berge-brewer & associates, inc.

phone (719) 227-7181 - fax (719) 227-7186 - 711 north cascade avenue - colorado springs, co 80903

ENGINEERS
PLANNERS
SURVEYORS

MASTER DEVELOPMENT DRAINAGE PLAN

DUBLIN NORTH

PREPARED FOR:

DUBLIN NORTH, LLC

25 NORTH TEJON ST

COLORADO SPRINGS, CO 80903

PREPARED BY:

BERGE-BREWER AND ASSOCIATES, INC.

711 N. CASCADE AVENUE

COLORADO SPRINGS, CO 80903

Prepared by: Zachary Collins, EI
Reviewed by: Roger G. Berge, PE & PLS
October 31, 2005
Revised: January 23, 2006

15040-10

TABLE OF CONTENTS

I. CERTIFICATION:

Engineer Statement

This attached drainage plan and report for "Master Development Drainage Plan Dublin North" were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the City of Colorado Springs\El Paso County for drainage reports and said report is in conformity with the Master Plan of the Drainage Basin. I accept responsibility for any liability caused by any acts, errors of omissions on my part in preparing this report.

1/24/06

Roger G. Berge, Professional Engineer No. 9646
For and on behalf of Berge-Brewer & Associates, Inc.

Developer Statement

The developer has read and will comply with all of the requirements specified in this report and plan.

Dublin North Investments LLC
(Business Name)
Willard L Clary Jr
BY
Manager
TITLE 25 N. Tejon St. Suite 300
Colorado Springs, Co. 80903
ADDRESS

City of Colorado Springs

Filed in accordance with Section 7.7.906 of the Code of the City of Colorado Springs, 2001, as amended.

FOR THE CITY ENGINEER DATE Jan 30, 2006

Conditions

An updated MDDP will be required prior to approval of 1st Development Plan.

II. GENERAL INFORMATION:

Purpose

The purpose of this Master Development Drainage Plan is to analyze the existing and proposed drainage facilities, determine runoff quantities from both on-site and off-site sources, ensure adequacy of existing facilities, size any new proposed facilities, and present solutions for proper conveyance of developed storm water runoff. This report addresses conceptual drainage for ultimate condition discharges (fully developed) in accordance with the design discharges presented in the *Sand Creek Drainage Basin Planning Study* produced by Kiowa Engineering, March 1996 *(Ref. 8)* and the *Cottonwood Creek Drainage Basin Planning Study* produced by URS Consultants June 1994 *(Ref. 4)*.

Location

"Dublin North" (hereby referred to as the *Site*) is located within Section 7, T 13 S, R 65 W, of the 6th P.M., in the City of Colorado Springs, El Paso County, Colorado. The general location is NE of the intersection of Dublin Blvd and Powers Blvd. The *Site* is bound by the Dublin Blvd ROW to the South, Templeton Gap ROW to the West, unplatted parcels to the North, the Future Falcon High School and Greenhaven Filing No. 2 tot the East. The pertinent figure is included in the "Location" appendix of this report.

Description

The *Site* contains 119.1-acres, more or less, is currently developed with large lot residential and zoned within El Paso County Colorado. A portion of the *Site* is currently platted as Lots 1 thru 15, AA Subdivision and Vickie Lane ROW, in El Paso County Colorado, Colorado. The remainders of the parcels are unplatted. Existing vegetation consists of native grasses with some bushes and trees located around the residences. It is being proposed to annex the *Site* into the City of Colorado Springs. Planned development will consists of approximately 106.5-acres of medium to high density residential (1/4-acre to 1/8-acre per lot) and the remainder (approx. 9.9-acres) into Neighborhood Commercial.

Drainage Basin

The *Site* lies within both the Sand Creek Drainage Basin and the Cottonwood Creek Drainage Basin. This major basin boundary separation and the impact to the development of the *Site* will be discussed in detail later in this report.

Floodplain

Panel Number 08041C 0537 F dated March 17, 1997 of the Federal Emergency Management Agency's Flood Insurance Rate Map show that no portion of the *Site* is located within a designated 100-year floodplain. The pertinent figures are included in the "Floodplain" appendix of this report.

Soils

According to the S.C.S. "Soil Survey of El Paso County Area, Colorado" (*Ref. 1*) the *Site* lies within soil type number "8", which is "Blakeland loamy sand, 1 to 9 percent slopes". The Blakeland soil is deep and somewhat excessively drained, permeability is rapid, surface runoff is slow, the hazard of erosion is moderate, and the hazard of soil blowing is severe. The pertinent figures are included in the "Soils" appendix of this report.

III. DRAINAGE CONDITIONS:

Previous Drainage Studies

Below is a list of the previous drainage studies that affect this Master Development Drainage Plan. A quick summary of why the report is referenced is included.

The following report(s) analyze the drainage basins at the NW corner of the *Site*. More specifically, they cover a small portion of the *Site* that is within the Cottonwood Creek Drainage Basin, which drains Westerly under Templeton Gap to a Powers Boulevard culvert crossing.

Cottonwood Creek DBPS
URS Consultants, June 1994 (*Ref. 4*)

Cottonwood Creek Drainage Basin Planning Study
Ayres Associates, June 2000 (*Ref. 5*)

Powers Boulevard / Woodmen Road Interchange Preliminary Drainage Report
URS Consultants, February 2002 (*Ref. 6*)

The following report(s) analyze the drainage basins at the NE corner of the *Site*. More specifically, the Cottonwood Creek / Sand Creek Drainage Basin boundaries are more clearly defined to the North of the *Site*.

Master Development Drainage Plan for Powerwood / Greenbriar
Associated Design Professionals, Inc., May 2003 (Ref. 7)

The following reports analyze the drainage basins at the SW corner of the *Site*. More specifically, the Tutt Boulevard storm sewer system is initially sized for developed flows.

Master Development Drainage Plan for Ridgeview Subdivision
URS Greiner, Inc., October 1998 (*Ref. 9*)

The following reports analyze the drainage basins on the East side of the *Site*. More specifically, these reports cover stormwater that exits the *Site* into the Future Flacon High School as well as the Greenhaven Filing No. 2 subdivision.

Sand Creek Drainage Basin Planning Study
Kiowa Engineering Company, March 1996 (*Ref. 8*)

Master Development Drainage Plan Amendment II for the Easterly Portion of Ridgeview Subdivision and Preliminary Drainage Report for the Northeasterly portion of Ridgeview Subdivision and Phase II Sand Creek Channel Improvements
JR Engineering, December 2002 (*Ref. 10*)

Final Drainage Report for Greenhaven Filing No.1 and No.2
Terra Nova Engineering, Inc., October 2003 (*Ref. 11*)

Drainage Letter Addendum for Greenhaven Filing No.1 and No.2
Terra Nova Engineering, Inc., October 2003, revised January 2005, March 2005 (*Ref. 12*)

Existing Drainage Conditions

Please refer to the "Master Development Drainage Plan (Existing Conditions)" in the "Exhibits" Appendix of this report before reading this section. This plan shows the existing drainage basin delineations, drainage facilities, topography, surrounding development, and roads. Basin boundaries and designations shown on this plan are reproduced from several existing drainage studies.

Basin OS5 and OS6 (Q_5/Q_{100} = 12.4/30.3 and 8.2/20.1 cfs, respectively)
The *Site* is affected by drainage of off-site basins to the North. The *Master Development Drainage Plan for Powerwood / Greenbriar* (*Ref. 7*) studied the drainage basins located SE of the intersection of Powers Blvd and Woodmen Rd and bound to the east by Templeton Gap Rd. The proposed drainage conditions presented in that report adjust the boundary of the Cottonwood Creek / Sand Creek Drainage Basins to account for proposed grading and development.

> "Basin OS5 crosses under Woodmen Road through a 36-inch CMP. No change is planned to this pipe under the upcoming roadway improvements. Basins OS6 and OS5 combine and flow to the roadway ditch and will continue under Templeton Gap Road at the 35" x 24" CMP. These flows will continue along the east side of Templeton Gap Road until they head overland in a swale flowing easterly. These off-site areas are tributary to the Sand Creek Basin." (*Ref. 7*)

Runoff coefficients (C_5/C_{100} = 0.25/0.35) used for hydrologic calculations in *Ref. 7* are consistent with current criteria and the existing / proposed use of the area, which is pasture / meadow. The cumulative stormwater quantities from offiste Basins OS5 and OS6 (Q_5/Q_{100} = 27.2/58.3 cfs) are represented as Design Point 3 on the Drainage Plan (Existing Conditions) and flow into the northern end of Basin OS145-3.

Basin H1-C (Q_5/Q_{100} = 16.8/35.8 cfs)
The Site is also affected by offsite runoff from basin H1-C as defined in the *Powers Boulevard / Woodmen Road Interchange Preliminary Drainage Report*, URS Consultants, February 2002 (*Ref. 6*). This basin consists of approximately 10.23-acres that lies on the east side of Templeton Gap and is part of a larger basin designated as H1. Runoff quantities from the entire H1 basin were calculated using the SCS method with CN=75, Type IIA storm, and type B soil. These numbers are associated with a developed condition of ¼ acre per dwelling unit.

> "In addition there is a small area north of Woodmen Road that contributes via a 36" CMP culvert crossing north to south. The DBPS includes this small area north of Woodmen Road as well as F1 and all areas north of the three CMP's as one watershed contributing flow flows to the three CMP's draining watershed G1. After examination of field conditions and current contour data it has been determined that the accumulated flow from north of Woodmen Road and from east of Templeton Gap Road flows into the two CMP's located at the intersection of Templeton Gap Road and Powers Blvd as indicated earlier in this report." (*Ref. 6*)

This statement contradicts the results of *Ref. 7* and is incorrect, which states that the flows from the north of Woodmen will flow under Templeton Gap Road and continue easterly. This discrepancy will be discussed in detail in the Proposed Drainage Conditions of this report.

Basin 100 (Q_5/Q_{100} = 75.8/136.2 cfs)
This drainage basin was originally defined in the *Cottonwood Creek DBPS,* URS Consultants, June 1994 (*Ref. 4*). The basin was further studied in the *Master Development Drainage Plan for Ridgeview Subdivision,* URS Greiner, Inc., October 1998 (*Ref. 9*). The latter report analyzed Basin 100 as an offiste basin and used composite runoff coefficients (C_5/C_{100} = 0.65/0.70) consistent with current criteria and proposed development of the area. The peak stormwater quantities from Basin 100 are represented as Design Point T8 on the Drainage Plan (Existing Conditions) and flow into the Tutt Boulevard storm sewer system.

> "Basin 100 has a 100-year developed peak runoff of 115.2 cfs. This basin will drain under Dublin blvd just west of Tutt Blvd via twin 36" CMP's where the flow will enter the Tutt Blvd storm sewer. This arrangement diverts flow from Cottonwood Creek watershed to the Sand Creek watershed as discussed above." (*Ref. 9*)

Actual development of Tutt Blvd contains a 36" RCP that crosses under Dublin Boulevard to a Manhole on the north side of Dublin. This manhole accepts flows from an 18" RCP w/ FES that extends into the *Site*, as well as a 24" RCP from a curb-opening inlet in Dublin Blvd.

Basin OS145-1 (Q_5/Q_{100} = 20.2/40.9 cfs)
This basin was defined in the *Master Development Drainage Plan Amendment II for the Easterly Portion of Ridgeview Subdivision and Preliminary Drainage Report for the Northeasterly portion of Ridgeview Subdivision and Phase II Sand Creek Channel* Improvements, JR Engineering, December 2002 (*Ref. 10*). Composite runoff coefficients (C_5/C_{100} = 0.50/0.60) used for hydrologic calculations in *Ref.* 10 and *Ref. 12* is consistent with current criteria and proposed development. The peak stormwater quantities from Basin OS145-1 are represented as Design Point 2 on the Drainage Plan (Existing Conditions) and are intercepted by an 8' sump inlet at the boundary between the *Site* and the Greenhaven subdivision.

Basin OS145-2A and OS145-2B (Q_5/Q_{100} = 27.08/57.8 and 10.7/23.0 cfs, respectively)
These drainage basins are further sub-basins of a larger basin OS145-2 established in the *Master Development Drainage Plan Amendment II for the Easterly Portion of Ridgeview Subdivision and Preliminary Drainage Report for the Northeasterly portion of Ridgeview Subdivision and Phase II Sand Creek Channel* Improvements, JR Engineering, December 2002 (*Ref. 10*). Basin OS145-2 was divided into two sub-basins due to the proposed extension / realignment of existing Vickie Lane as outlined in the *Drainage Letter Addendum for Greenhaven Filing No.1 and No.2,* Terra Nova Engineering, Inc., October 2003, revised January 2005, March 2005 (*Ref. 12*).

> "Sub-basin OS145-2, 27.1 acres, Q_5 = 38 cfs, Q_{100} = 81 cfs, lies to the west of Ridgeview Development. The developed condition land use is assumed to be single family residential and school site. The single family residential density is assumed to be 2 DU/Acre, as the 5 to 10% existing ground slope is not conducive to higher density."

Composite runoff coefficients (C_5/C_{100} = 0.39/0.49) used for hydrologic calculations in *Ref.* 10 and *Ref. 12* are consistent with current criteria. However the proposed development of this basin will have a higher density than originally anticipated. At this time proposed grading of the *Site* has not been determined, so drainage analysis included in this report will assume that the developed basin boundaries will be the same as the existing basin boundaries. Using the rational method of computation (Q=CiA); holding the Time of Concentration, Rainfall Intensity (I), and Area (A) constant, while increasing the Runoff Coefficient (C), will result in an increase in the Peak Flow (Q).

The impact to the development of the *Site* is discussed in the Proposed Drainage Conditions below.

The peak stormwater quantities from Basin OS145-2A are represented as Design Point 1A on the Drainage Plan (Existing Conditions) and are intercepted by a 12' sump inlet at the boundary between the *Site* and the Greenhaven subdivision.

The peak stormwater quantities from Basin OS145-2B are represented as Design Point 1B on the Drainage Plan (Existing Conditions) and are intercepted by an 8' sump inlet at the boundary between the *Site* and the Greenhaven subdivision.

Basin OS145-3 (Q_5/Q_{100} = 140.2/258.0 cfs)
Basin OS145-3 was originally defined as Basin OS145/45 in the *Sand Creek Drainage Basin Planning Study*, Kiowa Engineering Company, March 1996 (*Ref. 8*). Basin OS145/45 was subdivided into 4 basins (OS145-1 thru 4) as outlined in the *Master Development Drainage Plan Amendment II for the Easterly Portion of Ridgeview Subdivision and Preliminary Drainage Report for the Northeasterly portion of Ridgeview Subdivision and Phase II Sand Creek Channel Improvements*, JR Engineering, December 2002 (*Ref. 10*). A grass-lined swale along the northern edge of the Greenhaven subdivision intercepts runoff from Basin OS145-3 and routes it easterly. A culvert inlet with headwalls routes these flows into the Black Forest Rd storm sewer system.

Composite runoff coefficients (C_5/C_{100} = 0.64/0.70) used for hydrologic calculations in *Ref. 7* are consistent with current criteria and the proposed use of the area. The peak stormwater quantities generated in basin OS145-3 are represented as Design Point 3A on the Drainage Plan (Existing Conditions) in the "Exhibits" section of this report. Neither *Ref. 9* or *Ref. 10* account for the stormwater entering the North side of basin OS145-3 as outlined in *Ref. 7*. The proposed drainage conditions provided later in this report will address these discrepancies.

Unstudied (Q_5/Q_{100} = 33.8/72.1 cfs)
This basin is comprised of an area that was studied in the *Cottonwood Creek DBPS* and was originally routed westerly to Cottonwood Creek. The area south of Templeton Gap and west of the original major basin boundary (approx. 64.3-acres) was studied in the *Master Development Drainage Plan for Ridgeview Subdivision,* URS Greiner, Inc., October 1998 (*Ref. 9*). That report modified the routing of this area to be into the Tutt Blvd storm sewer system, which is tributary to the Sand Creek basin. However, *Ref. 9* only accounted for 41.9-acres of this area, which leaves about 22.4-acres that are currently not studied by any MDDP or Drainage report. This discrepancy will be discussed in the "Proposed Drainage Conditions" section of this report.

The portion of Dublin Boulevard adjacent to the site has been constructed, as well as all of the associated drainage improvements. No offsite stormwater enters the site from the Dublin Blvd road section and will remain this way throughout the development of the *Site*. A small portion of the SE corner of the *Site* drains overland as sheet flow to the Dublin Blvd road section.

Proposed Drainage Conditions

Please refer to the "Master Development Drainage Plan (Proposed Conditions)" in the "Exhibits" Appendix of this report before reading this section. This plan shows the proposed drainage basin delineations, drainage facilities, topography, development, and roads.

The general goal of the proposed drainage conditions is to comply with the limitations of the existing downstream drainage facilities. This means that the proposed stormwater quantities at Design Points must be equal to or less than the values calculated in previous reports (previously calculated developed flows). If new hydrologic calculations result in higher stormwater quantities then downstream drainage facilities must be improved to handle the increased flows, or else detention of stormwater will be required to release proposed developed stormwater quantities at a rate equal to or less than previously calculated developed flows.

At this time, detailed information regarding the development of the site is unknown. Therefore, conveyance structures within the *Site* will not be specified at this time. However, conveyance structures at the edges of the *Site* (where required) are specified in this report. Hydraulic criteria of storm sewer inlets, pipes, etc. are included in the Appendix of this report in order to properly establish criteria for the development of the Site. Curb opening inlets will be placed (in sag locations whenever possible) where street capacities are exceeded.

Basin OS5 and OS6 (Q_5/Q_{100} = 12.4/30.3 and 8.2/20.1 cfs, respectively)
These offsite basins remain unaffected by the development of the *Site*. The outfall for these basins will be directed into OS145-3 and routed overland to design point 3A. These offsite basins will continue be tributary to the Sand Creek Drainage Basin.

Basin H1-C (Q_5/Q_{100} = 16.8/35.8 cfs)
As stated previously in this report, hydrology for this basin was calculated using the TR-55 method. Curve numbers established in *Ref. 6* reflect a land use of ¼ acre residential. For this drainage study, the rational method was used for this basin, with runoff coefficients associated with ¼ acre residential (proposed land use is consistent with previous MDDP and DBPS). Runoff quantities of the proposed developed basin will therefore be assumed equivalent to the previously calculated developed flows.

Basin 100 (Q_5/Q_{100} = 70.6/135.6 cfs)
The proposed development of the *Site* results in composite runoff coefficients that are slightly lower than those used in previous drainage studies, so no detention or downstream improvements will be needed at the existing outfall for this basin.

Basin OS145-1 (Q_5/Q_{100} = 20.2/40.9 cfs)
This basin remains unaffected by the development of the *Site*. Runoff coefficients, travel times, peak flows, flow patterns, discharge drainage facilities, etc. remain the same as described in the Existing Drainage Conditions.

Basin OS145-2A and OS145-2B (Q_5/Q_{100} = 37.5/75.4 and 16.6/32.9 cfs, respectively)
These basins were originally assumed to be developed as 2 acre/du residential due to the existing steep slopes. Current proposed development of these basins is 1/8 acre residential, which results in higher runoff coefficients than those used for previous calculations. Runoff quantities increase, and due to the limitations of the existing downstream drainage facilities of the Greenhaven subdivision, which were sized for the lower quantities, detention will be required for these basins. A single detention pond may be utilized for both drainage basins.

Basin OS145-3 (Q_5/Q_{100} = 98.3/206.2 cfs)
The proposed development of the *Site* results in composite runoff coefficients that is slightly lower than those used in previous drainage studies, so no detention or downstream improvements will be needed at the existing outfall for this basin.

(Unstudied) (Q_5/Q_{100} = 33.8/72.1 cfs)
The proposed development of this basin will have a land use density of ¼ acre residential. This basin will discharge westerly towards Templeton Gap Rd. The existing 24" CMP culvert will have to be upgraded to a 42" RCP (min.) in order to properly convey these flows (along with Basin HC-1 and offiste Basins OS5 and OS6) westerly to the double 54" culvert.

Design Point Summary

Design Point 1A

Existing (Q_5/Q_{100} = 27.0/57.8 cfs)

This design point was originally defined in the *Drainage Letter Addendum for Greenhaven Filing No.1 and No.2 (Ref. 12)*. Stormwater at this design point flows overland as shallow concentrated flow and is intercepted by a 12' D-10 R sump inlet with 2' of head.

Proposed (Q_5/Q_{100} = 37.5/75.4 cfs)

Proposed land use(s) result in higher runoff coefficients and stormwater quantities. Detention will be required at this design point due to the limitations of downstream drainage structures as outlined in *Ref. 12*. Specific design of the Detention Pond as well as upstream (on-site) conveyance structures will be addressed in a Final Drainage Report specific to the appropriate subdivision.

Design Point 1B

Existing (Q_5/Q_{100} = 10.7/23.0 cfs)

This design point was originally defined in the *Drainage Letter Addendum for Greenhaven Filing No.1 and No.2 (Ref. 12)*. Stormwater at this design point flows overland as shallow concentrated flow and is intercepted by a 8' D-10 R sump inlet with 2' of head.

Proposed (Q_5/Q_{100} = 16.6/32.9 cfs)

Proposed land use(s) result in higher runoff coefficients and stormwater quantities. Detention at this design point will be required due to the limitations of downstream drainage structures as outlined in *Ref. 12*. The detention pond at this design point will most likely be combined with the detention pond required at Design Point 1A. Specific design of this Detention Pond as well as upstream (on-site) conveyance structures will be addressed in a Final Drainage Report specific to the appropriate subdivision.

Design Point 2

Existing (Q_5/Q_{100} = 20.2/40.9 cfs)

This design point was originally defined in the *Drainage Letter Addendum for Greenhaven Filing No.1 and No.2 (Ref. 12)*. Stormwater at this design point flows overland as shallow concentrated flow and is intercepted by a 8' D-10 R sump inlet with 2' of head.

Proposed (Q_5/Q_{100} = 20.2/40.9 cfs)

Proposed land use(s) are consistent with previously proposed land uses resulting in no change in stormwater quantities at this design point. No Detention or downstream (off-site) drainage improvements will be required at this design point. The detention pond at this design point will most likely be combined with the detention pond required at Design Point 1A. Specific design of upstream (on-site) conveyance structures to properly route stormwater to this design point will be addressed in a Final Drainage Report specific to the appropriate subdivision.

Design Point 3

Existing (Q_5/Q_{100} = 18.5/45.1 cfs)

This design point was originally defined in the *Master Development Drainage Plan for Powerwood / Greenbriar (Ref. 7)*. Stormwater at this design point is the outfall from a 24"x35" CMP arch culvert under Templeton Gap. Stormwater at this design point flows overland into Basin OS145-3.

Proposed (Q_5/Q_{100} = 18.5/45.1 cfs)

This design point remains unchanged. At this time, no Detention or drainage improvements will be required at this design point. Future drainage improvements, if required, will be analyzed in a separate drainage study.

Design Point 3A

Existing (Q_5/Q_{100} = 140.2/258.0 cfs)

This design point was originally defined in the *Final Drainage Report for Greenhaven Filing No.1 and No.2 (Ref. 11)*. Stormwater at this design point flows overland as shallow concentrated flow and is intercepted by a grass swale on the northern edge of the Greenhaven subdivision.

Proposed (Q_5/Q_{100} = 116.8/251.3 cfs)

Proposed land uses result in lower runoff coefficients and stormwater quantities at this design point. At this time no detention or drainage improvements are needed at this design point.

Design Point 4

Existing (Q_5/Q_{100} = 50.6/107.9 cfs)

Stormwater at this design point flows overland as shallow concentrated flow and is intercepted by a 24" CMP culvert under Templeton Gap. The stormwater discharged form this culvert flows overland to a 54"-54" double culvert under Powers Blvd. The capacity is large enough to handle flows generated within the *Site* as well as the stormwater generated downstream (offiste).

Proposed (Q_5/Q_{100} = 50.6/107.9 cfs)

The stormwater quantities at this design point remain unchanged. The existing 24" CMP will have to be upgraded to a 42" culvert in order to properly convey stormwater at this deign point. Since the proposed stormwater quantities and flow paths are the same as existing no detention or downstream (off-site) drainage improvements are needed at this design point.

Design Point T8

Existing (Q_5/Q_{100} = 75.8/136.2 cfs)

Stormwater at this design point flows overland as shallow concentrated flow and is intercepted by a 18" FES that is connected to the 36" storm sewer trunline in Tutt Blvd. The capacity is large enough to handle flows generated within the *Site* as well as the stormwater generated downstream (offiste).

Proposed (Q_5/Q_{100} = 70.6/135.6 cfs)

Proposed land uses result in lower runoff coefficients and stormwater quantities at this design point. The existing 18" FES will have to be removed and replaced with a 36" trunk-line extension in order to properly convey the stormwater at this design point. At this time, no detention will be required at this design point. Specific design of upstream (on-site) conveyance structures to properly route stormwater to this design point will be addressed in a Final Drainage Report specific to the appropriate subdivision.

Street Capacity Criteria

As stated previously in this report, proposed layout of streets and individual subdivisions is not known at this time, therefore specific design of drainage improvements within the *Site* is not provided herein. Hydraulic capacity of future streets will follow the criteria set forth in the *Drainage Criteria Manual – City of Colorado Springs and El Paso County* (*Ref. 2*) and any applicable addendums. Design charts are reproduced from this manual and included in the "Hydraulics: Criteria & Calculations" Appendix of this report as a design guide for future drainage studies.

Drainage Improvements Design Criteria

As stated previously in this report, proposed layout of streets and individual subdivisions is not known at this time, therefore specific design of drainage improvements within the *Site* is not provided herein. Hydraulic capacity of future storm sewer inlets and pipes will follow the criteria set forth in the *Drainage Criteria Manual – City of Colorado Springs and El Paso County* (*Ref. 2*) and any applicable addendums. Design charts are reproduced from this manual and included in the "Hydraulics: Criteria & Calculations" Appendix of this report as a guide for the design of future drainage improvements. Rating tables produced from Flowmaster are included in the "Hydraulics: Criteria & Calculations" Appendix of this report as a guide for the design of future drainage improvements.

Stormwater Quality

Stormwater quality will not be required for the residential portion of the *Site*. The small area of proposed commercial development will require stormwater quality BMP's as required in *Ref. 3*. Future Final Drainage Reports will address stormwater quality for these areas.

Detention

Basins OS145-2A and OS145-2B will require detention. Future Final Drainage Reports will address detention requirements for these basins. All other basins do not require detention.

Erosion Control

Erosion control in conformance with an approved Grading and Erosion Control Plan and SWQ will be installed during the construction phase of this development.

IV. IMPROVEMENT COSTS:

As stated previously, final site design is not known at this time. Improvement cost estimates for this development cannot be produced at this time.

V. DRAINAGE FEES:

Drainage Fees for the 2006 Sand Creek Drainage Basin are as follows:

Drainage Fee	$8,133/acre x 95.42 acres =	$776,050.86
Bridge Fee	$511/acre x 95.42 acres =	$48,759.62
Pond Land Fee	$734/acre x 95.42 acres =	$70,038.28
Pond Facilities Fee	$1,788/acre x 95.42 acres =	$170,610.96
TOTAL		**$1,065,459.72**

Drainage Fees for the 2006 Cottonwood Creek Drainage Basin are as follows:

Drainage Fee	$9,315/acre x 23.68 acres =	$220,579.20
Bridge Fee	$760/acre x 23.68acres =	$17,996.80
TOTAL		**$238,576.00**

VI. REFERENCES:

Soil Survey of El Paso County Area, Colorado
United States Department of Agriculture, Soil Conservation Service, 1981 (*Ref. 1*)

Drainage Criteria Manual – City of Colorado Springs and El Paso County
City of Colorado Springs, Department of Public Works, El Paso County, Engineering Division Oct. 1987, revised November 1991, October 1994, January 2003 (*Ref. 2*)

Drainage Criteria Manual Vol. 2 – City of Colorado Springs and El Paso County
City of Colorado Springs, Department of Public Works, El Paso County, Engineering Division, November 2, 2002 (*Ref. 3*)

Cottonwood Creek DBPS
URS Consultants, June 1994 (*Ref. 4*)

Cottonwood Creek Drainage Basin Planning Study
Ayres Associates, June 2000 (*Ref. 5*)

Powers Boulevard / Woodmen Road Interchange Preliminary Drainage Report
URS Consultants, February 2002 (*Ref. 6*)

Master Development Drainage Plan for Powerwood / Greenbriar
Associated Design Professionals, Inc., May 2003 (Ref. 7)

Sand Creek Drainage Basin Planning Study
Kiowa Engineering Company, March 1996 (*Ref. 8*)

Master Development Drainage Plan for Ridgeview Subdivision
URS Greiner, Inc., October 1998 (*Ref. 9*)

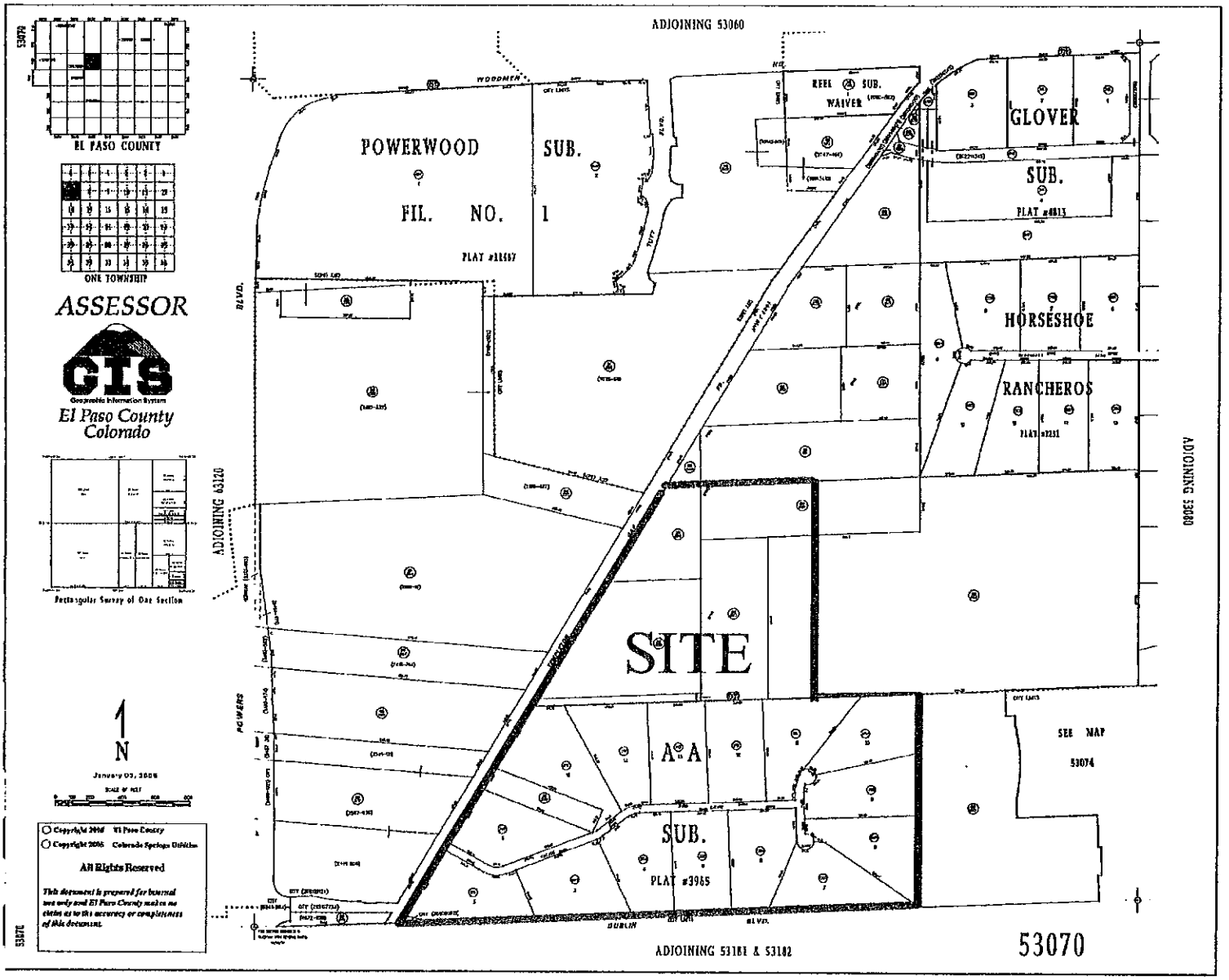
Master Development Drainage Plan Amendment II for the Easterly Portion of Ridgeview Subdivision and Preliminary Drainage Report for the Northeasterly portion of Ridgeview Subdivision and Phase II Sand Creek Channel Improvements
JR Engineering, December 2002 (*Ref. 10*)

Final Drainage Report for Greenhaven Filing No.1 and No.2
Terra Nova Engineering, Inc., October 2003 (*Ref. 11*)

Drainage Letter Addendum for Greenhaven Filing No.1 and No.2
Terra Nova Engineering, Inc., October 2003, revised January 2005, March 2005 (*Ref. 12*)

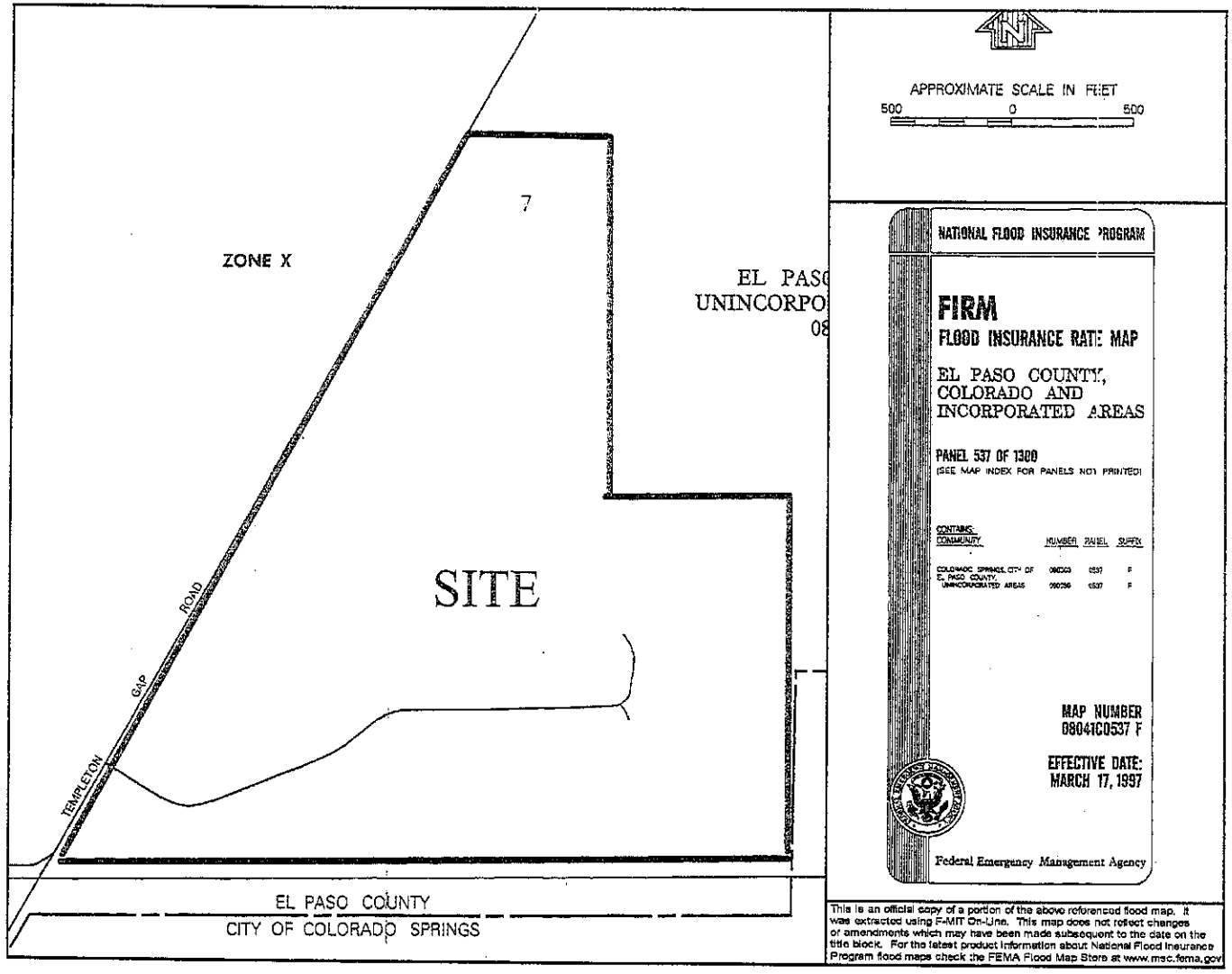
LOCATION:

VICINTY MAP


ADJOINING 53060
POWERWOOD SUB.
FIL. NO. 1
PLAT #11587
REEL A SUB.
WAIVER
GLOVER
SUB.
PLAT #4813
HORSESHOE
RANCHEROS
PLAT #2251
SITE
A A
SUB.
PLAT #3985
SEE MAP
53074
ADJOINING 53180
ADJOINING 53060
ADJOINING 53181 & 53182
53070
EL PASO COUNTY
ONE TOWNSHIP
ASSESSOR
GIS
Geographic Information System
El Paso County
Colorado
Rectangular Survey of One Section
N
January 03, 2006
All Rights Reserved
This document is prepared for internal use only and El Paso County makes no claim as to the accuracy or completeness of this document.

FLOODPLAIN:

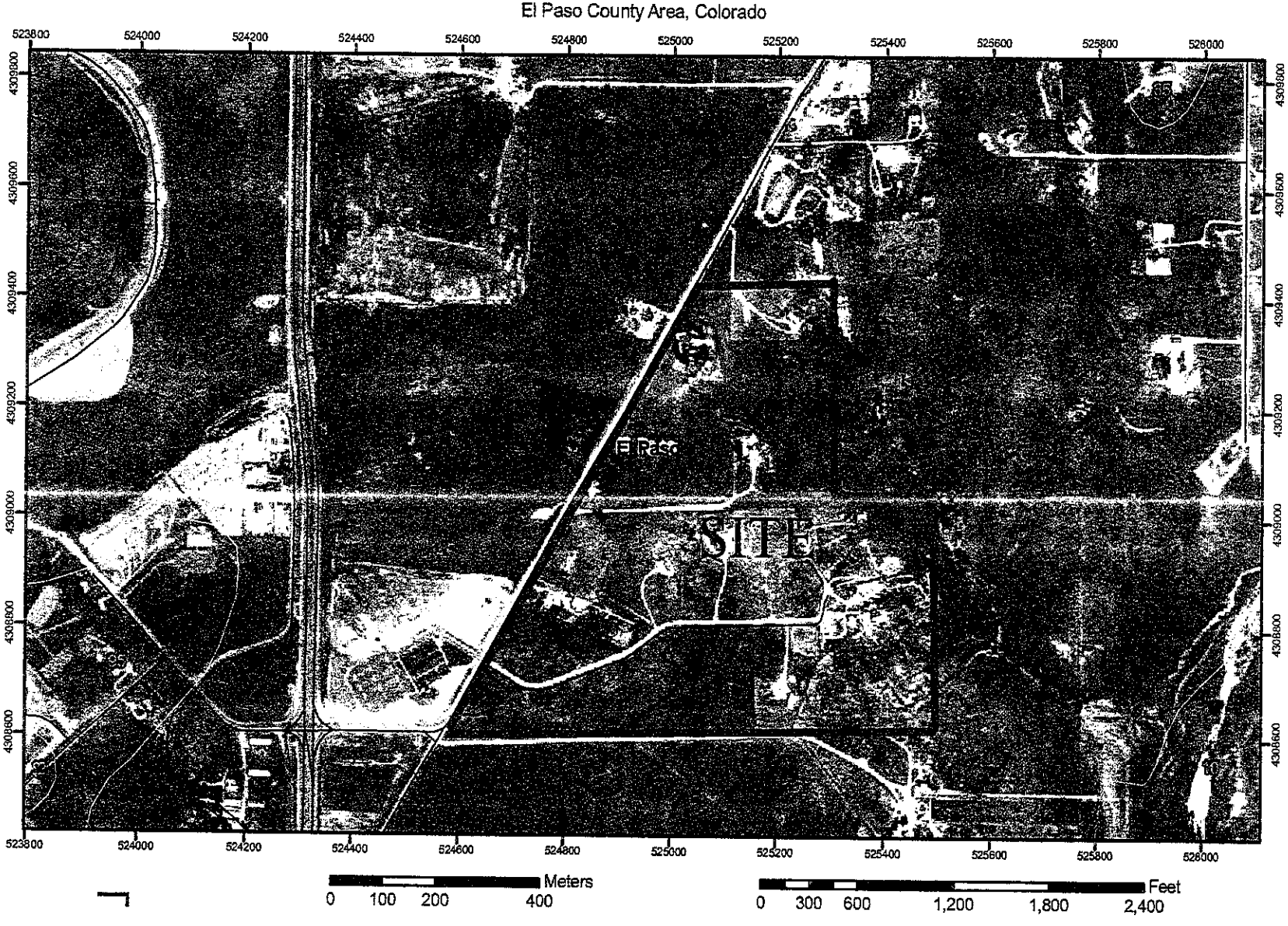
FEMA FIRM MAP


ZONE X
7
EL PASC
UNINCORPO
08
SITE
TEMPLETON GAP ROAD
EL PASO COUNTY
CITY OF COLORADO SPRINGS
APPROXIMATE SCALE IN FEET
500 0 500
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO AND INCORPORATED AREAS
PANEL 537 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
COLORADO SPRINGS, CITY OF 080060 0537 F
EL PASO COUNTY, UNINCORPORATED AREAS 080059 0537 F
MAP NUMBER
08041C0537 F
EFFECTIVE DATE:
MARCH 17, 1997
Federal Emergency Management Agency
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

SOILS:

S.C.S. SOIL CLASSIFICATION

SOIL SURVEY OF EL PASO COUNTY AREA, COLORADO



USDA Natural Resources Conservation Service

El Paso County Area, Colorado

MAP LEGEND

- Soil Map Units
- Cities
- Detailed Counties
- Interstate Highways
- Roads
- Rails
- Water
- Hydrography
- Oceans

MAP INFORMATION

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov

Coordinate System: UTM Zone 13

Soil Survey Area: El Paso County Area, Colorado
Spatial Version of Data: 1
Soil Map Compilation Scale: 1:24000

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

TABLE 16.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. See "flooding" in Glossary for definition of terms as "rare," "brief," and "very brief." The symbol > means greater than]

Soil name and map symbol	Hydrologic group	Flooding			Bedrock		Potential frost action
		Frequency	Duration	Months	Depth	Hardness	
					In		
Alamosa: 1	C	Frequent	Brief	May-Jun	>60	---	High.
Ascalon: 2, 3	B	None	---	---	>60	---	Moderate.
Badland: 4	D	---	---	---	---	---	---
Bijou: 5, 6, 7	B	None	---	---	>60	---	Low.
Blakeland: 8	A	None	---	---	>60	---	Low.
[1]9: Blakeland part	A	None	---	---	>60	---	Low.
Fluvaquentic Haplaquolls part	D	Common	Very brief	Mar-Aug	>60	---	High.
Blendon: 10	B	None	---	---	>60	---	Moderate.
Bresser: 11, 12, 13	B	None	---	---	>60	---	Low.
Brussett: 14, 15	B	None	---	---	>60	---	Moderate.
Chaseville: 16, 17	A	None	---	---	>60	---	Low.
[1]18: Chaseville part	A	None	---	---	>60	---	Low.
Midway part	D	None	---	---	10-20	Rippable	Moderate.
Columbine: 19	A	None to rare	---	---	>60	---	Low.
Connerton: [1]20: Connerton part	B	None	---	---	>60	---	High.
Rock outcrop part	D	---	---	---	---	---	---
Cruckton: 21	B	None	---	---	>60	---	Moderate.
Cushman: 22, 23	C	None	---	---	20-40	Rippable	Moderate.
[1]24: Cushman part	C	None	---	---	20-40	Rippable	Moderate.
Kutch part	C	None	---	---	20-40	Rippable	Moderate.
Elbeth: 25, 26	B	None	---	---	>60	---	Moderate.
[1]27: Elbeth part	B	None	---	---	>60	---	Moderate.

See footnote at end of table.

HYDROLOGY:

CRITERIA & CALCULATIONS

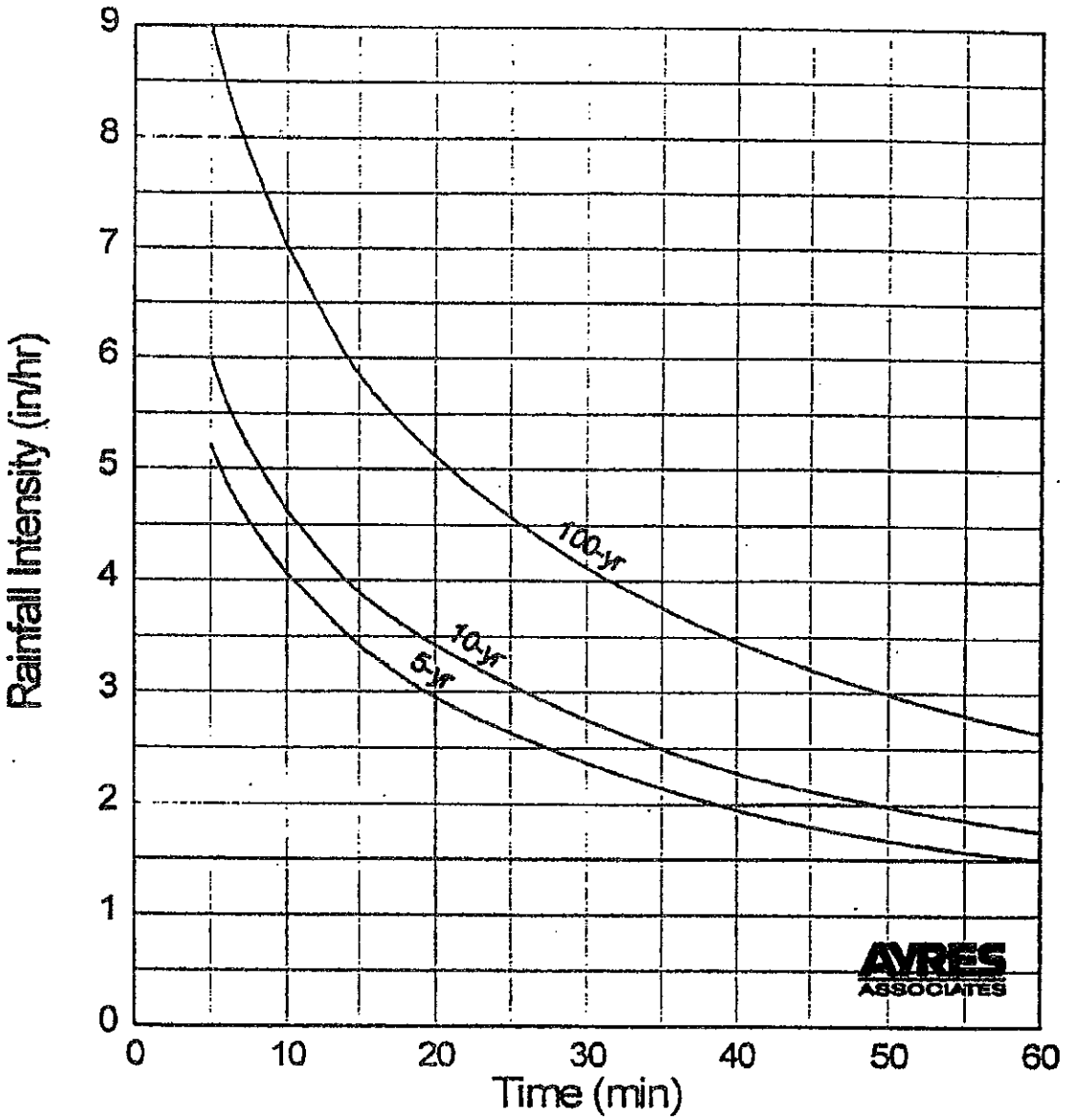
TABLE 5-1

RECOMMENDED AVERAGE RUNOFF COEFFICIENTS AND PERCENT IMPERVIOUS

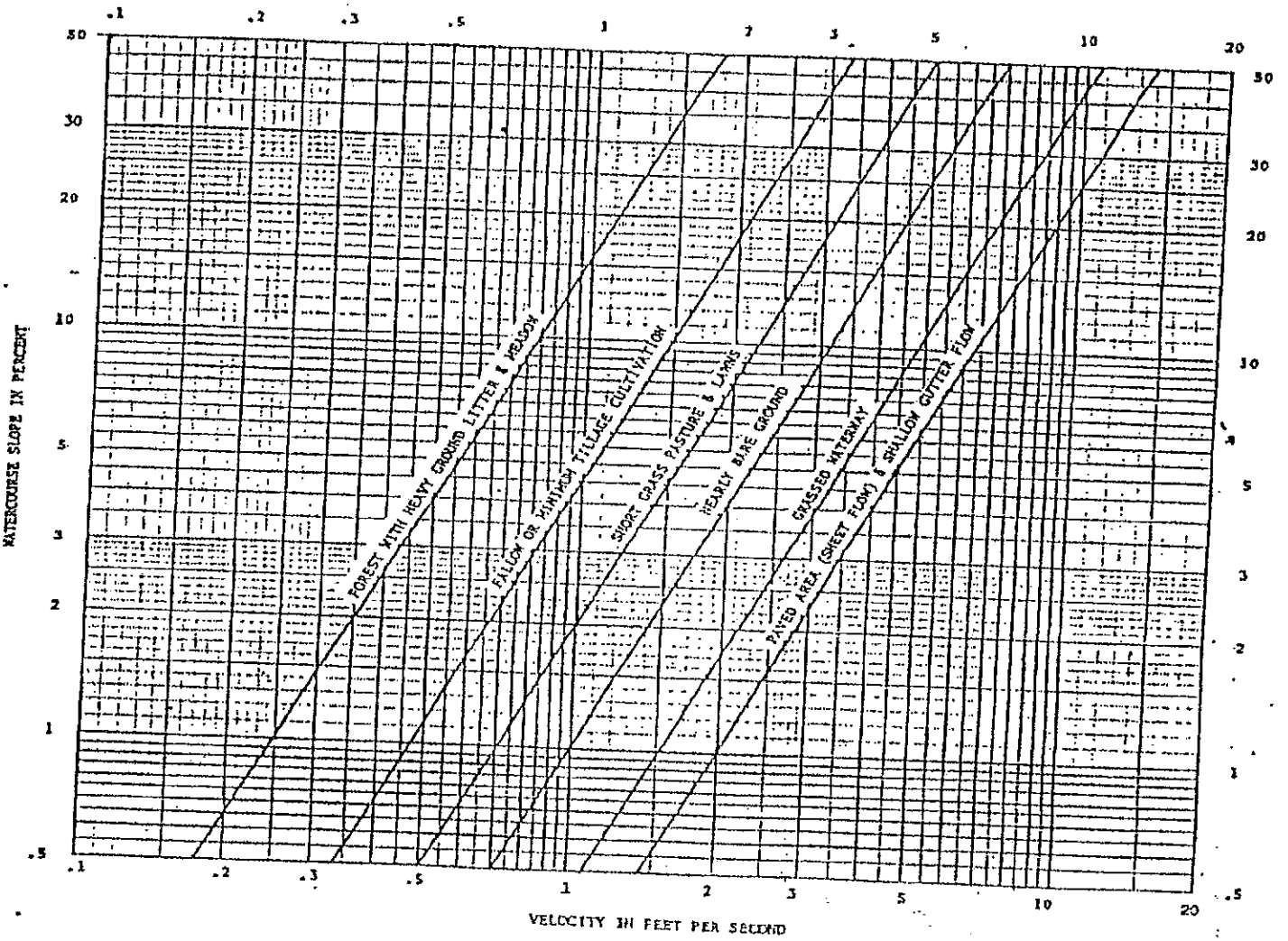
LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	"C" FREQUENCY 10 A&B*	10 C&D*	100 A&B*	100 C&D*
Business					
Commercial Areas	95	0.90	0.90	0.90	0.90
Neighborhood Areas	70	0.75	0.75	0.80	0.80
Residential					
1/8 Acre or less	65	0.60	0.70	0.70	0.80
1/4 Acre	40	0.50	0.60	0.60	0.70
1/3 Acre	30	0.40	0.50	0.55	0.60
1/2 Acre	25	0.35	0.45	0.45	0.55
1 Acre	20	0.30	0.40	0.40	0.50
Industrial					
Light Areas	80	0.70	0.70	0.80	0.80
Heavy Areas	90	0.80	0.80	0.90	0.90
Parks and Cemeteries	7	0.30	0.35	0.55	0.60
Playgrounds	13	0.30	0.35	0.60	0.65
Railroad Yard Areas	40	0.50	0.55	0.60	0.65
Undeveloped Areas					
Historic Flow Analysis- Greenbelts, Agricultural	2	0.15	0.25	0.20	0.30
Pasture/Meadow	0	0.25	0.30	0.35	0.45
Forest	0	0.10	0.15	0.15	0.20
Exposed Rock	100	0.90	0.90	0.95	0.95
Offsite Flow Analysis (when land use not defined)	45	0.55	0.60	0.65	0.70
Streets					
Paved	100	0.90	0.90	0.95	0.95
Gravel	80	0.80	0.80	0.85	0.85
Drive and Walks	100	0.90	0.90	0.95	0.95
Roofs	90	0.90	0.90	0.95	0.95
Lawns	0	0.25	0.30	0.35	0.45

* Hydrologic Soil Group

9/30/90



Interim Release October 12, 1994 , Rainfall Intensity Curves
City Of Colorado Springs Drainage Criteria Manual



--Average velocities for estimating travel time for overland flow.

FIGURE 4

Composite Runoff Coefficients

Project: **Dublin North**
Date: **November 11, 2005**
Hydrology Group: **A**

Basin Summary		Area 1				Area 2				Composite	
Basin	Area (acres)	Area (acres)	Use	C_5	C_{100}	Area (acres)	Use	C_5	C_{100}	C_5	C_{100}
HISTORIC											
OS5*	15.00									0.25	0.35
OS6*	12.04									0.25	0.35
H1-C*	10.23									0.50	0.60
100*	41.90									0.60	0.70
OS-145-1*	12.30									0.50	0.60
OS145-2A*	19.40									0.39	0.49
OS145-2B*	7.70									0.39	0.49
OS145-3*	67.60									0.64	0.70
(unstudied)	22.40	22.40	1/4-acre res.	0.50	0.60					0.50	0.60
DEVELOPED											
OS5*	15.00									0.25	0.35
OS6*	12.04									0.25	0.35
H1-C*	10.23	10.23	1/4-acre res.	0.50	0.60	0.00				0.50	0.60
100*	41.90	9.90	Nbhd Comm	0.75	0.80	32.00	1/4-acre res.	0.50	0.60	0.56	0.65
OS-145-1*	12.30	12.30	1/4-acre res.	0.50	0.60	0.00				0.50	0.60
OS145-2A*	19.40	15.90	1/8-acre res.	0.60	0.70	3.50	pasture/meadow	0.25	0.35	0.54	0.64
OS145-2B*	7.70	7.70	1/8-acre res.	0.60	0.70	0.00				0.60	0.70
OS145-3*	67.60	39.51	1/8-acre res.	0.60	0.70	28.09	pasture/meadow	0.25	0.35	0.45	0.55
(unstudied)	22.40	22.40	1/4-acre res.	0.50	0.60	0.00				0.50	0.60

* Information taken from various MDDP's and FDR's. See Report for reference.

Basin Drainage Summary

Project: **Dublin North**
Date: **November 11, 2005**
Hydrology Group: **A**

Basin Summary		Composite		Overland / Undeveloped				Streets / Developed					Total T	Used T	Intensity		Total Flow	
Basin	Area (acres)	C_5	C_{100}	C_5	Length (ft)	Height (ft)	T_C (min)	Length (ft)	Height (ft)	Slope (%)	Velocity (fps)	T_C (min)	T_C total (min)	T_C used (min)	I_5 (in/hr)	I_{100} (in/hr)	Q_5 (cfs)	Q_{100} (cfs)
HISTORIC																		
OS5*	15.00	0.25	0.35											15.7	3.30	5.80	12.4	30.3
OS6*	12.04	0.25	0.35											22.6	2.70	4.80	8.2	20.1
H1-C*	10.23	0.50	0.60					2640	86.0	3.3	3.7	11.9	12	16.9	3.27	5.83	16.8	35.8
100*	41.90	0.60	0.70											20.0	3.01	5.00	75.8	136.2
OS-145-1*	12.30	0.50	0.60											16.9	3.30	5.50	20.2	40.9
OS145-2A*	19.40	0.39	0.49											14.0	3.60	6.10	27.0	57.8
OS145-2B*	7.70	0.39	0.49											14.0	3.60	6.10	10.7	23.0
OS145-3*	67.60	0.64	0.70											17.5	3.20	5.50	140.2	258.0
(unstudied)	22.40	0.50	0.60					1420	44.0	3.1	3.5	6.8	7	20.0	3.01	5.37	33.8	72.1
DEVELOPED																		
OS5*	15.00	0.25	0.35											15.7	3.30	5.80	12.4	30.3
OS6*	12.04	0.25	0.35											22.6	2.70	4.80	8.2	20.1
H1-C*	10.23	0.50	0.60					2640	86.0	3.3	3.7	11.9	12	16.9	3.27	5.83	16.8	35.8
100*	41.90	0.56	0.65											20.0	3.01	5.00	70.6	135.6
OS-145-1*	12.30	0.50	0.60											16.9	3.30	5.50	20.2	40.9
OS145-2A*	19.40	0.54	0.64											14.0	3.60	6.10	37.5	75.4
OS145-2B*	7.70	0.60	0.70											14.0	3.60	6.10	16.6	32.9
OS145-3*	67.60	0.45	0.55											17.5	3.20	5.50	98.3	206.2
(unstudied)	22.40	0.50	0.60					1420	44.0	3.1	3.5	6.8	7	20.0	3.01	5.37	33.8	72.1

* Information taken from various MDDP's and FDR's. See Report for reference.

HYDRAULICS:

CRITERIA & CALCULATIONS

COMPARISON OF EXISTING AND PROPOSED CRITERIA

INITIAL STORM:

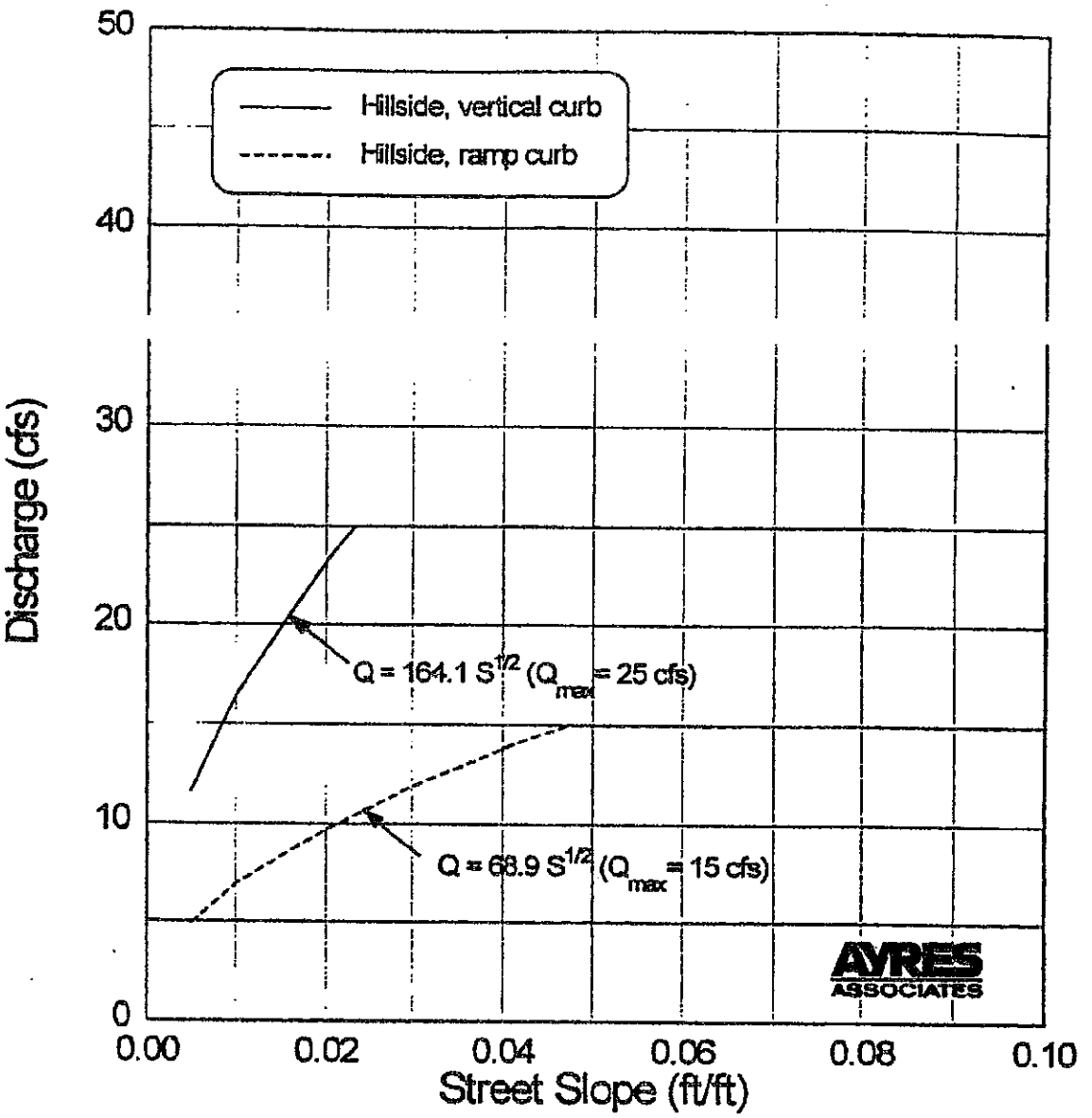
STREET TYPE	OLD	NEW
Hillside Residential ramp curb	flow spread to crown, maximum 25 cfs. per side, whichever is more restrictive	flow spread to crown max. 15 cfs. per side
Hillside Residential vertical curb	flow spread to crown, maximum 25 cfs. per side, whichever is more restrictive	6" allowable depth @ flo line max. 25 cfs. per side
Residential Street ramp curb	flow spread to crown	flow spread to crown max. 20 cfs. per side
Residential Street vertical curb	flow spread to crown	6" allowable depth @ flo line max. 34 cfs. per side
Collector Street	20 foot flow spread	6" allowable depth @ flo line, max. 34 cfs. per side, no overtop ng the crown
Arterial Street	flow may encroach onto one outside lane	6" allowable depth @ flo line, max. 34 cfs. per side, one ten foo lane free of water in each direction

MAJOR STORM:

STREET TYPE	OLD	NEW
Hillside Residential Residential Streets Collector Streets	12" max. depth @ flowline no adjacent flooding	NO CHANGE
Arterial Streets	8" max. depth @ flowline (no curb overtopping)	NO CHANGE

CROSS FLOWS: No changes to any street types for the initial storm.
Only change for Major Storm is the Arterial street will now allow 12" max. dep @ flowline and 4" max. depth @ crown whichever is more restrictive. Existing criteria allows no crossfl w.

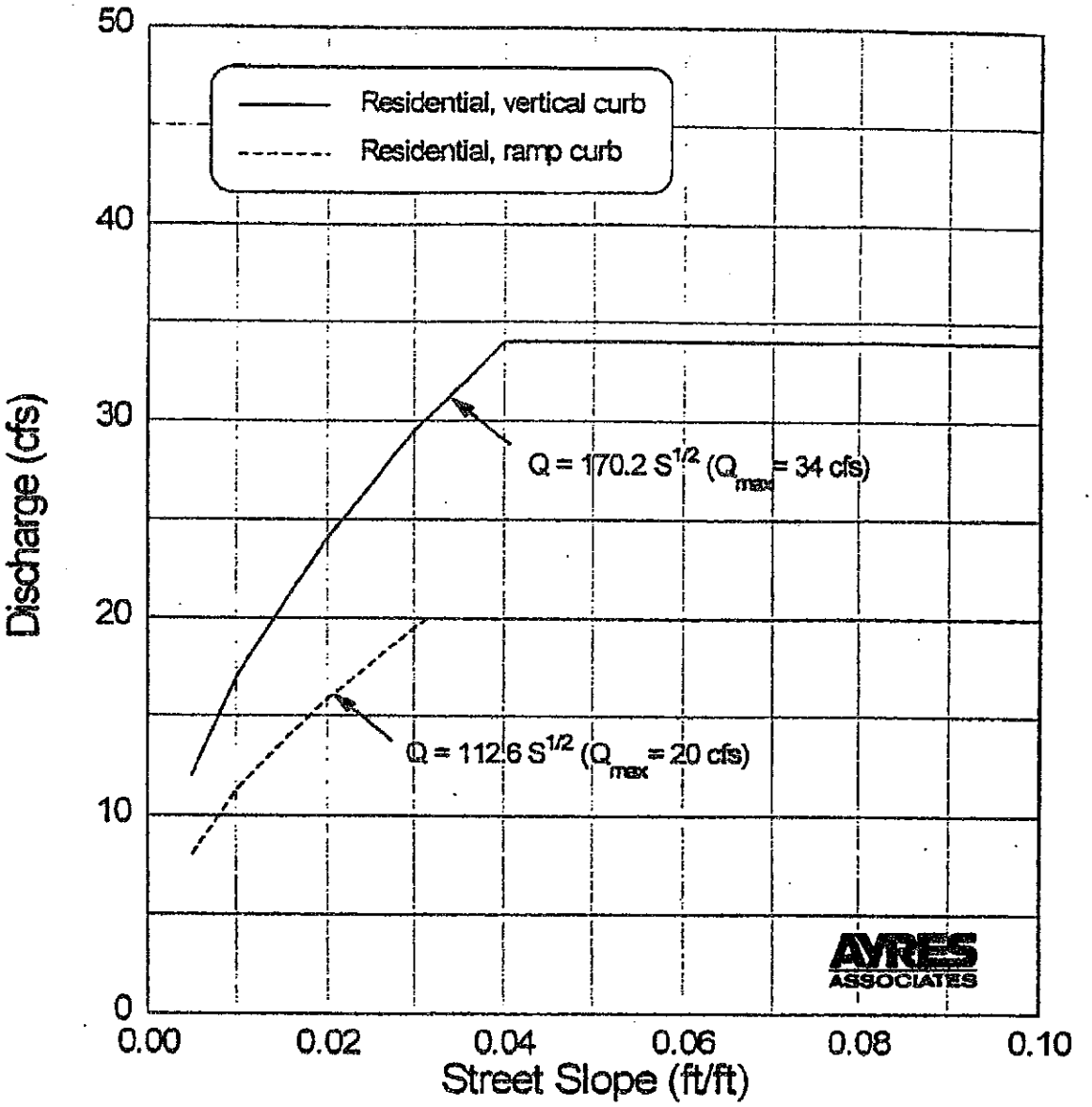
HILLSIDE MINOR RESIDENTIAL



Interim Release October 12, 1994
City of Colorado Springs

Use this graph to determine the allowable street capacity per side, initial storm, for the typical street section using a 2% crown.

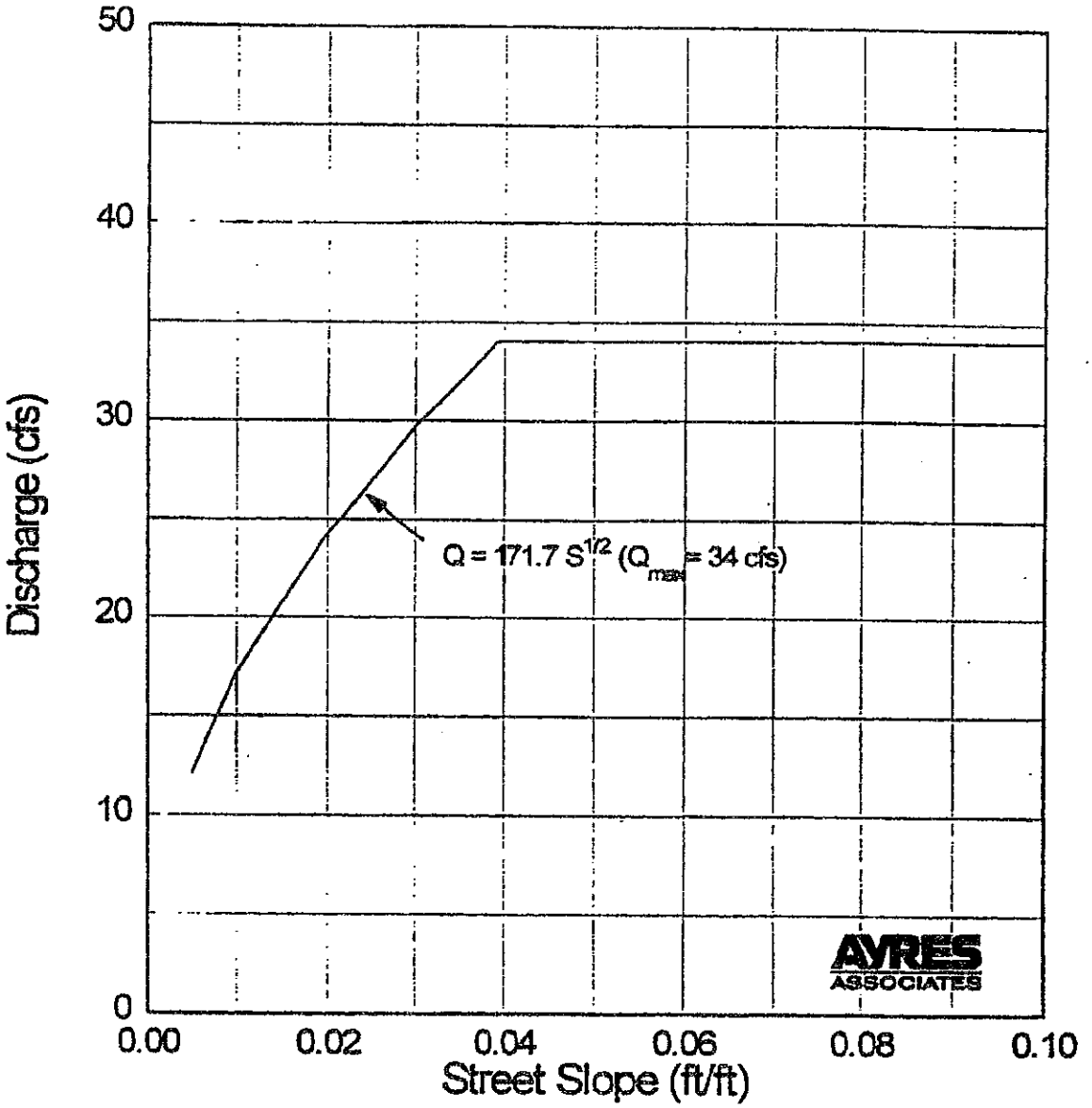
RESIDENTIAL STREET (34′ Flowline to flowline)



Interim Release October 12, 1994
City of Colorado Springs

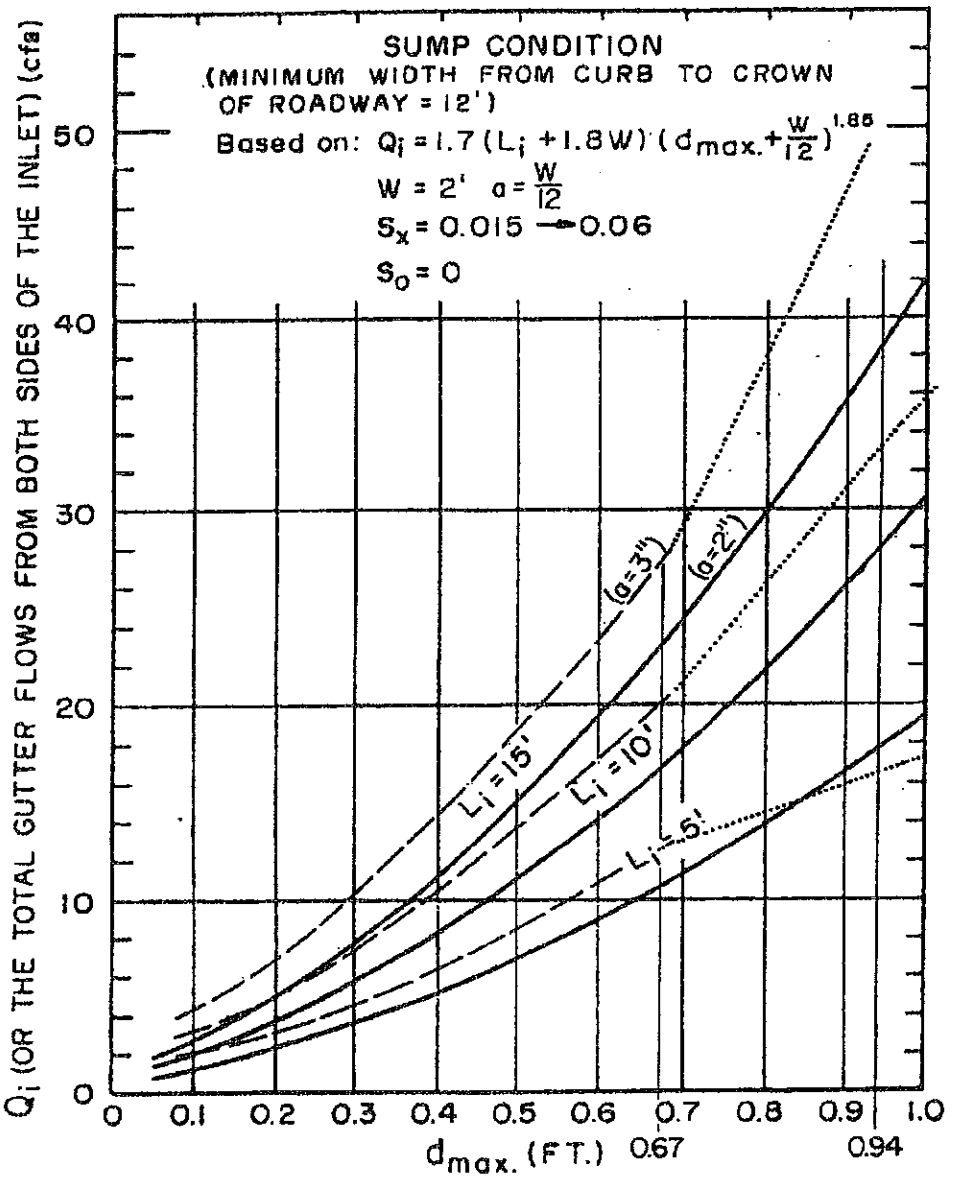
Use this graph to determine the allowable street capacity per side, initial storm, for the typical street section using a 2% crown.

COLLECTOR STREETS (Major and Minor)



Interim Release October 12, 1994
City of Colorado Springs

Use this graph to determine the allowable street capacity per side, initial storm, for the typical street section using a 2% crown. No flow may cross the crown.



REFERENCE : Izzard, Carl. F., Report presented at the Annual Meeting of the National Transportation Board, January 1977; Simplified Method For Design of Curb-opening Inlets
— — — (As Modified by El Paso County, per Type R Inlet)

Note: Depth of ponding measured at curb above depressed area ; a = 3", For $d \leq .67$

$Q_i = (1.7 L_i + 6.12)(d_{max} + .25)^{1.85}$; $Q_i = 3.60 L_i (d - .08)^{.5}$ For $d \geq .94$; Note : No Clogging Factor

9/30/90

HDR Infrastructure, Inc.
A Centerra Company

The City of Colorado Springs / El Paso County
Drainage Criteria Manual

Date
OCT. 1987

Figure
7-11

Sump Capacity for Curb-opening Inlets

Table
Rating Table for Curb Inlet On Grade

Project Description	
Worksheet	Curb Inlet ON GRADE (D-10 R
Type	Curb Inlet On Grade
Solve For	Efficiency

Input Data		
Gutter Width	3.00	ft
Gutter Cross Slope	0.062500	ft/ft
Road Cross Slope	0.020000	ft/ft
Mannings Coefficient	0.013	
Local Depression	3.0	in
Local Depression Width	3.00	ft

Attribute	Minimum	Maximum	Increment
Discharge (cfs)	5.00	35.00	5.00
Slope (ft/ft)	0.010000	0.100000	0.010000
Curb Opening Length (ft)	5.00	20.00	5.00

Discharge (cfs)	Slope (ft/ft)	Curb Opening Length (ft)	Efficiency	Intercepted Flow (cfs)
5.00	0.010000	5.00	0.51	2.55
10.00	0.010000	5.00	0.36	3.58
15.00	0.010000	5.00	0.29	4.31
20.00	0.010000	5.00	0.25	4.91
25.00	0.010000	5.00	0.22	5.43
30.00	0.010000	5.00	0.20	5.89
35.00	0.010000	5.00	0.18	6.31
5.00	0.020000	5.00	0.45	2.24
10.00	0.020000	5.00	0.31	3.12
15.00	0.020000	5.00	0.25	3.75
20.00	0.020000	5.00	0.21	4.26
25.00	0.020000	5.00	0.19	4.70
30.00	0.020000	5.00	0.17	5.10
35.00	0.020000	5.00	0.16	5.45
5.00	0.030000	5.00	0.41	2.06
10.00	0.030000	5.00	0.29	2.88
15.00	0.030000	5.00	0.23	3.46
20.00	0.030000	5.00	0.20	3.93
25.00	0.030000	5.00	0.17	4.33
30.00	0.030000	5.00	0.16	4.68
35.00	0.030000	5.00	0.14	5.01
5.00	0.040000	5.00	0.39	1.95
10.00	0.040000	5.00	0.27	2.72
15.00	0.040000	5.00	0.22	3.26
20.00	0.040000	5.00	0.19	3.70
25.00	0.040000	5.00	0.16	4.08
30.00	0.040000	5.00	0.15	4.41
35.00	0.040000	5.00	0.13	4.72
5.00	0.050000	5.00	0.37	1.86
10.00	0.050000	5.00	0.26	2.60
15.00	0.050000	5.00	0.21	3.12
20.00	0.050000	5.00	0.18	3.54
25.00	0.050000	5.00	0.16	3.89
30.00	0.050000	5.00	0.14	4.21
35.00	0.050000	5.00	0.13	4.50

Table
Rating Table for Curb Inlet On Grade

Discharge (cfs)	Slope (ft/ft)	Curb Opening Length (ft)	Efficiency	Intercepted Flow (cfs)
5.00	0.060000	5.00	0.36	1.78
10.00	0.060000	5.00	0.25	2.50
15.00	0.060000	5.00	0.20	3.00
20.00	0.060000	5.00	0.17	3.40
25.00	0.060000	5.00	0.15	3.75
30.00	0.060000	5.00	0.14	4.06
35.00	0.060000	5.00	0.12	4.33
5.00	0.070000	5.00	0.34	1.72
10.00	0.070000	5.00	0.24	2.42
15.00	0.070000	5.00	0.19	2.91
20.00	0.070000	5.00	0.16	3.30
25.00	0.070000	5.00	0.15	3.63
30.00	0.070000	5.00	0.13	3.93
35.00	0.070000	5.00	0.12	4.20
5.00	0.080000	5.00	0.33	1.67
10.00	0.080000	5.00	0.24	2.35
15.00	0.080000	5.00	0.19	2.83
20.00	0.080000	5.00	0.16	3.21
25.00	0.080000	5.00	0.14	3.53
30.00	0.080000	5.00	0.13	3.82
35.00	0.080000	5.00	0.12	4.08
5.00	0.090000	5.00	0.33	1.63
10.00	0.090000	5.00	0.23	2.29
15.00	0.090000	5.00	0.18	2.76
20.00	0.090000	5.00	0.16	3.13
25.00	0.090000	5.00	0.14	3.45
30.00	0.090000	5.00	0.12	3.73
35.00	0.090000	5.00	0.11	3.98
5.00	0.100000	5.00	0.32	1.59
10.00	0.100000	5.00	0.22	2.24
15.00	0.100000	5.00	0.18	2.70
20.00	0.100000	5.00	0.15	3.06
25.00	0.100000	5.00	0.13	3.37
30.00	0.100000	5.00	0.12	3.65
35.00	0.100000	5.00	0.11	3.89
5.00	0.010000	10.00	0.85	4.26
10.00	0.010000	10.00	0.64	6.43
15.00	0.010000	10.00	0.53	7.96
20.00	0.010000	10.00	0.46	9.20
25.00	0.010000	10.00	0.41	10.26
30.00	0.010000	10.00	0.37	11.20
35.00	0.010000	10.00	0.34	12.05
5.00	0.020000	10.00	0.77	3.87
10.00	0.020000	10.00	0.57	5.71
15.00	0.020000	10.00	0.47	7.02
20.00	0.020000	10.00	0.40	8.07
25.00	0.020000	10.00	0.36	8.97
30.00	0.020000	10.00	0.33	9.77
35.00	0.020000	10.00	0.30	10.49
5.00	0.030000	10.00	0.73	3.63
10.00	0.030000	10.00	0.53	5.32
15.00	0.030000	10.00	0.43	6.51
20.00	0.030000	10.00	0.37	7.46
25.00	0.030000	10.00	0.33	8.29

Table
Rating Table for Curb Inlet On Grade

Discharge (cfs)	Slope (ft/ft)	Curb Opening Length (ft)	Efficiency	Intercepted Flow (cfs)
30.00	0.030000	10.00	0.30	9.01
35.00	0.030000	10.00	0.28	9.67
5.00	0.040000	10.00	0.69	3.45
10.00	0.040000	10.00	0.50	5.04
15.00	0.040000	10.00	0.41	6.16
20.00	0.040000	10.00	0.35	7.06
25.00	0.040000	10.00	0.31	7.83
30.00	0.040000	10.00	0.28	8.51
35.00	0.040000	10.00	0.26	9.13
5.00	0.050000	10.00	0.66	3.32
10.00	0.050000	10.00	0.48	4.84
15.00	0.050000	10.00	0.39	5.90
20.00	0.050000	10.00	0.34	6.76
25.00	0.050000	10.00	0.30	7.49
30.00	0.050000	10.00	0.27	8.14
35.00	0.050000	10.00	0.25	8.72
5.00	0.060000	10.00	0.64	3.21
10.00	0.060000	10.00	0.47	4.67
15.00	0.060000	10.00	0.38	5.70
20.00	0.060000	10.00	0.33	6.52
25.00	0.060000	10.00	0.29	7.23
30.00	0.060000	10.00	0.26	7.85
35.00	0.060000	10.00	0.24	8.41
5.00	0.070000	10.00	0.62	3.12
10.00	0.070000	10.00	0.45	4.54
15.00	0.070000	10.00	0.37	5.53
20.00	0.070000	10.00	0.32	6.33
25.00	0.070000	10.00	0.28	7.01
30.00	0.070000	10.00	0.25	7.61
35.00	0.070000	10.00	0.23	8.15
5.00	0.080000	10.00	0.61	3.04
10.00	0.080000	10.00	0.44	4.42
15.00	0.080000	10.00	0.36	5.39
20.00	0.080000	10.00	0.31	6.16
25.00	0.080000	10.00	0.27	6.82
30.00	0.080000	10.00	0.25	7.41
35.00	0.080000	10.00	0.23	7.93
5.00	0.090000	10.00	0.59	2.97
10.00	0.090000	10.00	0.43	4.32
15.00	0.090000	10.00	0.35	5.27
20.00	0.090000	10.00	0.30	6.02
25.00	0.090000	10.00	0.27	6.67
30.00	0.090000	10.00	0.24	7.23
35.00	0.090000	10.00	0.22	7.75
5.00	0.100000	10.00	0.58	2.90
10.00	0.100000	10.00	0.42	4.23
15.00	0.100000	10.00	0.34	5.16
20.00	0.100000	10.00	0.29	5.90
25.00	0.100000	10.00	0.26	6.53
30.00	0.100000	10.00	0.24	7.08
35.00	0.100000	10.00	0.22	7.58
5.00	0.010000	15.00	1.00	5.00
10.00	0.010000	15.00	0.85	8.52
15.00	0.010000	15.00	0.73	10.92

Table
Rating Table for Curb Inlet On Grade

Discharge (cfs)	Slope (ft/ft)	Curb Opening Length (ft)	Efficiency	Intercepted Flow (cfs)
20.00	0.010000	15.00	0.64	12.83
25.00	0.010000	15.00	0.58	14.47
30.00	0.010000	15.00	0.53	15.91
35.00	0.010000	15.00	0.49	17.22
5.00	0.020000	15.00	0.96	4.82
10.00	0.020000	15.00	0.77	7.75
15.00	0.020000	15.00	0.65	9.77
20.00	0.020000	15.00	0.57	11.40
25.00	0.020000	15.00	0.51	12.78
30.00	0.020000	15.00	0.47	14.00
35.00	0.020000	15.00	0.43	15.11
5.00	0.030000	15.00	0.93	4.64
10.00	0.030000	15.00	0.73	7.29
15.00	0.030000	15.00	0.61	9.13
20.00	0.030000	15.00	0.53	10.61
25.00	0.030000	15.00	0.47	11.86
30.00	0.030000	15.00	0.43	12.98
35.00	0.030000	15.00	0.40	13.98
5.00	0.040000	15.00	0.90	4.49
10.00	0.040000	15.00	0.70	6.96
15.00	0.040000	15.00	0.58	8.69
20.00	0.040000	15.00	0.50	10.07
25.00	0.040000	15.00	0.45	11.25
30.00	0.040000	15.00	0.41	12.29
35.00	0.040000	15.00	0.38	13.22
5.00	0.050000	15.00	0.87	4.36
10.00	0.050000	15.00	0.67	6.72
15.00	0.050000	15.00	0.56	8.36
20.00	0.050000	15.00	0.48	9.67
25.00	0.050000	15.00	0.43	10.79
30.00	0.050000	15.00	0.39	11.78
35.00	0.050000	15.00	0.36	12.67
5.00	0.060000	15.00	0.85	4.25
10.00	0.060000	15.00	0.65	6.51
15.00	0.060000	15.00	0.54	8.09
20.00	0.060000	15.00	0.47	9.35
25.00	0.060000	15.00	0.42	10.42
30.00	0.060000	15.00	0.38	11.37
35.00	0.060000	15.00	0.35	12.22
5.00	0.070000	15.00	0.83	4.16
10.00	0.070000	15.00	0.63	6.34
15.00	0.070000	15.00	0.52	7.87
20.00	0.070000	15.00	0.45	9.09
25.00	0.070000	15.00	0.40	10.12
30.00	0.070000	15.00	0.37	11.04
35.00	0.070000	15.00	0.34	11.86
5.00	0.080000	15.00	0.81	4.07
10.00	0.080000	15.00	0.62	6.20
15.00	0.080000	15.00	0.51	7.68
20.00	0.080000	15.00	0.44	8.86
25.00	0.080000	15.00	0.39	9.87
30.00	0.080000	15.00	0.36	10.76
35.00	0.080000	15.00	0.33	11.56
5.00	0.090000	15.00	0.80	3.99

Table
Rating Table for Curb Inlet On Grade

Discharge (cfs)	Slope (ft/ft)	Curb Opening Length (ft)	Efficiency	Intercepted Flow (cfs)
10.00	0.090000	15.00	0.61	6.07
15.00	0.090000	15.00	0.50	7.51
20.00	0.090000	15.00	0.43	8.67
25.00	0.090000	15.00	0.39	9.65
30.00	0.090000	15.00	0.35	10.51
35.00	0.090000	15.00	0.32	11.29
5.00	0.100000	15.00	0.78	3.92
10.00	0.100000	15.00	0.60	5.95
15.00	0.100000	15.00	0.49	7.37
20.00	0.100000	15.00	0.42	8.50
25.00	0.100000	15.00	0.38	9.46
30.00	0.100000	15.00	0.34	10.30
35.00	0.100000	15.00	0.32	11.06
5.00	0.010000	20.00	1.00	5.00
10.00	0.010000	20.00	0.98	9.75
15.00	0.010000	20.00	0.88	13.14
20.00	0.010000	20.00	0.79	15.79
25.00	0.010000	20.00	0.72	18.04
30.00	0.010000	20.00	0.67	20.01
35.00	0.010000	20.00	0.62	21.80
5.00	0.020000	20.00	1.00	5.00
10.00	0.020000	20.00	0.92	9.18
15.00	0.020000	20.00	0.80	12.00
20.00	0.020000	20.00	0.71	14.23
25.00	0.020000	20.00	0.64	16.12
30.00	0.020000	20.00	0.59	17.79
35.00	0.020000	20.00	0.55	19.29
5.00	0.030000	20.00	1.00	5.00
10.00	0.030000	20.00	0.88	8.77
15.00	0.030000	20.00	0.75	11.32
20.00	0.030000	20.00	0.67	13.34
25.00	0.030000	20.00	0.60	15.06
30.00	0.030000	20.00	0.55	16.57
35.00	0.030000	20.00	0.51	17.93
5.00	0.040000	20.00	1.00	4.98
10.00	0.040000	20.00	0.85	8.46
15.00	0.040000	20.00	0.72	10.84
20.00	0.040000	20.00	0.64	12.72
25.00	0.040000	20.00	0.57	14.33
30.00	0.040000	20.00	0.52	15.74
35.00	0.040000	20.00	0.49	17.01
5.00	0.050000	20.00	0.99	4.93
10.00	0.050000	20.00	0.82	8.21
15.00	0.050000	20.00	0.70	10.46
20.00	0.050000	20.00	0.61	12.26
25.00	0.050000	20.00	0.55	13.78
30.00	0.050000	20.00	0.50	15.11
35.00	0.050000	20.00	0.47	16.32
5.00	0.060000	20.00	0.97	4.87
10.00	0.060000	20.00	0.80	8.00
15.00	0.060000	20.00	0.68	10.16
20.00	0.060000	20.00	0.59	11.88
25.00	0.060000	20.00	0.53	13.34
30.00	0.060000	20.00	0.49	14.62

Table
Rating Table for Curb Inlet On Grade

Discharge (cfs)	Slope (ft/ft)	Curb Opening Length (ft)	Efficiency	Intercepted Flow (cfs)
35.00	0.060000	20.00	0.45	15.78
5.00	0.070000	20.00	0.96	4.81
10.00	0.070000	20.00	0.78	7.82
15.00	0.070000	20.00	0.66	9.91
20.00	0.070000	20.00	0.58	11.57
25.00	0.070000	20.00	0.52	12.97
30.00	0.070000	20.00	0.47	14.21
35.00	0.070000	20.00	0.44	15.33
5.00	0.080000	20.00	0.95	4.75
10.00	0.080000	20.00	0.77	7.66
15.00	0.080000	20.00	0.65	9.69
20.00	0.080000	20.00	0.56	11.30
25.00	0.080000	20.00	0.51	12.67
30.00	0.080000	20.00	0.46	13.87
35.00	0.080000	20.00	0.43	14.95
5.00	0.090000	20.00	0.94	4.69
10.00	0.090000	20.00	0.75	7.52
15.00	0.090000	20.00	0.63	9.50
20.00	0.090000	20.00	0.55	11.07
25.00	0.090000	20.00	0.50	12.40
30.00	0.090000	20.00	0.45	13.57
35.00	0.090000	20.00	0.42	14.62
5.00	0.100000	20.00	0.93	4.63
10.00	0.100000	20.00	0.74	7.40
15.00	0.100000	20.00	0.62	9.33
20.00	0.100000	20.00	0.54	10.86
25.00	0.100000	20.00	0.49	12.16
30.00	0.100000	20.00	0.44	13.30
35.00	0.100000	20.00	0.41	14.33

Table
Rating Table for Circular Channel

Project Description	
Worksheet	Circular Channel (RCP)
Flow Element	Circular Channel
Method	Manning's Formula
Solve For	Full Flow Capacity

Input Data	
Mannings Coefficient	0.013

Attribute	Minimum	Maximum	Increment
Slope (ft/ft)	0.010000	0.100000	0.010000
Diameter (in)	18	60	6

Slope (ft/ft)	Diameter (in)	Discharge (cfs)	Depth (ft)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
0.010000	18	10.50	1.50	5.94	1.8	4.71	0.00
0.020000	18	14.85	1.50	8.41	1.8	4.71	0.00
0.030000	18	18.19	1.50	10.30	1.8	4.71	0.00
0.040000	18	21.01	1.50	11.89	1.8	4.71	0.00
0.050000	18	23.49	1.50	13.29	1.8	4.71	0.00
0.060000	18	25.73	1.50	14.56	1.8	4.71	0.00
0.070000	18	27.79	1.50	15.73	1.8	4.71	0.00
0.080000	18	29.71	1.50	16.81	1.8	4.71	0.00
0.090000	18	31.51	1.50	17.83	1.8	4.71	0.00
0.100000	18	33.22	1.50	18.80	1.8	4.71	0.00
0.010000	24	22.62	2.00	7.20	3.1	6.28	0.00
0.020000	24	31.99	2.00	10.18	3.1	6.28	0.00
0.030000	24	39.18	2.00	12.47	3.1	6.28	0.00
0.040000	24	45.24	2.00	14.40	3.1	6.28	0.00
0.050000	24	50.58	2.00	16.10	3.1	6.28	0.00
0.060000	24	55.41	2.00	17.64	3.1	6.28	0.00
0.070000	24	59.85	2.00	19.05	3.1	6.28	0.00
0.080000	24	63.98	2.00	20.37	3.1	6.28	0.00
0.090000	24	67.86	2.00	21.60	3.1	6.28	0.00
0.100000	24	71.53	2.00	22.77	3.1	6.28	0.00
0.010000	30	41.01	2.50	8.36	4.9	7.85	0.00
0.020000	30	58.00	2.50	11.82	4.9	7.85	0.00
0.030000	30	71.04	2.50	14.47	4.9	7.85	0.00
0.040000	30	82.03	2.50	16.71	4.9	7.85	0.00
0.050000	30	91.71	2.50	18.68	4.9	7.85	0.00
0.060000	30	100.47	2.50	20.47	4.9	7.85	0.00
0.070000	30	108.52	2.50	22.11	4.9	7.85	0.00
0.080000	30	116.01	2.50	23.63	4.9	7.85	0.00
0.090000	30	123.04	2.50	25.07	4.9	7.85	0.00
0.100000	30	129.70	2.50	26.42	4.9	7.85	0.00
0.010000	36	66.69	3.00	9.44	7.1	9.42	0.00
0.020000	36	94.32	3.00	13.34	7.1	9.42	0.00
0.030000	36	115.52	3.00	16.34	7.1	9.42	0.00
0.040000	36	133.39	3.00	18.87	7.1	9.42	0.00
0.050000	36	149.13	3.00	21.10	7.1	9.42	0.00
0.060000	36	163.37	3.00	23.11	7.1	9.42	0.00
0.070000	36	176.46	3.00	24.96	7.1	9.42	0.00
0.080000	36	188.64	3.00	26.69	7.1	9.42	0.00
0.090000	36	200.08	3.00	28.31	7.1	9.42	0.00
0.100000	36	210.91	3.00	29.84	7.1	9.42	0.00

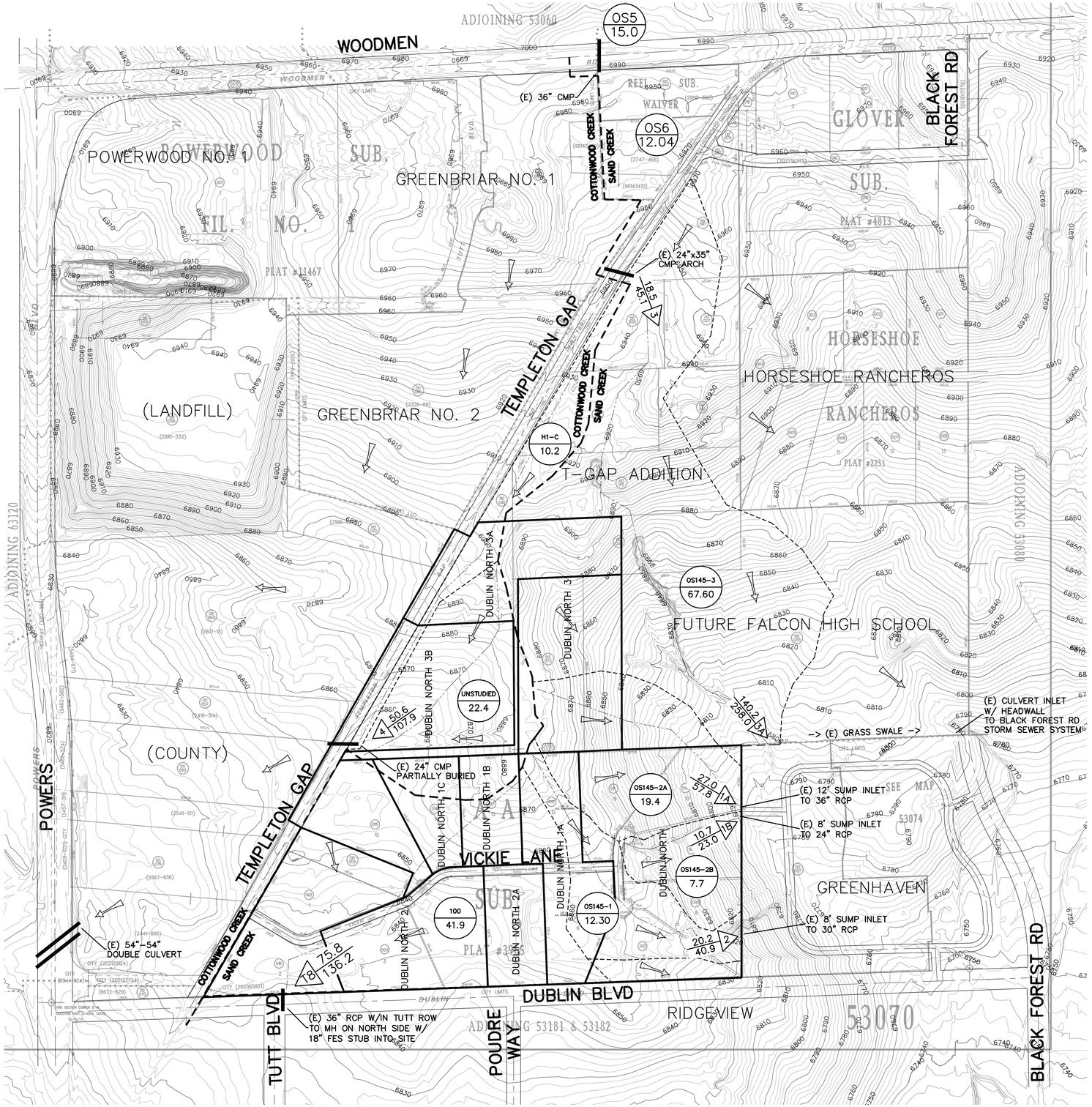
Table
Rating Table for Circular Channel

Slope (ft/ft)	Diameter (in)	Discharge (cfs)	Depth (ft)	Velocity (ft/s)	Flow Area (ft^2)	Wetted Perimeter (ft)	Top Width (ft)
0.010000	42	100.60	3.50	10.46	9.6	11.00	0.00
0.020000	42	142.28	3.50	14.79	9.6	11.00	0.00
0.030000	42	174.25	3.50	18.11	9.6	11.00	0.00
0.040000	42	201.21	3.50	20.91	9.6	11.00	0.00
0.050000	42	224.96	3.50	23.38	9.6	11.00	0.00
0.060000	42	246.43	3.50	25.61	9.6	11.00	0.00
0.070000	42	266.17	3.50	27.67	9.6	11.00	0.00
0.080000	42	284.55	3.50	29.58	9.6	11.00	0.00
0.090000	42	301.81	3.50	31.37	9.6	11.00	0.00
0.100000	42	318.14	3.50	33.07	9.6	11.00	0.00
0.010000	48	143.64	4.00	11.43	12.6	12.57	0.00
0.020000	48	203.13	4.00	16.16	12.6	12.57	0.00
0.030000	48	248.78	4.00	19.80	12.6	12.57	0.00
0.040000	48	287.27	4.00	22.86	12.6	12.57	0.00
0.050000	48	321.18	4.00	25.56	12.6	12.57	0.00
0.060000	48	351.83	4.00	28.00	12.6	12.57	0.00
0.070000	48	380.02	4.00	30.24	12.6	12.57	0.00
0.080000	48	406.26	4.00	32.33	12.6	12.57	0.00
0.090000	48	430.91	4.00	34.29	12.6	12.57	0.00
0.100000	48	454.22	4.00	36.15	12.6	12.57	0.00
0.010000	54	196.64	4.50	12.36	15.9	14.14	0.00
0.020000	54	278.09	4.50	17.49	15.9	14.14	0.00
0.030000	54	340.59	4.50	21.41	15.9	14.14	0.00
0.040000	54	393.28	4.50	24.73	15.9	14.14	0.00
0.050000	54	439.70	4.50	27.65	15.9	14.14	0.00
0.060000	54	481.66	4.50	30.29	15.9	14.14	0.00
0.070000	54	520.26	4.50	32.71	15.9	14.14	0.00
0.080000	54	556.18	4.50	34.97	15.9	14.14	0.00
0.090000	54	589.92	4.50	37.09	15.9	14.14	0.00
0.100000	54	621.83	4.50	39.10	15.9	14.14	0.00
0.010000	60	260.43	5.00	13.26	19.6	15.71	0.00
0.020000	60	368.30	5.00	18.76	19.6	15.71	0.00
0.030000	60	451.08	5.00	22.97	19.6	15.71	0.00
0.040000	60	520.86	5.00	26.53	19.6	15.71	0.00
0.050000	60	582.34	5.00	29.66	19.6	15.71	0.00
0.060000	60	637.92	5.00	32.49	19.6	15.71	0.00
0.070000	60	689.03	5.00	35.09	19.6	15.71	0.00
0.080000	60	736.60	5.00	37.51	19.6	15.71	0.00
0.090000	60	781.29	5.00	39.79	19.6	15.71	0.00
0.100000	60	823.55	5.00	41.94	19.6	15.71	0.00

EXHIBITS:

DRAINAGE PLAN

DUBLIN NORTH
MASTER DEVELOPMENT DRAINAGE PLAN
(EXISTING CONDITIONS)



DRAINAGE PLAN LEGEND	
	DRAINAGE BASIN BOUNDARY
	SUB-BASIN BOUNDARY
	DRAINAGE PATH
OS-8 / 88.8	DRAINAGE BASIN TAG BASIN DESIGNATION BASIN AREA (acres)
A8 / 67.5 / 188.2	DESIGN POINT TAG MINOR FLOW (cfs) MAJOR FLOW (cfs) DESIGN POINT DESIGNATION

DRAINAGE BASIN SUMMARY

BASIN DESIGNATION:	MINOR FLOW (cfs):	MAJOR FLOW (cfs):
OS5	12.4	30.3
OS6	8.2	20.1
H1-C	16.8	35.8
100	75.8	136.2
OS145-1	20.2	40.9
OS145-2A	27.0	57.8
OS145-2B	10.9	23.4
OS145-3	140.2	258.0
(UNSTUDIED)	33.8	72.1

DESIGN POINT SUMMARY

DESIG POINT:	MINOR FLOW (cfs):	MAJOR FLOW (cfs):
1A	27.0	57.8
1B	10.7	23.0
2	20.2	40.9
3	18.5	45.1
3A	140.2	258.0
4	50.6	107.9
T8	75.8	136.2

GRAPHIC SCALE

300 0 150 300 600

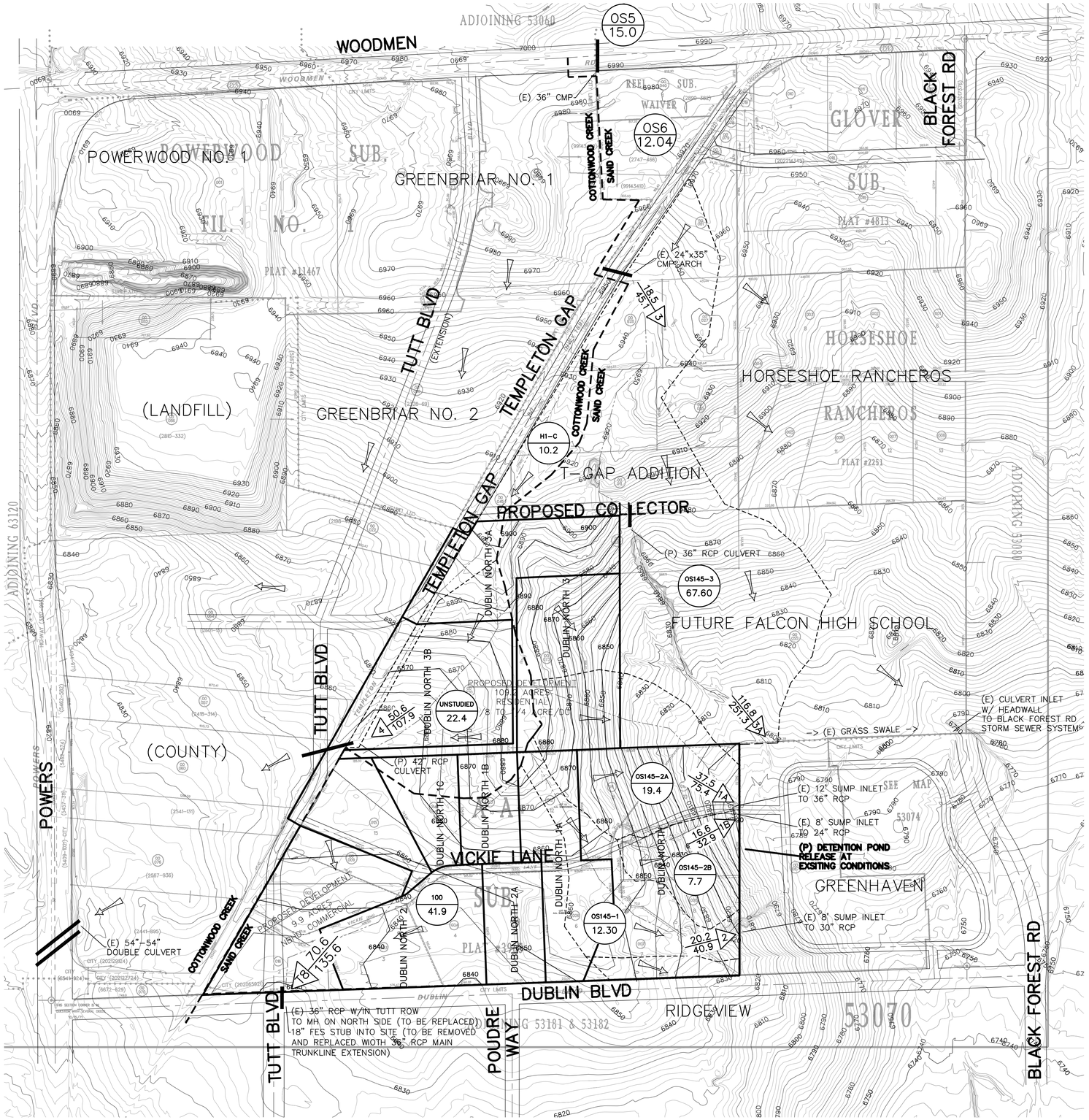
1 inch = 300 feet

REVISED: 1/23/06 ZC, PER CITY COMMENTS

DRAWN BY:	ZC	DATE:	11/11/2005
CHECKED BY:	RGB	DRAWING NO:	
JOB NO:	050086	SHEET	1 OF 1

berge-brewer & associates, inc.
711 n. cascade avenue
colorado springs, colorado
(719) 227-7181
ENGINEERS PLANNERS SURVEYORS

DUBLIN NORTH
MASTER DEVELOPMENT DRAINAGE PLAN
(PROPOSED CONDITIONS)



DRAINAGE PLAN LEGEND	
	DRAINAGE BASIN BOUNDARY
	SUB-BASIN BOUNDARY
	DRAINAGE PATH
OS-8 / 88.8	DRAINAGE BASIN TAG BASIN DESIGNATION BASIN AREA (acres)
A8 67.5 / 188.2	DESIGN POINT TAG MINOR FLOW (cfs) MAJOR FLOW (cfs) DESIGN POINT DESIGNATION

DRAINAGE BASIN SUMMARY

BASIN DESIGNATION:	MINOR FLOW (cfs):	MAJOR FLOW (cfs):
OS5	12.4	30.3
OS6	8.2	20.1
H1-C	16.8	35.8
100	70.6	135.6
OS145-1	20.2	40.9
OS145-2A	37.5	75.4
OS145-2B	16.6	32.9
OS145-3	98.3	206.2
(UNSTUDIED)	33.8	72.1

DESIGN POINT SUMMARY

DESIG POINT:	MINOR FLOW (cfs):	MAJOR FLOW (cfs):
1A	37.5	75.4
1B	16.6	32.9
2	20.2	40.9
3	18.5	45.1
3A	116.8	251.3
4	50.6	107.9
T8	70.6	135.6

GRAPHIC SCALE

300 0 150 300 600

1 inch = 300 feet

REVISED: 1/23/06 ZC, PER CITY COMMENTS

DRAWN BY: ZC	DATE: 11/11/2005	berge-brewer & associates, inc.
CHECKED BY: RGB	DRAWING NO.:	711 n. cascade avenue colorado springs, colorado (719) 227-7181
JOB NO. 050086	SHEET 1 OF 1	ENGINEERS PLANNERS SURVEYORS