

August 12, 2024

Town of Castle Rock
100 N. Wilcox St.
Castle Rock, CO 80104

RE: SDP 24-0024
Lot 1, Block 1, Outlets at Castle Rock Filing No. 1
Outlets at Castle Rock – Pad B1
Drainage Conformance Letter (Phase II Report)

General

This letter is provided to demonstrate the subject site's conformance to previous design documents used to develop existing infrastructure serving the site and surrounding properties. The **subject site** is a part of Lot 1, Block 1, Outlets at Castle Rock Filing No. 1; generally located at 5050 Factory Shops Boulevard, otherwise a part of the Outlets at Castle Rock owned by Craig Realty Group (see attachments; Vicinity Map). Portions of this lot are intended to be developed by the owner as a pad lot, generally within the existing parking field west of the overall outlet development. Final development of the pad site, including building construction, is to be accomplished by future tenants (see attachments; Site Maps/Calculations/Figures & Tables).

More particularly, the subject site is situated in the north half of Section 27, Township 7 South, Range 67 West of the 6th Principal Meridian, Town of Castle Rock, County of Douglas, State of Colorado. Factory Shops Boulevard lies generally west of the site; the Outlet Access Road intersecting with Factory Shops Boulevard lies generally north of the site; the Outlets at Castle Rock retail development lies generally east of the site; and parking for the Outlets at Castle Rock retail development lies generally south of the site. Land use on all sides of the subject site is existing or assumed future commercial development (see attachments; Vicinity Map).

The portion of the subject site to be developed as a leased pad site will be approximately 0.23 acre. Improvements to the existing parking field within which the pad site lies; including parking island reconfiguration, re-grading, and re-paving will occur over a larger area (i.e. the pad lot). The subject site mainly consists of existing pavement and landscaping typical of commercial development. The Natural Resources Conservation Service (**NRCS**) Web Soil Survey indicates site soils are mainly (BrB) Bresser sandy loam, cool, 1 to 3 percent slopes, rated as Hydrologic Soil Group B; and (Bo) Blakeland-Orsa association, 1 to 4 percent slopes, rated as Hydrologic Soil Group A, (see attachments; **NRCS SOIL MAP**). The Federal Emergency Management Agency (**FEMA**) Flood Map Service Center documents the site on Flood Insurance Rate Map (**FIRM**), Map No. 08035C0167G, Map revised March 16, 2016, and Map No. 08035C0186G, Map revised March 16, 2016; and indicates the site is within Flood Zone X (Unshaded), "Areas determined to be outside the 0.2% annual chance floodplain..." (see attachments; FEMA FIRM).

For the purposes of this letter, the reports and documents referenced herein are considered the most recent and most pertinent. Phase III report(s) (other than any referenced herein) specific to the subject site have not been found or made available from typical sources such as the Town of Castle Rock, online resources, or the property owner(s).

Existing Drainage Analysis – General

Runoff from the subject site is currently captured by two on site inlets (a.k.a. IN-3 and IN-X3) and conveyed in associated underground storm sewer systems to an offsite detention and water quality pond (a.k.a. Lowe's South Detention Pond; see attachments, *Castle Rock Utilities Map* a.k.a. **ToCR Map 1**). The Lowe's South Detention Pond is the final pond in a succession of ponds (Pond 220, Detention Pond B, Temporary Detention Pond C, Lowe's South Detention Pond respectively) designed to serve the subject site and surrounding areas.

Existing Drainage Analysis – Detailed

Table 1 (below) summarizes the chronology and relevance of the existing reports referenced herein.

The most current, existing drainage document obtained from the Town of Castle Rock pertaining to the subject site is the *Phase III Drainage Report, Castle Pines Commercial Filing 10A, Part 2 – Lowe's Detention Ponds (East Plum Creek Tributaries B2 & C Ponds)*, prepared by Civil Design Group, Inc., dated August 20, 2007 (a.k.a. **LOWE'S REPORT**; see attachments). This report indicates that it "...presents the final design of stormwater detention for the under construction Lowe's home improvement store..." and that the "...South Detention Pond is designed to detain for [the] south half of the Lowe's development, the existing tributary Factory Outlet Shops, and the future development of the currently vacant portions of Filing No. 10A..." The **LOWE'S REPORT** goes on to say that the *Castle Pines Commercial Filing 10A – Part 1 (Lowe's Interim Pond) Phase III Drainage Report*, prepared by TST Inc. of Denver, Consulting Engineers, dated August 9, 2006 (a.k.a. **INTERIM REPORT**; see attachments) "...presented a detailed and comprehensive analysis of the off-site and on-site flows which drain to the area proposed for Lowe's South Detention Pond..." including contributions from "...the 70 acres Factory Shops basin..." and that the "...Part 1 [INTERIM] report specified the required water quality volume for the South Detention Pond..."

The **INTERIM REPORT** describes revisions to the downstream portion of the drainage facilities within Factory Shops Boulevard and New Memphis Court serving the subject site and surrounding areas, including the construction of Temporary Detention Pond C (a.k.a. Lowe's South Detention Pond; see above). The **INTERIM REPORT** states that the "...detention requirements for all basins have been included in the temporary detention pond proposed with water quality..." and that "...volume was calculated accounting for developed flows of the basins reported in this [INTERIM] report in addition to all upstream basins. The assumed imperviousness for all of the basins was based on previously approved drainage reports and field verification, with primarily commercial usage." Previous reports referenced in the **INTERIM REPORT** include the *Castle Pines Commercial P.D.*, *Castle Rock, Colorado, Master Drainage*

Report, prepared by TST Inc. of Denver, Consulting Engineers, dated February 10, 1995 (a.k.a. **MASTER REPORT**; see attachments); and the *Phase III Drainage Report, Castle Pines Commercial P.D. Parcel 5*, prepared by TST Inc. of Denver, Consulting Engineers, dated April 14, 1997 (unavailable). The INTERIM REPORT includes the subject site within its Basin 111 with an area of 70 acres and an imperviousness of 80% which correlates with the report's inclusion of "...an off-site contribution to the improvements from...the Factory Shops to the east..." and suggests it simulates "...the general drainage concept of regional detention for the existing Detention Pond B by relocating this pond further south and adding a defined water quality volume to this pond [a.k.a. Temporary Detention Pond C]."

The MASTER REPORT states that the site considered within its analysis is comprised of the "...Castle Pines Commercial P.D. ... a parcel of approximately 450 acres...generally bounded by Interstate 25 to the east, U.S. Highway 85 to the west, Meadows Parkway to the south, and the Castle Pines development to the north." The MASTER REPORT also indicates that described within it "...are the results of an investigation of the proposed hydrologic conditions for the site..." and that the "...background information and assumptions...have been taken from the *Master Drainage Study for Castle Rock Business Park ("Study")*, TST Inc., October 1991 [see below] and further discussed and refined in the *Preliminary Drainage Report for Castle Pines Commercial P.D.*, TST Inc. of Denver, July 7, 1994 [unavailable]." The MASTER REPORT includes a description of existing drainage improvements consisting of "...the parking lot and building drainage, storm inlets and piping ...[and] detention pond...that is associated with the development of the Factory Shops."

Although a copy of the *Master Drainage Study for Castle Rock Business Park ("Study")*, prepared by TST Inc., dated October 1991 (see above), tying the MASTER REPORT (and subsequent INTERIM REPORT and LOWE'S REPORT) more specifically to the "Factory Shops" and their associated drainage facilities within Factory Shops Boulevard and New Memphis Court serving the subject site and surrounding areas noted above does not appear to be available; a copy of the *Master Drainage Study for Castle Pines Commercial Amended*, prepared by TST Inc., Consulting Engineers, dated October 1991, and revised December 1991 (a.k.a. **MASTER STUDY**; see attachments), is available and does appear to be a report that fills this role in the succession of existing documents.

The MASTER STUDY is a revision to the *Master Drainage Study for the Castle Pines Commercial, Metropolitan District No.'s 1 through 5*, prepared by Taranto, Stanton & Tagge, Consulting Engineers, dated January 1987 (a.k.a. **1987 REPORT**), "...necessitated by a change in the master plan to allow primarily for the inclusion of a factory outlet mall." The MASTER STUDY indicates that at the time of its preparation, "...Castle Pines Holdings, Inc., [had] become the owner of a portion of the original development, that portion being generally the southern two-thirds of the development..." and that "...This revised report addresses primarily this property, although the additional property to the north has been included for completeness." The MASTER STUDY also indicates that it presents "...the results of an investigation into...the...hydrologic conditions for the Castle Pines Holdings site..." and that it "...is intended to evaluate the site in connection with the most intense probable development." The MASTER

STUDY's considered scope of work includes "...Evaluation of detention pond locations and sizing..." and reports such in its Section III.C, Table V for a Pond 221 modeled by node 220.

Shortly after the preparation of the MASTER STUDY to account for "...the inclusion of a factory outlet mall..." the *Final Drainage Report for Castle Rock Factory Shops*, prepared by Rocky Mountain Consultants, Inc., dated February 1992, and revised March 1992 (a.k.a. **FACTORY SHOPS REPORT**; see attachments), was prepared to address "...A drainage system design for the Castle Rock Factory Shops retail center..." and "...A design of the offsite detention pond facilities." The FACTORY SHOPS REPORT indicates it was based on both the 1987 REPORT and an October 1991 version of the MASTER STUDY resulting in "...proposed drainage facilities [that would] intercept the on-site and off-site runoff for 100-year storm frequency, and convey it to a detention pond 220..." and more specifically that "...Discharge from the site's west and north parking areas [would be] collected at inlets and routed to a... branch of storm sewer in Factory Shops Boulevard... [outfalling] to a detention pond [(Pond 220)] just west of Factory Shops Boulevard."

ToCR MAP 1 indicates the existence of this drainage system and detention pond serving the subject site. Review of as-built plans provided by the Town of Castle Rock within the *Castle Rock Factory Shops Construction Plans – As-Built*, prepared by Rocky Mountain Consultants, Inc., dated December 6, 1993 (a.k.a. **SOUTH ASBUILT**; see attachments), corroborates the construction of the majority of this system including Pond 220 located at the west end of New Memphis Court even though the ultimate alignment of Factory Shops Boulevard and other upstream improvements appear to have been installed after preparation of the as-built plan.

Table 1

DOCUMENT	YEAR	RELEVANT CONTENT
LOWE'S REPORT	2007	Design of Lowe's South Detention Pond; dependent on INTERIM REPORT analysis
INTERIM REPORT	2006	Design of Temporary Detention Pond C, a revision to Detention Pond B; dependent on MASTER REPORT assumptions
MASTER REPORT	1995	Analysis of hydrologic conditions including the Factory Shops development; dependent on assumptions in previous studies similar to MASTER STUDY
MASTER STUDY	1991	Evaluation and preliminary design of detention ponds necessary due to changes in 1987 REPORT including Pond 221 (a.k.a. Pond 220 in succeeding documents)
1987 REPORT	1987	
FACTORY SHOPS REPORT	1992	Detailed design of Factory Shops drainage system and Pond 220

SOUTH ASBUILT	1993	Asbuilt of Factory Shops drainage system and Pond 220
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Conformance

Conformance to these existing conditions and the designs described within the aforementioned documents can be shown by a comparison of impervious area. Without a specific breakdown in the INTERIM REPORT of impervious and pervious areas within Basin 111, a direct comparison to the subject site is not possible. However, a comparison of imperviousness between the existing and proposed conditions for basins impacted by the proposed pad lot limit (existing Basins IN-3, X2 and X3) in conjunction with tributary basins not impacted by the proposed pad lot limit (Basins X1 and X4 through X6) does indicate a reduction in imperviousness when combined with pad site development which is less than or equal to 90% imperviousness (see table below and attachments; Site Maps/Calculations/Figures & Tables and ToCR Map 1. Basins X1 through X6 are equivalent to Basins B1 through B6 described in the Lot 3, Block 1, Castel Rock Factory Shops, Amendment 1 – Qdoba-Starbucks Development Drainage Conformance Letter, prepared by Sterling Design Associates, llc, dated December 3, 2014 (a.k.a. **PAD A LETTER**; see attachments). Such an imperviousness for the pad lot also represents compliance with the imperviousness for Basin 111 (80%) and therefore conformance as described herein.

Table 2

BASIN	IMPERVIOUSNESS (%)	TRIBUTARY TO POND	STORMWATER QUALITY PROVISION
Exist. Site	82	Lowe's South Detention Pond	WQCV
Prop. Site ^{1,2}	80	Lowe's South Detention Pond	WQCV

¹Pad Site Imperviousness must not exceed 90%

²"Site" includes basins both impacted and not impacted by pad lot development; all tributary during varying storm events and/or emergency situations to the existing drainage system serving the "Site."

Stormwater Quality

The Town of Castle Rock, *Storm Drainage Design and Technical Criteria Manual* (a.k.a. **SDDTCM**), Section 14.1 – Stormwater Quality Design Process, describes a four-step process regarding stormwater quality. In addition, Section 4.4.2.V.C – Water Quality Enhancement Control Measures, lists attributes of stormwater quality facilities to consider. The pad lots' proposed design as described in this letter addresses the four steps and subsequent attributes in the following manner:



The pad lot design attempts to reduce runoff volume to the maximum extent practicable (Step 1) by including the installation of additional landscape areas. Water Quality Capture Volume and flood control detention (Step 2) for the pad lot and pad site are provided by off site facilities. Previous reports discuss specific attributes associated with these facilities. The previous design, approval, and construction of these facilities and their outfalls, as well as for any applicable open channel conveyance facilities, would be the appropriate time and place to address stream channel stabilization (Step 3). As neither the pad lot nor the pad site discharges directly to any open channels or streams, but rather to existing underground storm sewer systems ultimately the responsibility of the Town of Castle Rock; stream channel stabilization techniques do not appear applicable to the design described in this letter. In addition, structural and/or non-structural source controls to reduce the potential for illicit discharges (as defined in the SDDTCM) (Step 4) such as covering chemical, oil, fertilizer, and other pollutant storage and handling areas; addressing spill containment and control; provision of proper waste receptacles; good housekeeping practices (as described in the SDDTCM or its referenced documents); preventative maintenance; and employee education and training should be employed by the owner/operator as applicable and as required by the Town of Castle Rock or other jurisdictional entities with authority. Snow storage within areas not exceeding 15% of the required parking spaces should be anticipated as a part of these practices. Such snow storage is tributary to the onsite drainage system described herein and therefore to the downstream, offsite stormwater quality pond also described herein. Additional practices that could be employed by the owner/operator include storing snow in landscape areas to facilitate treatment and runoff reduction through infiltration, dilution, and biodegradation; and clearing and proper disposal of debris from snow storage areas shortly after melting and prior to conveyance by rainfall runoff.

Proposed Drainage System

The majority of the proposed improvements occur on Lot 1, Block 1, Outlets at Castle Rock Filing No. 1, all of which is private property owned by Craig Realty Group. Therefore, maintenance of the storm sewer system will be the property owner's responsibility. Water quality enhancement control measures serving the site are regional. Maintenance and operation of these measures are outside the scope of this report. Maintenance of the storm sewer system described within this report could include annual inspections and inspections after major storm events of the inlets, manholes, and pipes comprising the system. Routine maintenance may include removal of debris which could diminish the system's capacity. Non-routine maintenance may include structural repair of the same.

Supporting calculations, tables, figures, and exhibits are included in the attachments to this letter.

Conclusions

The proposed improvements are not anticipated to impact on-site nor off-site major drainage basin characteristics. Neither are the proposed improvements anticipated to significantly impact existing drainage patterns or paths. Existing inlets IN-3 and IN-X3 are intended to remain and two new inlets (IN-1 and IN-2) are proposed to accommodate changes to the pad lot. Inlets IN-1 and IN-2 are intended to capture and convey runoff in a proposed storm sewer system to the



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GROUP

Craig Realty Group

August 12, 2024

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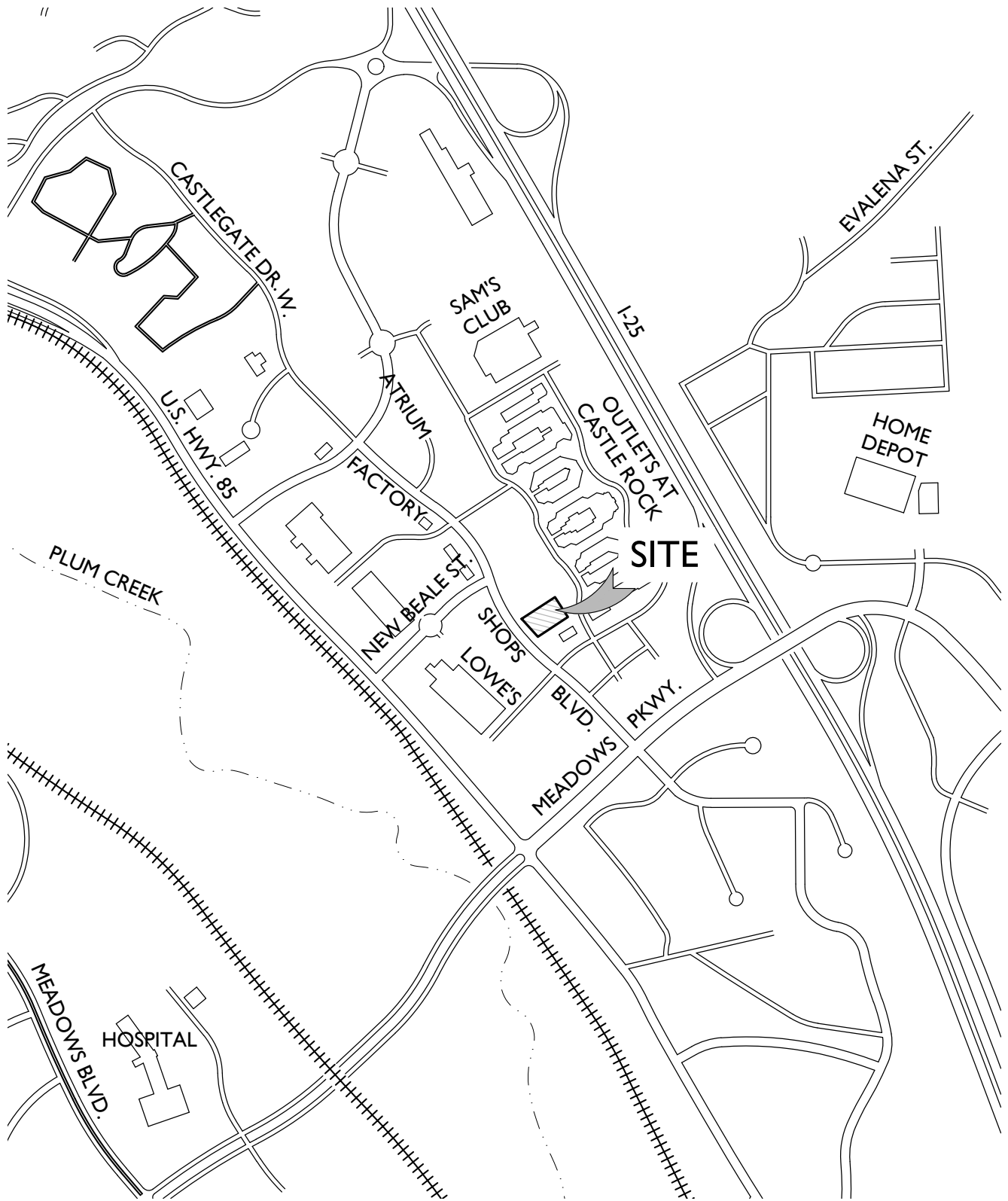
existing storm sewer system serving the subject site and outfalling to the storm sewer system in Factory Shops Boulevard which should function in its historic manner. Subsequently, associated existing storm sewer systems are not anticipated to require capacity in addition to what they currently convey. Storage facilities and permanent, post construction, structural stormwater quality enhancement control measures are provided downstream in the Lowe's South Detention Pond described above. Final development of the pad site, including improvements such as additional inlets and storm sewer systems associated with the building construction as necessary, are to be designed and constructed by future tenants. Therefore, the proposed improvements associated with the development of the subject site as described herein are intended to effectively manage, and to properly convey, store, and treat stormwater.

If you have any questions; please contact me by email or phone at jnewell@f-w.com or (303) 692-8838.

Thank you,

Jay M. Newell, PE
For and on behalf of
Farnsworth Group, Inc.

ATTACHMENTS



1

VICINITY MAP

SCALE: 1"=1000'



Farnsworth
GROUP

5613 DTC PARKWAY, SUITE 1100
GREENWOOD VILLAGE, COLORADO 80111
(303) 692-8838 / info@f-w.com

VICINITY MAP
CROM PAD B1

PROJECT NO.: 0240544.00
DRAWN: DEK
REVIEWED: DEK
DATE: 5/15/24

NRCS SOIL MAP

Custom Soil Resource Report
Soil Map



Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Bo	Blakeland-Orsa association, 1 to 4 percent slopes	0.2	16.4%
BrB	Bresser sandy loam, cool, 1 to 3 percent slopes	1.1	83.6%
Totals for Area of Interest		1.3	100.0%

Map Unit Descriptions

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

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

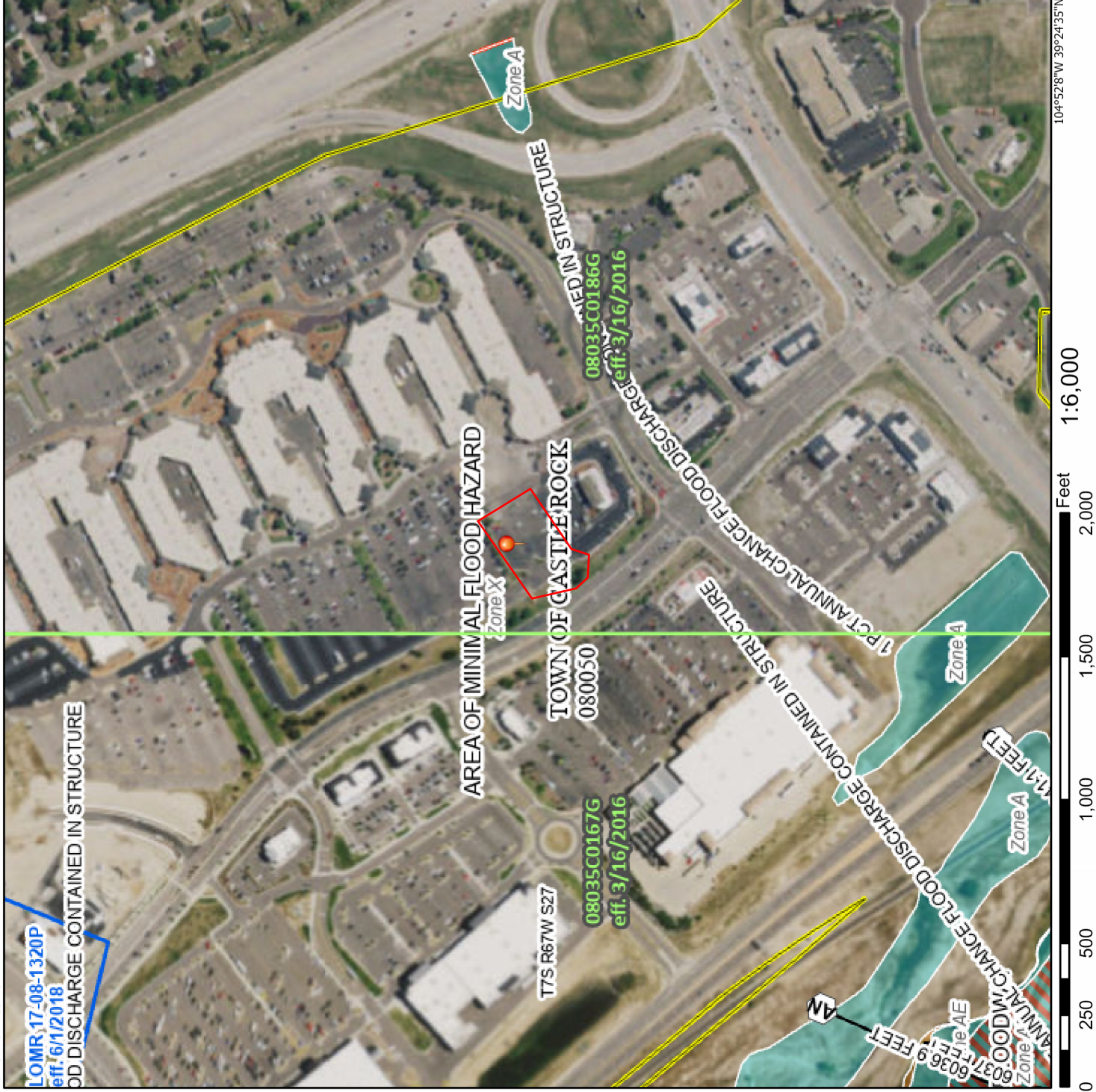
Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however,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

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

FEMA FIRM

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT



This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards.

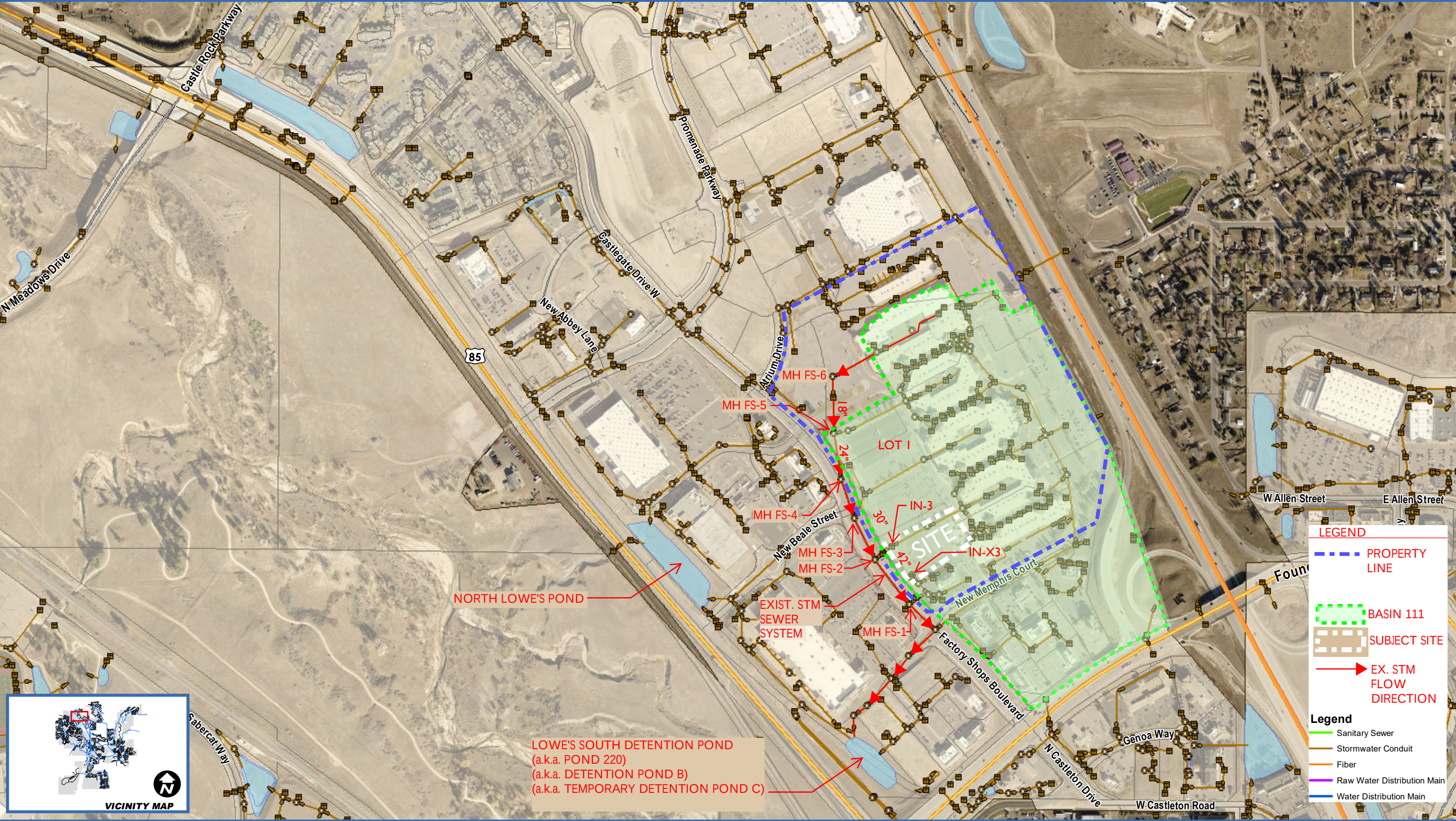
The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on **5/6/2024 at 2:55 PM** and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

TOWN OF CASTLE ROCK UTILITY MAP 1
November 15, 2019

(a.k.a. ToCR MAP 1)

Town of Castle Rock - Map 1



PHASE III DRAINAGE REPORT, CASTLE PINES COMMERCIAL FILING 10A, PART 2 –
LOWE'S DETENTION PONDS (EAST PLUM CREEK TRIBUTARIES B2 & C PONDS)
August 20, 2007

(a.k.a. LOWE'S REPORT)

PHASE III DRAINAGE REPORT

**Castle Pines Commercial Filing 10A
Part 2 - Lowe's Detention Ponds
(East Plum Creek Tributaries B2 & C Ponds)**

Prepared for:

**Dev-Vic, LLC
858 Happy Canyon Road, Suite 200
Castle Rock, Colorado 80108
(303) 688-6300
(303) 688-6985 Fax**

Prepared by:

**Civil Design Group, Inc.
2300 15th St., Suite 400
Denver, Colorado 80202
(303) 431-0505**

August 20, 2007

IA.

GENERAL LOCATION

- 1) Castle Pines Commercial, Filing No. 10A contains 27.6 acres.
- 2) The project is located in Section 27, Township 7 South, Range 67 West of the 6th p.m., Town of Castle Rock, Douglas County Colorado (See Vicinity Map in the Appendix A).
- 3) The project is located at the northeast corner of Meadows Parkway and U.S. Highway 85.
- 4) The Castle Rock Factory Outlet Shops are located east of the site, while undeveloped parcels within the Castle Pines Commercial development lie to the north. Existing commercial and industrial development is located southeast of Meadows Parkway. The land west of U.S. Highway 85 is currently undeveloped.

IB.

DESCRIPTION OF PROPERTY

- 1) Ground cover consists of native grasses. The Lowe's building, utilities, and parking lot are currently under construction.
- 2) FEMA FIRM Panels 08035C0186F and 08035C0167F delineates a floodplain on the site for Tributary C to East Plum Creek. This floodplain is an approximate Zone A floodplain without base flood elevations and encompasses the previous Factory Outlet Shops' detention pond. There are no irrigation facilities on the property.
- 3) This report presents the final design of stormwater detention for the under construction Lowe's home improvement store. The South Detention Pond is designed to detain for south half of the Lowe's development, the existing tributary Factory Outlet Shops, and the future development of the currently vacant portions of Filing No. 10A bound by Lowe's, Factory Shops Boulevard, Meadows Parkway, and U.S. Highway 85 (approximately 17 acres). The North detention Pond is designed to detain for the north half of the Lowe's development, as well as, the development of the currently vacant portions of Filings No. 10A and 10C bound by Lowe's, Factory Shops Boulevard, Atrium Circle and Drive, and U.S. Highway 85.

II.

DRAINAGE BASINS AND SUB-BASINS

A. Major Basin Description

- 1) The site is located between Tributaries B2 and C of the East Plum Creek major drainage basin. FEMA FIRM Panels 08035C0186F and 08035C0167F delineates a floodplain on the site for Tributary C. This floodplain is an approximate Zone A floodplain without base flood elevations and encompasses the previous Factory Outlet Shops' detention pond. Following the construction of the South Detention Pond, a LOMR application will be submitted to FEMA to update the Zone A

floodplain (South Detention Pond's 100-year water surface limits). There are no irrigation facilities on the property.

- 2) Tributary's C's drainage basin has experienced a large amount of development during the past two decades. TST, Inc. of Denver prepared Phase III Drainage Report - Castle Pines Commercial Filing No. 10A – Part 1 (August 9, 2006) which designed Lowe's Interim (Temporary) South Detention Pond. This report presented a detailed and comprehensive analysis of the off-site and on-site flows which drain to the area proposed for Lowe's South Detention Pond (Tributary C). The off-site flows originate from a 200 acre basin east of U.S. Interstate 25 (I-25 Basin), the 70 acres Factory Shops basin, and a 200 acre basin southeast of Meadows Parkway. A storm sewer collects the flows from the I-25 and Factory Shops basins and discharges to the South Detention Pond. The aforementioned Part 1 report prepared a SWMM drainage analysis for the flows along this storm sewer. The hydrograph from the Part 1 report was input into the updated SWMM analysis for the final design of the South Detention Pond as presented in this Part 2 report. Excerpts from the Part 1 report are presented in Appendix A of this Part 2 report. Additionally, the Part 1 report approximated the 100-year flows from the 200 acre Meadows Parkway Basin to be 400 cfs. These flows are conveyed to the site by 3 – 48" RCP culverts under Meadows Parkway. The 400 cfs flow was based upon culvert capacity analysis which limited the headwater on the three culverts to one foot below the finish floor elevation of the existing buildings in the southeast corner of Meadows Parkway and U.S. 85 (per Town of Castle Rock direction). The project proposes to divert the Meadows Parkway basin's flows around the South Detention Pond by extending the three existing 48" culverts under Meadows Parkway to the existing U.S. 85, 10' x 6' box culvert located immediately west of Lowe's.
- 3) TST's aforementioned Part 1, Phase III Drainage report for the Interim South Detention Pond identified the area soils to be primarily hydrologic soil group designation C (See Appendix A).

B. Sub-Basin Description

- 1) Three sub-basins (B1, B2, and B3) have been designated for the design of Lowe's North Detention Pond. The North Detention Pond is currently designed to detain for Lowe's basin B1 and the future development of the undeveloped basin B2 (34 acres), but has additional volume to detain for basin B3 if it regraded to drain to the pond. This would require a future modification to the outlet structure. A composite imperviousness of 80% was projected for the two basins. As basins B2 and B3 are developed, the North Detention Pond's tributary area and imperviousness needs to be reevaluated. The South Detention Pond is designed to detain for the future development of the vacant portions of Filing No. 10A (Basin 113), as well as, the Lowe's and the existing Factory Outlet Shops. This 17.2 acre basin includes the South Detention Pond, and therefore, only 10.5 acres can be developed in the future with an estimated imperviousness of 90%. This results in a composite basin imperviousness of 55%.

- 2) As previously mentioned, the site is impacted by large quantities of off-site flows. The off-site flows originate from a 200 acre basin east of U.S. Interstate 25 (I-25 Basin), the 70 acres Factory Shops basin, and a 200 acre basin southeast of Meadows Parkway.

III. DRAINAGE DESIGN CRITERIA:

A. Regulations

The Town of Castle Rock Storm Drainage Design and Technical Criteria Manual (SDD&TC) is used as the basis for the drainage facility design for this project. The UD & FCD Manual was used to supplement the town's regulations. Applicable charts and figures from these manuals are enclosed in this report.

B. Development Criteria Reference and Constraints

- 1) TST, Inc. of Denver prepared Phase III Drainage Report - Castle Pines Commercial Filing No. 10A – Part 1 (August 9, 2006) which designed Lowe's Interim (Temporary) South Detention Pond. This report presented a detailed and comprehensive analysis of the off-site and on-site flows which drain to the area proposed for Lowe's South Detention Pond as discussed previously in the "Major Basin Description" section of this report. The off-site flows originate from a 200 acre basin east of U.S. Interstate 25 (I-25 Basin), the 70 acres Factory Shops basin, and a 200 acre basin southeast of Meadows Parkway. The I-25 and factory shops basins are conveyed to the South Detention Pond by an existing storm sewer, while the project proposes to divert the Meadows Parkway basin's flows around the South Detention Pond by extending the three existing 48" culverts under Meadows Parkway to the existing U.S. 85, 10' x 6' box culvert. Additionally, the **Part 1 report specified the required water quality volume for the South Detention Pond** to be 4.5 acre-feet.
- 2) The previous drainage studies for the adjacent developments do not negatively affect the drainage design presented in this report.
- 3) Besides the large quantity of off-site stormwater flows, site constraints do not have a large influence upon the drainage design for the site.

C. Hydrological Criteria:

- 1) The design rainfall was developed from Chapter 4 of the SDD&TC.
- 2) Runoff flow rates are based upon a SWMM computer analysis.
- 3) The South Detention Pond was designed using a SWMM analysis with an assumption that the pond's water quality volume is full at the start of the storm. TST's aforementioned Part 1 report, identified the existing 10 and 100-year flows from the I-25 Basin to be 73 cfs and 284 cfs, respectively. The Part 1 analysis did consider the upstream detention at Home Depot and Conoco. The tributary basin from the Factory Shops and Filing No.

SUBBASIN BOUNDARY

DESIGN CONDITION

EXISTING CONDITION

SUBBASIN ID

SUBBASIN AREA

CONVEYANCE ELEMENT

CONVEYANCE ELEMENT ID

SWMM NODE ID

DETENTION POND

EXISTING AND DESIGN
SUBBASIN CHANGES

AC2 DC-DEV
TB-C (4.4 ac.)

AERIAL PHOTO: NAP 2005 Imagery.
NOTE: TRIBUTARIES DIGITIZED FROM AERIAL PHOTO



(previously TEMPORARY
DETENTION POND C)
(a.k.a. DETENTION POND B)
(a.k.a. POND 220)

REVISIONS:	 CONTOUR INTERVAL 2 FEET ORIGINAL SCALE: 1"=200' 	PROJECT NUMBER: COTST74	DRAWN BY: DSL	 ANDERSON CONSULTING ENGINEERS, INC. Civil • Water Resources • Environmental 772 Whalers Way, Suite 100, Fort Collins, CO 80526 Phone (970) 226-0120 / Fax (970) 226-0121	CASTLE PINES COMMERCIAL FILING 10A - PART 1 PHASE III DRAINAGE REPORT - HYDROLOGY	DESIGN CONDITION SUBBASIN AND CONVEYANCE ELEMENT MAP	C.1
REV1		AS-CD FILE:	DESIGNED BY:				
REV2		HISTORIC CONDITION MAP	BLV				
REV3		DATE:	08/08/2006				
REV4							
REV5							
REV6							

CASTLE PINES COMMERCIAL FILING 10A – PART I (LOWE'S INTERIM POND)
PHASE III DRAINAGE REPORT
August 9, 2006

(a.k.a. INTERIM REPORT)

Castle Pines Commercial Filing 10A – Part 1
(Lowe's Interim Pond)

PHASE III DRAINAGE REPORT

PREPARED FOR

Dev-Vic LLC

August 9, 2006

BY:

TST INC. OF DENVER, CONSULTING ENGINEERS
9222 TEDDY LANE
LONE TREE, CO 80124

PROJECT NO. 771-039



TST

INTRODUCTION

This document is Part 1 of the Phase III Drainage Report for Castle Pines Commercial Filing 10A in the Town of Castle Rock, Douglas County, Colorado. The purpose of this report is to estimate anticipated storm water runoff quantities, recommend specific solutions for onsite and off-site drainage resulting from development, and identify necessary improvements to safely route storm water runoff to adequate outfall facilities to allow for early grading and earthwork associated with the construction of Lowe's on Lot 1.

LOCATION

Castle Pines Commercial Filing 10A is approximately 27.59 acres located in Section 27, Township 7 South, Range 67 West of the 6th Principal Meridian, Castle Rock, Douglas County, Colorado. The area of study includes Filing 10A and upstream basins in addition to public roads adjacent to the filings totaling 61.8 acres. It is bounded by Castlegate Drive West to the north, Prime Outlet Factory Shops to the east, Meadows Parkway to the south, and Highway 85 to the west (see Vicinity Map, in Appendix A). Castle Pines Commercial Filing 10A is composed of six commercial lots.

EXISTING BASIN DESCRIPTION

The site generally drains from east to west across the parcel. There is an off-site contribution to the improvements from Meadows Parkway and from the Factory Shops to the east. There are known 100-year floodplains within the project limits per the published maps and the *Castle Rock Factor Shops LOMR-Tributary B* produced by Anderson Consulting Engineers from the Federal Emergency Management Agency (FEMA). The Castle Rock Factory Shops LOMR removes the 100-year floodplain from all improvements within Atrium Drive.

The existing drainage improvements on the site include those associated with the existing factory shops and the expansion of the factory shops: a 72" RCP storm sewer, an outfall energy dissipation structure, Detention Pond B, and an outlet structure, and 10' x 6' RCB under Highway 85.

The soils vary from quartz and granite cobble, cobbly sandy loam to Fondis and Kutch clay loam, have medium to rapid runoff, and have slight to moderate erosion hazard. Soils included on site are Bresser Sandy Loam (BrB), Blakeland-Orsa association (Bo), Newlin gravelly sandy loam (NeE), Sampson loam (Sa), and Sandy alluvial land (Sd). From the SCS Soils Classification Map, it is indicated that this area is primarily hydrological soil group designation C.

PROPOSED DEVELOPMENT

The proposed development will include simulating the general drainage concept of regional detention for the existing Detention Pond B by relocating this pond further south and adding a defined water quality volume to this pond. This is required before any improvements can be made on Castle Pines Commercial Filing 10A.

1. Overlot grading and storm sewer conveyance of all flows, on and off-site.
2. Drainage swales with capacities to route the 5-year and 100-year events as required.

DISCUSSION

The following portion of this report addresses the results of the study and overall drainage plan. Please refer to the calculation sheets and exhibits for actual sizes and flows. The calculations shown in Appendix B are summary in nature, using spreadsheets that use accepted engineering equations to calculate the result of a given set of the above-mentioned parameters.

Drainage System

The proposed drainage system provides conveyance for the 100-year (major) storm event for all of the developed on-site contributions (see Exhibit in Appendix F). The majority of flows will be directed to proposed and existing inlets and routed to existing detention ponds via proposed and existing storm pipe and existing storm swales.

Basins

Design Point 1 collects developed flows from upstream basins in an existing 72" RCP storm sewer. At Design Point 1 a 10-foot by 15-foot junction box is proposed. From this point downstream, the existing 72" storm sewer will be removed and a 6-foot by 10-foot reinforced box culvert shall be installed, following the same alignment. This will require the removal of the existing energy dissipater in the existing detention pond.

Design Point 2 collects on-site flows from parking lots within Castle Pines Commercial Filing 10A. Preliminary calculations for these flows have been used for this analysis and shall be confirmed with the on-site Phase III Drainage Report for each lot to be developed. Flows from Design Point 2 enter the 6-foot by 10-foot RBC and continue downstream to the temporary detention pond at Design Point 5.

Design Point 3 collects on-site flows from parking lots within Castle Pines Commercial Filing 10A. Preliminary calculations for these flows have been used for this analysis and

shall be confirmed with the on-site Phase III Drainage Report for each lot to be developed. Flows from Design Point 3 enter the 6-foot by 10-foot RBC and continue downstream to the temporary detention pond at Design Point 5.

Design Point 4 collects on-site flows from parking lots within Castle Pines Commercial Filing 10A. Preliminary calculations for these flows have been used for this analysis and shall be confirmed with the on-site Phase III Drainage Report for each lot to be developed. Flows from Design Point 4 enter the 6-foot by 10-foot RBC and continue downstream to the temporary detention pond at Design Point 5.

Design Point 5 is outfall to the temporary detention pond and includes flows from Design Point 1 through Design Point 4. Rip rap will be placed at this Design Point 5 to mitigate any erosion from occurring.

Design Point 6 is the water quality outlet structure for the temporary pond and is designed to the ultimate configuration. Flows enter the structure at defined rates set by the Urban Drainage Flood Control District into a proposed 24" RCP storm sewer and enter an improved open channel which conveys flows to an existing 6-foot by 10-foot reinforced box culvert at Design Point 9.

Design Point 7 is the 10-year and 100-year weir release for the temporary detention pond. Design of this weir system will release events at the defined rates into the improved open channel.

Design Point 8 collects flows from upstream basins considered to be Tributary C1. Calculations for these flows can be found in Appendix C. Flows are conveyed downstream via an improved trapezoidal open channel with a 5' bottom width and 3:1 maximum side slopes to an existing 6-foot by 10-foot reinforced box culvert at Design Point 9.

Design Point 9 collects flows from all of the upstream design points noted in an existing 6-foot by 10-foot reinforced box culvert. Capacity calculations for the box culvert can be found in Appendix C.

Detention

The detention requirements for all basins have been included in the temporary detention pond proposed with water quality. From the existing approved report, there is no clear delineation of volumes attributed to each basin, only to overall performance of the regional system as defined from the Drainage Report. The proposed total design volume available at the temporary pond is V_{100} of 10.6 acre-feet. This includes 4.5 acre-feet of water quality volume. This volume was calculated accounting for developed flows of the basins reported in this report in addition to all upstream basins. The assumed imperviousness for all of the basins

was based on previously approved drainage reports and field verification, with primarily commercial usage. The release rates will be maintained with the additional developed flows. Calculations for the sizing and volumes of the outlet grate and orifices can be found in Appendix D. An overflow weir is proposed on the western side of the detention pond adjacent to Highway 85. The design and size of the overflow weir is based on the calculated historic release rates for Tributary C for the 10-year and 100-year events.

The temporary detention pond C discharges into an improved open channel running parallel to Highway 85. The flows are then discharged into an existing 6-foot by 10-foot reinforced box culvert under Highway 85 and railroad tracks and enter an unimproved arroyo channel that discharges directly into East Plum Creek. With the proposed improvements, the detention pond volume will be relocated as well as a new outlet structure and 36" outlet pipe that will convey water quality flows to the improved open channel. In the larger events (10-year and 100-year), a weir structure will release flows to historic rates.

The existing detention pond B located within Lot 1 of Castle Pines Commercial Filing 10A is proposed to be removed including the existing outfall structure, trickle channel, and outlet structure. The volume of detention storage lost with the removal of this pond will be allocated to the temporary Pond C. Flows that were discharged into Pond B will now be conveyed south to Pond C. The existing detention Pond B had a design volume of 10.6 acre-feet and a release rate of 319 cfs during the 100-year event.

Erosion Control

The erosion control required for this site will include structural erosion control measures. These following measures, as a minimum, will be in place prior to any construction activity to properly control the sediment:

- 1) The entire lower perimeter of the site shall have silt fence installed before grading of the site occurs. Periodic maintenance will be necessary to remove sediment build-up along this perimeter. This fence must remain in place for the duration of all construction activities.
- 2) Dust control during the construction shall include the use of water, snow fences, and other barriers to help minimize any movement of dust. These measures will be monitored by the contractors and Town's field representative.
- 3) All areas that have been graded but are not scheduled for immediate development have been re-seeded using the Town-approved specifications. Any areas not taking hold will need to be re-seeded again per Town standards.

APPENDIX B

HYDROLOGY

**CASTLE PINES COMMERCIAL FILING 10A – PART 1,
PHASE III DRAINAGE REPORT:
LOWES SITE - HYDROLOGY**

Submitted To:

***Town of Castle Rock
Utilities Department
175 Kellogg Court
Castle Rock, CO 80109***

Prepared For:

***TST Inc. of Denver
9222 Teddy Lane
Lone Tree, CO 80124***

Prepared By:

***Anderson Consulting Engineers, Inc.
772 Whalers Way, Suite 200
Fort Collins, CO 80525
(ACE Project No. COTST74)***



August 8, 2006

Table 1. Hydrologic Modeling Subbasin Parameters.

Subbasin No.	Basin Width (ft)	Basin Area (acres)	Percent Impervious	Average Basin Slope (ft/ft)	Manning's Roughness		Depression Storage (inches)		Infiltration Rates (in/hr)		Horton's Decay Rate
					Impervious	Pervious	Impervious	Pervious	Initial	Final	
HISTORIC CONDITION											
101	17,840	204.8	2.0	0.290	0.020	0.400	0.1	0.35	3.0	0.5	0.0018
103	6,930	79.5	2.0	0.036	0.020	0.200	0.1	0.35	4.2	0.6	0.0018
EXISTING CONDITION											
110	11,890	136.5	5.0	0.290	0.020	0.400	0.1	0.35	3.0	0.5	0.0018
111	30,510	70.0	80.0	0.040	0.020	0.200	0.1	0.35	4.0	0.6	0.0018
112	1,230	14.1	14.0	0.045	0.020	0.200	0.1	0.35	4.5	0.6	0.0018
113	1,590	18.3	24.0	0.040	0.020	0.200	0.1	0.35	4.5	0.6	0.0018
120	6,740	46.4	27.0	0.040	0.020	0.200	0.1	0.35	3.0	0.5	0.0018
121	7,380	17.0	2.0	0.107	0.020	0.400	0.1	0.35	3.0	0.5	0.0018
122	2,240	2.6	80.0	0.045	0.020	0.200	0.1	0.35	3.0	0.5	0.0018
123	2,850	3.3	80.0	0.045	0.020	0.200	0.1	0.35	3.0	0.5	0.0018
124	2,460	5.7	10.0	0.090	0.020	0.200	0.1	0.35	3.0	0.5	0.0018
125	2,070	4.7	50.0	0.050	0.020	0.200	0.1	0.35	3.0	0.5	0.0018
DESIGN CONDITION											
113	1,500	17.2	24.0	0.040	0.020	0.200	0.1	0.35	4.5	0.6	0.0018
116	6,990	8.0	90.0	0.025	0.020	0.200	0.1	0.35	4.5	0.6	0.0018

APPENDIX D

DETENTION

DETENTION POND VOLUMES
CASTLE PINES COMMERCIAL TEMPORARY DETENTION POND C

Elevation	Area (sf)	Volume (cf)	Total Volume (cf)	Total Volume (ac-ft)
6057.75	-	603	603	0.0
6058	4,823	38,378	38,981	0.9
6060	33,555	97,870	136,851	3.1
6062	64,315	164,502	301,353	6.9
6064	100,187	237,502	538,855	12.4
6066	137,315	142,240	681,095	15.6
6067	147,164	149,975	831,070	19.1
6068	152,786			

	CF	AC-FT
Vol Req (WQ)=	196020	4.5
Vol Req (100-YR)=	461736	10.6
Vol Required (TOTAL)=	657756	15.1
100-Year WSE	=	6067.70
Provided 100-Year Volume	=	780,160 CF
		17.9 AC-FT
WQ WSE	=	6062.72
WQ Volume	=	196,020 CF
		4.5 AC-FT

Note: The provided 100-year detention volume is greater than the required volume due to the necessity to create a headwater condition to diverge flows into the open channel which has a large tailwater condition.

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Sheet 1 of 3

Designer: Taylor C. Goertz, P.E.

Company: TST Inc. of Denver

Date: August 1, 2006

Project: Castle Pines Commercial Filing 10A-Part 1

Location: Castle Rock, CO

<p>1. Basin Storage Volume</p> <p>A) Tributary Area's Imperviousness Ratio ($I = I_a / 100$)</p> <p>B) Contributing Watershed Area (Area)</p> <p>C) Water Quality Capture Volume (WQCV) ($WQCV = 1.0 * (0.91 * I^3 - 1.19 * I^2 + 0.78 * I)$)</p> <p>D) Design Volume: $Vol = (WQCV / 12) * Area * 1.2$</p>	<p>$I_a = 95.00$ % $i = 0.95$</p> <p>Area = 100.60 acres</p> <p>WQCV = 0.45 watershed inches</p> <p>Vol = 4.4992 acre-feet</p>
<p>2. Outlet Works</p> <p>A) Outlet Type (Check One)</p> <p>B) Depth at Outlet Above Lowest Perforation (H)</p> <p>C) Recommended Maximum Outlet Area per Row, (A_o)</p> <p>D) Perforation Dimensions: i) Circular Perforation Diameter or ii) 2" Height Rectangular Perforation Width</p> <p>E) Number of Columns (nc, See Table 6a-1 For Maximum)</p> <p>F) Actual Design Outlet Area per Row (A_o)</p> <p>G) Number of Rows (nr)</p> <p>H) Total Outlet Area (A_{ot})</p>	<p>☒ Orifice Plate ☐ Perforated Riser Pipe ☐ Other:</p> <p>H = 2.75 feet</p> <p>$A_o = 6.2$ square inches</p> <p>D = 2.000 inches W = inches</p> <p>nc = 2 number</p> <p>$A_o = 6.3$ square inches</p> <p>nr = 8 number</p> <p>$A_{ot} = 51.8$ square inches</p>
<p>3. Trash Rack</p> <p>A) Needed Open Area: $A_t = 0.5 * (\text{Figure 7 Value}) * A_{ot}$</p> <p>B) Type of Outlet Opening (Check One)</p> <p>C) For 2", or Smaller, <u>Round Opening</u> (Ref.: Figure 6a):</p> <p>i) Width of Trash Rack and Concrete Opening (W_{conc}) from Table 6a-1</p> <p>ii) Height of Trash Rack Screen (H_{TR})</p>	<p>$A_t = 1.557$ square inches</p> <p>☒ ≤ 2" Diameter <u>Round</u> ☐ 2" High <u>Rectangular</u> ☐ Other:</p> <p>$W_{conc} = 48$ inches</p> <p>$H_{TR} = 63$ inches</p>

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Sheet 2 of 3

Designer:	Taylor C. Goertz, P.E.
Company:	TST Inc. of Denver
Date:	August 1, 2006
Project:	Castle Pines Commercial Filing 10A-Part 1
Location:	Castle Rock, CO

<p>iii) Type of Screen (Based on Depth H), Describe if "Other"</p> <p>iv) Screen Opening Slot Dimension, Describe if "Other"</p> <p>v) Spacing of Support Rod (O.C.) Type and Size of Support Rod (Ref.: Table 6a-2)</p> <p>vi) Type and Size of Holding Frame (Ref.: Table 6a-2)</p> <p>D) For 2" High Rectangular Opening (Refer to Figure 6b):</p> <p>i) Width of Rectangular Opening (W)</p> <p>ii) Width of Perforated Plate Opening ($W_{conc} = W + 12"$)</p> <p>iii) Width of Trashrack Opening ($W_{opening}$) from Table 6b-1</p> <p>iv) Height of Trash Rack Screen (H_{TR})</p> <p>v) Type of Screen (based on depth H) (Describe if "Other")</p> <p>vi) Cross-bar Spacing (Based on Table 6b-1, Klemp™ KPP Grating). Describe if "Other"</p> <p>vii) Minimum Bearing Bar Size (Klemp™ Series, Table 6b-2) (Based on depth of WQCV surcharge)</p>	<p>_____ S.S. #93 VEE Wire (US Filter) Other: _____</p> <p>_____ 0.139" (US Filter) Other: _____</p> <p>_____ inches</p> <p>_____</p> <p>W = _____ inches</p> <p>W_{conc} = _____ inches</p> <p>$W_{opening}$ = _____ inches</p> <p>H_{TR} = _____ inches</p> <p>_____ Klemp™ KPP Series Aluminum Other: _____</p> <p>_____ inches Other: _____</p> <p>_____</p>
<p>4. Detention Basin length to width ratio</p>	<p>_____ 0.75 (L/W)</p>
<p>5 Pre-sedimentation Forebay Basin - Enter design values</p> <p>A) Volume (no less than 5% of Design Volume from 1D)</p> <p>B) Surface Area</p> <p>C) Connector Pipe Diameter (Size to drain this volume in 5-minutes under inlet control)</p> <p>D) Paved/Hard Bottom and Sides</p>	<p>_____ acre-feet</p> <p>_____ acres</p> <p>_____ inches</p> <p>_____ yes/no</p>

Design Procedure Form: Extended Detention Basin (EDB) - Sedimentation Facility

Sheet 3 of 3

Designer: Taylor C. Goertz, P.E.

Company: TST Inc. of Denver

Date: August 1, 2006

Project: Castle Pines Commercial Filing 10A-Part 1

Location: Castle Rock, CO

6. Two-Stage Design - See Figure EDB-1

A) Top Stage (Depth $D_{WQ} = 2'$ Minimum)

$D_{WQ} =$ _____ feet
Storage = _____ acre-feet

B) Bottom Stage Depth ($D_{BS} = 1.0'$ Minimum, $2.0'$ Maximum)

Bottom Stage Storage (no less than 3% of Design Volume (0.13497590025 acre-feet.))

$D_{BS} =$ _____ feet
Storage = _____ acre-feet
Surf. Area = _____ acres

C) Micro Pool (Minimum Depth = the Larger of
0.5 * Top Stage Depth or 2.5 Feet)

Depth = _____ feet
Storage = _____ acre-feet
Surf. Area = _____ acres

D) Total Volume: $Vol_{tot} =$ Storage from 5A + 6A + 6B
(Must be > Design Volume in 1D, or 4.499196675 acre-feet.)

$Vol_{tot} =$ _____ acre-feet

7. Basin Side Slopes (Z, horizontal distance per unit vertical)
Minimum Z = 4, Flatter Preferred

Z = _____ (horizontal/vertical)

8. Dam Embankment Side Slopes (Z, horizontal distance)
per unit vertical) Minimum Z = 3, Flatter Preferred

Z = _____ (horizontal/vertical)

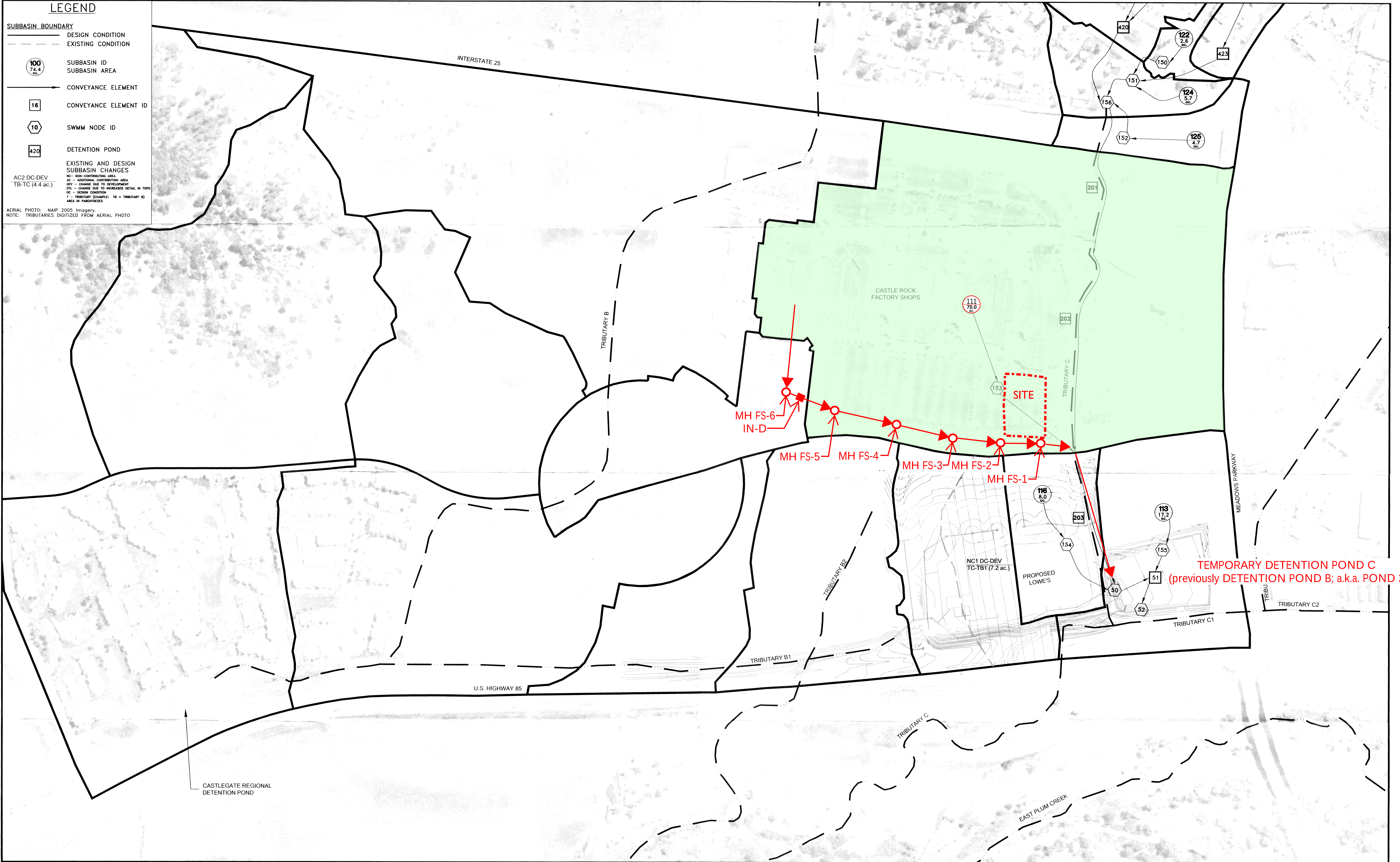
9. Vegetation (Check the method or describe "Other")

_____ Native Grass
_____ Irrigated Turf Grass
_____ Other: _____

Notes:

APPENDIX F

PHASE III DRAINAGE EXHIBIT



LEGEND

SUBBASIN BOUNDARY

DESIGN CONDITION

EXISTING CONDITION

100

74.4 ac.

SUBBASIN ID

SUBBASIN AREA

16

CONVEYANCE ELEMENT

10

CONVEYANCE ELEMENT ID

10

SWMM NODE ID

420

DETENTION POND

EXISTING AND DESIGN SUBBASIN CHANGES

AC2 DC-DEV

TB-TC (4.4 ac.)

NC- NON-CONTRIBUTING AREA

AC - ADDITIONAL CONTRIBUTING AREA

DEV - CHANGE DUE TO DEVELOPMENT

DTL - CHANGE DUE TO INCREASED DETAIL IN TOPO

DC - DESIGN CONDITION

T - TRIBUTARY (EXAMPLE: TB = TRIBUTARY B)

AREA IN PARENTHESES

AERIAL PHOTO: NAIP 2005 Imagery.

NOTE: TRIBUTARIES DIGITIZED FROM AERIAL PHOTO

TEMPORARY DETENTION POND C
(previously DETENTION POND B; a.k.a. POND 220)

REVISIONS:

REV1

REV2

REV3

REV4

REV5

REV6

CONTOUR INTERVAL

2 FEET

ORIGINAL SCALE: 1"=200'

0 100 200 400

PROJECT NUMBER:

COTST74

ACAD FILE:

HISTORIC CONDITION MAP

DATE:

08/08/2006

DRAWN BY:

DSL

DESIGNED BY:

BLV

CHECKED BY:

BLV / CJP

Anderson Consulting Engineers, Inc.
Civil • Water Resources • Environmental
772 Whalers Way, Suite 100, Fort Collins, CO 80526
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CASTLE PINES COMMERCIAL FILING 10A - PART 1

PHASE III DRAINAGE REPORT - HYDROLOGY

DESIGN CONDITION

SUBBASIN AND CONVEYANCE ELEMENT MAP

SHEET

C.1

CASTLE PINES COMMERCIAL P.D., CASTLE ROCK, COLORADO, MASTER
DRAINAGE REPORT
February 10, 1995

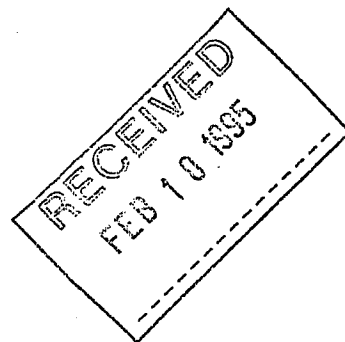
(a.k.a. MASTER REPORT)

1234

1
2
3
4

CASTLE PINES COMMERCIAL P.D.
CASTLE ROCK, COLORADO

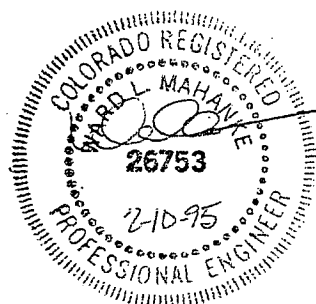
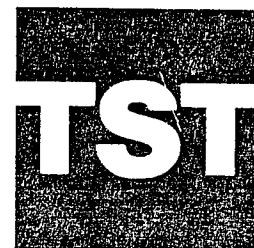
**MASTER DRAINAGE
REPORT**



PREPARED FOR
DEV-VIC LTD. LIABILITY CO.
FEBRUARY 10, 1995

BY:
TST INC. OF DENVER, CONSULTING ENGINEERS
102 INVERNESS TERRACE EAST, SUITE 105
ENGLEWOOD, CO 80112
(303) 792-0557

PROJECT NO. 40-771-001



INTRODUCTION

The Castle Pines Commercial P.D. ("PD") is a parcel of approximately 450 acres located within the northern limits of the Town of Castle Rock, Colorado ("Town"). It is generally bounded by Interstate 25 to the east, U.S. Highway 85 to the west, Meadows Parkway to the south, and the Castle Pines development to the north. It is a planned development which is currently zoned for commercial and office use. A revised PD has been submitted to the Town to change the parcel layout and to include a residential area in the northern portion of the parcel. Currently, the only improvements on the parcel are those associated with the Castle Rock Factory Shops. The general location of the project is shown on Figure 1.

The development has a divided ownership, with the Dev-Vic Ltd. Liability Co. owning the southern two-thirds of the property and CCRT & Co. owning the remainder. This report was authorized by and prepared for Dev-Vic Ltd. Liability Co.

Described in this report are the results of an investigation of the proposed hydrologic conditions for the site. The background information and assumptions, including all of the modeling parameters, have been taken from the *Master Drainage Study for Castle Rock Business Park ("Study")*, TST Inc., October 1991 and further discussed and refined in the *Preliminary Drainage Report for Castle Pines Commercial P.D.*, TST Inc. of Denver, July 7, 1994. This master study is culmination of the review of the above-mentioned documents and comments from the Town of Castle Rock.

EXISTING SITE DESCRIPTION

The PD site generally drains from east to west across the site. There is a substantial off-site contributing area upstream of the site. This flow is deposited onto the site in several eastern locations in the form of culverts that cross under Interstate 25. Well-defined channels are evident downstream of these culverts. The flows that come from off-site and on-site locations are then conveyed under Highway 85 by one of five culverts. These culverts have comparable crossings under the adjacent railroad, and after a relatively short side-channel, flows reach East Plum Creek. The known 100-year floodplains within the property were defined by the Federal Emergency Management Agency (FEMA) and subsequently revised by a Letter of Map Revision (LOMR) prepared by Rocky Mountain Consultants, Inc.

The drainage improvements on the site consist of the parking lot and building drainage, storm inlets and piping, an outfall energy dissipation structure, detention pond, and outlet control structure that is associated with the development of the Factory Shops.

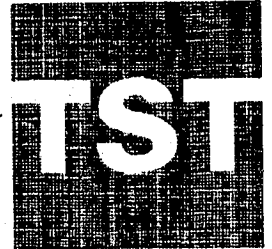
MASTER DRAINAGE STUDY FOR CASTLE PINES COMMERCIAL AMENDED
December 1991

(a.k.a. MASTER STUDY)

656

MASTER DRAINAGE STUDY

For



**CASTLE PINES
COMMERCIAL AMENDED**

**Prepared For
CASTLE PINES HOLDINGS, INC.**

**OCTOBER 1991
REVISED
DECEMBER 1991**

**TST, Inc.
CONSULTING
ENGINEERS**

SECTION I. INTRODUCTION

A. Background

The Castle Pines Commercial Amended development project is located at the northern edge of the Town of Castle Rock limits (see Vicinity Map, Figure 1). The area will be accessed via Highway 85 along the project's southwestern boundaries, and from I-25 at the Silver Heights interchange off Meadows Parkway

A Master Drainage Study for the Castle Pines Commercial site was prepared in January 1987 by TST, Consulting Engineers. This revised report was necessitated by a change in the master plan to allow primarily for the inclusion of a factory outlet mall. Road alignments and usage information changed as a result of the mall inclusion. Castle Pines Holdings, Inc. has become the owner of a portion of the original development, that portion being generally the southern two-thirds of the development lying on the south side of Interstate 25. This revised report addresses primarily this property, although the additional property to the north has been included for completeness.

The proposed "integrated business" development area encompasses approximately 400 acres. The area presently receives off-site drainage flows from the east side of I-25, at a number of culvert crossings as shown on the Historic Drainage Basin Map (Figure 2).

This report will present the results of an investigation into both the existing and proposed hydrologic conditions for the Castle Pines Holdings site. The drainage analysis for the maximum probable development conditions has been based upon the land use projections used in the Felsburg, Holt and Ullevig traffic study. The property on the east side of I-25 which was included in the 1987 study has not been included as there is no known change in the use. For information on that property, refer to the 1987 study. A comparison of the developed-condition results with the pre-development (historic) system response is provided for the 100-year event, for critical locations throughout the development area.

The majority of the site will drain toward Highway 85, from a ridge line along I-25. Runoff from the site will then pass through culverts beneath Highway 85 and contribute to flows in East Plum Creek.

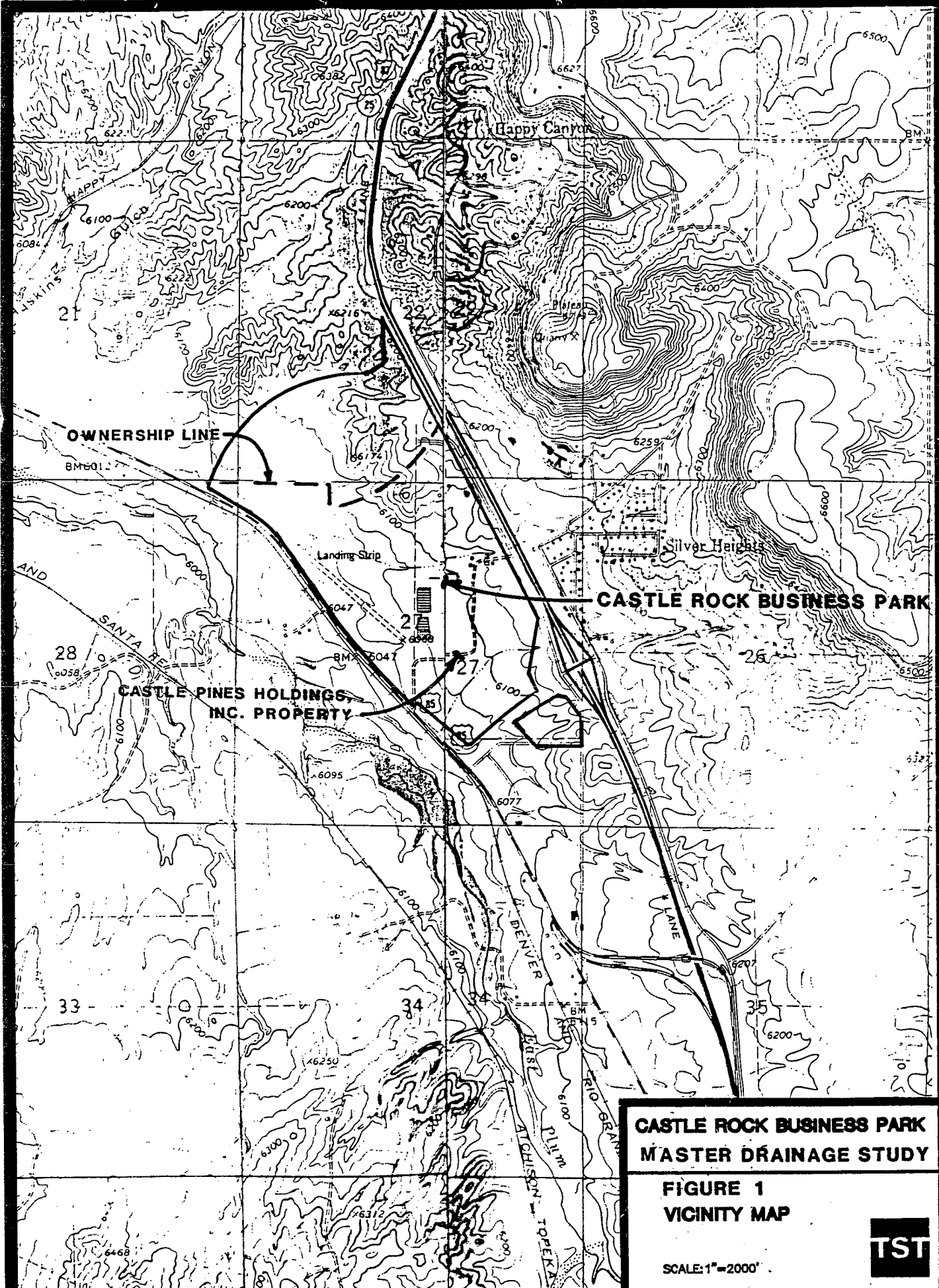
This report is intended to evaluate the site in connection with the most intense probable development. Actual design and sizing of drainage facilities will be accomplished in conjunction with development of parcels and roads at the time they are developed.

B. Scope of Work

The areas of emphasis investigated as part of this study are:

1. A hydrologic analysis, including the computations of storm hydrographs at locations throughout the development area.

2. Evaluation of detention pond locations and sizing.
3. Calculation of existing culvert capacity under Highway 85 at the points of discharge.



SECTION III. DRAINAGE DESIGN

A. Scope of Design

The drainage design specified for the Castle Pines Commercial Amended area includes preliminary estimate of storm system dimensions and detention pond volumes and release rates. Each of these design items are covered in detail in this chapter.

A map illustration of the proposed storm system is presented as Figure 3.

B. Storm Sewer Sizing and Location

At each location within the proposed development area shown on the project Master Plan where concentrated runoff flows will intersect a major roadway, an assumed culvert crossing has been sized to accommodate the 100-year flow release rates based upon fully developed conditions.

The estimate of cross culvert sizing has been performed using the Manning's equation for pipe flow, under presumed slope conditions. Final storm sewer sizing will be performed when the road design is undertaken. Results of this sizing along with estimated open channel sizes are included in Table VI.

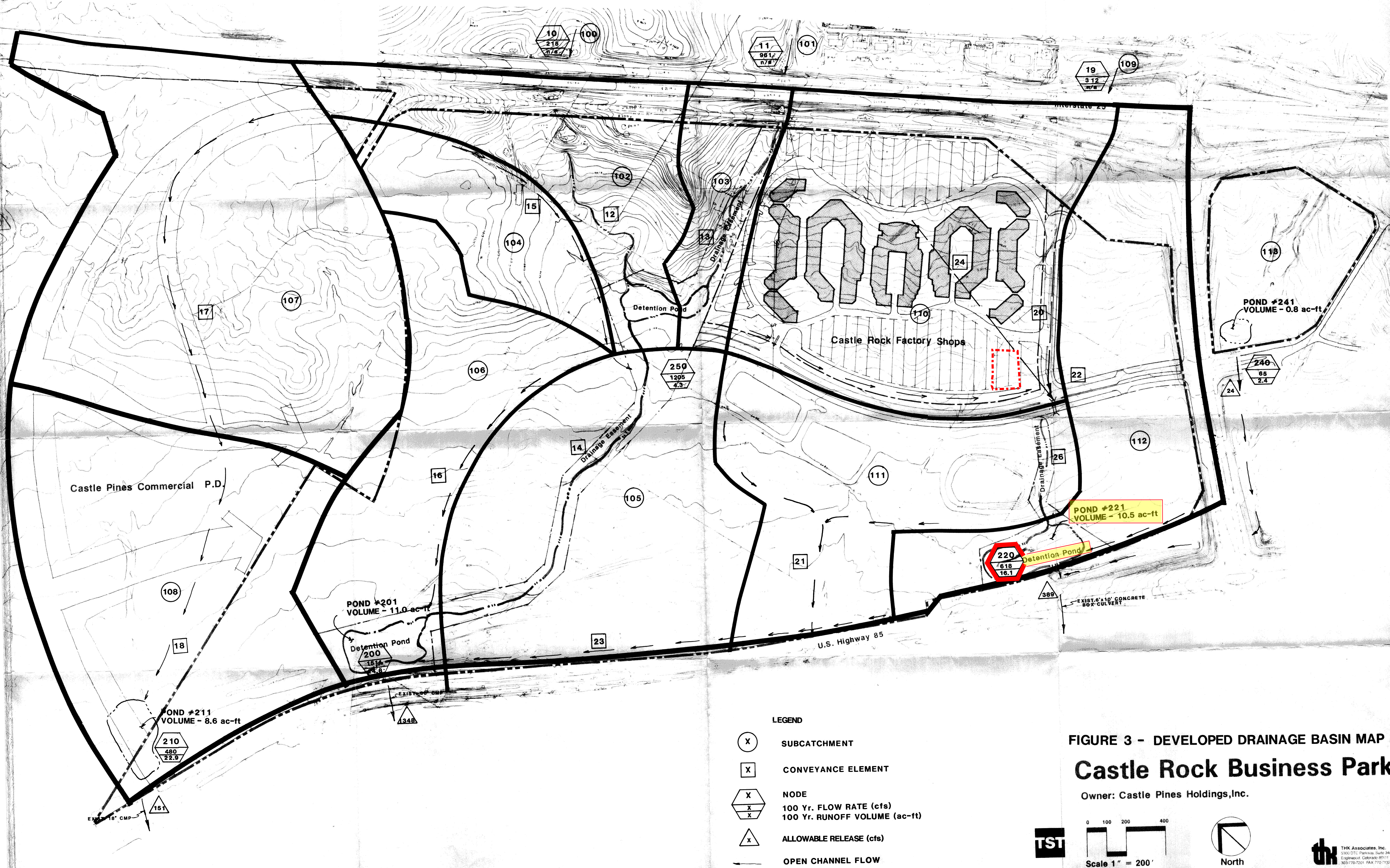
For the purposes of this report, it has been assumed that no storm sewer other than conveyance element numbers 20 and 24 will be installed. It is recognized that future development areas may want to put some of these flows into conduits, however the extent and location of those is not currently known. This document therefore recommends that as the parcels are developed the Phase III report identify the method of drainage and propose methods to keep it within the flow and routing assumptions of this study. This may necessitate some additional detention within development sites.

C. Detention Pond Design

Three major detention pond facilities are anticipated within the project area, for the purposes of reducing major storm peak flow rates. One additional minor detention pond will be provided within the parcel south of Meadows Parkway.

The preliminary sizing of these detention areas has been accomplished by measurement of the required storage volume indicated at an assumed release rate, as illustrated in Figures 5 and 6. Inflow and outflow hydrograph peaks for each of the six ponds are reproduced in Table V.

TABLE V Detention Pond Inflow and Release Rates			
Pond	Peak Inflow (cfs)	Peak Release (cfs)	Detention Volume (ac-ft)
201	1514	1348	11.0
211	480	151	8.6
221	618	389	10.5
241	65	24	0.8



FINAL DRAINAGE REPORT FOR CASTLE ROCK FACTORY SHOPS
March 1992

(a.k.a. FACTORY SHOPS REPORT)

#654

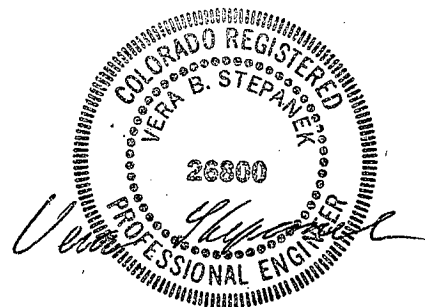
Final Drainage Report
for
CASTLE ROCK FACTORY SHOPS

Prepared for:

CASTLE PINES HOLDINGS, INC.
c/o Colorado National Bank
950 17th Street, Suite 2240
Denver, Colorado 80202

Prepared by:

ROCKY MOUNTAIN CONSULTANTS, INC.
8301 East Prentice Avenue
Englewood, Colorado 80111



RMC Job No. 1811.001.02
February 1992
Revised March 1992

Approved:
Daniel W. Bore II
4-1-92

The Master Drainage Study identified the subject site as basin 110. The offsite flows entering the site originate in area designated as a basin 109. Conveyances 20 and 26 modeled an existing drainageway "C", described further. Detention Pond was labeled No. 220.

The site's historic basin lies between two right bank tributaries to East Plum Creek as outlined on the Flood Insurance Rate Map (FIRM - Reference 5). One of these tributaries, drainageway "A", follows the site's northerly boundary and flows east to west. The drainageway lies entirely off-site and its designated preliminary floodplain does not encroach within the site boundary. The second of these tributaries, drainageway "C", enters the site at its southeast corner and crosses the site in a westerly direction. Both of the drainageways cross Highway 85 through culverts and join East Plum Creek approximately 1/2 mile west of Highway 85.

2. Scope of Study and Design Criteria

This study addresses three aspects of the development:

1) A drainage system design for the Castle Rock Factory Shops retail center.

2) Conveyance of the historic drainageway "C" peak flows through the developed area.

3) A design of the offsite detention pond facilities.

3. Design Criteria

This report was prepared pursuant to the Town of Castle Rock drainage design criteria (Reference 3) and the Urban Storm Drainage Criteria Manual (Reference 4).

The Rational Method was used for determining on-site developed runoff rates and subsequent sizing of inlets and storm sewers. The minor storm was based upon a two-year storm frequency, and the major storm was based upon a one hundred-year storm frequency.

The drainageway "C" peak flows, detention volumes and release rates, were determined in the Master Drainage Study (Reference 2), using computer modeling of the area hydrology. In order to incorporate the project site in the computer model, the Colorado Urban Hydrograph Procedure (CUHP) and Storm Water Management Model (SWMM) were used. This allowed the development of on-site hydrographs which would confirm the flows' routing through the proposed facilities such as storm sewers and a pond.

The drainage system will provide carrying capacity to keep the 2-year and 100-year storm flows below 6 inches at the crown or flowline of the median curb. Wherever the hydraulic grade line for 2-year storm exceeded the top of a pipe, R-4 sealant joints were used in the sewer design.

The storm sewer hydraulic grade lines were calculated using the Hydroflow computer program. Hydroflow uses the energy equation, with friction loss computation based on Manning's Formula.

C. DRAINAGE FACILITY DESIGN

1. On-Site Drainage System

The proposed storm drain facilities will intercept the on-site and off-site runoff for 100-year storm frequency, and convey it to a detention pond 220 (Reference 3) to be constructed on the east side of Highway 85.

Discharge from the site's east parking area is collected at the low points and is conveyed by a storm sewer to the main storm sewer in New Memphis Court. Discharge from the site's west and north parking areas is collected at inlets and routed to a second branch of storm sewer in Factory Shops Boulevard. Both storm sewer lines will outfall to a detention pond just west of Factory Shops Boulevard.

2. Relocation of Drainageway "C"

The peak flows for the natural drainageway "C" relocation were based on a 100-year storm frequency. A proposed 60" diameter storm sewer will replace the natural drainage channel along the south boundary of the site. At the southeast corner of the site, a concrete inlet structure,

6. Emergency Provisions

The inlets and storm sewers in the east parking lot were designed to accommodate the runoff from the 100-year storm event. An emergency route for storm water in the event of a blockage of the inlets, storm sewer or a greater than 100-year event was designed between the buildings. Should any of these conditions occur the storm water would overtop the high point and flow on the landscaped passageway and safely pass to Factory Shops Boulevard without inundating any finished floors.

7. Development Phasing

The site's development is planned to progress in three construction phases. Phase I includes the development of 20.2 acres of Lot 1, access roads and private drives and all utilities serving Lot 1.

The project's drainage system is designed for the ultimate development and will also serve the partially undeveloped site. The erosion control plan that will be prepared for Phase I construction, will provide protection for areas prone to erosion due to the phased nature of the development. Temporary seeding of areas exposed by rough grading of the site and a sedimentation pond will control erosion prior to site's ultimate development.

D. CONCLUSION

The revised routing of the natural drainageway "C" channel flow will not adversely affect the adjacent properties. The alteration to the drainageway floodplain, discussed in this report will be supported in a Letter of Map Revision (LOMR) submitted to the Town of Castle Rock. The proposed storm sewer system has adequate capacity to convey the 100-year frequency storm flows. Additionally, the storm sewer outfall into the detention pond has been designed to reduce scour and downstream erosion.

The net effect of the storm drainage system for the proposed Castle Rock Factory Shops will be to maintain developed storm water release rates from the proposed detention facility to historic levels.

The facilities proposed in this report are in compliance with the Town of Castle Rock criteria and the Master Drainage Report.

CASTLE ROCK FACTORY SHOPS CONSTRUCTION PLANS – AS-BUILT
December 6, 1993

(a.k.a. SOUTH ASBUILT)

CASTLE ROCK FACTORY SHOPS CONSTRUCTION PLANS

PREPARED FOR

THE PRIME GROUP, INC.
36 SOUTH CHARLES STREET, SUITE 2401
BALTIMORE, MARYLAND 21201
PHONE: (301) 234-0782

SHEET INDEX

AS BUILT

DUWAYNE M. PHILLIPS L.S. NO. 9329
FOR AND ON BEHALF OF
ROCKY MOUNTAIN CONSULTANTS, INC.
DATE 12/6/93 FIELD BOOK

CALL UTILITY NOTIFICATION
CENTER OF COLORADO
1-800-922-1987
IN METRO DENVER
534-6700
CALL 2-BUSINESS DAYS IN ADVANCE
BEFORE YOU DIG, GRADE, OR EXCAVATE
FOR THE MARKING OF UNDERGROUND
MEMBER UTILITIES.

ORIGIN BENCHMARK

U.S.C. AND G.S. BENCHMARK A 355
ELEVATION = 6,047.50

3 1/2" BRASS CAP AT NORTH END OF A CONCRETE HEADWALL, EAST SIDE OF DENVER AND RIO
GRANDE WESTERN RAILROAD TRACKS, APPROXIMATELY 3.1 MILES NORTH OF CASTLE ROCK
STATION (SEE VICINITY MAP FOR APPROXIMATE LOCATION).

PROJECT BENCHMARK

RMC TBM #95026
ELEVATION = 6,090.55 (U.S.C. AND G.S.)
SOUTHEAST BONNET BOLT ON FIRE HYDRANT AT THE SOUTH SIDE OF MEADOWS PARKWAY AT
STATION 340+50, 700 FEET EAST OF CENTERLINE INTERSECTION OF HIGHWAY 85 AND
MEADOWS PARKWAY.

THE PLANS ARE REVIEWED FOR CONCEPT ONLY AND THE REVIEW
DOES NOT IMPLY RESPONSIBILITY BY THE REVIEWING DEPARTMENT,
THE TOWN ENGINEER OR THE TOWN OF CASTLE ROCK FOR ACCURACY
AND CORRECTNESS OF CALCULATION. THE REVIEW DOES NOT IMPLY
THAT QUANTITIES OF ITEMS INDICATED ON THE PLANS ARE THE
FINAL QUANTITIES REQUIRED. THE REVIEW SHALL NOT BE
CONSTRUED FOR ANY REASON AS ACCEPTANCE OF FINANCIAL
RESPONSIBILITY BY THE TOWN OR REVIEWING DEPARTMENTS FOR
ADDITIONAL ITEMS AND ADDITIONAL QUANTITIES OF ITEMS SHOWN
THAT MAY BE REQUIRED DURING THE CONSTRUCTION PHASE.

ALL WORK SHALL BE CONSTRUCTED TO THE MOST RECENT TOWN OF
CASTLE ROCK STANDARD CONSTRUCTION SPECIFICATIONS.

APPROVED FOR ONE YEAR FROM THIS DATE

Town Engineer

Date

Director of Public Works

Date

Fire Department

Date

DATE MAR. 27 1992

DESIGNED BY

DRAWN BY

CHECKED BY

JOB NO.

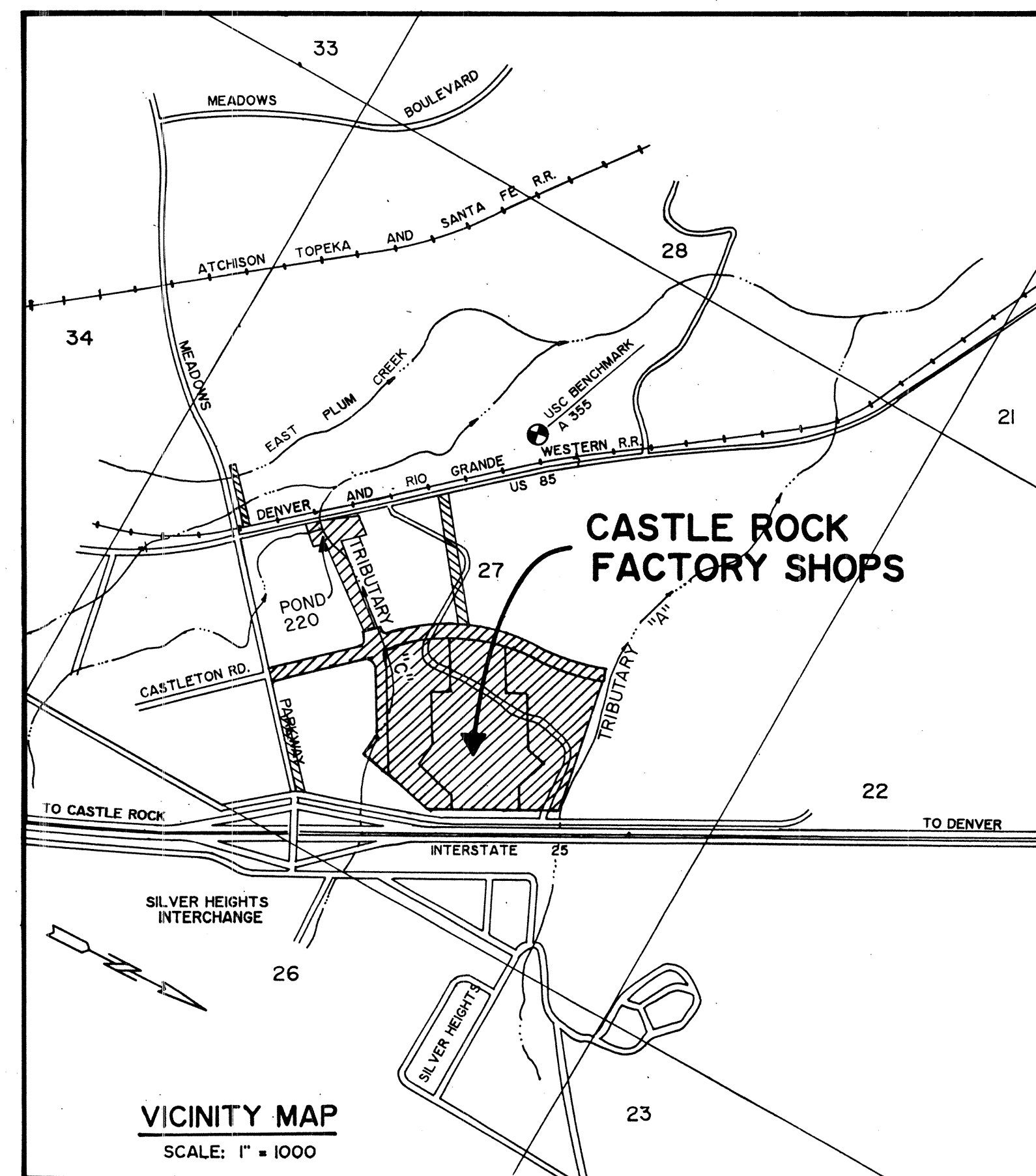
1811-001-02

SHEET

1 OF 46

- REISSUED 6/18/92 WHK

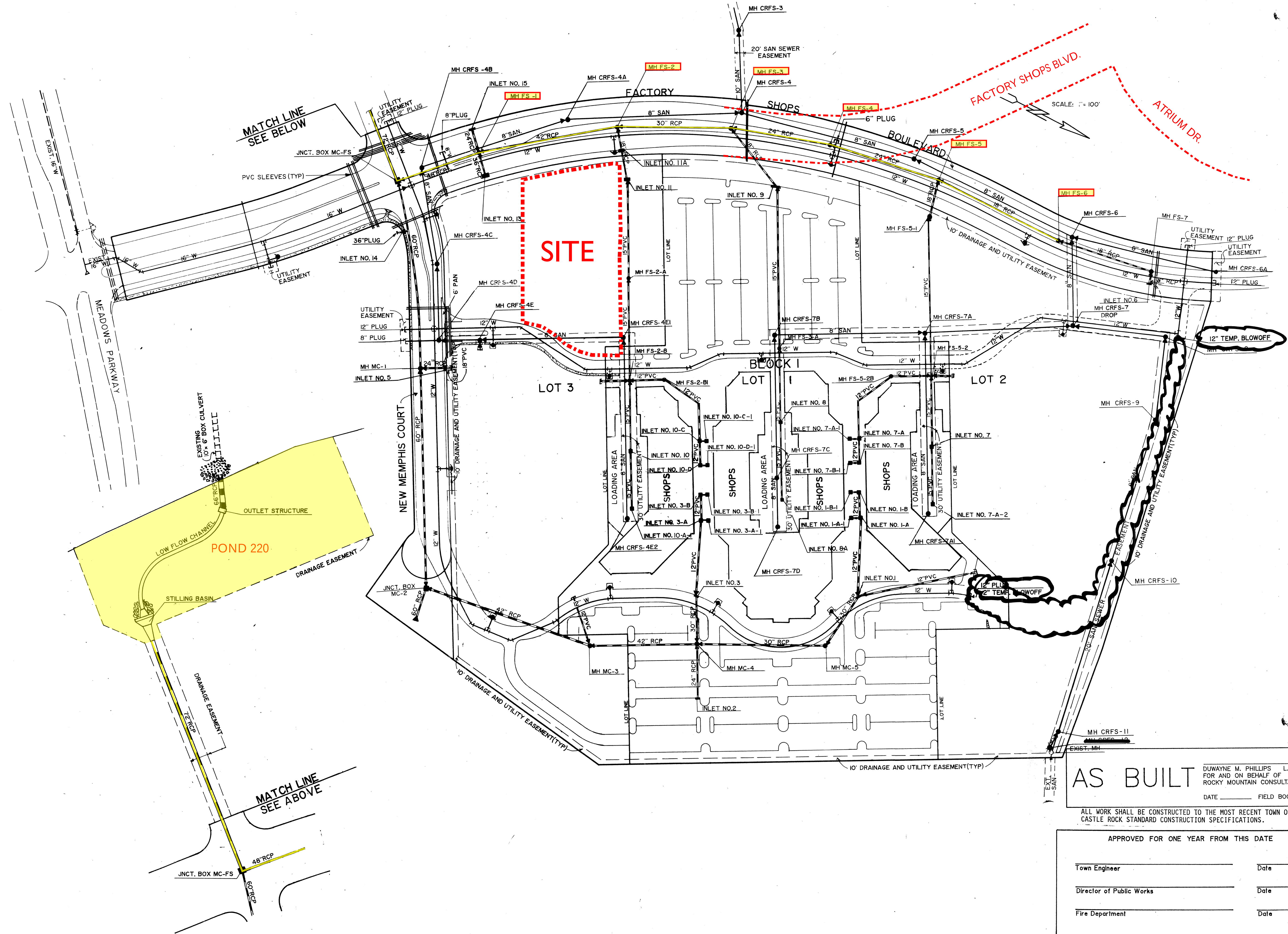
PHAS MA031002
Castle Rock Factory Shops
Phase I - Streets, Utility, Grading
RMC
12/6/93



- 1 OF 46 COVER SHEET
- 2 OF 46 GENERAL NOTES
- 3 OF 46 FINAL PLAT
- 4 OF 46 FINAL PLAT
- 5 OF 46 MEADOWS PARKWAY PLAN AND PROFILE
- 6 OF 46 MEADOWS PARKWAY PLAN AND PROFILE
- 7 OF 46 FACTORY SHOPS BOULEVARD PLAN AND PROFILE
- 8 OF 46 FACTORY SHOPS BOULEVARD PLAN AND PROFILE
- 9 OF 46 NEW MEMPHIS COURT PLAN AND PROFILE STREET
- 10 OF 46 STREET DETAILS AND TYPICAL SECTIONS
- 10A OF 46 PAVEMENT PLAN
- 10B OF 46 PARKING PLAN
- 11 OF 46 SIGNING AND STRIPING PLAN
- 12 OF 46 OVERALL UTILITY PLAN
- 13 OF 46 DETENTION POND AND STORM SEWER
- 14 OF 46 STORM SEWER NEW MEMPHIS COURT
- 15 OF 46 STORM SEWER
- 16 OF 46 STORM SEWER FACTORY SHOPS BOULEVARD
- 17 OF 46 STORM SEWER FACTORY SHOPS BOULEVARD
- 18 OF 46 STORM SEWER DETAILS
- 19 OF 46 STORM SEWER DETAILS
- 20 OF 46 STORM SEWER DETAILS
- 21 OF 46 STORM SEWER DETAILS
- 22 OF 46 STORM SEWER DETAILS
- 23 OF 46 SANITARY SEWER OUTFALL LINE
- 24 OF 46 SANITARY SEWER FACTORY SHOPS BOULEVARD

- 25 OF 46 SANITARY SEWER ON-SITE
- 26 OF 46 SANITARY SEWER ON-SITE
- 27 OF 46 SANITARY SEWER ON-SITE
- 28 OF 46 SANITARY SEWER FACTORY SHOPS BOULEVARD
- 29 OF 46 SANITARY SEWER NEW MEMPHIS COURT
- 30 OF 46 SANITARY SEWER ON-SITE
- 31 OF 46 SANITARY SEWER DETAILS
- 31A OF 46 SANITARY SEWER FLOW METER DETAIL
- 32 OF 46 16" WATERLINE MEADOWS PKWY AT PLUM CREEK
- 33 OF 46 16" WATERLINE DETAILS
- 34 OF 46 WATERLINE FACTORY SHOPS BOULEVARD
- 35 OF 46 WATERLINE FACTORY SHOPS BOULEVARD
- 36 OF 46 WATERLINE NEW MEMPHIS COURT
- 37 OF 46 WATERLINE ON-SITE
- 38 OF 46 WATERLINE ON-SITE
- 39 OF 46 WATERLINE DETAILS
- 40 OF 46 DETAIL SHEET AND CURVE DATA TABLE
- 41 OF 46 GRADING PLAN AND HORIZONTAL CONTROL
- 42 OF 46 GRADING PLAN AND HORIZONTAL CONTROL
- 43 OF 46 GRADING PLAN AND HORIZONTAL CONTROL
- 44 OF 46 GRADING PLAN AND HORIZONTAL CONTROL
- 45 OF 46 GRADING PLAN AND HORIZONTAL CONTROL
- 46 OF 46 GRADING PLAN AND HORIZONTAL CONTROL
- 46A OF 46 ROUGH GRADING PLAN (50 SCALE)
- 46B OF 46 ROUGH GRADING PLAN (50 SCALE)
- 46C OF 46 EROSION CONTROL PLAN
- 46D OF 46 EROSION CONTROL PLAN AND DETAIL
- 46E OF 46 DEMOLITION PLAN

PREPARED UNDER THE SUPERVISION



AS BUILT

DUWAYNE M. PHILLIPS L.S. NO. 9329
FOR AND ON BEHALF OF
ROCKY MOUNTAIN CONSULTANTS, INC.
DATE _____ FIELD BOOK _____

ALL WORK SHALL BE CONSTRUCTED TO THE MOST RECENT TOWN OF
CASTLE ROCK STANDARD CONSTRUCTION SPECIFICATIONS.

APPROVED FOR ONE YEAR FROM THIS DATE	
Town Engineer _____	Date _____
Director of Public Works _____	Date _____
Fire Department _____	Date _____

DATE: MAY 21, 1992
DESIGNED BY: _____
DRAWN BY: HRH
CHECKED BY: A.K.
JOB NO. 1811-001-02
SHEET 12 OF 46

CASTLE ROCK FACTORY SHOPS OVERALL UTILITY PLAN

RMC ROCKY MOUNTAIN CONSULTANTS
8301 EAST PRENTICE AVENUE, SUITE 101
ENGLEWOOD, COLORADO 80111
(303) 741-6000

NO.	REVISIONS	DESCRIPTION	DATE BY
1	REVISED WATERLINE	6/18/92 MJK	
2	REVISED LOTS 1 & 2	REISSUED	

**LOT 3, BLOCK I, CASTLE ROCK FACTORY SHOPS,
AMENDMENT I - QDOBA-STABUCKS DEVELOPMENT DRAINAGE
CONFORMANCE LETTER**

December 3, 2014

(a.k.a. PAD A LETTER)



Sterling Design Associates, LLC

CIVIL ENGINEERS - LANDSCAPE ARCHITECTS

December 3, 2014

Town of Castle Rock
100 North Wilcox Street
Castle Rock, CO 80104

RE: RE: Lot 3, Block I, Castle Rock Factory Shops, Amendment I- Qdoba-Starbucks Development; Project # CD14-0016 ; Drainage Conformance Letter

Dear Ms. Vargish:

The proposed Qdoba-Starbucks development includes an approximately 5,200 square foot restaurant on a portion of Lot 3, Block I, Castle Rock Factory Shops, Amendment I in Castle Rock, Colorado. Lot 3 is situated in the northeast quarter of Section 27, Township 7 South, Range 67 West of the 6th P.M. in the Town of Castle Rock, State of Colorado. The proposed development will impact approximately 2.1 acres of Lot 3. The site is currently developed with a parking lot that services the existing outlet mall. Drainage systems serving this area have been installed as a part of the surrounding, overall development. Design of these systems is described within the "Final Drainage Report for Castle Rock Factory Shops" prepared by Rocky Mountain Consultants, Inc., dated March 1992 (Factory Shops Report).

The site lies within Subbasins A6 and B7, tributary to Design Point 19A, as described in the Factory Shops Report. The Factory Shops Report indicates that the proposed drainage facilities will, "...intercept the on-site and off-site runoff for 100-year storm frequency, and convey it to a detention pond 220.....to be constructed on the east side of Highway 85." The Final Drainage Plan from the Factory Shops Report, showing the drainage subbasins, has been included with this letter.

Review of the Flood Insurance Rate Maps published by the Federal Emergency Management Agency for Douglas County, Colorado, and Incorporated Areas, Map Number 08035C0186F, dated September 30, 2005; indicates that the subject property lies in Zone "X" (unshaded), "Areas determined to be outside the 0.2% annual chance floodplain." A copy of the FIRM has been included with this letter.

The development will result in an increase of impervious area of 3,796-sf. There are six drainage basins on the site. Site runoff will generally be conveyed as surface flow across building roof, paved drive, and landscape areas to proposed curb and gutter and/or proposed concrete pan. These improvements will convey runoff to proposed on-site inlets throughout the parking lot. After being captured by the inlets, runoff will be conveyed in an underground storm sewer pipe to an existing storm sewer system within Factory Shops Blvd at Design Point 19A.

Capacities for the various storm sewer pipes were determined using Manning's Equation calculations assuming uniform flow. The UDFCD spreadsheet for Street and Inlet Hydraulics was used to analyze the proposed inlet capacity. Storm sewer pipes are designed to convey 100-yr flows assuming free outfall and without surcharging; therefore, hydraulic grade line calculations were not performed.

Jay M. Newell, PE
Wayne T. Sterling, RLA, LEED AP

2009 W. Littleton Blvd. #300
Littleton, CO 80120

303.794.4727
www.SterlingDesignAssociates.com

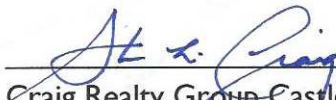
Calculations included with this letter include the existing and developed 100-yr and 2-yr storm event flows for the site development area. The design peak 100-yr flow rate at Design Point 19A is 20.7-cfs, per the Factory Shops Report. In the developed condition, the peak 100-yr flow rate tributary to Design Point 19A is 18.21-cfs. The developed peak 100-yr flow rate at Design Point 19A is less than the design flow rate; therefore the development will have minimal impact on the existing storm drain system.

Sincerely,

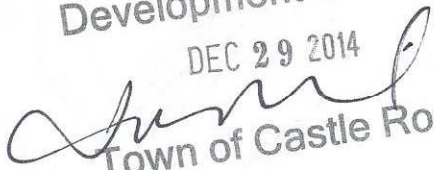


Sara J. Martin, PE
On behalf of
Sterling Design Associates, LLC

This drainage conformance letter is on file at the Town of castle rock and appears to fulfill the applicable Town of castle rock storm drainage criteria, as amended. The requirements of this letter are the obligation of the permittees until such time as the project is properly completed, modified or voided.


Craig Realty Group Castle Rock LLC

12-5-14
Date

Approved
Development Services
DEC 29 2014

Town of Castle Rock

Jay M. Newell, PE
Wayne T. Sterling, RLA, LEED AP

2009 W. Littleton Blvd. #300
Littleton, CO 80120

303.794.4727
www.SterlingDesignAssociates.com

Weighted Runoff Coefficients

Date: 10/20/2014 9:54

Project: Outlets at Castle Rock

By: SJM

	Frequency				%
	2	5	10	100	Impervious ¹
Roof	0.80	0.85	0.90	0.90	90
Landscape	0.00	0.10	0.20	0.50	0
Pavement	0.87	0.88	0.90	0.93	100

Basin	Roof	Landscape	Pavement	Total	Weighted Runoff Coefficient ²			% Impervious	
					C2	C5	C10	C100	Impervious
B1	0.000	0.079	0.600	0.679	0.70	0.72	0.75	0.82	88%
B2	0.000	0.091	0.700	0.791	0.70	0.73	0.75	0.82	88%
B3	0.000	0.070	0.980	1.050	0.78	0.79	0.82	0.87	93%
B4	0.000	0.003	0.180	0.183	0.86	0.87	0.89	0.93	98%
B5	0.120	0.003	0.138	0.261	0.79	0.81	0.83	0.88	94%
B6	0.000	0.000	0.075	0.075	0.89	0.90	0.92	0.96	100%
Total	0.120	0.246	2.673	3.039					

¹Imperviousness from UDFCD - DCM, Vol. I, Table RO-3

²Weighted Runoff Coefficient from UDFCD - DCM, Vol. I, Table RO-4, Soil Type C



PROPOSED DRAINAGE BASINS
OUTLETS AT CASTLE ROCK - PAD A
CASTLE ROCK, CO
SCALE: 1"= 100'-0"
DATE: 10/23/14



Sterling Design Associates, LLC

PAVING UTILITY STRIPS
LOT 1

CONVEYANCE SYSTEM ANALYSIS AND SIZING TABLE USING THE RATIONAL METHOD

Location		Sub Basin Number	Area (ac)	C	C*A	Sum C*A	Tc (min.)	I(R)	Q(R) (c.f.s.)	Pipe (in.)	Typ. n	Slope (ft.ft.)	Q(F) (pipe full)	V (pipe full)	V (at Q(R))	L (ft.)	Tt (min.)	% d/D
From	To																	
Inlet 1	MH 1	B1	0.68	0.82	0.56	0.56	10.0	7.03	3.91	12	0.014	3.0%	5.75	7.32	7.88	6	0.01	60.50%
MH 1	MH 2		0.00	0.00	0.00	0.56	10.0	7.03	3.91	12	0.014	3.0%	5.75	7.32	7.88	105	0.22	60.50%
Inlet 2	MH 2	B2	0.79	0.82	0.65	0.65	10.0	7.03	4.56	12	0.014	3.0%	5.75	7.32	8.22	6	0.01	66.50%
MH 2	MH 3		0.00	0.00	0.00	1.21	10.2	7.03	8.47	18	0.014	3.3%	17.69	10.01	9.71	84	0.14	49.50%
Inlet 3	MH 4	B3	1.05	0.87	0.91	0.91	10.0	7.03	6.42	18	0.014	3.0%	16.94	9.59	8.84	7	0.01	43.00%
MH 4	MH 3		0.00	0.00	0.00	2.12	10.3	7.03	14.90	18	0.014	3.0%	16.94	9.59	10.86	60	0.09	72.50%
MH 3	MH 6		0.00	0.00	0.00	2.12	10.4	7.03	14.90	18	0.014	3.0%	16.94	9.59	10.86	80	0.12	72.50%
Inlet 4	MH 5	B4	0.18	0.93	0.17	0.17	10.0	7.03	1.20	12	0.014	1.0%	3.32	4.23	3.82	178	0.78	42.00%
Inlet 5	MH 5	B5	0.26	0.88	0.23	0.23	10.0	7.03	1.61	12	0.014	4.0%	6.63	8.44	7.00	32	0.08	33.50%
Inlet 6	MH 5	B6	0.08	0.96	0.07	0.07	10.0	7.03	0.51	12	0.014	2.9%	5.65	7.19	4.53	44	0.16	20.00%
MH 5	MH 6		0.00	0.00	0.00	0.47	11.0	7.03	3.32	12	0.014	10.0%	10.49	13.36	11.50	62	0.09	39.50%
MH 6	EX Inlet		0.00	0.00	0.00	2.59	11.2	7.03	18.21	18	0.014	3.3%	17.77	10.06	10.31	63	0.10	99.90%
<div> <div>Project: Outlets at Castle Rock-Pad A</div> <div>Location: Castle Rock, CO</div> </div> <div> <div>R= 100 yr</div> <div>2.60</div> </div> <div> <div>Calcs by: SJM</div> <div>Date: 10/22/14</div> </div> <div> <div>Job No: CD 14-0016</div> <div>Page 1</div> </div>																		

SITE MAPS / CALCULATIONS / FIGURES & TABLES



Weighted Imperviousness

Job Name: CROM Pad - Castle Rock, Colorado

Date: 8/12/24

By: JMN

	¹ I (%)
Roof	90
Lawn	2
Drives & Walks	90

¹% Impervious from MHFD, *USDCM Vol. I*, Table 6-3

EXISTING

Basin	³ Hydrologic Soil Classification	Drives & Walks (ac.)	Pad (ac.)	Lawn (ac.)	Roof (ac.)	Total (ac.)	² Weighted Runoff Coeff.					
							I (%)	C ₅	C ₁₀	C ₂₅	C ₅₀	C ₁₀₀
IN-3	A	2.374	0.000	0.202	0.098	2.675	83	0.68	0.70	0.72	0.74	0.76
X1	(PAD A LETTER)	0.600		0.079	0.000	0.679	88	0.72	0.75			0.82
X2	(PAD A LETTER)	0.700		0.091	0.000	0.791	88	0.73	0.75			0.82
	(B	0.655	0.000	0.139	0.000	0.794	75	0.62	0.66	0.72	0.74	0.77
X3	(PAD A LETTER)	0.980		0.070	0.000	1.050	93	0.79	0.82			0.87
	(B	0.937	0.000	0.125	0.000	1.062	80	0.67	0.70	0.75	0.77	0.80
X4	(PAD A LETTER)	0.180		0.003	0.000	0.183	98	0.87	0.89			0.93
X5	(PAD A LETTER)	0.138		0.003	0.120	0.261	94	0.81	0.83			0.88
X6	(PAD A LETTER)	0.075		0.000	0.000	0.075	100	0.90	0.92			0.96
⁴ Total		5.047		0.448	0.218	5.714	83	(PAD A LETTER)				
⁵	(	4.959		0.551	0.218	5.728	82	(Field Survey)				

²Rational Coefficient from MHFD, *USDCM Vol. I*, Table 6-4

³Hydrologic Soil Group from NRCS Web Soil Survey

⁴Totals including variables from PAD A LETTER for Basins X1 through X6 with footnote (I) imperviouness

⁵Totals including variables from PAD A LETTER Basins X1 & X4 through X6; Basins X2 and X3 from field survey with footnote (I) imperviouness



Weighted Imperviousness

Job Name: CROM Pad - Castle Rock, Colorado

Date: 8/12/24

By: JMN

	¹ I (%)
Roof	90
Lawn	2
Drives & Walks	90

¹% Impervious from MHFD, *USDCM Vol. I*, Table 6-3

PROPOSED

Basin	³ Hydrologic Soil Classification	Drives & Walks (ac.)	Pad (ac.)	Lawn (ac.)	Roof (ac.)	Total (ac.)	² Weighted Runoff Coeff.					
							I (%)	C ₅	C ₁₀	C ₂₅	C ₅₀	C ₁₀₀
IN-3	A	2.335	0.000	0.277	0.098	2.710	81	0.66	0.67	0.70	0.72	0.74
X1	(PAD A LETTER)	0.600		0.079	0.000	0.679	88	0.72	0.75			0.82
X2	B	0.676	0.000	0.118	0.000	0.794	77	0.64	0.68	0.73	0.76	0.78
X3	B	0.517	0.037	0.068	0.000	0.623	80	0.68	0.71	0.75	0.78	0.80
X4	(PAD A LETTER)	0.180		0.003	0.000	0.183	98	0.87	0.89			0.93
X5	(PAD A LETTER)	0.138		0.003	0.120	0.261	94	0.81	0.83			0.88
X6	(PAD A LETTER)	0.075		0.000	0.000	0.075	100	0.90	0.92			0.96
Street	B	0.000	0.000	0.053	0.000	0.053	2	0.01	0.07	0.26	0.34	0.44
IN-1	B	0.058	0.162	0.009	0.000	0.229	87	0.73	0.76	0.79	0.81	0.83
IN-2	B	0.080	0.031	0.010	0.000	0.121	83	0.70	0.73	0.77	0.79	0.81
⁵ Total		4.659	0.231	0.619	0.218	5.728	80					

²Rational Coefficient from MHFD, *USDCM Vol. I*, Table 6-4

³Hydrologic Soil Group from NRCS Web Soil Survey

⁵Totals including variables from PAD A LETTER Basins X1 & X4 through X6; Basins X2 and X3 from survey with footnote (1) imperviouness

⁶Pad Site Imperviousness must not exceed 90 % for overall compliance to existing condition

Table 6-3. Recommended percentage imperviousness values

Land Use or Surface Characteristics	Percentage Imperviousness (%)
Business:	
Downtown Areas	95
Suburban Areas	75
Residential lots (lot area only):	
Single-family	
2.5 acres or larger	12
0.75 – 2.5 acres	20
0.25 – 0.75 acres	30
0.25 acres or less	45
Apartments	75
Industrial:	
Light areas	80
Heavy areas	90
Parks, cemeteries	10
Playgrounds	25
Schools	55
Railroad yard areas	50
Undeveloped Areas:	
Historic flow analysis	2
Greenbelts, agricultural	2
Off-site flow analysis (when land use not defined)	45
Streets:	
Paved	100
Gravel (packed)	40
Drive and walks	90
Roofs	90
Lawns, sandy soil	2
Lawns, clayey soil	2

Table 6-4. Runoff coefficient equations based on NRCS soil group and storm return period

NRCS Soil Group	Storm Return Period						
	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	500-Year
A	$C_A =$ $0.84i^{1.302}$	$C_A =$ $0.86i^{1.276}$	$C_A =$ $0.87i^{1.232}$	$C_A =$ $0.88i^{1.124}$	$C_A =$ $0.85i+0.025$	$C_A =$ $0.78i+0.110$	$C_A =$ $0.65i+0.254$
B	$C_B =$ $0.84i^{1.169}$	$C_B =$ $0.86i^{1.088}$	$C_B =$ $0.81i+0.057$	$C_B =$ $0.63i+0.249$	$C_B =$ $0.56i+0.328$	$C_B =$ $0.47i+0.426$	$C_B =$ $0.37i+0.536$
C/D	$C_{C/D} =$ $0.83i^{1.122}$	$C_{C/D} =$ $0.82i+0.035$	$C_{C/D} =$ $0.74i+0.132$	$C_{C/D} =$ $0.56i+0.319$	$C_{C/D} =$ $0.49i+0.393$	$C_{C/D} =$ $0.41i+0.484$	$C_{C/D} =$ $0.32i+0.588$

Where:

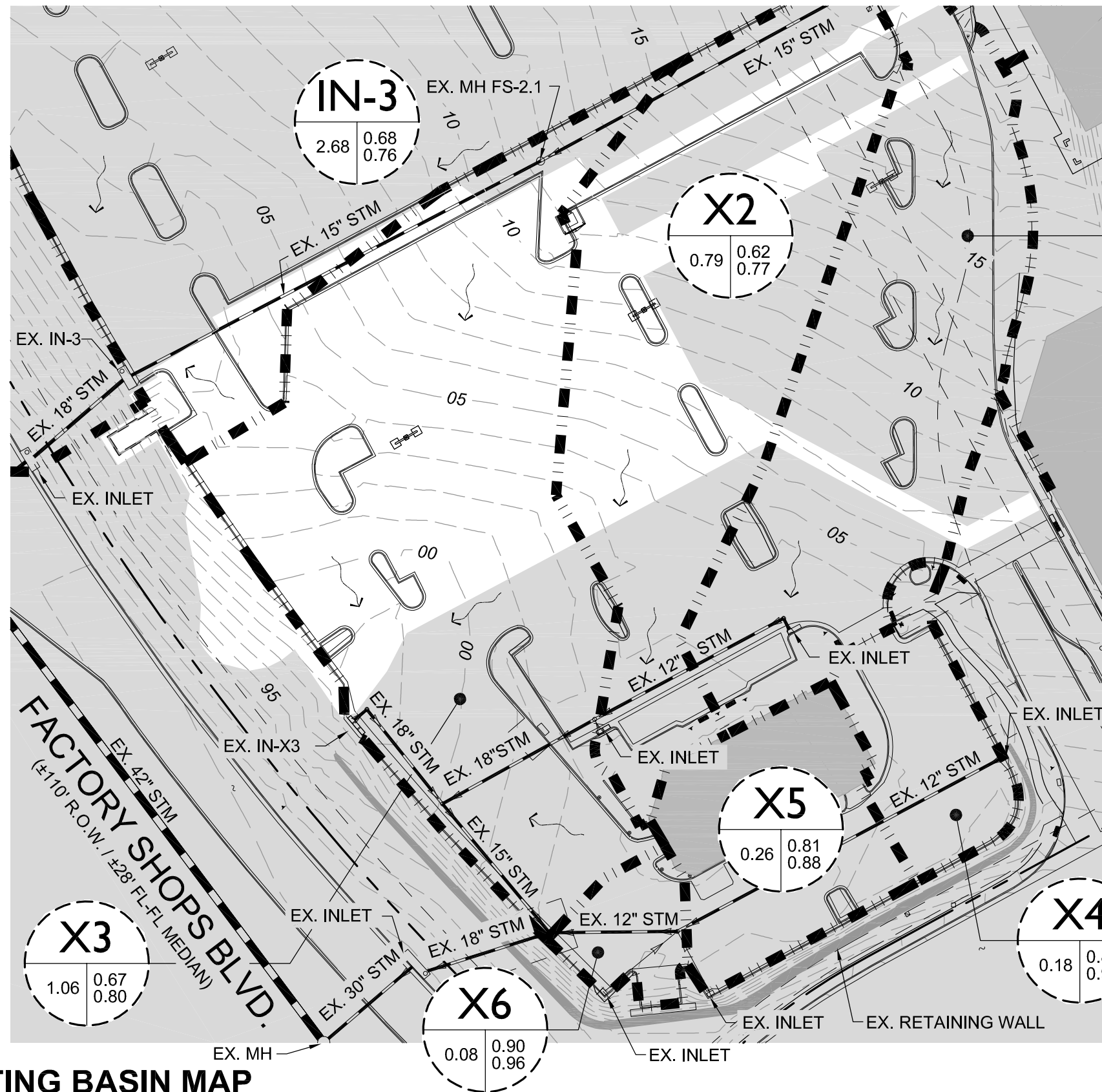
i = % imperviousness (expressed as a decimal)

C_A = Runoff coefficient for Natural Resources Conservation Service (NRCS) HSG A soils

C_B = Runoff coefficient for NRCS HSG B soils

$C_{C/D}$ = Runoff coefficient for NRCS HSG C and D soils.

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LEGEND

- PROPERTY LINE / R.O.W.
- EXIST. CURB & GUTTER
- PROP. CURB & GUTTER
- - - 98 - - - EXIST. CONTOUR
- - - 98 - - - PROP. CONTOUR
- EXIST. BASIN LIMIT
- PROP. RETAINING WALL

PAD LOT LIMIT

- RN** EXIST. BASIN ID
- C_5
- C_{100}
- AREA (AC.)
- 6 DESIGN POINT
- ~> FLOW DIRECTION

EXISTING STORM SEWER SYSTEM BASED
ON PAD A LETTER, SOUTH ASBUILT AND
FIELD SURVEY WHERE AVAILABLE.



1

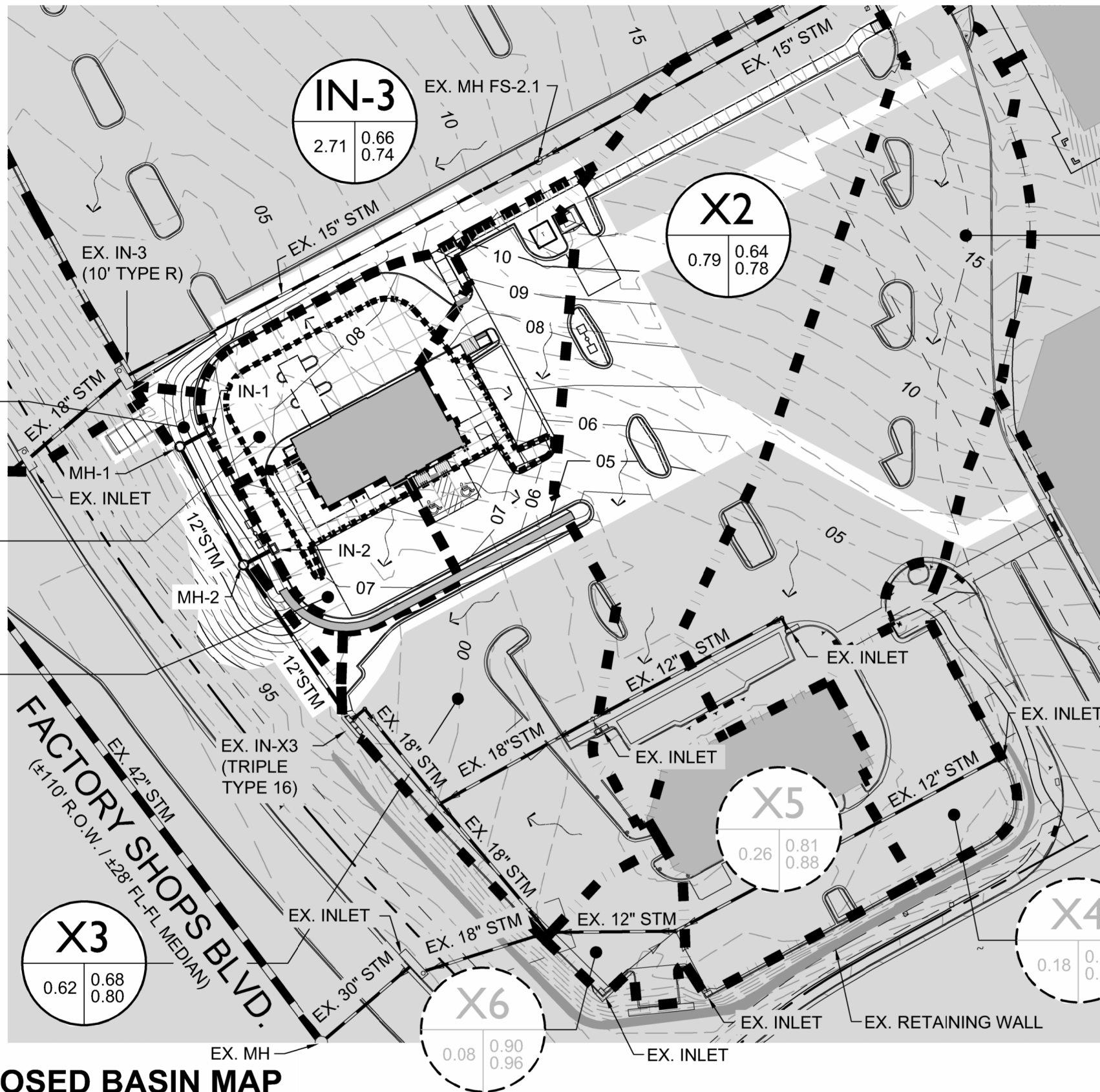
EXISTING BASIN MAP

SCALE: 1"=60'

Farnsworth
GROUP
5613 DTC PARKWAY, SUITE 1100
GREENWOOD VILLAGE, COLORADO 80111
(303) 692-8838 / info@f-w.com

PROJECT NO.: 0240544.00
DRAWN: JN
REVIEWED: JN
DATE: 08/12/2024

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LEGEND

- PROPERTY LINE / R.O.W.
- EXIST. CURB & GUTTER
- PROP. CURB & GUTTER
- 98 EXIST. CONTOUR
- 98 PROP. CONTOUR
- EXIST. BASIN LIMIT
- PROP. BASIN LIMIT
- PROP. RETAINING WALL

PAD LOT LIMIT

PAD SITE LIMIT

EXIST. BASIN ID
C₅
C₁₀₀
AREA (AC.)

PROP. BASIN ID
C₅
C₁₀₀
AREA (AC.)

DESIGN POINT
FLOW DIRECTION

STORM SYSTEM

STRUCTURE	SIZE
IN-1	3' CCD TYPE 16 COMB.
IN-2	3' CCD TYPE 16 COMB.

1

PROPOSED BASIN MAP

SCALE: 1"=60'

Farnsworth
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