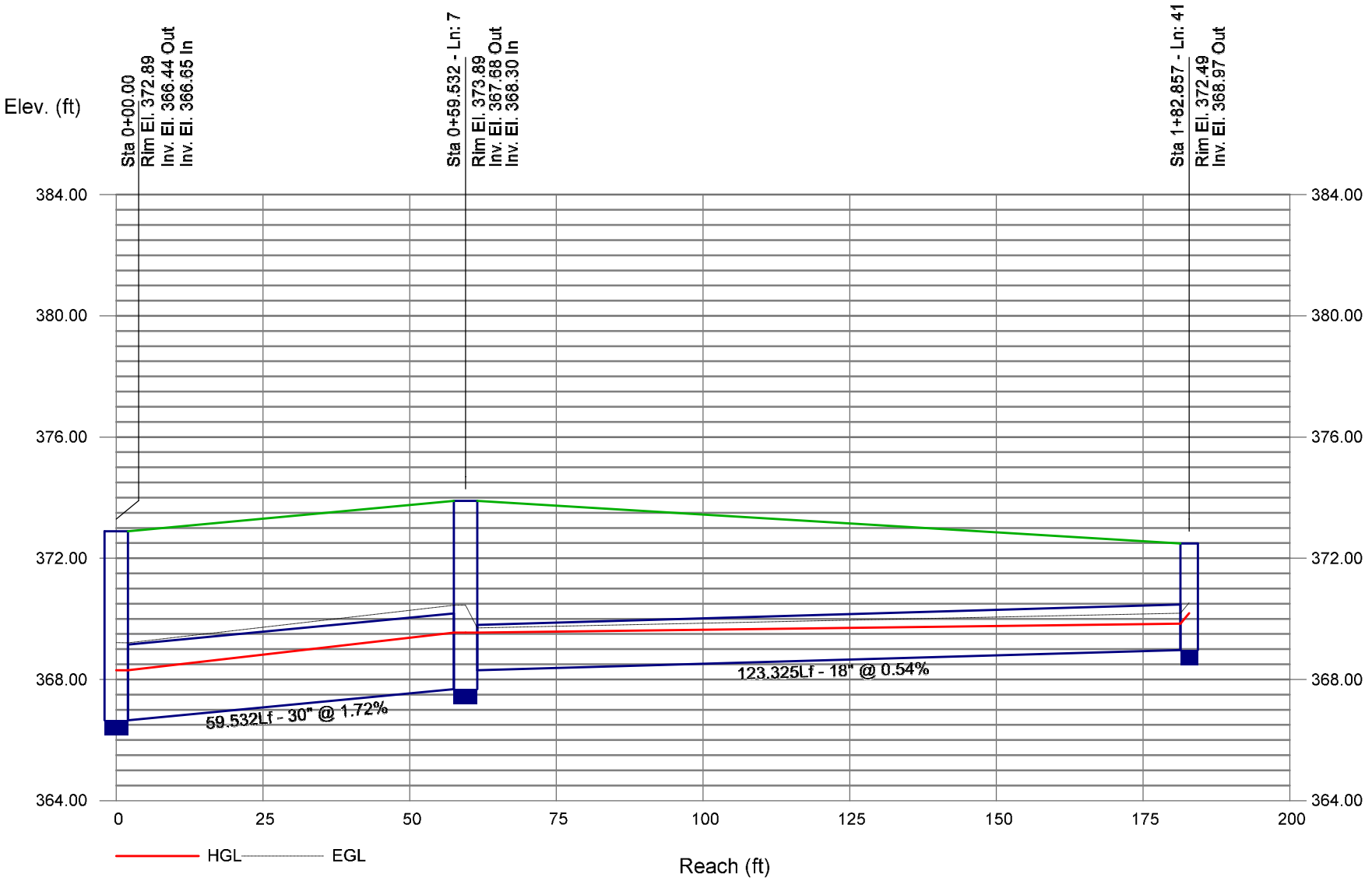
Storm Sewer Profile

25-Year: 39-39 Profile Proj. file: Outfall #1.stm



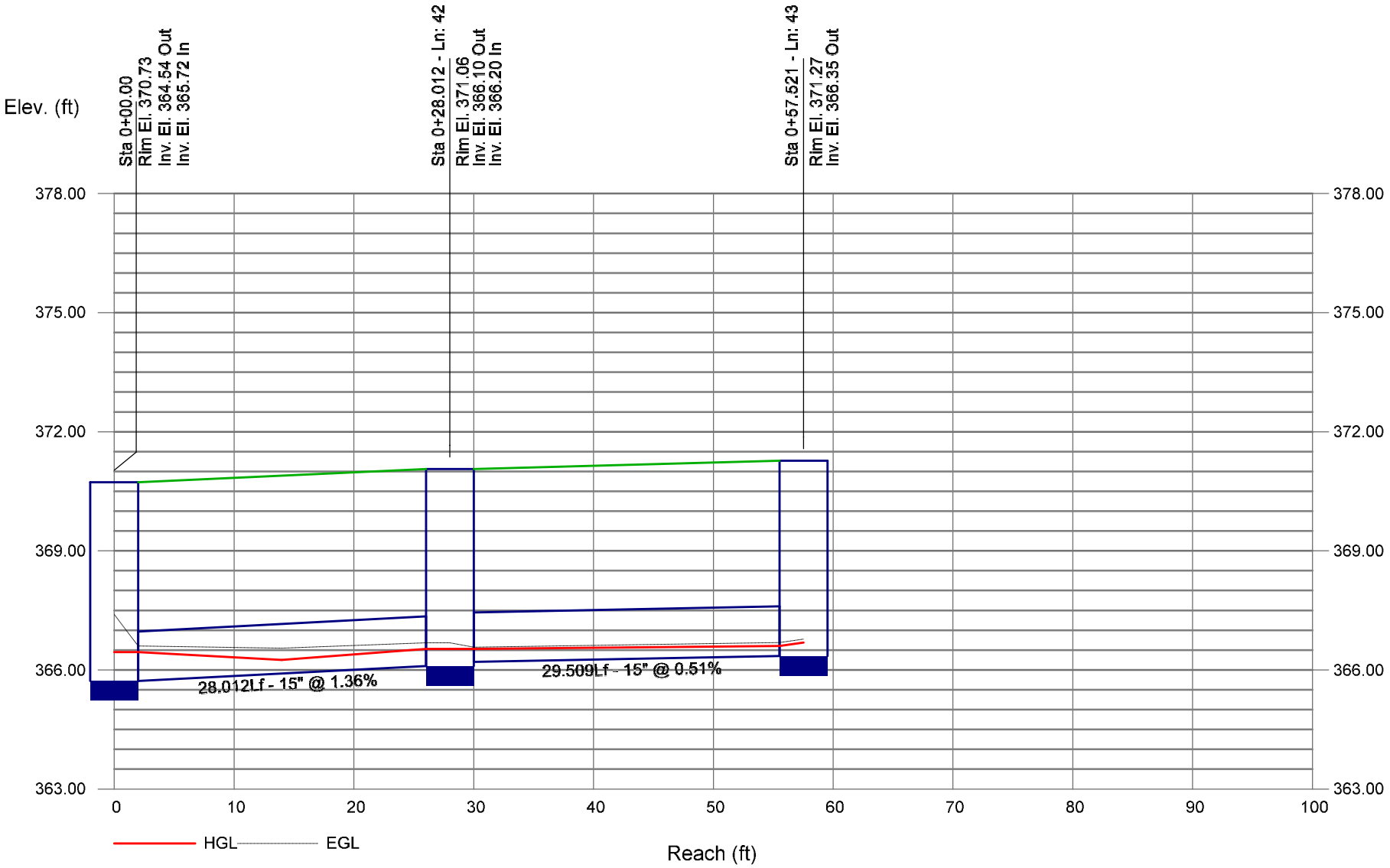
Storm Sewer Profile

25-Year: 40-41 Profile Proj. file: Outfall #1.stm



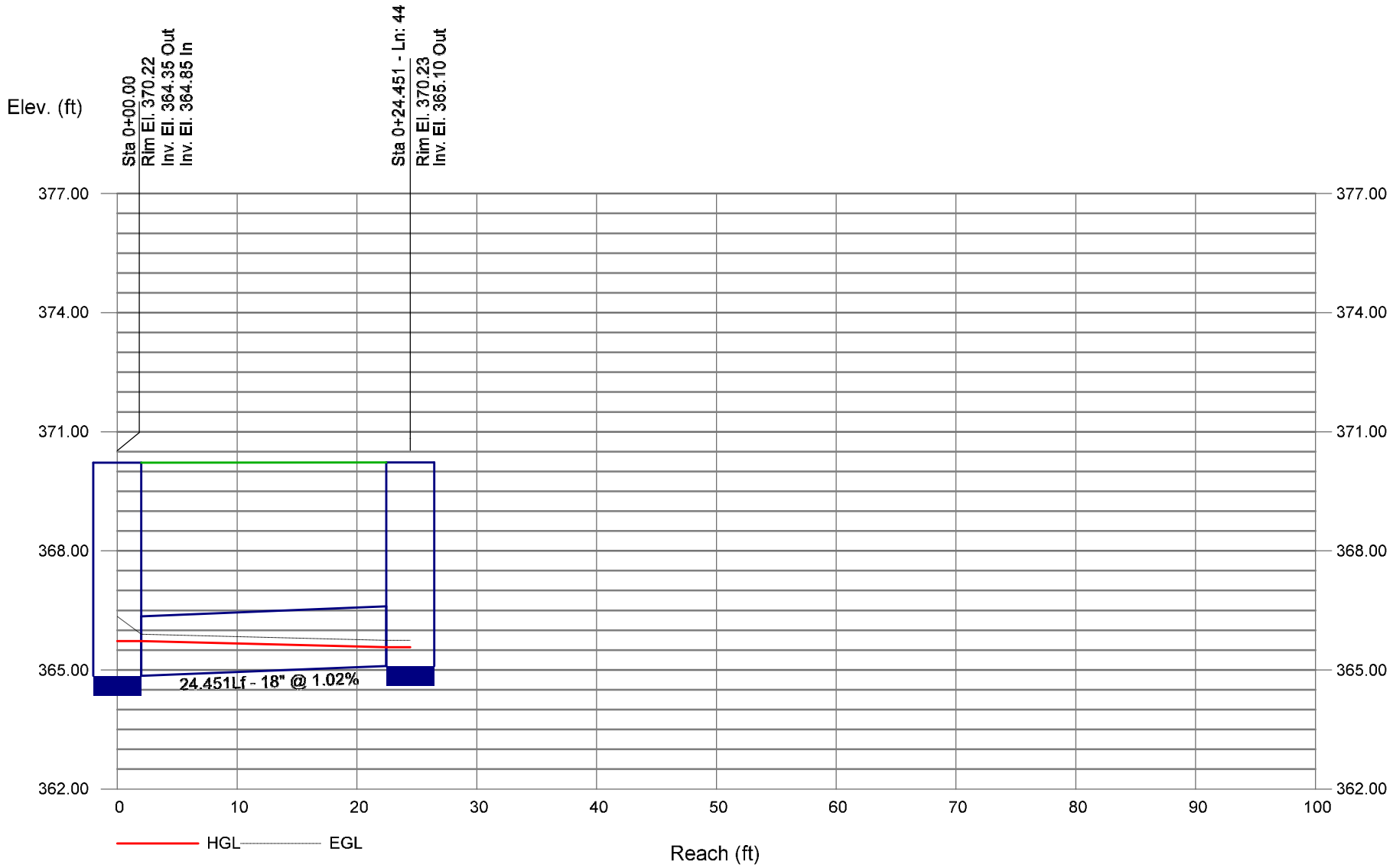
Storm Sewer Profile

25-Year: 42-43 Profile Proj. file: Outfall #1.stm



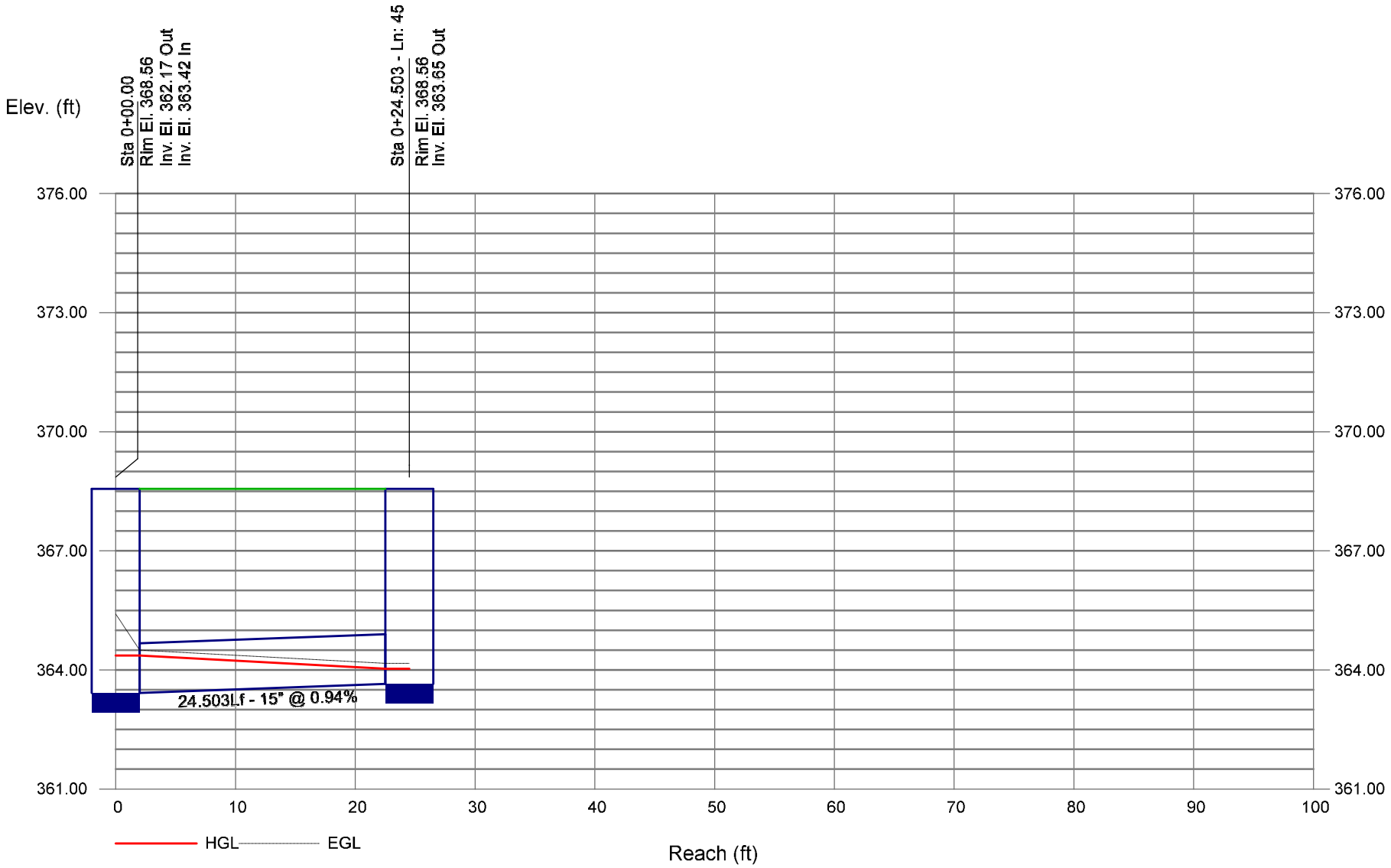
Storm Sewer Profile

25-Year: 44-44 Profile Proj. file: Outfall #1.stm



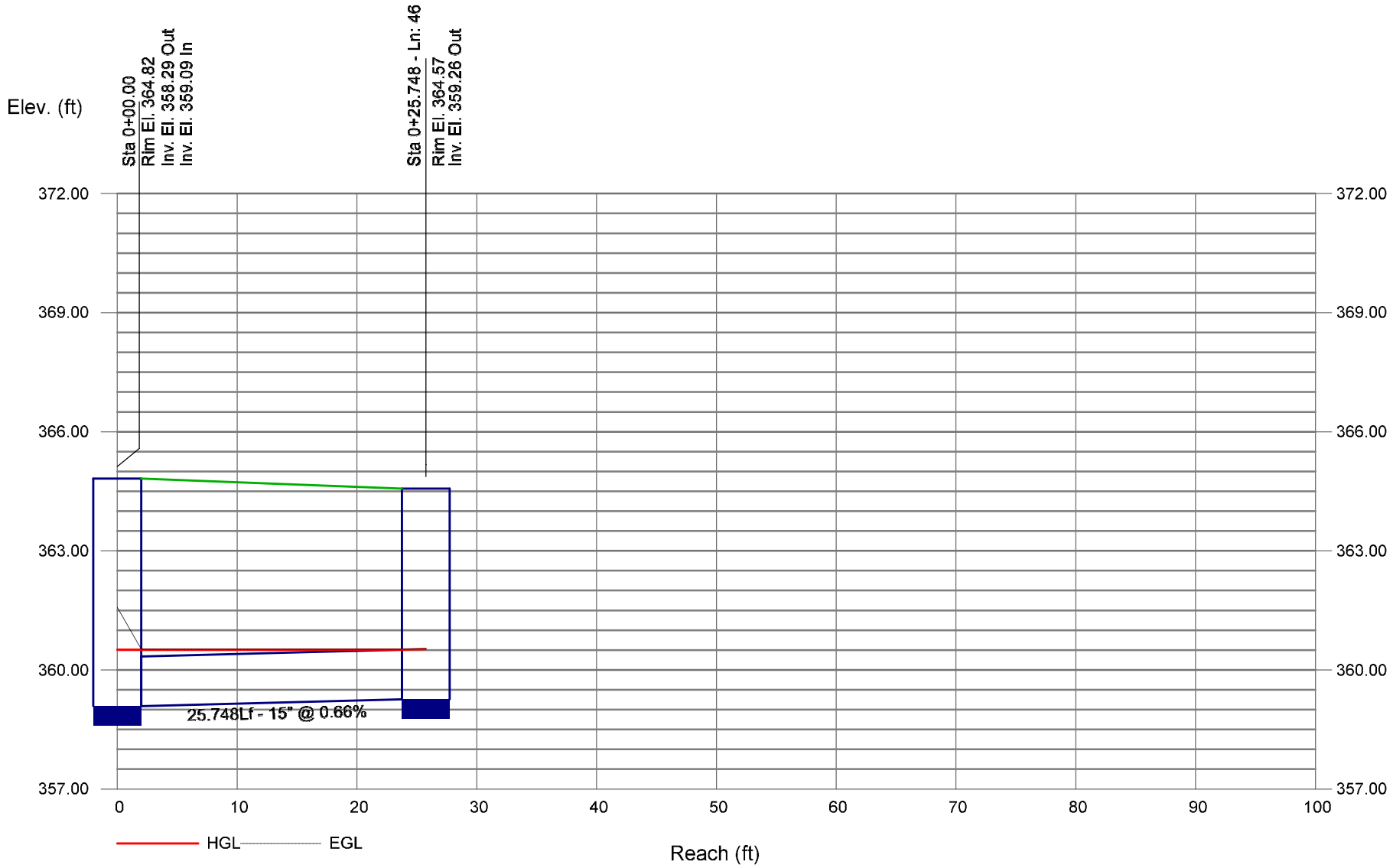
Storm Sewer Profile

25-Year: 45-45 Profile Proj. file: Outfall #1.stm



Storm Sewer Profile

25-Year: 46-46 Profile Proj. file: Outfall #1.stm



Storm Sewer Profile

25-Year: 47-50 Profile Proj. file: Outfall #1.stm