PHASE I DRAINAGE REPORT

MEADOWS MEDICAL PLAZA

A PORTION OF THE MEADOWS FILING NO. 21
(NEW HOPE PRESBYTERIAN CHURCH)

NEC OF MEADOWS PKWY. & RED HAWK DR.
CASTLE ROCK, CO 80109

PREPARED FOR:
DCP Meadows Medical LLC
524 South Tejon St.,
Colorado Springs, CO 80903
Attn: Matt Call & Joe Niebur

PREPARED BY:
Galloway & Company, Inc.
1155 Kelly Johnson Blvd., Ste. 305
Colorado Springs, CO 80920

DATE:
August 13, 2024

ENGINEER'S STATEMENT

I affirm that this report and plan for the Phase I drainage design for Meadows Medical Plaza was prepared by me (or under my direct supervision) in accordance with the provisions of the Town of Castle Rock Drainage Criteria Manual for the owners thereof. I understand that the Town of Castle Rock does not and will not assume liability for drainage facilities designed by others.

Treven June Edwards, PE #60124 Date
For and on behalf of Galloway & Company, Inc.

DEVELOPER'S CERTIFICATION

"DCP Meadows Medical LLC hereby certifies that the drainage facilities for Meadows Medical Plaza shall be constructed according to the design presented in this report. I understand that the Town of Castle Rock does not and will not assume liability for the drainage facilities designed and/or certified by my engineer and that the Town of Castle Rock reviews drainage plans pursuant to the Municipal Code; but cannot, on behalf of Meadows Medical Plaza guarantee that the drainage design review will absolve DCP Meadows Medical LLC and/or their successors and/or assigns of future liability for improper design."

Authorized Signature Date
DCP Meadows Medical LLC

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I. INTRODUCTION

LOCATION

The Meadows Medical Plaza - referred to herein as the 'site' or 'project site' - is generally located at the northeast corner of Meadows Parkway & Red Hawk Drive in Castle Rock, CO. The project site is located within the existing subdivision The Meadows Filing No. 21 (New Hope Presbyterian Church). The site is bordered to the north and east by the existing church building and parking lot; to the south by Red Hawk Dr.; and to the west by Meadows Parkway. The project site is situated in the northwest Quarter of Section 34, Township 7 South, Range 67 West of the 6th Principal Meridian, Town of Castle Rock, County of Douglas, State of Colorado. Refer to Appendix A for a Vicinity Map showing the project location and the surrounding area.

PROPOSED DEVELOPMENT

The project site is currently located within Lot 1, The Meadows Filing No. 21. The proposed development would subdivide the existing Lot 1 into (2) separate lots. The project site would then cover ±1.50 acres of this new subdivision. The proposed improvements include a new medical office building, parking lot expansion, wet/dry utilities and landscaping in common areas.

II. HISTORIC DRAINAGE

OVERALL BASIN DESCRIPTION

The site is located within the 6400 South Tributary per the Town of Caste Rock *Stormwater Master Plan Update,* dated 2017 which outfalls into East Plum Creek.

The site is located outside of the 100-year floodplain per FIRM Map Panel #08035C0169G, effective 03/16/2016. There are no major drainage ways or irrigation facilities located through the site. The development will not affect the floodplain. A copy of the FEMA FIRM Map can be found in **Appendix A** for reference.

Soils can be classified in four different hydrologic groups, A, B, C, or D to help predict stormwater runoff rates. Hydrologic group "A" is characterized by deep, well-drained coarse-grained soils with a rapid infiltration rate when thoroughly wet and having a low runoff potential. Group "D" typically has a clay layer at or near to the surface, or very shallow depth to impervious bedrock and has a very slow infiltration rate and a high runoff potential. According to the Natural Resources Conservation Service (NRCS) Web Soil Survey, the project site consists of a mix of soil types and Hydrologic Soil Groups (HSGs) including:

Table 1 – USDA NRCS Soil Data

Soil Name	HSG	Percent of Site
Bresser Sandy Loam	B	61.9%
Englewood Clay Loam	C	38.1%

The predominant on-site HSG is 'B'. Refer to **Appendix A** for soils information.

SUB-BASIN DESCRIPTION

The project site was included as a part of the *Phase III Drainage Report for The Meadows Filing No. 21 (New Hope Presbyterian Church)* by M.V.E., Inc. dated December 5, 2007. Refer to Appendix A for excerpts from this report that pertain to the proposed development. The project site is a part of Subcatchments PP-MB, which discharges directly to Meadows Pkwy. ROW; and PP-PK, which is conveyed to the northeast and captured/treated within the existing full spectrum EDB (Pond B) in sub catchment PP-PDB.

The proposed basins from this report are being utilized as the existing drainage basins for the new project site as drainage patterns closely reflect those from the original design and will need to be utilized to determine what improvements may need to be provided to the existing EDB Pond B. The remaining drainage basins and patterns that are located outside the scope of the new project are not being revised and were not re-analyzed in this report.

III. DESIGN CRITERIA

DEVELOPMENT CRITERIA REFERENCE

The final drainage design presented herein was prepared in accordance with:

- STORM DRAINAGE DESIGN AND TECHNICAL CRITERIA MANUAL of the *Town of Castle Rock, dated June 2019 (with current revisions)* **[Town DCM];**
- URBAN STORM DRAINAGE CRITERIA MANUAL, of the *Mile High Flood District,* Volumes 1-3, dated March 2024 **[MHFD DCM]**;
- PHASE III DRAINAGE REPORT FOR THE MEADOWS FILING NO. 21 (NEW HOPE PRESBYTERIAN CHURCH), prepared by M.V.E., Inc., dated December 5, 2007 **[Phase III Report**].

HYDROLOGIC CRITIERIA

For urban catchments that are not complex and are generally 160 acres or less in size, it is acceptable that the design storm runoff be analyzed using the Rational Method. The Rational Method is often used when only the peak flow rate or total volume of runoff is needed (e.g., storm sewer sizing or simple detention basin sizing). The Rational Method was used to estimate the peak flow at each design point. For preliminary design, no routing (i.e., time attenuation) calculations were completed; this work will occur at Final Design. When a total flow is reported within this preliminary drainage report, assume it is simply a summation of all upstream flows.

The Rational Method is based on the Rational Formula:

$Q = CiA$

Where:

Q = the maximum rate of runoff, cfs

C = a runoff coefficient that is the ratio between the runoff volume from an area and the average rate of rainfall depth over a given duration for that area

i = average intensity of rainfall in inches per hour for a duration equal to the Time of Concentration (Tc)

A = area, acres

The one-hour rainfall depths for use with the Rational Method of runoff analysis were obtained from the National Oceanic and Atmospheric Administration (NOAA) Atlas 14 for the project site location. A copy of this data is provided in Appendix A for reference.

The 5-year and 100-year storm events are the basis for the preliminary drainage system design. The 5-year storm is considered the minor storm event. It has a twenty percent probability of exceedance during any given year. The 100-year storm is considered the major storm event. It has a one percent probability of exceedance during any given year.

The 5-year drainage system, at a minimum, must be designed to transport runoff from the 5-year recurrence interval storm event with minimal disruption to the urban environment. The 100-year drainage system, as a minimum, must be designed to convey runoff from the 100-year recurrence interval flood to minimize life hazards and health, damage to structures, and interruption to traffic and services.

HYDRAULIC CRITERIA

Street and Inlet Capacity
Street and Inlet capacity are not included in this report and will be analyzed within the future Phase III drainage report.

Storm Sewer
The storm drain system hydraulic analysis was not included in this report and will be analyzed within the future Phase III drainage report.

Drainage Swales
Drainage swale hydraulic analysis was not included in this report and will be analyzed within the future Phase III drainage report.

Detention and Water Quality Storage Facility
The site currently drains to (2) separate stormwater detention and water quality storage facilities; Pond A, located in the northwest corner of the site, within catchment PP-PDA; and Pond B, located in the northeast corner of the site, within catchment PP-PDB. Pond A is outside the scope of the project and was not re-analyzed as part of this report.

Pond B was analyzed using total catchment tributary areas and cumulative imperviousness. These values, along with the project site physical features, were utilized within the MHFD UD-Detention *v4.06* to determine the required storage volume required for Pond B with the proposed new development. These values were then compared to the pond volume requirements within the previously approved Phase III Drainage Report.

Specific hydraulic structures within the EDB were not analyzed with this report. The analysis provided was to determine if additional storage volume is required within Pond B for the proposed addition to the pond tributary area. A subsequent Phase III Drainage Report will be required to provide detailed hydraulic analysis for all proposed improvements.

IV. DRAINAGE PLAN

GENERAL CONCEPT

The overall development was divided into two major basins that receive detention and water quality, PDA and PDB. Various catchments from the original Phase III Drainage Report flow off-site un-treated. The tributary area to PDA is not impacted by the proposed improvements and are not re-analyzed within this report. The proposed improvements are located within catchments PP-MB & PP-PK from the previously analyzed Phase III Drainage Report. The site will ultimately consist of ground covered by pavement, rooftop, and landscaping. The existing full spectrum detention pond B will capture catchments PP-FS, PP-SE, PP-NW, and PP-PDB as previously described in the Phase III Drainage Report prepared by M.V.E., Inc. Revised catchment PP-PK is also tributary to Pond B and described within this report.

Catchment PP-MB has also been re-analyzed within this report and is described below.

SPECIFIC DETAILS

The following is a detailed description of the proposed onsite developed drainage patterns and conveyance facilities. Refer to the Proposed Drainage Map located in **Appendix C** of this report.

Catchment PP-MB (0.69 Ac., Q_5= 1.0 cfs,Q_{100}= 3.0 cfs): This catchment is located along the western boundary of the site, parallel to Meadows Pkwy. Right-of-way. This catchment consists entirely of existing developed area as described in the previous Phase III Drainage Report. This catchment sheet flows off-site, directly into Meadows Pkwy. Right-of-way. The area of this catchment was originally analyzed as 1.47 Ac. and in the proposed condition will decrease by +/- 53%. The difference in area of 0.78 Ac. will be included in the revised **catchment PP-PK** which is described below.

Catchment PP-PK (4.37 Ac., Q_5= 12.8 cfs,Q_{100}= 28.0 cfs): This catchment is located centrally within the overall site. This catchment consists mostly of existing developed area as described in the previous Phase III Drainage Report; however, will also include in the addition of a proposed medical office building, additional parking area, and associated landscaping. This catchment sheet flows north, to an existing private 15’ CDOT Type ‘R’ Inlet (in Sump condition) within the parking lot. The area of this catchment was originally analyzed as 3.59 Ac. and in the proposed condition will increase by +/- 22%.

STORMWATER CONVEYANCE FACILITIES

Runoff from the project site will be conveyed through the site via overland flow to curb and gutter and swales. It is currently proposed that the proposed improvements will sheet flow to the existing 15’ CDOT Type ‘R’ Inlet located at the north end of the existing parking lot. Additional hydraulic analysis will be provided with a Phase III Drainage Report once grading design has been completed for the proposed improvements.

STORMWATER STORAGE FACILITIES

The existing full spectrum detention facility Pond B was designed to provide WQ, EURV, and 100-year detention for the tributary catchments PP-FS, PP-SE, PP-NW, PP-PK, and PP-PDB. Due to an increase in catchment PP-PK with the proposed improvements, Pond B was re-analyzed to determine

what increase in storage volume is required. A table is provided below showing a comparison to the original pond design requirements with the new requirements:

POND B COMPARISON TABLE		
	*EXISTING	PROPOSED
Tributary Area	7.82 Ac.	8.60 Ac.
% Impervious	53.0%	54.9%
WQ Volume	0.169 Ac-Ft	0.158 Ac-Ft
EURV Volume	-	0.351 Ac-Ft
100-YR Volume	0.762 Ac-Ft	0.380 Ac-Ft
Total Volume	0.931 Ac-Ft	0.899 Ac-Ft

*Values taken from "The Meadows Filing No. 21 (New Hope Presbyterian Church) - Phase III Drainage Report," Prepared by M.V.E., Inc., Dated December 5, 2007

Calculations for Pond B from the Phase III Drainage Report by M.V.E., Inc. can be found in **Appendix A**. Calculations for the revised tributary area to Pond B can be found in **Appendix B**.

From the volume analysis, the existing Pond B design has sufficient storage capacity for the proposed improvements. However, the existing pond does not meet current Town design criteria and will need to be brought up to current standards. This will include ensuring forebays, trickle channels, and micropool have sufficient volume. Additionally, a maintenance access road was not provided and will need to be added per the Town drainage criteria. Detail design of these elements will be included in a future Phase III Drainage Report, along with analysis of the existing outlet structure.

V. CONCLUSIONS

COMPLIANCE WITH STANDARDS

The design presented in this Phase I Drainage Report for Meadows Medical Plaza has been prepared in accordance with the design standards and guidelines presented in STORM DRAINAGE DESIGN AND TECHNICAL CRITERIA MANUAL of the *Town of Castle Rock,* and the URBAN STORM DRAINAGE CRITERIA MANUAL, of the *Mile High Flood District,* Volumes 1-3.

VARIANCES

No variance(s) requested at this time.

VI. REFERENCES

1. STORM DRAINAGE DESIGN AND TECHNICAL CRITERIA MANUAL of the *Town of Castle Rock, dated June 2019 (with current revisions)*

2. URBAN STORM DRAINAGE CRITERIA MANUAL, of the *Mile High Flood District,* Volumes 1-3, dated March 2024

3. PHASE III DRAINAGE REPORT FOR THE MEADOWS FILING NO. 21 (NEW HOPE PRESBYTERIAN CHURCH), prepared by M.V.E., Inc., dated December 5, 2007

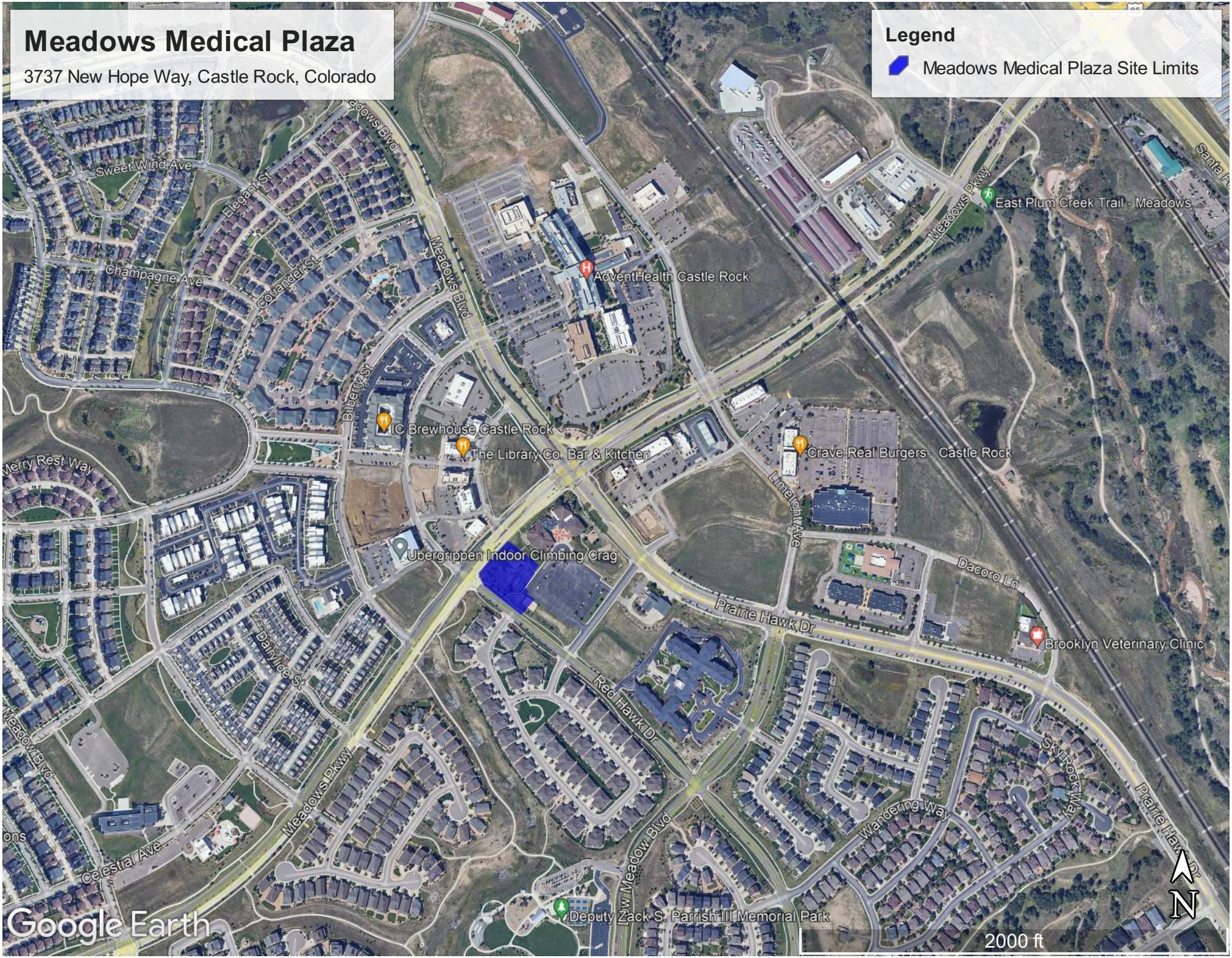
4. Flood Insurance Rate Map – Douglas County, Colorado and Incorporated Areas Community Panel No. 08035C0169G, Effective March 16, 2016.

5. Soil Map – Douglas County Area, Colorado as available through the Natural Resources Conservation Service National Cooperative Soil Survey web site via Web Soil Survey 2.0.

VII. Appendices

APPENDIX A

Exhibits, Figures & Reference Data


Meadows Medical Plaza
3737 New Hope Way, Castle Rock, Colorado
Legend
Meadows Medical Plaza Site Limits
Sweet Wind Ave
Elegant St
Champagne Ave
Coriander St
Meadows Blvd
Liberty St
AdventHealth Castle Rock
East Plum Creek Trail - Meadows
Meadows Pkwy
IC Brewhouse Castle Rock
The Library Co. Bar & Kitchen
Crave Real Burgers - Castle Rock
Lime Light Ave
Ubergrippen Indoor Climbing Crag
Dacoro Ln
Prairie Hawk Dr
Brooklyn Veterinary Clinic
Red Hawk Dr
Dairyvale St
Meadow Blvd
Celestial Ave
Sw Meadow Blvd
Wandering Way
Sky Rock Way
Deputy Zack S. Parrish III Memorial Park
Google Earth
N
2000 ft

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables shown on this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Floodway Data table shown on this FIRM.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 13. The **horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was provided by the Douglas County GIS Department and the Town of Castle Rock GIS Department. Additional input was provided by the City of Lone Tree and Town of Parker. These data are current as of 2010.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **profile baselines** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the **profile baseline**, in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

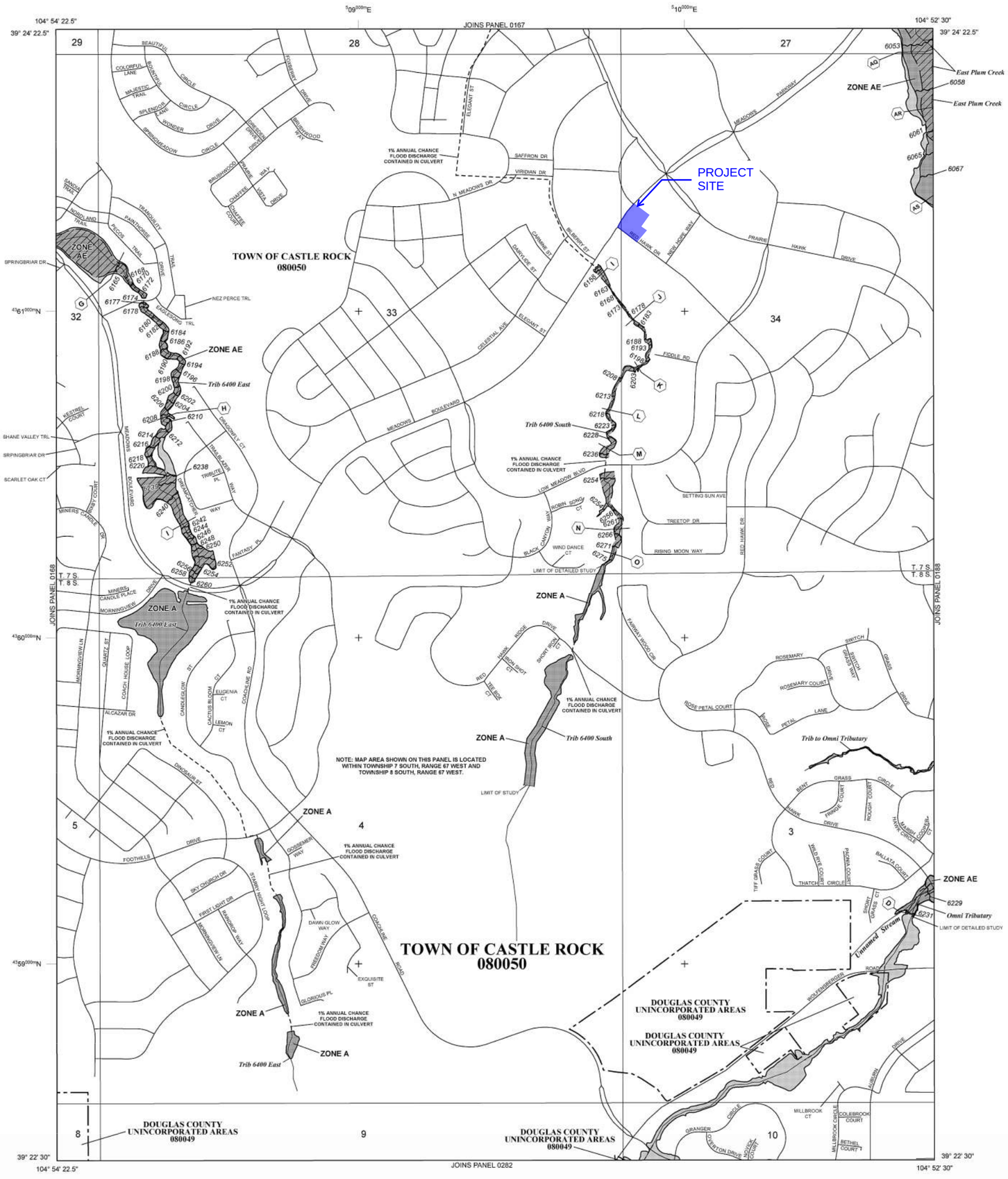
Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables for multiple streams in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on the map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map,** how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	1% Annual Chance Floodplain Boundary
	0.2% Annual Chance Floodplain Boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

A A	Cross section line
23 23	Transect line
45° 02' 08", 93° 02' 12"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
4389000mN	1000-meter Universal Transverse Mercator grid values, zone 13
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
M1.5	River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP

SEPTEMBER 30, 2005

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

MARCH 16, 2016: to update corporate limits, to change base flood elevations, to add base flood elevations, to add special flood hazard areas, to update map format, to add roads and road names, to reflect updated topographic information, to incorporate previously issued letters of map revision.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

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

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0169G

FIRM

FLOOD INSURANCE RATE MAP

DOUGLAS COUNTY, COLORADO AND INCORPORATED AREAS

PANEL 169 OF 495
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
CASTLE ROCK, TOWN OF	080050	0169	G
DOUGLAS COUNTY	080049	0169	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
08035C0169G
MAP REVISED
MARCH 16, 2016

Federal Emergency Management Agency

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Castle Rock Area, Colorado

August 8, 2024

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination, write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.

Contents

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map

Map Scale: 1:2,010 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 13N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Castle Rock Area, Colorado
Survey Area Data: Version 16, Aug 24, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 1, 2023—Sep 1, 2023

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BrB	Bresser sandy loam, cool, 1 to 3 percent slopes	5.7	61.9%
En	Englewood clay loam	3.5	38.1%
Totals for Area of Interest		**9.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Castle Rock Area, Colorado

BrB—Bresser sandy loam, cool, 1 to 3 percent slopes

Map Unit Setting

National map unit symbol: 2tlpj
Elevation: 5,500 to 6,500 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 100 to 130 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Bresser, cool, and similar soils: 90 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Bresser, Cool

Setting

Landform: Hillslopes, terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Tertiary aged alluvium derived from arkose

Typical profile

Ap - 0 to 5 inches: sandy loam
Bt1 - 5 to 8 inches: sandy loam
Bt2 - 8 to 27 inches: sandy clay loam
Bt3 - 27 to 36 inches: sandy loam
C - 36 to 80 inches: loamy coarse sand

Properties and qualities

Slope: 1 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 5 percent
Maximum salinity: Nonsaline to very slightly saline (0.1 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: Low (about 5.4 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 4s
Hydrologic Soil Group: B
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Minor Components

Truckton

Percent of map unit: 5 percent
Landform: Hillslopes, terraces
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R049XB210CO - Sandy Foothill
Hydric soil rating: No

Sampson

Percent of map unit: 5 percent
Landform: Terraces, alluvial fans
Landform position (two-dimensional): Toeslope
Landform position (three-dimensional): Base slope, tread
Down-slope shape: Linear
Across-slope shape: Linear
Ecological site: R049XC202CO - Loamy Foothill 14-19 PZ
Hydric soil rating: No

En—Englewood clay loam

Map Unit Setting

National map unit symbol: jqym
Elevation: 5,500 to 6,600 feet
Mean annual precipitation: 15 to 19 inches
Mean annual air temperature: 47 to 52 degrees F
Frost-free period: 120 to 135 days
Farmland classification: Prime farmland if irrigated

Map Unit Composition

Englewood and similar soils: 80 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Englewood

Setting

Landform: Terraces, swales
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Weathered from alluvium derived from sedimentary rock

Typical profile

H1 - 0 to 10 inches: clay loam
H2 - 10 to 29 inches: clay
H3 - 29 to 60 inches: clay

Properties and qualities

Slope: 1 to 4 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Available water supply, 0 to 60 inches: High (about 9.7 inches)

Interpretive groups

Land capability classification (irrigated): 2e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: R049XB208CO - Clayey Foothill
Hydric soil rating: No

Minor Components

Sampson

Percent of map unit: 10 percent
Hydric soil rating: No

Satanta

Percent of map unit: 9 percent
Hydric soil rating: No

Fluvaquentic haplustolls

Percent of map unit: 1 percent
Landform: Terraces
Hydric soil rating: Yes

EXCERPTS FROM EXISTING REPORT

PHASE III DRAINAGE REPORT
FOR
THE MEADOWS FILING NO. 21
(NEW HOPE PRESBYTERIAN CHURCH)
CASTLE ROCK, COLORADO
(PWP 07-013)

PREPARED FOR:

New Hope Presbyterian Church
2100 W. Meadows Parkway
Castle Rock, CO 80104
(303) 660-0057

PREPARED BY:

M.V.E., Inc.
1903 Lelaray Street, Suite 200
Colorado Springs, CO 80909
(719) 635-5736

December 5, 2007
Project No. 60790

PROJECT: New Hope Presbyterian Church
DATE: December 5, 2007

I. ENGINEER'S STATEMENT:

The enclosed drainage report, and exhibits, were prepared by me, or under my direct supervision, and are correct to the best of my knowledge and belief. Said drainage report has bee prepared in accordance with applicable Town of Castle Rock criteria and is in conformance with the master plan of drainage for the effected area. I accept responsibility for any liability caused by negligent acts, errors or omissions on my part in preparing this report.

12/11/07

David R. Gorman, P.E. Colorado Registration No. 31672
MVE, Inc.

II. OWNER/DEVELOPER'S STATEMENT:

As Owner/Developer of land(s) identified within this report, I agree to proceed, implement and comply with all recommendations and requirements outlined herein.

Chris Hudson
New Hope Presbyterian Church

III. TOWN OF CASTLE ROCK APPROVALS:

R Kuhl
ENGINEERING DIVISION

12/19/07
DATE

ACCEPTED

DEVELOPMENT SERVICES DIRECTOR

DATE

DATE 12/19/07

drain inlets are included in Appendix C. Prints of result obtained with these calculators for pond outlet structure are included in Appendix D. All calculations of storm drain capacities, hydraulic grade lines (HGL) and energy grade lines (EGL) were performed using the Haestad Methods software package StormCAD v5.5. Prints of results obtained with this package, including profiles of storm drains with HGLs and EGLs are included in Appendix C.

III-E Variances from Criteria

No variances from the drainage criteria outlined in the DCM and PWR are requested as part of this drainage report.

IV DRAINAGE FACILITY DESIGN

IV-A General Concept

As a result of the proposed redevelopment of the **church site** and **fire station property**, the onsite drainage patterns will change significantly, but the changes will result in an improvement of the drainage patterns of runoff leaving the site.

As described in the above Section II-B, most of the surrounding offsite properties do not, and will not with development, drain onto the **church site** or **fire station property**. The small area of offsite land that does drain onto the **church site** or **fire station property** is included in the drainage design for the redevelopment of the site. The drainage patterns of upstream properties will not be negatively impacted by the redevelopment of the site.

As described in the above Section II-B, virtually all runoff originating on or flowing through the **church site** and the **fire station property** under existing conditions flows into the gutters of Meadows Boulevard or Prairie Hawk Drive. The drainage performance of these two roads will be improved by the redevelopment of the site through the significant reduction of area draining to the two roads. All runoff originating on or flowing through the **church site** and the **fire station property** under redeveloped conditions will, however, continue to enter the Meadows Boulevard storm drain system and drain to 6400 South Tributary. The downstream drainage patterns will not be significantly altered or negatively impacted by the redevelopment of the site.

The redeveloped site will drain generally north on slopes of 2% to 10% with some areas as steep as 3:1. The existing fire station detention pond will be removed and the portion of the **fire station property** that now drains into that pond will be directed into a proposed detention pond (**Pond B**) to be located near the east corner of the **church site**. Most of the **church site** will also drain into the proposed detention **Pond B**. The existing **church site** detention **Pond A** will remain and continue to function, but the area and volume of the existing detention **Pond A** will be reduced as a result of the construction of a portion of the proposed future church building expansion in part of the existing pond area. However, the area draining into the existing detention **Pond A** will also be significantly reduced. The outlets for both the existing **church site** detention **Pond A** and the proposed **church site** detention **Pond B** will be connected directly to the existing Meadows Boulevard storm drain system. A public access road, New Hope Way,

The basin will drain northeast to the existing roadside ditch and/or gutter on the southwest side of Prairie Hawk Drive and then northwest to **Design Point PPDP-MBPH**, described below. Post-redevelopment flow rates will be significantly lower than the existing flow rates. All runoff leaving the basin and entering the adjacent gutter will cross an irrigated turf grass strip with adequate width to provide grass buffer (GB) stormwater quality management. A small portion of this strip will be steeper than the recommended maximum 4% grade, however, this portion will have additional width to compensate. Over-detention for runoff originating in **Sub-Basin PP-PH** will not be provided in the proposed detention **Pond B** because redeveloped peak flows are lower than existing flows, and no over-detention for existing flows was provided in the existing **Pond A**. Redevelopment of the **church site** will not adversely affect the stormwater runoff performance in the existing gutter on the southwest side of Prairie Hawk Drive.

Sub-Basin PP-PDA will encompass the existing detention **Pond A** near the northeast edge of the **church site**. The basin will drain into the existing detention **Pond A**, which will be modified to accommodate proposed construction and the resulting changes in runoff patterns and flow rates. Post-redevelopment flow rates of runoff draining into the pond will be significantly lower than the existing flow rates. A discussion of the post-redevelopment performance of the existing detention **Pond A** follows the sub-basin discussions.

Sub-Basin PP-FS will encompass all but the northeast and southeast edges of the **fire station property** along with the southwest portion of offsite Tract FF, The Meadows Filing 18. The basin will drain north to a proposed grate inlet in sump to be installed in the area of the existing detention pond near the north corner of the **fire station property**, at **Design Point PPDP-FS**. Collected runoff will be carried in a proposed short storm drain system to the proposed detention **Pond B** near the east corner of the **church site**. The proposed **church site** detention **Pond B** will include capacity for the increase in runoff over existing conditions due to the previous and potential future development of the **fire station property**.

Sub-Basin PP-SE will encompass the southeast lane of the proposed New Hope Way access road between the **church site** and the **fire station property**. The basin will drain northeast to a proposed curb inlet on grade, at **Design Point PPDP-SE**. The proposed inlet will collect all of the 5-year and nearly all of the 100-year peak flows. Collected runoff will be carried in a proposed short storm drain system to the proposed detention **Pond B** near the east corner of the **church site**. The proposed **church site** detention **Pond B** will include capacity for the increase in runoff due to the construction of the proposed access road. Runoff bypassing the inlet will continue northeast to the southwest gutter of Prairie Hawk Drive and then northwest to **Design Point PPDP-MBPH**, described below. Over-detention for flows bypassing **Design Point PPDP-SE** will not be provided in the proposed detention **Pond B** because the bypass flows are insignificant.

Sub-Basin PP-NW will encompass the northwest lane of the proposed access road between the **church site** and the **fire station property**. The basin will drain northeast to a proposed curb inlet on grade, at **Design Point PPDP-NW**. The proposed inlet will collect nearly all of the 5-year and most of the 100-year peak flows. Collected runoff will be carried in a proposed storm drain system to the proposed detention **Pond B** near the east corner of the **church site**. The proposed **church site** detention **Pond B** will include capacity for the increase in runoff due to the construction of the proposed access road. Runoff bypassing the inlet will continue northeast to the southwest gutter of Prairie Hawk Drive and then northwest to **Design Point PPDP-MBPH**,

EX-OSFS. The area, drainage patterns, and peak flow rates only slightly changed as a result of the widening of Prairie Hawk Drive described in the paragraph above. **Sub-Basin PP-OSFS** will continue to drain north to the adjacent Prairie Hawk Drive and then northwest to **Design Point PPDP-MBPH**, described below. Over-detention for runoff originating in **Sub-Basin PP-OSFS** will not be provided in the proposed detention **Pond B** because the expected small increase in peak flows is a result of proposed redevelopment unrelated to the **church site** or **fire station property**, and no over-detention for existing flows was provided in the existing **fire station property** detention pond.

Design Point PPDP-MBPH refers to the two existing 15' CDOT Type-R curb inlets in sump condition near the south corner of the intersection of Meadows Boulevard and Prairie Hawk Drive The redevelopment of the **church site** and **fire station property**, along with the proposed widening of Prairie Hawk Drive will result in total runoff flowing in the gutters of Meadows Boulevard and Prairie Hawk Drive to **Design Point PPDP-MBPH** with estimated peak runoff rates that will be significantly less than existing peak rates. The two 15' CDOT Type-R curb inlets in sump condition will provide more than adequate interception capacity to collect all the arriving runoff with virtually no encroachment into Prairie Hawk Drive.

The design of the proposed widening of Prairie Hawk Drive – part of another development plan by others – upon which some of the above redeveloped sub-basins are based is approved for construction and includes some changes to the existing storm drain system extension in Prairie Hawk Drive near the intersection with Meadows Boulevard/Parkway. The approved widening design proposes that the tops of the two existing curb inlets on either side of the existing median in Prairie Hawk Drive be removed and replaced with manhole tops. The existing 5' CDOT Type-R curb inlet on the northeast gutter of the Prairie Hawk Drive at **Design Point PPDP-USSD**, near the east corner of Prairie Hawk Drive and Meadows Parkway, will be unchanged and will continue to drain through the existing 18" storm drain extension to the two 15' inlets on the southwest gutter of Prairie Hawk Drive at **Design Point PPDP-MBPH** with the resulting combined flows being referred to as **Design Point PPDP-DSSD**. **Sub-Basin PP-USSD** refers to all runoff that would reach **Design Point PPDP-USSD**, based on the Prairie Hawk widening design and based on runoff patterns outlined in *Phase III Drainage Report for Meadows Filing 17, Lots 5 and 6.* Estimated peak flows intercepted at **Design Point PPDP-USSD** are less than existing peak flows intercepted at Design Point EXDP-USSD while flows bypassing **Design Point PPDP-USSD** are much greater than flows bypassing Design Point EXDP-USSD. Runoff bypassing this inlet will flow northeast in the southeast gutter of Meadows Parkway to a storm drain system which outlets into East Plum Creek. Over-detention for runoff originating in **Sub-Basin PP-USSD** will not be provided in the proposed detention **Pond B** because the expected increase in bypass flows is a result of proposed redevelopment unrelated to the **church site**, and no over-detention for existing flows was provided in the existing detention **Pond A**.

IV-B-2 Specific Details – Detention Pond and Outlet Design

Detention pond sizing, outlet release rate, water quality capture volume, and routing check calculations for the below detention ponds are included in Appendix D. Detention pond outlet structure details, with stage levels, are also included in Appendix D.

All runoff from **Sub-Basins PP-PDB**, **PP-FS**, and **PP-PK** and nearly all runoff from **Sub Basins PP-SE** and **PP-NW** will drain to the proposed detention **Pond B**. Runoff from the other **Sub-Basins PP-MB**, **PP-PH**, **PP-PDA**, **PP-OSFS**, **PP-OSMB**, and **PP-OSPH** will not drain to **Pond B** and these basins are not included in the design of **Pond B**. See the discussion on each of these other sub-basins for an explanation of where runoff does drain and why that sub-basin is not included in the design of **Pond B**.

The proposed detention **Pond B** will be sized based on the areas and imperviousness of the sub-basins that drain into the pond as described above. The **Pond B** outlet structure will be designed for outflows based on the areas of the sub-basins that drain into the pond. Routing calculations confirm the functionality of the pond/outlet combination. The **Pond B** outlet will direct flows at **Design Point PPDP-PDB** to a proposed storm drain system expansion that will connect directly to the existing Meadows Boulevard Storm Drain System at **Design Point PPDP-MBPH**, with the resulting combined flows being referred to as **Design Point PPDP-DSSD**.

The proposed detention **Pond B** will be configured as an extended detention basin (EDB) to provide stormwater quality management. In addition to the detention volume described above, the extended detention basin will have a water quality capture volume (WQCV) based on the areas and imperviousness of the sub-basins that drain into the pond. A micro pool will be provided at the outlet structure and a pre-sedimentation forebay will be provided at each of the two storm drain outfalls into **Pond B**.

The proposed detention **Pond B** requires a spillway with a capacity of at least twice the allowable peak outflow rate for a 100-year storm event. A spillway will be provided with a maximum capacity of much more than twice the allowable peak outflow rate for a 100-year storm event.

All runoff from **Sub-Basin PP-PDA** will drain to the existing detention **Pond A**. A proposed future building expansion will encroach into the existing detention **Pond A**, resulting in smaller detention pond. The remaining pond volume will, however, be much larger than the minimum required volume based on the area and imperviousness of **Sub-Basin PP-PDA**. The existing **Pond A** outlet structure will be modified to release peak flows that are less than or equal to the maximum allowed outflows based on the area of **Sub-Basin PP-PDA**. Routing calculations confirm the functionality of the pond/outlet combination, both under proposed conditions as described in this drainage report, which include the proposed future building expansion, and under interim conditions that do not include the proposed future building expansion. The existing **Pond A** outlet pipe will be connected to a proposed storm drain system at **Design Point PPDP-PDA**. This proposed storm drain system expansion will connect directly to the existing Meadows Boulevard Storm Drain System at **Design Point PPDP-MBPH**, with the resulting combined flows being referred to as **Design Point PPDP-DSSD**.

The existing detention **Pond A** was originally configured as an extended detention basin (EDB) to provide stormwater quality management. In addition to the detention volume described above, the existing extended detention basin will have, after modification due to redevelopment, water quality capture volume (WQCV) more than the minimum required based on the area and imperviousness of **Sub-Basin PP-PDA**. The existing perforated riser pipe will be removed and an orifice plate with screen with be installed to release flows over an extended time based on the area and imperviousness of **Sub-Basin PP-PDA**. Because of the proximity of the existing outlet

Proposed Basins and Design Points

Basin or Design Point Definition	Contributing Area (acres)	Weighted Percent Impervious	5-Year Runoff Coefficient†	100-Year Runoff Coefficient†	5-Year Peak Flow (cfs)	100-Year Peak Flow (cfs)	Notes
PP-RH	0.14	55	0.38	0.54	0.21	0.55	Church Site and New Hope Way runoff to the northeast lane of Red Hawk Dr.
PP-MB	1.47	18	0.18	0.43	0.99	4.22	Church Site runoff to the southeast lane of Meadows Blvd.
PP-PH	0.19	30	0.25	0.47	0.23	0.79	Church Site and New Hope Way runoff to the southwest lane of Praire Hawk Dr.
PP-PDA	0.43	53	0.37	0.53	0.76	2.03	Church Site runoff to existing detention Pond A.
PPDP-PDA	N/A	N/A	N/A	N/A	0.04	0.08	Outflow from redeveloped detention Pond A to a proposed storm drain system (see Appendix D).
PP-FS	2.72	16	0.17	0.43	1.58	7.14	Fire Station Property and offsite Tract FF runoff to the proposed grate inlet at Design Point PPDP-FS.
PPDP-FS	N/A	N/A	N/A	N/A	1.58	7.14	Sub-Basin PP-FS runoff intercepted by the grate inlet near the north corner of Fire Station Property (see Appendix C).
PP-SE	0.25	97	0.84	0.90	1.02	2.00	Southeast lane of New Hope Way runoff to the proposed 10' curb inlet at Design Point PPDP-SE.
PPDP-SE	N/A	N/A	N/A	N/A	1.02	1.98	Sub-Basin PP-SE runoff intercepted by the 10' curb inlet in the southeast lane of New Hope Way (see Appendix C).
PPDPs FS + SE	N/A	N/A	N/A	N/A	2.60	9.12	Runoff carried in the storm drain pipe section immediately downstream of the inlet at PPDP-SE (see Appendix D).
PP-NW	0.23	97	0.85	0.91	0.94	1.85	Northwest lane of New Hope Way runoff to the proposed 5' curb inlet at Design Point PPDP-NW.
PPDP-NW	N/A	N/A	N/A	N/A	0.86	1.32	Sub-Basin PP-NW runoff intercepted by the 5' curb inlet in the northwest lane of New Hope Way (see Appendix C).
PPDPs FS + SE + NW	N/A	N/A	N/A	N/A	3.46	10.44	Runoff carried in the storm drain pipe section immediately downstream of the inlet at PPDP-NW (see Appendix D).
PP-PK	3.59	81	0.61	0.71	10.35	21.99	Church Site proposed parking lot runoff to the proposed 15' curb inlet at Design Point PPDP-PK.
PPDP-PK	N/A	N/A	N/A	N/A	10.35	21.99	Sub-Basin PP-PK runoff intercepted by the 15' curb inlet on the northeast edge of the parking lot (see Appendix C).
PP-PDB	1.03	35	0.27	0.48	1.36	4.37	Church Site runoff directly to proposed detention Pond B.
Combined Flows to Pond B	7.82	53	0.43	0.59	11.33	28.67	All runoff draining to proposed detention Pond B, including Sub-Basin PP-PDB and runoff intercepted by inlets at Design Points PPDP-FS, PPDP-SE, PPDP-NW, and PPDP-PK.
PPDP-PDB	N/A	N/A	N/A	N/A	1.53	5.99	Outflow from proposed detention Pond B to a proposed storm drain system (see Appendix D).
PPDPs PDA + PDB	N/A	N/A	N/A	N/A	1.57	6.07	Runoff carried in the storm drain pipe section immediately downstream of the junction of the pipe sections from PPDP-PDA and PPDP-PDB (see Appendix D).

EXCERPTS FROM EXISTING REPORT

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Hope Presbyterian Church
Catchment ID: PP-MB 2-Year

I. Catchment Hydrologic Data

Catchment ID = PP-MB
Area = 1.47 Acres
Percent Imperviousness = 18 % = (0.29ac roofs*90% + 1.18 ac lawns*0%) / 1.47ac total
NRCS Soil Type = B A, B, C, or D

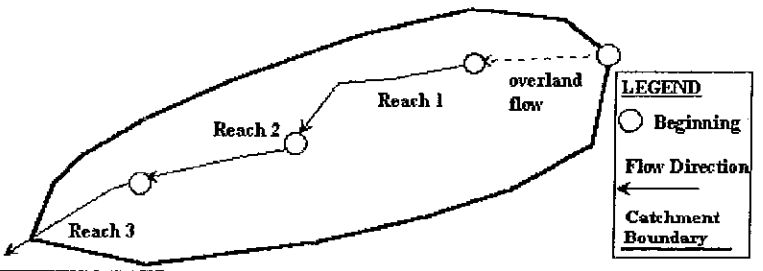
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 2 years (input return period for design storm)
C1 = 28.50 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.06 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.10
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.18
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0375	294	0.18	N/A	0.27	18.31
1						
2						
3						
4						
5						
	Sum	294				

Computed Tc = 18.31
Regional Tc = 11.63
User-Entered Tc = 11.63

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 2.18 inch/hr — Peak Flowrate, Qp = 0.32 cfs
Rainfall Intensity at Regional Tc, I = 2.70 inch/hr — Peak Flowrate, Qp = 0.40 cfs
Rainfall Intensity at User-Defined Tc, I = 2.70 inch/hr — Peak Flowrate, Qp = 0.40 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Hope Presbyterian Church
Catchment ID: PP-MB 5-Year

I. Catchment Hydrologic Data

Catchment ID = PP-MB
Area = 1.47 Acres
Percent Imperviousness = 18 % = (0.29ac roofs*90% + 1.18 ac lawns*0%) / 1.47ac total
NRCS Soil Type = B A, B, C, or D

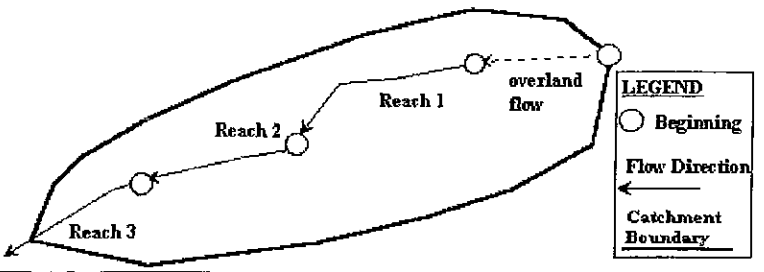
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr = 5 years (input return period for design storm)
C1 = 28.50 (input the value of C1)
C2= 10.00 (input the value of C2)
C3= 0.786 (input the value of C3)
P1= 1.43 inches (input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.18
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.18
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0375	294	0.18	N/A	0.27	18.31
1						
2						
3						
4						
5						
	Sum	294				

Computed Tc = 18.31
Regional Tc = 11.63
User-Entered Tc = 11.63

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = 2.94 inch/hr — Peak Flowrate, Qp = 0.80 cfs
Rainfall Intensity at Regional Tc, I = 3.64 inch/hr — Peak Flowrate, Qp = 0.99 cfs
Rainfall Intensity at User-Defined Tc, I = 3.64 inch/hr — Peak Flowrate, Qp = 0.99 cfs

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Hope Presbyterian Church
Catchment ID: PP-MB 100-Year

I. Catchment Hydrologic Data

Catchment ID = PP-MB
Area = 1.47 Acres
Percent Imperviousness = 18 % = (0.29ac roofs*90% + 1.18 ac lawns*0%) / 1.47ac total
NRCS Soil Type = B A, B, C, or D

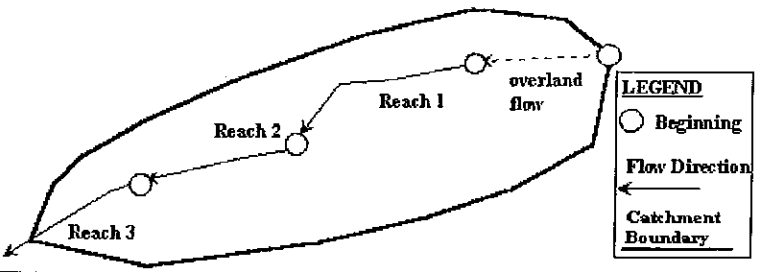
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100 years	(input return period for design storm)
C1 =	28.50	(input the value of C1)
C2=	10.00	(input the value of C2)
C3=	0.786	(input the value of C3)
P1=	2.60 inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = 0.43
Overide Runoff Coefficient, C = (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = 0.18
Overide 5-yr. Runoff Coefficient, C = (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland	0.0375	294	0.18	N/A	0.27	18.31
1						
2						
3						
4						
5						
	Sum	294				

Computed Tc = 18.31
Regional Tc = 11.63
User-Entered Tc = 11.63

IV. Peak Runoff Prediction

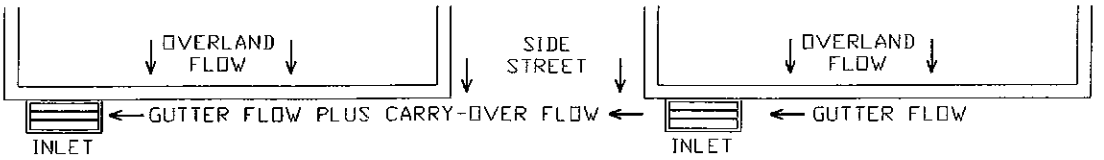
Rainfall Intensity at Computed Tc, I =	5.35 inch/hr	Peak Flowrate, Qp =	3.41 cfs
Rainfall Intensity at Regional Tc, I =	6.61 inch/hr	Peak Flowrate, Qp =	4.22 cfs
Rainfall Intensity at User-Defined Tc, I =	6.61 inch/hr	Peak Flowrate, Qp =	4.22 cfs

DESIGN PEAK FLOW FOR ONE-HALF OF STREET BY THE RATIONAL METHOD

New Hope Presbyterian Church - 60790

PP-PK

Design Flow = Gutter Flow + Carry-over Flow



Design Flow: ONLY if already determined through other methods:
(local peak flow for 1/2 of street, plus flow bypassing upstream subcatchments):
* If you entered a value here, skip the rest of this sheet and proceed to sheet Q-Allow)

	Minor Storm	Major Storm	
*Q =			cfs

Geographic Information: (Enter data in the blue cells):

Subcatchment Area =	3.59	Acres
Percent Imprviousness = (2.92ac paved*100% + 0.67ac lawns*0%) / 3.59ac total=	81	%
NRCS Soil Type =	B	A, B, C, or D

Site: (Check One Box Only)

Site is Urban:	X
Site Is Non-Urban:	

	Slope (ft/ft)	Length (ft)
Overland Flow =	0.0311	32
Gutter Flow =	0.0240	384

Rainfall Information: Intensity I (inch/hr) = $C_1 * P_1 / (C_2 + T_c) ^ C_3$

	Minor Storm	Major Storm	
Design Storm Return Period, T_r =	5	100	years
Return Period One-Hour Precipitation, P_1 =	1.43	2.60	inches
C_1 =	28.5	28.5	
C_2 =	10.0	10.0	
C_3 =	0.786	0.786	
User-Defined Storm Runoff Coefficient (leave this blank to accept a calculated value), C =			
User-Defined 5-yr. Runoff Coefficient (leave this blank to accept a calculated value), C_5 =			
Bypass (Carry-Over) Flow from upstream Subcatchments, Q_b =	0.00	0.00	cfs

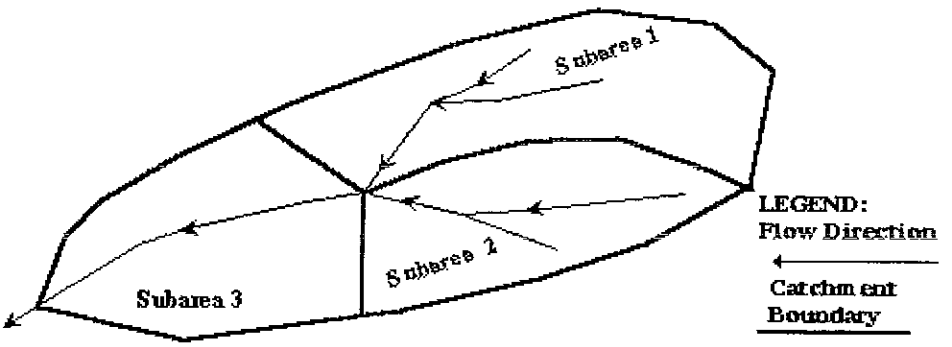
Analysis of Flow Time (Time of Concentration) for a Catchment:

	Minor Storm	Major Storm	
Calculated Design Storm Runoff Coefficient, C =	0.61	0.71	
Calculated 5-yr. Runoff Coefficient, C5 =	0.61	0.61	
Overland Flow Velocity, V_O =	0.16	0.16	fps
Gutter Flow Velocity, V_G =	3.10	3.10	fps
Overland Flow Time, t_O =	3.45	3.45	minutes
Gutter Flow Time, t_G =	2.06	2.06	minutes
Calculated Time of Concentration, T_c =	5.51	5.51	minutes
Time of Concentration by Regional Formula, T_c =	12.31	12.31	minutes
Recommended T_c =	5.51	5.51	minutes
Time of Concentration Selected by User, T_c =	5.51	5.51	**minutes**
Design Rainfall Intensity, I =	4.72	8.59	inch/hr
Calculated Local Peak Flow, Q_p =	10.35	21.99	cfs
Total Design Peak Flow, Q =	10.35	21.99	cfs

Area-Weighting for Runoff Coefficient Calculation

Project Title: New Hope Presbyterian Church - 60790
Catchment ID: Combined Sub-Basin at Pond B (drains to PPDP-PDB) - 5-year

Illustration



Instructions: For each catchment subarea, enter values for A and C.

Subarea ID	Area acres	Runoff Coeff.	Product	Percent Imperv.	Product
	A	C*	CA	I	IA
input	input	input	output	input	output
PP-FS	2.72	0.17	0.47	16	42
PP-SE	0.25	0.84	0.21	97	24
PP-NW	0.23	0.85	0.19	97	22
PP-PK	3.59	0.61	2.19	81	292
PP-PDB	1.03	0.27	0.28	35	36
Sum:	7.82	Sum:	3.34	Sum:	417

Area-Weighted Runoff Coefficient (sum CA/sum A) = 0.43 I = 53

*See sheet "Design Info" for inperviousness-based runoff coefficient values.

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Hope Presbyterian Church - 60790
Catchment ID: Combined Sub-Basin at Pond B (drains to PPDP-PDB) - 5-year

I. Catchment Hydrologic Data

Catchment ID = PPDP-PDB
Area = 7.82 Acres
Percent Imperviousness = ____ %
NRCS Soil Type = B A, B, C, or D

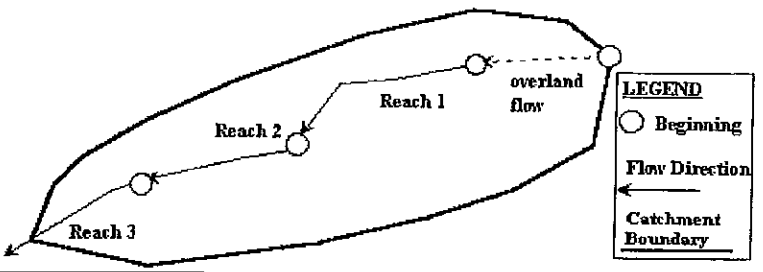
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	5 years	(input return period for design storm)
C1 =	28.50	(input the value of C1)
C2=	10.00	(input the value of C2)
C3=	0.786	(input the value of C3)
P1=	1.43 inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = ____
Overide Runoff Coefficient, C = 0.43 (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = ____
Overide 5-yr. Runoff Coefficient, C = 0.43 (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland			0.43	N/A	0.00	0.00
1						
2						
3						
4						
5						
	Sum	0				

Computed Tc = 0.00
Regional Tc = 10.00
User-Entered Tc = 13.65

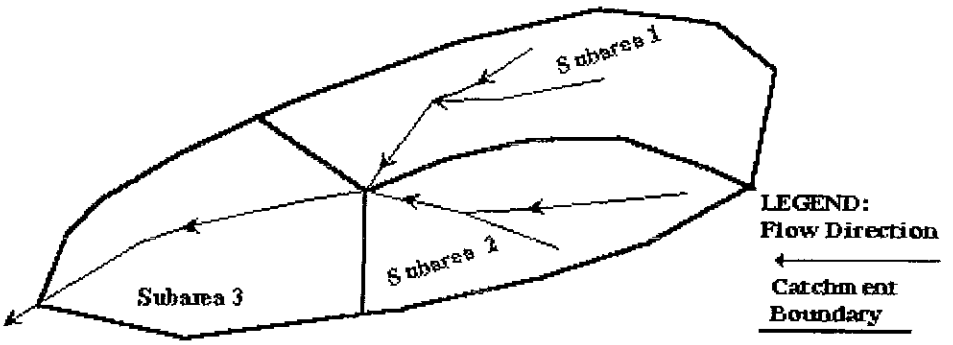
IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = ____ inch/hr — Peak Flowrate, Qp = #VALUE! cfs
Rainfall Intensity at Regional Tc, I = ____ inch/hr — Peak Flowrate, Qp = #VALUE! cfs
Rainfall Intensity at User-Defined Tc, I = 3.39 inch/hr — Peak Flowrate, Qp = 11.33 cfs

Area-Weighting for Runoff Coefficient Calculation

Project Title: New Hope Presbyterian Church - 60790
Catchment ID: Combined Sub-Basin at Pond B (drains to PPDP-PDB) - 100-year

Illustration



Instructions: For each catchment subarea, enter values for A and C.

Subarea ID	Area acres	Runoff Coeff.	Product
	A	C*	CA
input	input	input	output
PP-FS	2.72	0.43	1.16
PP-SE	0.25	0.90	0.23
PP-NW	0.23	0.91	0.21
PP-PK	3.59	0.71	2.56
PP-PDB	1.03	0.48	0.50
Sum:	7.82	Sum:	4.65

Area-Weighted Runoff Coefficient (sum CA/sum A) = 0.59

*See sheet "Design Info" for inperviousness-based runoff coefficient values.

CALCULATION OF A PEAK RUNOFF USING RATIONAL METHOD

Project Title: New Hope Presbyterian Church - 60790
Catchment ID: Combined Sub-Basin at Pond B (drains to PPDP-PDB) - 100-year

I. Catchment Hydrologic Data

Catchment ID = PPDP-PDB
Area = 7.82 Acres
Percent Imperviousness = ____ %
NRCS Soil Type = B A, B, C, or D

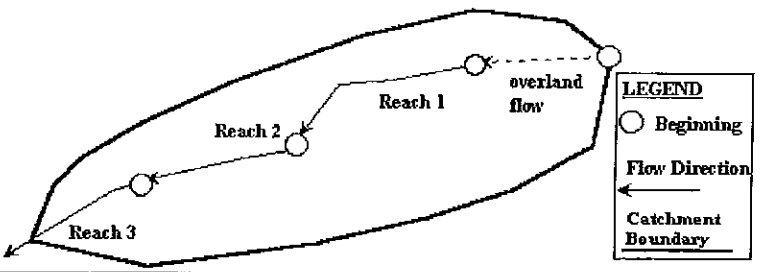
II. Rainfall Information I (inch/hr) = C1 * P1 /(C2 + Td)^C3

Design Storm Return Period, Tr =	100 years	(input return period for design storm)
C1 =	28.50	(input the value of C1)
C2=	10.00	(input the value of C2)
C3=	0.786	(input the value of C3)
P1=	2.60 inches	(input one-hr precipitation--see Sheet "Design Info")

III. Analysis of Flow Time (Time of Concentration) for a Catchment

Runoff Coefficient, C = ____
Overide Runoff Coefficient, C = 0.59 (enter an overide C value if desired, or leave blank to accept calculated C.)
5-yr. Runoff Coefficient, C-5 = ____
Overide 5-yr. Runoff Coefficient, C = 0.43 (enter an overide C-5 value if desired, or leave blank to accept calculated C-5.)

Illustration



NRCS Land Type	Heavy Meadow	Tillage/ Field	Short Pasture/ Lawns	Nearly Bare Ground	Grassed Swales/ Waterways	Paved Areas & Shallow Paved Swales (Sheet Flow)
Conveyance	2.5	5	7	10	15	20

Calculations:

Reach ID	Slope S ft/ft input	Length L ft input	5-yr Runoff Coeff C-5 output	NRCS Convey-ance input	Flow Velocity V fps output	Flow Time Tf minutes output
Overland			0.43	N/A	0.00	0.00
1						
2						
3						
4						
5						
		Sum 0			Computed Tc =	0.00
					Regional Tc =	10.00
					User-Entered Tc =	13.65

IV. Peak Runoff Prediction

Rainfall Intensity at Computed Tc, I = ____ inch/hr — Peak Flowrate, Qp = #VALUE! cfs
Rainfall Intensity at Regional Tc, I = ____ inch/hr — Peak Flowrate, Qp = #VALUE! cfs
Rainfall Intensity at User-Defined Tc, I = 6.17 inch/hr — Peak Flowrate, Qp = 28.67 cfs

Inlets Configuration and Performance

Existing Inlets

Design Point	Inlet Type	Inlet Number and/or Size	Roadway Slope or Sump Depth	5-Year				100-Year				Bypass Flow Destination
				Approach Flow* (cfs)	Intercept Flow (cfs)	Bypass Flow (cfs)	Intercept Percent	Approach Flow (cfs)	Intercept Flow (cfs)	Bypass Flow (cfs)	Intercept Percent	
EXDP-MBPH	CDOT Type R Curb Opening In Sump	2 - 15 ft	11 in	10.91	10.91	0.00	100	36.30	36.30	0.00	100	N/A
EXDP-USSD	CDOT Type R Curb Opening On Grade	2 - 5 ft	2.3%	1.39	1.06	0.33	76	3.85	1.82	2.03	47	Offsite**

* "Approach Flow" includes all flow reaching the inlet, including runoff from the tributary basin and bypass flow from upstream inlets, as calculated on the corresponding "DESIGN PEAK FLOW FOR ONE-HALF OF STREET BY THE RATIONAL METHOD" sheet located in Appendix B.

** Flows approaching the inlets at EXDP-USSD do not originate on or flow through the site and are not in any way affected by runoff from the site. These inlets are only being analyised to determine intercepted flow. A downstream analysis of bypass flows is not necessary and is not included.

Proposed Inlets

Basin or Design Point Definition	Inlet Type	Inlet Number and/or Size	Roadway Slope or Sump Depth	5-Year				100-Year				Bypass Flow Destination
				Approach Flow* (cfs)	Intercept Flow (cfs)	Bypass Flow (cfs)	Intercept Percent	Approach Flow (cfs)	Intercept Flow (cfs)	Bypass Flow (cfs)	Intercept Percent	
PPDP-FS	CDOT Type C w/ Close Mesh Grate In Sump	1	12 in	1.58	1.58	0.00	100	7.14	7.14	0.00	100	N/A
PPDP-SE	CDOT Type R Curb Opening On Grade	1 - 10 ft	1.00%	1.02	1.02	0.00	100	2.00	1.98	0.02	99	PPDP-MBPH
PPDP-NW	CDOT Type R Curb Opening On Grade	1 - 5 ft	2.00%	0.94	0.86	0.08	91	1.85	1.32	0.53	71	PPDP-MBPH
PPDP-PK	CDOT Type R Curb Opening In Sump	1 - 15 ft	6 in	10.35	10.35	0.00	100	21.99	21.99	0.00	100	N/A
PPDP-MBPH	CDOT Type R Curb Opening In Sump	2 - 15 ft	11 in	6.82	6.82	0.00	100	21.11	21.11	0.00	100	N/A
PPDP-USSD	CDOT Type R Curb Opening On Grade	1 - 5 ft	2.3%	2.73	0.80	1.93	29	6.36	1.17	5.19	18	Offsite**

* "Approach Flow" includes all flow reaching the inlet, including runoff from the tributary basin and bypass flow from upstream inlets, as calculated on the corresponding "DESIGN PEAK FLOW FOR ONE-HALF OF STREET BY THE RATIONAL METHOD" sheet located in Appendix B.

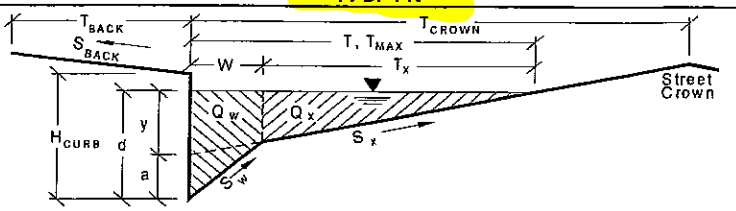
** Flows approaching the inlets at PPDP-USSD do not originate on or flow through the site and are not affected by the redevelopment of the site. These inlets are only being analyised to determine intercepted flow. A downstream analysis of bypass flows is not necessary and is not included.

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

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

Project: New Hope Presbyterian Church - 60790

Inlet ID: PPDP-PK



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	6.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.0200	ft. vert. / ft. horiz
Manning's Roughness Behind Curb	n_{BACK} =	0.0160	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown (included for calculation purposes)	T_{CROWN} =	33.0	ft
Gutter Depression	a =	0.26	inches
Gutter Width	W =	1.00	ft
Street Transverse Slope	S_X =	0.0173	ft. vert. / ft. horiz
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.0000	ft. vert. / ft. horiz
Manning's Roughness for Street Section	n_{STREET} =	0.0160	

		Minor Storm	Major Storm	
Max. Allowable Water Spread for Minor & Major Storm	T_{MAX} =	14.0	33.0	ft
Max. Allowable Depth at Gutter Flow Line for Minor & Major Storm	d_{MAX} =	6.00	18.00	inches
Allow Flow Depth at Street Crown (leave blank for no)				X = yes

Maximum Gutter Capacity Based On Allowable Water Spread

		Minor Storm	Major Storm	
Gutter Cross Slope (Eq. ST-8)	S_W =	0.0390	0.0390	ft/ft
Water Depth without Gutter Depression (Eq. ST-2)	y =	2.81	6.85	inches
Water Depth with a Gutter Depression	d =	3.17	7.11	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	13.0	32.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.191	0.081	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Water Spread	Q_T =	SUMP	SUMP	cfs
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Gutter Capacity Based on Allowable Gutter Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	27.6	85.5	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	26.6	84.5	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.097	0.031	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm	Q =	0.0	0.0	cfs
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	SUMP	SUMP	
Max Flow Based on Allow. Gutter Depth (Safety Factor Applied)	Q_d =	SUMP	SUMP	cfs
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

		Minor Storm	Major Storm	
Max. Allowable Gutter Capacity Based on Minimum of Q_T or Q_d	Q_{allow} =	SUMP	SUMP	cfs

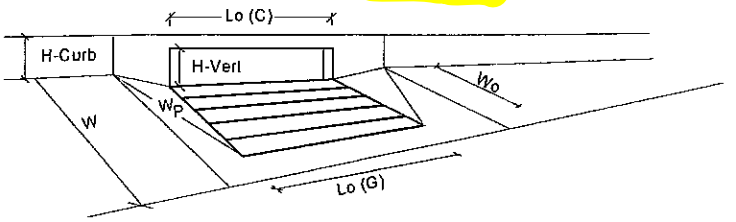
MINOR STORM max. allowable capacity OK - greater than flow given on sheet 'Q-Peak'

MAJOR STORM max. allowable capacity OK - greater than flow given on sheet 'Q-Peak'

INLET IN A SUMP OR SAG LOCATION

Project = New Hope Presbyterian Church - 60790

Inlet ID = PPDP-PK



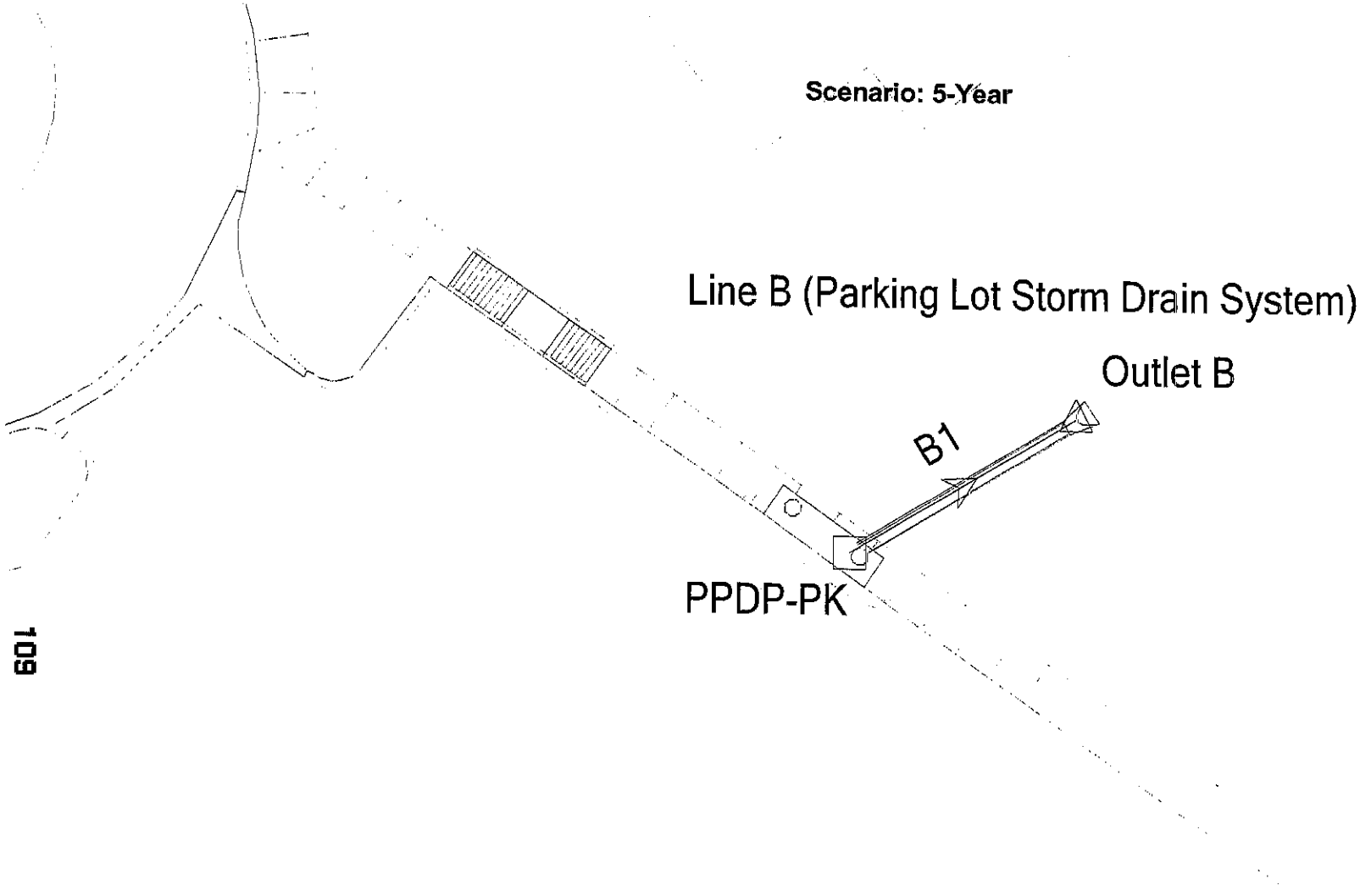
Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	3.00	3.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 3.00)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.67)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	6.00	6.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	5.95	5.95	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.4	63.4	degrees
Side Width for Depression Pan (typically the gutter width of 1 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.30-3.00)	C_w (C) =	3.00	3.00	
Curb Opening Orifice Coefficient (typical value 0.67)	C_o (C) =	0.67	0.67	

Resulting Gutter Flow Depth for Grate Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate as a Weir				
Flow Depth at Local Depression without Clogging (0 cfs grate, 10.35 cfs curb)	d_{wi} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb-un}$ =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 10.35 cfs curb)	d_{wa} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb-cl}$ =	N/A	N/A	inches
Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 10.35 cfs curb)	d_{oi} =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 10.35 cfs curb)	d_{oa} =	N/A	N/A	inches
Resulting Gutter Flow Depth Outside of Local Depression	$d_{a-Grate}$ =	N/A	N/A	inches

Resulting Gutter Flow Depth for Curb Opening Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Curb as a Weir, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 10.35 cfs curb)	d_{wi} =	4.50	7.44	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 10.35 cfs curb)	d_{wa} =	4.83	7.99	inches
Curb as an Orifice, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 10.35 cfs curb)	d_{oi} =	3.48	6.29	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 10.35 cfs curb)	d_{oa} =	3.85	7.14	inches
Resulting Gutter Flow Depth Outside of Local Depression	d_{a-Curb} =	1.83	4.99	inches

Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	15.0	15.0	feet
Total Inlet Interception Capacity (Design Discharge from *Q-Peak*)	Q_a =	10.4	22.0	cfs
Resultant Gutter Flow Depth (based on sheet *Q-Allow* geometry)	d =	1.83	4.99	inches
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	T =	7.6	22.8	feet
Resultant Flow Depth at Street Crown	d_{CROWN} =	0.00	0.00	inches

Scenario: 5-Year



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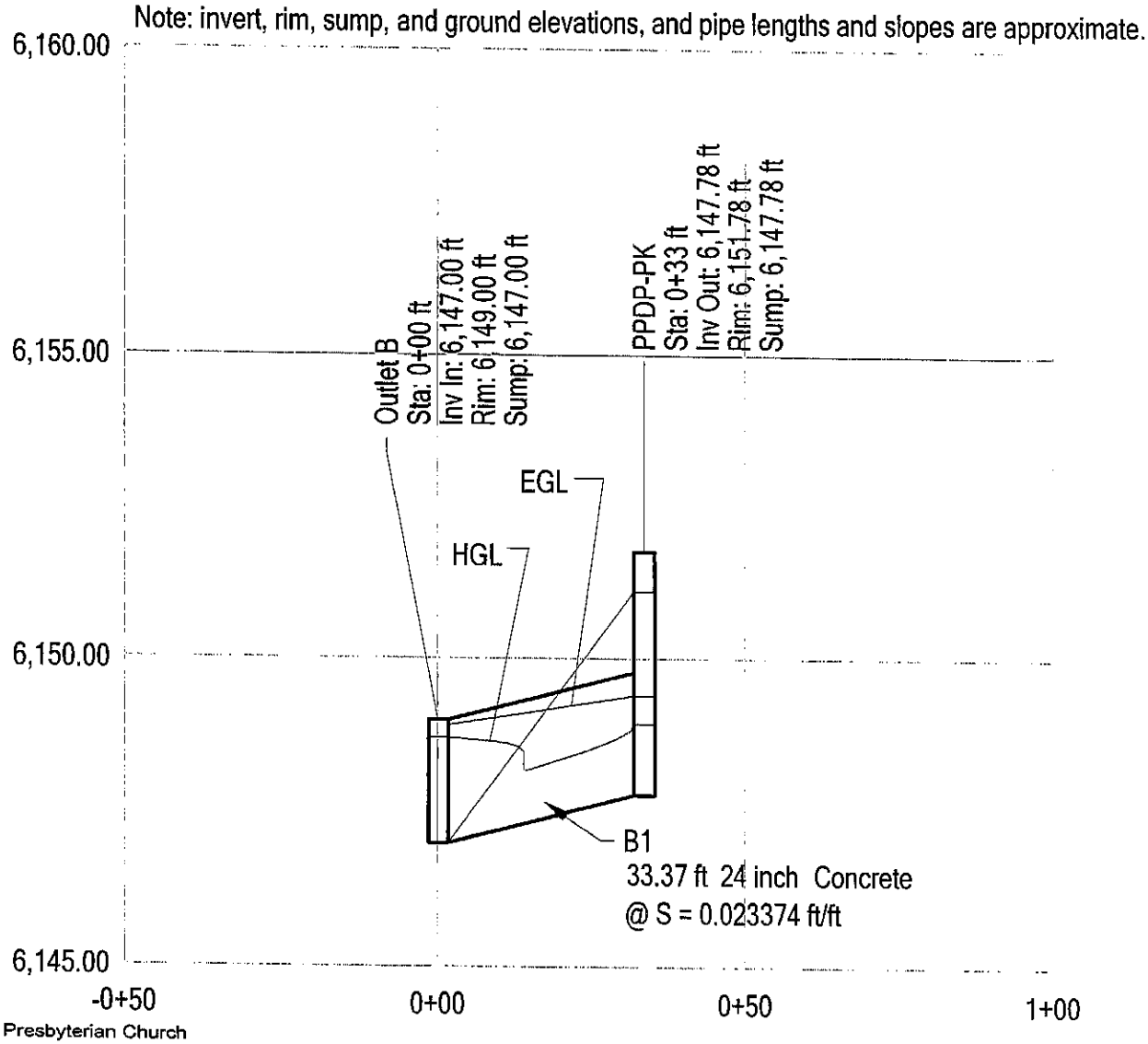
EXCERPTS FROM EXISTING REPORT

Profile
Scenario: 5-Year

Line B (Parking Lot)



Title: New Hope Presbyterian Church
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10/30/07 02:47:42 PM

MVE Inc.
 37 Brookside Road Waterbury, CT 06708 USA +1-203-755-1666

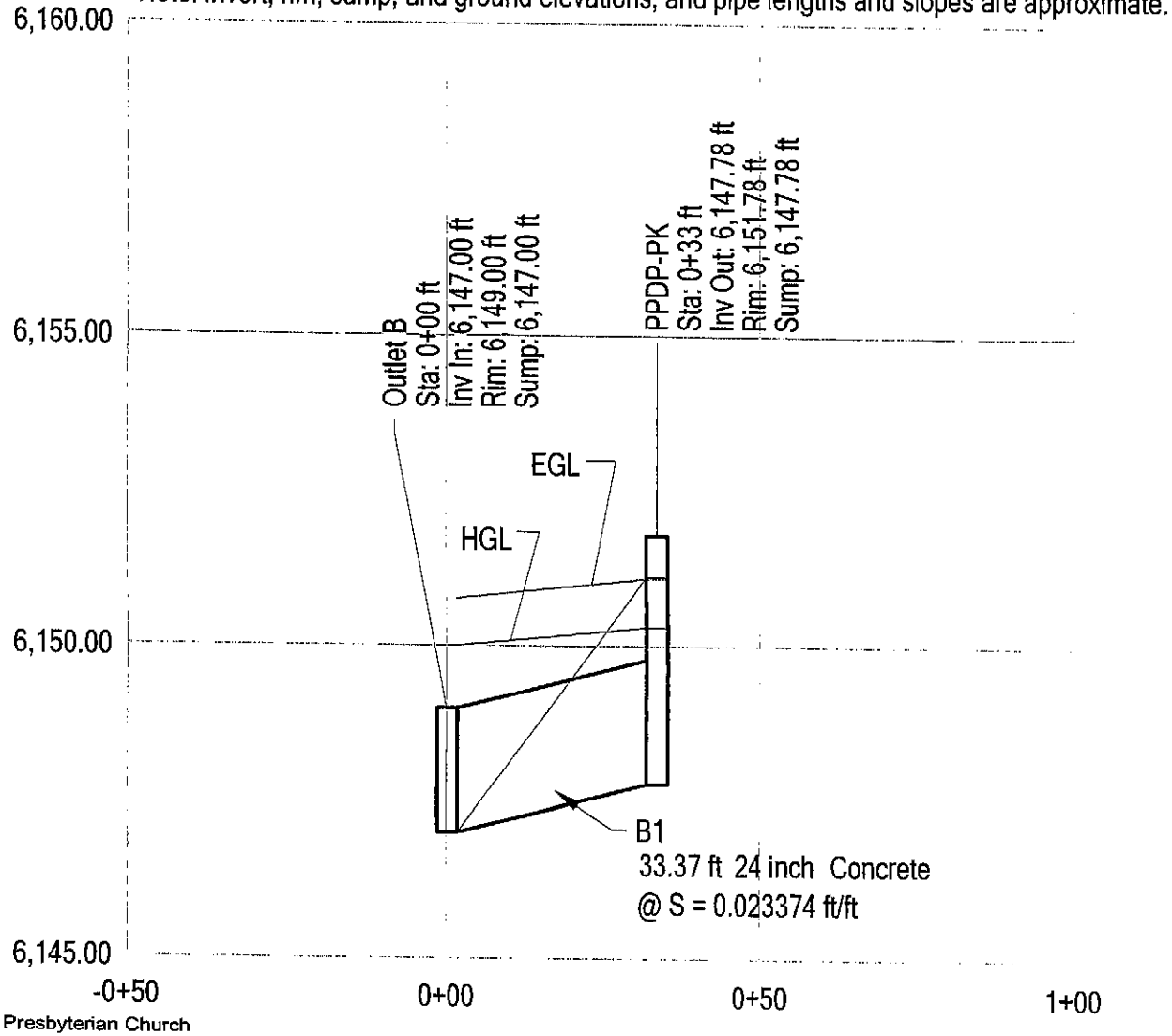
Project Engineer: Dave Gorman
StormCAD v5.5 [5.5006]

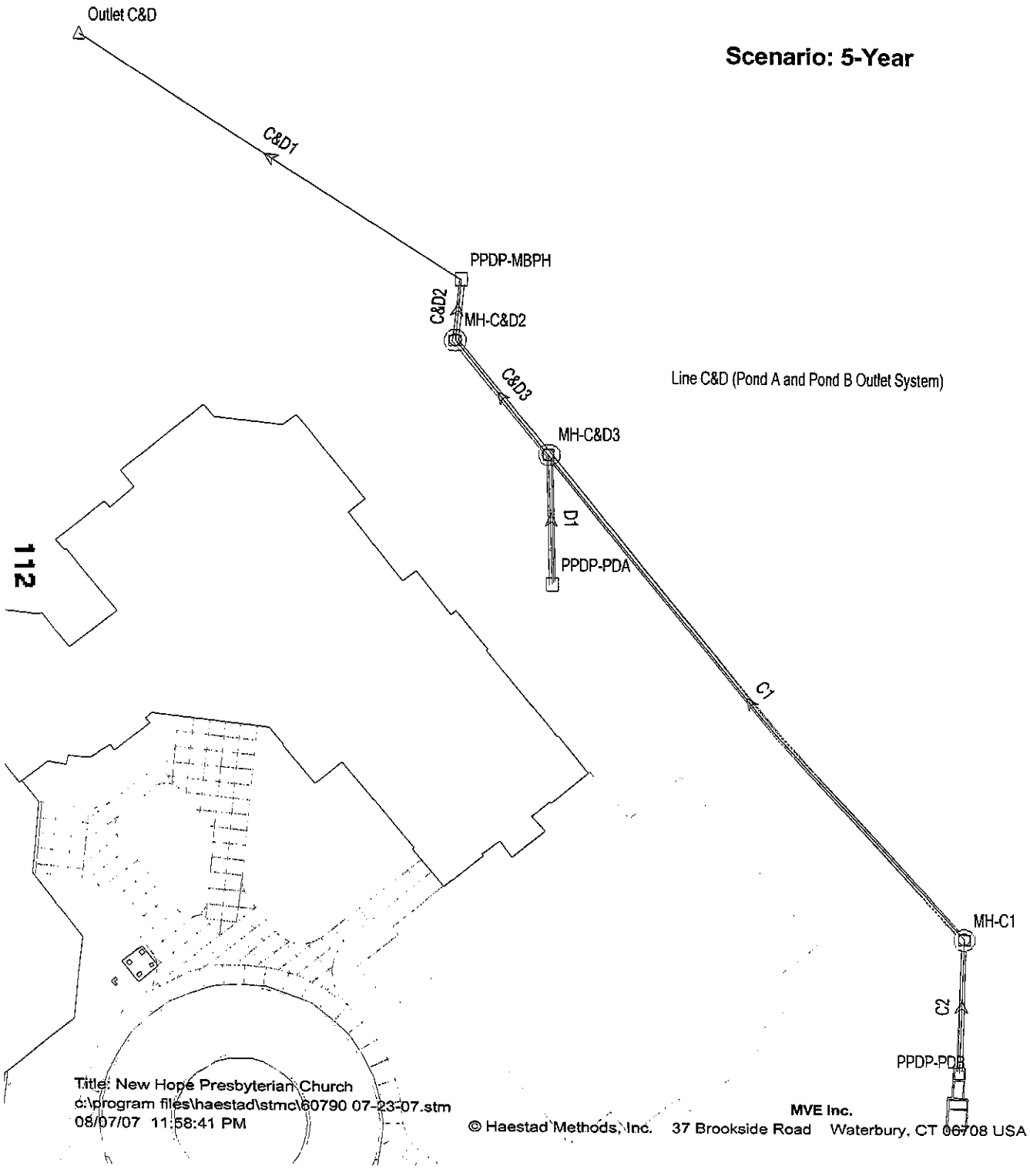
EXCERPTS FROM EXISTING REPORT

Profile
Scenario: 100-Year

Line B (Parking Lot)

Note: invert, rim, sump, and ground elevations, and pipe lengths and slopes are approximate.





Scenario: 5-Year

Line C&D (Pond A and Pond B Outlet System)

EXCERPTS FROM EXISTING REPORT

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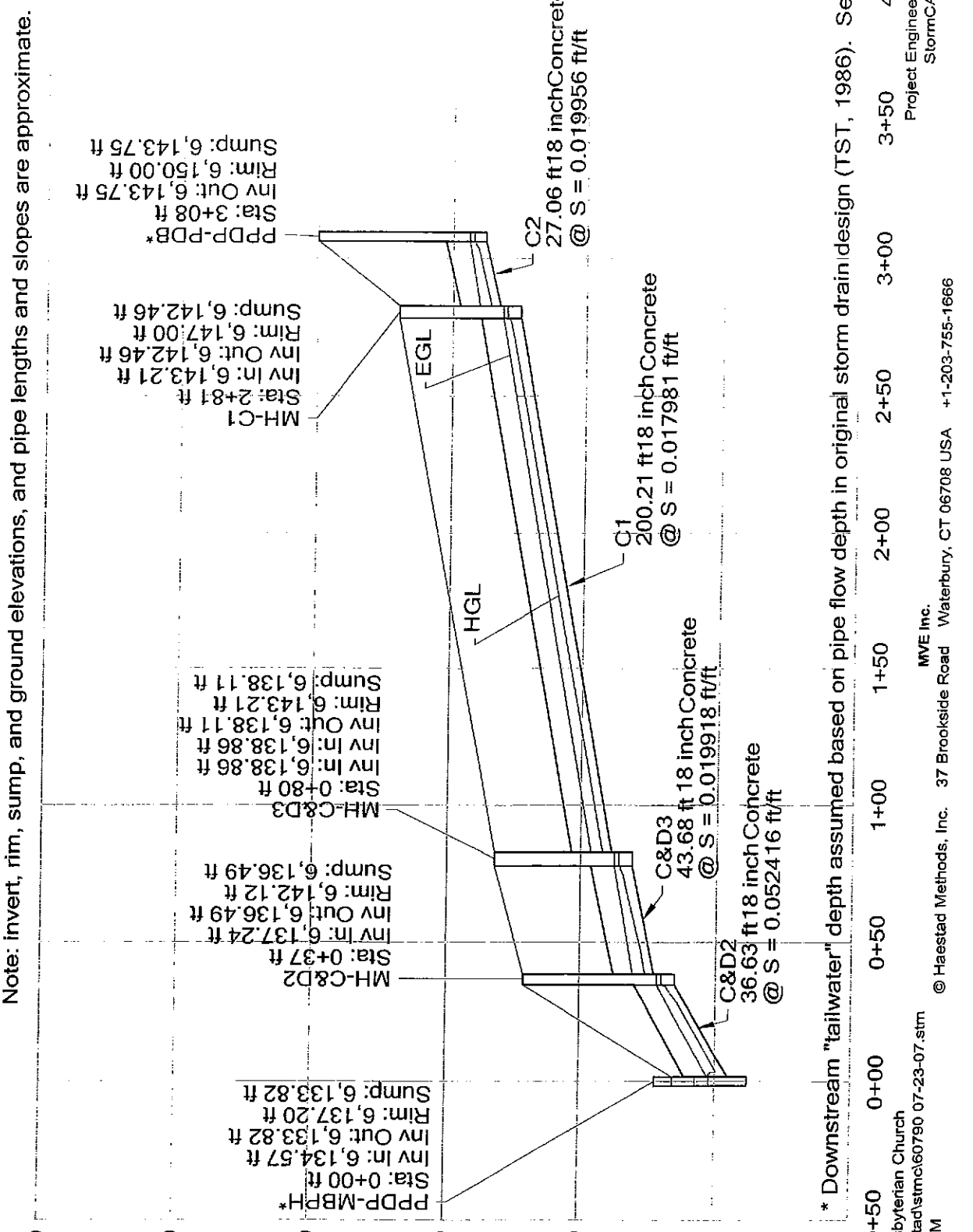
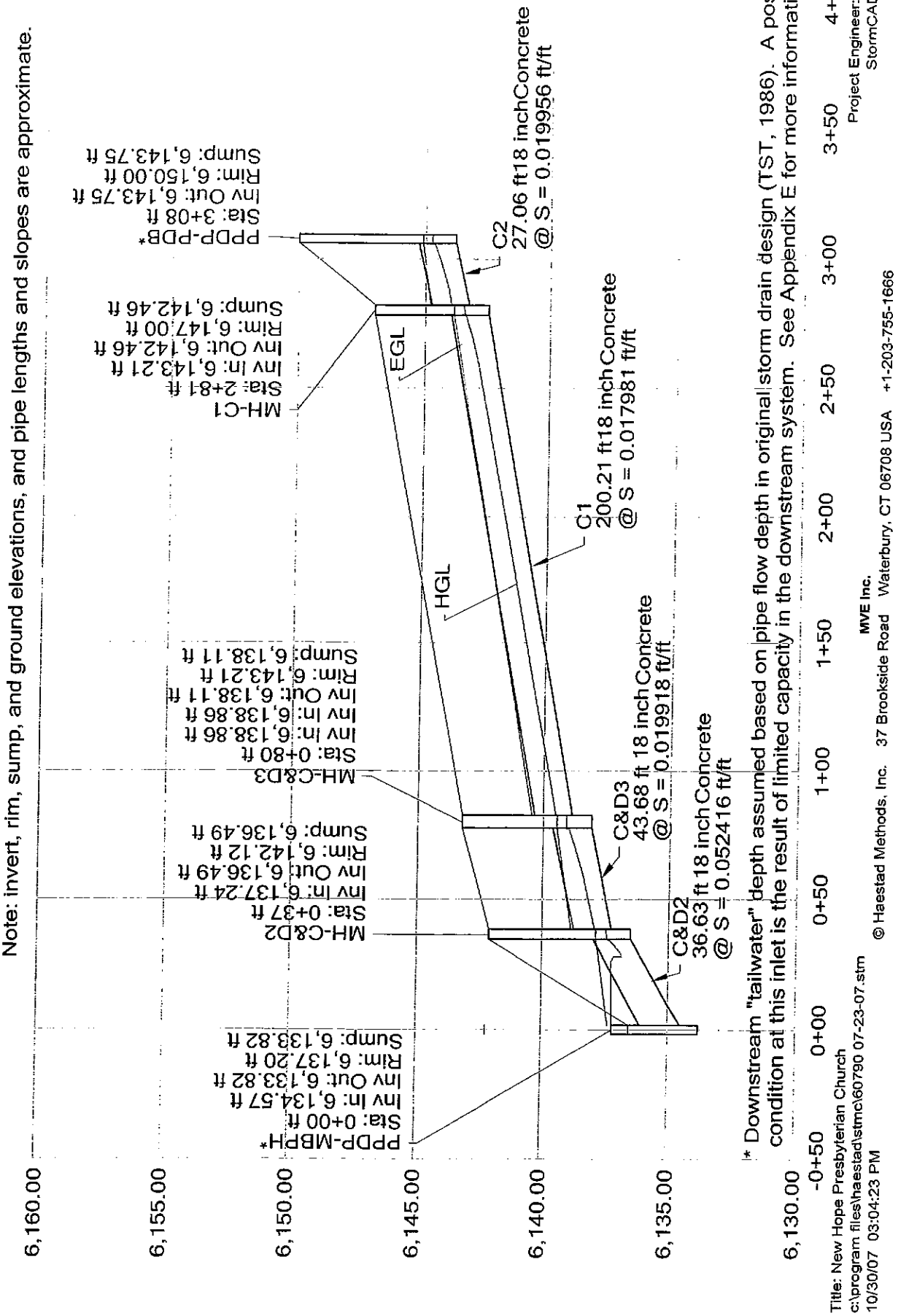
Profile
Scenario: 5-Year

Line C (Pond B)



Profile
Scenario: 100-Year

Line C (Pond B)



* Downstream "tailwater" depth assumed based on pipe flow depth in original storm drain design (TST, 1986). A possible overflow condition at this inlet is the result of limited capacity in the downstream system. See Appendix E for more information.

Title: New Hope Presbyterian Church
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10/30/07 03:04:23 PM

MVE Inc.
37 Brookside Road Waterbury, CT 06708 USA +1-203-755-1666

Project Engineer: Dave Gorman
StormCAD v5.5 [5.5006]
Page 1 of 1

EXCERPTS FROM EXISTING REPORT

Scenario: 5-Year

>>>> Info: Subsurface Network Rooted by: Outlet B
>>>> Info: Subsurface Analysis iterations: 1
>>>> Info: Convergence was achieved.

>>>> Info: Subsurface Network Rooted by: Outlet A
>>>> Info: Subsurface Analysis iterations: 1
>>>> Info: Convergence was achieved.

>>>> Info: Subsurface Network Rooted by: Outlet C&D
>>>> Info: Subsurface Analysis iterations: 1
>>>> Info: Convergence was achieved.

CALCULATION SUMMARY FOR SURFACE NETWORKS

Label	Inlet Type	Inlet	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Capture Efficiency (%)	Gutter Spread (ft)	Gutter Depth (ft)
PPDP-FS	Generic Inlet	Generic Default 100%	1.58	0.00	100.0	0.00	0.00
PPDP-PK	Generic Inlet	Generic Default 100%	10.35	0.00	100.0	0.00	0.00
PPDP-NW	Generic Inlet	Generic Default 91%	0.86	0.08	91.5	5.22	0.23
PPDP-SE	Generic Inlet	Generic Default 100%	1.02	0.00	100.0	5.56	0.24
PPDP-MBPH	Generic Inlet	Generic Default 100%	6.82	0.00	100.0	0.00	0.00
PPDP-PDB	Generic Inlet	Generic Default 100%	1.53	0.00	100.0	0.00	0.00
PPDP-PDA	Generic Inlet	Generic Default 100%	0.04	0.00	100.0	0.00	0.00

CALCULATION SUMMARY FOR SUBSURFACE NETWORK WITH ROOT: Outlet A

Label	Number of Sections	Section Size	Section Shape	Length (ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Hydraulic Grade Upstream (ft)	Hydraulic Grade Downstream (ft)
A1	1	18 inch	Circular	37.01	3.46	7.92	6,148.82	6,148.70
A2	1	18 inch	Circular	52.28	2.60	7.30	6,150.41	6,148.95
A3	1	18 inch	Circular	13.24	1.58	6.28	6,150.78	6,150.51

Label	Total System Flow (cfs)	Ground Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
Outlet A	3.46	6,147.00	6,148.70	6,148.70
PPDP-NW	3.46	6,153.98	6,148.95	6,148.82
PPDP-SE	2.60	6,154.78	6,150.51	6,150.41
PPDP-FS	1.58	6,154.00	6,150.78	6,150.78

CALCULATION SUMMARY FOR SUBSURFACE NETWORK WITH ROOT: Outlet B

Calculation Results Summary

Scenario: 100-Year

>>>> Info: Subsurface Network Rooted by: Outlet B
>>>> Info: Subsurface Analysis iterations: 1
>>>> Info: Convergence was achieved.

>>>> Info: Subsurface Network Rooted by: Outlet A
>>>> Info: Subsurface Analysis iterations: 1
>>>> Info: Convergence was achieved.

>>>> Info: Subsurface Network Rooted by: Outlet C&D
>>>> Info: Subsurface Analysis iterations: 1
>>>> Info: Convergence was achieved.

CALCULATION SUMMARY FOR SURFACE NETWORKS

Label	Inlet Type	Inlet	Total Intercepted Flow (cfs)	Total Bypassed Flow (cfs)	Capture Efficiency (%)	Gutter Spread (ft)	Gutter Depth (ft)
PPDP-FS	Generic Inlet	Generic Default 100%	7.14	0.00	100.0	0.00	0.00
PPDP-PK	Generic Inlet	Generic Default 100%	21.99	0.00	100.0	0.00	0.00
PPDP-NW	Generic Inlet	Generic Default 71%	1.32	0.53	71.3	7.72	0.28
PPDP-SE	Generic Inlet	Generic Default 99%	1.98	0.02	99.0	8.10	0.29
PPDP-MBPH	Generic Inlet	Generic Default 100%	21.11	0.00	100.0	0.00	0.00
PPDP-PDB	Generic Inlet	Generic Default 100%	5.99	0.00	100.0	0.00	0.00
PPDP-PDA	Generic Inlet	Generic Default 100%	0.08	0.00	100.0	0.00	0.00

CALCULATION SUMMARY FOR SUBSURFACE NETWORK WITH ROOT: Outlet A

Label	Number of Sections	Section Size	Section Shape	Length (ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Hydraulic Grade Upstream (ft)	Hydraulic Grade Downstream (ft)
A1	1	18 inch	Circular	37.01	10.44	5.91	6,150.37	6,150.00
A2	1	18 inch	Circular	52.28	9.12	10.31	6,151.28	6,150.88
A3	1	18 inch	Circular	13.24	7.14	9.61	6,151.60	6,151.59

Label	Total System Flow (cfs)	Ground Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
Outlet A	10.44	6,147.00	6,150.00	6,150.00
PPDP-NW	10.44	6,153.98	6,150.88	6,150.37
PPDP-SE	9.12	6,154.78	6,151.59	6,151.28
PPDP-FS	7.14	6,154.00	6,151.60	6,151.60

CALCULATION SUMMARY FOR SUBSURFACE NETWORK WITH ROOT: Outlet B

Calculation Results Summary

Label	Number of Sections	Section Size	Section Shape	Length (ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Hydraulic Grade Upstream (ft)	Hydraulic Grade Downstream (ft)
B1	1	24 inch	Circular	33.37	21.99	7.00	6,150.32	6,150.00

Label	Total System Flow (cfs)	Ground Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
Outlet B	21.99	6,147.00	6,150.00	6,150.00
PPDP-PK	21.99	6,151.11	6,150.32	6,150.32

CALCULATION SUMMARY FOR SUBSURFACE NETWORK WITH ROOT: Outlet C&D

Label	Number of Sections	Section Size	Section Shape	Length (ft)	Total System Flow (cfs)	Average Velocity (ft/s)	Hydraulic Grade Upstream (ft)	Hydraulic Grade Downstream (ft)
C&D1	1	21 inch	Circular	145.00	28.35	11.79	6,138.73	6,134.09
C&D2	1	18 inch	Circular	36.63	6.07	11.34	6,137.44	6,137.20
C&D3	1	18 inch	Circular	43.68	6.07	7.97	6,139.06	6,137.93
``	1	18 inch	Circular	22.70	0.08	1.98	6,139.28	6,139.09
C1	1	18 inch	Circular	200.21	5.99	7.65	6,143.41	6,139.54
C2	1	18 inch	Circular	27.06	5.99	7.95	6,144.70	6,143.91

Label	Total System Flow (cfs)	Ground Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
Outlet C&D	28.35	6,139.20	6,134.09	6,134.09
PPDP-MBPH	28.35	6,136.53	6,140.04	6,137.20
MH-C&D2	6.07	6,142.12	6,137.47	6,137.44
MH-C&D3	6.07	6,143.21	6,139.07	6,139.06
PPDP-PDA	0.08	6,140.88	6,139.28	6,139.28
MH-C1	5.99	6,147.00	6,143.43	6,143.41
PPDP-PDB	5.99	6,150.00	6,144.70	6,144.70

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Water Quality and Detention Volumes, Elevations, and Release Rates

By: PFM
Date: 12/5/2007

WATER QUALITY AND DETENTION FOR POND A AS REDEVELOPED (PP-PDA AT PPDP-PDA)

	Volume Required (Cubic Ft)	Volume Required (Acre-Ft)	Volume Provided (Cubic Ft)	Volume Provided (Acre-Ft)	Elevation at Top of Volume (Ft)	Release Rate Allowed (cfs) or Drain Time Required (min)	Release Rate Provided (cfs) or Drain Time Provided (min)
Water Quality*	401	0.0092	409	0.0094	6140.44	2400 min	**
10 year	897	0.0206	909	0.0209		0.10	0.09
10 year + WQ	1298	0.0298	1318	0.0303	6141.10		0.12
100 year	1782	0.0409	1784	0.0410		0.37	0.36
100 year + WQ[†]	2182	0.0501	2193	0.0503	6141.51		0.40

* The UDFCD Drainage Criteria Manual Volume 3 specifies that a Water Quality Capture Volume drain in 40 hours.

** The "Reservoir Routing though Detention Pond" calculator provided by UDFCD and used to estimate WQCV drain time does not offer adequate precision to determine the drain time of Pond A because of the very small flow rates involved. The WQ orifice plate design for Pond A follows the UDFCD design guidelines and therefore should theoretically provide sufficient drain time.

[†] The existing walk-out basment adjacent to Pond A has a finished floor elevation of 6143.08, which is 1.57 ft above the top of the 100 year + WQ volume.

WATER QUALITY AND DETENTION FOR POND B (PP-PDB AT PPDP-PDB)

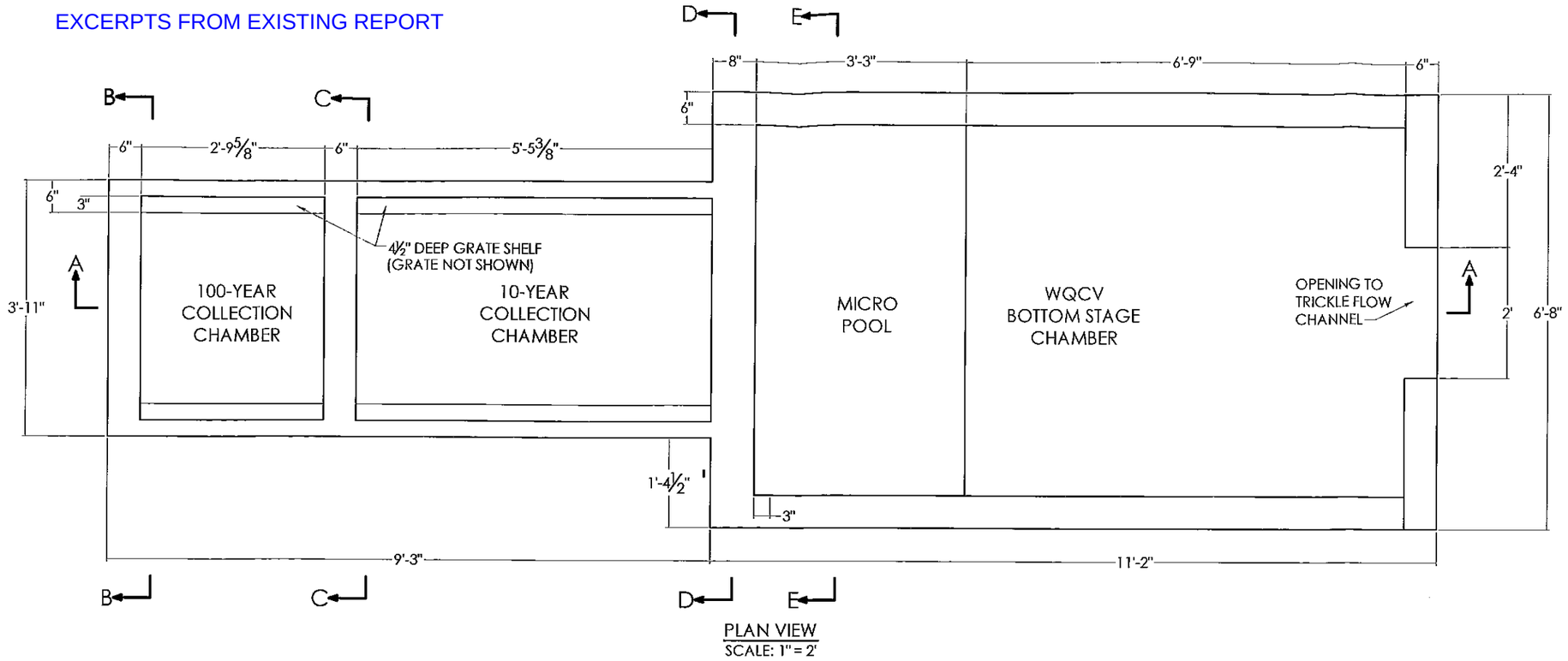
	Volume Required (Cubic Ft)	Volume Required (Acre-Ft)	Volume Provided (Cubic Ft)	Volume Provided (Acre-Ft)	Elevation at Top of Volume (Ft)	Release Rate Allowed (cfs) or Drain Time Required (min)	Release Rate Provided (cfs) or Drain Time Provided (min)
Forebays*	219 – 365	0.005 – 0.008	344	0.0079	6148.00	3 – 5 min	4.4 min
Micropool**			43	0.0010	6144.00		
Water Quality[†]	7309	0.1678	7372	0.1692	6147.00	2400 min	2400 min
10 year	16352	0.3754	16617	0.3815		1.80 cfs	1.76 cfs
10 year + WQ	23662	0.5432	23989	0.5507	6148.70		1.87 cfs
100 year	32361	0.7429	33207	0.7623		6.65 cfs	6.65 cfs
100 year + WQ	39670	0.9107	40579	0.9316	6150.00		6.77 cfs

* The UDFCD Drainage Criteria Manual Volume 3 specifies that a forebay be 3% to 5% of the Water Quality Capture Volume and that a forebay drain in 3 min to 5min. For this design, the volume provided is divided between two equally sized forebays.

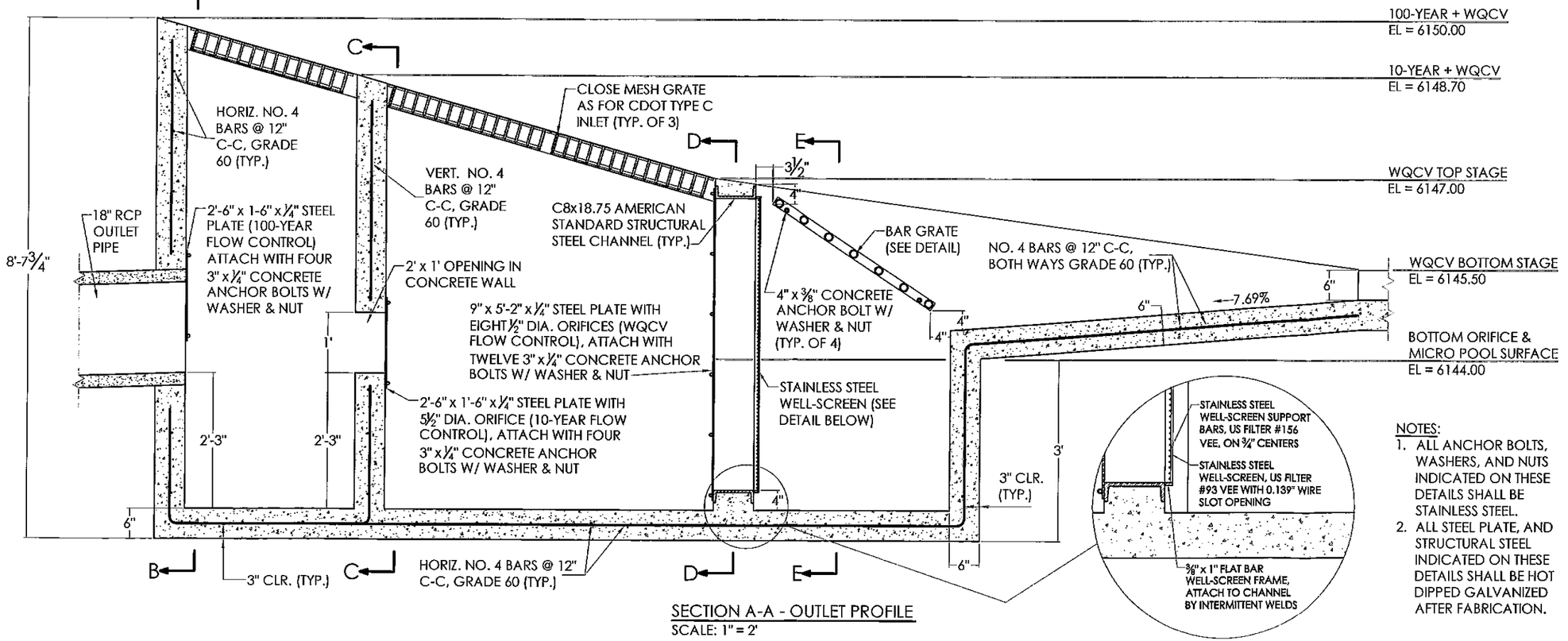
** The UDFCD Drainage Criteria Manual Volume 3 does not specify a micropool volume but does requre that the micropool be at least 2.5' deep. The micropool proposed for Pond B is 2.5' deep.

[†] The UDFCD Drainage Criteria Manual Volume 3 specifies that a Water Quality Capture Volume drain in 40 hours.

EXCERPTS FROM EXISTING REPORT



PLAN VIEW
SCALE: 1" = 2'

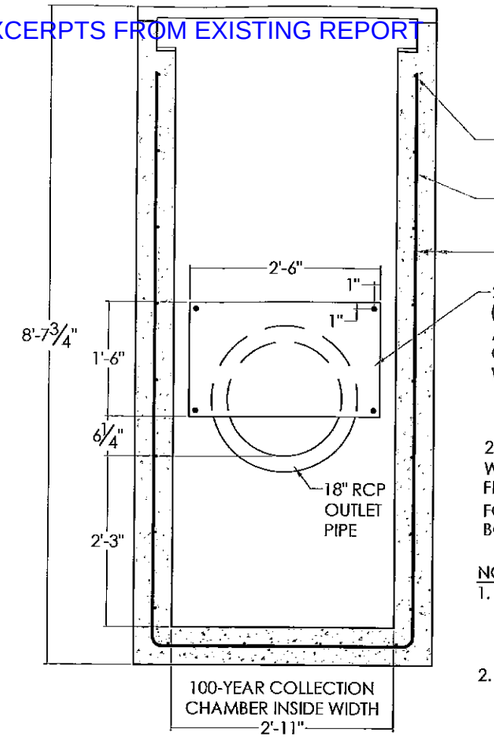


SECTION A-A - OUTLET PROFILE
SCALE: 1" = 2'

NOTES:
1. ALL ANCHOR BOLTS, WASHERS, AND NUTS INDICATED ON THESE DETAILS SHALL BE STAINLESS STEEL.
2. ALL STEEL PLATE, AND STRUCTURAL STEEL INDICATED ON THESE DETAILS SHALL BE HOT DIPPED GALVANIZED AFTER FABRICATION.

PROPOSED DETENTION POND B OUTLET (PAGE 1 OF 2)

EXCERPTS FROM EXISTING REPORT



SECTION B-B - 100-YEAR FLOW CONTROL
SCALE: 1" = 2'

HORIZ. NO. 4 BARS @ 12" C-C, GRADE 60 (TYP.)

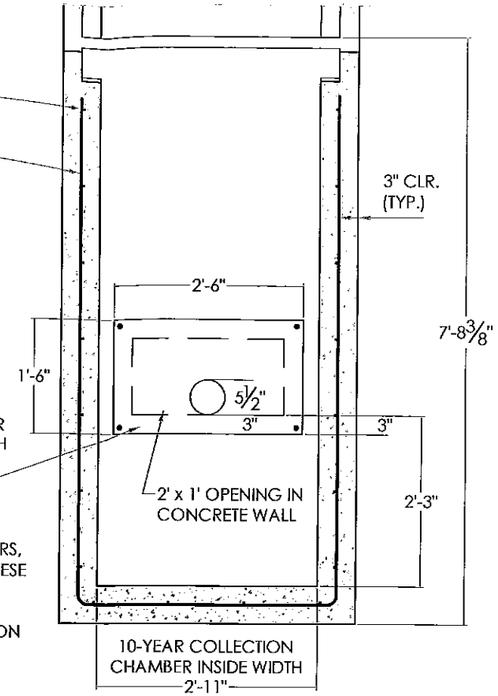
VERT. NO. 4 BARS @ 12" C-C, GRADE 60 (TYP.)

3" CLR. (TYP.)

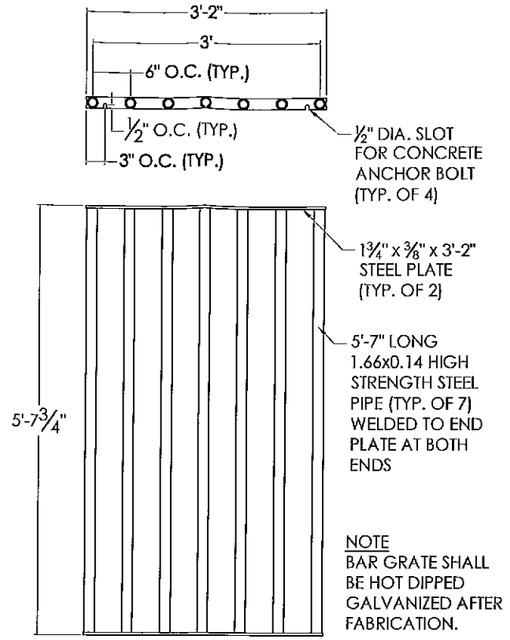
2'-6" x 1'-6" x ¼" STEEL PLATE (100-YEAR FLOW CONTROL) ATTACH WITH FOUR ¼" CONCRETE ANCHOR BOLTS W/ WASHER & NUT

2'-6" x 1'-6" x ¼" STEEL PLATE WITH 5½" DIA. ORIFICE (10-YEAR FLOW CONTROL), ATTACH WITH FOUR ¼" CONCRETE ANCHOR BOLTS W/ WASHER & NUT

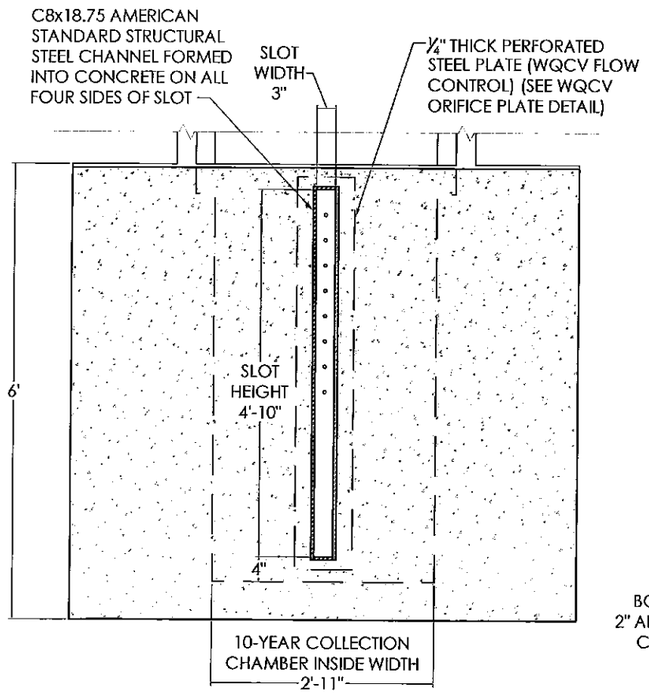
NOTES:
1. ALL ANCHOR BOLTS, WASHERS, AND NUTS INDICATED ON THESE DETAILS SHALL BE STAINLESS STEEL.
2. ALL STEEL PLATE INDICATED ON THESE DETAILS SHALL BE HOT DIPPED GALVANIZED AFTER FABRICATION.



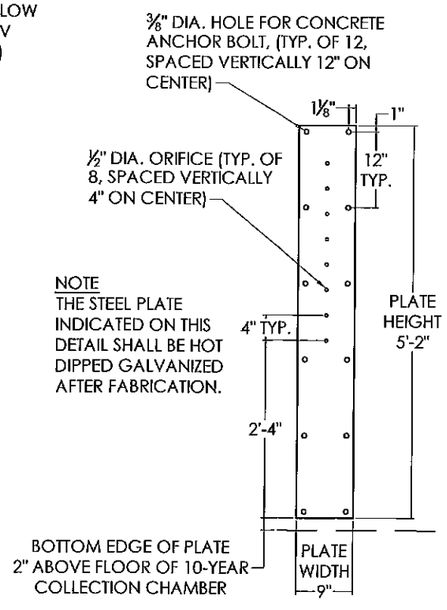
SECTION C-C - 10-YEAR FLOW CONTROL
SCALE: 1" = 2'



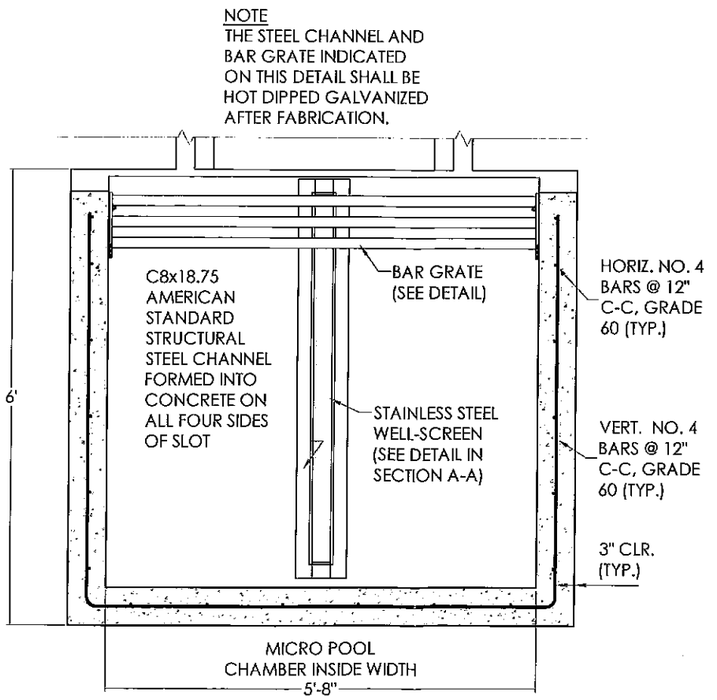
BAR GRATE DETAILS
SCALE: 1" = 2'



SECTION D-D - WQCV FLOW CONTROL
SCALE: 1" = 2'



WQCV ORIFICE PLATE DETAIL
SCALE: 1" = 2'



SECTION E-E - MICRO POOL
SCALE: 1" = 2'

PROPOSED DETENTION POND B OUTLET (PAGE 2 OF 2)

STORM WATER DETENTION VOLUMES AND RELEASE RATES

Project: New Hope Presbyterian Church
Detention Pond: Proposed Pond B (PPDP-PDB)

Minimum Detention Volumes

$V = KA$

Where:

V = required volume in acre-feet for the 100-year or 10-year storm above the WQCV

For the 100-Year Storm:
$K_{100} = (1.78I - 0.002I^2 - 3.56) / 900$

For the 10-Year Storm:
$K_{10} = (0.95I - 1.90) / 1000$

I = developed basin imperviousness (%)

A = tributary area (acres)

Solution:

A = 7.82 acres

I = 53%

K_{100} = (1.78*53 - 0.002*53^2 - 3.56) / 900 = 0.095

K_{10} = (0.95*53 - 1.90) / 1000 = 0.048

V_{100} = 0.095*7.82 = 0.7429 acre-feet

V_{10} = 0.048*7.82 = 0.3754 acre-feet

Maximum Allowable Release Rates

$Q = FA$

Where:

Q = allowable release rate for the 100-year or 10-year storm in cfs

F = release rate factor by hydrologic soil group for the 100-year or 10-year storm in cfs/acre:

	NRCS Hydrologic Soil Group		
Design Frequency	A	B	C&D
100-year	0.50	0.85	1.00
10-year	0.13	0.23	0.30

A = Tributary Area (acres)

Solution:

A = 7.82 acres

Predominant Soil Group: B F_{100} = 0.85 F_{10} = 0.23

Q_{100} = 0.85*7.82 = 6.65 cfs

Q_{10} = 0.23*7.82 = 1.80 cfs

STAGE-DISCHARGE SIZING OF THE WATER QUALITY CAPTURE VOLUME (WQCV) OUTLET

Project: New Hope Presbyterian Church
Basin ID: Proposed Pond B (PPDP-PDB)

WQCV Design Volume (Input):

Catchment Imperviousness, I_a = 53 percent
Catchment Area, A = 7.82 acres
Depth at WQCV outlet above lowest perforation, H = 36.00 inches = (6147.00 - 6144.00)*12
Number of layers, N_L = 8
Vertical distance between layers, h = 4.00 inches
Orifice discharge coefficient, C_o = 0.65

Diameter of holes, D = 0.500 in
Number of holes per layer, N = 1
OR
Height of slot, H = _____ in
Width of slot, W = _____ in

Outlet Design Information (Output):

Water Quality Capture Volume (1.0 * (0.91 * I^3 - 1.19 * I^2 + 0.78 * I)), WQCV = 0.21 watershed inches
Design Volume (WQCV / 12 * Area * 1.2) Vol = 0.1678 acre-feet
Recommended maximum outlet area per layer (based on 4" vertical spacing of layers), A_o = 0.30 square inches
Total opening area at each layer, A_o = 0.20 square inches
Total opening area at each layer, A_o = 0.0014 square feet

Calculation of Collection Capacity :

Stage ft (input)	Central Elevations of Layers of Holes in feet: Layer 1 6144.00	Layer 2 6144.33	Layer 3 6144.67	Layer 4 6145.00	Layer 5 6145.33	Layer 6 6145.67	Layer 7 6146.00	Layer 8 6146.33	Layer 9	Layer 10	Layer 11	Layer 12	Flow cfs
	Collection Capacity for Each Layer of Holes in cfs												
6144.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000					0.00
6144.50	0.005	0.003	0.000	0.000	0.000	0.000	0.000	0.000					0.01
6145.50	0.009	0.008	0.006	0.005	0.003	0.000	0.000	0.000					0.03
6146.00	0.010	0.009	0.008	0.007	0.006	0.004	0.000	0.000					0.04
6147.00	0.012	0.012	0.011	0.010	0.009	0.008	0.007	0.006					0.08
6148.00	0.014	0.014	0.013	0.012	0.012	0.011	0.010	0.009					0.09
6148.70	0.015	0.015	0.014	0.014	0.013	0.012	0.012	0.011					0.11
6149.00	0.016	0.015	0.015	0.014	0.014	0.013	0.012	0.012					0.11
6150.00	0.017	0.017	0.016	0.016	0.015	0.015	0.014	0.014					0.12
6151.00	0.019	0.018	0.018	0.017	0.017	0.016	0.016	0.016					0.14

STAGE-STORAGE SIZING FOR POLYGONAL, ELLIPTICAL, OR IRREGULAR PONDS

Project: New Hope Presbyterian Church
Basin ID: Proposed Pond B (PPDP-PDB)

Irregular Pond: X (Use Overide values in cells G32:G52)

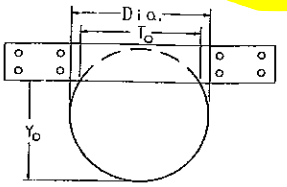
	MINOR	MAJOR	
Storage Requirement from Sheet "Storm Water Detetnion Volumes and Release Rates" :	0.3754	0.7429	acre-ft.
Stage-Storage Relationship: Storage Requirement from Sheet 'Hydrograph':			acre-ft.
Water Quality Capture Design Volume from Sheet 'WQCV':	0.1678		acre-ft.

Labels for WQCV, Minor, & Major Storage Stages (input)	Stage ft (input)	Side Slope (H:V) ft/ft Below El. (input)	Pond Width at Stage ft (output)	Pond Length at Stage ft (output)	Surface Area at Stage ft^2 (output)	Surface Area at Stage ft^2 User Overide	Volume Below Stage ft^3 (output)	Surface Area at Stage acres (output)	Volume Below Stage acre-ft (output)	Target Volumes for WQCV, Minor, & Major Storage acre-ft (for goal seek)
	6144.00					17	0	0.0004	0.0000	
	6144.50					20	9	0.0005	0.0002	
WQCV Bot. Stage	6145.50					59	49	0.0014	0.0011	
	6146.00					4,343	1,149	0.0997	0.0264	
WQCV Top Stage	6147.00					8,102	7,372	0.1860	0.1692	0.1678
	6148.00					10,054	16,450	0.2308	0.3776	
MINOR	6148.70					11,550	23,989	0.2652	0.5507	0.1692+0.3754=0.5446
	6149.00					12,036	27,551	0.2763	0.6325	
MAJOR	6150.00					14,020	40,579	0.3219	0.9316	0.1692+0.7429=0.9121
	6151.00					16,200	55,689	0.3719	1.2784	

STAGE DISCHARGE SIZING OF THE WEIRS AND ORIFICES IN DET CONTROL)

EXCERPTS FROM EXISTING REPORT

Project: New Hope Presbyterian Church
Basin ID: Proposed Pond B (PPDP-PDB)



Sizing the Restrictor Plate for Circular Vertical Orifices or Pipes (Input)

	#1 Vertical Orifice	#2 Vertical Orifice	
Water Surface Elevation at Design Depth (Elev: WS)		6,150.00	feet
Pipe/Vertical Orifice Entrance Invert Elevation (Elev: Invert)		6,143.75	feet
Required Peak Flow through Orifice at Design Depth (Q)		6.8	cfs
Pipe/Vertical Orifice Diameter (inches) (Dia)		18.00	inches
Orifice Coefficient (C_o)		0.65	

Full-flow Capacity (Calculated)

Full-flow area (Af)		1.77	sq ft
Half Central Angle in Radians (Theta)		3.14	rad
Full-flow capacity (Qf)		21.6	cfs
Percent of Design Flow		320%	

Calculation of Orifice Flow Condition

Half Central Angle (0<Theta<3.1416) (Theta)		1.25	rad
Flow area (A_o)		0.53	sq ft
Top width of Orifice (inches) (T_o)		17.05	inches
Height from Invert of Pipe to Bottom of Plate (inches) (Y_o)		6.12	inches
Elevation of Bottom of Plate (Elev Plate Bottom Edge)		6,144.26	feet
Resultant Peak Flow Through Orifice at Design Depth (Q_o)		6.8	cfs

Design Information (Input):

		#1 Horiz.	#2 Horiz.	#1 Vert.	#2 Vert.	
Circular Opening: Diameter in Inches	Dia. =			5.50		inches
OR						
Rectangular Opening: Width in Feet	W =	2.92	2.92		1.04	ft.
Length (Height for Vertical)	L or H =	5.44	2.80		0.51	ft.
Percentage of Open Area After Trash Rack Reduction	% open =	50.00	50.00	100.00	100.00	%
Orifice Coefficient	C_o =	0.65	0.65	0.65	0.65	
Weir Coefficient	C_w =	3.40	3.40			
Orifice Elevation (Bottom for Vertical)	E_o =	6147.00	6148.70	6,143.75	6,143.75	ft.

Calculation of Collection Capacity:

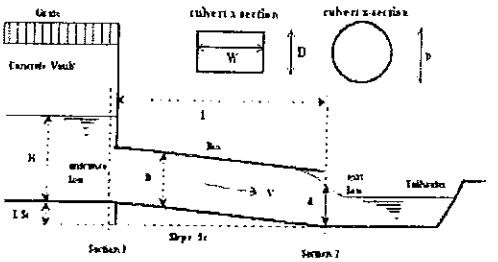
Net Opening Area (after Trash Rack Reduction)	A_o =	7.94	4.09	0.16	0.53	sq. ft.
User-Overide Net Opening Area	A_o =					sq. ft.
Perimeter as Weir Length	L_w =	13.61	8.53	ft.		
User-Overide Weir Length	L_w =			ft.		
Top Elevation of Vertical Orifice Opening, Top =				6144.21	6144.28	ft.
Center Elevation of Vertical Orifice Opening, Cen =				6143.98	6144.01	ft.

Routing 1: Water flows through WQCV plate and #1 horizontal opening into #1 vertical opening. This flow plus flow from #2 horizontal opening flows through #2 vertical opening.

			Horizontal Orifices				Vertical Orifices			
Labels for WQCV, Minor, & Major Storage W.S. Elevations (input)	Water Surface Elevation ft (linked)	WQCV Plate/Riser Flow cfs (User-linked)	#1 Horiz. Weir Flow cfs (output)	#1 Horiz. Orifice Flow cfs (output)	#2 Horiz. Weir Flow cfs (output)	#2 Horiz. Orifice Flow cfs (output)	#1 Vert. Collection Capacity cfs (output)	#2 Vert. Collection Capacity cfs (output)	Total Collection Capacity cfs (output)	Target Collection Capacity for Minor & Major cfs (link for goal seek)
	6144.00	0.00	0.00	0.00	0.00	0.00	0.17	0.48	0.00	
	6144.50	0.01	0.00	0.00	0.00	0.00	0.62	1.95	0.01	
WQCV Bot. Stage	6145.50	0.03	0.00	0.00	0.00	0.00	1.08	3.38	0.03	
	6146.00	0.04	0.00	0.00	0.00	0.00	1.22	3.80	0.04	
WQCV Top Stage	6147.00	0.08	0.00	0.00	0.00	0.00	1.50	4.78	0.08	
	6148.00	0.09	46.94	41.42	0.00	0.00	1.73	5.53	1.73	
MINOR	6148.70	0.11	103.85	53.97	0.00	0.00	1.87	6.00	1.87	0.11+1.80=1.91
	6149.00	0.11	132.76	58.67	4.81	11.72	1.93	6.18	6.18	
MAJOR	6150.00	0.12	243.89	71.74	43.06	24.84	2.11	6.77	6.77	0.12+6.65=6.77
	6151.00	0.14	375.50	82.83	101.24	32.37	2.28	7.31	7.31	

STAGE-DISCHARGE SIZING OF THE OUTLET CULVERT (INLET vs. OUTLET CONTROL WITH TAILWATER EFFECTS)

Project: New Hope Presbyterian Church
Basin ID: Proposed Pond B (PPDP-PDB)



Design Information (Input):

Circular Culvert: Barrel Diameter in Inches	D =	18.00 inches
Circular Culvert: Inlet Edge Type (choose from pull-down list)		Square End with Headwall
Number of Barrels	No =	1
Inlet Elevation at Culvert Invert	I_{elev} =	6143.75 ft elev.
Outlet Elevation at Culvert Invert	O_{elev} =	6142.90 ft elev.
Culvert Length in Feet	L =	42.00 ft.
Manning's Roughness	n =	0.0130
Bend Loss Coefficient	K_b =	0.00
Exit Loss Coefficient	K_x =	1.00

Design Information (calculated):

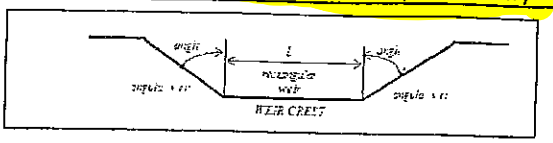
Entrance Loss Coefficient	K_e =	0.50
Friction Loss Coefficient	K_f =	0.76
Sum of All Loss Coefficients	K_s =	2.26
Orifice Inlet Condition Coefficient	C_d =	0.66
Minimum Energy Condition Coefficient	KE_{low} =	-0.0831

Calculations of Culvert Capacity (output):

Water Surface Elevation From Sheet "Pond" (ft, linked)	Tailwater Surface Elevation ft (input if known)	Culvert Inlet-Control Flowrate cfs (output)	Culvert Outlet-Control Flowrate cfs (output)	Flowrate into Culvert From Sheet "Outlet" (cfs, linked)	Controlling Culvert Flowrate cfs (output)	Inlet equation used:
6144.00		0.30	2.30	0.00	0.00	min. energy equation
6144.50		7.84	8.90	0.01	0.01	regression equation
6145.50		7.84	0.10	0.03	0.03	regression equation
6146.00		10.14	10.50	0.04	0.04	regression equation
6147.00		13.54	13.00	0.08	0.08	regression equation
6148.00		16.14	15.10	1.73	1.73	regression equation
6148.70		17.72	16.50	1.87	1.87	orifice equation
6149.00		18.32	17.00	6.18	6.18	orifice equation
6150.00		20.32	18.80	6.77	6.77	orifice equation
6151.00		22.02	20.30	7.31	7.31	orifice equation

STAGE-DISCHARGE SIZING OF THE SPILLWAY

Project: New Hope Presbyterian Church
Basin ID: Proposed Pond B (PPDP-PDB)



Design Information (input):

Bottom Length of Weir	L =	14.50 feet
Angle of Side Slope Weir	Angle =	75.96 degrees
Elev. for Weir Crest	EL. Crest =	6,150.00 feet
Coef. for Rectangular Weir	C_w =	3.10
Coef. for Trapezoidal Weir	C_t =	3.10
Required Spillway Release Rate	$2*Q_{100} = Q_S$ =	57.34

Calculation of Spillway Capacity (output):

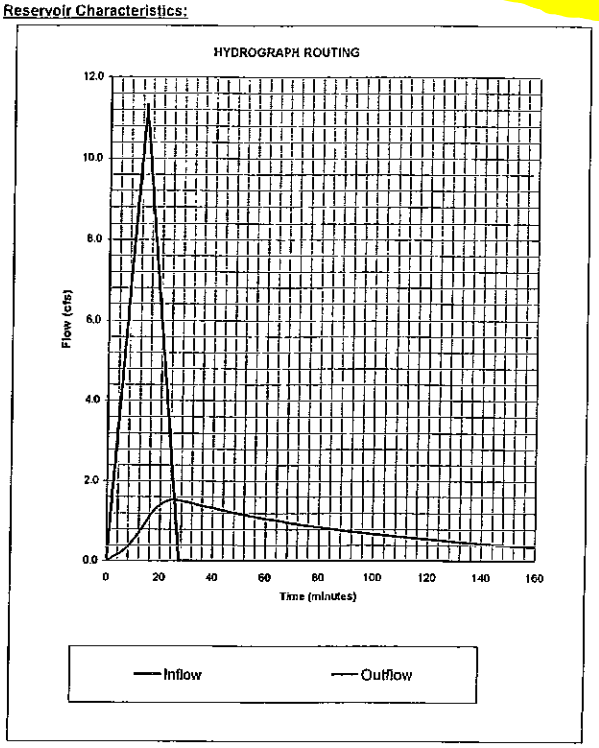
Water Surface Elevation ft. (linked)	Rect. Weir Flowrate cfs (output)	Triangle Weir Flowrate cfs (output)	Total Spillway Release cfs (output)	Total Pond Release cfs (output)
6144.00	0.00	0.00	0.00	0.00
6144.50	0.00	0.00	0.00	0.01
6145.50	0.00	0.00	0.00	0.03
6146.00	0.00	0.00	0.00	0.04
6147.00	0.00	0.00	0.00	0.08
6148.00	0.00	0.00	0.00	1.73
6148.70	0.00	0.00	0.00	1.87
6149.00	0.00	0.00	0.00	6.18
6150.00	0.00	0.00	0.00	6.77
6151.00	44.95	12.40	57.35	64.66

EXCERPTS FROM EXISTING REPORT

Project: New Hope Presbyterian Church

Basin ID: Proposed Pond B (PPDP-PDB) 5-Year (assumes WQCV is full at the beginning of the storm event)

Reservoir Characteristics:



Stage St, Feet	Outflow O, cfs	Storage S, cu.ft.	2S cu.ft.	O*dt+2S R, cu.ft.
6,144.00	0.00	0	0	0
6,144.50	0.01	9	18	20
6,145.50	0.03	49	97	102
6,146.00	0.04	1,149	2,298	2,305
6,147.00	0.08	7,372	14,743	14,756
6,148.00	1.73	16,450	32,899	33,183
6,148.70	1.87	23,989	47,979	48,285
6,149.00	6.18	27,551	55,102	56,114
6,150.00	6.77	40,579	81,158	82,287
6,151.00	43.00	55,689	111,378	118,422

Reservoir Routing:

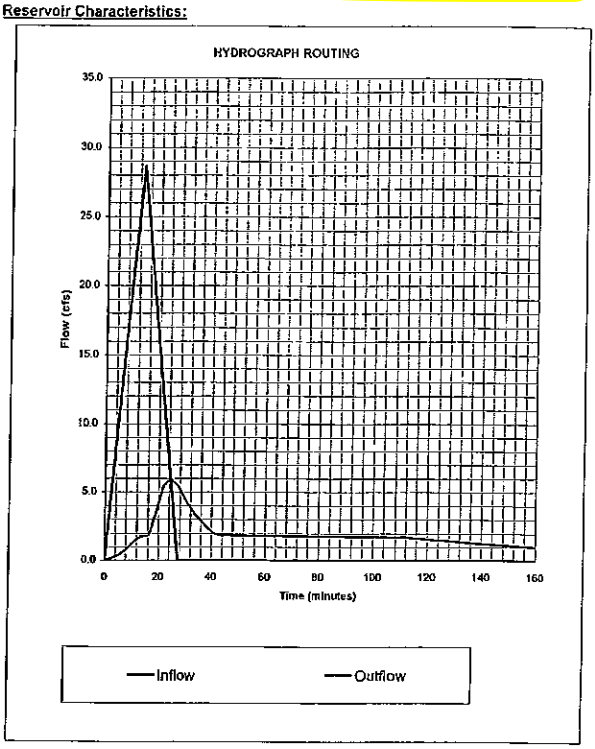
Time increment dt = 2.73 minutes

Time (minutes)	Inflow Hydrograph (cfs)	I_1 - cfs	O_1	S_1 - cu.ft.	R - cu.ft.	O_2 - cfs	S_2 - cu.ft.	Stage @ O_2	S_2 - ac. ft.
0.00	0.00	2.3	0.00	7,372	15,114	0.11	7,648	6,144.00	0.1738
2.73	2.27	4.5	0.11	7,648	16,161	0.21	8,078	6,147.08	0.1855
5.46	4.53	6.8	0.21	8,078	17,078	0.37	8,959	6,147.17	0.2057
8.19	6.80	9.1	0.37	8,959	20,455	0.59	10,179	6,147.31	0.2337
10.92	9.06	11.3	0.59	10,179	23,802	0.87	11,730	6,147.48	0.2693
13.65	11.33	9.1	0.87	11,730	26,656	1.15	13,234	6,147.65	0.3038
16.38	9.06	6.8	1.15	13,234	28,879	1.34	14,329	6,147.77	0.3290
19.11	6.80	4.5	1.34	14,329	30,294	1.47	15,026	6,147.84	0.3450
21.84	4.53	2.3	1.47	15,026	30,925	1.53	15,337	6,147.88	0.3521
24.57	2.27	0.0	1.53	15,337	30,790	1.52	15,274	6,147.87	0.3506
27.30	0.00	0.0	1.52	15,274	30,299	1.47	15,026	6,147.84	0.3450
30.03	0.00	0.0	1.47	15,026	29,817	1.43	14,791	6,147.82	0.3396
32.76	0.00	0.0	1.43	14,791	29,349	1.39	14,561	6,147.79	0.3343
35.49	0.00	0.0	1.39	14,561	28,894	1.35	14,337	6,147.77	0.3291
38.22	0.00	0.0	1.35	14,337	28,453	1.31	14,120	6,147.74	0.3241
40.95	0.00	0.0	1.31	14,120	28,025	1.27	13,909	6,147.72	0.3193
43.68	0.00	0.0	1.27	13,909	27,610	1.23	13,704	6,147.70	0.3146
46.41	0.00	0.0	1.23	13,704	27,207	1.19	13,506	6,147.68	0.3100
49.14	0.00	0.0	1.19	13,506	26,815	1.16	13,313	6,147.65	0.3056
51.87	0.00	0.0	1.16	13,313	26,435	1.13	13,125	6,147.63	0.3013
54.60	0.00	0.0	1.13	13,125	26,067	1.09	12,944	6,147.61	0.2971
57.33	0.00	0.0	1.09	12,944	25,709	1.06	12,767	6,147.59	0.2931
60.06	0.00	0.0	1.06	12,767	25,361	1.03	12,596	6,147.58	0.2892
62.79	0.00	0.0	1.03	12,596	25,024	1.00	12,430	6,147.56	0.2854
65.52	0.00	0.0	1.00	12,430	24,698	0.97	12,269	6,147.54	0.2817
68.25	0.00	0.0	0.97	12,269	24,379	0.94	12,112	6,147.52	0.2781
70.98	0.00	0.0	0.94	12,112	24,070	0.91	11,960	6,147.51	0.2746
73.71	0.00	0.0	0.91	11,960	23,771	0.88	11,813	6,147.49	0.2712
76.44	0.00	0.0	0.89	11,813	23,480	0.86	11,669	6,147.47	0.2679
79.17	0.00	0.0	0.86	11,669	23,199	0.84	11,530	6,147.46	0.2647
81.90	0.00	0.0	0.84	11,530	22,924	0.81	11,396	6,147.44	0.2616
84.63	0.00	0.0	0.81	11,396	22,658	0.79	11,265	6,147.43	0.2586
87.36	0.00	0.0	0.79	11,265	22,400	0.76	11,137	6,147.41	0.2557
90.09	0.00	0.0	0.76	11,137	22,150	0.74	11,014	6,147.40	0.2528
92.82	0.00	0.0	0.74	11,014	21,907	0.72	10,894	6,147.39	0.2501
95.55	0.00	0.0	0.72	10,894	21,674	0.70	10,778	6,147.38	0.2474
98.28	0.00	0.0	0.70	10,778	21,442	0.68	10,665	6,147.36	0.2448
101.01	0.00	0.0	0.68	10,665	21,219	0.66	10,556	6,147.35	0.2423
103.74	0.00	0.0	0.66	10,556	21,004	0.64	10,449	6,147.34	0.2399
106.47	0.00	0.0	0.64	10,449	20,794	0.62	10,346	6,147.33	0.2375
109.20	0.00	0.0	0.62	10,346	20,591	0.60	10,246	6,147.32	0.2352
111.93	0.00	0.0	0.60	10,246	20,393	0.58	10,149	6,147.31	0.2330
114.66	0.00	0.0	0.59	10,149	20,202	0.57	10,054	6,147.30	0.2308
117.39	0.00	0.0	0.57	10,054	20,016	0.55	9,963	6,147.29	0.2287
120.12	0.00	0.0	0.55	9,963	19,835	0.53	9,874	6,147.28	0.2267
122.85	0.00	0.0	0.53	9,874	19,660	0.52	9,788	6,147.27	0.2247
125.58	0.00	0.0	0.52	9,788	19,490	0.50	9,704	6,147.26	0.2228
128.31	0.00	0.0	0.50	9,704	19,325	0.49	9,622	6,147.25	0.2209
131.04	0.00	0.0	0.49	9,622	19,165	0.47	9,544	6,147.24	0.2191
133.77	0.00	0.0	0.47	9,544	19,009	0.46	9,467	6,147.23	0.2173
136.50	0.00	0.0	0.46	9,467	18,858	0.45	9,393	6,147.22	0.2156
139.23	0.00	0.0	0.45	9,393	18,712	0.43	9,320	6,147.21	0.2140
141.96	0.00	0.0	0.43	9,320	18,570	0.42	9,250	6,147.21	0.2124
144.69	0.00	0.0	0.42	9,250	18,431	0.41	9,182	6,147.20	0.2108
147.42	0.00	0.0	0.41	9,182	18,297	0.40	9,116	6,147.19	0.2093
150.15	0.00	0.0	0.40	9,116	18,167	0.39	9,052	6,147.19	0.2078
152.88	0.00	0.0	0.39	9,052	18,041	0.37	8,990	6,147.18	0.2064
155.61	0.00	0.0	0.37	8,990	17,919	0.36	8,930	6,147.17	0.2050
158.34	0.00	0.0	0.36	8,930	17,800	0.35	8,871	6,147.17	0.2036
161.07	0.00	0.0	0.35	8,871	17,684	0.34	8,814	6,147.16	0.2023
163.80	0.00	0.0	0.34	8,814	17,572	0.33	8,758	6,147.15	0.2011
					Maximum Values:	1.53	15,337	6,147.88	0.3521

Project: New Hope Presbyterian Church

Basin ID: Proposed Pond B (PPDP-PDB) 100-Year (assumes WQCV is full at the beginning of the storm event)

Reservoir Characteristics:



Stage St., Feet	Outflow O, cfs	Storage S, cu.ft.	2S cu.ft.	O*dt+2S R, cu.ft.
6,144.00	0.00	0	0	0
6,144.50	0.01	9	18	20
6,145.50	0.03	49	97	102
6,146.00	0.04	1,149	2,298	2,305
6,147.00	0.08	7,372	14,743	14,755
6,148.00	1.73	16,450	32,899	33,163
6,148.70	1.87	23,989	47,978	48,285
6,149.00	6.18	27,551	55,102	55,114
6,150.00	6.77	40,579	81,158	82,267
6,151.00	43.00	55,689	111,378	118,422

Reservoir Routing:

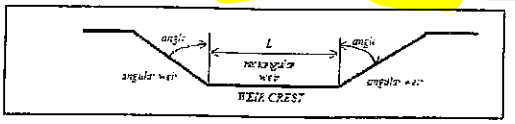
Time increment

dt = 2.73 minutes

Time (minutes)	Inflow Hydrograph (cfs)	I_2 - cfs	O_1	S_1 - cu.ft.	R - cu.ft.	O_2 - cfs	S_2 - cu.ft.	Stage @ O_2	S_2 - ac. ft.
0.00	0.00	5.7	0.00	7,372	15,683	0.16	7,826	6,144.00	0.1797
2.73	5.73	11.5	0.16	7,826	18,447	0.41	8,180	6,147.20	0.2110
5.46	11.47	17.2	0.41	8,180	23,009	0.82	11,437	6,147.45	0.2626
8.19	17.20	22.9	0.82	11,437	29,315	1.38	14,544	6,147.79	0.3339
10.92	22.94	28.7	1.38	14,544	37,315	1.77	18,513	6,148.19	0.4250
13.65	28.67	22.6	1.77	18,513	45,186	1.84	22,444	6,148.55	0.5152
16.38	22.94	17.2	1.84	22,444	51,160	3.45	25,207	6,148.81	0.5807
19.11	17.20	11.5	3.45	25,207	54,728	5.42	26,619	6,148.95	0.6180
21.84	11.47	5.7	5.42	26,619	55,789	5.99	27,394	6,148.99	0.6289
24.57	5.73	0.0	5.99	27,394	54,746	5.43	26,629	6,148.95	0.6182
27.30	0.00	0.0	5.43	26,629	52,858	4.45	26,120	6,148.88	0.5996
30.03	0.00	0.0	4.45	26,120	51,511	3.65	25,457	6,148.82	0.5844
32.76	0.00	0.0	3.65	25,457	50,317	2.99	24,914	6,148.78	0.5718
35.49	0.00	0.0	2.99	24,914	49,338	2.45	24,488	6,148.74	0.5617
38.22	0.00	0.0	2.45	24,488	48,535	2.01	24,103	6,148.71	0.5533
40.95	0.00	0.0	2.01	24,103	47,878	1.67	23,788	6,148.68	0.5460
43.68	0.00	0.0	1.67	23,788	47,299	1.39	23,481	6,148.65	0.5390
46.41	0.00	0.0	1.39	23,481	46,857	1.85	23,178	6,148.62	0.5321
49.14	0.00	0.0	1.85	23,178	46,049	1.85	22,873	6,148.59	0.5251
51.87	0.00	0.0	1.85	22,873	45,443	1.84	22,571	6,148.57	0.5181
54.60	0.00	0.0	1.84	22,571	44,839	1.84	22,269	6,148.54	0.5112
57.33	0.00	0.0	1.84	22,269	44,237	1.83	21,968	6,148.51	0.5043
60.06	0.00	0.0	1.83	21,968	43,637	1.83	21,669	6,148.48	0.4974
62.79	0.00	0.0	1.83	21,669	43,038	1.82	21,370	6,148.46	0.4906
65.52	0.00	0.0	1.82	21,370	42,442	1.82	21,072	6,148.43	0.4837
68.25	0.00	0.0	1.82	21,072	41,847	1.81	20,775	6,148.40	0.4769
70.98	0.00	0.0	1.81	20,775	41,254	1.80	20,478	6,148.37	0.4701
73.71	0.00	0.0	1.80	20,478	40,662	1.80	20,184	6,148.35	0.4634
76.44	0.00	0.0	1.80	20,184	40,073	1.79	19,890	6,148.32	0.4566
79.17	0.00	0.0	1.79	19,890	39,485	1.79	19,596	6,148.29	0.4499
81.90	0.00	0.0	1.79	19,596	38,899	1.78	19,304	6,148.26	0.4432
84.63	0.00	0.0	1.78	19,304	38,315	1.78	19,012	6,148.24	0.4365
87.36	0.00	0.0	1.78	19,012	37,733	1.77	18,721	6,148.21	0.4298
90.09	0.00	0.0	1.77	18,721	37,152	1.77	18,431	6,148.18	0.4231
92.82	0.00	0.0	1.77	18,431	36,573	1.76	18,142	6,148.16	0.4165
95.55	0.00	0.0	1.76	18,142	35,996	1.76	17,854	6,148.13	0.4099
98.28	0.00	0.0	1.76	17,854	35,421	1.75	17,567	6,148.10	0.4033
101.01	0.00	0.0	1.75	17,567	34,849	1.75	17,281	6,148.08	0.3967
103.74	0.00	0.0	1.75	17,281	34,278	1.74	16,995	6,148.05	0.3902
106.47	0.00	0.0	1.74	16,995	33,709	1.73	16,711	6,148.02	0.3836
109.20	0.00	0.0	1.73	16,711	33,137	1.73	16,427	6,148.00	0.3771
111.93	0.00	0.0	1.73	16,427	32,572	1.68	16,149	6,147.97	0.3707
114.66	0.00	0.0	1.68	16,149	32,023	1.63	15,876	6,147.94	0.3646
117.39	0.00	0.0	1.63	15,876	31,490	1.58	15,610	6,147.91	0.3585
120.12	0.00	0.0	1.58	15,610	30,973	1.53	15,361	6,147.88	0.3528
122.85	0.00	0.0	1.53	15,361	30,471	1.48	15,114	6,147.85	0.3470
125.58	0.00	0.0	1.48	15,114	29,984	1.44	14,874	6,147.83	0.3415
128.31	0.00	0.0	1.44	14,874	29,511	1.40	14,641	6,147.80	0.3361
131.04	0.00	0.0	1.40	14,641	29,052	1.36	14,415	6,147.78	0.3309
133.77	0.00	0.0	1.36	14,415	28,607	1.32	14,195	6,147.75	0.3258
136.50	0.00	0.0	1.32	14,195	28,174	1.28	13,982	6,147.73	0.3210
139.23	0.00	0.0	1.28	13,982	27,754	1.24	13,775	6,147.71	0.3162
141.96	0.00	0.0	1.24	13,775	27,347	1.21	13,574	6,147.68	0.3116
144.69	0.00	0.0	1.21	13,574	26,951	1.17	13,380	6,147.66	0.3072
147.42	0.00	0.0	1.17	13,380	26,567	1.14	13,190	6,147.64	0.3028
150.15	0.00	0.0	1.14	13,190	26,195	1.10	13,007	6,147.62	0.2988
152.88	0.00	0.0	1.10	13,007	25,833	1.07	12,829	6,147.60	0.2945
155.61	0.00	0.0	1.07	12,829	25,482	1.04	12,656	6,147.58	0.2905
158.34	0.00	0.0	1.04	12,656	25,141	1.01	12,488	6,147.56	0.2867
161.07	0.00	0.0	1.01	12,488	24,810	0.98	12,325	6,147.55	0.2829
163.80	0.00	0.0	0.98	12,325	24,489	0.95	12,167	6,147.53	0.2793
					Maximum Values:	5.99	27,394	6,148.99	0.6289

STAGE-DISCHARGE SIZING OF THE SPILLWAY

Project: New Hope Presbyterian Church
Basin ID: Pond B Forebay Outlet



Design Information (Input):

Bottom Length of Weir	L =	1.50 feet
Angle of Side Slope Weir	Angle =	0.00 degrees
Elev. for Weir Crest	EL. Crest =	6,147.00 feet
Coef. for Rectangular Weir	C_w =	3.10
Coef. for Trapezoidal Weir	C_t =	3.10

Calculation of Spillway Capacity (output):

Water Surface Elevation ft. (linked)	Rect. Weir Flowrate cfs (output)	Triangle Weir Flowrate cfs (output)	Total Spillway Release cfs (output)	Total Pond Release cfs (output)
6147.00	0.00	0.00	0.00	0.00
6147.50	1.64	0.00	1.64	1.64
6148.00	4.65	0.00	4.65	4.65

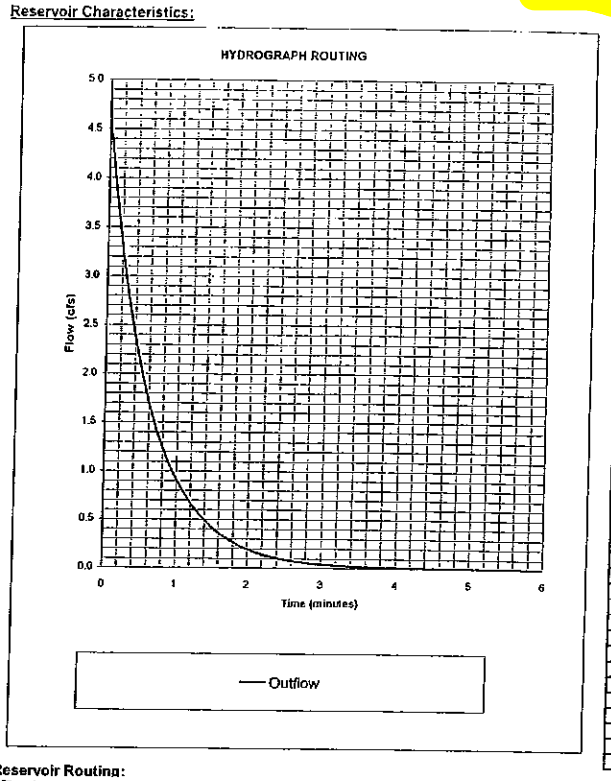
RESERVOIR ROUTING THROUGH THE DETENTION POND

EXCERPTS FROM EXISTING REPORT

Project: New Hope Presbyterian Church

Basin ID: Pond B Forebay Outlet

Reservoir Characteristics:



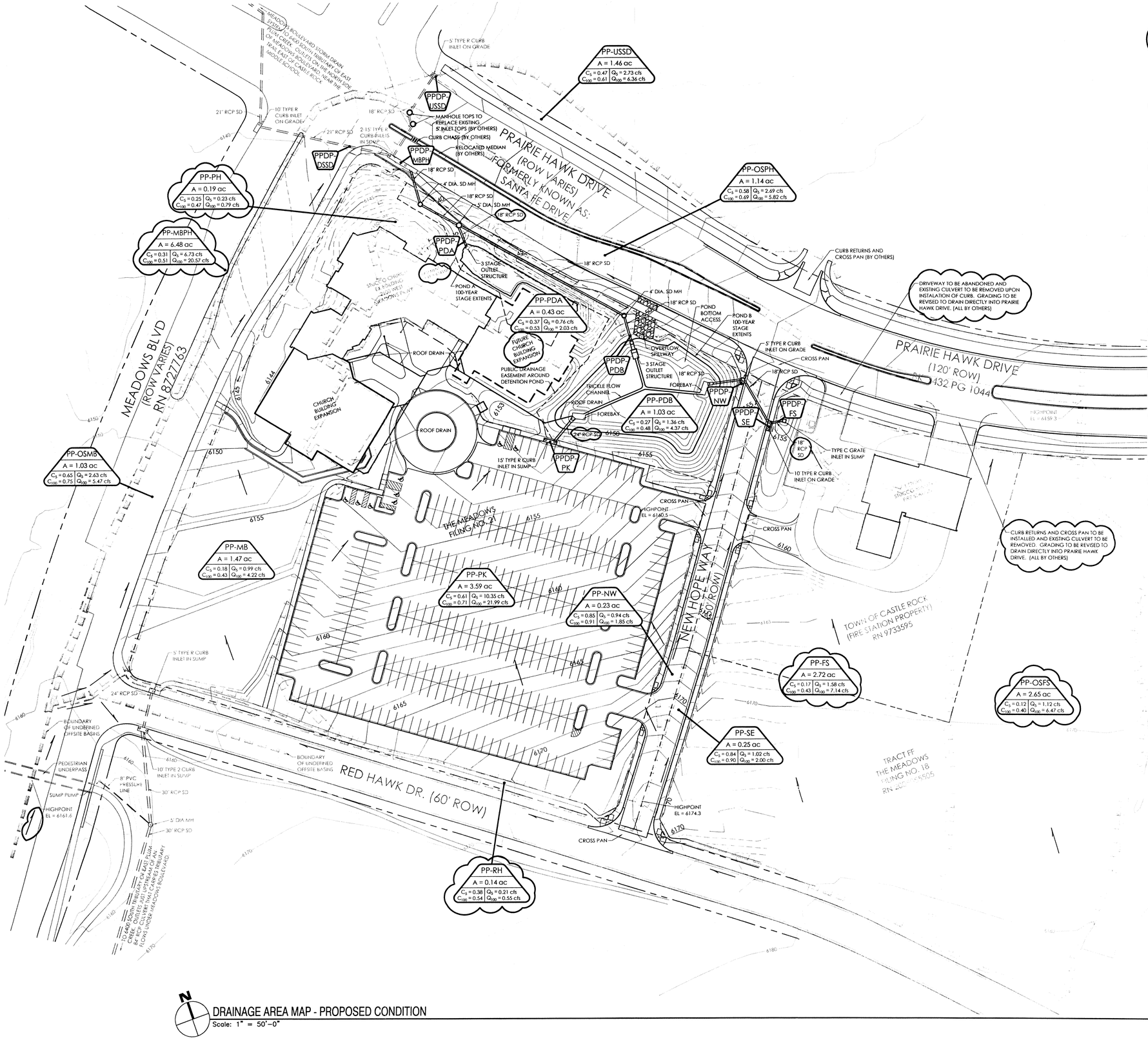
Stage St., Feet	Outflow O, cfs	Storage S, cu.ft.	2S cu.ft.	O*dt+2S R, cu.ft.
6,147.00	0.00	0	0	0
6,147.50	1.64	64	128	138
6,148.00	4.65	172	344	372

Reservoir Routing:

Time increment dt = 0.10 minutes

Time (minutes)	Inflow Hydrograph (cfs)	I_2 - cfs	O_1	S_1 - cu.ft.	R - cu.ft.	O_2 - cfs	S_2 - cu.ft.	Stage @ O_1	S_2 - ac. ft.
0.00	0.00	0.0	4.65	172	316	3.93	146	6,148.00	0.0034
0.10	0.00	0.0	3.93	146	269	3.33	124	6,147.78	0.0028
0.20	0.00	0.0	3.33	124	229	2.81	106	6,147.69	0.0024
0.30	0.00	0.0	2.81	106	195	2.38	90	6,147.62	0.0021
0.40	0.00	0.0	2.38	90	167	2.01	77	6,147.56	0.0018
0.50	0.00	0.0	2.01	77	142	1.70	66	6,147.51	0.0015
0.60	0.00	0.0	1.70	66	122	1.46	57	6,147.44	0.0013
0.70	0.00	0.0	1.46	57	105	1.25	49	6,147.38	0.0011
0.80	0.00	0.0	1.25	49	90	1.07	42	6,147.32	0.0010
0.90	0.00	0.0	1.07	42	77	0.92	36	6,147.28	0.0008
1.00	0.00	0.0	0.92	36	66	0.78	31	6,147.24	0.0007
1.10	0.00	0.0	0.78	31	56	0.67	26	6,147.20	0.0006
1.20	0.00	0.0	0.67	26	48	0.58	22	6,147.18	0.0005
1.30	0.00	0.0	0.58	22	41	0.49	19	6,147.15	0.0004
1.40	0.00	0.0	0.49	19	35	0.42	16	6,147.13	0.0004
1.50	0.00	0.0	0.42	16	30	0.36	14	6,147.11	0.0003
1.60	0.00	0.0	0.36	14	26	0.31	12	6,147.09	0.0003
1.70	0.00	0.0	0.31	12	22	0.27	10	6,147.08	0.0002
1.80	0.00	0.0	0.27	10	19	0.23	9	6,147.07	0.0002
1.90	0.00	0.0	0.23	9	16	0.20	8	6,147.06	0.0002
2.00	0.00	0.0	0.20	8	14	0.17	7	6,147.05	0.0001
2.10	0.00	0.0	0.17	7	12	0.14	6	6,147.04	0.0001
2.20	0.00	0.0	0.14	6	10	0.12	5	6,147.04	0.0001
2.30	0.00	0.0	0.12	5	9	0.11	4	6,147.03	0.0001
2.40	0.00	0.0	0.11	4	8	0.09	4	6,147.03	0.0001
2.50	0.00	0.0	0.09	4	6	0.08	3	6,147.02	0.0001
2.60	0.00	0.0	0.08	3	6	0.07	3	6,147.02	0.0001
2.70	0.00	0.0	0.07	3	5	0.06	2	6,147.02	0.0001
2.80	0.00	0.0	0.06	2	4	0.05	2	6,147.01	0.0000
2.90	0.00	0.0	0.05	2	3	0.04	2	6,147.01	0.0000
3.00	0.00	0.0	0.04	2	3	0.04	1	6,147.01	0.0000
3.10	0.00	0.0	0.04	1	3	0.03	1	6,147.01	0.0000
3.20	0.00	0.0	0.03	1	2	0.03	1	6,147.01	0.0000
3.30	0.00	0.0	0.03	1	2	0.02	1	6,147.01	0.0000
3.40	0.00	0.0	0.02	1	2	0.02	1	6,147.01	0.0000
3.50	0.00	0.0	0.02	1	1	0.02	1	6,147.01	0.0000
3.60	0.00	0.0	0.02	1	1	0.01	1	6,147.00	0.0000
3.70	0.00	0.0	0.01	1	1	0.01	0	6,147.00	0.0000
3.80	0.00	0.0	0.01	0	1	0.01	0	6,147.00	0.0000
3.90	0.00	0.0	0.01	0	1	0.01	0	6,147.00	0.0000
4.00	0.00	0.0	0.01	0	1	0.01	0	6,147.00	0.0000
4.10	0.00	0.0	0.01	0	1	0.01	0	6,147.00	0.0000
4.20	0.00	0.0	0.01	0	0	0.01	0	6,147.00	0.0000
4.30	0.00	0.0	0.01	0	0	0.00	0	6,147.00	0.0000
4.40	0.00	0.0	0.00	0	0	0.00	0	6,147.00	0.0000
4.50	0.00	0.0	0.00	0	0	0.00	0	6,147.00	0.0000
4.60	0.00	0.0	0.00	0	0	0.00	0	6,147.00	0.0000
4.70	0.00	0.0	0.00	0	0	0.00	0	6,147.00	0.0000
4.80	0.00	0.0	0.00	0	0	0.00	0	6,147.00	0.0000
4.90	0.00	0.0	0.00	0	0	0.00	0	6,147.00	0.0000
5.00	0.00	0.0	0.00	0	0	0.00	0	6,147.00	0.0000
5.10	0.00	0.0	0.00	0	0	0.00	0	6,147.00	0.0000
5.20	0.00	0.0	0.00	0	0	0.00	0	6,147.00	0.0000
5.30	0.00	0.0	0.00	0	0	0.00	0	6,147.00	0.0000
5.40	0.00	0.0	0.00	0	0	0.00	0	6,147.00	0.0000
5.50	0.00	0.0	0.00	0	0	0.00	0	6,147.00	0.0000
5.60	0.00	0.0	0.00	0	0	0.00	0	6,147.00	0.0000
5.70	0.00	0.0	0.00	0	0	0.00	0	6,147.00	0.0000
5.80	0.00	0.0	0.00	0	0	0.00	0	6,147.00	0.0000
5.90	0.00	0.0	0.00	0	0	0.00	0	6,147.00	0.0000
6.00	0.00	0.0	0.00	0	0	0.00	0	6,147.00	0.0000
					Maximum Values:	3.93	146	6,148.00	0.0034

EXCERPTS FROM EXISTING REPORT



DRAINAGE AREA MAP - PROPOSED CONDITION
Scale: 1" = 50'-0"

BASIN AND DESIGN POINT CONTRIBUTING AREA, PERCENT IMPERVIOUS, RUNOFF COEFFICIENTS, AND PEAK FLOWS

Basin or Design Point Definition	Contributing Area (acres)	Weighted Percent Impervious	5-Year Runoff Coefficient	100-Year Runoff Coefficient	5-Year Peak Flow (cfs)	100-Year Peak Flow (cfs)	Notes
PP-RH	0.14	55	0.38	0.54	0.21	0.55	Church Site and New Hope Way runoff to the northeast lane of Red Hawk Dr.
PP-MB	1.47	18	0.18	0.43	0.99	4.22	Church Site runoff to the southeast lane of Meadows Blvd.
PP-PH	0.19	30	0.25	0.47	0.23	0.79	Church Site and New Hope Way runoff to the southwest lane of Prairie Hawk Dr.
PP-PDA	0.43	53	0.37	0.53	0.76	2.03	Church Site runoff to existing detention Pond A.
PPDP-PDA	N/A	N/A	N/A	N/A	0.04	0.08	Outflow from redeveloped detention Pond A to a proposed storm drain system (see Appendix D).
PP-FS	2.72	16	0.17	0.43	1.58	7.14	Fire Station Property and offsite Tract FF runoff to the proposed grate inlet at Design Point PPDP-FS.
PPDP-FS	N/A	N/A	N/A	N/A	1.58	7.14	Sub-Basin PP-FS runoff intercepted by the grate inlet near the north corner of Fire Station Property (see Appendix C).
PP-SE	0.25	97	0.84	0.90	1.02	2.00	Southeast lane of New Hope Way runoff to the proposed 10' curb inlet at Design Point PPDP-SE.
PPDP-SE	N/A	N/A	N/A	N/A	1.02	1.98	Sub-Basin PP-SE runoff intercepted by the 10' curb inlet in the southeast lane of New Hope Way (see Appendix C).
PP-NW	0.23	97	0.85	0.91	0.94	1.85	Northwest lane of New Hope Way runoff to the proposed 5' curb inlet at Design Point PPDP-NW.
PPDP-NW	N/A	N/A	N/A	N/A	0.86	1.32	Sub-Basin PP-NW runoff intercepted by the 5' curb inlet in the northwest lane of New Hope Way (see Appendix C).
PP-PK	3.59	81	0.61	0.71	10.35	21.99	Church Site proposed parking lot runoff to the proposed 15' curb inlet at Design Point PPDP-PK.
PPDP-PK	N/A	N/A	N/A	N/A	10.35	21.99	Sub-Basin PP-PK runoff intercepted by the 15' curb inlet on the northeast edge of the parking lot (see Appendix C).
PP-PDB	1.03	35	0.27	0.48	1.36	4.37	Church Site runoff directly to proposed detention Pond B.
Combined Flows to Pond B	7.82	53	0.43	0.59	11.33	28.67	All runoff draining to proposed detention Pond B, including Sub-Basin PP-PDB and runoff intercepted by inlets at Design Points PPDP-FS, PPDP-SE, PPDP-NW, and PPDP-PK.
PPDP-PDB	N/A	N/A	N/A	N/A	1.53	5.99	Outflow from proposed detention Pond B to a proposed storm drain system (see Appendix D).
PP-OSMB	1.03	85	0.65	0.75	2.63	5.47	Offsite runoff to and originating in the southeast lane of Meadows Blvd.
PP-OSPH	1.14	79	0.58	0.69	2.69	5.82	Offsite runoff to and originating in the southwest lane of Prairie Hawk Dr.
PP-OSFS	2.65	8	0.12	0.40	1.12	6.47	Fire Station Property and offsite Tract FF runoff to the southwest lane of Prairie Hawk Dr.
PP-MBPH	6.48	N/A	0.31	0.51	6.73	20.57	All non-bypass surface runoff reaching the two 15' curb inlets near the south corner of Meadows Blvd and Prairie Hawk Dr, including Sub-Basins PP-MB, PP-PH, PP-OSMB, PP-OSPH, and PP-OSFS.
PPDP-MBPH	N/A	N/A	N/A	N/A	6.82	21.11	All surface runoff reaching the two 15' curb inlets near the south corner of Meadows Blvd and Prairie Hawk Dr, including the Combined Sub-Basin PP-MBPH and bypass flows from Design Points PPDP-NW and PPDP-SE.
PP-USSD	1.46	68	0.47	0.61	2.73	6.36	Offsite runoff to and originating in the northeast lane of Prairie Hawk Dr.
PPDP-USSD	N/A	N/A	N/A	N/A	0.80	1.17	Sub-Basin PP-USSD runoff intercepted by the 5' curb inlet in the northeast gutter of Prairie Hawk Dr (see Appendix C).
PPDP-DSSD	N/A	N/A	N/A	N/A	9.19 *	28.35 *	All runoff entering the two 15' curb inlets near the south corner of Meadows Blvd and Prairie Hawk Dr, including runoff intercepted by the inlets and runoff carried in the upstream stormdrain system (see Appendix C).

* the sum of peak flows from PPDP-PDA, PPDP-PDB, PPDP-MBPH, and PPDP-USSD

WATER QUALITY AND DETENTION FOR POND A AS REDEVELOPED (PP-PDA AT PPDP-PDA)

	Volume Required (Cubic Ft)	Volume Required (Acre-Ft)	Volume Provided (Cubic Ft)	Volume Provided (Acre-Ft)	Elevation at Top of Volume (Ft)	Release Rate Allowed (cfs) or Drain Time Required (min)	Release Rate Provided (cfs) or Drain Time Provided (min)
Water Quality[†]	401	0.0092	409	0.0094	6140.44	2400 min	"
10 year	897	0.0206	909	0.0209		0.10	0.09
10 year + WQ	1298	0.0298	1318	0.0303	6141.10		0.12
100 year	1782	0.0409	1784	0.0410		0.37	0.36
100 year + WQ	2182	0.0501	2193	0.0503	6141.51		0.40

[†] The UDFCD Drainage Criteria Manual Volume 3 specifies that a Water Quality Capture Volume drain in 40 hours.

" The "Reservoir Routing though Detention Pond" calculator provided by UDFCD and used to estimate WQCV drain time does not offer adequate precision to determine the drain time of Pond A because of the very small flow rates involved. The WQ orifice plate design for Pond A follows the UDFCD design guidelines and therefore should theoretically provide sufficient drain time.

WATER QUALITY AND DETENTION FOR POND B (PP-PDB AT PPDP-PDB)

	Volume Required (Cubic Ft)	Volume Required (Acre-Ft)	Volume Provided (Cubic Ft)	Volume Provided (Acre-Ft)	Elevation at Top of Volume (Ft)	Release Rate Allowed (cfs) or Drain Time Required (min)	Release Rate Provided (cfs) or Drain Time Provided (min)
Forebays*	219 – 365	0.005 – 0.008	344	0.0079	6148.00	3 – 5 min	4.5 min
Micropool**			43	0.0010	6144.00		
Water Quality[†]	7309	0.1678	7372	0.1692	6147.00	2400 min	2400 min
10 year	16352	0.3754	16617	0.3815		1.80 cfs	1.76 cfs
10 year + WQ	23662	0.5432	23989	0.5507	6148.70		1.87 cfs
100 year	32361	0.7429	33207	0.7623		6.65 cfs	6.65 cfs
100 year + WQ	39670	0.9107	40579	0.9316	6150.00		6.77 cfs

* The UDFCD Drainage Criteria Manual Volume 3 specifies that a forebay be 3% to 5% of the Water Quality Capture Volume and that a forebay drain in 3 min to 5min. For this design, the volume provided is divided between two equally sized forebays.

** The UDFCD Drainage Criteria Manual Volume 3 does not specify a micropool volume but does requre that the micropool be at least 2.5' deep. The micropool proposed for Pond B is 2.5' deep.

[†] The UDFCD Drainage Criteria Manual Volume 3 specifies that a Water Quality Capture Volume drain in 40 hours.

New Hope Presbyterian Church

Date: 10-31-2007 Project No. 05030.1

The Meadows Filing No. 21 (PWP 07-013)

Owner Address: New Hope Presbyterian Church
2100 W. Meadows Parkway
Castle Rock, CO 80104
(303)660-0057 F (303)660-1532

Architect Address: Eidos Architects
5400 South Syracuse St.
Greenwood Village, CO. 80231
(720)200-0630 F (720)200-0631

Engineer Address: MVE
1903 LeLaray Street, Suite 200
Colorado Springs, Colorado 80909
(719)635-5736 F (719)635-5450

Date: XX
Revised:
Revised:
Revised:

Drainage Area Map Proposed Condition

APPENDIX B

Hydrologic Computations

COMPOSITE % IMPERVIOUS CALCULATIONS

Subdivision: The Meadows Filing No. 21
Location: CO, Castle Rock

Project Name: Meadows Medical Plaza
Project No.: NBD000002.20
Calculated By: TJE
Checked By:
Date: 8/13/24

		Paved Area			Landscape Area			Roofs			Basins Total
Basin ID	Total Area (ac)	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	Weighted % Imp.
PP-MB	0.69	95		0.0	20	0.43	12.5	95	0.26	35.80	48.3
PP-PK	4.37	95	3.08	67.0	20	0.93	4.3	95	0.36	7.80	79.1

Galloway

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision: The Meadows Filing No. 21
Location: CO, Castle Rock

Project Name: Meadows Medical Plaza
Project No.: NBD000002.20
Calculated By: TJE
Checked By:
Date: 8/13/24

SUB-BASIN DATA						INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)					Tc CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (AC)	Hydrologic Soils Group	Impervious (%)	C_{100}	C_5	L (FT)	S (%)	T_i (MIN)	L (FT)	S (%)	Cv	VEL. (FPS)	T_t (MIN)	COMP. T_c (MIN)	TOTAL LENGTH (FT)	Urbanized T_c (MIN)	T_c (MIN)
PP-MB	0.69	B	48.3	0.65	0.39	50	0.5	11.6	146	4.0	20.0	4.0	0.6	12.2	196.0	11.1	11.1
PP-PK	4.37	B	79.1	0.79	0.66	80	5.0	4.2	590	4.0	20.0	4.0	2.5	6.7	670.0	13.7	6.7

NOTES:

$T_i = (0.395*(1.1 - C_5)*(L)^{0.5})/((S)^{0.33})$, S in ft/ft

T_t=L/60V (Velocity From Fig. 501)

Velocity V=Cv*S^0.5, S in ft/ft

Tc Check = 10+L/180

For Urbanized basins a minimum T_c of 5.0 minutes is required.

For non-urbanized basins a minimum T_c of 10.0 minutes is required

Galloway

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: The Meadows Filing No. 21
Location: CO, Castle Rock
Design Storm: 5-Year

Project Name: Meadows Medical Plaza
Project No.: NBD000002.2(
Calculated By: TJE
Checked By:
Date: 8/13/24

		DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			
STREET	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
		PP-MB	0.69	0.39	11.1	0.27	3.71	1.0													Off-site to Meadows Pkwy. ROW
	PK	PP-PK	4.37	0.66	6.7	2.88	4.46	12.8													Ex. 15' CDOT Type 'R' Inlet (Sump - Private)

Galloway

STANDARD FORM SF-3
STORM DRAINAGE SYSTEM DESIGN
(RATIONAL METHOD PROCEDURE)

Subdivision: The Meadows Filing No. 21
Location: CO, Castle Rock
Design Storm: 100-Year

Project Name: Meadows Medical Plaza
Project No.: NBD000002.2(
Calculated By: TJE
Checked By:
Date: 8/13/24

		DIRECT RUNOFF							TOTAL RUNOFF				STREET		PIPE			TRAVEL TIME			
STREET	Design Point	Basin ID	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Slope (%)	Street Flow (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	REMARKS
		PP-MB	0.69	0.65	11.1	0.45	6.75	3.0													Off-site to Meadows Pkwy. ROW
	PK	PP-PK	4.37	0.79	6.7	3.45	8.12	28.0													Ex. 15' CDOT Type 'R' Inlet (Sump - Private)

Galloway

DETENTION POND TRIBUTARY AREAS

Subdivision: The Meadows Filing No. 21
Location: CO, Castle Rock

Project Name: Meadows Medical Plaza
Project No.: NBD000002.20
Calculated By: TJE
Checked By:
Date: 8/13/24

Existing Pond B

Basin	Area	% Imp
PK	4.37	79.1
*FS	2.72	16
*SE	0.25	97
*NW	0.23	97
*PDB	1.03	35
Total	**8.60**	**54.9**

*Values taken from "The Meadows Filing No. 21 (New Hope Presbyterian Church) - Phase III Drainage Report," Prepared by M.V.E., Inc., Dated December 5, 2007

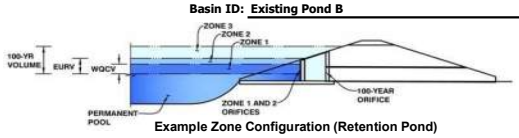
Galloway

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

Project: Meadows Medical Plaza

Basin ID: Existing Pond B



Example Zone Configuration (Retention Pond)

Watershed Information

Selected BMP Type =	EDB	
Watershed Area =	8.60	acres
Watershed Length =	650	ft
Watershed Length to Centroid =	300	ft
Watershed Slope =	0.040	ft/ft
Watershed Imperviousness =	54.90%	percent
Percentage Hydrologic Soil Group A =	0.0%	percent
Percentage Hydrologic Soil Group B =	100.0%	percent
Percentage Hydrologic Soil Groups C/D =	0.0%	percent
Target WQCV Drain Time =	40.0	hours
Location for 1-hr Rainfall Depths =	User Input	

After providing required inputs above including 1-hour rainfall depths, click 'Run CUHP' to generate runoff hydrographs using the embedded Colorado Urban Hydrograph Procedure.

			Optional User Overrides
Water Quality Capture Volume (WQCV) =	0.158	acre-feet	acre-feet
Excess Urban Runoff Volume (EURV) =	0.509	acre-feet	acre-feet
2-yr Runoff Volume (P1 = 1.06 in.) =	0.373	acre-feet	1.06 inches
5-yr Runoff Volume (P1 = 1.43 in.) =	0.585	acre-feet	1.43 inches
10-yr Runoff Volume (P1 = 1.66 in.) =	0.724	acre-feet	1.66 inches
25-yr Runoff Volume (P1 = 1.69 in.) =	0.784	acre-feet	inches
50-yr Runoff Volume (P1 = 2.26 in.) =	1.166	acre-feet	2.26 inches
100-yr Runoff Volume (P1 = 2.6 in.) =	1.425	acre-feet	2.60 inches
500-yr Runoff Volume (P1 = 3.14 in.) =	1.804	acre-feet	inches
Approximate 2-yr Detention Volume =	0.345	acre-feet	
Approximate 5-yr Detention Volume =	0.502	acre-feet	
Approximate 10-yr Detention Volume =	0.653	acre-feet	
Approximate 25-yr Detention Volume =	0.632	acre-feet	
Approximate 50-yr Detention Volume =	0.784	acre-feet	
Approximate 100-yr Detention Volume =	0.889	acre-feet	

Define Zones and Basin Geometry

Zone 1 Volume (WQCV) =	0.158	acre-feet
Zone 2 Volume (EURV - Zone 1) =	0.351	acre-feet
Zone 3 Volume (100-year - Zones 1 & 2) =	0.380	acre-feet
Total Detention Basin Volume =	0.889	acre-feet
Initial Surcharge Volume (ISV) =	user	ft^3
Initial Surcharge Depth (ISD) =	user	ft
Total Available Detention Depth (H_{total}) =	user	ft
Depth of Trickle Channel (H_{TC}) =	user	ft
Slope of Trickle Channel (S_{TC}) =	user	ft/ft
Slopes of Main Basin Sides (S_{main}) =	user	H:V
Basin Length-to-Width Ratio ($R_{L/W}$) =	user	

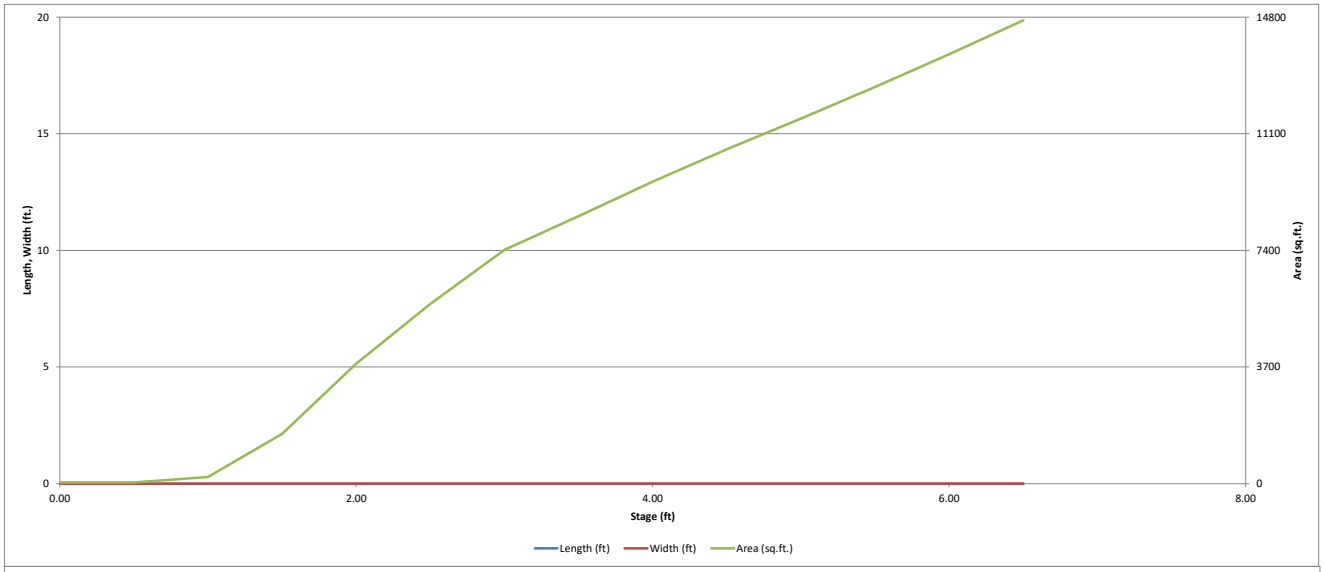
Initial Surcharge Area (A_{ISV}) =	user	ft^2
Surcharge Volume Length (L_{ISV}) =	user	ft
Surcharge Volume Width (W_{ISV}) =	user	ft
Depth of Basin Floor (H_{FLOOR}) =	user	ft
Length of Basin Floor (L_{FLOOR}) =	user	ft
Width of Basin Floor (W_{FLOOR}) =	user	ft
Area of Basin Floor (A_{FLOOR}) =	user	ft^2
Volume of Basin Floor (V_{FLOOR}) =	user	ft^3
Depth of Main Basin (H_{MAIN}) =	user	ft
Length of Main Basin (L_{MAIN}) =	user	ft
Width of Main Basin (W_{MAIN}) =	user	ft
Area of Main Basin (A_{MAIN}) =	user	ft^2
Volume of Main Basin (V_{MAIN}) =	user	ft^3
Calculated Total Basin Volume (V_{total}) =	**user**	acre-feet

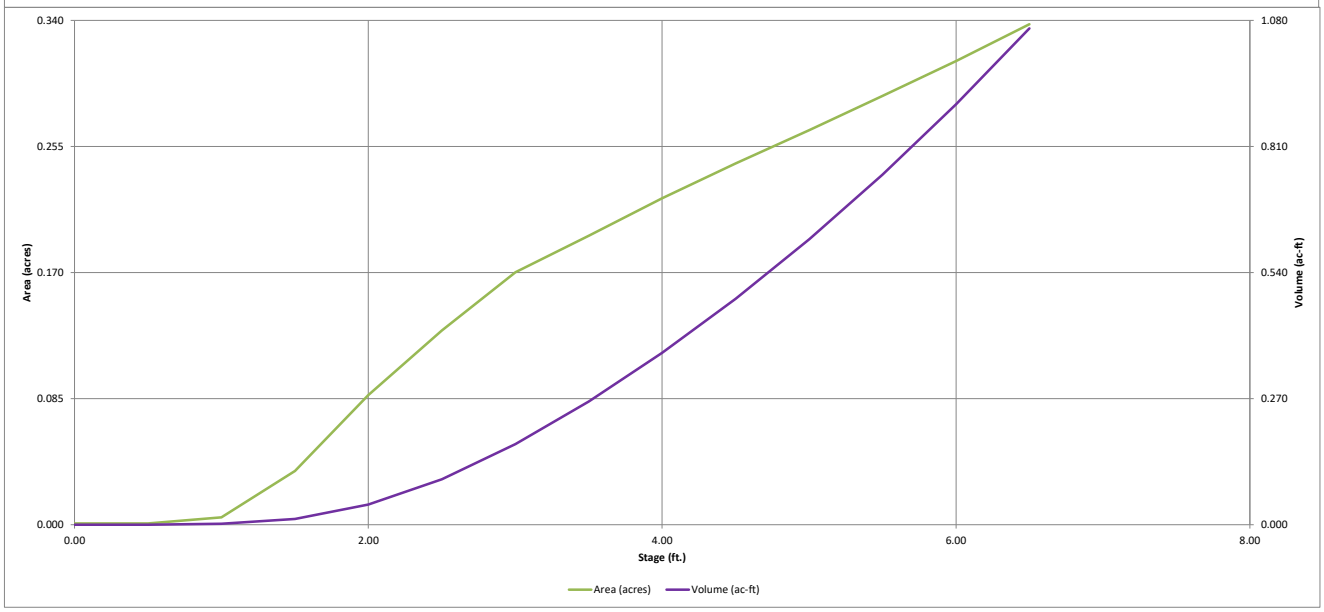
Depth Increment = 0.50 ft

Stage - Storage Description	Stage (ft)	Optional Override Stage (ft)	Length (ft)	Width (ft)	Area (ft^2)	Optional Override Area (ft^2)	Area (acre)	Volume (ft^3)	Volume (ac-ft)
Top of Micropool	--	0.00	--	--	--	35	0.001		
	--	0.50	--	--	--	35	0.001	17	0.000
6145	--	1.00	--	--	--	213	0.005	79	0.002
	--	1.50	--	--	--	1,585	0.036	529	0.012
6146	--	2.00	--	--	--	3,805	0.087	1,876	0.043
	--	2.50	--	--	--	5,700	0.131	4,252	0.098
6147	--	3.00	--	--	--	7,418	0.170	7,532	0.173
	--	3.50	--	--	--	8,489	0.195	11,509	0.264
6148	--	4.00	--	--	--	9,584	0.220	16,027	0.368
	--	4.50	--	--	--	10,607	0.244	21,075	0.484
6149	--	5.00	--	--	--	11,586	0.266	26,623	0.611
	--	5.50	--	--	--	12,590	0.289	32,667	0.750
6150	--	6.00	--	--	--	13,621	0.313	39,220	0.900
	--	6.50	--	--	--	14,699	0.337	46,300	1.063

DETENTION BASIN STAGE-STORAGE TABLE BUILDER

MHFD-Detention, Version 4.06 (July 2022)

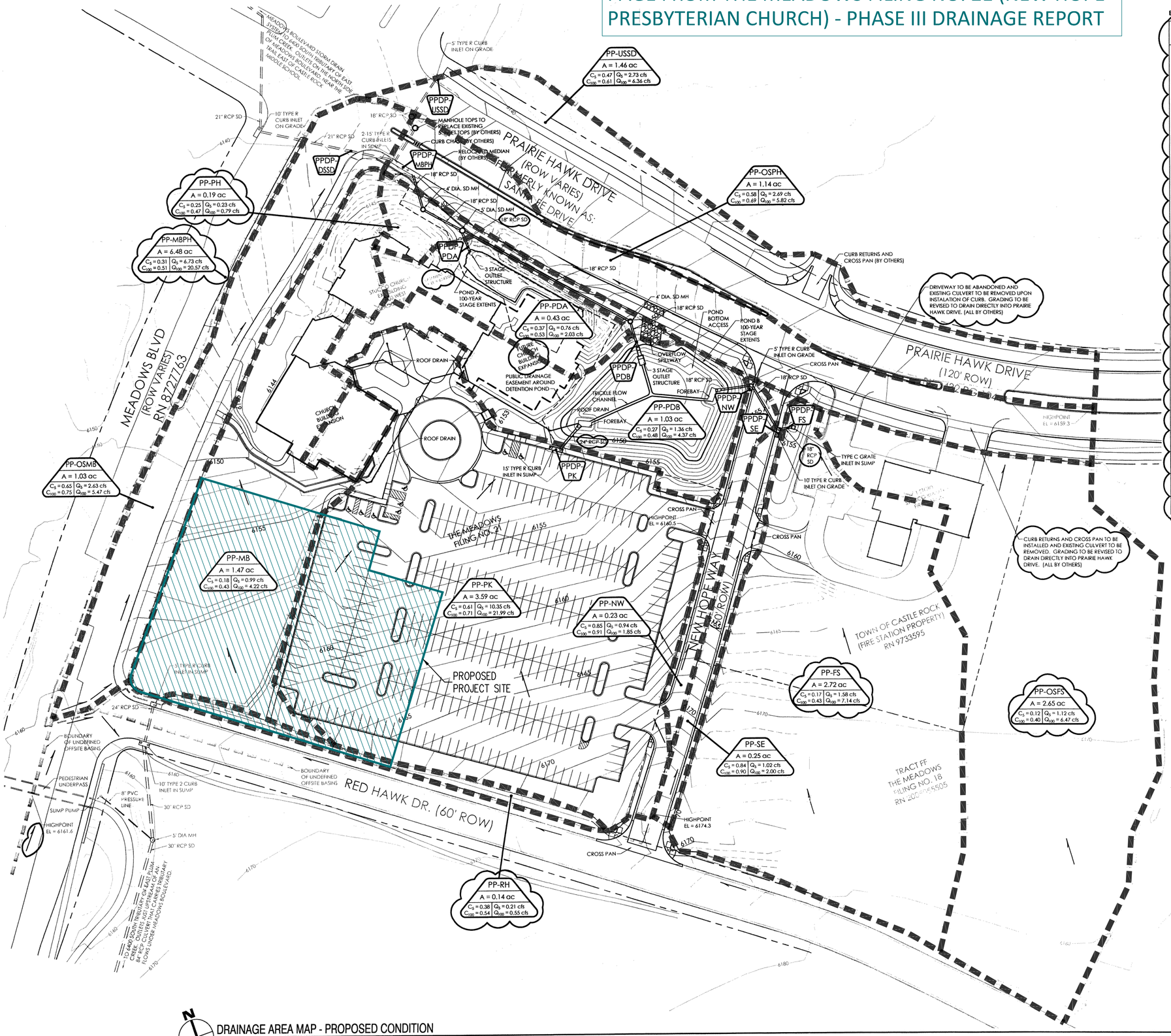




APPENDIX C

Drainage Maps

PAGE FROM THE MEADOWS FILING NO. 21 (NEW HOPE PRESBYTERIAN CHURCH) - PHASE III DRAINAGE REPORT



DRAINAGE AREA MAP - PROPOSED CONDITION
Scale: 1" = 50'-0"

BASIN AND DESIGN POINT CONTRIBUTING AREA, PERCENT IMPERVIOUS, RUNOFF COEFFICIENTS, AND PEAK FLOWS

Basin or Design Point Definition	Contributing Area (acres)	Weighted Percent Impervious	5-Year Runoff Coefficient	100-Year Runoff Coefficient	5-Year Peak Flow (cfs)	100-Year Peak Flow (cfs)	Notes
PP-RH	0.14	55	0.38	0.54	0.21	0.55	Church Site and New Hope Way runoff to the northeast lane of Red Hawk Dr.
PP-MB	1.47	18	0.18	0.43	0.99	4.22	Church Site runoff to the southeast lane of Meadows Blvd.
PP-PH	0.19	30	0.25	0.47	0.23	0.79	Church Site and New Hope Way runoff to the southwest lane of Prairie Hawk Dr.
PP-PDA	0.43	53	0.37	0.53	0.76	2.03	Church Site runoff to existing detention Pond A.
PPDP-PDA	N/A	N/A	N/A	N/A	0.04	0.08	Outflow from redeveloped detention Pond A to a proposed storm drain system (see Appendix D).
PP-FS	2.72	16	0.17	0.43	1.58	7.14	Fire Station Property and offsite Tract FF runoff to the proposed grate inlet at Design Point PPDP-FS.
PPDP-FS	N/A	N/A	N/A	N/A	1.58	7.14	Sub-Basin PP-FS runoff intercepted by the grate inlet near the north corner of Fire Station Property (see Appendix C).
PP-SE	0.25	97	0.84	0.90	1.02	2.00	Southeast lane of New Hope Way runoff to the proposed 10' curb inlet at Design Point PPDP-SE.
PPDP-SE	N/A	N/A	N/A	N/A	1.02	1.98	Sub-Basin PP-SE runoff intercepted by the 10' curb inlet in the southeast lane of New Hope Way (see Appendix C).
PP-NW	0.23	97	0.85	0.91	0.94	1.85	Northwest lane of New Hope Way runoff to the proposed 5' curb inlet at Design Point PPDP-NW.
PPDP-NW	N/A	N/A	N/A	N/A	0.86	1.32	Sub-Basin PP-NW runoff intercepted by the 5' curb inlet in the northwest lane of New Hope Way (see Appendix C).
PP-PK	3.59	81	0.61	0.71	10.35	21.99	Church Site proposed parking lot runoff to the proposed 15' curb inlet at Design Point PPDP-PK.
PPDP-PK	N/A	N/A	N/A	N/A	10.35	21.99	Sub-Basin PP-PK runoff intercepted by the 15' curb inlet on the northeast edge of the parking lot (see Appendix C).
PP-PDB	1.03	35	0.27	0.48	1.36	4.37	Church Site runoff directly to proposed detention Pond B.
Combined Flows to Pond B	7.82	53	0.43	0.59	11.33	28.67	All runoff draining to proposed detention Pond B, including Sub-Basin PP-PDB and runoff intercepted by inlets at Design Points PPDP-FS, PPDP-SE, PPDP-NW, and PPDP-PK.
PPDP-PDB	N/A	N/A	N/A	N/A	1.53	5.99	Outflow from proposed detention Pond B to a proposed storm drain system (see Appendix D).
PP-OSMB	1.03	85	0.65	0.75	2.63	5.47	Offsite runoff to and originating in the southeast lane of Meadows Blvd.
PP-OSPH	1.14	79	0.58	0.69	2.69	5.82	Offsite runoff to and originating in the southwest lane of Prairie Hawk Dr.
PP-OSFS	2.65	8	0.12	0.40	1.12	6.47	Fire Station Property and offsite Tract FF runoff to the southwest lane of Praire Hawk Dr.
PP-MBPH	6.48	N/A	0.31	0.51	6.73	20.57	All non-bypass surface runoff reaching the two 15' curb inlets near the south corner of Meadows Blvd and Prairie Hawk Dr, including Sub-Basins PP-MB, PP-PH, PP-OSMB, PP-OSPH, and PP-OSFS.
PPDP-MBPH	N/A	N/A	N/A	N/A	6.82	21.11	All surface runoff reaching the two 15' curb inlets near the south corner of Meadows Blvd and Prairie Hawk Dr, including the Combined Sub-Basin PP-MBPH and bypass flows from Design Points PPDP-NW and PPDP-SE.
PP-USSD	1.46	68	0.47	0.61	2.73	6.36	Offsite runoff to and originating in the northeast lane of Praire Hawk Dr.
PPDP-USSD	N/A	N/A	N/A	N/A	0.80	1.17	Sub-Basin PP-USSD runoff intercepted by the 5' curb inlet in the northeast gutter of Praire Hawk Dr (see Appendix C).
PPDP-DSSD	N/A	N/A	N/A	N/A	9.19 *	28.35 *	All runoff entering the two 15' curb inlets near the south corner of Meadows Blvd and Prairie Hawk Dr, including runoff intercepted by the inlets and runoff carried in the upstream stormdrain system (see Appendix C).

* the sum of peak flows from PPDP-PDA, PPDP-PDB, PPDP-MBPH, and PPDP-USSD

WATER QUALITY AND DETENTION FOR POND A AS REDEVELOPED (PP-PDA AT PPDP-PDA)

	Volume Required (Cubic Ft)	Volume Required (Acre-Ft)	Volume Provided (Cubic Ft)	Volume Provided (Acre-Ft)	Elevation at Top of Volume (Ft)	Release Rate Allowed (cfs) or Drain Time Required (min)	Release Rate Provided (cfs) or Drain Time Provided (min)
Water Quality[1]	401	0.0092	409	0.0094	6140.44	2400 min	**
10 year	897	0.0206	909	0.0209		0.10	0.09
10 year + WQ	1298	0.0298	1318	0.0303	6141.10		0.12
100 year	1782	0.0409	1784	0.0410		0.37	0.36
100 year + WQ	2182	0.0501	2193	0.0503	6141.51		0.40

[1] The UDFCD Drainage Criteria Manual Volume 3 specifies that a Water Quality Capture Volume drain in 40 hours.

** The "Reservoir Routing though Detention Pond" calculator provided by UDFCD and used to estimate WQCV drain time does not offer adequate precision to determine the drain time of Pond A because of the very small flow rates involved. The WQ orifice plate design for Pond A follows the UDFCD design guidelines and therefore should theoretically provide sufficient drain time.

WATER QUALITY AND DETENTION FOR POND B (PP-PDB AT PPDP-PDB)

	Volume Required (Cubic Ft)	Volume Required (Acre-Ft)	Volume Provided (Cubic Ft)	Volume Provided (Acre-Ft)	Elevation at Top of Volume (Ft)	Release Rate Allowed (cfs) or Drain Time Required (min)	Release Rate Provided (cfs) or Drain Time Provided (min)
Forebays*	219 – 365	0.005 – 0.008	344	0.0079	6148.00	3 – 5 min	4.5 min
Micropool**			43	0.0010	6144.00		
Water Quality[1]	7309	0.1678	7372	0.1692	6147.00	2400 min	2400 min
10 year	16352	0.3754	16617	0.3815		1.80 cfs	1.76 cfs
10 year + WQ	23662	0.5432	23989	0.5507	6148.70		1.87 cfs
100 year	32361	0.7429	33207	0.7623		6.65 cfs	6.65 cfs
100 year + WQ	39670	0.9107	40579	0.9316	6150.00		6.77 cfs

* The UDFCD Drainage Criteria Manual Volume 3 specifies that a forebay be 3% to 5% of the Water Quality Capture Volume and that a forebay drain in 3 min to 5min. For this design, the volume provided is divided between two equally sized forebays.

** The UDFCD Drainage Criteria Manual Volume 3 does not specify a micropool volume but does requre that the micropool be at least 2.5' deep. The micropool proposed for Pond B is 2.5' deep.

[1] The UDFCD Drainage Criteria Manual Volume 3 specifies that a Water Quality Capture Volume drain in 40 hours.

New Hope Presbyterian Church

Date: 10-31-2007 Project No. 05030.1

The Meadows Filing No. 21 (PWP 07-013)

Owner Address: New Hope Presbyterian Church
2100 W. Meadows Parkway
Castle Rock, CO 80104
(303)660-0057 F (303)660-1532

Architect Address: Eidos Architects
5400 South Syracuse St.
Greenwood Village, CO. 80231
(720)200-0630 F (720)200-0631

Engineer Address: MVE
1903 LeLaray Street, Suite 200
Colorado Springs, Colorado 80909
(719)635-5736 F (719)635-5450

Date: XX
Revised:
Revised:
Revised:

Drainage Area Map Proposed Condition

BASIN SUMMARY TABLE						
Tributary Sub-basin	Area (acres)	C_5	C_{100}	t_c (min)	Q_5 (cfs)	Q_{100} (cfs)
PP-MB	0.69	0.39	0.65	11.09	1.0	3.0
PP-PK	4.37	0.66	0.79	6.67	12.8	28.0

DRAINAGE LEGEND

- PROPERTY BOUNDARY LINE
- PROPOSED PROPERTY LINE
- EXISTING EASEMENT
- 6485 EXISTING MAJOR CONTOUR
- 6483 EXISTING MINOR CONTOUR
- 6485 PROPOSED MAJOR CONTOUR
- 84 PROPOSED MINOR CONTOUR
- EXISTING BASIN BOUNDARY LINE
- REVISED BASIN BOUNDARY LINE
- PP-FS / 2.72 — EXISTING BASIN DESIGNATION; BASIN AREA IN ACRES
- OS-1 / 0.13 / 0.70 / .80 — REVISED BASIN DESIGNATION; 100-YEAR RUNOFF, CFS; 5-YEAR RUNOFF, CFS; BASIN AREA IN ACRES
- 7 DESIGN POINT
- EXISTING STORM SEWER
- PROPOSED STORM SEWER
- EXISTING DIRECTION OF RUNOFF
- PROPOSED DIRECTION OF RUNOFF

N

0 20 40
SCALE: 1"=40'

PRAIRE HAWK DR. (PUBLIC ROW - VARIES)

MEADOWS PKWY. (PUBLIC ROW - VARIES)

NEW HOPE WAY (PUBLIC ROW - VARIES)

RED HAWK DR. (PUBLIC ROW - VARIES)

PP-USSD 1.46 | PP-PH 0.19 | PP-OSPH 1.14 | PP-PDA 0.43 | PP-OSMB 1.03 | PP-MB 0.69 / 1.0 / 3.0 | PP-PDB 1.03 | PP-PK 4.37 / 12.8 / 28.0 | PP-FS 2.72 | PP-OSFS 2.65 | PP-SE 0.25 | PP-RH 0.14

EX. 15" CDOT TYPE 'R' INLET (PUBLIC)
EX. 18" RCP SD PIPE (PRIVATE)
EX. SDMH (TYP)
EX. SPILLWAY
EX. POND A (PRIVATE)
EX. FOREBAY (PRIVATE)
EX. OUTLET STR. W/ MICROPOOL (PRIVATE)
EX. TRICKLE CHANNEL
EX. POND B (PRIVATE)
EX. 24" RCP SD PIPE (PRIVATE)
EX. 15" CDOT TYPE 'R' INLET (PRIVATE)
EX. 5' CDOT TYPE 'R' INLET (PUBLIC)
EX. 18" RCP SD PIPE (PUBLIC)
EX. 10' CDOT TYPE 'R' INLET (PUBLIC)
PR. PROPERTY LINE
PR. MEDICAL OFFICE BUILDING
PR. PARKING ISLAND (TYP.)
EX. PARKING ISLAND (TYP)
PR. CURB & GUTTER

FLOODPLAIN STATEMENT

THIS SITE IS LOCATED WITHIN A 100-YEAR FLOODPLAIN AS DETERMINED BY THE FLOOD INSURANCE RATE MAP (FIRM) NUMBER 08041C0528G, EFFECTIVE DECEMBER 7, 2018 (SEE APPENDIX A).

Galloway
1155 Kelly Johnson Blvd., Suite 305
Colorado Springs, CO 80920
719.900.7220
GallowayUS.com

PRELIMINARY
NOT FOR BIDDING
NOT FOR CONSTRUCTION

PHASE I DRAINAGE REPORT - DRAINAGE MAP
-
LOT 1, THE MEADOWS
NIEBUR DEVELOPMENT

3737 NEW HOPE WAY
CASTLE ROCK, CO 80109

#	Date	Issue / Description	Init.

Project No:	NBD000002.20
Drawn By:	TJE
Checked By:	
Date:	08/15/24

PROPOSED CONDITION DRAINAGE MAP

DR 1