

TOWN OF GOLDSBY PLANNING COMMISSION

Regular Meeting
July 24, 2025 6:30 PM
TOWN HALL
100 E CENTER RD
COUNCIL ROOM
GOLDSBY OK 73093-9112

AGENDA

Meeting Procedure: Comments from the Public are welcome during the course of the meeting; Comments not scheduled on the agenda will be heard under Public Comments; and Comments on all scheduled Agenda items will be heard immediately following the presentation by Staff or Petitioner. Please wait until you are recognized by the PC Chairman and keep comments as brief as possible.

1. Call to order.
2. Roll call, declaration of quorum being present.
3. Discussion and possible action (approval, rejection, amendment or postponement) to adopt the rules of conduct and debate for the Planning Commission meetings
4. Public Comments: *(Comments on topics not listed on the agenda, the board shall make no decision or take any action, except to possibly direct the town staff to take action, or schedule the matter for board discussion at a later date. Please identify yourself and limit comments or questions to 3 minutes.)*
5. Discussion and possible action (approval, rejection, amendment or postponement): of regular minutes from June 26, 2025 and April 24, 2025.
6. Discussion and possible action (approval, rejection, amendment or postponement) for Brentwood phase 3 final plat application. It has been recommended from the Town Administrator that a 2-month extension will be necessary to review the final plat. The Planning Commission can provide an extension to provide an exemption to the 3-year preliminary plat filing, according to the Subdivision regulations Section 2-5. C.1 and 2.
7. **Public Hearing** for the purpose of considering, approving, modifying, or rejecting amendments to add new classifications to the zoning ordinance for the purpose of developing a Town Square District and Employment Overlay.
8. Discussion and possible action (approval, rejection, amendment or postponement) to add new classifications to the zoning ordinance for the purpose of developing a Town Square District and Employment Overlay.
9. Communication from Planning Commission members and employees.
10. Adjournment.

Sandy Jenkins, Deputy Town Clerk

Rules of Conduct and Debate for the Town of Goldsby Planning Commission meetings

(a) Any citizen wanting to speak before the Town of Goldsby Planning Commission must sign the appearance request before the meeting begins. At the appropriate place on the agenda, the chairman or vice-chairman will recognize those persons wishing to speak, once such citizen has been recognized, citizens shall state their name and address,

(b) All of the citizens' comments must directly pertain to the item on the agenda which is being discussed; or if no such item appears on the agenda, then their remarks shall be made when the Town of Goldsby Planning Commission considers Public Comments.

(c) Every citizen's conversation and comments shall be limited to 3 minutes discussion unless such time is extended or shortened by the chairman or vice-chairman.

(d) All questions and comments must be directed to the chairman or vice-chairman, and no citizen may address or question any individual Town of Goldsby Planning Commission member or Town staff member or Town employee except with the permission of the chairman or vice-chairman.

(e) No gestures or activities intended to disturb the order and decorum of the Town of Goldsby Planning Commission meeting shall be permitted.

(f) No citizen shall speak or comment so as to distract, disturb or interrupt any other speaker but shall only make comments after the chairman or vice-chairman has recognized him and after he has stated his name and address.

(g) Any citizen who shall wantonly disturb the lawful assembly of the Town of Goldsby Planning Commission meeting shall be asked by the chairman or vice-chairman to leave the meeting; and in the event that such citizen will not leave the public assembly and continues to disturb and disrupt such assembly, such person may be subject to removal from the chamber for disturbing the peace.

TOWN OF GOLDSBY PLANNING COMMISSION

Regular Meeting
April 24, 2025 6:30 PM
TOWN HALL
100 E CENTER RD
COUNCIL ROOM
GOLDSBY OK 73093-9112

MINUTES

1. Call to order.
Kevin McDonough called the meeting to order.
2. Roll call, declaration of quorum being present.
Roll: Kevin McDonough, present; Trish Crow, present; Wayne Leiker, present; Clint Porter, absent; Chris Goldsby, present.
Kevin McDonough declared a quorum present.
3. Public Comments:
No comments.
4. Discussion and possible action (approval, rejection, amendment or postponement): of regular minutes from March 27, 2025.
Trish Crow moved to approve the minutes from March 27, 2025, Wayne Leiker seconded the motion.
Ayes: Kevin McDonough, Trish Crow, Wayne Leiker and Chris Goldsby.
Nays: None.
5. Discussion and possible action (approval, rejection, amendment or postponement): of preliminary plat for The Run.
The board discussed the preliminary plat with Braeden Schafer (Engineer for the developer) items that were talked about were developing in phases, drainage, sidewalks and how the lots would be laid out.
Trish Crow moved to approve the preliminary plat; Wayne Leiker seconded the motion.
Ayes: Kevin McDonough, Trish Crow, Wayne Leiker and Chris Goldsby.
Nays: None.
6. Discussion and possible action (approval, rejection, amendment or postponement) of a lot split request from Charlotte Seward off of Hwy 74 (Maple Ave) between Sooner and Ladd Ave Section 17 T7N R2W (35°04'27.7"N, 97°25'37.6"W (35.07437, -97.4271). Requesting to split 12.65 into 2 lots of 6.32 acres.
Chris Goldsby moved to approve the lot split; Trish Crow seconded the motion.
Ayes: Kevin McDonough, Trish Crow, Wayne Leiker and Chris Goldsby.
Nays: None.
7. Communication from Planning Commission members and employees.
Nothing communicated.
8. Adjournment.
Trish Crow moved to adjourn the meeting, Chris Goldsby seconded the motion
Ayes: Kevin McDonough, Trish Crow, Wayne Leiker and Chris Goldsby.
Nays: None.

Kevin McDonough, Chairman

Date

Sandy Jenkins, Deputy Town Clerk

TOWN OF GOLDSBY

PLANNING COMMISSION

Minutes

Regular Meeting
June 26, 2025 6:30 PM
TOWN HALL
100 E CENTER RD
COUNCIL ROOM
GOLDSBY OK 73093-9112

1. Call to order.
Kevin McDonough called the meeting to order.
2. Roll call, declaration of quorum being present.
Roll: Kevin McDonough, present; Trish Crow, present; Wayne Leiker, present; Clint Porter, present; Chris Goldsby, present.
Kevin McDonough declared a quorum present.
3. Public Comments:
There were no comments.
4. Discussion and possible action (approval, rejection, amendment or postponement): of regular minutes from May 22, 2025.
Chris Goldsby moved take no action for the regular minutes from May 22, 2025, the meeting was cancelled, Clint Porter seconded the motion
Ayes: Kevin McDonough, Trish Crow, Wayne Leiker, Clint Porter and Chris Goldsby.
Nays: None.
5. Discussion and possible action (approval, rejection, amendment or postponement) of an application for a lot split from Ronny McGee of 68.1 acres to two lots of 63.1 acres and 5 acres at 800 S Main Ave of Section 26, 35°08'13.6"N, 97°28'53"W (35.13711, -97.4814).
Ronny McGee stated he is splitting the acreage to allow his son to build a home.
Chris Goldsby moved to approve the lot split at 800 S Main Ave into two lots of 63.1 acres and 5 acres, Trish Crow seconded the motion
Ayes: Kevin McDonough, Trish Crow, Wayne Leiker, Clint Porter and Chris Goldsby.
Nays: None.
6. Discussion and possible action (approval, rejection, amendment or postponement) of an application for a lot split/line adjustment to correct east boundary lines at Southwind Hills property on Santa Fe and 290th St. (35°08'35.2"N, 97°30'27.1"W (35.14312, -97.50753).
Trish Crow moved to approve the lot line adjustment correcting boundary lines at Southwind Hills property on Santa Fe and 290th St, Chris Goldsby seconded the motion
Ayes: Kevin McDonough, Trish Crow, and Chris Goldsby. Wayne Leiker and Clint Porter recused themselves from this decision.
Nays: None.
7. Communication from Planning Commission members and employees.
Kara stated there is an application Brentwood Phase 3, the engineer is looking over the phase 3 plat. Sandy reminded the board the new zoning additions for a Town Square and Employment District will be heard. As soon as those are approved, she will get them to everyone.
Kara stated that the 4th Festival is Sunday June 29th at 5:00pm. Purcell is celebrating Friday, Washington on Saturday.
8. Adjournment.
Trish Crow moved to adjourn the meeting Chris Goldsby seconded the motion
Ayes: Kevin McDonough, Trish Crow, Wayne Leiker, Clint Porter and Chris Goldsby.
Nays: None.

Kevin McDonough, Chairman

Date

Sandy Jenkins, Town Clerk

Draft Town Square District

This draft is intended to supplement the Goldsby Zoning Code by adding new sections to the following parts, to be numbered as appropriate:

- Article I: Administrative and General Provisions
 - Section 1-4. Zoning Districts Established
 - (NEW) TS – TOWN SQUARE
 - (NEW) EM – EMPLOYMENT OVERLAY
- Article II: Specific Zoning District Regulations
 - (NEW) TS – Town Square
 - **Section 2-87 TS Purpose and Applicability.** *(Overview and where the district applies)*
 - **Section 2-88 TS Definitions.** *(Key terms for Town Square standards)*
 - **Section 2-89 TS Administrative Modifications.** *(When and how administrative adjustments can be made)*
 - **Section 2-90 TS Measurement Methodologies.** *(How measurements are taken for the TS District)*
 - **Section 2-91 TS Regulating Plan and Rights-of-Way Design.** *(Framework for street design and block structure)*
 - **Section 2-92 TS Use Permissions.** *(What uses are allowed in Town Square)*
 - **Section 2-93 TS Access and Block Standards.** *(Street blocks and site access requirements)*
 - **Section 2-94 TS Building and Parking Standards.** *(Rules for building placement and parking)*
 - **Section 2-95 TS Refuse Collection Standards.** *(Trash collection placement and screening)*
 - **Section 2-96 TS Architectural Standards.** *(Façade design, entrances, and materials)*
 - **Section 2-97 TS Lighting and Streetscape Standards.** *(Pedestrian lights, street furniture, and materials)*
 - **Section 2-98 TS Landscape Standards.** *(Rules for tree planting, buffers, and open space landscape)*
 - (NEW) EO – Employment Overlay
 - **Section 2-99 EM Purpose and Applicability.** *(Where and why the overlay applies)*

- **Section 2-100 EM Administrative Modifications.** (*How exceptions may be granted*)
- **Section 2-101 EM Measurement Methodologies.** (*How measurements are taken for the EM Overlay*)
- **Section 2-102 EM Access Standards.** (*Cross-access and site entry requirements*)
- **Section 2-103 EM Architectural Standards.** (*Minimum design and façade quality requirements*)
- **Section 2-104 EM Landscape Standards.** (*Minimum plantings and tree protection*)

Outside of the Goldsby Zoning Code, we also recommend amending the language in Section 4-34 District Sign Regulations, subpart C (On-premise sign standards), in the Goldsby Code of Ordinances—modifying Section 4-34.C.1.ii as follows (*recommended added language is **bolded and underlined***):

“Commercial: C-1, C-2, C-3, **TS**, and Planned Unit Developments.”

This amendment would clarify that the recommended Town Square (TS) Zoning District is treated as a commercial district for the purposes of sign regulations.

The recommended Employment (EM) Overlay would not modify signage-related provisions of the underlying C-2 Zoning District, and therefore would not require a similar added reference.

[Amend Article I, Section 1-4 of the Goldsby Zoning Code per the following, with edits marked as ~~striketthrough~~ (to delete) and **bolded and underlined** (to add), including updates to the title]

Section 1-4. Zoning and Overlay Districts Established (including Names and Abbreviated Designations).

Fifteen (15) ~~Seventeen (17)~~ Zoning and **Overlay** Districts are hereby established for current and future use within the corporate limits of the Town of Goldsby, Oklahoma. ... The Districts established herein shall be known as:

Abbreviated Designation	Zoning District Name
A-1	AGRICULTURE-RESIDENTIAL DISTRICT
...	...
R-7	PLANNED RESIDENTIAL DEVELOPMENT DISTRICT
<u>TS</u>	<u>TOWN SQUARE DISTRICT</u>
C-1	GENERAL COMMERCIAL DISTRICT
...	...
PUD	PLANNED UNIT DEVELOPMENT
<u>EM</u>	<u>EMPLOYMENT OVERLAY</u>

[Amend Article II of the Goldsby Zoning Code by adding the following, all of which is proposed as a new draft and does not replace any existing text]

TS – Town Square

Section 2-87. TS Purpose and Applicability.

- A. Purpose. This district is intended to encourage and support a vibrant, walkable and bikeable town center with a variety of activities in a pedestrian-oriented setting. In addition to serving essential civic and social functions for the community, the Town Square (TS) District will support a mix of commercial and office activities, providing jobs and boosting economic growth.
- B. Applicability by project activity. The development standards applicable to the TS District apply to certain types of project activities (defined in Section 2-88), as provided in Table 87-1 and per the following key:
 - 1. A filled circle (“●”) identifies a development standard that generally applies.
 - 2. An unfilled circle (“○”) identifies a development standard that does not apply.

Table 87-1: TS Development Standard Applicability

Development Standards (Section Reference)	Project Activity						
	New Construction	Addition	Site Modification	Facade Modification	Change of Use	Renovation	Maintenance / Repair
Regulating Plan (Section 2-91)	●	●	○	○	●	○	○
Use Permissions (Section 2-92)	●	●	○	○	●	○	○
Access and Block Standards (Section 2-93)	●	●	●	○	○	○	○
Building and Parking Standards (Section 2-94)	●	●	●	●	○	○	○
Refuse Collection Standards (Section 2-95)	●	●	●	○	●	○	○
Architectural Standards (Section 2-96)	●	●	○	●	○	●	○
Lighting and Streetscape Standards (Section 2-97)	●	○	●	●	●	○	○
Landscape Standards (Section 2-98)	●	●	●	●	●	●	○

C. **Applicability to nonconformities.** In addition to the provisions of Section 1-14 (Non-Conforming Lots, Structures, and Uses), lots with one or more nonconforming structures subject to an expansion of their gross floor area by 25% or more (comparing the existing gross floor area to the total proposed gross floor area) must come into full compliance with the applicable standards of the TS District.

D. **Effect on other provisions.** In case of conflict with other provisions of the Zoning Code, the provisions applicable to the TS District shall supersede and govern development on applicable lots, unless otherwise expressly stated.

Section 2-88. TS Definitions.

In case of any conflict between these definitions and the definitions in Section 1-6, the definitions within this Section 2-88 shall govern.

A. **Active Depth.** The horizontal depth of a building that must contain active uses.

B. **Administrator.** The Town Administrator or their designee, which may include but is not limited to the Code Compliance Officer.

C. **Arts and Cultural Establishment.** A use involved in the advancement of art, science, or culture. Such uses do not have a central mission to sell products or services for profit and

include, but are not limited to, the following: (See also, the definition for **recreation / entertainment, indoor**, as defined within this Section 2-88.)

1. **Art Gallery / Museum.** An institution for the collection, display and/or distribution of objects of art or science, and which is typically sponsored by a public or quasi-public agency and is generally open to the public.
 2. **Community Center.** A central social and/or recreational structure that is open to the public.
 3. **Fraternal Organization, Sorority, Lodge, or Civic Club.** An organized group, service club or philanthropic organization having a restricted membership and specific purpose related to the welfare of the members such as, but not limited to, the Improved Benevolent Protective Order of Elks of the World (IBPOEW), Prince Hall Freemasonry, Knights of Columbus, or a labor union.
 4. **Library.** A facility for on-site use or loan for off-site use of literary, musical, artistic, or reference materials by patrons of the facility.
- D. **Block.** An area of land, intended to be used for development purposes, which is entirely surrounded by public and/or private streets, highways, railroad rights-of-way, public walks, parks, rural lands, drainage channels or boundary lines of municipalities and not traversed by a through street.
- E. **Block Face.** The collective frontage line along a right-of-way (public or private) extending from one intersecting right-of-way to the next intersecting right-of-way; or the collective frontage line along a right-of-way (public or private) extending from one intersecting right-of-way to the end of a street in the case of a dead-end street or cul-de-sac.
- F. **Eating or Drinking Establishment.** A facility for the preparation and on-site sale and consumption of food and/or non-alcoholic beverages and/or alcoholic beverages. This definition explicitly excludes establishments with drive-thru facilities. This definition otherwise includes, but is not limited to:
1. **Bar or Tavern.** An establishment primarily devoted to the serving of alcoholic beverages for on-premises consumption and in which the service of food is only incidental to the consumption of such beverages.
 2. **Brew Pub or Micro-Brewery.** A restaurant or other facility that meets the definition of “brewpub” and/or “small brewer” as defined in O.S. Title 37A Oklahoma Alcoholic Beverage Control Act.
 3. **Food Catering and Take-Out Service.** An establishment in which the principal use is the

preparation of food and/or meals on the premises, and where such food and/or meals are delivered to another location for consumption or distribution.

4. **Food Truck Park.** An area designed to accommodate four or more mobile food units and offering food and/or beverages for sale to the public. A food truck park may be accessory to a separate commercial and/or industrial use. See also, **mobile food unit**.
5. **Micro-Distillery.** A facility that meets the definition of “distiller” as defined in O.S. Title 37A Oklahoma Alcoholic Beverage Control Act and produces distilled spirits in a total quantity of no more than 40,000 proof gallons per calendar year.
6. **Mobile Food Unit.** A unit designed to be movable and from which food or beverages are prepared and offered for sale, whether a truck, container, trailer or otherwise.
7. **Restaurant (without Drive-Thru).** An eating establishment where customers are primarily served at tables or are self-served, where food is consumed on the premises, where at least 75 percent of its revenues are derived from the on-premises consumption of food or nonalcoholic beverages, and

which does not have a drive-through window.

8. **Small-Farm Winery.** A winery that meets the definition of “small farm winery” as defined in O.S. Title 37A Oklahoma Alcoholic Beverage Control Act.
- G. **Pawn Shop.** An establishment where money is loaned on the security of personal property pledged in the keeping of the shop owner (pawnbroker). Such a use typically includes retail sale of used (i.e., pre-owned) items.
- H. **Neighborhood Agriculture.** An area less than one acre in size that is managed and maintained by an individual, group, or business entity to grow and harvest food crops or nonfood crops (e.g., flowers). Such an area may be divided into separate garden plots or orchard areas for cultivation by one or more individuals or may be farmed collectively by members of the group. See also, **agriculture** (as defined in Section 1-6).
- I. **Nursery.** Land and/or greenhouses and similar structures that are used to raise flowers, shrubs, trees, and/or other plants for sale. See also, **retail sales** (as defined within this Section 2-88).
- J. **Office.** A structure used primarily for the provision of executive, management, or administrative services and that does not include the

storage or staging of hazardous materials (e.g., the administrative office and not the chemical warehouse of a pest extermination company). This type of use includes, but is not limited to, accountant office, administrative office, architecture office, armed services recruiting center, bank or financial service, broadcasting studio, copy shop or printing, insurance office, landscape architecture office, planning office, property management office, real estate office, recording studio, security monitoring company, title company, and travel agency. This use is separated defined from medical facilities (as defined in Section 1-6).

- K. **Personal Services.** Uses that provide individualized or small-group services focused on personal care, fitness, or creative instruction. Examples of this use include, but are not limited to, art studio, barber or beauty shop, dance or music studio, health club, laundromat (without dry cleaning services), training studio (such as boxing, martial arts, music, and personal fitness studios), spa, and tattoo or body piercing shop. See also recreation / entertainment, indoor.
- L. **Project Activity.** Any activity on a lot that is controlled by the Goldsby Zoning Ordinance. Such activities include the following, as further defined:

1. **New Construction.** Any activity that includes the construction of a new building, structure, vehicle parking lot, greenway, and/or thoroughfare.
2. **Addition.** Any expansion of an existing building or structure, including activity that increases the floor area or the height of an enclosed space within an existing building or structure adding up to the lesser of (A) 100% of the existing floor area, or (B) 25,000 square feet of floor area. Any addition that exceeds this threshold is considered new construction.
3. **Site Modification.** Any modification of an existing site, including activity that impacts trees, fences and walls, lighting, land disturbance, and repaving parking lots affecting up to the lesser of (A) 50% of the existing site area, or (B) 25,000 square feet of site area. Any site modification that exceeds this threshold is considered new construction.
4. **Façade Modification.** Any change to the exterior envelope of a building that goes beyond the definition of maintenance and repair, including changes to the amount of exterior foundation wall exposed above finished grade; and changes to the size, location, and finishes of architectural elements

such as a balcony, porch, storefront, windows, or deck.

5. **Change of Use**. Any change in use or a modification of an area designed and intended for a specific use that is different from the previously approved use, including changing the principal use of any portion of a building from one use specified in Section 2-92 to another use; or expanding the floor area or site area dedicated to a use; or increasing the intensity of a use, such as increasing the seating capacity associated with the use.
6. **Renovation**. Any modification to an existing building or structure that does not affect the building or structure beyond (as applicable) 50% of the perimeter wall framing; or 50% of the roof framing; or 50% of any other structural members. Any modification that exceeds these thresholds is considered **new construction**.
7. **Maintenance and Repair**. Any activity done to correct the deterioration, decay of, or damage to any part of a building, structure, or site that does not involve a change or modification to the existing design, outward appearance, or applicable zoning requirements. Maintenance and repair includes, but is not limited to, in-kind replacement of deteriorated or damaged parts of a

building; repair of site components such as fences, walls, or landscaping; and modifications to meet fire, life safety, and ADA requirements.

M. **Recreation / Entertainment, Indoor**.

A use that provides for large-group entertainment, fitness, assembly, instruction, leisure, and/or spectating activities inside an enclosed structure. This definition includes, but is not limited to, amusement arcade, billiard or pool hall, bingo facility, bowling alley, boxing club, dance club or nightclub, dinner theater, entertainment district (as defined in 68 O.S. § 2393(6)), exhibition or reception hall, gun range (indoor), gymnastic studio, physical fitness center, skating rink, and theater. Uses for indoor recreation and entertainment that are in enclosed structures (or individual tenant spaces therein) smaller than 15,000 square feet shall be classified as **personal services** uses.

N. **Recreation / Entertainment, Outdoor (Large)**.

A use that may attract large volumes of visitors in an outdoor setting for leisure, spectating, or fitness, and typically occupying two or more contiguous acres of land or having an occupancy capacity of 1,000 persons or more. This type of use includes, but is not limited to, amphitheater, amusement park, arena, country club, fairgrounds, golf

course, gun range (outdoor), outdoor concert venue, and stadium.

O. **Recreation / Entertainment,**

Outdoor (Small). A use that does not meet the definition of **recreation / entertainment outdoor (large)**, has an occupancy capacity of less than 1,000 persons, and that provides small outdoor parks for play and relaxation. This type of use includes, but is not limited to, basketball court, pickleball court, playground, pocket park, swimming pool, and tennis court.

P. **Religious Place of Worship.** A use of land and/or structures that provides organized spiritual and/or faith-based assembly and related incidental activities. Such uses may be known as, but are not limited to, church, mosque, temple, rectory, convent, or monastery.

Q. **Retail Sales.** The sale or leasing of goods directly to end consumers. This use includes, but is not limited to, alcoholic beverage off-premises retail, antique shop, vehicle supply store, bakery or confectionary (retail), bicycle sales and repair, building material and hardware sales, convenience store without fuel pumps, department store, farmer's market, florist shop, furniture store, garden shop, grocery store, nursery, and tool and machinery rental. See also, **nursery** (as defined within this Section 2-88). This use is separately defined from and does not include

medical marijuana dispensary (as defined in Section 1-6) or **pawn shop** (as defined within this Section 2-88).

R. **School or Library.** An educational institution that may be operated privately or publicly and primarily providing any of the following:

1. Instruction for children or other students;
2. Accessory facilities traditionally associated with a program of study; or
3. The use of on-site or loan for off-site use of literary, musical, artistic, or reference materials by patrons of the facility.

S. **Story.** The part of a building between the finished floor of one floor and the finished floor of the next floor above, or if there are no floors above, the bottom of the structure for the roof. A story includes the following, as further defined:

1. **Ground Story.** The lowest story, or the first floor of a building, whose finished floor surface is no higher than six feet above the abutting existing grade, and whose elevation is exposed a minimum height of six feet above the abutting existing grade, as shown in Figure 88-A: Ground Story Elevation.

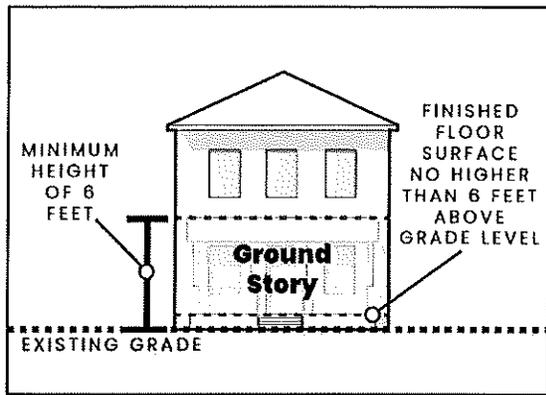


Figure 88-A: Ground Story Elevation

- 2. **Upper Story.** Any story of a building located above the **ground story**.
- T. **Vehicle Charging.** A use that provides one or more charging stations equipped with Level 1 or Level 2 electric vehicle supply equipment (EVSE) for battery-powered vehicles. This term is defined separately from **vehicle fueling**.
- U. **Vehicle Fueling.** A use that sells and dispenses vehicle fuel, including diesel, gasoline, hydrogen, electricity, and other alternative fuels. Such uses may have associated retail sale of perishable and non-perishable goods and may be known as travel centers. This term is defined separately from **vehicle charging**.
- V. **Vehicle Parking Lot.** Unenclosed areas of a lot that allow for the maneuvering and parking of five or more vehicles. Such a use may or may not include charging a fee for vehicle parking.

- W. **Vehicle Parking Structure.** An enclosed or semi-enclosed structure that allows for the maneuvering and parking of five or more vehicles. Such a use may or may not include charging a fee for vehicle parking.
- X. **Vehicular Access Point.** A curb cut or curb-less driveway that creates a break along a block face and provides access for maneuvering a vehicle from a right-of-way to a property. See also, **block face**.

Section 2-89. TS Administrative Modifications.

- A. **Applicability.** The following provisions expressly grant the administrator authority to modify certain provisions that apply to development within the TS District.
- B. **Alternative exterior materials.** The administrator is hereby authorized to approve minor modifications to the allowed exterior materials where novel materials that are not expressly prohibited are proposed, and where such materials clearly meet the purpose of the TS District.
- C. **Numerical adjustments.** The administrator is hereby authorized to approve adjustments to dimensional requirements applicable to the TS District by no more than 10 percent (increase or decrease) with the following exceptions:
 - 1. The administrator may not adjust the allowed height of buildings.

2. The administrator may not adjust required spacing from an easement or floodplain required by other sections of the Zoning Code.

D. Approved site plan adjustments. The administrator is hereby authorized to approve minor changes to an approved site plan that do not materially alter building orientation or size, building placement by more than 10 feet, vehicle or pedestrian traffic flow, or location of parking areas.

Section 2-90. TS Measurement Methodologies.

- A. Conflict with other provisions. In case of any conflict between these methodologies and other sections of the Zoning Code, the provisions within this Section 2-90 shall govern.
- B. Active depth area. The active depth area is measured from the thoroughfare-facing elevation towards the interior of the building, for the full width (along the thoroughfare) of the building, as shown in Figure 90-A: Active Depth Area Measurement.

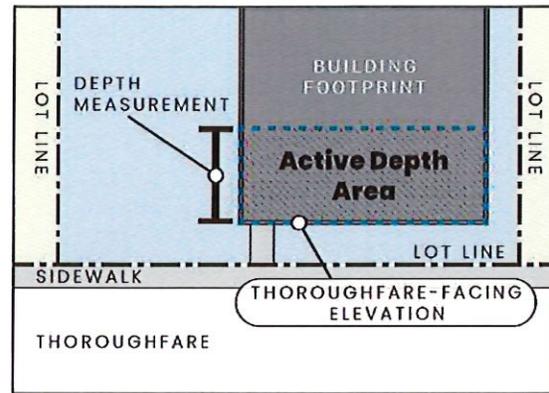


Figure 90-A: Active Depth Area Measurement

C. Blank wall area. Blank wall area is measured as horizontal width and vertical height of a portion of a building's exterior facade that does not include windows, doors, substantial material change, and/or pedestrian-scale articulation greater than 6 inches in depth including recesses, projections, belt courses, columns, and brackets as shown in Figure 90-B: Blank Wall Area Measurement. Downspouts, utility conduit, color changes, EIFS control joints, and similar elements do not count as substantial material changes or pedestrian-scale articulation. Blank wall area does not apply to building foundations and parapets.

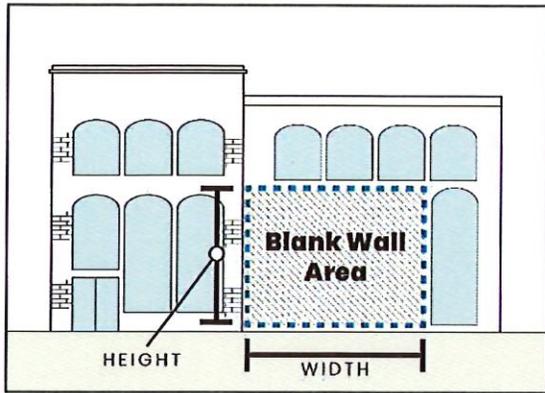


Figure 90-B: Blank Wall Area Measurement

D. Block face length. A block face length is measured as the linear length of consecutive lot lines abutting a right-of-way and stretching between two intersecting rights-of-way, or between an intersecting right-of-way and the end of a street in the case of a dead-end street or cul-de-sac, as shown in Figure 90-C: Block Face Length Measurement.

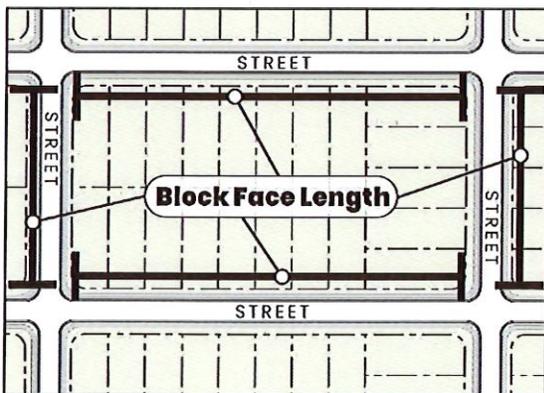


Figure 90-C: Block Face Length Measurement

E. Block perimeter. A block perimeter is measured as the cumulative sum of the lengths of each block face that make up the block, as shown in Figure 90-D: Block Perimeter Measurement.

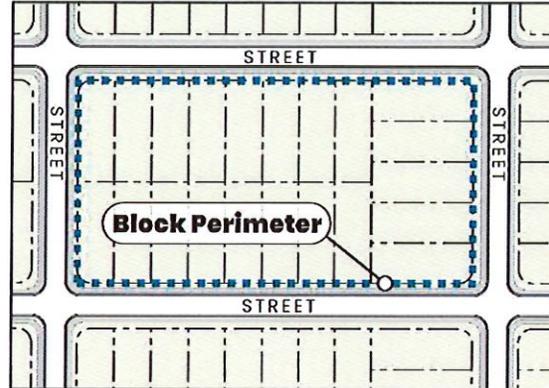


Figure 90-D: Block Perimeter Measurement

F. Gross floor area. Gross floor area is measured as the cumulative square footage of all enclosed and semi-enclosed spaces within a building, as shown in Figure 90-E: Gross Floor Area Measurement.

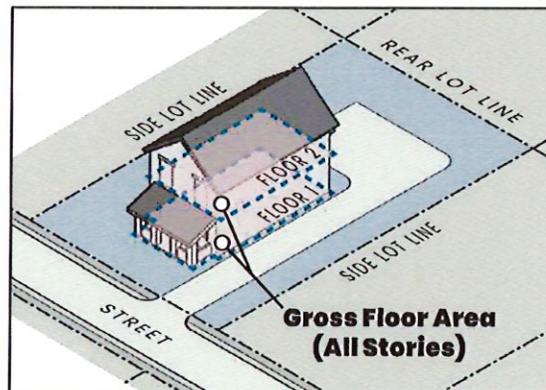


Figure 90-E: Gross Floor Area Measurement

G. Thoroughfare right-of-way width. A thoroughfare right-of-way width is measured as the narrowest linear dimension between opposing block faces on either side of the right-of-way, as shown in Figure 90-F: Thoroughfare Right-of-Way Width Measurement. Where provided, a right-of-way may include vehicular travel lanes, on-street parking spaces, tree lawns, and sidewalks.

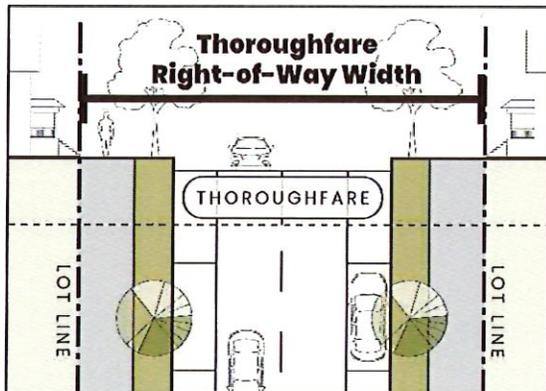


Figure 90-F: Thoroughfare Right-of-Way Width Measurement

H. Unimproved lot area. Unimproved lot area is measured as the surface area of a lot that is not covered by buildings or permanent structures.

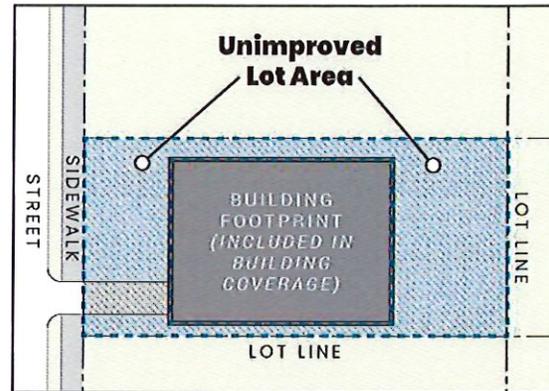


Figure 90-G: Unimproved Lot Area Measurement

I. Vehicular access point distance.

1. The distance between a vehicular access point and a right-of-way intersection is measured as the shortest linear measurement along the right-of-way between the leading edge of the break in curbing (or driveway pavement edge for a curb-less driveway) and the end of the block face, as shown in Figure 90-H: Vehicular Access Point Distance Measurement.
2. The distance between two vehicular access points is measured as the shortest linear measurement along the right-of-way between the closest leading edges of the breaks in curbing or driveway pavement edges (for curb-less driveways), as shown in Figure 90-H: Vehicular Access Point Distance Measurement.

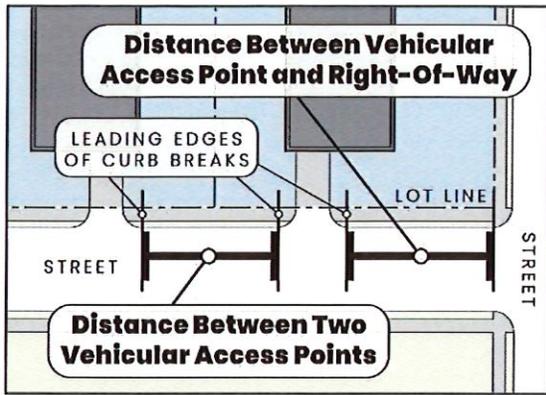


Figure 90-H: Vehicular Access Point Distance Measurement

J. Window surface ratio. Window surface ratio is measured as the proportion of glass to the total surface area of a building elevation, excluding roofs and rooflines, as shown in Figure 90-I: Window Surface Ratio Measurement.

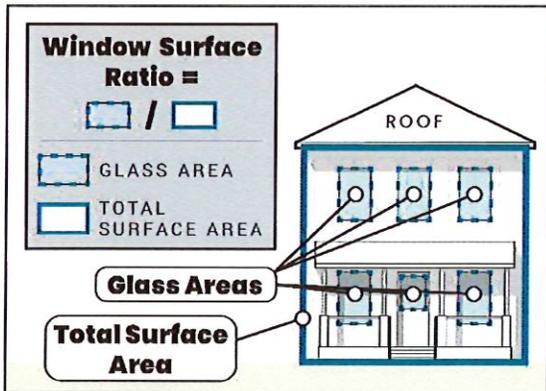


Figure 90-I: Window Surface Ratio Measurement

Section 2-91. TS Regulating Plan and Rights-of-Way Design.

A. Town Square Regulating Plan adopted. The Town Square Regulating Plan, together with all explanatory matter thereon, is hereby adopted by reference and declared to be a part of

this Zoning Code as fully as if the same were set forth herein in detail.

B. Contents of Town Square Regulating Plan. The locations of the following are as shown on the Town Square Regulating Plan:

1. Existing thoroughfares.
2. Planned thoroughfares.
3. Existing greenways.
4. Planned greenways.

C. Public or private rights-of-way.

Thoroughfares and greenways required by the Town Square Regulating Plan may be private or may be dedicated to the public, if formally accepted by the Town of Goldsby.

D. Compliance required.

1. Applications for building permits within the Town Square District, in addition to all other applicable provisions of the Goldsby Code of Ordinances, shall only be approved if the subject lot includes or proposes the construction of compliant thoroughfares and greenways for those portions of a lot that contain or abut a planned thoroughfare or planned greenway according to the Town Square Regulating Plan.

2. Prior to the issuance of a certificate of occupancy for any new development on applicable lots, the thoroughfare and/or greenway shall be constructed, excluding public utilities, in

accordance with the standards established herein and on the Town Square Regulating Plan.

E. Arrangement of thoroughfares.

1. Except where otherwise shown in the Town Square Regulating Plan, all thoroughfares shall terminate at other thoroughfares, forming an interconnected network.
2. Internal thoroughfares shall connect wherever possible to those on adjacent sites.
3. Where adjacent sites are nonconforming with regards to the thoroughfare network requirements of this Code, stub-out streets shall be provided to provide future connectivity at such time as the adjacent sites are developed or redeveloped.
4. Stub-out streets 150 feet in length or less shall terminate at a curb designed to be removed when the adjacent site is developed and the street is extended.

F. Adjustment of required thoroughfare or greenway locations. The owner of a single lot or multiple abutting lots in this district may apply for approval to adjust the locations of thoroughfares and greenways from those shown in the Town Square Regulating Plan by up to a total of 300 horizontal feet, provided that the interconnected network shown in the Town Square Regulating Plan is maintained. An

adjustment of the Town Square Regulating Plan shall be subject to the application process provided in Section 1-11 Uses and Structures Permitted on Review. Where approved, such adjustment shall be reflected in an updated Town Square Regulating Plan.

G. Creation of other thoroughfares or greenways. Additional thoroughfares and/or greenways that are not required by the Town Square Regulating Plan may be developed, provided such thoroughfares and/or greenways meet applicable standards and extend the network of existing and/or planned thoroughfares and greenways by connecting to or between such thoroughfares and greenways.

H. Dimensional right-of-way standards. New rights-of-way and paved travel path widths for thoroughfares and/or greenways must meet the applicable minimum dimensional standards required in Table 91-1.

Table 91-1: TS Thoroughfare and Greenway Dimensional Standards

Thoroughfare / Greenway Designation	Right-of-Way Width	Paved Travel Path Width
Thoroughfare A	86 feet (min.)	24 feet (min.)
Thoroughfare B	64 feet (min.)	24 feet (min.)
Thoroughfare C	46 feet (min.)	24 feet (min.)
Greenway	15 feet (min.)	10 feet (min.)

- I. Required right-of-way elements. Each type of right-of-way, as referenced in the Town Square Regulating Plan, requires certain elements at minimum widths as stipulated in Table 91-2 per the following key. Required widths are measured perpendicular to the right-of-way edge for the entire length of the right-of-way:
1. A filled circle (“●”) identifies an element that is required on both sides of the thoroughfare vehicular travel lanes or greenway travel paths (as applicable).
 2. An unfilled circle (“○”) identifies an element that is required only on one side of the thoroughfare vehicular travel lanes or greenway travel paths (as applicable).

Table 91-2: TS Required Thoroughfare and Greenway Elements

Designation and Element Type	Dimensional Width Requirement
Thoroughfare A	
● Paved Sidewalk	6 feet (min.)
● Landscape Area	5 feet (min.)
● Angled On-Street Parking	20 feet (min.)
Thoroughfare B	
● Paved Sidewalk	6 feet (min.)
● Landscape Area	5 feet (min.)
○ Perpendicular On-Street Parking	18 feet (min.)
Thoroughfare C	
● Paved Sidewalk	6 feet (min.)
● Landscape Area	5 feet (min.)
Greenway	
● Landscape Area	2.5 feet (min.)

- J. Sidewalks required on existing thoroughfares. Development with frontage along existing thoroughfares, as shown in the Town Square Regulating Plan must construct, expand, and/or improve continuous sidewalks along such frontage to be a minimum width of 6 feet and subject to the following:
1. The 6-foot path of travel must be clear of obstructions between grade level and 8 feet above grade level.

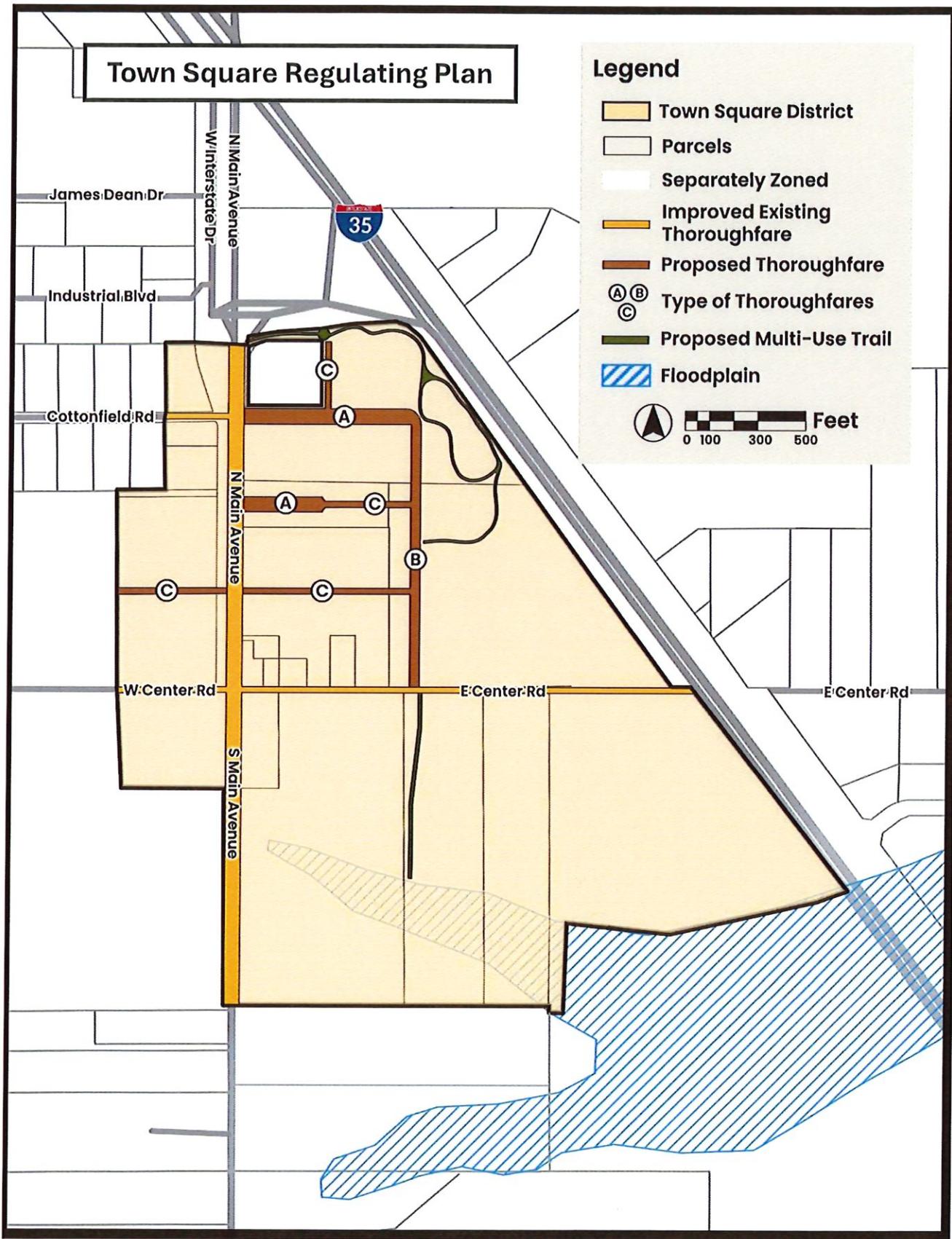
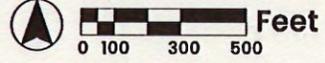
2. The sidewalk may only be interrupted by approved vehicular access points.
3. Sidewalks may only be located outside of the right-of-way if the administrator determines that such placement is the only feasible means of providing a continuous sidewalk.

K. Additional thoroughfare elements. The standards of Table 91-2 shall not be construed to prohibit the construction of wider thoroughfare elements, the provision of additional thoroughfare elements, or the provision of street furniture and related features allowed or required by Section 2-97.

Town Square Regulating Plan

Legend

-  Town Square District
-  Parcels
-  Separately Zoned
-  Improved Existing Thoroughfare
-  Proposed Thoroughfare
-  Type of Thoroughfares
-  Proposed Multi-Use Trail
-  Floodplain



Section 2-92. TS Use Permissions.

A. Use permissions table. The use permissions in Table 92-1 identify the principal uses and select accessory uses that are allowed by-right through approval of a zoning permit, allowed through approval of a special exception, or prohibited per the following key:

1. A filled circle (“●”) identifies a use that is allowed through approval of an administrative zoning permit.
2. An unfilled circle (“○”) identifies a use that is allowed through approval of a specific use permit (per Section 1-11).

Table 92-1: TS Use Permissions

Use	TS District Permission
Principal Uses	
Arts and Cultural Establishment	●
Childcare or Day Care Center	●
Eating or Drinking Establishment	●
Hotel or Motel	●
Medical Facilities	○
Medical Marijuana Dispensary	○
Neighborhood Agriculture	●
Nursery	●
Office	●
Personal Services	●

Use	TS District Permission
Recreation / Entertainment, Indoor	○
Recreation / Entertainment, Outdoor (Large)	○
Recreation / Entertainment, Outdoor (Small)	●
Religious Place of Worship	●
Retail Sales	●
School or Library	●
Vehicle Parking Structure	○
Accessory Uses	
Vehicle Charging - Accessory	●
Vehicle Parking Lot - Accessory	●
Vehicle Parking Structure - Accessory	●

Section 2-93. TS Access and Block Standards.

A. Purpose. The purpose of this Section 2-93 is to require, incentivize, and support the establishment of pedestrian-friendly development that accommodates safe, comfortable, aesthetically pleasing environments for people navigating the TS District outside of a vehicle. This section also serves to reduce the total amount of paved surfaces for vehicular maneuvering by providing for shared

facilities and limited interruptions to pedestrian pathways.

- B. Block dimensional standards. Blocks, whether developed as part of one lot or across a collection of abutting lots, are subject to the dimensional standards of Table 93-1.

Table 93-1: TS Block Dimensional Standards

Block Dimensional Standard	
Block Perimeter (max.)	2,000 feet
Block Face Length (max.)	700 feet

- C. Vehicular access points. Vehicular access points are subject to the requirements and dimensional standards of Table 93-2 and the following:

1. Vehicular access points, other than the existing and planned thoroughfares shown in the Town Square Regulating Plan in Section 2-91, are prohibited along South Main Avenue and North Main Street (Highway 74).
2. Noncompliant vehicular access points must be removed as part of the development or redevelopment of lots subject to these requirements and prior to the issuance of a building permit and/or occupancy permit for work on the subject lot.
3. Minimum distances from intersecting rights-of-way apply to

existing and planned thoroughfares as shown in the Town Square Regulating Plan (Section 2-91) and/or as may be officially adopted by the Town of Goldsby.

Table 93-2: TS Vehicular Access Point Dimensional Standards

Vehicular Access Point Dimensional Standard	
Number of Vehicular Access Points (max.)	2 per 300 feet of block face length
Width of Vehicular Access Point (max.)	<i>One-way drive: 12 feet Two-way drive: 24 feet</i>
Distance from Intersecting Right-of-Way (min.)	100 feet
Distance from Vehicular Access Point in Same Block Face (min.)	100 feet

- D. Cross-access required. All properties, including previously developed lots, that are proposed to be replatted or subdivided must provide cross-access between adjacent newly created lots to encourage shared parking and shared access points on public or private rights-of-way. The standards in Table 93-3 identify the type of cross-access required based on the type of development on the subject lot per the following key:

1. A filled circle (“●”) means that the identified type of cross-access that is required.
2. An unfilled circle (“○”) means that the identified type of cross-access is optional unless certain conditions are met.
3. Where cross-access of any type is required, a cross-access easement for the applicable connection points must be recorded before the issuance of a zoning permit and/or building permit for work on the newly created lot.
4. When cross-access is deemed impractical by the administrator due to topography, the presence of natural features, legal considerations, or pedestrian and vehicular safety factors, requirements for vehicular cross-access may be waived by the administrator provided that appropriate pedestrian connections are included in the development.

Table 93-3: TS Cross-Access Requirements

Type of Development	Type of Cross-Access Required	
	Pedestrian	Vehicular
Construction of New Principal or Accessory Structure	●	○ ^[1]
Construction of New Parking Lot or Parking Structure	○ ^[2]	●
Expansion of Principal or Accessory Structure ^[3]	●	○ ^[1]
Expansion of Parking Lot or Parking Structure ^[4]	●	○ ^[1]

Table Notes:
 [1] Required if the subject lot has a parking lot or parking structure of any size.
 [2] Required if the subject lot has an enclosed structure.
 [3] Applies if the collective gross floor area of enclosed structures on the lot is increased by 50% or more.
 [4] Applies if either the number of parking spaces within, or total surface area of, the parking lot or parking structure is increased by 50% or more.

E. Standard pedestrian cross-access design. Pedestrian cross-access shall meet the minimum standards provided below, except where an alternative design is approved by the administrator. Existing connections across lot lines that meet the

following standards may be counted towards required cross-access:

1. Pedestrian cross-access must provide at least one contiguous walking path that is a minimum of 5 feet wide and that connects the primary entrance of the principal structure to the lot lines of applicable abutting lots. This contiguous walking path may be interrupted by vehicular paths if clearly marked crosswalks are provided.
2. Where a stub walkway or similar connection point is available from an abutting lot, the pedestrian cross-access on the subject lot must align with such stub walkway.
3. Where a stub walkway or similar connection point is not available from an abutting lot, the pedestrian cross-access on the subject lot must be designed to allow for practical future connection from the abutting lot. A stub walkway may not be designed to terminate into an enclosed structure, parking space, or parking structure on the abutting lot if such walkway were continued in the same direction from the stub by 10 feet into the abutting lot.

F. Standard vehicular cross-access design. Vehicular cross-access shall meet the minimum standards provided herein, except where an

alternative design is approved by the administrator. Existing connections across lot lines that meet the following standards may be counted towards required cross-access:

1. Vehicular cross-access must provide at least one contiguous vehicular path extending from each abutting applicable lot with a paved and drivable surface at least 24 feet wide for a minimum distance of 25 feet along the path of travel. This provision is not intended to prohibit the construction of a median that separates opposite directions of travel. A vehicular path that connects the parking lot(s) and/or parking structure(s) on the lot to the vehicular cross-access point(s) must be provided.
2. Where a stub driveway or similar connection point is available from an abutting lot, the stub driveway on the subject lot must align with such stub driveway.
3. Where a stub driveway or similar connection point is not available from an abutting lot, the vehicular cross-access on the subject lot must be designed to allow for practical future connection from the abutting lot. A stub driveway may not be designed to terminate into an enclosed structure, parking space, or parking structure on the abutting lot if such driveway were

continued in the same direction from the stub by 25 feet into the abutting lot.

G. Alternative cross-access design.

Designs that allow for cross-access include, but are not limited to, stub pedestrian walkways and stub driveways. The administrator may allow alternative designs for cross-access based on the following criteria:

1. The purpose of this Section 2-93 is substantially met;
2. Physical site constraints, such as topography, existing structures, or utility infrastructure make strict compliance impractical;
3. The alternative design does not create undue burdens on emergency access, deliveries, or general circulation between lots;
4. The alternative design provides safe, direct, and convenient pedestrian and/or vehicular connections between lots;
5. The alternative design minimizes conflicts between pedestrians and vehicles through appropriate separation, markings, or traffic-calming measures; and
6. The alternative design supports future connectivity to and from adjacent lots.

H. Future connectivity. Where abutting lots within the TS District are under separate ownership, the following applies:

1. No development may be designed to prohibit or obstruct the ability for future vehicle, bicycle, and pedestrian access and connectivity to adjacent lots, including using new public or private streets, except where the administrator determines that such is impractical due to legal, topographic, or other site-specific constraints.
2. This provision shall not be interpreted to prohibit or restrict that which would otherwise be permitted within this district or require inter-lot rights to be granted to adjacent property owners.

Section 2-94. TS Building and Parking Standards.

- A. Building setbacks and heights. All principal and accessory buildings shall be subject to the dimensional standards of Table 94-1, except that accessory buildings are not subject to maximum setback requirements.

Table 94-1: TS Building Dimensional Standards

Building Dimensional Standard	
Building Height (max.)	3 stories / 45 feet
Ground Story Height (min.)	14 feet
Front Lot Line Setback (min.)	0 feet
Front Lot Line Setback (max.)	30 feet
Side Lot Line Setback (min.)	0 feet
Rear Lot Line Setback (min.)	5 feet

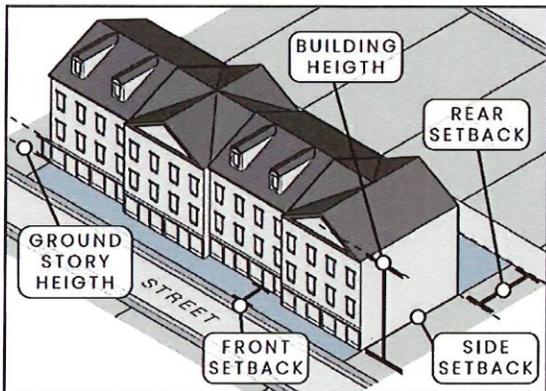


Figure 94-A: TS Building Dimensional Standards Diagram

B. Parking requirements.

1. Off-street parking is required per the standards of Table 94-2 for uses outside of public and private rights-of-way.
2. Off-street parking may only be provided in a rear or side yard. When parking is located on a corner lot, parking spaces and

drive aisles (other than a driveway extended from an approved vehicular access point) may not be closer to abutting thoroughfare rights-of-way than the principal building(s) on the subject lot.

3. In determining the required number of parking spaces, fractional calculations are rounded to the nearest whole number, with one-half or more counted as an additional space.
4. All required and voluntarily provided parking spaces and associated drive aisles and maneuvering areas must be constructed of a non-gravel, all-weather surface to prevent erosion, prevent the creation of dust, and prevent vehicle wheels from making direct contact with soil, sod, or mud.
5. The requirements of Table 94-2 shall not be construed to prohibit the construction of additional off-street parking spaces.

Table 94-2: TS Required Off-Street Parking Spaces

Type of Improvement	Minimum Required Off-Street Parking Spaces
Enclosed Building ^[1]	1 parking space per 1,000 sq.ft. GFA
Unenclosed Reserved Area ^[2]	1 parking space per 2,000 sq.ft. ULA
<p>Table Notes: GFA = Gross floor area, as calculated per Section 2-90 ULA = Unimproved lot area, as calculated per Section 2-90 [1] For the purposes of this table, a vehicle parking structure is not considered an enclosed building. [2] For the purposes of this table, unenclosed reserved areas are those portions of a lot that are not improved with an enclosed building but are used for a principal use (such as outdoor recreation).</p>	

C. Adjustments to parking requirements.

Minimum off-street parking requirements may be reduced in accordance with the following:

1. A lot that is within a 2,000-foot walk (as measured along sidewalks and/or greenways) from an operating transit stop may reduce the minimum required off-street parking spaces by 20%, before accounting for other allowable reductions within this section.
2. On-street parking immediately abutting the lot may count towards minimum required off-street

parking. Each marked on-street parking space that completely or partially abuts the right-of-way frontage of the subject lot may count for one required off-street parking space.

3. Public shared parking facilities located within a 300-foot radius of the subject lot may count towards minimum required off-street parking spaces. Each marked parking space within a public parking facility that is completely or partially within a 300-foot radius of the subject lot may count for one required off-street parking space.
4. Lots that are 10,000 square feet or less in area are not required to provide off-street parking.

Section 2-95. TS Refuse Collection Standards.

- A. Applicability. The standards of this Section 2-95 apply to private dumpsters, grease containers, trash receptacles, and similar refuse collection points within the TS District.
- B. Refuse container placement. Refuse containers must:
 1. Be placed in the least visible location from rights-of-way (excluding the right-of-way for I-35); and
 2. Be serviced through an alley, where alley access is available.

- C. Refuse container enclosure design. Except where a refuse container is located inside of a building, enclosures must:
1. Be opaque on three sides with the fourth side comprising of a self-closing gate made from noncombustible materials;
 2. Be at least 12 inches taller than the receptacle; and
 3. Be constructed of masonry.

Section 2-96. TS Architectural Standards.

- A. Maximum blank wall area. Building elevations on all buildings, including principal and accessory buildings, that face a thoroughfare must incorporate a combination of windows, doors, substantial material changes, and/or pedestrian-scale articulation greater than 6 inches in depth including recesses, projections, belt courses, columns, and brackets to break up otherwise continuous flat wall expanses. Blank wall areas must not exceed the dimensions specified in Table 96-1.

Table 96-1: TS Blank Wall Dimensions

Blank Wall Measurement Type ^[1]	Requirement
Horizontal Width	20 feet (max.)
Vertical Height	30 feet (max.)
Table Notes:	
[1] As measured according to Section 2-90.	

- B. Pedestrian entrance required. Each building that is set back less than 30 feet from a front lot line must provide at least one pedestrian entrance within the elevation facing a thoroughfare, subject to the following standards:

1. Each separate ground story tenant space
2. Building elevations for a single tenant space that are wider than 100 feet as measured along and facing a thoroughfare must provide a pedestrian entrance at a rate of 1 required pedestrian entrance per 100 feet of elevation width. This calculation is rounded to the nearest whole number (e.g., a 149-foot-wide elevation calculated as 149 divided by 100, or 1.49, is rounded to '1' and requires one pedestrian entrance; a 150-foot-wide elevation calculated as 150 divided by 100, or 1.5, is rounded to '2' and requires two pedestrian entrances).
3. Such entrance(s) must be connected by a flat, paved pedestrian walkway at least 6 feet wide across the entire length of the walkway from the pedestrian entrance to the sidewalk along the thoroughfare.

- C. Active depth. Buildings that have a pedestrian entrance facing a thoroughfare must provide a minimum area of active depth, as defined in

Section 2-88, in accordance with Table 96-2 and the following standards:

1. No more than 20% of the floor area of the required active depth can be used for inactive uses such as storage, hallways, kitchens, stairwells, elevators, and equipment rooms.
2. Vehicle parking spaces and vehicular use areas are not allowed in any portion of a required active depth.

Table 96-2: TS Minimum Active Depth

Type of Elevation	Active Depth
Thoroughfare-Facing Elevation	20 feet (min.)
Non-Thoroughfare-Facing Elevation	N/A

D. Exterior materials. Exterior finish materials on all buildings, including principal and accessory buildings, must comply with the following standards:

1. Wall finishes on sides of individual buildings seen from a public or private right-of-way must be the same on all visible sides; architecturally significant portions must conform.
2. If provided, trim types and dimensions must be consistent on all sides of the building; the main building mass and/or façade may

be further embellished or enhanced with pedestrian-scale architectural details.

3. No more than three different exterior materials, exterior colors, or any combination thereof may be used on a single building, not including windows, doors, porches, balconies, foundations, and architectural details.
4. Materials may be combined on exterior walls only horizontally, with the larger material units (e.g., large stone blocks) below smaller or thinner material units (e.g., siding; hand-held bricks).
5. Exterior materials are limited to brick, natural stone, clapboard, board and batten, or hard-coat stucco.
6. Vinyl siding, aluminum siding, and synthetic stone veneer are prohibited.
7. Hard-coat stucco must be a 3-coat plaster finish, applied on brick or concrete block. Control joints must be concealed where possible.
8. Clapboards and board and battens must be wood or cementitious board. Cement board (or equivalent) must have a 4-inch maximum exposure. Full three-quarter-inch wood siding (or equivalent) may have up to an 8-inch exposure. False wood graining is prohibited.

9. Vents, stacks, and roof-mounted equipment must be painted to match the roof material, hidden from street-level pedestrian view by parapet walls, or otherwise camouflaged and screened in materials similar to the exterior finish materials of the building.
10. Ground-mounted mechanical and auxiliary equipment (e.g., air handlers, heat pumps, and the like) must be screened from view of a thoroughfare or greenway by walls that match the associated building in material and color.

E. Windows. All windows on all elevations of principal and accessory buildings must comply with the following standards, except where otherwise noted:

1. Windows must be included in thoroughfare-facing elevations of principal buildings and accessory buildings.
2. Ganged windows and bays must have a continuous sill and at least 4-inch-wide mullions.
3. Grills between glass, reflective glazing, and pop-in grills are prohibited.
4. Non-glass exterior window components must be faced in wood, metal-clad wood, or polymer materials. Such materials must be paint grade or pre-finished.

5. Building elevations must include a minimum proportion of window surface area as required in Table 96-3. Glass within doors which are part of an applicable elevation may be counted towards minimum required window surface ratios.

Table 96-3: TS Required Window Surface Ratio

Type of Elevation	Window Surface Ratio
Ground Story Thoroughfare-Facing Elevation	60% (min.)
Upper Story Thoroughfare-Facing Elevation	30% (min.)

F. Doors. All doors on all elevations of principal and accessory buildings must comply with the following standards, except where otherwise noted:

1. Exterior doors must be finished in wood (stained or painted) or metal.
2. Plastic laminated, stamped metal, and leaded/beveled glass doors are prohibited.
3. Garage doors must be wood, composite, or metal.
4. A ground story thoroughfare-facing elevation must include at least one street-facing pedestrian doorway.

G. Trim. Where provided, all trim on all elevations of principal and accessory

buildings must comply with the following standards, except where otherwise noted:

1. Trim must be consistent on all sides of building masses, with emphasis on the main building mass and facade.
2. Trim for wings not along a thoroughfare may be simplified from other areas of trim.
3. Trim must be of wooden or synthetic planks thick enough to conceal the edge of the siding.
4. When used on buildings that are clad in horizontal siding, all corner boards, casings, frieze boards, and similar architectural details must be at least 1.25 inches thick.
5. Pressure-treated trim is prohibited.
6. Trim must be paint grade or pre-finished.

Section 2-97. TS Lighting and Streetscape Standards.

A. Lighting standards. Outdoor lighting provided in rights-of-way, in parking lots, and other outdoor spaces are subject to the following, as applicable:

1. Decorative-style streetlights meeting Town specifications must be installed at all thoroughfare intersections and along thoroughfares at a spacing not to exceed 60 feet on center as each lot is developed or redeveloped.

Existing streetlights meeting these standards may count towards required streetlights.

2. Lighting fixtures attached to buildings shall be of a decorative character.
3. Lighting for structures and signs adjacent to properties in a residential zoning district shall be shielded and/or angled downward to prevent light from glaring directly onto residential lots.

B. Street furniture standards.

Decorative-style seating benches meeting Town specifications must be installed at all thoroughfare intersections and along thoroughfares at a spacing not to exceed 60 feet on center as each lot is developed or redeveloped. Existing benches meeting these standards may count towards required benches.

C. Utility placement standards. Electrical utilities and other cables and wires in rights-of-way must be placed underground and in a manner that accommodates street trees along all sides of thoroughfares.

D. Street landscaping standards. Subject to the additional applicable standards of Section 2-98, required landscaped areas along thoroughfares must include at least one tree planted every 60 feet on center as spaced equidistant between street lights. Existing non-invasive trees that are healthy and located within the

landscaped area may count towards required street tree plantings.

Section 2-98. TS Landscape Standards.

- A. Prohibited materials. The following landscaping materials are prohibited in rights-of-way and in yards:
1. Invasive plant species, as identified by the Oklahoma State University’s Extension Office (<https://extension.okstate.edu/>; website subject to change).
 2. Gravel (except where used in a tree bed within a right-of-way).
- B. Required thoroughfare yard landscaping. Lots that are developed with a front yard setback must provide landscaping within the front yard that meets the requirements of Table 98-1. Required landscaping may be interrupted by permitted travel paths and allowed signage.

Table 98-1: TS Thoroughfare Yard Landscaping

Front Yard Setback Provided	Percentage of Setback Yard to be Landscaped
Less than 5 Feet	25% (min.)
5—15 Feet	40% (min.)
Greater than 15 Feet	60% (min.)

C. Required parking lot interior landscaping. Parking lots must provide landscaping within them as required in Table 98-2 and in compliance with the following standards:

1. Each separate landscaped island or landscaped area must contain a minimum of 150 square feet of area, have a minimum dimension of 8 feet in any direction, and include at least one tree.
2. If curbs, wheel stops, or similar elements are installed in a parking lot abutting a landscaped area, such elements must have openings allowing drainage from the pavement to enter the abutting landscaped area.
3. Within parking lots that are less than 4,500 square feet in area, required trees may be planted along the perimeter instead of within interior islands.

Table 98-2: TS Parking Lot Interior Landscaping

Size of Parking Area ^[1]	Interior Landscaped Area
Less than 3,000 Square Feet	None required
3,000—4,500 Square Feet	5% (min.) of total area
4,501—30,000 Square Feet	7.5% (min.) of total area
More than 30,000 Square Feet	10% (min.) of total area
Table Notes: [1] For the purposes of this table, the size of a parking area is measured as the cumulative square footage of the parking spaces, drive aisles, driveways, and other associated vehicular maneuvering spaces that are outside of a right-of-way.	

D. Required landscaping. Where a landscaped area is required, a minimum ratio of trees, shrubs, and non-sod groundcover is required, as provided in Table 98-3 and subject to the following:

- Existing plant material that is non-invasive, healthy, and in the required location may count towards landscaping requirements.
- Where proposed, artificial turf may count towards living groundcover landscaping requirements at a ratio of 2-to-1 (e.g., if 100 square feet of non-sod living ground cover is required in accordance with

Table 98-3, then at least 200 square feet of artificial turf must be installed to meet the requirement).

Table 98-3: TS Required Landscaping

Type of Landscaping	Amount per Required Landscaping Area Size
Trees	1 per 250 square feet (min.)
Shrubs	4 per 250 square feet (min.)
Non-Sod Living Groundcover	25% of total required landscaping area (min.)

E. Hardscaped plazas. Hardscaped plazas may be counted at a rate of 1-square-foot-to-1-square-foot towards meeting the non-sod living groundcover requirements in Table 98-3 if such plazas meet all of the following standards:

- The plaza is a minimum of 1,000 square feet;
- The plaza is contiguous;
- The ground plane of the plaza is finished in a material that is compliant with ADA standards;
- The plaza abuts a sidewalk along a thoroughfare or abuts a greenway or is connected to such sidewalk or greenway by a continuous paved sidewalk that is at least 6 feet wide;

5. The plaza includes at least one tree per 1,000 square feet;
6. The plaza includes at least one anchored bench or similar fixed seating element; and
7. The plaza includes at least one exterior-rated electrical outlet.

F. Tree planting. Trees proposed to be planted must meet the following standards, as applicable, at the time of their planting:

1. Shade trees shall be a minimum of three inches in caliper and 10 feet in height.
2. Ornamental trees shall be a minimum of two inches in caliper and six feet in height.
3. Container-grown trees are preferred to ball and burlap and shall have been in their container for at least six months prior to planting.
4. Ball and burlap trees may not be loose in their balls and will have been cured for a minimum of one year prior to planting. Curing time begins once the tree is dug up from the soil.
5. Deciduous tree species must be planted while in dormancy.
6. Tree bed areas shall be treated with a four-inch cover of mulch, rock, or crushed granite that is consistent in appearance with nearby landscape installations. Plastic edging for tree bed areas is prohibited. Rock or crushed

granite shall not extend outside of the tree bed area.

7. If trees cannot be planted at the time of occupancy of the associated lot due to seasonal conditions, required trees must be planted in the next suitable season. Failure to do so may result in revocation of the occupancy permit and other enforcement actions.

G. Sod planting. Where proposed, sod shall be laid end-to-end during the growing season, while staggering each layer. Sod shall be rolled prior to the initial irrigation.

H. Irrigation requirements. Irrigation shall be provided for, at a minimum, the first growing season following installation and according to the following standards:

1. The primary function of the irrigation system is to help establish new trees, shrubs, and perennial plantings.
2. The use of municipal-provided potable water for landscape irrigation is discouraged. All efforts should be made to incorporate the use of captured rainwater, ground water, and/or recycled site water for all irrigation needs.
3. In areas where the use of municipal-provided potable water is the only feasible option, temporary aboveground irrigation

shall be installed for all tree, shrub, and bed plantings.

4. Temporary irrigation shall be actively maintained and routinely evaluated. All aboveground irrigation components shall be removed no later than one year after installation.
5. Irrigation delivery systems shall be designed in such a manner to prevent water from running off or spraying onto adjacent pavement, sidewalks, structures, or other non-landscaped areas. Irrigation delivery systems should not spray within 18 inches of a structure's foundation.

I. Maintenance and replacement required. Landscaping and hardscaping is subject to the following:

1. All landscaping and hardscaping, required or voluntarily provided, must be maintained in accordance with the Property Maintenance Code, as established in Chapter 4 Building and Construction of the Goldsby Code of Ordinances, as may be amended.
2. All landscaping and hardscaping, required or voluntarily provided, must be maintained to avoid creating a nuisance or nuisances must be remedied in accordance with Chapter 12 Nuisances of the Goldsby Code of Ordinances, as may be amended.

3. All landscaping and hardscaping that is installed to meet the requirements of this Section 2-98 and that subsequently falls into disrepair, becomes unhealthy, or dies (as applicable) must be repaired or replaced to bring the landscaping and hardscaping into compliance within 6 months (for hardscaping) or within the next suitable planting season (for landscaping).

EM – Employment Overlay

Section 2-99. EM Purpose and Applicability.

- A. Purpose. This overlay is intended to encourage and support aesthetically pleasing commercial developments that are in close proximity to the I-35 corridor. The standards of this overlay supplement and/or modify the standards applicable to underlying zoning districts, as specified herein.
- B. General applicability. The provisions of the Employment (EM) Overlay apply to development on each lot that is:
 1. Completely or partially within 1,000 feet of the I-35 right-of-way centerline (as measured perpendicular to said centerline); and
 2. Within the C-2 Commercial zoning district.

C. Applicability by project activity. The development standards applicable to the EM Overlay apply to certain types of project activities (defined in Section 2-88), as provided in Table 99-1 and per the following key:

1. A filled circle (“●”) identifies a development standard that generally applies.
2. An unfilled circle (“○”) identifies a development standard that does not apply.

D. Applicability to extended lots. The provisions of the EM Overlay apply to all areas of a lot, including the areas extending beyond 1,000 feet from the I-35 right-of-way centerline, if any portion of the lot is subject to these provisions.

E. Applicability to nonconformities. In addition to the provisions of Section 1-14 (Non-Conforming Lots, Structures, and Uses), lots with one or more nonconforming structures subject to an expansion of their gross floor area by 25% or more (comparing the existing gross floor area to the total proposed gross floor area) must come into full compliance with the applicable standards of the EM Overlay.

Table 99-1: EM Development Standard Applicability

Development Standards (Section Reference)	Project Activity ^[1]						
	New Construction	Addition	Site Modification	Facade Modification	Change of Use	Renovation	Maintenance / Repair
Access Standards (Section 2-102)	●	●	●	○	○	○	○
Architectural Standards (Section 2-103)	●	●	○	●	○	●	○
Landscape Standards (Section 2-104)	●	●	●	●	●	●	○
Table Notes: [1] As defined in Section 2-88.							

Section 2-100. EM Administrative Modifications.

- A. Applicability. The following provisions expressly grant the administrator (as defined in Section 2-88) authority to modify certain provisions that apply to development within the EM Overlay.
- B. Alternative exterior materials. The administrator is hereby authorized to approve minor modifications to the allowed exterior materials in Section 2-103 where materials that are not expressly prohibited are proposed, and where such materials clearly meet the purpose of the EM Overlay.
- C. Numerical adjustments. The administrator is hereby authorized to approve adjustments to dimensional

requirements applicable to the EM Overlay by no more than 10 percent (increase or decrease) with the following exceptions:

1. The administrator may not adjust the allowed height of buildings.
2. The administrator may not adjust required spacing from an easement or floodplain required by other sections of the Zoning Code.

D. Approved site plan adjustments. The administrator is hereby authorized to approve minor changes to an approved site plan that do not materially alter building orientation or size, building placement by more than 10 feet, vehicle or pedestrian traffic flow, or location of parking areas.

Section 2-101. EM Measurement Methodologies.

- A. Conflict with other provisions. In case of any conflict between these methodologies and other sections of the Zoning Code, the provisions within this Section 2-101 shall govern.
- B. Vehicular access point distance.
 1. The distance between a vehicular access point and a right-of-way intersection is measured as the shortest linear measurement along the right-of-way between the leading edge of the break in curbing (or driveway pavement edge for a curb-less driveway) and

the end of the block face, as shown in Figure 101-A: Vehicular Access Point Distance Measurement.

2. The distance between two vehicular access points is measured as the shortest linear measurement along the right-of-way between the closest leading edges of the breaks in curbing or driveway pavement edges (for curb-less driveways), as shown in Figure 101-A: Vehicular Access Point Distance Measurement.

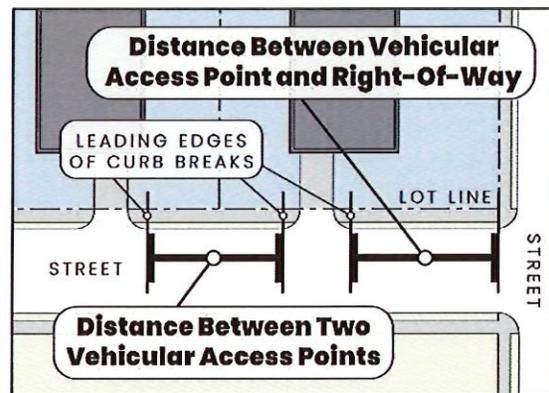


Figure 101-A: Vehicular Access Point Distance Measurement

- C. Blank wall width. Blank wall width is measured as the horizontal distance on an exterior wall between pedestrian-scale architectural elements, like windows, doors, recesses, projections, columns, brackets, and material changes as shown in Figure 101-B: Blank Wall Width Measurement. Downspouts, utility conduit, color changes, EIFS control joints, and similar elements

do not count as pedestrian-scale architectural elements.

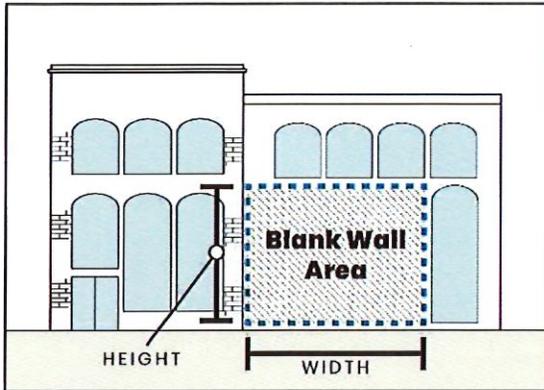


Figure 101-B: Blank Wall Width Measurement

D. Window surface ratio. Window surface ratio is measured as the proportion of glass to the total surface area of a building elevation, excluding roofs and rooflines, as shown in Figure 101-C: Window Surface Ratio Measurement.

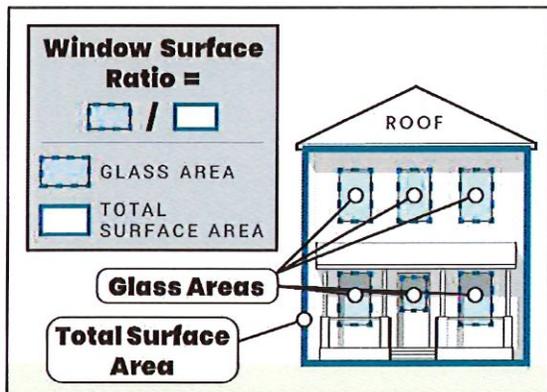


Figure 101-C: Window Surface Ratio Measurement

Section 2-102. EM Access Standards.

A. Purpose. The purpose of this Section 2-102 is to require, incentivize, and support the establishment of pedestrian-friendly development that

accommodates safe, comfortable, aesthetically pleasing environments for people navigating the TS District outside of a vehicle. This section also serves to reduce the total amount of paved surfaces for vehicular maneuvering by providing for shared facilities and limited interruptions to pedestrian pathways.

B. Vehicular access points. Vehicular access points are subject to the requirements and dimensional standards of Table 102-1 and the following:

1. New vehicular access points are prohibited along North Main Street (Highway 74).
2. Noncompliant vehicular access points must be removed as part of the development or redevelopment of lots subject to these requirements and prior to the issuance of a building permit and/or occupancy permit for work on the subject lot.
3. Minimum distances from intersecting rights-of-way apply to existing and planned thoroughfares as shown in the Town Square Regulating Plan (Section 2-91) and/or as may be officially adopted by the Town of Goldsby.

Table 102-1: EM Vehicular Access Point Standards

Vehicular Access Point Standard	
Number of Vehicular Access Points (max.)	2 per lot
Width of Vehicular Access Point (max.)	<i>One-way drive:</i> 12 feet <i>Two-way drive:</i> 24 feet
Distance from Intersecting Right-of-Way (min.)	200 feet
Distance from Vehicular Access Point in Same Block Face (min.)	200 feet

C. Cross-access required. All properties, including previously developed lots, that are proposed to be replatted or subdivided must provide cross-access between adjacent newly created lots to encourage shared parking and shared access points on public or private rights-of-way. The standards in Table 102-2 identify the type of cross-access required based on the type of development on the subject lot per the following key:

1. A filled circle (“●”) means that the identified type of cross-access that is required.
2. An unfilled circle (“○”) means that the identified type of cross-access is optional unless certain conditions are met.

3. Where cross-access of any type is required, a cross-access easement for the applicable connection points must be recorded before the issuance of a zoning permit and/or building permit for work on the newly created lot.
4. When cross-access is deemed impractical by the administrator (as defined in Section 2-88) on the basis of topography, the presence of natural features, legal considerations, or pedestrian and vehicular safety factors, requirements for vehicular cross-access may be waived by the administrator provided that appropriate pedestrian connections are included in the development.

Table 102-2: EM Cross-Access Requirements

Type of Development	Type of Cross-Access Required	
	Pedestrian	Vehicular
Change of Principal Use	●	○ ^[1]
Construction of New Principal or Accessory Use	●	○ ^[1]
Construction of New Parking Lot or Parking Structure	○ ^[2]	●
Expansion of Principal or Accessory Structure ^[3]	●	○ ^[1]
Expansion of Parking Lot or Parking Structure ^[4]	●	○ ^[1]
Table Notes: [1] Required if the subject lot has a parking lot or parking structure of any size. [2] Required if the subject lot has an enclosed structure. [3] Applies if the collective gross floor area of enclosed structures on the lot is increased by 50% or more. [4] Applies if either the number of parking spaces within, or total surface area of, the parking lot or parking structure is increased by 50% or more.		

D. Standard pedestrian cross-access design. Pedestrian cross-access shall meet the minimum standards provided below, except where an alternative design is approved.

Existing connections across lot lines that meet the following standards may be counted towards required cross-access:

1. Pedestrian cross-access must provide at least one contiguous walking path that is a minimum of 5 feet wide and that connects the primary entrance of the principal structure to the lot lines of applicable abutting lots. This contiguous walking path may be interrupted by vehicular paths if clearly marked crosswalks are provided.
2. Where a stub walkway or similar connection point is available from an abutting lot, the pedestrian cross-access on the subject lot must align with such stub walkway.
3. Where a stub walkway or similar connection point is not available from an abutting lot, the pedestrian cross-access on the subject lot must be designed to allow for practical future connection from the abutting lot. A stub walkway may not be designed to terminate into an enclosed structure, parking space, or parking structure on the abutting lot if such walkway were continued in the same direction from the stub by 10 feet into the abutting lot.

E. Standard vehicular cross-access design. Vehicular cross-access shall meet the minimum standards provided herein, except where an alternative design is approved. Existing connections across lot lines that meet the following standards may be counted towards required cross-access:

1. Vehicular cross-access must provide at least one contiguous vehicular path extending from each abutting applicable lot with a paved and drivable surface at least 24 feet wide for a minimum distance of 25 feet along the path of travel. This provision is not intended to prohibit the construction of a median that separates opposite directions of travel. A vehicular path that connects the parking lot(s) and/or parking structure(s) on the lot to the vehicular cross-access point(s) must be provided.
2. Where a stub driveway or similar connection point is available from an abutting lot, the stub driveway on the subject lot must align with such stub driveway.
3. Where a stub driveway or similar connection point is not available from an abutting lot, the vehicular cross-access on the subject lot must be designed to allow for practical future connection from the abutting lot. A stub driveway

may not be designed to terminate into an enclosed structure, parking space, or parking structure on the abutting lot if such driveway were continued in the same direction from the stub by 25 feet into the abutting lot.

F. Alternative cross-access design. Designs that allow for cross-access include, but are not limited to, stub pedestrian walkways and stub driveways. The administrator may allow alternative designs for cross-access based on the following criteria:

1. The purpose of this Section 2-102 is substantially met;
2. Physical site constraints, such as topography, existing structures, or utility infrastructure make strict compliance impractical;
3. The alternative design does not create undue burdens on emergency access, deliveries, or general circulation between lots;
4. The alternative design provides safe, direct, and convenient pedestrian and/or vehicular connections between lots;
5. The alternative design minimizes conflicts between pedestrians and vehicles through appropriate separation, markings, or traffic-calming measures; and
6. The alternative design supports future, practical connectivity to and from adjacent lots.

G. Future connectivity. Where abutting lots within the EM Overlay are under separate ownership, the following applies:

1. No development may be designed to prohibit or obstruct the ability for future vehicle, bicycle, and pedestrian access and connectivity to adjacent lots, including using new public or private streets, except where the administrator determines that such is impractical due to legal, topographic, or other site-specific constraints.
2. This provision shall not be interpreted to prohibit or restrict that which would otherwise be permitted within this district or require inter-lot rights to be granted to adjacent property owners.

Section 2-103. EM Architectural Standards.

A. Maximum blank wall. Building elevations on all buildings, including principal and accessory buildings, that face a thoroughfare must incorporate a combination of windows, doors, substantial material changes, and/or pedestrian-scale articulation greater than 6 inches in depth including recesses, projections, belt courses, columns, and brackets to break up otherwise continuous flat wall expanses. Blank wall areas must

not exceed the dimensions specified in Table 103-1.

Table 103-1: EM Blank Wall Dimensions

Blank Wall Measurement Type ^[1]	Requirement
Horizontal Width	30 feet (max.)
Vertical Height	40 feet (max.)
Table Notes: [1] As measured according to Section 2-90.	

B. Exterior materials. Exterior finish materials on all buildings, including principal and accessory buildings, must comply with the following standards:

1. Wall finishes on sides of individual buildings seen from a public or private right-of-way must be the same on all visible sides; architecturally significant portions must conform; appendages or secondary wings may assume a differing finish according to visibility and architectural merit.
2. Trim types and dimensions must be consistent on all sides of the building; the main building mass and/or façade may be further embellished or enhanced with pedestrian-scale architectural details.
3. No more than three different exterior materials, exterior colors, or any combination thereof may be used on a single building, not including windows, doors,

- porches, balconies, foundations, and architectural details.
4. Materials may be combined on exterior walls only horizontally, with the larger material units (e.g., large stone blocks) below smaller or thinner material units (e.g., siding; hand-held bricks).
 5. Exterior materials are limited to brick, natural stone, clapboard, board and batten, or hard-coat stucco.
 6. Vinyl or aluminum siding, and synthetic stone veneer are prohibited.
 7. Hard-coat stucco must be a 3-coat plaster finish, applied on brick or concrete block. Control joints must be concealed where possible.
 8. Clapboards and board and battens must be wood or cementitious board. Cement board (or equivalent) must have a 4-inch maximum exposure. Full three-quarter-inch wood siding (or equivalent) may have up to an 8-inch exposure. False wood graining is prohibited.
 9. Vents, stacks, and roof-mounted equipment must be painted to match the roof material, hidden from street-level pedestrian view by parapet walls, or otherwise camouflaged and screened in materials similar to the exterior finish materials of the building.
 10. Ground-mounted mechanical and auxiliary equipment (e.g., air handlers, heat pumps, and the like) must be screened from view of a thoroughfare or greenway by walls that match the associated building in material and color.
- C. Windows. All windows on all elevations of principal and accessory buildings must comply with the following standards, except where otherwise noted:
1. Windows must be included in each elevation of principal buildings and on right-of-way-facing elevations of accessory buildings.
 2. Ganged windows and bays must have a continuous sill and at least 4-inch mullions.
 3. Grills between glass, reflective glazing, and pop-in grills are prohibited.
 4. Non-glass exterior window components must be faced in wood, clad wood, or polymer materials. Such materials must be paint grade or pre-finished.
 5. Building elevations must include a minimum proportion of window surface area as required in Table 103-2. Glass within doors which are part of an applicable elevation may be counted towards minimum required window surface ratios.

Table 103-2: EM Required Window Surface Ratio

Type of Elevation	Window Surface Ratio
Ground Story Thoroughfare-Facing Elevation	40% (min.)
Upper Story Thoroughfare-Facing Elevation	20% (min.)

D. Doors. All doors on all elevations of principal and accessory buildings must comply with the following standards, except where otherwise noted:

1. Exterior doors must be finished in wood (stained or painted) or metal.
2. Plastic laminated, stamped metal, and leaded/beveled glass doors are prohibited.
3. Garage doors must be wood, composite, or metal.
4. A ground story thoroughfare-facing elevation must include at least one street-facing pedestrian doorway.

E. Trim. All trim on all elevations of principal and accessory buildings must comply with the following standards, except where otherwise noted:

1. Trim must be consistent on all sides of building masses, with emphasis on the main building mass and façade.

2. Trim for wings not along a thoroughfare may be simplified from other areas of trim.
3. Trim must be of wooden or synthetic planks thick enough to conceal the edge of the siding.
4. When used on buildings that are clad in horizontal siding, all corner boards, casings, frieze boards, and similar architectural details must be at least 1.25 inches thick.
5. Pressure-treated trim is prohibited.
6. Trim must be paint grade or pre-finished.

Section 2-104. EM Landscape Standards.

A. Prohibited materials. The following landscaping materials are prohibited in rights-of-way and in yards:

1. Invasive plant species, as identified by the Oklahoma State University’s Extension Office (<https://extension.okstate.edu/>; website subject to change).
2. Gravel (except where used in a tree bed within a right-of-way).

B. Required parking lot interior landscaping. Parking lots must provide landscaping within them as required in Table 104-1 and in compliance with the following standards:

1. Each separate landscaped island or landscaped area must contain a

minimum of 150 square feet of area, have a minimum dimension of 8 feet in any direction, and include at least one tree.

2. If curbs, wheel stops, or similar elements are installed in a parking lot abutting a landscaped area, such elements must have openings allowing drainage from the pavement to enter the abutting landscaped area.
3. Within parking lots that are less than 4,500 square feet in area, required trees may be planted along the perimeter instead of within interior islands.

Table 104-1: EM Parking Lot Interior Landscaping

Size of Parking Area ^[1]	Interior Landscaped Area
Less than 3,000 Square Feet	None required
3,000—4,500 Square Feet	5% (min.) of total area
4,501—30,000 Square Feet	7.5% (min.) of total area
More than 30,000 Square Feet	10% (min.) of total area

Table Notes:

[1] For the purposes of this table, the size of a parking area is measured as the cumulative square footage of the parking spaces, drive aisles, driveways, and other associated vehicular maneuvering spaces that are outside of a right-of-way.

C. Required landscaping. Where a landscaped area is required, a minimum ratio of non-invasive trees, shrubs, and non-sod groundcover is required, as provided in Table 104-2 and subject to the following:

1. Existing plant material that is non-invasive, healthy, and in the required location may count towards landscaping requirements.
2. Where proposed, artificial turf may count towards living groundcover landscaping requirements at a ratio of 2-to-1 (e.g., if 100 square feet of non-sod living ground cover is required in accordance with Table 104-2, then at least 200 square feet of artificial turf must be installed to meet the requirement).

Table 104-2: EM Required Landscaping

Type of Landscaping	Amount per Required Landscaping Area Size
Trees	1 per 500 square feet (min.)
Shrubs	4 per 500 square feet (min.)
Non-Sod Living Groundcover	15% of total required landscaping area (min.)

D. Hardscaped plazas. Hardscaped plazas may be counted at a rate of 1-square-foot-to-1-square-foot towards

meeting the non-sod living groundcover requirements in Table 104-2 if such plazas meet all of the following standards:

1. The plaza is a minimum of 1,000 square feet;
2. The plaza is contiguous;
3. The ground plane of the plaza is finished in a material that is compliant with ADA standards;
4. The plaza abuts a sidewalk along a thoroughfare or abuts a greenway or is connected to such sidewalk or greenway by a continuous paved sidewalk that is at least 6 feet wide;
5. The plaza includes at least one tree per 1,000 square feet;
6. The plaza includes at least one anchored bench or similar fixed seating element; and
7. The plaza includes at least one exterior-rated electrical outlet.

E. Tree planting. Trees proposed to be planted must meet the following standards, as applicable, at the time of their planting:

1. Shade trees shall be a minimum of three inches in caliper and 10 feet in height.
2. Ornamental trees shall be a minimum of two inches in caliper and six feet in height.
3. Container-grown trees are preferred to ball and burlap and shall have been in their container

for at least six months prior to planting.

4. Ball and burlap trees may not be loose in their balls and will have been cured for a minimum of one year prior to planting. Curing time begins once the tree is dug up from the soil.
5. Deciduous tree species must be planted while in dormancy.
6. Tree bed areas shall be treated with a four-inch cover of mulch, rock, or crushed granite that is consistent in appearance with nearby landscape installations. Plastic edging for tree bed areas is prohibited. Rock or crushed granite shall not extend outside of the tree bed area.
7. If trees cannot be planted at the time of occupancy of the associated lot due to seasonal conditions, required trees must be planted in the next suitable season. Failure to do so may result in revocation of the occupancy permit and other enforcement actions.

F. Sod planting. Where proposed, sod shall be laid end-to-end during the growing season, while staggering each layer. Sod shall be rolled prior to the initial irrigation.

G. Irrigation requirements. Irrigation shall be provided for, at a minimum, the first growing season following

installation and according to the following standards:

1. The primary function of the irrigation system is to help establish new trees, shrubs, and perennial plantings.
2. The use of municipal-provided potable water for landscape irrigation is discouraged. All efforts should be made to incorporate the use of captured rainwater, ground water, and/or recycled site water for all irrigation needs.
3. In areas where the use of municipal-provided potable water is the only feasible option, temporary aboveground irrigation shall be installed for all tree, shrub, and bed plantings.
4. Temporary irrigation shall be actively maintained and routinely evaluated. All aboveground irrigation components shall be removed no later than one year after installation.
5. Irrigation delivery systems shall be designed in such a manner to prevent water from running off or spraying onto adjacent pavement, sidewalks, structures, or other non-landscaped areas. Irrigation delivery systems should not spray within 18 inches of a structure's foundation.

H. Maintenance and replacement required. Landscaping and hardscaping is subject to the following:

1. All landscaping and hardscaping, required or voluntarily provided, must be maintained in accordance with the Property Maintenance Code, as established in Chapter 4 Building and Construction of the Goldsby Code of Ordinances, as may be amended.
2. All landscaping and hardscaping, required or voluntarily provided, must be maintained to avoid creating a nuisance or nuisances must be remedies in accordance with Chapter 12 Nuisances of the Goldsby Code of Ordinances, as may be amended.
3. All landscaping and hardscaping that is installed to meet the requirements of this Section 2-104 and that subsequently falls into disrepair, becomes unhealthy, or dies (as applicable) must be repaired or replaced to bring the landscaping and hardscaping into compliance within 6 months (for hardscaping) or within the next suitable planting season (for landscaping).

DRAINAGE STUDY

BRENTWOOD SECTION 3

PART OF THE NE/4 OF SECTION 16, T8N, R3W, I.M.
Goldsby, McClain County, Oklahoma

Holtzen Engineering Group Project No.: 25.004

July 17, 2025

Submitted to:

Town of Goldsby
100 E. Center Rd.
Goldsby, OK 73093



Prepared by:



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- A. FEMA Mapping
- B. ODOT Rainfall Intensity
- C. Historic Run-off Calculations
- D. Proposed Run-off Calculations
 - a. Design Point 2 and Detention Pond C (Part of Section 2)
 - b. Design Point 3 and Detention Pond D
- E. Drainage Structures



PROJECT LOCATION

This project is located in the NE/4, Section 16, Township 8N, Range 3W Indian Meridian, at the southwest corner of 320th St. (Lamar Rd.) and NW 24th Ave. within the Town of Goldsby, McClain County, OK. Figure 1 below illustrates the project.

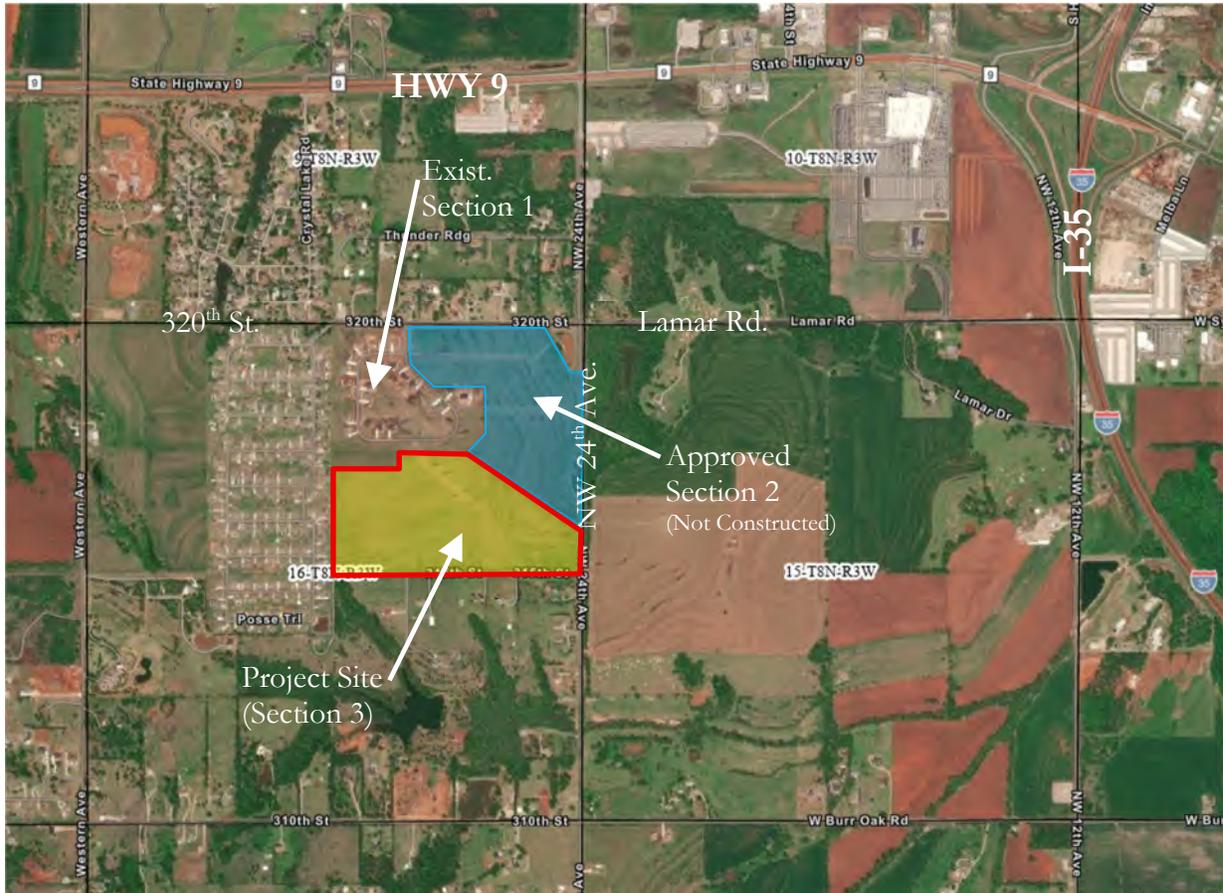


Figure 1 – Project Vicinity

PROJECT DESCRIPTION

This project is phase 3 of a residential subdivision. All sections of this subdivision is considered a rural estate with single family residential lots approximately 0.75 acres each. Section 1, the first phase, contained 37 single family residential lots on a total of 41.5 acres. Section 2, the second phase, is not yet constructed, but is approved for construction and consists of 46 single family residential lots on a total of 57.3 acres. Section 3, the third phase consists of 62 single family residential lots on 61.6 acres. On-site storm water retention pond and outlet structure were constructed in the northeast corner of the quarter section as part of Section 1. As part of Section 2 a new retention pond connecting to the existing Section 1 retention pond was included, along with a new detention pond along the east-central property line. This third phase includes a proposed detention pond on the east property line in the southern area, and utilizes the east-central detention pond that is part of Section 2. The east-central pond part of Section 2 was designed for a portion of the fully developed area of Section 3, and updated design calculations are provided in this report.



To be consistent with the Section 2 Drainage Study, the historic and developed drainage basins utilize the same nomenclature in this report, as they were in the Section 2 report.

HYDROLOGY

The drainage study has been prepared based on the Town of Goldsby Drainage Criteria and requirements and following phase 1 planning and drainage study.

The following criteria was used to in this drainage study.

- Spreadsheets were used to calculate the historic condition peak flows, proposed condition peak flows, and times of concentration using ODOT Roadway Design Manual.
- HydroCad 10.20 was used to calculate stormwater detention with the Modified Rational Method
- Rainfall intensities are based on ODOT Zone V.
- Time span – 24-hour storm
- Peak historic flows, and peak proposed flows for the 2-year, 5-year, 10-year, 25-year, 50 year, and 100-year storms events are analyzed at design points leaving the site, and at each drainage structure.

Below are the run-off coefficient values used for calculating the run-off:

- Historic Unimproved Areas C=0.35
- Residential Rural Estate C= 0.55

DRAINAGE BASINS

Design Points are denoted with a “DP#” and are at the same location for pre-developed conditions and post developed conditions. Historic drainage basins are designated with an “E#” for existing. Post-developed drainage basins are denoted with a “DEV#” for developed.

Drainage basins for drainage structures are denoted with a “P#”.

HISTORIC DRAINAGE BASINS

The historic conditions of the property are used to determine the pre-developed peak flows. The historic site consisted of agriculture land with crops and native grass and slopes from west to east towards NW 24th Ave. The site historically consisted of three drainage basins. Below is a summary of flow for the existing drainage basins:

Drainage Area (E1):

E1 is the northern most basin and runoff flows northerly to 320th St. and easterly to NW 24th Ave. The runoff is routed through ditches paralleling the respective streets to an existing 42” CMP culvert at the southwest corner of 320th St. and NW 24th Ave. This 42” CMP culvert is denoted as Design Point DP1. Basin E1 was considered in the Section 2 Drainage Study. This drainage basin is unchanged by development of Section 3 and is not evaluated in this report.

Drainage Area (E2):

E2 consists of the central portion of the quarter section and runoff flows easterly toward NW 24th Ave. and is routed to an existing drop inlet box with a 36” CMP which crosses NW 24th Ave. and



discharge to a low area east of NW 24th Ave. This 36” CMP is located near the mid quarter section (approximately 1/4 mile south of 320th St.) This 36” CMP is denoted as Design Point DP2.

Drainage Area (E3):

E3 consists of the southern portion of the quarter section and runoff flows easterly toward NW 24th Ave. and is routed to an existing drop inlet box with a 36” CMP which crosses NW 24th Ave. and discharge to a low area east of NW 24th Ave. This 36” CMP is located near the mid quarter section (approximately 3/4 miles south of 320th St.) This 36” CMP is denoted as Design Point DP3.

PROPOSED DRAINAGE BASINS

The proposed developed drainage basin convey flow to the same design points through barditches along new streets, new culverts, and new channels that lead to an on-site detention facility. Below is a summary of the post-developed drainage basins:

Drainage Basin (DEV1):

DEV1 consists of the northern drainage basin that discharges to Design Point DP1 (42” CMP) and was considered in the Section 2 Drainage Study. This drainage basin is unchanged by Section 3 and is not evaluated in this report.

Drainage Basin (DEV2)

DEV2 consists of the central portion of the subdivision, including 4-lots from Section 1, the east central lots of Section 2, and the northern and northeastern lots of Section 3. Most of the run-off from this basin is routed through roadside barditches and channels to Detention Pond C located in Section 2. The portion of DEV2 that is routed to Detention Pond C is denoted as sub-basin DEV2.1. The most eastern part of DEV2 bypasses Detention Pond C, this sub-basin is denoted as DEV2.2. This report contains the pertinent design values considering the developed portions of Sections 1, 2, & 3 that are routed to Detention Pond C, and the bypass run-off. The run-off from DEV2 discharges at Design Point DP2, the existing 36” CMP which crosses NW 24th Ave.

Drainage Basin (DEV3)

DEV3 consists (2)-sub-basins which make up most of the Section 3 development area.

- DEV3.1 includes most of the DEV3 area and is routed through roadside barditches and channels to proposed Detention Pond D located along the east property line. The design of Detention Pond D considers the bypass run-off of DEV3.2 sub-basin. Detention Pond D’s outlet discharges to Design Point DP3 an existing drop inlet box with a 36” CMP which crosses NW 24th Ave.
- DEV3.1 is a smaller developed area consisting of the eastern most part of DEV3. This sub-basin is undetained and discharges directly to DP3.



DRAINAGE VALUES

Detention Pond C (Part of Brentwood - Section 2)

Drainage Basin	DEV2.1					
Storm Frequency – years	2	5	10	25	50	100
Peak Pond Inflow (cfs)	33.76	44.34	51.28	62.48	69.89	79.18
Peak Pond Outflow (cfs)	26.72	35.17	39.77	46.07	50.01	54.68
Maximum Water Surface Elevation (ft)	1194.92	1195.43	1195.75	1196.35	1196.77	1197.32
Maximum Pond Storage (CF)	31414	45779	55394	74201	88095	106970
Percent of Available Storage Used	18%	27%	32%	43%	51%	62%

Available Storage = 172,219 C.F.

Top of Berm= 1199.00

Detention Pond D (Part of Brentwood - Section 3)

Drainage Basin	DEV3.1					
Storm Frequency – years	2	5	10	25	50	100
Peak Pond Inflow (cfs)	33.08	44.65	51.63	63.05	70.51	80.00
Peak Pond Outflow (cfs)	19.36	26.48	31.83	38.13	41.65	45.71
Maximum Water Surface Elevation (ft)	1201.59	1202.68	1203.14	1203.92	1204.46	1205.15
Maximum Pond Storage (CF)	63943	96316	110956	137860	157473	184403
Percent of Available Storage Used	29%	44%	51%	63%	72%	84%

Available Storage = 219,532 C.F.

Top of Berm= 1206.50

Design Point DP2 (36" CMP): Historic Peak Flows -vs- Proposed Peak Flows

Design Point – DP2			
Storm Frequency	Existing Condition	Developed Condition	% of Existing Condition
2-year	34.8	29.11	84%
5-year	45.8	38.24	83%
10-year	53.0	43.29	82%
25-year	63.7	49.91	78%
50-year	71.3	54.05	76%
100-year	80.2	58.94	73%



Design Point DP3 (36" CMP): Historic Peak Flows -vs- Proposed Peak Flows

Design Point – DP3			
Storm Frequency	Existing Condition	Developed Condition	% of Existing Condition
2-year	21.0	19.36	92%
5-year	28.0	26.48	95%
10-year	32.3	31.83	99%
25-year	39.2	38.13	97%
50-year	43.8	41.65	95%
100-year	49.5	45.71	92%

The increased run-off from the developed site has been detained and has not increased for the 2-year thru the 100-year storm events.

Culvert Analysis

The culverts were analyzed with HY-8 software. The culverts were sized to maintain a 100-year WSEL below the road crown elevation. The calculations are shown in Appendix E.

Culvert ‘C’ – South of Greenfield Circle on Paige Lane

- Part of Section 2 (to Pond C)

Culvert ‘E’ – Cul-de-sac of Pine Ridge Dr. (to Channel D)

- Relief culvert for barditch at Cul-de-sac (DS-16) not designed for Q100

Culvert ‘F’ – Southwest of Pine Ridge Dr. on Edgewood Lane

- to Barditch on southeast side of Edgewood Lane

Culvert ‘G’ – Under Greenfield Circle west of Paige Lane (to Culvert C)

Culvert ID	Culvert	Peak 100-Year Flow (cfs)	Allowable Headwater Elevation	Actual Headwater Elevation
C	(3)-36.25"x22.5" A-RCP at -0.50%	65.03	1204.26	1202.63
E	(2)-18" HP at -0.64%	21.96	1211.56	1211.56
F	(3)-28.5"x18" A-RCP at -0.77%	48.27	1213.26	1212.47
G	(4)-18" HP at -0.50%	40.74	1217.58	1216.80



Channel Analysis

Channels were designed to contain the 100-year WSEL.

Channel 'D' – 12' wide earthen channel

- From Detention Pond D to Pine Ridge Dr. Cul-de-sac barditch

Channel 'E' – 6' wide earthen channel

- Along south property line, from west property line to Culvert E

Channel 'F' – 4' wide earthen channel

- Back lots of Block 3 to North barditch of Edgewood Lane

Channel "G" – 4' wide earthen channel

- Back lots of Block 2 northeast of Pine Ridge Dr. to north barditch of Paige Lane

Channel ID	Peak 100-Year Flow (cfs)	Maximum Water Depth (ft)	Minimum Channel Depth (ft)
D	74.79	1.39	2'
E	21.81	1.10	2'
F	20.72	1.07	2'
G	7.93	0.67	2'

If you have any questions or request any additional information, please do not hesitate to contact me.

Scott E. Holtzen, P.E.



APPENDIX A

FEMA Mapping

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 contained within the Flood Insurance Study (FIS) report that accompanies 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 FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations (BFEs) shown on this map apply only to landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

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 Flood Insurance Study report for this jurisdiction.

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 projection used in the preparation of this map was Universal Transverse Mercator (UTM) zone 14. The horizontal datum was NAD83, GRS1980 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:

Spatial Reference System Division
National Geodetic Survey, NOAA
Silver Spring Metro Center
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3191

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 in digital format by McClain County and by the Geo Information Systems department of the University of Oklahoma.

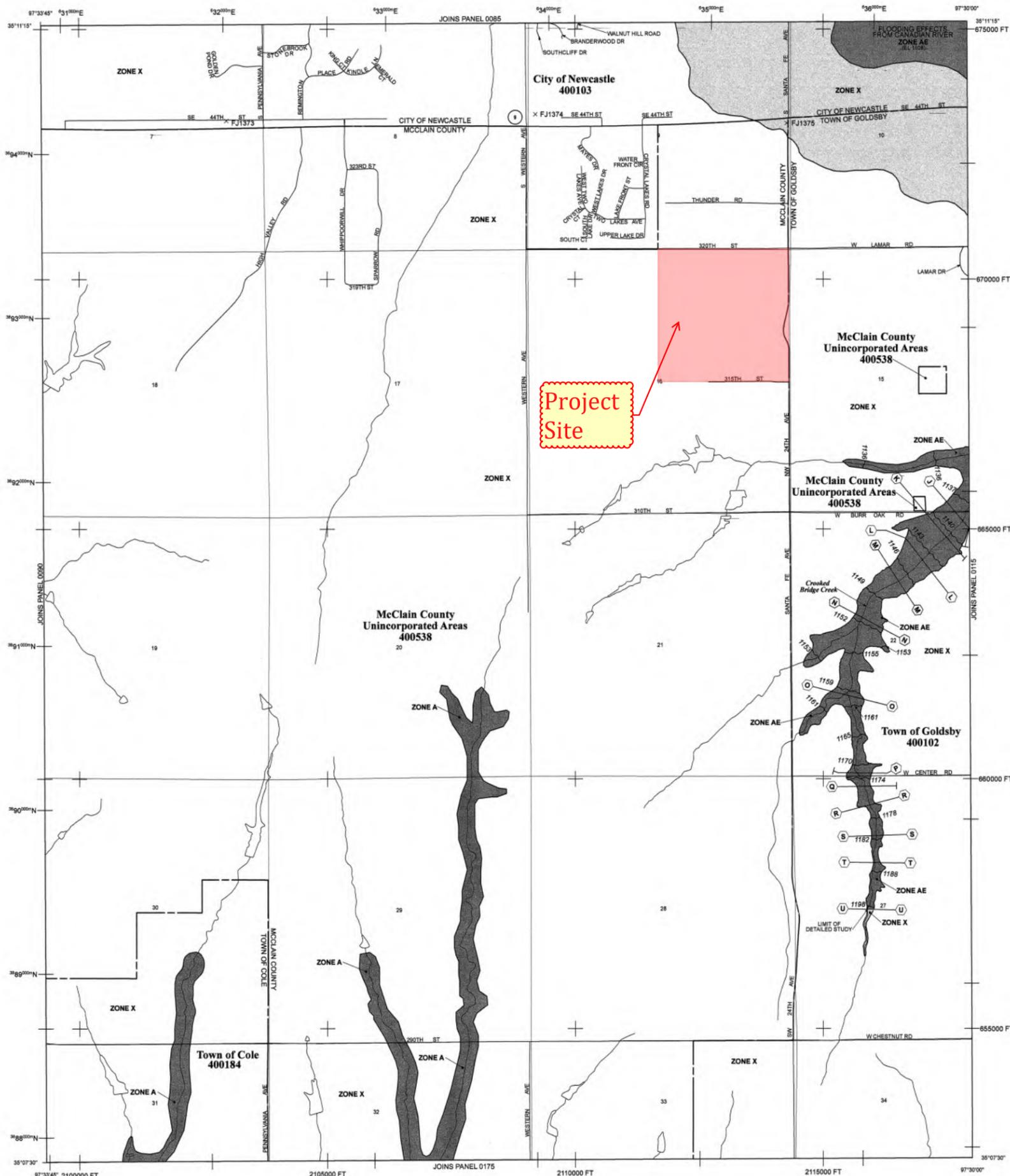
This map reflects more detailed and up-to-date stream channel configurations than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

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.

Contact the FEMA Map Service Center at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at <http://www.msc.fema.gov/>.

If you have questions about this map or questions concerning the National Flood Insurance Program in general, please call 1-877-FEMA MAP (1-877-336-2627) or visit the FEMA website at <http://www.fema.gov/>.



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 Elevation 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 atypical fan flooding, velocities also determined.

ZONE AR Area of special flood hazard formerly protected from the 1% annual chance flood event by a flood control system that was subsequently decommissioned. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance of greater flood event.

ZONE A99 Areas to be protected from 1% annual chance flood event 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 D Areas determined to be outside the 0.2% annual chance floodplain.

ZONE O 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.

Floodplain boundary
Floodway boundary
Zone D boundary
CBRS and OPA boundary
Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities
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 (NAVD 88)
Cross section line
Transect line
Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)
1000-meter Universal Transverse Mercator grid ticks, zone 14
5000-foot grid values: Oklahoma State Plane coordinate system, South Zone (FIPSZONE = 3502), Lambert projection
Bench mark (see explanation in Notes to Users section of this FIS panel)
DX5510
M 1.5
River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
November 16, 2007

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

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 1-800-833-8620.

MAP SCALE 1" = 1000'

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0095G

FIRM FLOOD INSURANCE RATE MAP

MCCLAIN COUNTY, OKLAHOMA AND INCORPORATED AREAS

PANEL 95 OF 575
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
COLE TOWN OF	400184	0095	G
GOLDSBY TOWN OF	400102	0095	G
MCCLAIN COUNTY UNINCORPORATED AREAS	400538	0095	G
NEWCASTLE CITY OF	400103	0095	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 40087C0095G

EFFECTIVE DATE NOVEMBER 16, 2007

Federal Emergency Management Agency



BRENTWOOD

APPENDIX B

ODOT Rainfall Intensity

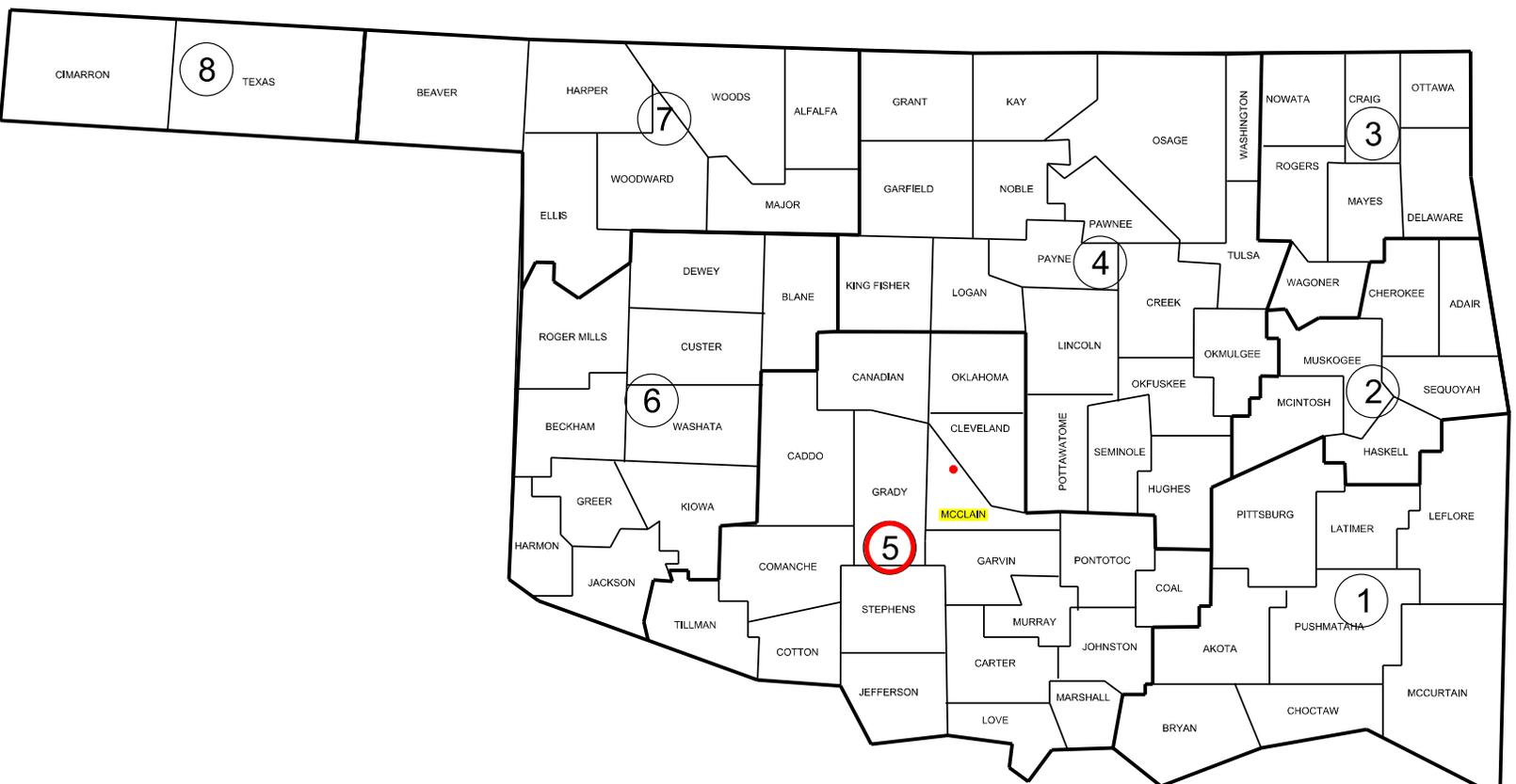


Figure 7.6-G — IDF CURVE ZONES IN OKLAHOMA

Zone	Values	2-year	5-year	10-year	25-year	50-year	100-year	500-year
1	a	43	47	58	70	77	91	126
	b	9	9	10	10	11	12	13
	c	0.76	0.73	0.74	0.74	0.74	0.75	0.76
2	a	42	45	49	67	70	83	120
	b	8	8	8	10	10	11	11
	c	0.78	0.74	0.73	0.75	0.74	0.75	0.78
3	a	41	45	53	71	91	126	169
	b	8	8	9	11	13	16	16
	c	0.77	0.74	0.74	0.76	0.78	0.82	0.83
4	a	46	59	69	81	106	116	153
	b	10	11	12	12	15	15	15
	c	0.79	0.78	0.78	0.78	0.80	0.80	0.80
5	a	53	64	74	93	104	108	130
	b	10	12	12	15	15	15	15
	c	0.82	0.79	0.79	0.79	0.79	0.77	0.75
6	a	40	53	67	81	88	104	148
	b	7	9	11	12	12	13	15
	c	0.79	0.78	0.79	0.79	0.78	0.79	0.80
7	a	44	59	75	90	98	110	129
	b	7	9	11	12	12	13	12
	c	0.83	0.82	0.83	0.83	0.82	0.82	0.80
8	a	64	97	113	140	160	205	240
	b	12	15	15	15	15	18	18
	c	0.93	0.93	0.93	0.93	0.93	0.94	0.92

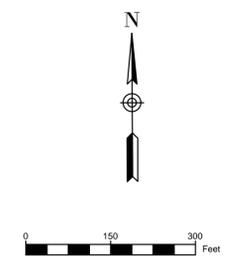
Source: (4)

Figure 7.6-P — IDF CURVE COEFFICIENTS for $I = a/(t_c + b)^c$

APPENDIX C

HISTORIC RUN-OFF CALCULATIONS

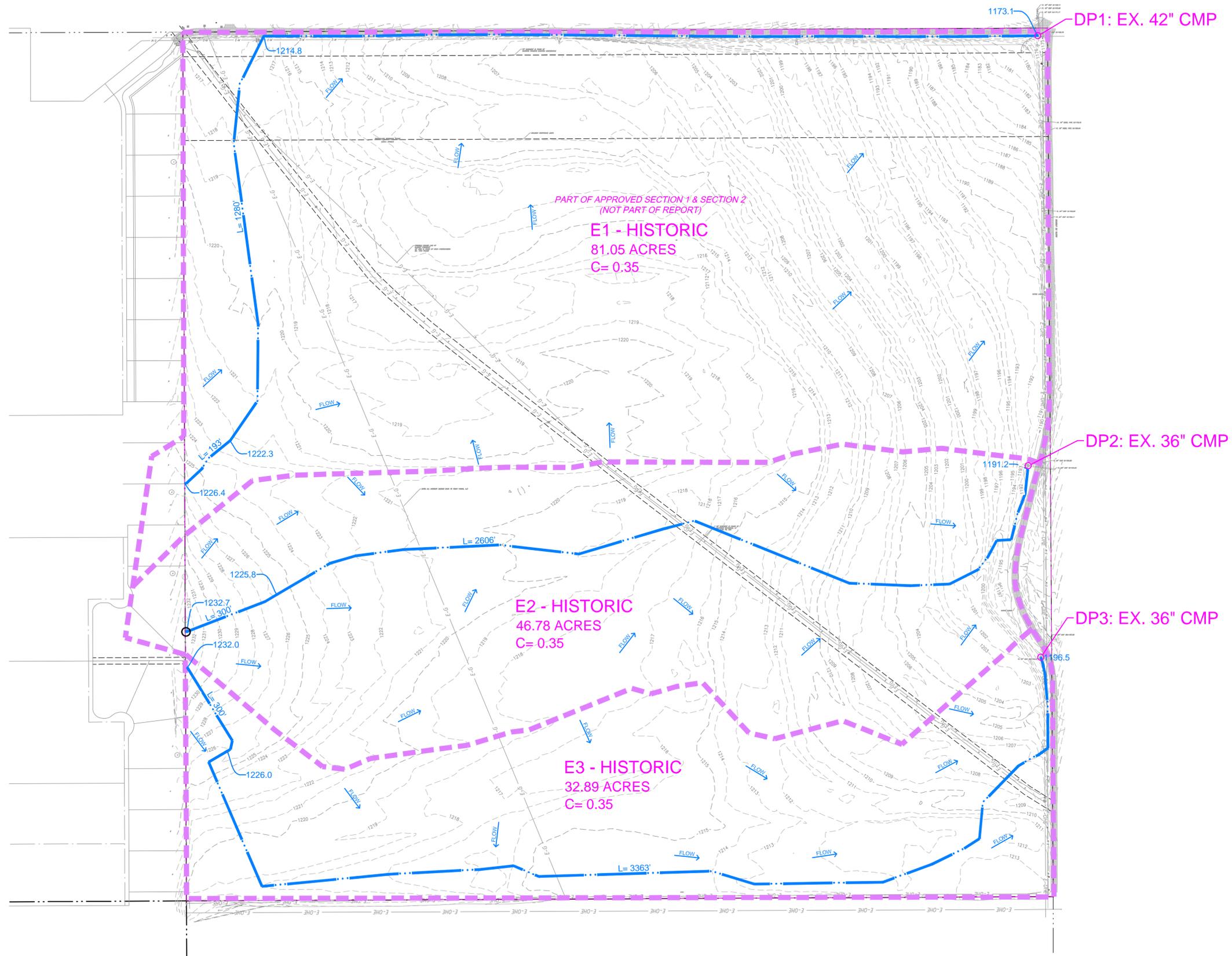
DRAINAGE MAP LEGEND	
	DRAINAGE AREA BOUNDARY
	FLOW PATH & FLOW LENGTH
	E1 EXISTING DRAINAGE BASIN
	E2.1 EXISTING DRAINAGE SUBBASIN
	DP1 DESIGN POINT
	ELEVATION ALONG FLOW PATH



REV	DATE	DESCRIPTION
0	J/25	

DRAINAGE PLANS
BRENTWOOD SECTION 3
GOLDSBY, OKLAHOMA
HISTORIC DRAINAGE MAP

DATE: 05/28/2025
PROJECT NO. 25.004
SHEET: D100



WEIGHTED 'C' VALUE : TIME OF CONCENTRATION : RUNOFF CALCULATIONS

Project Name: **Brentwood Section 3**

Project No.: **25.004**

Notes:

Overland Flow: $Tc=K(L^{0.37}/S^{0.20})$ Rainfall Intensity = $I = a/((Tc+b)^c)$

Channel Flow: $Tc=K(L^{0.77}/S^{0.385})$ Min. Tc: **5** min.

Drainage Basin ID: **E2 - Historic**

DRAINAGE AREA AND WEIGHTED 'C' VALUE

Area (Acres)	'C'		C x A	Calculation Notes:
46.780	0.35	Historic Unimproved Areas	16.373	DP2 - Existing 36" CMP
	0.00	-	0.000	
	0.00	-	0.000	
	0.00	-	0.000	
	0.00	-	0.000	
TOTAL AREA: 46.780				
Total: C x A			16.373	
Weighted "C":			0.350	

TIME OF CONCENTRATION (Tc)

Flow Type	L (ft)	Surface Type	K	Start Elevation	End Elevation	Slope (ft/ft)	Tc (min)
Overland 1	300	Average Grass	1	1232.70	1225.80	0.023	17.5
Overland 2		-	0			0.000	0.0
Overland 3		-	0			0.000	0.0
Overland 4		-	0			0.000	0.0
Channelized 1	2606	Meandering stream with pools	0.0102	1225.80	1191.20	0.013	23.0
Channelized 2		-	0			0.000	0.0
Channelized 3		-	0			0.000	0.0
Channelized 4		-	0			0.000	0.0
	L (ft)	Avg. Velocity (fps)					
Pipe 1							0.00
Pipe 2							0.00
Pipe 3							0.00
Pipe 4							0.00
TOTAL Tc:							40.5

RAINFALL INTENSITY & PEAK FLOW

Town of Goldsby (ODOT Zone V)				Rainfall Intensity (in/hr)	Run-Off Q=CIA (cfs)
Storm Frequency	Parameters for the IDF Equation				
	a	b	c		
50% (2-Year)	53	10	0.82	2.12	34.8
20 % (5-Year)	64	12	0.79	2.80	45.8
10% (10-Year)	74	12	0.79	3.24	53.0
4% (25-Year)	93	15	0.79	3.89	63.7
2 % (50-Year)	104	15	0.79	4.35	71.3
1% (100-Year)	108	15	0.77	4.90	80.2

WEIGHTED 'C' VALUE : TIME OF CONCENTRATION : RUNOFF CALCULATIONS

Project Name: **Brentwood Section 3**

Project No.: **25.004**

Notes:

Overland Flow: $T_c = K(L^{0.37}/S^{0.20})$ | Rainfall Intensity = $I = a/((T_c+b)^c)$

Channel Flow: $T_c = K(L^{0.77}/S^{0.385})$ | Min. Tc: **5** min.

Drainage Basin ID: **E3 - Historic**

DRAINAGE AREA AND WEIGHTED 'C' VALUE

Area (Acres)	'C'		C x A	Calculation Notes:
32.890	0.35	Historic Unimproved Areas	11.512	DP3 - Existing 36" CMP
	0.00	-	0.000	
	0.00	-	0.000	
	0.00	-	0.000	
	0.00	-	0.000	
TOTAL AREA: 32.890				
Total: C x A			11.512	
Weighted "C":			0.350	

TIME OF CONCENTRATION (Tc)

Flow Type	L (ft)	Surface Type	K	Start Elevation	End Elevation	Slope (ft/ft)	Tc (min)
Overland 1	300	Average Grass	1	1232.00	1226.00	0.020	18.0
Overland 2		-	0			0.000	0.0
Overland 3		-	0			0.000	0.0
Overland 4		-	0			0.000	0.0
Channelized 1	3363	Meandering stream with pools	0.0102	1226.00	1196.50	0.009	32.8
Channelized 2		-	0			0.000	0.0
Channelized 3		-	0			0.000	0.0
Channelized 4		-	0			0.000	0.0
	L (ft)	Avg. Velocity (fps)					
Pipe 1							0.0
Pipe 2							0.0
Pipe 3							0.0
Pipe 4							0.0
TOTAL Tc:							50.9

RAINFALL INTENSITY & PEAK FLOW

Town of Goldsby (ODOT Zone V)				Rainfall Intensity (in/hr)	Run-Off Q=CIA (cfs)
Storm Frequency	Parameters for the IDF Equation				
	a	b	c		
50% (2-Year)	53	10	0.82	1.82	21.0
20 % (5-Year)	64	12	0.79	2.43	28.0
10% (10-Year)	74	12	0.79	2.81	32.3
4% (25-Year)	93	15	0.79	3.40	39.2
2 % (50-Year)	104	15	0.79	3.80	43.8
1% (100-Year)	108	15	0.77	4.30	49.5

APPENDIX D

PROPOSED RUN-OFF CALCULATIONS

- Design Point DP2 and Detention Pond C (Part of Section 2)
- Design Point DP3 and Detention Pond D

REV	DATE	DESCRIPTION
0	1/1/25	

REV	DATE	DESCRIPTION
0	1/1/25	

DRAINAGE PLANS
BRENTWOOD SECTION 3
NE/4, SECTION 16, T8N, R3W, I.M.
GOLDSBY, OKLAHOMA
POST-DEVELOPED DRAINAGE MAP

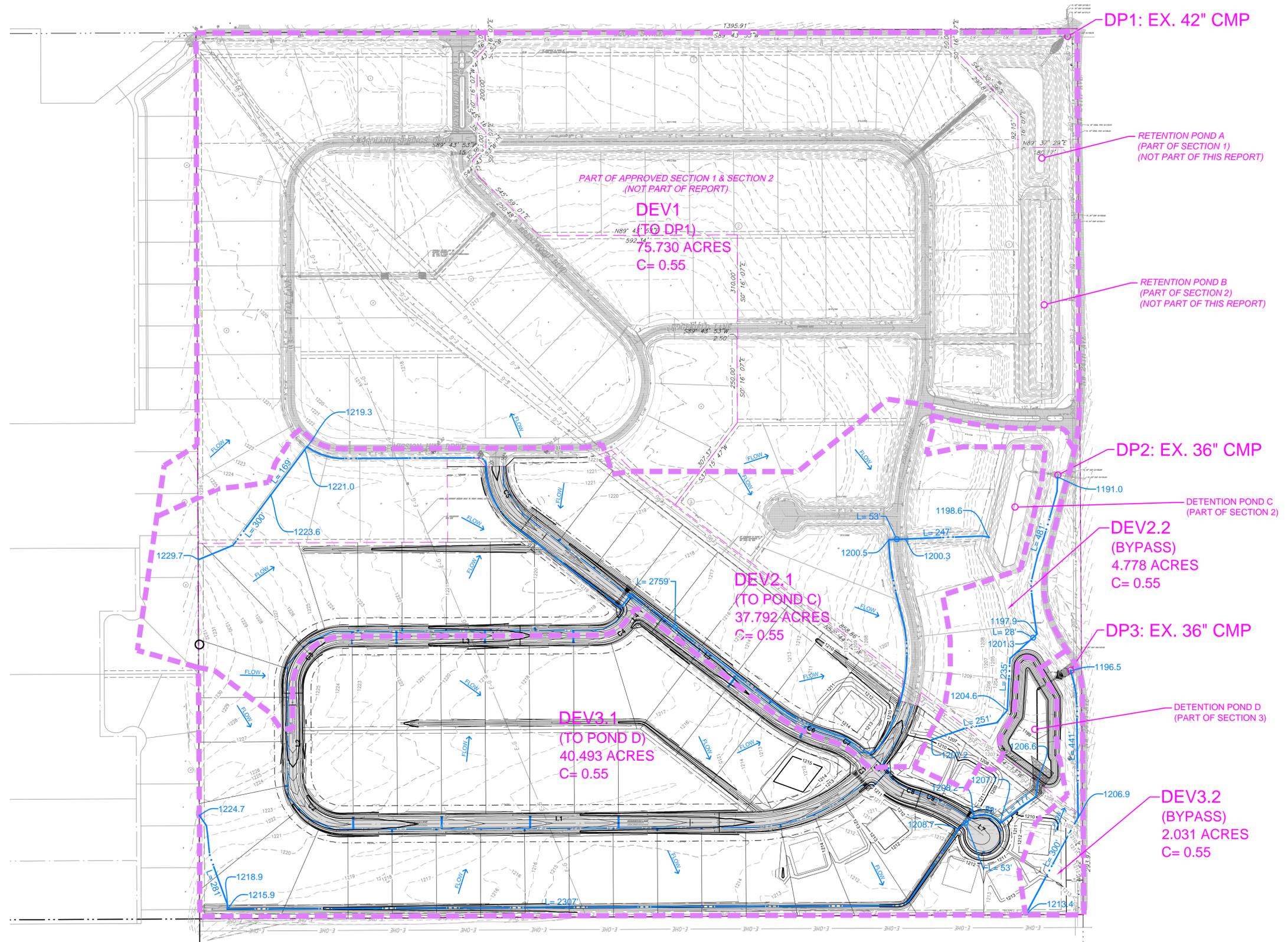
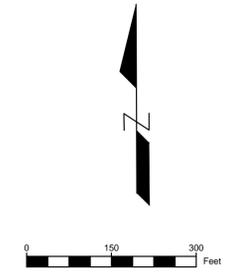
DATE: 05/28/2025

PROJECT NO. 25.004

SHEET: D101

DRAINAGE MAP LEGEND

- DRAINAGE AREA BOUNDARY
- FLOW PATH AND FLOW LENGTH
- DEV1 PROPOSED DRAINAGE BASIN
- DEV2.1 PROPOSED DRAINAGE SUBBASIN
- DP1 DESIGN POINT
- ELEVATION ALONG FLOW PATH
- 100-YR. DETENTION POND WATER SURFACE ELEVATION



WEIGHTED 'C' VALUE : TIME OF CONCENTRATION : RUNOFF CALCULATIONS

Project Name: **Brentwood Section 3**

Project No.: **25.004**

Notes:

Overland Flow: $T_c = K(L^{0.37}/S^{0.20})$ | Rainfall Intensity = $I = a/((T_c+b)^c)$

Channel Flow: $T_c = K(L^{0.77}/S^{0.385})$ | Min. Tc: **5** min.

Drainage Basin ID: **DEV2.1 (to Channel A & Pond C)**

DRAINAGE AREA AND WEIGHTED 'C' VALUE

Area (Acres)	'C'		C x A	Calculation Notes:
37.792	0.55	Residential Rural Estate	20.786	
	0.00	-	0.000	
	0.00	-	0.000	
	0.00	-	0.000	
TOTAL AREA: 37.792				
Total: C x A 20.786				
Weighted "C": 0.550				

TIME OF CONCENTRATION (Tc)

Flow Type	L (ft)	Surface Type	K	Start Elevation	End Elevation	Slope (ft/ft)	Tc (min)
Overland 1	300	Average Grass	1	1229.70	1223.60	0.020	18.0
Overland 2		-	0			0.000	0.0
Overland 3		-	0			0.000	0.0
Overland 4		-	0			0.000	0.0
Channelized 1	169	Meandering stream with pools	0.0102	1223.60	1221.00	0.015	2.6
Channelized 2	2759	\-/Ditch	0.012	1219.30	1200.50	0.007	36.5
Channelized 3	247	Few Weeds, Clean Bottom	0.00835	1200.30	1198.60	0.007	3.9
Channelized 4		-	0			0.000	0.0
	L (ft)	Avg. Velocity (fps)					
Pipe 1	53	2					0.4
Pipe 2							0.0
Pipe 3							0.0
Pipe 4							0.0
TOTAL Tc:							61.5

RAINFALL INTENSITY & PEAK FLOW

Town of Goldsby (ODOT Zone V)				Rainfall Intensity (in/hr)	Run-Off Q=CIA (cfs)
Storm Frequency	Parameters for the IDF Equation				
	a	b	c		
50% (2-Year)	53	10	0.82	1.60	33.2
20 % (5-Year)	64	12	0.79	2.15	44.6
10% (10-Year)	74	12	0.79	2.48	51.6
4% (25-Year)	93	15	0.79	3.02	62.8
2 % (50-Year)	104	15	0.79	3.38	70.3
1% (100-Year)	108	15	0.77	3.83	79.6

WEIGHTED 'C' VALUE : TIME OF CONCENTRATION : RUNOFF CALCULATIONS

Project Name: **Brentwood Section 3**
 Project No.: **25.004**

Notes:

Overland Flow: $T_c = K(L^{0.37}/S^{0.20})$ | Rainfall Intensity = $I = a/((T_c+b)^c)$
 Channel Flow: $T_c = K(L^{0.77}/S^{0.385})$ | Min. Tc: **5** min.

Drainage Basin ID: **DEV2.2 (Bypass to DP2)**

DRAINAGE AREA AND WEIGHTED 'C' VALUE

Area (Acres)	'C'		C x A	Calculation Notes:
4.778	0.55	Residential Rural Estate	2.628	
	0.00	-	0.000	
	0.00	-	0.000	
	0.00	-	0.000	
TOTAL AREA: 4.778				
Total: C x A 2.628				
Weighted "C": 0.550				

TIME OF CONCENTRATION (Tc)

Flow Type	L (ft)	Surface Type	K	Start Elevation	End Elevation	Slope (ft/ft)	Tc (min)
Overland 1	251	Average Grass	1	1207.20	1204.60	0.010	19.3
Overland 2		-	0			0.000	0.0
Overland 3		-	0			0.000	0.0
Overland 4		-	0			0.000	0.0
Channelized 1	235	Meandering stream with pools	0.0102	1204.60	1201.30	0.014	3.5
Channelized 2	28	Meandering stream with pools	0.0102	1201.30	1197.90	0.121	0.3
Channelized 3	481	Few Weeds, Clean Bottom	0.00835	1197.90	1191.00	0.014	5.0
Channelized 4		-	0			0.000	0.0
	L (ft)	Avg. Velocity (fps)					
Pipe 1							0.0
Pipe 2							0.0
Pipe 3							0.0
Pipe 4							0.0
TOTAL Tc:							28.1

RAINFALL INTENSITY & PEAK FLOW

Town of Goldsby (ODOT Zone V)				Rainfall Intensity (in/hr)	Run-Off Q=CIA (cfs)
Storm Frequency	Parameters for the IDF Equation				
	a	b	c		
50% (2-Year)	53	10	0.82	2.68	7.0
20 % (5-Year)	64	12	0.79	3.47	9.1
10% (10-Year)	74	12	0.79	4.01	10.5
4% (25-Year)	93	15	0.79	4.76	12.5
2 % (50-Year)	104	15	0.79	5.32	14.0
1% (100-Year)	108	15	0.77	5.96	15.7

Proposed Condition (DP2)

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- 1 Routing Diagram
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- Design Point DP2

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- 4 Subcat DEV2.1: DEV2.1 (to Channel & Pond C)
- 5 Subcat DEV2.2: DEV2.2 (Bypass)
- 6 Reach C1: Channel to Pond C
- 8 Pond P3: Pond C
- 10 Link DP2: DP2 (Ex. 36" CMP)

5-Year Event

- 11 Node Listing
- 12 Subcat DEV2.1: DEV2.1 (to Channel & Pond C)
- 13 Subcat DEV2.2: DEV2.2 (Bypass)
- 14 Reach C1: Channel to Pond C
- 16 Pond P3: Pond C
- 18 Link DP2: DP2 (Ex. 36" CMP)

10-Year Event

- 19 Node Listing
- 20 Subcat DEV2.1: DEV2.1 (to Channel & Pond C)
- 21 Subcat DEV2.2: DEV2.2 (Bypass)
- 22 Reach C1: Channel to Pond C
- 24 Pond P3: Pond C
- 26 Link DP2: DP2 (Ex. 36" CMP)

25-Year Event

- 27 Node Listing
- 28 Subcat DEV2.1: DEV2.1 (to Channel & Pond C)
- 29 Subcat DEV2.2: DEV2.2 (Bypass)
- 30 Reach C1: Channel to Pond C
- 32 Pond P3: Pond C
- 34 Link DP2: DP2 (Ex. 36" CMP)

50-Year Event

- 35 Node Listing
- 36 Subcat DEV2.1: DEV2.1 (to Channel & Pond C)
- 37 Subcat DEV2.2: DEV2.2 (Bypass)
- 38 Reach C1: Channel to Pond C
- 40 Pond P3: Pond C
- 42 Link DP2: DP2 (Ex. 36" CMP)

100-Year Event

- 43 Node Listing
- 44 Subcat DEV2.1: DEV2.1 (to Channel & Pond C)
- 45 Subcat DEV2.2: DEV2.2 (Bypass)
- 46 Reach C1: Channel to Pond C

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48 Pond P3: Pond C

50 Link DP2: DP2 (Ex. 36" CMP)

Multi-Event Tables

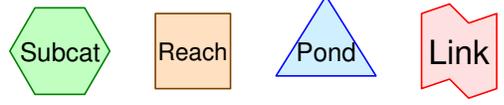
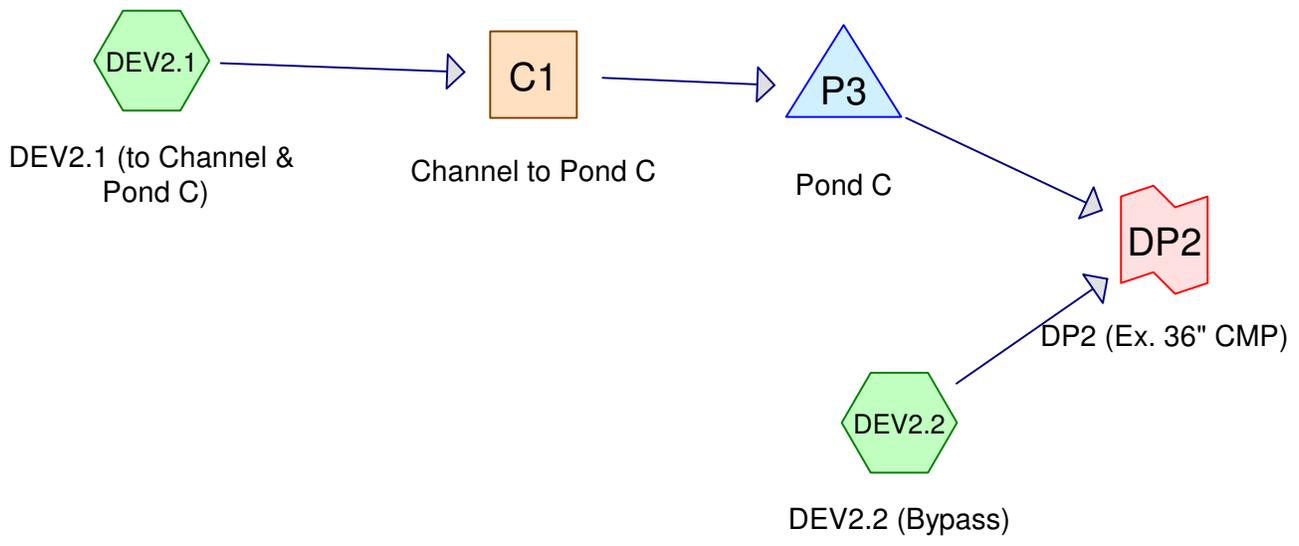
51 Subcat DEV2.1: DEV2.1 (to Channel & Pond C)

52 Subcat DEV2.2: DEV2.2 (Bypass)

53 Reach C1: Channel to Pond C

54 Pond P3: Pond C

55 Link DP2: DP2 (Ex. 36" CMP)



Routing Diagram for Proposed Condition (DP2)
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Proposed Condition (DP2)

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Area Listing (all nodes)

Area (acres)	C	Description (subcatchment-numbers)
4.778	0.55	(DEV2.2)
37.792	0.55	Residential Rural Estate (DEV2.1)
42.570	0.55	TOTAL AREA

Proposed Condition (DP2)

ODOT Zone V 2-Year Duration=62 min, Inten=1.59 in/hr

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points

Runoff by Rational method, Rise/Fall=1.0/2.0 xTc

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DEV2.1: DEV2.1 (to Channel) Runoff Area=37.792 ac 0.00% Impervious Runoff Depth=1.35"
Tc=61.5 min C=0.55 Runoff=33.32 cfs 4.256 af

Subcatchment DEV2.2: DEV2.2 (Bypass) Runoff Area=4.778 ac 0.00% Impervious Runoff Depth=1.11"
Tc=28.1 min C=0.55 Runoff=4.21 cfs 0.441 af

Reach C1: Channel to Pond C Avg. Flow Depth=1.52' Max Vel=2.16 fps Inflow=33.32 cfs 4.256 af
n=0.055 L=248.5' S=0.0071 '/' Capacity=154.08 cfs Outflow=32.97 cfs 4.256 af

Pond P3: Pond C Peak Elev=1,194.92' Storage=31,414 cf Inflow=32.97 cfs 4.256 af
36.0" Round Culvert n=0.012 L=57.1' S=0.0088 '/' Outflow=26.72 cfs 4.256 af

Link DP2: DP2 (Ex. 36" CMP) Inflow=29.11 cfs 4.697 af
Primary=29.11 cfs 4.697 af

Total Runoff Area = 42.570 ac Runoff Volume = 4.697 af Average Runoff Depth = 1.32"
100.00% Pervious = 42.570 ac 0.00% Impervious = 0.000 ac

Proposed Condition (DP2)

ODOT Zone V 2-Year Duration=62 min, Inten=1.59 in/hr

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Summary for Subcatchment DEV2.1: DEV2.1 (to Channel & Pond C)

Runoff = 33.32 cfs @ 1.03 hrs, Volume= 4.256 af, Depth= 1.35"
 Routed to Reach C1 : Channel to Pond C

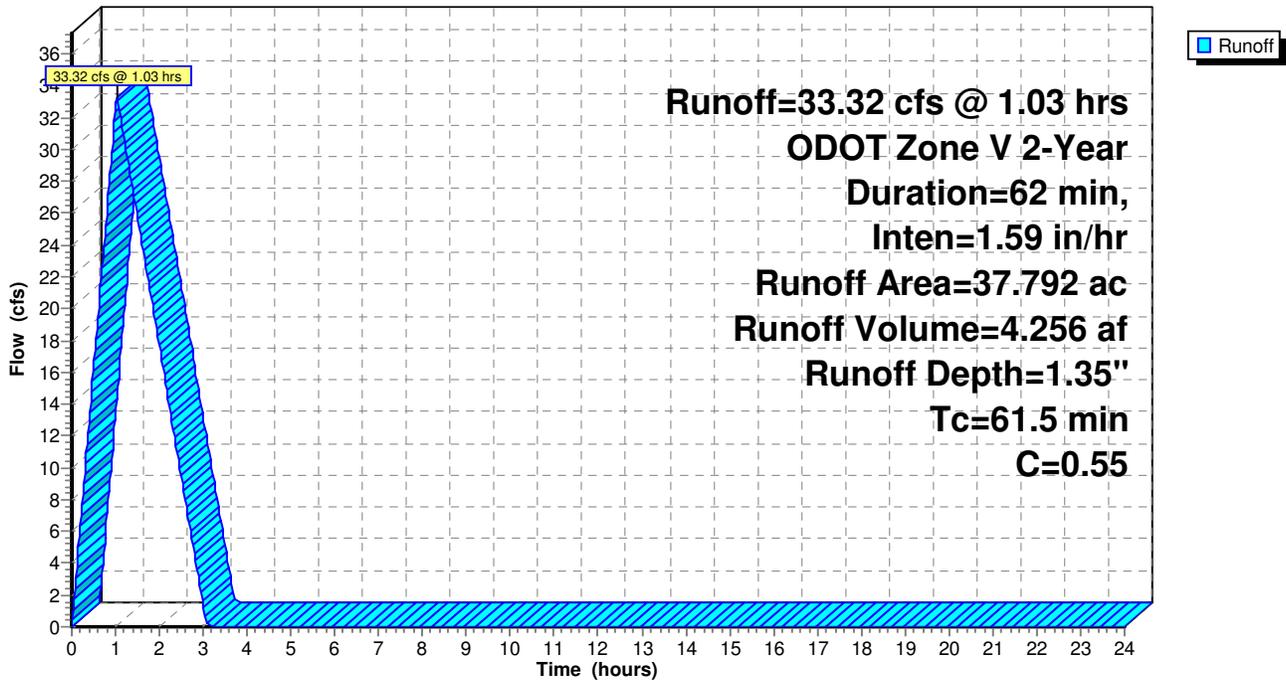
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 ODOT Zone V 2-Year Duration=62 min, Inten=1.59 in/hr

Area (ac)	C	Description
37.792	0.55	Residential Rural Estate
37.792		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
61.5					Direct Entry,

Subcatchment DEV2.1: DEV2.1 (to Channel & Pond C)

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 2-Year Duration=62 min, Inten=1.59 in/hr

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Summary for Subcatchment DEV2.2: DEV2.2 (Bypass)

Runoff = 4.21 cfs @ 0.47 hrs, Volume= 0.441 af, Depth= 1.11"
 Routed to Link DP2 : DP2 (Ex. 36" CMP)

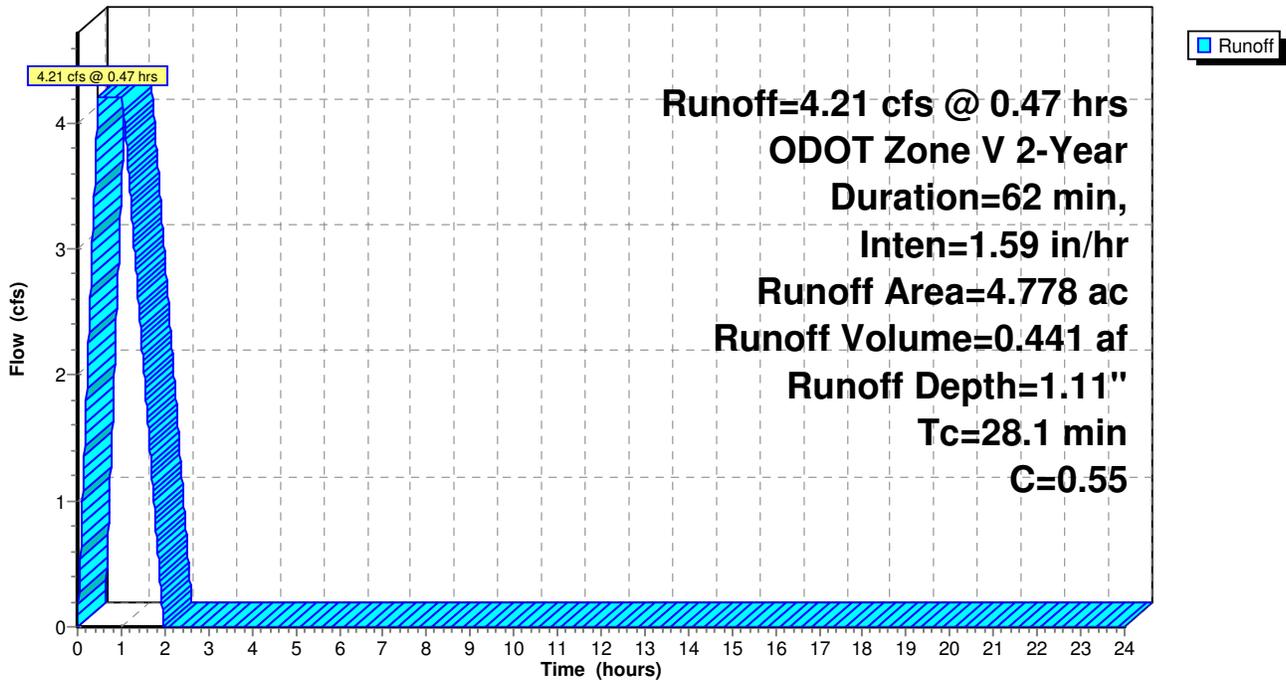
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 ODOT Zone V 2-Year Duration=62 min, Inten=1.59 in/hr

Area (ac)	C	Description
4.778	0.55	
4.778		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.1					Direct Entry,

Subcatchment DEV2.2: DEV2.2 (Bypass)

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 2-Year Duration=62 min, Inten=1.59 in/hr

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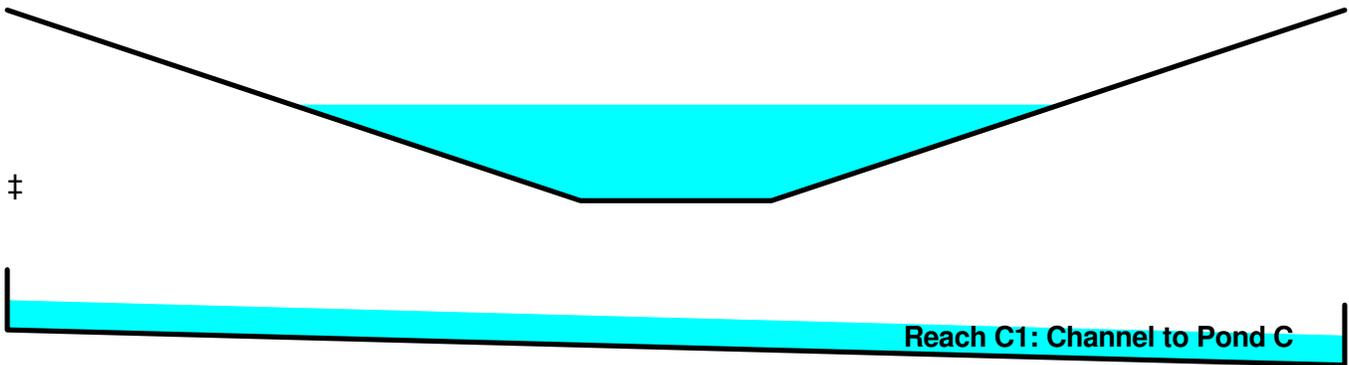
Summary for Reach C1: Channel to Pond C

Inflow Area = 37.792 ac, 0.00% Impervious, Inflow Depth = 1.35" for 2-Year event
 Inflow = 33.32 cfs @ 1.03 hrs, Volume= 4.256 af
 Outflow = 32.97 cfs @ 1.09 hrs, Volume= 4.256 af, Atten= 1%, Lag= 3.4 min
 Routed to Pond P3 : Pond C

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Max. Velocity= 2.16 fps, Min. Travel Time= 1.9 min
 Avg. Velocity = 1.03 fps, Avg. Travel Time= 4.0 min

Peak Storage= 3,788 cf @ 1.05 hrs
 Average Depth at Peak Storage= 1.52' , Surface Width= 16.12'
 Bank-Full Depth= 3.00' Flow Area= 48.0 sf, Capacity= 154.08 cfs

4.00' x 3.00' deep channel, n= 0.055
 Side Slope Z-value= 4.0 ' / ' Top Width= 28.00'
 Length= 248.5' Slope= 0.0071 ' / '
 Inlet Invert= 1,200.30', Outlet Invert= 1,198.53'



Proposed Condition (DP2)

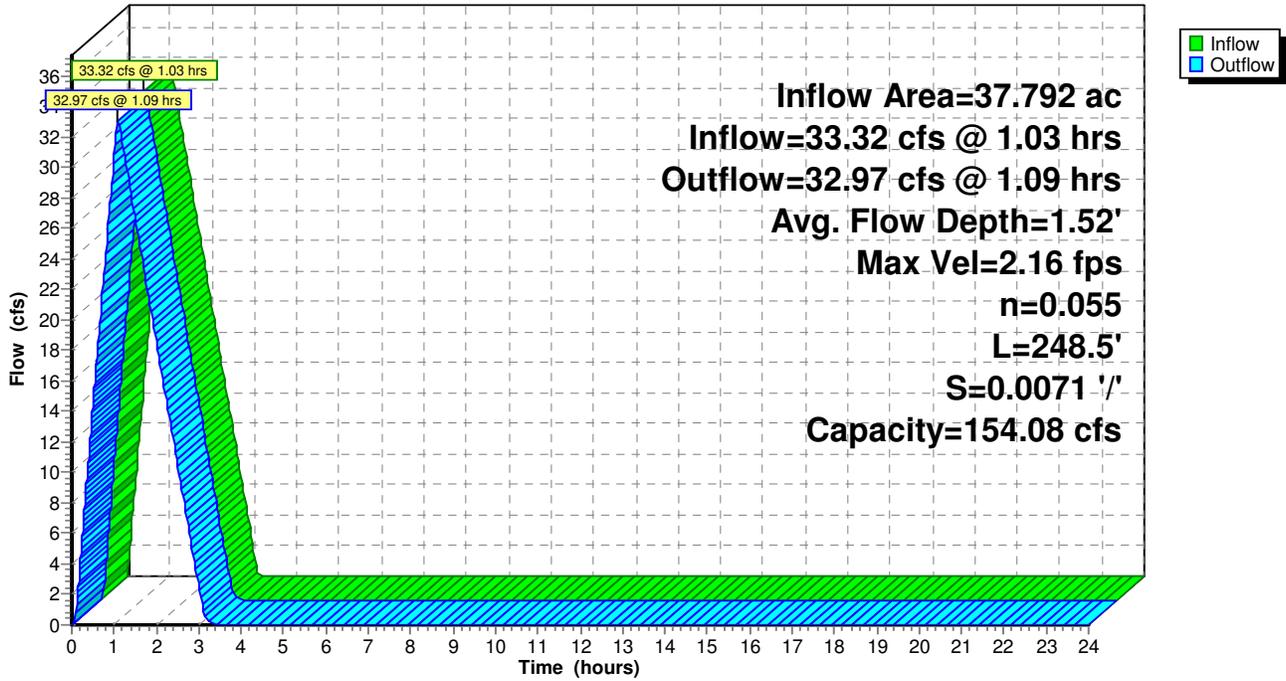
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25.004 Brentwood Section 3
ODOT Zone V 2-Year Duration=62 min, Inten=1.59 in/hr

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Reach C1: Channel to Pond C

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 2-Year Duration=62 min, Inten=1.59 in/hr

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Summary for Pond P3: Pond C

Inflow Area = 37.792 ac, 0.00% Impervious, Inflow Depth = 1.35" for 2-Year event
 Inflow = 32.97 cfs @ 1.09 hrs, Volume= 4.256 af
 Outflow = 26.72 cfs @ 1.50 hrs, Volume= 4.256 af, Atten= 19%, Lag= 24.5 min
 Primary = 26.72 cfs @ 1.50 hrs, Volume= 4.256 af
 Routed to Link DP2 : DP2 (Ex. 36" CMP)

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,194.92' @ 1.50 hrs Surf.Area= 27,037 sf Storage= 31,414 cf

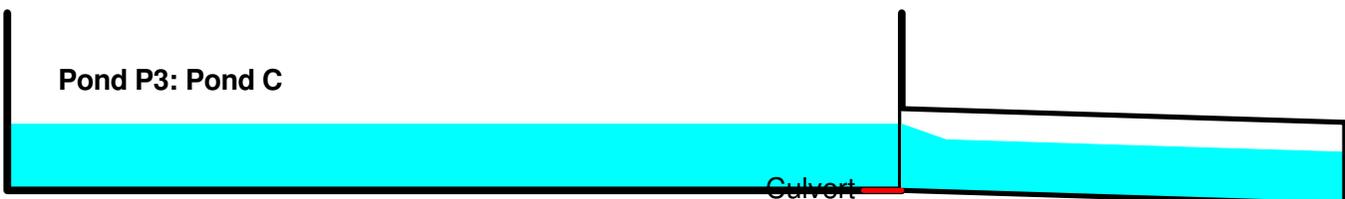
Plug-Flow detention time= (not calculated: outflow precedes inflow)
 Center-of-Mass det. time= 17.2 min (103.6 - 86.3)

Volume	Invert	Avail.Storage	Storage Description
#1	1,192.50'	172,219 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,192.50	0	0	0
1,193.00	2,742	686	686
1,194.00	17,519	10,131	10,816
1,195.00	27,813	22,666	33,482
1,196.00	31,167	29,490	62,972
1,197.00	34,614	32,891	95,863
1,198.00	38,155	36,385	132,247
1,199.00	41,788	39,972	172,219

Device	Routing	Invert	Outlet Devices
#1	Primary	1,192.50'	36.0" Round Culvert L= 57.1' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 1,192.50' / 1,192.00' S= 0.0088 '/' Cc= 0.900 n= 0.012, Flow Area= 7.07 sf

Primary OutFlow Max=26.72 cfs @ 1.50 hrs HW=1,194.92' (Free Discharge)
 ↑=Culvert (Barrel Controls 26.72 cfs @ 5.96 fps)



Proposed Condition (DP2)

ODOT Zone V 2-Year Duration=62 min, Inten=1.59 in/hr

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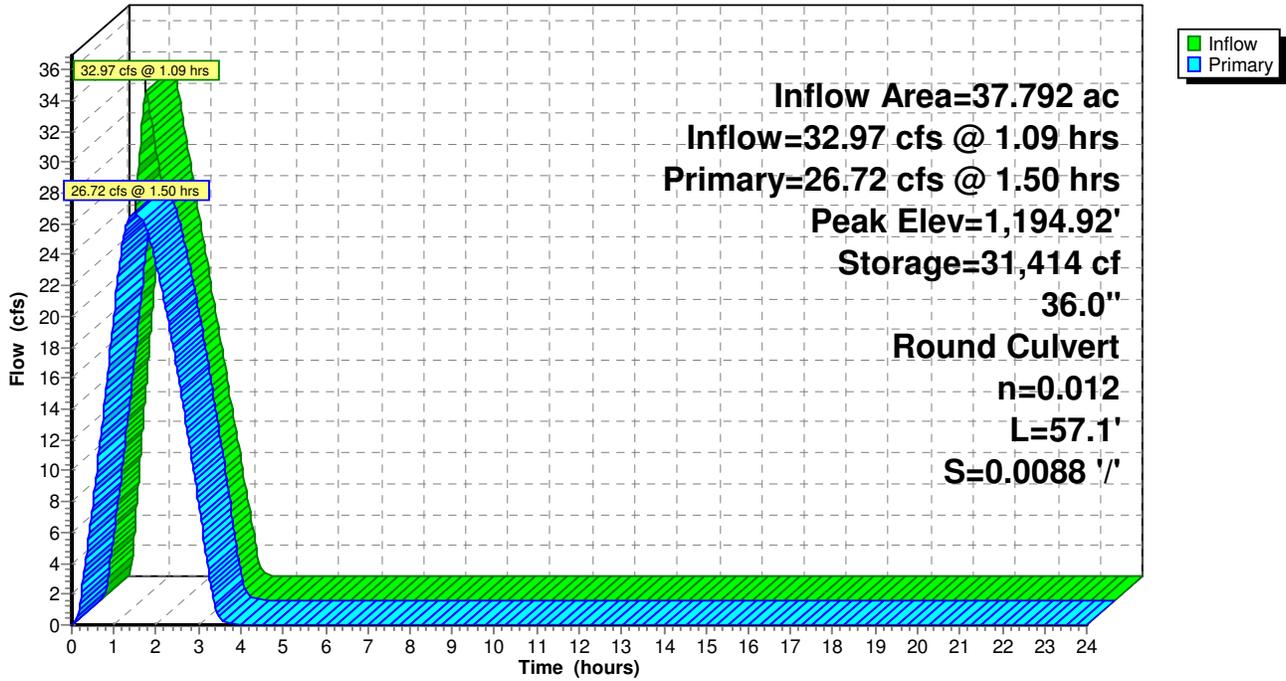
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Pond P3: Pond C

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 2-Year Duration=62 min, Inten=1.59 in/hr

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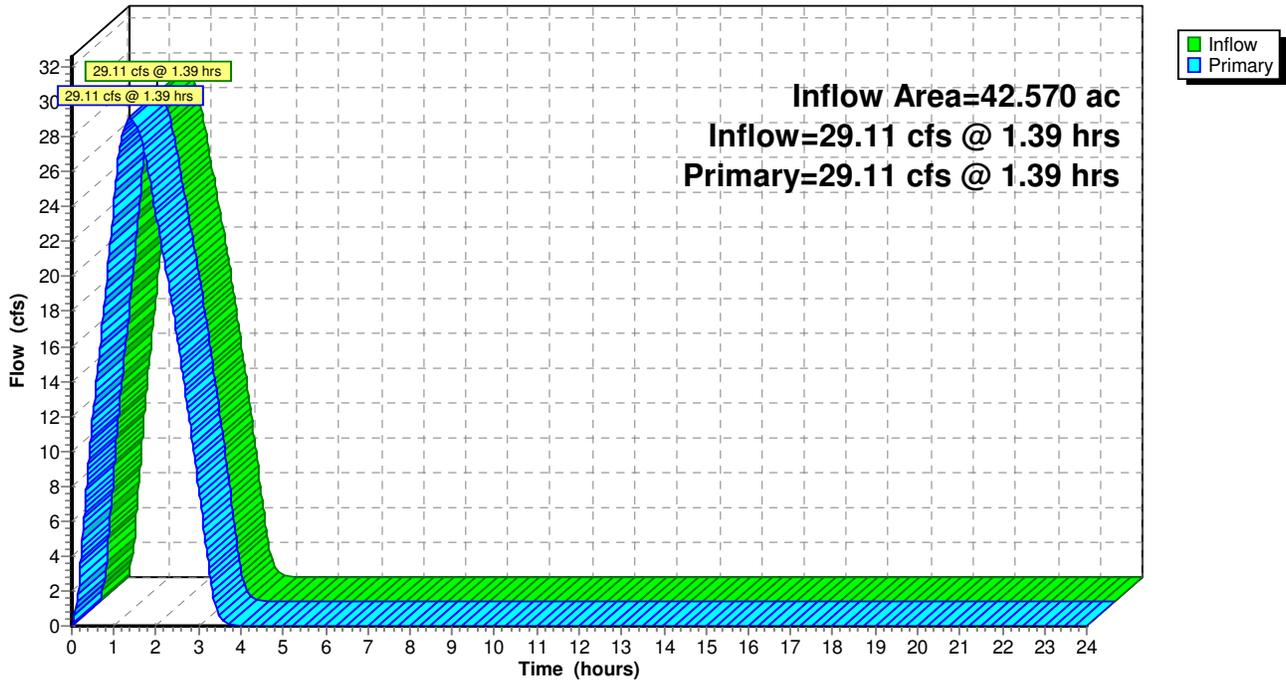
Summary for Link DP2: DP2 (Ex. 36" CMP)

Inflow Area = 42.570 ac, 0.00% Impervious, Inflow Depth = 1.32" for 2-Year event
Inflow = 29.11 cfs @ 1.39 hrs, Volume= 4.697 af
Primary = 29.11 cfs @ 1.39 hrs, Volume= 4.697 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP2: DP2 (Ex. 36" CMP)

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 5-Year Duration=62 min, Inten=2.14 in/hr

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points

Runoff by Rational method, Rise/Fall=1.0/2.0 xTc

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DEV2.1: DEV2.1 (to Channel) Runoff Area=37.792 ac 0.00% Impervious Runoff Depth=1.82"
Tc=61.5 min C=0.55 Runoff=44.76 cfs 5.718 af

Subcatchment DEV2.2: DEV2.2 (Bypass) Runoff Area=4.778 ac 0.00% Impervious Runoff Depth=1.49"
Tc=28.1 min C=0.55 Runoff=5.66 cfs 0.593 af

Reach C1: Channel to Pond C Avg. Flow Depth=1.74' Max Vel=2.34 fps Inflow=44.76 cfs 5.718 af
n=0.055 L=248.5' S=0.0071 '/' Capacity=154.08 cfs Outflow=44.34 cfs 5.718 af

Pond P3: Pond C Peak Elev=1,195.43' Storage=45,779 cf Inflow=44.34 cfs 5.718 af
36.0" Round Culvert n=0.012 L=57.1' S=0.0088 '/' Outflow=35.17 cfs 5.718 af

Link DP2: DP2 (Ex. 36" CMP) Inflow=38.24 cfs 6.311 af
Primary=38.24 cfs 6.311 af

Total Runoff Area = 42.570 ac Runoff Volume = 6.311 af Average Runoff Depth = 1.78"
100.00% Pervious = 42.570 ac 0.00% Impervious = 0.000 ac

Proposed Condition (DP2)

ODOT Zone V 5-Year Duration=62 min, Inten=2.14 in/hr

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Summary for Subcatchment DEV2.1: DEV2.1 (to Channel & Pond C)

Runoff = 44.76 cfs @ 1.03 hrs, Volume= 5.718 af, Depth= 1.82"
 Routed to Reach C1 : Channel to Pond C

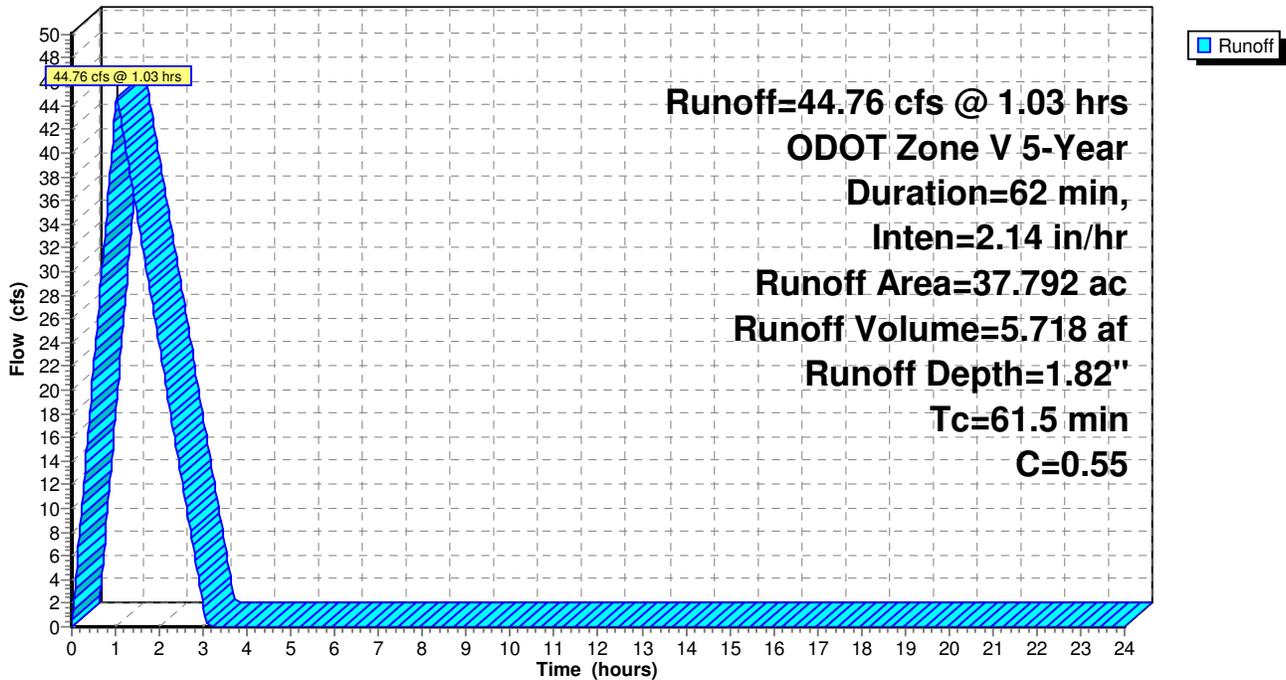
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 ODOT Zone V 5-Year Duration=62 min, Inten=2.14 in/hr

Area (ac)	C	Description
37.792	0.55	Residentail Rural Estate
37.792		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
61.5					Direct Entry,

Subcatchment DEV2.1: DEV2.1 (to Channel & Pond C)

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 5-Year Duration=62 min, Inten=2.14 in/hr

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Summary for Subcatchment DEV2.2: DEV2.2 (Bypass)

Runoff = 5.66 cfs @ 0.47 hrs, Volume= 0.593 af, Depth= 1.49"
 Routed to Link DP2 : DP2 (Ex. 36" CMP)

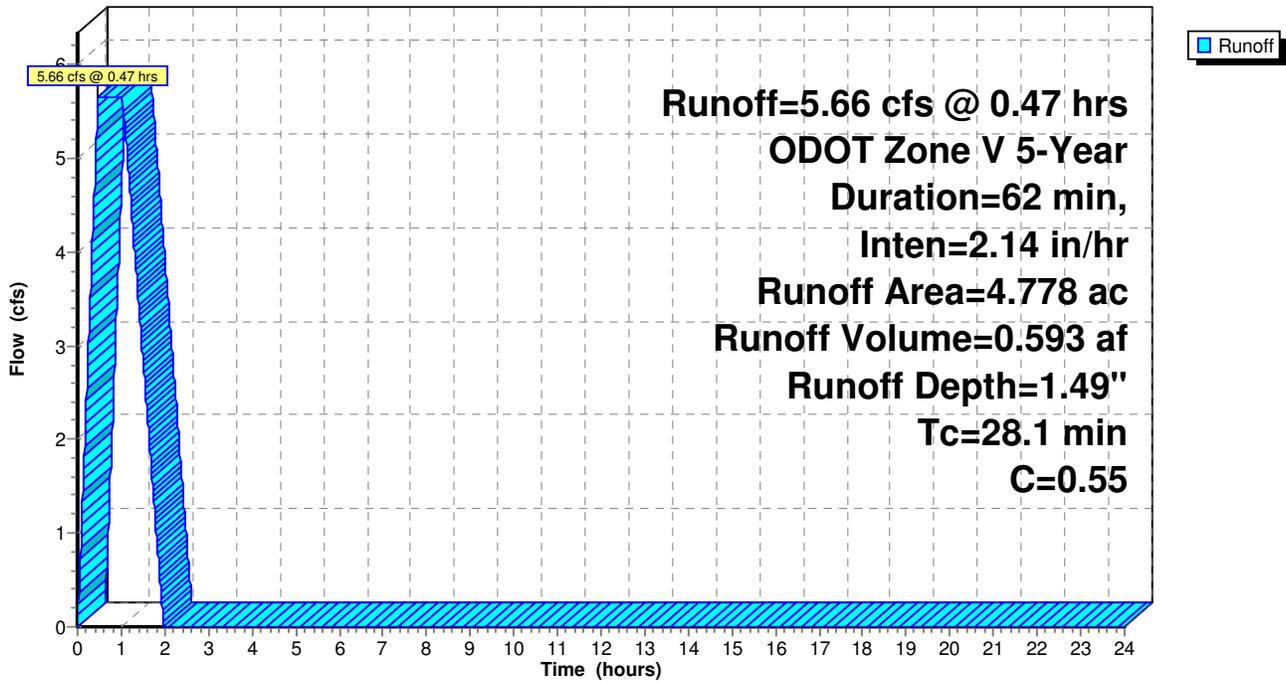
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 ODOT Zone V 5-Year Duration=62 min, Inten=2.14 in/hr

Area (ac)	C	Description
4.778	0.55	
4.778		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.1					Direct Entry,

Subcatchment DEV2.2: DEV2.2 (Bypass)

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 5-Year Duration=62 min, Inten=2.14 in/hr

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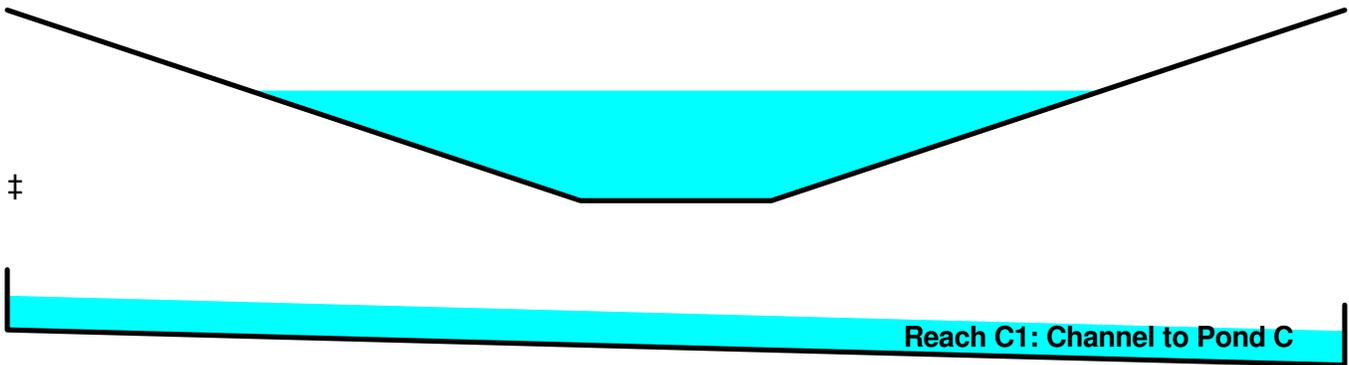
Summary for Reach C1: Channel to Pond C

Inflow Area = 37.792 ac, 0.00% Impervious, Inflow Depth = 1.82" for 5-Year event
 Inflow = 44.76 cfs @ 1.03 hrs, Volume= 5.718 af
 Outflow = 44.34 cfs @ 1.08 hrs, Volume= 5.718 af, Atten= 1%, Lag= 3.1 min
 Routed to Pond P3 : Pond C

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Max. Velocity= 2.34 fps, Min. Travel Time= 1.8 min
 Avg. Velocity = 1.10 fps, Avg. Travel Time= 3.8 min

Peak Storage= 4,717 cf @ 1.05 hrs
 Average Depth at Peak Storage= 1.74' , Surface Width= 17.88'
 Bank-Full Depth= 3.00' Flow Area= 48.0 sf, Capacity= 154.08 cfs

4.00' x 3.00' deep channel, n= 0.055
 Side Slope Z-value= 4.0 '/' Top Width= 28.00'
 Length= 248.5' Slope= 0.0071 '/'
 Inlet Invert= 1,200.30', Outlet Invert= 1,198.53'



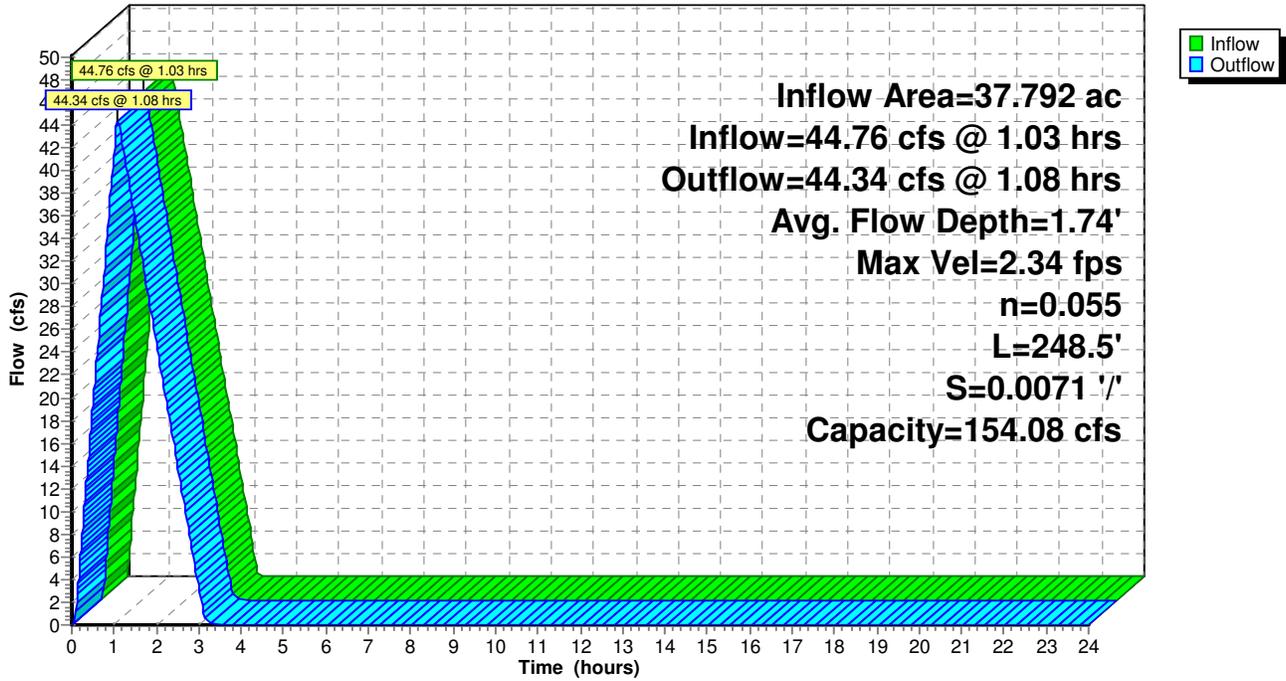
Proposed Condition (DP2)

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Reach C1: Channel to Pond C

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 5-Year Duration=62 min, Inten=2.14 in/hr

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Summary for Pond P3: Pond C

Inflow Area = 37.792 ac, 0.00% Impervious, Inflow Depth = 1.82" for 5-Year event
 Inflow = 44.34 cfs @ 1.08 hrs, Volume= 5.718 af
 Outflow = 35.17 cfs @ 1.52 hrs, Volume= 5.718 af, Atten= 21%, Lag= 26.5 min
 Primary = 35.17 cfs @ 1.52 hrs, Volume= 5.718 af
 Routed to Link DP2 : DP2 (Ex. 36" CMP)

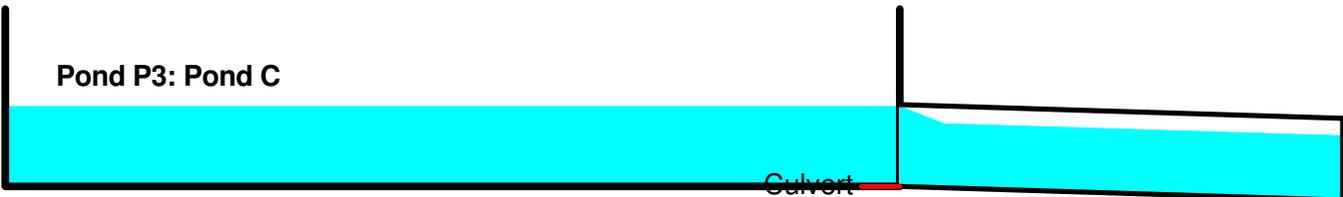
Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,195.43' @ 1.52 hrs Surf.Area= 29,258 sf Storage= 45,779 cf

Plug-Flow detention time= 19.1 min calculated for 5.715 af (100% of inflow)
 Center-of-Mass det. time= 19.1 min (105.2 - 86.0)

Volume	Invert	Avail.Storage	Storage Description
#1	1,192.50'	172,219 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,192.50	0	0	0
1,193.00	2,742	686	686
1,194.00	17,519	10,131	10,816
1,195.00	27,813	22,666	33,482
1,196.00	31,167	29,490	62,972
1,197.00	34,614	32,891	95,863
1,198.00	38,155	36,385	132,247
1,199.00	41,788	39,972	172,219

Device	Routing	Invert	Outlet Devices
#1	Primary	1,192.50'	36.0" Round Culvert L= 57.1' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 1,192.50' / 1,192.00' S= 0.0088 '/' Cc= 0.900 n= 0.012, Flow Area= 7.07 sf

Primary OutFlow Max=35.17 cfs @ 1.52 hrs HW=1,195.43' (Free Discharge)
 ↑1=Culvert (Barrel Controls 35.17 cfs @ 6.34 fps)



Proposed Condition (DP2)

ODOT Zone V 5-Year Duration=62 min, Inten=2.14 in/hr

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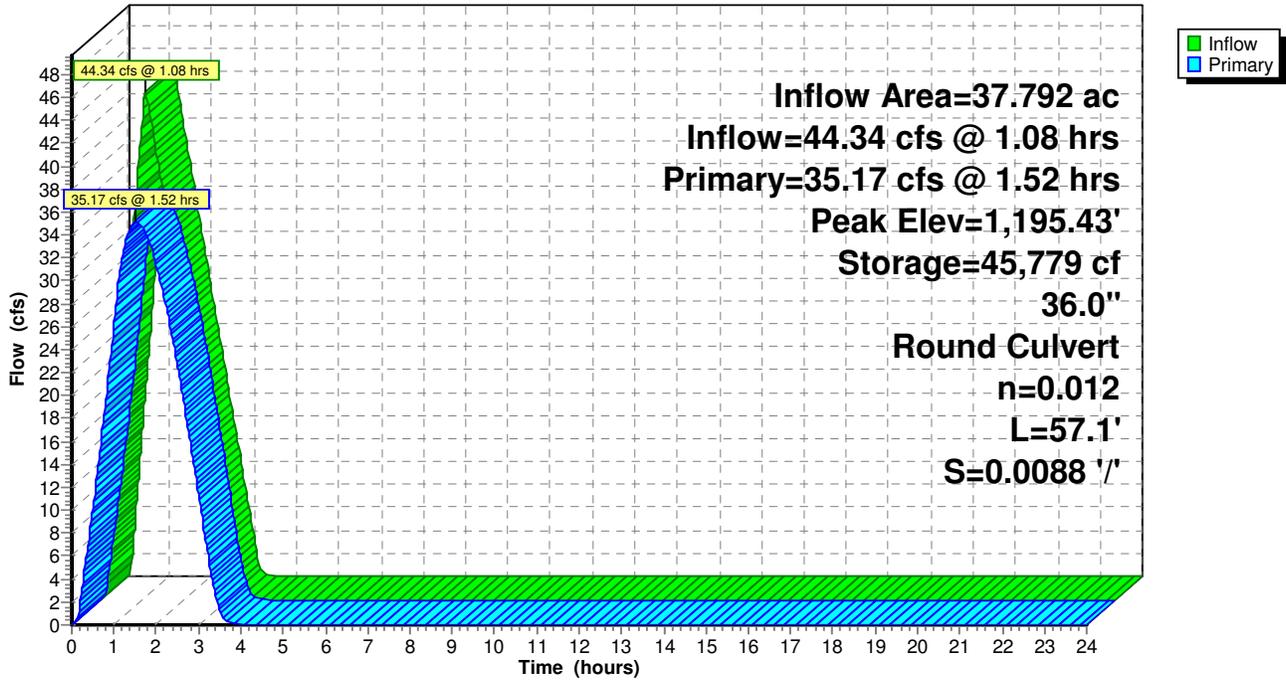
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Pond P3: Pond C

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 5-Year Duration=62 min, Inten=2.14 in/hr

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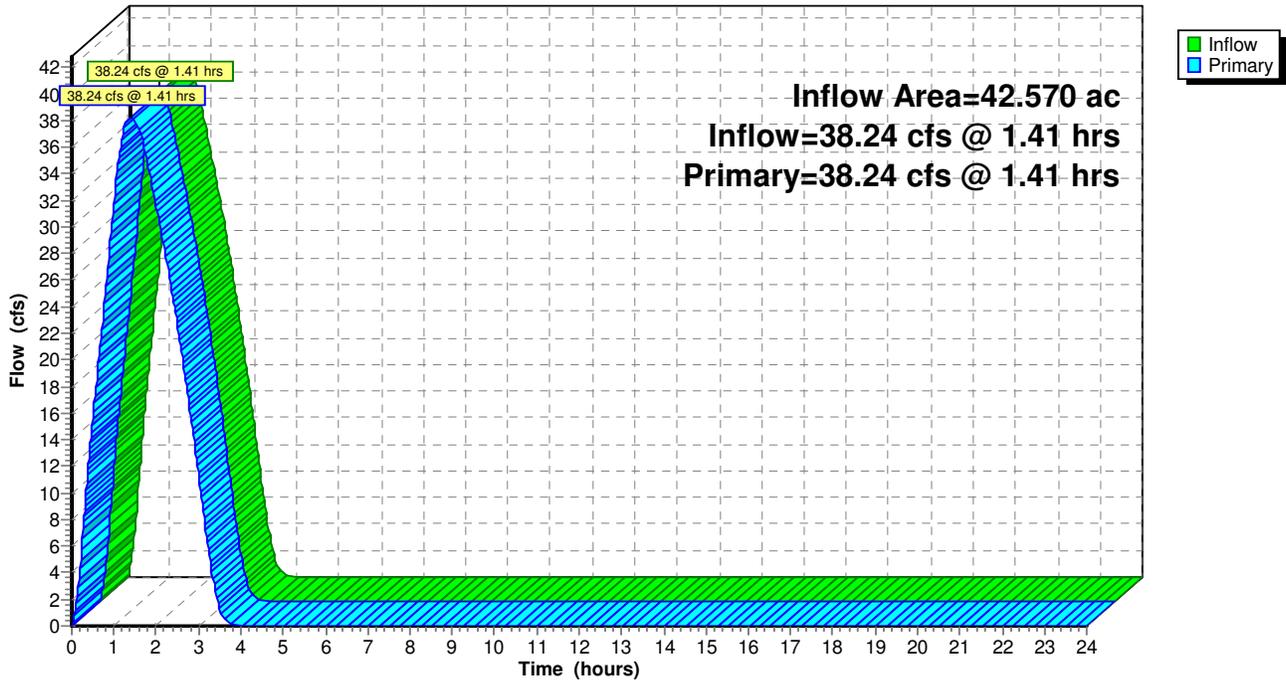
Summary for Link DP2: DP2 (Ex. 36" CMP)

Inflow Area = 42.570 ac, 0.00% Impervious, Inflow Depth = 1.78" for 5-Year event
Inflow = 38.24 cfs @ 1.41 hrs, Volume= 6.311 af
Primary = 38.24 cfs @ 1.41 hrs, Volume= 6.311 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP2: DP2 (Ex. 36" CMP)

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 10-Year Duration=62 min, Inten=2.47 in/hr

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points

Runoff by Rational method, Rise/Fall=1.0/2.0 xTc

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DEV2.1: DEV2.1 (to Channel) Runoff Area=37.792 ac 0.00% Impervious Runoff Depth=2.10"
Tc=61.5 min C=0.55 Runoff=51.75 cfs 6.611 af

Subcatchment DEV2.2: DEV2.2 (Bypass) Runoff Area=4.778 ac 0.00% Impervious Runoff Depth=1.72"
Tc=28.1 min C=0.55 Runoff=6.54 cfs 0.685 af

Reach C1: Channel to Pond C Avg. Flow Depth=1.85' Max Vel=2.43 fps Inflow=51.75 cfs 6.611 af
n=0.055 L=248.5' S=0.0071 '/' Capacity=154.08 cfs Outflow=51.28 cfs 6.611 af

Pond P3: Pond C Peak Elev=1,195.75' Storage=55,394 cf Inflow=51.28 cfs 6.611 af
36.0" Round Culvert n=0.012 L=57.1' S=0.0088 '/' Outflow=39.77 cfs 6.611 af

Link DP2: DP2 (Ex. 36" CMP) Inflow=43.29 cfs 7.297 af
Primary=43.29 cfs 7.297 af

Total Runoff Area = 42.570 ac Runoff Volume = 7.297 af Average Runoff Depth = 2.06"
100.00% Pervious = 42.570 ac 0.00% Impervious = 0.000 ac

Proposed Condition (DP2)

ODOT Zone V 10-Year Duration=62 min, Inten=2.47 in/hr

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Summary for Subcatchment DEV2.1: DEV2.1 (to Channel & Pond C)

Runoff = 51.75 cfs @ 1.03 hrs, Volume= 6.611 af, Depth= 2.10"
 Routed to Reach C1 : Channel to Pond C

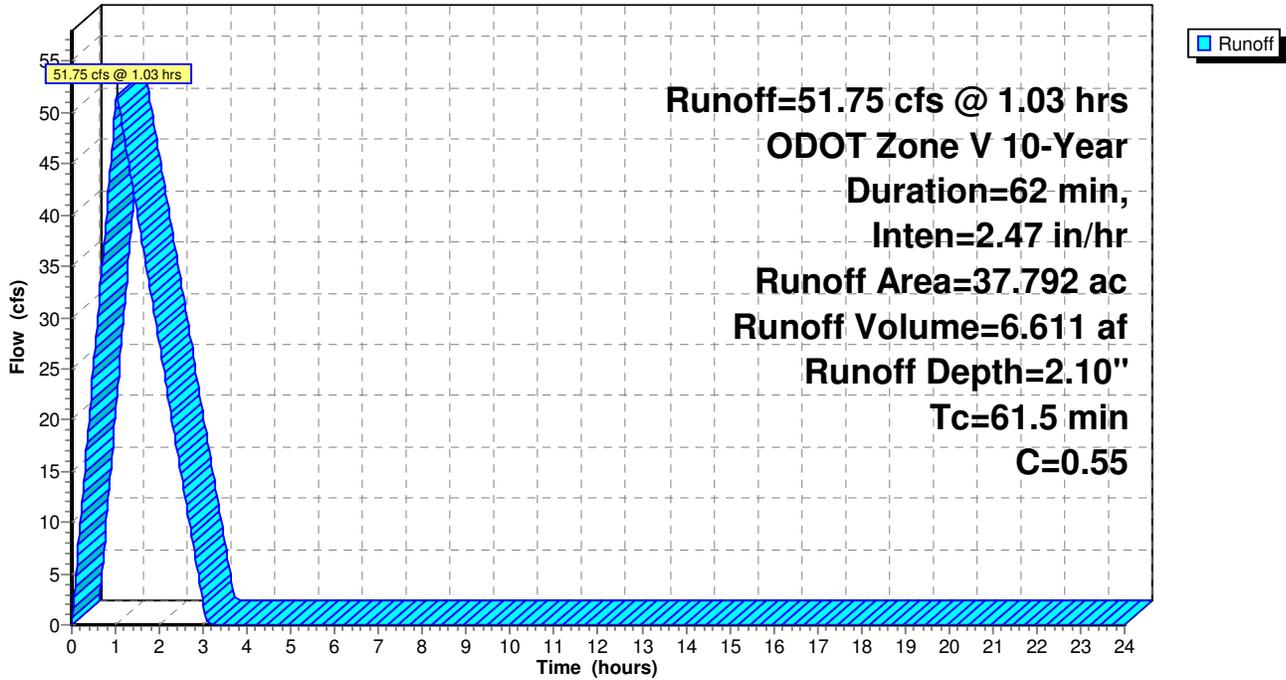
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 ODOT Zone V 10-Year Duration=62 min, Inten=2.47 in/hr

Area (ac)	C	Description
37.792	0.55	Residential Rural Estate
37.792		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
61.5					Direct Entry,

Subcatchment DEV2.1: DEV2.1 (to Channel & Pond C)

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 10-Year Duration=62 min, Inten=2.47 in/hr

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Summary for Subcatchment DEV2.2: DEV2.2 (Bypass)

Runoff = 6.54 cfs @ 0.47 hrs, Volume= 0.685 af, Depth= 1.72"
 Routed to Link DP2 : DP2 (Ex. 36" CMP)

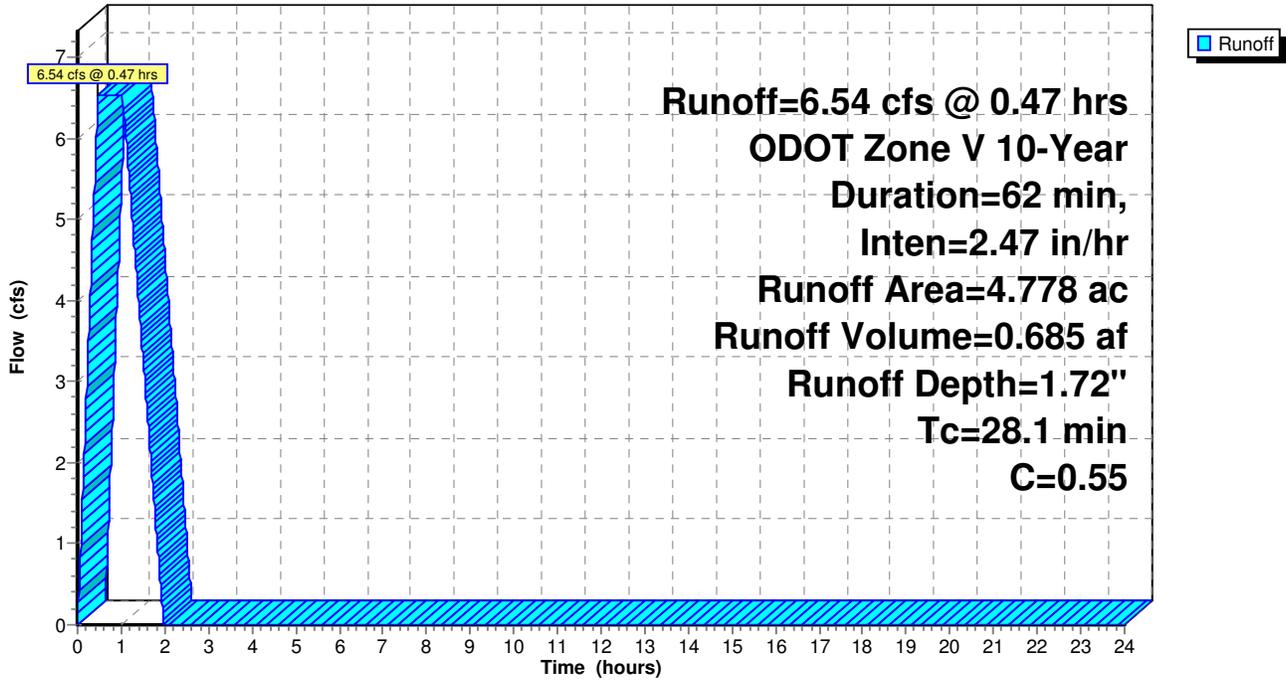
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 ODOT Zone V 10-Year Duration=62 min, Inten=2.47 in/hr

Area (ac)	C	Description
4.778	0.55	
4.778		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.1					Direct Entry,

Subcatchment DEV2.2: DEV2.2 (Bypass)

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 10-Year Duration=62 min, Inten=2.47 in/hr

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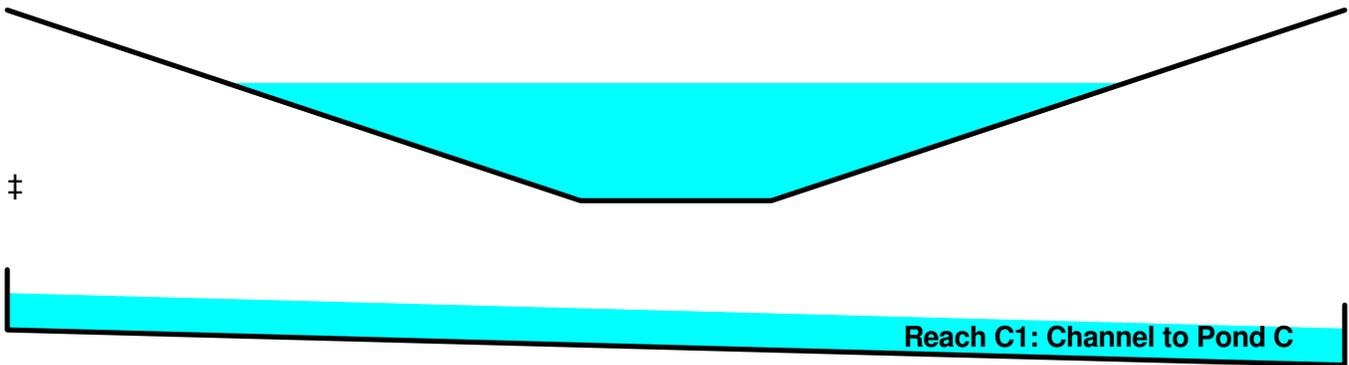
Summary for Reach C1: Channel to Pond C

Inflow Area = 37.792 ac, 0.00% Impervious, Inflow Depth = 2.10" for 10-Year event
 Inflow = 51.75 cfs @ 1.03 hrs, Volume= 6.611 af
 Outflow = 51.28 cfs @ 1.08 hrs, Volume= 6.611 af, Atten= 1%, Lag= 3.0 min
 Routed to Pond P3 : Pond C

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Max. Velocity= 2.43 fps, Min. Travel Time= 1.7 min
 Avg. Velocity = 1.14 fps, Avg. Travel Time= 3.6 min

Peak Storage= 5,255 cf @ 1.05 hrs
 Average Depth at Peak Storage= 1.85' , Surface Width= 18.82'
 Bank-Full Depth= 3.00' Flow Area= 48.0 sf, Capacity= 154.08 cfs

4.00' x 3.00' deep channel, n= 0.055
 Side Slope Z-value= 4.0 '/' Top Width= 28.00'
 Length= 248.5' Slope= 0.0071 '/'
 Inlet Invert= 1,200.30', Outlet Invert= 1,198.53'



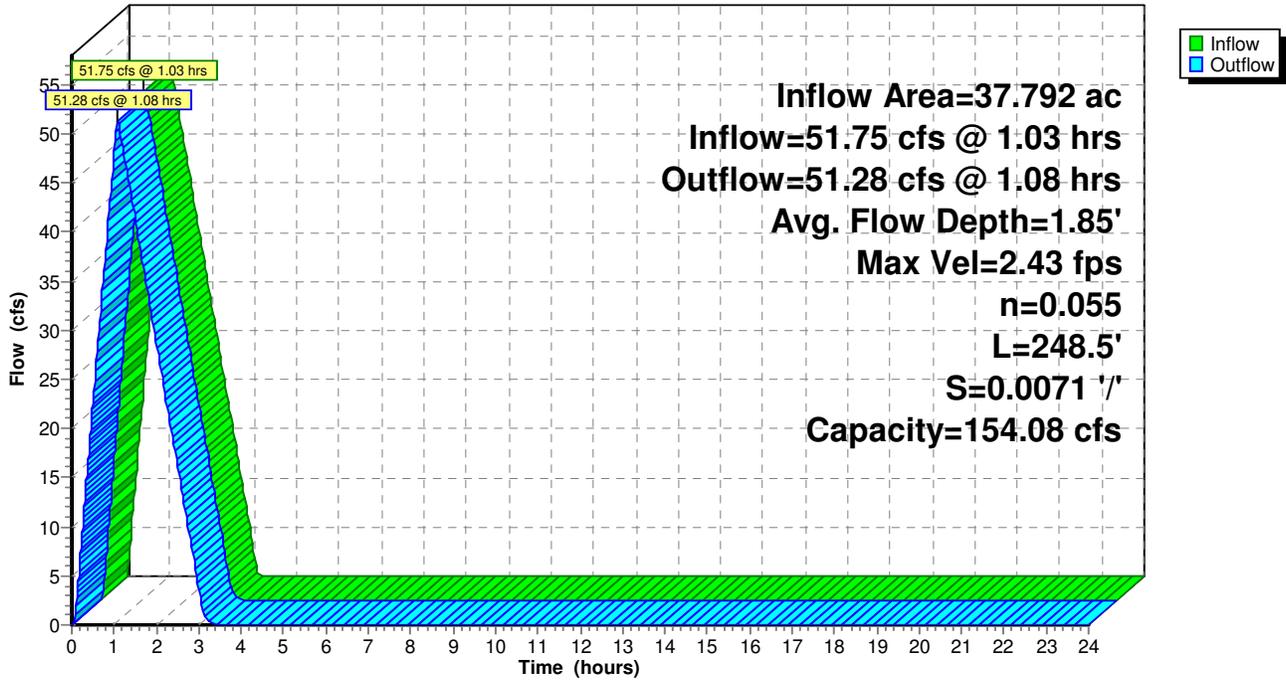
Proposed Condition (DP2)

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Reach C1: Channel to Pond C

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 10-Year Duration=62 min, Inten=2.47 in/hr

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Summary for Pond P3: Pond C

Inflow Area = 37.792 ac, 0.00% Impervious, Inflow Depth = 2.10" for 10-Year event
 Inflow = 51.28 cfs @ 1.08 hrs, Volume= 6.611 af
 Outflow = 39.77 cfs @ 1.56 hrs, Volume= 6.611 af, Atten= 22%, Lag= 28.6 min
 Primary = 39.77 cfs @ 1.56 hrs, Volume= 6.611 af
 Routed to Link DP2 : DP2 (Ex. 36" CMP)

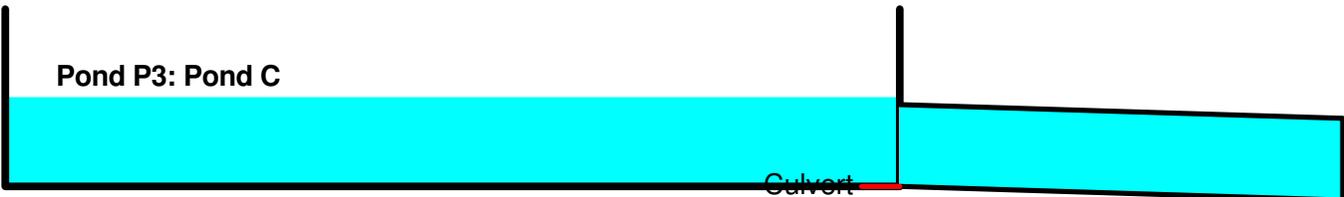
Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,195.75' @ 1.56 hrs Surf.Area= 30,340 sf Storage= 55,394 cf

Plug-Flow detention time= 20.2 min calculated for 6.608 af (100% of inflow)
 Center-of-Mass det. time= 20.2 min (106.1 - 85.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,192.50'	172,219 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,192.50	0	0	0
1,193.00	2,742	686	686
1,194.00	17,519	10,131	10,816
1,195.00	27,813	22,666	33,482
1,196.00	31,167	29,490	62,972
1,197.00	34,614	32,891	95,863
1,198.00	38,155	36,385	132,247
1,199.00	41,788	39,972	172,219

Device	Routing	Invert	Outlet Devices
#1	Primary	1,192.50'	36.0" Round Culvert L= 57.1' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 1,192.50' / 1,192.00' S= 0.0088 '/ Cc= 0.900 n= 0.012, Flow Area= 7.07 sf

Primary OutFlow Max=39.77 cfs @ 1.56 hrs HW=1,195.75' (Free Discharge)
 ↑=Culvert (Inlet Controls 39.77 cfs @ 5.63 fps)



Proposed Condition (DP2)

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25.004 Brentwood Section 3

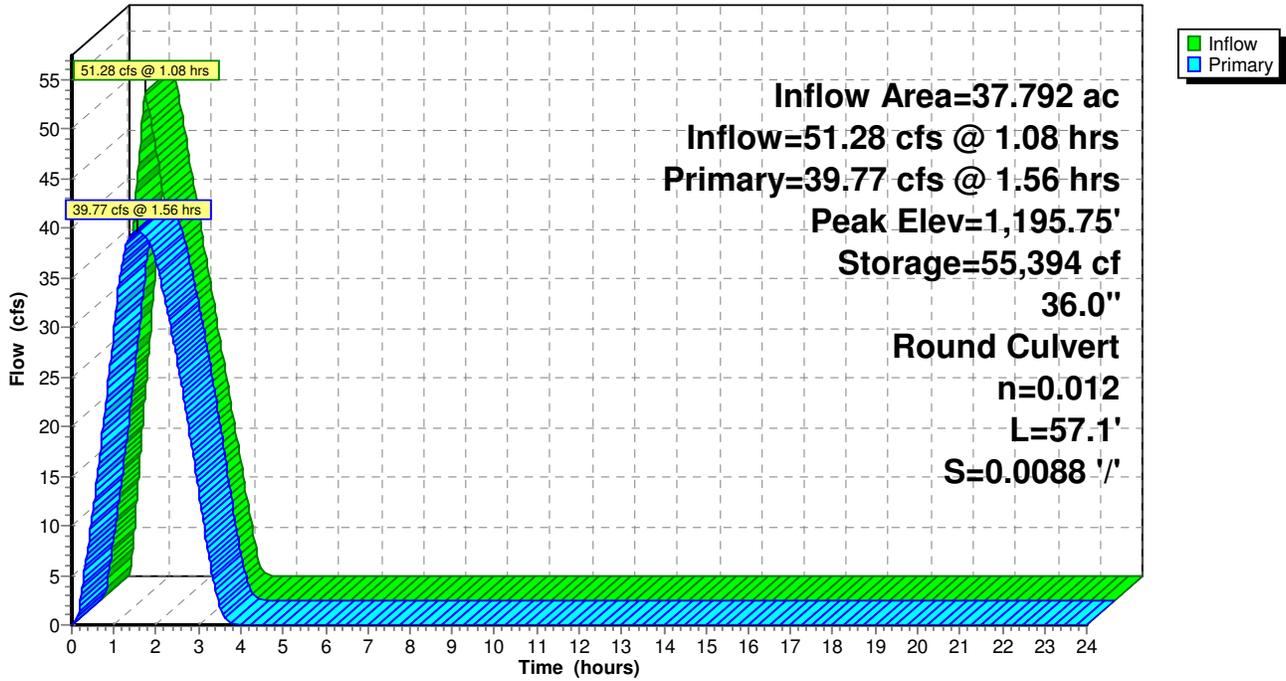
ODOT Zone V 10-Year Duration=62 min, Inten=2.47 in/hr

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Pond P3: Pond C

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 10-Year Duration=62 min, Inten=2.47 in/hr

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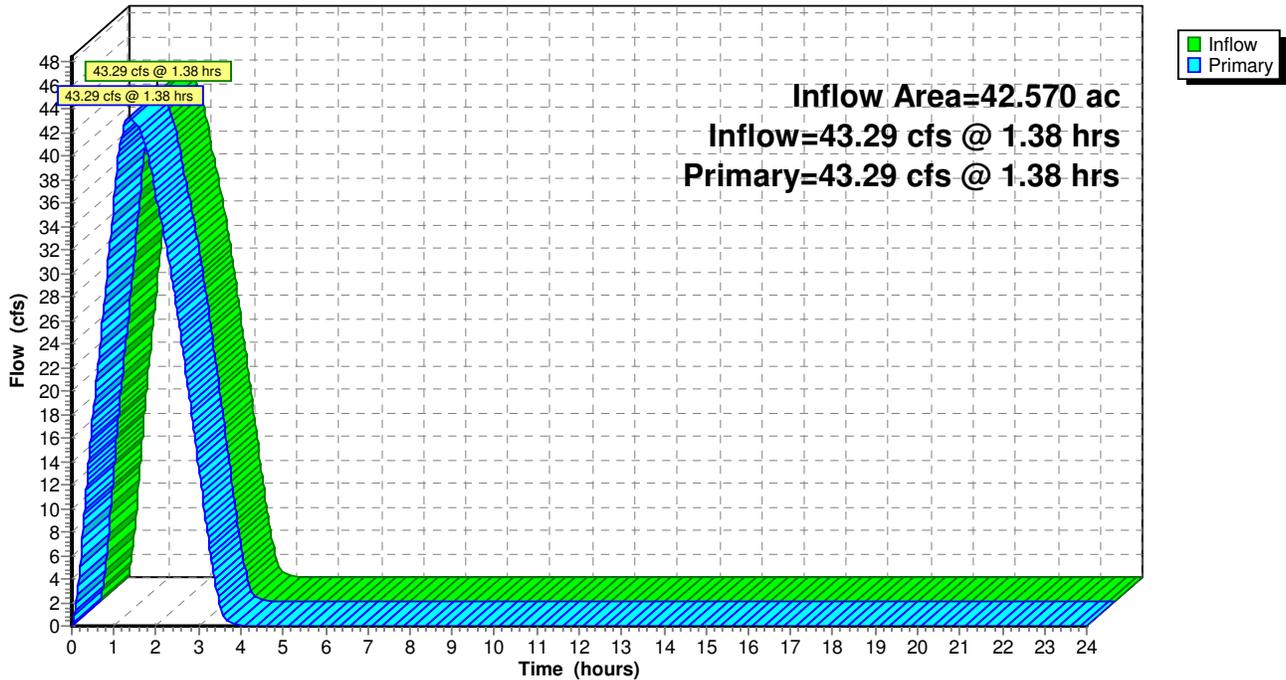
Summary for Link DP2: DP2 (Ex. 36" CMP)

Inflow Area = 42.570 ac, 0.00% Impervious, Inflow Depth = 2.06" for 10-Year event
Inflow = 43.29 cfs @ 1.38 hrs, Volume= 7.297 af
Primary = 43.29 cfs @ 1.38 hrs, Volume= 7.297 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP2: DP2 (Ex. 36" CMP)

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 25-Year Duration=62 min, Inten=3.01 in/hr

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points

Runoff by Rational method, Rise/Fall=1.0/2.0 xTc

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DEV2.1: DEV2.1 (to Channel) Runoff Area=37.792 ac 0.00% Impervious Runoff Depth=2.56"
Tc=61.5 min C=0.55 Runoff=63.03 cfs 8.052 af

Subcatchment DEV2.2: DEV2.2 (Bypass) Runoff Area=4.778 ac 0.00% Impervious Runoff Depth=2.10"
Tc=28.1 min C=0.55 Runoff=7.97 cfs 0.835 af

Reach C1: Channel to Pond C Avg. Flow Depth=2.02' Max Vel=2.55 fps Inflow=63.03 cfs 8.052 af
n=0.055 L=248.5' S=0.0071 '/' Capacity=154.08 cfs Outflow=62.48 cfs 8.052 af

Pond P3: Pond C Peak Elev=1,196.35' Storage=74,201 cf Inflow=62.48 cfs 8.052 af
36.0" Round Culvert n=0.012 L=57.1' S=0.0088 '/' Outflow=46.07 cfs 8.052 af

Link DP2: DP2 (Ex. 36" CMP) Inflow=49.91 cfs 8.887 af
Primary=49.91 cfs 8.887 af

Total Runoff Area = 42.570 ac Runoff Volume = 8.887 af Average Runoff Depth = 2.51"
100.00% Pervious = 42.570 ac 0.00% Impervious = 0.000 ac

Proposed Condition (DP2)

ODOT Zone V 25-Year Duration=62 min, Inten=3.01 in/hr

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Summary for Subcatchment DEV2.1: DEV2.1 (to Channel & Pond C)

Runoff = 63.03 cfs @ 1.03 hrs, Volume= 8.052 af, Depth= 2.56"
 Routed to Reach C1 : Channel to Pond C

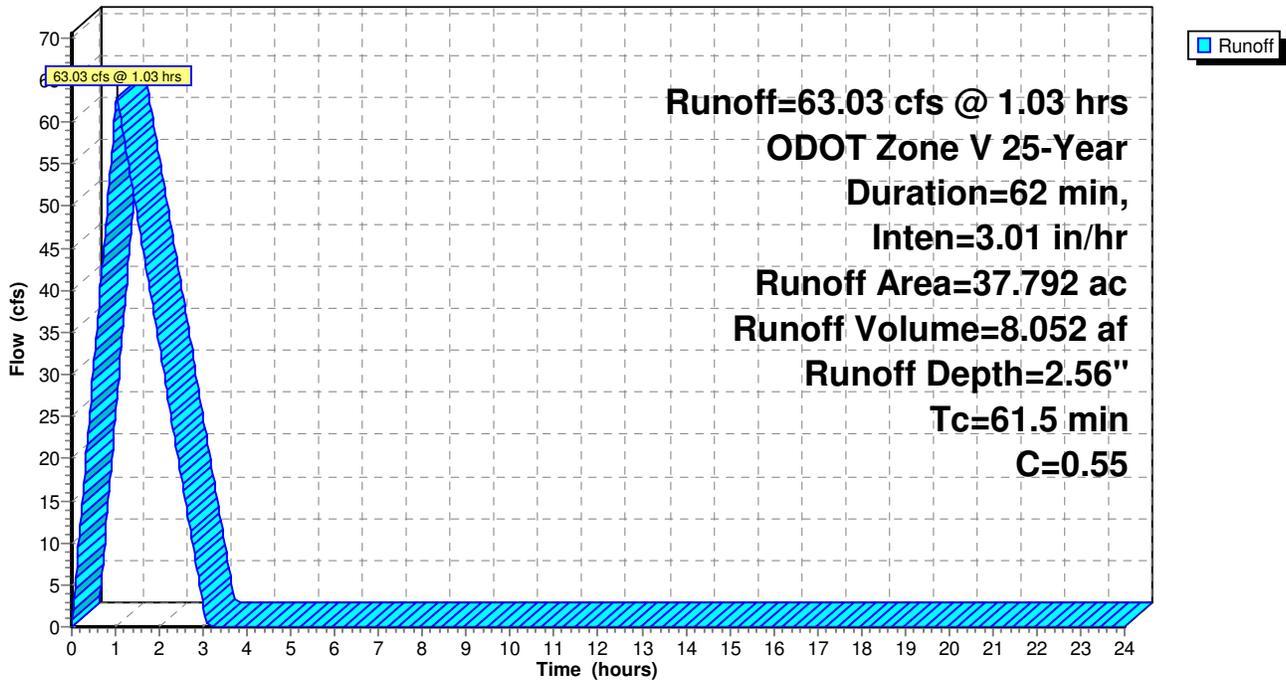
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 ODOT Zone V 25-Year Duration=62 min, Inten=3.01 in/hr

Area (ac)	C	Description
37.792	0.55	Residential Rural Estate
37.792		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
61.5					Direct Entry,

Subcatchment DEV2.1: DEV2.1 (to Channel & Pond C)

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 25-Year Duration=62 min, Inten=3.01 in/hr

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Summary for Subcatchment DEV2.2: DEV2.2 (Bypass)

Runoff = 7.97 cfs @ 0.47 hrs, Volume= 0.835 af, Depth= 2.10"
 Routed to Link DP2 : DP2 (Ex. 36" CMP)

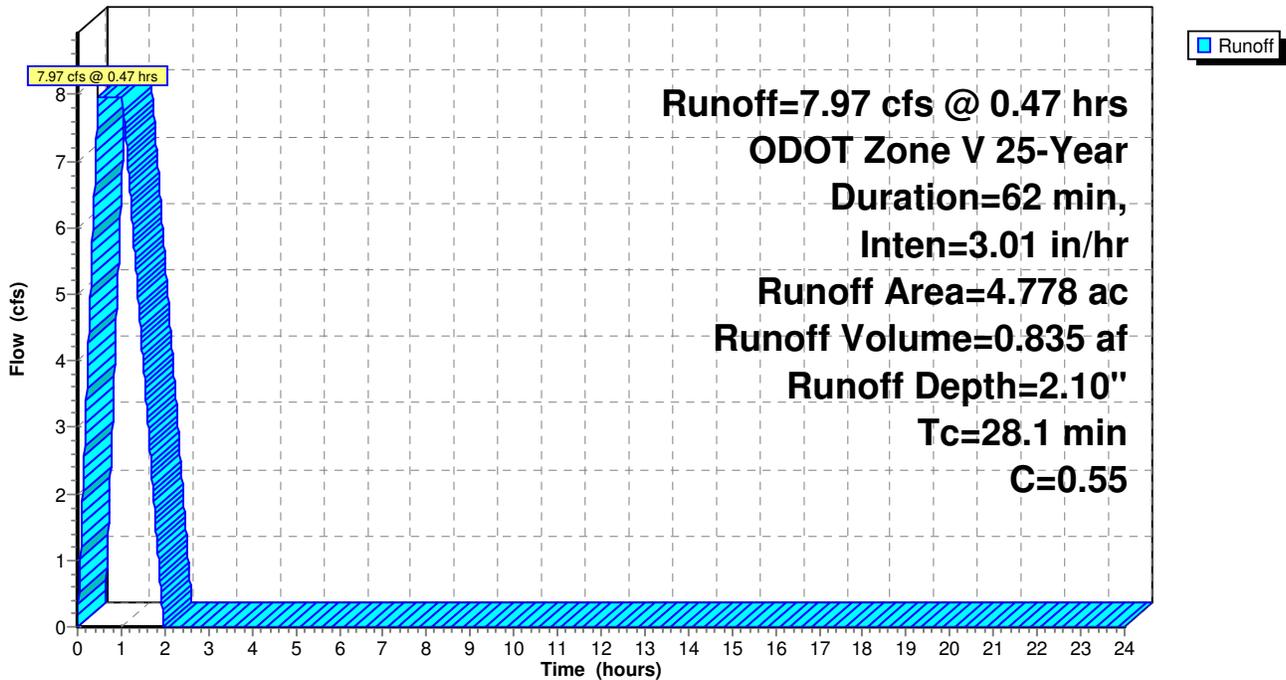
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 ODOT Zone V 25-Year Duration=62 min, Inten=3.01 in/hr

Area (ac)	C	Description
4.778	0.55	
4.778		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.1					Direct Entry,

Subcatchment DEV2.2: DEV2.2 (Bypass)

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 25-Year Duration=62 min, Inten=3.01 in/hr

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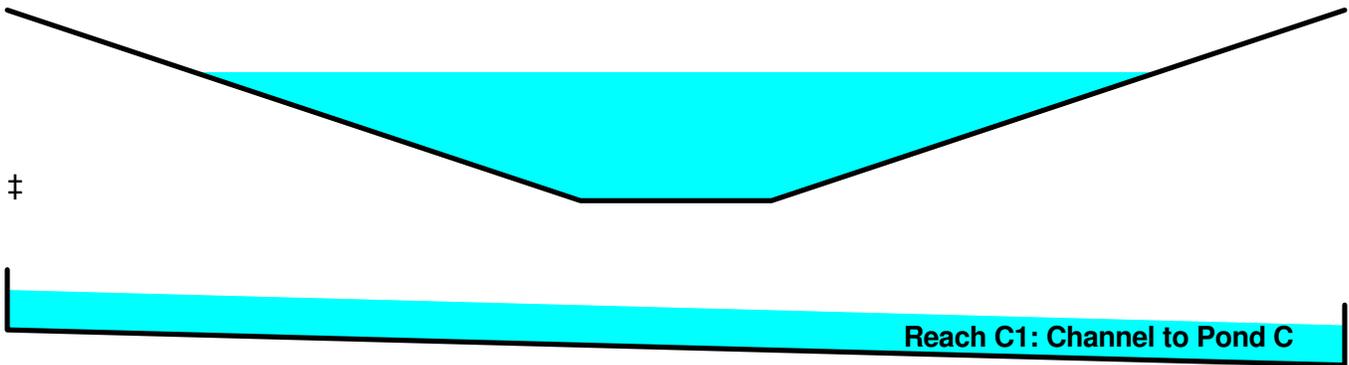
Summary for Reach C1: Channel to Pond C

Inflow Area = 37.792 ac, 0.00% Impervious, Inflow Depth = 2.56" for 25-Year event
 Inflow = 63.03 cfs @ 1.03 hrs, Volume= 8.052 af
 Outflow = 62.48 cfs @ 1.08 hrs, Volume= 8.052 af, Atten= 1%, Lag= 2.9 min
 Routed to Pond P3 : Pond C

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Max. Velocity= 2.55 fps, Min. Travel Time= 1.6 min
 Avg. Velocity = 1.20 fps, Avg. Travel Time= 3.5 min

Peak Storage= 6,087 cf @ 1.05 hrs
 Average Depth at Peak Storage= 2.02' , Surface Width= 20.20'
 Bank-Full Depth= 3.00' Flow Area= 48.0 sf, Capacity= 154.08 cfs

4.00' x 3.00' deep channel, n= 0.055
 Side Slope Z-value= 4.0 '/' Top Width= 28.00'
 Length= 248.5' Slope= 0.0071 '/'
 Inlet Invert= 1,200.30', Outlet Invert= 1,198.53'



Proposed Condition (DP2)

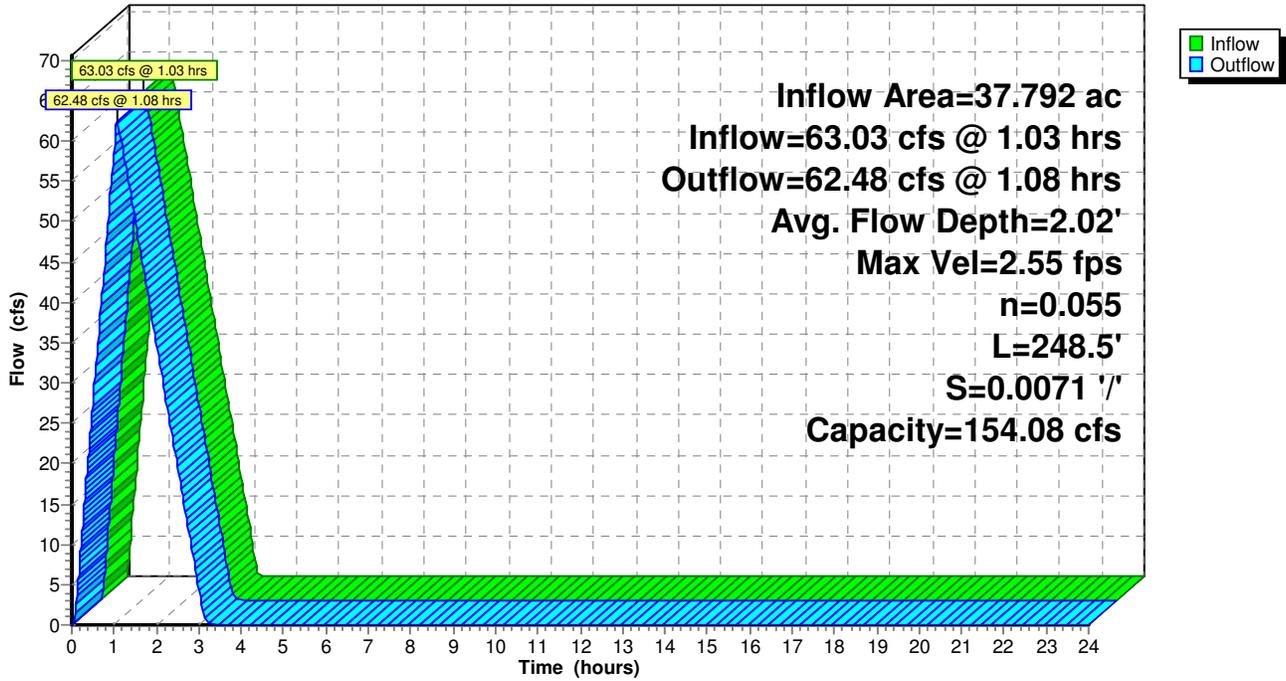
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25.004 Brentwood Section 3
ODOT Zone V 25-Year Duration=62 min, Inten=3.01 in/hr

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Reach C1: Channel to Pond C

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 25-Year Duration=62 min, Inten=3.01 in/hr

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Summary for Pond P3: Pond C

Inflow Area = 37.792 ac, 0.00% Impervious, Inflow Depth = 2.56" for 25-Year event
 Inflow = 62.48 cfs @ 1.08 hrs, Volume= 8.052 af
 Outflow = 46.07 cfs @ 1.63 hrs, Volume= 8.052 af, Atten= 26%, Lag= 33.3 min
 Primary = 46.07 cfs @ 1.63 hrs, Volume= 8.052 af
 Routed to Link DP2 : DP2 (Ex. 36" CMP)

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,196.35' @ 1.63 hrs Surf.Area= 32,385 sf Storage= 74,201 cf

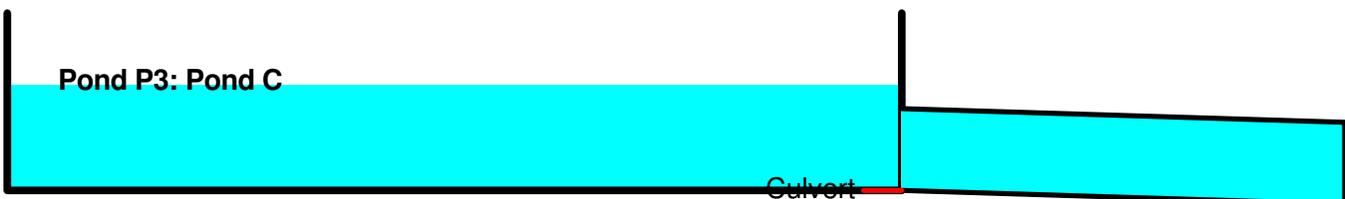
Plug-Flow detention time= 22.6 min calculated for 8.048 af (100% of inflow)
 Center-of-Mass det. time= 22.6 min (108.3 - 85.7)

Volume	Invert	Avail.Storage	Storage Description
#1	1,192.50'	172,219 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,192.50	0	0	0
1,193.00	2,742	686	686
1,194.00	17,519	10,131	10,816
1,195.00	27,813	22,666	33,482
1,196.00	31,167	29,490	62,972
1,197.00	34,614	32,891	95,863
1,198.00	38,155	36,385	132,247
1,199.00	41,788	39,972	172,219

Device	Routing	Invert	Outlet Devices
#1	Primary	1,192.50'	36.0" Round Culvert L= 57.1' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 1,192.50' / 1,192.00' S= 0.0088 '/ Cc= 0.900 n= 0.012, Flow Area= 7.07 sf

Primary OutFlow Max=46.07 cfs @ 1.63 hrs HW=1,196.35' (Free Discharge)
 ↑1=Culvert (Inlet Controls 46.07 cfs @ 6.52 fps)



Proposed Condition (DP2)

ODOT Zone V 25-Year Duration=62 min, Inten=3.01 in/hr

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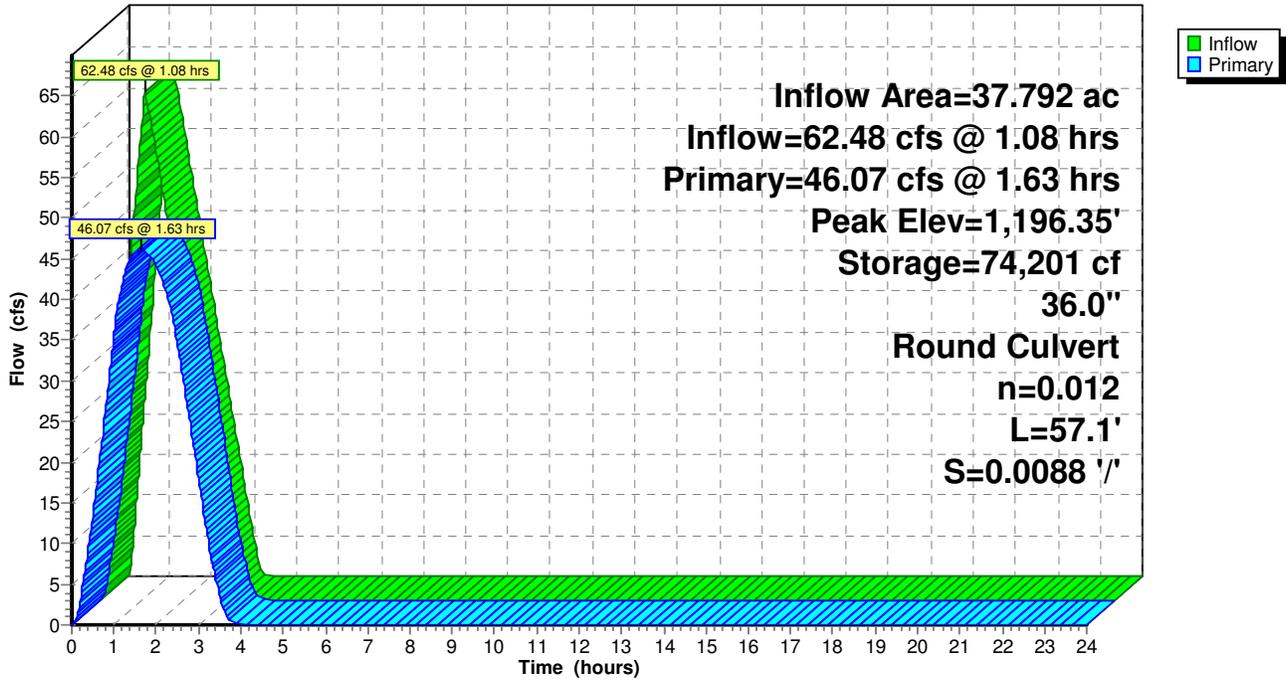
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Pond P3: Pond C

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 25-Year Duration=62 min, Inten=3.01 in/hr

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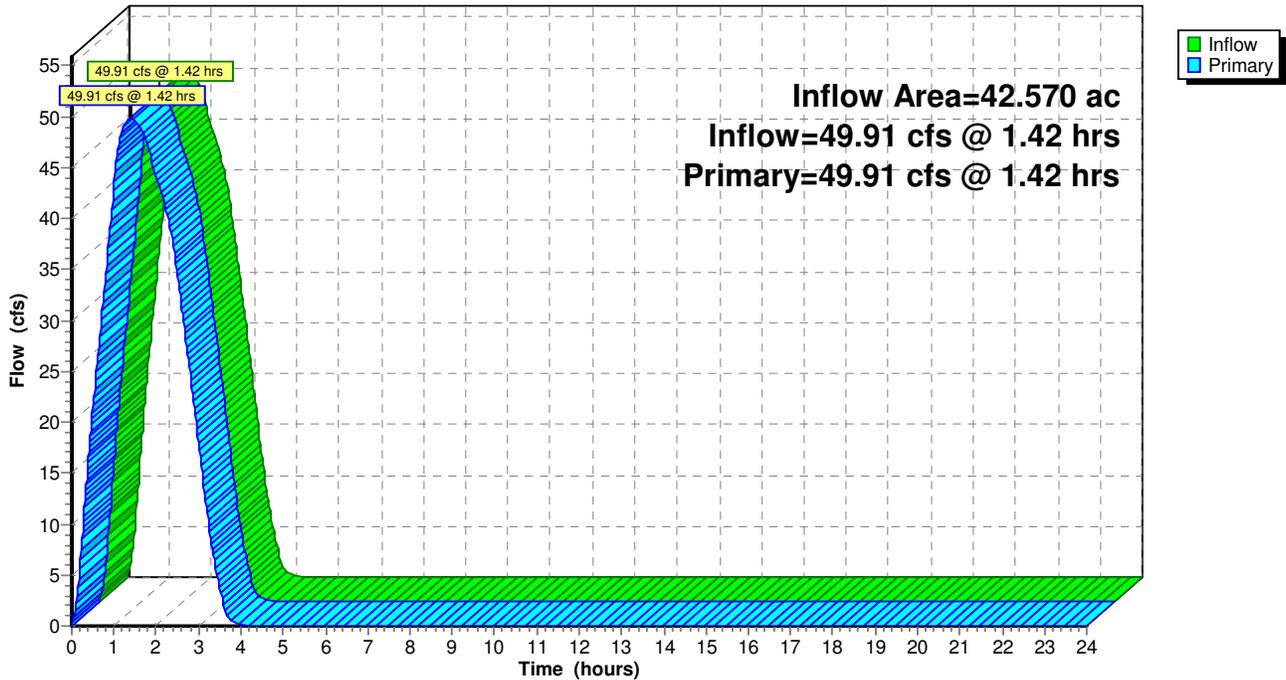
Summary for Link DP2: DP2 (Ex. 36" CMP)

Inflow Area = 42.570 ac, 0.00% Impervious, Inflow Depth = 2.51" for 25-Year event
Inflow = 49.91 cfs @ 1.42 hrs, Volume= 8.887 af
Primary = 49.91 cfs @ 1.42 hrs, Volume= 8.887 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP2: DP2 (Ex. 36" CMP)

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 50-Year Duration=62 min, Inten=3.36 in/hr

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points

Runoff by Rational method, Rise/Fall=1.0/2.0 xTc

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DEV2.1: DEV2.1 (to Channel) Runoff Area=37.792 ac 0.00% Impervious Runoff Depth=2.86"
Tc=61.5 min C=0.55 Runoff=70.48 cfs 9.004 af

Subcatchment DEV2.2: DEV2.2 (Bypass) Runoff Area=4.778 ac 0.00% Impervious Runoff Depth=2.34"
Tc=28.1 min C=0.55 Runoff=8.91 cfs 0.933 af

Reach C1: Channel to Pond C Avg. Flow Depth=2.13' Max Vel=2.63 fps Inflow=70.48 cfs 9.004 af
n=0.055 L=248.5' S=0.0071 '/' Capacity=154.08 cfs Outflow=69.89 cfs 9.004 af

Pond P3: Pond C Peak Elev=1,196.77' Storage=88,095 cf Inflow=69.89 cfs 9.004 af
36.0" Round Culvert n=0.012 L=57.1' S=0.0088 '/' Outflow=50.01 cfs 9.004 af

Link DP2: DP2 (Ex. 36" CMP) Inflow=54.05 cfs 9.938 af
Primary=54.05 cfs 9.938 af

Total Runoff Area = 42.570 ac Runoff Volume = 9.938 af Average Runoff Depth = 2.80"
100.00% Pervious = 42.570 ac 0.00% Impervious = 0.000 ac

Proposed Condition (DP2)

ODOT Zone V 50-Year Duration=62 min, Inten=3.36 in/hr

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Summary for Subcatchment DEV2.1: DEV2.1 (to Channel & Pond C)

Runoff = 70.48 cfs @ 1.03 hrs, Volume= 9.004 af, Depth= 2.86"
 Routed to Reach C1 : Channel to Pond C

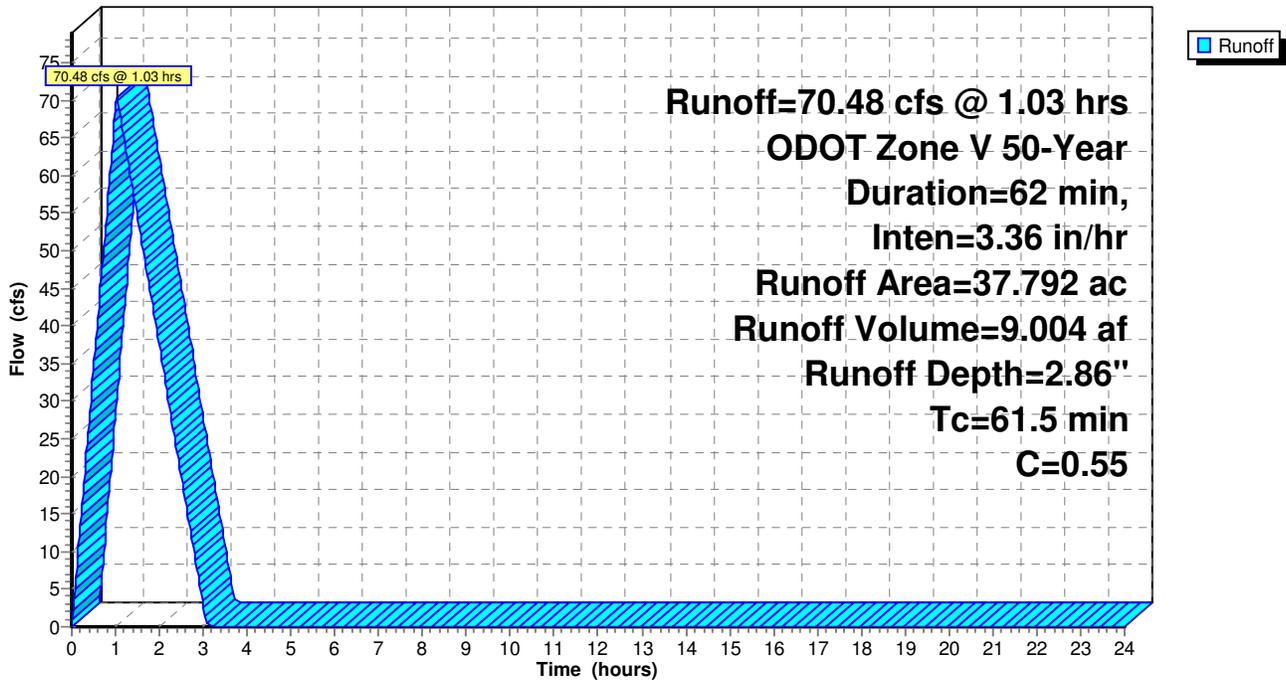
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 ODOT Zone V 50-Year Duration=62 min, Inten=3.36 in/hr

Area (ac)	C	Description
37.792	0.55	Residential Rural Estate
37.792		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
61.5					Direct Entry,

Subcatchment DEV2.1: DEV2.1 (to Channel & Pond C)

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 50-Year Duration=62 min, Inten=3.36 in/hr

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Summary for Subcatchment DEV2.2: DEV2.2 (Bypass)

Runoff = 8.91 cfs @ 0.47 hrs, Volume= 0.933 af, Depth= 2.34"
 Routed to Link DP2 : DP2 (Ex. 36" CMP)

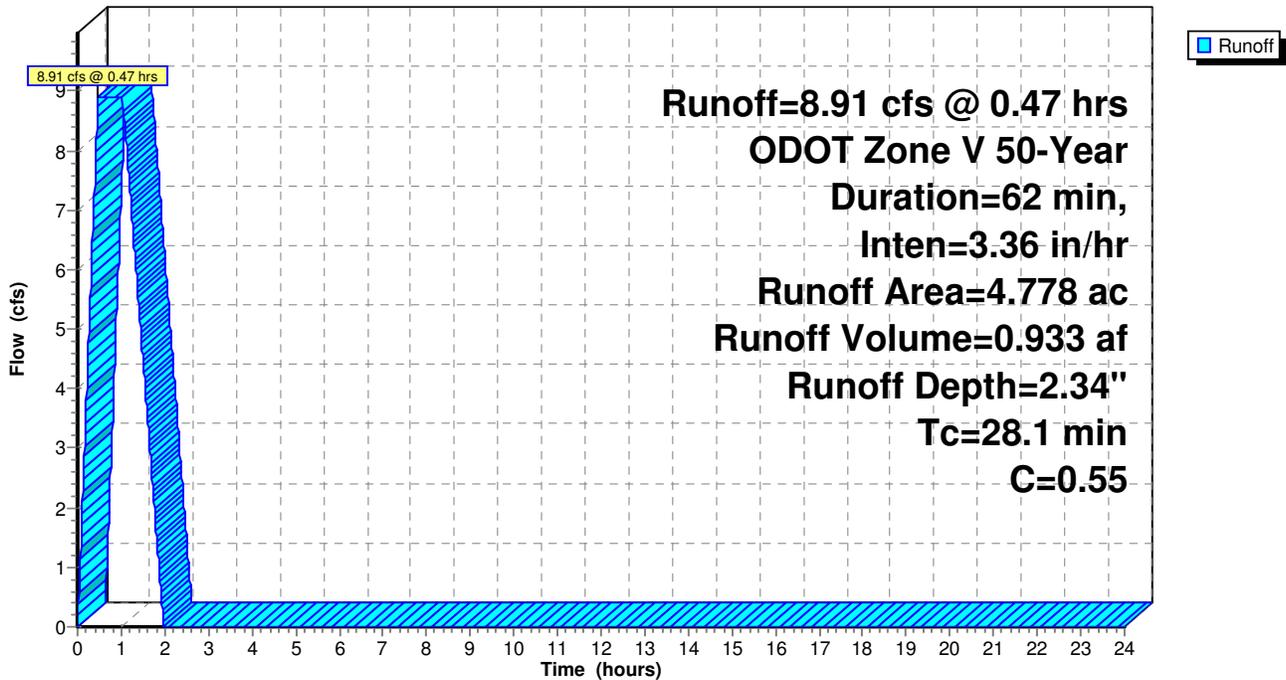
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 ODOT Zone V 50-Year Duration=62 min, Inten=3.36 in/hr

Area (ac)	C	Description
4.778	0.55	
4.778		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.1					Direct Entry,

Subcatchment DEV2.2: DEV2.2 (Bypass)

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 50-Year Duration=62 min, Inten=3.36 in/hr

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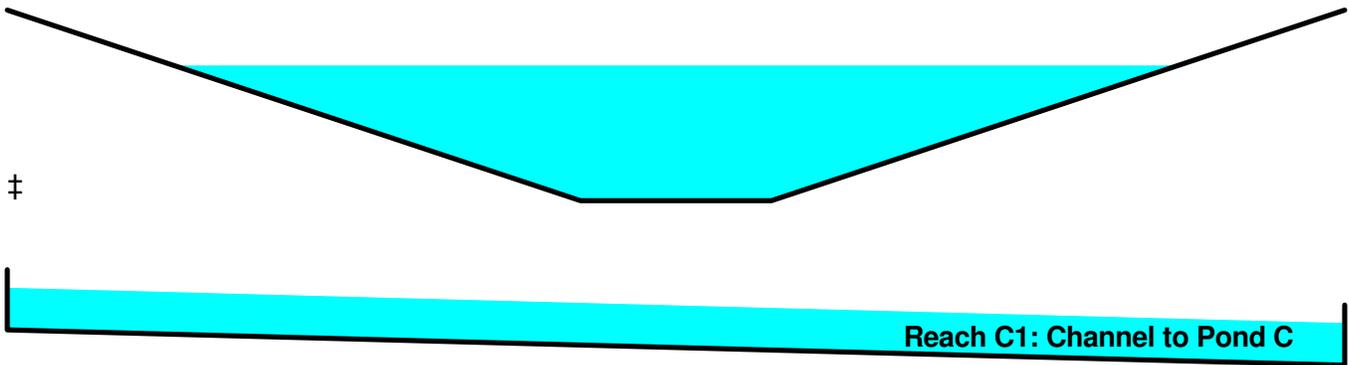
Summary for Reach C1: Channel to Pond C

Inflow Area = 37.792 ac, 0.00% Impervious, Inflow Depth = 2.86" for 50-Year event
 Inflow = 70.48 cfs @ 1.03 hrs, Volume= 9.004 af
 Outflow = 69.89 cfs @ 1.08 hrs, Volume= 9.004 af, Atten= 1%, Lag= 2.8 min
 Routed to Pond P3 : Pond C

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Max. Velocity= 2.63 fps, Min. Travel Time= 1.6 min
 Avg. Velocity = 1.23 fps, Avg. Travel Time= 3.4 min

Peak Storage= 6,616 cf @ 1.05 hrs
 Average Depth at Peak Storage= 2.13' , Surface Width= 21.02'
 Bank-Full Depth= 3.00' Flow Area= 48.0 sf, Capacity= 154.08 cfs

4.00' x 3.00' deep channel, n= 0.055
 Side Slope Z-value= 4.0 ' / ' Top Width= 28.00'
 Length= 248.5' Slope= 0.0071 ' / '
 Inlet Invert= 1,200.30', Outlet Invert= 1,198.53'



Proposed Condition (DP2)

ODOT Zone V 50-Year Duration=62 min, Inten=3.36 in/hr

Prepared by Holtzen Engineering Group

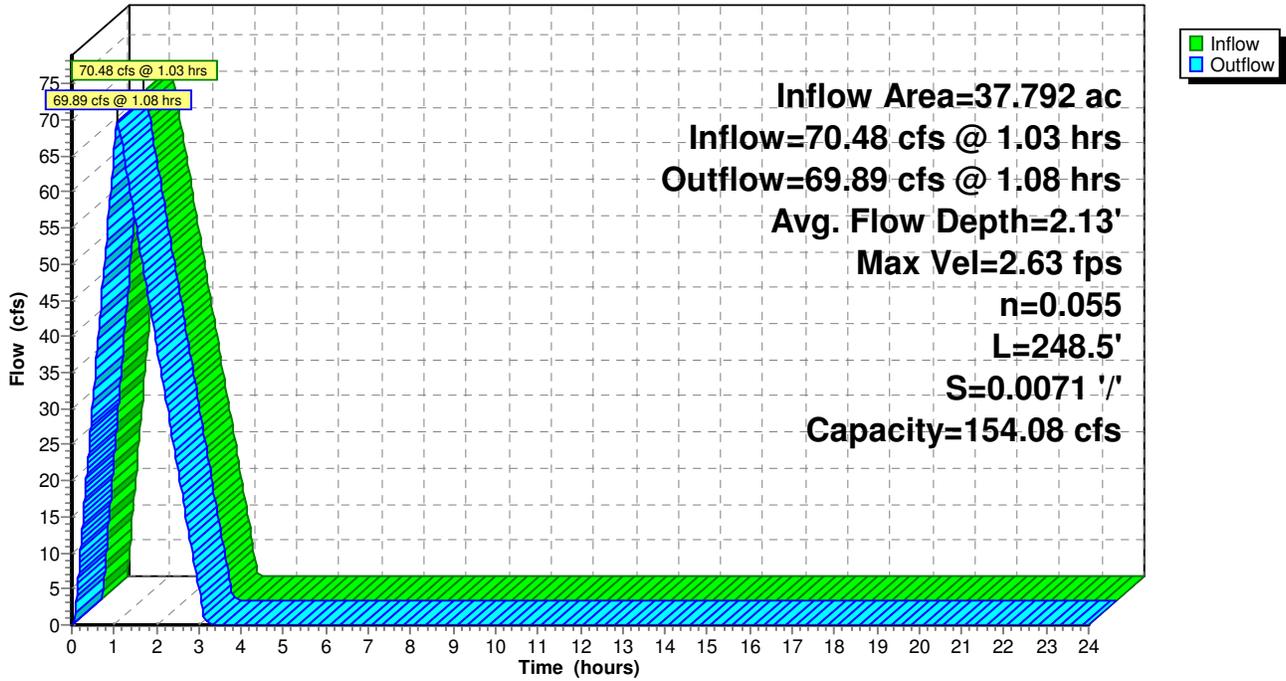
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Reach C1: Channel to Pond C

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 50-Year Duration=62 min, Inten=3.36 in/hr

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Summary for Pond P3: Pond C

Inflow Area = 37.792 ac, 0.00% Impervious, Inflow Depth = 2.86" for 50-Year event
 Inflow = 69.89 cfs @ 1.08 hrs, Volume= 9.004 af
 Outflow = 50.01 cfs @ 1.68 hrs, Volume= 9.004 af, Atten= 28%, Lag= 35.9 min
 Primary = 50.01 cfs @ 1.68 hrs, Volume= 9.004 af
 Routed to Link DP2 : DP2 (Ex. 36" CMP)

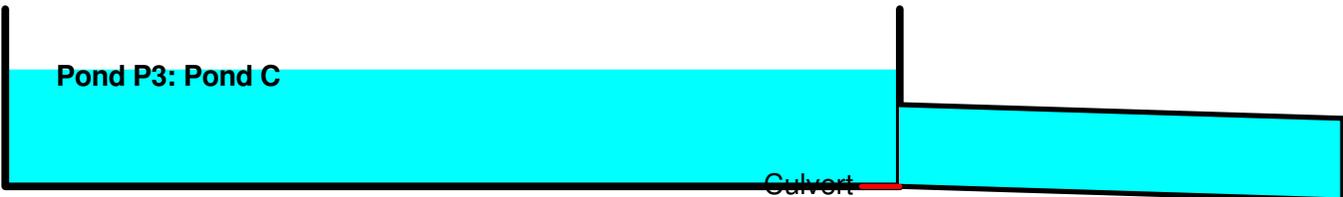
Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,196.77' @ 1.68 hrs Surf.Area= 33,832 sf Storage= 88,095 cf

Plug-Flow detention time= 24.3 min calculated for 9.000 af (100% of inflow)
 Center-of-Mass det. time= 24.3 min (110.0 - 85.6)

Volume	Invert	Avail.Storage	Storage Description
#1	1,192.50'	172,219 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,192.50	0	0	0
1,193.00	2,742	686	686
1,194.00	17,519	10,131	10,816
1,195.00	27,813	22,666	33,482
1,196.00	31,167	29,490	62,972
1,197.00	34,614	32,891	95,863
1,198.00	38,155	36,385	132,247
1,199.00	41,788	39,972	172,219

Device	Routing	Invert	Outlet Devices
#1	Primary	1,192.50'	36.0" Round Culvert L= 57.1' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 1,192.50' / 1,192.00' S= 0.0088 '/ Cc= 0.900 n= 0.012, Flow Area= 7.07 sf

Primary OutFlow Max=50.01 cfs @ 1.68 hrs HW=1,196.77' (Free Discharge)
 ↑1=Culvert (Inlet Controls 50.01 cfs @ 7.07 fps)



Proposed Condition (DP2)

ODOT Zone V 50-Year Duration=62 min, Inten=3.36 in/hr

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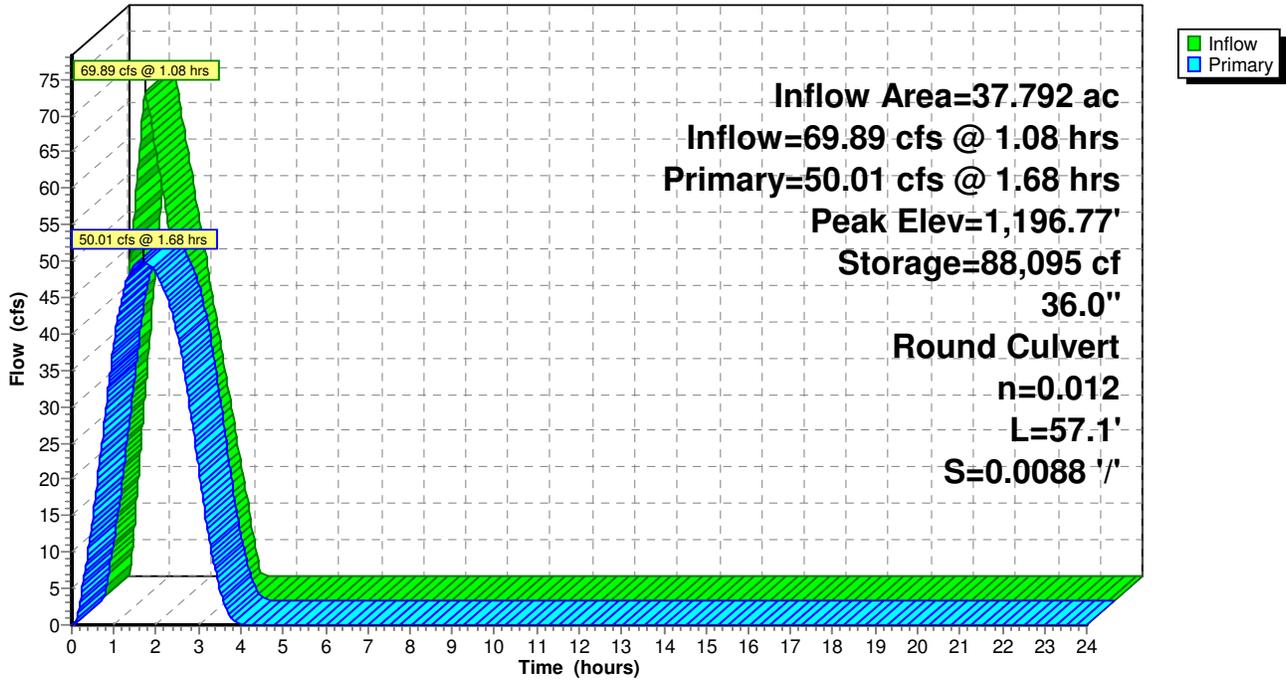
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Pond P3: Pond C

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 50-Year Duration=62 min, Inten=3.36 in/hr

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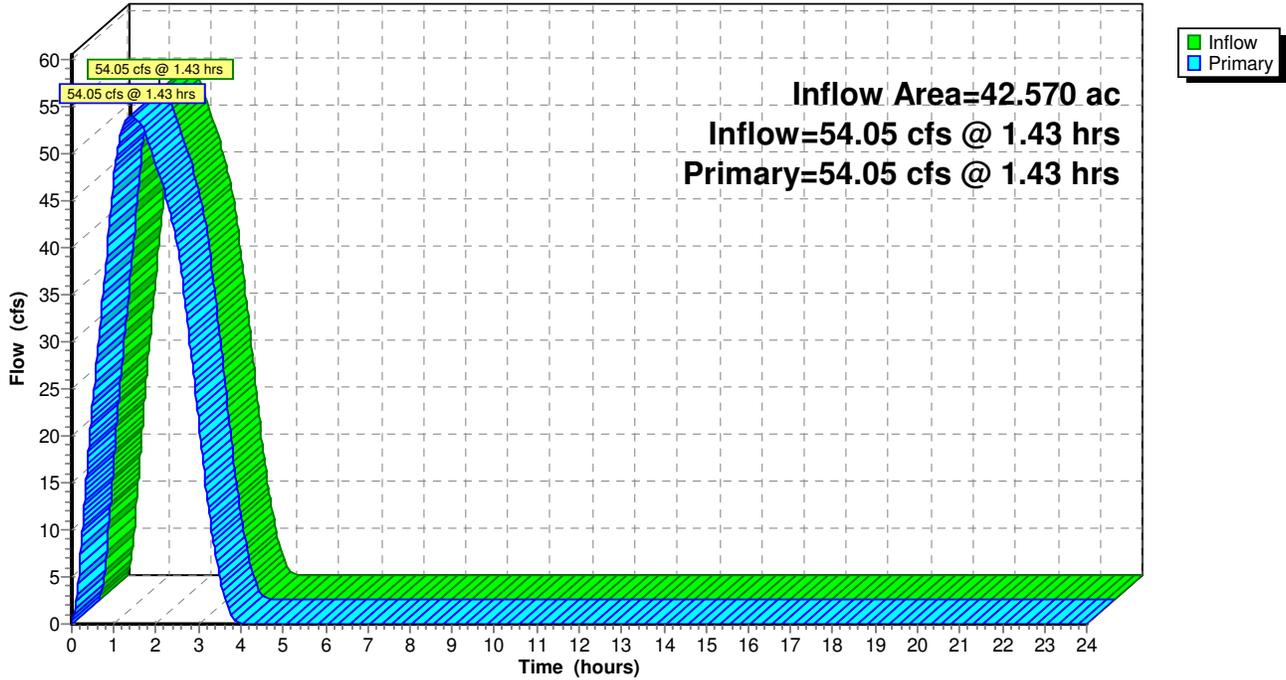
Summary for Link DP2: DP2 (Ex. 36" CMP)

Inflow Area = 42.570 ac, 0.00% Impervious, Inflow Depth = 2.80" for 50-Year event
Inflow = 54.05 cfs @ 1.43 hrs, Volume= 9.938 af
Primary = 54.05 cfs @ 1.43 hrs, Volume= 9.938 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP2: DP2 (Ex. 36" CMP)

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 100-Year Duration=62 min, Inten=3.81 in/hr

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points

Runoff by Rational method, Rise/Fall=1.0/2.0 xTc

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DEV2.1: DEV2.1 (to Channel) Runoff Area=37.792 ac 0.00% Impervious Runoff Depth=3.24"
Tc=61.5 min C=0.55 Runoff=79.84 cfs 10.199 af

Subcatchment DEV2.2: DEV2.2 (Bypass) Runoff Area=4.778 ac 0.00% Impervious Runoff Depth=2.66"
Tc=28.1 min C=0.55 Runoff=10.09 cfs 1.057 af

Reach C1: Channel to Pond C Avg. Flow Depth=2.25' Max Vel=2.71 fps Inflow=79.84 cfs 10.199 af
n=0.055 L=248.5' S=0.0071 '/' Capacity=154.08 cfs Outflow=79.18 cfs 10.199 af

Pond P3: Pond C Peak Elev=1,197.32' Storage=106,970 cf Inflow=79.18 cfs 10.199 af
36.0" Round Culvert n=0.012 L=57.1' S=0.0088 '/' Outflow=54.68 cfs 10.199 af

Link DP2: DP2 (Ex. 36" CMP) Inflow=58.94 cfs 11.256 af
Primary=58.94 cfs 11.256 af

Total Runoff Area = 42.570 ac Runoff Volume = 11.256 af Average Runoff Depth = 3.17"
100.00% Pervious = 42.570 ac 0.00% Impervious = 0.000 ac

Proposed Condition (DP2)

ODOT Zone V 100-Year Duration=62 min, Inten=3.81 in/hr

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Summary for Subcatchment DEV2.1: DEV2.1 (to Channel & Pond C)

Runoff = 79.84 cfs @ 1.03 hrs, Volume= 10.199 af, Depth= 3.24"
 Routed to Reach C1 : Channel to Pond C

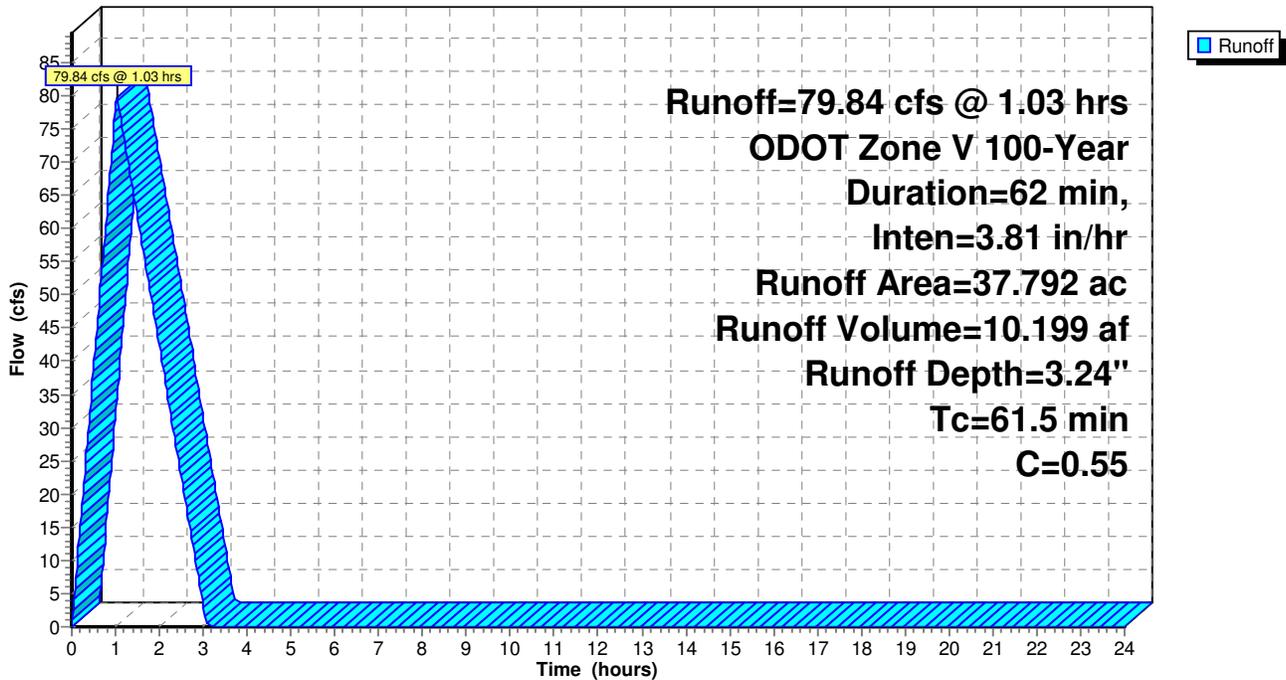
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 ODOT Zone V 100-Year Duration=62 min, Inten=3.81 in/hr

Area (ac)	C	Description
37.792	0.55	Residential Rural Estate
37.792		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
61.5					Direct Entry,

Subcatchment DEV2.1: DEV2.1 (to Channel & Pond C)

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 100-Year Duration=62 min, Inten=3.81 in/hr

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Summary for Subcatchment DEV2.2: DEV2.2 (Bypass)

Runoff = 10.09 cfs @ 0.47 hrs, Volume= 1.057 af, Depth= 2.66"
 Routed to Link DP2 : DP2 (Ex. 36" CMP)

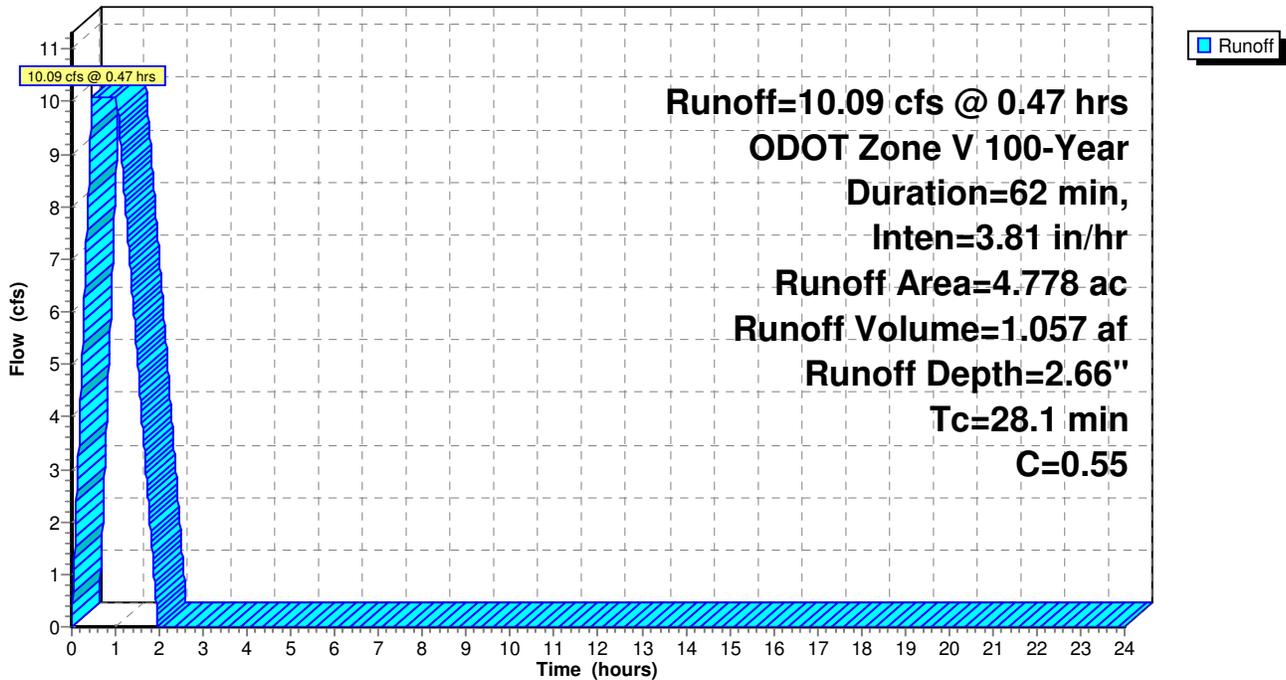
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 ODOT Zone V 100-Year Duration=62 min, Inten=3.81 in/hr

Area (ac)	C	Description
4.778	0.55	
4.778		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
28.1					Direct Entry,

Subcatchment DEV2.2: DEV2.2 (Bypass)

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 100-Year Duration=62 min, Inten=3.81 in/hr

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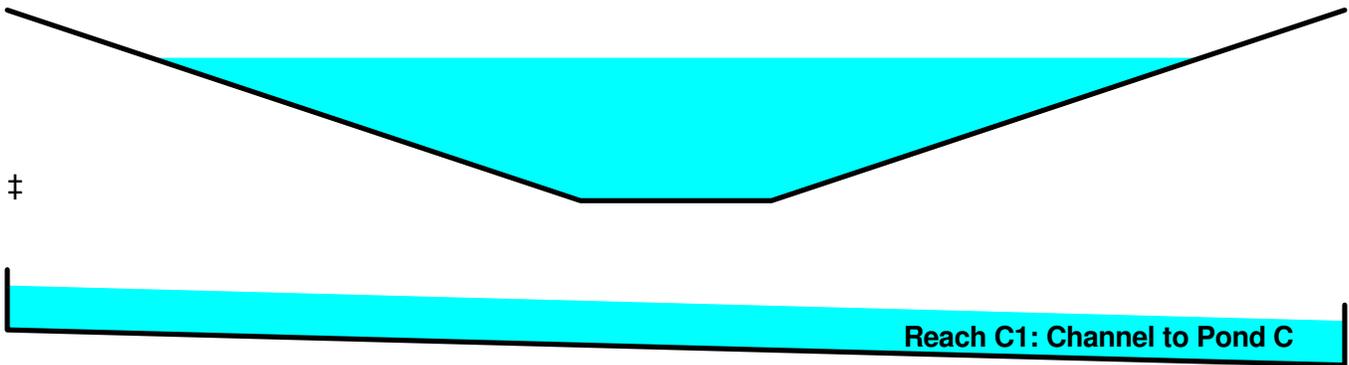
Summary for Reach C1: Channel to Pond C

Inflow Area = 37.792 ac, 0.00% Impervious, Inflow Depth = 3.24" for 100-Year event
 Inflow = 79.84 cfs @ 1.03 hrs, Volume= 10.199 af
 Outflow = 79.18 cfs @ 1.08 hrs, Volume= 10.199 af, Atten= 1%, Lag= 2.7 min
 Routed to Pond P3 : Pond C

Routing by Stor-Ind+Trans method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Max. Velocity= 2.71 fps, Min. Travel Time= 1.5 min
 Avg. Velocity = 1.26 fps, Avg. Travel Time= 3.3 min

Peak Storage= 7,261 cf @ 1.05 hrs
 Average Depth at Peak Storage= 2.25' , Surface Width= 21.99'
 Bank-Full Depth= 3.00' Flow Area= 48.0 sf, Capacity= 154.08 cfs

4.00' x 3.00' deep channel, n= 0.055
 Side Slope Z-value= 4.0 '/' Top Width= 28.00'
 Length= 248.5' Slope= 0.0071 '/'
 Inlet Invert= 1,200.30', Outlet Invert= 1,198.53'



Proposed Condition (DP2)

ODOT Zone V 100-Year Duration=62 min, Inten=3.81 in/hr

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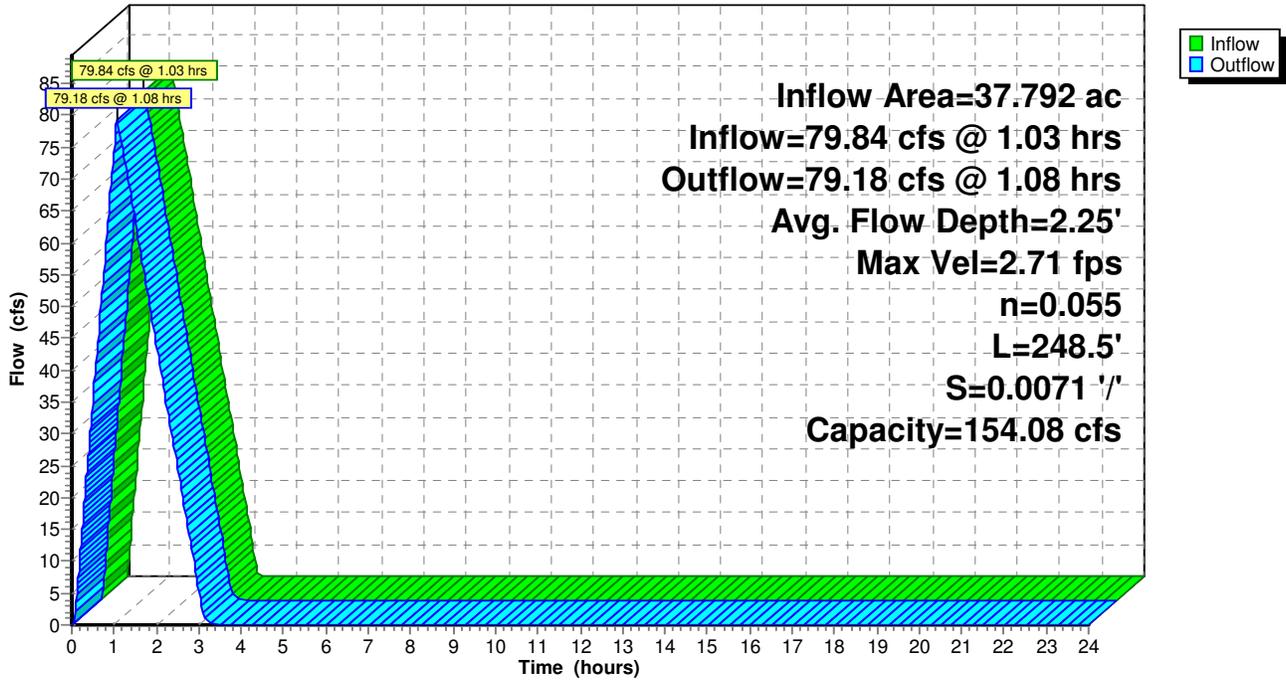
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Reach C1: Channel to Pond C

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 100-Year Duration=62 min, Inten=3.81 in/hr

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Summary for Pond P3: Pond C

Inflow Area = 37.792 ac, 0.00% Impervious, Inflow Depth = 3.24" for 100-Year event
 Inflow = 79.18 cfs @ 1.08 hrs, Volume= 10.199 af
 Outflow = 54.68 cfs @ 1.73 hrs, Volume= 10.199 af, Atten= 31%, Lag= 38.9 min
 Primary = 54.68 cfs @ 1.73 hrs, Volume= 10.199 af
 Routed to Link DP2 : DP2 (Ex. 36" CMP)

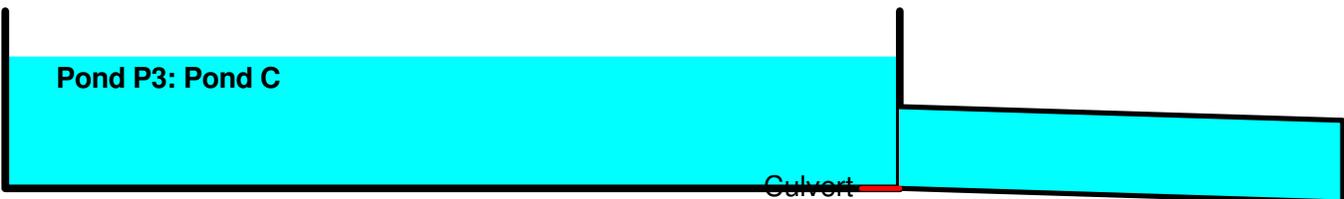
Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,197.32' @ 1.73 hrs Surf.Area= 35,732 sf Storage= 106,970 cf

Plug-Flow detention time= 26.6 min calculated for 10.199 af (100% of inflow)
 Center-of-Mass det. time= 26.6 min (112.1 - 85.5)

Volume	Invert	Avail.Storage	Storage Description
#1	1,192.50'	172,219 cf	Custom Stage Data (Prismatic) Listed below (Recalc)
Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,192.50	0	0	0
1,193.00	2,742	686	686
1,194.00	17,519	10,131	10,816
1,195.00	27,813	22,666	33,482
1,196.00	31,167	29,490	62,972
1,197.00	34,614	32,891	95,863
1,198.00	38,155	36,385	132,247
1,199.00	41,788	39,972	172,219

Device	Routing	Invert	Outlet Devices
#1	Primary	1,192.50'	36.0" Round Culvert L= 57.1' RCP, mitered to conform to fill, Ke= 0.700 Inlet / Outlet Invert= 1,192.50' / 1,192.00' S= 0.0088 '/ Cc= 0.900 n= 0.012, Flow Area= 7.07 sf

Primary OutFlow Max=54.68 cfs @ 1.73 hrs HW=1,197.32' (Free Discharge)
 ↑=Culvert (Inlet Controls 54.68 cfs @ 7.74 fps)



Proposed Condition (DP2)

ODOT Zone V 100-Year Duration=62 min, Inten=3.81 in/hr

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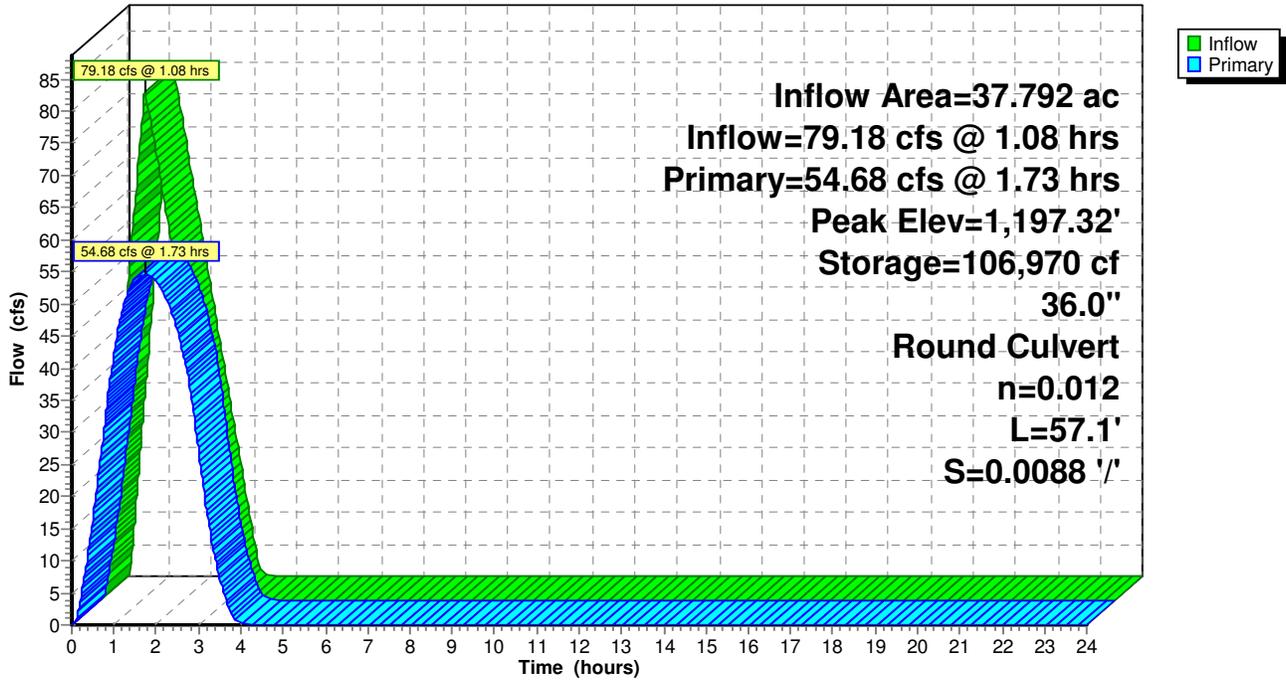
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Pond P3: Pond C

Hydrograph



Proposed Condition (DP2)

ODOT Zone V 100-Year Duration=62 min, Inten=3.81 in/hr

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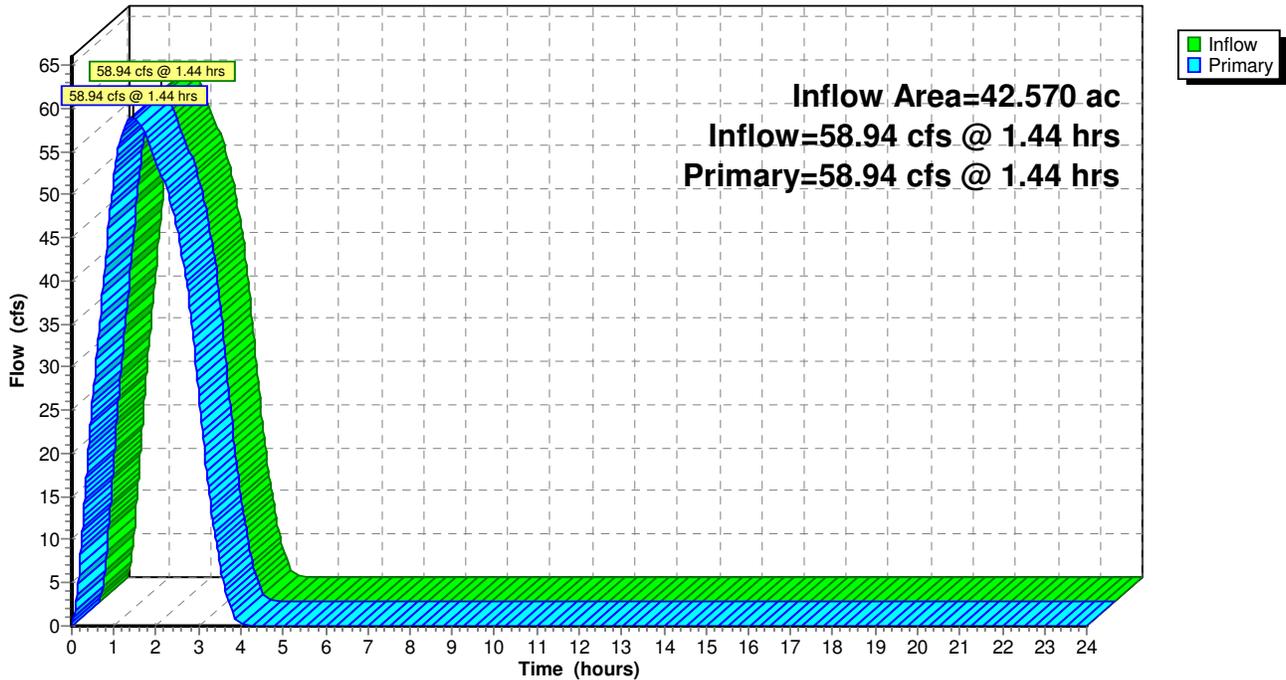
Summary for Link DP2: DP2 (Ex. 36" CMP)

Inflow Area = 42.570 ac, 0.00% Impervious, Inflow Depth = 3.17" for 100-Year event
Inflow = 58.94 cfs @ 1.44 hrs, Volume= 11.256 af
Primary = 58.94 cfs @ 1.44 hrs, Volume= 11.256 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP2: DP2 (Ex. 36" CMP)

Hydrograph



Proposed Condition (DP2)

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Events for Subcatchment DEV2.1: DEV2.1 (to Channel & Pond C)

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-Year	1.64	33.32	4.256	1.35
5-Year	2.21	44.76	5.718	1.82
10-Year	2.55	51.75	6.611	2.10
25-Year	3.11	63.03	8.052	2.56
50-Year	3.47	70.48	9.004	2.86
100-Year	3.94	79.84	10.199	3.24

Proposed Condition (DP2)

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Events for Subcatchment DEV2.2: DEV2.2 (Bypass)

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-Year	1.64	4.21	0.441	1.11
5-Year	2.21	5.66	0.593	1.49
10-Year	2.55	6.54	0.685	1.72
25-Year	3.11	7.97	0.835	2.10
50-Year	3.47	8.91	0.933	2.34
100-Year	3.94	10.09	1.057	2.66

Proposed Condition (DP2)

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Events for Reach C1: Channel to Pond C

Event	Inflow (cfs)	Outflow (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Year	33.32	32.97	1,201.82	3,788
5-Year	44.76	44.34	1,202.04	4,717
10-Year	51.75	51.28	1,202.15	5,255
25-Year	63.03	62.48	1,202.32	6,087
50-Year	70.48	69.89	1,202.43	6,616
100-Year	79.84	79.18	1,202.55	7,261

Proposed Condition (DP2)

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Events for Pond P3: Pond C

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Year	32.97	26.72	1,194.92	31,414
5-Year	44.34	35.17	1,195.43	45,779
10-Year	51.28	39.77	1,195.75	55,394
25-Year	62.48	46.07	1,196.35	74,201
50-Year	69.89	50.01	1,196.77	88,095
100-Year	79.18	54.68	1,197.32	106,970

MAX. DEVELOPED 100-YR WSEL FOR
 SECTION 3 DEVELOPMENT

Proposed Condition (DP2)

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Events for Link DP2: DP2 (Ex. 36" CMP)

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)
2-Year	29.11	29.11	0.00
5-Year	38.24	38.24	0.00
10-Year	43.29	43.29	0.00
25-Year	49.91	49.91	0.00
50-Year	54.05	54.05	0.00
100-Year	58.94	58.94	0.00

MAX. DEVELOPED DISCHARGE AT DP2 FOR
SECTION 3 CONSTRUCTION

WEIGHTED 'C' VALUE : TIME OF CONCENTRATION : RUNOFF CALCULATIONS

Project Name: **Brentwood Section 3**

Project No.: **25.004**

Notes:

Overland Flow: $T_c = K(L^{0.37}/S^{0.20})$ | Rainfall Intensity = $I = a/((T_c+b)^c)$

Channel Flow: $T_c = K(L^{0.77}/S^{0.385})$ | Min. Tc: **5** min.

Drainage Basin ID: **DEV3.1 (to Channel A & Pond C)**

DRAINAGE AREA AND WEIGHTED 'C' VALUE

Area (Acres)	'C'		C x A	Calculation Notes:
40.493	0.55	Residential Rural Estate	22.271	
	0.00	-	0.000	
	0.00	-	0.000	
	0.00	-	0.000	
TOTAL AREA: 40.493				
Total: C x A 22.271				
Weighted "C": 0.550				

TIME OF CONCENTRATION (Tc)

Flow Type	L (ft)	Surface Type	K	Start Elevation	End Elevation	Slope (ft/ft)	Tc (min)
Overland 1	281	Average Grass	1	1224.70	1218.90	0.021	17.5
Overland 2		-	0			0.000	0.0
Overland 3		-	0			0.000	0.0
Overland 4		-	0			0.000	0.0
Channelized 1	2307	\-/Ditch	0.012	1215.90	1209.30	0.003	44.5
Channelized 2	88	\-/Ditch	0.012	1208.20	1207.70	0.006	2.8
Channelized 3	177	\-/Ditch	0.012	1207.70	1206.30	0.008	4.2
Channelized 4		-	0			0.000	0.0
	L (ft)	Avg. Velocity (fps)					
Pipe 1							0.0
Pipe 2							0.0
Pipe 3							0.0
Pipe 4							0.0
TOTAL Tc:							68.9

RAINFALL INTENSITY & PEAK FLOW

Town of Goldsby (ODOT Zone V)				Rainfall Intensity (in/hr)	Run-Off Q=CIA (cfs)
Storm Frequency	Parameters for the IDF Equation				
	a	b	c		
50% (2-Year)	53	10	0.82	1.47	32.8
20 % (5-Year)	64	12	0.79	1.99	44.3
10% (10-Year)	74	12	0.79	2.30	51.3
4% (25-Year)	93	15	0.79	2.81	62.6
2 % (50-Year)	104	15	0.79	3.14	70.0
1% (100-Year)	108	15	0.77	3.57	79.4

WEIGHTED 'C' VALUE : TIME OF CONCENTRATION : RUNOFF CALCULATIONS

Project Name: **Brentwood Section 3**

Project No.: **25.004**

Notes:

Overland Flow: $Tc=K(L^{0.37}/S^{0.20})$ | Rainfall Intensity = $I = a/((Tc+b)^c)$

Channel Flow: $Tc=K(L^{0.77}/S^{0.385})$ | Min. Tc: **5** min.

Drainage Basin ID: **DEV3.2 (Bypass to DP3)**

DRAINAGE AREA AND WEIGHTED 'C' VALUE

Area (Acres)	'C'		C x A	Calculation Notes:
2.031	0.55	Residential Rural Estate	1.117	
	0.00	-	0.000	
	0.00	-	0.000	
	0.00	-	0.000	
TOTAL AREA: 2.031				
Total: C x A 1.117				
Weighted "C": 0.550				

TIME OF CONCENTRATION (Tc)

Flow Type	L (ft)	Surface Type	K	Start Elevation	End Elevation	Slope (ft/ft)	Tc (min)
Overland 1	300	Average Grass	1	1213.40	1206.90	0.022	17.8
Overland 2		-	0			0.000	0.0
Overland 3		-	0			0.000	0.0
Overland 4		-	0			0.000	0.0
Channelized 1	441	Meandering stream with pools	0.0102	1206.90	1196.50	0.024	4.7
Channelized 2		-	0			0.000	0.0
Channelized 3		-	0			0.000	0.0
Channelized 4		-	0			0.000	0.0
	L (ft)	Avg. Velocity (fps)					
Pipe 1							0.0
Pipe 2							0.0
Pipe 3							0.0
Pipe 4							0.0
TOTAL Tc:							22.4

RAINFALL INTENSITY & PEAK FLOW

Town of Goldsby (ODOT Zone V)				Rainfall Intensity (in/hr)	Run-Off Q=CIA (cfs)
Storm Frequency	Parameters for the IDF Equation				
	a	b	c		
50% (2-Year)	53	10	0.82	3.06	3.4
20 % (5-Year)	64	12	0.79	3.91	4.4
10% (10-Year)	74	12	0.79	4.52	5.0
4% (25-Year)	93	15	0.79	5.31	5.9
2 % (50-Year)	104	15	0.79	5.94	6.6
1% (100-Year)	108	15	0.77	6.64	7.4

Proposed Condition (DP3)

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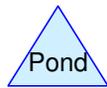
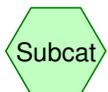
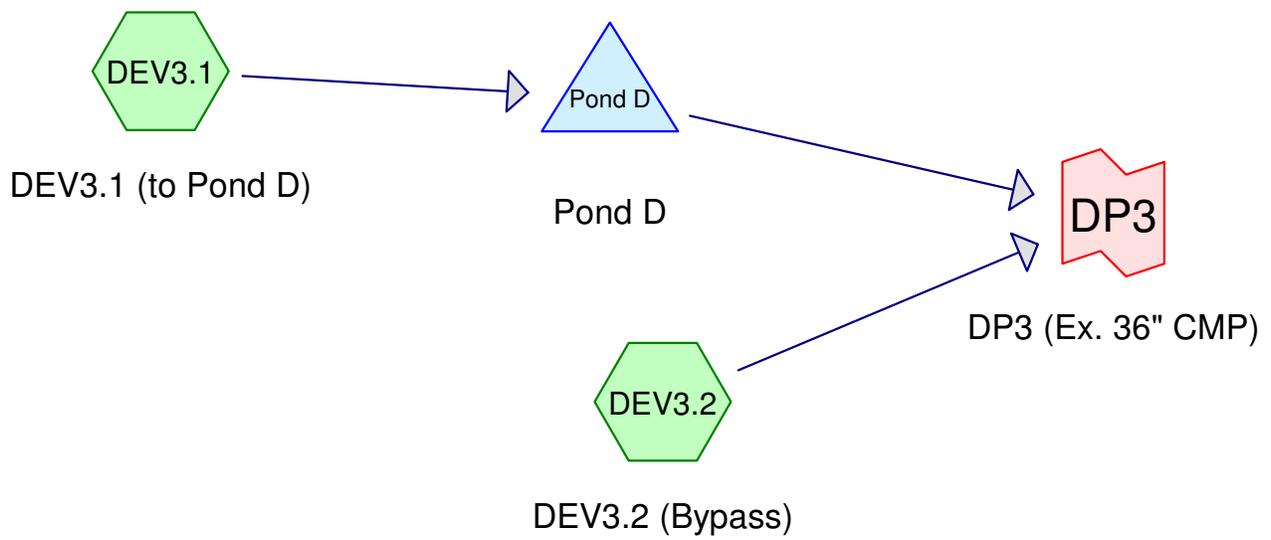
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41 Pond Pond D: Pond D

42 Link DP3: DP3 (Ex. 36" CMP)



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Area Listing (all nodes)

Area (acres)	C	Description (subcatchment-numbers)
42.524	0.55	(DEV3.1, DEV3.2)
42.524	0.55	TOTAL AREA

Proposed Condition (DP3)

ODOT Zone V 2-Year Duration=69 min, Inten=1.47 in/hr

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points

Runoff by Rational method, Rise/Fall=1.0/2.0 xTc

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DEV3.1: DEV3.1 (to Pond D) Runoff Area=40.493 ac 0.00% Impervious Runoff Depth=1.40"
Tc=68.9 min C=0.55 Runoff=33.08 cfs 4.714 af

Subcatchment DEV3.2: DEV3.2 (Bypass) Runoff Area=2.031 ac 0.00% Impervious Runoff Depth=1.08"
Tc=22.4 min C=0.55 Runoff=1.66 cfs 0.183 af

Pond Pond D: Pond D Peak Elev=1,201.59' Storage=63,943 cf Inflow=33.08 cfs 4.714 af
Outflow=19.36 cfs 4.714 af

Link DP3: DP3 (Ex. 36" CMP) Inflow=19.36 cfs 4.897 af
Primary=19.36 cfs 4.897 af

Total Runoff Area = 42.524 ac Runoff Volume = 4.897 af Average Runoff Depth = 1.38"
100.00% Pervious = 42.524 ac 0.00% Impervious = 0.000 ac

Proposed Condition (DP3)

ODOT Zone V 2-Year Duration=69 min, Inten=1.47 in/hr

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Summary for Subcatchment DEV3.1: DEV3.1 (to Pond D)

Runoff = 33.08 cfs @ 1.15 hrs, Volume= 4.714 af, Depth= 1.40"
 Routed to Pond Pond D : Pond D

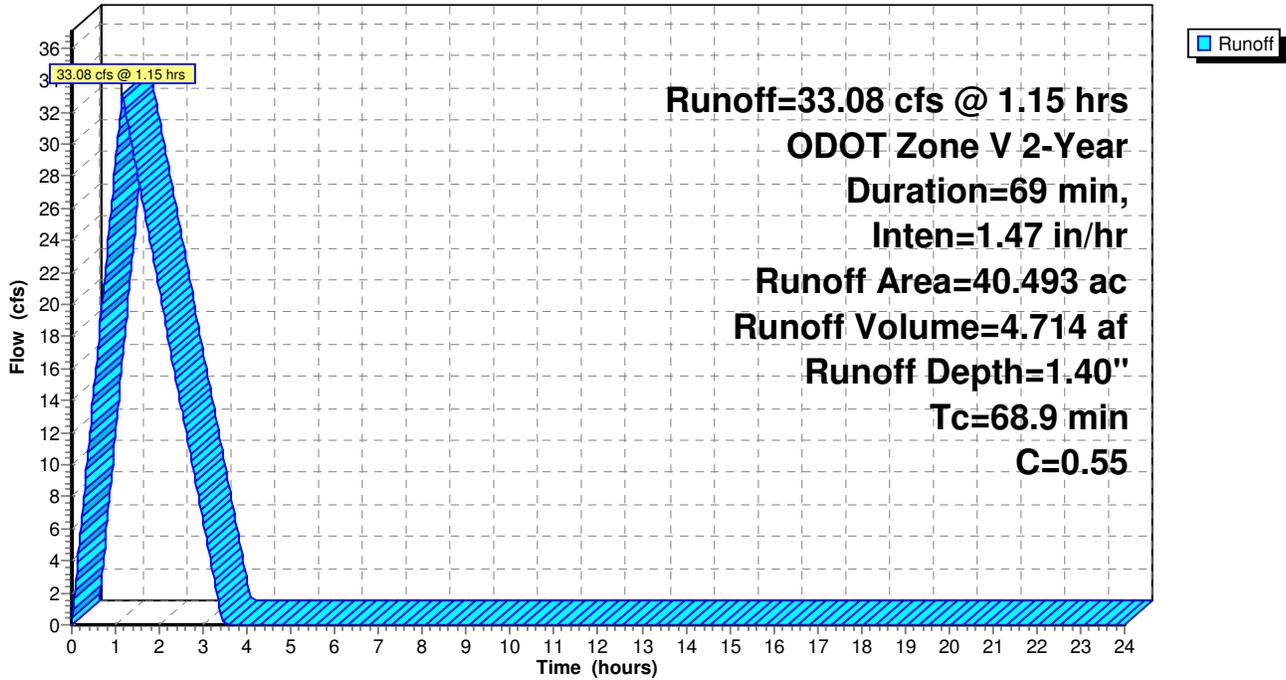
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 ODOT Zone V 2-Year Duration=69 min, Inten=1.47 in/hr

Area (ac)	C	Description
40.493	0.55	
40.493	0.55	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
68.9					Direct Entry,

Subcatchment DEV3.1: DEV3.1 (to Pond D)

Hydrograph



Proposed Condition (DP3)

ODOT Zone V 2-Year Duration=69 min, Inten=1.47 in/hr

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Summary for Subcatchment DEV3.2: DEV3.2 (Bypass)

Runoff = 1.66 cfs @ 0.38 hrs, Volume= 0.183 af, Depth= 1.08"
 Routed to Link DP3 : DP3 (Ex. 36" CMP)

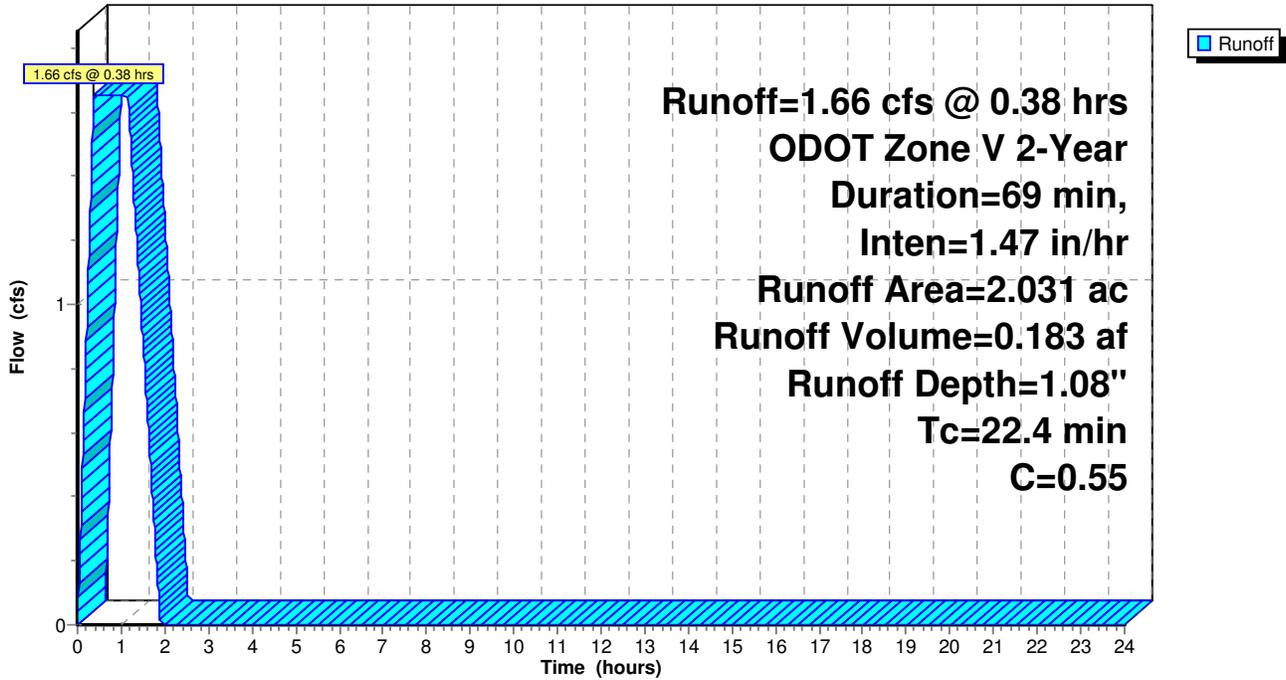
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 ODOT Zone V 2-Year Duration=69 min, Inten=1.47 in/hr

Area (ac)	C	Description
2.031	0.55	
2.031	0.55	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.4					Direct Entry,

Subcatchment DEV3.2: DEV3.2 (Bypass)

Hydrograph



Proposed Condition (DP3)

ODOT Zone V 2-Year Duration=69 min, Inten=1.47 in/hr

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Summary for Pond Pond D: Pond D

[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 40.493 ac, 0.00% Impervious, Inflow Depth = 1.40" for 2-Year event
 Inflow = 33.08 cfs @ 1.15 hrs, Volume= 4.714 af
 Outflow = 19.36 cfs @ 2.10 hrs, Volume= 4.714 af, Atten= 41%, Lag= 57.1 min
 Primary = 19.36 cfs @ 2.10 hrs, Volume= 4.714 af
 Routed to Link DP3 : DP3 (Ex. 36" CMP)

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,201.59' @ 2.10 hrs Surf.Area= 27,868 sf Storage= 63,943 cf

Plug-Flow detention time= 42.2 min calculated for 4.714 af (100% of inflow)
 Center-of-Mass det. time= 42.2 min (134.1 - 91.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,198.00'	219,532 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,198.00	0	0	0
1,198.50	4,600	1,150	1,150
1,199.00	11,002	3,901	5,051
1,199.50	20,203	7,801	12,852
1,200.00	22,906	10,777	23,629
1,201.00	25,988	24,447	48,076
1,202.00	29,179	27,584	75,660
1,203.00	32,479	30,829	106,489
1,204.00	35,887	34,183	140,672
1,205.00	39,403	37,645	178,317
1,206.00	43,028	41,216	219,532

Device	Routing	Invert	Outlet Devices
#1	Primary	1,197.82'	30.0" Round Culvert L= 86.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,197.82' / 1,197.39' S= 0.0050 '/' Cc= 0.900 n= 0.012, Flow Area= 4.91 sf
#2	Device 1	1,197.92'	21.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,202.00'	14.0" Vert. Orifice/Grate X 2.00 C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=19.36 cfs @ 2.10 hrs HW=1,201.59' (Free Discharge)

- ↑ **1=Culvert** (Passes 19.36 cfs of 34.79 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 19.36 cfs @ 8.05 fps)
- ↑ **3=Orifice/Grate** (Controls 0.00 cfs)

Proposed Condition (DP3)

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25.004 Brentwood Section 3

ODOT Zone V 2-Year Duration=69 min, Inten=1.47 in/hr

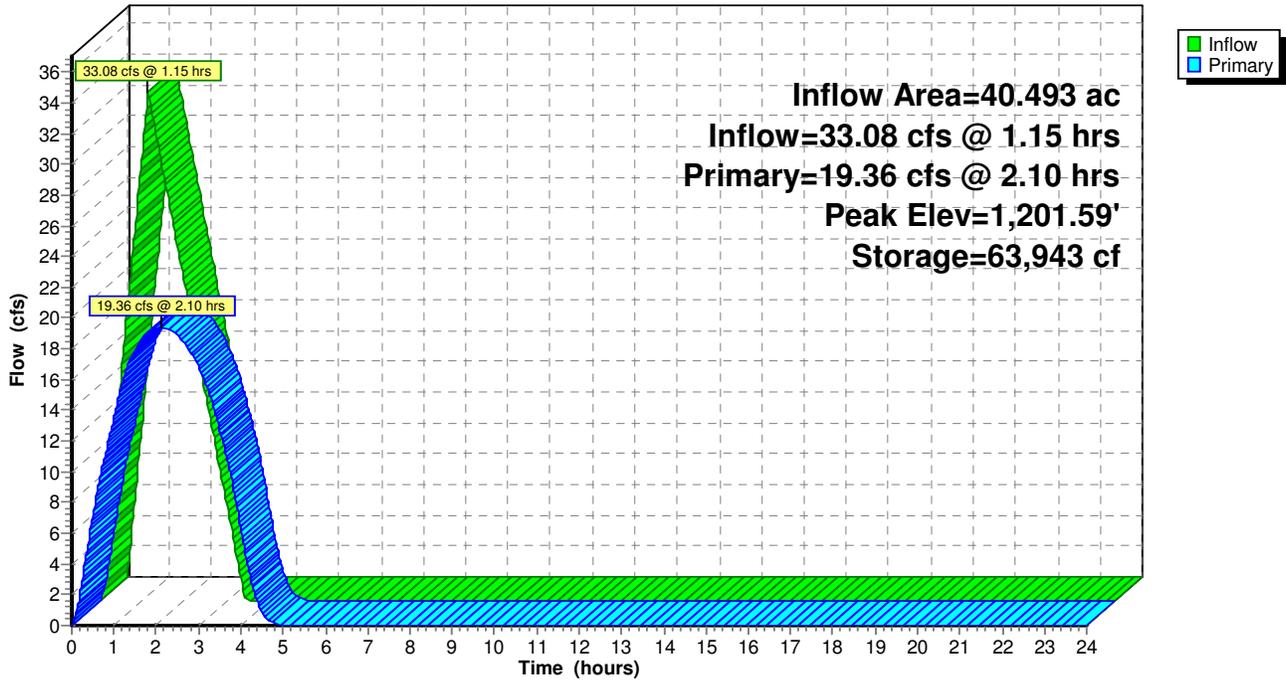
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Pond Pond D: Pond D

Hydrograph



Proposed Condition (DP3)

ODOT Zone V 2-Year Duration=69 min, Inten=1.47 in/hr

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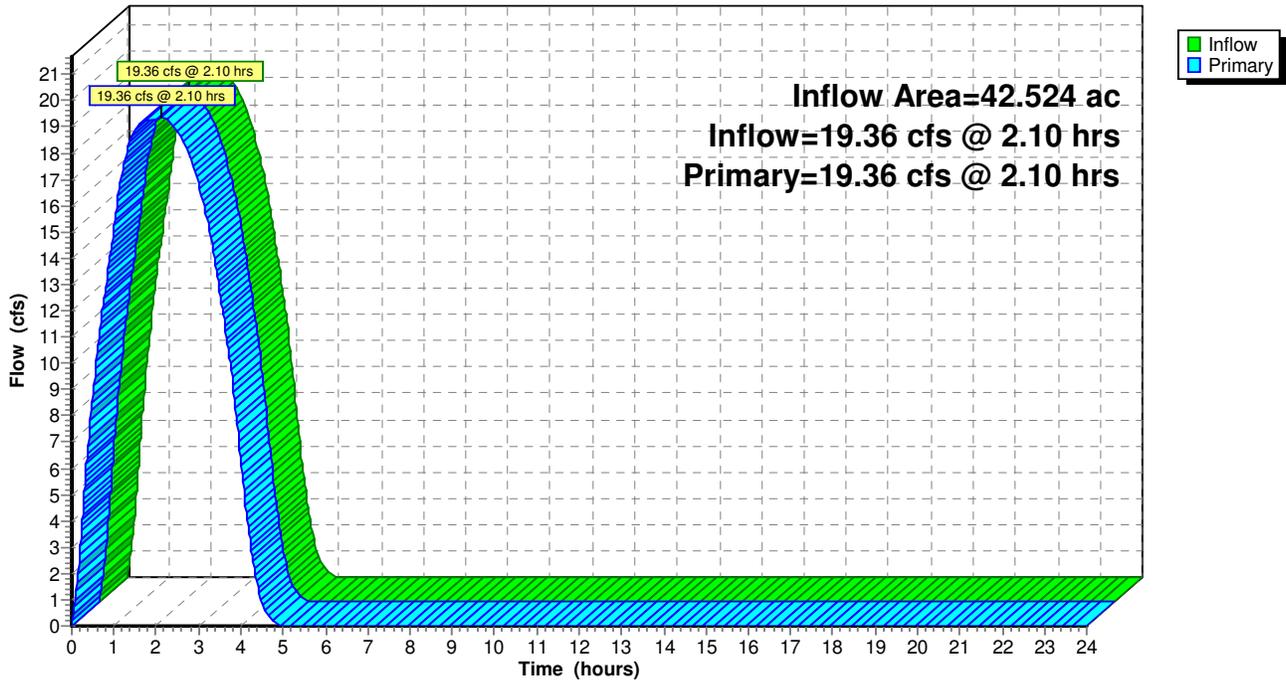
Summary for Link DP3: DP3 (Ex. 36" CMP)

Inflow Area = 42.524 ac, 0.00% Impervious, Inflow Depth = 1.38" for 2-Year event
Inflow = 19.36 cfs @ 2.10 hrs, Volume= 4.897 af
Primary = 19.36 cfs @ 2.10 hrs, Volume= 4.897 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP3: DP3 (Ex. 36" CMP)

Hydrograph



Proposed Condition (DP3)

ODOT Zone V 5-Year Duration=69 min, Inten=1.99 in/hr

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points

Runoff by Rational method, Rise/Fall=1.0/2.0 xTc

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DEV3.1: DEV3.1 (to Pond D) Runoff Area=40.493 ac 0.00% Impervious Runoff Depth=1.89"
Tc=68.9 min C=0.55 Runoff=44.65 cfs 6.362 af

Subcatchment DEV3.2: DEV3.2 (Bypass) Runoff Area=2.031 ac 0.00% Impervious Runoff Depth=1.46"
Tc=22.4 min C=0.55 Runoff=2.24 cfs 0.247 af

Pond Pond D: Pond D Peak Elev=1,202.68' Storage=96,316 cf Inflow=44.65 cfs 6.362 af
Outflow=26.48 cfs 6.362 af

Link DP3: DP3 (Ex. 36" CMP) Inflow=26.48 cfs 6.610 af
Primary=26.48 cfs 6.610 af

Total Runoff Area = 42.524 ac Runoff Volume = 6.610 af Average Runoff Depth = 1.87"
100.00% Pervious = 42.524 ac 0.00% Impervious = 0.000 ac

Proposed Condition (DP3)

ODOT Zone V 5-Year Duration=69 min, Inten=1.99 in/hr

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Summary for Subcatchment DEV3.1: DEV3.1 (to Pond D)

Runoff = 44.65 cfs @ 1.15 hrs, Volume= 6.362 af, Depth= 1.89"
 Routed to Pond D : Pond D

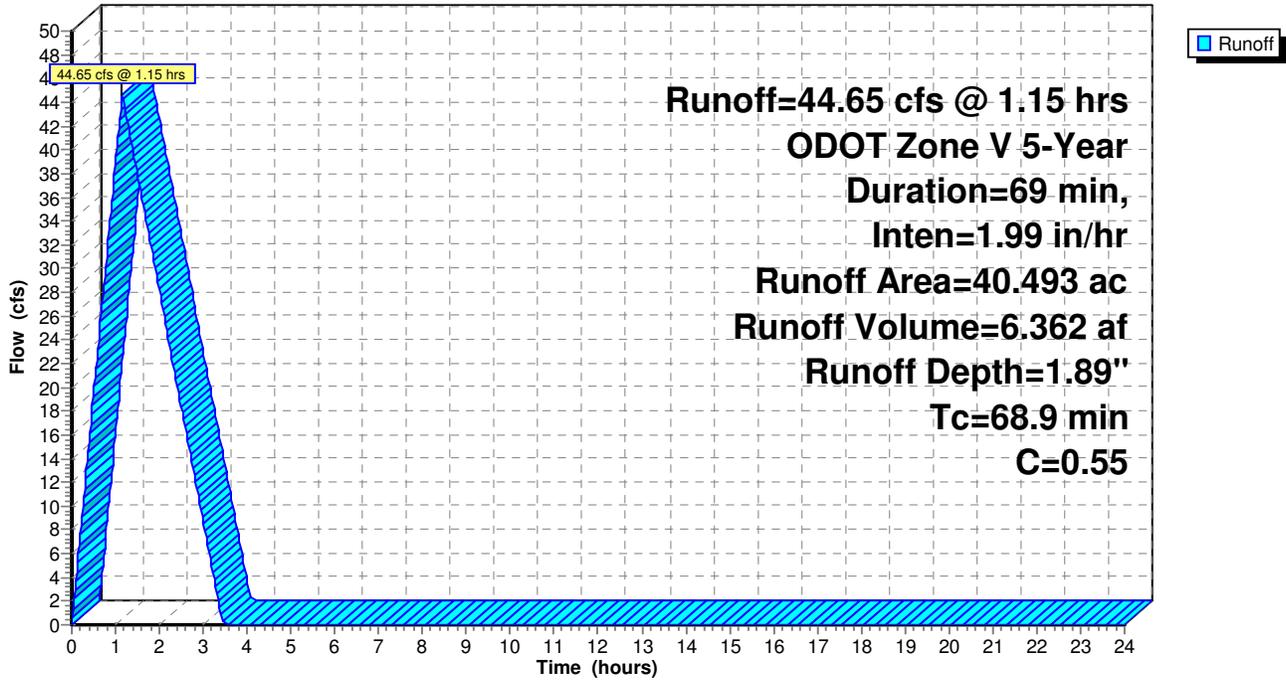
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 ODOT Zone V 5-Year Duration=69 min, Inten=1.99 in/hr

Area (ac)	C	Description
40.493	0.55	
40.493	0.55	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
68.9					Direct Entry,

Subcatchment DEV3.1: DEV3.1 (to Pond D)

Hydrograph



Proposed Condition (DP3)

ODOT Zone V 5-Year Duration=69 min, Inten=1.99 in/hr

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Summary for Subcatchment DEV3.2: DEV3.2 (Bypass)

Runoff = 2.24 cfs @ 0.38 hrs, Volume= 0.247 af, Depth= 1.46"
 Routed to Link DP3 : DP3 (Ex. 36" CMP)

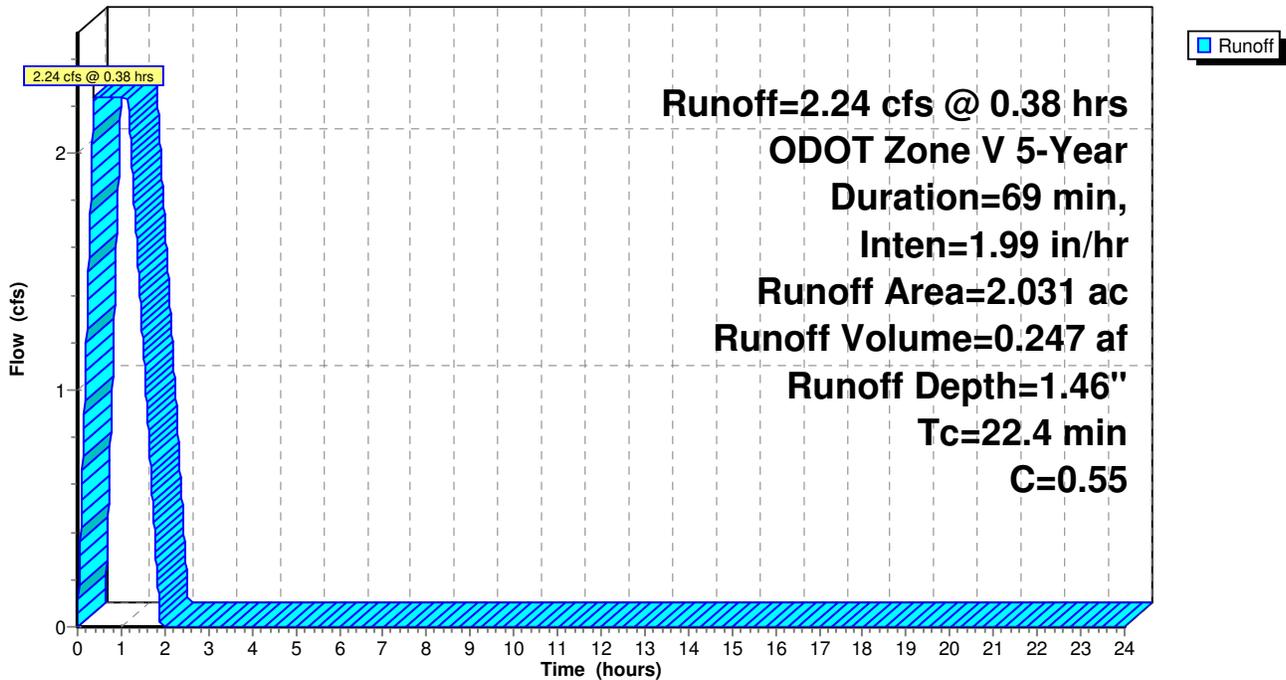
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 ODOT Zone V 5-Year Duration=69 min, Inten=1.99 in/hr

Area (ac)	C	Description
2.031	0.55	
2.031	0.55	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.4					Direct Entry,

Subcatchment DEV3.2: DEV3.2 (Bypass)

Hydrograph



Proposed Condition (DP3)

ODOT Zone V 5-Year Duration=69 min, Inten=1.99 in/hr

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Summary for Pond Pond D: Pond D

[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 40.493 ac, 0.00% Impervious, Inflow Depth = 1.89" for 5-Year event
 Inflow = 44.65 cfs @ 1.15 hrs, Volume= 6.362 af
 Outflow = 26.48 cfs @ 2.08 hrs, Volume= 6.362 af, Atten= 41%, Lag= 56.0 min
 Primary = 26.48 cfs @ 2.08 hrs, Volume= 6.362 af
 Routed to Link DP3 : DP3 (Ex. 36" CMP)

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,202.68' @ 2.08 hrs Surf.Area= 31,428 sf Storage= 96,316 cf

Plug-Flow detention time= 50.7 min calculated for 6.360 af (100% of inflow)
 Center-of-Mass det. time= 50.7 min (142.7 - 91.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,198.00'	219,532 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,198.00	0	0	0
1,198.50	4,600	1,150	1,150
1,199.00	11,002	3,901	5,051
1,199.50	20,203	7,801	12,852
1,200.00	22,906	10,777	23,629
1,201.00	25,988	24,447	48,076
1,202.00	29,179	27,584	75,660
1,203.00	32,479	30,829	106,489
1,204.00	35,887	34,183	140,672
1,205.00	39,403	37,645	178,317
1,206.00	43,028	41,216	219,532

Device	Routing	Invert	Outlet Devices
#1	Primary	1,197.82'	30.0" Round Culvert L= 86.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,197.82' / 1,197.39' S= 0.0050 '/ Cc= 0.900 n= 0.012, Flow Area= 4.91 sf
#2	Device 1	1,197.92'	21.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,202.00'	14.0" Vert. Orifice/Grate X 2.00 C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=26.48 cfs @ 2.08 hrs HW=1,202.68' (Free Discharge)

- 1=Culvert (Passes 26.48 cfs of 44.59 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 22.83 cfs @ 9.49 fps)
- 3=Orifice/Grate (Orifice Controls 3.65 cfs @ 2.81 fps)

Proposed Condition (DP3)

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25.004 Brentwood Section 3

ODOT Zone V 5-Year Duration=69 min, Inten=1.99 in/hr

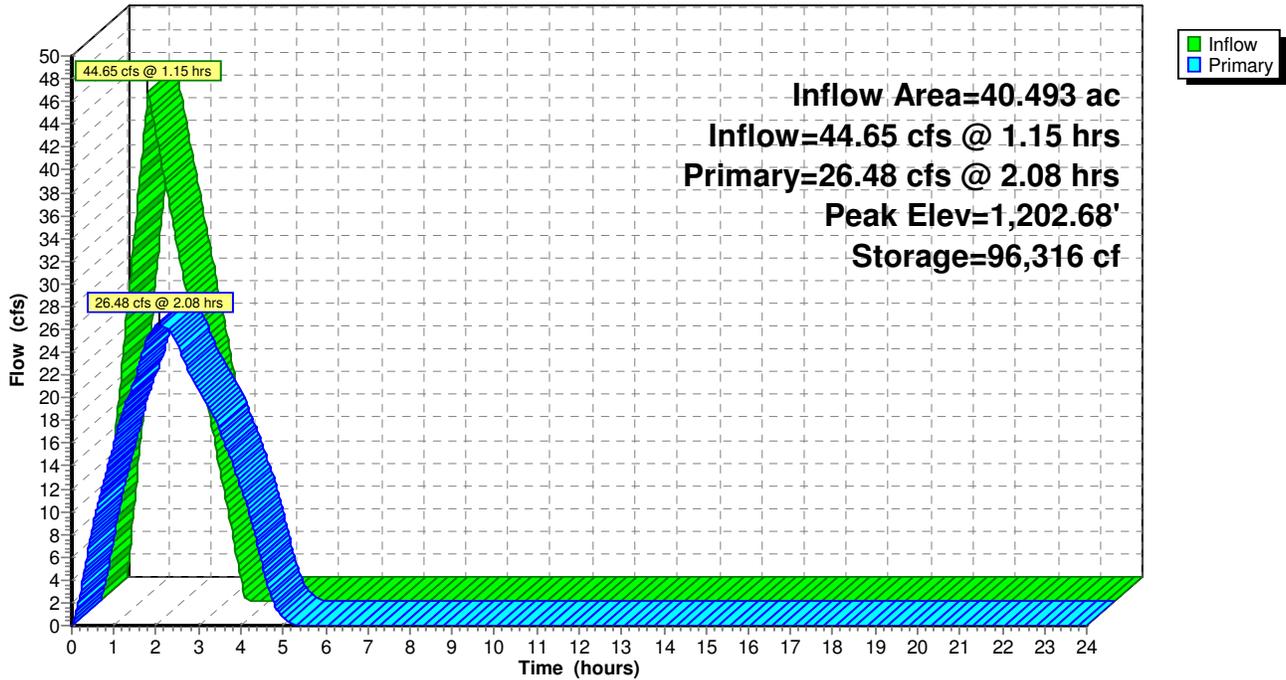
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Pond D: Pond D

Hydrograph



Proposed Condition (DP3)

ODOT Zone V 5-Year Duration=69 min, Inten=1.99 in/hr

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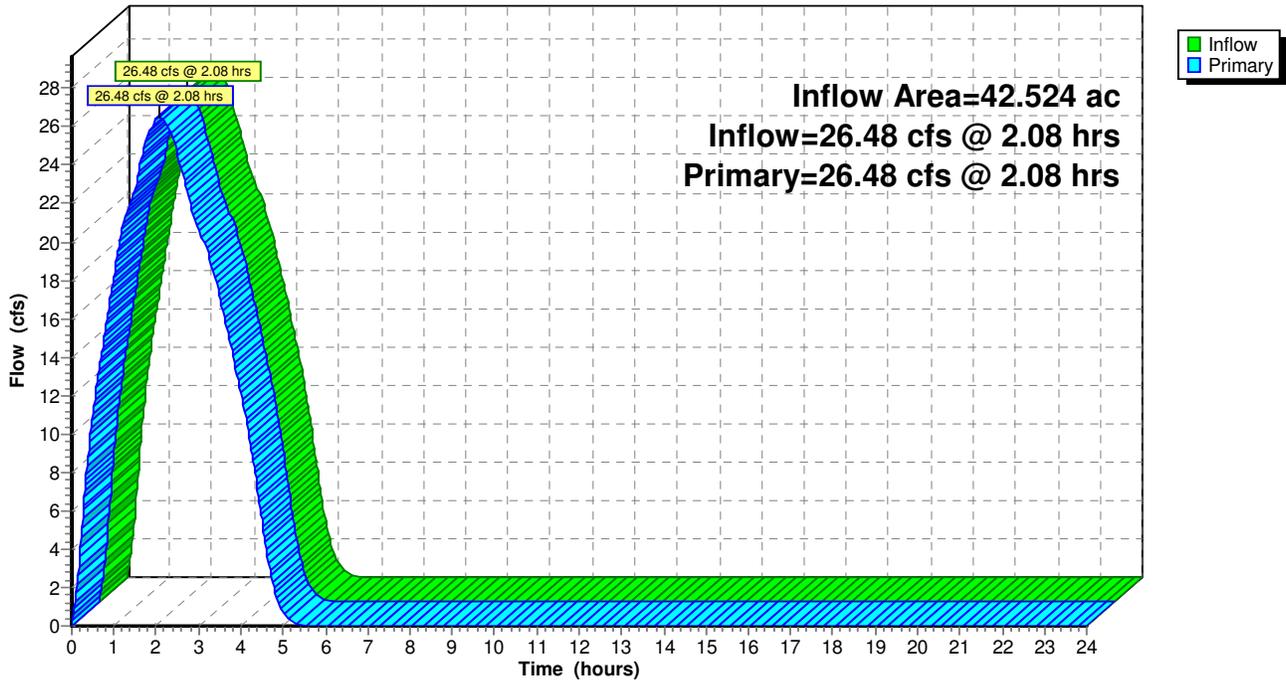
Summary for Link DP3: DP3 (Ex. 36" CMP)

Inflow Area = 42.524 ac, 0.00% Impervious, Inflow Depth = 1.87" for 5-Year event
Inflow = 26.48 cfs @ 2.08 hrs, Volume= 6.610 af
Primary = 26.48 cfs @ 2.08 hrs, Volume= 6.610 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP3: DP3 (Ex. 36" CMP)

Hydrograph



Proposed Condition (DP3)

ODOT Zone V 10-Year Duration=69 min, Inten=2.30 in/hr

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points

Runoff by Rational method, Rise/Fall=1.0/2.0 xTc

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DEV3.1: DEV3.1 (to Pond D) Runoff Area=40.493 ac 0.00% Impervious Runoff Depth=2.18"
Tc=68.9 min C=0.55 Runoff=51.63 cfs 7.356 af

Subcatchment DEV3.2: DEV3.2 (Bypass) Runoff Area=2.031 ac 0.00% Impervious Runoff Depth=1.69"
Tc=22.4 min C=0.55 Runoff=2.59 cfs 0.286 af

Pond Pond D: Pond D Peak Elev=1,203.14' Storage=110,956 cf Inflow=51.63 cfs 7.356 af
Outflow=31.83 cfs 7.356 af

Link DP3: DP3 (Ex. 36" CMP) Inflow=31.83 cfs 7.643 af
Primary=31.83 cfs 7.643 af

Total Runoff Area = 42.524 ac Runoff Volume = 7.643 af Average Runoff Depth = 2.16"
100.00% Pervious = 42.524 ac 0.00% Impervious = 0.000 ac

Proposed Condition (DP3)

ODOT Zone V 10-Year Duration=69 min, Inten=2.30 in/hr

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Summary for Subcatchment DEV3.1: DEV3.1 (to Pond D)

Runoff = 51.63 cfs @ 1.15 hrs, Volume= 7.356 af, Depth= 2.18"
 Routed to Pond D : Pond D

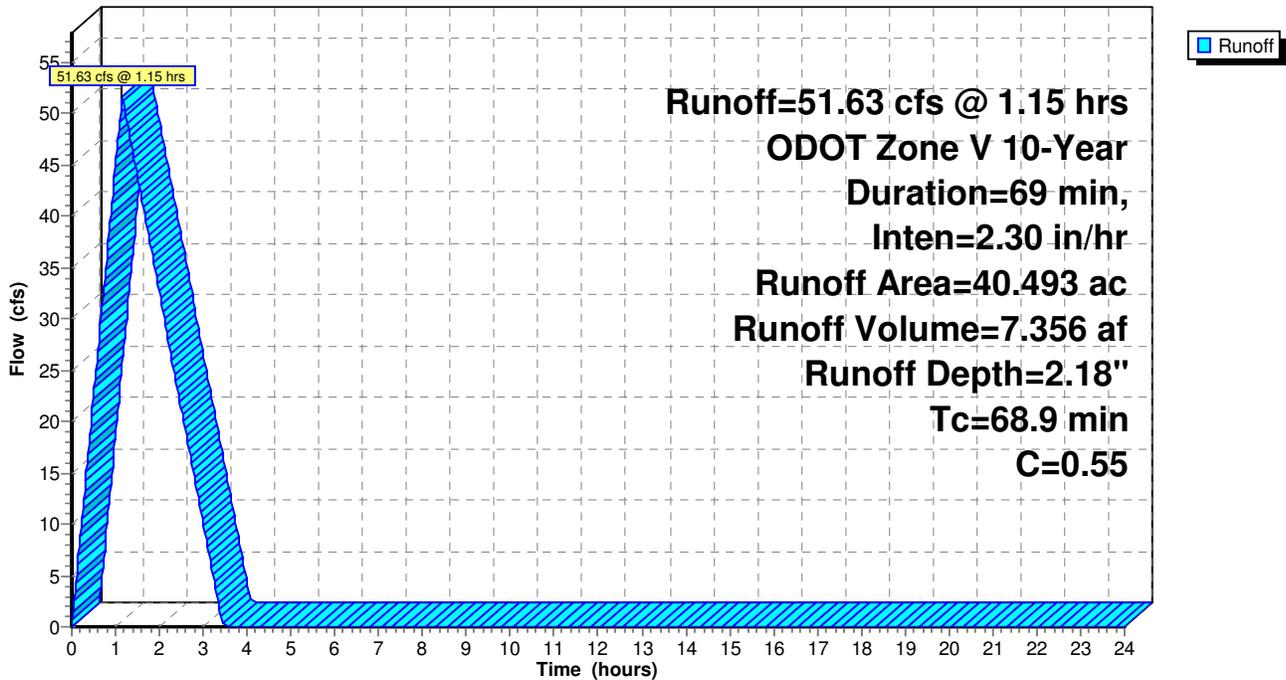
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 ODOT Zone V 10-Year Duration=69 min, Inten=2.30 in/hr

Area (ac)	C	Description
40.493	0.55	
40.493	0.55	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
68.9					Direct Entry,

Subcatchment DEV3.1: DEV3.1 (to Pond D)

Hydrograph



Proposed Condition (DP3)

ODOT Zone V 10-Year Duration=69 min, Inten=2.30 in/hr

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Summary for Subcatchment DEV3.2: DEV3.2 (Bypass)

Runoff = 2.59 cfs @ 0.38 hrs, Volume= 0.286 af, Depth= 1.69"
 Routed to Link DP3 : DP3 (Ex. 36" CMP)

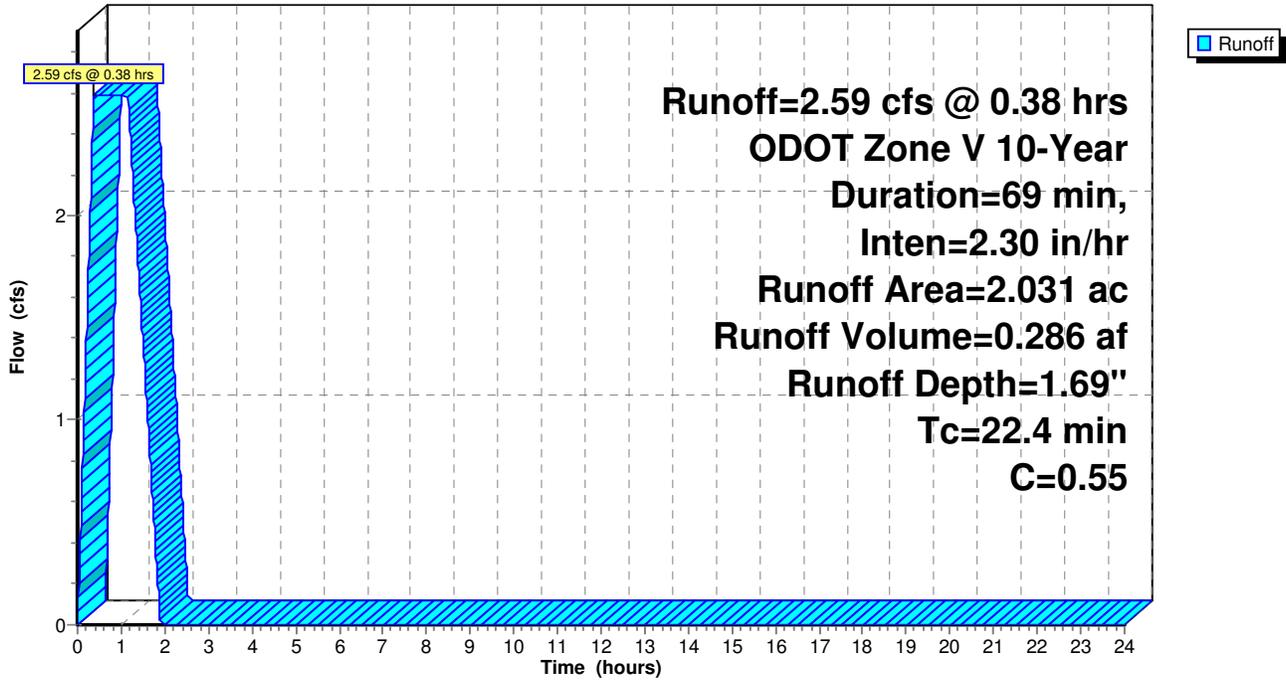
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 ODOT Zone V 10-Year Duration=69 min, Inten=2.30 in/hr

Area (ac)	C	Description
2.031	0.55	
2.031	0.55	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.4					Direct Entry,

Subcatchment DEV3.2: DEV3.2 (Bypass)

Hydrograph



Proposed Condition (DP3)

ODOT Zone V 10-Year Duration=69 min, Inten=2.30 in/hr

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Summary for Pond Pond D: Pond D

[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 40.493 ac, 0.00% Impervious, Inflow Depth = 2.18" for 10-Year event
 Inflow = 51.63 cfs @ 1.15 hrs, Volume= 7.356 af
 Outflow = 31.83 cfs @ 2.03 hrs, Volume= 7.356 af, Atten= 38%, Lag= 52.8 min
 Primary = 31.83 cfs @ 2.03 hrs, Volume= 7.356 af
 Routed to Link DP3 : DP3 (Ex. 36" CMP)

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,203.14' @ 2.03 hrs Surf.Area= 32,944 sf Storage= 110,956 cf

Plug-Flow detention time= 51.5 min calculated for 7.353 af (100% of inflow)
 Center-of-Mass det. time= 51.5 min (143.4 - 91.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,198.00'	219,532 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,198.00	0	0	0
1,198.50	4,600	1,150	1,150
1,199.00	11,002	3,901	5,051
1,199.50	20,203	7,801	12,852
1,200.00	22,906	10,777	23,629
1,201.00	25,988	24,447	48,076
1,202.00	29,179	27,584	75,660
1,203.00	32,479	30,829	106,489
1,204.00	35,887	34,183	140,672
1,205.00	39,403	37,645	178,317
1,206.00	43,028	41,216	219,532

Device	Routing	Invert	Outlet Devices
#1	Primary	1,197.82'	30.0" Round Culvert L= 86.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,197.82' / 1,197.39' S= 0.0050 '/ Cc= 0.900 n= 0.012, Flow Area= 4.91 sf
#2	Device 1	1,197.92'	21.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,202.00'	14.0" Vert. Orifice/Grate X 2.00 C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=31.84 cfs @ 2.03 hrs HW=1,203.14' (Free Discharge)

- 1=Culvert (Passes 31.84 cfs of 47.66 cfs potential flow)
- 2=Orifice/Grate (Orifice Controls 24.13 cfs @ 10.03 fps)
- 3=Orifice/Grate (Orifice Controls 7.71 cfs @ 3.63 fps)

Proposed Condition (DP3)

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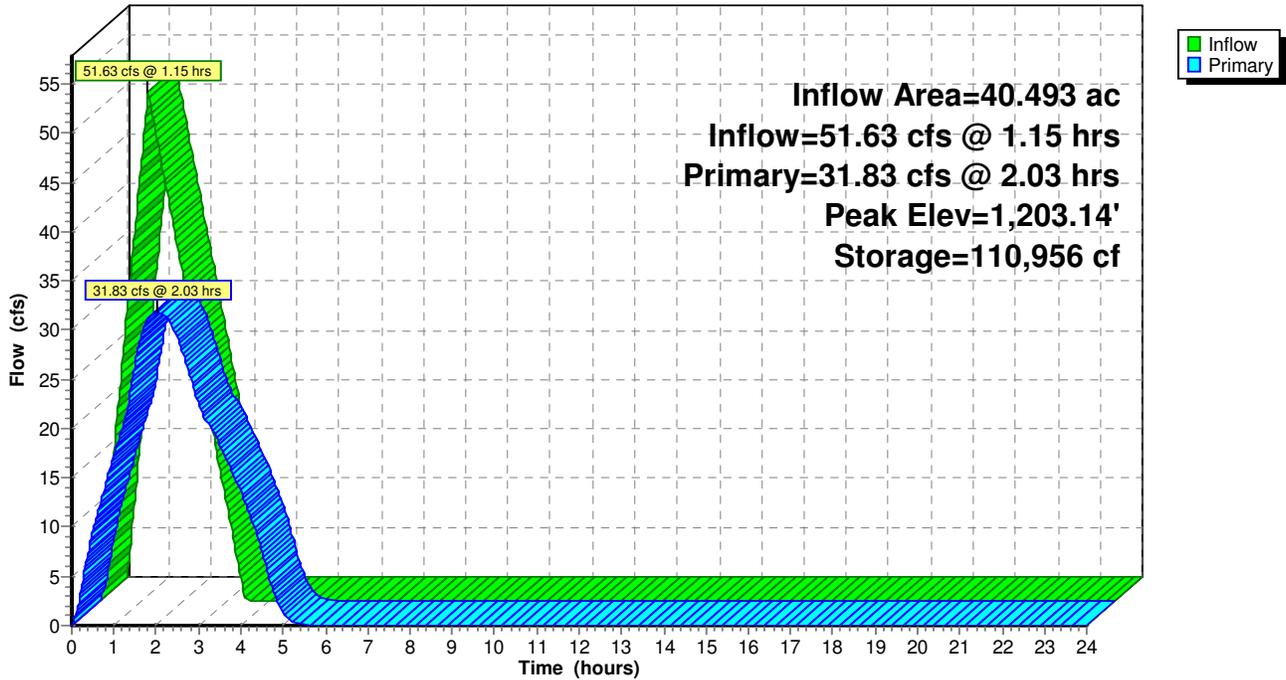
25.004 Brentwood Section 3
ODOT Zone V 10-Year Duration=69 min, Inten=2.30 in/hr

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Pond Pond D: Pond D

Hydrograph



Proposed Condition (DP3)

ODOT Zone V 10-Year Duration=69 min, Inten=2.30 in/hr

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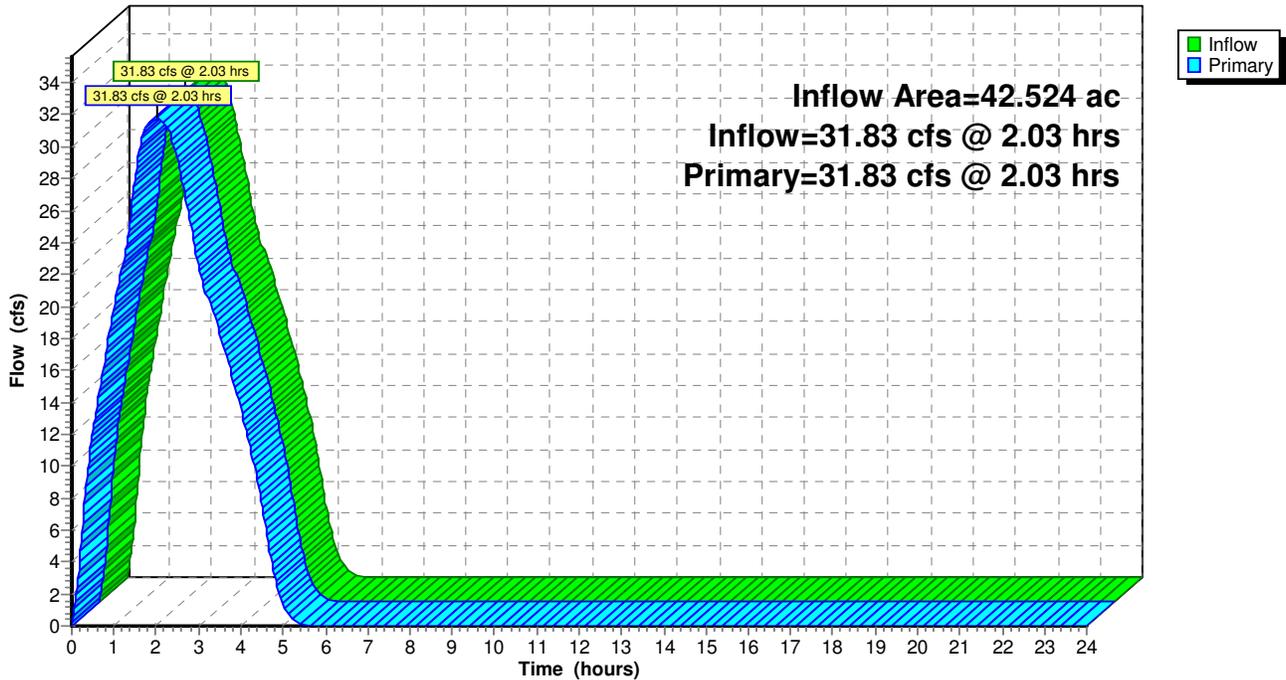
Summary for Link DP3: DP3 (Ex. 36" CMP)

Inflow Area = 42.524 ac, 0.00% Impervious, Inflow Depth = 2.16" for 10-Year event
Inflow = 31.83 cfs @ 2.03 hrs, Volume= 7.643 af
Primary = 31.83 cfs @ 2.03 hrs, Volume= 7.643 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP3: DP3 (Ex. 36" CMP)

Hydrograph



Proposed Condition (DP3)

ODOT Zone V 25-Year Duration=69 min, Inten=2.81 in/hr

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points

Runoff by Rational method, Rise/Fall=1.0/2.0 xTc

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DEV3.1: DEV3.1 (to Pond D) Runoff Area=40.493 ac 0.00% Impervious Runoff Depth=2.66"
Tc=68.9 min C=0.55 Runoff=63.05 cfs 8.983 af

Subcatchment DEV3.2: DEV3.2 (Bypass) Runoff Area=2.031 ac 0.00% Impervious Runoff Depth=2.06"
Tc=22.4 min C=0.55 Runoff=3.16 cfs 0.349 af

Pond Pond D: Pond D Peak Elev=1,203.92' Storage=137,860 cf Inflow=63.05 cfs 8.983 af
Outflow=38.13 cfs 8.983 af

Link DP3: DP3 (Ex. 36" CMP) Inflow=38.13 cfs 9.333 af
Primary=38.13 cfs 9.333 af

Total Runoff Area = 42.524 ac Runoff Volume = 9.333 af Average Runoff Depth = 2.63"
100.00% Pervious = 42.524 ac 0.00% Impervious = 0.000 ac

Proposed Condition (DP3)

ODOT Zone V 25-Year Duration=69 min, Inten=2.81 in/hr

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Summary for Subcatchment DEV3.1: DEV3.1 (to Pond D)

Runoff = 63.05 cfs @ 1.15 hrs, Volume= 8.983 af, Depth= 2.66"
 Routed to Pond D : Pond D

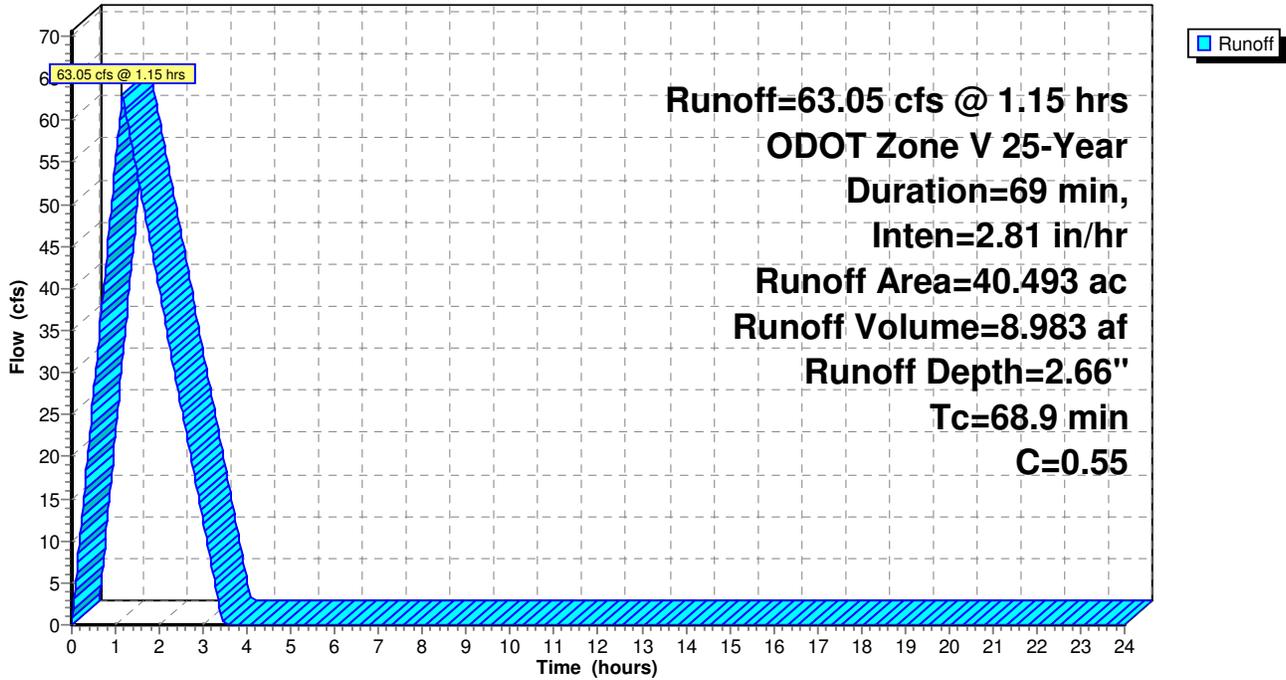
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 ODOT Zone V 25-Year Duration=69 min, Inten=2.81 in/hr

Area (ac)	C	Description
40.493	0.55	
40.493	0.55	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
68.9					Direct Entry,

Subcatchment DEV3.1: DEV3.1 (to Pond D)

Hydrograph



Proposed Condition (DP3)

ODOT Zone V 25-Year Duration=69 min, Inten=2.81 in/hr

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Summary for Subcatchment DEV3.2: DEV3.2 (Bypass)

Runoff = 3.16 cfs @ 0.38 hrs, Volume= 0.349 af, Depth= 2.06"
 Routed to Link DP3 : DP3 (Ex. 36" CMP)

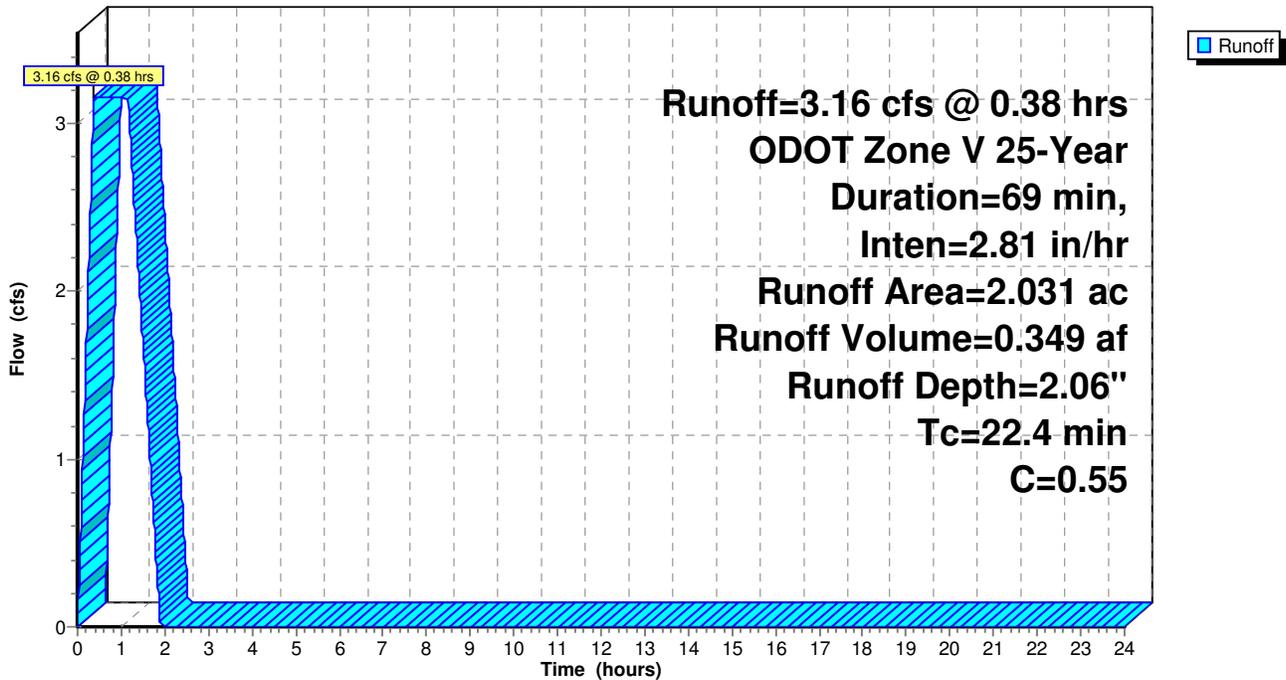
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 ODOT Zone V 25-Year Duration=69 min, Inten=2.81 in/hr

Area (ac)	C	Description
2.031	0.55	
2.031	0.55	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.4					Direct Entry,

Subcatchment DEV3.2: DEV3.2 (Bypass)

Hydrograph



Proposed Condition (DP3)

ODOT Zone V 25-Year Duration=69 min, Inten=2.81 in/hr

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Summary for Pond D: Pond D

[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 40.493 ac, 0.00% Impervious, Inflow Depth = 2.66" for 25-Year event
 Inflow = 63.05 cfs @ 1.15 hrs, Volume= 8.983 af
 Outflow = 38.13 cfs @ 2.06 hrs, Volume= 8.983 af, Atten= 40%, Lag= 54.4 min
 Primary = 38.13 cfs @ 2.06 hrs, Volume= 8.983 af
 Routed to Link DP3 : DP3 (Ex. 36" CMP)

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,203.92' @ 2.06 hrs Surf.Area= 35,619 sf Storage= 137,860 cf

Plug-Flow detention time= 53.3 min calculated for 8.983 af (100% of inflow)
 Center-of-Mass det. time= 53.3 min (145.2 - 91.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,198.00'	219,532 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,198.00	0	0	0
1,198.50	4,600	1,150	1,150
1,199.00	11,002	3,901	5,051
1,199.50	20,203	7,801	12,852
1,200.00	22,906	10,777	23,629
1,201.00	25,988	24,447	48,076
1,202.00	29,179	27,584	75,660
1,203.00	32,479	30,829	106,489
1,204.00	35,887	34,183	140,672
1,205.00	39,403	37,645	178,317
1,206.00	43,028	41,216	219,532

Device	Routing	Invert	Outlet Devices
#1	Primary	1,197.82'	30.0" Round Culvert L= 86.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,197.82' / 1,197.39' S= 0.0050 '/ Cc= 0.900 n= 0.012, Flow Area= 4.91 sf
#2	Device 1	1,197.92'	21.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,202.00'	14.0" Vert. Orifice/Grate X 2.00 C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=38.13 cfs @ 2.06 hrs HW=1,203.92' (Free Discharge)

- ↑ **1=Culvert** (Passes 38.13 cfs of 52.06 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 26.22 cfs @ 10.90 fps)
- ↑ **3=Orifice/Grate** (Orifice Controls 11.91 cfs @ 5.57 fps)

Proposed Condition (DP3)

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25.004 Brentwood Section 3

ODOT Zone V 25-Year Duration=69 min, Inten=2.81 in/hr

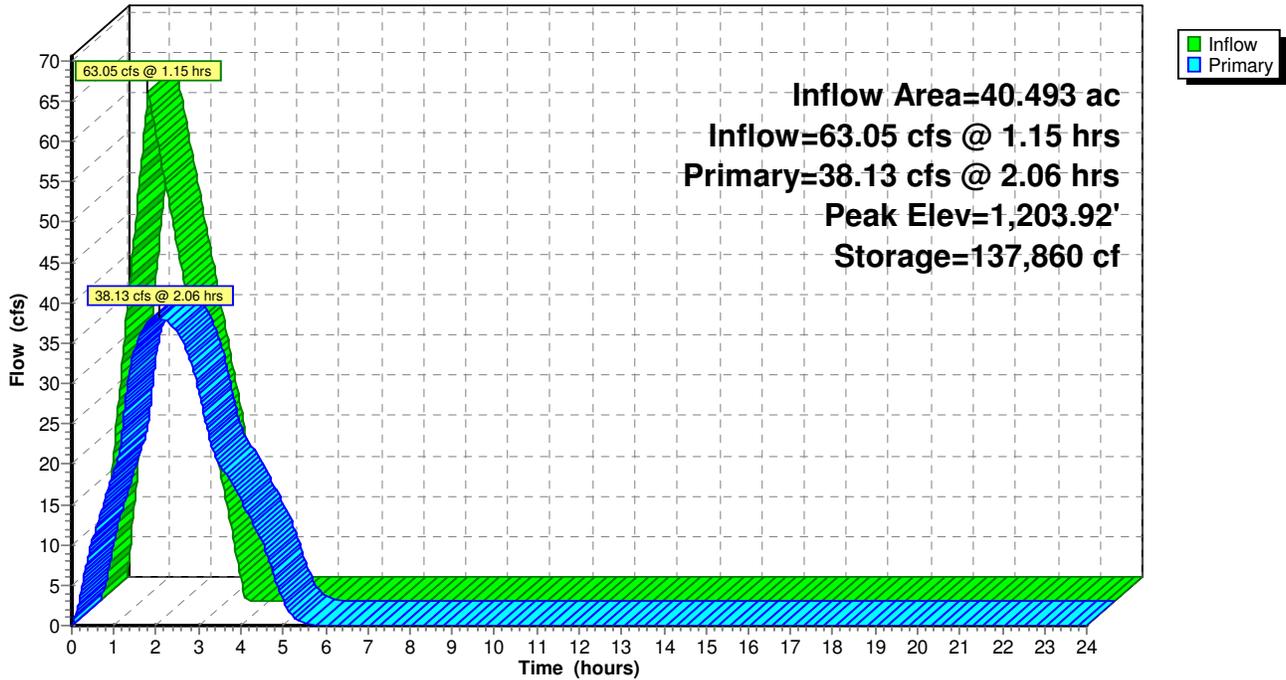
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Pond D: Pond D

Hydrograph



Proposed Condition (DP3)

ODOT Zone V 25-Year Duration=69 min, Inten=2.81 in/hr

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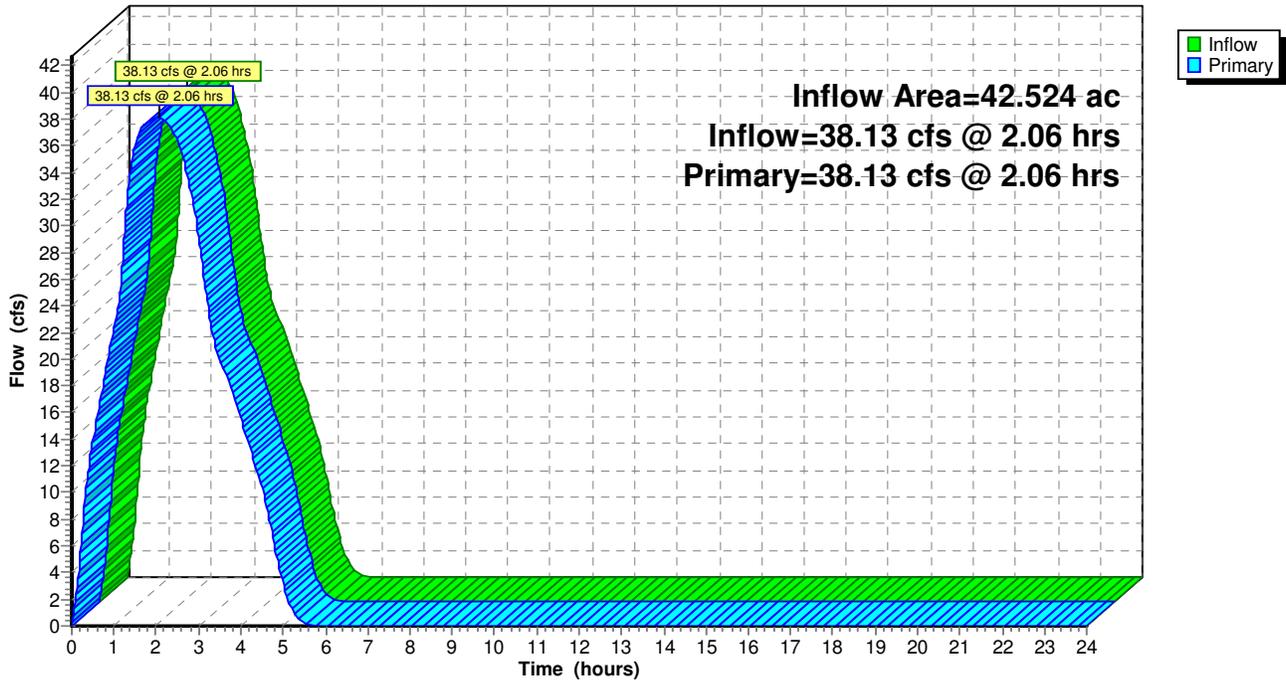
Summary for Link DP3: DP3 (Ex. 36" CMP)

Inflow Area = 42.524 ac, 0.00% Impervious, Inflow Depth = 2.63" for 25-Year event
Inflow = 38.13 cfs @ 2.06 hrs, Volume= 9.333 af
Primary = 38.13 cfs @ 2.06 hrs, Volume= 9.333 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP3: DP3 (Ex. 36" CMP)

Hydrograph



Proposed Condition (DP3)

ODOT Zone V 50-Year Duration=69 min, Inten=3.14 in/hr

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points

Runoff by Rational method, Rise/Fall=1.0/2.0 xTc

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DEV3.1: DEV3.1 (to Pond D) Runoff Area=40.493 ac 0.00% Impervious Runoff Depth=2.98"
Tc=68.9 min C=0.55 Runoff=70.51 cfs 10.046 af

Subcatchment DEV3.2: DEV3.2 (Bypass) Runoff Area=2.031 ac 0.00% Impervious Runoff Depth=2.31"
Tc=22.4 min C=0.55 Runoff=3.54 cfs 0.391 af

Pond Pond D: Pond D Peak Elev=1,204.46' Storage=157,473 cf Inflow=70.51 cfs 10.046 af
Outflow=41.65 cfs 10.046 af

Link DP3: DP3 (Ex. 36" CMP) Inflow=41.65 cfs 10.437 af
Primary=41.65 cfs 10.437 af

Total Runoff Area = 42.524 ac Runoff Volume = 10.437 af Average Runoff Depth = 2.95"
100.00% Pervious = 42.524 ac 0.00% Impervious = 0.000 ac

Proposed Condition (DP3)

ODOT Zone V 50-Year Duration=69 min, Inten=3.14 in/hr

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Summary for Subcatchment DEV3.1: DEV3.1 (to Pond D)

Runoff = 70.51 cfs @ 1.15 hrs, Volume= 10.046 af, Depth= 2.98"
 Routed to Pond D : Pond D

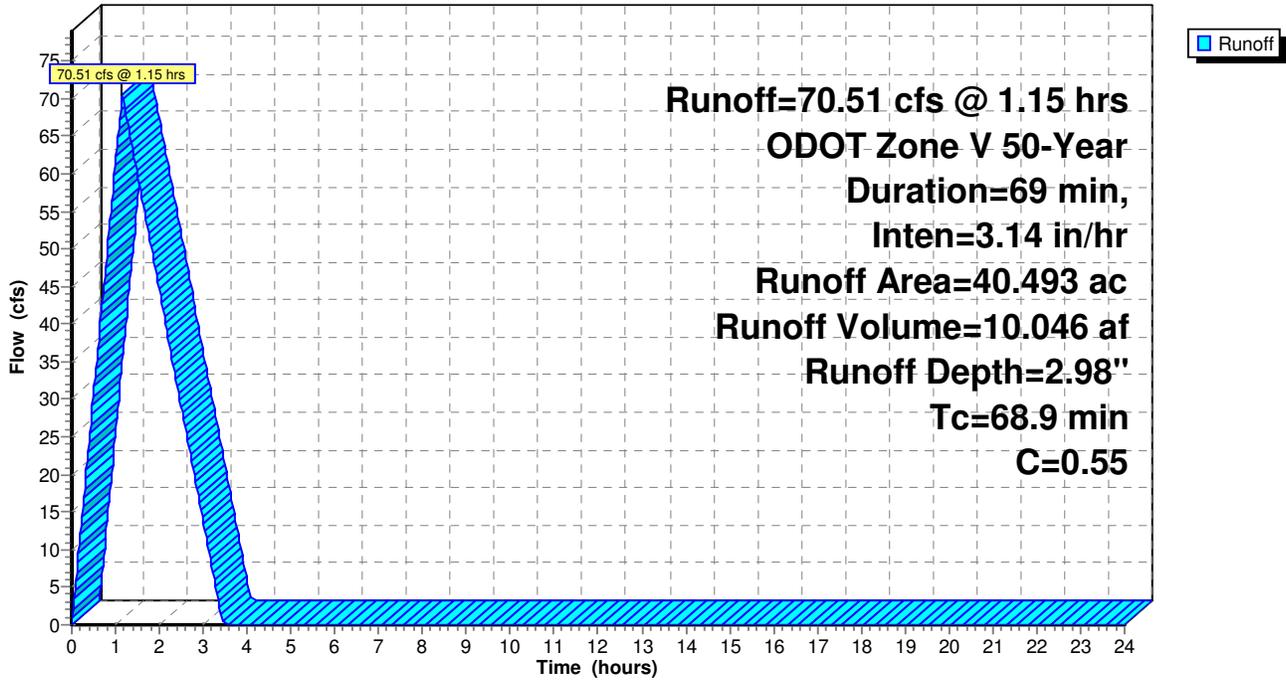
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 ODOT Zone V 50-Year Duration=69 min, Inten=3.14 in/hr

Area (ac)	C	Description
40.493	0.55	
40.493	0.55	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
68.9					Direct Entry,

Subcatchment DEV3.1: DEV3.1 (to Pond D)

Hydrograph



Proposed Condition (DP3)

ODOT Zone V 50-Year Duration=69 min, Inten=3.14 in/hr

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Summary for Subcatchment DEV3.2: DEV3.2 (Bypass)

Runoff = 3.54 cfs @ 0.38 hrs, Volume= 0.391 af, Depth= 2.31"
 Routed to Link DP3 : DP3 (Ex. 36" CMP)

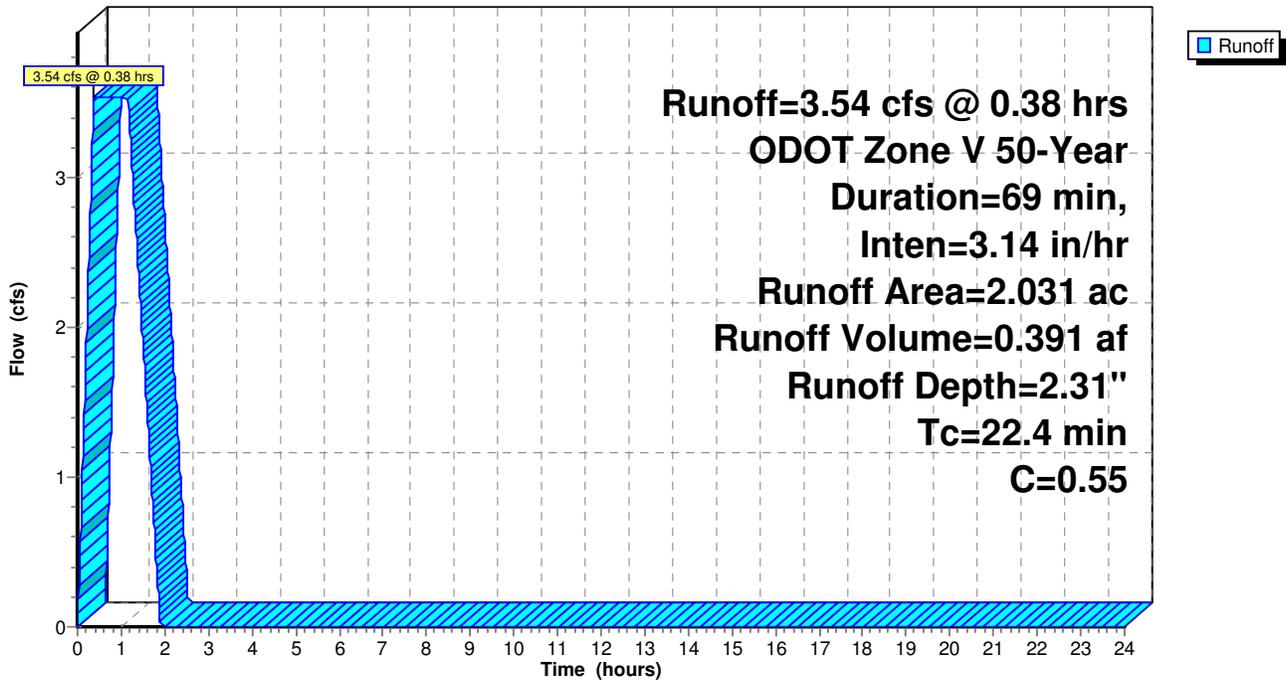
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 ODOT Zone V 50-Year Duration=69 min, Inten=3.14 in/hr

Area (ac)	C	Description
2.031	0.55	
2.031	0.55	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.4					Direct Entry,

Subcatchment DEV3.2: DEV3.2 (Bypass)

Hydrograph



Proposed Condition (DP3)

ODOT Zone V 50-Year Duration=69 min, Inten=3.14 in/hr

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Summary for Pond Pond D: Pond D

[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 40.493 ac, 0.00% Impervious, Inflow Depth = 2.98" for 50-Year event
 Inflow = 70.51 cfs @ 1.15 hrs, Volume= 10.046 af
 Outflow = 41.65 cfs @ 2.09 hrs, Volume= 10.046 af, Atten= 41%, Lag= 56.3 min
 Primary = 41.65 cfs @ 2.09 hrs, Volume= 10.046 af
 Routed to Link DP3 : DP3 (Ex. 36" CMP)

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,204.46' @ 2.09 hrs Surf.Area= 37,497 sf Storage= 157,473 cf

Plug-Flow detention time= 55.1 min calculated for 10.042 af (100% of inflow)
 Center-of-Mass det. time= 55.1 min (147.0 - 91.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,198.00'	219,532 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,198.00	0	0	0
1,198.50	4,600	1,150	1,150
1,199.00	11,002	3,901	5,051
1,199.50	20,203	7,801	12,852
1,200.00	22,906	10,777	23,629
1,201.00	25,988	24,447	48,076
1,202.00	29,179	27,584	75,660
1,203.00	32,479	30,829	106,489
1,204.00	35,887	34,183	140,672
1,205.00	39,403	37,645	178,317
1,206.00	43,028	41,216	219,532

Device	Routing	Invert	Outlet Devices
#1	Primary	1,197.82'	30.0" Round Culvert L= 86.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,197.82' / 1,197.39' S= 0.0050 '/ Cc= 0.900 n= 0.012, Flow Area= 4.91 sf
#2	Device 1	1,197.92'	21.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,202.00'	14.0" Vert. Orifice/Grate X 2.00 C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=41.65 cfs @ 2.09 hrs HW=1,204.46' (Free Discharge)

- ↑ **1=Culvert** (Passes 41.65 cfs of 54.86 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 27.56 cfs @ 11.46 fps)
- ↑ **3=Orifice/Grate** (Orifice Controls 14.09 cfs @ 6.59 fps)

Proposed Condition (DP3)

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25.004 Brentwood Section 3

ODOT Zone V 50-Year Duration=69 min, Inten=3.14 in/hr

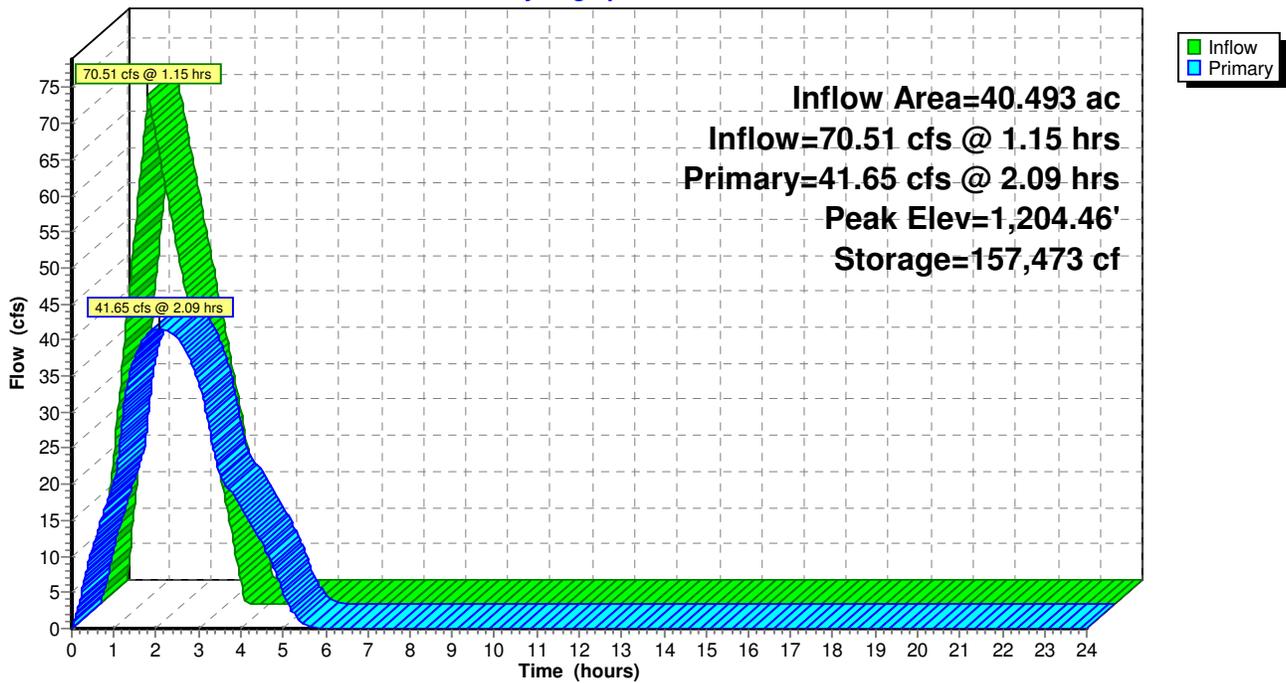
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Pond Pond D: Pond D

Hydrograph



Proposed Condition (DP3)

ODOT Zone V 50-Year Duration=69 min, Inten=3.14 in/hr

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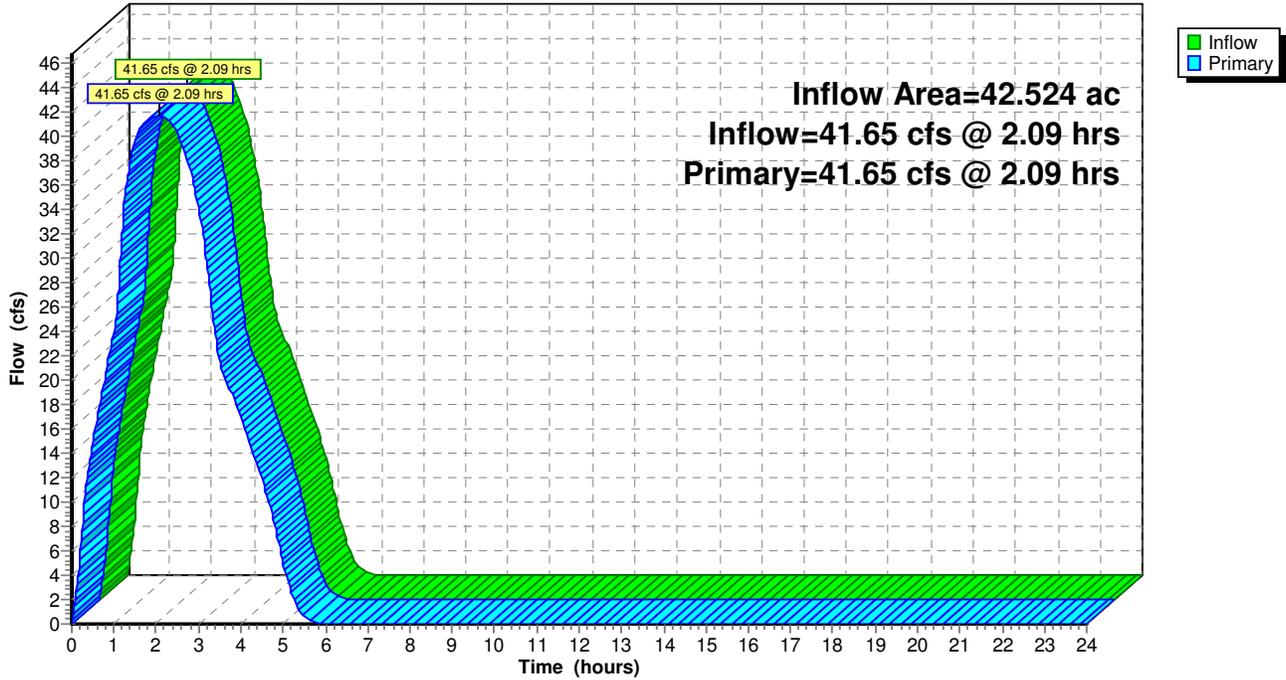
Summary for Link DP3: DP3 (Ex. 36" CMP)

Inflow Area = 42.524 ac, 0.00% Impervious, Inflow Depth = 2.95" for 50-Year event
Inflow = 41.65 cfs @ 2.09 hrs, Volume= 10.437 af
Primary = 41.65 cfs @ 2.09 hrs, Volume= 10.437 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP3: DP3 (Ex. 36" CMP)

Hydrograph



Proposed Condition (DP3)

ODOT Zone V 100-Year Duration=69 min, Inten=3.56 in/hr

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Time span=0.00-24.00 hrs, dt=0.01 hrs, 2401 points

Runoff by Rational method, Rise/Fall=1.0/2.0 xTc

Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment DEV3.1: DEV3.1 (to Pond D) Runoff Area=40.493 ac 0.00% Impervious Runoff Depth=3.38"
Tc=68.9 min C=0.55 Runoff=80.00 cfs 11.399 af

Subcatchment DEV3.2: DEV3.2 (Bypass) Runoff Area=2.031 ac 0.00% Impervious Runoff Depth=2.62"
Tc=22.4 min C=0.55 Runoff=4.01 cfs 0.443 af

Pond Pond D: Pond D Peak Elev=1,205.15' Storage=184,403 cf Inflow=80.00 cfs 11.399 af
Outflow=45.71 cfs 11.399 af

Link DP3: DP3 (Ex. 36" CMP) Inflow=45.71 cfs 11.842 af
Primary=45.71 cfs 11.842 af

Total Runoff Area = 42.524 ac Runoff Volume = 11.842 af Average Runoff Depth = 3.34"
100.00% Pervious = 42.524 ac 0.00% Impervious = 0.000 ac

Proposed Condition (DP3)

ODOT Zone V 100-Year Duration=69 min, Inten=3.56 in/hr

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Summary for Subcatchment DEV3.1: DEV3.1 (to Pond D)

Runoff = 80.00 cfs @ 1.15 hrs, Volume= 11.399 af, Depth= 3.38"
 Routed to Pond Pond D : Pond D

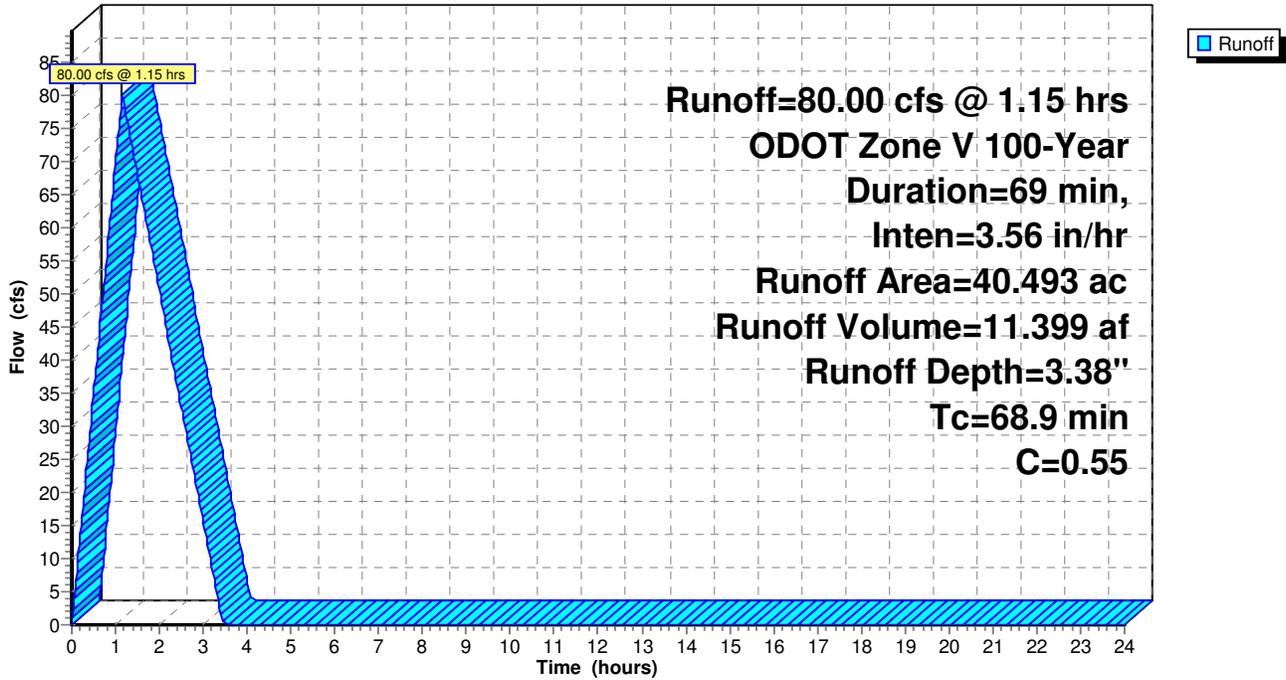
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 ODOT Zone V 100-Year Duration=69 min, Inten=3.56 in/hr

Area (ac)	C	Description
40.493	0.55	
40.493	0.55	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
68.9					Direct Entry,

Subcatchment DEV3.1: DEV3.1 (to Pond D)

Hydrograph



Proposed Condition (DP3)

ODOT Zone V 100-Year Duration=69 min, Inten=3.56 in/hr

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Summary for Subcatchment DEV3.2: DEV3.2 (Bypass)

Runoff = 4.01 cfs @ 0.38 hrs, Volume= 0.443 af, Depth= 2.62"
 Routed to Link DP3 : DP3 (Ex. 36" CMP)

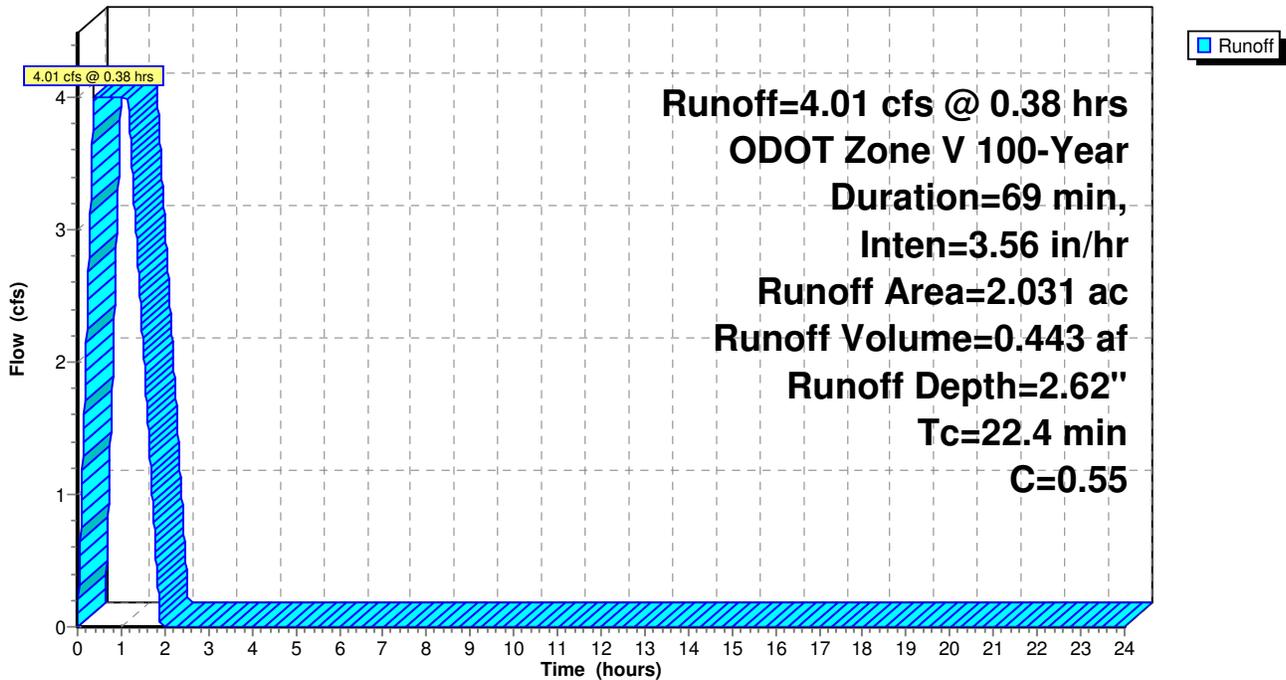
Runoff by Rational method, Rise/Fall=1.0/2.0 xTc, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 ODOT Zone V 100-Year Duration=69 min, Inten=3.56 in/hr

Area (ac)	C	Description
2.031	0.55	
2.031	0.55	100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
22.4					Direct Entry,

Subcatchment DEV3.2: DEV3.2 (Bypass)

Hydrograph



Proposed Condition (DP3)

ODOT Zone V 100-Year Duration=69 min, Inten=3.56 in/hr

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Summary for Pond Pond D: Pond D

[44] Hint: Outlet device #2 is below defined storage

Inflow Area = 40.493 ac, 0.00% Impervious, Inflow Depth = 3.38" for 100-Year event
 Inflow = 80.00 cfs @ 1.15 hrs, Volume= 11.399 af
 Outflow = 45.71 cfs @ 2.13 hrs, Volume= 11.399 af, Atten= 43%, Lag= 59.0 min
 Primary = 45.71 cfs @ 2.13 hrs, Volume= 11.399 af
 Routed to Link DP3 : DP3 (Ex. 36" CMP)

Routing by Stor-Ind method, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs
 Peak Elev= 1,205.15' @ 2.13 hrs Surf.Area= 39,959 sf Storage= 184,403 cf

Plug-Flow detention time= 57.8 min calculated for 11.394 af (100% of inflow)
 Center-of-Mass det. time= 57.8 min (149.7 - 91.9)

Volume	Invert	Avail.Storage	Storage Description
#1	1,198.00'	219,532 cf	Custom Stage Data (Prismatic) Listed below (Recalc)

Elevation (feet)	Surf.Area (sq-ft)	Inc.Store (cubic-feet)	Cum.Store (cubic-feet)
1,198.00	0	0	0
1,198.50	4,600	1,150	1,150
1,199.00	11,002	3,901	5,051
1,199.50	20,203	7,801	12,852
1,200.00	22,906	10,777	23,629
1,201.00	25,988	24,447	48,076
1,202.00	29,179	27,584	75,660
1,203.00	32,479	30,829	106,489
1,204.00	35,887	34,183	140,672
1,205.00	39,403	37,645	178,317
1,206.00	43,028	41,216	219,532

Device	Routing	Invert	Outlet Devices
#1	Primary	1,197.82'	30.0" Round Culvert L= 86.0' RCP, square edge headwall, Ke= 0.500 Inlet / Outlet Invert= 1,197.82' / 1,197.39' S= 0.0050 '/' Cc= 0.900 n= 0.012, Flow Area= 4.91 sf
#2	Device 1	1,197.92'	21.0" Vert. Orifice/Grate C= 0.600 Limited to weir flow at low heads
#3	Device 1	1,202.00'	14.0" Vert. Orifice/Grate X 2.00 C= 0.600 Limited to weir flow at low heads

Primary OutFlow Max=45.71 cfs @ 2.13 hrs HW=1,205.15' (Free Discharge)

- ↑ **1=Culvert** (Passes 45.71 cfs of 58.30 cfs potential flow)
- ↑ **2=Orifice/Grate** (Orifice Controls 29.20 cfs @ 12.14 fps)
- ↑ **3=Orifice/Grate** (Orifice Controls 16.50 cfs @ 7.72 fps)

Proposed Condition (DP3)

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25.004 Brentwood Section 3

ODOT Zone V 100-Year Duration=69 min, Inten=3.56 in/hr

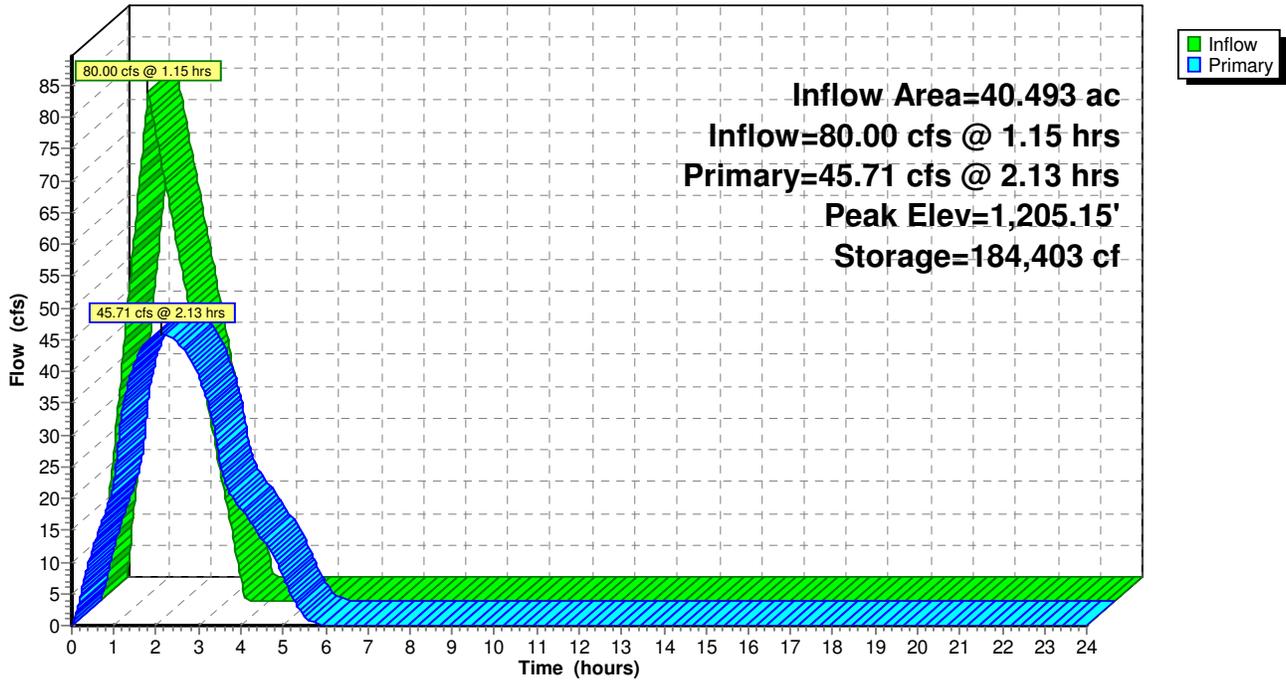
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Pond Pond D: Pond D

Hydrograph



Proposed Condition (DP3)

ODOT Zone V 100-Year Duration=69 min, Inten=3.56 in/hr

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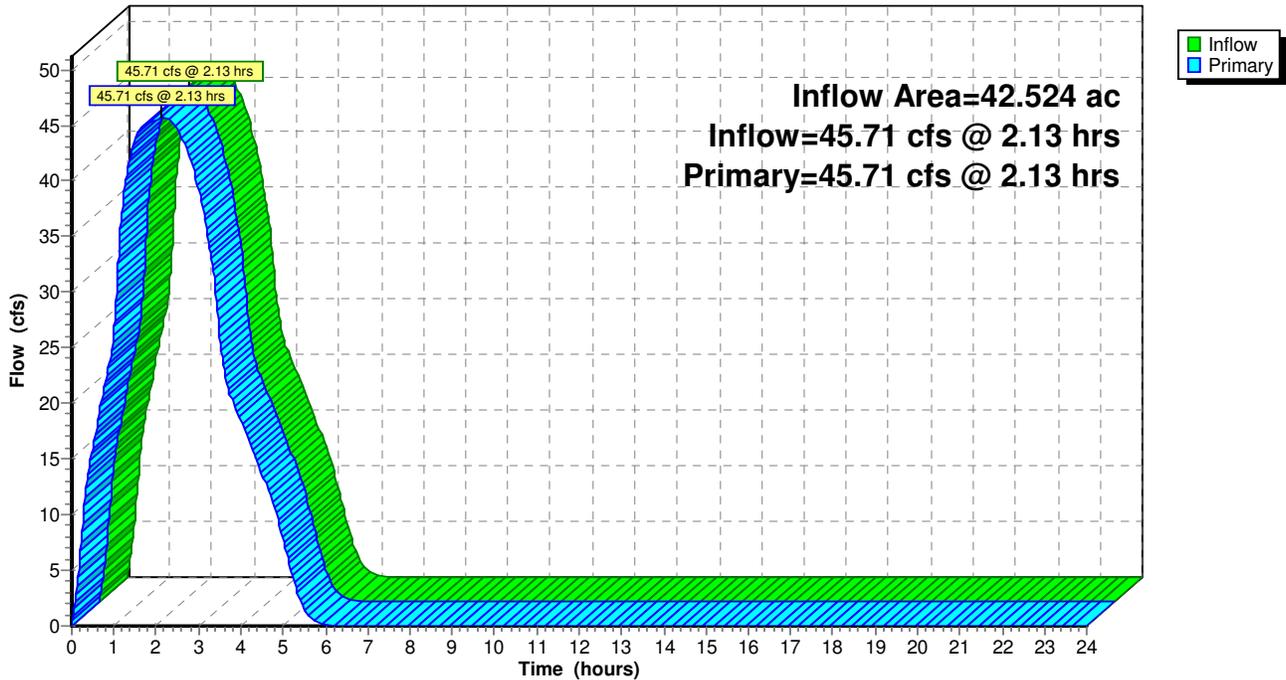
Summary for Link DP3: DP3 (Ex. 36" CMP)

Inflow Area = 42.524 ac, 0.00% Impervious, Inflow Depth = 3.34" for 100-Year event
Inflow = 45.71 cfs @ 2.13 hrs, Volume= 11.842 af
Primary = 45.71 cfs @ 2.13 hrs, Volume= 11.842 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-24.00 hrs, dt= 0.01 hrs

Link DP3: DP3 (Ex. 36" CMP)

Hydrograph



Proposed Condition (DP3)

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Events for Subcatchment DEV3.1: DEV3.1 (to Pond D)

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-Year	1.69	33.08	4.714	1.40
5-Year	2.29	44.65	6.362	1.89
10-Year	2.64	51.63	7.356	2.18
25-Year	3.23	63.05	8.983	2.66
50-Year	3.61	70.51	10.046	2.98
100-Year	4.10	80.00	11.399	3.38

Proposed Condition (DP3)

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Events for Subcatchment DEV3.2: DEV3.2 (Bypass)

Event	Rainfall (inches)	Runoff (cfs)	Volume (acre-feet)	Depth (inches)
2-Year	1.69	1.66	0.183	1.08
5-Year	2.29	2.24	0.247	1.46
10-Year	2.64	2.59	0.286	1.69
25-Year	3.23	3.16	0.349	2.06
50-Year	3.61	3.54	0.391	2.31
100-Year	4.10	4.01	0.443	2.62

Proposed Condition (DP3)

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Events for Pond Pond D: Pond D

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)	Storage (cubic-feet)
2-Year	33.08	19.36	1,201.59	63,943
5-Year	44.65	26.48	1,202.68	96,316
10-Year	51.63	31.83	1,203.14	110,956
25-Year	63.05	38.13	1,203.92	137,860
50-Year	70.51	41.65	1,204.46	157,473
100-Year	80.00	45.71	1,205.15	184,403

MAX. DEVELOPED 100-YR WSEL FOR
 SECTION 3 DEVELOPMENT

Proposed Condition (DP3)

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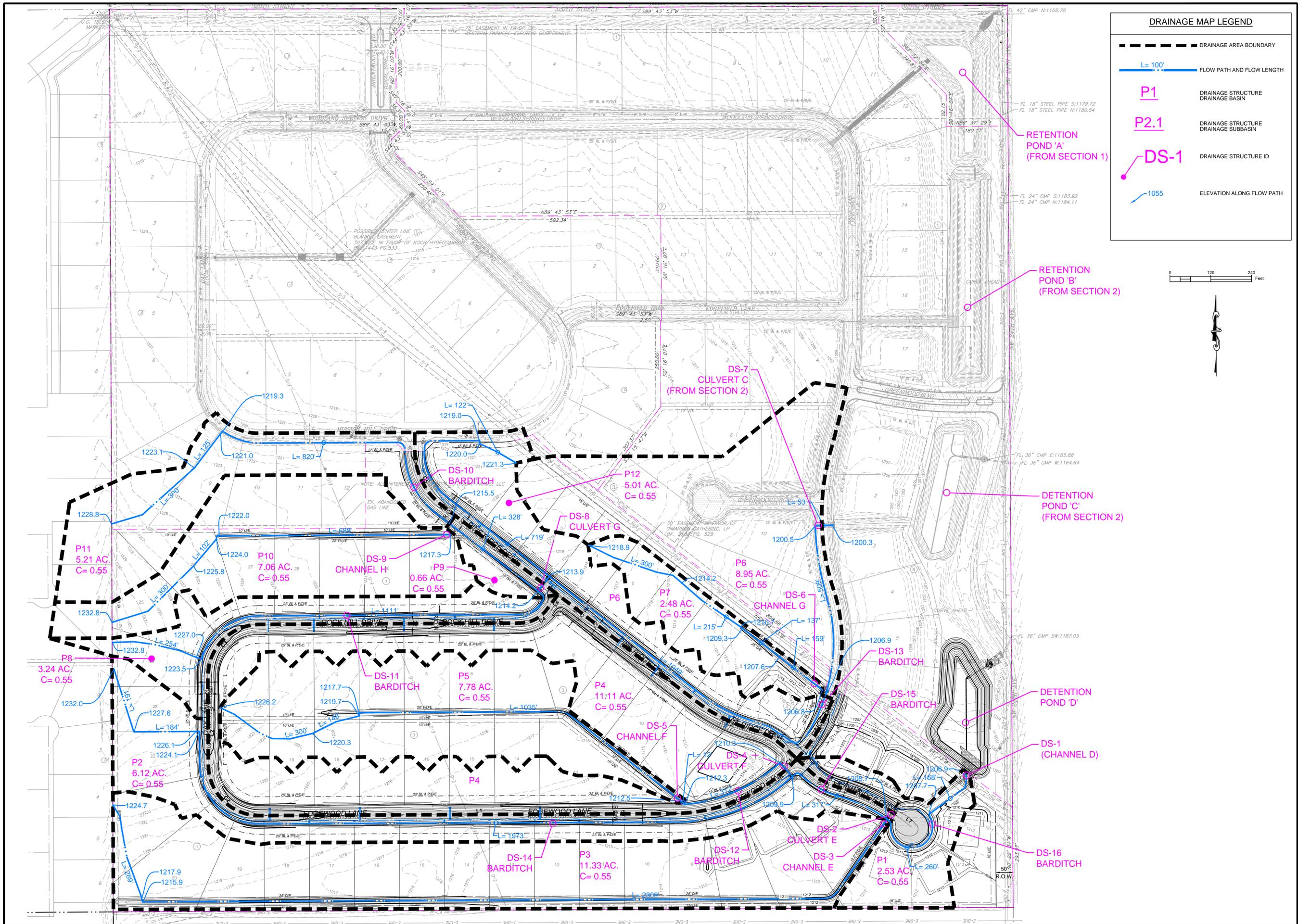
Events for Link DP3: DP3 (Ex. 36" CMP)

Event	Inflow (cfs)	Primary (cfs)	Elevation (feet)
2-Year	19.36	19.36	0.00
5-Year	26.48	26.48	0.00
10-Year	31.83	31.83	0.00
25-Year	38.13	38.13	0.00
50-Year	41.65	41.65	0.00
100-Year	45.71	45.71	0.00

MAX. DEVELOPED DISCHARGE AT DP3 FOR
SECTION 3 CONSTRUCTION

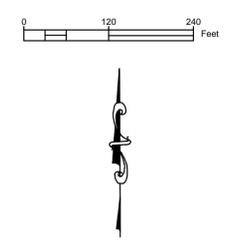
APPENDIX E

DRAINAGE STRUCTURES



DRAINAGE MAP LEGEND

- DRAINAGE AREA BOUNDARY
- L= 100' FLOW PATH AND FLOW LENGTH
- P1 DRAINAGE STRUCTURE DRAINAGE BASIN
- P2.1 DRAINAGE STRUCTURE DRAINAGE SUBBASIN
- DS-1 DRAINAGE STRUCTURE ID
- 1055 ELEVATION ALONG FLOW PATH



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REV	DATE	DESCRIPTION
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DRAINAGE PLANS
BRENTWOOD SECTION 3
NE/4, SECTION 16, T8N, R3W, I.M.
GOLDSBY, OKLAHOMA

DRAINAGE STRUCTURE - DRAINAGE MAP

DATE: 05/28/2025
PROJECT NO. 25.004
SHEET: D102

DRAINAGE STRUCTURE ANALYSIS

Project Name: **Brentwood Section 3**
 Project No.: **25.004**

Design Point ID: **DS-1: Channel D (to Pond D)**
 Drainage Area(s): **P1 + P2 + P3 + P4 + P5**

DRAINAGE AREA AND WEIGHTED 'C' VALUE

Area (Acres)	'C'		C x A	Calculation Notes:
38.87	0.55	Residential Rural Estate	21.379	
	0.00	-	0.000	
	0.00	-	0.000	
	0.00	-	0.000	
TOTAL AREA: 38.87				
Total: C x A			21.379	
Weighted "C":			0.550	

TIME OF CONCENTRATION (Tc)

Overland Flow: Time of Concentration ($T_c = K(L^{0.37}/S^{0.20})$)
 Channel Flow: Time of Concentration ($T_c = K(L^{0.77}/S^{0.385})$)
 Pipe Flow: Time of Concentration ($T_c = L/V$)

Flow Type	Length (ft)	Surface Type	K	Start Elevation	End Elevation	Slope (ft/ft)	Tc (min)
Overland 1	289	Average Grass	1	1224.70	1217.90	0.0235	17.2
Overland 2		-	0			0.0000	0.0
Overland 3		-	0			0.0000	0.0
Overland 4		-	0			0.0000	0.0
Channelized 1	2309	∩-Ditch	0.012	1215.90	1208.70	0.0031	43.0
Channelized 2	260	∩-Ditch	0.012	1208.70	1207.70	0.0038	7.4
Channelized 3	168	Few Weeds, Clean Bottom	0.0084	1207.70	1206.90	0.0048	3.4
Channelized 4		-	0			0.0000	0.0
	L (ft)	Average Velocity (fps)					
Pipe 1							0.0
Pipe 2							0.0
Total Tc:							71.0

RAINFALL INTENSITY & PEAK FLOW

$Rainfall Intensity = I = a / ((Tc + b)c)$

Town of Goldsby (ODOT Zone V)				Rainfall Intensity (in/hr)	Runoff Q=CIA (cfs)
Storm Frequency	Parameters for IDF Equation				
	a	b	c		
50% (2-Year)	53	10	0.82	1.44	30.85
20% (5-Year)	64	12	0.79	1.95	41.70
10% (10-Year)	74	12	0.79	2.26	48.21
4% (25-Year)	93	15	0.79	2.76	58.91
2% (50-Year)	104	15	0.79	3.08	65.88
1% (100-Year)	108	15	0.77	3.50	74.79

Design Point ID: DS-1: Channel D (to Pond D)

TRAPEZOIDAL CHANNEL		
Design Storm:	1% (100-Year)	
Design Storm Q:	74.79	cfs
Channel Bottom (b):	12	ft.
Max. Water Surface Depth (y):	1.39	ft
Channel Site Slopes (z:1)	4. :1	
Longitudinal Channel Slope (S):	0.005	ft/ft
Manning roughness coefficient:	0.035	
Cross Sectional Area (A):	24.41	SF
Wetted Perimeter (P):	23.46	ft.
Hydraulic Radius (Rh):	1.040	ft.
Velocity (at capacity):	3.22	fps
Capacity Q= $1.49/n \times A \times Rh^{2/3} \times S^{1/2}$ =	75.44	cfs
Design / Capacity:	99%	OKAY

DRAINAGE STRUCTURE ANALYSIS							
Project Name:		Brentwood Section 3					
Project No.:		25.004					
Design Point ID:		DS-2: Culvert E (Relief culvert, not designed for full flow)					
Drainage Area(s):		P2 + P3 +P4 + P5					
DRAINAGE AREA AND WEIGHTED 'C' VALUE							
Area (Acres)	'C'		C x A	Calculation Notes:			
6.12	0.55	Residential Rural Estate	3.366				
11.33	0.55	Residential Rural Estate	6.232				
11.11	0.55	Residential Rural Estate	6.111				
7.78	0.55	Residential Rural Estate	4.279				
TOTAL AREA:		36.34					
Total: C x A		19.987					
Weighted "C":		0.550					
TIME OF CONCENTRATION (Tc)							
Overland Flow: Time of Concentration ($T_c=K(L^{0.37}/S^{0.20})$)							
Channel Flow: Time of Concentration ($T_c=K(L^{0.77}/S^{0.385})$)							
Pipe Flow: Time of Concentration ($T_c=L/V$)							
Flow Type	Length (ft)	Surface Type	K	Start Elevation	End Elevation	Slope (ft/ft)	Tc (min)
Overland 1	289	Average Grass	1	1224.70	1217.90	0.0235	17.2
Overland 2		-	0			0.0000	0.0
Overland 3		-	0			0.0000	0.0
Overland 4		-	0			0.0000	0.0
Channelized 1	2309	\/-Ditch	0.012	1215.90	1208.70	0.0031	43.0
Channelized 2		-	0			0.0000	0.0
Channelized 3		-	0			0.0000	0.0
Channelized 4		-	0			0.0000	0.0
	L (ft)	Average Velocity (fps)					
Pipe 1				0.0			
Pipe 2				0.0			
Total Tc:							60.2
RAINFALL INTENSITY & PEAK FLOW							
				<i>Rainfall Intensity = $I = a/((Tc+b)c$)</i>			
Town of Goldsby (ODOT Zone V)				Rainfall Intensity (in/hr)		Runoff Q=CIA (cfs)	
Storm Frequency	Parameters for IDF Equation						
	a	b	c				
50% (2-Year)	53	10	0.82	1.62		32.44	
20 % (5-Year)	64	12	0.79	2.18		43.52	
10% (10-Year)	74	12	0.79	2.52		50.32	
4% (25-Year)	93	15	0.79	3.06		61.24	
2 % (50-Year)	104	15	0.79	3.43		68.48	
1% (100-Year)	108	15	0.77	3.88		77.53	

OPEN CHANNEL GRADUAL VAIED FLOW

Project Name: **Brentwood Section 3**
 Project No.: **25.004**

Channel ID: DS-1 to DS-3 (Channel D to Channel E discharge)

Is downstream tailwater depth known: **Yes**
 Known Tailwater Elevation: **1208.3**

Known Q: **74.79** cfs **100-year**

Culvert E Tailwater

GRADUAL VARIED FLOW FOR OPEN CHANNELS (RECTANGULAR OR TRAPEZOIDAL)

	Downstream Section 1		Upstream Section 1		Downstream Section 2		Upstream Section 2	
Length of Channel from point 1 to point 2 (L1):	165.11		165.11	ft.	279.00	ft.	279.00	ft.
HGL at downstream side of channel section:	1208.35		1209.22		1209.22		1210.61	
Invert Elevation at downstream end (Elevo):	1206.9		1207.73		1207.73		1208.68	
Channel Bottom (b):	12	ft.	12	ft.	8	ft.	8	ft.
Channel Site Slopes (m:1)	4. :1		4. :1		4. :1		4. :1	
Longitudinal Channel Slope (S):	0.005	ft/ft	0.005	ft/ft	0.00341	ft/ft	0.00341	ft/ft
Manning roughness coefficient (n):	0.040		0.040		0.035		0.035	
Iteration of depth (yo):	0	ft.	1.493	ft.	1.493	ft.	1.938	ft.
Qn/(1.49/S ^{1/2}):	0.00							
A x Rh ^{2/3} :	0.00							
Normal Depth (yo):	1.45	ft.	1.49	ft.	1.49	ft.	1.94	ft.
Top Width (B):	23.57	ft.	23.94	ft.	19.94	ft.	23.50	ft.
Area (A):	25.716	SF	26.832	SF	20.860	SF	30.527	SF
Wetted Perimeter (P):	23.924	ft.	24.312	ft.	20.312	ft.	23.981	ft.
Hydraulic Radius (Rh):	1.07	ft.	1.10	ft.	1.03	ft.	1.27	ft.
Velocity:	2.91	fps	2.79	fps	3.59	fps	2.45	fps
Velocity Head:	0.131	ft	0.121	ft	0.200	ft	0.093	ft
Froude Number (Fr):	0.491	Subcritical	0.464	Subcritical	0.618	Subcritical	0.379	Subcritical
HGL:	1208.35	ft	1209.22	ft	1209.22	ft	1210.61	ft
Headloss at each section (HLup or HLdn):	0.91	ft.	0.81	ft.	1.91	ft.	0.67	ft.
Average Friction Slope (HLup+HLdn)/2= (HL)		ft.	0.862	ft.		ft.	1.290	ft.
EGL:	1208.48	ft	1209.34	ft	1209.42	ft	1210.71	ft
EGL + Avg. HL:	1209.340				1210.71			
Error (tolorance +/-0.015-ft)			0.000	OK			0.000	OK

Channel E Tailwater

CULVERT E

HY-8 Culvert Analysis Report

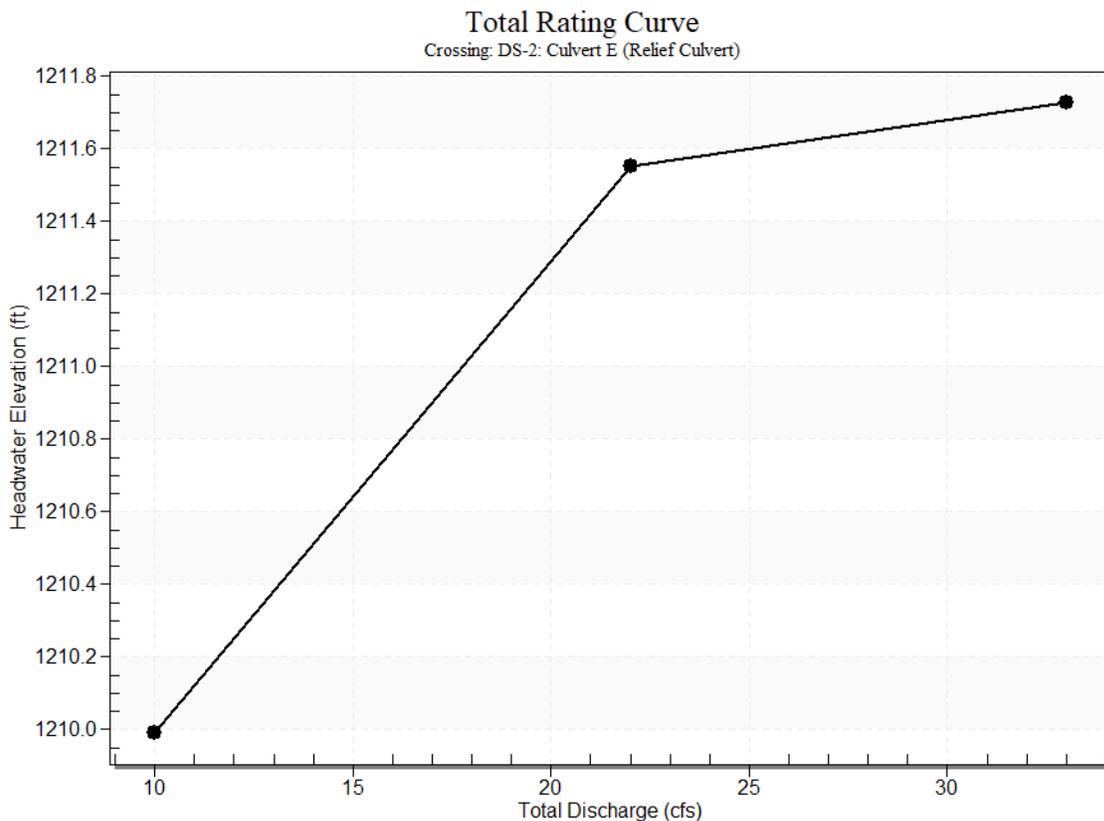
Crossing Discharge Data

Discharge Selection Method: User Defined

Table 1 - Summary of Culvert Flows at Crossing: DS-2: Culvert E (Relief Culvert)

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	Culvert E Discharge (cfs)	Roadway Discharge (cfs)	Iterations
1209.99	Low Relief Flow	10.00	10.00	0.00	1
1211.55	High Relief Flow	22.00	21.92	0.00	41
1211.56	Overtopping	21.96	21.96	0.00	Overtopping

Rating Curve Plot for Crossing: DS-2: Culvert E (Relief Culvert)



This culvert is a relief culvert for DS-16 Barditch. This culvert is not designed to handle the peak 100-year run-off.

Culvert Data: Culvert E

Table 1 - Culvert Summary Table: Culvert E

Discharge Names	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
Low Relief Flow	10.00 cfs	10.00 cfs	1209.99	1.31	0.847	1-S2n	0.79	0.86	0.79	0.86	5.30	0.00
High Relief Flow	22.00 cfs	21.92 cfs	1211.55	2.87	2.509	7-M2c	1.50	1.27	1.27	0.86	6.88	0.00

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

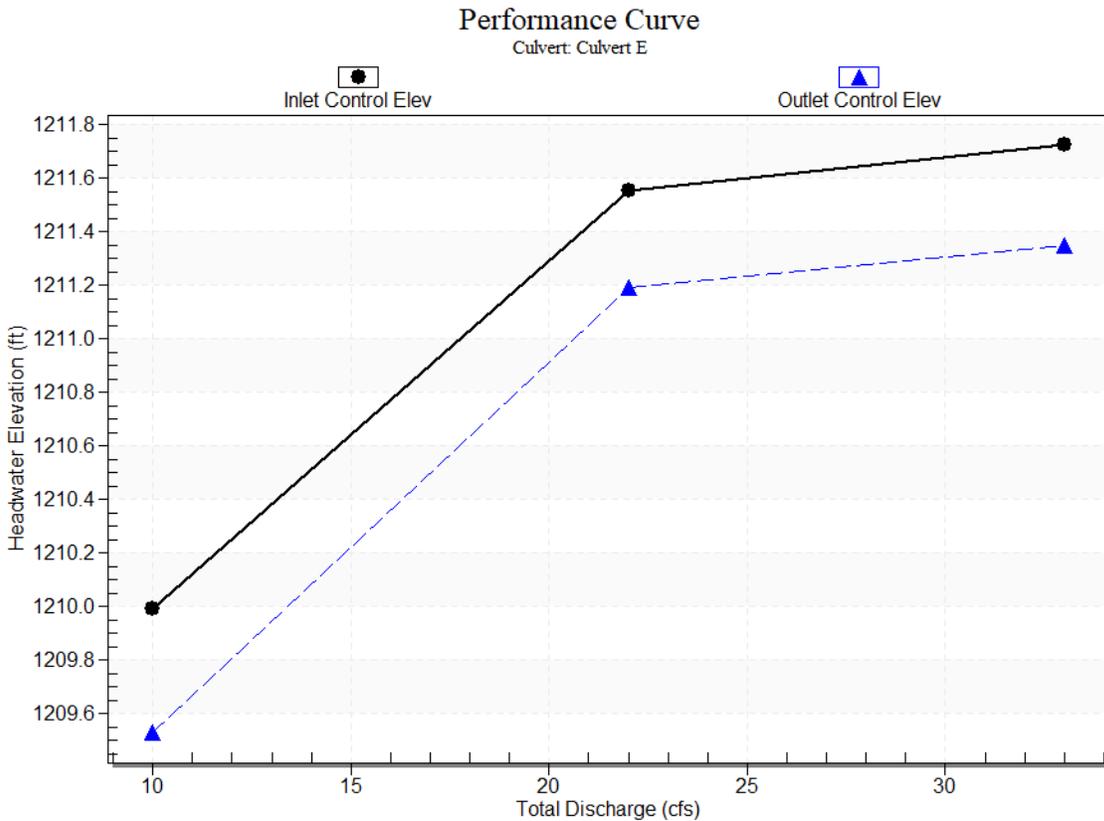
Inlet Elevation (invert): 1208.68 ft,

Outlet Elevation (invert): 1208.36 ft

Culvert Length: 49.63 ft,

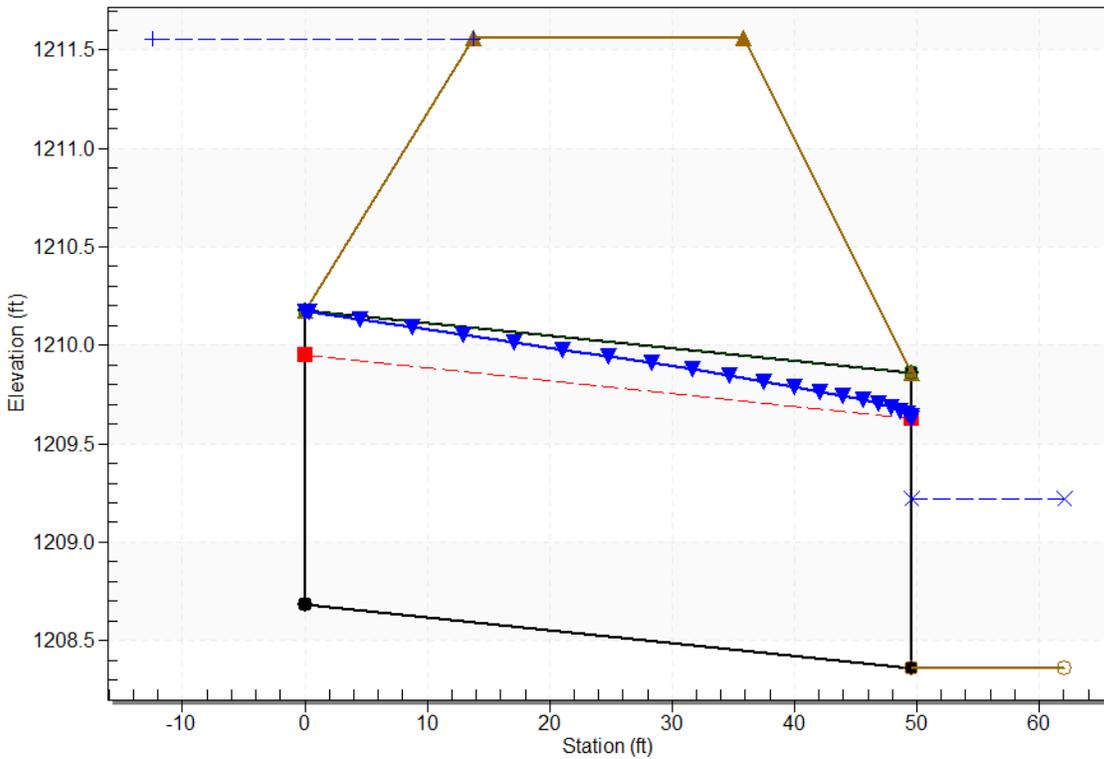
Culvert Slope: 0.0064

Culvert Performance Curve Plot: Culvert E



Water Surface Profile Plot for Culvert: Culvert E

Crossing - DS-2: Culvert E (Relief Culvert), Design Discharge - 22.0 cfs
Culvert - Culvert E, Culvert Discharge - 21.9 cfs



Site Data - Culvert E

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 1208.68 ft

Outlet Station: 49.63 ft

Outlet Elevation: 1208.36 ft

Number of Barrels: 2

Culvert Data Summary - Culvert E

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Smooth HDPE

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Mitered to Conform to Slope ($K_e=0.7$)

Inlet Depression: None

Tailwater Data for Crossing: DS-2: Culvert E (Relief Culvert)

Table 2 - Downstream Channel Rating Curve (Crossing: DS-2: Culvert E (Relief Culvert))

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
10.00	1209.22	0.86
22.00	1209.22	0.86

Tailwater Channel Data - DS-2: Culvert E (Relief Culvert)

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 1209.22 ft

Roadway Data for Crossing: DS-2: Culvert E (Relief Culvert)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 1211.56 ft

Roadway Surface: Paved

Roadway Top Width: 22.00 ft

DRAINAGE STRUCTURE ANALYSIS

Project Name: **Brentwood Section 3**
 Project No.: **25.004**

Design Point ID: **DS-3 - Channel E (South Earthen Channel Block 1)**
 Drainage Area(s): **P3**

DRAINAGE AREA AND WEIGHTED 'C' VALUE

Area (Acres)	'C'		C x A	Calculation Notes:
11.33	0.55	Residential Rural Estate	6.234	
	0.00	-	0.000	
	0.00	-	0.000	
	0.00	-	0.000	
TOTAL AREA: 11.33				
Total: C x A			6.234	
Weighted "C":			0.550	

TIME OF CONCENTRATION (Tc)

Overland Flow: Time of Concentration ($T_c = K(L^{0.37}/S^{0.20})$)
 Channel Flow: Time of Concentration ($T_c = K(L^{0.77}/S^{0.385})$)
 Pipe Flow: Time of Concentration ($T_c = L/V$)

Flow Type	Length (ft)	Surface Type	K	Start Elevation	End Elevation	Slope (ft/ft)	Tc (min)
Overland 1	289	Average Grass	1	1224.70	1217.90	0.0235	17.2
Overland 2		-	0			0.0000	0.0
Overland 3		-	0			0.0000	0.0
Overland 4		-	0			0.0000	0.0
Channelized 1	2309	∩-Ditch	0.012	1215.90	1208.70	0.0031	43.0
Channelized 2	260	∩-Ditch	0.012	1208.70	1207.70	0.0038	7.4
Channelized 3	168	Few Weeds, Clean Bottom	0.0084	1207.70	1206.90	0.0048	3.4
Channelized 4		-	0			0.0000	0.0
	L (ft)	Average Velocity (fps)					
Pipe 1							0.0
Pipe 2							0.0
Total Tc:							71.0

RAINFALL INTENSITY & PEAK FLOW

$Rainfall Intensity = I = a / ((Tc + b)c)$

Town of Goldsby (ODOT Zone V)				Rainfall Intensity (in/hr)	Runoff Q=CIA (cfs)
Storm Frequency	Parameters for IDF Equation				
	a	b	c		
50% (2-Year)	53	10	0.82	1.44	9.00
20% (5-Year)	64	12	0.79	1.95	12.16
10% (10-Year)	74	12	0.79	2.26	14.06
4% (25-Year)	93	15	0.79	2.76	17.18
2% (50-Year)	104	15	0.79	3.08	19.21
1% (100-Year)	108	15	0.77	3.50	21.81

Design Point ID: DS-3 - Channel E (South Earthen Channel Block 1)

TRAPEZOIDAL CHANNEL		
Design Storm:	1% (100-Year)	
Design Storm Q:	21.81	cfs
Channel Bottom (b):	6	ft.
Max. Water Surface Depth (y):	1.10	ft
Channel Site Slopes (z:1)	4. :1	
Longitudinal Channel Slope (S):	0.003	ft/ft
Manning roughness coefficient:	0.035	
Cross Sectional Area (A):	11.44	SF
Wetted Perimeter (P):	15.07	ft.
Hydraulic Radius (Rh):	0.759	ft.
Velocity (at capacity):	1.47	fps
Capacity Q= $1.49/n \times A \times Rh^{2/3} \times S^{1/2}$ =	22.20	cfs
Design / Capacity:	98%	OKAY

OPEN CHANNEL GRADUAL VAIED FLOW

Project Name: Brentwood Section 3

Project No.: 25.004

Channel ID: **DS-3 (Channel E)**

Is downstream tailwater depth known: Yes
 Known Tailwater Elevation: 1210.6

From Culvert E
 Tailwater Calc.

Known Q: 21.81 cfs 100-year

GRADUAL VARIED FLOW FOR OPEN CHANNELS (RECTANGULAR OR TRAPEZOIDAL)

	Downstream Section 1	Upstream Section 1
Length of Channel from point 1 to point 2 (L1):	2362.90	2362.90 ft.
HGL at downstream side of channel section:	1210.61	1217.02
Invert Elevation at downstream end (Elevo):	1208.97	1216.059
Channel Bottom (b):	6 ft.	6 ft.
Channel Site Slopes (m:1)	4. :1	4. :1
Longitudinal Channel Slope (S):	0.003 ft/ft	0.003 ft/ft
Manning roughness coefficient (n):	0.035	0.035
Iteration of depth (yo):	0 ft.	0.9613 ft.
Qn/(1.49/S ^{1/2}):	0.00	
A x Rh ^{2/3} :	0.00	
Normal Depth (yo):	1.64 ft.	0.96 ft.
Top Width (B):	19.12 ft.	13.69 ft.
Area (A):	20.598 SF	9.464 SF
Wetted Perimeter (P):	19.524 ft.	13.927 ft.
Hydraulic Radius (Rh):	1.06 ft.	0.68 ft.
Velocity:	1.06 fps	2.30 fps
Velocity Head:	0.017 ft	0.082 ft
Froude Number (Fr):	0.180 Subcritical	0.488 Subcritical
HGL:	1210.61 ft	1217.02 ft
Headloss at each section (HLup or HLdn):	1.36 ft.	11.59 ft.
Average Friction Slope (HLup+HLdn)/2= (HL)		6.475 ft.
EGL:	1210.63 ft	1217.10 ft
EGL + Avg. HL:	1217.102	
Error (tolorance +/-0.015-ft)		0.000 OK

DRAINAGE STRUCTURE ANALYSIS

Project Name: **Brentwood Section 3**
 Project No.: **25.004**

Design Point ID: **DS-4: Culvert F**

Drainage Area(s): **P4 + P5**

DRAINAGE AREA AND WEIGHTED 'C' VALUE

Area (Acres)	'C'		C x A	Calculation Notes:
11.11	0.55	Residential Rural Estate	6.111	
7.78	0.55	Residential Rural Estate	4.279	
	0.00	-	0.000	
	0.00	-	0.000	
TOTAL AREA: 18.89				
Total: C x A			10.390	
Weighted "C":			0.550	

TIME OF CONCENTRATION (Tc)

Overland Flow: Time of Concentration ($T_c = K(L^{0.37}/S^{0.20})$)
 Channel Flow: Time of Concentration ($T_c = K(L^{0.77}/S^{0.385})$)
 Pipe Flow: Time of Concentration ($T_c = L/V$)

Flow Type	Length (ft)	Surface Type	K	Start Elevation	End Elevation	Slope (ft/ft)	Tc (min)
Overland 1	300	Average Grass	1	1226.20	1219.70	0.0217	17.8
Overland 2		-	0			0.0000	0.0
Overland 3		-	0			0.0000	0.0
Overland 4		-	0			0.0000	0.0
Channelized 1	1035	∩-Ditch	0.012	1217.70	1212.50	0.0050	19.3
Channelized 2	12	∩-Ditch	0.012	1212.50	1212.30	0.0167	0.4
Channelized 3	312	∩-Ditch	0.012	1212.30	1210.30	0.0064	7.0
Channelized 4		-	0			0.0000	0.0
	L (ft)	Average Velocity (fps)					
Pipe 1							0.0
Pipe 2							0.0
Total Tc:							44.5

RAINFALL INTENSITY & PEAK FLOW

$Rainfall Intensity = I = a/((Tc+b)c)$

Town of Goldsby (ODOT Zone V)				Rainfall Intensity (in/hr)	Runoff Q=CIA (cfs)
Storm Frequency	Parameters for IDF Equation				
	a	b	c		
50% (2-Year)	53	10	0.82	2.00	20.75
20% (5-Year)	64	12	0.79	2.64	27.46
10% (10-Year)	74	12	0.79	3.06	31.75
4% (25-Year)	93	15	0.79	3.69	38.30
2% (50-Year)	104	15	0.79	4.12	42.83
1% (100-Year)	108	15	0.77	4.65	48.27

OPEN CHANNEL GRADUAL VAIED FLOW

Project Name: **Brentwood Section 3**
 Project No.: **25.004**

Channel ID: DS-15 (Barditch to Culvert F Tailwater)

Is downstream tailwater depth known: **Yes**
 Known Tailwater Elevation: **1210.6**

**Channel E Tailwater
 > From Culvert E Tailwater Calc.**

Known Q: **56.57** cfs **100-year**

GRADUAL VARIED FLOW FOR OPEN CHANNELS (RECTANGULAR OR TRAPEZOIDAL)

	Downstream Section 1	Upstream Section 1
Length of Channel from point 1 to point 2 (L1):	314.53	314.53 ft.
HGL at downstream side of channel section:	1210.61	1211.52
Invert Elevation at downstream end (Elevo):	1208.68	1209.9
Channel Bottom (b):	6 ft.	6 ft.
Channel Site Slopes (m:1)	4. :1	4. :1
Longitudinal Channel Slope (S):	0.00388 ft/ft	0.00388 ft/ft
Manning roughness coefficient (n):	0.035	0.035
Iteration of depth (yo):	0 ft.	1.615 ft.
Qn/(1.49/S ^{1/2}):	0.00	
A x Rh ^{2/3} :	0.00	
Normal Depth (yo):	1.93 ft.	1.62 ft.
Top Width (B):	21.44 ft.	18.92 ft.
Area (A):	26.480 SF	20.123 SF
Wetted Perimeter (P):	21.915 ft.	19.318 ft.
Hydraulic Radius (Rh):	1.21 ft.	1.04 ft.
Velocity:	2.14 fps	2.81 fps
Velocity Head:	0.071 ft	0.123 ft
Froude Number (Fr):	0.339 Subcritical	0.480 Subcritical
HGL:	1210.61 ft	1211.52 ft
Headloss at each section (HLup or HLdn):	0.62 ft.	1.30 ft.
Average Friction Slope (HLup+HLdn)/2= (HL)		0.957 ft.
EGL:	1210.68 ft	1211.64 ft
EGL + Avg. HL:	1211.638	
Error (tolorance +/-0.015-ft)		0.000 OK

Culvert F Tailwater

CULVERT F

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 20.75 cfs

Design Flow: 42.83 cfs

Maximum Flow: 48.27 cfs **Q100**

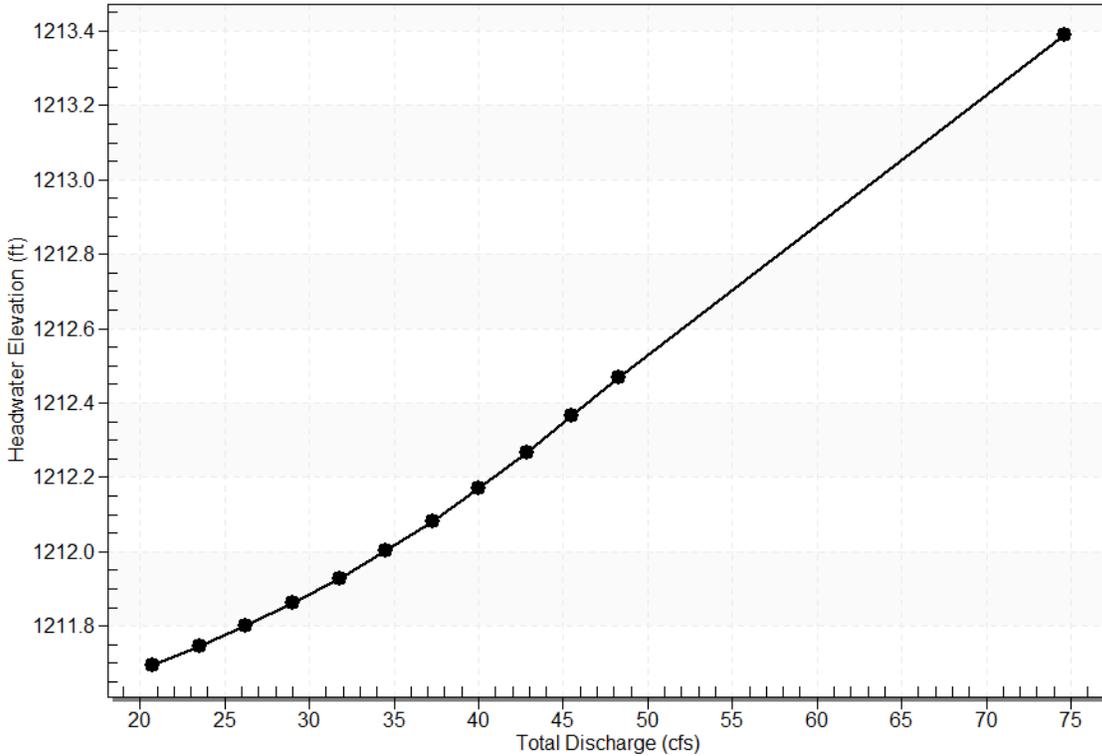
Table 1 - Summary of Culvert Flows at Crossing: DS-4: Culvert F

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert F Discharge (cfs)	Roadway Discharge (cfs)	Iterations
1211.70	20.75	20.75	0.00	1
1211.74	23.50	23.50	0.00	1
1211.80	26.25	26.25	0.00	1
1211.86	29.01	29.01	0.00	1
1211.93	31.76	31.76	0.00	1
1212.00	34.51	34.51	0.00	1
1212.08	37.26	37.26	0.00	1
1212.17	40.01	40.01	0.00	1
1212.27	42.83	42.83	0.00	1
1212.36	45.52	45.52	0.00	1
1212.47	48.27	48.27	0.00	1
1213.26	65.38	65.38	0.00	Overtopping

Rating Curve Plot for Crossing: DS-4: Culvert F

Total Rating Curve

Crossing: DS-4: Culvert F



Culvert Data: Culvert F

Table 1 - Culvert Summary Table: Culvert F

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
20.75 cfs	20.75 cfs	1211.70	1.05	1.395	1-S1f	0.58	0.72	1.50	1.62	2.48	0.00
23.50 cfs	23.50 cfs	1211.74	1.15	1.444	1-S1f	0.63	0.77	1.50	1.62	2.81	0.00
26.25 cfs	26.25 cfs	1211.80	1.24	1.499	1-S1f	0.67	0.82	1.50	1.62	3.14	0.00
29.01 cfs	29.01 cfs	1211.86	1.34	1.561	1-S1f	0.72	0.87	1.50	1.62	3.47	0.00
31.76 cfs	31.76 cfs	1211.93	1.43	1.628	1-S1f	0.77	0.92	1.50	1.62	3.80	0.00
34.51 cfs	34.51 cfs	1212.00	1.53	1.701	1-S1f	0.81	0.96	1.50	1.62	4.13	0.00
37.26 cfs	37.26 cfs	1212.08	1.63	1.782	1-S1f	0.86	1.00	1.50	1.62	4.46	0.00
40.01 cfs	40.01 cfs	1212.17	1.74	1.869	1-S1f	0.91	1.05	1.50	1.62	4.79	0.00
42.83 cfs	42.83 cfs	1212.27	1.85	1.967	1-S1f	0.96	1.09	1.50	1.62	5.12	0.00
45.52 cfs	45.52 cfs	1212.36	1.96	2.064	4-FFf	1.01	1.12	1.50	1.62	5.44	0.00
48.27 cfs	48.27 cfs	1212.47	2.08	2.169	4-FFf	1.07	1.16	1.50	1.62	5.77	0.00

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

Inlet Elevation (invert): 1210.30 ft,

Outlet Elevation (invert): 1209.90 ft

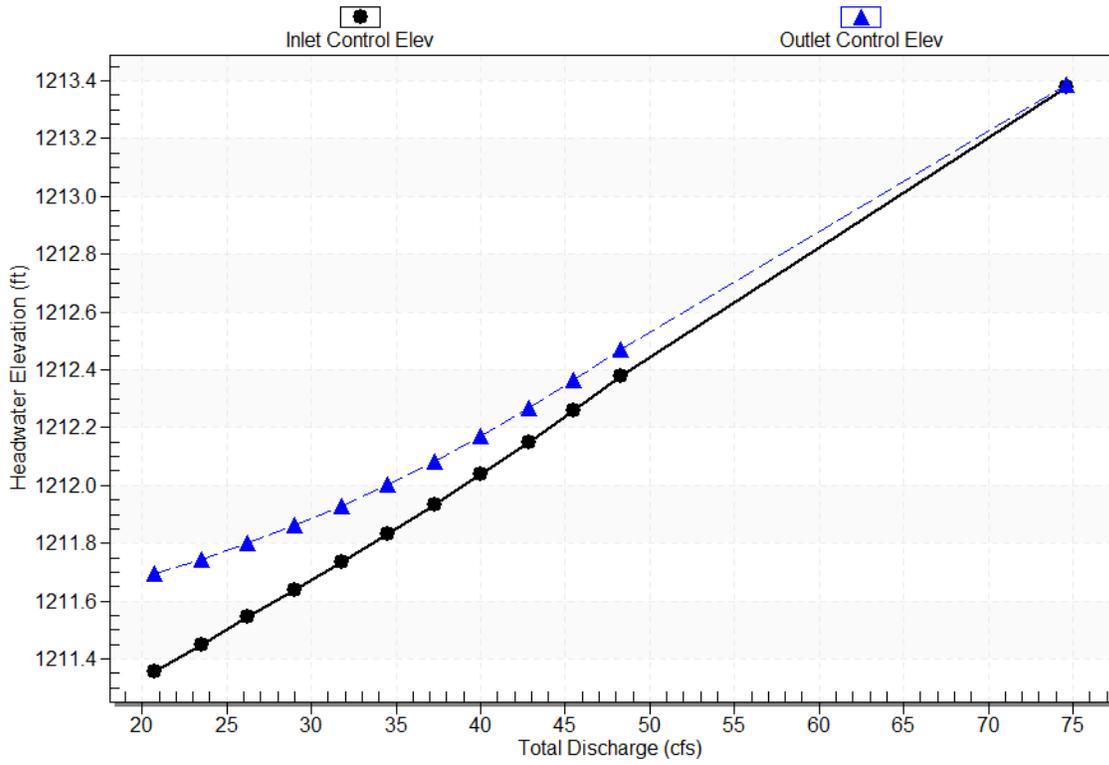
Culvert Length: 52.00 ft,

Culvert Slope: 0.0077

Culvert Performance Curve Plot: Culvert F

Performance Curve

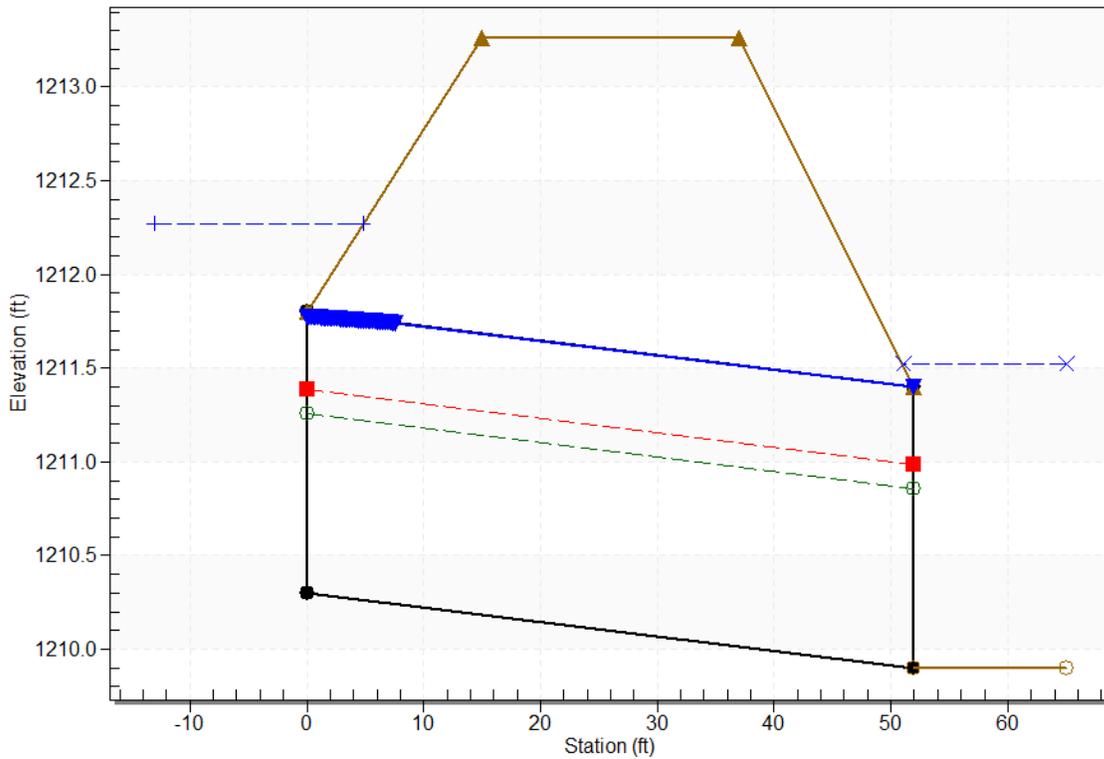
Culvert: Culvert F



Water Surface Profile Plot for Culvert: Culvert F

Crossing - DS-4: Culvert F, Design Discharge - 42.8 cfs

Culvert - Culvert F, Culvert Discharge - 42.8 cfs



Site Data - Culvert F

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 1210.30 ft

Outlet Station: 52.00 ft

Outlet Elevation: 1209.90 ft

Number of Barrels: 3

Culvert Data Summary - Culvert F

Barrel Shape: Pipe Arch

Barrel Span: 28.50 in

Barrel Rise: 18.00 in

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Grooved Edge Projecting (Ke=0.2)

Inlet Depression: None

Tailwater Data for Crossing: DS-4: Culvert F

Table 2 - Downstream Channel Rating Curve (Crossing: DS-4: Culvert F)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
20.75	1211.52	1.62
23.50	1211.52	1.62
26.25	1211.52	1.62
29.01	1211.52	1.62
31.76	1211.52	1.62
34.51	1211.52	1.62
37.26	1211.52	1.62
40.01	1211.52	1.62
42.83	1211.52	1.62
45.52	1211.52	1.62
48.27	1211.52	1.62

Tailwater Channel Data - DS-4: Culvert F

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 1211.52 ft

Roadway Data for Crossing: DS-4: Culvert F

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 1213.26 ft

Roadway Surface: Paved

Roadway Top Width: 22.00 ft

DRAINAGE STRUCTURE ANALYSIS

Project Name: **Brentwood Section 3**
 Project No.: **25.004**

Design Point ID: **DS5 - Channel F (Backyard Channel Block 3)**
 Drainage Area(s): **P5**

DRAINAGE AREA AND WEIGHTED 'C' VALUE

Area (Acres)	'C'		C x A	Calculation Notes:
7.78	0.55	Residential Rural Estate	4.280	
	0.00	-	0.000	
	0.00	-	0.000	
	0.00	-	0.000	
TOTAL AREA: 7.78				
Total: C x A			4.280	
Weighted "C":			0.550	

TIME OF CONCENTRATION (Tc)

Overland Flow: Time of Concentration ($T_c = K(L^{0.37}/S^{0.20})$)
 Channel Flow: Time of Concentration ($T_c = K(L^{0.77}/S^{0.385})$)
 Pipe Flow: Time of Concentration ($T_c = L/V$)

Flow Type	Length (ft)	Surface Type	K	Start Elevation	End Elevation	Slope (ft/ft)	Tc (min)
Overland 1	300	Average Grass	1	1226.20	1220.30	0.0197	18.1
Overland 2		-	0			0.0000	0.0
Overland 3		-	0			0.0000	0.0
Overland 4		-	0			0.0000	0.0
Channelized 1	148	Meandering stream with pools	0.0102	1220.30	1219.70	0.0041	4.0
Channelized 2	1035	\-/Ditch	0.012	1217.66	1212.48	0.0050	19.3
Channelized 3		-	0			0.0000	0.0
Channelized 4		-	0			0.0000	0.0
	L (ft)	Average Velocity (fps)					
Pipe 1							0.0
Pipe 2							0.0
Total Tc:							41.4

RAINFALL INTENSITY & PEAK FLOW

$Rainfall Intensity = I = a / ((Tc + b)c)$

Town of Goldsby (ODOT Zone V)				Rainfall Intensity (in/hr)	Runoff Q=CIA (cfs)
Storm Frequency	Parameters for IDF Equation				
	a	b	c		
50% (2-Year)	53	10	0.82	2.10	8.97
20% (5-Year)	64	12	0.79	2.76	11.83
10% (10-Year)	74	12	0.79	3.20	13.68
4% (25-Year)	93	15	0.79	3.85	16.46
2% (50-Year)	104	15	0.79	4.30	18.41
1% (100-Year)	108	15	0.77	4.84	20.72

Design Point ID: DS5 - Channel F (Backyard Channel Block 3)

TRAPEZOIDAL CHANNEL		
Design Storm:	1% (100-Year)	
Design Storm Q:	20.72	cfs
Channel Bottom (b):	4	ft.
Max. Water Surface Depth (y):	1.07	ft
Channel Site Slopes (z:1)	4. :1	
Longitudinal Channel Slope (S):	0.005	ft/ft
Manning roughness coefficient:	0.035	
Cross Sectional Area (A):	8.86	SF
Wetted Perimeter (P):	12.82	ft.
Hydraulic Radius (Rh):	0.691	ft.
Velocity (at capacity):	1.63	fps
Capacity Q= $1.49/n \times A \times Rh^{2/3} \times S^{1/2}$ =	20.84	cfs
Design / Capacity:	99%	OKAY

DRAINAGE STRUCTURE ANALYSIS

Project Name: **Brentwood Section 3**
 Project No.: **25.004**

Design Point ID: **DS-6 - Channel G (Backyard Channel Block 2)**
 Drainage Area(s): **P7**

DRAINAGE AREA AND WEIGHTED 'C' VALUE

Area (Acres)	'C'		C x A	Calculation Notes:
2.48	0.55	Residential Rural Estate	1.364	
	0.00	-	0.000	
	0.00	-	0.000	
	0.00	-	0.000	
	0.00	-	0.000	
TOTAL AREA: 2.48				
Total: C x A			1.364	
Weighted "C":			0.550	

TIME OF CONCENTRATION (Tc)

Overland Flow: Time of Concentration ($T_c = K(L^{0.37}/S^{0.20})$)
 Channel Flow: Time of Concentration ($T_c = K(L^{0.77}/S^{0.385})$)
 Pipe Flow: Time of Concentration ($T_c = L/V$)

Flow Type	Length (ft)	Surface Type	K	Start Elevation	End Elevation	Slope (ft/ft)	Tc (min)
Overland 1	300	Average Grass	1	1218.90	1214.20	0.0157	18.9
Overland 2		-	0			0.0000	0.0
Overland 3		-	0			0.0000	0.0
Overland 4		-	0			0.0000	0.0
Channelized 1	215	Meandering stream with pools	0.0102	1214.20	1210.70	0.0163	3.1
Channelized 2	137	\/-Ditch	0.012	1209.30	1207.60	0.0124	2.9
Channelized 3	159	\/-Ditch	0.012	1207.60	1206.80	0.0050	4.6
Channelized 4		-	0			0.0000	0.0
	L (ft)	Average Velocity (fps)					
Pipe 1							0.0
Pipe 2							0.0
Total Tc:							29.5

RAINFALL INTENSITY & PEAK FLOW

$Rainfall Intensity = I = a / ((Tc + b)c)$

Town of Goldsby (ODOT Zone V)				Rainfall Intensity (in/hr)	Runoff Q=CIA (cfs)
Storm Frequency	Parameters for IDF Equation				
	a	b	c		
50% (2-Year)	53	10	0.82	2.60	3.55
20% (5-Year)	64	12	0.79	3.37	4.60
10% (10-Year)	74	12	0.79	3.90	5.32
4% (25-Year)	93	15	0.79	4.64	6.33
2% (50-Year)	104	15	0.79	5.19	7.07
1% (100-Year)	108	15	0.77	5.81	7.93

Design Point ID: DS-6 - Channel G (Backyard Channel Block 2)

TRAPEZOIDAL CHANNEL		
Design Storm:	1% (100-Year)	
Design Storm Q:	7.93	cfs
Channel Bottom (b):	4	ft.
Max. Water Surface Depth (y):	0.67	ft
Channel Site Slopes (z:1)	4. :1	
Longitudinal Channel Slope (S):	0.005	ft/ft
Manning roughness coefficient:	0.035	
Cross Sectional Area (A):	4.48	SF
Wetted Perimeter (P):	9.52	ft.
Hydraulic Radius (Rh):	0.470	ft.
Velocity (at capacity):	0.85	fps
Capacity Q= $1.49/n \times A \times Rh^{2/3} \times S^{1/2}$ =	8.14	cfs
Design / Capacity:	97%	OKAY

DRAINAGE STRUCTURE ANALYSIS
 Project Name: **Brentwood Section 3**
 Project No.: **25.004**
 Design Point ID: **DS-7: Culvert C (from Section 2)**
 Drainage Area(s): **P6 + P7 + P8 + P9+ P10 + P11 + P12**

DRAINAGE AREA AND WEIGHTED 'C' VALUE				
Area (Acres)	'C'		C x A	Calculation Notes:
32.61	0.55	Residential Rural Estate	17.936	
	0.00	-	0.000	
	0.00	-	0.000	
	0.00	-	0.000	
TOTAL AREA: 32.61				
Total: C x A			17.936	
Weighted "C":			0.550	

TIME OF CONCENTRATION (Tc)							
Overland Flow: Time of Concentration ($T_c = K(L^{0.37}/S^{0.20})$)							
Channel Flow: Time of Concentration ($T_c = K(L^{0.77}/S^{0.385})$)							
Pipe Flow: Time of Concentration ($T_c = L/V$)							
Flow Type	Length (ft)	Surface Type	K	Start Elevation	End Elevation	Slope (ft/ft)	Tc (min)
Overland 1	300	Average Grass	1	1228.80	1223.10	0.0190	18.2
Overland 2		-	0			0.0000	0.0
Overland 3		-	0			0.0000	0.0
Overland 4		-	0			0.0000	0.0
Channelized 1	125	Meandering stream with pools	0.0102	1223.10	1221.00	0.0168	2.0
Channelized 2	820	∩-Ditch	0.012	1219.30	1215.50	0.0046	16.7
Channelized 3	328	∩-Ditch	0.012	1215.50	1214.20	0.0040	8.7
Channelized 4	1558	∩-Ditch	0.012	1213.90	1200.50	0.0086	21.5
	L (ft)	Average Velocity (fps)					
Pipe 1							0.0
Pipe 2							0.0
Total Tc:							67.1

RAINFALL INTENSITY & PEAK FLOW				Rainfall Intensity = $I = a / ((Tc+b)^c)$		
Town of Goldsby (ODOT Zone V)				Rainfall Intensity (in/hr)	Runoff Q=CIA (cfs)	
Storm Frequency	Parameters for IDF Equation					
	a	b	c			
50% (2-Year)	53	10	0.82	1.50	26.95	
20% (5-Year)	64	12	0.79	2.03	36.34	
10% (10-Year)	74	12	0.79	2.34	42.01	
4% (25-Year)	93	15	0.79	2.86	51.27	
2% (50-Year)	104	15	0.79	3.20	57.33	
1% (100-Year)	108	15	0.77	3.63	65.03	

TRAPEZOIDAL CHANNEL		
Design Storm:	1% (100-Year)	
Design Storm Q:	65.03	cfs
Channel Bottom (b):	4	ft.
Max. Water Surface Depth (y):	1.82	ft
Channel Site Slopes (z:1)	4 : 1	
Longitudinal Channel Slope (S):	0.005	ft/ft
Manning roughness coefficient:	0.035	
Cross Sectional Area (A):	20.53	SF
Wetted Perimeter (P):	19.01	ft.
Hydraulic Radius (Rh):	1.080	ft.
Velocity (at capacity):	3.42	fps
Capacity Q= 1.49/n x A x Rh ^{2/3} x S ^{1/2} =	65.05	cfs
Design / Capacity:	100%	OKAY

CULVERT C (Located in Section 2)

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 26.95 cfs

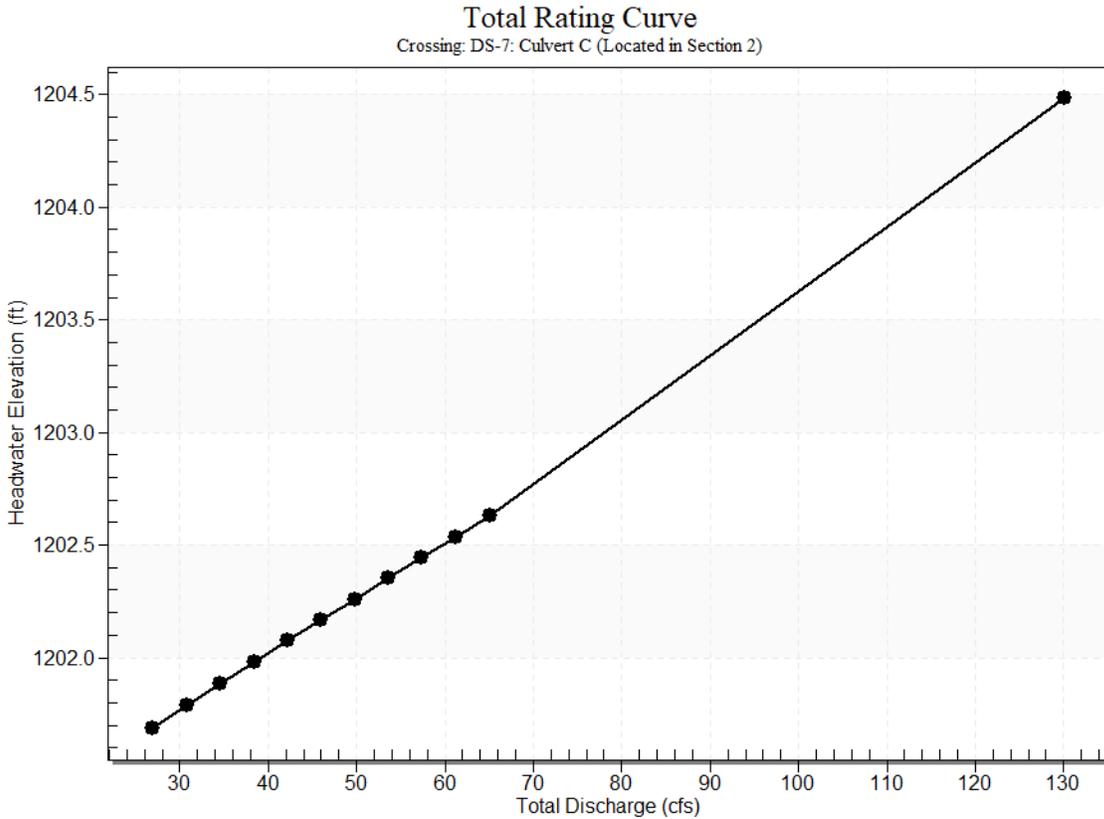
Design Flow: 57.33 cfs

Maximum Flow: 65.03 cfs **Q100**

Table 1 - Summary of Culvert Flows at Crossing: DS-7: Culvert C (Located in Section 2)

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert C (Section 2) Discharge (cfs)	Roadway Discharge (cfs)	Iterations
1201.69	26.95	26.95	0.00	1
1201.79	30.76	30.76	0.00	1
1201.89	34.57	34.57	0.00	1
1201.98	38.37	38.37	0.00	1
1202.07	42.18	42.18	0.00	1
1202.17	45.99	45.99	0.00	1
1202.26	49.80	49.80	0.00	1
1202.35	53.61	53.61	0.00	1
1202.44	57.33	57.33	0.00	1
1202.54	61.22	61.22	0.00	1
1202.63	65.03	65.03	0.00	1
1204.26	112.06	112.06	0.00	Overtopping

Rating Curve Plot for Crossing: DS-7: Culvert C (Located in Section 2)



Culvert Data: Culvert C (Section 2)

Table 1 - Culvert Summary Table: Culvert C (Section 2)

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
26.95 cfs	26.95 cfs	1201.69	1.03	1.148	1-S1t	0.67	0.76	1.12	1.12	3.00	2.84
30.76 cfs	30.76 cfs	1201.79	1.13	1.248	1-S1t	0.73	0.81	1.19	1.19	3.22	2.95
34.57 cfs	34.57 cfs	1201.89	1.22	1.346	1-S1t	0.78	0.87	1.26	1.26	3.44	3.04
38.37 cfs	38.37 cfs	1201.98	1.31	1.441	1-S1t	0.83	0.92	1.32	1.32	3.65	3.12
42.18 cfs	42.18 cfs	1202.07	1.40	1.535	1-S1t	0.89	0.97	1.38	1.38	3.85	3.20
45.99 cfs	45.99 cfs	1202.17	1.49	1.627	1-S1t	0.94	1.02	1.44	1.44	4.06	3.27
49.80 cfs	49.80 cfs	1202.26	1.59	1.719	1-S1t	0.99	1.07	1.49	1.49	4.27	3.34
53.61 cfs	53.61 cfs	1202.35	1.68	1.811	1-S1t	1.05	1.12	1.55	1.55	4.48	3.41
57.33 cfs	57.33 cfs	1202.44	1.77	1.901	1-S1t	1.10	1.16	1.59	1.59	4.68	3.47
61.22 cfs	61.22 cfs	1202.54	1.86	1.997	1-S1t	1.16	1.20	1.64	1.64	4.90	3.53
65.03 cfs	65.03 cfs	1202.63	1.96	2.092	1-S1t	1.22	1.25	1.69	1.69	5.12	3.58

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

Inlet Elevation (invert): 1200.54 ft,

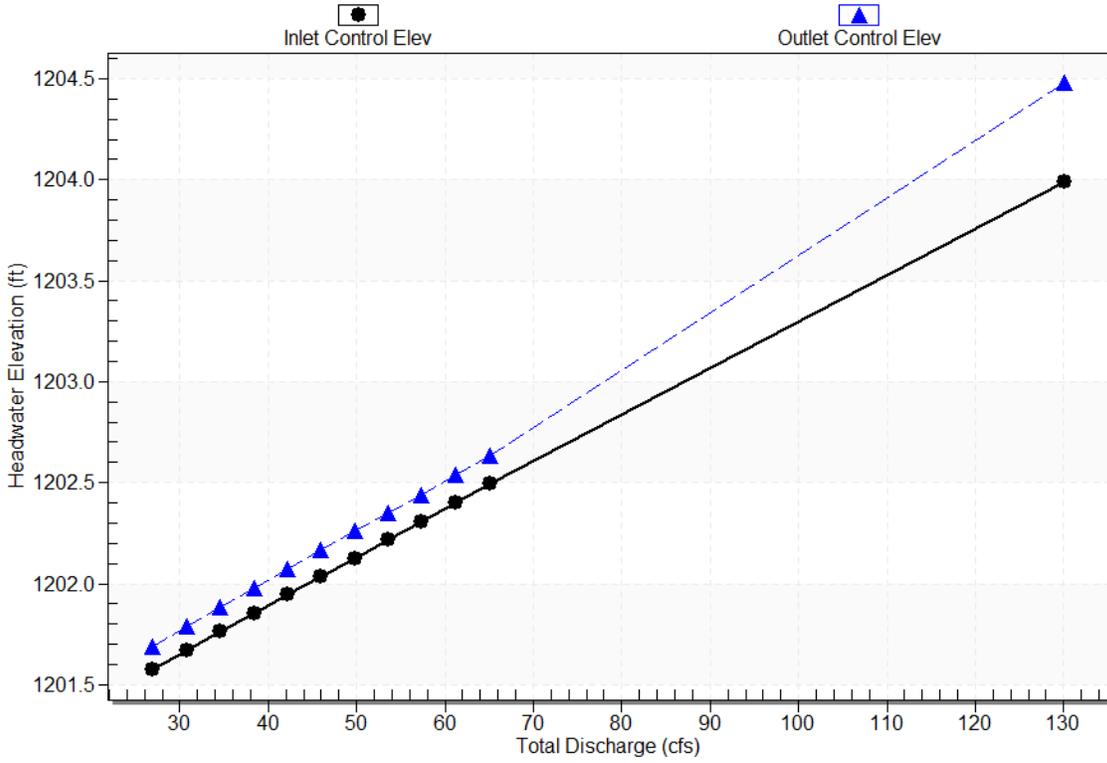
Outlet Elevation (invert): 1200.30 ft

Culvert Length: 48.02 ft,

Culvert Slope: 0.0050

Culvert Performance Curve Plot: Culvert C (Section 2)

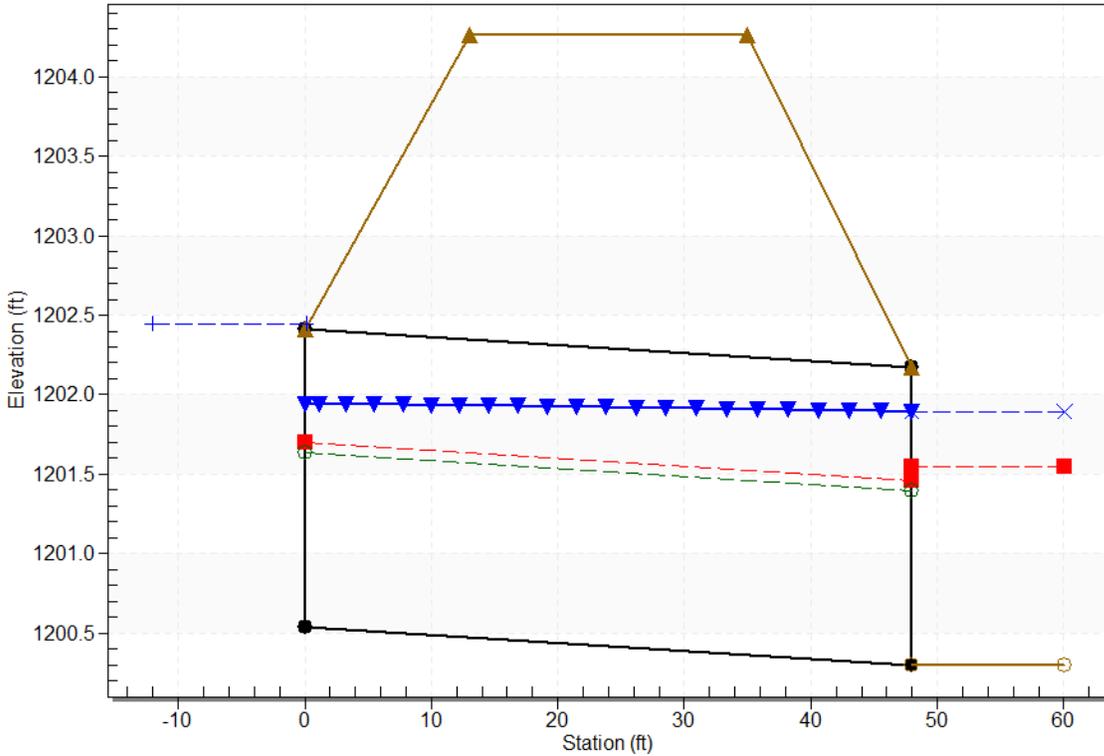
Performance Curve
Culvert: Culvert C (Section 2)



Water Surface Profile Plot for Culvert: Culvert C (Section 2)

Crossing - DS-7: Culvert C (Located in Section 2), Design Discharge - 57.3 cfs

Culvert - Culvert C (Section 2), Culvert Discharge - 57.3 cfs



Site Data - Culvert C (Section 2)

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 1200.54 ft

Outlet Station: 48.02 ft

Outlet Elevation: 1200.30 ft

Number of Barrels: 3

Culvert Data Summary - Culvert C (Section 2)

Barrel Shape: Pipe Arch

Barrel Span: 36.25 in

Barrel Rise: 22.50 in

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Grooved Edge with Headwall (Ke=0.2)

Inlet Depression: None

Tailwater Data for Crossing: DS-7: Culvert C (Located in Section 2)

Table 2 - Downstream Channel Rating Curve (Crossing: DS-7: Culvert C (Located in Section 2))

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
26.95	1201.42	1.12	2.84	0.49	0.59
30.76	1201.49	1.19	2.95	0.52	0.59
34.57	1201.56	1.26	3.04	0.55	0.60
38.37	1201.62	1.32	3.12	0.58	0.60
42.18	1201.68	1.38	3.20	0.60	0.60
45.99	1201.74	1.44	3.27	0.63	0.61
49.80	1201.79	1.49	3.34	0.65	0.61
53.61	1201.85	1.55	3.41	0.67	0.61
57.33	1201.89	1.59	3.47	0.70	0.62
61.22	1201.94	1.64	3.53	0.72	0.62
65.03	1201.99	1.69	3.58	0.74	0.62

Tailwater Channel Data - DS-7: Culvert C (Located in Section 2)

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

Side Slope (H:V): 4.00 (:1)

Channel Slope: 0.0070

Channel Manning's n: 0.0350

Channel Invert Elevation: 1200.30 ft

Roadway Data for Crossing: DS-7: Culvert C (Located in Section 2)

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 1204.26 ft

Roadway Surface: Paved

Roadway Top Width: 22.00 ft

DRAINAGE STRUCTURE ANALYSIS

Project Name: **Brentwood Section 3**
 Project No.: **25.004**

Design Point ID: **DS-8: Culvert G**
 Drainage Area(s): **P8 + P9 + P10 + P11**

DRAINAGE AREA AND WEIGHTED 'C' VALUE

Area (Acres)	'C'		C x A	Calculation Notes:
3.24	0.55	Residential Rural Estate	1.782	
0.66	0.55	Residential Rural Estate	0.363	
7.06	0.55	Residential Rural Estate	3.883	
5.21	0.55	Residential Rural Estate	2.866	
TOTAL AREA: 16.17				
Total: C x A 8.894				
Weighted "C": 0.550				

TIME OF CONCENTRATION (Tc)

Overland Flow: Time of Concentration ($T_c = K(L^{0.37}/S^{0.20})$)
 Channel Flow: Time of Concentration ($T_c = K(L^{0.77}/S^{0.385})$)
 Pipe Flow: Time of Concentration ($T_c = L/V$)

Flow Type	Length (ft)	Surface Type	K	Start Elevation	End Elevation	Slope (ft/ft)	Tc (min)
Overland 1	300	Average Grass	1	1228.80	1223.10	0.0190	18.2
Overland 2		-	0			0.0000	0.0
Overland 3		-	0			0.0000	0.0
Overland 4		-	0			0.0000	0.0
Channelized 1	125	Meandering stream with pools	0.0102	1223.10	1221.00	0.0168	2.0
Channelized 2	820	\-/Ditch	0.012	1219.30	1215.50	0.0046	16.7
Channelized 3	328	\-/Ditch	0.012	1215.50	1214.20	0.0040	8.7
Channelized 4		-	0			0.0000	0.0
	L (ft)	Average Velocity (fps)					
Pipe 1							0.0
Pipe 2							0.0
Total Tc:							45.6

RAINFALL INTENSITY & PEAK FLOW

$Rainfall Intensity = I = a / ((Tc + b)c)$

Town of Goldsby (ODOT Zone V)				Rainfall Intensity (in/hr)	Runoff Q=CIA (cfs)
Storm Frequency	Parameters for IDF Equation				
	a	b	c		
50% (2-Year)	53	10	0.82	1.96	17.47
20% (5-Year)	64	12	0.79	2.60	23.15
10% (10-Year)	74	12	0.79	3.01	26.77
4% (25-Year)	93	15	0.79	3.63	32.31
2% (50-Year)	104	15	0.79	4.06	36.14
1% (100-Year)	108	15	0.77	4.58	40.74

Design Point ID: DS-8: Culvert G

TRAPEZOIDAL CHANNEL		
Design Storm:	1% (100-Year)	
Design Storm Q:	40.74	cfs
Channel Bottom (b):	4	ft.
Max. Water Surface Depth (y):	1.55	ft
Channel Site Slopes (z:1):	4. :1	
Longitudinal Channel Slope (S):	0.004	ft/ft
Manning roughness coefficient:	0.035	
Cross Sectional Area (A):	15.81	SF
Wetted Perimeter (P):	16.78	ft.
Hydraulic Radius (Rh):	0.942	ft.
Velocity (at capacity):	2.44	fps
Capacity Q= $1.49/n \times A \times Rh^{2/3} \times S^{1/2}$ =	40.91	cfs
Design / Capacity:	100%	OKAY

CULVERT G

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: Specify Minimum, Design, and Maximum Flow

Minimum Flow: 17.47 cfs

Design Flow: 36.14 cfs

Maximum Flow: 40.74 cfs **Q100**

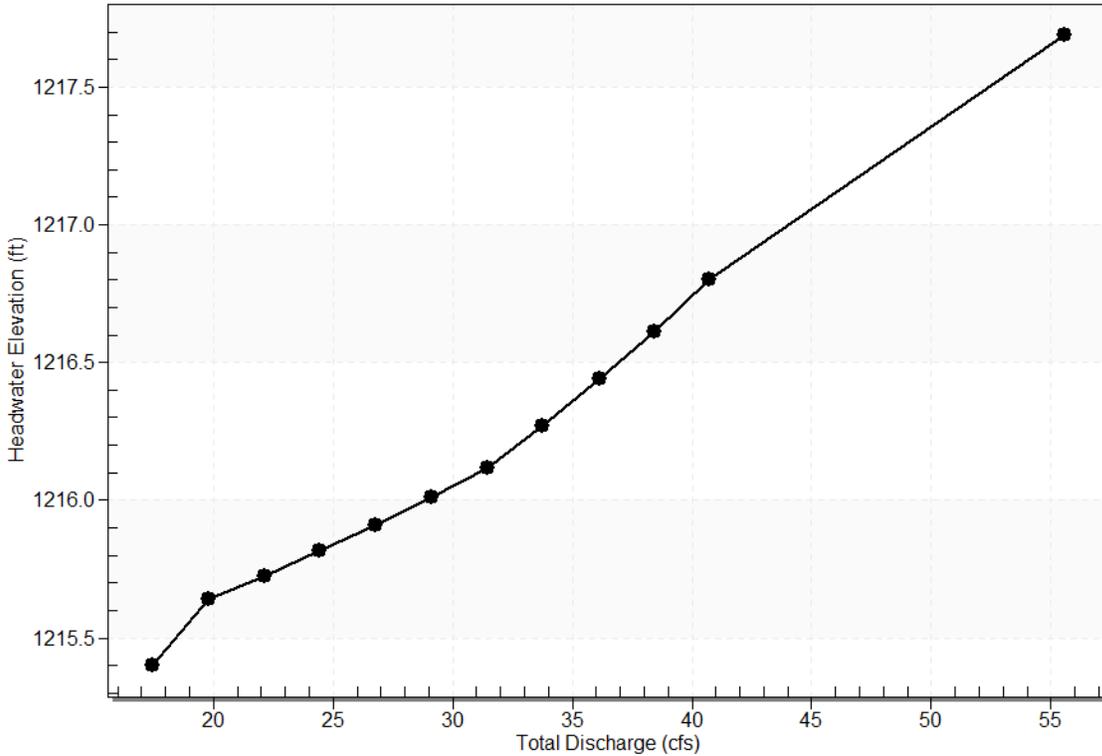
Table 1 - Summary of Culvert Flows at Crossing: DS-8: Culvert G

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert G Discharge (cfs)	Roadway Discharge (cfs)	Iterations
1215.40	17.47	17.47	0.00	1
1215.64	19.80	19.80	0.00	1
1215.72	22.12	22.12	0.00	1
1215.82	24.45	24.45	0.00	1
1215.91	26.78	26.78	0.00	1
1216.01	29.11	29.11	0.00	1
1216.12	31.43	31.43	0.00	1
1216.27	33.76	33.76	0.00	1
1216.44	36.14	36.14	0.00	1
1216.61	38.41	38.41	0.00	1
1216.80	40.74	40.74	0.00	1
1217.58	49.28	49.28	0.00	Overtopping

Rating Curve Plot for Crossing: DS-8: Culvert G

Total Rating Curve

Crossing: DS-8: Culvert G



Culvert Data: Culvert G

Table 1 - Culvert Summary Table: Culvert G

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
17.47 cfs	17.47 cfs	1215.40	1.20	1.015	1-JS1t	0.79	0.80	1.04	1.04	3.35	2.06
19.80 cfs	19.80 cfs	1215.64	1.30	1.441	1-S1t	0.85	0.86	1.10	1.10	3.55	2.13
22.12 cfs	22.12 cfs	1215.72	1.41	1.524	7-M1t	0.91	0.91	1.16	1.16	3.76	2.20
24.45 cfs	24.45 cfs	1215.82	1.52	1.615	7-M1t	0.97	0.96	1.22	1.22	3.97	2.26
26.78 cfs	26.78 cfs	1215.91	1.64	1.710	7-M1t	1.04	1.00	1.27	1.27	4.19	2.31
29.11 cfs	29.11 cfs	1216.01	1.77	1.810	7-M1t	1.11	1.04	1.32	1.32	4.41	2.36
31.43 cfs	31.43 cfs	1216.12	1.91	1.918	7-M1t	1.19	1.09	1.37	1.37	4.63	2.41
33.76 cfs	33.76 cfs	1216.27	2.07	2.038	7-M1t	1.30	1.12	1.42	1.42	4.88	2.46
36.14 cfs	36.14 cfs	1216.44	2.24	2.207	7-M2t	1.50	1.16	1.50	1.47	5.14	2.50
38.41 cfs	38.41 cfs	1216.61	2.41	2.393	4-FFf	1.50	1.20	1.50	1.51	5.43	2.54
40.74 cfs	40.74 cfs	1216.80	2.60	2.578	4-FFf	1.50	1.23	1.50	1.55	5.76	2.58

Culvert Barrel Data

Culvert Barrel Type Straight Culvert

Inlet Elevation (invert): 1214.20 ft,

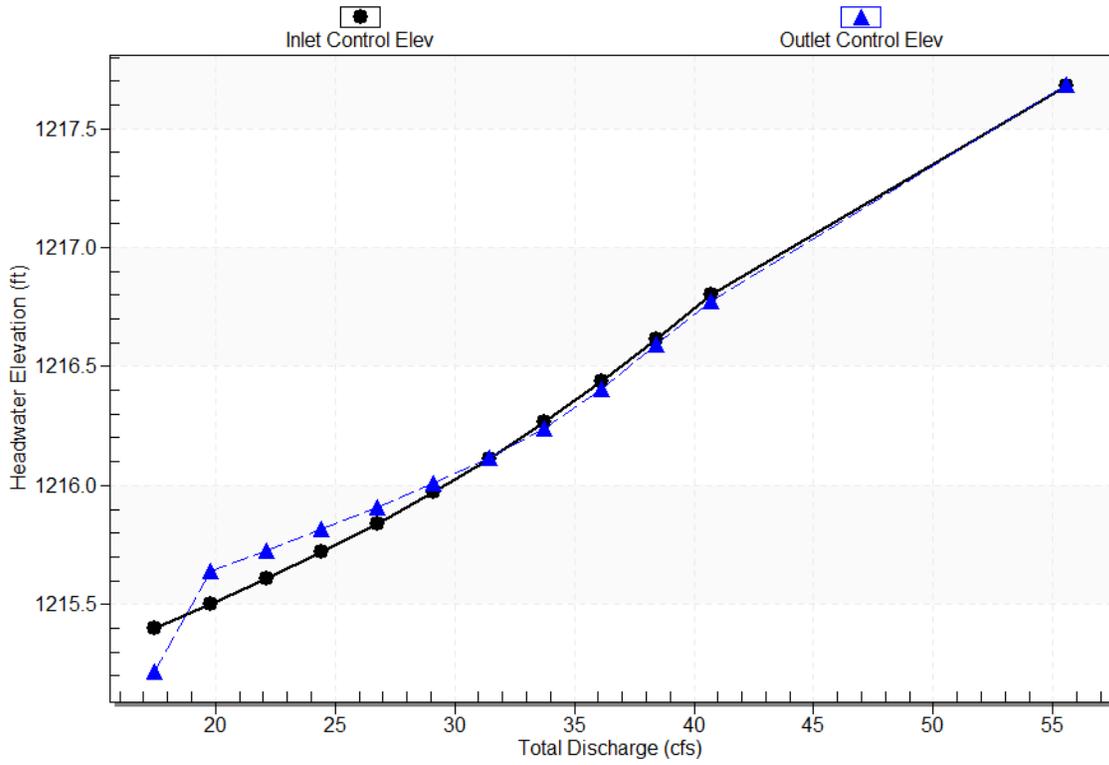
Outlet Elevation (invert): 1213.94 ft

Culvert Length: 51.73 ft,

Culvert Slope: 0.0050

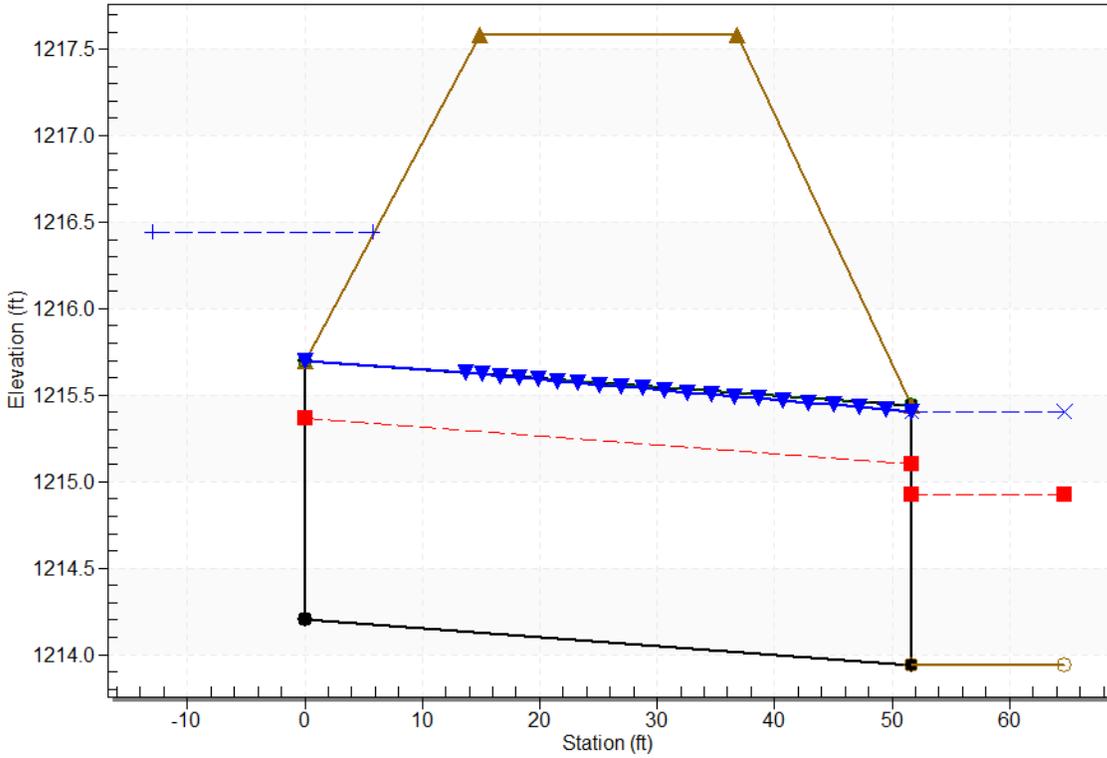
Culvert Performance Curve Plot: Culvert G

Performance Curve Culvert: Culvert G



Water Surface Profile Plot for Culvert: Culvert G

Crossing - DS-8: Culvert G, Design Discharge - 36.1 cfs
Culvert - Culvert G, Culvert Discharge - 36.1 cfs



Site Data - Culvert G

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 1214.20 ft

Outlet Station: 51.73 ft

Outlet Elevation: 1213.94 ft

Number of Barrels: 4

Culvert Data Summary - Culvert G

Barrel Shape: Circular

Barrel Diameter: 1.50 ft

Barrel Material: Smooth HDPE

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Culvert Type: Straight

Inlet Configuration: Mitered to Conform to Slope (Ke=0.7)

Inlet Depression: None

Tailwater Data for Crossing: DS-8: Culvert G

Table 2 - Downstream Channel Rating Curve (Crossing: DS-8: Culvert G)

Flow (cfs)	Water Surface Elev (ft)	Velocity (ft/s)	Depth (ft)	Shear (psf)	Froude Number
17.47	1214.98	1.04	2.06	0.26	0.44
19.80	1215.04	1.10	2.13	0.28	0.44
22.12	1215.10	1.16	2.20	0.29	0.45
24.45	1215.16	1.22	2.26	0.30	0.45
26.78	1215.21	1.27	2.31	0.32	0.45
29.11	1215.26	1.32	2.36	0.33	0.45
31.43	1215.31	1.37	2.41	0.34	0.46
33.76	1215.36	1.42	2.46	0.35	0.46
36.14	1215.41	1.47	2.50	0.37	0.46
38.41	1215.45	1.51	2.54	0.38	0.46
40.74	1215.49	1.55	2.58	0.39	0.46

Tailwater Channel Data - DS-8: Culvert G

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 4.00 ft

Side Slope (H:V): 4.00 (1:1)

Channel Slope: 0.0040

Channel Manning's n: 0.0350

Channel Invert Elevation: 1213.94 ft

Roadway Data for Crossing: DS-8: Culvert G

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 50.00 ft

Crest Elevation: 1217.58 ft

Roadway Surface: Paved

Roadway Top Width: 22.00 ft

DRAINAGE STRUCTURE ANALYSIS

Project Name: **Brentwood Section 3**
 Project No.: **25.004**

Design Point ID: **DS-9: Channel H (North Backyard Channel Block 1)**
 Drainage Area(s): **P10**

DRAINAGE AREA AND WEIGHTED 'C' VALUE

Area (Acres)	'C'		C x A	Calculation Notes:
7.06	0.55	Residential Rural Estate	3.883	
	0.00	-	0.000	
	0.00	-	0.000	
	0.00	-	0.000	
TOTAL AREA: 7.06				
Total: C x A			3.883	
Weighted "C":			0.550	

TIME OF CONCENTRATION (Tc)

Overland Flow: Time of Concentration ($T_c = K(L^{0.37}/S^{0.20})$)
 Channel Flow: Time of Concentration ($T_c = K(L^{0.77}/S^{0.385})$)
 Pipe Flow: Time of Concentration ($T_c = L/V$)

Flow Type	Length (ft)	Surface Type	K	Start Elevation	End Elevation	Slope (ft/ft)	Tc (min)
Overland 1	300	Average Grass	1	1232.80	1225.80	0.0233	17.5
Overland 2		-	0			0.0000	0.0
Overland 3		-	0			0.0000	0.0
Overland 4		-	0			0.0000	0.0
Channelized 1	102	Meandering stream with pools	0.0102	1225.80	1224.00	0.0176	1.7
Channelized 2	688	\-/Ditch	0.012	1222.00	1217.90	0.0060	13.2
Channelized 3		-	0			0.0000	0.0
Channelized 4		-	0			0.0000	0.0
	L (ft)	Average Velocity (fps)					
Pipe 1							0.0
Pipe 2							0.0
Total Tc:							32.4

RAINFALL INTENSITY & PEAK FLOW

$Rainfall Intensity = I = a / ((Tc + b)c)$

Town of Goldsby (ODOT Zone V)				Rainfall Intensity (in/hr)	Runoff Q=CIA (cfs)
Storm Frequency	Parameters for IDF Equation				
	a	b	c		
50% (2-Year)	53	10	0.82	2.45	9.53
20% (5-Year)	64	12	0.79	3.20	12.41
10% (10-Year)	74	12	0.79	3.70	14.35
4% (25-Year)	93	15	0.79	4.41	17.13
2% (50-Year)	104	15	0.79	4.93	19.16
1% (100-Year)	108	15	0.77	5.53	21.49

Design Point ID: DS-9: Channel H (North Backyard Channel Block 1)

TRAPEZOIDAL CHANNEL		
Design Storm:	1% (100-Year)	
Design Storm Q:	21.49	cfs
Channel Bottom (b):	4	ft.
Max. Water Surface Depth (y):	1.09	ft
Channel Site Slopes (z:1)	4. :1	
Longitudinal Channel Slope (S):	0.005	ft/ft
Manning roughness coefficient:	0.035	
Cross Sectional Area (A):	9.11	SF
Wetted Perimeter (P):	12.99	ft.
Hydraulic Radius (Rh):	0.702	ft.
Velocity (at capacity):	1.67	fps
Capacity Q= $1.49/n \times A \times Rh^{2/3} \times S^{1/2}$ =	21.66	cfs
Design / Capacity:	99%	OKAY

DRAINAGE STRUCTURE ANALYSIS

Project Name: **Brentwood Section 3**
 Project No.: **25.004**

Design Point ID: **DS-10 - South of Mission Hills Dr. on west side of Pine Ridge Drive**
 Drainage Area(s): **P11**

DRAINAGE AREA AND WEIGHTED 'C' VALUE

Area (Acres)	'C'		C x A	Calculation Notes:
5.21	0.55	Residential Rural Estate	2.866	
	0.00	-	0.000	
	0.00	-	0.000	
	0.00	-	0.000	
	0.00	-	0.000	
TOTAL AREA: 5.21				
Total: C x A			2.866	
Weighted "C":			0.550	

TIME OF CONCENTRATION (Tc)

Overland Flow: Time of Concentration ($T_c = K(L^{0.37}/S^{0.20})$)
 Channel Flow: Time of Concentration ($T_c = K(L^{0.77}/S^{0.385})$)
 Pipe Flow: Time of Concentration ($T_c = L/V$)

Flow Type	Length (ft)	Surface Type	K	Start Elevation	End Elevation	Slope (ft/ft)	Tc (min)
Overland 1	300	Average Grass	1	1228.80	1223.10	0.0190	18.2
Overland 2		-	0			0.0000	0.0
Overland 3		-	0			0.0000	0.0
Overland 4		-	0			0.0000	0.0
Channelized 1	125	Meandering stream with pools	0.0102	1223.10	1221.00	0.0168	2.0
Channelized 2	820	\-/Ditch	0.012	1219.30	1215.50	0.0046	16.7
Channelized 3		-	0			0.0000	0.0
Channelized 4		-	0			0.0000	0.0
	L (ft)	Average Velocity (fps)					
Pipe 1							0.0
Pipe 2							0.0
Total Tc:							36.9

RAINFALL INTENSITY & PEAK FLOW

$Rainfall Intensity = I = a / ((Tc + b)c)$

Town of Goldsby (ODOT Zone V)				Rainfall Intensity (in/hr)	Runoff Q=CIA (cfs)
Storm Frequency	Parameters for IDF Equation				
	a	b	c		
50% (2-Year)	53	10	0.82	2.26	6.47
20% (5-Year)	64	12	0.79	2.96	8.49
10% (10-Year)	74	12	0.79	3.43	9.81
4% (25-Year)	93	15	0.79	4.11	11.77
2% (50-Year)	104	15	0.79	4.59	13.16
1% (100-Year)	108	15	0.77	5.16	14.79

Design Point ID: DS-10 - South of Mission Hills Dr. on west side of Pine Ridge Drive

TRAPEZOIDAL CHANNEL		
Design Storm:	1% (100-Year)	
Design Storm Q:	14.79	cfs
Channel Bottom (b):	4	ft.
Max. Water Surface Depth (y):	0.87	ft
Channel Site Slopes (z:1)	4. :1	
Longitudinal Channel Slope (S):	0.006	ft/ft
Manning roughness coefficient:	0.035	
Cross Sectional Area (A):	6.51	SF
Wetted Perimeter (P):	11.17	ft.
Hydraulic Radius (Rh):	0.582	ft.
Velocity (at capacity):	1.34	fps
Capacity Q= $1.49/n \times A \times Rh^{2/3} \times S^{1/2}$ =	14.97	cfs
Design / Capacity:	99%	OKAY

DRAINAGE STRUCTURE ANALYSIS

Project Name: **Brentwood Section 3**
 Project No.: **25.004**

Design Point ID: **DS-11: North Barditch at Rock Hill Dr.**
 Drainage Area(s): **P8**

DRAINAGE AREA AND WEIGHTED 'C' VALUE

Area (Acres)	'C'		C x A	Calculation Notes:
3.24	0.55	Residential Rural Estate	1.782	
	0.00	-	0.000	
	0.00	-	0.000	
	0.00	-	0.000	
TOTAL AREA: 3.24				
Total: C x A			1.782	
Weighted "C":			0.550	

TIME OF CONCENTRATION (Tc)

Overland Flow: Time of Concentration ($T_c = K(L^{0.37}/S^{0.20})$)
 Channel Flow: Time of Concentration ($T_c = K(L^{0.77}/S^{0.385})$)
 Pipe Flow: Time of Concentration ($T_c = L/V$)

Flow Type	Length (ft)	Surface Type	K	Start Elevation	End Elevation	Slope (ft/ft)	Tc (min)
Overland 1	254	Average Grass	1	1232.80	1227.00	0.0228	16.5
Overland 2		-	0			0.0000	0.0
Overland 3		-	0			0.0000	0.0
Overland 4		-	0			0.0000	0.0
Channelized 1	1111	∩/-Ditch	0.012	1223.50	1214.20	0.0084	16.8
Channelized 2		-	0			0.0000	0.0
Channelized 3		-	0			0.0000	0.0
Channelized 4		-	0			0.0000	0.0
	L (ft)	Average Velocity (fps)					
Pipe 1							0.0
Pipe 2							0.0
Total Tc:							33.3

RAINFALL INTENSITY & PEAK FLOW

$Rainfall Intensity = I = a / ((Tc + b)c)$

Town of Goldsby (ODOT Zone V)				Rainfall Intensity (in/hr)	Runoff Q=CIA (cfs)
Storm Frequency	Parameters for IDF Equation				
	a	b	c		
50% (2-Year)	53	10	0.82	2.41	4.30
20% (5-Year)	64	12	0.79	3.15	5.61
10% (10-Year)	74	12	0.79	3.64	6.48
4% (25-Year)	93	15	0.79	4.35	7.75
2% (50-Year)	104	15	0.79	4.86	8.66
1% (100-Year)	108	15	0.77	5.45	9.72

Design Point ID: DS-11: North Barditch at Rock Hill Dr.

TRAPEZOIDAL CHANNEL		
Design Storm:	1% (100-Year)	
Design Storm Q:	9.72	cfs
Channel Bottom (b):	4	ft.
Max. Water Surface Depth (y):	0.66	ft
Channel Site Slopes (z:1)	4. :1	
Longitudinal Channel Slope (S):	0.008	ft/ft
Manning roughness coefficient:	0.035	
Cross Sectional Area (A):	4.38	SF
Wetted Perimeter (P):	9.44	ft.
Hydraulic Radius (Rh):	0.464	ft.
Velocity (at capacity):	1.06	fps
Capacity Q= $1.49/n \times A \times Rh^{2/3} \times S^{1/2}$ =	10.00	cfs
Design / Capacity:	97%	OKAY

DRAINAGE STRUCTURE ANALYSIS

Project Name: **Brentwood Section 3**
 Project No.: **25.004**

Design Point ID: **DS-12: North Barditch Edgewood Ln.**
 Drainage Area(s): **P4 + P5**

DRAINAGE AREA AND WEIGHTED 'C' VALUE

Area (Acres)	'C'		C x A	Calculation Notes:
11.11	0.55	Residential Rural Estate	6.111	
7.78	0.55	Residential Rural Estate	4.279	
	0.00	-	0.000	
	0.00	-	0.000	
TOTAL AREA: 18.89				
Total: C x A 10.390				
Weighted "C": 0.550				

TIME OF CONCENTRATION (Tc)

Overland Flow: Time of Concentration ($T_c = K(L^{0.37}/S^{0.20})$)
 Channel Flow: Time of Concentration ($T_c = K(L^{0.77}/S^{0.385})$)
 Pipe Flow: Time of Concentration ($T_c = L/V$)

Flow Type	Length (ft)	Surface Type	K	Start Elevation	End Elevation	Slope (ft/ft)	Tc (min)
Overland 1	300	Average Grass	1	1226.20	1220.30	0.0197	18.1
Overland 2		-	0			0.0000	0.0
Overland 3		-	0			0.0000	0.0
Overland 4		-	0			0.0000	0.0
Channelized 1	148	Meandering stream with pools	0.0102	1220.30	1219.70	0.0041	4.0
Channelized 2	1035	\-/Ditch	0.012	1217.70	1212.50	0.0050	19.3
Channelized 3	312	\-/Ditch	0.012	1212.50	1210.30	0.0071	6.7
Channelized 4		-	0			0.0000	0.0
	L (ft)	Average Velocity (fps)					
Pipe 1							0.0
Pipe 2							0.0
Total Tc:							48.1

RAINFALL INTENSITY & PEAK FLOW

$Rainfall Intensity = I = a / ((Tc + b)c)$

Town of Goldsby (ODOT Zone V)				Rainfall Intensity (in/hr)	Runoff Q=CIA (cfs)
Storm Frequency	Parameters for IDF Equation				
	a	b	c		
50% (2-Year)	53	10	0.82	1.90	19.69
20% (5-Year)	64	12	0.79	2.52	26.15
10% (10-Year)	74	12	0.79	2.91	30.24
4% (25-Year)	93	15	0.79	3.52	36.56
2% (50-Year)	104	15	0.79	3.94	40.89
1% (100-Year)	108	15	0.77	4.44	46.13

Design Point ID: DS-12: North Barditch Edgewood Ln.

TRAPEZOIDAL CHANNEL		
Design Storm:	1% (100-Year)	
Design Storm Q:	46.13	cfs
Channel Bottom (b):	4	ft.
Max. Water Surface Depth (y):	1.56	ft
Channel Site Slopes (z:1)	4. :1	
Longitudinal Channel Slope (S):	0.005	ft/ft
Manning roughness coefficient:	0.035	
Cross Sectional Area (A):	15.97	SF
Wetted Perimeter (P):	16.86	ft.
Hydraulic Radius (Rh):	0.947	ft.
Velocity (at capacity):	2.75	fps
Capacity Q= $1.49/n \times A \times Rh^{2/3} \times S^{1/2}$ =	46.38	cfs
Design / Capacity:	99%	OKAY

DRAINAGE STRUCTURE ANALYSIS

Project Name: **Brentwood Section 3**
 Project No.: **25.004**

Design Point ID: **DS-13: North Barditch at Pine Ridge Dr. & Paige Ln. before Channel G**
 Drainage Area(s): **P6 + P7 + P8 + P9+ P10 + P11 + P12**

DRAINAGE AREA AND WEIGHTED 'C' VALUE

Area (Acres)	'C'		C x A	Calculation Notes:
23.66	0.55	Residential Rural Estate	13.013	
	0.00	-	0.000	
	0.00	-	0.000	
	0.00	-	0.000	
TOTAL AREA: 23.66				
Total: C x A			13.013	
Weighted "C":			0.550	

TIME OF CONCENTRATION (Tc)

Overland Flow: Time of Concentration ($T_c = K(L^{0.37}/S^{0.20})$)
 Channel Flow: Time of Concentration ($T_c = K(L^{0.77}/S^{0.385})$)
 Pipe Flow: Time of Concentration ($T_c = L/V$)

Flow Type	Length (ft)	Surface Type	K	Start Elevation	End Elevation	Slope (ft/ft)	Tc (min)
Overland 1	300	Average Grass	1	1228.80	1223.10	0.0190	18.2
Overland 2		-	0			0.0000	0.0
Overland 3		-	0			0.0000	0.0
Overland 4		-	0			0.0000	0.0
Channelized 1	125	Meandering stream with pools	0.0102	1223.10	1221.00	0.0168	2.0
Channelized 2	820	\-/Ditch	0.012	1219.30	1215.50	0.0046	16.7
Channelized 3	328	\-/Ditch	0.012	1215.50	1214.20	0.0040	8.7
Channelized 4	1049	\-/Ditch	0.012	1213.90	1206.80	0.0068	17.4
	L (ft)	Average Velocity (fps)					
Pipe 1							0.0
Pipe 2							0.0
Total Tc:							63.0

RAINFALL INTENSITY & PEAK FLOW

$Rainfall Intensity = I = a / ((Tc + b)c)$

Town of Goldsby (ODOT Zone V)				Rainfall Intensity (in/hr)	Runoff Q=CIA (cfs)
Storm Frequency	Parameters for IDF Equation				
	a	b	c		
50% (2-Year)	53	10	0.82	1.57	20.45
20% (5-Year)	64	12	0.79	2.11	27.50
10% (10-Year)	74	12	0.79	2.44	31.79
4% (25-Year)	93	15	0.79	2.98	38.74
2% (50-Year)	104	15	0.79	3.33	43.32
1% (100-Year)	108	15	0.77	3.77	49.08

Design Point ID: DS-13: North Barditch at Pine Ridge Dr. & Paige Ln. before Channel G

TRAPEZOIDAL CHANNEL		
Design Storm:	1% (100-Year)	
Design Storm Q:	49.08	cfs
Channel Bottom (b):	4	ft.
Max. Water Surface Depth (y):	1.28	ft
Channel Site Slopes (z:1)	4. :1	
Longitudinal Channel Slope (S):	0.0131	ft/ft
Manning roughness coefficient:	0.035	
Cross Sectional Area (A):	11.67	SF
Wetted Perimeter (P):	14.56	ft.
Hydraulic Radius (Rh):	0.802	ft.
Velocity (at capacity):	3.37	fps
Capacity Q= $1.49/n \times A \times Rh^{2/3} \times S^{1/2}$ =	49.10	cfs
Design / Capacity:	100%	OKAY

DRAINAGE STRUCTURE ANALYSIS

Project Name: **Brentwood Section 3**
 Project No.: **25.004**

Design Point ID: **DS-14: Barditch at Edgewood Ln. South side before Culvert F**
 Drainage Area(s): **P2**

DRAINAGE AREA AND WEIGHTED 'C' VALUE

Area (Acres)	'C'		C x A	Calculation Notes:
6.12	0.55	Residential Rural Estate	3.366	
	0.00	-	0.000	
	0.00	-	0.000	
	0.00	-	0.000	
TOTAL AREA: 6.12				
Total: C x A			3.366	
Weighted "C":			0.550	

TIME OF CONCENTRATION (Tc)

Overland Flow: Time of Concentration ($T_c = K(L^{0.37}/S^{0.20})$)
 Channel Flow: Time of Concentration ($T_c = K(L^{0.77}/S^{0.385})$)
 Pipe Flow: Time of Concentration ($T_c = L/V$)

Flow Type	Length (ft)	Surface Type	K	Start Elevation	End Elevation	Slope (ft/ft)	Tc (min)
Overland 1	191	Average Grass	1	1232.00	1227.60	0.0230	14.8
Overland 2		-	0			0.0000	0.0
Overland 3		-	0			0.0000	0.0
Overland 4		-	0			0.0000	0.0
Channelized 1	184	Meandering stream with pools	0.0102	1227.60	1226.10	0.0082	3.6
Channelized 2	1973	\-/Ditch	0.012	1224.10	1209.90	0.0072	27.6
Channelized 3		-	0			0.0000	0.0
Channelized 4		-	0			0.0000	0.0
	L (ft)	Average Velocity (fps)					
Pipe 1							0.0
Pipe 2							0.0
Total Tc:							46.0

RAINFALL INTENSITY & PEAK FLOW

$Rainfall Intensity = I = a / ((Tc + b)c)$

Town of Goldsby (ODOT Zone V)				Rainfall Intensity (in/hr)	Runoff Q=CIA (cfs)
Storm Frequency	Parameters for IDF Equation				
	a	b	c		
50% (2-Year)	53	10	0.82	1.95	6.57
20% (5-Year)	64	12	0.79	2.59	8.71
10% (10-Year)	74	12	0.79	2.99	10.07
4% (25-Year)	93	15	0.79	3.61	12.17
2% (50-Year)	104	15	0.79	4.04	13.61
1% (100-Year)	108	15	0.77	4.56	15.34

Design Point ID: DS-14: Barditch at Edgewood Ln. South side before Culvert F

TRAPEZOIDAL CHANNEL		
Design Storm:	1% (100-Year)	
Design Storm Q:	15.34	cfs
Channel Bottom (b):	4	ft.
Max. Water Surface Depth (y):	0.93	ft
Channel Site Slopes (z:1)	4. :1	
Longitudinal Channel Slope (S):	0.005	ft/ft
Manning roughness coefficient:	0.035	
Cross Sectional Area (A):	7.18	SF
Wetted Perimeter (P):	11.67	ft.
Hydraulic Radius (Rh):	0.615	ft.
Velocity (at capacity):	1.34	fps
Capacity Q= $1.49/n \times A \times Rh^{2/3} \times S^{1/2}$ =	15.63	cfs
Design / Capacity:	98%	OKAY

DRAINAGE STRUCTURE ANALYSIS

Project Name: **Brentwood Section 3**
 Project No.: **25.004**

Design Point ID: **DS-15: Barditch at Pine Ridge Dr. South side before Culvert E & Channel E**
 Drainage Area(s): **P2 + P4 + P5**

DRAINAGE AREA AND WEIGHTED 'C' VALUE

Area (Acres)	'C'		C x A	Calculation Notes:
6.12	0.55	Residential Rural Estate	3.366	
11.11	0.55	Residential Rural Estate	6.111	
7.78	0.55	Residential Rural Estate	4.279	
	0.00	-	0.000	
TOTAL AREA: 25.01				
Total: C x A			13.756	
Weighted "C":			0.550	

TIME OF CONCENTRATION (Tc)

Overland Flow: Time of Concentration ($T_c = K(L^{0.37}/S^{0.20})$)
 Channel Flow: Time of Concentration ($T_c = K(L^{0.77}/S^{0.385})$)
 Pipe Flow: Time of Concentration ($T_c = L/V$)

Flow Type	Length (ft)	Surface Type	K	Start Elevation	End Elevation	Slope (ft/ft)	Tc (min)
Overland 1	191	Average Grass	1	1232.00	1227.60	0.0230	14.8
Overland 2		-	0			0.0000	0.0
Overland 3		-	0			0.0000	0.0
Overland 4		-	0			0.0000	0.0
Channelized 1	184	Meandering stream with pools	0.0102	1227.60	1226.10	0.0082	3.6
Channelized 2	1973	\-/Ditch	0.012	1224.10	1209.90	0.0072	27.6
Channelized 3	317	\-/Ditch	0.012	1209.90	1208.70	0.0038	8.7
Channelized 4		-	0			0.0000	0.0
	L (ft)	Average Velocity (fps)					
Pipe 1							0.0
Pipe 2							0.0
Total Tc:							54.7

RAINFALL INTENSITY & PEAK FLOW

$Rainfall Intensity = I = a / ((Tc + b)c)$

Town of Goldsby (ODOT Zone V)				Rainfall Intensity (in/hr)	Runoff Q=CIA (cfs)
Storm Frequency	Parameters for IDF Equation				
	a	b	c		
50% (2-Year)	53	10	0.82	1.74	23.87
20% (5-Year)	64	12	0.79	2.32	31.89
10% (10-Year)	74	12	0.79	2.68	36.87
4% (25-Year)	93	15	0.79	3.25	44.75
2% (50-Year)	104	15	0.79	3.64	50.04
1% (100-Year)	108	15	0.77	4.11	56.57

Design Point ID: DS-15: Barditch at Pine Ridge Dr. South side before Culvert E & Channel E

TRAPEZOIDAL CHANNEL		
Design Storm:	1% (100-Year)	
Design Storm Q:	56.57	cfs
Channel Bottom (b):	6	ft.
Max. Water Surface Depth (y):	1.63	ft
Channel Site Slopes (z:1)	4. :1	
Longitudinal Channel Slope (S):	0.004	ft/ft
Manning roughness coefficient:	0.035	
Cross Sectional Area (A):	20.41	SF
Wetted Perimeter (P):	19.44	ft.
Hydraulic Radius (Rh):	1.050	ft.
Velocity (at capacity):	2.92	fps
Capacity Q= $1.49/n \times A \times Rh^{2/3} \times S^{1/2}$ =	56.75	cfs
Design / Capacity:	100%	OKAY

DRAINAGE STRUCTURE ANALYSIS

Project Name: **Brentwood Section 3**
 Project No.: **25.004**

Design Point ID: **DS-16: Barditch at Pine Ridge Dr. Cul-de-Sac (Neglects Culvert E)**
 Drainage Area(s): **P1 + P2 + P3 + P4 + P5**

DRAINAGE AREA AND WEIGHTED 'C' VALUE

Area (Acres)	'C'		C x A	Calculation Notes:
38.87	0.55	Residential Rural Estate	21.379	
	0.00	-	0.000	
	0.00	-	0.000	
	0.00	-	0.000	
TOTAL AREA: 38.87				
Total: C x A			21.379	
Weighted "C":			0.550	

TIME OF CONCENTRATION (Tc)

Overland Flow: Time of Concentration ($T_c = K(L^{0.37}/S^{0.20})$)
 Channel Flow: Time of Concentration ($T_c = K(L^{0.77}/S^{0.385})$)
 Pipe Flow: Time of Concentration ($T_c = L/V$)

Flow Type	Length (ft)	Surface Type	K	Start Elevation	End Elevation	Slope (ft/ft)	Tc (min)
Overland 1	289	Average Grass	1	1224.70	1217.90	0.0235	17.2
Overland 2		-	0			0.0000	0.0
Overland 3		-	0			0.0000	0.0
Overland 4		-	0			0.0000	0.0
Channelized 1	2309	∇/-Ditch	0.012	1215.90	1208.70	0.0031	43.0
Channelized 2	260	∇/-Ditch	0.012	1208.70	1207.70	0.0038	7.4
Channelized 3		-	0			0.0000	0.0
Channelized 4		-	0			0.0000	0.0
	L (ft)	Average Velocity (fps)					
Pipe 1							0.0
Pipe 2							0.0
Total Tc:							67.6

RAINFALL INTENSITY & PEAK FLOW

Rainfall Intensity = $I = a / ((Tc + b)c$)

Town of Goldsby (ODOT Zone V)				Rainfall Intensity (in/hr)	Runoff Q=CIA (cfs)
Storm Frequency	Parameters for IDF Equation				
	a	b	c		
50% (2-Year)	53	10	0.82	1.49	31.96
20% (5-Year)	64	12	0.79	2.02	43.10
10% (10-Year)	74	12	0.79	2.33	49.83
4% (25-Year)	93	15	0.79	2.84	60.82
2% (50-Year)	104	15	0.79	3.18	68.01
1% (100-Year)	108	15	0.77	3.61	77.15

Design Point ID: DS-16: Barditch at Pine Ridge Dr. Cul-de-Sac (Neglects Culvert E)

TRAPEZOIDAL CHANNEL		
Design Storm:	1% (100-Year)	
Design Storm Q:	77.15	cfs
Channel Bottom (b):	8	ft.
Max. Water Surface Depth (y):	1.81	ft
Channel Site Slopes (z:1)	4. :1	
Longitudinal Channel Slope (S):	0.00341	ft/ft
Manning roughness coefficient:	0.035	
Cross Sectional Area (A):	27.58	SF
Wetted Perimeter (P):	22.93	ft.
Hydraulic Radius (Rh):	1.203	ft.
Velocity (at capacity):	3.38	fps
Capacity Q= $1.49/n \times A \times Rh^{2/3} \times S^{1/2}$ =	77.57	cfs
Design / Capacity:	99%	OKAY

Conservative,
neglects flow
diverted at Culvert E



TECHNICAL SPECIFICATIONS

FOR

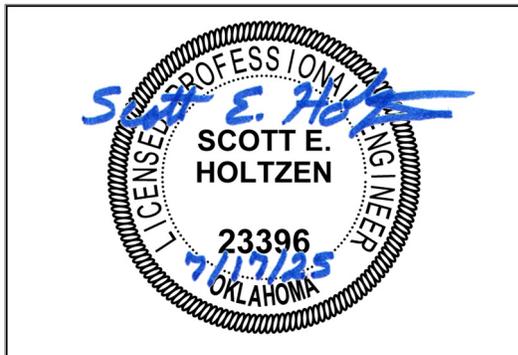
BRENTWOOD SECTION 3

WATER LINE EXTENSION

H.E.G. PROJECT NO.: 25.004

TOWN OF GOLDSBY
McCLAIN COUNTY, OKLAHOMA

July 17, 2025



Prepared by:



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SECTION 33 10 00 - WATER UTILITIES

PART 1 - GENERAL

1.1 DESCRIPTION:

Underground water distribution system complete, ready for operation, including all appurtenant structures, and connections to new building service lines and to existing water supply.

1.2 RELATED WORK & DOCUMENTS:

- A. Excavation, trench widths, pipe bedding, backfill, shoring, sheeting, bracing: as indicated
- C. Standard drawings, details, and policies of the Town of Goldsby
- D. Oklahoma Department of Environmental Quality (ODEQ) rules and regulations
Oklahoma Administrative Code (OAC) 252:626-2023

1.3 DEFINITIONS:

- A. Water Distribution: Pipelines and appurtenances which are part of the distribution system. The distribution system comprises the network of piping located throughout project area, including hydrants, valves, and other appurtenances used to supply water for domestic and fire-fighting/fire protection purposes.
- B. Water Service Line: Pipe line connecting building piping to water distribution lines.

1.4 QUALITY ASSURANCE:

- A. Comply with the rules and regulations of the Public Utility having jurisdiction over the connection to Public Water lines and the extension, and/or modifications to Public Utility systems.
- B. Comply with all rules and regulations of Federal, State, and Department of Environmental Quality. Having jurisdiction over the design, construction, and operation of potable water systems.
- C. All material surfaces in contact with potable water shall comply with NSF 61.

1.5 SUBMITTALS:

- A. Submit PRODUCT DATA
- B. Manufacturers' Literature and Data submit all items as one package:
 - Ductile Iron Pipe and Polyvinyl Chloride (PVC) shall be in accordance with AWWA C600 and C605 respectively; and shall be provided to the Engineer for approval.
 - 1. Piping.

- 2. Valves.
- 3. Fire hydrants.
- 5. Vaults, frames and covers.
- 7. Valve boxes.
- 8. Corporation and curb stops.
- 9. Curb stop boxes.
- 10. Joint restraint.
- 11. Link/sleeve seals.

C. Testing Certifications:

- 1. Pressure and Leakage Testing.
- 2. Disinfection testing, including free chlorine residuals, and bacteriological examinations.

1.6 APPLICABLE PUBLICATIONS:

A. The publications (using latest edition as of project date) listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

D. American Water Works Association (AWWA):

- B300 Hypochlorites
- B301 Liquid Chlorine
- C104 Cement Mortar Lining for Ductile Iron Pipe and Fittings
for Water
- C105 Polyethylene Encasement for Gray and Ductile C.I. Piping
for Water and Other Liquids
- C110 Ductile-Iron and Gray-Iron Fittings, 80 mm (3 Inches)
Through 1200 mm (48 Inches) for Water and Other
Liquids
- C111 Rubber-Gasket Joints for Ductile-Iron and Gray-Iron
Pressure Pipe and Fittings
- C115 Flanged Ductile-Iron and Gray-Iron Pipe with Threaded
Flanges
- C150 American National Standard for Thickness Design of
Ductile Iron Pipe

C151	Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids
C153	Ductile-Iron Compact Fittings, 80 mm (3 inches) Through 300 mm (12 Inches) for Water and Other Liquids
C500	Gate Valves for Water and Sewerage Systems
C502	Dry-Barrel Fire Hydrants
C508	Swing Check Valves for Waterworks Service, 2 Inches (50 mm) Through 24 Inches (600mm) NPS
C509	Resilient Seated Gate Valve for Water and Sewage System
C510	Double Check Valve Back-Flow Prevention Assembly
C550	Protective Epoxy Interior Coatings for Valves and Hydrants
C600	Installation for Ductile-Iron Water Mains and Their Appurtenances
C605	Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
C651	Disinfecting Water Mains
C800	Underground Service Line Valves and Fittings
C900	Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches thru 12 Inches, for Water
C905	Polyvinyl Chloride (PVC) Pressure Pipe, 14 Inches thru 36 Inches

PART 2 - PRODUCTS

2.1 POLYVINYL CHLORIDE PIPE AND FITTINGS:

- A. Class-Rated Polyvinyl Chloride (PVC) Pipe:
 - 1. PVC pipe and accessories ASTM D2241, Pressure Class 200.
- C. Fittings:
 - 1. Class-Rated Pipe 4 inches through 12 inches in Diameter: Ductile iron with mechanical joints conforming to the requirements of AWWA C153 with transition gaskets as required for ASTM D2241 pipe.
 - 2. Fittings shall have a pressure class at least equal to the pipe pressure class.

2. Joint fittings shall require mechanical joint restraints and concrete blocking. Concrete blocking is as indicated on plans.
3. Joint restraints shall be manufactured by EEBA Eron Sales, or by Uni-Flange by the Ford Meter Box Co., Inc. or equivalent approved by town engineer.

2.2 POLYETHYLENE PRESURE PIPE AND TUBING:

A. Polyethylene (PE) Pipe:

1. PE pipe and accessories 3/4 inches–3 inches in diameter, AWWA C901 “Polyethylene Pressure Pipe and Tubing”, Class 250, PE4710, SDR 9, unless otherwise shown or specified.

B. Fittings:

1. Provide fittings of the same size and pressure rating as the pipe to which they are connected.
2. Provide fittings as recommended by the pipe manufacturer to comply with the appropriate Standard listed below:
 - a. PE Fused Butt Type, Schedule 40: ASTM D3261
 - b. PE Fused Socket Type, SDR11: ASTM D2683
 - c. Insert Type for PE Pipe: ASTM D2609
3. Provide stainless steel clamps with inserts type fittings for PE pipe.

2.3 VALVES:

A. Asbestos packing is not allowed.

B. Gate:

1. 3 inches and Larger: Resilient seated, ductile iron body, bronze mounted, inclined seats, non-rising stem type turning counter-clockwise to open, 200 pound WOG. AWWA C509. The resilient seat shall be fastened to the gate with stainless steel fasteners or vulcanizing methods. The interior and exterior shall be coated with thermo-setting or fusion epoxy coating in accordance with AWWA C550.
2. Operator:
 - a. Underground: Except for use with post indicators, furnish valves with 2 inch nut for socket wrench operation. Post indicator shall comply with the requirements of NFPA 24 and shall be fully compatible with the valve provided.
 - b. Above Ground and in Pits: Hand wheels unless indicated otherwise.
3. Joints: Ends of valves shall accommodate, or be adapted to, pipe installed.

D. Corporation stops and saddles shall conform to AWWA C800.

2.4 VALVE BOX:

Valve box as indicated on drawings. Box shall be adapted, to depth of cover required over pipe at valve location. Cast the word "WATER" in cover. After final grading has been completed and trenches have settled provide concrete pad six (6) inches thick and 2-foot x 2-foot square around each water valve box.

2.5 RESTRAINED JOINTS:

- A. Restrained joint assemblies with ductile iron mechanical joint pipe shall be "Flex-Ring", "Lok-Ring", or mechanical joint coupled as manufactured by EBAA Iron Sales, "Mega-Lug" or approved equal.
- B. Thrust blocks shall be 3,000 psi concrete, as indicated on drawings.
- C. PVC pipe bell and spigot joints shall be restrained with the Uni-Flange Corp. Series 1350 Restrainer, or approved equal. The restraining device and Tee head bolts shall be manufactured of high strength ductile iron meeting ASTM A536. Clamping bolts and nuts shall be manufactured of corrosion resistant high strength, low alloy steel meeting the requirements of ASTM A242.
- D. Ductile iron mechanical joint fittings used with PVC pipe shall be restrained with UNI-Flange Corp. Series 1500-SA Restrainer for ASTM D2241 PVC, EBAA Iron, Inc, Series 2000PV Mechanical Joint Restrainer Gland, or approved equal. The restraining device and Tee head bolts shall be manufactured of high strength ductile iron meeting ASTM A-536. Clamping bolts and nuts shall be manufactured of corrosion resistant high strength, low alloy steel meeting the requirements of ASTM A242.

2.5 FIRE HYDRANTS:

- A. Furnish and install fire hydrants approved by local jurisdictions Water Service Utility, or as specified with remote reading system compatible with local jurisdiction. Forward approval.

2.6 PIPE SLEEVES:

Ductile iron.

2.7 WATER METER:

Furnish and install meter approved by local jurisdictions Water Service Utility, or as specified with remote reading system compatible with local jurisdiction. Forward approval.

2.8 POTABLE WATER:

Water used for filling, flushing, and disinfection of water mains and appurtenances shall conform to Safe Drinking Water Act. Contractor shall pay utility for water used for testing and disinfection.

2.9 DISINFECTION CHLORINE:

- A. Liquid chlorine shall conform to AWWA B301 and AWWA C651.
- B. Sodium hypochlorite shall conform to AWWA B300 with 5 percent to 15 percent available chlorine.
- C. Calcium hypochlorite shall conform to AWWA B300 supplied in granular form or 5.g tablets, and shall contain 65 percent chlorine by weight.

2.10 WARNING TAPE

Standard, 4-Mil polyethylene 3 inch wide tape, non-detectable type, blue with black letters, and imprinted with "CAUTION BURIED WATER LINE BELOW".

2.11 TRACER WIRE

- A. Tracer wire shall be on strand of no. 12 gauge copper wire.
- B. When non-ferrous piping is used, install tracer wire along top of pipe. Bring the tracer wire to top of ground and anchor at all valves, fire hydrants, and other appurtenances.

PART 3 – EXECUTION

3.1 REGRADING:

Raise or lower existing valve and curb stop boxes and fire hydrants to finish grade in areas being graded.

3.2 PIPE LAYING, GENERAL:

- A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired as directed by the Resident Engineer.
- B. All pipe and fittings shall be subjected to a careful inspection just prior to being laid or installed. If any defective piping is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional expense to the Owner. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when installed or laid, shall conform to the lines and grades required.
- C. All buried piping shall be installed to the lines and grades as shown on the drawings. All underground piping shall slope uniformly between joints where elevations are shown.

- D. Contractor shall exercise extreme care when installing piping to shore up and protect from damage all existing underground water line and power lines, and all existing structures.
- E. Do not lay pipe on unstable material, in wet trench, or when trench or weather conditions are unsuitable.
- F. Do not lay pipe in same trench with other pipes or utilities unless shown otherwise on drawings.
- G. Hold pipe securely in place while joint is being made.
- H. Do not walk on pipes in trenches until covered by layers of earth well tamped in place to a depth of 12 inches over pipe.
- I. Full length of each section of pipe shall rest solidly upon pipe bed with recesses excavated to accommodate bells or joints. Do not lay pipes on wood blocking.
- J. Tees, plugs, caps, bends and hydrants on pipe installed underground shall be anchored.
- K. Close pipe openings with caps or plugs during installation. Tightly cover and protect equipment against dirt, water and chemical, or mechanical injury. At completion of all work, thoroughly clean exposed materials and equipment.
- L. Good alignment shall be preserved in laying. The deflection at joints shall not exceed that recommended by the manufacturer.
- M. Warning tape shall be continuously placed 12 inches above buried water pipes, or as indicated.

3.3 PVC PIPE:

- A. PVC piping shall be installed in strict accordance with the manufacturer's instructions and AWWA 605. Place selected material and thoroughly compacted to six inches above the top of the pipe and thereafter backfilled as indicated.
- B. Copper Tracer Wire: Copper tracer wire consisting of No. 12 AWG solid, single conductor, insulated copper wire shall be installed in the trench with all piping to permit location of the pipe with electronic detectors. The wire shall not be spiraled around the pipe nor taped to the pipe. Wire connections are to be made by stripping the insulation from the wire and soldering with rosin core solder. Solder joints shall be wrapped with rubber tape and electrical tape.

3.4 PE PIPE:

- A. PE piping shall be installed in accordance with the manufacturer's instructions and as indicated on plans. Place selected material and thoroughly compacted to six inches above the top of the pipe and thereafter back filled as indicated.

- B. Copper Tracer Wire: Copper tracer wire consisting of No. 12 AWG solid, single conductor, insulated copper wire shall be installed in the trench with all piping to permit location of the pipe with electronic detectors. The wire shall not be spiraled around the pipe nor taped to the pipe. Wire connections are to be made by stripping the insulation from the wire and soldering with rosin core solder. Solder joints shall be wrapped with rubber tape and electrical tape.

3.5 RESTRAINED JOINTS:

- A. Sections of piping requiring restrained joints shall be constructed using pipe and fittings with restrained “locked-type” joints and the joints shall be capable of holding against withdrawal for line pressures 50 percent above the normal working pressure but not less than 200 psi. The pipe and fittings shall be restrained push-on joints or restrained mechanical joints.
- B. The minimum number of restrained joints required for resisting force at fittings and changes in direction of pipe shall be determined from the length of retained pipe on each side of fittings and changes in direction necessary to develop adequate resisting friction with the soil. Restrained pipe length shall be per manufacturer recommendations.
- C. Where ductile iron pipe manufactured with restrained joints is utilized, all restrained joints shall be fully extended and engaged prior to back filling the trench and pressurizing the pipe.
- D. Thrust blocking at all fittings, as indicated on drawings.

3.6 PIPE SEPARATION:

- A. Horizontal Separation-Water Mains and Sewers:
 - 1. As indicated on drawings.
- B. Vertical Separation-Water Mains and Sewers:
 - 1. As indicated on drawings.

3.7 SETTING OF VALVES AND BOXES:

- A. Provide a surface concrete pad 24 by 24 by 6 inches to protect valve box when valve is not located below pavement.
- B. Clean valve and curb stops interior before installation.
- C. Set valve and curb stop box cover flush with finished grade.
- D. Valves shall be installed plumb and level and in accordance with manufacturer’s recommendations.

3.8 SETTING OF FIRE HYDRANTS:

- A. Set center of each hydrant not less than 3 feet nor more than 6 feet back of edge of road or face of curb. Fire apparatus connection shall face road with center of nozzle 18 inches above finished grade. Set barrel flange not more than 2 inches above finished grade.
- B. Set each hydrant on a slab of stone or concrete not less than 6 inches thick and 15 inches square. The service line to the hydrant, between the tee and the shoe of the hydrant, shall be fully restrained.
- C. Set bases in not less than 1/2 cubic yard of crushed rock or gravel placed entirely below hydrant drainage device.
- D. Clean interiors of hydrants of all foreign matter before installation.

3.9 FLUSHING AND DISINFECTING:

- A. Flush and disinfect new water lines in accordance with AWWA C651.
 - 1. Public Water Mains: Additionally meet OAC 252:626-19-2(f)
- B. The Contractor shall be responsible to provide the water source for filling, flushing, and disinfecting the lines. Only potable water shall be used, and the Contractor shall provide all required temporary pumps, storage facilities required to complete the specified flushing, and disinfection operations.
- C. The Contractor shall be responsible for the disposal of all water used to flush and disinfect the system in accordance with all governing rules and regulations. The discharge water shall not be allowed to create a nuisance for activities occurring on or adjacent to the site.
- D. The bacteriological test specified in AWWA C651 shall be performed by a laboratory approved by the Department of Environmental Quality of the State. The cost of sampling, transportation, and testing shall be the responsibility of the Contractor.
- E. Re-disinfection and bacteriological testing of failed sections of the system shall be the sole responsibility of the Contractor.

3.10 HYDROSTATIC TESTING:

- A. Hydrostatic testing of the system shall occur prior to disinfecting the system.
- B. After new system is installed, except for connections to existing system, backfill at least 12 inches above pipe barrel, leaving joints exposed. The depth of the backfill shall be adequate to prevent the horizontal and vertical movement of the pipe during testing.
- C. Prior to pressurizing the line, all joint restraints shall be completely installed and inspected.
- D. If the system is tested in sections, and at the temporary caps at connections to the existing system and buildings, the Contractor shall provide and install all required temporary thrust restraints required to safely conduct the test.

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- E. The Contractor shall install corporation stops in the line as required to purge the air out of the system. At the completion of the test, all corporation stops shall be capped.
- F. The Contractor shall perform pressure and leakage tests for the new system for 24 hours at 150 psi. in accordance with OAC 252:626-19-2(e) and AWWA 605. Leakage shall not exceed the following requirements.
 - 1. Not to exceed 10 gallons/inch diameter/mile of pipe/24 hours

END OF SECTION 33 10 00