Town Of Erie
Planning Commission Regular Meeting
Wednesday, September 16, 2015
6:30 P.M.
Board Room, Erie Town Hall, 645 Holbrook, Erie, CO 80516

I. **CALL TO ORDER & PLEDGE OF ALLEGIANCE TO THE FLAG**

II. **ROLL CALL**

III. **APPROVAL OF THE AGENDA**

IV. **APPROVAL OF MINUTES**

Approval of the September 2, 2015, Planning Commission Regular Meeting Minutes

V. **PUBLIC COMMENTS** (This agenda item provides the public an opportunity to discuss items other than items that are on the agenda. The Planning Commission is not prepared to decide on matters brought up at this time, but it warranted, will place them on a future agenda.)

VI. **RESOLUTIONS** (This agenda item is for all matters that should be decided by resolutions.)

1. **HIGHWAY 287 URA**

Purpose: Consideration of a URA District for Highway 287
Request: Consideration of Resolution P15-28, A Resolution Of The Planning Commissioners Of The Town Of Erie Finding That The Urban Renewal Plan For The Highway 287 Area Is In Conformance With The Town Of Erie Comprehensive Plan
Location: Highway 287
Applicants: Erie Urban Renewal Authority
(Staff Planner: Marty Ostholthoff)

2. **4 CORNERS URA**

Purpose: Consideration of a URA District for 4 Corners
Request: Consideration of Resolution P15-29, A Resolution Of The Planning Commissioners Of The Town Of Erie Finding That The Urban Renewal Plan For The Four Corners Area Is In Conformance With The Town Of Erie Comprehensive Plan
Location: The SW Corner of Erie Parkway and County Line Road
Applicants: Erie Urban Renewal Authority
(Staff Planner: Marty Ostholthoff)

VII. **GENERAL BUSINESS** (This agenda item is reserved for matters that are ready for Commission action, and do not fit into other categories, i.e. resolutions)

1. **ERIE HIGHLANDS PA 5, 6 & 14 SKETCH PLAN**

Purpose: Consideration & comments for proposed sketch plan.
Location: South of Erie Parkway between Bonanza Drive and WCR 5
Applicants: Oakwood Homes
(Staff Planner: Deborah Bachelder)

VIII. **STAFF REPORTS** (This agenda items is reserved for specific items from Staff requiring Commission direction or just relaying important information.)

FOR MORE INFORMATION ON THE AGENDA ITEMS LISTED, PLEASE CONTACT THE COMMUNITY DEVELOPMENT OFFICE AT 645 HOLBROOK STREET, 303-926-2770

IX. **COMMISSIONER REPORTS AND DISCUSSION ITEMS** (This agenda item is for all Planning Commission reports and items of information as well as Commission discussion items, not listed on the agenda.)

X. **ADJOURNMENT TO STUDY SESSION**

XI. **STUDY SESSION**

Comprehensive Plan Update

Purpose: Review Chapters 4 & 5 Redlines, Land Use Plan Map

FOR MORE INFORMATION ON THE AGENDA ITEMS LISTED, PLEASE CONTACT THE COMMUNITY DEVELOPMENT OFFICE AT 645 HOLBROOK STREET, 303-926-2770

Town of Erie
Planning Commission Regular Meeting
Wednesday, September 2, 2015
6:30 p.m.
Board Room, Erie Town Hall, 645 Holbrook, Erie, Co 80516

I. CALL MEETING TO ORDER & PLEDGE OF ALLEGIANCE

Chairman Bottenhorn called the Regular Meeting of the Erie Planning Commission to order at 6:28 p.m.

II. ROLL CALL

Commissioner Bottenhorn - Present
Commissioner Burgard –Present (6:29)
Commissioner Campbell - Present
Commissioner Kemp - Present (6:30)
Commissioner Fraser - Present
Commissioner Gippe - Present
Commissioner Harrison - Present

Staff Present: R. Martin Ostholthoff, Community Development Director; and
Hallie Sawyer, Secretary to the Commission

III. APPROVAL OF THE AGENDA

Commissioner Campbell moved to approve the September 2, 2015, Regular Meeting Agenda as submitted. The motion, seconded by Commissioner Gippe, carried with all voting in favor thereof.

IV. APPROVAL OF MINUTES

a. Minutes from the August 19, 2015, Regular Meeting.

Commissioner Gippe moved to approve the August 19, 2015, Minutes as submitted. The motion, seconded by Commissioner Campbell, carried with all voting in favor thereof.

V. PUBLIC COMMENTS

(This agenda item provides the public an opportunity to discuss items other than items that are on the agenda. The Planning Commission is not prepared to decide on matters brought up at this time, but it warranted, will place them on a future agenda.)

None.

VI. RESOLUTIONS

(This agenda item is for all matters that should be decided by resolutions.)

1. Public Hearing – Morgan Hills Wells Special Review Use

Purpose: Consideration of the Special Review Use
Project File #: SRU-000503-2015
Request: Consideration of Resolution P15-26, A Resolution Making Certain Findings Of Fact And Conclusions Favorable To The Special Review Use For The Morgan Hills 1A-7H-A168, 1B-7H-A168, 1C-7H-A168, 1D-7H-A168, 1E-7H-A168, 1F-7H-A168, 1G-7H-A168, 1H-7H-A168 AND 1I-7H-A168 Well Site.
Location: The SW corner of WCR 3 & WCR 12
Applicants: EnCana Oil & Gas, USA
(Staff Planner: R. Martin Ostholthoff)

2. Public Hearing – Morgan Hills Wells Site Plan

Purpose: Consideration of the Site Plan
Project File #: SP-000504-2015
Request: Consideration of Resolution P15-27, A Resolution Making Certain Findings Of Fact And Conclusions Favorable To The Site Plan For The Morgan Hills 1A-7H-A168, 1B-7H-A168, 1C-7H-A168, 1D-7H-A168, 1E-7H-A168, 1F-7H-A168, 1G-7H-A168, 1H-7H-A168 AND 1I-7H-A168 Well Site.

Location: The SW corner of WCR 3 & WCR 12
Applicants: EnCana Oil & Gas, USA
(Staff Planner: R. Martin Ostholthoff)

Chairman Bottenhorn opened the Public Hearings at 6:31 p.m. Marty Ostholthoff, Community Development Director presented the applications for the EnCana Morgan Hills Oil & Gas Wells Special Review Use and Site Plan, entered the documents into evidence and presented the staff recommendations for approval of the two resolutions.

Erin Lind, Miracle Pfister, Ted Rich & John Schmidt from EnCana Oil & Gas USA, was available to answer questions and address concerns from the Planning Commission.

There was no public comment.

Commissioner questions and comments included the location of the Best Management Practices (BMP's) in the packet on line; environmental impacts to the town; completion operations; how does this location fit into the Morgan Hill development; are the setback in compliance for the homeowner to the north; why is the site on the edge of the property; and route of the pipeline to the HUB facility.

Chairman Bottenhorn closed the public hearing at 6:56 p.m.

Commissioner comments regarded impact mitigations and note that oil and gas decisions are tough to make.

Commissioner Kemp moved approval of Resolution P15-26, A Resolution Making Certain Findings Of Fact And Conclusions Favorable To The Special Review Use For The Morgan Hills 1A-7H-A168, 1B-7H-A168, 1C-7H-A168, 1D-7H-A168, 1E-7H-A168, 1F-7H-A168, 1G-7H-A168, 1H-7H-A168 AND 1I-7H-A168 Well Site. The motion, seconded by Commissioner Campbell, carried 6-1 with Commissioner Gippe voting nay.

Commissioner Kemp moved approval of Resolution P15-27, A Resolution Making Certain Findings Of Fact And Conclusions Favorable To The Site Plan For The Morgan Hills 1A-7H-A168, 1B-7H-A168, 1C-7H-A168, 1D-7H-A168, 1E-7H-A168, 1F-7H-A168, 1G-7H-A168, 1H-7H-A168 AND 1I-7H-A168 Well Site. The motion, seconded by Commissioner Campbell, carried 6-1 with Commissioner Gippe voting nay.

VII. STAFF REPORTS (This agenda items is reserved for specific items from Staff requiring Commission direction or just relaying important information.)

None.

VIII. COMMISSIONER REPORTS AND DISCUSSION ITEMS (This agenda item is for all Planning Commission reports and items of information as well as Commission discussion items, not listed on the agenda)

None.

IX. ADJOURNMENT

There being no further business to come before the Commission, Chairman Bottenhorn adjourned the September 2, 2015, Regular Meeting of the Planning Commission at 6:58 p.m. to a Study Session.

The Study Session was adjourned at 8:45 p.m.

Respectfully Submitted,

Town of Erie Planning Commission

By: _____
Hallie S. Sawyer, Secretary

By: _____
J. Eric Bottenhorn, Chair

TOWN OF ERIE
PLANNING COMMISSION MEETING
September 16, 2015

SUBJECT: Highway 287 Urban Renewal Plan

PURPOSE: Planning Commission to make finding that the Highway 287 Urban Renewal Plan (Highway 287 Plan) is in conformance with the Town's Comprehensive Master Plan.

LOCATION: See map in Highway 287 Plan

URA CONSULTANT:
Anne Ricker
Ricker | Cunningham
8200 South Quebec Street, Suite A3-104
Centennial, CO 80112

URA LEGAL COUNSEL:
Carolynne White, Esq.
Brownstein | Hyatt | Farber | Schreck, LLP
410 Seventeenth Street, Suite 2200
Denver, CO 80202

DEPARTMENT:
Community Development
R. Martin Ostholthoff, Community Development Director

REQUEST: Consideration of Resolution P15-28, a Resolution finding the Highway 287 Plan to be in conformance with the Town of Erie Comprehensive Master Plan.

STAFF RECOMMENDATION

Staff recommends that the Planning Commission finds the Highway 287 Plan in conformance with the Town of Erie Comprehensive Master Plan by approving Resolution P15-28.

SUMMARY AND BACKGROUND OF SUBJECT MATTER

The Town of Erie formed an Urban Renewal Authority (URA) in 2011 pursuant to Title 31 of the Colorado Revised Statutes when the Board of Trustees accepted the February 2012 Town of Erie – Survey of Conditions. The survey indicated that factors contributing to blight are present; and secondly, enough factors were present in the surveyed areas to create a URA. The general purpose of the URA is to reduce, eliminate or prevent the spread of blight within a defined area and to stimulate growth and investment within said area.

After creation of the URA the next step is to create Urban Renewal Plans that outline the general scope of the plan under consideration for a defined area as identified in the Survey of Conditions.

The current plan being brought forward at this time is the Highway 287 Plan, attached hereto as Attachment B. Prior to the URA approving the Highway 287 Plan, state statute requires that the Planning Commission review and make a recommendation on the conformity of the Highway 287 Plan to the Town of Erie Comprehensive Master Plan.

Approved by:

R. Martin Ostholthoff
Community Development Director

ATTACHMENTS:

A. Resolution No. P15-28
B. Highway 287 Urban Renewal Plan

ATTACHMENT A

RESOLUTION NO. P15-28

A RESOLUTION OF THE PLANNING COMMISSIONERS OF THE TOWN OF ERIE FINDING THAT THE URBAN RENEWAL PLAN FOR THE HIGHWAY 287 AREA IS IN CONFORMANCE WITH THE TOWN OF ERIE COMPREHENSIVE PLAN

WHEREAS, Section 31-23-206 C.R.S. directs the Planning Commission of each town to prepare and submit a master plan for the physical development of the Town; and

WHEREAS, the Commission and Town Board have previously adopted the Town of Erie Comprehensive Plan for the Town, most recently updated and effective as of March 20, 2015; and

WHEREAS, Section 31-25-107(2), C. R. S., requires an urban renewal plan to be submitted to the Planning Commission for review and recommendation as to its conformity to the general plan for the development of the municipality as a whole, and submit written recommendations if any prior to approval of the plan; and

WHEREAS, the Public Hearing for the Highway 287 Area Urban Renewal Plan is set for September 22, 2015 at 6:30 p.m.

NOW, THEREFORE, BE IT RESOLVED BY THE PLANNING COMMISSION OF THE TOWN OF ERIE, COLORADO:

1. The Planning Commission finds that the Highway 287 Area Urban Renewal Plan is in conformity with the Erie Comprehensive Plan and recommends approval of the Highway 287 Area Urban Renewal Plan by the Town Board of Trustees.

MOVED, SECONDED AND ADOPTED BY THE TOWN OF ERIE PLANNING COMMISSION THIS 16th DAY OF SEPTEMBER, 2015.

PLANNING COMMISSION
TOWN OF ERIE, COLORADO

_____
J. Eric Bottenhorn, Chairman

ATTEST:

_____
Hallie S. Sawyer, Secretary

ATTACHMENT B

Ricker|Cunningham

Highway 287 Urban Renewal Plan

Town of Erie, Colorado

September 2015

Prepared for:

Town of Erie Urban Renewal Authority (TOEURA)
Town of Erie Board of Trustees

Prepared by:

RickerICunningham
8200 South Quebec Street, Suite A3-104
Centennial, CO 80112

303.458.5800 phone
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Highway 287 Urban Renewal Plan

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Highway 287 Urban Renewal Plan

Town of Erie, Colorado

1.0 Introduction

1.1 Preface

This Highway 287 Urban Renewal Plan (the "**Plan**" or the "**Urban Renewal Plan**") has been prepared for the Town of Erie ("Town"). It will be carried out by the Town of Erie Urban Renewal Authority (the "**Authority**" or TOEURA), pursuant to the provisions of the Urban Renewal Law of the State of Colorado, Part 1 of Article 25 of Title 31, Colorado Revised Statutes, 1973, as amended (the "**Act**"). The administration and implementation of this Plan, including the preparation and execution of any documents implementing it, shall be performed by the **Authority**.

1.2 Blight Findings

Under the **Act**, an urban renewal area is a blighted area, which has been designated as appropriate for an urban renewal project. In each urban renewal area, conditions of blight, as defined by the **Act**, must be present, and in order for the **Authority** to exercise its powers, the **Town Board** must find that the presence of those conditions of blight, "substantially impairs or arrests the sound growth of the municipality or constitutes an economic or social liability, and is a menace to the public health, safety, morals or welfare."

The Highway 287 Urban Renewal Plan Area Conditions Survey, prepared by RickerICunningham, dated June, 2015, and presented to the **Authority** under separate cover, demonstrates that the Highway 287 **Area** (the "**Study Area**"), as defined in the Survey, is a blighted area under the **Act**.

1.3 Other Findings

The **Area**, as defined in Section 1.4 below, is appropriate for one or more urban renewal activities and undertakings authorized by the **Act** to be advanced by the **Authority**.

It is the intent of the **Town Board** in adopting this **Plan** that the **Authority** has available to it any and all powers authorized in the **Act** which are necessary and appropriate to

accomplish the objectives stated herein. Further, it is the intent of this Plan that the **Authority** exercises these powers for the elimination of qualifying conditions in the **Area** and furtherance of the goals and objectives of the community's general plan.

The powers conferred by the **Act** are for public uses and purposes for which public money may be expended. This Plan is in the public interest and necessity -- such finding being a matter of legislative determination by the **Town Board**.

1.4 Urban Renewal Area Boundaries

The **Area** includes 3 legal parcels comprising approximately 50.3 acres and adjacent rights-of-way, located at the southeast and southwest corners of Arapahoe Road and U.S. Highway 287. As illustrated in Table 1, the parcels are owned by the Town of Erie and Town of Erie Urban Renewal **Authority**, and zoned Planned Development and Community Commercial. As shown in the Town of Erie 2005 Comprehensive Plan, the **Area** is designated for future growth as Regional Commercial. Two of the parcels in the **Area** have free-standing residential units with auxiliary buildings. The **Urban Renewal Area** map is presented as Figure No. 1 on the following page.

Table 1
Highway 287 Urban Renewal Plan Survey Area
Property Ownership

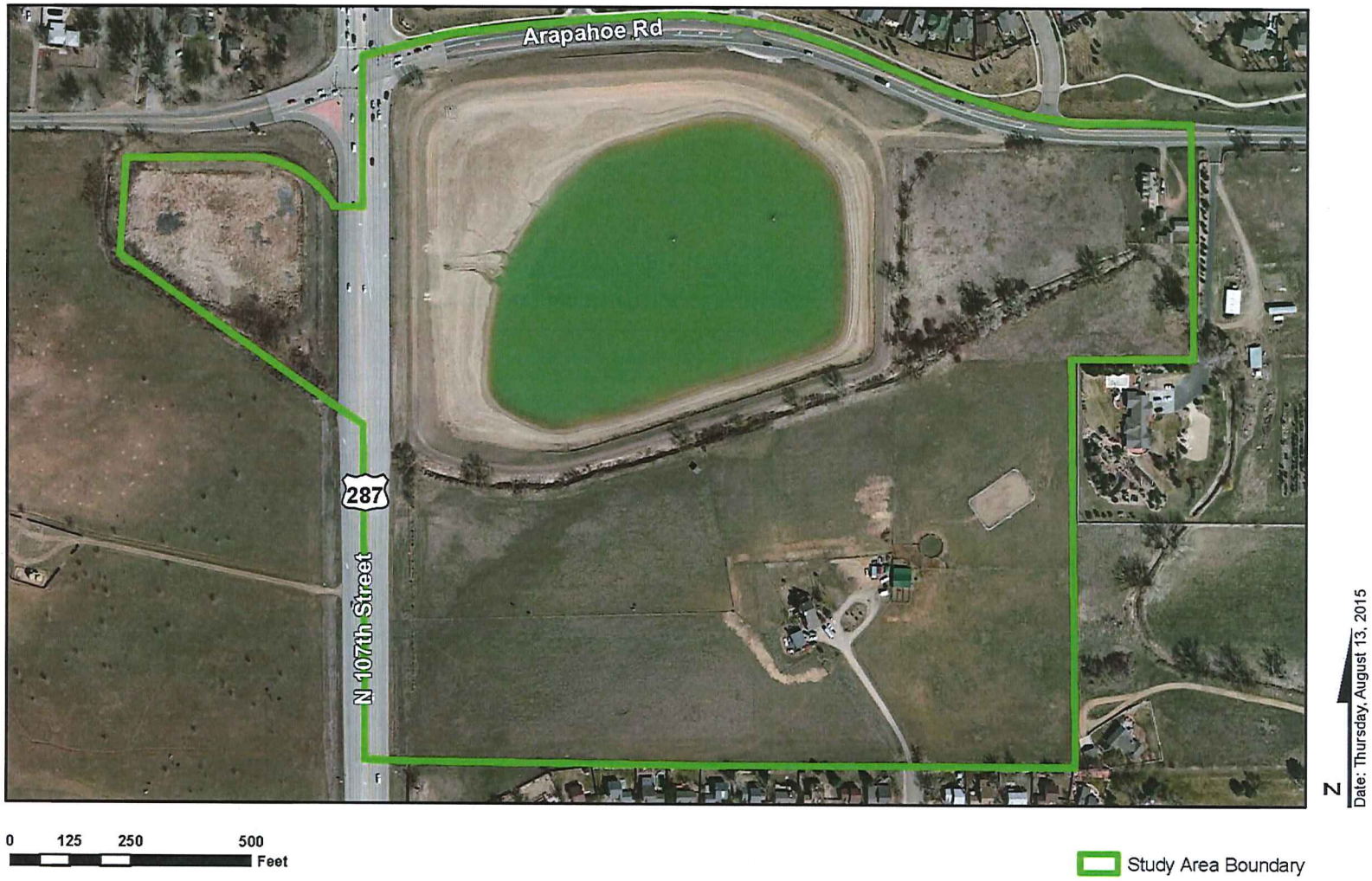
Map #	Parcel Number	Property Ownership	Acres	% of Area
0	146534100006	Erie Urban Renewal Authority	22.2	44%
1	146534100004	Erie Urban Renewal Authority	6.0	12%
2	146534100005	Town of Erie	22.1	44%
Totals			**50.3**	**100%**

Source: Boulder County Assessor and Ricker | Cunningham.

1.5 Public Participation

The **Authority** Board will consider the **Plan** on September 22, 2015 at a regular meeting of the **Authority**. Notification of the public hearing **will be** provided to property owners, residents and owners of business concerns at their last known address of record within the **Area** as required by the **Act**. Notice of the public hearing to consider the **Plan** will be published in the Colorado Hometown Weekly.

Figure No. 1: Highway 287 Urban Renewal Plan Area



The Planning Commission will review the **Plan** on September 16, 2015 and determine if it is consistent with the Town's **Comprehensive Plan**, adopted 2005.

2.0 Definitions

Act – means the Urban Renewal Law of the State of Colorado, Part 1 of Article 25 of Title 31, Colorado Revised Statutes, as amended. Unless otherwise stated, all capitalized terms herein shall have the same meaning as set forth in the **Act**.

Area or **Urban Renewal Area or Plan Area –** means the Highway 287 Urban Renewal Plan Area as depicted in Figure No. 1.

Authority – means Town of Erie Urban Renewal Authority (the **Authority**).

Base Amount – means that portion of *property taxes* which are produced by the levy at the rate fixed each year by or for each public body upon the valuation for assessment of taxable property in a **Tax Increment Area** last certified prior to the effective date of approval of the **Plan**; and, that portion of *municipal sales taxes* collected within the boundaries of the **Tax Increment Area** in the twelve-month period ending on the last day of the month prior to the effective date of approval of the **Plan**.

Comprehensive Plan – means the Town of Erie Comprehensive Plan, adopted 2005.

Cooperation Agreement – means any agreement between the **Authority** and the Town, or any public body (the term "public body" being used in this Plan as defined by the **Act**) respecting action to be taken pursuant to any of the powers set forth in the **Act** or in any other provision of Colorado law, for the purpose of facilitating public undertakings deemed necessary or appropriate by the **Authority** under this **Plan**.

Corridor – generally represents linear areas along major arterial streets and including commercial **corridor**s.

C.R.S. – means the Colorado Revised Statutes, as amended from time to time.

Impact Report – means the Highway 287 Urban Renewal Plan - Boulder County Impact Report prepared by RickerlCunningham, dated June 2015 and presented to the **Authority** under separate cover.

Plan or **Urban Renewal Plan** – means this Highway 287 Urban Renewal Plan (the **Plan**).

Project or Urban Renewal Project – for purposes of this plan, the **Project** includes any and all undertakings and activities within the **Plan Area** to remedy or prevent blighted conditions or otherwise achieve the goals of the **Plan**.

Redevelopment / Development Agreement – means one or more agreements between the **Authority** and developer(s) and / or property owners or such other individuals or entities as may be determined by the **Authority** to be necessary or desirable to carry out the purposes of this Plan.

Study Area – means the geographic area defined for the **Survey**.

Survey – means the Highway 287 Urban Renewal Plan Area Conditions Survey, prepared by RickerlCunningham, dated June, 2015 and presented to the **Authority** Board under separate cover.

Tax Increment – means that portion of property and / or municipal sales taxes in excess of the **Base Amount** set forth in Section 7.3.2 of this Plan allocated to and, when collected paid into the **Authority**'s **Tax Increment Revenue Fund**.

Tax Increment Areas – means one or more areas designated as a **Tax Increment Area**, as defined and pursuant to the procedures set forth in Section 6.12 of this Plan.

Tax Increment Finance (or Financing) (TIF) - means a financing mechanism which uses future revenues resulting from private investment within an established area (**Tax Increment Area**) to fund improvements for the public benefit.

Tax Increment Revenue Fund (and **Tax Increment Revenue)**- means a fund supervised by the **Authority** and the resources of which include incremental ad valorem property and municipal sales tax revenue resulting from investment and reinvestment in an established urban renewal area.

Town Board – means the **Town Board** of the Town of Erie.

3.0 Plan Purpose and Vision

The purpose of this Plan is to reduce, eliminate and prevent the spread of blight and to stimulate and catalyze growth and investment within the **Area** boundaries. To accomplish this purpose, the **Plan** is intended to promote local objectives expressed in adopted community plans and advance the priorities of the **Comprehensive Plan.** The Town of Erie's Comprehensive Plan was adopted in 2005. Presented below is an excerpt (taken verbatim) from that plan that describes its content and intentions for advancing a vision for the future of Erie. Additional excerpts are presented in Appendix A of this **Plan** and referenced in Section 5.0 below.

3.1 Plan Vision

Erie is a community which recognizes the importance of conserving and enhancing its historic small town character, the roots from which it grew, preserving the natural environment in which it resides; a caring community which offers its residents an environment in which to seek a high quality of life; a balanced community with a diverse range of housing, employment, educational, shopping and recreational opportunities; and a vital community which provides financial and social support for quality of life programs.

3.2. Plan Objective

The objective of this **Plan** is to alleviate conditions of blight by actively promoting investment and reinvestment within its commercial **corridor**s and to make financial resources available to assist its partners (private, public, non-profit and others) with addressing those conditions of blight identified herein, especially those that render undertakings or investment within its boundaries infeasible.

3.3 Plan Development and Design Objectives

All development in the **Area** shall conform to the zoning code and any site-specific zoning regulations or policies which might impact properties, all as are in effect and as may be amended from time to time. Although the **Act** authorizes the **Authority** to: undertake zoning and planning activities to regulate land use, establish maximum or minimum densities, and institute other building requirements in an urban renewal area, for the purpose of this **Plan**, the **Authority** anticipates that the Town will regulate land use and building requirements through existing municipal codes and ordinances.

General objectives include redevelopment of properties within the **Area** for the purpose of generating revenue sufficient to fund public improvements that address conditions of blight and facilitate investment. Specific objectives of the **Plan** include:

1. Eliminate and prevent blight by facilitating redevelopment.
2. Implement elements of the **Comprehensive Plan**.
3. Support and advance actions identified in existing plans related to development of vacant and under-utilized parcels that are consistent with the vision of this Plan.
4. Provide public infrastructure and make more efficient use of existing land.
5. Promote sustainability - development, fiscal, resource, etc.
6. Advance uses that can leverage public investment in planned improvements including multiple modes of transportation (vehicular and non-vehicular).
7. Enhance the public realm including streetscape amenities, trail connections and other pedestrian-friendly improvements in a manner consistent with the existing community character.
8. Encourage economic sustainability throughout the community and growth in appropriate locations.
9. Provide a range of financing mechanisms for improvements.
10. Provide additional opportunities for residential development to support commercial uses in the **Area**.
11. Support existing industry by encouraging a stronger jobs-housing balance.
12. Encourage growth and stability in local businesses.
13. Facilitate public-private partnerships.

3.4 Plan Implementation

As administrator of the **Plan**, the **Authority** will seek to advance the **Plan** objectives through the following if deemed necessary:

- Financing of redevelopment undertakings and activities and critical infrastructure; and
- Agreements with private, public and other partners to undertake redevelopment undertakings and activities.

The **Authority** will work in cooperation with the Town to advance objectives through:

- Investment in the public realm (roadway, parks, open space);
- Encouragement of development consistent with or exceeding existing standards;
- Provision of supportive programs to existing area businesses; and
- Judicious use of limited resources.

4.0 Blight Conditions

Before an urban renewal plan can be adopted by the Town, the **Area** must be determined to be a "blighted area" as defined in Section 31-25-103(2) of the **Act**, which provides that, in its present condition and use, the presence of at least four (or five in cases where the use of eminent domain is anticipated), of the following factors (see below) in the **Area**, substantially impairs or arrests the sound growth of the municipality, retards the provision of housing accommodations, or constitutes an economic or social liability, and is a menace to the public health, safety, morals, or welfare:

(a) Slum, deteriorated, or deteriorating structures;

(b) Predominance of defective or inadequate street layout;

(c) Faulty lot layout in relation to size, adequacy, accessibility, or usefulness;

(d) Unsanitary or unsafe conditions;

(e) Deterioration of site or other improvements;

(f) Unusual topography or inadequate public improvements or utilities;

(g) Defective or unusual conditions of title rendering the title nonmarketable;

(h) The existence of conditions that endanger life or property by fire or other causes;

(i) Buildings that are unsafe or unhealthy for persons to live or work in because of building code violations, dilapidation, deterioration, defective design, physical construction, or faulty or inadequate facilities;

(j) Environmental contamination of buildings or property;

(k.5) The existence of health, safety, or welfare factors requiring high levels of municipal services or substantial physical underutilization or vacancy of sites, buildings, or other improvements; or

(l) If there is no objection by the property owner or owners and the tenant or tenants of such owner or owners, if any, to the inclusion of such property in an urban renewal area, "blighted area" also means an area that, in its present condition and use and, by reason of the presence of any one of the factors specified in paragraphs (a) to (k.5) of Section 31-25-103(2), substantially impairs or arrests the sound growth of the municipality, retards the provision of housing accommodations, or constitutes an

economic or social liability, and is a menace to the public health, safety, morals, or welfare.

The general methodology for conducting the **Survey** is to: (i) define the **Study Area**; (ii) gather information about properties, infrastructure and other improvements within that **Study Area**; (iii) evaluate evidence of blight through field reconnaissance, review of aerial photography, discussions with representatives of various Town departments; and, (iv) record observed and documented conditions listed as blight factors in the **Act**.

Among the 11 qualifying factors identified in the **Act**, the Survey showed the presence of the following 7 blight factors in the **Study Area** which is the subject of this **Plan** and presented herein as Figure 1.

(b) Predominance of defective or inadequate street layout;

(c) Faulty lot layout in relation to size, adequacy, accessibility, or usefulness;

(d) Unsanitary or unsafe conditions;

(e) Deterioration of site or other improvements;

(f) Unusual topography or inadequate public improvements or utilities;

(g) Defective or unusual conditions of title rendering the title nonmarketable;

(k5) The existence of health, safety, or welfare factors requiring high levels of municipal services or substantial physical underutilization or vacancy of sites, buildings, or other improvements.

5.0 Plan Relationship to Other Community Documents

5.1 Plan Conformity

As supported by specific references presented herein, implementation of this Plan will further the objectives and requirements of the **Comprehensive Plan** with respect to development and redevelopment, particularly within the community's commercial corridors. In addition, as development occurs in the **Area**, it shall conform to the **Comprehensive Plan** and any subsequent updates, as well as any regulating documents including the current building code or other rules, regulations, and policies promulgated pursuant thereto. Any site-specific planning documents that might impact properties in the **Area** including, but not limited to Town-approved site, drainage, and public improvement plans; and, any applicable Town design standards, all as may be in effect and amended from time to time, will also be adhered to. Finally, conditions of blight

within the **Area** will be remedied by the **Plan** and redevelopment by private enterprise to the extent possible, but will need to first be identified as a priority investment by the **Authority** in consultation with the Town and affected property owners. It is the **Plan's** intent that public improvements will be phased as the market allows and funded in part by **Tax Increment Revenues**.

5.2 Consistency with the Comprehensive Plan

As explained earlier, a general plan for the Town, known as the Town of Erie Comprehensive Plan, was adopted in 2005. The **Authority**, with the cooperation of the Town, private enterprise and other public bodies, will engage in undertakings and activities described herein in order to eliminate the identified conditions of blight while also implementing the goals and objectives of the **Comprehensive Plan** and all other Town adopted plans which impact properties within the **Area**. Key goals and policies of that plan which this Highway 287 Urban Renewal Plan will advance are described in detail in Appendix A.

5.3 Correlation with Other Community Plans

Implementation of this Plan will be consistent with objectives expressed in all Town adopted and accepted plans that speak specifically to properties in the **Area.**

6.0 Authorized Authority Undertakings and Activities

Whereas the **Act** allows for a wide range of activities to be used in the implementation of an urban renewal plan, it is the **Authority**'s intent to provide both financial assistance and public improvements in partnership with property owners and other affected parties in order to accomplish the objectives stated herein. Public-private partnerships and other forms of cooperative development will be essential to the **Authority's** strategy for preventing the spread of blight and eliminating existing blighting conditions. Specific undertakings of the **Authority** in the furtherance of this Plan are described as follows.

6.1 Complete Public Improvements and Facilities

The **Authority** may, or may cooperate with others to, finance, install, construct, and reconstruct any public improvements. Additionally, the **Authority** may, or may cooperate with others to, demolish and clear existing improvements for the purpose of promoting the objectives of the **Plan** and the **Act**.

While public improvements or investment should, whenever possible, stimulate (directly and indirectly) desired private sector investment, it is the intent of this Plan that the combination of public and private investment that occurs in the **Area** will contribute to the overall economic well-being of the community at-large.

As described in Section 4.0 of this Plan, 7 qualifying conditions of blight, as defined in Section 31-25-103(2) of the **Act**, are evident in the **Area**. This Plan proposes to remedy those conditions by providing certain public improvements and facilities, including, but not limited to the following:

(b) Predominance of defective or inadequate street layout: road and parking area repairs; paving; gateway and driveway construction; and, safety improvements;

(c) Faulty lot layout in relation to size, adequacy, accessibility, or usefulness: improved access; and, property assemblage (if necessary);

(d) Unsanitary or unsafe conditions: enhanced lighting on public rights-of-way; parking lot construction; completion of pedestrian improvements; and, any required off-site improvements deemed reasonable and for the public benefit including drainage;

(e) Deterioration of site or other improvements: signage repairs and construction; landscaping; and, roadway surface improvements;

(f) Unusual topography or inadequate public improvements or utilities: on-site and off-site infrastructure improvements as approved by the **Authority**; sidewalk and complete street construction activities; and, improved curbs and gutters;

(g) Defective or unusual conditions of title rendering the title nonmarketable: acquisition and relocation of utility easements;

(k5) The existence of health, safety, or welfare factors requiring high levels of municipal services or substantial physical underutilization or vacancy of sites, buildings, or other improvements: property development and redevelopment.

6.2 Complete Other Improvements and Facilities

To the extent that non-public improvements in the **Area** may be required to accommodate development and redevelopment and still benefit the public, the **Authority** is hereby authorized to assist in the financing or construction of such improvements to the extent authorized by the **Act**.

6.3 Promote Development and Redevelopment

A key concept associated with implementation of the **Plan** is targeted investment that will serve to catalyze development throughout the **Area** and fund future public improvements. The potential impact of this investment to Boulder County is quantified in the Highway 287 Urban Renewal Plan – Boulder County Impact Report presented to the **Authority** Board under separate cover.

6.4 Adopt Standards

As stated earlier, all development in the **Area** shall conform to applicable rules, regulations, policies, other requirements, and standards of the Town, along with any other governmental entity which has jurisdiction in the **Area**. While the **Act** allows for the adoption of standards and requirements applicable to activities undertaken in an urban renewal area, in the context of this **Plan**, it is the **Authority's** intention that investment in the **Area** conform to Town-approved documents.

6.5 Modify the Plan

The **Authority** may propose, and the **Town Board** may make, modifications to this Plan as may be necessary provided they are consistent with the **Comprehensive Plan** and any subsequent updates. Additionally, any such amendments made in accordance with this Plan and as otherwise contemplated, must also be compliant with the **Act**. Finally, the **Authority** may, in specific cases, allow non-substantive variations from the provisions of this Plan if it determines that a literal enforcement of the provision would constitute an unreasonable limitation beyond the intent and purpose stated herein.

6.6 Review the Plan

The ongoing review process for the **Plan** is intended to provide a mechanism to allow those parties responsible for administering and implementing key activities within its boundaries to periodically evaluate its effectiveness and make adjustments to ensure efficiency in implementing these activities. To this end, the following steps are presented to serve as a guide for future **Plan** review:

(a) The **Authority** may propose modifications, and the **Town Board** may make such modifications as may be necessary provided they are consistent with **the Comprehensive Plan** and any subsequent updates, as well as the **Act**.

(b) Modifications may be developed from suggestions by the **Authority**, property and business owners, and Town staff operating in support of the **Authority** and advancement of this Plan.

6.7 Provide Relocation Assistance

While it is not anticipated as of the date of this Plan that acquisition of real property will result in the relocation of any individuals, families, or business concerns; if such relocation becomes necessary, the **Authority** will adopt a relocation plan in conformance with the **Act**.

6.8 Demolish, Clear and Prepare Improvements

While not anticipated as of the date of this Plan, the **Authority** may, on a case-by-case basis, elect to demolish or cooperate with others to clear buildings, structures and other improvements within the **Area** in an effort to advance activities and undertakings deemed consistent with the vision stated herein. Additionally, existing Development or **Cooperation Agreements** may require such demolition or site clearance to eliminate unhealthy, unsanitary, and unsafe conditions; obsolete uses deemed detrimental to the public welfare; and, otherwise remove and prevent the spread of deterioration.

6.9 Acquire and Dispose of Property

While the **Act** allows for the acquisition of property by negotiation or any other method, it is not the intent of this Plan that the **Authority** uses its resources to acquire property by eminent domain. Further, while the urban renewal law permits acquisition by eminent domain, within this **Plan Area**, any decisions considering the use of eminent domain will be made by the Erie **Town Board**. Properties acquired by entities other than the **Authority** may temporarily be operated, managed and maintained by the **Authority** if requested to do so by the acquiring entity and deemed in the best interest of the **Urban Renewal Project** and the **Plan**. Such property shall be under the management and control of the **Authority** and may be rented or leased pending its disposition for redevelopment.

The **Authority** may sell, lease, or otherwise transfer real property or any interest in real property subject to covenants, conditions and restrictions, including architectural and design controls, time restrictions on development, and building requirements in accordance with the **Act** and this Plan.

6.10 Enter Into Redevelopment / Development Agreements

The **Authority** may enter into **Redevelopment / Development Agreements** or other contracts with developer(s) or property owners or such other individuals or entities determined to be necessary to carry out the purposes of this **Plan**. Further, such Agreements, or other contracts, may contain terms and provisions deemed necessary or appropriate for the purpose of undertaking the activities contemplated by this Plan and the **Act**. Any existing agreements between the Town and private parties that are consistent with this **Plan** are intended to remain in full force and effect, unless all parties to such agreements agree otherwise.

6.11 Enter Into Cooperation Agreements

For the purpose of this Plan, the **Authority** may enter into one or more **Cooperation Agreements** pursuant to the **Act**. Whereas the Town and the **Authority** recognize the need to cooperate in the implementation of this Plan, these **Cooperation Agreements** may include without limitation the planning, financing, installation, construction and / or reconstruction of public or other eligible improvements. This paragraph shall not be construed to require any particular form of cooperation.

6.12 Create Tax Increment Areas

The boundaries of the **Urban Renewal Area** shall be as set forth in Section 1.4 and illustrated in Figure 1. It is the intent of the **Town Board** in approving this **Plan** to authorize the use of **Tax Increment Financing** by the **Authority** as part of its efforts to advance the vision, objectives and activities described herein. Pursuant to the provisions of Section 31-25-107(9) of the **Act**, the **Town Board** in approving this **Plan** further contemplates that one or more **Tax Increment Areas** may be created within the **Urban Renewal Area** as development occurs. Notwithstanding such distinction, the **Authority** is specifically authorized to expend the revenue from **Property and Sales Tax Increments** to the extent authorized by the **Act** and this **Plan**.

While this Highway 287 Urban Renewal Plan contemplates that the primary method of assisting with financing eligible expenses in the **Area** will be through the use of **Property Tax Increment** revenue, the **Town Board** may allocate **Municipal Sales Tax Increments** if requested to do so by the **Authority** and only after receipt of a financing plan outlining the proposed amounts and purpose for which the **Municipal Sales Tax Increment** is to

be used. As such, the use of **Sales Tax Increment** is hereby authorized pursuant to Section 31-25-107 (9), **C.R.S.**, which is by this reference incorporated herein as if set forth in its entirety, but any such pledge of **Sales Tax Increment** by the **Authority** in a **Development** or **Redevelopment Agreement** shall not be authorized until a separate **Cooperation Agreement** between the **Authority** and the Town setting forth the allocation of **Incremental Sales Taxes** between the Town and the **Project**. The approval of such **Cooperation Agreement** by the Town and the **Authority** is hereby found by the Town not to be a substantial modification of the **Urban Renewal Plan**, and is not an addition of a new **Urban Renewal Project**, does not alter the boundaries of the **Plan Area**, does not change the mill levy or sales tax component of the **Plan** (up to 100% of the **Sales Tax Increment** being hereby authorized by the **Plan**), and is not an extension of the **Plan** or the duration of a specific **Urban Renewal Project**, regardless of when such **Cooperation Agreement** may be approved. The entire **Plan Area** is hereby designated as a single **Tax Increment Area**.

7.0 Project Financing

7.1 Public Investment Objective

A critical component to the success of any urban renewal strategy is participation by both the public and private sectors. Leveraging of resources will be key, as no one entity, either public or private, has sufficient resources alone to sustain a long-term improvement effort. Possible public infrastructure investments may include, but will not be limited to completing: pedestrian improvements including construction of sidewalks, street lights and other design enhancements intended to improve safety for vehicular and non-vehicular movement; roadway improvements including curbs, gutters, and drainage infrastructure; and, utilities under the authority of the Town; as well as, providing financial assistance for expenses considered eligible under the **Act**.

7.2 Financial Mechanisms

The **Authority** may finance undertakings pursuant to this Plan by any method authorized under the **Act** or any other applicable law, including without limitation of the following: issuance of notes, bonds and other obligations as defined in the **Act** in an amount sufficient to finance all or part of this Plan; borrowing of funds and creation of indebtedness; reimbursement agreements; and / or utilization of the following: federal or state loans or grants; interest income; annual appropriation agreements; agreements with public or private entities; and loans, advances and grants from any other available

sources. The principal, interest, costs and fees on any indebtedness are to be paid for with any lawfully available funds of the **Authority**.

Debt may include bonds, refunding bonds, notes, interim certificates or receipts, temporary bonds, certificates of indebtedness, or any other obligation lawfully created.

7.3 Tax Increment Financing

Activities may be financed by the **Authority** under the **Tax Increment Financing** provisions of the **Act**. Such **Tax Incremental Revenues** may be used for a period not to exceed the statutory requirement, which is presently twenty-five (25) years after the effective date of the **Plan** adoption which authorizes and creates the **Tax Increment Area**.

7.3.1 Special Fund

In accordance with the requirements of the law, the **Authority** shall establish a **Tax Increment Revenue Fund** for the deposit of all funds generated pursuant to the division of ad valorem property and municipal sales tax revenue described in this section.

7.3.2 Base Amount

The **Base Amount** includes that portion of the property taxes which are produced by the levy at the rate fixed each year by or for each public body upon the valuation for assessment of taxable property in the **Tax Increment Area** last certified prior to the effective date of approval of the **Plan** (or future modifications); and, that portion of municipal sales taxes collected within the boundaries of the **Tax Increment Area** in the twelve-month period ending on the last day of the month prior to the effective date of approval of the **Plan** and paid to the public body, as are all other taxes collected by or for said public body.

7.3.3 Incremental Revenues

Incremental revenues including that portion of said property, and if authorized by **Town Board, Municipal Sales Taxes** in excess of the **Base Amount** set forth in

Section 7.3.2 above shall be allocated to and, when collected, paid into the **Authority**'s **Tax Increment Revenue Fund**. The **Authority** may use these funds to pay the principal of, the interest on, and any other premiums due in connection with the bonds of, loans or advances to, or indebtedness incurred (whether funded, refunded, assumed, or otherwise) by the **Authority**, for financing or refinancing, in whole or in part, any portion of an **Urban Renewal Project** considered eligible under the **Act**. Unless and until the total valuation for assessment of the taxable property in any **Tax Increment Area** exceeds the base valuation, all of the taxes levied upon taxable property in the **Tax Increment Area** shall be paid into the funds of the respective public bodies. Also, when such bonds, loans, advances and indebtedness, including interest thereon and any premiums due in connection therewith, have been paid, all taxes upon the same taxable property shall be paid to the respective public bodies.

Further, the incremental portion of said taxes, as described in this subsection 7.3.3, may be irrevocably pledged by the **Authority** for the payment of, principal and interest on, and any premiums due in connection with such bonds, loans, advances and / or indebtedness incurred by **Authority** to finance an **Urban Renewal Project** (as defined in the **Act**); except:

(a) Any offsets collected by the County Treasurer for return of overpayments or any funds reserved by the **Authority** for such purposes in accordance with Section 31-25-107(9)(a)(III) and (b), **C.R.S.**

(b) Any reasonable (as determined by the **Authority**) set-asides or reserves of incremental taxes paid to the **Authority** for payment of expenses associated with administering the **Plan**.

If there is any conflict between the **Act** and this **Plan**, the provisions of the **Act** shall prevail, and the language in the **Plan** automatically deemed to conform to the statute.

7.4 Other Financing Mechanisms / Structures

The **Plan** is designed to provide for the use of **Tax Increment Financing** as one tool to facilitate investment and reinvestment within the **Area**. However, in addition to **Tax Increment Financing**, the **Authority** shall be authorized to finance implementation of the **Plan** by any method authorized by the **Act**. The **Authority** is committed to making a

variety of strategies and mechanisms available which are financial, physical, market and organizational in nature. It is the intent of this Plan to use the tools either independently or in various combinations. Given the obstacles associated with redevelopment, the **Authority** recognizes that it is imperative that solutions and resources be put in place which are comprehensive, flexible and creative. Finally, the **Authority** may contract with the Town to administer various incentives.

8.0 Severability

If any portion of this Plan is held to be invalid or unenforceable, such invalidity will not affect the remaining portions of the **Plan**.

Highway 287 Urban Renewal Plan

Town of Erie, Colorado

Appendix A:

Town of Erie Comprehensive Plan, adopted 2005 (taken verbatim)

Chapter 2: Vision and Guiding Principles

Vision Statement

Erie is a community which recognizes the importance of conserving and enhancing its historic small town character, the roots from which it grew, preserving the natural environment in which it resides; a caring community which offers its residents an environment in which to seek a high quality of life; a balanced community with a diverse range of housing, employment, educational, shopping and recreational opportunities; and a vital community which provides financial and social support for quality of life programs.

Guiding Principles

Quality Design and Development

Erie will promote a high standard of design for all new development, renovation, and rehabilitation to reinforce and enhance its unique nature for residential neighborhoods, public places, and commercial businesses.

Balanced Land Use Mix

The Town will work to diversify and balance the mix of land uses as the Town grows. Particular emphasis will be placed on enhancing the local economic base to provide employment opportunities for residents, seeking to achieve a better balance as a place to work as well as live. In so doing, the community will seek a balance between the enhancement of Old Town's vitality and other existing areas of the community and the identification of opportunities for commercial and employment in outlying areas.

Chapter 3: Community Building Blocks

The following principles embody the community's vision for its future neighborhoods:

Activity Centers

- Each neighborhood should include an activity center for its residents. Activity centers may include a mix of commercial development, parks, open space, and other community facilities, where appropriate, to serve the needs of neighborhood residents. Larger, commercially-oriented activity centers may serve more than one neighborhood.
- Activity centers should be designed to be connected to adjacent neighborhoods with streets and sidewalks.

Mixed-Use Developments

The Land Use Plan (Chapter 4) includes a new land use category to accommodate Mixed-Use Development. At a general level these mixed-uses areas are similar in that they are intended to contain a variety of activities, such as offices, retail, and multiple housing types. They differ, however, in that the scale and configuration of development will vary by its location and development context (i.e., Old Town infill / redevelopment vs. new development). Common principles for mixed-use development include:

Mix of Uses

- Depending upon their location and scale, primary uses for mixed-use development areas may include commercial, office, retail, and / or housing. However, more active uses such as retail and commercial should be placed at the ground level to provide pedestrian interest. Where activity uses are limited, they should be concentrated at key intersections or new major public spaces to maximize public exposure and increased activity levels.

- Both vertical (stacked) and horizontal (side-by-side) mixed-use is encouraged in Erie provided it is well-connected to surrounding neighborhoods.

Gateways and Corridors

- Erie has an opportunity to establish distinct entryways to the community along its major gateway corridors. This opportunity is most evident along Leon A. Wurl (WCR 8) and Highway 52, where development to-date has been limited, but is anticipated on the Future Land Use Map. Other gateway corridor, including County Line Road (north and south), Baseline Road (Highway 7), and Arapahoe Road, have a character that is fairly well established either through existing open space or existing development patterns.

- Future development in any of the Town's gateway corridors should be designed with the following principles in mind:
  View Corridors

  - Development setbacks should be established along gateway corridors to preserve site lines and reduce visual impacts of development. Signage along the Town's gateway corridors should be

limited to low profile monument signs designed as part of a larger development scheme and should be consolidated for larger developments to minimize clutter.

Development Quality / Relationship to the Corridor

- Development setbacks should be landscaped to buffer development, to help preserve key view corridors, to provide an inviting environment for pedestrians, and to establish a consistent character.
- Development should be oriented towards the gateway corridor, providing a high level of architectural detailing and entrances for pedestrians.
- Buildings located at major intersections should be brought closer to the street and to anchor corners and to help form a gateway into adjoining neighborhoods.
- Parking, loading areas, and other unsightly uses should be located away from the gateway corridor where possible and should be fully screened using a combination of landscaping, berming and / or decorative fencing.

Economic Sustainability

- Employment opportunities and commercial services within Erie are currently very limited. The Town recognizes that expanding opportunities for employment and commercial development is important to enhance tax revenues generated in the Town, as well to reduce the need for residents to travel to neighboring communities to work, shop, and meet other daily needs. The Town also recognizes that attracting significant commercial and employment development will be challenging given the high volume of competition from neighboring Front Range communities. In light of these challenges, the Plan seeks to achieve economic sustainability over time by placing an emphasis on each of the community building blocks highlighted in this Chapter as follows:

  - the creation of high-quality residential neighborhoods;
  - encouraging a more mixed-use patter of development that allows the integration of commercial and employment uses on a smaller scale;
  - establishing a high-quality pattern of development along the community's major gateway corridors; and
  - protecting the community's rural character as a unique aspect of its appeal.

Together, these objectives will allow Erie to grow into a community that will be attractive to future commercial and employment development which opportunities arise.

Chapter 4: Land Use

Goal #1: Balanced Land Use Mix

Plan for a balanced mix of commercial and residential land uses in Erie.

High Density Residential Policies

HDR 1.1 - CHARACTERISTICS
The High Density Residential designation accommodates higher-intensity residential housing types, such as apartments, townhomes and condominiums, combined with complementary residential and non-residential land uses, such as single family attached and detached homes, retail, commercial, and office uses. Mixed-use buildings may also be appropriate, provided that they are designed in scale with other uses in the development area. Schools, places of worship, and other civic uses are also appropriate. Developments generally have shared parking and recreational facilities. Site design should allow for convenient access to work, service, and leisure destinations and should encourage the use of alternative modes of travel.

HDR 1.2 - DENSITY RANGE
High Density Residential neighborhoods typically have a gross density of 12 to 20 dwelling units per acre to allow for a variety of housing types; however, gross densities will not atypically exceed 16 dwelling units / acre.

HDR 1.2 - LOCATION
High Density Residential uses are typically located near intersections of arterials and collector streets, but may also be used to provide a transition between commercial or employment areas and lower density neighborhoods. High density neighborhoods should not be located in settings where the only access provided consists of local streets passing through lower density neighborhoods.

Mixed-Use Policies

MU 1.1 - CHARACTERISTICS
Mixed-Use development provides a mix of residential, commercial, retail and office uses in a compact, pedestrian-oriented environment. These uses should incorporate pedestrian-friendly design elements through management of location, scale and orientation of parking facilities, driveways, connective sidewalks and trails, public plazas, and storefronts. New surface parking should be located to the side or rear of structures and screened with a low masonry wall and landscaping.

MU 1.2 - LOCATION
Mixed-Use development may be located near the intersections of arterials and collector streets, but may also be used to provide a transition between commercial or employment centers and residential neighborhoods. It is also encouraged along the Briggs and Cheesman Street Corridors in downtown.

MU 1.2 - INTEGRATION OF USES
Mixed-Use development can occur in two primary configurations - Vertical Mixed-Use or Horizontal Mixed-Use. Vertical Mixed-Use refers to the integration of two or more land use types within a building, occurring on different floors. A typical example of a vertical mixed-use building would incorporate active uses, such as stores and restaurants, at the street level and residential or office uses on the upper floors. Horizontal mixed-use refers to a pattern where several types of uses or buildings are included, as part of a cohesive development in proximity to each other - but each building would contain its own

separate use. Either pattern should be designed as a set of coordinated uses, with common off-street parking areas, strong pedestrian connections, and similar design features.

MU 1.2 - GATEWAY CORRIDORS
Mixed-Use development located along an identified gateway corridor will be subject to additional development standards as specified in Policy CCD 1.5, Community Character and Design.

Commercial

C 1.1 - CIRCULATION AND ACCESS
Clear, direct pedestrian connections should be provided through parking areas to building entrances and to surrounding neighborhoods or streets. Integrate main entrances or driveways with the surrounding street network to provide clear connections between uses for vehicles, pedestrians and bicycles.

C 1.2 - PARKING DESIGN AND LOCATION
Uninterrupted expanses of parking should be avoided. Parking areas should be broken into smaller blocks divided by landscaping and pedestrian walkways that are physically separated from vehicular drive isles. Parking areas should be distributed between the front and sides of buildings, or front and rear, rather than solely in front of buildings to the maximum extent feasible. Parking facilities should also promote safe pedestrian, bike and public transit modes of transportation through appropriate placement of landscaped islands and facilities.

C 1.3 - ARCHITECTURAL CHARACTER
Commercial centers shall be required to meet design standards for commercial development as specified in the Unified Development Code to address the compatibility with surrounding areas and mitigation of negative visual impacts such as uninterrupted wall planes, parking areas, and service and loading areas. While design standards will apply to all Community Commercial development, they are particularly important to consider for larger footprint retail buildings, or "big-box? stores. Standards address such features such as:

- Facade and exterior wall plane projections or recesses;
- Arcades, display windows, entry areas, awnings, or other features along facades facing public streets;
- Location, distribution and screening of parking
- Building facades with a variety of detail features (materials, colors and patterns);
- Location and screening of mechanical equipment; and
- High-quality building materials.

C 1.4--GATEWAY CORRIDORS
Commercial centers located along an identified gateway corridor will be subject to additional development standards as specified in policy CCD 1.5, Community Character and Design.

Regional Commercial Policies

RC 1.1--CHARACTERISTICS
Regional Commercial centers provide more intense retail and employment designed to serve the community or region, including general retail, retail with outdoor storage, "big box" retail centers, office campuses, and regional malls. Retail centers typically serve a market radius of 25 miles or greater. Sites will typically range between 20 and 50 acres in size and have Gross Leasable Areas ranging from 250,000 to more than 500,000 square feet. Given the importance of access and volume of traffic, Regional Commercial developments should incorporate connectivity in parking facilities to minimize ingress-egress traffic impact on arterial and collector streets.

Community Commercial Policies

CC 1.1--CHARACTERISTICS
Community Commercial centers provide a mix of general retail (e.g., grocery stores, larger retailers) and commercial services in a concentrated and unified setting that serves the local community. These centers typically have a Gross Leasable Area of between 100,000 and 250,000 square feet and generally range between 10 and 20 acres in size.

CC 1.1--LOCATION
Community Commercial centers should be located at the intersection of one or more major arterial streets. They may be located adjacent to urban residential neighborhoods and may occur along primary highway corridors as existing uses become obsolete and are phased out and redeveloped over time. Large footprint retail buildings (often known as "big-box" stores) shall only be permitted where adequate access can be provided.

Chapter 14: Economic Development

Background and Intent

Employment opportunities and commercial services within Erie are currently very limited. The Town recognizes that expanding opportunities for employment and commercial development is important to enhance tax revenues generated in the Town as well to reduce the need for residents to travel to neighboring communities to work, shop, and meet other daily needs.

Goal #1: Diverse Economic Base

Expand and diversify the Town's economic base to create primary jobs as well as retail opportunities, in order to increase the Town's fiscal capacity to meet the needs of its citizens.

ED 1.2 - APPROPRIATE AREAS FOR COMMERCIAL AND EMPLOYMENT USES
The Future Land Use Plan map establishes appropriate locations for employment and commercial uses. In addition, the Town will develop criteria to determine appropriate locations for neighborhood commercial development. Criteria area intended to provide for flexibility in citing and design, resulting

in a mixed-use development pattern that encourages commercial and employment uses to occur as part of the Town's neighborhood fabric.

Chapter 14: Economic Development

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Highway 287 Urban Renewal Plan

Town of Erie, Colorado

Appendix B:

Highway 287 Urban Renewal Area Legal Description

EHRHART
LAND SURVEYING

EXHIBIT A

August 5, 2015

PROPERTY DESCRIPTION

A PARCEL OF LAND SITUATUED IN THE NORTH HALF OF SECTION 34 OF AND THE SOUTHEAST QUARTER OF SECTION 27, TOWNSHIP 1 NORTH, RANGE 69 WEST OF THE 6TH PRINCIPAL MERIDIAN, COUNTY OF BOULDER, STATE OF COLORADO, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTH QUARTER CORNER OF SAID SECTION 34; THENCE N00°13'14"W ALONG THE CENTERLINE OF SAID SECTION 27 A DISTANCE OF 210.06 FEET TO A POINT ON THE NORTH LINE OF PROPERTY DESCRIBED IN ARAPAHOE ROAD ANNEXATION NO. 1 RECORDED SEPTEMBER 4, 1997 AT RECEPTION NO. 1727895; THENCE ALONG SAID NORTH LINE FOR THE FOLLOWING THREE (3) COURSES: 1) N87°36'00"E A DISTANCE OF 810.25 FEET; 2) S50°58'00"E A DISTANCE OF 340.72 FEET; 3) S89°58'00"E A DISTANCE OF 620.97 FEET; THENCE S00°00'21"W A DISTANCE OF 499.87 FEET; THENCE N89°58'08"W A DISTANCE OF 252.20 FEET; THENCE S00°01'03"E A DISTANCE OF 846.38 FEET TO THE NORTH LINE OF A REPLAT OF BEACON HILL SUBDIVISION RECORDED MARCH 17, 1982 AT RECEPTION NO. 487195; THENCE S89°54'45"W ALONG SAID NORTH LINE A DISTANCE OF 1442.71 FEET TO A POINT ON THE EAST LINE OF ANNEXATION BY THE CITY OF LAFAYETTE RECORDED MAY 2, 1989 AT RECEPTION NO. 980491; THENCE ALONG SAID EAST LINE FOR THE FOLLOWING TWO (2) COURSES: 1) N00°22'04"W A DISTANCE OF 648.33 FEET; 2) N00°22'13"E A DISTANCE OF 26.98 FEET; THENCE ALONG THE BOUNDARY OF ANNEXATION BY THE TOWN OF ERIE RECORDED AUGUST 15, 1994 AT RECEPTION NO. 1454442 FOR THE FOLLOWING FOUR (4) COURSES: 1) N68°59'17"W A DISTANCE OF 20.09 FEET; 2) N54°14'17"W A DISTANCE OF 670.00 FEET; 3) N06°30'43"E A DISTANCE OF 254.00 FEET; 4) S89°14'17"E A DISTANCE OF 538.00 FEET TO THE **POINT OF BEGINNING**;

CONTAINING 2,512,547 SQUARE FEET OR 57.680 ACRES, MORE OR LESS.

_____

John P. Ehrhart, PLS
Colorado PLS 29414

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TOWN OF ERIE
PLANNING COMMISSION MEETING
September 16, 2015

SUBJECT: Four Corners Area Urban Renewal Plan

PURPOSE: Planning Commission to make finding that the Four Corners Area Urban Renewal Plan (Four Corners Area Plan) is in conformance with the Town's Comprehensive Master Plan.

LOCATION: See map in Four Corners Area Plan

URA CONSULTANT:
Anne Ricker
Ricker | Cunningham
8200 South Quebec Street, Suite A3-104
Centennial, CO 80112

URA LEGAL COUNSEL:
Carolynne White, Esq.
Brownstein | Hyatt | Farber | Schreck, LLP
410 Seventeenth Street, Suite 2200
Denver, CO 80202

DEPARTMENT:
Community Development
R. Martin Ostholthoff, Community Development Director

REQUEST: Consideration of Resolution P15-29, a Resolution finding the Four Corners Area Plan to be in conformance with the Town of Erie Comprehensive Master Plan.

STAFF RECOMMENDATION

Staff recommends that the Planning Commission finds the Four Corners Area Plan in conformance with the Town of Erie Comprehensive Master Plan by approving Resolution P15-29.

SUMMARY AND BACKGROUND OF SUBJECT MATTER

The Town of Erie formed an Urban Renewal Authority (URA) in 2011 pursuant to Title 31 of the Colorado Revised Statutes when the Board of Trustees accepted the February 2012 Town of Erie – Survey of Conditions. The survey indicated that factors contributing to blight are present; and secondly, enough factors were present in the surveyed areas to create a URA. The general purpose of the URA is to reduce, eliminate or prevent the spread of blight within a defined area and to stimulate growth and investment within said area.

After creation of the URA the next step is to create Urban Renewal Plans that outline the general scope of the plan under consideration for a defined area as identified in the Survey of Conditions.

The plan being brought forward at this time is the Four Corners Area Plan, attached hereto as Attachment B. Prior to the URA approving the Four Corners Area Plan, state statute requires that the Planning Commission review and make a recommendation on the conformity of the Four Corners Area Plan to the Town of Erie Comprehensive Master Plan.

Approved by:

R. Martin Ostholthoff
Community Development Director

ATTACHMENTS:

A. Resolution No. P15-29
B. Four Corners Area Urban Renewal Plan

ATTACHMENT A

RESOLUTION NO. P15-29

A RESOLUTION OF THE PLANNING COMMISSIONERS OF THE TOWN OF ERIE FINDING THAT THE URBAN RENEWAL PLAN FOR THE FOUR CORNERS AREA IS IN CONFORMANCE WITH THE TOWN OF ERIE COMPREHENSIVE PLAN

WHEREAS, Section 31-23-206 C.R.S. directs the Planning Commission of each town to prepare and submit a master plan for the physical development of the Town; and

WHEREAS, the Commission and Town Board have previously adopted the Town of Erie Comprehensive Plan for the Town, most recently updated and effective as of March 20, 2015; and

WHEREAS, Section 31-25-107(2), C. R. S., requires an urban renewal plan to be submitted to the Planning Commission for review and recommendation as to its conformity to the general plan for the development of the municipality as a whole, and submit written recommendations if any prior to approval of the plan; and

WHEREAS, the Public Hearing for the Four Corners Area Urban Renewal Plan is set for September 22, 2015 at 6:30 p.m.

NOW, THEREFORE, BE IT RESOLVED BY THE PLANNING COMMISSION OF THE TOWN OF ERIE, COLORADO:

1. The Planning Commission finds that the Four Corners Area Urban Renewal Plan is in conformity with the Erie Comprehensive Plan and recommends approval of the Four Corners Area Urban Renewal Plan by the Town Board of Trustees.

MOVED, SECONDED AND ADOPTED BY THE TOWN OF ERIE PLANNING COMMISSION THIS 16th DAY OF SEPTEMBER, 2015.

PLANNING COMMISSION
TOWN OF ERIE, COLORADO

_____
J. Eric Bottenhorn, Chairman

ATTEST:

_____
Hallie S. Sawyer, Secretary

ATTACHMENT B

Four Corners Urban Renewal Plan

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Four Corners Urban Renewal Plan

Town of Erie, Colorado

1.0 Introduction

1.1 Preface

This Four Corners Urban Renewal Plan (the "**Plan**" or the "**Urban Renewal Plan**") has been prepared for the Town of Erie ("Town"). It will be carried out by the Town of Erie Urban Renewal Authority (the "**Authority**" or "**TOEURA**"), pursuant to the provisions of the Urban Renewal Law of the State of Colorado, Part 1 of Article 25 of Title 31, Colorado Revised Statutes, 1973, as amended (the "**Act**"). The administration and implementation of this Plan, including the preparation and execution of any documents implementing it, shall be performed by the **Authority**.

1.2 Blight Findings

Under the **Act**, an urban renewal area is a blighted area, which has been designated as appropriate for an **Urban Renewal Project**. In each urban renewal area, conditions of blight, as defined by the **Act**, must be present, and in order for the **Authority** to exercise its powers, the **Town Board** must find that the presence of those conditions of blight, "substantially impairs or arrests the sound growth of the municipality or constitutes an economic or social liability, and is a menace to the public health, safety, morals or welfare."

The Four Corners Urban Renewal Plan Area Conditions Survey (the "**Survey**"), prepared by RickerlCunningham, dated July, 2015, and presented to the **Authority** under separate cover, demonstrates that the Four Corners Area (the "**Area**"), as defined in the **Survey** (therein referred to as the "**Study Area**"), is a blighted area under the **Act**.

1.3 Other Findings

The **Area**, as described in more detail in Section 1.4 below, will be eligible for one or more urban renewal activities and undertakings authorized by the **Act** to be advanced by the **Authority**. To this end, it is the intent of the **Town Board** in adopting this Plan

that the **Authority** has available to it any and all powers authorized in the **Act** which are necessary and appropriate to accomplish the objectives stated herein. Further, it is the intent of this Plan that the **Authority** exercises these powers for the elimination of qualifying blighting conditions in the **Area** and furtherance of the goals and objectives of the community's general plan. Because powers conferred by the **Act** are intended to advance improvements for which public money may be expended, the intent of this Plan is considered to be in the public interest and a necessity -- such finding being a matter of legislative determination by the **Town Board**.

1.4 Urban Renewal Area Boundaries

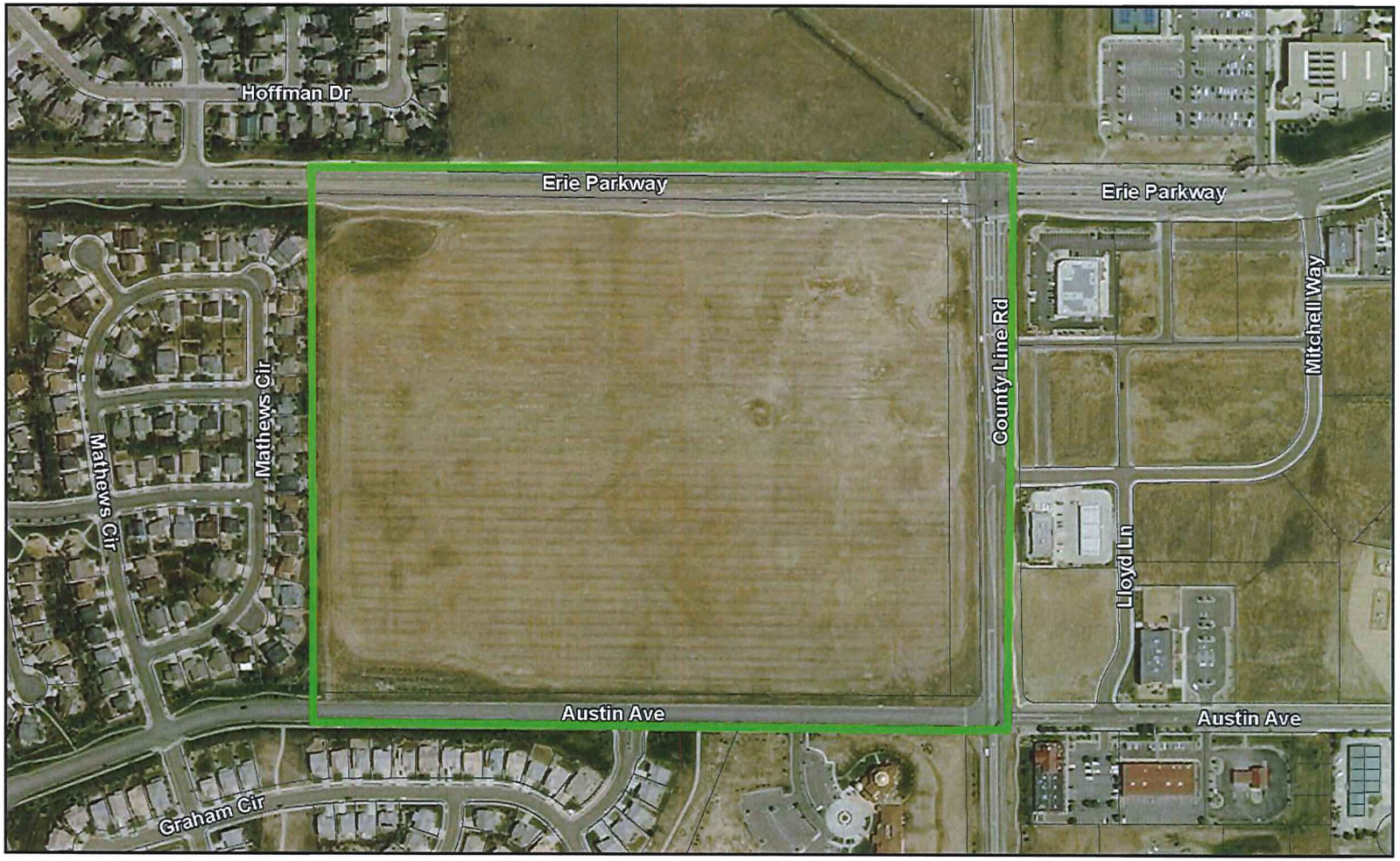
The **Area** includes one legal parcel comprising approximately 45.8 acres and adjacent rights-of-way, located in the southwest quadrant of Erie Parkway and East County Line Road in the town of Erie and Boulder County, Colorado and the parcel owned by the Colorado company, Erie Commercial Venture LLP. The sole property located within the **Area**'s boundaries is zoned Planned Development (PD); and, envisioned for development of a variety of uses allowed within the Community Commercial and Mixed-Use categories as reflected in the Land Use Map presented in the Town of Erie 2005 Comprehensive Plan. Principal land uses and associated permitted uses identified in the Canyon Creek PD Amendment No. 8 are referred to as Business Commercial (BC) and Commercial / Business / Retail (CBR), neither of which is allowed under the current zoning.

1.5 Public Participation

The **TOEURA** will consider the **Plan** on September 22, 2015 at a regular meeting of the **Authority**. The sole property owner waived its right to receive notice of the public hearing for consideration of the **Plan** because the urban renewal designation is being pursued voluntarily. The hearing notice did, however, as required by the **Act**, appear in the Colorado Hometown Weekly, the community's designated legal newspaper of general circulation.

The Planning Commission will review the **Plan** on September 16, 2015 and found that it is consistent with the Town's **Comprehensive Plan,** adopted 2005.

Figure No. 1: Four Corners Urban Renewal Plan Area



Four Corners Urban Renewal Plan (8.20.2015)

2.0 Definitions

Act – means the Urban Renewal Law of the State of Colorado, Part 1 of Article 25 of Title 31, Colorado Revised Statutes, as amended. Unless otherwise stated, all capitalized and bolded terms herein shall have the same meaning as set forth in the **Act**.

Area or **Urban Renewal Area** – means the Four Corners Urban Renewal Plan Area as depicted in Figure No. 1.

Authority – means the Town of Erie Urban Renewal Authority (the **Authority**).

Base Amount – means that portion of *property taxes* which are produced by the levy at the rate fixed each year by or for taxing entities upon the valuation for assessment of taxable property in a **Tax Increment Area** last certified prior to the effective date of approval of the **Plan**; and, that portion of *municipal sales taxes* collected within the boundaries of the **Tax Increment Area** in the twelve-month period ending on the last day of the month prior to the effective date of approval of the Plan.

Boulder County Impact Report – means the Four Corners Urban Renewal Plan - **Boulder County Impact Report** prepared by RickerlCunningham, dated July, 2015 and presented to the **Authority** Board under separate cover.

Comprehensive Plan – means the Town of Erie Comprehensive Plan, adopted 2005.

Cooperation Agreement – means any agreement between the **Authority** and the Town, or any public body (the term "public body" being used in this Plan as defined by the **Act**) respecting action to be taken pursuant to any of the powers set forth in the **Act** or in any other provision of Colorado law, for the purpose of facilitating public undertakings deemed necessary or appropriate by the **Authority** under this Plan.

C.R.S. – means the Colorado Revised Statutes, as amended from time to time.

Plan or **Urban Renewal Plan** – means this Four Corners Urban Renewal **Plan** (the **Plan**).

Redevelopment / Development Agreement – means one or more agreements between the **Authority** and developer(s) and / or property owners or such other individuals or entities as may be determined by the **Authority** to be necessary or desirable to carry out the purposes of this **Plan**.

Study Area – means the geographic area defined for the **Survey**.

Survey – means the Four Corners Urban Renewal Plan Area Conditions Survey, prepared by RickerlCunningham, dated July, 2015 and presented to the **Authority** Board under separate cover.

Tax Increment – means that portion of property and / or municipal sales taxes in excess of the **Base Amount** set forth in Section 7.3.2 of this **Plan** allocated to and, when collected paid into the **Authority**'s **Tax Increment Revenue Fund**.

Tax Increment Areas – means one or more areas designated as a **Tax Increment Area**, as defined and pursuant to the procedures set forth in Section 6.12 of this **Plan**.

Tax Increment Finance (or Financing) (TIF) - means a financing mechanism which uses future revenues resulting from private investment within an established area (**Tax Increment Area**) to fund improvements for the public benefit.

Tax Increment Revenue Fund - means a fund supervised by the **Authority** and the resources of which include incremental ad valorem property and municipal sales tax revenue resulting from investment and reinvestment in an established urban renewal area.

Town Board – means the **Town Board** of the Town of Erie.

Urban Renewal Project – as defined in the **Act**.

3.0 Plan Purpose

The purpose of this **Plan** is to reduce, eliminate and prevent the spread of blight and to stimulate and catalyze growth and investment within the **Area** boundaries. To accomplish this purpose, the **Plan** is intended to promote local objectives expressed in adopted community plans and advance the vision and priorities of the Town of Erie Comprehensive Plan, adopted in 2005. These objectives and priorities are referenced in the discussion that follows and more specific excerpts (taken verbatim) presented in Appendix A of this **Plan** and further addressed in Section 5.0 below.

3.1 Plan Approach - Eliminating Conditions of Blight

As explained above, the purpose and intent of this, and all urban renewal plans, is to both remove conditions of blight and advance local objectives. The approach to eliminating conditions of blight in the **Area** will be to actively promote investment within its boundaries; where necessary participate in investment within its boundaries; and, to make financial resources available to assist property and business interests with the same, especially investment that otherwise would have been infeasible due to the presence of these conditions.

3.2 Plan Approach - Advancing Local Objectives

The approach to advancing local objectives is to ensure the vision aligns with that of the community; and, to further stated principles, both as expressed in the 2005 **Comprehensive Plan** and presented below.

3.2.1 Plan Vision

"Erie (will be) a community which recognizes the importance of: conserving and enhancing its historic small town character, the roots from which it grew, preserving the natural environment in which it resides; a caring community which offers its residents an environment in which to seek a high quality of life; a balanced community with a diverse range of housing, employment, education, shopping and recreational opportunities; and a vital community which provides financial and social support for quality of life programs."

According to the Canyon Creek PD Amendment No. 9, submitted to the Town in early 2015, the proposed Four Corners development is envisioned as "a vibrant mixed-use community with a strong emphasis on public and private amenities, diverse housing options, and most importantly, uniquely designed commercial space supported by restaurants and a shopping district." Further, "uses will reflect the range of activities where people live, shop, reside and build their families -- and provide its residents with a sense of community, while also giving the Four Corners intersection a sense of identity."

3.2.2 Plan Principles

While an overriding goal of the **Plan** is to facilitate investment in the **Area** sufficient to fund public improvements, particularly those that serve to mitigate

conditions of blight, in order to effectively advance local objectives, development within its boundaries will need to reflect intentions expressed in the general plan for the community. The following text (taken from the Canyon Creek PD Amendment No. 9) offers a description of how the Four Corners development concept will support stated principles presented in the 2005 **Comprehensive Plan**.

1. **A Coordinated and Efficient Pattern of Growth** -- Four Corners is already incorporated into the Town and is an excellent example of utilizing existing infrastructure. This plan does not result in undue impacts or unnecessary burdens to the City's existing infrastructure and provides important linkages to other planned developments in the area. Detention has been designed in a compact and efficient way that allows for more commercial square footage, and in turn tax base that can be offered to the town.

   In addition, the proposed development concept is compliant with the **Comprehensive Plan**'s vision of mixed-use while using existing services. As reflected in the proposed sketch plan, its design integrates an array of residential and commercial uses in a compact manner promoting pedestrian connectivity. The application for mixed-use, if approved, provides for a variety of single and multi-family housing choices within a pedestrian-oriented site plan. The concept also proposes logical transitions between uses and adjacent neighbors, while providing pedestrian connections to neighborhood amenities.

2. **Quality Design and Development** -- Erie promotes a high standard of design for all new development, renovations, and rehabilitated buildings in order to reinforce and enhance its unique environment for residential neighborhoods, public places, and commercial businesses. The Four Corners development concept reflects a similar high quality urban design with consistent landscaping, fencing, berming, and buffering throughout the site.

3. **Overall Economic Vitality** -- Erie promotes a healthy, thriving economy that provides opportunities for quality employment with livable wages for its residents. Uses within the project are both commercial and residential, providing employment opportunities, both during construction and once stabilized, thereby generating temporary and permanent revenue from taxable sales and income. The subject parcel is designed in a compact form reflective of responsible growth initiatives and promoting walkability and connections to existing and proposed recreation, retail and commercial

activity centers. A quality pedestrian-oriented community like Four Corners provides the opportunity for future and existing residents to enjoy the assets of living in the a small community.

4. **Downtown Vitality** -- Erie considers the maintenance, enhancement and expansion of Old Town's vitality to be important to the health and well-being of the community as a whole. The Four Corners project promotes development and continued enhancement of this "center" of the community. As a mixed-use development within the Canyon Creek PD, it compliments surrounding uses. With the Erie Recreation Center located nearly proximate, and Old Town Erie less than one mile away (north on County Line Road), the proposed site plan is a logical extension of the town and its amenity offerings.

5. **A Comprehensive, Integrated Transportation System** -- Erie has a safe, efficient, and innovative transportation system that reduces neighborhood isolation and promotes a sense of community by -- connecting all areas of town, accommodating various modes of transit public and private, and facilitating travel to regional centers. The Four Corners development will be able capitalize on this infrastructure given its location at a highly-visible intersection, proximate to the Town's Recreation Center, and less than a quarter mile from RTD's JUMP line which extends service to the Erie Community Center, Community Park and Community Library. The JUMP line also links Erie to the cities of Lafayette to the south and Boulder to the north, where additional bus service connect to the region. This extension makes it easy for existing and future residents along its route to access uses within the project via public transit.

6. **Stewardship of the Natural Environment** -- Erie will continue to identify and make efforts to conserve its natural, scenic, and environmentally-sensitive areas including important wildlife habitats, waterways, and visually sensitive areas, and to this end strive to be a clean, sustainable, environmentally-friendly community. Improvement within the Four Corners project area will not adversely impact natural or historically-significant assets either within or outside its boundaries. Further, the subject property has not been identified as a Natural Area or has no commitments with PROST (Parks, Recreation Open Space and Trails Master Plan.)

7. **Trails, Parks and Recreation Opportunities** -- Erie will continue to provide a diverse range of recreational opportunities including facilities and programming for all ages and varying interests, passive and active. Trails,

parks, and recreation opportunities will be connected to and integrate with open spaces between neighborhoods. The Four Corners development includes a linear green space for residents to connect with trails and sidewalks existing and proposed along Erie Parkway and East County Line Road. Internal neighborhood pedestrian corridors are also anticipated which lead to a large central park and commercial areas within its boundaries.

8. **Open Space will Serve a Variety of Functions** -- Erie will continue to maintain open spaces that -- buffer adjacent towns and cities; create view corridors to the mountains, plains, and agricultural areas; preserve agricultural lands; restore riparian areas and other areas of natural habitat; protect significant archeological and cultural resources; preserve native plant and animal habitats and travel corridors; provide areas for passive recreation; and, distinguish, yet link neighborhoods with activity areas through a system of continuous, connected open lands and trails. The Four Corners project furthers this principle through significant amounts of open space, pocket and community parks, and non-vehicular connections.

9. **Balanced Land Use Mix** -- Erie will work to diversify and balance the mix of land uses within the Town as it grows. Particular emphasis will be placed on growing the local economic base, and providing employment opportunities for residents seeking to achieve a better balance between where they live and work. The Four Corners development concept includes a mix of uses, as reflected in the general plan for the community.

10. **Stable, Cohesive Neighborhoods Offering a Variety of Housing Types** -- Erie will promote new neighborhoods that contain a mix of land uses and diversity of housing options, while maintaining the quality and character of established neighborhoods and ensuring that development is designed in a manner that minimizes potentially negative impacts on rural neighborhoods in the Planning Area. New housing and neighborhoods will be appropriate in size, scale, design and use and located where residents will have access to a full range of infrastructure, facilities and services necessary for healthy, livable neighborhoods. The Four Corners development concept includes a mix of uses both commercial and residential, with housing products ranging from single family detached to attached ownership and multi-family rental units, each one targeted to Erie's diverse socioeconomic demographics.

11. **Provide Infrastructure and Public Services Efficiently and Equitably** -- Erie will coordinate future development and / or provide capital resources or

physical connections to infrastructure including water, wastewater, fire protection and other utilities; and, services including emergency management, police protection, schools, and parks that affect the quality of life and economic stability of the community. While no improvements exist within the property, all are available within adjacent rights-of-way; and, required services will be made available to its residents and businesses.

3.3 Plan Implementation

As the **Plan**'s administrator, the **Authority** will seek to advance its objectives through the completion of projects which leverage private investment and reinvestment within its boundaries. Specifically, the **Authority** will work in cooperation with the Town to: advance investment in the public realm (roadway, parks, open space), encourage development consistent with or exceeding existing standards; and, judiciously use limited resources which benefit the community at-large.

All development in the **Area** shall conform to the existing municipal codes and ordinances and any site-specific regulations or policies which might impact improvements within its boundaries, all as are in effect and as may be amended from time to time. Although the **Act** authorizes the **Authority** to regulate land uses, establish maximum or minimum densities, and institute other building requirements in an urban renewal area; for the purpose of this **Plan**, the **Authority** anticipates that these will be the responsibility of the Town.

4.0 Blight Conditions

Before an urban renewal plan can be adopted by the Town, the proposed urban renewal area must be determined to be "blighted" as defined in Section 31-25-103(2) of the **Act**, which provides that *"in its present condition and use, the presence of at least four (or five in cases where the use of eminent domain is anticipated) of the following factors (see below) substantially impairs or arrests the sound growth of the municipality, retards the provision of housing accommodations, or constitutes an economic or social liability, and is a menace to the public health, safety, morals, or welfare."* Statutory factors include:

(a) Slum, deteriorated, or deteriorating structures;

(b) Predominance of defective or inadequate street layout;

(c) Faulty lot layout in relation to size, adequacy, accessibility, or usefulness;

(d) Unsanitary or unsafe conditions;

(e) Deterioration of site or other improvements;

(f) Unusual topography or inadequate public improvements or utilities;

(g) Defective or unusual conditions of title rendering the title nonmarketable;

(h) The existence of conditions that endanger life or property by fire or other causes;

(i) Buildings that are unsafe or unhealthy for persons to live or work in because of building code violations, dilapidation, deterioration, defective design, physical construction, or faulty or inadequate facilities;

(j) Environmental contamination of buildings or property;

(k.5) The existence of health, safety, or welfare factors requiring high levels of municipal services or substantial physical underutilization or vacancy of sites, buildings, or other improvements; or

(l) If there is no objection by the property owner or owners and the tenant or tenants of such owner or owners, if any, to the inclusion of such property in an urban renewal area, "blighted area" also means an area that, in its present condition and use and, by reason of the presence of any one of the factors specified in paragraphs (a) to (k.5) of Section 31-25-103(2), substantially impairs or arrests the sound growth of the municipality, retards the provision of housing accommodations, or constitutes an economic or social liability, and is a menace to the public health, safety, morals, or welfare.

As stated earlier, factor "l" above applies because there is no objection by the **Area**'s property owner. However, despite the statutory allowance for the presence of fewer factors when creation of an urban renewal area is being requested voluntarily, every effort was made during preparation of the Four Corners Conditions Survey, dated July, 2015, to identify all factors impacting investment within its boundaries.

The general methodology for conducting the **Survey** is to: (i) define the **Study Area**; (ii) gather information about properties, infrastructure and other improvements within that **Study Area**; (iii) evaluate evidence of blight through field reconnaissance, review of aerial photography, discussions with representatives of various Town departments; and, (iv) record observed and documented conditions listed as blight factors in the **Act**.

Among the 11 qualifying factors identified in the **Act**, the **Survey** showed the presence of the following seven (7) blight factors in the area which is the subject of this **Plan** and reflected herein as Figure 1.

(b) Predominance of defective or inadequate street layout;

(c) Faulty lot layout in relation to size, adequacy, accessibility, or usefulness;

(d) Unsanitary or unsafe conditions;

(f) Unusual topography or inadequate public improvements or utilities;

(g) Defective or unusual conditions of title rendering the title nonmarketable;

(h) The existence of conditions that endanger life or property by fire or other causes;

(k5) The existence of health, safety, or welfare factors requiring high levels of municipal services or substantial physical underutilization or vacancy of sites, buildings, or other improvements.

5.0 Plan Relationship to Other Community Documents

5.1 Plan Conformity

As supported by specific references presented herein, implementation of this **Plan** will further the principles and objectives of the **Comprehensive Plan** (and any subsequent updates) with respect to development within the community's commercial corridors and the provision of a greater variety of residential product offerings. In addition, as also stated previously, development in the **Area** shall conform to all regulating documents, including the current building code and other rules, regulations, and policies promulgated pursuant thereto. Any planning documents that might impact development in the **Area** including, but not limited to, Town-approved site, drainage, and public improvement plans, and any applicable Town design standards that are in effect and may be amended from time to time, will also be adhered to. Finally, conditions of blight within the **Area** will be remedied by improvements, public and private and funded in part by incremental taxes, to the extent deemed appropriate by the **Authority** in consultation with the Town and affected property owners.

5.2 Consistency with the Comprehensive Plan

As explained earlier, a general plan for the Town known as the Town of Erie Comprehensive Plan, was adopted in 2005. The **Authority**, with the cooperation of the Town, private enterprise and other public bodies, will engage in undertakings and activities in order to eliminate the identified conditions of blight while also implementing the goals and objectives of the **Comprehensive Plan** and all other relevant Town-adopted plans for the **Area**. Key elements of that plan which this Four Corners Urban Renewal Plan will advance are described above and in greater detail in Appendix A.

As explained above, while the subject property that comprises the Area is zoned Planned Unit Development (PD) and envisioned as a Mixed-Use Development (MD), permitted uses as identified in the Canyon Creek PD Amendment No. 8 are referred to

as Business Commercial (BC) and Commercial / Business / Retail (CBR), neither of which is allowed under the current zoning.

The Land Use Plan (Chapter 4) includes a new land use category to accommodate Mixed-Use Development. At a general level these mixed- use areas are similar in that they are intended to contain a variety of activities, such as offices, retail, and multiple housing types. They differ, however, in that the scale and configuration of development will vary by its location and development context (i.e., Old Town infill/redevelopment vs. new development). Common principles for mixed-use development include:

Mix of Uses

- Depending upon their location and scale, primary uses for mixed-use development areas may include commercial, office, retail, and/or housing. However, more active uses such as retail and commercial should be placed at the ground level to provide pedestrian interest. Where activity uses are limited, they should be concentrated at key intersections or near major public spaces to maximize public exposure and increased activity levels.

- Both vertical (stacked) and horizontal (side-by-side) mixed-use is encouraged in Erie provided it is well-connected to surrounding neighborhoods.

5.3 Correlation with Other Community Plans

Implementation of this **Plan** will be consistent with objectives expressed in all Town-adopted and accepted plans that speak specifically to improvements in the **Area.**

6.0 Authorized Authority Undertakings and Activities

Whereas the **Act** allows for a wide range of activities to be used in the furtherance of the goals of an urban renewal plan, it is the **Authority**'s intent to provide financial assistance and deliver public improvements only as shown to be necessary, in partnership with property owners and other affected parties, in order to accomplish the objectives stated herein. Partnerships and other forms of cooperative agreements are an essential component of the **Authority**'s strategy for preventing the spread of and eliminating existing blighting conditions. Representative undertakings of the **Authority** in the furtherance of this **Plan** are described as follows.

6.1 Complete Public Improvements and Facilities

The **Authority** may, or may cooperate with others to, finance, install, construct, and reconstruct any public improvements. Additionally, the **Authority** may, or may cooperate with others to, demolish and clear existing improvements for the purpose of promoting the objectives of the **Plan** and the **Act**.

Whereas public improvements or investment should, whenever possible, stimulate directly and indirectly desired private sector investment, it is the intent of this **Plan** that the combination of public and private investment that occurs in the **Area** will benefit the properties within its boundaries, as well as the community at-large.

As described in Section 4.0 of this **Plan**, seven (7) qualifying conditions of blight, as defined in Section 31-25-103(2) of the **Act**, are evident in the **Area**. The **Plan** proposes to remedy these conditions (presented below) by making specific improvements or providing resources for improvements including the following:

(b) Predominance of defective or inadequate street layout -- curb and gutter, driveway, pedestrian, and safety improvements;

(c) Faulty lot layout in relation to size, adequacy, accessibility, or usefulness -- vehicular access and other roadway improvements; pedestrian and safety improvements ;

(d) Unsanitary or unsafe conditions -- enhanced lighting within public rights-of-way; pedestrian improvements within public spaces; and, any required off-site improvements deemed reasonable and for the public benefit;

(f) Unusual topography or inadequate public improvements or utilities -- grading to improve drainage, completion of onsite roadways and utility lines, as well as offsite improvements which impact development within the property;

(g) Defective or unusual conditions of title rendering the title nonmarketable -- mitigation of impacts associated with the presence of underground mines, and infrastructure within existing pipeline and utility easements;

(h) The existence of conditions that endanger life or property by fire or other causes -- roadway improvements that lessen the number of traffic incidents within adjacent rights-of-way;

(k5) The existence of health, safety, or welfare factors requiring high levels of municipal services or substantial physical underutilization or vacancy of sites, buildings, or other improvements -- investments which lessen both traffic and criminal incidents, participation in eligible expenses (as per the Statute) that make development in the **Area** feasible.

6.2 Complete Other Improvements and Facilities

To the extent that non-public improvements in the **Area** may be required to accommodate development and redevelopment and still benefit the public, the **Authority** is hereby authorized to assist in the financing or construction of such improvements to the extent authorized by the **Act**.

6.3 Promote Development and Redevelopment

A key concept associated with implementation of the **Plan** is commitment to priority public investments that serve to catalyze and make feasible private investment that generates resources to fund the same. The potential impact of this investment to Boulder County is quantified in the Four Corners Urban Renewal Plan – **Boulder County Impact Report** which was presented to the **Authority** Board under separate cover.

6.4 Adopt Standards

As stated earlier, all development shall conform to applicable rules, regulations, policies, other requirements, and standards of the Town and any other governmental entity with jurisdiction in the **Area**. While the **Act** allows for the adoption of standards and requirements applicable to projects undertaken in an urban renewal area, in the context of this **Plan**, it is the **Authority**'s intention that investment in the **Area** conform to Town-approved documents.

6.5 Modify the Plan

The **Authority** may propose, and the **Town Board** may make, modifications to this **Plan** as may be necessary provided they are consistent with the **Comprehensive Plan** and any subsequent updates. Additionally, any such amendments made in accordance with this **Plan** and as otherwise contemplated, must also be compliant with the **Act**. Finally, the **Authority** may, in specific cases, allow non-substantive variations from the provisions of this **Plan** if it determines that a literal enforcement of the provision would constitute an unreasonable limitation beyond the intent and purpose stated herein.

6.6 Review the Plan

An ongoing process of review is recommended as a mechanism to allow those parties responsible for administering and implementing key projects within its boundaries to

periodically evaluate its effectiveness and potentially make adjustments. Modifications may be developed from suggestions by the **Authority**, property and business owners, and Town staff operating in support of the **Authority** and advancement of this **Plan**.

6.7 Provide Relocation Assistance

Whereas there are no structures within the **Area** where individuals either live or work, it is not anticipated, as of the date of this **Plan**, that acquisition of real property will result in the relocation of any individuals, families, or business concerns. However, if such relocation becomes necessary, the **Authority** will adopt a relocation plan in conformance with the **Act**.

6.8 Demolish, Clear and Prepare Improvements

While not anticipated as of the date of this **Plan**, the **Authority** may, on a case-by-case basis, elect to demolish or cooperate with others to clear buildings, structures and other improvements within the **Area** in an effort to advance activities and undertakings deemed consistent with the vision stated herein. Additionally, existing **Development** or **Cooperation Agreement**s may require such demolition or site clearance to: eliminate unhealthy, unsanitary, and unsafe conditions, obsolete uses deemed detrimental to the public welfare; and, otherwise remove and prevent the spread of deterioration.

6.9 Acquire and Dispose of Property

While the **Act** allows for the acquisition of property by negotiation or any other method including eminent domain, it is not authorized for use within this **Plan Area**. Properties acquired by entities other than the **Authority** may temporarily be operated, managed and maintained by the **Authority** if requested to do so by the acquiring entity and deemed in the best interest of the **Urban Renewal Project** and the **Plan**. Such property shall be under the management and control of the **Authority** and may be rented or leased pending its disposition for redevelopment.

The **Authority** may sell, lease, or otherwise transfer real property or any interest in real property subject to covenants, conditions and restrictions, including architectural and design controls, time restrictions on development, and building requirements in accordance with the **Act** and this **Plan**.

6.10 Enter Into Redevelopment / Development Agreements

The **Authority** may enter into Redevelopment / Development Agreements or other contracts with developer(s) or property owners or such other individuals or entities determined to be necessary to carry out the purposes of this **Plan**. Further, such Agreements, or other contracts, may contain terms and provisions deemed necessary or appropriate for the purpose of undertaking the activities contemplated by this **Plan** and the Act. Any existing agreements between the Town and private parties that are consistent with this **Plan** are intended to remain in full force and effect, unless all parties to such agreements agree otherwise.

6.11 Enter Into Cooperation Agreements

For the purpose of this **Plan**, the **Authority** may enter into one or more **Cooperation Agreement**s pursuant to the **Act**. Whereas the Town and the **Authority** recognize the need to cooperate in the implementation of this **Plan**, these **Cooperation Agreement**s may include without limitation the planning, financing, installation, construction and / or reconstruction of public or other eligible improvements. This paragraph shall not be construed to require any particular form of cooperation.

6.12 Create Tax Increment Areas

The boundaries of the **Urban Renewal Area** shall be as set forth in Section 1.4 and illustrated in Figure 1. It is the intent of the **Town Board** in approving this **Plan** to authorize the use of **Tax Increment Financing** by the **Authority** as part of its efforts to advance the vision, objectives and activities described herein. Pursuant to the provisions of Section 31-25-107(9) of the **Act**, the **Town Board** in approving this **Plan** further contemplates that one or more **Tax Increment Areas** may be created within the **Urban Renewal Area** as development occurs. Notwithstanding such distinction, the **Authority** is specifically authorized to expend the revenue from **Property and Sales Tax Increments** to the extent authorized by the **Act** and this **Plan**.

While this Four Corners Urban Renewal Plan contemplates that the primary method of assisting with financing eligible expenses in the **Area** will be through the use of **Property Tax Increment** revenue, the **Town Board** may allocate **Municipal Sales Tax Increments** if requested to do so by the **Authority** and only after receipt of a financing plan outlining the proposed amounts and purpose for which the **Municipal Sales Tax Increment** is to be used. As such, the use of **Sales Tax Increment** is hereby authorized pursuant to Section 31-25-107 (9), **C.R.S.**, which is by this reference incorporated herein as if set

forth in its entirety, but any such pledge of **Sales Tax Increment** by the **Authority** in a **Development** or **Redevelopment Agreement** shall not be authorized until a separate **Cooperation Agreement** between the **Authority** and the Town setting forth the allocation of **Incremental Sales Taxes** between the Town and the **Project**. The approval of such **Cooperation Agreement** by the Town and the **Authority** is hereby found by the Town not to be a substantial modification of the **Urban Renewal Plan**, and is not an addition of a new **Urban Renewal Project**, does not alter the boundaries of the **Plan Area**, does not change the mill levy or sales tax component of the **Plan** (up to 100% of the **Sales Tax Increment** being hereby authorized by the **Plan**), and is not an extension of the **Plan** or the duration of a specific **Urban Renewal Project**, regardless of when such **Cooperation Agreement** may be approved. The entire **Plan Area** is hereby designated as a single **Tax Increment Area**.

7.0 Project Financing

7.1 Public Investment Objective

A critical component to the success of any urban renewal strategy is participation by both the public and private sectors. Leveraging of resources is critical as no one entity, either public or private, has sufficient resources alone to sustain a long-term improvement effort. Possible public investments for which the **Authority**, with the support of the Town, may participate include (but are not limited to) include: pedestrian improvements including construction of sidewalks, street lights and other design enhancements intended to improve safety for vehicular and non-vehicular movement; roadway improvements including curbs, gutters, and traffic lights; and, infrastructure for drainage and utilities under the authority of the Town. The **Authority** may also provide financial assistance for other expenses considered eligible under the **Act**.

7.2 Financial Mechanisms

The **Authority** may finance undertakings pursuant to this **Plan** by any method authorized under the **Act** or any other applicable law, including without limitation of the following: issuance of notes, bonds and other obligations as defined in the **Act** in an amount sufficient to finance all or part of this **Plan**; borrowing of funds and creation of indebtedness; reimbursement agreements; and / or, utilization of federal or state loans or grants, interest income, annual appropriation agreements, agreements with public or private entities, loans, advances, and grants from any other available sources. The principal, interest, costs and fees on any indebtedness are to be paid for with any lawfully available funds of the **Authority**.

Debt incurred by the **Authority** may include bonds, refunding bonds, notes, interim certificates or receipts, temporary bonds, certificates of indebtedness, or any other obligation lawfully created.

7.3 Tax Increment Financing

Activities may be financed by the **Authority** under the TIF provisions of the **Act**. Such incremental revenues may be used for a period not to exceed the statutory requirement, which is presently twenty-five (25) years after the effective date of the Plan adoption which authorizes and creates the **Tax Increment Area**.

7.3.1 Special Fund

In accordance with the requirements of the law, the **Authority** shall establish a **Tax Increment Revenue Fund** for the deposit of all funds generated pursuant to the division of ad valorem property and municipal sales tax revenue described in this section.

7.3.2 Base Amount

The **Base Amount** includes that portion of property taxes which are produced by the levy at the rate fixed each year by or for each public body upon the valuation for assessment of taxable property in the **Tax Increment Area** last certified prior to the effective date of approval of the **Plan** (or future modifications); and, that portion of municipal sales taxes collected within the boundaries of the **Tax Increment Area** in the twelve-month period ending on the last day of the month prior to the effective date of approval of the **Plan** and paid to the public body, as are all other taxes collected by or for said public body.

7.3.3 Incremental Revenues

Incremental revenues including that portion of said property, and if authorized by the **Town Board**, municipal sales taxes in excess of the **Base Amount** set forth in Section 7.3.2 above shall be allocated to, and when collected, paid into the **Authority**'s **Tax Increment Revenue Fund**. The **Authority** may use these funds to pay the principal of, the interest on, and any other premiums due in

connection with the bonds, loans or advances to, or indebtedness incurred (whether funded, refunded, assumed, or otherwise) by the **Authority**, for financing or refinancing, in whole or in part, any portion of an **Urban Renewal Project** considered eligible under the **Act**. Unless and until the total valuation for assessment of the taxable property in any **Tax Increment Area** exceeds the base valuation, all of the taxes levied upon taxable property in the **Tax Increment Area** shall be paid into the funds of the respective public bodies. Also, when such bonds, loans, advances and indebtedness, including interest thereon and any premiums due in connection therewith, have been paid, all taxes upon the same taxable property shall be paid to the respective public bodies.

Further, the incremental portion of said taxes, as described in this subsection 7.3.3, may be irrevocably pledged by the **Authority** for the payment of, principal and interest on, and any premiums due in connection with such bonds, loans, advances and / or indebtedness incurred by **Authority** to finance an **Urban Renewal Project** (as defined in the **Act**); except:

(a) Any offsets collected by the County Treasurer for return of overpayments or any funds reserved by the **Authority** for such purposes in accordance with Section 31-25-107(9)(a)(III) and (b), **C.R.S.**

(b) Any reasonable (as determined by the **Authority**) set-asides or reserves of incremental taxes paid to the **Authority** for payment of expenses associated with administering the **Plan**.

If there is any conflict between the **Act** and this **Plan**, the provisions of the **Act** shall prevail, and the language in the **Plan** automatically deemed to conform to the statute.

7.4 Other Financing Mechanisms / Structures

The **Plan** is designed to provide for the use of TIF as one tool to facilitate investment and reinvestment within the **Area**. However, in addition to TIF, the **Authority** shall be authorized to finance implementation of the **Plan** by any method authorized by the **Act**. The **Authority** is committed to making a variety of strategies and mechanisms available which are financial, physical, market and organizational in nature. It is the intent of this **Plan** to use these tools either independently or in various combinations. Given the obstacles associated with infill development and redevelopment, the **Authority** recognizes that it is imperative that solutions and resources be put in place which are

comprehensive, flexible and creative. Finally, the **Authority** may contract with the Town to administer various incentives.

8.0 Severability

If any portion of this **Plan** is held to be invalid or unenforceable, such invalidity will not affect the remaining portions of the **Plan**.

Four Corners Urban Renewal Plan

Town of Erie, Colorado

Appendix A:

Town of Erie Comprehensive Plan, adopted 2005 (excerpts taken verbatim)

Chapter 2: Vision and Guiding Principles

Vision Statement

Erie is a community which recognizes the importance of conserving and enhancing its historic small town character, the roots from which it grew, preserving the natural environment in which it resides; a caring community which offers its residents an environment in which to seek a high quality of life; a balanced community with a diverse range of housing, employment, educational, shopping and recreational opportunities; and a vital community which provides financial and social support for quality of life programs.

Guiding Principles

Quality Design and Development

Erie will promote a high standard of design for all new development, renovation, and rehabilitation to reinforce and enhance its unique nature for residential neighborhoods, public places, and commercial businesses.

Balanced Land Use Mix

The Town will work to diversify and balance the mix of land uses as the Town grows. Particular emphasis will be placed on enhancing the local economic base to provide employment opportunities for residents, seeking to achieve a better balance as a place to work as well as live. In so doing, the community will seek a balance between the enhancement of Old Town's vitality and other existing areas of the community and the identification of opportunities for commercial and employment in outlying areas.

Stable, Cohesive Neighborhoods Offering a Variety of Housing Types

The Town will promote new neighborhoods that contain a mix of land uses and diversified housing options that meet the varying needs of its residents, including single family, attached homes (duplexes, townhomes), multifamily dwellings, and housing included as part of mixed-use developments. The Town will work to maintain the quality and character of established neighborhoods and ensure that infill and

redevelopment is designed in a manner that minimizes impacts on existing neighborhoods, including rural neighborhoods in the Planning Area. New housing and neighborhoods should be appropriate in size, scale, design and use. New housing areas should be located where residents will have access to the full range of infrastructure, facilities and services that are needed for healthy, livable neighborhoods

Chapter 3: Community Building Blocks

Neighborhood Emphasis

For most of its years Erie consisted of a single, compact neighborhood in what is referred to today as Old Town. Residents of Old Town were able to (and are still able to today, in some cases) walk to meet many of their daily needs and even go to work. In recent years, the Town's compact feel has begun to change as new development has sprung up in outlying areas of the Town's Planning Area, far from its historic center and both visually and physically detached from the rest of the community.

The goals and polices contained in the Plan are built around Erie's desire to distinguish itself as a community of free-standing, but integrated *neighborhoods,* linked together—and to Old Town—by an interconnected network of pedestrian pathways, trails, and open space.

The following principles embody the community's vision for its future neighborhoods:

Mix of Housing Types

- Neighborhoods should contain a variety of housing types (single family detached, single-family attached, townhomes, apartments, etc.) to provide a more diverse selection of lifestyles and housing pricing for Erie residents.
- Neighborhoods should incorporate a variety of housing models and façade treatments to create visual interest and a more inviting pedestrian environment.

Connectivity

- Neighborhoods should be connected to adjacent neighborhoods and the surrounding community with direct roadway and pedestrian connections and open space.
- Isolating neighborhoods with walls and gates should be avoided.

Parks and Open Space

- Neighborhoods should include or be easily accessible to a range of parks and open space amenities to appeal to residents of all ages and abilities.

Activity Centers

- Each neighborhood should include an activity center for its residents. Activity centers may include a mix of commercial development, parks, open space, and other community facilities, where appropriate, to serve the needs of neighborhood residents. Larger, commercially-oriented activity centers may serve more than one neighborhood.
- Activity centers should be designed to be connected to adjacent neighborhoods with streets and sidewalks.

Preservation of Natural Features

- Neighborhoods should be planned to maximize the preservation of natural features, such as drainages, significant trees, topographic features, and other features.

Distinct Identity

- Neighborhoods should be planned to incorporate unique characteristics that serve as identifiers for residents, such as such as distinct streetscape elements, architectural styles, and neighborhood center features. However, neighborhoods should also incorporate features that visually and physically link them to the larger community and the Town of Erie. This may occur through naming, street graphics (i.e. incorporating the Town of Erie logo), trail connections, or other features that serve to create a common link between the Town's many neighborhoods.

Mixed-Use Developments

The Land Use Plan (Chapter 4) includes a new land use category to accommodate Mixed-Use Development. At a general level these mixed-uses areas are similar in that they are intended to contain a variety of activities, such as offices, retail, and multiple housing types. They differ, however, in that the scale and configuration of development will vary by its location and development context (i.e., Old Town infill / redevelopment vs. new development). Common principles for mixed-use development include:

Mix of Uses

- Depending upon their location and scale, primary uses for mixed-use development areas may include commercial, office, retail, and / or housing. However, more active uses such as retail and commercial should be placed at the ground level to provide pedestrian interest. Where activity uses are limited, they should be concentrated at key intersections or new major public spaces to maximize public exposure and increased activity levels.

- Both vertical (stacked) and horizontal (side-by-side) mixed-use is encouraged in Erie provided it is well-connected to surrounding neighborhoods.

Gateways and Corridors

- Erie has an opportunity to establish distinct entryways to the community along its major gateway corridors. This opportunity is most evident along Leon A. Wurl (WCR 8) and Highway 52, where development to-date has been limited, but is anticipated on the Future Land Use Map. Other gateway corridor, including County Line Road (north and south), Baseline Road (Highway 7), and Arapahoe Road, have a character that is fairly well established either through existing open space or existing development patterns.

- Future development in any of the Town's gateway corridors should be designed with the following principles in mind:

  View Corridors

  - Development setbacks should be established along gateway corridors to preserve site lines and reduce visual impacts of development. Signage along the Town's gateway corridors should be limited to low profile monument signs designed as part of a larger development scheme and should be consolidated for larger developments to minimize clutter.

  Development Quality / Relationship to the Corridor

  - Development setbacks should be landscaped to buffer development, to help preserve key view corridors, to provide an inviting environment for pedestrians, and to establish a consistent character.
  - Development should be oriented towards the gateway corridor, providing a high level of architectural detailing and entrances for pedestrians.
  - Buildings located at major intersections should be brought closer to the street and to anchor corners and to help form a gateway into adjoining neighborhoods.
  - Parking, loading areas, and other unsightly uses should be located away from the gateway corridor where possible and should be fully screened using a combination of landscaping, berming and / or decorative fencing.

Economic Sustainability

- Employment opportunities and commercial services within Erie are currently very limited. The Town recognizes that expanding opportunities for employment and commercial development is important

to enhance tax revenues generated in the Town, as well to reduce the need for residents to travel to neighboring communities to work, shop, and meet other daily needs. The Town also recognizes that attracting significant commercial and employment development will be challenging given the high volume of competition from neighboring Front Range communities. In light of these challenges, the Plan seeks to achieve economic sustainability over time by placing an emphasis on each of the community building blocks highlighted in this Chapter as follows:

- the creation of high-quality residential neighborhoods;
- encouraging a more mixed-use patter of development that allows the integration of commercial and employment uses on a smaller scale;
- establishing a high-quality pattern of development along the community's major gateway corridors; and
- protecting the community's rural character as a unique aspect of its appeal.

Together, these objectives will allow Erie to grow into a community that will be attractive to future commercial and employment development which opportunities arise.

Chapter 4: Land Use

Goal #1: Balanced Land Use Mix

Plan for a balanced mix of commercial and residential land uses in Erie.

Medium Density Residential Policies

MDR 1.1—CHARACTERISTICS
Medium Density Residential areas should incorporate a mix of housing types and recognizable community centers such as park, recreation, and neighborhood or community commercial areas in a neighborhood setting. Neighborhoods should contain connective green spaces that unify the development and provide transitions between other uses. Commercial centers should be designed at a neighborhood scale that is in harmony with the area's residential characteristics and in conformance with the policies for Neighborhood and Community Commercial uses. Appropriate housing types may include a combination of small lot single-family, duplexes, townhomes, or fourplexes on individual lots. Larger apartment or condominium buildings may be permissible as well, provided the density range is complied with. Schools, places of worship, and other civic uses are also appropriate.

MDR 1.2—DENSITY RANGE
Medium Density Residential neighborhoods typically have a gross density of 6 to 12 dwelling units per acre, to allow for a variety of housing types; however, gross densities will not typically exceed 8 dwelling units / acre.

MDR 1.3—LOCATION
Medium Density Residential neighborhoods should be located close to arterial streets and be bounded by collector streets where site characteristics allow, with a direct connection to work, shopping, and leisure activities.

High Density Residential Policies

HDR 1.1 - CHARACTERISTICS
The High Density Residential designation accommodates higher-intensity residential housing types, such as apartments, townhomes and condominiums, combined with complementary residential and non-residential land uses, such as single family attached and detached homes, retail, commercial, and office uses. Mixed-use buildings may also be appropriate, provided that they are designed in scale with other uses in the development area. Schools, places of worship, and other civic uses are also appropriate. Developments generally have shared parking and recreational facilities. Site design should allow for convenient access to work, service, and leisure destinations and should encourage the use of alternative modes of travel.

HDR 1.2 - DENSITY RANGE
High Density Residential neighborhoods typically have a gross density of 12 to 20 dwelling units per acre to allow for a variety of housing types; however, gross densities will not atypically exceed 16 dwelling units / acre.

HDR 1.3 - LOCATION
High Density Residential uses are typically located near intersections of arterials and collector streets, but may also be used to provide a transition between commercial or employment areas and lower density neighborhoods. High density neighborhoods should not be located in settings where the only access provided consists of local streets passing through lower density neighborhoods.

Mixed-Use Policies

MU 1.1 - CHARACTERISTICS
Mixed-Use development provides a mix of residential, commercial, retail and office uses in a compact, pedestrian-oriented environment. These uses should incorporate pedestrian-friendly design elements through management of location, scale and orientation of parking facilities, driveways, connective sidewalks and trails, public plazas, and storefronts. New surface parking should be located to the side or rear of structures and screened with a low masonry wall and landscaping.

MU 1.2 - LOCATION
Mixed-Use development may be located near the intersections of arterials and collector streets, but may also be used to provide a transition between commercial or employment centers and residential neighborhoods. It is also encouraged along the Briggs and Cheesman Street Corridors in downtown.

MU 1.3 - INTEGRATION OF USES
Mixed-Use development can occur in two primary configurations - Vertical Mixed-Use or Horizontal Mixed-Use. Vertical Mixed-Use refers to the integration of two or more land use types within a building,

occurring on different floors. A typical example of a vertical mixed-use building would incorporate active uses, such as stores and restaurants, at the street level and residential or office uses on the upper floors. Horizontal mixed-use refers to a pattern where several types of uses or buildings are included, as part of a cohesive development in proximity to each other - but each building would contain its own separate use. Either pattern should be designed as a set of coordinated uses, with common off-street parking areas, strong pedestrian connections, and similar design features.

MU 1.4 - GATEWAY CORRIDORS
Mixed-Use development located along an identified gateway corridor will be subject to additional development standards as specified in Policy CCD 1.5, Community Character and Design.

Commercial

C 1.1 - CIRCULATION AND ACCESS
Clear, direct pedestrian connections should be provided through parking areas to building entrances and to surrounding neighborhoods or streets. Integrate main entrances or driveways with the surrounding street network to provide clear connections between uses for vehicles, pedestrians and bicycles.

C 1.2 - PARKING DESIGN AND LOCATION
Uninterrupted expanses of parking should be avoided. Parking areas should be broken into smaller blocks divided by landscaping and pedestrian walkways that are physically separated from vehicular drive isles. Parking areas should be distributed between the front and sides of buildings, or front and rear, rather than solely in front of buildings to the maximum extent feasible. Parking facilities should also promote safe pedestrian, bike and public transit modes of transportation through appropriate placement of landscaped islands and facilities.

C 1.3 - ARCHITECTURAL CHARACTER
Commercial centers shall be required to meet design standards for commercial development as specified in the Unified Development Code to address the compatibility with surrounding areas and mitigation of negative visual impacts such as uninterrupted wall planes, parking areas, and service and loading areas. While design standards will apply to all Community Commercial development, they are particularly important to consider for larger footprint retail buildings, or "big-box? stores. Standards address such features such as:

- Facade and exterior wall plane projections or recesses;
- Arcades, display windows, entry areas, awnings, or other features along facades facing public streets;
- Location, distribution and screening of parking
- Building facades with a variety of detail features (materials, colors and patterns);
- Location and screening of mechanical equipment; and
- High-quality building materials.

C1.4--GATEWAY CORRIDORS
Commercial centers located along an identified gateway corridor will be subject to additional development standards as specified in policy CCD 1.5, Community Character and Design.

Regional Commercial Policies

RC 1.1--CHARACTERISTICS
Regional Commercial centers provide more intense retail and employment designed to serve the community or region, including general retail, retail with outdoor storage, "big box" retail centers, office campuses, and regional malls. Retail centers typically serve a market radius of 25 miles or greater. Sites will typically range between 20 and 50 acres in size and have Gross Leasable Areas ranging from 250,000 to more than 500,000 square feet. Given the importance of access and volume of traffic, Regional Commercial developments should incorporate connectivity in parking facilities to minimize ingress-egress traffic impact on arterial and collector streets.

Community Commercial Policies

CC 1.1--CHARACTERISTICS
Community Commercial centers provide a mix of general retail (e.g., grocery stores, larger retailers) and commercial services in a concentrated and unified setting that serves the local community. These centers typically have a Gross Leasable Area of between 100,000 and 250,000 square feet and generally range between 10 and 20 acres in size.

CC 1.2--LOCATION
Community Commercial centers should be located at the intersection of one or more major arterial streets. They may be located adjacent to urban residential neighborhoods and may occur along primary highway corridors as existing uses become obsolete and are phased out and redeveloped over time. Large footprint retail buildings (often known as "big-box" stores) shall only be permitted where adequate access can be provided.

Chapter 5: Growth Management

Goal #1: Sustainable Development Patterns

Promote the sustainable use of land and other resources by encouraging orderly, contiguous growth and compact development.

POLICIES:

GM 1.1—ENCOURAGE A BALANCED MIX OF RESIDENTIAL AND NONRESIDENTIAL USES IN THE COMMUNITY
The Town will strive to achieve a more balanced mix of residential and nonresidential uses to shift its emphasis away from a "bedroom" community.

GM 1.2—COMPACT, NEIGHBORHOOD-ORIENTED PATTERN
The Town will strive to achieve a compact pattern of development focused in a series of interconnected, mixed-use neighborhoods.

Chapter 12: Housing and Neighborhoods

Goal #1: Neighborhoods as Primary Community Building Block

New residential development should be focused into a series of mixed-use neighborhoods that have a full range of urban services and contain a diversity of housing types. Guide the design and development of new neighborhoods to ensure connectivity, sustainability and quality of life.

POLICIES:

HN 1.1—NEIGHBORHOOD FOCUS
New residential development should be focused into a series of mixed-use neighborhoods that have a full range of urban services and that contain a diversity of housing types to support the housing needs of a diverse population. Each neighborhood should incorporate complementary and supporting non-residential uses that serve the neighborhood and are designed and operated in harmony with the residential characteristics of a neighborhood, including neighborhood commercial services.

HN 1.2—NEIGHBORHOOD CONNECTIVITY
Neighborhoods should be designed with connected systems of open space, bikeways, trails, and streets with sidewalks that provide internal links as well as links to other neighborhoods and to neighborhood centers. Neighborhoods should be designed with clear pedestrian connections to other neighborhoods and to neighborhood centers.

HN 1.3—NEIGHBORHOOD CENTERS
Neighborhoods should contain and be designed around an identifiable center that includes neighborhood scale retail and services, public and institutional uses, including but not limited to schools, daycare facilities, community centers, places of worship, parks and open space. Depending on the location and size, a single neighborhood center can serve several nearby neighborhoods.

HN 1.4—INCORPORATION OF NATURAL FEATURES
Neighborhoods should be designed in a manner which protects and preserves natural features of the site, including mature stands of trees, wetlands, or drainages as open space amenities that serve as identifying or character defining features.

Goal #3: Mix of Housing Types

Plan for a range of neighborhoods and housing types that can accommodate the diverse housing needs of all residents.

POLICIES:

HN 3.1—MIX OF HOUSING TYPES AND DENSITIES
The Town will encourage the incorporation of a mixture of housing types with varied price ranges, lot sizes, lot configurations, and densities, to attempt to meet the needs of all segments of the community. In addition, the Town will encourage the use of a mix of builders for larger developments and the incorporation of efficiency standards and clustering, where appropriate.

HN 3.2—MAINTAIN AND ENCOURAGE HOUSING THAT MEETS THE DIVERSE NEEDS OF RESIDENTS
There is growing concern about the availability of attainable housing for low and moderate-income families in Erie. The Town will work with the private sector and non-profit agencies to ensure that sites that are potentially suitable for housing are available within the Planning Area to achieve a variety of price points. This should include sites at a variety of scales to accommodate both small infill projects and larger redevelopment or green field projects. In addition, the Town will encourage innovative design in housing by considering financial incentives and other mechanisms to reduce development costs, such as:

- Varied lot sizes (including small lots);
- Varied lot configurations;
- Clustering;
- Mix of builders; and
- Efficiency standards.

Chapter 14: Economic Development

Background and Intent

Employment opportunities and commercial services within Erie are currently very limited. The Town recognizes that expanding opportunities for employment and commercial development is important to enhance tax revenues generated in the Town as well to reduce the need for residents to travel to neighboring communities to work, shop, and meet other daily needs.

Goal #1: Diverse Economic Base

Expand and diversify the Town's economic base to create primary jobs as well as retail opportunities, in order to increase the Town's fiscal capacity to meet the needs of its citizens.

ED 1.2 - APPROPRIATE AREAS FOR COMMERCIAL AND EMPLOYMENT USES
The Future Land Use Plan map establishes appropriate locations for employment and commercial uses. In addition, the Town will develop criteria to determine appropriate locations for neighborhood commercial development. Criteria area intended to provide for flexibility in citing and design, resulting in a mixed-use development pattern that encourages commercial and employment uses to occur as part of the Town's neighborhood fabric.

ED 1.6 - CRITERIA FOR CONSIDERING ECONOMIC DEVELOPMENT INCENTIVES
The Town acknowledges that certain, potential commercial developments are likely to request economic development incentives such as the reduction or waiver of impact fees, provision of public infrastructure or Tax Increment Financing (TIF). The Town will develop and publicize a list of incentives that might be willing to consider, along with minimum thresholds (e.g., hourly wages, targeted industries, employee benefits, etc.) to qualify.

Chapter 15: Action Plan

Community Character and Design

During preparation of the Plan, citizens of the community expressed a strong desire to see the Town implement stronger measures to preserve the community's character and image through design, planning and community-based events. To implement this aspect of the Plan, the following priority actions are recommended:

1. COMMUNITY GATEWAY CORRIDORS

The UDC will include basic design standards for roadway corridors that serve as gateways into the community. However, in the longer term, it may be appropriate to prepare concept designs for each of the major corridors. A landscape and urban design concept plan was completed for the portion of Leon Wurl Parkway that travels through Erie Commons, and implementation is beginning in 2005. As the major gateway into the Town from I-25, it would be appropriate to develop a landscape and urban design concept plan for the section of this gateway corridor from I-25 to Coal Creek. The Town should also consider preparing design concept plans for the other major gateway corridors, including Highway 52, Baseline Road, County Line Road, and Arapahoe Road, to establish basic requirements and the desired character of these important areas.

Four Corners Urban Renewal Plan

Town of Erie, Colorado

Appendix B:

Four Corners Urban Renewal Area Legal Description

4 CORNERS URBAN RENEWAL PLAN AREA BOUNDARY
LEGAL DESCRIPTION

A PARCEL OF LAND LOCATED IN THE SOUTHEAST QUARTER OF SECTION 24, TOWNSHIP 1 NORTH, RANGE 69 WEST OF THE 6TH PRINCIPAL MERIDIAN, TOWN OF ERIE, COUNTY OF BOULDER, STATE OF COLORADO AND ALSO BEING LOCATED IN THE SOUTHWEST QUARTER OF SECTION 19, TOWNSHIP 1 NORTH, RANGE 69 WEST OF THE 6TH PRINCIPAL MERIDIAN, TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO AND BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:
BEARINGS CONTAINED HEREIN ARE BASED ON ASSUMPTION THAT THE EAST LINE OF THE SOUTHEAST QUARTER OF SECTION 24, TOWNSHIP 1 NORTH, RANGE 69 WEST OF THE 6TH PRINCIPAL MERIDIAN BEARS S 0° 59' 04" E BETWEEN A FOUND 2" ALUMINUM CAP MONUMENT IN RANGE BOX, WITH ILLEGIBLE STAMPING, AT THE EAST QUARTER CORNER OF SAID SECTION 24 AND A FOUND 2" ALUMINUM CAP MONUMENT STAMPED LS 14083 AT THE SOUTHEAST CORNER OF SAID SECTION 24.

COMMENCING AT A FOUND 2" ALUMINUM CAP MONUMENT IN RANGE BOX, WITH ILLEGIBLE STAMPING, AT THE EAST QUARTER CORNER OF SAID SECTION 24;

THENCE S 89°50'16" E A DISTANCE OF 70.01 FEET TO A POINT ON THE EASTERLY RIGHT-OF-WAY LINE OF COUNTY LINE ROAD;

THENCE N 00°59'04" W ALONG SAID EASTERLY RIGHT-OF-WAY LINE A DISTANCE OF 70.01 FEET TO A POINT OF INTERSECTION OF THE NORTHERLY RIGHT-OF-WAY LINE OF ERIE PARKWAY PROJECTED EAST AND THE EASTERLY RIGHT-OF-LINE OF COUNTY LINE ROAD AND BEING THE POINT OF BEGINNING;

THENCE N 89°50'16" W ALONG THE NORTHERLY RIGHT-OF-WAY LINE PROJECTED EAST AND ALONG THE NORTHERLY RIGHT-OF-WAY LINE OF ERIE PARKWAY A DISTANCE OF 1767.49 FEET;

THENCE S 00°54'34" E A DISTANCE OF 140.02 FEET TO A POINT ON THE SOUTHERLY RIGHT-OF-WAY OF ERIE PARKWAY AND ALSO BEING THE NORTHEAST CORNER OF THE CANYON CREEK SUBDIVISION FILING NO. 5;

THENCE S 00°54'34" E ALONG THE EASTERLY LINE OF SAID CANYON CREEK SUBDIVISION FILING NO. 5 A DISTANCE OF 1217.83 FEET TO THE SOUTHEAST CORNER OF CANYON CREEK SUBDIVISION FILING NO. 5 AND ALSO BEING A POINT ON THE NORTHERLY RIGHT-OF-WAY LINE OF AUSTIN AVENUE;

THENCE S 00°54'34" E A DISTANCE OF 80.02 FEET TO A POINT ON THE SOUTHERLY RIGHT-OF-WAY LINE OF AUSTIN AVENUE AND ALSO BEING A POINT ON THE NORTHERLY LINE OF CANYON CREEK SUBDIVISION FILING NO. 6;

THENCE S 89°52'59" E ALONG THE SOUTHERLY RIGHT-OF-WAY LINE OF AUSTIN AVENUE A DISTANCE OF 1614.32 FEET TO A POINT ON THE WESTERLY RIGHT-OF-WAY LINE OF COUNTY LINE ROAD;

THENCE S 89°52'59" E A DISTANCE OF 155.03 FEET TO A POINT ON THE EASTERLY RIGHT-OF-WAY LINE OF COUNTY LINE ROAD;

THENCE N 00°59'04" W A DISTANCE OF 1436.51 FEET TO THE POINT OF BEGINNING.

PARCEL CONTAINS: 2,541,096.5 SQUARE FEET OR 58.34 ACRES.

PREPARED BY:

ROBERT A. RICKARD, PLS
COLORADO PROFESSIONAL
LAND SURVEYOR NO. 28283
FOR AND ON BEHALF OF
ROCK CREEK SURVEYING, LLC
3021 GARDENIA WAY, SUPERIOR, CO 80027
PHONE: 303-521-7376.

TOWN OF ERIE
PLANNING COMMISSION MEETING
September 16, 2015

SUBJECT:	Erie Highlands Planning Areas 5, 6 and 14 - Sketch Plan - A Sketch Plan represents a generalized land use plan and layout for the area proposed to be included within a subdivision. A Sketch Plan application is required to allow for an early, informal evaluation of a proposed subdivision before detailed planning and engineering work has occurred.
PURPOSE:	Planning Commission review of a proposed Sketch Plan.
PROJECT NO.:	SK-000676-2015
CODE:	Municipal Code Title 10
DEPARTMENT:	Community Development Department
PRESENTER:	Deborah Bachelder AICP, Senior Planner

STAFF RECOMMENDATION

Not applicable; review and comment session for the Planning Commission.

SUMMARY AND BACKGROUND OF SUBJECT MATTER

Location:

The Erie Highlands development is located south of Erie Parkway; west of Road 5 and Blake's Auto Salvage Yard; and, east of the Grandview Subdivision.

Existing Conditions within Sketch Plan Area:

Zoning: AG/OS – Agriculture/Open Space; LR – Low Density Residential; both with PUD – Planned Unit Development Overlay.

Project Size: 101.7 Acres

Existing Use: Vacant

Existing Site Features:

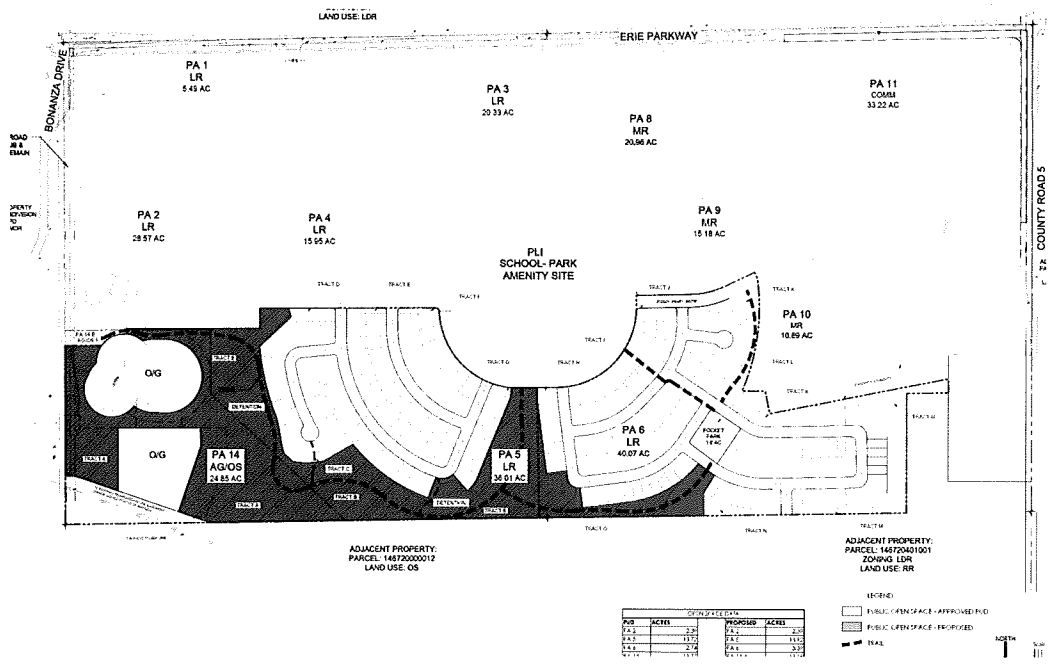
- Western Area Power Association (WAPA) Distribution Lines
- 3 Oil/Gas Well Facility Sites: Existing wells & access roads; potential for future well activity
- Undermining

Adjacent Land-Use/Zoning:

	ZONING	LAND USE
NORTH	CC/PUD – Community Commercial LR/PUD – Low Density Residential PLI/PUD – Public Lands & Institutions	Erie Highlands – Vacant Commercial Erie Highlands – Single Family Residential Erie Highlands – Vacant Elementary School Site; Neighborhood Park; HOA Amenity Site
SOUTH	AG – Agricultural Weld County LR – Low Density Residential	Green Mill Sportsman Club Sunset - Vacant Residential
EAST	AG – Agricultural Weld County	Blake's Auto Salvage Yard
WEST	PD – Planned Development	Grandview – Single Family Residential

SITE SPECIFIC DEVELOPMENT INFORMATION:

The Erie Highlands Planning Area 5, 6 and 14 Sketch Plan application is for the southern half of the overall development. The northwest portion of Erie Highlands is currently under development with 7 different final plat filings. The full development is 296 acres in size.



Sketch Plan Development Data:

- Sketch Plan Area: 101.7 acres
- Residential Development:
  - Single Family Detached 243 dwelling units
- Open Space and Parks:
  - 1 Pocket Park 1.0 acres
  - Public Open Space 31.0 acres
  - Oil/Gas Well Sites 9.0 acres
  - Private Open Space 6.4 acres

Mix of Housing:

To meet the UDC Mix of Housing Type requirement (UDC 10.6.7 D.) for the full development, 237.2 acres, of proposed residential zoned property; the Erie Highlands development should provide one of the following UDC housing diversities:

- 4 housing types, or
- 3 types and 1 variation, or
- 2 types and 2 variations.

The applicant stated in a previous Sketch Plan application narrative letter that they will provide two housing types with two variations within the overall development. They anticipated that the two housing types would be single family and either apartments or townhomes; the two variations would be 2 variations in the single family lot sizes.

Within the current development of Erie Highlands, in the northwest portion of the development, the applicant has provided 1 housing type (single family – lot size 5,000-9,999 square feet) with 2 variations (single family – lot size under 5,000 square feet; single family – lot size 10,000-39,999 square feet). The proposed Sketch Plan does not add to the diversity of the housing in Erie Highlands. The applicant anticipates providing the additional, required housing type in the future residential area zoned MR-Medium Density Residential in the east portion of the Erie Highlands Development.

Parks and Open Space:

The Erie Highlands PUD contains a "Parks & Open Space" dedication table that identifies the overall park and open space dedication requirements. The table includes:

- Community Park: The full development of Erie Highlands requires a dedication of 13.87 acres of community park land. The Board of Trustees approved a fee in lieu of land dedication for the Community Park dedication requirement. A fee in lieu will be calculated with each final plat and included in the associated development agreement.
- Neighborhood Park: The applicant is required to dedicate an 8.32 acre neighborhood park within Planning Area 13 of the Erie Highlands PUD.
- Pocket Park: A 1 acre pocket park is required in the PUD for Planning Area 6. The applicant has met this requirement in the Sketch Plan submittal.
- Open Space:
  - The open space dedication requirement for the full development of Erie Highlands is 47.15 acres. The Board of Trustees approved a minimum dedication of 32.65 acres of open space to the Town and the remainder of the dedication requirement is to be paid as a fee in lieu.

- MC 10.6.3 C.4.: The open space dedication on the current PUD was approved by the Board of Trustees with the approval of the PUD. The oil/gas well sites and the WAPA overhead power line easement are not included in public dedication acreage. There are some areas of the open space that are narrower than 300 feet; however, they contain trails in which the Town approved these narrower areas.
- The applicant is proposing to modify the open space dedication areas that are defined on the approved Erie Highlands PUD Zoning Map. This will require a PUD rezoning amendment application.
- The Sketch Plan represents an open space dedication amount of 31 acres; combined with the proposed open space dedication in Erie Highlands Filing 1-7, Erie Highlands would provide a total of 33.38 acres of open space dedication within the development. Public open space dedication is not anticipated in the future development areas (northeast) within Erie Highlands.

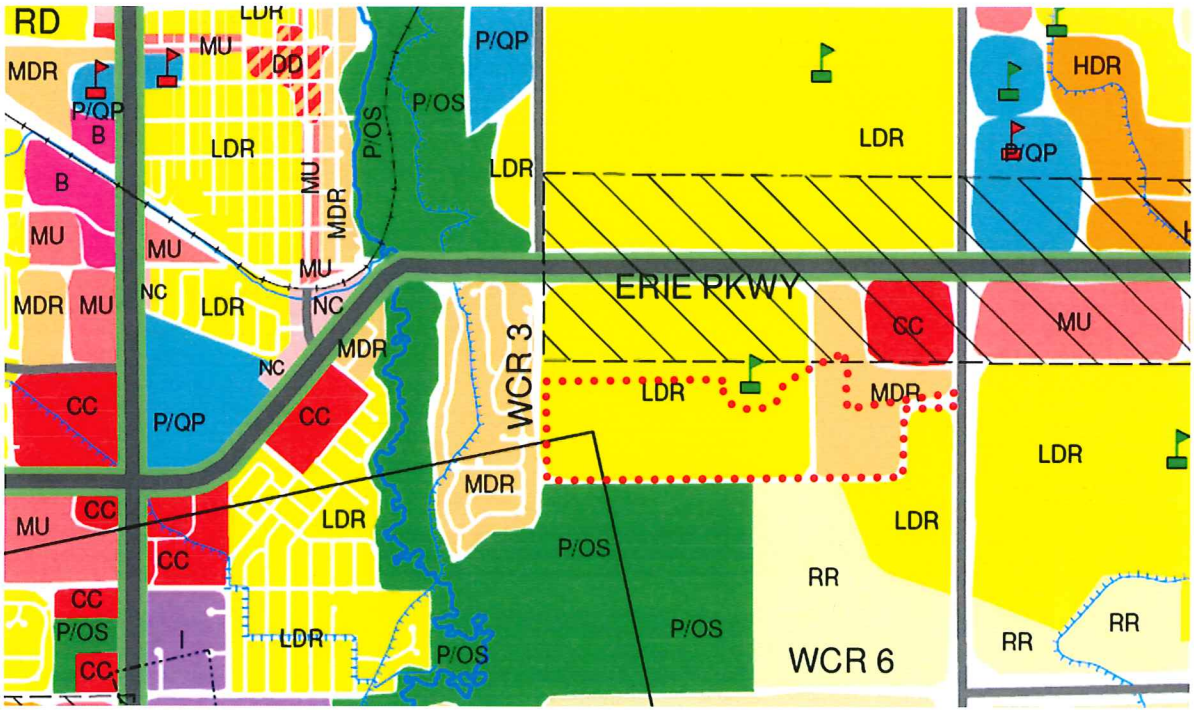
Open Space and Trails Advisory Board:

The Open Space and Trails Advisory Board have provided the applicant with comments in the attached memo.

Compliance with Town of Erie Comprehensive Plan:

The Land Use designations, in this portion of the Erie Highlands development, on the 2005 Comprehensive Plan, Land Use Plan Map are:

- LDR – Low Density Residential (Gross Density of 2-6 Dwelling Units/Acre)
- MDR – Medium Density Residential (Gross Density of 6-12 DU/Acre)



Compliance with Municipal Code Title 10 (UDC)

Town staff has reviewed the proposed Sketch Plan for compliance with the UDC and has provided the applicant with comments in the attached memo.

Compliance with the Erie Highlands Zoning Map and Erie Highlands PUD Zoning Map

Town staff has reviewed the proposed Sketch Plan for compliance with the zoning and PUD overlay zoning and has provided the applicant with comments in the attached memo.

Natural Areas Inventory and Endangered Species:

The Town of Erie, Natural Areas Inventory has two natural areas identified in Erie Highlands as part of the Town wide inventory that was done in 2008. The natural areas report sheet is attached to this memo.

- Inventory Site #75: Only the northeast portion of this natural area is on the property. The WAPA utility lines provide excellent perches for raptors.
- Inventory Site #76: This site is fully on the west end of the property. A prairie dog colony was noted which would make it a potential site for burrowing owls. The prairie dog colony is considered a raptor hunting ground.

SKETCH PLAN PROCESS

Below is the process outlined in Title 10 (UDC) of the Municipal Code for Sketch Plan review.

2. **Step 2A (Development Application Submittal – Sketch Plan)**
   Two types of application submittals are required – first, a Sketch Plan, followed by a Preliminary Plat. The Sketch Plan requirements are listed in this Subsection. The Preliminary Plat requirements are listed below as "Step 2B." Applications for Subdivision shall only be accepted for property annexed into the municipality. A Subdivision application cannot be reviewed concurrently with an annexation application.

   a. ***Purpose***
   A Sketch Plan represents a generalized land use plan and layout for the area proposed to be included within a subdivision. Sketch Plan is required to allow early, informal evaluation of a proposed subdivision before detailed planning and engineering work has been undertaken and before substantial expenses have been incurred by the applicant.

   b. ***Sketch Plan Submittal Requirements***
   A Sketch Plan shall be prepared and submitted to the Community Development Director pursuant to the User's Guide. An Alta Survey shall be prepared and submitted to illustrate the existing conditions on the property and, at a minimum, the Sketch Plan shall contain the following:

      i. Uses proposed;

      ii. Intensity or density of uses proposed;

      iii. Location of public and private open space;

      iv. Drainage Facilities;

      v. Road, street, and pedestrian networks proposed; and

      vi. Existing or proposed utilities and public services for the development.

   c. ***Staff Review***
   The Community Development Department shall review the Sketch Plan, focusing on standards and criteria of this UDC that are applicable to the proposed development. The Community Development Department shall summarize the results of the review in writing and provide a copy to the applicant. The summary shall include any special information regarding the proposed project, plus an evaluation of the proposal with respect to the current policies of the Town, identifying areas of potential compatibility or conflict with these policies. All comments made by the Community Development Department shall not be binding on the Town's consideration of any subsequent application, and are intended only to provide an informal evaluation of the proposed project.

d. ***Meeting to Discuss Sketch Plan***
At the request of the Community Development Director or applicant, the parties shall meet to discuss the results of the review. The applicant shall be informed of the necessary provisions of this UDC relating to subdivision application, including submittal requirements, required public improvements, design standards, and Development Agreements. The Community Development Director shall inform the applicant whether or not a Planning Commission Review shall be required.

e. ***Planning Commission Review***
In addition to the staff review the Community Development Director may require that the Sketch Plan be reviewed by the Planning Commission or the applicant may request this review. The staff review summary shall be submitted to the Planning Commission for consideration. All comments made by the Planning Commission shall not be binding on the Town's consideration of any subsequent application, and are intended only to provide an informal evaluation of the proposed project.

f. ***Effect of Review***
The Sketch Plan is not part of a formal application for approval of a subdivision and any comments made by the Town in reaction to a Sketch Plan shall not be binding on the Town's consideration of any subsequent Preliminary or Final Plat application, nor result in a vested property right under this UDC or State Statute. Since the Sketch Plan is conceptual only, there are no lapse provisions applicable.

Approved by:

R. Martin Ostholthoff
Community Development Director

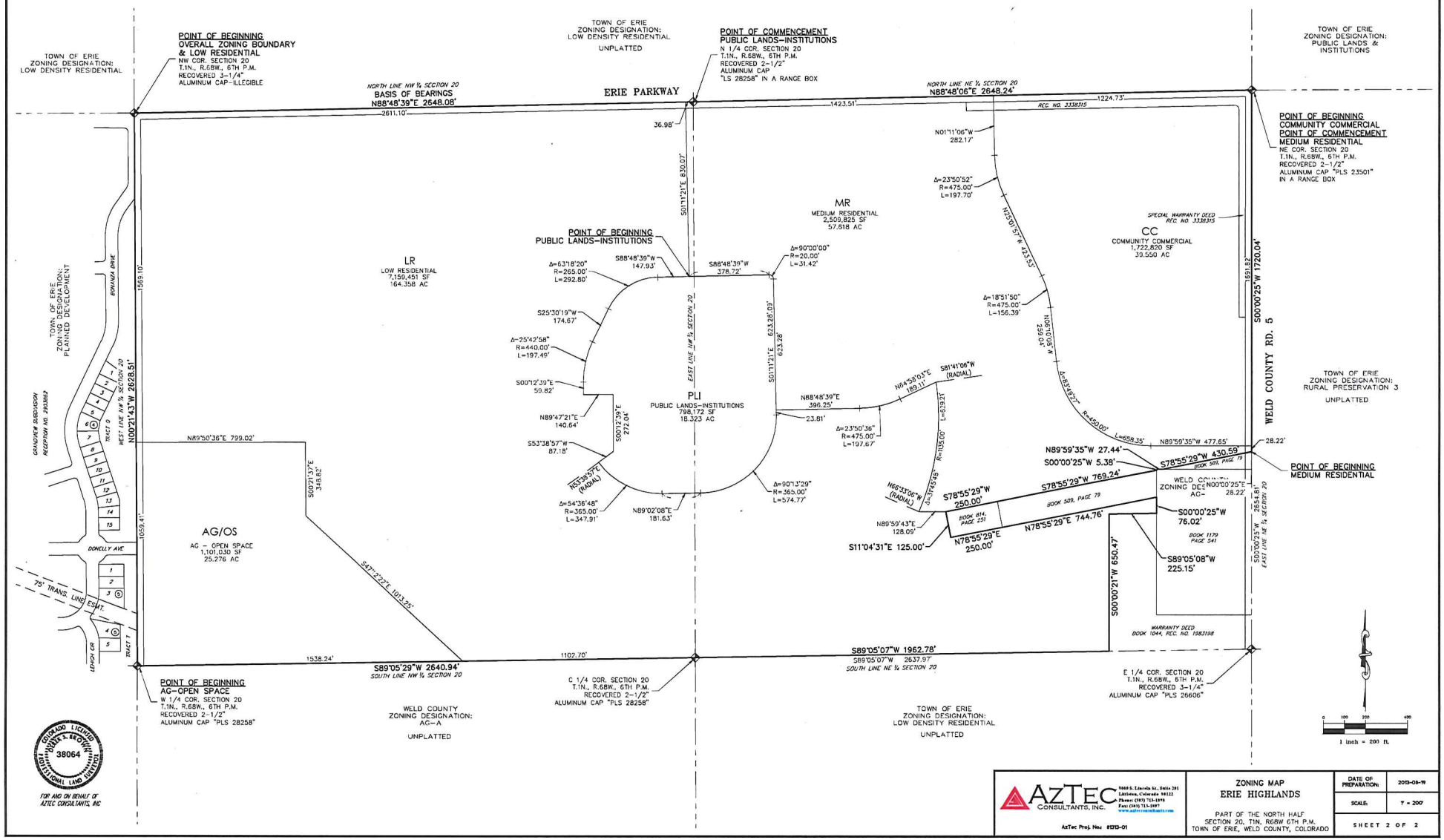
Attachments:

A. Erie Highlands Zoning Map and Erie Highlands PUD Zoning Map
B. Application Materials
C. Staff Review Memos
D. OSTAB Referral Comments

EXHIBIT A

ERIE HIGHLANDS ZONING MAP

A PART OF THE NORTH HALF OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN,
TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO.
305.126 ACRES
RZ-13-00020



COLORADO LICENSED
JAMES S. BROOM
38064
PROFESSIONAL LAND SURVEYOR
FOR AND ON BEHALF OF
AZTEC CONSULTANTS, INC

AzTec Consultants, Inc. — 3500 E. Lincoln St., Suite 201, Littleton, Colorado 80122, Phone: (303) 713-1898, Fax: (303) 713-1897, www.aztecconsultants.com — AzTec Proj. No: 8313-01	ZONING MAP ERIE HIGHLANDS PART OF THE NORTH HALF SECTION 20, T1N, R68W 6TH P.M. TOWN OF ERIE, WELD COUNTY, COLORADO	DATE OF PREPARATION: 2013-08-19 SCALE: 1" = 200' SHEET 2 OF 2

ERIE HIGHLANDS PUD ZONING MAP

A PORTION OF THE NORTH HALF OF SECTION 20,
TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN
TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO
305.126 ACRES
PUD-13-00021

OVERALL BOUNDARY DESCRIPTION:

A PARCEL OF LAND BEING A PART OF THE NORTH HALF OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTHWEST CORNER OF SAID SECTION 20, AND CONSIDERING THE NORTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 20 TO BEAR NORTH 88°48'39" EAST, WITH ALL BEARINGS CONTAINED HEREIN RELATIVE THERETO;

THENCE ALONG SAID NORTH LINE, NORTH 88°48'39" EAST, A DISTANCE OF 2,648.08 FEET TO THE NORTH QUARTER CORNER OF SAID SECTION 20;

THENCE ALONG THE NORTH LINE OF THE NORTHEAST QUARTER OF SAID SECTION 20, NORTH 88°48'06" EAST, A DISTANCE OF 2648.24 FEET TO THE NORTHEAST CORNER OF SAID SECTION 20;

THENCE ALONG THE EAST LINE OF SAID NORTHEAST QUARTER, SOUTH 00°00'25" WEST, A DISTANCE OF 1720.04 FEET TO A POINT ON THE NORTHERLY BOUNDARY OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 509 AT PAGE 79, IN THE OFFICE OF THE CLERK AND RECORDER OF WELD COUNTY;

THENCE DEPARTING SAID EAST LINE AND ALONG SAID NORTHERLY BOUNDARY, SOUTH 78°55'29" WEST, A DISTANCE OF 430.59 FEET TO A POINT ON THE NORTHERLY BOUNDARY OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 1179 AT PAGE 541, IN SAID RECORDS;

THENCE ALONG SAID NORTHERLY BOUNDARY, NORTH 89°59'35" WEST, A DISTANCE OF 27.44 FEET TO THE NORTHWEST CORNER OF SAID PARCEL;

THENCE ALONG THE WESTERLY BOUNDARY OF SAID PARCEL, SOUTH 00°00'25" WEST, A DISTANCE OF 5.38 FEET TO A POINT ON THE NORTHERLY BOUNDARY OF SAID PARCEL DESCRIBED IN BOOK 509 AT PAGE 79;

THENCE ALONG SAID NORTHERLY BOUNDARY, SOUTH 78°55'29" WEST, A DISTANCE OF 769.24 FEET TO THE NORTHEASTERLY CORNER OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 509 AT PAGE 79, IN SAID RECORDS;

THENCE ALONG THE NORTHERLY, WESTERLY AND SOUTHERLY BOUNDARIES OF SAID PARCEL THE FOLLOWING THREE (3) COURSES:

1) SOUTH 78°55'29" WEST, A DISTANCE OF 250.00 FEET;

2) SOUTH 11°04'31" EAST, A DISTANCE OF 125.00 FEET;

3) NORTH 78°55'29" EAST, A DISTANCE OF 250.00 FEET TO THE SOUTHWESTERLY CORNER OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 509 AT PAGE 79, IN SAID RECORDS;

THENCE ALONG THE SOUTHERLY BOUNDARY OF SAID PARCEL, NORTH 78°55'29" EAST, A DISTANCE OF 744.76 FEET TO A POINT ON THE WESTERLY BOUNDARY OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 1179 AT PAGE 541, IN SAID RECORDS;

THENCE ALONG SAID WESTERLY BOUNDARY, SOUTH 00°00'25" WEST, A DISTANCE OF 76.02 FEET TO THE NORTHEASTERLY CORNER OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 1044 AT RECEPTION NO. 1983198, IN SAID RECORDS;

THENCE ALONG THE NORTHERLY BOUNDARY OF SAID PARCEL, SOUTH 89°05'08" WEST, A DISTANCE OF 225.15 FEET TO THE NORTHWESTERLY CORNER OF SAID PARCEL;

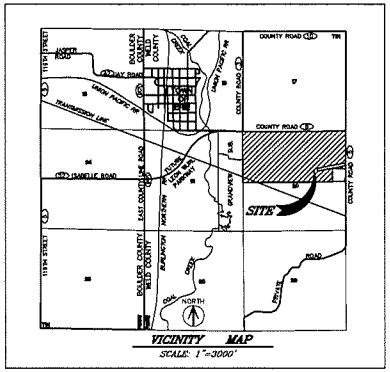
THENCE ALONG THE WESTERLY BOUNDARY OF SAID PARCEL, SOUTH 00°00'21" WEST, A DISTANCE OF 650.47 FEET TO THE SOUTHWESTERLY CORNER OF SAID PARCEL AND A POINT ON THE SOUTH LINE OF THE NORTHEAST QUARTER OF SAID SECTION 20;

THENCE ALONG SAID SOUTH LINE, SOUTH 89°05'07" WEST, A DISTANCE OF 1,962.78 FEET TO THE CENTER QUARTER CORNER OF SAID SECTION 20;

THENCE ALONG THE SOUTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 20, SOUTH 89°05'29" WEST, A DISTANCE OF 2640.94 FEET TO THE WEST QUARTER CORNER OF SAID SECTION 20;

THENCE ALONG THE WEST LINE OF SAID NORTHWEST QUARTER, NORTH 00°21'46" WEST, A DISTANCE OF 2628.51 FEET TO THE **POINT OF BEGINNING.**

CONTAINING AN AREA OF 305.126 ACRES, (13,291,297 SQUARE FEET), MORE OR LESS.



NOTES:
1. THIS PUD ZONING MAP MODIFIED THE DIMENSIONAL STANDARDS SET FORTH IN THE TOWN OF ERIE UDC AS PROVIDED FOR IN SECTION 10.2.7.D.
2. IN THE EVENT THAT THERE IS ANY DISCREPENCY BETWEEN THE CODE AND THIS PUD, THE PUD SHALL CONTROL. ANY PROVISIONS THAT ARE NOT SPECIFICALLY ADDRESSED IN THIS PUD ZONING MAP SHALL COMPLY WITH THE CODE.
3. THE MAXIMUM NUMBER OF UNITS ALLOWED IN THIS PUD IS 994.

SURVEYOR'S CERTIFICATE

I, DEREK BROWN, A DULY REGISTERED PROFESSIONAL LAND SURVEYOR IN THE STATE OF COLORADO, DO HEREBY CERTIFY THAT THIS PUD ZONING MAP TRULY AND CORRECTLY REPRESENTS THE ABOVE DESCRIBED LEGAL DESCRIPTIONS FOR EACH PUD OVERLAY ZONE DISTRICT.

I ATTEST TO THE ABOVE ON THIS _____DAY OF _____, 2013.

_____
DEREK BROWN

COLORADO REGISTERED PROFESSIONAL LAND SURVEYOR #

PLANNING COMMISSION CERTIFICATE

THIS PUD ZONING MAP WAS REVIEWED BY THE PLANNING COMMISSION ON THE _____DAY OF _____, 2013.

_____ _____
CHAIRPERSON DATE

BOARD OF TRUSTEES APPROVAL CERTIFICATE

THIS PUD ZONING MAP IS TO BE KNOWN AS THE "ERIE HIGHLANDS PUD ZONING MAP" AND IS APPROVED AND ACCEPTED BY ORDINANCE NO._____, PASSED AND ADOPTED AT THE REGULAR MEETING OF THE BOARD OF TRUSTEES OF ERIE, COLORADO, HELD ON _____, 2013.

_____
MAYOR

ATTEST _____
TOWN CLERK

CLERK & RECORDER CERTIFICATE

STATE OF COLORADO)
) ss.
COUNTY OF WELD)

I DO HEREBY CERTIFY THAT THIS PUD ZONING MAP WAS FILED IN MY OFFICE ON THIS _____ DAY OF _____, 2013 A.D. AND WAS RECORDED AT RECEPTION NUMBER _____.

_____
_____ ____ COUNTY CLERK AND RECORDER

APPLICANT	OWNER	OWNER	OWNER	OWNER	PLANNER	ENGINEER	SURVEYOR
OAKWOOD HOMES LLC	J DEARMIN LLC	J GAZ LLC	THE JACK SHELL & SONYA SHELL	WY&K HOLDINGS, LLC	TERRACINA DESIGN	ENGINEERING PARTNERS	AZTEC CONSULTANTS
4908 TOWER ROAD	10343 FEDERAL BOULEVARD	4955 WEST 65TH AVENUE	FAMILY TRUSTS	28221 HIDDEN VILLAGE DRIVE	9025 E KENYON AVE	1950 WEST LITTLETON BLVD.	8000 S. LINCOLN ST, STE 201
DENVER, CO 80249	UNIT 515	ARVADA, CO 80003	10015 MEADE COURT	EVERGREEN, CO 80439	SUITE 219	SUITE 109	LITTLETON, COLORADO 80122
(303) 486-8500	WESTMINSTER, CO 80260	CONTACT: JOHNNY GAZ	WESTMINSTER, CO 80031	CONTACT: ROBERT E. YOULE	DENVER, CO 80237	LITTLETON, COLORADO 80120	(303)713-1898
CONTACT: CHAD ELLINGTON	CONTACT: JAMES DEARMIN		CONTACT: JACK SHELL		(720) 263-4866	(303)709-4680	CONTACT: DEREK BROWN
					CONTACT: LAYLA ROSALES	CONTACT: DAVID FORBES	

SHEET INDEX

1 COVER
2 PUD PLAN
3 PUD NOTES

Terracina Design
Land Planning & Landscape Architecture
9025 E. Kenyon Ave. #219
Denver, CO 80237
Phone (303) 953-4666
www.terracinadesign.com

PROJECT NAME

ERIE HIGHLANDS
PUD ZONING MAP
TOWN OF ERIE, COLORADO

SHEET TITLE

COVER SHEET

SHEET NUMBER

1

SHEET 1 OF 3

SEPTEMBER 13, 2013

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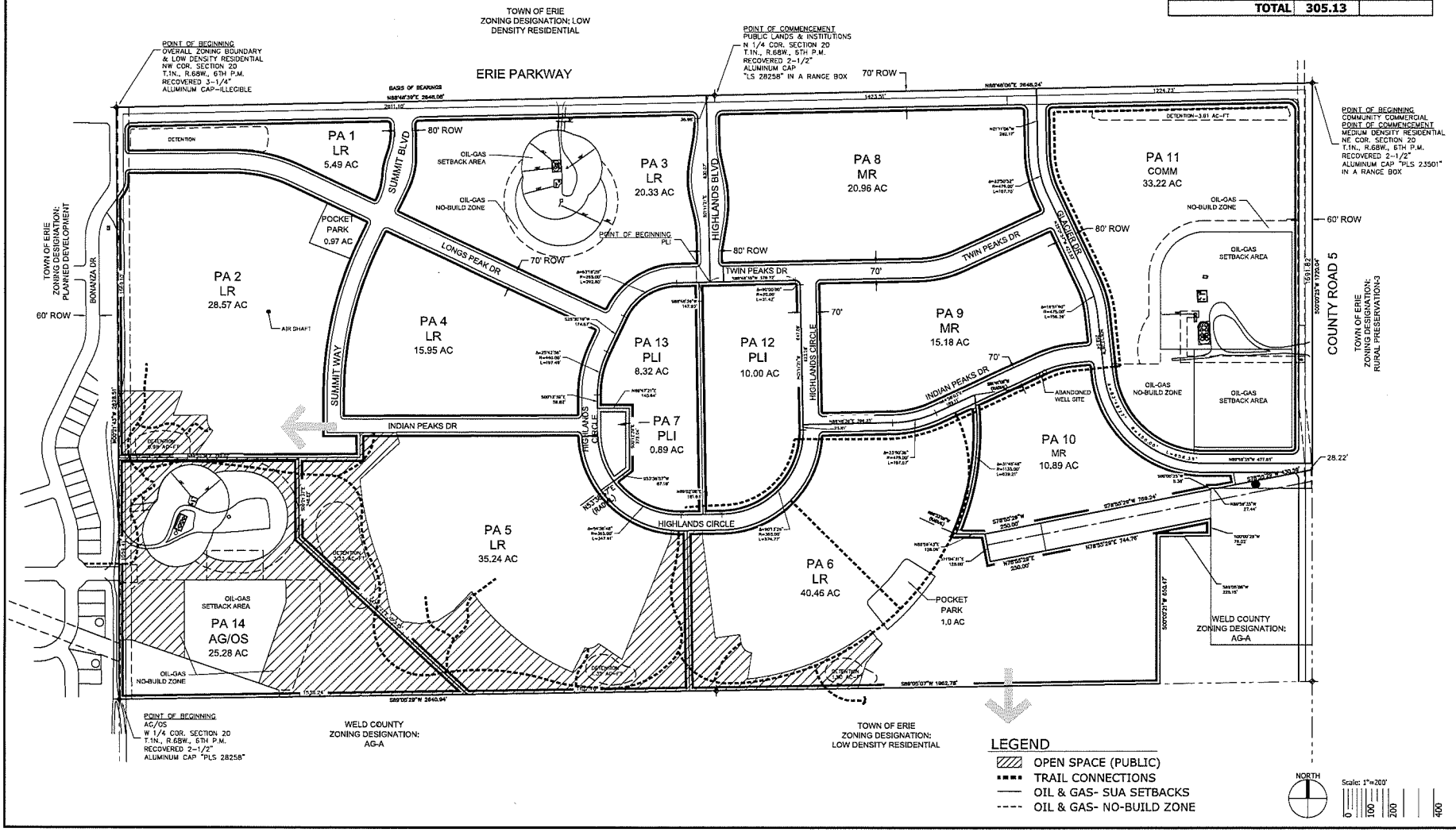
ERIE HIGHLANDS PUD ZONING MAP

A PORTION OF THE NORTH HALF OF SECTION 20,
TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN
TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO
305.126 ACRES
PUD-13-00021

PARKS & OPEN SPACE		
PARK AREA	ACRES REQUIRED	ACRES TO BE PROVIDED
COMMUNITY PARK	13.87	FEE IN LIEU
NEIGHBORHOOD PARK	8.32	8.32
POCKET PARK	1.39	1.97
OPEN SPACE (PUBLIC)	47.15	32.65 + FEE IN LIEU

DEVELOPMENT SUMMARY		
LAND USE	ACRES	% ACRES
Residential	175.66	57.6%
Commercial	33.22	10.9%
School	10.00	3.3%
Parks & Open Space	51.90	17.0%
Right-of-Way	34.35	11.3%
TOTAL	305.13	



Terracina Design
Land Planning & Landscape Architecture
3900 E Mexico Ave, Suite 619
Denver, CO 80210
Phone: (303) 953-4455
www.TerracinaDesign.com

PROJECT NAME

ERIE HIGHLANDS
PUD ZONING MAP
TOWN OF ERIE, COLORADO

SHEET TITLE

PUD PLAN

SHEET NUMBER

2

SHEET 2 OF 3

SEPTEMBER 13, 2013

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ERIE HIGHLANDS PUD ZONING MAP

A PORTION OF THE NORTH HALF OF SECTION 20,
TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN
TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO
305.126 ACRES
PUD-13-00021

ARCHITECTURAL STANDARDS-SINGLE FAMILY RESIDENTIAL DETACHED

1. Architectural Variety and Character
   a. Architectural Variety

      I. Design Standards
         (A) No identical model plan elevation shall be repeated directly across any street from the same model plan and elevation.
         (B) No identical model plan elevation shall be repeated more than once within every 4 lots on the same side of any street.
         (C) A minimum of 3 alternative elevations for each model plan shall be submitted to the Town for review.

   b. Architectural Character
      Each single family detached model plan and elevation shall demonstrate the following design attributes:

      I. Design Standards

         (A) Each elevation shall include a minimum of two windows (or one window and one door) per floor.
         (B) Each front and rear elevation shall include more than one wall plane. Articulation that adds shadow and visual interest is encouraged.
         (C) A variety of roof forms should be used. Single unbroken roof pitches should be avoided, except where a single roof treatment is an essential element of the Architectural Style. (e.g. Mansard)
         (D) The main roof should extend beyond the primary façade by a minimum of one foot.
         (E) An elevation of the home that faces a street, park, trail corridor or open space area shall provide an "Enhanced Elevation". An "Enhanced Elevation" shall provide three or more of the following design enhancements listed in (1) through (5) below. Application of the design enhancement shall be applied in a manner that is consistent with the style of the home. Side and rear elevation design enhancements shall be consistent with the design elements of the front elevation.

            (1) The addition of one window unit.
            (2) A change in wall plane by providing one or more of the following options:
               - An additional wall plane change. Minimum six feet in width and one foot projection.
               - A projecting or cantilevered living space.
               - A bay or boxed window.
            (3) A covered porch or deck.
            (4) The addition of architectural detail elements such as: shutters, eave brackets, exposed rafter tails, corbels, lintels, trellises, columns or pilasters.
            (5) The use of a minimum of two exterior cladding materials that can include materials such as masonry (cultured stone, stone, brick, stucco, or tile), lap siding, shingles, board and batten, or other decorative siding treatment.

         (F) Columns or posts extending more than 36 inches above the ground which support structural elements such as porches, decks, or roofs should appear to be of adequate mass to support the structure above. (No exposed 4"x4" posts shall be allowed more than 36 inches above the ground). Columns supporting upper story decks should be 8"x8" minimum finished.

      II. Materials
         (A) All exterior materials shall be of high quality, used in applications and treated appropriately to provide an attractive and long lasting appearance.
         (B) When masonry cladding is used in locations where its mass is logical and appropriate. In instances where masonry wraps the exterior corner of the home the masonry should continue to a natural transition point such as an inside corner of a projecting wall, a column, a door or window or other logical point. In cases where no such feature exists near the corner, the masonry wrap shall extend at least six feet from the corner.

2. Orientation of Dwellings to the Street
   Each residence shall have at least one primary pedestrian doorway for access to the dwelling unit facing and generally visible from the front lot line of the property, and within twelve feet of the most forward plane of the ground level living space. On corner lots, the pedestrian doorway may face any adjacent street. An exception shall be made for alley-loaded single-family detached dwelling units that do not have street frontage but do front onto a park, or landscaped common area . In such case where the dwelling unit does not have street frontage, one primary pedestrian doorway shall be oriented toward a common pedestrian walk that connects to a street.

3. Garages
   These regulations for garages shall be applied to non-living space or storage areas within garages whether used for storage of automobiles or other items.
   a. Diversity of Garage Orientation:
      A. Except for garages oriented to alleys, all single family homes shall provide garages that meet one of the requirements below, and a variety in garage orientation by providing a minimum of two of the following garage orientations on any subdivision filing.

         - Recessed garage; where the primary garage door generally faces the front lot line and the garage is recessed a minimum of two feet behind the most forward plane of the main floor living space or a front porch.
         - Projecting garages; where the primary garage door generally faces the front lot line and the garage projects no more than fifteen feet from the front door.
         - Side loaded garages.
         - Garages recessed a minimum of two feet beneath a second floor living space.

   b. Width / Façade Ratio
      The width of a front loaded garage shall not exceed 65% of the width of the front elevation.
   c. Three or More Car Garage Orientation
      The third of more bay of any three or more garage shall either:
         i. Have a different orientation from the first two; or
         ii. Shall be recessed behind the first two by at least two feet when having the same orientation; or
         iii. Shall be tandem to the first two.

4. Front Stoop
   For model plans with a front stoop; the front stoop shall include the platform and stairs that are generally in front of a door that can be covered or uncovered. The maximum width of a covered front stoop shall be three feet in width from the side of the front door. Covered platforms that exceed three feet in width from the side of the front door shall be considered a front porch.

5. Front Porches
   For model plans with a front porch; the front porch shall be a minimum size of fifty square feet, excluding the stoop with a minimum depth of five feet.

DEVELOPMENT STANDARDS

PLANNING AREA	ZONE DISTRICT	MIN LOT WIDTH	MIN LOT NET AREA (SF)	FRONT SETBACK	FRONT SETBACK (PORCH)	STREET SETBACK	INTERIOR LOT LINE SETBACK	REAR SETBACK	MAX. HEIGHT
PA-1	LR	60(4)	6,000	16 (2)	10	10 (1)(4)	5 (1)	20 (3)	35'
PA-2	LR	45 (4)	4,500	16 (2)	10	10 (1)(4)	5 (1)	20 (3)	35'
PA-3	LR	60 (4)	6,000	16 (2)	10	10 (1)(4)	5 (1)	20 (3)	35'
PA-4	LR	50(4)	5,000	16 (2)	10	10 (1)(4)	5 (1)	20 (3)	35'
PA-5	LR	60 (4)	6,000	16 (2)	10	10 (1)(4)	5 (1)	20 (3)	35'
PA-6	LR	45 (4)	4,500	16 (2)	10	10 (1)(4)	5 (1)	20 (3)	35'
PA-7	MR	45 (4)	4,500	16 (2)	10	10 (1)(4)	5 (1)	20 (3)	35'
PA-8	MR	40 (4)	2,800	16 (2)	10	10 (1)(4)	5 (1)	10	35'

(1) Permitted encroachments. Side setbacks shall allow for encroachments up to twelve(12) inches beyond the building foundation for window wells and above grade features including eaves, counterforts, fireplace box out, stoops, bay windows, room cantilevers and overhangs provided that the living space of the projection does not exceed six (6) feet in width. There shall be no more than two above grade encroachments per elevation totaling no more than twenty (20) sf.
(2) Front loaded garages shall be set back twenty (20) feet. A sixteen(16) foot front setback allowed with side loaded garage
(3) Unenclosed covered patios may project up to eight (8) feet into a rear setback. The projection shall be at least five feet from the property line.
(4) The minimum lot width shall be measured from the front setback line and shall be increased on corner lots to accommodate the additional side on street setback.

LAND USE SUMMARY

TRACT	ZONE DISTRICT	AREA (ACRES)	PRIMARY USE	DWELLING UNITS	PUBLIC OPEN SPACE PROVIDED
LOW DENSITY RESIDENTIAL					
PA 1	LR	5.49	SFD	7	
PA 2	LR	28.57	SFD	112	2.33
PA 3	LR	20.33	SFD	37	
PA 4	LR	15.95	SFD	95	
PA 5	LR	35.24	SFD	95	12.54
PA 6	LR	40.46	SFD	155	3.92
PA 7	LR	0.89	AMENITY	0	
SUBTOTAL		**146.93**			
RIGHT OF WAY		17.43			
SUBTOTAL		**164.36**		**501**	**18.8**
MEDIUM DENSITY RESIDENTIAL					
PA 8	MR	20.96	SFD	120	
PA 9	MR	15.18	SFD	170	
PA 10	MR	10.89	TH/ APT	203	
SUBTOTAL		**47.03**			
RIGHT OF WAY		12.32			
SUBTOTAL		**59.35**		**493**	
COMMUNITY COMMERCIAL					
PA 11		33.22	COMM		
SUBTOTAL		**33.22**			
RIGHT OF WAY		4.60			
SUBTOTAL		**37.82**			
PUBLIC LAND AND INSTITUTIONS					
PA 12		10.00	SCHOOL		
PA 13		8.32	N PARK		
SUBTOTAL		**18.32**			
AGRICULTURAL / OPEN SPACE					
PA 14		25.28	OPEN SPACE		13.86
SUBTOTAL		**25.28**			
TOTAL		**305.13**		**994**	**32.65**

NOTES

1. Density: Dwelling units may be transferred between planning areas in the same zone district as long as the maximum density allowed within that zone district is not exceeded.
2. Erie Parkway: Thirty (30) foot landscape buffer not required when a local road is directly adjacent. (i.e. frontage road condition). Thirty (30)foot landscape buffer is required when lots abut Erie Parkway right of way.
3. Fencing along Erie Parkway shall not exceed six feet in height which may include opaque fencing in straight runs limited to approximately 600 feet in length without a break and shall be limited to 30% of the total frontage of Erie Parkway. Masonry columns shall not exceed six feet in height with a four inch cap and shall be provided on corners of lots a minimum of every three lots for all opaque fencing along Erie Parkway.
4. Double frontage lots abutting collector or local roads shall be an additional 10 feet in depth. A twenty (20) foot landscape buffer will be provided along local and collector roads abutting double frontage lots.
5. Planning areas shown with apartments and townhomes land use designation shall be allowed to develop with lower density uses including single family attached and detached as long as the minimum housing diversity requirements and minimum gross density for the zone district are met.
6. The trail along Indian Peaks Drive within PA-6 and PA-10 shall be located within a landscape tract and meander.

Terracina Design
Land Planning & Landscape Architecture
9025 Kenyon Ave, Ste 219
Denver, CO 80237
Phone: (720) 263-4866
www.TerracinaDesign.com

PROJECT NAME

ERIE HIGHLANDS
PUD ZONING MAP
TOWN OF ERIE, COLORADO

SHEET TITLE

PUD NOTES

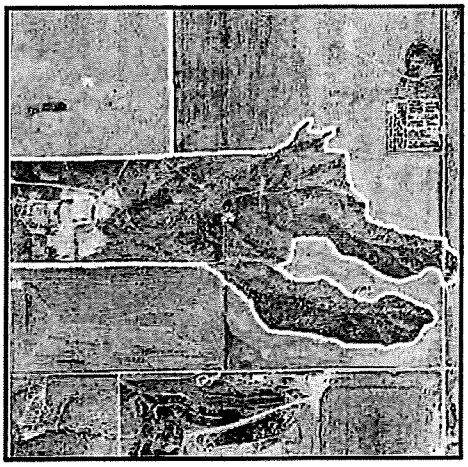
SHEET NUMBER

3

SEPTEMBER 13, 2013

EXHIBIT B

TOWN OF ERIE NATURAL AREAS INVENTORY



Site #: 75 Map: B2
Big Draw Acres 177

This site is a shooting range with interesting topography created by rolling hills and swales.

Wetlands:
Wetland Functionality: 3 Wetland Value: 1

Landscape Context
Nearby Land Use:
Field without Crops
Subdivision
Natural Area

Habitat Types Present: 2
Agriculture
Other

Viewshed: From Site

Vegetation
Plant Communities: ADUD, CSL, ISAP

Vegetation Structure:
Forbs
Grass

County-listed Noxious Weeds:
Musk Thistle
Canada Thistle

Noxious Weed Cover 5
Ground Disturbance: 3
Plant Diversity: 2
Grassland Value: 0

Wildlife Habitat
Prairie Dog Habitat: 0%
Overall Wildlife Habitat Quality: 3

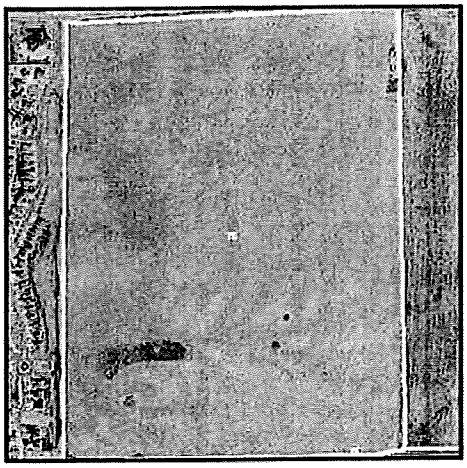
Wildlife Species of Concern:
ferruginous hawk, plains harvest mouse, hispid pocket mouse

Primary Factors Present	Secondary Factors Present
Water or wetland is present State or federally listed species potentially present	Site is larger than 3 acres Site is adjacent to another natural area One of the three vegetation structure types is in good condition

Wildlife Species Seen western meadowlark

Enhancement Effort: Low
Summary Rating: 13
Site Comments
This site comprises a large field with interesting topography created by rolling hills and swales. Monoculture stands of rye grass dominate the site and have out-competed other vegetation. This abundance of rye grass has kept the area devoid of other weeds. This also means that native species are few. The site is used as a shooting range. Utility lines overhead provide excellent perches for raptors such as ferruginous hawks that would forage on the adjacent prairie dog colonies. Access was denied to the site, and the evaluation was conducted from aerials and adjacent roads.

TOWN OF ERIE NATURAL AREAS INVENTORY



Site #: 76 Map: B2
Grandview Rectangular Field Acres 116

Grandview Rectangular Field is predominately a mowed field with a high percentage of bare ground, adjacent to the shooting range (site 75).

Wetlands:
Wetland Functionality: 0 Wetland Value: 1

Landscape Context
Nearby Land Use:
Field without Crops
Subdivision
Natural Area

Habitat Types Present: 1
Other

Viewshed: None

Vegetation
Plant Communities: CSL

Vegetation Structure:
Forbs
Grass

County-listed Noxious Weeds:

Noxious Weed Cover 5
Ground Disturbance: 3
Plant Diversity: 1
Grassland Value: 2

Wildlife Habitat
Prairie Dog Habitat: 20%
Overall Wildlife Habitat Quality: 5

Wildlife Species of Concern:
burrowing owl

Primary Factors Present	Secondary Factors Present
Water or wetland is present State or federally listed species potentially present Site is an irreplaceable source of food and cover, or important for breeding Prairie dogs present	Site is larger than 3 acres Site is adjacent to another natural area One of the three vegetation structure types is in good condition Site is potentially part of a corridor, or a lower quality corridor

Wildlife Species Seen black-tailed prairie dog

Enhancement Effort: Low
Summary Rating: 12
Site Comments
Grandview Rectangular Field is predominately a mowed field with a high percentage of bare ground, adjacent to the shooting range (site 75). A prairie dog colony was noted within the site. The vegetation consisted mainly of weedy forbs. No trees or shrubs were present. Wildlife in this polygon is likely confined to prairie dogs and burrowing owls, as there was no observable water or shelter present. Due to the prairie dog colony, however, this area would be suitable as a raptor hunting ground. Enhancement could include the planting of natives, but it presently looks as though the area is slated for residential development.

EXHIBIT C

TOWN OF ERIE
1874

Department of Community Development

Planning and Building

The Town of Erie
645 Holbrook St.
P.O. Box 750
Erie, CO 80516
(303) 926-2775
FAX (303) 926-2706

Memo

To: John Cheney

From: Deborah Bachelder

Date: September 3, 2015

Re: SK-000676-2015: Erie Highlands Planning Area 5, 6 & 14 – Sketch Plan Application

cc: Layla Rosales, Marty Ostholthoff, Russell Pennington, Matt Wiederspahn, Farrell Buller

Comments:

The Erie Highlands Planning Area 5, 6 & 14 – Sketch Plan application was reviewed at the September 3, 2015 Development Review Team meeting. Below are the Community Development Department comments. Additional comments from the Public Works Department and the Open Space and Trails Advisory Board are being forwarded to you as well. We did not receive comments from the Parks & Recreation Department; if they submit comments after this memo is sent to you we will follow up and forward the comments to you at that time.

The Sketch Plan application process allows staff, Planning Commission and the Board of Trustees the opportunity to make comments that the applicant should then address with the Preliminary Plat application. All of the comments will be forwarded, as an attachment to the staff memos, to the Planning Commission and Board of Trustees for their review of the application.

Staff has scheduled your review with the Planning Commission on September 16th and with the Board of Trustees on October 13th. No further application materials are required from you at this time to proceed to those reviews. Staff will not be making a presentation at Sketch Plan, but will introduce the item to the Planning Commission and Board of Trustees. The Sketch Plan process is really for the applicant to present their concept and receive comments only.

Community Development Department comments:

1. Section 7 – ALTA:
   a. Tract L: At Preliminary Plat, you will need to identify what is being done with the two 55 gallon barrels identified on the property and on the edge of the property.

2. Section 8 - Sketch Plan:
   a. General Issues:
      i. Town of Erie Natural Areas Inventory:
         1. Two sites are identified in this Town document as being fully or partially located on the Dearmin property; they are:
            a. Inventory Site #75: Only the northeast portion of this site is on the property. Access to the site was not provided so the report was done from the road. Utility lines provide excellent perches for raptors.

b. Inventory Site #76: This site is fully on the west end of the property. A prairie dog colony was noted which would make it a potential site for burrowing owls. The prairie dog colony is considered a raptor hunting ground.

2. The applicant will be required to provide an endangered species report with the Preliminary Plat application that will be reviewed by outside agencies.

ii. Natural and Scenic Resource Protection:
   1. MC 10.6.2 A.3.b.vi.: The Town lists "slopes of greater than 20 percent" as a priority for protection. The Sketch Plan identifies "8% or greater slopes" that do not correlate to Town standards. Only those areas with slopes greater than 20% are addressed by this section of the Code.

iii. Parks and Open Space:
   1. The Erie Highlands PUD contains a "Parks & Open Space" dedication table that identifies the overall park and open space dedication requirements. The table includes:
      a. Community Park: The full development of Erie Highlands requires a dedication of 13.87 acres of community park land. The Board of Trustees approved a fee in lieu of land dedication for the Community Park dedication requirement. A fee in lieu will be calculated with each final plat and included in the associated development agreement.
      b. Neighborhood Park: The applicant is required to dedicate an 8.32 acre neighborhood park within Planning Area 13 of the Erie Highlands PUD.
      c. Pocket Park: A 1 acre pocket park is required in the PUD for Planning Area 6. The applicant has met this requirement in the Sketch Plan submittal.
      d. Open Space:
         i. The open space dedication requirement for the full development of Erie Highlands is 47.15 acres. The Board of Trustees approved a minimum dedication of 32.65 acres of open space to the Town and the remainder of the dedication requirement is to be paid as a fee in lieu.
         ii. MC 10.6.3 C.4.: The open space dedication on the current PUD was approved by the Board of Trustees with the approval of the PUD. There are some areas of the open space that are narrower than 300 feet; however, they contain trails in which the Town approved these narrower areas.
         iii. The applicant is proposing to modify the open space dedication areas that are defined on the approved Erie Highlands PUD Zoning Map. This will require a PUD rezoning amendment application. Staff believes that in general the minor changes proposed are still within the intent of the open space on the approved PUD.

iv. Pedestrian Facilities and Trails:
   1. MC 10.6.5 F.3. Trails:
      a. MC 10.6.5 F.3.a. and b.: The east-west trail is a spine trail in the Town's Parks, Recreation, Open Space and Trails (PROST) Master Plan. Construction of this trail will need to meet our Town standards for a spine trail.
      b. MC 10.6.5 F.3.c.: A trail connection will be required for access to the Sunset property to the south. Please add the trail connection based on the approved Sunset Preliminary Plat location.
      c. MC 10.6.5 F.3.d.: The minimum trail width of 30 feet has not been met in all areas of the Sketch Plan submittal.

d. MC 10.6.5 F.3.e.: Trails proposed on private HOA/Metro District property will be required to grant a public access easement.

2. Erie Highlands PUD Zoning Map:
   a. The trail configurations are not as complete as those illustrated in the PUD Zoning Map; revision is needed to meet the requirements.
   b. PUD Sheet 3 Note 6 states that the trail along Indian Peaks Drive within PA-6 and PA-10 shall be located within a landscape tract and meander. Please add this trail. Additionally, MC 10.6.5 F.3.d. requires a minimum trail width of 30 feet in the tract.

v. Mineral Rights:
   1. There is an existing oil/gas well on the west side of the site, in the open space, that will need to be accommodated in the development of the site. Setbacks and well facility requirements that are identified in the UDC and the SUA will need to be met at the time of Preliminary Plat. The mineral right holders will be sent referrals at Preliminary Plat.

vi. Utilities:
   1. Stormwater Facilities:
      a. The proposed detention ponds in the proposed open space dedication area will need to meet the requirements in MC 10.6.3 C. and 10.6.4 E.9 to qualify as Town dedicated open space.
   2. WAPA (Western Area Power Association) Transmission Lines:
      a. Any proposed grading and improvements within the easement will need to be reviewed and permitted by WAPA. WAPA will be sent a referral at Preliminary Plat for review and comment.

vii. Streets:
   1. Highlands Circle:
      a. Highlands Circle has not yet been platted adjacent to these Planning Areas. This road will need to be platted before many of these lots can be platted.
   2. Cul-de-sacs
      a. MC 10.5.G 6: Maximum length of a cul-de-sac is 750 feet. The western cul-de-sac comes close to that length.
      b. MC 10.6.5 F.2.d. Cul-de-sacs are required to provide a pedestrian path connection from the end of the cul-de-sac. The Sketch Plan proposes two cul-de-sacs and one has a pedestrian path and one does not.
      c. MC 10.6.5 D.2.e.:
         i. The cul-de-sac heads are required to have a minimum of a 35 foot view and pedestrian access. Neither cul-de-sac meets this requirement.
         ii. The trail needs to be shown in each tract connecting to the main trail corridor. The Sketch Plan proposes two cul-de-sacs and one has a pedestrian path and one does not.
   3. Residential Streets:
      a. MC 10.6.5 D.3.c. Maximum Block Lengths:
         i. There is a requirement that the average block face be a maximum of 600 feet. Staff's calculation of the block faces proposed in this Sketch Plan exceeds that 600 foot maximum. At Preliminary Plat, the applicant needs to submit an illustration showing how the overall development of Preliminary Plat 1 and 2 meets this requirement.
      b. MC 10.6.5 F.2.c. Through-Block Connections:

i. Blocks 900 feet or longer are required to have a through-block pedestrian connection, in a tract that is 30 feet in width with a trail at least 5 feet in width.
    1. There are several blocks proposed that appear to be 900 feet or more in length that have not provided the through-block connection.
    2. The through-block connection provided does not meet the 30 foot minimum tract width.

viii. Residential Lots:
    1. PUD Sheet 3 Notes 4: This note requires double frontage lots abutting collector or local roads to be an additional 10 feet in depth and have a 20 foot landscape buffer. There a not very many double frontage lots in the Sketch Plan; however, the lots that back to Indian Peaks Drive appear to be some of the shallowest lots that do not provide the additional 10 feet in depth and do not have the minimum 20 foot landscape buffer in some areas.
    2. There are a couple of lots just north and east of the pocket park that are clipped off in the back. Staff questions if they meet the minimum lot size.

b. Sheet 2:
    i. Dwelling Unit Summary Chart:
        1. Filing/PA Area" column: When I add the numbers in this column it comes to a total that is less than the legal description on Sheet 1.
        2. The note below the table is not correct. The note references the Comprehensive Plan Map LDR-Low Density Residential density of 2-5 dwelling units per acre when it should be referencing the Unified Development Code LR-Low Density Residential zone district density. MC 10.2.2 E.1. allows residential development in LR at a gross density not to exceed 5 dwelling units per acre.

3. Section 10 – Ecological Site Assessment:
    a. At the time of Preliminary Plat the Ecological Site Assessment will need to be updated. Areas within the report that contain Prairie Dogs and Remnant Native Grassland will need further evaluation by staff at the time of Preliminary Plat.

TOWN OF ERIE
1874

Memo

To: Deb Bachelder
From: Matt Wiederspahn, P.E., CFM, Development Engineer
Date: September 8, 2015
Subject: **Erie Highlands Planning Areas 5, 6, and 14 Sketch Plan Comments**
CC: Russell Pennington
Wendi Palmer

Comments for Phase I Drainage Report:

1. Basin OS includes numerous walkout lots that are shown draining un-detained with no water quality off site. All developed lots must provide detention and water quality for runoff.
2. Several detention ponds are shown in open space and will need to meet the UDC design criteria for storm water facilities in open space. Section 10.6.3.C.4.g.ix of the UDC requires that they cannot be deeper than five feet nor have slopes greater than 5:1.
3. Outfall locations and downstream facilities of the ponds will need to be identified in a future Phase II Drainage Report.

Comments for Sketch Plan:

1. A Preliminary Utility Study and Utility Plan were not included in the submittal. Therefore, Public Works cannot provide any comments on the feasibility of the utilities required for this development.
2. Roadway curve radii were not provided so Public Works cannot determine if the proposed road layout meets Town standards.

EXHIBIT D

TOWN OF ERIE
Community Development Department – Planning Division
645 Holbrook Street – PO Box 750 – Erie, CO 80516
Tel: 303.926.2770 – Fax: 303.926.2706 – Web: www.erieco.gov

LAND USE APPLICATION

Please fill in this form completely. Incomplete applications will not be processed.

STAFF USE ONLY

FILE NAME:

FILE NO: DATE SUBMITTED: FEES PAID:

PROJECT/BUSINESS NAME: Erie Highlands PA 5 and PA 6, PA 14

PROJECT ADDRESS: N/A. Located South of Indian Peaks Drive and Highlands Circle

PROJECT DESCRIPTION: Planning Areas 5 and 6 of the Erie Highlands PUD

LEGAL DESCRIPTION *(attach legal description if Metes & Bounds)*

Subdivision Name: Erie Highlands (see attached legal descriptions)

Filing #: Lot #: Block #: Section: Township: Range:

OWNER *(attach separate sheets if multiple)*

Name/Company: see attached

Contact Person:

Address:

City/State/Zip:

Phone: Fax:

E-mail:

AUTHORIZED REPRESENTATIVE

Company/Firm: Oakwood Homes, LLC

Contact Person: John Cheney

Address: 4908 Tower Road

City/State/Zip: Denver, CO 80249

Phone: 303-486-8567 Fax:

E-mail: jcheney@oakwoodhomesco.com

MINERAL RIGHTS OWNER *(attach separate sheets if multiple)*

Name/Company: William H Peltier / Boulder Valley Coal Co.

Address: 5503 S. Franklin Lane

City/State/Zip: Littleton, CO 80121

MINERAL LEASE HOLDER *(attach separate sheets if multiple)*

Name/Company: Encana Oil & Gas Inc.

Address: 370 17th Street, Suite 1700

City/State/Zip: Denver, CO 80202

LAND-USE & SUMMARY INFORMATION

Present Zoning: LR

Proposed Zoning: LR

Gross Acreage: 101.71

Gross Site Density (du/ac): 2.33 du/ac

Lots/Units Proposed: 243

Gross Floor Area:

SERVICE PROVIDERS

Electric: United Power

Metro District: Erie Highlands Metro District No. 1

Water *(if other than Town)*:

Gas: XCel Energy

Fire District: Mountain View Fire District

Sewer *(if other than Town)*:

PAGE TWO MUST BE SIGNED AND NOTARIZED

DEVELOPMENT REVIEW FEES

ANNEXATION		SUBDIVISION	
☐ Major (10+ acres)	$ 4000.00	☑ Sketch Plan	$ 1000.00 + 10.00 per lot
☐ Minor (less than 10 acres)	$ 2000.00	☐ Preliminary Plat	$ 2000.00 + 40.00 per lot
☐ Deannexation	$ 1000.00	☐ Final Plat	$ 2000.00 + 20.00 per lot
COMPREHENSIVE PLAN AMENDMENT		☐ Minor Subdivision Plat	$ 2000.00
☐ Major	$ 3000.00	☐ Minor Amendment Plat	$ 1000.00 + 10.00 per lot
☐ Minor	$ 1200.00	☐ Road Vacation (constructed)	$ 1000.00
ZONING/REZONING		☐ Road Vacation (paper)	$ 100.00
☐ Rezoning	$ 1700.00 + 10.00 per acre	**SITE PLAN**	
☐ PUD Rezoning	$ 1700.00 + 10.00 per acre	☐ Residential	$ 1400.00 + 10.00 per unit
☐ PUD Amendment	$ 1700.00 + 10.00 per acre	☐ Non-Resi. (>10,000 sq. ft.)	$ 2200.00
☐ Major PD Amendment	$ 3700.00 + 10.00 per acre	☐ Non-Resi. (>2,000 sq. ft.)	$ 1000.00
☐ Minor PD Amendment	$ 500.00	☐ Non-Resi. (<2,000 sq. ft.)	$ 200.00
SPECIAL REVIEW USE		☐ Amendment (major)	$ 1100.00
☐ Major	$ 1000.00	☐ Amendment (minor)	$ 350.00
☐ Minor	$ 400.00	**VARIANCE**	$ 600.00
☐ Oil & Gas	$ 1200.00	**SERVICE PLAN**	$ 10,000.00

*All fees **include** both Town of Erie Planning & Engineering review. These fees **do not include** referral agency review fees, outside consultant review fees, or review fees incurred by consultants acting on behalf of staff. See Town of Erie Municipal Code, Title 2-10-5 for all COMMUNITY DEVELOPMENT FEES.*

The undersigned is fully aware of the request/proposal being made and the actions being initiated on the referenced property. The undersigned understand that the application must be found to be complete by the Town of Erie before the request can officially be accepted and the development review process initiated. The undersigned is aware that the applicant is fully responsible for all reasonable costs associated with the review of the application/request being made to the Town of Erie. Pursuant to Chapter 7 (Section 7.2.B.5) of the Unified Development Code (UDC) of the Town of Erie, applicants shall pay all costs billed by the Town for legal, engineering and planning costs incurred by staff, including consultants acting on behalf of staff, necessary for project review. By this acknowledgement, the undersigned hereby certify that the above information is true and correct.

Owner: _____ Date: _____

Owner: _____ Date: _____

Applicant: _____ Date: 5/22/15

STATE OF COLORADO)
) ss.
County of Denver)

The foregoing instrument was acknowledged before me this 22nd day of May, 2015, by John Cheney.

My commission expires: 6/17/2016
Witness my hand and official seal.

Karen L. Wilson
Notary Public

Dearmin Property

Owners

Mr. James R. Dearmin
J Dearmin LLC
10343 Federal Boulevard, Unit 515
Westminster, CO 80260
doublebubble1956@gmail.com

Johnny Gaz
J Gaz LLC
4955 West 65th Avenue
Arvada, CO 80003
john.gaz@berkadia.com

Mr. Jack Shell
The Jack Shell and Sonya Shell Family Trusts
10015 Meade Court
Westminster, CO 80031
JackShell@comcast.net

Mr. Robert E. Youle
WY&K Holdings, LLC
28221 Hidden Village Drive
Evergreen, CO 80439
ryoule@shermanhoward.com

EXHIBIT A

LEGAL DESCRIPTION

A PORTION OF TRACT L, ERIE HIGHLANDS FILING NO. 1, AS RECORDED ON SEPTEMBER 10, 2014, AT RECEPTION NO. 4044915 OF THE RECORDS OF THE WELD COUINTY CLERK AND RECORDERS OFFICE, SITUATED IN THE NORTH HALF OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE CENTER QUARTER OF SAID SECTION 20 AND CONSIDERING THE NORTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 20 TO BEAR NORTH 88°48'39" EAST, WITH ALL BEARINGS CONTAINED HEREIN RELATIVE THERETO;

THENCE ALONG THE SOUTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 20 SOUTH 89°05'29" WEST, A DISTANCE OF 46.82 FEET TO THE SOUTHWEST CORNER OF SAID TRACT L;

THENCE ALONG THE SOUTHWESTERLY BOUNDARY OF SAID TRACT L NORTH 00°56'35" WEST, A DISTANCE OF 709.11 FEET;

THENCE DEPARTING SAID NORTH 89°02'08" EAST, A DISTANCE OF 83.93 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE NORTHWESTERLY HAVING A RADIUS OF 435.00 FEET;

THENCE NORTHEASTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 86°17'38", AN ARC LENGTH OF 655.16 FEET;

THENCE NON-TANGENT TO SAID CURVE, NORTH 00°38'58" WEST, A DISTANCE OF 88.63 FEET;

THENCE NORTH 88°48'39" EAST, A DISTANCE OF 326.44 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE NORTHERLY HAVING A RADIUS OF 440.00 FEET;

THENCE EASTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 23°50'36", AN ARC LENGTH OF 183.10 FEET;

THENCE TANGENT TO SAID CURVE NORTH 64°58'03" EAST, A DISTANCE OF 189.11 FEET;

THENCE SOUTH 24°54'48" EAST, A DISTANCE OF 34.89 FEET TO THE BEGINNING OF A NON-TANGENT CURVE CONCAVE WESTERLY HAVING A RADIUS OF 1,135.00 FEET, THE RADIUS POINT OF SAID CURVE BEARS SOUTH 81°41'06" WEST;

THENCE SOUTHERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 31°45'48", AN ARC LENGTH OF 629.21 FEET;

THENCE NON-TANGENT TO SAID CURVE SOUTH 89°58'19" EAST, A DISTANCE OF 128.21 FEET TO THE NORTHWEST CORNER OF A PARCEL RECORDED IN BOOK 814, PAGE 251, IN SAID RECORDS;

THENCE ALONG THE WESTERLY BOUNDARY OF SAID PARCEL, SOUTH 11°04'31" EAST, A DISTANCE OF 125.00 FEET;

THENCE ALONG THE SOUTHERLY BOUNDARY OF SAID PARCEL AND THE SOUTHERLY BOUNDARY OF THAT PARCEL OF LAND RECORDED IN BOOK 509 AT PAGE 79, IN SAID RECORDS, NORTH 78°55'29" EAST, A DISTANCE OF 994.76 FEET TO THE SOUTHEAST CORNER

OF SAID PARCEL RECORDED IN BOOK 509, PAGE 79, ALSO BEING A POINT ON THE WESTERLY BOUNDARY OF A PARCEL RECORDED IN BOOK 1179, PAGE 541, IN SAID RECORDS;

THENCE ALONG SAID WESTERLY BOUNDARY SOUTH 00°00'25" WEST, A DISTANCE OF 76.02 FEET TO THE NORTHEAST CORNER OF A PARCEL RECORDED AT RECEPTION NO. 1983198, IN SAID RECORDS;

THENCE DEPARTING SAID WESTERLY BOUNDARY AND ALONG THE NORTHERLY AND WESTERLY BOUNDARIES OF SAID PARCEL RECORDED AT RECEPTION NO. 1983198 THE FOLLOWING TWO (2) COURSES:

1) SOUTH 89°05'08" WEST, A DISTANCE OF 225.15 FEET;

2) SOUTH 00°00'21" WEST, A DISTANCE OF 650.47 FEET TO A POINT ON THE SOUTH LINE OF SAID NORTHEAST QUARTER;

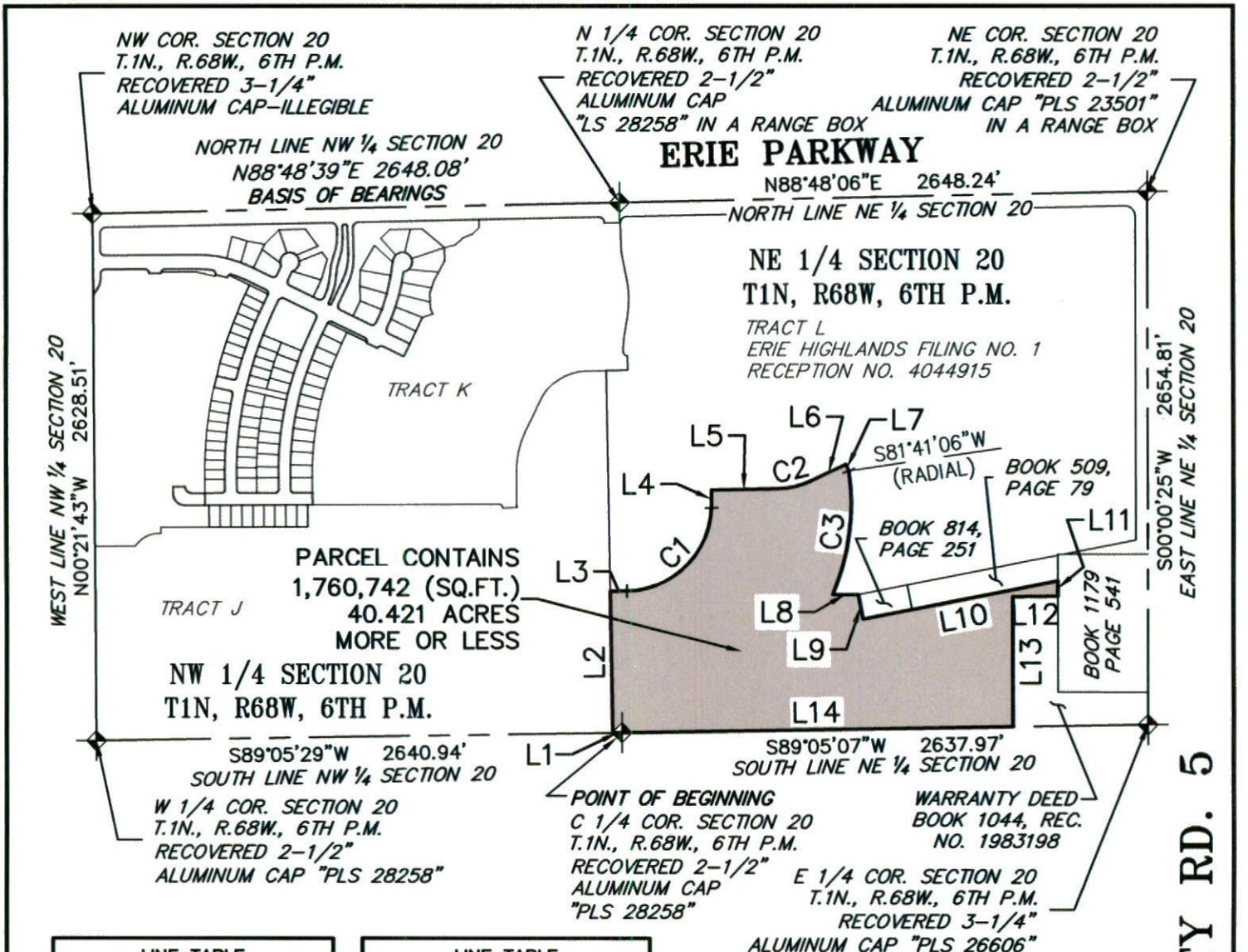
THENCE DEPARTING SAID WESTERLY BOUNDARY, ALONG SAID SOUTH LINE SOUTH 89°05'07" WEST, A DISTANCE OF 1,962.78 FEET TO THE **POINT OF BEGINNING**.

CONTAINING AN AREA OF 40.421 ACRES, (1,760,742 SQUARE FEET), MORE OR LESS.

EXHIBIT ATTACHED AND MADE A PART HEREOF.

DEREK S. BROWN, PLS NO. 38064
FOR AND ON BEHALF OF AZTEC CONSULTANTS, INC.
300 EAST MINERAL AVENUE SUITE 1, LITTLETON, CO 80122
303-713-1898

ILLUSTRATION TO EXHIBIT A



LINE TABLE		
LINE	BEARING	LENGTH
L1	S89°05'29"W	46.82'
L2	N00°56'35"W	709.11'
L3	N89°02'08"E	83.93'
L4	N00°38'58"W	88.63'
L5	N88°48'39"E	326.44'
L6	N64°58'03"E	189.11'
L7	S24°54'48"E	34.89'

LINE TABLE		
LINE	BEARING	LENGTH
L8	S89°58'19"E	128.21'
L9	S11°04'31"E	125.00'
L10	N78°55'29"E	994.76'
L11	S00°00'25"W	76.02'
L12	S89°05'08"W	225.15'
L13	S00°00'21"W	650.47'
L14	S89°05'07"W	1962.78'

CURVE TABLE			
CURVE	DELTA	RADIUS	LENGTH
C1	86°17'38"	435.00'	655.16'
C2	23°50'36"	440.00'	183.10'
C3	31°45'48"	1135.00'	629.21'

NOTE:
THIS EXHIBIT DOES NOT REPRESENT A MONUMENTED SURVEY. IT IS INTENDED ONLY TO DEPICT THE ATTACHED DESCRIPTION.

0 400 800 1600

1 inch = 800 ft.

PATH: V:\19315-13\DWG
DWG NAME: PH2-TAKEDOWN NO. 2
DWG: BJM CHK: DSB
DATE: 2015-06-30
SCALE: 1" = 800'

AZTEC CONSULTANTS, INC.
300 E. MINERAL AVE., SUITE 1
Littleton, Colorado 80122
Phone: (303)713-1898
Fax: (303)713-1897
www.aztecconsultants.com

ERIE HIGHLANDS
PHASE 2 - TAKEDOWN NO. 2
TOWN OF ERIE, COUNTY OF WELD, CO
JOB NUMBER 19315-13

EXHIBIT A

LEGAL DESCRIPTION

A PORTION OF TRACT J, ERIE HIGHLANDS FILING NO. 1, AS RECORDED ON SEPTEMBER 10, 2014, AT RECEPTION NO. 4044915 OF THE RECORDS OF THE WELD COUINTY CLERK AND RECORDERS OFFICE, SITUATED IN THE NORTHWEST QUARTER OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE WEST QUARTER CORNER OF SAID SECTION 20 AND CONSIDERING THE NORTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 20 TO BEAR NORTH 88°48'39" EAST, WITH ALL BEARINGS CONTAINED HEREIN RELATIVE THERETO;

THENCE ALONG THE WEST LINE OF SAID NORTHWEST QUARTER, NORTH 00°21'43" WEST, A DISTANCE OF 974.96 FEET;

THENCE DEPARTING SAID SECTION LINE, NORTH 89°38'17" EAST, A DISTANCE OF 202.88 FEET TO THE BEGINNING OF A NON-TANGENT CURVE CONCAVE SOUTHEASTERLY HAVING A RADIUS OF 150.00 FEET, THE RADIUS POINT OF SAID CURVE BEARS SOUTH 54°25'57" EAST;

THENCE NORTHEASTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 57°07'55", AN ARC LENGTH OF 149.57 FEET;

THENCE NON-TANGENT TO SAID CURVE NORTH 00°23'47" WEST, A DISTANCE OF 29.61 FEET;

THENCE NORTH 89°47'21" EAST, A DISTANCE OF 736.93 FEET;

THENCE NORTH 00°12'39" WEST, A DISTANCE OF 110.00 FEET;

THENCE NORTH 89°47'21" EAST, A DISTANCE OF 960.32 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE SOUTHWESTERLY HAVING A RADIUS OF 20.00 FEET;

THENCE SOUTHEASTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 87°50'43", AN ARC LENGTH OF 30.66 FEET TO THE BEGINNING OF A REVERSE CURVE CONCAVE NORTHEASTERLY HAVING A RADIUS OF 435.00 FEET;

THENCE SOUTHEASTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 88°35'56", AN ARC LENGTH OF 672.66 FEET;

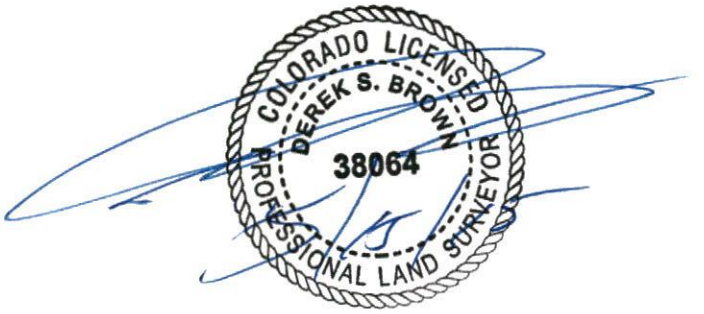
THENCE TANGENT TO SAID CURVE NORTH 89°02'08" EAST, A DISTANCE OF 97.70 FEET;

THENCE SOUTH 00°56'35" EAST, A DISTANCE OF 709.11 FEET TO A POINT ON THE SOUTH LINE OF SAID NORTHWEST QUARTER;

THENCE ALONG SAID SOUTH LINE, SOUTH 89°05'29" WEST, A DISTANCE OF 2,594.12 FEET TO THE **POINT OF BEGINNING**.

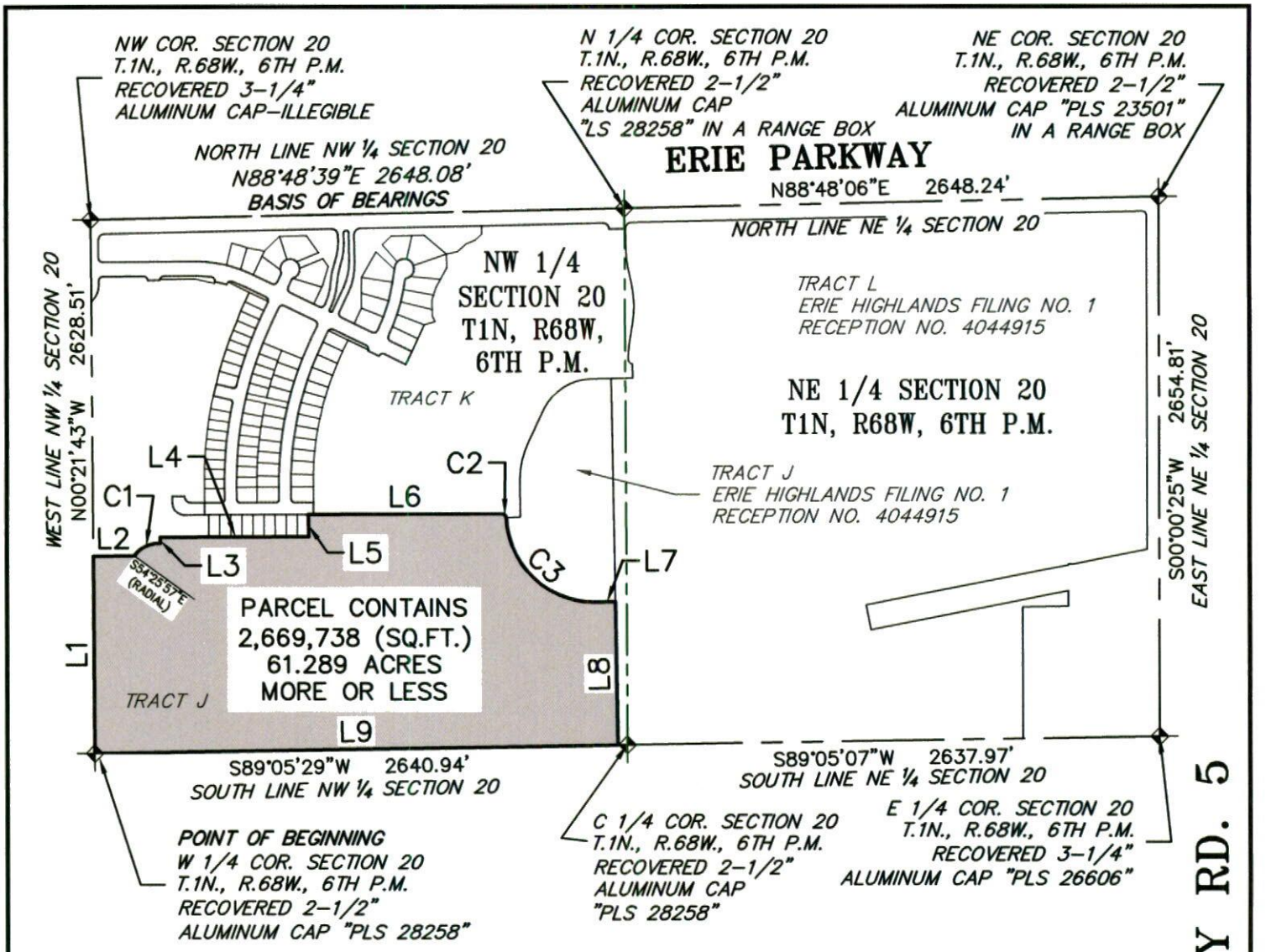
CONTAINING AN AREA OF 61.289 ACRES, (2,669,738 SQUARE FEET), MORE OR LESS.

EXHIBIT ATTACHED AND MADE A PART HEREOF.



DEREK S. BROWN, PLS NO. 38064
FOR AND ON BEHALF OF AZTEC CONSULTANTS, INC.
300 EAST MINERAL AVENUE SUITE 1, LITTLETON, CO 80122
303-713-1898

ILLUSTRATION TO EXHIBIT A



LINE TABLE		
LINE	BEARING	LENGTH
L1	N00°21'43"W	974.96'
L2	N89°38'17"E	202.88'
L3	N00°23'47"W	29.61'
L4	N89°47'21"E	736.93'
L5	N00°12'39"W	110.00'

LINE TABLE		
LINE	BEARING	LENGTH
L6	N89°47'21"E	960.32'
L7	N89°02'08"E	97.70'
L8	S00°56'35"E	709.11'
L9	S89°05'29"W	2594.12'

CURVE TABLE			
CURVE	DELTA	RADIUS	LENGTH
C1	57°07'55"	150.00'	149.57'
C2	87°50'43"	20.00'	30.66'
C3	88°35'56"	435.00'	672.66'

NOTE:
THIS EXHIBIT DOES NOT REPRESENT A MONUMENTED SURVEY. IT IS INTENDED ONLY TO DEPICT THE ATTACHED DESCRIPTION.

0 400 800 1600

1 inch = 800 ft.

PATH: V:\19315-13\DWG
DWG NAME: PH2-TAKEDOWN NO. 3
DWG: BJM CHK: DSB
DATE: 2015-05-15
SCALE: 1" = 800'

AZTEC CONSULTANTS, INC.
300 E. MINERAL AVE., SUITE 1
Littleton, Colorado 80122
Phone: (303)713-1898
Fax: (303)713-1897
www.aztecconsultants.com

ERIE HIGHLANDS
PHASE 2 – TAKEDOWN NO. 3
TOWN OF ERIE, COUNTY OF WELD, CO

JOB NUMBER 19315-13 3 OF 3 SHEETS

Erie Highlands Planning Areas 5, 6 & 14

Sketch Plan Narrative
August 3, 2015

a. General project concept and purpose of the request:

Oakwood Homes is proposing to begin the subdivision process for Phase 2 of Erie Highlands. This phase includes 243 single family homes ranging from 47' to 64' in width, a one acre pocket park and the remaining public open space. The neighborhood is organized around the south side of the school-park site with trail connections through the open space corridors. The following is a summary of the how the plan complies with the Dearmin Property PUD.

b. The total land area to be subdivided:

76.08 acres

c. The total number of lots, and if residential the proposed density:

In Planning Area 5, the plan shows 86 lots with a minimum lot size of 6,000 sf. The PUD allows for transfer of density between planning areas of the same zone district. Planning Area 5 is zoned LR with the PUD permitting up to 95 single family lots with a minimum lot size of 6,000 sf.
Planning Area 6 is also zoned LR with the PUD permitting up to 155 single family lots with a minimum lot size of 4,500 sf. The plan shows 157 lots with a minimum lot size of 4,700 sf. With the transfer, Planning Areas 5 and 6 allow for a total of 250 units. The Sketch Plan shows 243 homes.

d. N/A

e. The total land area to be preserved as open space:

The public open space generally follows the configuration in the PUD. The Open Space Plan shows the minor refinements specifically around the south side of the neighborhoods. The total area of open space is 33.38 acres. The changes are due to refinements in the site plan and the enlarging of the school park site.

f. A brief description regarding the phasing of the proposed subdivision:

Portions of planning area 5 and Planning Area 14 will be platted first, likely in multiple filings. This will be followed by Planning Area 6 in multiple filings.

g. *A brief description regarding the availability and adequacy of existing infrastructure and other necessary services including schools, fire protection, water/sewer service, and utility providers:*

The existing portions of the Erie Highlands community have been designed for the extension of utilities and roadways into the southern portions of the site. Utilities and fire protection were accepted for the full buildout of the property at the time of the PUD. Highlands Circle will be extended as necessary to build out each filing of this area. There is also a current application in for a minor subdivision of the school/park/private amenity site in the center of Highlands Circle, which will ultimately dedicate an elementary school site to the school district and a neighborhood park site to the Town for the residents of the Erie Highlands community.

h. *A brief description regarding the location, function and ownership/maintenance of public and private open space, parks, trails, common areas, common buildings:*

Within PA 5, 6 and 14, there are approximately 33 acres of open space proposed. These areas will be dedicated to the Town of Erie, except for a few small tracts adjacent to the lots within PA 5 and 6. Trails connecting to regional connections and throughout the community will be included in the open space areas being dedicated to the Town. There is also a 1 acre pocket park proposed in Planning Areas 6. These are all in addition to the existing amenities in Phase 1 and the neighborhood park being proposed north of this sketch plan area.

i. A brief description regarding the substance of any existing or proposed covenants, special conditions, grants of easements, or other restrictions applying to the proposed subdivision.

Three oil and gas sites exist on the property. A Compatible Development and Surface Use Agreement is in place for the property and additional Oil and Gas Operations Areas will not be required.
The existing covenants and design guidelines and any subsequent revisions for Erie Highlands are applicable to the residential portions of this sketch plan.

Entitlements

Preliminary Plat
A site plan for Phase 2 is provided. The applicant will prepare the required Preliminary Plat documents for Phase 2 once the Sketch Plan has been reviewed.

COMPATIBLE DEVELOPMENT AND SURFACE USE AGREEMENT

THIS COMPATIBLE DEVELOPMENT AND SURFACE USE AGREEMENT ("Agreement") is effective this 31ST day of July, 2013, by and between Encana Oil & Gas (USA) Inc. (hereinafter referred to as "Encana"), with an address of 370 17th Street, Suite 1700, Denver, Colorado 80202, and J Dearmin LLC ("Dearmin"), J Gaz LLC ("Gaz"), the Jack Shell Family Trust and the Sonya Shell Family Trust, and WY&K Holdings, LLC ("WY&K") (hereinafter Dearmin, Gaz, Shell F/T and WY&K may be referred to collectively as "Owner"), with an address of 10343 Federal Blvd, #J515, Westminster, Colorado 80260. Encana and Owner may be referred to as a "Party" or collectively, as the "Parties."

RECITALS

A. Owner owns the surface estate in that tract of land described as the N/2 of Section 20, Township 1 North, Range 68 West, Weld County, Colorado (the "Described Premises") as delineated on Exhibit A, and Owner intends to develop the Described Premises.

B. Encana owns certain working interests in the Oil and Gas Leases covering the Described Premises ("Leases"), currently operates one or more oil and gas wells ("Existing Wells") on the Described Premises, and has the right to develop its oil and gas leasehold estate by drilling additional wells ("Future Wells") on the Described Premises. Existing Wells and Future Wells are sometimes referred to herein as "Wells."

C. Colorado Oil & Gas Conservation Commission ("COGCC") rules and regulations allow the owner of the oil and gas rights under the Described Premises to drill, twin, deepen or recomplete a well for production from any of the Cretaceous Age formations from drilling locations comprised of a square with sides four hundred (400) feet in length, the center of which is the center of any quarter/quarter section, and a square with sides eight hundred (800) feet in length, the center of which is the center of any quarter section ("Drilling Window"). Owner and Encana recognize that Encana has the right to a reasonable use of the surface estate of the Described Premises for oil and gas development and operations.

D. The Parties enter into this Agreement to provide for the coexistence and joint development of the surface estate and the oil and gas estate for the Described Premises and to delineate the process with which they shall comply with respect to the development of the two estates.

NOW THEREFORE, in consideration of the covenants and mutual promises set forth in this Agreement, including in the recitals, the Parties agree as follows:

1. Oil and Gas Operations Areas (OGOA):

a. Encana agrees to limit its oil and gas operations conducted on the Described Premises to the Oil & Gas Operations Areas ("OGOA") outlined in solid red on Exhibits B, C and D. The OGOA set forth on Exhibit D (the "North OGOA") may be used for maintenance of the Existing Well and appurtenant equipment, production operations, workovers and plugging and abandonment operations. Encana agrees that it shall not expand the size or scope of use of the North OGOA unless otherwise required by new COGCC Rules; provided, however, Encana shall have the right to expand the size and scope of use of the OGOA set forth on Exhibit B (the

"East OGOA")and OGOA set forth on Exhibit C (the "West OGOA") to accommodate additional production. The East and West OGOAs may be used for all oil and gas operations including, but not limited to, drilling, completion, and maintenance of wells and equipment, production operations, workovers, well recompletions and deepenings, fracturing, twinning, the drilling of replacement wells, plugging and abandonment operations, and the location of associated oil and gas production and facilities and also the location and drilling of oil and gas wells that produce from and drain the Described Premises as well as lands which are pooled or communitized with the Described Premises and/or are directionally or horizontally drilled to bottomhole locations outside the Described Premises to the extent such activities are authorized by local and state authorities and regulations; provided, however, that Encana's associated oil and gas production facilities and Future Wells shall only be located in the Equipment Areas of the East OGOA and the West OGOA. Surface Owner and KMG acknowledge that Encana and KMG each shall be permitted to use the Joint Encana and KMG Equipment Area shown on Exhibit B as a co-location for wells and permanent production equipment so long as such use is acceptable to the other operator.

b. The Parties recognize that a fifty (50) foot no-build zone exists around each OGOA, as illustrated in red hatch marks on Exhibits B, C and D ("No Build Zone"). The Parties agree that the No Build Zone prohibits the construction of habitable structures. Encana acknowledges that Owner may use the No Build Zone for the planting and maintenance of shallow-root landscaping provided that Encana shall have no liability for damage to such landscaping and that such landscaping shall not unreasonably interfere with Encana's operations on the Described Premises.

c. Encana agrees to locate its production facilities within the Equipment Areas of the East OGOA and the West OGOA provided that, as set forth above, Encana is able to expand those facilities to accommodate additional production. Such expansion may involve, among other things, installation and connection of flowlines, installation of additional temporary tank batteries, separators, combustors, vapor recovery units, temporary water and oil tanks.

d. Within the Equipment Areas of the East and West OGOAs only, Encana shall continue to have the right to drill more than one well with attendant facilities and to deepen, complete, recomplete, fracture, workover, replace, plug and abandon, or twin any well that is drilled or has been drilled, as well as to drill directional and horizontal wells that produce from and drain the Described Premises or lands other than the Described Premises.

e. Owner shall not plat any surface property line within the OGOAs or within the one hundred and fifty foot (150') Tank Battery Setback. Owner shall not locate any temporary or permanent habitable building or other habitable structure within the OGOAs, Tank Battery Setback or No Build Zone, nor shall Owner locate any improvement within the OGOAs or Tank Battery Setback.

f. The area within the East OGOA but outside the Equipment Area ("Ancillary Operations Area") may be used by Encana for construction and completion staging and operations, production operations and other temporary oil and gas mineral development uses. Encana understands and agrees that Kerr McGee Oil & Gas Onshore, L.P. ("KMG") or other mineral interest owners of the Described Premises may also use the Ancillary Operations Area for construction and completion staging and operations, production operations and other temporary oil and gas mineral development uses other than drilling operations and the placement of permanent surface equipment and facilities. Owner will include in its surface use agreement with KMG a covenant requiring KMG to cooperate with Encana in its use of the

Ancillary Operations Area so that each operator does not directly interfere with the other's temporary production and completion equipment and facilities. Owner will also include in its surface use agreement with KMG a covenant requiring KMG to maintain a minimum distance of 200' between its wellheads and Encana's wellheads. Encana agrees that in its use of the Ancillary Operations Area, it will not directly interfere with KMG's temporary production and completion equipment and facilities and will maintain a minimum distance of 200' between its wellheads and KMG's wellheads..

2. Access to the Oil and Gas Operations Area (OGOA).

a. Access to the OGOAs shall be at the locations identified on Exhibits B, C and D. Owner agrees that neither it nor its agents, contractors, subcontractors, lessees, invitees or guests shall interrupt Encana's access to all of its oil and gas operations on the Described Premises at any time, and no such access may be closed to Encana until an acceptable replacement access route is available.

b. Access may be changed by mutual agreement of the Parties, provided however, all costs and expenses of such relocations shall be borne by the Party which requests them.

c. No party shall unreasonably interfere with the use by the other of an access road.

d. Owner shall keep the portions of access roads jointly used by Owner, its subdivision occupants, and Encana in good condition and repair until such roads are dedicated to the local jurisdiction; provided, however, if Encana causes damage to a portion of a road that is jointly used by both Owner or its subdivision occupants and Encana which is constructed to the specifications in Section 2.e.(1), Encana agrees to promptly repair any damage that is caused by a direct result of its use of the road.

e. Construction and Width of Access Roads.

(1) Access roads or portions of access roads that are jointly used by Encana and Owner shall be thirty (30) feet or more in width. For roads jointly used by Owner and Encana, Owner shall construct or improve all paved or improved joint access roads so as to withstand the weight of oilfield equipment; specifically, Owner shall construct the roads so that they can be used to withstand the weight of 110,000 pounds and 28,000 pounds per axle.

(2) Access roads or portions of access roads that are used exclusively by Encana shall be thirty (30) feet or more in width, and Encana shall install and maintain them to those state and local standards that apply to oil and gas operations.

f. Owner shall provide curb cut access to Encana's oil and gas operation on the Described Premises of forty (40) feet in width with a turn radius of no less than twenty-two (22) feet.

3. **Pipelines, Flowlines and Pipeline Easements.**

a. Owner acknowledges and understands that Encana has the right to continue to use the existing gathering lines identified on Exhibits B, C and D, as well as any other flowlines and pipelines, that it is currently utilizing to service the Existing Wells and to construct, repair, maintain and replace such lines.

b. Upon request of Encana, Owner shall grant Encana easements for future flowlines and pipelines servicing the Wells in the approximate locations shown on Exhibit B, and such flowlines and pipelines shall be installed to a minimum depth of forty eight (48) inches below the surface of the ground.

c. Within thirty (30) days from the date installation of any flowlines or pipelines is complete, Encana shall provide Owner with a set of as-builts to identify the location of such improvements.

d. The location of gathering lines, flowlines and pipelines and easements for future flowlines and pipelines may be changed at the request of Owner, provided that, the change does not interfere with oil and gas operations and is paid for by Owner. In the event that Owner requests the relocation of an existing pipeline or flowline, Encana will provide Owner with a written estimate of the relocation costs. If, after receipt of the written estimate, Owner elects to proceed with the relocation, Encana will designate the contractor to complete the work and schedule the work with Owner. Owner will remit the amount of the estimate to Encana prior to the commencement of the relocation work. After completion of the work Encana will provide to Owner an itemized statement showing the actual cost of the work. Should the actual cost of the work be less than the estimate, Encana will pay the difference to Owner. Should the actual cost of the work be greater than the estimate, Owner will pay the difference to Encana within ten (10) days of receipt of the itemized statement.

e. All pipeline easements shall be fifty (50) feet in width during original construction activities and, after construction, the pipeline easements shall be reduced to thirty (30) feet in width for all other operations, maintenance and transportation activities.

f. Owner shall have the right to cross the pipeline easements at an angle of not less than sixty (60) degrees and not more than ninety (90) degrees, and Owner shall also have the right to install and maintain access to such easements for utility lines, including those for water, gas, sewer, electric, telephone, cable, television and fiber optic and other pipelines that travel along, but not within, the pipeline easements provided for herein; provided however;

i) any new underground facilities which travel along a pipeline easement identified herein shall be located a distance horizontally of at least ten (10) feet from parallel existing pipelines;

ii) any new underground facilities shall have at least twenty-four (24) inches of vertical clearance between such new facility and a pipeline provided for herein; and

iii) any overhead power lines shall be at least twenty (20) feet above the ground.

Owner shall pay Encana all costs and expenses incurred by Encana to encase its pipelines and flowlines to the extent that such pipelines and flowlines intersect and underlie any street or any

other road either in advance of or at the time that Owner commences construction of any street and/or such other road.

g. Under no circumstances shall Owner prohibit Encana from flowing gas through its flowlines and pipelines at any time.

h. Conditioned on Owner's provision of a copy of the as-built drawings identifying the location of any pipelines and flowlines, Owner shall maintain a minimum ground cover of 48 inches and not more than 72 inches over such pipelines and flowlines in the conduct of its operations and its construction activities.

i. Owner, its successors and assigns, hereby agrees to cooperate, at its sole cost and expense, with Encana in its efforts to obtain all necessary permits, licenses and other approvals from state, county and municipal authorities for applications to drill all future wells within the OGOAs.

j. Encana acknowledges that any pipeline easements Owner grants to Encana will be non-exclusive and agrees that it will not object to KMG, other oil and gas operators or utilities concurrently using such easements as Owner may grant from time to time, so long as KMG's, other oil and gas operators' and utilities' concurrent use does not interfere with Encana's pipelines or its oil and gas operations on the Described Premises.

4. Surface Use and Damages.

a. Encana shall pay Owner the sum of $10,000 per Future Well ("Damage Payment") upon or prior to the date that each Future Well is spudded. Payments shall be made to Owner at the below address in cash, certified funds or cashiers' check. Such payment shall constitute a onetime payment in full by Encana and its affiliates for all normal damages for the applicable Well, including, but not limited to, damages to growing crops associated with the access to and the drilling, construction, completion, recompletion, reworking, re-entry, production, operation and maintenance of the applicable Well within that designated OGOA. Normal damages include, but are not limited to, reasonable and customary ingress, egress, rights-of-way, construction of all access roads, preparation and use of the drillsite area, preparation and use of reserve pits, and construction, installation and maintenance of production equipment and facilities such as flowlines, gas pipelines, separators, tank batteries and other equipment or facilities necessary or convenient for the production, transportation and sale of oil and/or gas therefrom.

b. The Damage Payment provided herein for surface damage shall release and discharge Encana, its agents, contractors and employees from all ordinary claims, losses, demands and causes of action for damage to the Described Premises, loss of and damage to crops, and loss of dwelling units for the anticipated residential land use and loss of commercial value use of the Described Premises, hereafter arising as a result of Encana's oil and gas operations and other activities conducted pursuant to this Agreement including marketing operations on the Described Premises.

c. Except the Damage Payment set forth in Section 4(a), Owner hereby waives all surface damage payments pursuant to any present or future COGCC rule or regulation or local regulation, state statute, common law or prior agreement for each and every Well and related wellsite that is drilled within an OGOA and for each production facility and access and pipeline easement. Encana or its lessees or assignees may provide a copy of this Agreement to the

COGCC or to any local jurisdiction, person or entity or any court of law as evidence of this waiver.

5. Subdivision Plat. Owner shall identify the OGOA, Tank Battery Setback, No Build Zone and all access routes and pipeline easements on its subdivision plat and in all applications for development it files with the local jurisdiction, and the plat shall include restrictions that no property line or temporary or permanent building, structure or other improvement related to the surface development shall be located, constructed or installed within the OGOA, Tank Battery Setback, or the No Build Zone. Owner shall record the subdivision plat in the Office of the Clerk and Recorder of Weld County and provide written evidence to Encana within fifteen (15) days of recording.

6. Waiver of Setback Requirements. Owner understands and acknowledges that the COGCC has rules and regulations that apply to the distance between a wellhead and public roads, production facilities, building units and surface property lines, among other things. Owner hereby waives all setback requirements in COGCC Rule 603 and 318A, or other rule or amendment to the COGCC setback rules, and to any other state or local setback requirements that are or become inconsistent with this Agreement or that would prohibit or interfere with the rights of Encana to explore for and produce the oil and gas in accordance with this Agreement. Owner understands (and shall notify parties who purchase any portions of the Described Premises) that Encana may cite the waiver in this Section 7 in order to obtain a location exception or variance consistent with this Agreement under COGCC rules or from a local jurisdiction. Notwithstanding the foregoing, Owner reserves all rights to contest or otherwise object to any proposed rule, regulation or proceeding by any governmental authority that would seek to apply setbacks to the Owner's development of the Described Premises, and the foregoing waiver shall not be effective against Owner in any such proceeding.

7. Governmental Proceedings.

a. Owner Will Not Object. Owner agrees that it will not object in any forum to the use by Encana of the surface of the Described Premises, provided such use is in compliance with this Agreement, and Owner hereby waives such right to object to such use so long as it is in compliance with this Agreement. Owner further agrees that it will provide such other written approvals and waivers which are reasonably requested by Encana and consistent with this Agreement, including, but not limited to, all approvals and waivers to drill a well or to conduct oil and gas operations within the OGOA that are needed because of any law or regulation, including any local ordinance and regulations of the COGCC, and including, for example, waivers to state and local setback requirements and to any setback requirements from a surface property line or for an exception location for a well drilled within the OGOA.

b. Encana Will Not Object. Encana agrees that it will not object to the use by Owner of the surface of the Described Premises or to the sale or development by Owner of all or portions of the Described Premises consistent with this Agreement, and Encana will not object in any forum to a request by Owner to annex, zone, rezone, plat or re-plat all or any portion of the Described Premises to extent such request is consistent with this Agreement. Encana further agrees that it will provide such other written approvals or waivers, which are reasonably requested by Owner consistent with this Agreement in connection with the development of the surface estate in any state or local jurisdiction.

8. **Notices of Hearings**. Owner shall provide Encana with written notice not less than thirty (30) days before each hearing for consideration of a plat application or other land use application for the Described Premises or portions of the Described Premises to be held before the Town of Erie or other local jurisdiction.

9. **Notice to Homeowners and Builders**. Owner shall furnish all builders and developers and others which purchase all or any portion of the Described Premises from Owner and each person or entity who proposes to enter into a contract to purchase or lease a lot or other portion of the Demised Premises from Owner which is adjacent to, or within, 350 feet from the OGOA, Tank Battery Setback, No Build Zone or a flowline or pipeline easement, with a plat that shows the locations of the OGOA, No Build Zone and Tank Battery Setback and the flowlines and pipeline easements. In addition, Owner shall provide written notice to all such purchasers that shall include the following:

i there may be ongoing oil and gas operations and production within the OGOA, Tank Battery Setback, pipeline and flowline easements and access routes;

ii. there are likely to be wells drilled and additional oil and gas production facilities constructed and installed within the OGOA, Tank Battery Setback and additional flowlines and pipelines constructed and maintained on the Described Premises,

iii. heavy equipment will be used by Encana from time to time for oil and gas drilling and production operations and such operations may be conducted on a 24-hour basis; and

iv. homeowner associations and buyers of individual lots or homes or portions of the Described Premises will be subject to and burdened by all of the covenants and waivers made by Owner in this Agreement, including, but not limited to those covenants and waivers:

a) prohibiting the location of any temporary or permanent building, structure, or other improvement within the OGOA, No Build Zone and Tank Battery Setback;

b) waiving objections to the drilling of wells, the construction of facilities, and the conduct of oil and gas operations performed in accordance with this Agreement;

c) waiving surface damages payments as provided herein;

d) granting the easements described herein for pipelines; and

e) waiving the setback requirements under the rules of the COGCC or any local jurisdiction consistent with this Agreement, among other things.

10. **Notice of Oil and Gas Operations**. Encana shall provide the Owner with notice of drilling operations and subsequent well operations in accordance with COGCC rules and regulations.

11. **Notice of Construction Activities by Owner.** Owner shall provide Encana with thirty (30) days written notice prior to commencement of any dirt work, grading or other surface construction activities it will be conducting on the Described Premises. Owner shall meet with Encana representatives at the Described Premises to locate existing flowlines, gathering lines or pipelines and to coordinate proposed surface construction activities with current and prospective oil and gas operations.

12. **Impact Mitigation**. Encana agrees that it will install and maintain at its sole cost and expense such fences, gates and locks around the wells and production facilities as are required by the COGCC. Owner may upgrade fences, gates and locks at its expense and with the

consent of Encana, such consent not to be unreasonably withheld, provided that such fences, gates and locks comply with COGCC and local regulations. Encana shall paint production facilities for wells, including wellhead guards, with paint approved by the COGCC and the local jurisdiction. Owner shall have the right of subjacent and lateral support to whatever extent is necessary or desirable for full and complete use and enjoyment of the surface of the Described Property provided that it does not interfere with Encana's operations. Owner shall bear all costs and expense to install such noise and visual impact mitigation measures it desires or the County or other local jurisdiction requires at or around the OGOA which are in excess of or in addition to those measures which are required by COGCC regulations for areas which are not high density; provided, however, Encana shall have reasonable discretion to refuse to allow impact mitigation measures interfere with, or prevent, safe oil and gas operations.

13. **Compliance with Common Law and Statutory and Regulatory Requirements**. Owner expressly acknowledges that this Agreement satisfies the obligations and requirements of Encana pursuant to COGCC rules and regulations and Colorado statutes to consult in good faith with Owner regarding existing and proposed oil and gas operations on the Described Premises. Owner, on the one hand, and Encana, on the other hand, each further expressly acknowledge that this Agreement shall be deemed to be specifically applicable to, and to fully satisfy, the obligations of Encana and Owner to accommodate the use of the surface of the Described Premises by the other, existing and future, and Owner and Encana each waive any statutory and common law claims to the contrary, including, but not limited to, any claims pursuant to C.R.S. 34-60-127. Unless expressly waived in this Agreement, Encana shall comply with all applicable rules and regulations of COGCC, the Town of Erie and any other applicable governing jurisdiction in conducting its oil and gas operations on, under or within the Described Premises. Encana, its employees, lessees, assignees, successors and authorized agents and licensees shall have no right to disturb, access, use or travel upon any portion of the Described Premises which is located outside of the OGOA, the No Build Zone, the Tank Battery Setback and the Access Roads, unless operating within an easement area.

14. **Environmental Indemnification**.

a. "Environmental Claims" shall mean all claims asserted by governmental bodies, Owner or other third parties for pollution or environmental damage of any kind, arising from a violation of Environmental Law and related to operations on the Described Premises or ownership of the oil and gas leasehold interest, whichever is applicable, and all cleanup and remediation costs, fines and penalties associated therewith. Environmental Claims shall not include the costs of any remediation undertaken voluntarily by any party, unless such remediation is performed under the imminent threat of a Environmental Claim by a governmental body or other third party.

b. "Environmental Laws" shall mean any laws, regulations, rules, ordinances, or order of any governmental authority(ies), which relate to or otherwise impose liability, obligation, or standards with respect to pollution or the protection of the environment, including but not limited to, the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (42 U.S.C. § 9601 et seq.), the Resource Conservation and Recovery Act of 1976 (42 U.S.C. §§ 6901 et seq.), the Clean Water Act (33 U.S.C. §§ 466 et seq.), the Safe Drinking Water Act (14 U.S.C. §§ 1401-1450), the Hazardous Material Transportation Act (49 U.S.C. §§ 1801 et seq.), the Clean Air Act, and the Toxic Substances Control Act (15 U.S.C. §§ 2601-2629).

c. Encana shall defend, indemnify and hold harmless the Owner, its successors and assigns, from Environmental Claims caused by Encana's oil and gas activities on and under the Described Premises or those of its agents, contractors and subcontractors, except to the extent caused by Owner.

d. Owner shall defend, protect, indemnify, and hold harmless Encana and its employees, directors, officers, managers, agents, contractors, subcontractors, successors and assigns from all Environmental Claims relating to the Described Premises or this Agreement in any manner caused by, directly or indirectly resulting from, incident to, connected with or arising out of Owner's or its tenants', lessees', invitees', guests' and the like's development or use of the Described Premises.

15. **Authority to Execute Agreement**. Each party represents that he/she/it has the full right and authority to enter into this Agreement with respect to the surface rights, oil and gas interests, or oil and gas leasehold interests that he/she/it owns in the Described Premises, as applicable.

16. **No Waiver of Rights**. Encana does not waive the rights it has pursuant to its oil and gas interests to explore for, drill and produce the oil and gas underlying the Described Premises or for ingress and egress to the OGOA, except as specifically provided in this Agreement. Owner does not waive any of its rights to the Described Premises, except as specifically provided in this Agreement.

17. **Successors and Assigns**. This Agreement and all of the covenants in it shall be binding upon the subsequent lessees and assignees of lessees and also the personal representatives, heirs, successors and assigns of all of the Parties, and the benefits of this Agreement shall inure to all of them. This Agreement and all of the covenants in it shall be covenants running with the land. Encana shall advise Owner of any agreements it enters into with any other entity or person which purport to grant or assign any interests conveyed to Encana under this Agreement to a third party.

18. **Recording**. Encana shall record a memorandum of this Agreement with the Clerk and Recorder of Weld County and provide evidence to Owner of the recording.

19. **Governing Law.** The validity, interpretation and performance of this Agreement shall be governed and construed in accordance with the laws of the local jurisdiction and the State of Colorado without reference to its conflict of laws provisions.

20. **Severability**. If any part of this Agreement is found to be in conflict with applicable laws, such part shall be inoperative, null and void insofar as it conflicts with such laws; however, the remainder of this Agreement shall be in full force and effect. In the event that any part of this Agreement would otherwise be unenforceable or in conflict with applicable laws due to the term or period for which such part is in effect, the term or period for which such part of this Agreement shall be in effect shall be limited to the longest period allowable which does not cause such part to be unenforceable or in conflict with applicable laws.

22. **Notices.** Any notice or communication required or permitted by this Agreement shall be given in writing either by; i) personal delivery; ii) expedited delivery service with proof of delivery; iii) United States mail, postage prepaid, and registered or certified mail with return receipt requested; or iv) prepaid telecopy or fax, the receipt of which shall be acknowledged, addressed as follows:

OWNER(s):

J Dearmin LLC
10343 Federal Blvd, #J515
Westminster, Colorado, 80260
Attn: James Dearmin

Jack Shell Family Trust
10015 Meade Ct.
Westminster, CO 80031

Sonya Shell Family Trust
10015 Meade Ct.
Westminster, CO 80031

J Gaz LLC
4955 W. 65th Ave
Arvada, CO 80003
Attn: Johnny Gaz

WY&K Holdings, LLC
c/o Fairfield & Woods
1700 Lincoln Street, Suite 2400
Denver, CO 80203

ENCANA:

Encana Oil & Gas (USA) Inc.
370 17th Street, Suite 1700
Denver, CO 80202
Attn: DJ Land Department

Any Party may, by written notice as provided in this Section, change the address of the individual to which delivery of notices shall be made thereafter.

23. Incorporation by Reference. Exhibits A, B, C and D are incorporated into this Agreement by this reference.

24. Entire Agreement. This Agreement sets forth the entire understanding among the Parties and supersedes any previous communications, representations or agreements, whether oral or written. No change of any of the terms or conditions herein shall be valid or binding on any Party unless in writing and signed by an authorized representative of each Party.

25. Counterpart Executions. This Agreement may be executed in counterparts, each of which shall be deemed an original and together of which shall constitute one and the same instrument.

IN WITNESS WHEREOF, the undersigned Parties have caused this Agreement to be executed by a duly authorized representative on the dates set forth in the acknowledgements, but to be effective on the date written above.

[Signatures on following pages]

ENCANA OIL & GAS (USA) INC.

By: Helen M Capps
Helen M. Capps, Attorney-in-Fact dp CO

ACKNOWLEDGMENT

State Of Colorado)
City and)ss
County Of Denver)

On this 31st day of July, 2013, before me personally appeared Helen M. Capps, who, being by me duly sworn, did say that he is Attorney-in-Fact for Encana Oil & Gas (USA) Inc, that he signed the foregoing instrument on behalf of said corporation for the uses and purposes therein set forth.

My Commission Expires: 03/18/2017

(SEAL) Notary Public: C. DiaFerio

COURTNEY DIAFERIO
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID # 20134017782
MY COMMISSION EXPIRES MARCH 18, 2017

J DEARMIN LLC

By: James R. Dearmin by Debra M. Dearmin
James R. Dearmin, by Debra M. Dearmin, attorney-in-fact
Title Attorney in Fact

ACKNOWLEDGMENT

State Of Colorado)
)ss
County Of Adams)

On this 29th day of _____, 2013, before me personally appeared Debra M. Dearmin, as attorney in fact for James R. Dearmin, who, being by me duly sworn, did say that he is the Power of Attorney for J Dearmin LLC., that he signed the foregoing instrument on behalf of said company and acknowledged the instrument to be the free and voluntary act and deed of said company for the uses and purposes therein set forth.

My Commission Expires: 11-18-13

(SEAL)

NOTARY PUBLIC
MARIANNE DICKERSON
STATE OF COLORADO

Notary Public: Marianne Dickerson

J GAZ LLC

By: Emmalou Gaz
Emmalou Gaz, as Attorney in Fact for Johnny Gaz

Title: Manager

ACKNOWLEDGMENT

State Of Colorado)
)ss
City and
County Of Denver)

On this 30th day of July, 2013, before me personally appeared Emmalou Gaz, who, being by me duly sworn, did say that she is the Attorney in Fact for Johnny Gaz, that she signed the foregoing instrument on his behalf as Manager of said company and acknowledged the instrument to be the free and voluntary act and deed of said company for the uses and purposes therein set forth.

My Commission Expires: 8/10/2014

(SEAL)

Notary Public: Debra P. Simon

DEBRA P. SIMON
NOTARY
PUBLIC
STATE OF COLORADO

My Commission Expires 08/10/2014

WY&K HOLDINGS, LLC

By: Robert E Youle
Name: ROBERT E YOULE
Title: MANAGER

ACKNOWLEDGMENT

State Of Colorado)
City and)ss
County Of Denver)

On this 31st day of July, 2013, before me personally appeared Robert E. Youle who, being by me duly sworn, did say that he is the MANAGER for WY&K HOLDINGS, LLC,, that he signed the foregoing instrument on behalf of said company and acknowledged the instrument to be the free and voluntary act and deed of said company for the uses and purposes therein set forth.

My Commission Expires: 3/15/16

(SEAL)

KEHAULANI MERRIE PUNILEI
Notary Public
State of Colorado

Notary Public: Kehaulani M Punilei

JACK SHELL FAMILY TRUST

By: Jack Shell

Name: Jack Shell
Title: Trustee

SONYA SHELL FAMILY TRUST

By: Jack Shell

Name: Jack Shell
Title: Trustee

ACKNOWLEDGMENT

State Of Colorado)
)ss
County Of Adams)

On this 30th day of July, 2013, before me personally appeared Jack Shell, who, being by me duly sworn, did say that he is the Trustee for the Jack Shell Family Trust., that he signed the foregoing instrument on behalf of said trust and acknowledged the instrument to be the free and voluntary act and deed of said trust for the uses and purposes therein set forth.

My Commission Expires: My Commission Expires 08/25/2014

(SEAL)

TANYA S REED NOTARY PUBLIC STATE OF COLORADO

Notary Public: Tanya S Reed

ACKNOWLEDGMENT

State Of Colorado)
)ss
County Of Adams)

On this 30th day of July, 2013, before me personally appeared Jack Shell, who, being by me duly sworn, did say that he is the Trustee for the Sonya Shell Family Trust., that he signed the foregoing instrument on behalf of said trust and acknowledged the instrument to be the free and voluntary act and deed of said trust for the uses and purposes therein set forth.

My Commission Expires: My Commission Expires 08/25/2014

(SEAL)

TANYA S REED NOTARY PUBLIC STATE OF COLORADO

Notary Public: Tanya S Reed

{00547068.1}

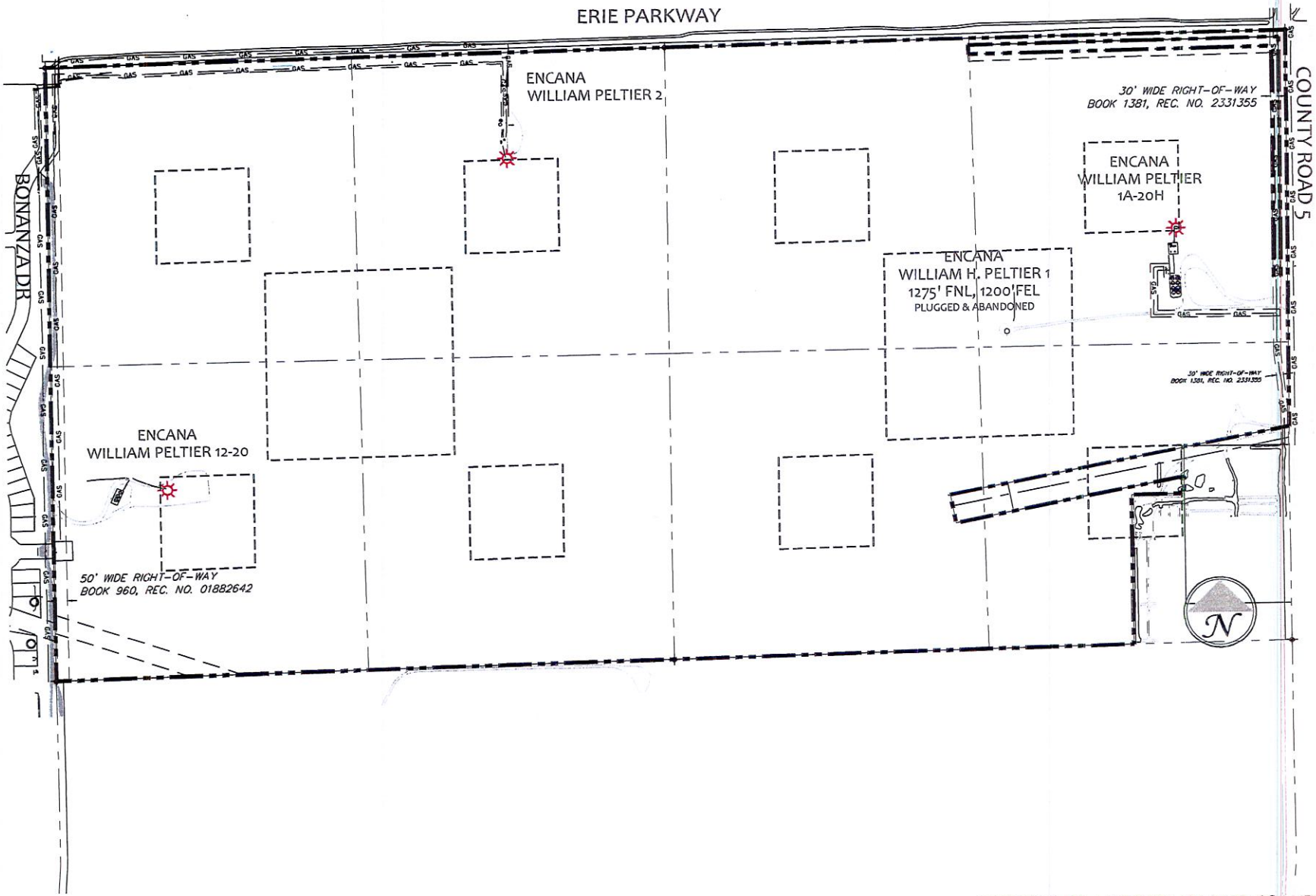


EXHIBIT A

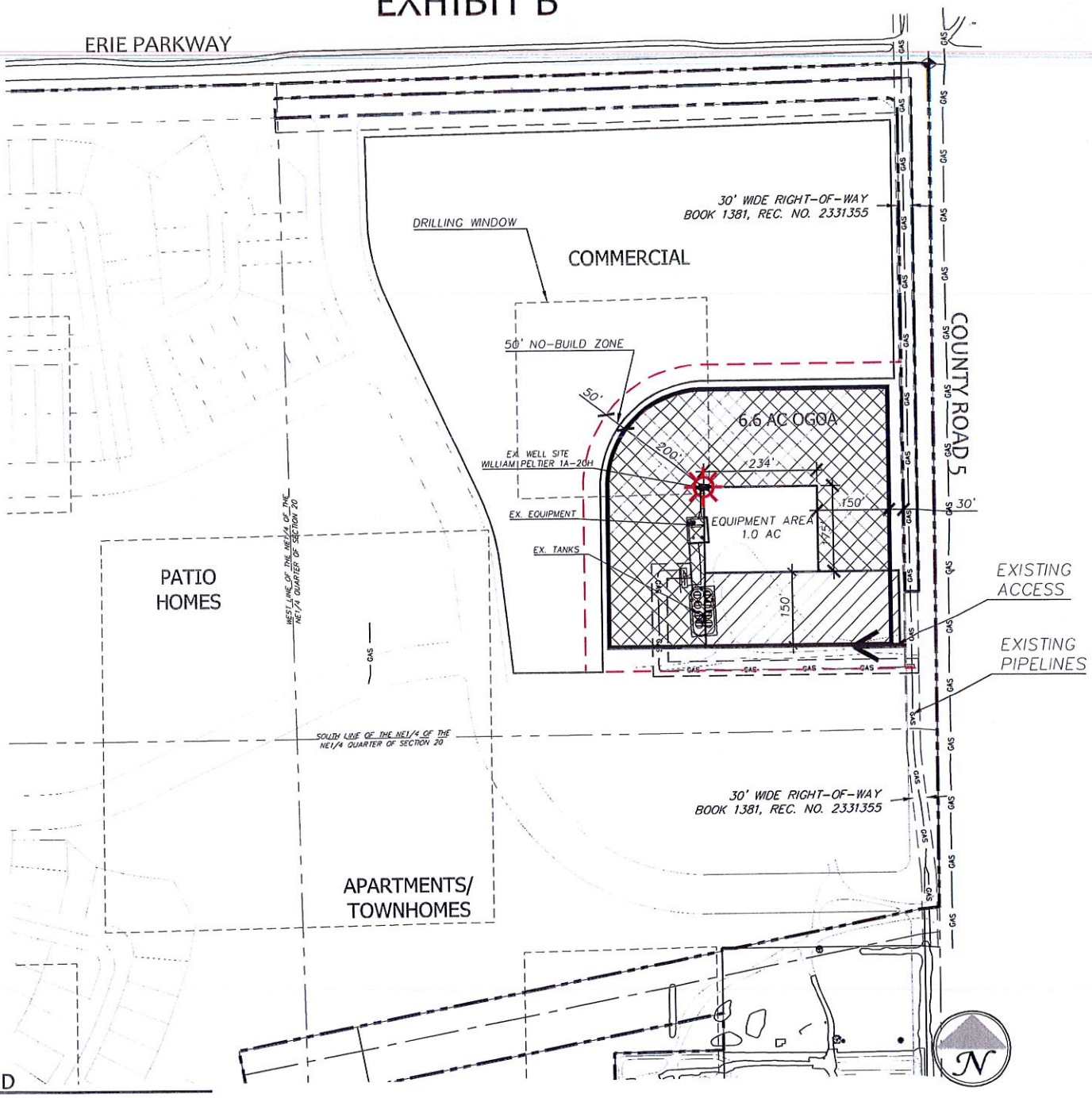
TOWNSHIP 1 NORTH, RANGE 68 WEST

SECTION 20: N½ OIL& GAS

WELD COUNTY, COLORADO

Scale: 1"=600' July 30, 2013

EXHIBIT B



LEGEND

- OIL & GAS OPERATIONS AREA (200' SETBACK)
- 50' NO BUILD ZONE
- JOINT ENCANA & KMG EQUIPMENT AREA
- JOINT ENCANA & KMG OPERATIONS AREA
- DRILLING WINDOWS

LOCATION OF ROADS, LOTS AND OTHER LAND DEVELOPMENT COMPONENTS ARE CONCEPTUAL AND SUBJECT TO CHANGE.

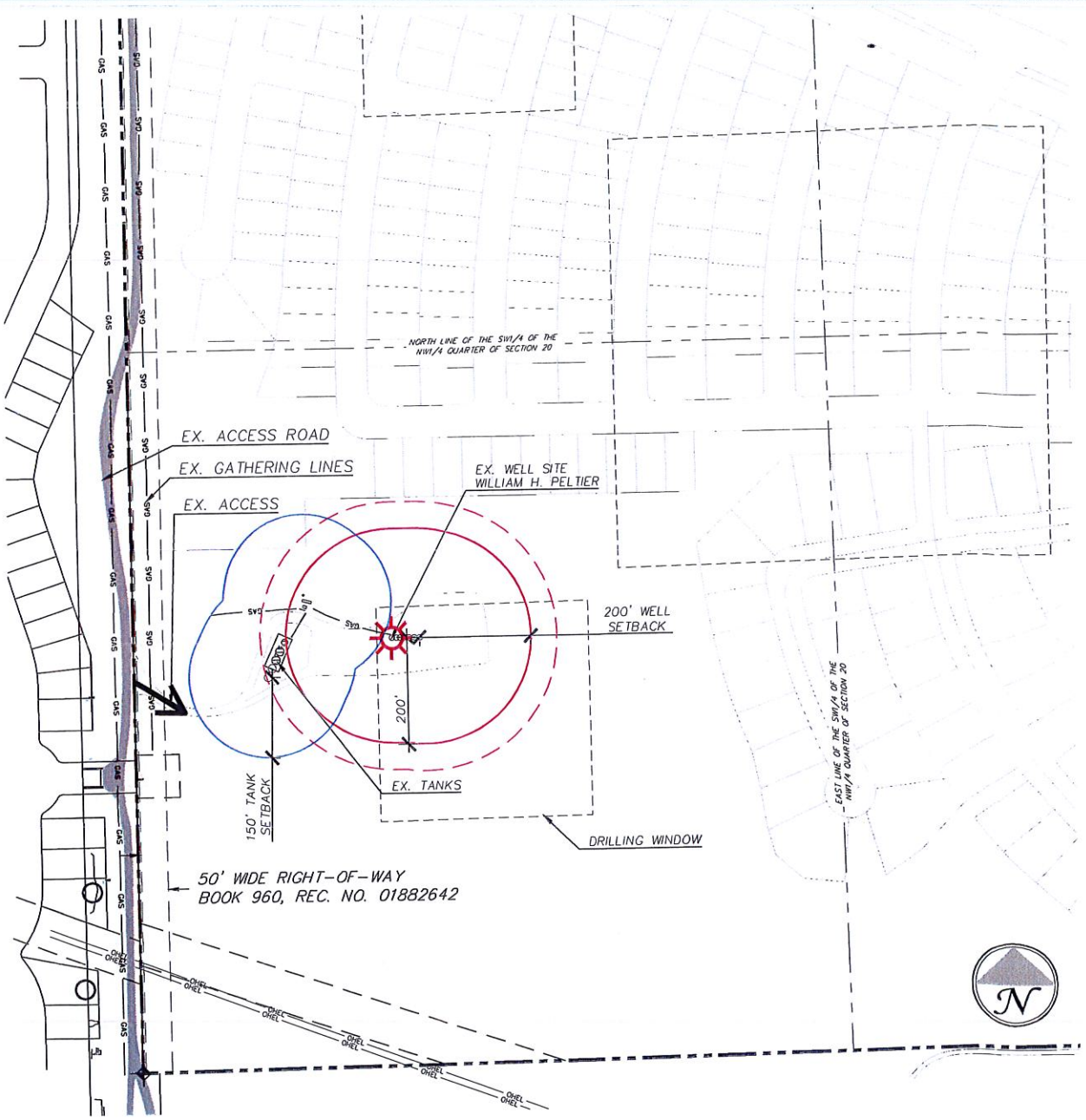
TOWNSHIP 1 NORTH, RANGE 68 WEST

SECTION 20: NE1/4

WELD COUNTY, COLORADO

Scale: 1"=300' July 30, 2013

EXHIBIT C



LEGEND

- OIL & GAS OPERATIONS AREA (200' SETBACK)
- 50' NO BUILD ZONE
- TANK BATTERY SETBACK (150' SETBACK)
- DRILLING WINDOWS

LOCATION OF ROADS, LOTS AND OTHER LAND DEVELOPMENT COMPONENTS ARE CONCEPTUAL AND SUBJECT TO CHANGE.

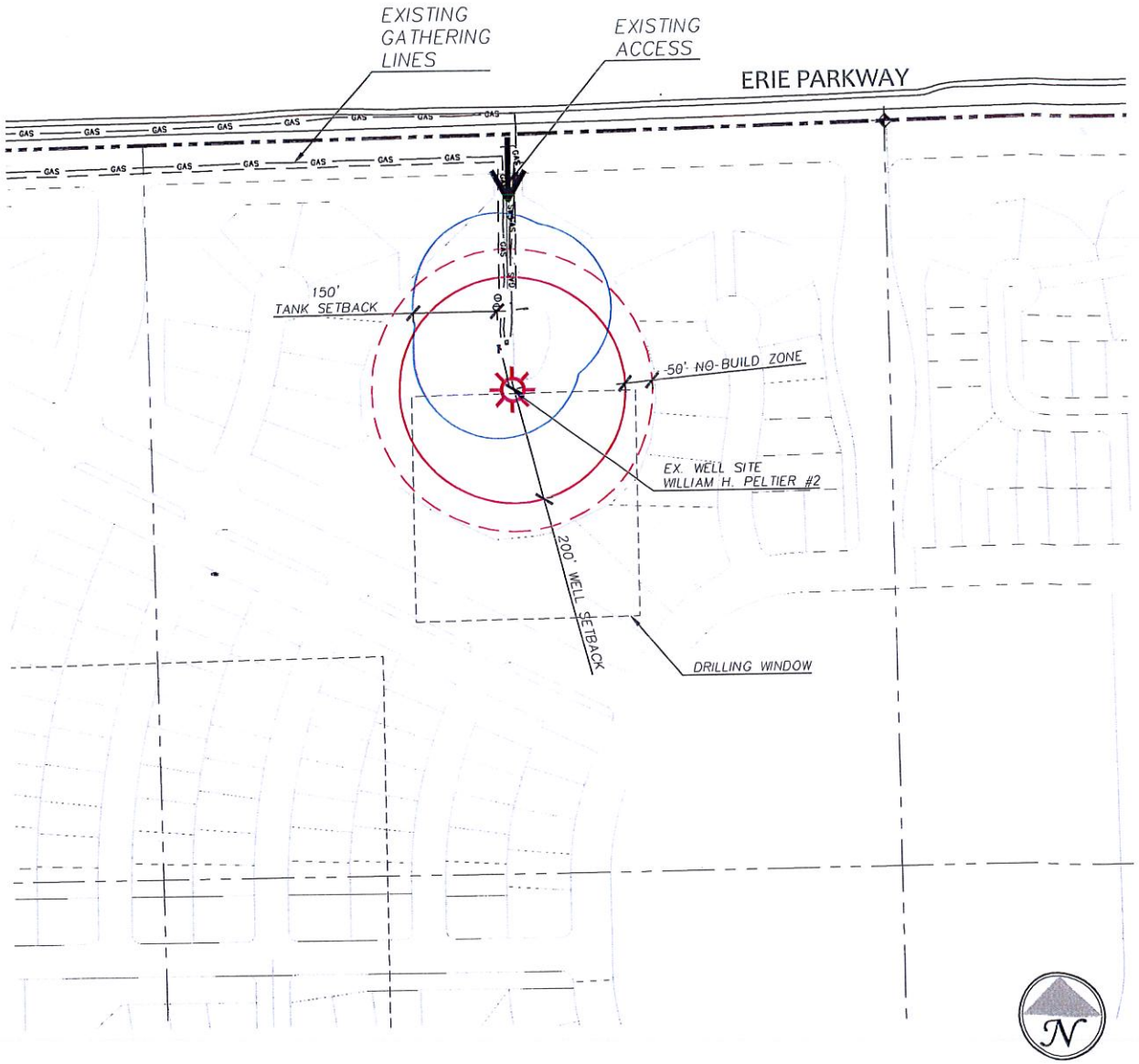
TOWNSHIP 1 NORTH, RANGE 68 WEST

SECTION 20: NW1/4

WELD COUNTY, COLORADO

Scale: 1"=300' July 30, 2013

EXHIBIT D



LEGEND

- OIL & GAS OPERATIONS AREA (200' SETBACK)
- 50' NO BUILD ZONE
- TANK BATTERY SETBACK (150' SETBACK)
- DRILLING WINDOWS

LOCATION OF ROADS, LOTS AND OTHER LAND DEVELOPMENT COMPONENTS ARE CONCEPTUAL AND SUBJECT TO CHANGE.

TOWNSHIP 1 NORTH, RANGE 68 WEST

SECTION 20: NW1/4

WELD COUNTY, COLORADO

Scale: 1"=300' July 30, 2013

SURFACE USE AGREEMENT

This Surface Use Agreement ("**Agreement**") is dated and made effective this 1ST day of AUGUST, 2013, and is between Kerr-McGee Oil & Gas Onshore LP, a Delaware limited partnership, with an address of 1099 18th Street, Suite 1800, Denver, CO 80202 (**"KMG"**) and Kerr-McGee Gathering LLC,a Colorado limited liability company (KMGG), J Dearmin LLC ("Dearmin"), J Gaz LLC ("Gaz"), Jack Shell Family Trust and Sonya Shell Family Trust (collectively "Shell F/T"), and WY&K Holdings, LLC ("WY&K") (hereinafter Dearmin, Gaz, Shell F/T and WY&K may be referred to collectively as "Owner"), with an address of 10343 Federal Blvd, #J515, Westminster, Colorado, 80260 ("**Surface Owner**"). KMG and Surface Owner may be referred to collectively as "Parties" and individually as a "Party."

A. Surface Owner owns the surface estate of that certain tract of land more particularly described on Exhibit A attached hereto, being a part of the N/2 of Section 20, T1N, R68W, Weld County, Colorado (hereinafter referred to as the "**Property**");

B. Surface Owner plans to develop the surface of the Property as a residential and commercial development known as "Erie Highlands";

C. The Parties acknowledge that Encana Oil & Gas (USA) Inc. ("**Encana**") owns certain working interests in oil and gas leases covering the Property;

D. Encana currently operates wells on the Property under such leases and subject to an unrecorded Compatible Development and Surface Use Agreement with the current owners of the property dated March 6, 2012;

E. This Agreement sets forth the Parties' rights, obligations and agreements regarding the relationship between the development of the Property by Surface Owner and KMG's use of the surface of the Property, such rights and obligations to be binding upon the Parties' successors and assigns.

In consideration of the mutual covenants contained herein, and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the parties agree as follows:

1. FUTURE WELL LOCATIONS, VERTICAL, DIRECTIONAL and HORIZONAL DRILLING.

KMG shall drill and operate oil and gas wells on the Property only within the two locations identified and depicted on Exhibits B and C as the "Permanent Operations Areas" ("POA"). The POAs shall include the areas that are in the configurations and sizes depicted on Exhibits B and C. KMG shall have the right to drill future wells within the Permanent Well and Production Area as described below within the POAs identified on Exhibit B and C, including horizontal, vertical and directional wells that produce from and drain the Property ("Future Wells"), and so long as such locations are permitted locations under the then applicable well spacing regulations of the COGCC or exceptions granted thereto by the Director of the COGCC.

The POAs include a Permanent Wellhead and Production Equipment Area and an Ancillary OperationsArea to be used for purposes as follows:

The POAs shall be the location for wells and production facilities, flowlines and portions of pipelines and pipeline easements and for oil and gas drilling and production operations and facilities as more particularly described on Exhibits B and C.

The POAs shall be made available to KMG for its exclusive use for all oil and gas operations to be conducted by KMG, including, but are not limited to, drilling and production activities, workovers, well deepenings, recompletions, fracturing, re-fracturing, twinning, and the drilling of replacement wells and the location of associated oil and gas production and drilling equipment and facilities and flowlines and portions of pipeline easements.

a. Within the designated POAs is an area specifically identified as the Permanent Wellhead and Production Equipment Area. This area is the only location for future wells but this does not limit KMG's rights to install production facility equipment necessary for production of the wells. KMG still will have the right to install and construct production facility equipment and ancillary equipment such as flowlines, pipelines, electrical lines, electrical poles, pedestals, transformers and all other associated equipment necessary for the wells and the production facility. The setbacks from the Permanent Wellhead and Production Equipment Area shall be 250' from that area line to permanent habitable structures. The Permanent Production Area, also more particularly described on Exhibits B and C, shall be limited to use for the installation and operation of production facilities other than wellheads, and the setback shall be 200' from that area line to permanent habitable structures.

b. The Ancillary Operations Areas may be used for operations that include the preparation, drilling and completion of wells to be drilled at locations within a Permanent Operations Area and for the temporary location of production facilities and equipment. Except for portions of pipeline easements, electrical easements and flowlines, KMG may not locate wells or permanent production facilities within the Ancillary Operations Areas, but may use the Ancillary Operations Areas only for temporary uses relating to the drilling and completion of the wells and the temporary location of production facilities.

c. With respect to the POA, Surface Owner shall not plat any surface property lines or install or construct fences, roadways, trees, bushes or any other permanent or temporary improvements within the POAs or upon the pipeline easements provided for herein, and no temporary or permanent building or other structure or improvement shall be located by Surface Owner within the Permanent Operations Areas or the pipeline easement areas. The Permanent Operations Areas shall be for the exclusive use of oil and gas operations and production.

d. Surface Owner may use the Ancillary Operations Areas for grazing and ranching purposes and, with the consent of KMG not to be unreasonably withheld, for landscaping and the installation of irrigation systems; provided, however, KMG shall in

no event be liable for damages to such landscaping and irrigation systems caused by its non-negligent oil and gas operations, and KMG shall at all times have priority of use.

e. KMG shall have the right to locate build, repair and maintain tanks, separators, dehydrators, flowlines, pipelines and all other associated drilling and production equipment and gathering equipment within the POAs and otherwise, as provided in this subsection 4.a. and c.

KMG understands and agrees that the Ancillary Operations Areas is being set aside by Surface Owner to accommodate Encana Oil & Gas (USA) Inc. or other mineral interest owners of the Property to be used for construction and completion staging and operations, production operations and other oil and gas mineral development uses other than drilling operations and the placement of its surface equipment and facilities. Surface Owner will include in its surface use agreement with Encana a covenant requiring Encana to cooperate with KMG in its use of the Ancillary Operations Areas so that each operator does not directly interfere with the wellheads, tanks, and other surface equipment and facilities of the other operator and to require a minimum distance of 150' between the wellheads of each operator. KMG agrees that in its use of the Ancillary Operations Areas, it will not directly interfere with the wellheads, tanks and other surface equipment and facilities of Encana. KMG acknowledges that the perimeter outside the Ancillary Operations Areas fifty feet (50') in width may be used by Surface Owner for the planting and maintenance of shallow-root landscaping provided that KMG shall have no liability for damage to such landscaping and that such landscaping shall not unreasonably interfere with KMG's operations on the Property.

As part of the consideration for this Agreement, Surface Owner hereby waives its right to, and covenants that it shall not protest or object to any COGCC exception location or application for same by KMG. Notwithstanding the foregoing, the wellhead location of any Future Well drilled from the oil and gas operations areas located in the Property shall not be closer than 250' from a residential lot line or publicly dedicated roadway whether platted or planned. KMG shall locate its wellheads, tanks and other surface equipment and facilities entirely within the Permanent Operations Area depicted on Exhibit B and C.

In its preliminary and final plats of Erie Highlands, Surface Owner shall set aside for use by KMG the POAs as referenced above. Any mining tailings or remnants shall be removed and remediated from the POAs; otherwise the POAs are to be made available to KMG in their present conditionfor any oil and gas operations conducted by KMG in connection with the Future Wells, including, but not limited to, production activities, workovers, well deepenings, recompletions, hydraulic fracturing and replacement wells and for a tank battery and all potential flowline routes

In its use of the POAs upon the Property, KMG agrees not to interfere with the separate Encana Equipment Area, as described on Exhibit B, provided for by Surface Owner to Encana in their separate surface use agreement, understanding that all mineral owners and operators are obligated, to the extent possible, to access their separate POAs/OGOAs from the joint or existing access roads contained in Exhibits B and C.

2. RELEASE OF SURFACE RIGHTS

In consideration of Ten Dollars ($10.00) and other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, KMG hereby permanently releases, all of KMG's rights to enter upon, access or otherwise use the surface of the Property except as specifically otherwise provided herein. Notwithstanding the foregoing, KMG expressly reserves, retains and excludes from this release of surface rights all of its mineral interest it may own currently or in the future. This Release shall have no effect whatsoever on KMG's subsurface rights in the Property. KMG reserves all necessary subsurface easements to produce the mineral estate in the Property.KMG retains and reserves in connection with its mineral rights the right to develop through vertical, horizontal or directional drilling or otherwise its mineral interest from the OGOAs provided, however, such mineral interest development does not damage or interfere with the Surface Owner's ownership, use and development of the Property. Further, nothing in this release shall be deemed to release any surface rights that may be currently owned by any other person or entity.

This agreement is contingent upon and subject to KMG owning a mineral interest in the Property.

3. SETBACK REQUIREMENTS.

Surface Owner will not locate any lot line, building, or structure within the entirety of the POAss. Surface Owner will not construct habitable structures within the No Build Zone depicted on Exhibit B. Surface Owner understands and acknowledges that the COGCC has rules and regulations that apply to the distance between a wellhead and public roads, production facilities, building units and surface property lines, among other things. In order to give full effect to the purposes of this Agreement, Surface Owner hereby waives its right to object to the location of any of KMG's facilities made in accordance with this Agreement on the basis of setback requirements in the rules and regulations of the COGCC, as they may be amended from time to time. Surface Owner further and similarly waives its right to object to the location of any KMG facilities based upon any other state or local setback requirements or other requirements or regulations that are or become inconsistent with this Agreement provided such locations are made in accordance with this Agreement. KMG or its successors and assigns may cite the waiver in this paragraph in order to obtain a location exception or variance under COGCC rules or from any other state or local governmental body having jurisdiction. Surface Owner agrees not to object to the use of the surface in the OGOA so long as such use is consistent with this Agreement and Surface Owner will provide KMG or its successors and assigns with whatever written support they may reasonably require to obtain permits from the COGCC or any local jurisdiction. This setback distance shall be binding upon Surface Owner's successors and assigns.

Notwithstanding the foregoing, and provided KMG's rights under this Agreement are not adversely affected, Surface Owner reserves all rights to contest or otherwise object to any proposed rule, regulation or proceeding by any governmental authority that would seek to increase setbacks beyond those specified in this Agreement or to apply setbacks to the development of the Property by the Surface Owner, and the foregoing waiver shall not be effective against Surface Owner in any such proceeding.

4. PIPELINES and FLOWLINES.

Subject to the limitations hereinafter described, KMG has a continuing right and entitlement to own, operate, maintain, repair and replace all flowlines and pipelines that may be necessary or convenient to its operations on the OGOAs. This Agreement is intended to generally confine the placement of future flowlines, electrical lines and water lines within the POAs and gathering lines and pipelines to certain specified locations within the Property along County Road 5, and West and center section lines as shown on Exhibit D hereto. Surface Owner understands that the installation of the gathering lines that will service Future Wells will have to be accomplished by entering into a separate petroleum pipeline easement with KMGG. If flowlines or pipelines are not located entirely within a POA that is immediately adjacent to County Road 5, or the West and center section lines as shown on Exhibit D, then Surface Owner agrees to grant an easement from the POAs to the specified flowline or pipeline easement locations by the most direct route.

With respect to the POAs, KMG will need to construct or have constructed by KMGG or the purchaser of gas from the well(s) drilled on the POAs gas sales lines to transport gas from the gas sales meters within the POAs to the location at which the gas will be processed. Subject to the agreement of KMGG or purchaser, the pipelines will be constructed at the sole expense of KMG or KMGG in the Petroleum Pipeline Easements.

All Future Pipelines shall be located as identified above unless otherwise agreed upon between Surface Owner and KMG and KMGG, which agreement shall not be unreasonably withheld. Future Pipelines shall be installed at KMG's or KMGG's sole cost and expense. KMG or KMGG shall abandon all flowline locations that will no longer be used due to any relocations. KMG and KMGG acknowledges that any pipeline easements will be non-exclusive and agrees that it will not object to its concurrent use by Encana, other oil and gas operators or utilities, as Surface Owner may grant from time to time, so long as such other parties comply with KMGG's pipeline guidelines, attached hereto as Exhibit E, and so long as such concurrent use does not unreasonably interfere with KMG's or KMGG's operations. Any pipeline easements and the POAs shall be depicted and labeled on all subdivision plats submitted to the Town of Erie.

The location of gathering lines, flowlines and pipelines and easements for future flowlines and pipelines may be changed at the request of Surface Owner, provided that, the change does not interfere with oil and gas operations and is paid for by Surface Owner. In the event that Surface Owner requests the relocation of an existing pipeline or flowline, KMG or KMGG will provide Surface Owner with a written estimate of the relocation costs. If, after receipt of the written estimate, Surface Owner elects to proceed with the relocation, KMG or KMGG will designate the contractor to complete the work and schedule the work with Surface Owner. Surface Owner will remit the amount of the estimate to KMG or KMGG prior to the commencement of the relocation work. After completion of the work KMG or KMGG will provide to Owner an itemized statement showing the actual cost of the work. Should the actual cost of the work be less than the estimate, KMG will pay the difference to Surface Owner. Should the actual cost of the work be greater than the estimate, Surface Owner will pay the difference to KMG within ten (10) days of receipt of the itemized statement.

All flowlines and pipelines shall be buried to a depth of approximately forty-eight (48) inches from the surface. Surface Owner shall maintain a minimum of forty-eight (48) inches and not more than seventy-two (72) inches of cover over all pipelines and flowlines. The construction and burying of additional flowlines, gathering lines and pipelines shall be at the sole cost and expense of KMG, KMGG or its gas purchaser.

Notwithstanding the preceding paragraph, KMG or KMGG, shall be entitled, from time to time and if necessary to conduct its operations, to locate temporary waterlines within the pipeline easements. The temporary waterline can be used by KMG or KMGG during the duration of the drilling and completion of the Future Wells drilled in the POAs.

Such waterlines will be above ground lines constructed on the Property and shall be constructed and maintained to the following specifications:

a. Temporary above ground waterline easements shall be at the locations identified on ExhibitD as the pipeline easements. If a certified survey has not been completed for existing and future pipeline corridors, the locations of such pipelines as depicted on Exhibit D are approximate locations. In the event that KMG prepares a certified survey for a pipeline, KMG and KMGG shall furnish a copy of the survey to Surface Owner upon its written request.

b. The width of this easement shall be as reflected in Exhibit D for all operations, maintenance and transportation activities or as otherwise agreed to between the parties.

c. Locations of waterline easements may be changed by mutual agreement of Surface Owner and KMG; provided, however, all costs and expenses of such relocations shall be borne by the Party which requests the relocation. KMG or KMGG, as applicable, and Surface Owner shall enter into a separate relocation agreement for the relocation of lines and easements, all costs and expenses of such relocations to be paid by the Party which requests the relocation.

5. ACCESS.

KMG agrees to access the POAs according to the joint or existing access roads depicted and described on the attached Exhibit "D". Surface Owner shall have the right to relocate any access in the future at Surface Owner's cost and expense so long as KMG has convenient and uninterrupted access. Roads no longer used by KMG shall be abandoned. Surface Owner shall not inhibit KMG's access to the POAs or inhibit KMG's operations within the POAs. KMG acknowledges that access to the POAs will be non-exclusive to accommodate use of such access by the other mineral operator upon the Property, Encana, however no third party – including EnCana - shall impact KMG's access.

6. BATTERIES, EQUIPMENT, and OPERATIONS.

Any necessary additional future tanks and related surface equipment shall be located by KMG in the POAs. KMG shall have the right to locate, build, repair and maintain tanks, separators, dehydrators, compressors and other equipment reasonably appropriate for the

operation and production of any Future Wells only within the POAs. No compressors, other than wellhead compressors, shall be located on the Property.

With respect to KMG's equipment and facilities, flowlines or pipelines, KMG shall comply with all requisite mitigation measures contained in the COGCC Rules and Regulations and Erie Rules, Regulations and Ordinances that are not inconsistent with those of the COGCC, and shall include the following:

a. KMG shall install and maintain, at its sole cost and expense, all fences around any Future Wells and production facilities in compliance with the Rules and Regulations of the COGCC and the Town of Erie. The fence material may be upgraded at Surface Owner's option and expense, so long as the upgrade complies with COGCC and Town of Erie rules and regulations and provided Surface Owner obtains the prior written consent of KMG which consent shall not be unreasonably withheld;

b. KMG shall install and maintain, at its sole cost and expense, all gates and locks reasonably necessary for the security of any wells or facilities in the POAs. Such gates and locks shall be the standard gates and locks used by KMG;

c. KMG shall paint all production facilities for all wells, including wellhead guards, with paint that is approved by the COGCC. The color may be selected by Surface Owner, provided that any additional costs of using the color is paid by Surface Owner and that it is in compliance with COGCC and Town of Erie Rules and Regulations; and

d. KMG shall remediate and reclaim the Joint Use Areas depicted on Exhibit B and C in accordance with COGCC and Erie Rules and Regulations, and as soon as reasonably practicable following completion of the last of the Future Wells drilled within a particular POAs.

e. KMG shall not dispose of or permanently store upon or in the Property sludge, cuttings, produced water, chemicals or any hazardous or noxious substances.

Surface Owner shall not inhibit KMG's access to the POAs or inhibit KMG's operations within the POAs.

7. NOTICES TO PROPERTY OWNERS AND BUILDERS.

Surface Owner shall deliver to all buyers of the Property from Surface Owner a plat or map showing the POAs and then existing easements for flowlines, pipelines and access. In addition, Surface Owner shall provide notice to all builders, property owners, property owners' associations, special districts and other buyers of the Property from Surface Owner that:

a. There may be ongoing oil and gas operations and production in the POAs on the surface of the Property;

b. There are likely to be additional Future Wells drilled and oil and gas operations and production from the POAs that affect the surface of the Property;

c. Heavy equipment may be used by KMG from time to time for oil and gas production operations and that such operations may be conducted on a 24 hour basis upon access roads and within the POAs;

d. Future purchasers of all or a portion of the Property, as successors in interest to Surface Owner, will be acquiring a proportionate interest in Surface Owner's rights under this Agreement and assuming those obligations undertaken by Surface Owner pursuant to this Agreement; and

e. Property owner associations, special districts and buyers of individual lots, as successors in interest to Surface Owner, will be subject to the waivers contained in Sections 2 and 3, and the covenants contained in Section 3 prohibiting the location of any building or structure within the POAs or the easements and waiving objection to any setback rules of the COGCC or any local jurisdiction.

f. Surface Owner may comply with such notice obligation by including the above items as notes on the final plats of Erie Highlands.

8. GOVERNMENTAL PROCEEDINGS.

Surface Owner shall not, directly or indirectly, oppose KMG in any agency or governmental proceedings, including but not limited to the COGCC, the Town of Erie or other governing body, related to KMG's operations on the Property, including but not limited to drilling, workovers, well deepenings and recompletions, provided that KMG's position in such proceedings is consistent with this Agreement.

KMG shall not, directly or indirectly, oppose Surface Owner in any agency or governmental proceedings, including but not limited to the Town of Erie or other governing body, related to Surface Owner's application for development of the Property including but not limited to zoning, platting, subdivision, dedications, and subdivision improvement agreements, provided that Surface Owner's applications are consistent with this Agreement. KMG shall withdraw any such opposition previously filed in any agency or governmental proceedings.

9. LIMITATION OF LIABILITY, RELEASE AND INDEMNITY.

a. No Party shall be liable for, or be required to pay for, special, punitive, exemplary, incidental, consequential or indirect damages to any other Party for activities undertaken within the scope of this Agreement;

b. Except as to claims arising out of pollution or environmental damage (which claims are governed by Section 10 below) or out of other provisions of this Agreement (which claims shall be governed by the terms of this Agreement), each Party shall be and remain responsible for its own liability for all losses, claims, damages, demands, suits, causes of action, fines, penalties, expenses and liabilities, including without limitation attorneys' fees and other costs associated therewith (all of the aforesaid

herein referred to collectively as "Claims"), arising out of or connected with each such Party's ownership or operations on the Property, no matter when asserted, subject to applicable statutes of limitations. Each such Party shall release, defend, indemnify and hold the other Parties, their officers, directors, employees, successors and assigns, harmless against all such Claims. This provision does not, and shall not be construed to, create any rights in persons or entities not a party to this Agreement, nor does it create any separate rights in Parties to this Agreement other than the right to be indemnified for Claims as provided herein.

c. Notwithstanding the foregoing, to the maximum extent permitted by applicable law, KMG releases, waives and discharges Surface Owner, its affiliates, and its respective members, managers, officers, directors, employees, agents, attorneys, successors and assigns, from and against any and all liability for personal injury, death, property damage or other liability arising out of KMG's or its agents' operations upon, or use of, the Property unless such liability is the result of Surface Owner's gross negilgence or willful misconduct.

10. ENVIRONMENTAL INDEMNITY.

The provisions of Section 9 above, except for Section 9.a, shall not apply to any environmental matters, which shall be governed exclusively by the following, subject to the limitations of Section 9.a. above:

a. "Environmental Claims" shall mean all Claims asserted by governmental bodies or other third parties for pollution or environmental damage of any kind, arising from operations on or ownership of the Property or ownership of the oil and gas leasehold interest, whichever is applicable, and all cleanup and remediation costs, fines and penalties associated therewith, including but not limited to any Claims arising from Environmental Laws or relating to asbestos or to naturally occurring radioactive material. Environmental Claims shall not include the costs of any remediation undertaken voluntarily by any Party, unless such remediation is performed under the imminent threat of a Claim by a governmental body or other third party;

b. "Environmental Laws" shall mean any laws, regulations, rules, ordinances, or order of any governmental authority(ies), which relate to or otherwise impose liability, obligation, or standards with respect to pollution or the protection of the environment, including but not limited to, the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended (42 U.S.C. § 9601 et seq.), the Resource Conservation and Recovery Act of 1976 (42 U.S.C. §§ 6901 et seq.), the Clean Water Act (33 U.S.C. §§ 466 et seq.), the Safe Drinking Water Act (14 U.S.C. §§ 1401-1450), the Hazardous Material Transportation Act (49 U.S.C. §§ 1801 et seq.), the Clean Air Act, and the Toxic Substances Control Act (15 U.S.C. §§ 2601-2629); and

c. Environmental Indemnification. KMG shall protect, indemnify, and hold harmless Surface Owner, any property owners' association, any special district and any lot owner who purchases a lot from Surface Owner from any Environmental Claims relating to the Property or mineral interest thereunder that arise out of KMG's ownership

of the minerals and oil and gas operations upon the Property and its ownership and operation of its pipeline easement or rights-of-way and access easements or rights of way on the Property. Surface Owner shall fully protect, defend, indemnify and hold harmless KMG from any and all Environmental Claims relating to the Property that arise out of Surface Owner's development of the Property.

11. EXCLUSION FROM INDEMNITIES AND INSURANCE REQUIREMENTS.

The indemnities of the Parties herein shall not cover or include any amounts which the indemnified Party is actually reimbursed by any third party. The indemnities in this Agreement shall not relieve any Party from any obligations to third parties.

1. Insurance. KMG shall maintain during the term of this Agreement:

a. Workmen's Comp. Insurance which shall comply with all applicable Workers' Compensation and Occupational Disease Laws and which shall cover all of the KMG's employees performing any work or activities as to the Property.

b. Liability. Commercial General Liability Insurance, including contractual liability coverage as well as sudden and accidental pollution liability coverage, with a combined bodily injury and property damage limit of not less than $5,000,000 per occurrence.

c. Environmental. Environmental Impairment Liability Insurance with a limit of not less than $5,000,000 per occurrence.

KMG shall ensure that it and its contractors' insurers waive all rights of recovery or subrogation against Surface Owner, its parent, subsidiaries, affiliates, agents, directors, officers, employees, servants, co-lessees or co-venturers. As to such liability insurance, Surface Owner shall be named as an additional insured to the extent of KMG's liabilities and obligations hereunder that are covered by such liability insurance. Such liability insurance of KMG shall be written on customary policy forms and by insurance companies with ratings of no less than A- VII or better. Upon request, KMG shall endeavor to furnish Surface Owner with certificates of insurance evidencing compliance with this provision. All such certificates must be signed by authorized representatives of the insurance companies and provide for not less than ten days prior written notice to Owner in the event of cancellation affecting Surface Owner's interest. Neither failure to comply, nor full compliance with the insurance provisions of this Agreement, shall limit or relieve KMG from its indemnity obligations in accordance with this Agreement. KMG agrees to maintain all such liability insurance in accordance with the terms of this Section 11__ until the termination of this Agreement. On the second anniversary date of this Agreement, and every two years thereafter (or, upon request of Surface Owner if the parties have failed to meet during any biennial period), the parties shall meet to discuss whether the policy limits stated in this Section 11 should be adjusted and, as appropriate, adjust such policy limits to reflect then-current economic conditions and industry practices.

Alternatively, KMG may elect to self-insure for so long as such self insurance is the obligation of KMG's parent, Anadarko Petroleum Corporation, and such parent corporation has a

market capitalization in excess of $1 billion. If KMG elects to self-insure, such self-insurance shall include its common law and assumed liability under this Agreement for bodily injury and/or property damage to third parties in connection with accidents arising out of its operations, but only to the extent of those liabilities assumed herein. KMG self-insures the first $5,000,000 of its general liability, with excess liability insurance covering all operations and attaching over its self-insurance retention. KMG's self-insurance will respond to the same extent as if an insurance policy had been purchased naming Owner as an additional insured, but only to the extent of those liabilities assumed herein. Any limitations of KMG's self-insurance shall not limit its obligations to Surface Owner as provided in this Agreement or the Owner OGL. In the event of an assignment or transfer of this Agreement, as a condition precedent to the effectiveness of such assignment, the assignee or transferee shall be required to provide insurance coverage that is reasonably acceptable to Surface Owner before Surface Owner shall be required to consent to such assignment.

12. NOTICE OF CLAIM FOR INDEMNIFICATION.

If a Claim is asserted against a Party for which the other Party would be liable under the provisions of Section 9 or 10 above, it is a condition precedent to the indemnifying Party's obligations hereunder that the indemnified Party give the indemnifying Party written notice of such Claim setting forth all particulars of the Claim, as known by the indemnified Party, including a copy of the Claim (if it is a written Claim). The indemnified Party shall make a good faith effort to notify the indemnifying Party within five days of receipt of a Claim and shall affect such notice in all events within such time as will allow the indemnifying Party to defend against such Claim.

13. REPRESENTATIONS.

Each Party represents that it has the full right and authority to enter into this Agreement. KMG does not represent that it has rights to settle matters for all of the mineral owners or any other lessees in the Property and this Agreement shall only apply to and bind the KMG mineral interest in the Property.

14. SUCCESSORS.

The terms, covenants, and conditions hereof shall be binding upon and shall inure to the benefit of the Parties and their respective heirs, devises, executors, administrators, successors and assigns.

15 TERM.

This Agreement shall become effective when it is fully executed and shall remain in full force and effect until KMG has plugged and abandoned all wells owned all or in part by KMG and complied with the requirements of all applicable existing laws and regulations pertaining to removal of equipment, reclamation, cleanup and all other applicable provisions of existing laws and regulations.

16. NOTICES.

Any notice or other communication required or permitted under this Agreement shall be deemed to have been given and effective and sufficient if deposited in U.S. Mail, postage prepaid, addressed to each of the following:

If to KMG:

Kerr McGee Oil & Gas Onshore LP
1099 18th Street, Suite 1800
Denver, Colorado 80202
Attention: Surface Land Manager

If to Surface Owner:

J Dearmin LLC
10343 Federal Blvd, #J515
Westminster, Colorado, 80260
Attn: James Dearmin

Jack Shell Family Trust
10015 Meade Ct.
Westminster, CO 80031

Sonya Shell Family Trust
10015 Meade Ct.
Westminster, CO 80031

J Gaz LLC
4955 W. 65th Ave
Arvada, CO 80003
Attn: Johnny Gaz
with a copy to:

Oakwood Homes LLC
4908 Tower Road
Denver, Colorado 80249
Attn: Bruce Rau

WY&K Holdings, LLC
c/o Fairfield & Woods
1700 Lincoln Street, Suite 2400
Denver, CO 80203

Dufford & Brown, P.C.
1700 Broadway, Suite 2100
Denver, Colorado 80290-2101
Attn: Randall J. Feuerstein, Esq.

Any Party may, by written notice so delivered to the other Parties, change the address or individual to which delivery shall thereafter be made.

17. RECORDING.

This Agreement, any amendment hereto shall be recorded by KMG, which shall provide the other Parties with a copy showing the recording information as soon as practicable thereafter.

18. SURFACE DAMAGES.

Damages for each Future Well in the amount of $10,000.00 per well shall be paid by KMG to Surface Owner upon or prior to the date that each Future Well is spudded provided that Surface Owner still owns the Property on the date that the Future Wells is spudded. Payments shall be made to Surface Owner at the above address in cash, certified funds or cashiers' check. Upon conveyance of the Property to Oakwood Homes, LLC or an affiliated entity from the individually named surface owners, such damages shall no longer be payable.

19. COVENANT RUNNING WITH THE PROPERTY.

This Agreement constitutes a covenant running with the Property and will be binding upon and inure to the benefit of, and be enforceable by, the Parties and their respective successors, representatives, affiliates, administrators, trustees, executors and assigns.

20. ARBITRATION.

Any controversy or claim arising out of or relating to this Agreement, or the breach thereof, shall be resolved by arbitration conducted in Denver, Colorado and shall be administered by the American Arbitration Association under its commercial rules, and judgment on the award rendered by the arbitrator(s) may be entered in any court having jurisdiction thereof. The prevailing Party in any Arbitration, any other dispute resolution proceeding, or any regulatory or judicial proceeding shall be entitled to recover its reasonable attorneys' fees, experts' fees, costs and expenses from the other Party.

21. APPLICABLE LAW.

This Agreement shall be governed by and construed in accordance with the laws of the State of Colorado, without reference to its conflict of laws provisions.

22. ENTIRE AGREEMENT.

This Agreement sets forth the entire understanding among the parties hereto regarding the matters addressed herein, and supersedes any previous communications, representations or agreement, whether oral or written. This Agreement shall not be amended, except by written document signed by all Parties.

23. EXECUTION AND BINDING EFFECT.

This Agreement may be executed in any number of counterparts each of which shall be deemed an original instrument but all of which together shall constitute one and the same instrument, and shall be binding upon and inure to the benefit of the Parties, and each of their

respective heirs, executors, administrators, successors and assigns and is executed by the Parties as of the Effective Date set forth above.

24. ACKNOWLEDGMENT BY SURFACE OWNER.

Surface Owner expressly acknowledges that this Agreement satisfies KMG's obligation under COGCC rules to consult in good faith with the Surface Owner regarding the proposed oil and gas operations. The Parties further expressly acknowledge that this Agreement shall be deemed to be specifically applicable to and to fully satisfy, the obligation of the Parties to reasonably accommodate each other's use of the surface of the Property.

The parties have executed this Agreement on the day and year first above written.

[Remainder of page intentionally blank]

Kerr-McGee Oil & Gas Onshore LP

By: _____
Name: David Bell
Title: Agent and Attorney-In-Fact

STATE OF COLORADO)
) ss.
COUNTY OF Adams)

The foregoing instrument was acknowledged before me this 31 day of July 2013 by David Bell, as Agent and Attorney-In-Fact of Kerr-McGee Oil & Gas Onshore LP, a Delaware limited partnership.

Witness my hand and official seal.

Rhonda Sutton
Notary Public
My Commission Expires: May 4, 2016

RHONDA SUTTON
NOTARY PUBLIC, STATE OF COLORADO
My Comm. Expires May 4, 2016

Kerr-McGee Gathering LLC

By: _____
Name: Ronal H. Olsen
Title: Land Manager

STATE OF COLORADO)
) ss.
COUNTY OF DENVER)

The foregoing instrument was acknowledged before me this 1st day of August 2013 by Ronald H. Olsen _____, as Land Manager of Kerr-McGee Gathering LLC, a Colorado limited liability company.

Witness my hand and official seal.

Lorri L. Simpson
Notary Public
My Commission Expires: 4/27/2017

LORRI L. SIMPSON
NOTARY PUBLIC
STATE OF COLORADO
NOTARY ID # 19974006744
MY COMMISSION EXPIRES APRIL 27, 2017

J DEARMIN LLC

By: James R. Dearmin by Debra M. Dearmin
James R. Dearmin, by Debra M. Dearmin, attorney-in-fact
Title Attorney-in-fact

ACKNOWLEDGMENT

State Of Colorado)
)ss
County Of Adams)

On this 29th day of July, 2013, before me personally appeared Debra M. Dearmin, as attorney in fact for James R. Dearmin, who, being by me duly sworn, did say that he is the Power of Attorney for J Dearmin LLC., that he signed the foregoing instrument on behalf of said company and acknowledged the instrument to be the free and voluntary act and deed of said company for the uses and purposes therein set forth.

My Commission Expires: 11-18-13

(SEAL)

NOTARY PUBLIC
MARIANNE DICKERSON
STATE OF COLORADO

Notary Public: Marianne Dickerson

J GAZ LLC

By: Emmalou Gaz
Emmalou Gaz, as Attorney in Fact for Johnny Gaz

Title: Manager

ACKNOWLEDGMENT

State Of Colorado)
)ss
City and
County Of Denver)

On this 30th day of July, 2013, before me personally appeared Emmalou Gaz, who, being by me duly sworn, did say that she is the Attorney in Fact for Johnny Gaz, that she signed the foregoing instrument on his behalf as Manager of said company and acknowledged the instrument to be the free and voluntary act and deed of said company for the uses and purposes therein set forth.

My Commission Expires: 8/10/2014

(SEAL)

DEBRA P. SIMON NOTARY PUBLIC STATE OF COLORADO

My Commission Expires 08/10/2014

Notary Public: Debra P. Simon

WY&K HOLDINGS, LLC

By: _____
Name: ROBERT E YOULE
Title: _____

ACKNOWLEDGMENT

State Of Colorado)
City and)ss
County Of DENVER)

On this 31st day of July, 2013, before me personally appeared ROBERT E YOULE who, being by me duly sworn, did say that he is the MANAGER for WY&K HOLDINGS, LLC,, that he signed the foregoing instrument on behalf of said company and acknowledged the instrument to be the free and voluntary act and deed of said company for the uses and purposes therein set forth.

My Commission Expires: 3/15/16

(SEAL)

KEHAULANI MERRIE PUNILEI
Notary Public
State of Colorado

Notary Public: _____

JACK SHELL FAMILY TRUST

By: Jack Shell

Name: Jack Shell
Title: Trustee

SONYA SHELL FAMILY TRUST

By: Jack Shell

Name: Jack Shell
Title: Trustee

ACKNOWLEDGMENT

State Of Colorado)
)ss
County Of Adams)

On this 30th day of July, 2013, before me personally appeared Jack Shell, who, being by me duly sworn, did say that he is the Trustee for the Jack Shell Family Trust., that he signed the foregoing instrument on behalf of said trust and acknowledged the instrument to be the free and voluntary act and deed of said trust for the uses and purposes therein set forth.

My Commission Expires: My Commission Expires 08/25/2014

(SEAL) TANYA S REED NOTARY PUBLIC STATE OF COLORADO

Notary Public: Tanya Reed

ACKNOWLEDGMENT

State Of Colorado)
)ss
County Of Adams)

On this 30th day of July, 2013, before me personally appeared Jack Shell, who, being by me duly sworn, did say that he is the Trustee for the Sonya Shell Family Trust., that he signed the foregoing instrument on behalf of said trust and acknowledged the instrument to be the free and voluntary act and deed of said trust for the uses and purposes therein set forth.

My Commission Expires: My Commission Expires 08/25/2014

(SEAL) TANYA S REED NOTARY PUBLIC STATE OF COLORADO

Notary Public: Tanya Reed

Oakwood Homes LLC, as an optionee to purchase the Property from Surface Owner, hereby consents to this Agreement and upon its acquisition of all or any part of the Property, agrees to be bound by the terms and provisions of this Agreement.

OAKWOOD HOMES LLC

By: _____
Name: Robert J Sanderman
Title: Executive Vice President

STATE OF Colorado)
) ss.
COUNTY OF Denver)

The foregoing instrument was acknowledged before me this 31st day of July 2013 by Robert J. Sanderman, as EVP of Oakwood Homes LLC, a Colorado limited liability company.

Witness my hand and official seal.

_____
Karen L. Wilborn
Notary Public

KAREN L. WILBORN NOTARY PUBLIC STATE OF COLORADO

My Commission Expires: 6/17/2016

545333....

EXHIBIT A
To
Surface Use Agreement

PROPERTY DESCRIPTION

Exhibit A

LEGAL DESCRIPTION

A PARCEL OF LAND BEING A PART OF THE NORTH HALF OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTHWEST CORNER OF SAID SECTION 20, AND CONSIDERING THE NORTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 20 TO BEAR NORTH 88°48'39" EAST, WITH ALL BEARINGS CONTAINED HEREIN RELATIVE THERETO;

THENCE ALONG SAID NORTH LINE, NORTH 88°48'39" EAST, A DISTANCE OF 2,648.08 FEET TO THE NORTH QUARTER CORNER OF SAID SECTION 20;

THENCE ALONG THE NORTH LINE OF THE NORTHEAST QUARTER OF SAID SECTION 20, NORTH 88°48'06" EAST, A DISTANCE OF 2,648.24 FEET TO THE NORTHEAST CORNER OF SAID SECTION 20;

THENCE ALONG THE EAST LINE OF SAID NORTHEAST QUARTER, SOUTH 00°00'25" WEST, A DISTANCE OF 1,720.04 FEET TO A POINT ON THE NORTHERLY BOUNDARY OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 509 AT PAGE 79, IN SAID RECORDS;

THENCE DEPARTING SAID EAST LINE AND ALONG SAID NORTHERLY BOUNDARY, SOUTH 78°55'29" WEST, A DISTANCE OF 430.59 FEET TO A POINT ON THE NORTHERLY BOUNDARY OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 1179 AT PAGE 541, IN SAID RECORDS;

THENCE ALONG SAID NORTHERLY BOUNDARY, NORTH 89°59'35" WEST, A DISTANCE OF 27.44 FEET TO THE NORTHWEST CORNER OF SAID PARCEL;

THENCE ALONG THE WESTERLY BOUNDARY OF SAID PARCEL, SOUTH 00°00'25" WEST, A DISTANCE OF 5.38 FEET TO A POINT ON THE NORTHERLY BOUNDARY OF SAID PARCEL DESCRIBED IN BOOK 509 AT PAGE 79;

THENCE ALONG SAID NORTHERLY BOUNDARY, SOUTH 78°55'29" WEST, A DISTANCE OF 769.24 FEET TO THE NORTHEASTERLY CORNER OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 814 AT PAGE 251, IN SAID RECORDS;

THENCE ALONG THE NORTHERLY, WESTERLY AND SOUTHERLY BOUNDARIES OF SAID PARCEL THE FOLLOWING THREE (3) COURSES:

1) SOUTH 78°55'29" WEST, A DISTANCE OF 250.00 FEET;

2) SOUTH 11°04'31" EAST, A DISTANCE OF 125.00 FEET;

3) NORTH 78°55'29" EAST, A DISTANCE OF 250.00 FEET TO THE SOUTHWESTERLY CORNER OF SAID PARCEL DESCRIBED IN BOOK 509 AT PAGE 79;

THENCE ALONG THE SOUTHERLY BOUNDARY OF SAID PARCEL, NORTH 78°55'29" EAST, A DISTANCE OF 744.76 FEET TO A POINT ON THE WESTERLY BOUNDARY OF SAID PARCEL DESCRIBED IN BOOK 1179 AT PAGE 541;

THENCE ALONG SAID WESTERLY BOUNDARY, SOUTH 00°00'25" WEST, A DISTANCE OF 76.02 FEET TO THE NORTHEASTERLY CORNER OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 1044 AT RECEPTION NO. 1983198, IN SAID RECORDS;

THENCE ALONG THE NORTHERLY BOUNDARY OF SAID PARCEL, SOUTH 89°05'08" WEST, A DISTANCE OF 225.15 FEET TO THE NORTHWESTERLY CORNER OF SAID PARCEL;

THENCE ALONG THE WESTERLY BOUNDARY OF SAID PARCEL, SOUTH 00°00'21" WEST, A DISTANCE OF 650.47 FEET TO THE SOUTHWESTERLY CORNER OF SAID PARCEL AND A POINT ON THE SOUTH LINE OF THE NORTHEAST QUARTER OF SAID SECTION 20;

THENCE ALONG SAID SOUTH LINE, SOUTH 89°05'07" WEST, A DISTANCE OF 1,962.78 FEET TO THE CENTER QUARTER CORNER OF SAID SECTION 20;

THENCE ALONG THE SOUTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 20, SOUTH 89°05'29" WEST, A DISTANCE OF 2,640.94 FEET TO THE WEST QUARTER CORNER OF SAID SECTION 20;

THENCE ALONG THE WEST LINE OF SAID NORTHWEST QUARTER, NORTH 00°21'43" WEST, A DISTANCE OF 2,628.51 FEET TO THE **POINT OF BEGINNING**.

CONTAINING AN AREA OF 305.126 ACRES, (13,291,297 SQUARE FEET), MORE OR LESS.

EXCEPTING THEREFROM:

A PARCEL OF LAND AS DESCRIBED IN SPECIAL WARRANTY DEED AS RECORDED AT RECEPTION NO. 3338315 OF THE RECORDS OF THE WELD COUNTY CLERK AND RECORDER'S OFFICE, BEING A PART OF THE NORTHEAST QUARTER OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO DESCRIBED FURTHER MORE AS FOLLOWS;

COMMENCING AT THE NORTHEAST CORNER OF SAID SECTION 20, THENCE SOUTH 44°24'16" WEST, A DISTANCE OF 42.88 FEET TO A LINE PARALLEL WITH AND 30 FEET WESTERLY, MEASURED AT RIGHT ANGLES, FROM THE EAST LINE OF THE NORTHEAST QUARTER OF SAID SECTION 20 AND THE TO THE **POINT OF BEGINNING**;

THENCE ALONG SAID PARALLEL LINE, SOUTH 00°00'25" WEST, A DISTANCE OF 1,048.55 FEET;

THENCE DEPARTING SAID PARALLEL LINE, NORTH 89°59'35" WEST, A DISTANCE OF 30.00 FEET TO A LINE PARALLEL WITH AND 60 FEET WESTERLY, MEASURED AT RIGHT ANGLES, FROM THE EAST LINE OF THE NORTHEAST QUARTER OF SAID SECTION 20;

THENCE ALONG SAID PARALLEL LINE, NORTH 00°00'25" EAST, A DISTANCE OF 987.48 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE SOUTHEWESTERLY;

THENCE DEPARTING SAID PARALLEL LINE, NORTHWESTERLY ALONG SAID CURVE, THROUGH A CENTRAL ANGLE OF 91°12'20", AN ARC LENGTH OF 31.84 FEET TO A LINE PARALLEL WITH AND 70 FEET SOUTHERLY, MEASURED AT RIGHT ANGLES, FROM THE NORTH LINE OF THE NORTHEAST QUARTER OF SAID SECTION 20;

THENCE ALONG SAID PARALLEL LINE, SOUTH 88°48'06" WEST, A DISTANCE OF 1,272.60 FEET;

THENCE DEPARTING SAID PARALLEL LINE, NORTH 01°11'53" WEST, A DISTANCE OF 40.00 FEET TO A LINE PARALLEL WITH AND 30 FEET SOUTHERLY, MEASURED AT RIGHT ANGLES, FROM THE NORTH LINE OF THE NORTHEAST QUARTER OF SAID SECTION 20;

THENCE ALONG SAID PARALLEL LINE, NORTH 88°48'06" EAST, A DISTANCE OF 1,323.87 FEET TO THE **POINT OF BEGINNING**;

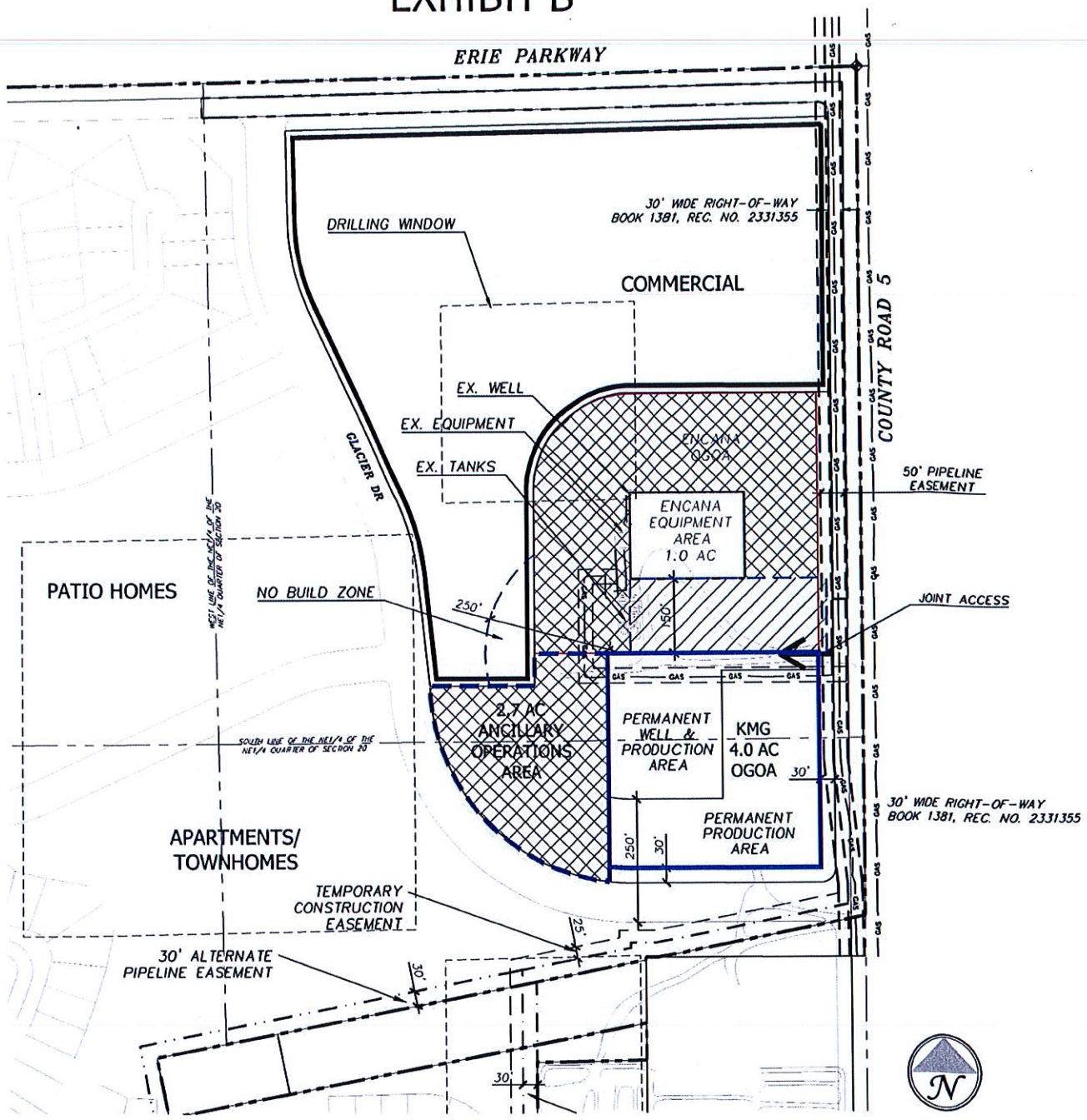
CONTAINING AN AREA OF 1.912 ACRES, (83,275 SQUARE FEET), MORE OR LESS.

THE RESULTANT OR NET AREA FOR THE OVERALL BOUNDARY BEING 303.214 ACRES, (13,208,022 SQUARE FEET), MORE OR LESS.

EXHIBIT B
To
Surface Use Agreement

PERMANENT OPERATIONS AREAS
Section 20: NE1/4

EXHIBIT B



LEGEND

- PERMANENT OPERATIONS AREA
- JOINT ENCANA & KMG ANCILLARY OPERATIONS AREA
- JOINT ENCANA & KMG ANCILLARY EQUIPMENT AREA
- JOINT ACCESS
- DRILLING WINDOWS

LOCATION OF ROADS, LOTS AND OTHER LAND DEVELOPMENT COMPONENTS ARE CONCEPTUAL AND SUBJECT TO CHANGE.

KERR MCGEE

TOWNSHIP 1 NORTH, RANGE 68 WEST

SECTION 20: NE1/4

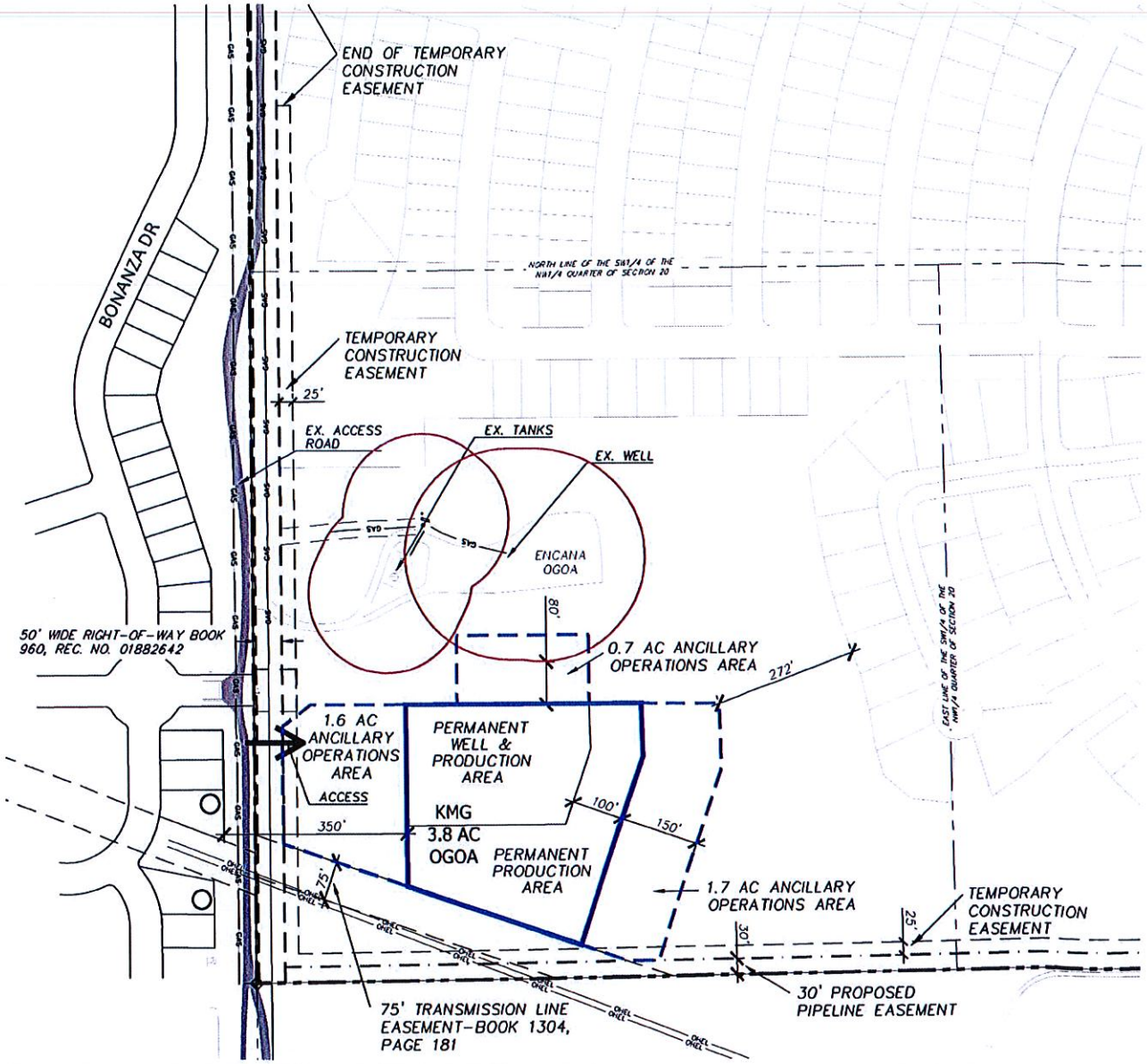
WELD COUNTY, COLORADO

Scale: 1"=300' July 31, 2013

Exhibit C
To
Surface Use Agreement

PERMANENT OPERATIONS AREAS
Section 20: NW1/4

EXHIBIT C



LEGEND

PERMANENT OPERATIONS AREA

ANCILLARY OPERATIONS AREA

ACCESS

LOCATION OF ROADS, LOTS AND OTHER LAND DEVELOPMENT COMPONENTS ARE CONCEPTUAL AND SUBJECT TO CHANGE.

KERR MCGEE

TOWNSHIP 1 NORTH, RANGE 68 WEST

SECTION 20: NW1/4

WELD COUNTY, COLORADO

Scale: 1"=300' July 31, 2013

EXHIBIT D
To
Surface Use Agreement

PETROLEUM PIPELINE EASEMENT LOCATIONS

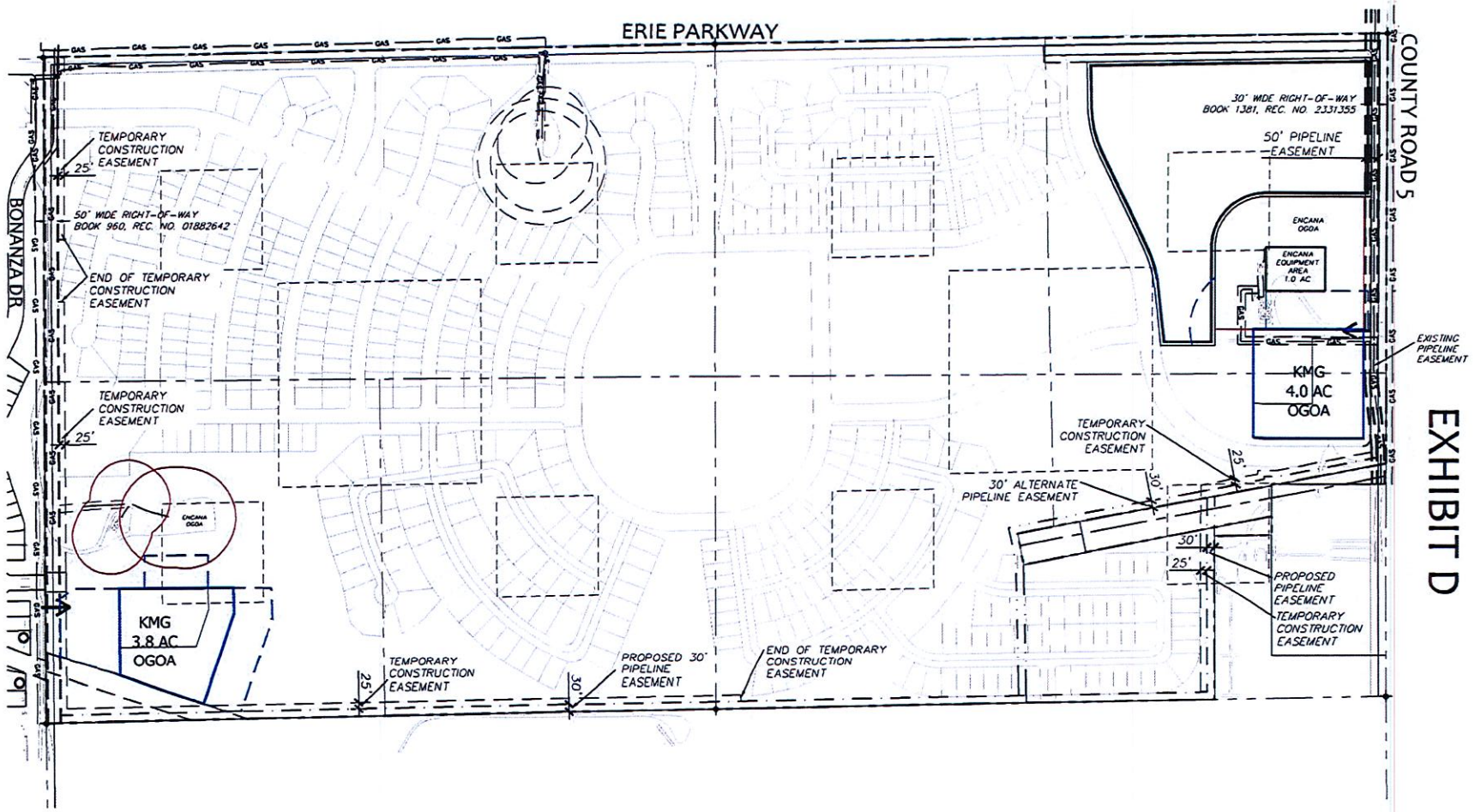


EXHIBIT D

LEGEND

- ENCANA OGOA
- KMG OGOA
- PROPOSED 30' PIPELINE EASEMENT
- ALTERNATE 30' PIPELINE EASEMENT
- EXISTING 50' PIPELINE ROW BOOK 960, REC. NO. 01882642
- EXISTING 30' PIPELINE ROW BOOK 1381, REC. NO. 2331355

KERR MCGEE

TOWNSHIP 1 NORTH, RANGE 68 WEST

SECTION 20: N1/2

WELD COUNTY, COLORADO

Scale: 1"=600' July 31, 2013

EXHIBIT E
To
Surface Use Agreement

PIPELINE GUIDELINES

General Guidelines for Design and Construction Activities On or Near Kerr- McGee Gathering LLC Pipelines and Related Facilities

This list of design, construction and contractor requirements, including but not limited to the following, is for the design and installation of foreign utilities or improvements on Kerr McGee Gathering LLC (KMGG) right-of-way (ROW). These are not intended to, nor do they waive or modify any rights KMGG may have under existing easements or ROW agreements. For information regarding KMGG's rights and requirements as they pertain to the existing easements, please reference existing easements and amendments documents. This list of requirements is applicable for KMGG facilities on easements and in road rights of ways only. Encroachments on fee property should be referred to the Land & ROW Department. Any reference to KMGG in the below requirements is meant to include and apply to any Kerr McGee entity.

Design

- KMGG shall be provided sufficient prior notice of planned activities involving excavation, blasting, or any type of construction on KMGG's ROW or near its facilities. This is to determine and resolve any location, grade or encroachment problems and allow for the protection of KMGG's facilities and the general public. This prior notification is to be made **before** the actual work is to take place.

- The encroaching entity shall provide KMGG with a set of drawings for review and a set of final construction drawings showing all aspects of the proposed facilities in the vicinity of KMGG's ROW. The encroaching entity shall also provide a set of "as-built drawings" and submit to KMGG, showing the facilities in the vicinity of KMGG's ROW upon completion of the work.

- Only facilities shown on drawings reviewed by KMGG will be approved for installation on KMGG's ROW. All drawing revisions that affect facilities proposed to be placed on KMGG's ROW must be approved by KMGG in writing.

- KMGG shall approve the design of all permanent road crossings.

- Any repair to surface facilities following future pipeline maintenance or repair work by KMGG on its "prior rights" ROW will be at the expense of the developer or landowner. In addition, any repair to surface facilities following future pipeline maintenance or repair work by KMGG on replacement ROW granted to relocate KMGG facilities will also be done at the expense of the developer or landowner unless expressly addressed in surface use agreements and approved in writing by KMGG.

- The depth of cover over the KMGG pipelines shall not be increased or reduced nor surface modified for drainage without KMGG's written approval.

- Construction of any permanent structure within KMGG pipeline easement is **not** permitted without written approval by KMGG.

- Planting of shrubs and trees is not permitted on KMGG pipeline easement without written approval by KMGG.

- Irrigation equipment i.e. backflow prevent devices, meters, valves, valve boxes, etc. shall not be located on KMGG easement without written approval by KMGG.

- Foreign utility installations, i.e., distribution gas, oil and gas gathering, water, electric, telephone, cable and sewer lines, etc., may cross perpendicular to KMGG's pipeline within the ROW, provided that a minimum of eighteen inches (18") of vertical clearance is maintained between KMGG pipeline(s) and the foreign utility. Any installation by a foreign utility with less than 18" of vertical separation is not allowed without written approval by KMGG. In no case will vertical separation be less than 12". Constant line elevations must be maintained across KMGG's entire ROW width, gravity drain lines are the only exception and must be approved in writing. Foreign line crossings below the KMGG pipeline must be evaluated by KMGG to ensure that a significant length of the KMGG line is not exposed and unsupported during construction. **Foreign line crossings above the KMGG pipeline with less than 18" of clearance must be evaluated by KMGG to ensure that additional support is not necessary to prevent settling on top of the KMGG natural gas pipeline.** A KMGG representative must be on site during any crossing activities to verify clearance depths and to assure the integrity and support of the KMGG facility. All installations of foreign crossings done by boring and or jacking require the KMGG facility to be exposed to verify clearances.

General Guidelines for Design and Construction Activities On or Near Kerr- McGee Gathering LLC Pipelines and Related Facilities

- Foreign utilities shall not run parallel to KMGG pipelines within the KMGG easement without written permission by KMGG. **A minimum of 10 feet of horizontal separation must be maintained in parallel installations whether the foreign utility is placed within the KMGG easement or adjacent to the KMGG easement. Any deviation from the 10' horizontal requirement must be approved in writing by KMGG and an "as built survey" provided to KMGG after installation.** In the instance that high voltage electric lines, greater than 20kV, are installed parallel to a KMGG pipeline a minimum horizontal distance of 15' must be maintained.

- The foreign utility should be advised that KMGG maintains cathodic protection on its pipelines and facilities. The foreign utility must coordinate their cathodic protection system with KMGG's. At the request of KMGG, foreign utilities shall install (or allow to be installed) cathodic protection test leads at all crossings for the purposes of monitoring cathodic protection interference. The KMGG CP technician and the foreign utility CP technician shall perform post construction CP interference testing. Interference issues shall be resolved by mutual agreement between foreign utility and KMGG. All costs associated with the correction of cathodic protection interference issues on KMGG pipelines as a result of the foreign utility crossing shall be borne by the foreign utility for a period of one year from date the foreign utility is put in service.

- The developer shall understand that KMGG, whether specifically required per federal law or by company standard, will mark the routing of its underground facilities with aboveground pipeline markers and test leads and maintain those markers and test leads. Markers will be installed at every point the pipeline route changes direction and adequate markers will be installed on straight sections of pipeline to insure, in the sole opinion of KMGG, the safety of the public, contractor, KMGG personnel and KMGG facilities.

- On all foreign utility crossings and / or encroachments, metallic foreign lines shall be coated with a suitable pipe coating for a distance of at least 10 feet on either side of the crossing.

- AC Electrical lines must be installed in conduit and properly insulated.

- On all foreign pipelines, DOT approved pipeline markers shall be installed so as to indicate the route of the foreign pipeline across the KMGG ROW.

- No power poles, light standards, etc. shall be installed in the KMGG easement without written approval by KMGG.

- KMGG installs above ground appurtenances at various locations that are used in the operation of its facilities. Kerr McGee will install protective enclosures at the above ground appurtenances to protect them from outside damage. The design and placement of these above ground appurtenances and protective enclosures is done at KMGG's sole discretion, and may exceed any regulatory requirements.

Construction

- If KMGG will be relocating KMGG facilities for any entity, grading in the new KMGG ROW shall be +/- 6 inches before KMGG will mobilize to complete the relocation. Final cover after the completion of the project will not be manipulated by the requesting entity to be less than 48" nor more than 72". All cover that exceeds 72" or less than 48" will be approved in writing by KMGG. This does not preclude KMGG from installing the pipeline at a minimum cover of 36" as provided for in CFR 49 Part 192. Cover during all construction activities will NEVER be less than 36" unless approved in writing and a KMGG representative is on site during the time cover is reduced.

- The entity requesting relocation shall survey top of pipe after installation but before backfill to determine proper final elevation of KMGG facilities. The entity requesting relocation is solely responsible for the final depth of cover over the relocated KMGG facility. Any deviation from cover requirements as outlined above will be corrected at the sole expense of the entity requesting relocation.

- Contractors shall be advised of KMGG's requirements and be contractually obligated to comply.

- The continued integrity of KMGG's pipelines and the safety of all individuals in the area of proposed work near KMGG's facilities are of the utmost importance. Therefore, contractor must meet with KMGG representatives prior to construction to provide and receive notification listings for appropriate area operations and emergency personnel. **KMGG's on-site representative will require discontinuation of any work that, in his or her opinion, endangers the operations or safety of personnel, pipelines or facilities.**

General Guidelines for Design and Construction Activities On or Near Kerr- McGee Gathering LLC Pipelines and Related Facilities

- **The Contractor must expose all KMGG pipelines prior to crossing to determine the exact alignment and depth of the lines. A KMGG representative must be present.**

- The use of probing rods for pipeline locating shall be performed by KMGG representatives only, to prevent unnecessary damage to the pipeline coating. A KMGG representative shall do all line locating.

- Notification shall be given to KMGG at least 72 hours before start of construction. A schedule of activities for the duration of the project must be made available at that time to facilitate the scheduling of KMGG's work site representative. Any Contractor schedule changes shall be provided to KMGG immediately.

- Heavy equipment will not be allowed to operate directly over KMGG pipelines or in KMGG ROW unless written approval is obtained from KMGG. Heavy equipment shall only be allowed to cross KMGG pipelines at locations designated by KMGG. Haul roads will be constructed at all crossings. The haul roads will be constructed using lightweight equipment. The existing depth of cover over the pipeline must be verified. Cover will be added such that a total of 8' of fill exists over the pipeline and extends a minimum of 10' on each side of the pipeline. Depth of cover will then taper as required for equipment access. Steel plates may be used for load dissipation only if approved in writing by KMGG.

- Contractor shall comply with all precautionary measures required by KMGG, at its sole discretion to protect its pipelines. When inclement weather exists, provisions must be made to compensate for soil displacement due to subsidence of tires.

- Excavating or grading which might result in erosion or which could render the KMGG ROW inaccessible shall not be permitted unless the contractor agrees to restore the area to its original condition and provide protection to KMGG's facility. At no time will cover be reduced to less than 36" without written approval by KMGG and a KMGG representative on site.

- A KMGG representative shall be notified prior to construction activities within twenty-five (25) feet of a KMGG pipeline or above ground appurtenance. The contractor **shall not** be allowed to work within twenty-five (25) feet of KMGG facilities without approval from the KMGG representative. The KMGG representative may or may not remain on site during the entire construction activity. Contractor shall use extreme caution and take appropriate measures to protect KMGG facilities. The contractor shall call the KMGG representative prior to backfilling around the KMGG facility to allow for a final inspection of the KMGG facility.

- Ripping is only allowed when the position of the pipe is known and not within ten (10) feet of KMGG facility. KMGG personnel must be present.

- Temporary support of any exposed KMGG pipeline by Contractor may be necessary if required by KMGG's on-site representative. Backfill below the exposed lines and 12" above the lines shall be replaced with sand or other selected material as approved by KMGG's on-site representative and thoroughly compacted in 12" lifts to 95% of standard proctor dry density minimum or as approved by KMGG.'s on-site representative. This is to adequately protect against stresses that may be caused by the settling of the pipeline.

- No blasting shall be allowed within 1000 feet of KMGG's facilities unless blasting notification is given to KMGG Including complete Blasting Plan Data. A pre-blast meeting shall be conducted by the organization responsible for blasting.

- KMGG shall be indemnified and held harmless from any loss, cost of liability for personal injuries received, death caused or property damage suffered or sustained by any person resulting from any blasting operations undertaken within 500 feet of its facilities. The organization responsible for blasting shall be liable for any and all damages caused to KMGG's facilities as a result of their activities whether or not KMGG representatives are present. KMGG shall have a signed and executed Blasting Indemnification Agreement before authorized permission to blast can be given.

- No blasting shall be allowed within 200 feet of KMGG's facilities unless blasting notification is given to KMGG a minimum of one week before blasting. The organization responsible for blasting must complete Blasting Plan Data. KMGG shall review and analyze the blasting methods. A written blasting plan shall be provided by the organization responsible for blasting and agreed to in writing by KMGG. A written emergency plan shall be provided by the organization responsible for blasting.

- KMGG shall have a signed and executed Blasting Indemnification Agreement before authorized permission to blast can be given. A pre-blast meeting shall be conducted by the organization responsible for blasting.

General Guidelines for Design and Construction Activities On or Near Kerr- McGee Gathering LLC Pipelines and Related Facilities

- **Any** contact with any KMGG facility, pipeline, valve set, etc. shall be reported immediately to KMGG. If repairs to the pipe are necessary, they will be made and inspected before the section is re-coated and the line is back-filled.
- KMGG personnel shall install all test leads on KMGG facilities.

Local Kerr-McGee Gathering LLC Representation:

Operations Manager	Tim Bates	Phone: (303) 655-4352
Staff Engineer:	Wes Fortik	Phone: (720) 929-6985
Pipeline Foreman:	Wayne Knight	Phone: (303) 655-4329

Emergency Contacts:

On call integrated operation center	Phone: (970) 506-5980
One Call Emergency	Phone: 811

4044917 Pages: 1 of 26
09/10/2014 12:16 PM R Fee:$161.00
Steve Moreno, Clerk and Recorder, Weld County, CO

ERIE HIGHLANDS PROPERTY
MASTER PRE-DEVELOPMENT AGREEMENT

THIS MASTER PRE-DEVELOPMENT AGREEMENT ("Agreement") is made and entered into this 12th day of November 2013, by and among the **TOWN OF ERIE**, a Colorado municipal corporation, hereinafter referred to as "Erie;" **OAKWOOD HOMES, LLC**, a Colorado limited liability company, hereinafter referred to as "Developer;" and **J DEARMIN LLC, J GAZ LLC, THE JACK SHELL & SONYA SHELL FAMILY TRUSTS,** and **WY&K HOLDINGS, LLC**, (collectively, the "Owners").

RECITALS

WHEREAS, Developer is the contract purchaser of an approximately 295.8 acre parcel of land located on the west side of County Road 5 to the south of Erie Parkway, in the Town of Erie, Weld County, state of Colorado, commonly known as the Erie Highlands Property (the "Property"), and as more particularly described in "Exhibit A" attached hereto and incorporated herein by reference; and

WHEREAS, the Owners are collectively the owners of the Property; and

WHEREAS, Developer has applied to Erie for a rezoning of various tracts of the Property as Low Density Residential-LR, Medium Density Residential-MR, and Community Commercial-CC, Public Lands & Institutions-PLI, Agricultural/Opens Space-AG/OS (the "Rezoning") all with a Planned Unit Development Overlay (the "PUD") in order to develop a mixed use project within the Property (the "Development"); and

WHEREAS, the Owners have consented to the submission of such application by Developer; and

WHEREAS, the Board of Trustees of Erie held a public hearing on Developer's application for Rezoning and PUD on October 22, 2013 ("Public Hearing"), at which time evidence and testimony were received by the Board of Trustees, and which evidence and testimony was relied upon by the Board of Trustees in making findings and in determining whether or not the criteria set forth in the Erie Municipal Code ("Code") for rezoning had been met by Developer; and

WHEREAS, Developer presented evidence and testimony at the Public Hearing, including uses, maximum numbers of units, lot size, densities, phasing, open space dedication, park land dedication, and infrastructure for the Property, which evidence and testimony was specifically relied upon by the Board of Trustees in making findings and in determining that the for rezoning set forth in the Code had been met by Developer and in approving the Rezoning and PUD of the Property; and

WHEREAS, the Board of Trustees of Erie approved the Rezoning of the Property by Ordinance No. 35-2013 dated November 12, 2013, and approved the PUD by Ordinance No. 36-2013 dated November 12, 2013, as depicted on the Property zoning maps, attached hereto as "Exhibit B-1" and "Exhibit B-2" and incorporated herein by reference; and

WHEREAS, Erie and Developer now desire to enter into this Agreement to bind Developer to those uses, maximum numbers of units, lot sizes, densities, phasing, open space dedication, park land dedication, and infrastructure for the Property specifically relied upon by the Board of Trustees in approving the Rezoning and PUD; and

WHEREAS, the Development will be developed in multiple phases, wherein each phase will require Final Plat approval; and

WHEREAS, both Erie and Developer understand and agree that Developer intends to submit subsequent applications for Final Plats for each phase of development of the Property at some future date in accordance with the subdivision regulations set forth in the Code, and that at that time of subdivision a separate Development Agreement for each Final Plat will be required of Developer in conjunction with the subdivision process, which Development Agreement will address the required improvements and special provisions related to the subdivision and development of the Property located within each such Final Plat; and

WHEREAS, this Agreement is not intended to replace the Development Agreement for each Final Plat, but is intended only to bind the parties hereto to those items specifically relied upon by the Board of Trustees in making findings and in determining that the Code's criteria for rezoning had been met by Developer and provide assurances to the Developer regarding the overall process and Town interpretations applicable to the entire Property. Accordingly, a separate Development Agreement will be entered into with each Final Plat of the Property that will address matters related to the Property located within each such Final Plat; and

WHEREAS, the execution by Owners of this Agreement is only an acknowledgement of their agreement that Developer is authorized to enter into this Agreement with respect to the Property, and not an agreement by the Owners to undertake any development of the Property.

NOW, THEREFORE, in consideration of the foregoing, the parties hereto promise, covenant and agree as follows:

1. **Incorporation of Recitals.** The parties agree that the aforesaid recitals are true and correct, and those recitals are hereby incorporated into the body of this Agreement.

2. **Phasing.** Construction of the Development is anticipated to occur in multiple phases, as shown on the Phasing Map attached as "Exhibit C." The Owner shall determine the sequence of development of each phase provided that such sequencing meets the subdivision regulations of the Code.

3. **Separate Development Agreements**. Erie and Developer acknowledge and agree that the development obligations for the Property shall be set forth in separate development agreements, known herein as Development Agreements, to be entered into by the parties at the time of Final Plat for each such Final Plat, in accordance with the subdivision regulations of the Code and in conjunction with the subdivision process.

4. **Uses, Maximum Number of Dwelling Units, Lot Sizes, Densities.** The uses, maximum number of dwelling units, minimum lot sizes, and densities for the Development shall be as depicted on the PUD, attached as "Exhibit B-2." The parties expressly acknowledge that

the Rezoning of various tracts of the Property to Low Density Residential-LR, Medium Density Residential-MR, Community Commercial-CC, Public Lands & Institutions-PLI, and Agricultural/Open Space-AG/OS generally complies with the development standards of the respective zone districts, except as accounted for by the PUD which allows deviations from the underlying zoning in compliance with the Code.

5. **Open Space Dedication.** Developer shall not be required to dedicate open space at the time of approval of the Preliminary Plat or the Rezoning and shall, instead, dedicate open space to Erie as shown on "Exhibit B-2" attached hereto and incorporated herein by reference, within each Final Plat at the time of Final Plat approval for each phase of the Development. The minimum public open space dedication is shown on "Exhibit B-2." Erie acknowledges and agrees there is minimal open space dedication in the Phase 1 Final Plat and in other early phases of the Development and that most of the open space dedication identified on "Exhibit B-2" will occur in later phases of the Development. The minimum open space dedication of 31.33 acres, illustrated on "Exhibit B-2" is adequate to fulfill the open space dedication requirement for 667 dwelling units. The parties agree that after 667 dwelling units have been approved by final plats that for the Development to conform with the aggregate open space dedication requirements of the Code, the Developer shall either dedicate additional open space (above the 31.33 acres) or make a payment of cash in-lieu of land dedication for open space pursuant to the Code with each Final Plat. The Parties agree that the cash in-lieu for open space land dedication shall be $1,278.58 per dwelling unit, which amount is agreed upon and fixed for a period of five years from the effective date of this agreement. In the event that residential portions of the Development have not been final platted by such date, then the Developer shall be required to obtain an appraisal for submittal with the remaining Final Plat(s), which appraisal of then-current value shall be used to calculate a new cash in-lieu.

6. **Park Land Dedication.** The parties acknowledge and agree that the Pocket Park and Neighborhood Park land dedication requirements for the Development shall be based on the maximum number of dwelling units shown on "Exhibit B-2." Developer shall not be required to dedicate park land at the time of approval of the Preliminary Plat or the Rezoning and shall, instead, dedicate Pocket Park and Neighborhood Park land to Erie as shown on "Exhibit B-2" attached hereto and incorporated herein by reference, within each Final Plat at the time of Final Plat approval for each phase of the Development. The minimum Pocket Park and Neighborhood Park land dedication is shown on "Exhibit B-2" attached hereto and incorporated herein by reference. The parties agree that a cash in-lieu of Community Park land dedication will be required for the residential portion of the Development to conform to the Community Park land dedication requirements at the time of Final Plat. Developer shall make a payment of cash in-lieu of land dedication pursuant to the Code with each Final Plat. The Parties agree that the cash in-lieu for park land dedication shall be $376.12 per dwelling unit, which amount is agreed upon and fixed for a period of five years from the effective date of this agreement. In the event that residential portions of the Development have not been final platted by such date, then the Developer shall be required to obtain an appraisal for submittal with the last Final Plat(s), which appraisal of then-current value shall be used to calculate a new cash in-lieu.

7. **School Land Dedication.** The Development is anticipated to increase the demand on the St. Vrain Valley School District RE-1J (the "School District") due to the predictable increase in the number of school age children who will reside in the Development.

Developer has agreed to mitigate a portion of the costs and to meet its obligations under the Intergovernmental Agreement Concerning Fair Contributions for Public School Sites, dated June 8, 2011, between the Town of Erie and the School District ("IGA") by dedicating land for school purposes which would be reasonably necessary to serve the Development and the future residents thereof.

8. Erie Parkway. Future improvements are anticipated for Erie Parkway which runs along the northern border of the Development. The parties acknowledge and agree that Developer shall be responsible for improving the southern half of the Erie Parkway road section to Towns' principal arterial standards. In addition, Developer shall be responsible for making improvements (acceleration, deceleration, turn lanes, etc.) to provide fully functional intersections proposed adjacent to Erie Parkway. Developer shall be responsible for dedication of additional Erie Parkway right-of-way with the first final plat approved for the Development. However, the Parties agree that the obligation of Developer to construct improvements to Erie Parkway and to improve Erie Parkway shall be phased in accordance with the phasing of the overall Development, and the improvements to Erie Parkway required to serve each phase shall be required as part of each Final Plat, and addressed in the Development Agreement for each Final Plat.

9. County Road 5. Future improvements are anticipated for County Road 5 which runs along the east border of the Development. The parties acknowledge and agree that the Developer shall be responsible for improving the western half of the County Road 5 road section to the Towns' arterial standards. In addition, Owner shall be responsible for making improvements (acceleration, deceleration, turn lanes, etc.) to provide fully functional intersections proposed adjacent to County Road 5. Owner shall be responsible for dedication of additional County Road 5 right-of-way with the first final plat approved for the Development.

10. Prototype Site Plans. The parties acknowledge and agree that, prior to building permit application for any individual lot less than 5,000 square feet in size, the Town may require submittal of one or more Site Plans for each planning area within each filing. Site Plans shall be reviewed for approval in accordance with the Code.

11. Public Improvements. The parties acknowledge and agree that Developer shall not be required to construct or install public improvements or construct public infrastructure at the time of Preliminary Plat or the Rezoning and shall, instead, construct or install public improvements outlined in each separate Development Agreement as determined at the time of Final Plat for each phase of the Development based on the relevant engineering studies for each phase.

12. Default by either Party. If any material condition, obligation, or duty is not timely made, tendered, or performed by either Party under this Agreement, the non-defaulting Party may declare the defaulting party in default, following the notice and cure period referenced in Paragraph 15 of this Agreement, may proceed to seek any remedy available at law or in equity, including specific performance, damages, court costs, and attorney fees and costs as may be proper. In addition, if Developer fails to fulfill the terms and conditions of this Agreement, Erie, in its reasonable discretion, may declare Developer in default and may withhold any additional building permits, certificates of occupancy, or provision of new utilities fixtures or

services until the default is cured. No remedy or election hereunder shall be deemed exclusive but shall, whenever possible, be cumulative with all other remedies at law or in equity.

13. Notice of Default and Cure Period. In the event of an alleged Default by either Party under this Agreement, the non-defaulting Party may deliver written notice to the allegedly defaulting Party of such Default, at the address specified herein, and the allegedly defaulting Party shall have thirty (30) days from and after receipt of such notice to cure such Default. If such Default is not of a type which can be cured within such thirty (30) day period and the allegedly defaulting Party gives written notice to the non-defaulting Party within such thirty (30) day period that it is actively and diligently pursuing such cure, then the allegedly defaulting Party shall have a reasonable period of time given the nature of the Default following the end of such thirty (30) day period to cure such Default, provided that the allegedly defaulting Party is at all times within such additional time period actively and diligently pursuing such cure in good faith.

14. Separate Vested Rights Agreement. The parties acknowledge and agree that the parties have entered into a separate Vested Rights Agreement, entered into in accordance with the Code, acknowledging that the Rezoning, Preliminary Plat, Phase 1 Final Plat and any future Final Plats that are approved by Erie for the various phases of the Development, as such Preliminary Plat and plats may be amended from time to time, shall be considered a site specific development plan ("SSDP") for the purposes of the Vested Rights Statute and Sections 10.7.18 and 10.11.3 of the Code.

15. Representations and Warranties by Developer. Developer represents and warrants to Erie that:

a. Developer is duly organized, validly existing and in good standing under the laws of the State of Colorado and has the legal capacity and the authority to enter into and perform its obligations under this Agreement and the documents to be executed and delivered pursuant hereto;

b. The execution and delivery of this Agreement and such documents and the performance and observance of their terms, conditions and obligations have been duly and validly authorized by all necessary action on its part, and such documents and such performance and observance are valid and binding upon Developer;

c. The execution and delivery of this Agreement and the documents required hereunder and the consummation of the transactions contemplated by this Agreement will not (1) conflict with or contravene any law, order, rule or regulation applicable to Developer or to Developer's governing documents, (2) result in the breach of any of the terms or provisions or constitute a default under any agreement or other instrument to which Developer is a party or by which it may be bound or affected, or (3) permit any party to terminate any such agreement or instruments or to accelerate the maturity of any indebtedness or other obligation of Developer; and

d. This Agreement constitutes a valid and binding obligation of Developer, enforceable according to its terms, except to the extent limited by bankruptcy,

insolvency and other laws of general application affecting creditors' rights and by equitable principles, whether considered at law or in equity.

16. Indemnification and Release of Liability. Developer agrees to indemnify and hold harmless Erie, its officers, employees, agents, or servants, and to pay any and all judgments rendered against said persons on account of any suit, action, or claim caused by arising from, or on account of acts or omissions by Developer, its officers, employees, agents, consultants, contractors, and subcontractors, and/or suit, action, or claim resulting from Developer's failure to abide by the terms of this Agreement, and to pay to Erie and said persons their reasonable expenses, including but not limited to, reasonable attorney's fees and reasonable expert witness fees, incurred in defending any such suit, action or claim. Developer's obligation herein shall not apply to the extent said suit, action or claim results from any acts or omissions of officers, employees, agents, or servants of Erie or conformance with requirements imposed by Erie.

17. Title and Authority. Owners warrant to Erie that Owners are the record owners of the Property. The Owners further warrants that the Developer has full power and authority to enter into this Agreement.

18. Recording Agreement. Erie shall record this Agreement at Developer's expense in the office of the Clerk and Recorder, County of Weld, State of Colorado, and Erie shall retain the recorded Agreement.

19. Binding Effect of Agreement. This Agreement shall run with the Property and shall inure to the benefit of and be binding upon Erie and the successors, heirs, assigns, and any other person or entity acquiring or purchasing any interest in any of the Development.

20. Modification and Waiver. No modification of the terms of this Agreement shall be valid unless in writing and executed with the same formality as this Agreement, and no waiver of the breach of the provisions of any sections of this Agreement shall be construed as a waiver of any subsequent breach of the same section or any other sections which are contained herein.

21. Addresses for Notice. Any notice or communication required or permitted hereunder shall be given in writing and shall be personally delivered, sent via overnight delivery service or sent by United States mail, postage, prepaid, registered or certified mail, return receipt requested, addressed as follows:

Erie:	Developer:
Town of Erie Town Administrator P.O. Box 750 Erie, CO 80516-0750	Oakwood Homes, LLC Attn: Chad Ellington 4908 Tower Road Denver, CO 80249
With a copy (which shall not constitute notice) to:	With a copy (which shall not constitute notice) to:

Mark Shapiro	Carolynne C. White
Mark R. Shapiro, PC	Brownstein Hyatt Farber Schreck, LLP
1650 38th Street, Suite 103	410 17th Street, Suite 2200
Boulder, CO 80301-2624	Denver, CO 80202

With a copy to such other address or the attention of such other person(s) as hereafter designated in writing by the applicable parties in conformance with this procedure. Notices shall be effective upon mailing or personal delivery in compliance with this paragraph.

22. Previous Agreements. This Agreement shall constitute the entire agreement between the parties hereto and shall supersede all prior contracts, proposals, representations, negotiations and letters of intent, whether written or oral, pertaining to the Development.

23. Severability. If any part, section, subsection, sentence, clause or phrase of this Agreement is for any reason held to be invalid, such invalidity shall not affect the validity of the remaining sections of the Agreement. The parties hereby declare that they would have ratified this Agreement including each part, section, subsection, sentence, clause or phrase thereof; irrespective of the fact that one or more parts, sections, subsections, sentence, clauses or phrases be declared invalid.

24. Additional Documents or Action. The parties agree to execute any additional documents or take any additional action that is necessary to carry out this Agreement or is reasonably requested by the other party to confirm or clarify the intent of the provisions hereof and to effectuate the agreements herein contained and the intent hereof. If all or any portion of this Agreement are asserted or determined to be invalid, illegal or are otherwise precluded, the parties, within the scope of their powers and duties, shall cooperate in the joint defense of such documents and, if such defense is unsuccessful, the parties will use reasonable, diligent good faith efforts to amend, reform or replace such precluded items to assure, to the extent legally permissible, that each party substantially receives the benefits that it would have received under this Agreement.

25. Attorney Fees. In the event that either party finds it necessary to retain an attorney in connection with a default by the other as to any of the provisions contained in this Agreement, the defaulting party shall pay the other's reasonable attorney's fees and costs incurred in enforcing the provisions of this Agreement.

26. Situs, Venue and Severability. The laws of the State of Colorado shall govern the interpretation, validity, performance and enforcement of this Agreement. For the resolution of any dispute arising hereunder, venue shall be in the Courts of the County of Boulder, State of Colorado.

27. Paragraph Headings. Paragraph headings are inserted for convenience only and in no way limit or define the interpretation to be placed upon this Agreement.

28. Limited Third Party Beneficiaries. This Agreement is intended to describe the rights and responsibilities only as to the parties hereto and is not intended and shall not be deemed to confer any rights on any person or entity not named as a party hereto.

29. No Presumption. The parties to this Agreement and their attorneys have had a full opportunity to review and participate in the drafting of the final form of this Agreement. Accordingly, this Agreement shall be construed without regard to any presumption or other rule of construction against the party causing the Agreement to be drafted.

30. Parties Not Partners. Notwithstanding any language in this Agreement or any other agreement, representation, or warranty to the contrary, the parties shall not be deemed to be partners or joint venturers, and no party shall be responsible for any debt or liability of any other party.

31. No Waiver of Immunity. Nothing contained in this Agreement constitutes a waiver of sovereign immunity or governmental immunity by any party under applicable state law.

32. Nonliability of Officials, Agents and Employees. No trustee, board member, commissioner, official, employee, consultant, attorney or agent of any party shall be personally liable to any party under this Agreement or in the event of any Default or for any amount that may become due to any party.

33. Execution in Counterparts. This Agreement may be executed in counterparts, each of which shall be deemed an original and all of which shall constitute but one and the same instrument.

[SIGNATURES ON FOLLOWING PAGE]

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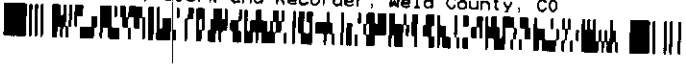
Steve Moreno, Clerk and Recorder, Weld County, CO



IN WITNESS WHEREOF, the parties have executed this Agreement as of the date first set forth above.

TOWN OF ERIE:

Joseph A. Wilson, Mayor

TOWN OF ERIE SEAL COLORADO

ATTEST:

Nancy J. Parker, Town Clerk

[SIGNATURES CONTINUE ON FOLLOWING PAGES]

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DEVELOPER:

OAKWOOD HOMES, LLC,
a Colorado limited liability company

By: _____
Name: Robert J. Sanderman
Title: Executive Vice President

STATE OF COLORADO)
) SS.
COUNTY OF Denver)

Subscribed and sworn to before me this 18th day of October, 2013, by Robert J. Sanderman as EVP of **Oakwood Homes, LLC,** a Colorado limited liability company.

Witness my hand and official seal.
My Commission expires 6/17/2016.

Karen L. Wilborn
Notary Public

KAREN L. WILBORN NOTARY PUBLIC STATE OF COLORADO

[SIGNATURES AND ACKNOWLEDGEMENTS OF OWNERS ON THE FOLLOWING PAGES]

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Steve Moreno, Clerk and Recorder, Weld County, CO

Solely for the purpose of acknowledging and consenting:

OWNERS:

J DEARMIN LLC, a Colorado limited liability company

By: Debra M. Dearmin
Name: James R. Dearmin by Debra M. Dearmin
Title: Attorney-in-fact

STATE OF COLORADO)
CITY AND) SS.
COUNTY OF DENVER)

Subscribed and sworn to before me this 11th day of October, 2013, by Debra M. Dearmin as attorney-in-fact for James R. Dearmin, Manager of **J DEARMIN LLC**, a Colorado limited liability company.

Witness my hand and official seal.
My Commission expires 8/10/2014.

Debra P. Simon
Notary Public

DEBRA P. SIMON NOTARY PUBLIC STATE OF COLORADO

My Commission Expires 08/10/2014

[SIGNATURES AND ACKNOWLEDGEMENTS OF OWNERS ON THE FOLLOWING PAGES]

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Steve Moreno, Clerk and Recorder, Weld County, CO

J GAZ LLC, a Colorado limited liability company

By: Emmalou Gaz
Name: Emmalou Gaz
Title: Attorney-in-fact

STATE OF COLORADO)
CITY AND) SS.
COUNTY OF DENVER)

Subscribed and sworn to before me this 14th day of October, 2013, by Emmalou Gaz as attorney-in-fact for Johnny Gaz, Manager of **J GAZ LLC** a Colorado limited liability company.

Witness my hand and official seal.
My Commission expires 8/10/2014.

Debra P. Simon
Notary Public

DEBRA P. SIMON NOTARY PUBLIC STATE OF COLORADO
My Commission Expires 08/10/2014

[SIGNATURES AND ACKNOWLEDGEMENTS OF OWNERS ON THE FOLLOWING PAGES]

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Steve Moreno, Clerk and Recorder, Weld County, CO

JACK SHELL FAMILY TRUST

By: Jack Shell
Jack Shell, Trustee

STATE OF COLORADO)
CITY AND) SS.
COUNTY OF DENVER)

Subscribed and sworn to before me this 2nd day of December, 2013 by Jack Shell as Trustee of **JACK SHELL FAMILY TRUST**.

Witness my hand and official seal.
My Commission expires 8/10/14.

Debra P. Simon
Notary Public

DEBRA P. SIMON NOTARY PUBLIC STATE OF COLORADO
My Commission Expires 08/10/2014

[SIGNATURES AND ACKNOWLEDGEMENTS OF OWNERS ON THE FOLLOWING PAGE]

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Steve Moreno, Clerk and Recorder, Weld County, CO

SONJA SHELL FAMILY TRUST

By: Jack Shell
Jack Shell, Successor Trustee

STATE OF COLORADO)
CITY AND) SS.
COUNTY OF DENVER)

Subscribed and sworn to before me this 2nd day of December, 2013, by Jack Shell as Successor Trustee of **SONJA SHELL FAMILY TRUST**.

Witness my hand and official seal.
My Commission expires 8/10/14.

Debra P. Simon
Notary Public

DEBRA P. SIMON NOTARY PUBLIC STATE OF COLORADO
My Commission Expires 08/10/2014

[SIGNATURES AND ACKNOWLEDGEMENTS OF OWNERS ON THE FOLLOWING PAGE]

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Steve Moreno, Clerk and Recorder, Weld County, CO

WY & K HOLDINGS, LLC,
a Colorado limited liability company

By: Robert E Youle
Name: ROBERT E YOULE
Title: Manager

STATE OF COLORADO)
) SS.
COUNTY OF DENVER)

Subscribed and sworn to before me this 14th day of October, 2013, by ROBERT E YOULE as MANAGER of **WY & K HOLDINGS, LLC,** a Colorado limited liability company.

Witness my hand and official seal.
My Commission expires 03-20-2014.

Roberta J Neal
Notary Public

ROBERTA J NEAL NOTARY PUBLIC STATE OF COLORADO

My Commission Expires 03/20/2014

[END OF SIGNATURES AND ACKNOWLEDGEMENTS]

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Steve Moreno, Clerk and Recorder, Weld County, CO

EXHIBIT A

Legal Description of the Erie Highlands Property

The North half of Section 20, Township 1 North, Range 68 West of the 6th P.M., County of Weld, State of Colorado, except those parcels as conveyed by instruments recorded in Book 509 at Page 79 and in Book 814 at Page 251 and in Book 1179 at Page 541 and under Reception No. 1983198 in Book 1044 and November 8, 2005 at Reception No. 3338315, County of Weld, State of Colorado.

The above legal also described as:

A PARCEL OF LAND BEING A PART OF THE NORTH HALF OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, COUNTY OF WELD, STATE OF COLORADO, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE NORTHEAST CORNER OF SECTION 20, AND CONSIDERING THE WEST LINE OF THE NORTHWEST QUARTER OF SECTION 20 TO BEAR NORTH 00°21'37" WEST, WITH ALL BEARINGS CONTAINED HEREIN RELATIVE THERETO;

THENCE SOUTH 44°24'15" WEST, A DISTANCE OF 42.88 FEET TO A POINT ON THE EASTERLY RIGHT-OF-WAY LINE OF WELD COUNTY ROAD NO. 5 AND THE POINT OF BEGINNING;

THENCE SOUTH 00°00'29" WEST, ALONG SAID EASTERLY RIGHT-OF-WAY LINE, A DISTANCE OF 1695.42 FEET TO A POINT ON THE NORTHERLY LINE OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 509 AT PAGE 79;

THENCE SOUTH 78°55'29" WEST, ALONG SAID NORTHERLY LINE, A DISTANCE OF 400.27 FEET TO A POINT ON THE NORTHERLY LINE OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 1179 AT PAGE 541;

THENCE NORTH 89°59'31" WEST, ALONG SAID NORTHERLY LINE, A DISTANCE OF 27.20 FEET TO THE NORTHWEST CORNER THEREOF;

THENCE SOUTH 00°00'29" WEST, ALONG THE WESTERLY LINE OF SAID PARCEL, A DISTANCE OF 5.33 FEET TO A POINT ON THE NORTHERLY LINE OF THE PARCEL OF LAND DESCRIBED IN SAID BOOK 509 AT PAGE 79;

THENCE SOUTH 78°55'29" WEST, ALONG SAID NORTHERLY LINE, A DISTANCE OF 769.23 FEET TO THE NORTHEASTERLY CORNER OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 814 AT PAGE 251;

THENCE ALONG THE NORTHERLY, WESTERLY AND SOUTHERLY LINES OF SAID PARCEL THE FOLLOWING THREE (3) COURSES:

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Steve Moreno, Clerk and Recorder, Weld County, CO

1. CONTINUING SOUTH 78°55'29" WEST, A DISTANCE OF 250.00 FEET;
2. SOUTH 11°04'31" EAST, A DISTANCE OF 125.00 FEET;
3. NORTH 78°55'29" EAST, A DISTANCE OF 250.00 FEET TO THE SOUTHWESTERLY CORNER OF THAT PARCEL OF LAND DESCRIBED IN SAID BOOK 509 AT PAGE 79;

THENCE CONTINUING NORTH 78°55'29" EAST, ALONG THE SOUTHERLY LINE OF SAID PARCEL, A DISTANCE OF 744.75 FEET TO THE WESTERLY LINE OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN SAID BOOK 1179 AT PAGE 541;

THENCE SOUTH 00°00'29" WEST, ALONG SAID WESTERLY LINE, A DISTANCE OF 76.02 FEET TO THE NORTHERLY LINE OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 1044 UNDER RECEPTION NUMBER 1983198;

THENCE SOUTH 89°05'16" WEST, ALONG SAID NORTHERLY LINE, A DISTANCE OF 225.19 FEET TO THE NORTHWESTERLY CORNER THEREOF;

THENCE SOUTH 00°00'29" WEST, ALONG THE WESTERLY LINE OF SAID PARCEL, A DISTANCE OF 650.48 FEET TO A POINT ON THE SOUTH LINE OF THE NORTHEAST QUARTER OF SECTION 20;

THENCE SOUTH 89°05'16" WEST, ALONG SAID SOUTH LINE OF THE NORTHEAST QUARTER OF SECTION 20, A DISTANCE OF 1962.78 FEET TO THE SOUTHEAST CORNER OF THE NORTHWEST QUARTER OF SECTION 20;

THENCE SOUTH 89°05'29" WEST, ALONG THE SOUTH LINE OF THE NORTHWEST QUARTER OF SECTION 20, A DISTANCE OF 2610.98 FEET;

THENCE NORTH 00°21'37" WEST, PARALLEL WITH THE WEST LINE OF THE NORTHWEST QUARTER OF SECTION 20, A DISTANCE OF 2598.72 FEET TO A POINT ON THE SOUTHERLY RIGHT-OF-WAY LINE OF WELD COUNTY ROAD NO. 8;

THENCE NORTH 88°48'44" EAST, ALONG SAID SOUTHERLY RIGHT-OF-WAY LINE, A DISTANCE OF 2617.94 FEET;

THENCE NORTH 88°48'01" EAST, CONTINUING ALONG SAID SOUTHERLY RIGHT-OF-WAY LINE, A DISTANCE OF 2618.25 FEET TO THE POINT OF BEGINNING;

EXCEPTING THEREFROM THAT PORTION DEDICATED FOR RIGHT-OF-WAY ON NOVEMBER 8, 2011 UNDER RECEPTION NO. 3338315.

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Steve Moreno, Clerk and Recorder, Weld County, CO

EXHIBIT B-1

Erie Highlands Property Zoning Map

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Steve Moreno, Clerk and Recorder, Weld County, CO

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Steve Moreno, Clerk and Recorder, Weld County, CO

ERIE HIGHLANDS ZONING MAP

A PART OF THE NORTH HALF OF
SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST
OF THE SIXTH PRINCIPAL MERIDIAN,
TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO.
305.126 ACRES
RZ-13-00020

OVERALL BOUNDARY DESCRIPTION

A PARCEL OF LAND BEING A PART OF THE NORTH HALF OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTHWEST CORNER OF SAID SECTION 20, AND CONSIDERING THE NORTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 20 TO BEAR NORTH 88°48'39" EAST, WITH ALL BEARINGS CONTAINED HEREIN RELATIVE THERETO;

THENCE ALONG SAID NORTH LINE, NORTH 88°48'39" EAST, A DISTANCE OF 2,848.08 FEET TO THE NORTH QUARTER CORNER OF SAID SECTION 20;

THENCE ALONG THE NORTH LINE OF THE NORTHEAST QUARTER OF SAID SECTION 20, NORTH 88°48'06" EAST, A DISTANCE OF 2848.24 FEET TO THE NORTHEAST CORNER OF SAID SECTION 20;

THENCE ALONG THE EAST LINE OF SAID NORTHEAST QUARTER, SOUTH 00°00'25" WEST, A DISTANCE OF 1720.04 FEET TO A POINT ON THE NORTHERLY BOUNDARY OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 509 AT PAGE 79, IN THE OFFICE OF THE CLERK AND RECORDER OF WELD COUNTY;

THENCE DEPARTING SAID EAST LINE AND ALONG SAID NORTHERLY BOUNDARY, SOUTH 78°55'29" WEST, A DISTANCE OF 430.59 FEET TO A POINT ON THE NORTHERLY BOUNDARY OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 1179 AT PAGE 541, IN SAID RECORDS;

THENCE ALONG SAID NORTHERLY BOUNDARY, NORTH 89°59'35" WEST, A DISTANCE OF 27.44 FEET TO THE NORTHWEST CORNER OF SAID PARCEL;

THENCE ALONG THE WESTERLY BOUNDARY OF SAID PARCEL, SOUTH 00°00'25" WEST, A DISTANCE OF 5.38 FEET TO A POINT ON THE NORTHERLY BOUNDARY OF SAID PARCEL DESCRIBED IN BOOK 509 AT PAGE 79;

THENCE ALONG SAID NORTHERLY BOUNDARY, SOUTH 78°55'29" WEST, A DISTANCE OF 789.24 FEET TO THE NORTHEASTERLY CORNER OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 814 AT PAGE 251, IN SAID RECORDS;

THENCE ALONG THE NORTHERLY, WESTERLY AND SOUTHERLY BOUNDARIES OF SAID PARCEL THE FOLLOWING THREE (3) COURSES:

1) SOUTH 78°55'29" WEST, A DISTANCE OF 250.00 FEET;

2) SOUTH 11°04'31" EAST, A DISTANCE OF 125.00 FEET;

3) NORTH 78°55'29" EAST, A DISTANCE OF 250.00 FEET TO THE SOUTHWESTERLY CORNER OF SAID PARCEL DESCRIBED IN BOOK 509 AT PAGE 79;

THENCE ALONG THE SOUTHERLY BOUNDARY OF SAID PARCEL, NORTH 78°55'29" EAST, A DISTANCE OF 744.78 FEET TO A POINT ON THE WESTERLY BOUNDARY OF SAID PARCEL DESCRIBED IN BOOK 1179 AT PAGE 541;

THENCE ALONG SAID WESTERLY BOUNDARY, SOUTH 00°00'25" WEST, A DISTANCE OF 76.02 FEET TO THE NORTHEASTERLY CORNER OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 1044 AT RECEPTION NO. 1983198, IN SAID RECORDS;

THENCE ALONG THE NORTHERLY BOUNDARY OF SAID PARCEL, SOUTH 89°05'08" WEST, A DISTANCE OF 225.15 FEET TO THE NORTHWESTERLY CORNER OF SAID PARCEL;

THENCE ALONG THE WESTERLY BOUNDARY OF SAID PARCEL, SOUTH 00°00'21" WEST, A DISTANCE OF 850.47 FEET TO THE SOUTHWESTERLY CORNER OF SAID PARCEL AND A POINT ON THE SOUTH LINE OF THE NORTHEAST QUARTER OF SAID SECTION 20;

THENCE ALONG SAID SOUTH LINE, SOUTH 89°05'07" WEST, A DISTANCE OF 1,982.78 FEET TO THE CENTER QUARTER CORNER OF SAID SECTION 20;

THENCE ALONG THE SOUTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 20, SOUTH 89°05'29" WEST, A DISTANCE OF 2640.94 FEET TO THE WEST QUARTER CORNER OF SAID SECTION 20;

THENCE ALONG THE WEST LINE OF SAID NORTHWEST QUARTER, NORTH 00°21'43" WEST, A DISTANCE OF 2628.51 FEET TO THE POINT OF BEGINNING.

CONTAINING AN AREA OF 305.126 ACRES, (13,291,297 SQUARE FEET), MORE OR LESS.

MEDIUM RESIDENTIAL ZONING DISTRICT

A PARCEL OF LAND BEING A PART OF THE NORTH HALF OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE NORTHEAST CORNER OF SAID SECTION 20, AND CONSIDERING THE NORTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 20 TO BEAR NORTH 88°48'39" EAST, WITH ALL BEARINGS CONTAINED HEREIN RELATIVE THERETO;

THENCE ALONG THE EAST LINE OF SAID NORTHEAST QUARTER, SOUTH 00°00'25" WEST, A DISTANCE OF 1,720.04 FEET TO A POINT ON THE NORTHERLY BOUNDARY OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 509 AT PAGE 79, IN THE OFFICE OF THE CLERK AND RECORDER OF WELD COUNTY AND THE POINT OF BEGINNING;

THENCE DEPARTING SAID EAST LINE AND ALONG SAID NORTHERLY BOUNDARY, SOUTH 78°55'29" WEST, A DISTANCE OF 430.59 FEET TO A POINT ON THE NORTHERLY BOUNDARY OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 1179 AT PAGE 541, IN SAID RECORDS;

THENCE ALONG SAID NORTHERLY BOUNDARY, NORTH 89°59'35" WEST, A DISTANCE OF 27.44 FEET TO THE NORTHWEST CORNER OF SAID PARCEL;

THENCE ALONG THE WESTERLY BOUNDARY OF SAID PARCEL, SOUTH 00°00'25" WEST, A DISTANCE OF 5.38 FEET TO A POINT ON THE NORTHERLY BOUNDARY OF SAID PARCEL DESCRIBED IN BOOK 509 AT PAGE 79;

THENCE ALONG SAID NORTHERLY BOUNDARY, SOUTH 78°55'29" WEST, A DISTANCE OF 789.24 FEET TO THE NORTHEASTERLY CORNER OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 814 AT PAGE 251, IN SAID RECORDS;

THENCE ALONG THE NORTHERLY BOUNDARY OF SAID PARCEL, SOUTH 78°55'29" WEST, A DISTANCE OF 250.00 FEET;

THENCE DEPARTING SAID NORTHERLY BOUNDARY, SOUTH 89°59'43" WEST, A DISTANCE OF 128.09 FEET TO THE BEGINNING OF A NON-TANGENT CURVE CONCAVE WESTERLY HAVING A RADIUS OF 1,135.00 FEET, THE RADIUS POINT OF SAID CURVE BEARS NORTH 88°33'08" WEST;

THENCE NORTHERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 31°45'48", AN ARC LENGTH OF 629.21 FEET;

THENCE SOUTH 64°58'03" WEST, A DISTANCE OF 189.11 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE NORTHERLY HAVING A RADIUS OF 475.00 FEET;

THENCE WESTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 23°50'36", AN ARC LENGTH OF 197.67 FEET;

THENCE TANGENT TO SAID CURVE, SOUTH 88°48'39" WEST, A DISTANCE OF 396.25 FEET;

THENCE NORTH 01°11'21" WEST, A DISTANCE OF 823.28 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE SOUTHWESTERLY HAVING A RADIUS OF 20.00 FEET;

THENCE NORTHWESTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 90°00'00", AN ARC LENGTH OF 31.42 FEET;

THENCE TANGENT TO SAID CURVE, SOUTH 88°48'39" WEST, A DISTANCE OF 378.72 FEET;

THENCE NORTH 01°11'21" WEST, A DISTANCE OF 830.07 FEET TO A POINT ON THE NORTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 20;

THENCE ALONG SAID NORTH LINE, NORTH 88°48'39" EAST, A DISTANCE OF 36.98 FEET TO THE NORTH QUARTER CORNER OF SAID SECTION 20;

THENCE ALONG THE NORTH LINE OF THE NORTHEAST QUARTER OF SAID SECTION 20, NORTH 88°48'06" EAST, A DISTANCE OF 1,423.51 FEET;

THENCE DEPARTING SAID NORTH LINE, SOUTH 01°11'06" EAST, A DISTANCE OF 282.17 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE EASTERLY HAVING A RADIUS OF 475.00 FEET;

THENCE SOUTHERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 23°50'52", AN ARC LENGTH OF 197.70 FEET;

THENCE TANGENT TO SAID CURVE, SOUTH 25°01'57" EAST, A DISTANCE OF 423.53 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE EASTERLY HAVING A RADIUS OF 475.00 FEET;

THENCE SOUTHEASTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 18°51'50", AN ARC LENGTH OF 156.39 FEET;

THENCE TANGENT TO SAID CURVE, SOUTH 06°10'08" EAST, A DISTANCE OF 259.04 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE NORTHEASTERLY HAVING A RADIUS OF 450.00 FEET;

THENCE TANGENT TO SAID CURVE, SOUTH 89°59'35" EAST, A DISTANCE OF 477.65 FEET TO A POINT ON THE EAST LINE OF THE NORTHEAST QUARTER OF SAID SECTION 20;

THENCE ALONG SAID EAST LINE, SOUTH 00°00'25" WEST, A DISTANCE OF 28.22 FEET TO THE POINT OF BEGINNING.

CONTAINING AN AREA OF 57.616 ACRES, (2,509,825 SQUARE FEET), MORE OR LESS.

COMMUNITY COMMERCIAL ZONING DISTRICT

A PARCEL OF LAND BEING A PART OF THE NORTHEAST QUARTER OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTHEAST CORNER OF SAID SECTION 20, AND CONSIDERING THE NORTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 20 TO BEAR NORTH 88°48'39" EAST, WITH ALL BEARINGS CONTAINED HEREIN RELATIVE THERETO;

THENCE ALONG THE EAST LINE OF SAID NORTHEAST QUARTER, SOUTH 00°00'25" WEST, A DISTANCE OF 1,691.82 FEET;

THENCE DEPARTING SAID EAST LINE, NORTH 89°59'35" WEST, A DISTANCE OF 477.65 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE NORTHEASTERLY HAVING A RADIUS OF 450.00 FEET;

THENCE NORTHWESTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 83°49'27", AN ARC LENGTH OF 658.35 FEET;

THENCE TANGENT TO SAID CURVE, NORTH 06°10'08" WEST, A DISTANCE OF 259.04 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE WESTERLY HAVING A RADIUS OF 475.00 FEET;

THENCE NORTHWESTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 18°51'50", AN ARC LENGTH OF 156.39 FEET;

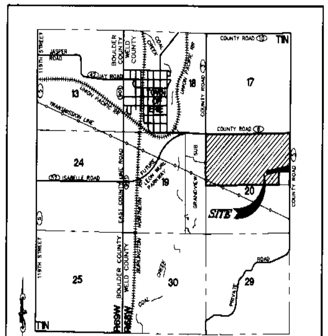
THENCE TANGENT TO SAID CURVE, NORTH 25°01'57" WEST, A DISTANCE OF 423.53 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE EASTERLY HAVING A RADIUS OF 475.00 FEET;

THENCE NORTHERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 23°50'52", AN ARC LENGTH OF 197.70 FEET;

THENCE TANGENT TO SAID CURVE, NORTH 01°11'06" WEST, A DISTANCE OF 282.17 FEET TO A POINT ON THE NORTH LINE OF SAID NORTHEAST QUARTER;

THENCE ALONG SAID NORTH LINE, NORTH 88°48'06" EAST, A DISTANCE OF 1,224.73 FEET TO THE POINT OF BEGINNING.

CONTAINING AN AREA OF 39.550 ACRES, (1,722,820 SQUARE FEET), MORE OR LESS.



VICINITY MAP
SCALE: 1"=3000'

LOW RESIDENTIAL ZONING DISTRICT

A PARCEL OF LAND BEING A PART OF THE NORTH HALF OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTHWEST CORNER OF SAID SECTION 20, AND CONSIDERING THE NORTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 20 TO BEAR NORTH 88°48'39" EAST, WITH ALL BEARINGS CONTAINED HEREIN RELATIVE THERETO;

THENCE ALONG SAID NORTH LINE, NORTH 88°48'39" EAST, A DISTANCE OF 2,811.10 FEET;

THENCE DEPARTING SAID NORTH LINE, SOUTH 01°11'21" EAST, A DISTANCE OF 830.07 FEET;

THENCE SOUTH 88°48'39" WEST, A DISTANCE OF 147.93 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE SOUTHEASTERLY HAVING A RADIUS OF 265.00 FEET;

THENCE SOUTHWESTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 63°18'20", AN ARC LENGTH OF 292.80 FEET;

THENCE TANGENT TO SAID CURVE, SOUTH 25°30'19" WEST, A DISTANCE OF 174.87 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE EASTERLY HAVING A RADIUS OF 440.00 FEET;

THENCE SOUTHERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 25°42'58", AN ARC LENGTH OF 197.49 FEET;

THENCE TANGENT TO SAID CURVE, SOUTH 00°12'39" EAST, A DISTANCE OF 59.82 FEET;

THENCE NORTH 89°47'21" EAST, A DISTANCE OF 140.64 FEET;

THENCE SOUTH 00°12'39" EAST, A DISTANCE OF 272.04 FEET;

THENCE SOUTH 53°38'57" WEST, A DISTANCE OF 87.18 FEET TO THE BEGINNING OF A NON-TANGENT CURVE CONCAVE NORTHEASTERLY HAVING A RADIUS OF 365.00 FEET, THE RADIUS POINT OF SAID CURVE BEARS NORTH 53°38'57" EAST;

THENCE SOUTHEASTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 54°36'57", AN ARC LENGTH OF 347.91 FEET;

THENCE TANGENT TO SAID CURVE, NORTH 89°02'08" EAST, A DISTANCE OF 181.63 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE NORTHWESTERLY HAVING A RADIUS OF 365.00 FEET;

THENCE NORTHEASTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 90°13'29", AN ARC LENGTH OF 574.77 FEET;

THENCE TANGENT TO SAID CURVE, NORTH 01°11'21" WEST, A DISTANCE OF 23.81 FEET;

THENCE NORTH 88°48'39" EAST, A DISTANCE OF 396.25 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE NORTHERLY HAVING A RADIUS OF 475.00 FEET;

THENCE EASTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 23°50'36", AN ARC LENGTH OF 197.87 FEET;

THENCE TANGENT TO SAID CURVE, NORTH 64°58'03" EAST, A DISTANCE OF 189.11 FEET TO THE BEGINNING OF A NON-TANGENT CURVE CONCAVE WESTERLY HAVING A RADIUS OF 1,135.00 FEET, THE RADIUS POINT OF SAID CURVE BEARS SOUTH 81°41'06" WEST;

THENCE SOUTHERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 31°45'48", AN ARC LENGTH OF 629.21 FEET;

THENCE NON-TANGENT TO SAID CURVE, NORTH 89°59'43" EAST, A DISTANCE OF 128.09 FEET TO THE NORTHWESTERLY CORNER OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 814 AT PAGE 251, IN THE OFFICE OF THE CLERK AND RECORDER OF WELD COUNTY;

THENCE ALONG THE WESTERLY BOUNDARY OF SAID PARCEL, SOUTH 11°04'31" EAST, A DISTANCE OF 125.00 FEET TO THE SOUTHWESTERLY CORNER OF SAID PARCEL;

THENCE ALONG THE SOUTHERLY BOUNDARY OF SAID PARCEL, NORTH 78°55'29" EAST, A DISTANCE OF 250.00 FEET TO THE SOUTHWESTERLY CORNER OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 509 AT PAGE 79, IN SAID RECORDS;

THENCE ALONG THE SOUTHERLY BOUNDARY OF SAID PARCEL, NORTH 78°55'29" EAST, A DISTANCE OF 744.76 FEET TO A POINT ON THE WESTERLY BOUNDARY OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 1179 AT PAGE 541, IN SAID RECORDS;

THENCE ALONG SAID WESTERLY BOUNDARY, SOUTH 00°00'25" WEST, A DISTANCE OF 76.02 FEET TO THE NORTHEASTERLY CORNER OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 1044 AT RECEPTION NO. 1983198, IN SAID RECORDS;

THENCE ALONG THE NORTHERLY BOUNDARY OF SAID PARCEL, SOUTH 89°05'08" WEST, A DISTANCE OF 225.15 FEET TO THE NORTHWESTERLY CORNER OF SAID PARCEL;

THENCE ALONG THE WESTERLY BOUNDARY OF SAID PARCEL, SOUTH 00°00'21" WEST, A DISTANCE OF 850.47 FEET TO THE SOUTHWESTERLY CORNER OF SAID PARCEL AND A POINT ON THE SOUTH LINE OF THE NORTHEAST QUARTER OF SAID SECTION 20;

THENCE ALONG SAID SOUTH LINE, SOUTH 89°05'07" WEST, A DISTANCE OF 1,982.78 FEET TO THE CENTER QUARTER CORNER OF SAID SECTION 20;

THENCE ALONG THE SOUTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 20, SOUTH 89°05'29" WEST, A DISTANCE OF 1102.70 FEET;

THENCE DEPARTING SAID SOUTH LINE, NORTH 47°12'22" WEST, A DISTANCE OF 1013.25 FEET;

THENCE NORTH 00°21'37" WEST, A DISTANCE OF 348.82 FEET;

THENCE SOUTH 89°50'38" WEST, A DISTANCE OF 799.02 FEET TO A POINT ON THE WEST LINE OF THE NORTHWEST QUARTER OF SAID SECTION 20;

THENCE ALONG SAID WEST LINE, NORTH 00°21'43" WEST, A DISTANCE OF 1,569.10 FEET TO THE POINT OF BEGINNING.

CONTAINING AN AREA OF 164.358 ACRES, (7,159,451 SQUARE FEET), MORE OR LESS.

AG-OPEN SPACE ZONING DISTRICT

A PARCEL OF LAND BEING A PART OF THE NORTHWEST QUARTER OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE WEST QUARTER CORNER OF SAID SECTION 20, AND CONSIDERING THE NORTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 20 TO BEAR NORTH 88°48'39" EAST, WITH ALL BEARINGS CONTAINED HEREIN RELATIVE THERETO;

THENCE ALONG SAID WEST LINE, NORTH 00°21'43" WEST, A DISTANCE OF 1059.41 FEET;

THENCE DEPARTING SAID WEST LINE, NORTH 89°50'38" EAST, A DISTANCE OF 799.02 FEET;

THENCE SOUTH 00°21'37" EAST, A DISTANCE OF 348.82 FEET;

THENCE SOUTH 47°12'22" EAST, A DISTANCE OF 1013.25 FEET TO A POINT ON THE SOUTH LINE OF SAID NORTHWEST QUARTER;

THENCE ALONG SAID SOUTH LINE, SOUTH 89°05'29" WEST, A DISTANCE OF 1538.24 FEET TO THE POINT OF BEGINNING.

CONTAINING AN AREA OF 25.276 ACRES, (1,101,030 SQUARE FEET), MORE OR LESS.

PUBLIC LANDS - INSTITUTIONS ZONING DISTRICT

A PARCEL OF LAND BEING A PART OF THE NORTH HALF OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE NORTH QUARTER CORNER OF SAID SECTION 20, AND CONSIDERING THE NORTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 20 TO BEAR NORTH 88°48'39" EAST, WITH ALL BEARINGS CONTAINED HEREIN RELATIVE THERETO;

THENCE ALONG SAID NORTH LINE, SOUTH 88°48'39 WEST, A DISTANCE OF 36.98 FEET;

THENCE DEPARTING SAID NORTH LINE, SOUTH 01°11'21" EAST, A DISTANCE OF 830.07 FEET TO THE POINT OF BEGINNING;

THENCE NORTH 88°48'39" EAST, A DISTANCE OF 378.72 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE SOUTHWESTERLY HAVING A RADIUS OF 20.00 FEET;

THENCE SOUTHEASTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 90°00'00", AN ARC LENGTH OF 31.42 FEET;

THENCE TANGENT TO SAID CURVE, SOUTH 01°11'21" EAST, A DISTANCE OF 647.09 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE NORTHWESTERLY HAVING A RADIUS OF 365.00 FEET;

THENCE SOUTHWESTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 90°13'29", AN ARC LENGTH OF 574.77 FEET;

THENCE TANGENT TO SAID CURVE, SOUTH 89°02'08" WEST, A DISTANCE OF 181.63 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE NORTHEASTERLY HAVING A RADIUS OF 365.00 FEET;

THENCE NORTHWESTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 54°36'48", AN ARC LENGTH OF 347.91 FEET;

THENCE NON-TANGENT TO SAID CURVE, NORTH 53°38'57" EAST, A DISTANCE OF 87.18 FEET;

THENCE NORTH 00°12'39" WEST, A DISTANCE OF 272.04 FEET;

THENCE SOUTH 89°47'21" WEST, A DISTANCE OF 140.64 FEET;

THENCE NORTH 00°12'39" WEST, A DISTANCE OF 59.82 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE EASTERLY HAVING A RADIUS OF 440.00 FEET;

THENCE NORTHERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 25°42'58", AN ARC LENGTH OF 197.49 FEET;

THENCE TANGENT TO SAID CURVE, NORTH 25°30'19" EAST, A DISTANCE OF 174.87 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE SOUTHEASTERLY HAVING A RADIUS OF 265.00 FEET;

THENCE NORTHEASTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 63°18'20", AN ARC LENGTH OF 292.80 FEET;

THENCE TANGENT TO SAID CURVE, NORTH 88°48'39" EAST, A DISTANCE OF 147.93 FEET TO THE POINT OF BEGINNING.

CONTAINING AN AREA OF 18.323 ACRES, (798,172 SQUARE FEET), MORE OR LESS.

GENERAL NOTES

1. THE BEARINGS SHOWN HEREON ARE BASED UPON THE NORTH LINE OF THE NORTHWEST QUARTER OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, COUNTY OF WELD, STATE OF COLORADO, ASSUMED TO BEAR NORTH 88°48'39" EAST, A DISTANCE OF 2848.08 FEET BETWEEN FOUND MONUMENTS AS SHOWN HEREON.
2. NOTICE: ACCORDING TO COLORADO LAW YOU MUST COMMENCE ANY LEGAL ACTION BASED UPON ANY DEFECT IN THIS SURVEY WITHIN THREE YEARS AFTER YOU FIRST DISCOVERED SUCH DEFECT. IN NO EVENT MAY ANY ACTION BASED UPON ANY DEFECT IN THIS SURVEY BE COMMENCED MORE THAN TEN YEARS FROM THE DATE OF THE CERTIFICATION SHOWN HEREON.
3. DISTANCES ON THIS MAP ARE GROUND DISTANCES EXPRESSED IN U.S. SURVEY FEET AND DECIMALS THEREOF. A U.S. SURVEY FOOT IS DEFINED AS EXACTLY 1200/3937 METERS.
4. THIS ZONING MAP IS NOT AN IMPROVEMENT SURVEY PLAT, NOR IS IT A LAND SURVEY PLAT. IT IS INTENDED TO SHOW THE ZONING AREAS DESCRIBED IN THE LEGAL DESCRIPTIONS.
5. ADJACENT TOWN ZONING BASED ON TOWN OF ERIE ZONING MAP WITH A REVISION DATE OF 11/16/2012. COUNTY ZONING INFORMATION FROM COUNTY WEBSITE ZONING MAPPING APPLICATION ACCESSED 04/15/2013.

SURVEYOR'S CERTIFICATE

I, DEREK BROWN, A DULY REGISTERED PROFESSIONAL LAND SURVEYOR IN THE STATE OF COLORADO, DO HEREBY CERTIFY THAT THIS ZONING MAP TRULY AND CORRECTLY REPRESENTS THE ABOVE DESCRIBED LEGAL DESCRIPTIONS FOR EACH ZONE DISTRICT.

I ATTEST TO THE ABOVE ON THIS ________ DAY OF ____________________, 2013.

COLORADO LICENSED DEREK S. BROWN 38064 PROFESSIONAL LAND SURVEYOR

____
DEREK BROWN
COLORADO REGISTERED PROFESSIONAL LAND SURVEYOR # 38064
FOR AND ON BEHALF OF AZTEC CONSULTANTS, INC.

PLANNING COMMISSION CERTIFICATE

THIS ZONING MAP WAS REVIEWED BY THE PLANNING COMMISSION ON THE _____ DAY OF ___________, 2013.

____
CHAIRPERSON DATE

BOARD OF TRUSTEES APPROVAL CERTIFICATE

THIS ZONING MAP IS TO BE KNOWN AS THE **ERIE HIGHLANDS ZONING MAP** AND IS APPROVED AND ACCEPTED BY ORDINANCE NO. ____________ PASSED AND ADOPTED AT THE REGULAR MEETING OF THE BOARD OF TRUSTEES OF ERIE, COLORADO, HELD ON ______________, 2013.

____
MAYOR

ATTEST ______________________________
TOWN CLERK

CLERK & RECORDER CERTIFICATE

STATE OF COLORADO)
) ss.
COUNTY OF WELD)

I DO HEREBY CERTIFY THAT THIS ZONING MAP WAS FILED IN MY OFFICE ON THIS ___ DAY OF _________ 2013 A.D. AND WAS RECORDED AT RECEPTION NUMBER ______________

____
WELD COUNTY CLERK AND RECORDER

AZTEC CONSULTANTS, INC. 8000 S. Lincoln St., Suite 201 Littleton, Colorado 80122 Phone: (303) 713-1898 Fax: (303) 713-1897 www.aztecconsultants.com AzTec Proj. No.: 81013-01	ZONING MAP ERIE HIGHLANDS PART OF THE NORTH HALF SECTION 20, T1N, R68W 6TH P.M. TOWN OF ERIE, WELD COUNTY, COLORADO	DATE OF PREPARATION	2013-08-19
		SCALE	NA
		SHEET 1 OF 2	

4044917 Pages: 20 of 26
09/10/2014 12:16 PM R Fee:$161.00
Steve Moreno, Clerk and Recorder, Weld County, CO

ERIE HIGHLANDS ZONING MAP

A PART OF THE NORTH HALF OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO.

305.126 ACRES

RZ-13-00020

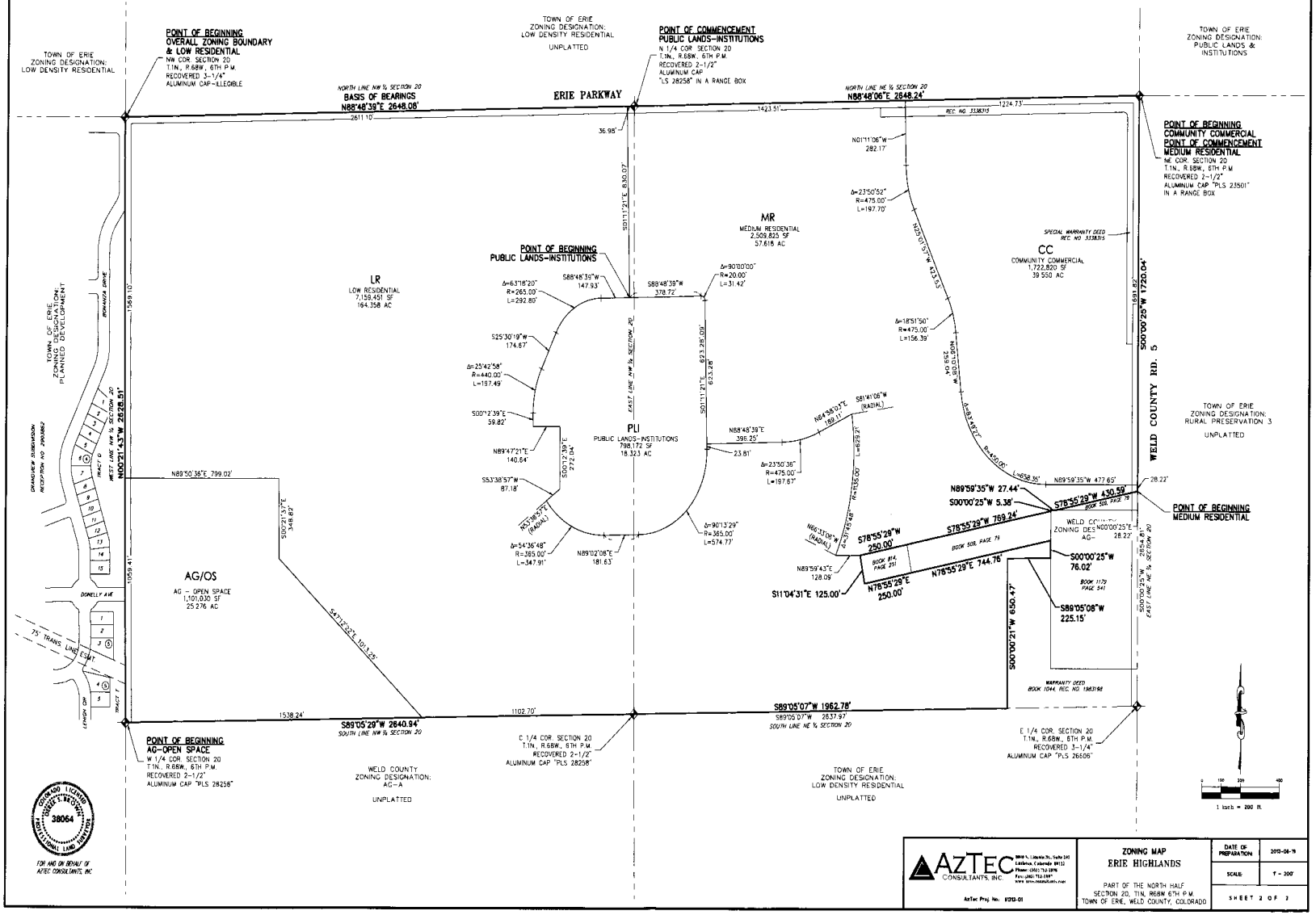


EXHIBIT B-2

Erie Highlands Property PUD Overlay Zoning Map

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09/10/2014 12:16 PM R Fee:$161.00
Steve Moreno, Clerk and Recorder, Weld County, CO

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09/10/2014 12:16 PM R Fee:$161.00
Steve Moreno, Clerk and Recorder, Weld County, CO

ERIE HIGHLANDS PUD ZONING MAP

A PORTION OF THE NORTH HALF OF SECTION 20,
TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN
TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO
305.126 ACRES
PUD-13-00021

OVERALL BOUNDARY DESCRIPTION:

A PARCEL OF LAND BEING A PART OF THE NORTH HALF OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTHWEST CORNER OF SAID SECTION 20, AND CONSIDERING THE NORTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 20 TO BEAR NORTH 88°48'39" EAST, WITH ALL BEARINGS CONTAINED HEREIN RELATIVE THERETO;

THENCE ALONG SAID NORTH LINE, NORTH 88°48'39" EAST, A DISTANCE OF 2,648.08 FEET TO THE NORTH QUARTER CORNER OF SAID SECTION 20;

THENCE ALONG THE NORTH LINE OF THE NORTHEAST QUARTER OF SAID SECTION 20, NORTH 88°48'06" EAST, A DISTANCE OF 2648.24 FEET TO THE NORTHEAST CORNER OF SAID SECTION 20;

THENCE ALONG THE EAST LINE OF SAID NORTHEAST QUARTER, SOUTH 00°00'25" WEST, A DISTANCE OF 1720.04 FEET TO A POINT ON THE NORTHERLY BOUNDARY OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 509 AT PAGE 79, IN THE OFFICE OF THE CLERK AND RECORDER OF WELD COUNTY;

THENCE DEPARTING SAID EAST LINE AND ALONG SAID NORTHERLY BOUNDARY, SOUTH 78°55'29" WEST, A DISTANCE OF 430.59 FEET TO A POINT ON THE NORTHERLY BOUNDARY OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 1179 AT PAGE 541, IN SAID RECORDS;

THENCE ALONG SAID NORTHERLY BOUNDARY, NORTH 89°59'35" WEST, A DISTANCE OF 27.44 FEET TO THE NORTHWEST CORNER OF SAID PARCEL;

THENCE ALONG THE WESTERLY BOUNDARY OF SAID PARCEL, SOUTH 00°00'25" WEST, A DISTANCE OF 5.38 FEET TO A POINT ON THE NORTHERLY BOUNDARY OF SAID PARCEL DESCRIBED IN BOOK 509 AT PAGE 79;

THENCE ALONG SAID NORTHERLY BOUNDARY, SOUTH 78°55'29" WEST, A DISTANCE OF 769.24 FEET TO THE NORTHEASTERLY CORNER OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 509 AT PAGE 79, IN SAID RECORDS;

THENCE ALONG THE NORTHERLY, WESTERLY AND SOUTHERLY BOUNDARIES OF SAID PARCEL THE FOLLOWING THREE (3) COURSES:

1) SOUTH 78°55'29" WEST, A DISTANCE OF 250.00 FEET;

2) SOUTH 11°04'31" EAST, A DISTANCE OF 125.00 FEET;

3) NORTH 78°55'29" EAST, A DISTANCE OF 250.00 FEET TO THE SOUTHWESTERLY CORNER OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 509 AT PAGE 79, IN SAID RECORDS;

THENCE ALONG THE SOUTHERLY BOUNDARY OF SAID PARCEL, NORTH 78°55'29" EAST, A DISTANCE OF 744.76 FEET TO A POINT ON THE WESTERLY BOUNDARY OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 1179 AT PAGE 541, IN SAID RECORDS;

THENCE ALONG SAID WESTERLY BOUNDARY, SOUTH 00°00'25" WEST, A DISTANCE OF 76.02 FEET TO THE NORTHEASTERLY CORNER OF THAT PARCEL OF LAND DESCRIBED IN DEED RECORDED IN BOOK 1044 AT RECEPTION NO. 1983198, IN SAID RECORDS;

THENCE ALONG THE NORTHERLY BOUNDARY OF SAID PARCEL, SOUTH 89°05'08" WEST, A DISTANCE OF 225.15 FEET TO THE NORTHWESTERLY CORNER OF SAID PARCEL;

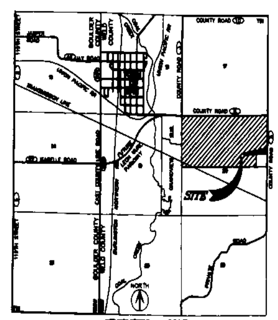
THENCE ALONG THE WESTERLY BOUNDARY OF SAID PARCEL, SOUTH 00°00'21" WEST, A DISTANCE OF 650.47 FEET TO THE SOUTHWESTERLY CORNER OF SAID PARCEL AND A POINT ON THE SOUTH LINE OF THE NORTHEAST QUARTER OF SAID SECTION 20;

THENCE ALONG SAID SOUTH LINE, SOUTH 89°05'07" WEST, A DISTANCE OF 1,962.78 FEET TO THE CENTER QUARTER CORNER OF SAID SECTION 20;

THENCE ALONG THE SOUTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 20, SOUTH 89°05'29" WEST, A DISTANCE OF 2640.94 FEET TO THE WEST QUARTER CORNER OF SAID SECTION 20;

THENCE ALONG THE WEST LINE OF SAID NORTHWEST QUARTER, NORTH 00°21'46" WEST, A DISTANCE OF 2628.51 FEET TO THE **POINT OF BEGINNING**.

CONTAINING AN AREA OF 305.126 ACRES, (13,291,297 SQUARE FEET), MORE OR LESS.



VICINITY MAP
SCALE: 1"=3000'

NOTES:

1. THIS PUD ZONING MAP MODIFIED THE DIMENSIONAL STANDARDS SET FORTH IN THE TOWN OF ERIE UDC AS PROVIDED FOR IN SECTION 10.2.7.D.
2. IN THE EVENT THAT THERE IS ANY DISCREPENCY BETWEEN THE CODE AND THIS PUD, THE PUD SHALL CONTROL. ANY PROVISIONS THAT ARE NOT SPECIFICALLY ADDRESSED IN THIS PUD ZONING MAP SHALL COMPLY WITH THE CODE.
3. THE MAXIMUM NUMBER OF UNITS ALLOWED IN THIS PUD IS 994.

SURVEYOR'S CERTIFICATE

I, DEREK BROWN, A DULY REGISTERED PROFESSIONAL LAND SURVEYOR IN THE STATE OF COLORADO, DO HEREBY CERTIFY THAT THIS PUD ZONING MAP TRULY AND CORRECTLY REPRESENTS THE ABOVE DESCRIBED LEGAL DESCRIPTIONS FOR EACH PUD OVERLAY ZONE DISTRICT.

I ATTEST TO THE ABOVE ON THIS ________DAY OF __________, 2013.

____
DEREK BROWN

COLORADO REGISTERED PROFESSIONAL LAND SURVEYOR #

PLANNING COMMISSION CERTIFICATE

THIS PUD ZONING MAP WAS REVIEWED BY THE PLANNING COMMISSION ON THE ________DAY OF __________, 2013.

______________________ ______________
CHAIRPERSON DATE

BOARD OF TRUSTEES APPROVAL CERTIFICATE

THIS PUD ZONING MAP IS TO BE KNOWN AS THE "ERIE HIGHLANDS PUD ZONING MAP" AND IS APPROVED AND ACCEPTED BY ORDINANCE NO.____________, PASSED AND ADOPTED AT THE REGULAR MEETING OF THE BOARD OF TRUSTEES OF ERIE, COLORADO, HELD ON ____________, 2013.

____
MAYOR

ATTEST ______________________
TOWN CLERK

CLERK & RECORDER CERTIFICATE

STATE OF COLORADO)
) ss.
COUNTY OF WELD)

I DO HEREBY CERTIFY THAT THIS PUD ZONING MAP WAS FILED IN MY OFFICE ON THIS ______ DAY OF ______________, 2013 A.D. AND WAS RECORDED AT RECEPTION NUMBER ______________.

____
________ ___ COUNTY CLERK AND RECORDER

APPLICANT
OAKWOOD HOMES LLC
4908 TOWER ROAD
DENVER, CO 80249
(303) 486-8500
CONTACT: CHAD ELLINGTON

OWNER
J DEARMIN LLC
10343 FEDERAL BOULEVARD
UNIT 515
WESTMINSTER, CO 80260
CONTACT: JAMES DEARMIN

OWNER
J GAZ LLC
4955 WEST 65TH AVENUE
ARVADA, CO 80003
CONTACT: JOHNNY GAZ

OWNER
THE JACK SHELL & SONYA SHELL FAMILY TRUSTS
10015 MEADE COURT
WESTMINSTER, CO 80031
CONTACT: JACK SHELL

OWNER
WY&K HOLDINGS, LLC
28221 HIDDEN VILLAGE DRIVE
EVERGREEN, CO 80439
CONTACT: ROBERT E. YOULE

PLANNER
TERRACINA DESIGN
9025 E KENYON AVE
SUITE 219
DENVER, CO 80237
(720) 263-4866
CONTACT: LAYLA ROSALES

ENGINEER
ENGINEERING PARTNERS
1950 WEST LITTLETON BLVD.
SUITE 109
LITTLETON, COLORADO 80120
(303)709-4680
CONTACT: DAVID FORBES

SURVEYOR
AZTEC CONSULTANTS
8000 S. LINCOLN ST, STE 201
LITTLETON, COLORADO 80122
(303)713-1898
CONTACT: DEREK BROWN

SHEET INDEX

1 COVER
2 PUD PLAN
3 PUD NOTES

Terracina Design
Land Planning & Landscape Architecture
9025 Kenyon Ave, Ste 219
Denver, CO 80237
Phone (720) 263-4866
www.TerracinaDesign.com

PROJECT NAME

ERIE HIGHLANDS
PUD ZONING MAP
TOWN OF ERIE, COLORADO

SHEET TITLE

COVER SHEET

SHEET NUMBER

1

SHEET 1 OF 3

SEPTEMBER 13, 2013

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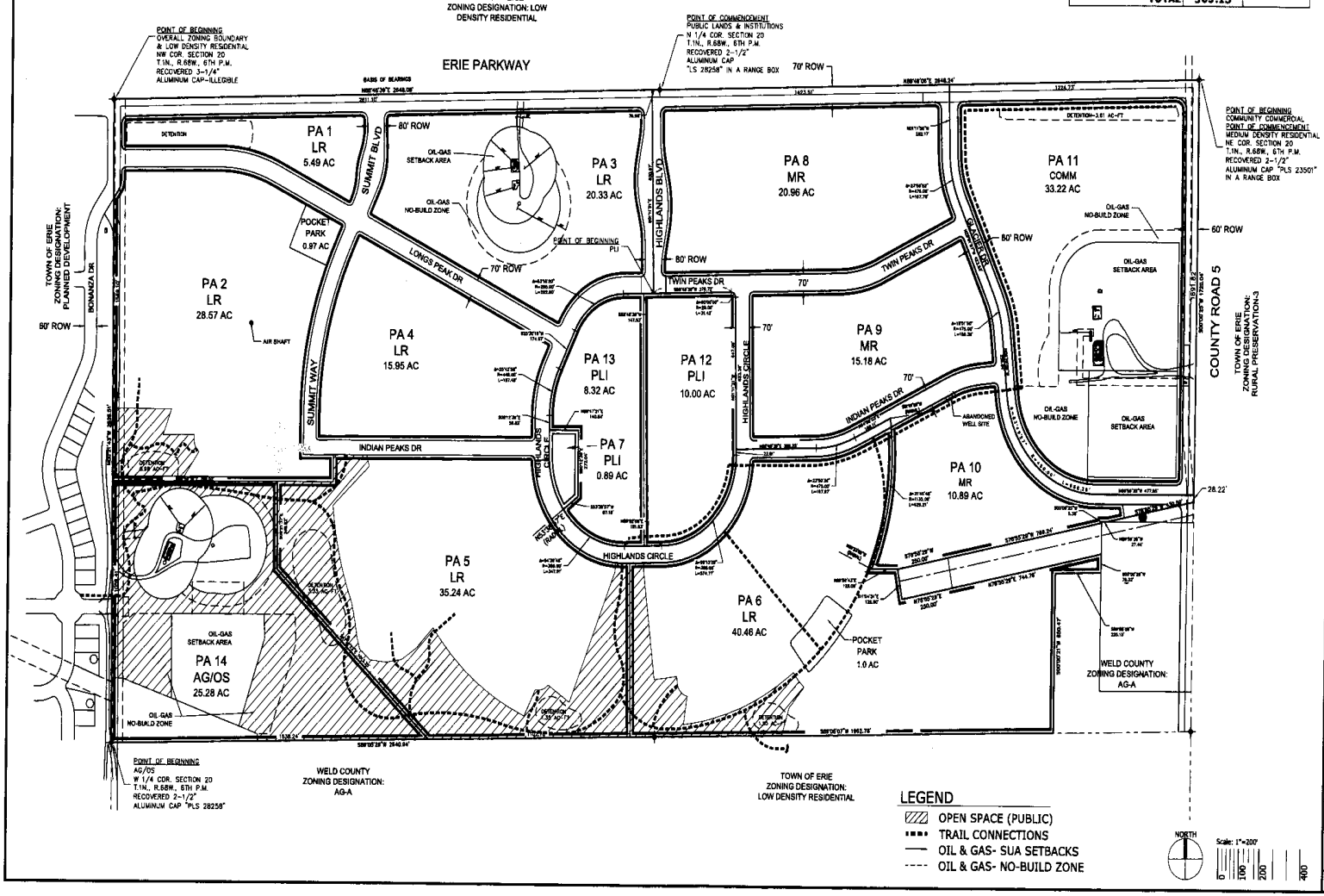
09/10/2014 12:16 PM R Fee:$161.00
Steve Moreno, Clerk and Recorder, Weld County, CO

ERIE HIGHLANDS PUD ZONING MAP

A PORTION OF THE NORTH HALF OF SECTION 20,
TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN
TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO
305.126 ACRES
PUD-13-00021

PARKS & OPEN SPACE		
PARK AREA	ACRES REQUIRED	ACRES TO BE PROVIDED
COMMUNITY PARK	13.87	FEE IN LIEU
NEIGHBORHOOD PARK	8.32	8.32
POCKET PARK	1.39	1.97
OPEN SPACE (PUBLIC)	47.15	32.65 + FEE IN LIEU

DEVELOPMENT SUMMARY		
LAND USE	ACRES	% ACRES
Residential	175.66	57.6%
Commercial	33.22	10.9%
School	10.00	3.3%
Parks & Open Space	51.90	17.0%
Right-of-Way	34.35	11.3%
TOTAL	305.13	



Terracina Design
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www.terracinadesign.com

PROJECT NAME
ERIE HIGHLANDS
PUD ZONING MAP
TOWN OF ERIE, COLORADO

SHEET TITLE
PUD PLAN

SHEET NUMBER
2
SHEET 2 OF 3

SEPTEMBER 13, 2013

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4044917 Pages: 24 of 26
09/10/2014 12:16 PM R Fee:$161.00
Steve Moreno, Clerk and Recorder, Weld County, CO

ERIE HIGHLANDS PUD ZONING MAP

A PORTION OF THE NORTH HALF OF SECTION 20,
TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN
TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO
305.126 ACRES
PUD-13-00021

ARCHITECTURAL STANDARDS-SINGLE FAMILY RESIDENTIAL DETACHED

1. Architectural Variety and Character
   a. Architectural Variety
      i. Design Standards
         (A) No identical model plan elevation shall be repeated directly across any street from the same model plan and elevation.
         (B) No identical model plan elevation shall be repeated more than once within every 4 lots on the same side of any street.
         (C) A minimum of 3 alternative elevations for each model plan shall be submitted to the Town for review.
   b. Architectural Character
      Each single family detached model plan and elevation shall demonstrate the following design attributes:
      i. Design Standards
         (A) Each elevation shall include a minimum of two windows (or one window and one door) per floor.
         (B) Each front and rear elevation shall include more than one wall plane. Articulation that adds shadow and visual interest is encouraged.
         (C) A variety of roof forms should be used. Single unbroken roof pitches should be avoided, except where a single roof treatment is an essential element of the Architectural Style. (e.g. Mansard)
         (D) The main roof should extend beyond the primary façade by a minimum of one foot.
         (E) An elevation of the home that faces a street, park, trail corridor or open space area shall provide an "Enhanced Elevation". An "Enhanced Elevation" shall provide three or more of the following design enhancements listed in (1) through (5) below. Application of the design enhancement shall be applied in a manner that is consistent with the style of the home. Side and rear elevation design enhancements shall be consistent with the design elements of the front elevation.
            (1) The addition of one window unit.
            (2) A change in wall plane by providing one or more of the following options:
               - An additional wall plane change. Minimum six feet in width and one foot projection.
               - A projecting or cantilevered living space.
               - A bay or boxed window.
            (3) A covered porch or deck.
            (4) The addition of architectural detail elements such as: shutters, eave brackets, exposed rafter tails, corbels, lintels, trellises, columns or pilasters.
            (5) The use of a minimum of two exterior cladding materials that can include materials such as masonry (cultured stone, stone, brick, stucco, or tile), lap siding, shingles, board and batten, or other decorative siding treatment.
         (F) Columns or posts extending more than 36 inches above the ground which support structural elements such as porches, decks, or roofs should appear to be of adequate mass to support the structure above. (No exposed 4"x4" posts shall be allowed more than 36 inches above the ground). Columns supporting upper story decks should be 8"x8" minimum finished.
      ii. Materials
         (A) All exterior materials shall be of high quality, used in applications and treated appropriately to provide an attractive and long lasting appearance.
         (B) When masonry cladding is used in locations where its mass is logical and appropriate. In instances where masonry wraps the exterior corner of the home the masonry should continue to a natural transition point such as an inside corner of a projecting wall, a column, a door or window or other logical point. In cases where no such feature exists near the corner, the masonry wrap shall extend at least six feet from the corner.

2. Orientation of Dwellings to the Street
   Each residence shall have at least one primary pedestrian doorway for access to the dwelling unit facing and generally visible from the front lot line of the property, and within twelve feet of the most forward plane of the ground level living space. On corner lots, the pedestrian doorway may face any adjacent street. An exception shall be made for alley-loaded single-family detached dwelling units that do not have street frontage but do front onto a park, or landscaped common area . In such case where the dwelling unit does not have street frontage, one primary pedestrian doorway shall be oriented toward a common pedestrian walk that connects to a street.

3. Garages
   These regulations for garages shall be applied to non-living space or storage areas within garages whether used for storage of automobiles or other items.
   a. Diversity of Garage Orientation:
      A. Except for garages oriented to alleys, all single family homes shall provide garages that meet one of the requirements below, and a variety in garage orientation by providing a minimum of two of the following garage orientations on any subdivision filing.
         - Recessed garage; where the primary garage door generally faces the front lot line and the garage is recessed a minimum of two feet behind the most forward plane of the main floor living space or a front porch.
         - Projecting garages; where the primary garage door generally faces the front lot line and the garage projects no more than fifteen feet from the front door.
         - Side loaded garages.
         - Garages recessed a minimum of two feet beneath a second floor living space.
   b. Width / Façade Ratio
      The width of a front loaded garage shall not exceed 65% of the width of the front elevation.
   c. Three or More Car Garage Orientation
      The third of more bay of any three or more garage shall either:
         i. Have a different orientation from the first two; or
         ii. Shall be recessed behind the first two by at least two feet when having the same orientation; or
         iii. Shall be tandem to the first two.

4. Front Stoop
   For model plans with a front stoop; the front stoop shall include the platform and stairs that are generally in front of a door that can be covered or uncovered. The maximum width of a covered front stoop shall be three feet in width from the side of the front door. Covered platforms that exceed three feet in width from the side of the front door shall be considered a front porch.

5. Front Porches
   For model plans with a front porch; the front porch shall be a minimum size of fifty square feet, excluding the stoop with a minimum depth of five feet.

DEVELOPMENT STANDARDS

PLANNING AREA	ZONE DISTRICT	MIN LOT WIDTH	MIN LOT NET AREA (SF)	FRONT SETBACK	FRONT SETBACK (PORCH)	STREET SETBACK	INTERIOR LOT LINE SETBACK	REAR SETBACK	MAX. HEIGHT
PA-1	LR	60(4)	6,000	16 (2)	10	10 (1)(4)	5 (1)	20 (3)	35'
PA-2	LR	45 (4)	4,500	16 (2)	10	10 (1)(4)	5 (1)	20 (3)	35'
PA-3	LR	60 (4)	6,000	16 (2)	10	10 (1)(4)	5 (1)	20 (3)	35'
PA-4	LR	50(4)	5,000	16 (2)	10	10 (1)(4)	5 (1)	20 (3)	35'
PA-5	LR	60 (4)	6,000	16 (2)	10	10 (1)(4)	5 (1)	20 (3)	35'
PA-6	LR	45 (4)	4,500	16 (2)	10	10 (1)(4)	5 (1)	20 (3)	35'
PA-7	MR	45 (4)	4,500	16 (2)	10	10 (1)(4)	5 (1)	20 (3)	35'
PA-8	MR	40 (4)	2,800	16 (2)	10	10 (1)(4)	5 (1)	10	35'

(1) Permitted encroachments. Side setbacks shall allow for encroachments up to twelve(12) inches beyond the building foundation for window wells and above grade features including eaves, counterforts, fireplace box out, stoops, bay windows, room cantilevers and overhangs provided that the living space of the projection does not exceed six (6) feet in width. There shall be no more than two above grade encroachments per elevation totaling no more than twenty (20) sf.
(2) Front loaded garages shall be set back twenty (20) feet. A sixteen(16) foot front setback allowed with side loaded garage
(3) Unenclosed covered patios may project up to eight (8) feet into a rear setback. The projection shall be at least five feet from the property line.
(4) The minimum lot width shall be measured from the front setback line and shall be increased on corner lots to accommodate the additional side on street setback.

LAND USE SUMMARY

TRACT	ZONE DISTRICT	AREA (ACRES)	PRIMARY USE	DWELLING UNITS	PUBLIC OPEN SPACE PROVIDED
LOW DENSITY RESIDENTIAL					
PA 1	LR	5.49	SFD	7	
PA 2	LR	28.57	SFD	112	2.33
PA 3	LR	20.33	SFD	37	
PA 4	LR	15.95	SFD	95	
PA 5	LR	35.24	SFD	95	12.54
PA 6	LR	40.46	SFD	155	3.92
PA 7	LR	0.89	AMENITY	0	
SUBTOTAL		**146.93**			
RIGHT OF WAY		17.43			
SUBTOTAL		**164.36**		**501**	**18.8**
MEDIUM DENSITY RESIDENTIAL					
PA 8	MR	20.96	SFD	120	
PA 9	MR	15.18	SFD	170	
PA 10	MR	10.89	TH/ APT	203	
SUBTOTAL		**47.03**			
RIGHT OF WAY		12.32			
SUBTOTAL		**59.35**		**493**	
COMMUNITY COMMERCIAL					
PA 11		33.22	COMM		
SUBTOTAL		**33.22**			
RIGHT OF WAY		4.60			
SUBTOTAL		**37.82**			
PUBLIC LAND AND INSTITUTIONS					
PA 12		10.00	SCHOOL		
PA 13		8.32	N PARK		
SUBTOTAL		**18.32**			
AGRICULTURAL / OPEN SPACE					
PA 14		25.28	OPEN SPACE		13.86
SUBTOTAL		**25.28**			
TOTAL		**305.13**		**994**	**32.65**

NOTES

1. Density: Dwelling units may be transferred between planning areas in the same zone district as long as the maximum density allowed within that zone district is not exceeded.
2. Erie Parkway: Thirty (30) foot landscape buffer not required when a local road is directly adjacent. (i.e. frontage road condition). Thirty (30)foot landscape buffer is required when lots abut Erie Parkway right of way.
3. Fencing along Erie Parkway shall not exceed six feet in height which may include opaque fencing in straight runs limited to approximately 600 feet in length without a break and shall be limited to 30% of the total frontage of Erie Parkway. Masonry columns shall not exceed six feet in height with a four inch cap and shall be provided on corners of lots a minimum of every three lots for all opaque fencing along Erie Parkway.
4. Double frontage lots abutting collector or local roads shall be an additional 10 feet in depth. A twenty (20) foot landscape buffer will be provided along local and collector roads abutting double frontage lots.
5. Planning areas shown with apartments and townhomes land use designation shall be allowed to develop with lower density uses including single family attached and detached as long as the minimum housing diversity requirements and minimum gross density for the zone district are met.
6. The trail along Indian Peaks Drive within PA-6 and PA-10 shall be located within a landscape tract and meander.

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PROJECT NAME

ERIE HIGHLANDS
PUD ZONING MAP
TOWN OF ERIE, COLORADO

SHEET TITLE

PUD NOTES

SHEET NUMBER

3

SHEET 3 OF 3

SEPTEMBER 13, 2013

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EXHIBIT C

Phasing Map

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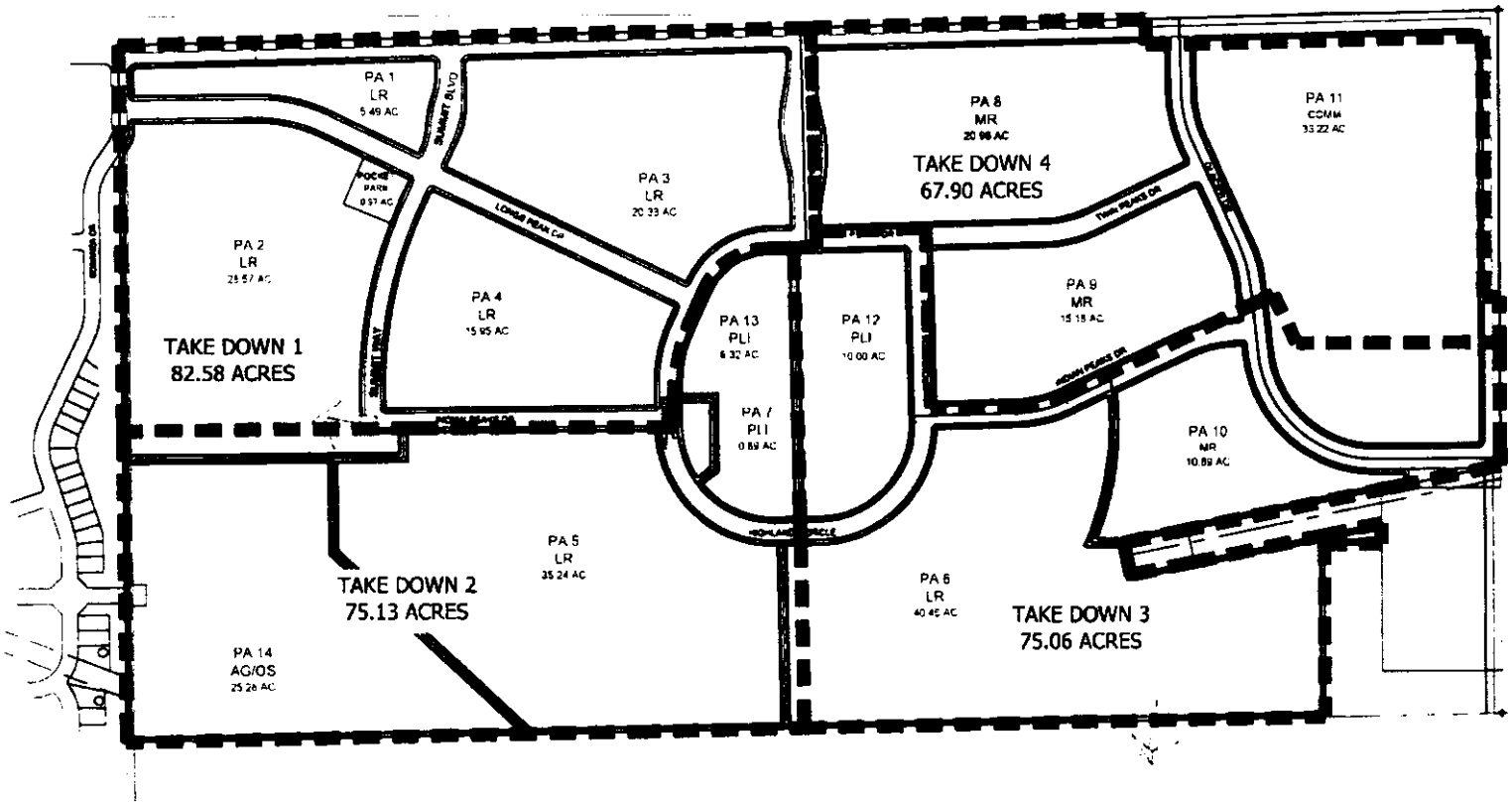


ERIE HIGHTLANDS

Takedown - Phasing Exhibit

Scale in Feet 0 200 400 800

October 1, 2013

ALTA/ACSM LAND TITLE SURVEY

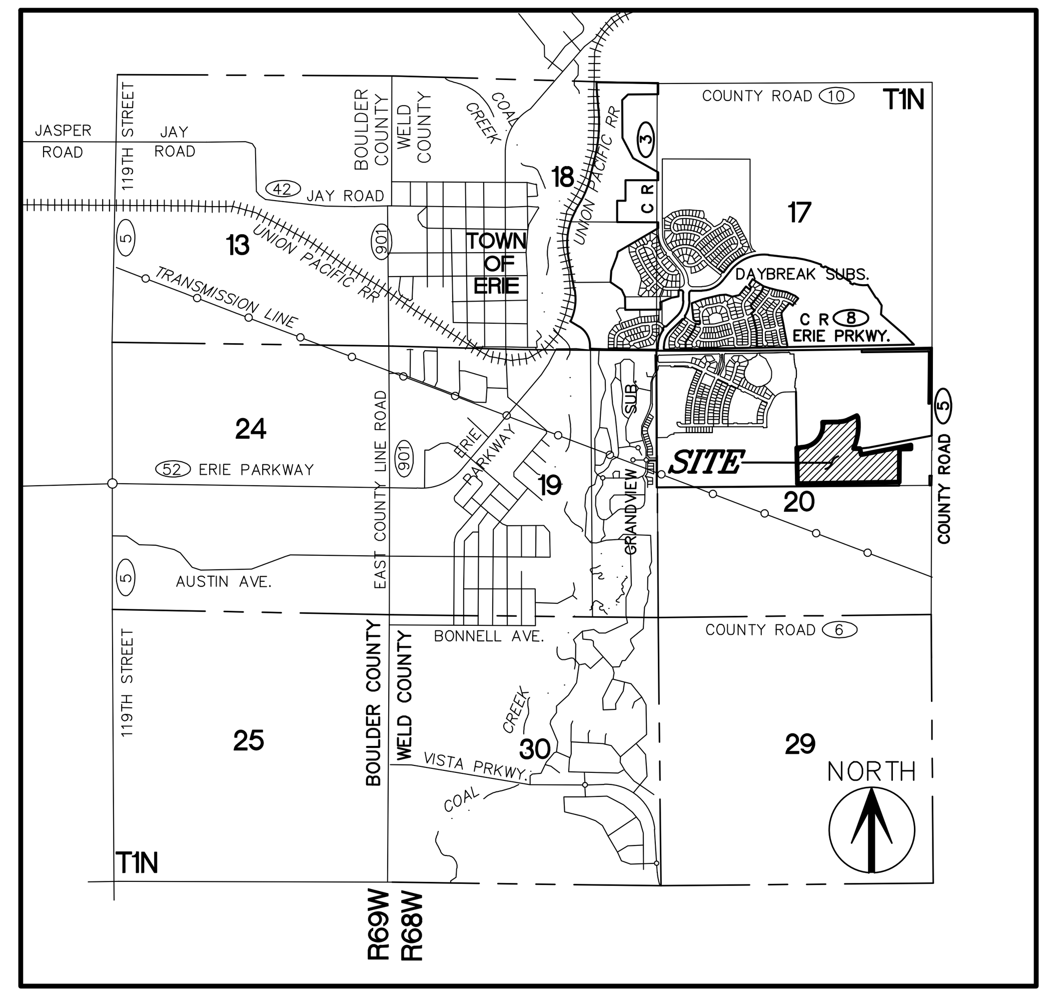
A PORTION OF TRACT L, ERIE HIGHLANDS FILING NO. 1,
LOCATED IN THE NORTH HALF OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN,
TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO.
SHEET 1 OF 2

TITLE COMMITMENT NOTES

STEWART TITLE GUARANTY COMPANY TITLE COMMITMENT FILE NO. 01330-61207, WITH AN EFFECTIVE DATE OF MAY 14, 2015 AT 8:00 A.M., WAS RELIED UPON FOR RECORD INFORMATION REGARDING RIGHTS-OF-WAY, EASEMENTS AND ENCUMBRANCES. THIS SURVEY DOES NOT REPRESENT A TITLE SEARCH BY AZTEC CONSULTANTS, INC. TO DETERMINE OWNERSHIP, RIGHTS-OF-WAY, EASEMENTS OR OTHER MATTERS OF PUBLIC RECORD.

ITEM NUMBERS BELOW REFER TO THOSE ITEMS AS LISTED UNDER SCHEDULE B – SECTION 2 EXCEPTIONS OF THE ABOVE REFERENCED TITLE COMMITMENT.

1. RIGHTS OR CLAIMS OF PARTIES IN POSSESSION, NOT SHOWN BY THE PUBLIC RECORDS. **NOT ADDRESSED AS PART OF THIS SURVEY.**
2. EASEMENTS, OR CLAIMS OF EASEMENTS, NOT SHOWN BY THE PUBLIC RECORDS. **NOT ADDRESSED AS PART OF THIS SURVEY.**
3. ANY ENCROACHMENT, ENCUMBRANCE, VIOLATION, VARIATION, OR ADVERSE CIRCUMSTANCE AFFECTING THE TITLE THAT WOULD BE DISCLOSED BY AN ACCURATE AND COMPLETE LAND SURVEY OF THE LAND AND NOT SHOWN BY THE PUBLIC RECORDS. **SAID MATTERS ARE SHOWN HEREON TO THE BEST OF OUR KNOWLEDGE, INFORMATION AND BELIEF.**
4. ANY LIEN, OR RIGHT TO A LIEN, FOR SERVICES, LABOR OR MATERIAL HERETOFORE OR HEREAFTER FURNISHED, IMPOSED BY LAW AND NOT SHOWN BY THE PUBLIC RECORDS. **NOT ADDRESSED AS PART OF THIS SURVEY.**
5. DEFECTS, LIENS, ENCUMBRANCES, ADVERSE CLAIMS OR OTHER MATTERS, IF ANY, CREATED, FIRST APPEARING IN THE PUBLIC RECORDS OR ATTACHING SUBSEQUENT TO THE EFFECTIVE DATE BUT PRIOR TO THE DATE THE PROPOSED INSURED ACQUIRES FOR VALUE OF RECORD THE ESTATE OR INTEREST OR MORTGAGE THEREON COVERED BY THIS COMMITMENT. **NOT ADDRESSED AS PART OF THIS SURVEY**
6. (A) UNPATENTED MINING CLAIMS; (B) RESERVATIONS OR EXCEPTIONS IN PATENTS OR IN ACTS AUTHORIZING THE ISSUANCE THEREOF; (C) MINERALS OF WHATSOEVER KIND, SUBSURFACE AND SURFACE SUBSTANCES, IN, ON, UNDER AND THAT MAY BE PRODUCED FROM THE LAND, TOGETHER WITH ALL RIGHTS, PRIVILEGES, AND IMMUNITIES RELATING THERETO, WHETHER OR NOT THE MATTERS EXCEPTED UNDER (A), (B) OR (C) ARE SHOWN BY THE PUBLIC RECORDS OR LISTED IN SCHEDULE B. **NOT ADDRESSED AS PART OF THIS SURVEY**
7. WATER RIGHTS, CLAIMS OR TITLE TO WATER. **NOT ADDRESSED AS PART OF THIS SURVEY**
8. ANY AND ALL UNPAID TAXES AND ASSESSMENTS AND ANY UNREDEEMED TAX SALES. **NOT ADDRESSED AS PART OF THIS SURVEY**
9. THE EFFECT OF INCLUSIONS IN ANY GENERAL OR SPECIFIC WATER CONSERVANCY, FIRE PROTECTION, SOIL CONSERVATION OR OTHER DISTRICT OR INCLUSION IN ANY WATER SERVICE OR STREET IMPROVEMENT AREA. **NOT ADDRESSED AS PART OF THIS SURVEY**
10. RIGHT OF WAY FOR COUNTY ROADS 30 FEET WIDE ON EITHER SIDE OF SECTION AND TOWNSHIP LINES, AS ESTABLISHED BY THE BOARD OF COUNTY COMMISSIONERS FOR WELD COUNTY, RECORDED OCTOBER 14, 1889 IN BOOK 86 AT PAGE 273. **THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT DOES NOT FALL WITHIN THE SUBJECT PROPERTY**
11. RESERVATION OF ALL ALL COAL AND OTHER MINERALS IN INSTRUMENT RECORDED SEPTEMBER 27, 1945 IN BOOK 1162 AT PAGE 31 AS RECEPTION NO. 962824, TOGETHER WITH THE APPURTENANT RIGHTS TO USE THE SURFACE OF THE LAND. THE COMPANY MAKES NO REPRESENTATION AS TO THE PRESENT OWNERSHIP OF THIS INTEREST. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
12. AN EASEMENT FOR ELECTRIC TRANSMISSION LINE AND INCIDENTAL PURPOSES AS GRANTED TO THE UNITED STATES OF AMERICA IN INSTRUMENT RECORDED JUNE 1, 1951 IN BOOK 1304 AT PAGE 181 AS RECEPTION NO. 1108167. **THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT DOES NOT FALL WITHIN THE SUBJECT PROPERTY.**
13. GRANT OF MINERALS IN INSTRUMENT RECORDED DECEMBER 22, 1967 AS RECEPTION NO. 1511171, TOGETHER WITH THE APPURTENANT RIGHTS TO USE THE SURFACE OF THE LAND. THE COMPANY MAKES NO REPRESENTATION AS TO THE PRESENT OWNERSHIP OF THIS INTEREST. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
14. OIL AND GAS LEASE RECORDED JUNE 17, 1970 AS RECEPTION NO. 1549405.
AMENDMENT OF OIL AND GAS LEASE RECORDED JUNE 25, 2012 AS RECEPTION NO. 3854517.
AFFIDAVIT OF PRODUCTION RECORDED AUGUST 2, 2013 AS RECEPTION NO. 3952922. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
15. OIL AND GAS LEASE RECORDED MARCH 23, 1976 AS RECEPTION NO. 1684120.
AMENDMENT OF OIL AND GAS LEASE RECORDED JUNE 25, 2012 AS RECEPTION NO. 3854517.
AFFIDAVIT OF PRODUCTION RECORDED AUGUST 2, 2013 AS RECEPTION NO. 3952922. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
16. EASEMENT AS GRANTED TO PANHANDLE EASTERN PIPE LINE COMPANY IN INSTRUMENT RECORDED FEBRUARY 10, 1982 AS RECEPTION NO. 1882642. **THE DESCRIBED LOCATION OF THE ABOVE REFERENCED EASEMENT DOES NOT FALL WITHIN THE SUBJECT PROPERTY.**
17. NOTICE CONCERNING UNDERGROUND FACILITIES RECORDED JUNE 26, 1986 AS RECEPTION NO. 2058722. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
18. NOTICE CONCERNING UNDERGROUND FACILITIES OF UNITED POWER, INC., FORMERLY UNION RURAL ELECTRIC ASSOCIATION, INC. RECORDED JANUARY 24, 1991 AS RECEPTION NO. 2239296. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
19. RIGHT-OF-WAY GRANT RECORDED MAY 3, 1993 IN BOOK 1381 AT PAGE 948 AS RECEPTION NO. 2331355. **THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT DOES NOT FALL WITHIN THE SUBJECT PROPERTY.**
20. OIL AND GAS LEASE RECORDED AUGUST 2, 1995 AS RECEPTION NO. 2449610.
AFFIDAVIT OF PRODUCTION RECORDED AUGUST 2, 2013 AS RECEPTION NO. 3952922. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
21. NOTICE OF RIGHT TO USE SURFACE OF LANDS RECORDED DECEMBER 26, 1996 IN BOOK 1583 AT PAGE 410 AS RECEPTION NO. 2526511. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
22. NOTICE OF RIGHT TO USE SURFACE OF LANDS RECORDED DECEMBER 26, 1996 IN BOOK 1583 AT PAGE 411 AS RECEPTION NO. 2526512. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
23. NOTICE OF RIGHT TO USE SURFACE OF LANDS RECORDED AUGUST 3, 1999 AS RECEPTION NO. 2711405. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
24. NOTICE OF OIL AND GAS INTERESTS AND SURFACE USE RECORDED JANUARY 23, 2001 AS RECEPTION NO. 2820923. **SAID ITEMS CONTAINED THEREIN ARE SHOWN HEREON TO THE BEST OF OUR KNOWLEDGE, INFORMATION AND BELIEF.**
25. TEMPORARY CONSTRUCTION EASEMENT AND DEED OF PERPETUAL EASEMENT RECORDED FEBRUARY 15, 2002 AS RECEPTION NO. 2925868. **THE DESCRIBED LOCATION OF THE ABOVE REFERENCED EASEMENT DOES NOT FALL WITHIN THE SUBJECT PROPERTY.**
26. TEMPORARY CONSTRUCTION EASEMENT AND DEED OF PERPETUAL EASEMENT RECORDED MARCH 28, 2002 AS RECEPTION NO. 2937484. **THE DESCRIBED LOCATION OF THE ABOVE REFERENCED EASEMENT DOES NOT FALL WITHIN THE SUBJECT PROPERTY.**
27. REQUEST FOR NOTIFICATION OF SURFACE DEVELOPMENT RECORDED MAY 28, 2002 AS RECEPTION NO. 2954714. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN A PORTION OF THE SUBJECT PROPERTY.**
28. EASEMENT GRANT RECORDED APRIL 2, 2003 AS RECEPTION NO. 3048212. **THE DESCRIBED LOCATION OF THE ABOVE REFERENCED EASEMENT DOES NOT FALL WITHIN THE SUBJECT PROPERTY.**
29. RIGHT OF WAY AND EASEMENT AS GRANTED TO THE TOWN OF ERIE IN INSTRUMENT RECORDED NOVEMBER 8, 2005 AS RECEPTION NO. 3338315. **THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT DOES NOT FALL WITHIN THE SUBJECT PROPERTY.**
30. NOTICE OF RIGHT TO USE SURFACE OF LANDS RECORDED DECEMBER 13, 2005 AS RECEPTION NO. 3346989. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
31. REQUEST FOR NOTIFICATION OF SURFACE DEVELOPMENT RECORDED APRIL 21, 2006 AS RECEPTION NO. 3381087. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
32. REQUEST FOR NOTIFICATION OF SURFACE DEVELOPMENT RECORDED OCTOBER 15, 2007 AS RECEPTION NO. 3511023. **THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT DOES NOT FALL WITHIN THE SUBJECT PROPERTY.**
33. REQUEST FOR NOTIFICATION OF SURFACE DEVELOPMENT RECORDED DECEMBER 21, 2007 AS RECEPTION NO. 3525268. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
34. RIGHT-OF-WAY GRANT RECORDED DECEMBER 9, 2011 AS RECEPTION NO. 3810941. **THE DESCRIBED LOCATION OF THE ABOVE REFERENCED RIGHT-OF-WAY DOES NOT FALL WITHIN THE SUBJECT PROPERTY.**
35. MEMORANDUM OF PURCHASE AGREEMENT RECORDED JUNE 26, 2013 AS RECEPTION NO. 3943199. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
36. ORDINANCE NO. 35-2013 RECORDED NOVEMBER 25, 2013 AS RECEPTION NO. 3980216. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
37. ORDINANCE NO. 36-2013 RECORDED NOVEMBER 25, 2013 AS RECEPTION NO. 3980217. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
38. ANY EFFECT OF INCLUSION WITHIN ERIE HIGHLANDS METROPOLITAN DISTRICT NO. 1 AS EVIDENCED BY ORDER AND DECREE RECORDED DECEMBER 2, 2013 AS RECEPTION NO. 3981397 AND NOTICE RECORDED DECEMBER 4, 2013 AS RECEPTION NO. 3981859. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
39. ANY EFFECT OF INCLUSION WITHIN ERIE HIGHLANDS METROPOLITAN DISTRICT NO. 2 AS EVIDENCED BY ORDER AND DECREE RECORDED DECEMBER 2, 2013 AS RECEPTION NO. 3981398 AND NOTICE RECORDED DECEMBER 4, 2013 AS RECEPTION NO. 3981860. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**



VICINITY MAP
SCALE: 1"=3000'

TITLE COMMITMENT NOTES - CONTINUED

40. ANY EFFECT OF INCLUSION WITHIN ERIE HIGHLANDS METROPOLITAN DISTRICT NO. 3 AS EVIDENCED BY ORDER AND DECREE RECORDED DECEMBER 2, 2013 AS RECEPTION NO. 3981399 AND NOTICE RECORDED DECEMBER 4, 2013 AS RECEPTION NO. 3981861. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
41. ANY EFFECT OF INCLUSION WITHIN ERIE HIGHLANDS METROPOLITAN DISTRICT NO. 4 AS EVIDENCED BY ORDER AND DECREE RECORDED DECEMBER 2, 2013 AS RECEPTION NO. 3981400 AND NOTICE RECORDED DECEMBER 4, 2013 AS RECEPTION NO. 3981862. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
42. ANY EFFECT OF INCLUSION WITHIN ERIE HIGHLANDS METROPOLITAN DISTRICT NO. 5 AS EVIDENCED BY ORDER AND DECREE RECORDED DECEMBER 2, 2013 AS RECEPTION NO. 3981401 AND NOTICE RECORDED DECEMBER 4, 2013 AS RECEPTION NO. 3981863. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
43. TERMS AND CONDITIONS OF UNRECORDED COMPATIBLE DEVELOPMENT AND SURFACE USE AGREEMENT DATED JULY 31, 2013, AS EVIDENCED BY MEMORANDUM OF COMPATIBLE DEVELOPMENT AND SURFACE USE AGREEMENT RECORDED DECEMBER 9, 2013 AS RECEPTION NO. 3982954. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
44. TERMINATION AND RELEASE OF ANNEXATION AGREEMENT RECORDED DECEMBER 10, 2013 AS RECEPTION NO. 3983026. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
45. GRANT OF PERMANENT AVIGATION EASEMENT AGREEMENT RECORDED DECEMBER 16, 2013 AS RECEPTION NO. 3984166. **THE EASEMENT AS DESCRIBED IN THE ABOVE REFERENCED EASEMENT IS BLANKET IN NATURE AND THEREFORE COULD NOT BE SHOWN HEREON. IT WAS DETERMINED THAT THE ABOVE REFERENCED EASEMENT DOES FALL WITHIN THE SUBJECT PROPERTY.**
46. ALL MATTERS AS SHOWN ON ALTA/ACSM LAND TITLE SURVEY RECORDED FEBRUARY 4, 2014 AS RECEPTION NO. 3993955. **ALL VISIBLE SITE IMPROVEMENTS AND EASEMENTS OF RECORD THAT FALL WITHIN THE SUBJECT PROPERTY ARE SHOWN HEREON.**
47. DECLARATION OF COVENANTS, CONDITIONS AND RESTRICTIONS FOR ERIE HIGHLANDS RECORDED JULY 21, 2014 AS RECEPTION NO. 4032135 AND FIRST AMENDMENT THERETO RECORDED APRIL 3, 2015 AS RECEPTION NO. 4095671. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE "INCLUDIBLE AREA" WITHIN THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
48. ALL MATTERS AS SHOWN ON ERIE HIGHLANDS ZONING MAP RECORDED SEPTEMBER 10, 2014 AS RECEPTION NO. 4044913. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
49. ALL MATTERS AS SHOWN ON ERIE HIGHLANDS PUD ZONING MAP RECORDED SEPTEMBER 10, 2014 AS RECEPTION NO. 4044914. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
50. ALL MATTERS AS SHOWN ON THE PLAT OF ERIE HIGHLANDS FILING NO. 1 RECORDED SEPTEMBER 10, 2014 AS RECEPTION NO. 4044915. **THERE ARE NO EASEMENTS AS SHOWN ON SAID PLAT OF ERIE HIGHLANDS FILING NO. 1 THAT FALL WITHIN THE SUBJECT PROPERTY.**
51. ERIE HIGHLANDS PROPERTY VESTED RIGHTS DEVELOPMENT AGREEMENT RECORDED SEPTEMBER 10, 2014 AS RECEPTION NO. 4044916. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
52. ERIE HIGHLANDS PROPERTY MASTER PRE-DEVELOPMENT AGREEMENT RECORDED SEPTEMBER 10, 2014 AS RECEPTION NO. 4044917. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
53. ERIE HIGHLANDS FILING NO. 1 DEVELOPMENT AGREEMENT RECORDED SEPTEMBER 10, 2014 AS RECEPTION NO. 4044918. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE "ERIE HIGHLANDS TAKEDOWN NO. 1" PARCEL AS LISTED IN THE ABOVE REFERENCED DOCUMENT DOES NOT FALL WITHIN THE SUBJECT PROPERTY.**
54. ENCROACHMENT LICENSE AGREEMENT RECORDED SEPTEMBER 10, 2014 AS RECEPTION NO. 4044919. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT DOES NOT FALL WITHIN THE SUBJECT PROPERTY.**
55. ERIE HIGHLANDS METROPOLITAN DISTRICT NO. 1 PUBLIC DISCLOSURE STATEMENT RECORDED OCTOBER 1, 2014 AS RECEPTION NO. 4050502. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
56. ERIE HIGHLANDS METROPOLITAN DISTRICT NO. 2 PUBLIC DISCLOSURE STATEMENT RECORDED OCTOBER 1, 2014 AS RECEPTION NO. 4050503. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
57. ERIE HIGHLANDS METROPOLITAN DISTRICT NO. 3 PUBLIC DISCLOSURE STATEMENT RECORDED OCTOBER 1, 2014 AS RECEPTION NO. 4050504. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
58. ERIE HIGHLANDS METROPOLITAN DISTRICT NO. 4 PUBLIC DISCLOSURE STATEMENT RECORDED OCTOBER 1, 2014 AS RECEPTION NO. 4050505. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
59. ERIE HIGHLANDS METROPOLITAN DISTRICT NO. 5 PUBLIC DISCLOSURE STATEMENT RECORDED OCTOBER 1, 2014 AS RECEPTION NO. 4050506. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
60. INTERGOVERNMENTAL AGREEMENT BETWEEN THE TOWN OF ERIE COLORADO AND ERIE HIGHLANDS METROPOLITAN DISTRICT NOS. 1-5 RECORDED NOVEMBER 20, 2014 AS RECEPTION NO. 4063179. **NOT ADDRESSED AS PART OF THIS SURVEY.**
61. SURFACE USE AGREEMENT RECORDED AUGUST 1, 2013 AS RECEPTION NO. 3952706. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
62. ORDER FOR INCLUSION OF LANDS WITHIN THE BOUNDARIES OF THE MUNICIPAL SUBDISTRICT, NORTHERN COLORADO WATER CONSERVANCY DISTRICT RECORDED DISTRICT RECORDED DECEMBER 1, 2014 AS RECEPTION NO. 4065129. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN A PORTION OF SUBJECT PROPERTY.**
63. ORDER FOR INCLUSION OF LANDS WITHIN THE BOUNDARIES OF THE NORTHERN COLORADO WATER CONSERVANCY DISTRICT RECORDED DECEMBER 4, 2014 AS RECEPTION NO. 4066298. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN A PORTION OF SUBJECT PROPERTY.**

LEGAL DESCRIPTION

(PER STEWART TITLE GUARANTY COMPANY TITLE COMMITMENT FILE NO. 01330-61207)

A PORTION OF TRACT L, ERIE HIGHLANDS FILING NO. 1, AS RECORDED ON SEPTEMBER 10, 2014, AT RECEPTION NO. 4044915 OF THE RECORDS OF THE WELD COUNTY CLERK AND RECORDERS OFFICE, SITUATED IN THE NORTH HALF OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE CENTER QUARTER OF SAID SECTION 20 AND CONSIDERING THE NORTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 20 TO BEAR NORTH 88°48'39" EAST, WITH ALL BEARINGS CONTAINED HEREIN RELATIVE THERETO;

THENCE ALONG THE SOUTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 20 SOUTH 89°05'29" WEST, A DISTANCE OF 46.82 FEET TO THE SOUTHWEST CORNER OF SAID TRACT L;

THENCE ALONG THE SOUTHWESTERLY BOUNDARY OF SAID TRACT L NORTH 00°56'35" WEST, A DISTANCE OF 709.11 FEET;

THENCE DEPARTING SAID NORTH 89°02'08" EAST, A DISTANCE OF 83.93 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE NORTHWESTERLY HAVING A RADIUS OF 435.00 FEET;

THENCE NORTHEASTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 86°17'38", AN ARC LENGTH OF 655.16 FEET;

THENCE NON-TANGENT TO SAID CURVE, NORTH 00°38'58" WEST, A DISTANCE OF 88.63 FEET;

THENCE NORTH 88°48'39" EAST, A DISTANCE OF 326.44 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE NORTHERLY HAVING A RADIUS OF 440.00 FEET;

THENCE EASTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 23°50'36", AN ARC LENGTH OF 183.10 FEET;

THENCE TANGENT TO SAID CURVE NORTH 64°58'03" EAST, A DISTANCE OF 189.11 FEET;

THENCE SOUTH 24°54'48" EAST, A DISTANCE OF 34.89 FEET TO THE BEGINNING OF A NON-TANGENT CURVE CONCAVE WESTERLY HAVING A RADIUS OF 1,135.00 FEET, THE RADIUS POINT OF SAID CURVE BEARS SOUTH 81°41'06" WEST;

THENCE SOUTHERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 31°45'48", AN ARC LENGTH OF 629.21 FEET;

THENCE NON-TANGENT TO SAID CURVE SOUTH 89°58'19" EAST, A DISTANCE OF 128.21 FEET TO THE NORTHWEST CORNER OF A PARCEL RECORDED IN BOOK 814, PAGE 251, IN SAID RECORDS;

THENCE ALONG THE WESTERLY BOUNDARY OF SAID PARCEL, SOUTH 11°04'31" EAST, A DISTANCE OF 125.00 FEET;

THENCE ALONG THE SOUTHERLY BOUNDARY OF SAID PARCEL AND THE SOUTHERLY BOUNDARY OF THAT PARCEL OF LAND RECORDED IN BOOK 509 AT PAGE 79, IN SAID RECORDS, NORTH 78°55'29" EAST, A DISTANCE OF 994.76 FEET TO THE SOUTHEAST CORNER OF SAID PARCEL RECORDED IN BOOK 509, PAGE 79, ALSO BEING A POINT ON THE WESTERLY BOUNDARY OF A PARCEL RECORDED IN BOOK 1179, PAGE 541, IN SAID RECORDS;

THENCE ALONG SAID WESTERLY BOUNDARY SOUTH 00°00'25" WEST, A DISTANCE OF 76.02 FEET TO THE NORTHEAST CORNER OF A PARCEL RECORDED AT RECEPTION NO. 1983198, IN SAID RECORDS;

THENCE DEPARTING SAID WESTERLY BOUNDARY AND ALONG THE NORTHERLY AND WESTERLY BOUNDARIES OF SAID PARCEL RECORDED AT RECEPTION NO. 1983198 THE FOLLOWING TWO (2) COURSES:

1) SOUTH 89°05'08" WEST, A DISTANCE OF 225.15 FEET;
2) SOUTH 00°00'21" WEST, A DISTANCE OF 650.47 FEET TO A POINT ON THE SOUTH LINE OF SAID NORTHEAST QUARTER;

THENCE DEPARTING SAID WESTERLY BOUNDARY, ALONG SAID SOUTH LINE SOUTH 89°05'07" WEST, A DISTANCE OF 1,962.78 FEET TO THE POINT OF BEGINNING.

GENERAL NOTES

1. THE FIELD WORK FOR THIS SURVEY WAS PERFORMED BY AN AZTEC CONSULTANTS, INC. SURVEY CREW AND COMPLETED ON MAY 15, 2015.
2. PER C.R.S. 38-51-106, "ALL LINEAL UNITS DEPICTED ON THIS LAND SURVEY PLAT ARE U.S. SURVEY FEET. ONE METER EQUALS 39.37/12 U.S. SURVEY FEET, EXACTLY ACCORDING TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY."
3. THIS SURVEY DOES NOT CERTIFY TO SUBSURFACE FEATURES, IMPROVEMENTS, UTILITIES OR BURIED LINES OF ANY TYPE, LOCATION DEPICTED HEREON ARE DERIVED FROM FIELD SURVEY OF UTILITY FLAGGING / PAINT MARKING, PERFORMED BY DIVERSIFIED UNDERGROUND, INC. ON JULY 09, 2014.
4. THE SURVEYED PARCEL CONTAINS A TOTAL OF 40.421 ACRES OR 1,760,742 SQUARE FEET, MORE OR LESS.
5. THERE WAS NO OBSERVED EVIDENCE OF CURRENT EARTH MOVING WORK, BUILDING CONSTRUCTION OF BUILDING ADDITIONS AT THE TIME OF THIS SURVEY.
6. THERE WAS NO OBSERVED EVIDENCE OF SITE USE AS A SOLID WASTE DUMP, SUMP OR SANITARY LANDFILL.
7. THE SUBJECT PARCEL'S PURPORTED ADDRESS IS VACANT LAND TR L ERIE HIGHLANDS ERIE CO 80516, PER PROVIDED TITLE COMMITMENT.
8. ALL REFERENCES HEREON TO BOOKS, PAGES, MAPS AND RECEPTION NUMBERS ARE PUBLIC DOCUMENTS RECORDED IN WELD COUNTY, COLORADO, CLERK AND RECORDER'S OFFICE.
9. NO BUILDINGS EXIST ON THE SUBJECT PROPERTY.

BASIS OF BEARINGS

THE BEARINGS SHOWN HEREON ARE BASED UPON THE NORTH LINE OF THE NORTHWEST QUARTER OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, COUNTY OF WELD, STATE OF COLORADO, ASSUMED TO BEAR NORTH 88°48'39" EAST, A DISTANCE OF 2648.08 FEET BETWEEN FOUND MONUMENTS AS SHOWN HEREON.

FLOOD ZONE

FLOODPLAIN: BASED ON A GRAPHICAL REPRESENTATION OF FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) FLOOD INSURANCE RATE MAP (FIRM) MAP NO. 08013C0441J, PANEL 441 OF 615, DATED DECEMBER 18, 2012. THE SUBJECT PROPERTY LIES WITHIN "ZONE X", BEING DEFINED AS "OTHER AREAS ... DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN".

SURVEYOR'S STATEMENT

TO: J DEARMIN, LLC, A COLORADO LIMITED LIABILITY COMPANY; J GAZ, LLC, A COLORADO LIMITED LIABILITY COMPANY; WY&K HOLDINGS, LLC, A COLORADO LIMITED LIABILITY COMPANY; JACK SHELL FAMILY TRUST AND SONJA SHELL FAMILY TRUST; OAKWOOD HOMES, LLC, A COLORADO LIMITED LIABILITY COMPANY; STEWART TITLE GUARANTY COMPANY:

THIS IS TO CERTIFY THAT THIS MAP OR PLAT AND THE SURVEY ON WHICH IT IS BASED WERE MADE IN ACCORDANCE WITH THE 2011 MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/ACSM LAND TITLE SURVEYS, JOINTLY ESTABLISHED AND ADOPTED BY ALTA AND NSPS, AND INCLUDES ITEMS 1-4, 8, 11(B), 13, 16, AND 18 OF TABLE A THEREOF. THE FIELD WORK WAS COMPLETED ON MAY 15, 2015.

DATE OF PLAT OR MAP: 06/30/2015

DEREK S. BROWN, PLS NO. 38064
COLORADO LICENSED PROFESSIONAL LAND SURVEYOR
FOR AND ON BEHALF OF AZTEC CONSULTANTS, INC.

COLORADO LICENSED DEREK S. BROWN 38064 PROFESSIONAL LAND SURVEYOR
FOR REVIEW

STATUTE OF LIMITATIONS

NOTICE: ACCORDING TO COLORADO LAW YOU MUST COMMENCE ANY LEGAL ACTION BASED UPON ANY DEFECT IN THIS SURVEY WITHIN THREE YEARS AFTER YOU FIRST DISCOVER SUCH DEFECT. IN NO EVENT MAY ANY ACTION BASED UPON ANY DEFECT IN THIS SURVEY BE COMMENCED MORE THAN TEN YEARS FROM THE DATE OF THE CERTIFICATION SHOWN HEREON.

INDEXING STATEMENT

DEPOSITED THIS _______ DAY OF _______________, 20____, AT _________, M., IN BOOK _____________ OF THE COUNTY SURVEYOR'S LAND SURVEY/RIGHT-OF-WAY SURVEYS AT PAGE(S) ____________, RECEPTION NUMBER________________________.

COUNTY SURVEYOR/DEPUTY COUNTY SURVEYOR

SCALE NA | DRN DSB | CHK MDW | DATE 06/30/15

DATE | APPV | REVISION DESCRIPTION | DATE | BY

AZTEC CONSULTANTS, INC.
300 E. Mineral Ave., Suite 1
Littleton, Colorado 80122
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Fax: (303) 713-1897
www.aztecconsultants.com

ALTA/ACSM LAND TITLE SURVEY
A PORTION OF TRACT L, ERIE HIGHLANDS FILING NO. 1
TOWN OF ERIE, WELD COUNTY, COLORADO

PREPARED FOR
OAKWOOD HOMES
4908 TOWER ROAD, DENVER, CO 80249

SHEET ONE OF 2 SHEETS

19315-16
JOB NO.

ALTA/ACSM LAND TITLE SURVEY

A PORTION OF TRACT L, ERIE HIGHLANDS FILING NO. 1,
LOCATED IN THE NORTH HALF OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN,
TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO.

SHEET 2 OF 2

NORTHWEST CORNER SECTION 20 T.1N., R.68W., 6TH P.M. RECOVERED NO. 6 REBAR WITH 3-1/4" ALUMINUM CAP--ILLEGIBLE IN A MONUMENT BOX

N88°48'39"E 2648.08'
NORTH LINE OF THE NW 1/4 OF SEC. 20
(BASIS OF BEARINGS)

NORTH 1/4 CORNER SECTION 20 T.1N., R.68W., 6TH P.M. RECOVERED NO. 6 REBAR WITH 2-1/2" ALUMINUM CAP "LS 28258" IN A MONUMENT BOX

N88°48'06"E 2648.24'
NORTH LINE OF THE NE 1/4 OF SEC. 20

EAST 1/4 CORNER SECTION 20 T.1N., R.68W., 6TH P.M. RECOVERED NO. 6 REBAR WITH 3-1/4" ALUMINUM CAP "PLS 26606"IN A MONUMENT BOX

LEGEND

- RECOVERED P.L.S.S. CORNER STAMPED AS NOTED
- 1 SET NO. 5 REBAR W/ 1-1/4" ORANGE PLASTIC CAP STAMPED "AZTEC PLS 38064"
- 2 RECOVERED NO. 5 REBAR W/ 1-1/4" ORANGE PLASTIC CAP STAMPED "PLS 28286"
- 3 RECOVERED NO. 4 REBAR W/ 1" YELLOW PLASTIC CAP STAMPED "AZTEC PLS 20685"
- 4 RECOVERED NO. 5 REBAR W/ 1-1/4" ORANGE PLASTIC CAP STAMPED "AZTEC PLS 38064"
- 5 RECOVERED NO. 4 REBAR W/ 1" YELLOW PLASTIC CAP ILLEGIBLE
- LIGHT POLE
- EDGE ROAD

0 50 100 200
1 inch = 100 ft.

N00°21'43"W 2628.51'
WESTERLY LINE OF THE NW 1/4 OF SEC. 20

N00°12'38"W 2641.55'
EAST LINE OF THE NE 1/4 OF SEC. 20

N00°00'25"E 2654.81'
EAST LINE OF THE NE 1/4 OF SEC. 20

N00°56'35"W 709.11'

N00°38'58"W 88.63'

N88°48'39"E 326.44'

Δ=23°50'36" R=440.00' L=183.10'

N64°58'03"E 189.11'

S24°54'48"E 34.89'

S81°41'06"W (RADIAL)

N89°02'08"E 83.93'

Δ=86°17'38" R=435.00' L=655.16'

Δ=37°45'48" R=1135.00' L=629.21'

S89°58'19"E 128.21'

S11°04'31"E 125.00'

N78°55'29"E 994.76'

S00°00'25"W 76.02'

S89°05'08"W 225.15'

S00°00'21"W 650.47'

S89°05'07"W 1962.78'

N89°05'07"E 2637.97'

S89°05'29"W 46.82'

N89°05'29"E 2640.94'

OWNERS:
J DEARMIN LLC
J GAZ LLC
JACK SHELL FAMILY TRUST
SONJA SHALL FAMILY TRUST
WY&K HOLDINGS, LLC

TRACT L
ERIE HIGHLANDS
FILING NO. 1
REC. NO. 4044915

COLORADO OIL & GAS CONSERVATION COMMISSION RULE 318A (TYP.) TC #24

800'

400'

OWNERS:
J DEARMIN LLC
J GAZ LLC
JACK SHELL FAMILY TRUST
SONJA SHALL FAMILY TRUST
WY&K HOLDINGS, LLC

TRACT L
ERIE HIGHLANDS
FILING NO. 1
REC. NO. 4044915

55 GALLON BARREL

BOOK 509, PAGE 79
OWNER:
DANIEL R. BLAKE

BOOK 814, PAGE 251

GRAVEL DRIVE FALLS INSIDE & OUTSIDE OF PROSPERITY

BOOK 1044, REC. NO. 1983198
WARRANTY DEED
OWNER:
DANIEL R. BLAKE

NW 1/4 SEC. 20,
T.1S., R.68W., SIXTH P.M.

NE 1/4 SEC. 20,
T.1S., R.68W., SIXTH P.M.

TRACT J
ERIE HIGHLANDS
FILING NO. 1
REC. NO. 4044915

OWNERS:
J DEARMIN LLC
J GAZ LLC
JACK SHELL FAMILY TRUST
SONJA SHALL FAMILY TRUST
WY&K HOLDINGS, LLC

PARCEL CONTAINS
1,760,742 (SQ.FT.)
40.421 ACRES
MORE OR LESS

COLORADO LICENSED
DEREK S. BROWN
38064
PROFESSIONAL LAND SURVEYOR

FOR AND ON BEHALF OF
AZTEC CONSULTANTS, INC

WEST 1/4 CORNER SECTION 20 T.1N., R.68W., 6TH P.M. RECOVERED NO. 6 REBAR WITH 2-1/2" ALUMINUM CAP "PLS 28258"

POINT OF BEGINNING
CENTER 1/4 CORNER SECTION 20 T.1N., R.68W., 6TH P.M. RECOVERED NO. 6 REBAR WITH 2-1/2" ALUMINUM CAP "PLS 28258"

SOUTHERLY LINE OF THE NW 1/4 OF SEC. 20

SOUTH LINE OF THE NE 1/4 OF SEC. 20

OWNER:
GREEN MILL SPORTSMANS CLUB

OWNER:
FS ERIE ESTATES, LLC

DRAINAGE

EAST 1/4 CORNER SECTION 20 T.1N., R.68W., 6TH P.M. RECOVERED NO. 6 REBAR WITH 3-1/4" ALUMINUM CAP "PLS 26606"IN A MONUMENT BOX

SCALE	CKD	DWG	DATE
1" = 50'	DSB	JFT	06/30/15

DATE	BY	REVISION DESCRIPTION	APP'V	DATE

AZTEC CONSULTANTS, INC.
300 E. Mineral Ave., Suite 1
Littleton, Colorado 80122
Phone: (303) 713-1898
Fax: (303) 713-1897
www.aztecconsultants.com

ALTA/ACSM LAND TITLE SURVEY
A PORTION OF TRACT L, ERIE HIGHLANDS FILING NO. 1
TOWN OF ERIE, WELD COUNTY, COLORADO

PREPARED FOR
OAKWOOD HOMES
4908 TOWER ROAD, DENVER, CO 80249

SHEET
TWO
OF 2 SHEETS

JOB NO.
19315-16

ALTA/ACSM LAND TITLE SURVEY

A PORTION OF TRACT J, ERIE HIGHLANDS FILING NO. 1, LOCATED IN THE NORTHWEST QUARTER OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO.

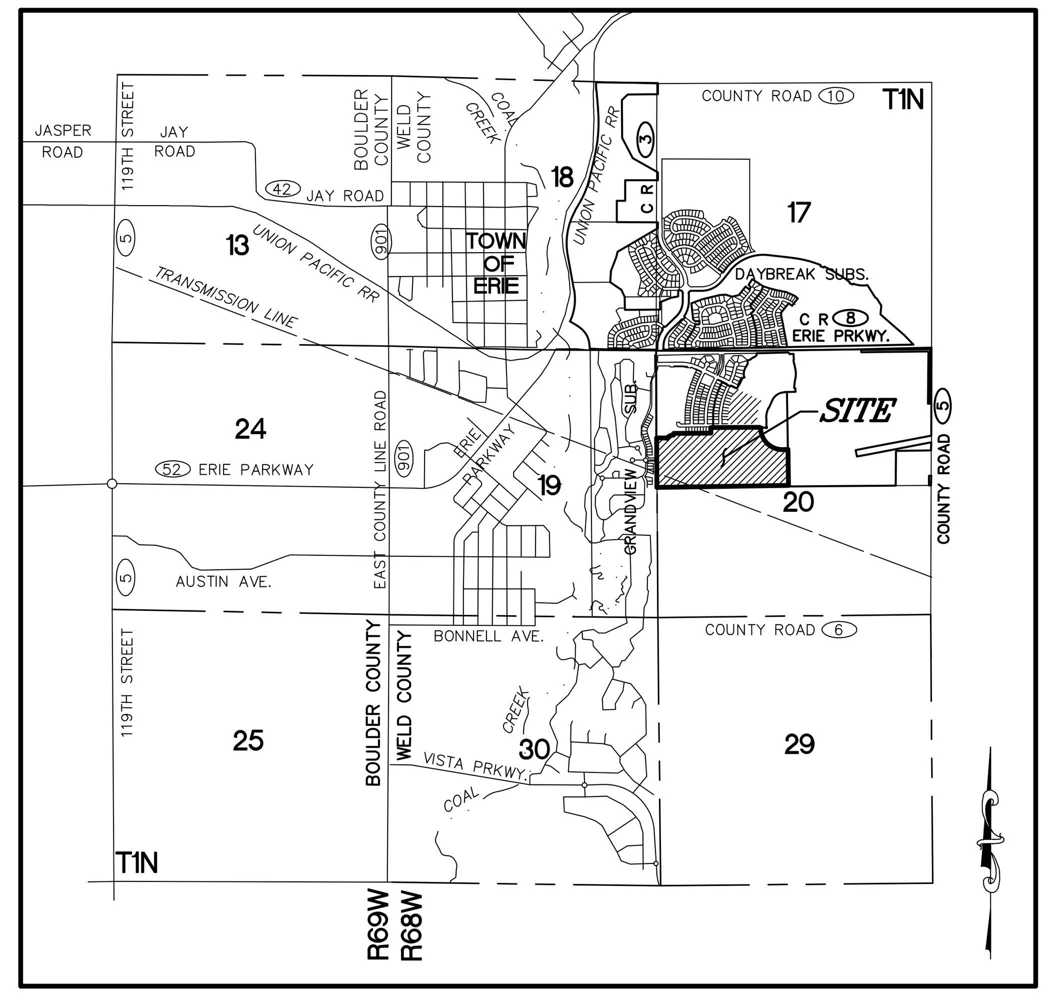
SHEET 1 OF 2

TITLE COMMITMENT NOTES

STEWART TITLE GUARANTY COMPANY TITLE COMMITMENT FILE NO. 01330–61207, WITH AN EFFECTIVE DATE OF MAY 14, 2015 AT 8:00 A.M., WAS RELIED UPON FOR RECORD INFORMATION REGARDING RIGHTS–OF–WAY, EASEMENTS AND ENCUMBRANCES. THIS SURVEY DOES NOT REPRESENT A TITLE SEARCH BY AZTEC CONSULTANTS, INC. TO DETERMINE OWNERSHIP, RIGHTS–OF–WAY, EASEMENTS OR OTHER MATTERS OF PUBLIC RECORD.

ITEM NUMBERS BELOW REFER TO THOSE ITEMS AS LISTED UNDER SCHEDULE B – SECTION 2 EXCEPTIONS OF THE ABOVE REFERENCED TITLE COMMITMENT.

1. RIGHTS OR CLAIMS OF PARTIES IN POSSESSION, NOT SHOWN BY THE PUBLIC RECORDS. **NOT ADDRESSED AS PART OF THIS SURVEY.**
2. EASEMENTS, OR CLAIMS OF EASEMENTS, NOT SHOWN BY THE PUBLIC RECORDS. **NOT ADDRESSED AS PART OF THIS SURVEY.**
3. ANY ENCROACHMENT, ENCUMBRANCE, VIOLATION, VARIATION, OR ADVERSE CIRCUMSTANCE AFFECTING THE TITLE THAT WOULD BE DISCLOSED BY AN ACCURATE AND COMPLETE LAND SURVEY OF THE LAND AND NOT SHOWN BY THE PUBLIC RECORDS. **SAID MATTERS ARE SHOWN HEREON TO THE BEST OF OUR KNOWLEDGE, INFORMATION AND BELIEF.**
4. ANY LIEN, OR RIGHT TO A LIEN, FOR SERVICES, LABOR OR MATERIAL HERETOFORE OR HEREAFTER FURNISHED, IMPOSED BY LAW AND NOT SHOWN BY THE PUBLIC RECORDS. **NOT ADDRESSED AS PART OF THIS SURVEY.**
5. DEFECTS, LIENS, ENCUMBRANCES, ADVERSE CLAIMS OR OTHER MATTERS, IF ANY, CREATED, FIRST APPEARING IN THE PUBLIC RECORDS OR ATTACHING SUBSEQUENT TO THE EFFECTIVE DATE BUT PRIOR TO THE DATE THE PROPOSED INSURED ACQUIRES FOR VALUE OF RECORD THE ESTATE OR INTEREST OR MORTGAGE THEREON COVERED BY THIS COMMITMENT. **NOT ADDRESSED AS PART OF THIS SURVEY.**
6. (A) UNPATENTED MINING CLAIMS; (B) RESERVATIONS OR EXCEPTIONS IN PATENTS OR IN ACTS AUTHORIZING THE ISSUANCE THEREOF; (C) MINERALS OF WHATSOEVER KIND, SUBSURFACE AND SURFACE SUBSTANCES, IN, ON, UNDER AND THAT MAY BE PRODUCED FROM THE LAND, TOGETHER WITH ALL RIGHTS, PRIVILEGES, AND IMMUNITIES RELATING THERETO, WHETHER OR NOT THE MATTERS EXCEPTED UNDER (A), (B) OR (C) ARE SHOWN BY THE PUBLIC RECORDS OR LISTED IN SCHEDULE B. **NOT ADDRESSED AS PART OF THIS SURVEY.**
7. WATER RIGHTS, CLAIMS OR TITLE TO WATER. **NOT ADDRESSED AS PART OF THIS SURVEY.**
8. ANY AND ALL UNPAID TAXES AND ASSESSMENTS AND ANY UNREDEEMED TAX SALES. **NOT ADDRESSED AS PART OF THIS SURVEY.**
9. THE EFFECT OF INCLUSIONS IN ANY GENERAL OR SPECIFIC WATER CONSERVANCY, FIRE PROTECTION, SOIL CONSERVATION OR OTHER DISTRICT OR INCLUSION IN ANY WATER SERVICE OR STREET IMPROVEMENT AREA. **NOT ADDRESSED AS PART OF THIS SURVEY.**
10. RIGHT OF WAY FOR COUNTY ROADS 30 FEET WIDE ON EITHER SIDE OF SECTION AND TOWNSHIP LINES, AS ESTABLISHED BY THE BOARD OF COUNTY COMMISSIONERS FOR WELD COUNTY, RECORDED OCTOBER 14, 1889 IN BOOK 86 AT PAGE 273. **SAID RIGHT OF WAY IS SHOWN HEREON TO THE BEST OF OUR KNOWLEDGE, INFORMATION AND BELIEF. SEE GENERAL NOTE NO. 5.**
11. RESERVATION OF ALL ALL COAL AND OTHER MINERALS IN INSTRUMENT RECORDED SEPTEMBER 27, 1945 IN BOOK 1162 AT PAGE 31 AS RECEPTION NO. 962824, TOGETHER WITH THE APPURTENANT RIGHTS TO USE THE SURFACE OF THE LAND. THE COMPANY MAKES NO REPRESENTATION AS TO THE PRESENT OWNERSHIP OF THIS INTEREST. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
12. AN EASEMENT FOR ELECTRIC TRANSMISSION LINE AND INCIDENTAL PURPOSES AS GRANTED TO THE UNITED STATES OF AMERICA IN INSTRUMENT RECORDED JUNE 1, 1951 IN BOOK 1304 AT PAGE 181 AS RECEPTION NO. 1108167. **SAID EASEMENT IS SHOWN HEREON TO THE BEST OF OUR KNOWLEDGE, INFORMATION AND BELIEF.**
13. GRANT OF MINERALS IN INSTRUMENT RECORDED DECEMBER 22, 1967 AS RECEPTION NO. 1511171, TOGETHER WITH THE APPURTENANT RIGHTS TO USE THE SURFACE OF THE LAND. THE COMPANY MAKES NO REPRESENTATION AS TO THE PRESENT OWNERSHIP OF THIS INTEREST. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
14. OIL AND GAS LEASE RECORDED JUNE 17, 1970 AS RECEPTION NO. 1549405.
    AMENDMENT OF OIL AND GAS LEASE RECORDED JUNE 25, 2012 AS RECEPTION NO. 3854517.
    AFFIDAVIT OF PRODUCTION RECORDED AUGUST 2, 2013 AS RECEPTION NO. 3952922. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
15. OIL AND GAS LEASE RECORDED MARCH 23, 1976 AS RECEPTION NO. 1684120.
    AMENDMENT OF OIL AND GAS LEASE RECORDED JUNE 25, 2012 AS RECEPTION NO. 3854517.
    AFFIDAVIT OF PRODUCTION RECORDED AUGUST 2, 2013 AS RECEPTION NO. 3952922. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
16. EASEMENT AS GRANTED TO PANHANDLE EASTERN PIPE LINE COMPANY IN INSTRUMENT RECORDED FEBRUARY 10, 1982 AS RECEPTION NO. 1882642. **SAID EASEMENT IS SHOWN HEREON TO THE BEST OF OUR KNOWLEDGE, INFORMATION AND BELIEF.**
17. NOTICE CONCERNING UNDERGROUND FACILITIES RECORDED JUNE 26, 1986 AS RECEPTION NO. 2058722. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
18. NOTICE CONCERNING UNDERGROUND FACILITIES OF UNITED POWER, INC., FORMERLY UNION RURAL ELECTRIC ASSOCIATION, INC. RECORDED JANUARY 24, 1991 AS RECEPTION NO. 2239296. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
19. RIGHT–OF–WAY GRANT RECORDED MAY 3, 1993 IN BOOK 1381 AT PAGE 948 AS RECEPTION NO. 2331355. **THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT DOES NOT FALL WITHIN THE SUBJECT PROPERTY.**
20. OIL AND GAS LEASE RECORDED AUGUST 2, 1995 AS RECEPTION NO. 2449610.
    AFFIDAVIT OF PRODUCTION RECORDED AUGUST 2, 2013 AS RECEPTION NO. 3952922. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
21. NOTICE OF RIGHT TO USE SURFACE OF LANDS RECORDED DECEMBER 26, 1996 IN BOOK 1583 AT PAGE 410 AS RECEPTION NO. 2526511. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
22. NOTICE OF RIGHT TO USE SURFACE OF LANDS RECORDED DECEMBER 26, 1996 IN BOOK 1583 AT PAGE 411 AS RECEPTION NO. 2526512. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
23. NOTICE OF RIGHT TO USE SURFACE OF LANDS RECORDED AUGUST 3, 1999 AS RECEPTION NO. 2711405. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
24. NOTICE OF OIL AND GAS INTERESTS AND SURFACE USE RECORDED JANUARY 23, 2001 AS RECEPTION NO. 2820923. **SAID ITEMS CONTAINED THEREIN ARE SHOWN HEREON TO THE BEST OF OUR KNOWLEDGE, INFORMATION AND BELIEF.**
25. TEMPORARY CONSTRUCTION EASEMENT AND DEED OF PERPETUAL EASEMENT RECORDED FEBRUARY 15, 2002 AS RECEPTION NO. 2925868. **THE DESCRIBED LOCATION OF THE ABOVE REFERENCED EASEMENT DOES NOT FALL WITHIN THE SUBJECT PROPERTY.**
26. TEMPORARY CONSTRUCTION EASEMENT AND DEED OF PERPETUAL EASEMENT RECORDED MARCH 28, 2002 AS RECEPTION NO. 2937484. **SAID EASEMENT IS SHOWN HEREON TO THE BEST OF OUR KNOWLEDGE, INFORMATION AND BELIEF.**
27. REQUEST FOR NOTIFICATION OF SURFACE DEVELOPMENT RECORDED MAY 28, 2002 AS RECEPTION NO. 2954714. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN A PORTION OF THE SUBJECT PROPERTY.**
28. EASEMENT GRANT RECORDED APRIL 2, 2003 AS RECEPTION NO. 3048212. **THE DESCRIBED LOCATION OF THE ABOVE REFERENCED EASEMENT DOES NOT FALL WITHIN THE SUBJECT PROPERTY.**
29. RIGHT OF WAY AND EASEMENT AS GRANTED TO THE TOWN OF ERIE IN INSTRUMENT RECORDED NOVEMBER 8, 2005 AS RECEPTION NO. 3338315. **THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT DOES NOT FALL WITHIN THE SUBJECT PROPERTY.**
30. NOTICE OF RIGHT TO USE SURFACE OF LANDS RECORDED DECEMBER 13, 2005 AS RECEPTION NO. 3346989. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
31. REQUEST FOR NOTIFICATION OF SURFACE DEVELOPMENT RECORDED APRIL 21, 2006 AS RECEPTION NO. 3381087. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
32. REQUEST FOR NOTIFICATION OF SURFACE DEVELOPMENT RECORDED OCTOBER 15, 2007 AS RECEPTION NO. 3511023. **THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT DOES NOT FALL WITHIN THE SUBJECT PROPERTY.**
33. REQUEST FOR NOTIFICATION OF SURFACE DEVELOPMENT RECORDED DECEMBER 21, 2007 AS RECEPTION NO. 3525268. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
34. RIGHT–OF–WAY GRANT RECORDED DECEMBER 9, 2011 AS RECEPTION NO. 3810941. **THE DESCRIBED LOCATION OF THE ABOVE REFERENCED RIGHT–OF–WAY DOES NOT FALL WITHIN THE SUBJECT PROPERTY.**
35. MEMORANDUM OF PURCHASE AGREEMENT RECORDED JUNE 26, 2013 AS RECEPTION NO. 3943199. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
36. ORDINANCE NO. 35–2013 RECORDED NOVEMBER 25, 2013 AS RECEPTION NO. 3980216. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
37. ORDINANCE NO. 36–2013 RECORDED NOVEMBER 25, 2013 AS RECEPTION NO. 3980217. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
38. ANY EFFECT OF INCLUSION WITHIN ERIE HIGHLANDS METROPOLITAN DISTRICT NO. 1 AS EVIDENCED BY ORDER AND DECREE RECORDED DECEMBER 2, 2013 AS RECEPTION NO. 3981397 AND NOTICE RECORDED DECEMBER 4, 2013 AS RECEPTION NO. 3981859. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
39. ANY EFFECT OF INCLUSION WITHIN ERIE HIGHLANDS METROPOLITAN DISTRICT NO. 2 AS EVIDENCED BY ORDER AND DECREE RECORDED DECEMBER 2, 2013 AS RECEPTION NO. 3981398 AND NOTICE RECORDED DECEMBER 4, 2013 AS RECEPTION NO. 3981860. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**



VICINITY MAP
SCALE: 1"=3000'

TITLE COMMITMENT NOTES - CONTINUED

40. ANY EFFECT OF INCLUSION WITHIN ERIE HIGHLANDS METROPOLITAN DISTRICT NO. 3 AS EVIDENCED BY ORDER AND DECREE RECORDED DECEMBER 2, 2013 AS RECEPTION NO. 3981399 AND NOTICE RECORDED DECEMBER 4, 2013 AS RECEPTION NO. 3981861. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
41. ANY EFFECT OF INCLUSION WITHIN ERIE HIGHLANDS METROPOLITAN DISTRICT NO. 4 AS EVIDENCED BY ORDER AND DECREE RECORDED DECEMBER 2, 2013 AS RECEPTION NO. 3981400 AND NOTICE RECORDED DECEMBER 4, 2013 AS RECEPTION NO. 3981862. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
42. ANY EFFECT OF INCLUSION WITHIN ERIE HIGHLANDS METROPOLITAN DISTRICT NO. 5 AS EVIDENCED BY ORDER AND DECREE RECORDED DECEMBER 2, 2013 AS RECEPTION NO. 3981401 AND NOTICE RECORDED DECEMBER 4, 2013 AS RECEPTION NO. 3981863. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
43. TERMS AND CONDITIONS OF UNRECORDED COMPATIBLE DEVELOPMENT AND SURFACE USE AGREEMENT DATED JULY 31, 2013, AS EVIDENCED BY MEMORANDUM OF COMPATIBLE DEVELOPMENT AND SURFACE USE AGREEMENT RECORDED DECEMBER 9, 2013 AS RECEPTION NO. 3982954. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
44. TERMINATION AND RELEASE OF ANNEXATION AGREEMENT RECORDED DECEMBER 10, 2013 AS RECEPTION NO. 3983026. **THE SETBACKS AS NOTED WITHIN THE ABOVE REFERENCED DOCUMENT AND ALSO SHOWN ON THE PLAT OF ERIE HIGHLANDS FILING NO. 1, ARE SHOWN HEREON TO THE BEST OF OUR KNOWLEDGE, INFORMATION AND BELIEF.**
45. GRANT OF PERMANENT AVIGATION EASEMENT AGREEMENT RECORDED DECEMBER 16, 2013 AS RECEPTION NO. 3984166. **THE EASEMENT AS DESCRIBED IN THE ABOVE REFERENCED EASEMENT IS BLANKET IN NATURE AND THEREFORE COULD NOT BE SHOWN HEREON. IT WAS DETERMINED THAT THE ABOVE REFERENCED EASEMENT DOES FALL WITHIN THE SUBJECT PROPERTY.**
46. ALL MATTERS AS SHOWN ON ALTA/ACSM LAND TITLE SURVEY RECORDED FEBRUARY 4, 2014 AS RECEPTION NO. 3993955. **ALL VISIBLE SITE IMPROVEMENTS AND EASEMENTS OF RECORD THAT FALL WITHIN THE SUBJECT PROPERTY ARE SHOWN HEREON.**
47. DECLARATION OF COVENANTS, CONDITIONS AND RESTRICTIONS FOR ERIE HIGHLANDS RECORDED JULY 21, 2014 AS RECEPTION NO. 4032135 AND FIRST AMENDMENT THERETO RECORDED APRIL 3, 2015 AS RECEPTION NO. 4095671. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE "INCLUDIBLE AREA" WITHIN THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
48. ALL MATTERS AS SHOWN ON ERIE HIGHLANDS ZONING MAP RECORDED SEPTEMBER 10, 2014 AS RECEPTION NO. 4044913. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
49. ALL MATTERS AS SHOWN ON ERIE HIGHLANDS PUD ZONING MAP RECORDED SEPTEMBER 10, 2014 AS RECEPTION NO. 4044914. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
50. ALL MATTERS AS SHOWN ON THE PLAT OF ERIE HIGHLANDS FILING NO. 1 RECORDED SEPTEMBER 10, 2014 AS RECEPTION NO. 4044915. **THE EASEMENTS AS SHOWN ON SAID PLAT OF ERIE HIGHLANDS FILING NO. 1 ARE SHOWN HEREON TO THE BEST OF OUR KNOWLEDGE, INFORMATION AND BELIEF.**
51. ERIE HIGHLANDS PROPERTY VESTED RIGHTS DEVELOPMENT AGREEMENT RECORDED SEPTEMBER 10, 2014 AS RECEPTION NO. 4044916. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
52. ERIE HIGHLANDS PROPERTY MASTER PRE–DEVELOPMENT AGREEMENT RECORDED SEPTEMBER 10, 2014 AS RECEPTION NO. 4044917. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
53. ERIE HIGHLANDS FILING NO. 1 DEVELOPMENT AGREEMENT RECORDED SEPTEMBER 10, 2014 AS RECEPTION NO. 4044918. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE "ERIE HIGHLANDS TAKEDOWN NO. 1" PARCEL AS LISTED IN THE ABOVE REFERENCED DOCUMENT DOES NOT FALL WITHIN THE SUBJECT PROPERTY.**
54. ENCROACHMENT LICENSE AGREEMENT RECORDED SEPTEMBER 10, 2014 AS RECEPTION NO. 4044919. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT DOES NOT FALL WITHIN THE SUBJECT PROPERTY.**
55. ERIE HIGHLANDS METROPOLITAN DISTRICT NO. 1 PUBLIC DISCLOSURE STATEMENT RECORDED OCTOBER 1, 2014 AS RECEPTION NO. 4050502. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
56. ERIE HIGHLANDS METROPOLITAN DISTRICT NO. 2 PUBLIC DISCLOSURE STATEMENT RECORDED OCTOBER 1, 2014 AS RECEPTION NO. 4050503. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
57. ERIE HIGHLANDS METROPOLITAN DISTRICT NO. 3 PUBLIC DISCLOSURE STATEMENT RECORDED OCTOBER 1, 2014 AS RECEPTION NO. 4050504. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
58. ERIE HIGHLANDS METROPOLITAN DISTRICT NO. 4 PUBLIC DISCLOSURE STATEMENT RECORDED OCTOBER 1, 2014 AS RECEPTION NO. 4050505. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
59. ERIE HIGHLANDS METROPOLITAN DISTRICT NO. 5 PUBLIC DISCLOSURE STATEMENT RECORDED OCTOBER 1, 2014 AS RECEPTION NO. 4050506. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN THE SUBJECT PROPERTY.**
60. INTERGOVERNMENTAL AGREEMENT BETWEEN THE TOWN OF ERIE COLORADO AND ERIE HIGHLANDS METROPOLITAN DISTRICT NOS. 1–5 RECORDED NOVEMBER 20, 2014 AS RECEPTION NO. 4063179. **NOT ADDRESSED AS PART OF THIS SURVEY.**
61. SURFACE USE AGREEMENT RECORDED AUGUST 1, 2013 AS RECEPTION NO. 3952706. **THE SETBACKS AS NOTED WITHIN THE ABOVE REFERENCED DOCUMENT AND ALSO SHOWN ON THE PLAT OF ERIE HIGHLANDS FILING NO. 1, ARE SHOWN HEREON TO THE BEST OF OUR KNOWLEDGE, INFORMATION AND BELIEF.**
62. ORDER FOR INCLUSION OF LANDS WITHIN THE BOUNDARIES OF THE MUNICIPAL SUBDISTRICT, NORTHERN COLORADO WATER CONSERVANCY DISTRICT RECORDED DISTRICT RECORDED DECEMBER 1, 2014 AS RECEPTION NO. 4065129. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN A PORTION OF SUBJECT PROPERTY.**
63. ORDER FOR INCLUSION OF LANDS WITHIN THE BOUNDARIES OF THE NORTHERN COLORADO WATER CONSERVANCY DISTRICT RECORDED DECEMBER 4, 2014 AS RECEPTION NO. 4066298. **THIS ITEM WAS NOT ADDRESSED OTHER THAN TO IDENTIFY THAT THE DESCRIBED LOCATION OF THE ABOVE REFERENCED DOCUMENT FALLS WITHIN A PORTION OF SUBJECT PROPERTY.**

LEGAL DESCRIPTION

(PER STEWART TITLE GUARANTY COMPANY TITLE COMMITMENT FILE NO. 01330–61208)

A PORTION OF TRACT J, ERIE HIGHLANDS FILING NO. 1, AS RECORDED ON SEPTEMBER 10, 2014, AT RECEPTION NO. 4044915 OF THE RECORDS OF THE WELD COUINTY CLERK AND RECORDERS OFFICE, SITUATED IN THE NORTHWEST QUARTER OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE WEST QUARTER CORNER OF SAID SECTION 20 AND CONSIDERING THE NORTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 20 TO BEAR NORTH 88°48'39" EAST, WITH ALL BEARINGS CONTAINED HEREIN RELATIVE THERETO;

THENCE ALONG THE WEST LINE OF SAID NORTHWEST QUARTER, NORTH 00°21'43" WEST, A DISTANCE OF 974.96 FEET;

THENCE DEPARTING SAID SECTION LINE, NORTH 89°38'17" EAST, A DISTANCE OF 202.88 FEET TO THE BEGINNING OF A NON–TANGENT CURVE CONCAVE SOUTHEASTERLY HAVING A RADIUS OF 150.00 FEET, THE RADIUS POINT OF SAID CURVE BEARS SOUTH 54°25'57" EAST;

THENCE NORTHEASTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 57°07'55", AN ARC LENGTH OF 149.57 FEET;

THENCE NON–TANGENT TO SAID CURVE NORTH 00°23'47" WEST, A DISTANCE OF 29.61 FEET;

THENCE NORTH 89°47'21" EAST, A DISTANCE OF 736.93 FEET;

THENCE NORTH 00°12'39" WEST, A DISTANCE OF 110.00 FEET;

THENCE NORTH 89°47'21" EAST, A DISTANCE OF 960.32 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE SOUTHWESTERLY HAVING A RADIUS OF 20.00 FEET;

THENCE SOUTHEASTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 87°50'43", AN ARC LENGTH OF 30.66 FEET TO THE BEGINNING OF A REVERSE CURVE CONCAVE NORTHEASTERLY HAVING A RADIUS OF 435.00 FEET;

THENCE SOUTHEASTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 88°35'56", AN ARC LENGTH OF 672.66 FEET;

THENCE TANGENT TO SAID CURVE NORTH 89°02'08" EAST, A DISTANCE OF 97.70 FEET;

THENCE SOUTH 00°56'35" EAST, A DISTANCE OF 709.11 FEET TO A POINT ON THE SOUTH LINE OF SAID NORTHWEST QUARTER;

THENCE ALONG SAID SOUTH LINE, SOUTH 89°05'29" WEST, A DISTANCE OF 2,594.12 FEET TO THE POINT OF BEGINNING.

GENERAL NOTES

1. THE FIELD WORK FOR THIS SURVEY WAS PERFORMED BY AN AZTEC CONSULTANTS, INC. SURVEY CREW AND COMPLETED ON MAY 15, 2015.
2. PER C.R.S. 38–51–106, "ALL LINEAL UNITS DEPICTED ON THIS LAND SURVEY PLAT ARE U.S. SURVEY FEET. ONE METER EQUALS 39.37/12 U.S. SURVEY FEET, EXACTLY ACCORDING TO THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY."
3. THIS SURVEY DOES NOT CERTIFY TO SUBSURFACE FEATURES, IMPROVEMENTS, UTILITIES OR BURIED LINES OF ANY TYPE, LOCATION DEPICTED HEREON ARE DERIVED FROM FIELD SURVEY OF UTILITY FLAGGING / PAINT MARKING, PERFORMED BY DIVERSIFIED UNDERGROUND, INC. ON JULY 09, 2014.
4. THE SURVEYED PARCEL CONTAINS A TOTAL OF 61.289 ACRES OR 2,669,738 SQUARE FEET, MORE OR LESS.
5. EXCEPTION #10 OF THE TITLE COMMITMENT NOTED HEREON DESCRIBES RIGHT–OF–WAY FOR COUNTY ROADS 30 FEET ON EITHER SIDE OF SECTION AND TOWNSHIP LINES, AS ESTABLISHED BY THE BOARD OF COUNTY COMMISSIONERS FOR WELD COUNTY, RECORDED OCTOBER 14, 1889, IN BOOK 86 AT PAGE 273. PREVIOUS SURVEYS HAVE STATED THAT: IT IS WELD COUNTY'S OPINION THAT SAID DOCUMENT DID NOT DEDICATE RIGHTS–OF–WAY, BUT INSTEAD, RESERVED THE LAND FOR FUTURE DEDICATION. IT IS WELD COUNTY'S CURRENT OPINION THAT THE FEE OWNERSHIP IN THE LAND UNDERLYING EXISTING ROAD REMAINS WITH THE OWNER, AND WHERE ROADWAYS DO EXIST, THERE ARE POSSIBLE ROADWAY USE EASEMENTS OR POSSIBLY "PRESCRIPTIVE RIGHTS".
6. THERE WAS OBSERVED EVIDENCE OF CURRENT EARTH MOVING WORK, BUILDING CONSTRUCTION OF BUILDING ADDITIONS AT THE TIME OF THIS SURVEY.
7. THERE WAS NO OBSERVED EVIDENCE OF SITE USE AS A SOLID WASTE DUMP, SUMP OR SANITARY LANDFILL.
8. THE SUBJECT PARCEL'S PURPORTED ADDRESS IS TR J ERIE HIGHLANDS, ERIE CO 80516, PER PROVIDED TITLE COMMITMENT.
9. ALL REFERENCES HEREON TO BOOKS, PAGES, MAPS AND RECEPTION NUMBERS ARE PUBLIC DOCUMENTS RECORDED IN WELD COUNTY, COLORADO, CLERK AND RECORDER'S OFFICE.
10. NO BUILDINGS EXIST ON THE SUBJECT PROPERTY.
11. THERE ARE NO VISIBLE PHYSICAL IMPROVEMENTS ON THE SUBJECT PROPERTY. THE SITE IS LOCATED WITHIN A RESIDENTIAL CONSTRUCTION PROJECT.

BASIS OF BEARINGS

THE BEARINGS SHOWN HEREON ARE BASED UPON THE NORTH LINE OF THE NORTHWEST QUARTER OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, COUNTY OF WELD, STATE OF COLORADO, ASSUMED TO BEAR SOUTH 88°48'39" WEST, A DISTANCE OF 2648.08 FEET BETWEEN FOUND MONUMENTS AS SHOWN HEREON.

FLOOD ZONE

FLOODPLAIN: BASED ON A GRAPHICAL REPRESENTATION OF FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) FLOOD INSURANCE RATE MAP (FIRM) MAP NO. 08013C0441J, PANEL 441 OF 615, DATED DECEMBER 18, 2012. THE SUBJECT PROPERTY LIES WITHIN "ZONE X", BEING DEFINED AS "OTHER AREAS ... DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN".

SURVEYOR'S STATEMENT

TO: J DEARMIN, LLC, A COLORADO LIMITED LIABILITY COMPANY; J GAZ, LLC, A COLORADO LIMITED LIABILITY COMPANY; WY&K HOLDINGS, LLC, A COLORADO LIMITED LIABILITY COMPANY; JACK SHELL FAMILY TRUST AND SONJA SHELL FAMILY TRUST; OAKWOOD HOMES, LLC, A COLORADO LIMITED LIABILITY COMPANY; STEWART TITLE GUARANTY COMPANY:

THIS IS TO CERTIFY THAT THIS MAP OR PLAT AND THE SURVEY ON WHICH IT IS BASED WERE MADE IN ACCORDANCE WITH THE 2011 MINIMUM STANDARD DETAIL REQUIREMENTS FOR ALTA/ACSM LAND TITLE SURVEYS, JOINTLY ESTABLISHED AND ADOPTED BY ALTA AND NSPS, AND INCLUDES ITEMS 1–4, 8, 11(B), 13, 16, AND 18 OF TABLE A THEREOF. THE FIELD WORK WAS COMPLETED ON MAY 15, 2015.

DATE OF PLAT OR MAP: 06/30/2015

DEREK S. BROWN, PLS NO. 38064
COLORADO LICENSED PROFESSIONAL LAND SURVEYOR
FOR AND ON BEHALF OF AZTEC CONSULTANTS, INC.

COLORADO LICENSED PROFESSIONAL LAND SURVEYOR DEREK S. BROWN 38064 — FOR REVIEW

STATUTE OF LIMITATIONS

NOTICE: ACCORDING TO COLORADO LAW YOU MUST COMMENCE ANY LEGAL ACTION BASED UPON ANY DEFECT IN THIS SURVEY WITHIN THREE YEARS AFTER YOU FIRST DISCOVER SUCH DEFECT. IN NO EVENT MAY ANY ACTION BASED UPON ANY DEFECT IN THIS SURVEY BE COMMENCED MORE THAN TEN YEARS FROM THE DATE OF THE CERTIFICATION SHOWN HEREON.

INDEXING STATEMENT

DEPOSITED THIS _______ DAY OF _______________, 20____, AT

_________, M., IN BOOK ______________ OF THE COUNTY SURVEYOR'S

LAND SURVEY/RIGHT–OF–WAY SURVEYS AT PAGE(S) ____________,

RECEPTION NUMBER________________________,

____
COUNTY SURVEYOR/DEPUTY COUNTY SURVEYOR

SCALE	CKD	DWG	DATE
NA	DSB	JFT	06/30/2015

DATE	BY	REVISION DESCRIPTION	APP'V	DATE

AZTEC CONSULTANTS, INC.
300 East Mineral Ave., Suite 1
Littleton, Colorado 80122
Phone: (303) 713-1898
Fax: (303) 713-1897
www.aztecconsultants.com

ALTA/ACSM LAND TITLE SURVEY
A PORTION OF TRACT J, ERIE HIGHLANDS FILING NO. 1
TOWN OF ERIE, WELD COUNTY, COLORADO

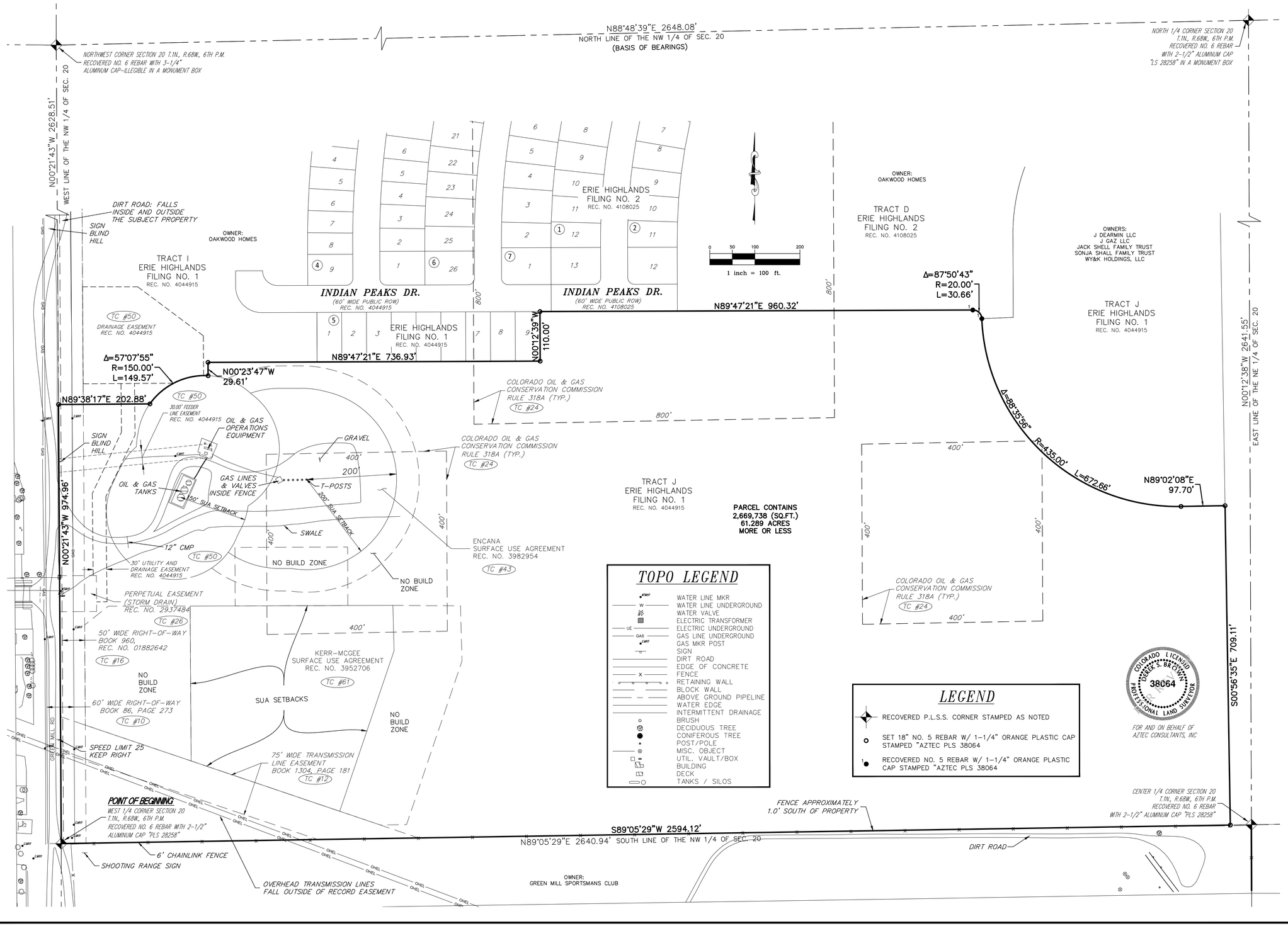
PREPARED FOR
OAKWOOD HOMES
4908 TOWER ROAD, DENVER, CO 80249

SHEET ONE OF 2 SHEETS

JOB NO. 19315-17

ALTA/ACSM LAND TITLE SURVEY

A PORTION OF TRACT J, ERIE HIGHLANDS FILING NO. 1,
LOCATED IN THE NORTHWEST QUARTER OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN,
TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO.
SHEET 2 OF 2



TOPO LEGEND

- WATER LINE MKR
- WATER LINE UNDERGROUND
- WATER VALVE
- ELECTRIC TRANSFORMER
- ELECTRIC UNDERGROUND
- GAS LINE UNDERGROUND
- GAS MKR POST
- SIGN
- DIRT ROAD
- EDGE OF CONCRETE
- FENCE
- RETAINING WALL
- BLOCK WALL
- ABOVE GROUND PIPELINE
- WATER EDGE
- INTERMITTENT DRAINAGE
- BRUSH
- DECIDUOUS TREE
- CONIFEROUS TREE
- POST/POLE
- MISC. OBJECT
- UTIL. VAULT/BOX
- BUILDING
- DECK
- TANKS / SILOS

LEGEND

- RECOVERED P.L.S.S. CORNER STAMPED AS NOTED
- SET 18" NO. 5 REBAR W/ 1-1/4" ORANGE PLASTIC CAP STAMPED "AZTEC PLS 38064
- RECOVERED NO. 5 REBAR W/ 1-1/4" ORANGE PLASTIC CAP STAMPED "AZTEC PLS 38064

SCALE	DWG	DATE
NA	JFT	06/30/2015
	DSB	

DATE	BY	REVISION DESCRIPTION	APPV	DATE

AZTEC CONSULTANTS, INC.
300 East Mineral Ave., Suite 1
Littleton, Colorado 80122
Phone: (303) 713-1898
Fax: (303) 713-1897
www.aztecconsultants.com

ALTA/ACSM LAND TITLE SURVEY
A PORTION OF TRACT J, ERIE HIGHLANDS FILING NO. 1
TOWN OF ERIE, WELD COUNTY, COLORADO

PREPARED FOR
OAKWOOD HOMES
4908 TOWER ROAD, DENVER, CO 80249

SHEET TWO OF 2 SHEETS

19315-17
JOB NO.

ERIE HIGHLANDS- PA 5, 6 & 14
SKETCH PLAN

A PART OF THE NORTH HALF OF SECTION 20,
TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN
TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO
101.7 ACRES- 242 LOTS/15 TRACTS
SK-000676-2015

LEGAL DESCRIPTION:

A PORTION OF TRACT L, ERIE HIGHLANDS FILING NO. 1, AS RECORDED ON SEPTEMBER 10, 2014, AT RECEPTION NO. 4044915 OF THE RECORDS OF THE WELD COUINTY CLERK AND RECORDERS OFFICE, SITUATED IN THE NORTH HALF OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE CENTER QUARTER OF SAID SECTION 20 AND CONSIDERING THE NORTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 20 TO BEAR NORTH 88°48'39" EAST, WITH ALL BEARINGS CONTAINED HEREIN RELATIVE THERETO;

THENCE ALONG THE SOUTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 20 SOUTH 89°05'29" WEST, A DISTANCE OF 46.82 FEET TO THE SOUTHWEST CORNER OF SAID TRACT L;

THENCE ALONG THE SOUTHWESTERLY BOUNDARY OF SAID TRACT L NORTH 00°56'35" WEST, A DISTANCE OF 709.11 FEET;

THENCE DEPARTING SAID NORTH 89°02'08" EAST, A DISTANCE OF 83.93 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE NORTHWESTERLY HAVING A RADIUS OF 435.00 FEET;

THENCE NORTHEASTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 86°17'38", AN ARC LENGTH OF 655.16 FEET;

THENCE NON-TANGENT TO SAID CURVE, NORTH 00°38'58" WEST, A DISTANCE OF 88.63 FEET;

THENCE NORTH 88°48'39" EAST, A DISTANCE OF 326.44 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE NORTHERLY HAVING A RADIUS OF 440.00 FEET;

THENCE EASTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 23°50'36", AN ARC LENGTH OF 183.10 FEET;

THENCE TANGENT TO SAID CURVE NORTH 64°58'03" EAST, A DISTANCE OF 189.11 FEET;

THENCE SOUTH 24°54'48" EAST, A DISTANCE OF 34.89 FEET TO THE BEGINNING OF A NON-TANGENT CURVE CONCAVE WESTERLY HAVING A RADIUS OF 1,135.00 FEET, THE RADIUS POINT OF SAID CURVE BEARS SOUTH 81°41'06" WEST;

THENCE SOUTHERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 31°45'48", AN ARC LENGTH OF 629.21 FEET;

THENCE NON-TANGENT TO SAID CURVE SOUTH 89°58'19" EAST, A DISTANCE OF 128.21 FEET TO THE NORTHWEST CORNER OF A PARCEL RECORDED IN BOOK 814, PAGE 251, IN SAID RECORDS;

THENCE ALONG THE WESTERLY BOUNDARY OF SAID PARCEL, SOUTH 11°04'31" EAST, A DISTANCE OF 125.00 FEET;

THENCE ALONG THE SOUTHERLY BOUNDARY OF SAID PARCEL AND THE SOUTHERLY BOUNDARY OF THAT PARCEL OF LAND RECORDED IN BOOK 509 AT PAGE 79, IN SAID RECORDS, NORTH 78°55'29" EAST, A DISTANCE OF 994.76 FEET TO THE SOUTHEAST CORNER OF SAID PARCEL RECORDED IN BOOK 509, PAGE 79, ALSO BEING A POINT ON THE WESTERLY BOUNDARY OF A PARCEL RECORDED IN BOOK 1179, PAGE 541, IN SAID RECORDS;

THENCE ALONG SAID WESTERLY BOUNDARY SOUTH 00°00'25" WEST, A DISTANCE OF 76.02 FEET TO THE NORTHEAST CORNER OF A PARCEL RECORDED AT RECEPTION NO. 1983198, IN SAID RECORDS;

THENCE DEPARTING SAID WESTERLY BOUNDARY AND ALONG THE NORTHERLY AND WESTERLY BOUNDARIES OF SAID PARCEL RECORDED AT RECEPTION NO. 1983198 THE FOLLOWING TWO (2) COURSES:

1) SOUTH 89°05'08" WEST, A DISTANCE OF 225.15 FEET;

2) SOUTH 00°00'21" WEST, A DISTANCE OF 650.47 FEET TO A POINT ON THE SOUTH LINE OF SAID NORTHEAST QUARTER;

THENCE DEPARTING SAID WESTERLY BOUNDARY, ALONG SAID SOUTH LINE SOUTH 89°05'07" WEST, A DISTANCE OF 1,962.78 FEET TO THE **POINT OF BEGINNING**.

CONTAINING AN AREA OF 40.421 ACRES, (1,760,742 SQUARE FEET), MORE OR LESS

A PORTION OF TRACT J, ERIE HIGHLANDS FILING NO. 1, AS RECORDED ON SEPTEMBER 10, 2014, AT RECEPTION NO. 4044915 OF THE RECORDS OF THE WELD COUINTY CLERK AND RECORDERS OFFICE, SITUATED IN THE NORTHWEST QUARTER OF SECTION 20, TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN, TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO, BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS:

BEGINNING AT THE WEST QUARTER CORNER OF SAID SECTION 20 AND CONSIDERING THE NORTH LINE OF THE NORTHWEST QUARTER OF SAID SECTION 20 TO BEAR NORTH 88°48'39" EAST, WITH ALL BEARINGS CONTAINED HEREIN RELATIVE THERETO;

THENCE ALONG THE WEST LINE OF SAID NORTHWEST QUARTER, NORTH 00°21'43" WEST, A DISTANCE OF 974.96 FEET;

THENCE DEPARTING SAID SECTION LINE, NORTH 89°38'17" EAST, A DISTANCE OF 202.88 FEET TO THE BEGINNING OF A NON-TANGENT CURVE CONCAVE SOUTHEASTERLY HAVING A RADIUS OF 150.00 FEET, THE RADIUS POINT OF SAID CURVE BEARS SOUTH 54°25'57" EAST;

THENCE NORTHEASTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 57°07'55", AN ARC LENGTH OF 149.57 FEET;

THENCE NON-TANGENT TO SAID CURVE NORTH 00°23'47" WEST, A DISTANCE OF 29.61 FEET;

THENCE NORTH 89°47'21" EAST, A DISTANCE OF 736.93 FEET;

THENCE NORTH 00°12'39" WEST, A DISTANCE OF 110.00 FEET;

THENCE NORTH 89°47'21" EAST, A DISTANCE OF 960.32 FEET TO THE BEGINNING OF A TANGENT CURVE CONCAVE SOUTHWESTERLY HAVING A RADIUS OF 20.00 FEET;

THENCE SOUTHEASTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 87°50'43", AN ARC LENGTH OF 30.66 FEET TO THE BEGINNING OF A REVERSE CURVE CONCAVE NORTHEASTERLY HAVING A RADIUS OF 435.00 FEET;

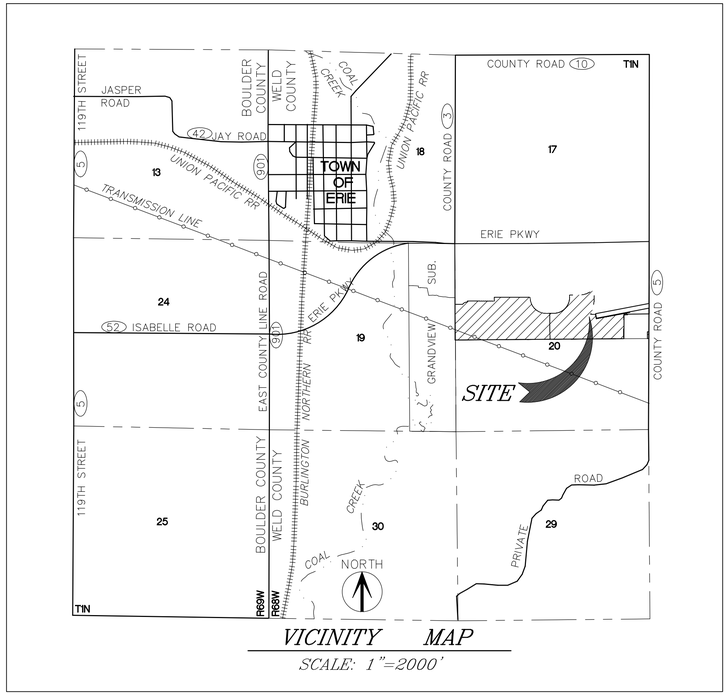
THENCE SOUTHEASTERLY ALONG SAID CURVE THROUGH A CENTRAL ANGLE OF 88°35'56", AN ARC LENGTH OF 672.66 FEET;

THENCE TANGENT TO SAID CURVE NORTH 89°02'08" EAST, A DISTANCE OF 97.70 FEET;

THENCE SOUTH 00°56'35" EAST, A DISTANCE OF 709.11 FEET TO A POINT ON THE SOUTH LINE OF SAID NORTHWEST QUARTER;

THENCE ALONG SAID SOUTH LINE, SOUTH 89°05'29" WEST, A DISTANCE OF 2,594.12 FEET TO THE **POINT OF BEGINNING**.

CONTAINING AN AREA OF 61.289 ACRES, (2,669,738 SQUARE FEET), MORE OR LESS.



APPLICANT	OWNER	OWNER	OWNER	OWNER	PLANNER	ENGINEER
OAKWOOD HOMES LLC	J DEARMIN LLC	J GAZ LLC	THE JACK SHELL & SONYA SHELL	WY&K HOLDINGS, LLC	TERRACINA DESIGN	CORE CONSULTANTS
4908 TOWER ROAD	10343 FEDERAL BOULEVARD	4955 WEST 65TH AVENUE	FAMILY TRUSTS	28221 HIDDEN VILLAGE DRIVE	10200 E. GIRARD AVE, A-314	1950 WEST LITTLETON BLVD., SUITE 109
DENVER, CO 80249	UNIT 515	ARVADA, CO 80003	10015 MEADE COURT	EVERGREEN, CO 80439	DENVER, CO 80231	LITTLETON, COLORADO 80120
(303) 486-8500	WESTMINSTER, CO 80260	CONTACT: JOHNNY GAZ	WESTMINSTER, CO 80031	CONTACT: ROBERT E. YOULE	(303) 632-8867	(303)709-4680
CONTACT: JOHN CHENEY	CONTACT: JAMES DEARMIN		CONTACT: JACK SHELL		CONTACT: LAYLA ROSALES	CONTACT: DAVID FORBES

SHEET INDEX

1	COVER
2	LAND USE PLAN
3	OPEN SPACE PLAN
4-5	DETAILED SITE PLAN

terracina design
10200 East Girard Ave, A-314
Denver, CO 80231
ph: 303.632.8867

PROJECT NAME

ERIE HIGHLANDS- PA 5,6 & 14
SKETCH PLAN
TOWN OF ERIE, COLORADO

SHEET TITLE

COVER SHEET

SHEET NUMBER

1

SHEET 1 OF 5

AUGUST 3, 2015

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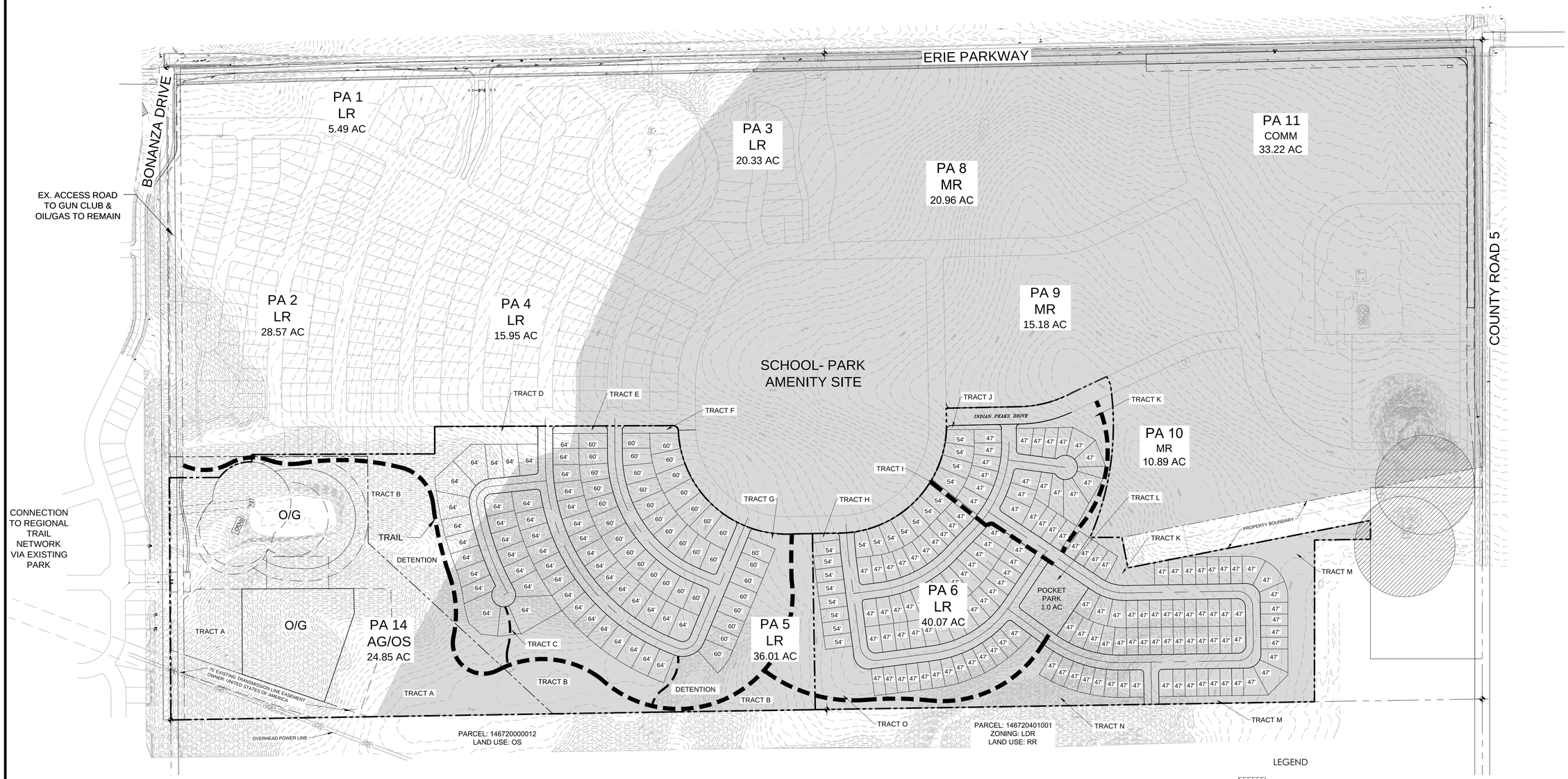
ERIE HIGHLANDS- PA 5, 6 & 14
SKETCH PLAN

A PART OF THE NORTH HALF OF SECTION 20,
TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN
TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO
101.7 ACRES- 242 LOTS/15 TRACTS
SK-000676-2015



DWELLING UNIT SUMMARY CHART

FILING/PA	UNITS	FILING/PA AREA (AC)	UNITS/ACRE
PA14	0	24.85	0.0
PA5	86	36.01	2.4
PA6	157	40.07	3.9

*LDR zoning district requires 2-6 DU/ACRE.

DEVELOPMENT SUMMARY

LAND USE	ACRES	% ACRES	UNITS	% UNITS	DU /AC
SINGLE FAMILY RESIDENTIAL	54.3	53.4%			
PARK HOUSE (47'X110') MIN. 47'			138	56.8%	
RANCH HOUSE (54'X110') MIN. 54'			19	7.8%	
RANCH HOUSE (60'X110') MIN. 60'			38	15.6%	
OVERLOOK (64'X110') MIN. 64'			48	19.8%	
PUBLIC OPEN SPACE (PA 5, PA 6 & PA 14-A)	31.0	30.5%			
PRIVATE OPEN SPACE	6.4	6.3%			
POCKET PARK	1.0	1.0%			
OIL AND GAS FACILITY	9.0	8.8%			
TOTAL	**101.7**	**100.0%**	**243**	**100.0%**	**2.4**

LEGEND
- UNDERMINING - SIGNIFICANT RISK
- UNDERMINING - LOW RISK
- TRAIL
- EXISTING MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- 8% OR GREATER SLOPES
- PARCEL BOUNDARY

NORTH

Scale: 1"=200'
0 100 200 400

terracina design
10200 East Girard Ave, A-314
Denver, CO 80231
ph: 303.632.8867

PROJECT NAME

ERIE HIGHLANDS- PA 5,6 & 14
SKETCH PLAN
TOWN OF ERIE, COLORADO

SHEET TITLE

LAND USE PLAN

SHEET NUMBER

2

SHEET 2 OF 5

AUGUST 3, 2015

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ERIE HIGHLANDS- PA 5, 6 & 14
SKETCH PLAN

A PART OF THE NORTH HALF OF SECTION 20,
TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN
TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO
101.7 ACRES- 242 LOTS/15 TRACTS
SK-000676-2015

ADJACENT PROPERTY:
COLLIERS HILLS
ZONING: LR
LAND USE: LDR

ERIE PARKWAY

BONANZA DRIVE

EX. ACCESS ROAD
TO GUN CLUB &
OIL/GAS TO REMAIN

ADJACENT PROPERTY:
GRANDVIEW SUBDIVISION
ZONING: PD
LAND USE: MDR

PA 1
LR
5.49 AC

PA 2
LR
28.57 AC

PA 3
LR
20.33 AC

PA 4
LR
15.95 AC

PA 8
MR
20.96 AC

PA 11
COMM
33.22 AC

PLI
SCHOOL- PARK
AMENITY SITE

PA 9
MR
15.18 AC

COUNTY ROAD 5

ADJACENT PROPERTY:
PARCEL: 146721300035
ZONING: RP 3
LAND USE: LDR & MU

TRACT D
TRACT E
TRACT F
TRACT J
INDIAN PEAKS DRIVE
TRACT K

PA 10
MR
10.89 AC

PA 14-B
AG/OS

TRACT I
TRACT G
TRACT H
TRACT L
TRACT K
PROPERTY BOUNDARY
TRACT M

CONNECTION
TO REGIONAL
TRAIL
NETWORK
VIA EXISTING
PARK

TRACT B
O/G
TRAIL
DETENTION

PA 6
LR
40.07 AC

POCKET
PARK
1.0 AC

TRACT A
O/G

PA 14
AG/OS
24.85 AC

TRACT C
TRACT B
TRACT A
DETENTION
TRACT B

PA 5
LR
36.01 AC

75' EXISTING TRANSMISSION LINE EASEMENT
OWNER: UNITED STATES OF AMERICA

OVERHEAD POWER LINE

TRACT O
TRACT N
TRACT M

ADJACENT PROPERTY:
PARCEL: 146720000012
LAND USE: OS

ADJACENT PROPERTY:
PARCEL: 146720401001
ZONING: LDR
LAND USE: RR

OPEN SPACE DATA				
PUD	**ACRES**		**PROPOSED**	**ACRES**
PA 2	2.39		PA 2	2.39
PA 5	13.72		PA 5	13.92
PA 6	2.74		PA 6	3.39
PA 14	13.77		PA 14-A	13.18
			PA 14-B	0.5
TOTAL	32.62		**TOTAL**	33.38

LEGEND
- PUBLIC OPEN SPACE - APPROVED PUD
- PUBLIC OPEN SPACE - PROPOSED
- TRAIL

NORTH

Scale: 1"=200'
0 100 200 400

terracina design
10200 East Girard Ave, A-314
Denver, CO 80231
ph: 303.632.8867

PROJECT NAME

ERIE HIGHLANDS- PA 5,6 & 14
SKETCH PLAN
TOWN OF ERIE, COLORADO

SHEET TITLE

OPEN SPACE PLAN

SHEET NUMBER

3

SHEET 3 OF 5

AUGUST 3, 2015

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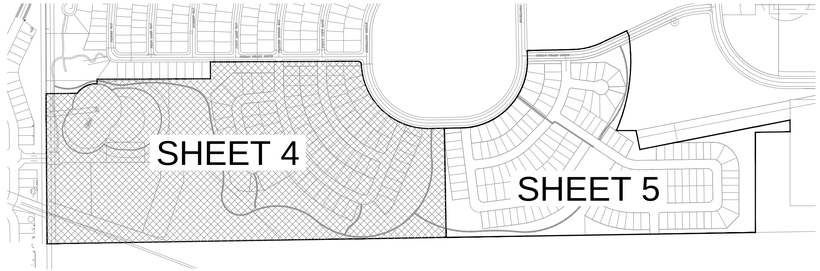
KEYMAP:



ERIE HIGHLANDS- PA 5, 6 & 14
SKETCH PLAN

A PART OF THE NORTH HALF OF SECTION 20,
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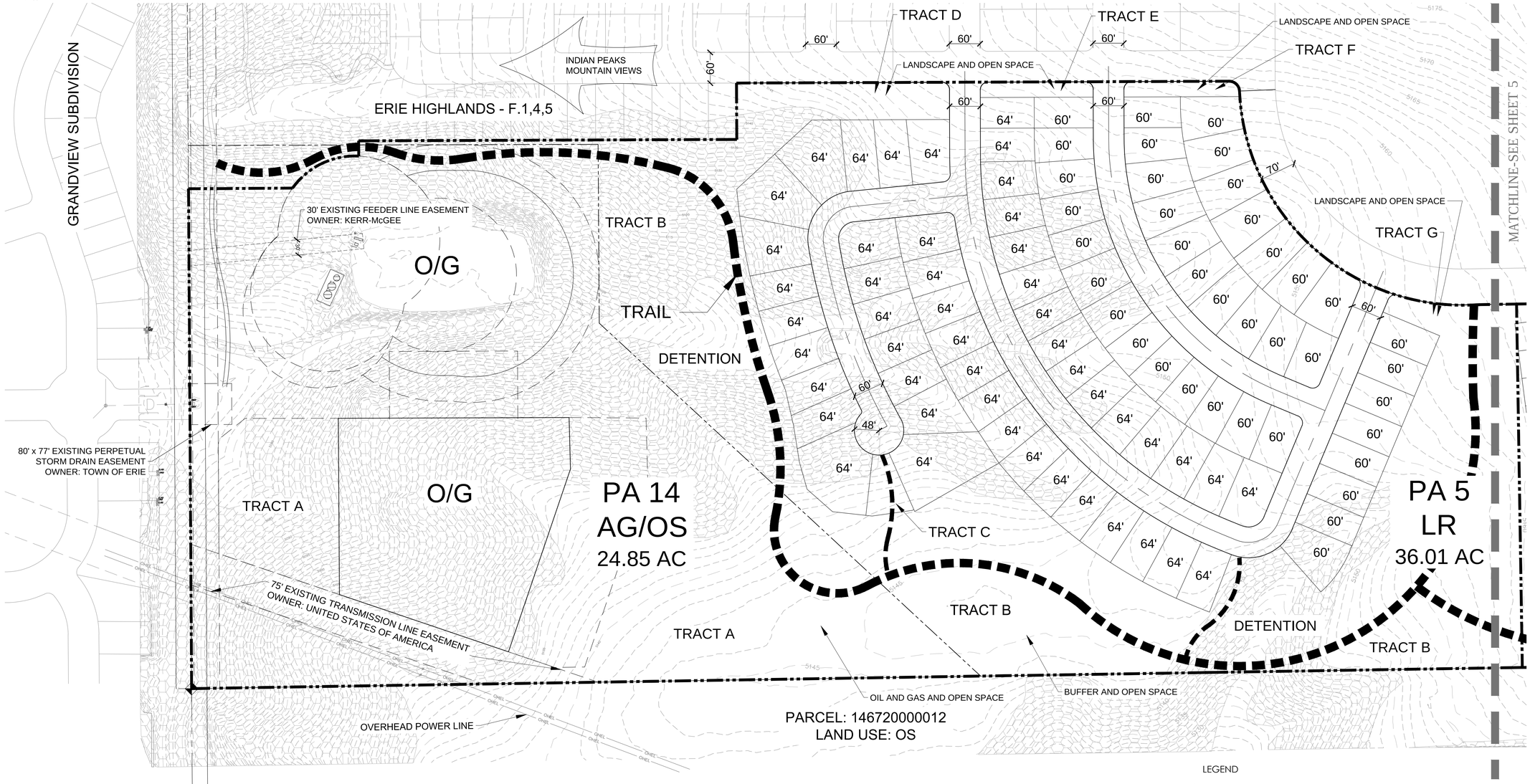


PA 5 LAND SUMMARY CHART

TYPE	AREA (AC)	% OF TOTAL AREA	LOTS	DU/AC
RESIDENTIAL UNITS	17.05	46.8%	86	2.4
TRACTS	14.85	40.8%		
PUBLIC ROW	4.54	12.5%		
TOTAL	**36.44**	**100.0%**		

*PA 14 is an open space tract encumbered by Oil + Gas and owned and maintained by the Erie Highlands Metro District.

PA 5 & 14 TRACT SUMMARY CHART

TRACT	AREA (SF)	USE	OWNERSHIP	MAINTENANCE
A	578,993.3	OIL AND GAS AND OPEN SPACE	EHMD	EHMD
B	602,514.1	BUFFER AND OPEN SPACE	EHMD	EHMD
C	7,351.1	LANDSCAPE AND OPEN SPACE	EHMD	EHMD
D	18,076.1	LANDSCAPE AND OPEN SPACE	EHMD	EHMD
E	6,503.4	LANDSCAPE AND OPEN SPACE	EHMD	EHMD
F	6,628.1	LANDSCAPE AND OPEN SPACE	EHMD	EHMD
G	5,340.4	LANDSCAPE AND OPEN SPACE	EHMD	EHMD

*EHMD - ERIE HIGHLANDS METRO DISTRICT

NOTES:

- 8' PROPOSED UTILITY EASEMENT ALONG BACK OF LOTS.
- 6' PROPOSED UTILITY EASEMENT ALONG ROAD RIGHT-OF-WAY.
- EXISTING GRADES ARE SHOWN AT A 1' INTERVAL
- THERE ARE NO EXISTING FLOODPLAINS, WETLANDS, OR WATER COURSES ON SITE.

LEGEND

- 64' OVERLOOK PRODUCT (64' x 110' MIN. LOT SIZE)
- 60' RANCH HOUSE PRODUCT (60' x 110' MIN. LOT SIZE)
- TRAIL
- EXISTING MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- 8% OR GREATER SLOPES
- PARCEL BOUNDARY

NORTH

Scale: 1"=100'

0 50 100 200

terracina design
10200 East Girard Ave, A314
Denver, CO 80231
ph: 303.632.8867

PROJECT NAME

ERIE HIGHLANDS- PA 5,6 & 14
SKETCH PLAN
TOWN OF ERIE, COLORADO

SHEET TITLE

DETAILED PLAN

SHEET NUMBER

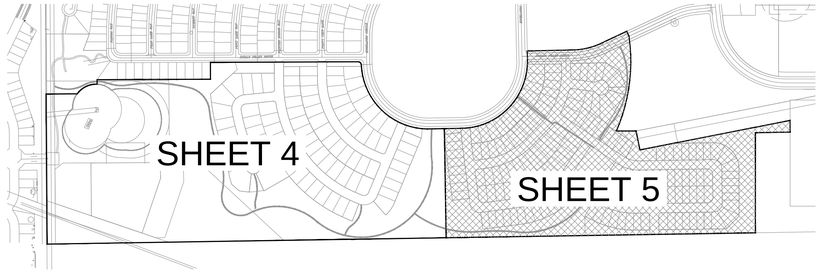
4

SHEET 4 OF 5

AUGUST 3, 2015

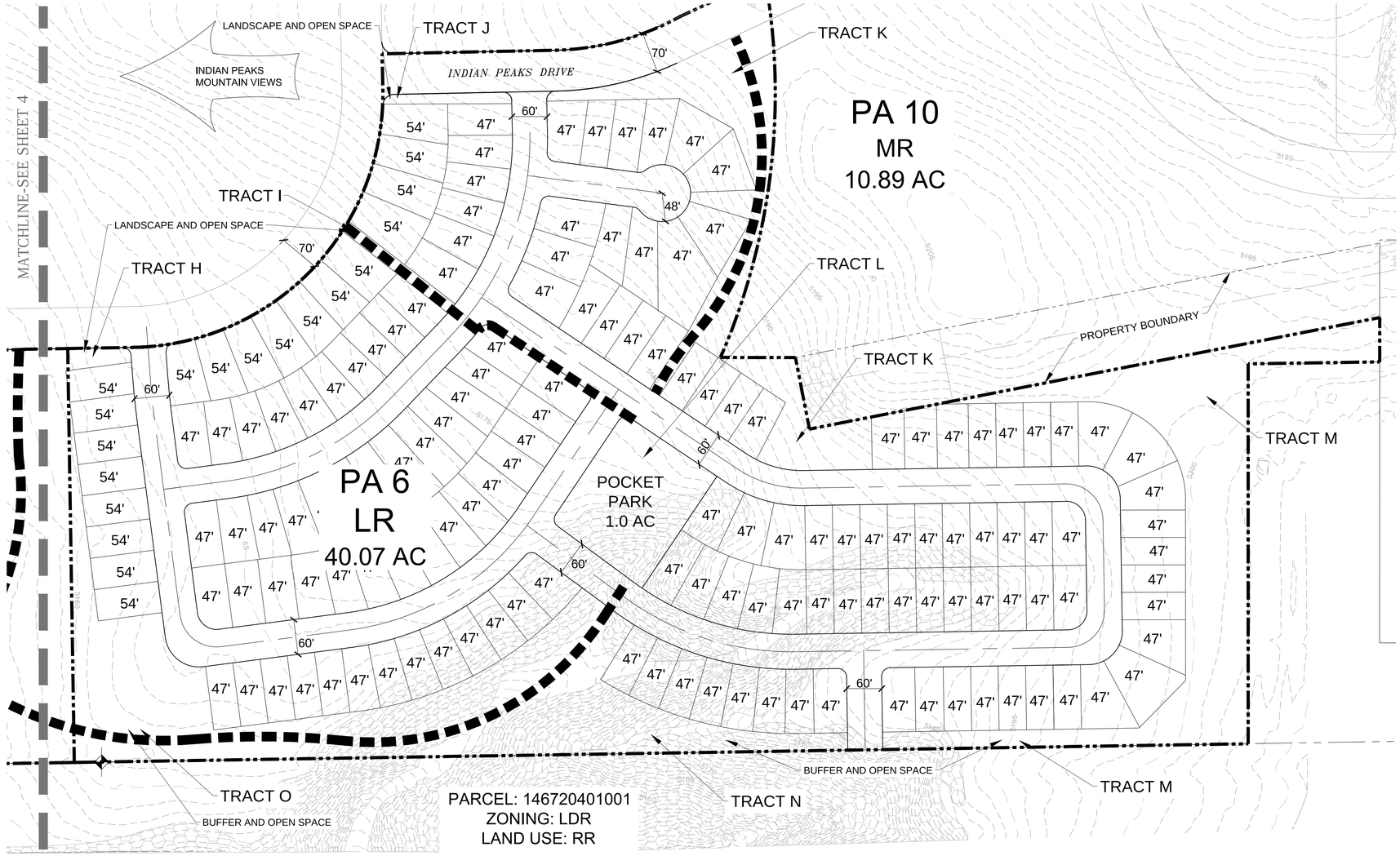
\\tcdserver\tcd_projects\dropbox (terracina design)\dearmin property-erie_pa 5-6\cad\submittals\eh pa 5&6 sketch plan 070215.dwg

KEYMAP:



ERIE HIGHLANDS- PA 5, 6 & 14
SKETCH PLAN

A PART OF THE NORTH HALF OF SECTION 20,
TOWNSHIP 1 NORTH, RANGE 68 WEST OF THE SIXTH PRINCIPAL MERIDIAN
TOWN OF ERIE, COUNTY OF WELD, STATE OF COLORADO
101.7 ACRES- 242 LOTS/ 15 TRACTS
SK-000676-2015



PA 6 TRACT SUMMARY CHART

TRACT	AREA (SF)	USE	OWNERSHIP	MAINTENANCE
H	3,519.4	LANDSCAPE AND OPEN SPACE	EHMD	EHMD
I	4,597.9	LANDSCAPE AND OPEN SPACE	EHMD	EHMD
J	3,864.9	LANDSCAPE AND OPEN SPACE	EHMD	EHMD
K	75,062.8	BUFFER AND OPEN SPACE	EHMD	EHMD
L	43,637.6	POCKET PARK	EHMD	EHMD
M	126,345.0	BUFFER AND OPEN SPACE	EHMD	EHMD
N	23,112.5	BUFFER AND OPEN SPACE	EHMD	EHMD
O	147,310.6	BUFFER AND OPEN SPACE	EHMD	EHMD

*EHMD - ERIE HIGHLANDS METRO DISTRICT

PA 6 LAND SUMMARY CHART

TYPE	AREA (AC)	% OF TOTAL AREA	LOTS	DU/AC
RESIDENTIAL UNITS	21.93	54.3%	157	3.9
TRACTS	9.81	24.3%		
PUBLIC ROW	8.68	21.5%		
TOTAL	**40.42**	**100.0%**		

NOTES:

- 8' PROPOSED UTILITY EASEMENT ALONG BACK OF LOTS.
- 6' PROPOSED UTILITY EASEMENT ALONG ROAD RIGHT-OF-WAY.
- EXISTING GRADES ARE SHOWN AT A 1' INTERVAL
- THERE ARE NO EXISTING FLOODPLAINS, WETLANDS, OR WATER COURSES OF ANY TYPE ON SITE.

LEGEND

- 54' RANCH HOUSE PRODUCT (54' x 110' MIN. LOT SIZE)
- 47' PARK HOUSE PRODUCT (47' x 110' MIN. LOT SIZE)
- TRAIL
- EXISTING MINOR CONTOUR
- EXISTING MAJOR CONTOUR
- 8% OR GREATER SLOPES
- PARCEL BOUNDARY

NORTH

Scale: 1"=100'
0 50 100 200

terracina design
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PROJECT NAME

ERIE HIGHLANDS- PA 5,6 & 14
SKETCH PLAN
TOWN OF ERIE, COLORADO

SHEET TITLE

DETAILED PLAN

SHEET NUMBER

5

SHEET 5 OF 5

AUGUST 3, 2015

\\tcdserver\tcd_projects\dropbox (terracina design)\deamin property-erie_pa 5-6\cad\submittals\eh pa 5&6 sketch plan 072215.dwg

Engineering Partners, Inc.
Right. On Time.

PHASE III DRAINAGE REPORT
for
ERIE HIGHLANDS

Erie, Colorado

NOVEMBER-2013

Prepared for:

Oakwood Homes LLC
4908 Tower Road
Denver, Colorado 80249
303-486-8500
Contact: John Cheney

Prepared by:

ENGINEERING PARTNERS, INC.
1950 West Littleton Blvd., Suite 109
LITTLETON, CO. 80120
(303) 703-4444

Engineer's Statement:

This report for ERIE HIGHLANDS was prepared by me (or under the direct supervision) in accordance with the provisions of the Town of Erie and Urban Drainage Criteria Manual. I understand that the Town of Erie and its designated town authority do not and will not assume liability for drainage facilities designed by others.

_____

David C. Forbes P.E.
Colorado Professional Engineer 36130
For and on behalf Engineering Partners Inc.

Contents

Final Drainage Report
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- Proposed Project 1

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Appendix A – Site Maps

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Introduction

Site Location

The 301.6 acre site is located in the north half of Section 20, Township 1 North, Range 68 West of the 6th Principal Meridian, Town of Erie, Weld County, State of Colorado.

The site is bound by Erie Parkway (CR 8) to the north, future Sunset Subdivision to the south, Grandview subdivision to the west and County Road 5 to the east.

The purpose of this drainage report is the address the impacts that this site will have on its surroundings and demonstrate how it will comply with the regulatory requirements as outlined in the Town of Erie standards.

Site Description

The site is mostly undeveloped farmland with moderate weeds and native grasses. The project site was historically mined for coal. A large tailings pile is located in the east central portion of the site. An above-ground gas line valve and associated facilities are located in the center of the northern part of the property. An existing dirt road off Bonanza Drive serves these facilities.

The site elevation ranges from 5205 near the middle of the site to various low points to the north, south, east and west. The lowest elevation is to the west, 5070 near the Donelly Avenue.

U.S. Department of Agriculture, Soil Conservation Service mapping of the area indicates that the soils are:
Colby loam, 3 to 5 percent with a Hydrological Soil group B
Colby loam, 5 to 9 percent with a Hydrological Soil group B
Colombo Clay loam, 1 to 3 percent with a Hydrological Soil group B
Midway-Shingle complex, 5 to 20 percent with a Hydrological Soil group D
Nunn loam, 1 to 3 percent with a Hydrological Soil group C
Weld County loam, 1 to 3 percent with a Hydrological Soil group C
Wiley-Colby complex, 1 to 3 percent with a Hydrological Soil group B.
Wiley-Colby complex, 3 to 3 percent with a Hydrological Soil group B

Refer to the SCS mapping in the appendix.

Proposed Project

The proposed project will include the construction various planning areas. Please refer to the preliminary concept plan in the appendix. The majority of the site will be development as Single Family. Planning areas will be set aside for parks and open space, a future school, commercial pads, and multi-family units.
There will be 254 lots within the ERIE HIGHLANDS Preliminary Plat No. 1. The majority of this drainage will collect near the northwest corner of the site at the intersection of Erie Parkway and Bonanza Drive. Another small Pond, Pond 2, will collect runoff for the southwest portion of the site. Pond 2 will discharge towards its historic route towards Donelly Avenue.

Historic Drainage

Major Basin Description

According to the Flood Insurance Rate Map No. 08013C0441J, Panel 441 of 615, Dated December 18, 2012 the subject property lines within "Zone C", being defined as "Areas of Minimal Flooding (No Shading).
Map has been included in Appendix for your reference.

Site Drainage and Existing Facilities

Existing topography divides the site into six historic basins, H-1 through H-6.

H-1 being 93.4 acres is located in the Southwest corner of the property and surface drains to the intersection of Erie Parkway and Bonanza Drive. An 18" RCP routes the flow across Erie Parkway into the Future Bridgewater subdivision's Irrigation Pond. Soils are 100% B.
Q2= 0.04(93.4) = 3.7 cfs
Q5= 0.13(93.4) = 12.1 cfs
Q10=0.23(93.4) = 21.5 cfs
Q100=0.85(93.4) = 79.4 cfs.

H-2 being 13.2 acres drains a small portion near the western edge of the property. Ultimately this runoff combines with basin H-3. Soils are 70% B and 30% C-D.
Q2= 0.04(9.2) + 0.06(4.0) = 0.6 cfs
Q5= 0.13(9.2) + 0.17(4.0) = 1.9 cfs
Q10=0.23(9.2) + 0.30(4.0) = 3.3 cfs
Q100=0.85(9.2) + 1.0(4.0) = 11.8 cfs.

H-3 being 68.6 acres drains the southwestern portion of the site. This area is collected by an area inlet. A 36" RCP within Donelly Avenue routes the flow though the Grandview Subdivision. The existing storm sewer has the design capacity of 83 cfs. Soils are 40% B and 60% C-D.
Q2= 0.04(27.4) + 0.06(41.2) = 3.6 cfs
Q5= 0.13(27.4) + 0.17(41.2) = 10.6 cfs
Q10=0.23(27.4) + 0.30(41.2) = 18.7 cfs
Q100=0.85(27.4) + 1.0(41.2) = 64.5 cfs.

Basins H-4 and H-5 are comprised of 26.5 and 29.0 acres, respectively. Both sub-basins direct runoff towards an unnamed tributary of Coal Creek. This unnamed tributary lies within the south half of Section 20 and the southeast one-quarter of Section 19, TS 1N, R68W of the 6h PM. Assume Soils are100% C-D.

Basin H-4:
Q2= .06(26.5) = 1.6 cfs
Q5= 0.17(26.5) = 4.5 cfs
Q10= 0.30(26.5) = 7.9 cfs
Q100=1.0(26.5) = 26.5 cfs

Basin H-5
Q2= .06(29.0) = 1.7 cfs
Q5= 0.17(29.0) = 4.9 cfs
Q10= 0.30(29.0) = 8.7 cfs
Q100=1.0(29.0) = 29.0 cfs

H-6 being 70.9 acres drains the northeast portion of the site. An existing 45"x63" CMP and 36"x42" CMP route the flow across Erie Parkway. Soils are 100% C-D.
Q2= .06(70.9) = 4.3 cfs
Q5= 0.17(70.9) = 12.1 cfs
Q10= 0.30(70.9) = 21.3 cfs
Q100=1.0(70.9) = 70.9 cfs

Proposed (Developed) Drainage

Drainage Design Criteria

The proposed storm drainage facilities for the project are designed to comply with the Town of Erie Standards and Specifications and Urban Drainage and Flood Control District's Drainage Criteria Manual (USDCM) 2008 Edition.

Hydrologic Method and Design Storm Frequencies

The rational method was utilized to determine peak 2-year, 5-year and 100-year flows associated with the proposed improvements from this site, in accordance with the Urban Drainage and Flood Control District, and the Town's Manual.

The storm pipes on the Site will been designed such that the hydraulic grade line (HGL) will remain inside the pipeline for the 5 yr event as required by the Town. All proposed storm sewer systems will discharge to a EURV detention pond. The storm pipe system is designed to capture the 2-year minor storm, inlets sized for 5 year storm and the 100 year storm at appropriate low points. Some 100-year flow will be allowed to surface flow into prospective Ponds.

Future Hydraulic grades will be derived for all pipelines (except local yard drains), and utilized headloss coefficients of 0.5 to 0.9.

Proposed Site Basins

Onsite inlets and the storm pipe system are designed to capture and convey the 5 yr flow, while maintaining the 5 yr HGL within the pipe. Though a portion of the 100 yr flow will be intercepted and routed by these same pipes, the HGL will be outside the pipe. For the purpose of this report we have therefore defined a conservative approach to the 100 event, which presumes that only the 5 yr Q will be captured and routed via the pipe system, and all other flows above and beyond those flow rates, will overflow and surface route to the onsite low points located near EURV Ponds. The 100-year HGL has been confined to rim elevations or less. In areas where the HGL is close we may choose to bolt the manholes.

Table R0-5 was used to calculate the percent impervious based on each areas densities.
The area draining towards Pond 1 has a density of 3.5 units per acre. We have assumed an average 2,500 s.f. home. A density of 4.5 units per acres will be used for future Ponds 3-5.
Pond 6 will have a mix of multi/single family with a large area designated as commercial.

Sub-basin A (6.42 acres) consists of a future multifamily and single family homes. Runoff will be routed to Design Point 1 via sheet and gutter flow, where a proposed 15' Type R inlet will fully capture the 5-year flow. Q_5 = 10.6 cfs and Q_{100} = 26.1 cfs.

Sub-basin B (9.23 acres) consists of a future school site, community-park and single family homes. Runoff will be routed to Design Point 2 via sheet and gutter flow, where a proposed 10' Type R inlet will fully capture the 5-year flow. Q_5 = 9.4 cfs and Q_{100} = 30.0 cfs.

Sub-basin C (11.73 acres) consists of future single family homes. Runoff will be routed to Design Point 3 via sheet and gutter flow, where a proposed Type C inlet will fully capture the 5-year flow. Q_5 = 11.7 cfs and Q_{100} = 36.9 cfs.

Sub-basin D (3.63 acres) consists of open space and future Erie Parkway Improvements. Runoff will be routed to Design Point 4 via sheet and gutter flow, where a proposed 15' Type R inlet will fully capture the 5-year flow. Q_5 = 4.6 cfs and Q_{100} = 12.6 cfs.

Sub-basin E (1.27 acres) consists of single family homes. Runoff will be routed to Design Point 5 via sheet and gutter flow, where a proposed 10' Type R inlet will fully capture the 5-year flow. Q_5 = 1.30 cfs and Q_{100} = 4.2 cfs.

Sub-basin F (3.47 acres) consists of single family homes and open space. Runoff will be routed to Design Point 6 via sheet and gutter flow, where a proposed 10' Type R inlet will fully capture the 5-year flow. Q_5 = 3.4 cfs and Q_{100} = 10.6 cfs.

Sub-basin G (6.22 acres) consists of single family homes and open space (Gas well site). Runoff will be routed to Design Point 7, where a proposed Type C inlet will fully capture the 5-year flow. After Erie Parkway is widened there will be a natural low point created. The inlet will intercept these flows just west of the oil pad access road. Q_5 = 4.6 cfs and Q_{100} = 17.7 cfs.

Sub-basin H (9.10 acres) consists of single family homes and open space (Gas well site). Runoff will be routed to Design Point 8 via sheet and gutter flow, where a proposed 15' Type R inlet will fully capture the 5-year flow. Q_5 = 5.0 cfs and Q_{100} = 23.8 cfs.

Sub-basin I (1.01 acres) consists of single family homes and open space. Runoff will be routed to Design Point 9 via sheet and gutter flow, where a proposed 5' Type R inlet will fully capture the 5-year flow. Q_5 = 0.7 cfs and Q_{100} = 2.9 cfs.

Sub-basin J (6.26 acres) consists of single family homes and open space. Runoff will be routed to Design Point 10 via sheet and gutter flow, where a proposed 15' Type R inlet will fully capture the 5-year flow. Q_5 = 6.6 cfs and Q_{100} = 20.7 cfs.

Sub-basin K (3.36 acres) consists of single family homes and open space. Runoff will be routed to Design Point 11 via sheet and gutter flow, where a proposed 10' Type R inlet will fully capture the 5-year flow. Q_5 = 3.5 cfs and Q_{100} = 11.1 cfs.

Sub-basin L (3.75 acres) consists of single family homes and open space. Runoff will be routed to Design Point 12 via sheet and gutter flow, where a proposed 10' Type R inlet will fully capture the 5-year flow. Q_5 = 3.9 cfs and Q_{100} = 12.2 cfs.

Sub-basin M (4.87 acres) consists of single family homes and open space. Runoff will be routed to Design Point 13 via sheet and gutter flow, where a proposed 15' Type R inlet will fully capture the 5-year flow. Q_5 = 4.9 cfs and Q_{100} = 15.7 cfs.

Sub-basin N (4.04 acres) consists of single family homes and open space. Runoff will be routed to Design Point 14 via sheet and gutter flow, where a proposed 10' Type R inlet will fully capture the 5-year flow. Q_5 = 3.6 cfs and Q_{100} = 11.6 cfs.

Sub-basin O (1.98 acres) consists of single family homes and open space. Runoff will be routed to Design Point 15 via sheet and gutter flow, where a proposed 5' Type R inlet will fully capture the 5-year flow. Q_5 = 2.0 cfs and Q_{100} = 6.4 cfs.

Sub-basin P (8.74 acres) consists of single family homes and open space. Runoff will be routed to Design Point 16 via sheet and gutter flow, where a proposed 10' Type R inlet will fully capture the 5-year flow. Q_5 = 8.8 cfs and Q_{100} = 26.9 cfs.

Sub-basin Q (2.52 acres) consists of single family homes and open space. Runoff will be routed to Design Point 17 via sheet and gutter flow, where a proposed 10' Type R inlet will fully capture the 5-year flow. Q_5 = 2.5 cfs and Q_{100} = 8.1 cfs.

Sub-basin Pond-1 (5.04 acres) consists of single family homes and open space. Runoff will be routed to Design Point J6 and controlled with a EURV outlet structure.
Total to Pond 1: Q_5 = 84.6 cfs and Q_{100} = 257.8 cfs.

Sub-basin R (6.32 acres) consists of single family homes and open space. Runoff will be routed to Design Point 18 via sheet and gutter flow, where a proposed 15' Type R inlet will fully capture the 5-year flow. Q_5 = 7.9 cfs and Q_{100} = 24.5 cfs.

Sub-basin S (4.86 acres) consists of single family homes and open space. Runoff will be routed to Design Point 19 via sheet and gutter flow, where a proposed 10' Type R inlet will fully capture the 5-year flow. Q_5 = 6.5 cfs and Q_{100} = 20.0 cfs.

Sub-basin T (3.78 acres) consists of single family homes and open space. Runoff will be routed to Design Point 20 via sheet and gutter flow, where a proposed 10' Type R inlet will fully capture the 5-year flow. Q_5 = 4.8 cfs and Q_{100} = 14.0 cfs.

Sub-basin W (1.55 acres) consists of single family homes and open space. Runoff will be routed to Design Point 20 via sheet and gutter flow, where a proposed 10' Type R inlet will fully capture the 5-year flow. An emergency channel 5' wide will route flows to Pond 2. Q_5 = 2.1 cfs and Q_{100} = 6.5 cfs.

Sub-basin Pond-2 (2.46 acres) consists of single family homes and open space. Runoff will be routed to Design Point J7 and controlled with a EURV outlet structure.
Total to Pond 2: Q_5 = 22.5 cfs and Q_{100} = 69.6 cfs.

Sub-basin Pond-3 (64.72 acres) will consist of single family homes sites and open space. Runoff will be routed to Design Point J8 via overland, sheet and gutter flow, where a proposed EURV Pond-3 will control flows to existing conditions.
Q_5 = 44.5 cfs and Q_{100} = 197.8 cfs.

Sub-basin Pond-4 (26.47 acres) will consist of single family homes sites and open space. Runoff will be routed to Design Point J9 via overland, sheet and gutter flow, where a proposed EURV Pond-4 will control flows to existing conditions.
Q_5 = 32.9 cfs and Q_{100} = 102.1 cfs.

Sub-basin Pond-5 (29.01 acres) will consist of single family homes sites and open space. Runoff will be routed to Design Point J10 via overland, sheet and gutter flow, where a proposed EURV Pond-5 will control flows to existing conditions.
Q_5 = 36.4 cfs and Q_{100} = 112.6 cfs.

Sub-basin Pond-6 (72.23 acres) will consist of single family homes sites, commercial and open space. Runoff will be routed to Design Point J11 via overland, sheet and gutter flow, where a proposed EURV Pond-6 will control flows to existing conditions.
Q_5 = 125.2 cfs and Q_{100} = 297.6 cfs.

Detention and Water Quality Enhancement Features

Pond 1 and Pond 2 have been designed to treat the water for this Filing. The EURV Water Quality and the 100-year detention pond volumes were calculated with the empirical and Full Spectrum methods per the UDFCD guideline. Water quality enhancement features have been designed as the EDB's (Extended Detention Basin) with forebay and micro pool. The ponds are designed to contain the 100-year volume.

The outlet structure for both ponds has been designed to restrict the 100 yr release rate with the use of a water quality plate and a 100-year orifice plate on the outlet pipe. Allowable release rates have been computed based on the EURV equations. A concrete trickle channel will convey flows for the flared section from the forebay to the micro pool.

Emergency overflow for Pond 1 will be routed onto Erie Parkway. The spillway has been designed to pass the entire 100-year event. The spillway is located on the northwest side of Pond 1.

Emergency flows from Pond 2 will be routed due south toward the newly graded low point just east of Donelly. Additional measures will also be provided offsite to protect the adjacent subdivision from flows. A berm and swale will direct a small about of discharge to Bonanza.

Erosion Control / Stormwater Management Plan

Erosion control features will be installed at strategic locations on the site as soon as construction activities commence. These features, which include VTC at the entrance, inlet protection, diversion ditched, etc are outlined in the stormwater management plans and details. The SWMP includes required erosion control measures, implementation specifications and detail sheets. A State and Town of Erie Stormwater permit will be require prior to any construction.

REQUIRED BEST MANAGEMENT PRACTICES (BMP)

1. Vehicle Tracking Control: This BMP is required at all access points to a construction site that are used by vehicular traffic or construction equipment. **A vehicle tracking control pad will be installed at the construction entrance prior to the mobilization of grading equipment onsite. At no time shall a contractor not use a VTC when entering public ROW.**

2. Inlet Protection: This BMP is required on all existing or proposed storm sewer inlets in the vicinity of the construction site that may receive site runoff. The BMP must be appropriate to the type of storm inlet and appropriate for the ground surface at the inlet. **Inlet protection will be installed on the existing curb inlets adjacent and downstream to the site. Curb socks will be installed in the street flow line just upstream of the inlet protection.**

3. Site Stabilization: **Any remaining soil areas disturbed by grading operations will be seeded and mulched.**

4. Spill Prevention/Containment: This BMP defines the measures proposed for preventing, controlling, or containing spills of fuel, lubricants, or other pollutants and protecting potential pollutants from contact with precipitation or runoff. **The contractor shall provide self-contained tanks for storage of fuel or other potential pollutants (i.e double walled or contained basins).**

5. Chute Washout Containment: This BMP requires that a containment area be designated for the washout of cement truck delivery chutes. This containment area is to be bermed so that wash water is totally contained. Water discharged into the containment area is allowed to infiltrate or evaporate. The dried cement waste is removed and properly disposed of. **Contractor shall locate washout per approved plans.**

6. Street Sweeping: This BMP requires that paved surfaces which are adjacent to construction sites be swept by the close of that business day when sediment and other materials are tracked or discharged on to them. Either sweeping by hand or use of Street Sweepers is acceptable. Street sweepers using water while sweeping is preferred in order to minimize dust. Flushing off paved surfaces with water is prohibited. **The contractor will be required to sweep the existing streets adjacent to the site and along the haul route.**

7. Perimeter Control: This BMP requires that a construction site install a perimeter control measure along the edge of the construction site to prevent, or filter the surface runoff leaving the construction site. The type of perimeter control used shall be determined based on site and location. Maintenance and repair of the control measure shall occur as needed, in a timely manner, but not longer than seven (7) days from the date identified. **Silt fence will be installed along the downstream edge of the area to be graded a grade differential (T) may also be used.**

8. Portable Toilets: Contractor shall locate portable toilets in location that is away from construction activities and runoff. **Contractor shall secure portable toilets due to the high wind gusts in this area.**

9. Construction waste management, such as dumpsters, trash collection and disposal shall occur in a timely manner to limit debris from leaving the site.

CONCLUSIONS

The design of drainage facilities for the Apartments is in compliance with the Urban Drainage and Flood Control District's Drainage Criteria Manual and the Town of Erie Storm Drainage Criteria.

REFERENCES

1) Urban Storm Drainage Criteria Manual, Volumes 1, 2, and 3, Urban Drainage and Flood Control District, June 2001, Revised 2008.
2) Standards and Specifications for Design and Construction of Public Improvements, Town of Erie 1874, 2013 Edition, Town of Erie, Colorado.
3) Soil Survey of Weld County, Colorado, U.S. Department of Agriculture, Soil Conservation Service in cooperation with Colorado Agricultural Experiment Station.

Appendix A – Site Maps

Appendix B – Calculations

COMPOSITE "C" AND "I" VALUES

Subdivision: ERIE HIGHLANDS
Location: ERIE, Colorado

Project Name: ERIE HIGHLANDS
Project No. 13-000
Calculated By: DCF
Checked By:
Date: 11/15/2013

Basin	Total Area (acres)	Area S.F. (acres)	Area Grass (acres)	Area Streets (acres)	Area Comm. (acres)	Area Schools (acres)	Soils (acres)	Composite C_2	Composite C_5	Composite C_{100}	Composite I
A	6.42	6.42	0.00	0.00	0.00	0.00	6.42	0.41	0.45	0.59	65.0
B	9.23	0.00	2.80	0.45	0.84	5.14	9.23	0.23	0.30	0.50	40.6
C	11.73	11.73	0.00	0.00	0.00	0.00	11.73	0.22	0.29	0.49	38.0
D	3.63	0.83	0.85	1.95	0.00	0.00	3.63	0.29	0.35	0.52	54.3
E	1.27	1.27	0.00	0.00	0.00	0.00	1.27	0.22	0.29	0.49	38.0
F	3.47	3.47	0.00	0.00	0.00	0.00	3.47	0.22	0.29	0.49	38.0
G	6.22	1.88	3.76	0.58	0.00	0.00	6.22	0.14	0.21	0.43	19.4
H	9.10	1.60	6.52	0.98	0.00	0.00	9.10	0.07	0.16	0.41	15.8
I	1.01	0.00	0.75	0.26	0.00	0.00	1.01	0.14	0.21	0.43	21.9
J	6.26	6.26	0.00	0.00	0.00	0.00	6.26	0.22	0.29	0.49	38.0
K	3.36	3.36	0.00	0.00	0.00	0.00	3.36	0.22	0.29	0.49	38.0
L	3.75	3.75	0.00	0.00	0.00	0.00	3.75	0.22	0.29	0.49	38.0
M	4.87	4.87	0.00	0.00	0.00	0.00	4.87	0.22	0.29	0.49	38.0
N	4.04	2.18	1.28	0.58	0.00	0.00	4.04	0.19	0.26	0.46	32.7
O	1.98	1.98	0.00	0.00	0.00	0.00	1.98	0.22	0.29	0.49	38.0
P	8.74	8.74	0.00	0.00	0.00	0.00	8.74	0.22	0.29	0.49	38.0
Q	2.52	2.52	0.00	0.00	0.00	0.00	2.52	0.22	0.29	0.49	38.0
POND-1	5.04	1.52	1.72	1.80	0.00	0.00	5.04	0.23	0.30	0.50	41.8
Totals Pond 1	**92.64**										**37.2**
*R	6.32	6.32	0.00	0.00	0.00	0.00	6.32	0.30	0.36	0.59	43.0
*S	4.86	4.86	0.00	0.00	0.00	0.00	4.86	0.30	0.36	0.59	43.0
*T	3.78	3.78	0.00	0.00	0.00	0.00	3.78	0.30	0.36	0.59	43.0
*W	1.55	1.55	0.00	0.00	0.00	0.00	1.55	0.30	0.36	0.59	43.0
*POND-2	2.46	1.09	1.36	0.00	0.00	0.00	2.46	0.15	0.25	0.55	19.1
Totals Pond 2	**18.97**										**39.9**
*POND-3	64.72	38.33	26.39	0.00	0.00	3.85	64.72	0.13	0.23	0.54	15.4
*POND-4	26.47	26.47	0.00	0.00	0.00	0.00	26.47	0.30	0.36	0.59	43.0
*POND-5	29.01	29.01	0.00	0.00	0.00	0.00	29.01	0.30	0.36	0.59	43.0
*POND-6	72.23	40.63	0.00	0.00	31.60	0.00	72.23	0.48	0.54	0.67	68.6

* Use C/D Soils

ingle Family Densites		% Imperv.	2,500 sf Home
Pond 1	3.50	38	
Pond 2	4.50	43	
Pond 3	1.00	21	26.39 acres of open space Pond 3 Area
Pond 4	4.50	43	
Pond 5	4.50	43	
Pond 6	7.5	48	

STANDARD FORM SF-2
TIME OF CONCENTRATION

Subdivision ERIE HIGHLANDS
Location ERIE, Colorado
NOTES:
$T_i = (0.395*(1.1 - C_5)*(L)^{0.5})/(S^{0.33})$
T_t=L/60V (Velocity From Fig. RO-1)
T_c Check = 10+L/180

Project Name: ERIE HIGHLANDS
Project No. 13-000
Calculated By: DCF
Checked By:
Date: 11/15/2013

SUB-BASIN DATA			INITIAL/OVERLAND (T_i)			TRAVEL TIME (T_t)				Tc CHECK (URBANIZED BASINS)			FINAL
BASIN ID	D.A. (AC)	C_5	L (FT)	S (%)	T_i (MIN)	L (FT)	S (%)	VEL. (FPS)	T_t (MIN)	COMP. T_c (MIN)	TOTAL LENGTH(FT)	MIN. T_c (MIN)	T_c (MIN)
A	6.42	0.45	50	2.0	6.6	850	2.0	2.9	4.9	11.5	900.0	15.0	11.5
B	9.23	0.30	50	2.0	8.1	950	2.5	3.2	4.9	13.0	1000.0	15.6	13.0
C	11.73	0.29	50	2.0	8.2	1075	3.0	3.5	5.1	13.3	1125.0	16.3	13.3
D	3.63	0.35	50	2.0	7.6	776	2.0	2.9	4.5	12.0	826.0	14.6	12.0
E	1.27	0.29	50	2.0	8.2	380	0.8	1.8	3.5	11.7	430.0	12.4	11.7
F	3.47	0.29	50	2.0	8.2	1190	2.5	3.2	6.2	14.4	1240.0	16.9	14.4
G	6.22	0.21	50	2.0	9.0	580	3.0	2.7	3.6	12.6	630.0	13.5	12.6
H	9.10	0.16	50	2.0	9.5	650	3.0	2.7	4.0	13.5	700.0	13.9	13.5
I	1.01	0.21	50	2.0	9.0	600	2.0	2.9	3.4	12.4	650.0	13.6	12.4
J	6.26	0.29	50	2.0	8.2	818	3.5	3.7	3.7	11.9	868.0	14.8	11.9
K	3.36	0.29	50	2.0	8.2	760	3.0	3.5	3.6	11.8	810.0	14.5	11.8
L	3.75	0.29	50	2.0	8.2	780	2.5	3.2	4.1	12.2	830.0	14.6	12.2
M	4.87	0.29	50	2.0	8.2	1080	4.0	4.0	4.5	12.7	1130.0	16.3	12.7
N	4.04	0.26	50	2.0	8.5	780	1.2	2.2	5.9	14.4	830.0	14.6	14.4
O	1.98	0.29	50	2.0	8.2	580	1.3	2.3	4.2	12.4	630.0	13.5	12.4
P	8.74	0.29	50	2.0	8.2	1100	2.5	3.2	5.7	13.9	1150.0	16.4	13.9
Q	2.52	0.29	50	2.0	8.2	850	2.8	3.2	4.4	12.6	900.0	15.0	12.6
POND-1	5.04	0.30	50	2.0	8.1	350	2.0	2.9	2.0	10.1	400.0	12.2	10.1
R	6.32	0.36	50	2.0	7.5	1234	4.0	4.0	5.1	12.6	1284.0	17.1	12.6
S	4.86	0.36	50	2.0	7.5	823	3.5	3.7	3.7	11.2	873.0	14.9	11.2
T	3.78	0.36	50	2.0	7.5	1550	4.0	4.0	6.5	13.9	1600.0	18.9	13.9
W	1.55	0.36	50	2.0	7.5	300	0.8	1.8	2.8	10.3	350.0	11.9	10.3
POND-2	2.46	0.25	50	2.0	8.6	180	2.0	2.9	1.0	9.6	230.0	11.3	9.6
POND-3	64.72	0.23	50	2.0	8.8	1900	4.0	4.0	7.9	16.7	1950.0	20.8	16.7
POND-4	26.47	0.36	50	2.0	7.5	1300	4.0	4.0	5.4	12.9	1350.0	17.5	12.9
POND-5	29.01	0.36	50	2.0	7.5	1150	3.5	3.7	5.2	12.7	1200.0	16.7	12.7
POND-6	72.23	0.54	50	2.0	5.7	1800	2.5	3.2	9.4	15.0	1850.0	20.3	15.0

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

Subdivision ERIE HIGHLANDS
Location ERIE, Colorado
Design Storm 2-Year

Project Name: ERIE HIGHLANDS
Project No. 13-000
Calculated By: DCF
Checked By:
Date: 11/15/2013

INLET TYPE	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				INLET		PIPE			TRAVEL TIME			Remarks
		Area Desig.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Interception (cfs)	Flowby (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
15' Type R	1	A	6.42	0.41	11.5	2.63	2.56	6.7							6.7	0.5	18	495	15.0	0.6	
10' Type R	2	B	9.23	0.23	13.0	2.12	2.45	5.2	12.0	4.76	2.50	11.9			11.9	2.5	18	766	15.0	0.9	
Type C	3	C	11.73	0.22	13.3	2.58	2.43	6.3													
15' Type R	4	D	3.63	0.29	12.0	1.05	2.50	2.6													
10' Type R	5	E	1.27	0.22	11.7	0.28	2.53	0.7													
10' Type R	6	F	3.47	0.22	14.4	0.76	2.36	1.8	12.9	9.43	2.46	23.2			23.2	2.0	30	750	15.0	0.8	Total flow to J1
Type C	7	G	6.22	0.14	12.6	0.87	2.48	2.2	13.7	10.30	2.41	24.8			24.8	1.5	30	656	15.0	0.7	Tc from DP7 to J2
15' Type R	8	H	9.10	0.07	13.5	0.64	2.42	1.5													
5' Type R	9	I	1.01	0.14	12.4	0.14	2.48	0.4	14.4	11.08	2.35	26.0			26.0	1.5	48	614	15.0	0.7	Total flow to J3
15' Type R	10	J	6.26	0.22	11.9	1.38	2.52	3.5							3.5	3.5	18	325	15.0	0.4	
10" Type R	11	K	3.36	0.22	11.8	0.74	2.52	1.9	12.2	2.12	2.49	5.3			5.3	3.5	18	325	15.0	0.4	
10' Type R	12	L	3.75	0.22	12.2	0.83	2.49	2.1													
15' Type R	13	M	4.87	0.22	12.7	1.07	2.47	2.6	12.7	4.01	2.47	9.9			9.9	1.5	24	285	15.0	0.3	Total flow to J4
10' Type R	14	N	4.04	0.19	14.4	0.77	2.36	1.8	14.4	4.78	2.36	11.3			11.3	1.5	24	700	15.0	0.8	
5' Type R	15	O	1.98	0.22	12.4	0.44	2.49	1.1													
10' Type R	16	P	8.74	0.22	13.9	1.92	2.39	4.6													
10' Type R	17	Q	2.52	0.22	12.6	0.55	2.47	1.4	15.2	7.69	2.29	17.6									Total Flow to J5
Pond-1	J6	Pond-1	5.04	0.23	10.1	1.16	2.75	3.2	15.2	19.93	2.29	45.6									Total Flow to J6

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

Subdivision ERIE HIGHLANDS
Location ERIE, Colorado
Design Storm 2-Year

Project Name: ERIE HIGHLANDS
Project No. 13-000
Calculated By: DCF
Checked By:
Date: 11/15/2013

INLET TYPE	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				INLET		PIPE			TRAVEL TIME			Remarks
		Area Desig.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Interception (cfs)	Flowby (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
15' Type R	18	R	6.32	0.30	12.6	1.90	2.47	4.7							4.7	3.0	18	670	15.0	0.7	
10' Type R	19	S	4.86	0.30	11.2	1.46	2.59	3.8	13.4	3.35	2.43	8.1			8.1	2.0	24	37	15.0	0.0	
10' Type R	20	T	3.78	0.30	13.9	1.13	2.39	2.7													
10' Type R	21	W	1.55	0.30	10.3	0.47	2.72	1.3													
Pond 2	J7	Pond2	2.46	0.15	9.6	0.37	2.90	1.1	13.4	5.32	2.43	12.9			12.9	2.0	36	156	15.0	0.2	Total Flow to J7, Pond 2
Pond 3	J8	Pond3	64.72	0.13	16.7	8.41	2.12	17.8													Total Flow to Pond 3
Pond 4	J9	Pond4	26.47	0.30	12.9	7.94	2.46	19.5													Total Flow to Pond 4
Pond 5	J10	Pond5	29.01	0.30	12.7	8.70	2.47	21.5													Total Flow to Pond 5
Pond 6	J11	Pond6	72.23	0.48	15.0	34.67	2.30	79.7													Total Flow to Pond 6

STANDARD FORM SF-3

STORM DRAINAGE SYSTEM DESIGN

(RATIONAL METHOD PROCEDURE)

Subdivision ERIE HIGHLANDS
Location ERIE, Colorado
Design Storm 5-Year

Project Name: ERIE HIGHLANDS
Project No. 13-000
Calculated By: DCF
Checked By:
Date: 11/15/2013

		DIRECT RUNOFF							TOTAL RUNOFF				INLET		PIPE			TRAVEL TIME			
INLET TYPE	Design Point	Area Desig.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Interception (cfs)	Flowby (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	Remarks
15' Type R	1	A	6.42	0.45	11.5	2.89	3.66	10.6							10.6	0.5	18	495	15.0	0.6	
10' Type R	2	B	9.23	0.30	13.0	2.77	3.41	9.4	12.0	5.66	3.60	20.4			20.4	2.5	18	766	15.0	0.9	
Type C	3	C	11.73	0.29	13.3	3.40	3.44	11.7													
15' Type R	4	D	3.63	0.35	12.0	1.27	3.60	4.6													
10' Type R	5	E	1.27	0.29	11.7	0.37	3.63	1.3													
10' Type R	6	F	3.47	0.29	14.4	1.01	3.41	3.4	12.9	11.70	3.45	40.4			40.4	2.0	30	750	15.0	0.8	Total flow to J1
Type C	7	G	6.22	0.21	12.6	1.31	3.51	4.6	13.7	13.01	3.46	45.1			45.1	1.5	30	656	15.0	0.7	Tc from DP7 to J2
15' Type R	8	H	9.10	0.16	13.5	1.46	3.46	5.0													
5' Type R	9	I	1.01	0.21	12.4	0.21	3.52	0.7	14.4	14.68	3.38	49.7			49.7	1.5	48	614	15.0	0.7	Total flow to J3
15' Type R	10	J	6.26	0.29	11.9	1.82	3.62	6.6							6.6	3.5	18	325	15.0	0.4	
10" Type R	11	K	3.36	0.29	11.8	0.97	3.62	3.5	11.8	2.79	3.62	10.1			10.1	3.5	18	325	15.0	0.4	
10' Type R	12	L	3.75	0.29	12.2	1.09	3.56	3.9													
15' Type R	13	M	4.87	0.29	12.7	1.41	3.49	4.9	12.7	5.29	3.49	18.4			18.4	1.5	24	285	15.0	0.3	Total flow to J4
10' Type R	14	N	4.04	0.26	14.4	1.05	3.41	3.6	14.4	6.34	3.41	21.6			21.6	1.5	24	700	15.0	0.8	
5' Type R	15	O	1.98	0.29	12.4	0.57	3.54	2.0													
10' Type R	16	P	8.74	0.29	13.9	2.53	3.49	8.8	15.2	9.45	3.20	30.2			30.2						
10' Type R	17	Q	2.52	0.29	12.6	0.73	3.49	2.5	13.9	10.18	3.49	35.5									Total Flow to J5
Pond-1	J6	Pond-1	5.04	0.30	10.1	1.51	3.80	5.7	15.1	26.37	3.21	84.6									Total Flow to J6

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

Subdivision ERIE HIGHLANDS
Location ERIE, Colorado
Design Storm 5-Year

Project Name: ERIE HIGHLANDS
Project No. 13-000
Calculated By: DCF
Checked By:
Date: 11/15/2013

INLET TYPE	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				INLET		PIPE			TRAVEL TIME			Remarks
		Area Desig.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Interception (cfs)	Flowby (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
15' Type R	18	R	6.32	0.36	12.6	2.28	3.49	7.9							7.9	3.0	18	670	15.0	0.7	
10' Type R	19	S	4.86	0.36	11.2	1.75	3.69	6.5	13.4	4.02	3.44	13.8			13.8	2.0	24	37	15.0	0.0	
10' Type R	20	T	3.78	0.36	13.9	1.36	3.49	4.8													
10' Type R	21	W	1.55	0.36	10.3	0.56	3.78	2.1													
Pond 2	J7	Pond2	2.46	0.25	9.6	0.62	4.04	2.5	13.4	6.56	3.44	22.5			22.5	2.0	36	156	15.0	0.2	Total Flow to J7, Pond 2
Pond 3	J8	Pond3	64.72	0.23	16.7	14.89	2.99	44.5													Total Flow to Pond 3
Pond 4	J9	Pond4	26.47	0.36	12.9	9.53	3.45	32.9													Total Flow to Pond 4
Pond 5	J10	Pond5	29.01	0.36	12.7	10.44	3.49	36.4													Total Flow to Pond 5
Pond 6	J11	Pond6	72.23	0.54	15.0	39.00	3.21	125.2													Total Flow to Pond 6

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

Subdivision ERIE HIGHLANDS
Location ERIE, Colorado
Design Storm 100-Year

Project Name: ERIE HIGHLANDS
Project No. 13-000
Calculated By: DCF
Checked By:
Date: 11/15/2013

INLET TYPE	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				INLET		PIPE			TRAVEL TIME			Remarks
		Area Desig.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Interception (cfs)	Flowby (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
15' Type R	1	A	6.42	0.59	11.5	3.79	6.88	26.1					26.1		26.1	0.5	18	495	15.0	0.6	
10' Type R	2	B	9.23	0.50	13.0	4.62	6.50	30.0	12.0	8.40	6.70	56.3	20	10.0	46.1	2.5	24	766	15.0	0.9	FB=10.0 to DP4
Type C	3	C	11.73	0.49	13.3	5.75	6.43	36.9					36.9								30" rcp stub from DP-4
15' Type R	4	D	3.63	0.52	12.0	1.89	6.70	12.6				22.6	20.0	2.6							Includs 10.0 FB from DP2
10' Type R	5	E	1.27	0.49	11.7	0.62	6.79	4.2					4.2								FB=2.6 to DP6
10' Type R	6	F	3.47	0.49	14.4	1.70	6.22	10.6	14.2	18.36	6.24	114.6	13.2	0.0	114.6	2.0	30	750	15.0	0.8	Total flow to J1 - all flow intercepted
Type C	7	G	6.22	0.43	12.6	2.67	6.60	17.7	15.0	21.04	6.16	129.6	17.7		129.6	1.5	30	656	15.0	0.7	Tc from DP7 to J2
15' Type R	8	H	9.10	0.41	13.5	3.73	6.38	23.8				30.4	29.8	0.6							Add 6.6 flowby from DP-13
5' Type R	9	I	1.01	0.43	12.4	0.43	6.62	2.9	15.7	25.20	5.89	148.5	3.5	0.0	148.5	1.5	48	614	15.0	0.7	also 0.6 cfs crown overflow to DP9 Total flow to J3 - all flow intercepted
15' Type R	10	J	6.26	0.49	11.9	3.07	6.76	20.7					17.2	3.5	17.2	3.5	18	325	15.0	0.4	FB to DP 11=3.5
10" Type R	11	K	3.36	0.49	11.8	1.65	6.76	11.1	12.2	4.71	6.66	31.4	14.7	0.8	31.9	3.5	18	325	15.0	0.4	FB to DP 12=0.8
10' Type R	12	L	3.75	0.49	12.2	1.84	6.66	12.2					13.0	0.00	44.90						
15' Type R	13	M	4.87	0.49	12.7	2.39	6.58	15.7	12.7	8.94	6.58	58.8	9.1	6.60	52.2	1.5	24	285	15.0	0.3	FB to Dp8=6.6
10' Type R	14	N	4.04	0.46	14.4	1.86	6.22	11.6	14.4	10.80	6.22	67.2	11.6	0	60.5	1.5	24	700	15.0	0.8	
5' Type R	15	O	1.98	0.49	12.4	0.97	6.64	6.4					9.3	0	9.3						
10' Type R	16	P	8.74	0.49	13.9	4.28	6.28	26.9	15.2	16.05	6.11	98.1	24.0	2.9	33.3						FB to Dp15=2.9Totoal flow=98.1-6.6=91.5
10' Type R	17	Q	2.52	0.49	12.6	1.23	6.58	8.1	15.2	17.28	6.11	105.7			99.1						Total Flow to J5(FB=6.6at DP13)
Pond-1	J6	Pond-1	5.04	0.50	10.1	2.52	7.20	18.1	16.4	45.00	5.73	257.8			257.8						Total Flow to J6

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

Subdivision ERIE HIGHLANDS
Location ERIE, Colorado
Design Storm 100-Year

Project Name: ERIE HIGHLANDS
Project No. 13-000
Calculated By: DCF
Checked By:
Date: 11/15/2013

INLET TYPE	Design Point	DIRECT RUNOFF							TOTAL RUNOFF				INLET		PIPE			TRAVEL TIME			Remarks
		Area Desig.	Area (Ac)	Runoff Coeff.	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Tc (min)	C*A (Ac)	I (in/hr)	Q (cfs)	Interception (cfs)	Flowby (cfs)	Design Flow (cfs)	Slope (%)	Pipe Size (inches)	Length (ft)	Velocity (fps)	Tt (min)	
15' Type R	18	R	6.32	0.59	12.6	3.73	6.58	24.5					17.5	7.0	17.5	3.0	24	670	15.0	0.7	
																					FB=7.0 to DP19
10' Type R	19	S	4.86	0.59	11.2	2.87	6.97	20.0	13.4	6.60	6.43	42.4	22	5	37.4	2.0	24	37	15.0	0.0	5.0FB to DP20
10' Type R	20	T	3.78	0.59	13.9	2.23	6.28	14.0	13.9	8.83	6.28	55.39	19	0	55.4		30				all flow intercepted
10' Type R	21	W	1.55	0.59	10.3	0.91	7.16	6.5					6.5	0.0							
Pond 2	J7	Pond2	2.46	0.55	9.6	1.35	7.64	10.3	13.9	11.09	6.28	69.6			69.6	2.5	36	238	15.0	0.3	Total Flow to J7, Pond 2
Pond 3	J8	Pond3	64.72	0.54	16.7	34.95	5.66	197.8													Total Flow to Pond 3
Pond 4	J9	Pond4	26.47	0.59	12.9	15.62	6.54	102.1													Total Flow to Pond 4
Pond 5	J10	Pond5	29.01	0.59	12.7	17.12	6.58	112.6													Total Flow to Pond 5
Pond 6	J11	Pond6	72.23	0.67	15.0	48.39	6.15	297.6													Total Flow to Pond 6

SUMMARY RUNOFF TABLE						
					ACCUMULATIONS	
DESIGN POINT	CONTRIBUTING BASIN	CONTRIBUTING AREA (ACRES)	5-YR Q (CFS)	100-YR Q (CFS)	5-YR Q (CFS)	100-YR Q (CFS)
1	A	6.42	10.57	26.06		
2	B	9.23	9.44	30.00	20.37	56.30
3	C	11.73	11.69	36.93		
4	D	3.63	4.57	12.65		
5	E	1.27	1.34	4.23		
6	F	3.47	3.43	10.58	40.36	114.57
7	G	6.22	4.58	17.65	45.07	129.58
8	H	9.10	5.03	23.79		
9	I	1.01	0.75	2.88	49.67	148.46
10	J	6.26	6.57	20.74		
11	K	3.36	3.53	11.13	10.10	31.39
12	L	3.75	3.87	12.24		
13	M	4.87	4.92	15.70	18.44	58.81
14	N	4.04	3.59	11.56	21.6	67.15
15	O	1.98	2.03	6.44		
16	P	8.74	8.85	26.87	30.2	91.5
17	Q	2.52	2.55	8.12	35.5	99.1
J6 Pond 1	Pond 1	5.04	5.75	18.14	84.65	257.83
18	R	6.32	7.93	24.54		
19	S	4.86	6.46	19.99	13.83	42.38
20	T	3.78	4.75	13.99		
21	W	1.55	2.11	6.55		
J7 Pond 2	Pond 2	18.97	2.48	10.34	22.54	69.61
J8 Pond 3	Pond 3	64.72	44.51	197.85		
J9 Pond 4	Pond 4	26.47	32.86	102.14		
J10 Pond 5	Pond 5	29.01	36.41	112.62		
J11 Pond 6	Pond 6	72.23	125.20	297.62		

Pond Volume 1
(FAA Method)

Subdivision ERIE HIGHLANDS
Location ERIE, Colorado

Project Name: ERIE HIGHLANDS
Project No. 13-000
By: DCF
Checked By:
Date: 6/26/2013

Volume=1/3 x Depth x (A+B+(A*B)^0.5)
A - Upper Surface
B - Lower Surface

Pond-1 Volume

Elevation	Surface Area (square feet)	A+B+(A*B)^0.5	1/3	Depth (feet)	Volume (cubic feet)	Cum. Volume (cubic feet)	Cum.Volume (acre-feet)
5099.80	50	0	0.00	0.00	0		
5100.00	926	1191	0.07	0.00	79	79	0.002
5101.00	7,009	10483	0.33	1.00	3,494	3,574	0.082
5102.00	15,932	33508	0.33	2.00	11,169	14,743	0.338
5103.00	26,748	63323	0.33	3.00	21,108	35,851	0.823
5104.00	38,130	96814	0.33	4.00	32,271	68,122	1.564
5105.00	47,573	128294	0.33	5.00	42,765	110,887	2.546
5106.00	53,127	150973	0.33	6.00	50,324	161,211	3.701
5107.00	58,101	166786	0.33	7.00	55,595	216,807	4.977
5108.00	63,145	181817	0.33	8.00	60,606	277,412	6.369
							100 yr WSEL

Water Quality Volume: 1.55 acre-feet
Water Quality Surface Elevation: 5103.98

EURV Volume 3.67 AF
EURV Surface Elevation: 5105.97

Q100(allowable)=78.74 cfs

100-YR Volume: 6.13 acre feet
100-YR Surface Elevation: 5107.83

MICRO POOL 1- Volume
(FAA Method)

Subdivision ERIE HIGHLANDS
Location ERIE, Colorado

Project Name: ERIE HIGHLANDS
Project No. 13-000
By: SAP
Checked By: SAP
Date: 6/24/2013

Volume=1/3 x Depth x (A+B+(A*B)^0.5)
A - Upper Surface
B - Lower Surface

Micro Pool Volume

Elevation	**Surface Area** (square feet)	**A+B+(A*B)^0.5**	**1/3**	**Depth** (feet)	**Volume** (cubic feet)	**Cum. Volume** (cubic feet)	**Cum.Volume** (acre-feet)
5097.50	1	1	0.00	0.00	0		
5098.00	926	957	0.17	0.70	160	160	0.004
5099.00	926	2778	0.33	1.70	926	1086	0.025
5100.00	926	2778	0.33	2.50	926	2012	0.046

DETENTION VOLUME BY THE FULL SPECTRUM METHOD

Project: _____

Basin ID: _____

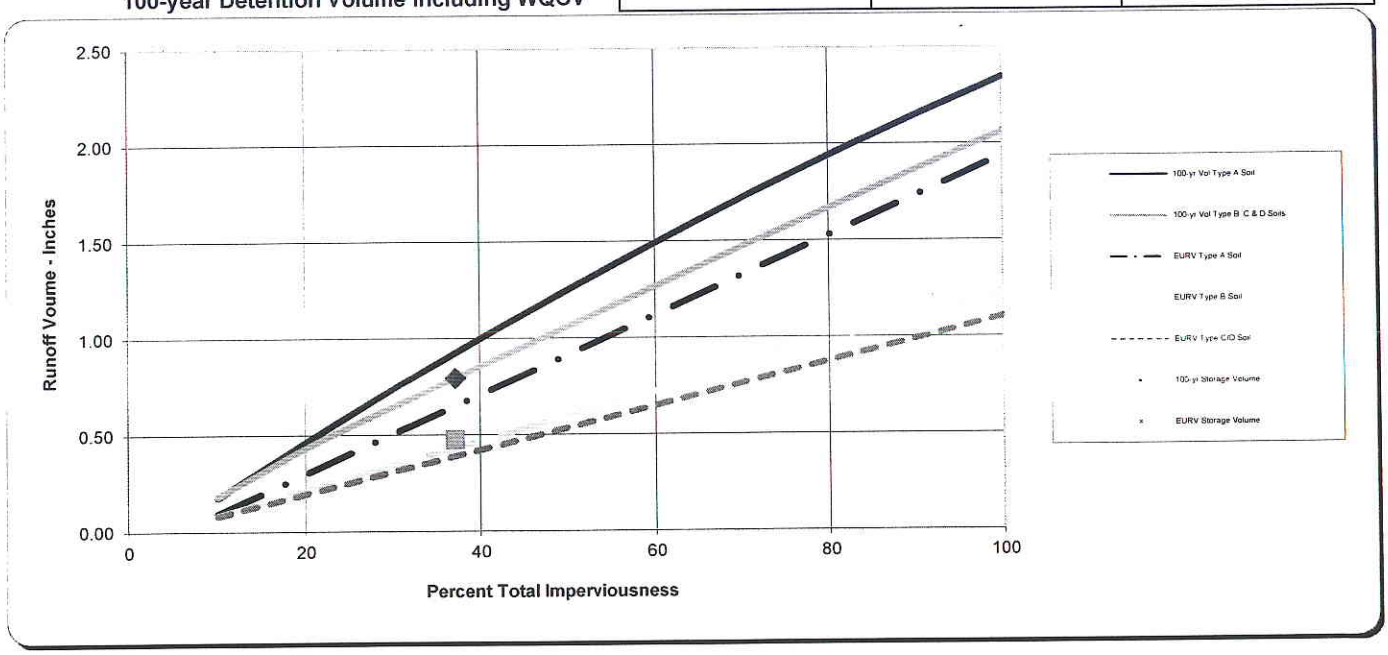
* User input data shown in blue.

Area of Watershed (acres)	92.64	
Subwatershed Imperviousness	37.2%	
Level of Minimizing Directly Connected Impervious Area (MDCIA)	0	0
Effective Imperviousness[1]	37.2%	

Hydrologic Soil Type	Percentage of Area	Area (acres)
Type A		0.0
Type B	100.0%	92.6
Type C or D		0.0

Recommended Horton's Equation Parameters for CUHP		
Infiltration (inches per hour)		Decay Coefficient--α
Initial--f_i	Final--fo	
4.5	0.6	0.0018

	Detention Volumes [2,5]		Maximum Allowable Release Rate, cfs[3]
	(watershed inches)	(acre-feet)	
Excess Urban Runoff Volume[4]	0.47	3.67	Design Oulet to Empty EURV in 72 Hours
100-year Detention Volume Including WQCV [5]	0.79	6.13	78.74



Notes:

1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).

2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.

3) Maximum allowable release rates for 100-year event are based on Table SO-1. Outlet for the Excess Urban Runoff Volume (EURV) to be designed to empty out the EURV in 72 hours. Outlet design is similar to one for the WQCV outlet of an extended detention basin (i.e., perforated plate with a micro-pool) and extends to top of EURV water surface elevation.

4) EURV approximates the difference between developed and pre-developed runoff volume.

5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV

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

Project: _____

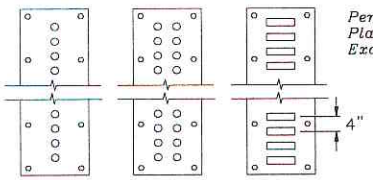
Basin ID: _____

WQCV Design Volume (Input):

Catchment Imperviousness, I_a = 37.2 percent
Catchment Area, A = 92.64 acres
Depth at WQCV outlet above lowest perforation, H = 4 feet
Vertical distance between rows, h = 4.00 inches
Number of rows, NL = 12
Orifice discharge coefficient, C_o = 0.60
Slope of Basin Trickle Channel, S = 0.005 ft / ft

Diameter of holes, D = 1.924 in
Number of holes per row, N = 1
OR
Height of slot, H = _____ in
Width of slot, W = _____ in.

Time to Drain the Pond = 70 hours



Perforated Plate Examples

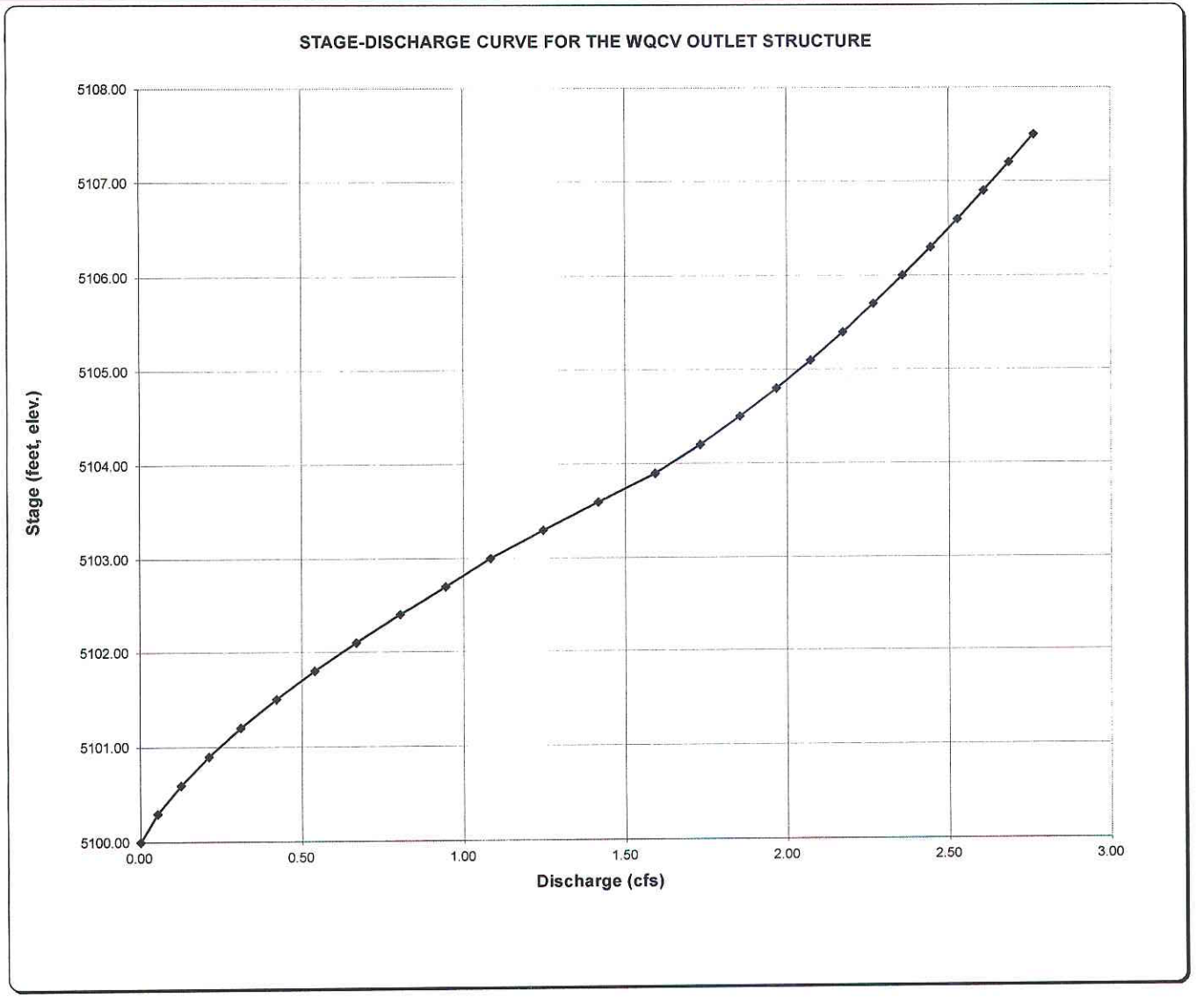
Outlet Design Information (Output):

Excess Urban Runoff Volume (From 'Full-Spectrum Sheet') 0.475 watershed inches
N/A
Excess Urban Runoff Volume (From 'Full-Spectrum Sheet') 3.667 **acre-feet**
Outlet area per row, Ao = 2.91 square inches
Total opening area at each row based on user-input above, Ao = 2.91 square inches
Total opening area at each row based on user-input above, Ao = 0.020 square feet

Calculation of Collection Capacity:

Stage	Central Elevations of Rows of Holes in feet																							Σ
	Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	Row 9	Row 10	Row 11	Row 12	Row 13	Row 14	Row 15	Row 16	Row 17	Row 18	Row 19	Row 20	Row 21	Row 22	Row 23	Flow
ft	5100.00	5100.33	5100.67	5101.00	5101.33	5101.67	5102.00	5102.33	5102.67	5103.00	5103.33	5103.67												
(input)	Collection Capacity for Each Row of Holes in cfs																							
5100.00	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000												0.00
5100.30	0.0533	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000												0.05
5100.60	0.0753	0.0505	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000												0.13
5100.90	0.0922	0.0734	0.0466	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000												0.21
5101.20	0.1065	0.0907	0.0708	0.0435	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000												0.31
5101.50	0.1191	0.1052	0.0886	0.0688	0.0401	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000												0.42
5101.80	0.1304	0.1179	0.1034	0.0870	0.0667	0.0351	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000												0.54
5102.10	0.1409	0.1294	0.1163	0.1020	0.0853	0.0638	0.0307	0.0000	0.0000	0.0000	0.0000	0.0000												0.67
5102.40	0.1506	0.1399	0.1279	0.1150	0.1006	0.0831	0.0615	0.0257	0.0000	0.0000	0.0000	0.0000												0.80
5102.70	0.1598	0.1497	0.1385	0.1268	0.1138	0.0987	0.0813	0.0591	0.0168	0.0000	0.0000	0.0000												0.94
5103.00	0.1684	0.1589	0.1484	0.1375	0.1256	0.1121	0.0972	0.0796	0.0559	0.0000	0.0000	0.0000												1.08
5103.30	0.1766	0.1676	0.1577	0.1475	0.1365	0.1241	0.1109	0.0958	0.0772	0.0533	0.0000	0.0000												1.25
5103.60	0.1845	0.1758	0.1664	0.1568	0.1465	0.1351	0.1230	0.1096	0.0938	0.0753	0.0505	0.0000												1.42
5103.90	0.1920	0.1837	0.1747	0.1656	0.1559	0.1452	0.1340	0.1218	0.1078	0.0922	0.0734	0.0466												1.59
5104.20	0.1993	0.1913	0.1827	0.1739	0.1647	0.1547	0.1442	0.1330	0.1203	0.1065	0.0907	0.0708												1.73
5104.50	0.2063	0.1985	0.1903	0.1819	0.1731	0.1636	0.1537	0.1432	0.1315	0.1191	0.1052	0.0886												1.85
5104.80	0.2130	0.2056	0.1976	0.1895	0.1811	0.1720	0.1627	0.1528	0.1419	0.1304	0.1179	0.1034												1.97
5105.10	0.2196	0.2124	0.2046	0.1969	0.1888	0.1801	0.1712	0.1618	0.1516	0.1409	0.1294	0.1163												2.07
5105.40	0.2259	0.2189	0.2115	0.2040	0.1962	0.1878	0.1793	0.1704	0.1607	0.1506	0.1399	0.1279												2.17
5105.70	0.2321	0.2253	0.2181	0.2108	0.2033	0.1952	0.1870	0.1785	0.1692	0.1598	0.1497	0.1385												2.27
5106.00	0.2382	0.2315	0.2245	0.2174	0.2101	0.2023	0.1945	0.1863	0.1774	0.1684	0.1589	0.1484												2.36
5106.30	0.2440	0.2376	0.2307	0.2238	0.2168	0.2092	0.2016	0.1937	0.1852	0.1766	0.1676	0.1577												2.44
5106.60	0.2498	0.2435	0.2368	0.2301	0.2232	0.2159	0.2085	0.2009	0.1928	0.1845	0.1758	0.1664												2.53
5106.90	0.2554	0.2492	0.2427	0.2362	0.2295	0.2224	0.2152	0.2079	0.2000	0.1920	0.1837	0.1747												2.61
5107.20	0.2609	0.2548	0.2485	0.2421	0.2356	0.2286	0.2217	0.2146	0.2069	0.1993	0.1913	0.1827												2.69
5107.50	0.2663	0.2604	0.2541	0.2479	0.2415	0.2348	0.2280	0.2211	0.2137	0.2063	0.1985	0.1903												2.76
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A												#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A												#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A												#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A												#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A												#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A												#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A												#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A												#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A												#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A												#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A												#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A												#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A												#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A												#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A												#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A												#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A												#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A												#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A												#N/A

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



Design Procedure Form: Extended Detention Basin (EDB)

Designer:
Company:
Date: October 9, 2013
Project:
Location:

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 37.2 %
B) Tributary Area's Imperviousness Ratio (i = I_a / 100)	i = 0.372
C) Contributing Watershed Area	Area = 92.640 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = ____ in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: (●) Water Quality Capture Volume (WQCV) ( ) Excess Urban Runoff Volume (EURV)
F) Design Volume (1.2 WQCV) Based on 40-hour Drain Time (V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area * 1.2)	V_{DESIGN}= 1.596 ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER}$ = (d_6*(V_{DESIGN}/0.43))	$V_{DESIGN\ OTHER}$= ____ ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= ____ ac-ft
I) Predominant Watershed NRCS Soil Group	Choose One: ( ) A (●) B ( ) C / D
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes	
A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 4.00 ft / ft
4. Inlet	
A) Describe means of providing energy dissipation at concentrated inflow locations:	

Project: Town of Erie Job #: 13-002
Client: Oakwood By: Chk. By: Date: 10.11.13
Subject: Pond 1 Orifice / Spillway Sheet #: 1 of 1

Engineering Partners, Inc.
Right. On Time.
Phone 303-703-4444 Fax 303-703-4530
www.eng-partners.com

Pond # 1 Emergency Spill Way $Q = 3.367 L H^{1.5}$

$Q = 258$ cfs

$H = 1.1'$

$258 = 3.367 (L)(1.1)^{1.5}$ $\underline{L = 66.4'}$ use 70'

Orifice Plate Calculation.

$Q = A\ 0.65 \sqrt{2gh}$

$Q = 78.74$ cfs

$H = 10.63$

$78.74 = A\ (0.65) \sqrt{2(32.2)(10.63)}$

$\frac{78.74}{17.00} = A$

$4.63 = A$

$\pi r^2 = 4.63$

$r^2 = 4.63/\pi$

$r^2 = 1.47$

$r = 1.21'$

Use $\underline{2.42'}$ Diam Orifice Plate

Trickle Channel Design 3% 100 year.

3' W x 6' Deep @ 1% = cap = 8.92 cfs. ok

Project: Eure Highlands. Job #:

Client: By: Chk. By: Date:

Subject: WQCV. Sheet #: of

Engineering Partners, Inc.
Right. On Time.
Phone 303-703-4444 Fax 303-703-4530
www.eng-partners.com

Pond # 1.

Required = 1.55 ac. ft.

Forebay / Micro Pool Required Size = 0.04 ac. ft.

Two Forebays : 1st @ 60% = 1046 c.f.

2nd @ 40% = 784 c.f.

Pond Volume-2
(FAA Method)

Subdivision ERIE HIGHLANDS
Location ERIE, Colorado

Project Name: ERIE HIGHLANDS
Project No. 13-000
By: DCF
Checked By: DCF
Date: 6/24/2013

Volume=1/3 x Depth x (A+B+(A*B)^0.5)
A - Upper Surface
B - Lower Surface

Pond-2 Volume

Elevation	Surface Area (square feet)	A+B+(A*B)^0.5	1/3	Depth (feet)	Volume (cubic feet)	Cum. Volume (cubic feet)	Cum.Volume (acre-feet)
5104.50	150	0	0.00	0.00	0		
5105.00	400	795	0.17	5.00	132	132	0.003
5106.00	4,132	5818	0.33	6.00	1,939	2,072	0.048
5107.00	10,705	21488	0.33	7.00	7,163	9,234	0.212
5108.00	17,213	41492	0.33	8.00	13,831	23,065	0.530
5109.00	21,372	57765	0.33	9.00	19,255	42,320	0.972
5110.00	25,541	70277	0.33	10.00	23,426	65,746	1.509
							100 yr WSEL

Water Quality Volume: 0.341 acre-feet
Water Quality Surface Elevation: 5107.41

EURV Volume 0.79 AF
EURV Surface Elevation: 5108.59

Q100(allowable)=16.98 cfs

100-YR Volume: 1.35 acre feet
100-YR Surface Elevation: 5109.70

MICRO POOL POND 2- Volume
(FAA Method)

Subdivision ERIE HIGHLANDS
Location ERIE, Colorado

Project Name: ERIE HIGHLANDS
Project No. 13-000
By: SAP
Checked By: SAP
Date: 6/24/2013

Volume=1/3 x Depth x (A+B+(A*B)^0.5)
A - Upper Surface
B - Lower Surface

Micro Pool Volume

Elevation	Surface Area (square feet)	A+B+(A*B)^0.5	1/3	Depth (feet)	Volume (cubic feet)	Cum. Volume (cubic feet)	Cum.Volume (acre-feet)
5102.00	1	1	0.00	0.00	0		
5103.00	230	246	0.33	0.70	82	82	0.002
5104.00	230	690	0.33	1.70	230	312	0.007
5104.50	230	690	0.17	2.50	115	427	0.010

DETENTION VOLUME BY THE FULL SPECTRUM METHOD

Project: _____

Basin ID: _____

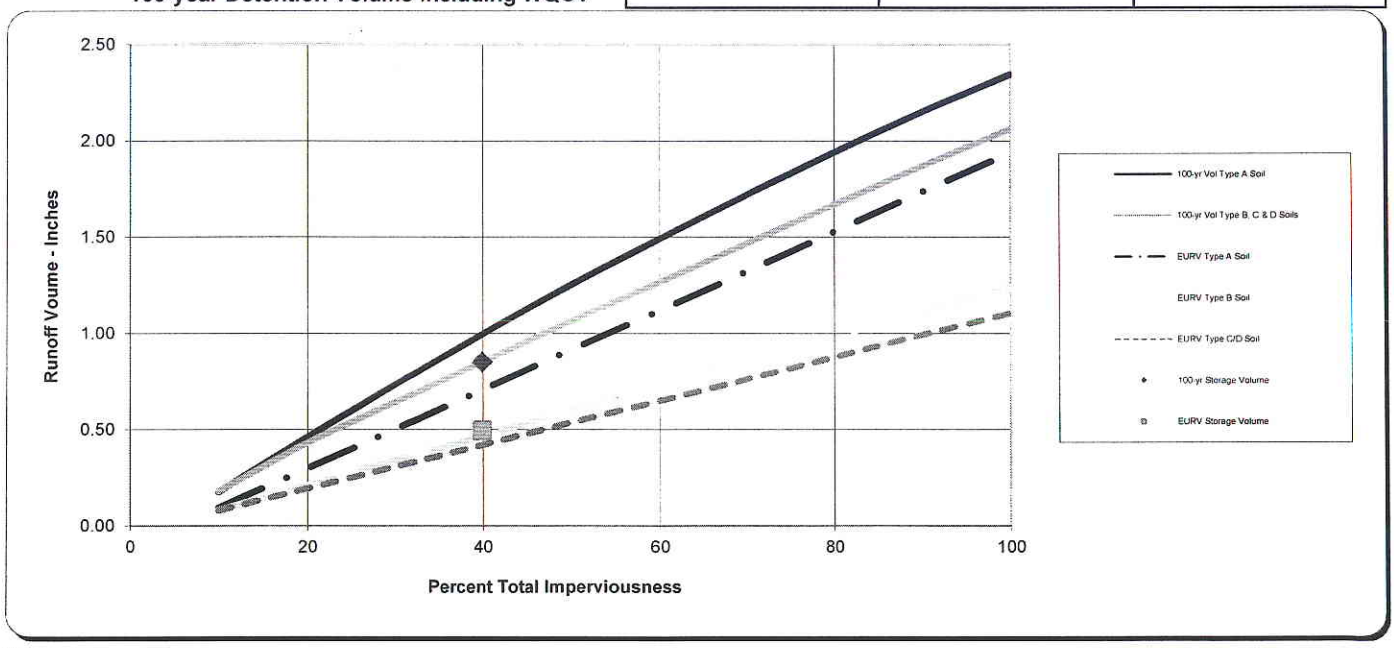
* User input data shown in blue.

Area of Watershed (acres)	18.97	
Subwatershed Imperviousness	39.9%	
Level of Minimizing Directly Connected Impervious Area (MDCIA)	0	0
Effective Imperviousness[1]	39.9%	

Hydrologic Soil Type	Percentage of Area	Area (acres)
Type A		0.0
Type B	70.0%	13.3
Type C or D	30.0%	5.7

Recommended Horton's Equation Parameters for CUHP		
Infiltration (inches per hour)		Decay Coefficient--α
Initial--f_i	Final--fo	
4.05	0.6	0.0018

	Detention Volumes [2,5]		
	(watershed inches)	(acre-feet)	Maximum Allowable Release Rate, cfs[3]
Excess Urban Runoff Volume[4]	0.50	0.79	Design Oulet to Empty EURV in 72 Hours
100-year Detention Volume Including WQCV [5]	0.85	1.35	16.98



Notes:

1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).

2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.

3) Maximum allowable release rates for 100-year event are based on Table SO-1. Outlet for the Excess Urban Runoff Volume (EURV) to be designed to empty out the EURV in 72 hours. Outlet design is similar to one for the WQCV outlet of an extended detention basin (i.e., perforated plate with a micro-pool) and extends to top of EURV water surface elevation.

4) EURV approximates the difference between developed and pre-developed runoff volume.

5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV

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

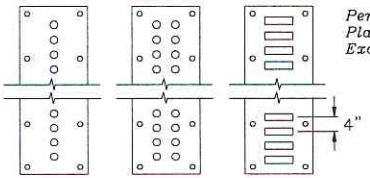
Project: _____

Basin ID: _____

WQCV Design Volume (Input):

Catchment Imperviousness, I_a =	40.0	percent	Diameter of holes, D =	1.067	in.
Catchment Area, A =	18.97	acres	Number of holes per row, N =	1	
Depth at WQCV outlet above lowest perforation, H =	3	feet		OR	
Vertical distance between rows, h =	4.00	inches			
Number of rows, NL =	9		Height of slot, H =		in.
Orifice discharge coefficient, C_o =	0.60		Width of slot, W =		in.
Slope of Basin Trickle Channel, S =	0.005	ft / ft			

Time to Drain the Pond = 72 hours



Perforated Plate Examples

Outlet Design Information (Output):

Excess Urban Runoff Volume (From 'Full-Spectrum Sheet')	0.498	watershed inches
	N/A	
Excess Urban Runoff Volume (From 'Full-Spectrum Sheet')	**0.787**	**acre-feet**
Outlet area per row, Ao =	0.89	square inches
Total opening area at each row based on user-input above, Ao =	0.89	square inches
Total opening area at each row based on user-input above, Ao =	0.006	square feet

Calculation of Collection Capacity:

Stage	Central Elevations of Rows of Holes in feet																								Σ
	Row 1	Row 2	Row 3	Row 4	Row 5	Row 6	Row 7	Row 8	Row 9	Row 10	Row 11	Row 12	Row 13	Row 14	Row 15	Row 16	Row 17	Row 18	Row 19	Row 20	Row 21	Row 22	Row 23	Row 23	Flow
ft	5104.50	5104.83	5105.17	5105.50	5105.83	5106.17	5106.50	5106 83	5107.17																
(Input)	Collection Capacity for Each Row of Holes in cfs																								
5104.50	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0 0000	0.0000																0.00
5104.80	0.0164	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0 0000	0.0000																0.02
5105.10	0.0231	0.0155	0.0000	0.0000	0.0000	0.0000	0.0000	0 0000	0.0000																0.04
5105.40	0.0284	0.0226	0.0143	0.0000	0.0000	0.0000	0.0000	0 0000	0.0000																0.07
5105.70	0.0327	0.0279	0.0218	0.0134	0.0000	0.0000	0.0000	0 0000	0.0000																0.10
5106.00	0.0366	0.0323	0.0272	0.0211	0.0123	0.0000	0.0000	0 0000	0.0000																0.13
5106.30	0.0401	0.0362	0.0318	0.0267	0.0205	0.0108	0.0000	0 0000	0 0000																0.17
5106.60	0.0433	0.0398	0.0357	0.0313	0.0262	0.0196	0.0095	0 0000	0.0000																0.21
5106.90	0.0463	0.0430	0 0393	0.0354	0.0309	0.0255	0.0189	0 0079	0.0000																0.25
5107.20	0.0491	0.0460	0.0426	0.0390	0 0350	0.0303	0.0250	0 0182	0 0052																0.29
5107.50	0.0518	0.0488	0 0456	0.0423	0.0386	0.0345	0.0299	0 0245	0 0172																0.33
5107.80	0.0543	0.0515	0.0485	0.0453	0.0419	0.0382	0.0341	0 0294	0.0237																0.37
5108.10	0.0567	0.0540	0.0512	0.0482	0.0450	0.0415	0.0378	0.0337	0.0288																0.40
5108.40	0.0590	0.0565	0.0537	0.0509	0.0479	0.0446	0.0412	0.0374	0.0331																0.42
5108.70	0.0612	0.0588	0.0561	0.0535	0.0506	0.0475	0.0443	0 0409	0 0370																0.45
5109.00	0.0634	0.0610	0.0585	0.0559	0.0532	0.0503	0.0473	0 0440	0.0404																0.47
5109.30	0.0655	0.0632	0.0607	0.0583	0 0557	0.0529	0.0500	0 0470	0.0436																0.50
5109.60	0.0675	0.0653	0.0629	0.0605	0.0580	0.0553	0.0526	0 0497	0.0466																0.52
5109.90	0.0694	0.0673	0.0650	0.0627	0.0603	0.0577	0.0551	0 0524	0.0494																0.54
5110.20	0.0713	0.0693	0.0670	0.0648	0.0625	0.0600	0.0575	0 0549	0.0520																0.56
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																#N/A
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	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																#N/A
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	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																#N/A
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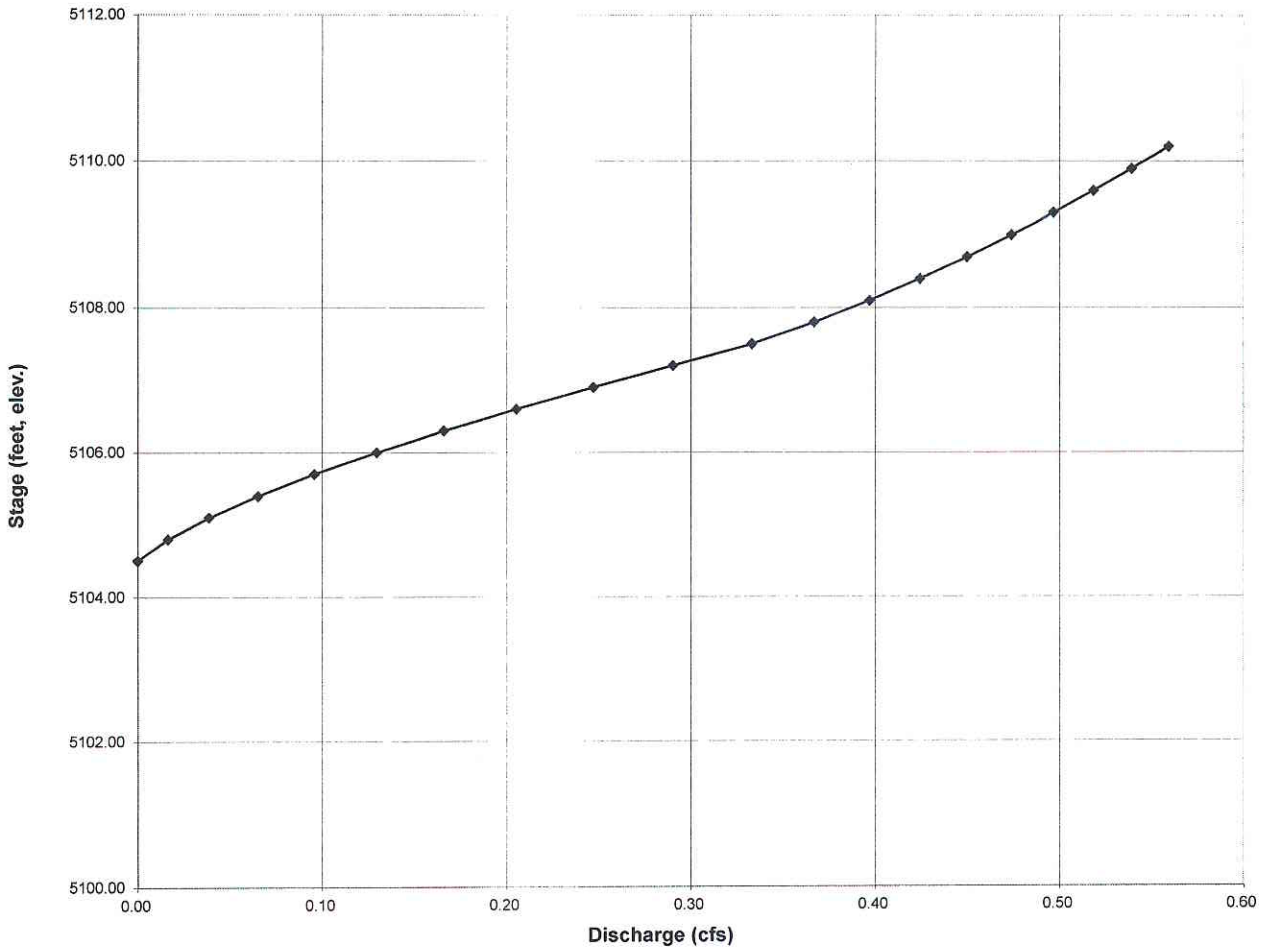
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																#N/A
	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A																#N/A

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

Project: _____

Basin ID: _____

STAGE-DISCHARGE CURVE FOR THE WQCV OUTLET STRUCTURE



DETENTION VOLUME BY THE FULL SPECTRUM METHOD

Project: _____

Basin ID: _____

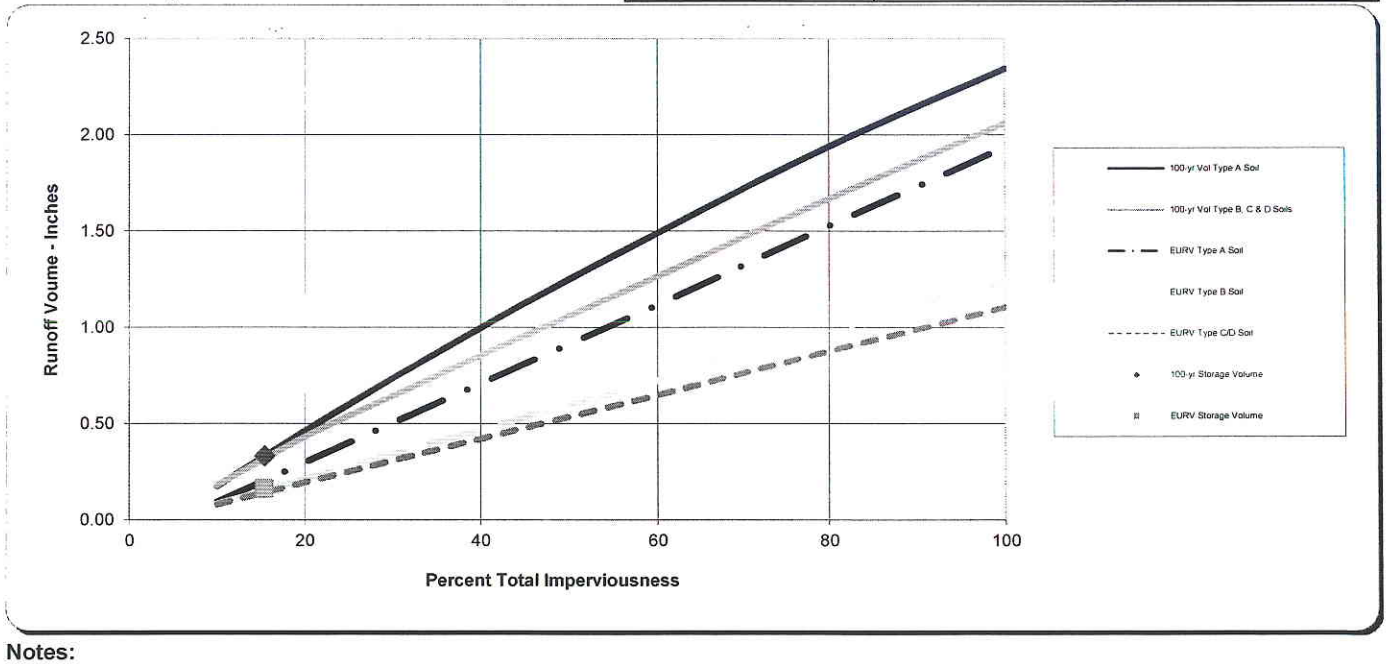
* User input data shown in blue.

Area of Watershed (acres)	64.72	
Subwatershed Imperviousness	15.4%	
Level of Minimizing Directly Connected Impervious Area (MDCIA)	0	0
Effective Imperviousness[1]	15.4%	

Hydrologic Soil Type	Percentage of Area	Area (acres)
Type A		0.0
Type B	41.0%	26.5
Type C or D	59.0%	38.2

Recommended Horton's Equation Parameters for CUHP		
Infiltration (inches per hour)		Decay Coefficient--α
Initial--f_i	Final--fo	
3.615	0.5	0.0018

	Detention Volumes [2,5]		Maximum Allowable Release Rate, cfs[3]
	(watershed inches)	(acre-feet)	
Excess Urban Runoff Volume[4]	0.16	0.86	Design Oulet to Empty EURV in 72 Hours
100-year Detention Volume Including WQCV [5]	0.33	1.80	60.74



Notes:

1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).

2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.

3) Maximum allowable release rates for 100-year event are based on Table SO-1. Outlet for the Excess Urban Runoff Volume (EURV) to be designed to empty out the EURV in 72 hours. Outlet design is similar to one for the WQCV outlet of an extended detention basin (i.e., perforated plate with a micro-pool) and extends to top of EURV water surface elevation.

4) EURV approximates the difference between developed and pre-developed runoff volume.

5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV

DETENTION VOLUME BY THE FULL SPECTRUM METHOD

Project: _____

Basin ID: _____

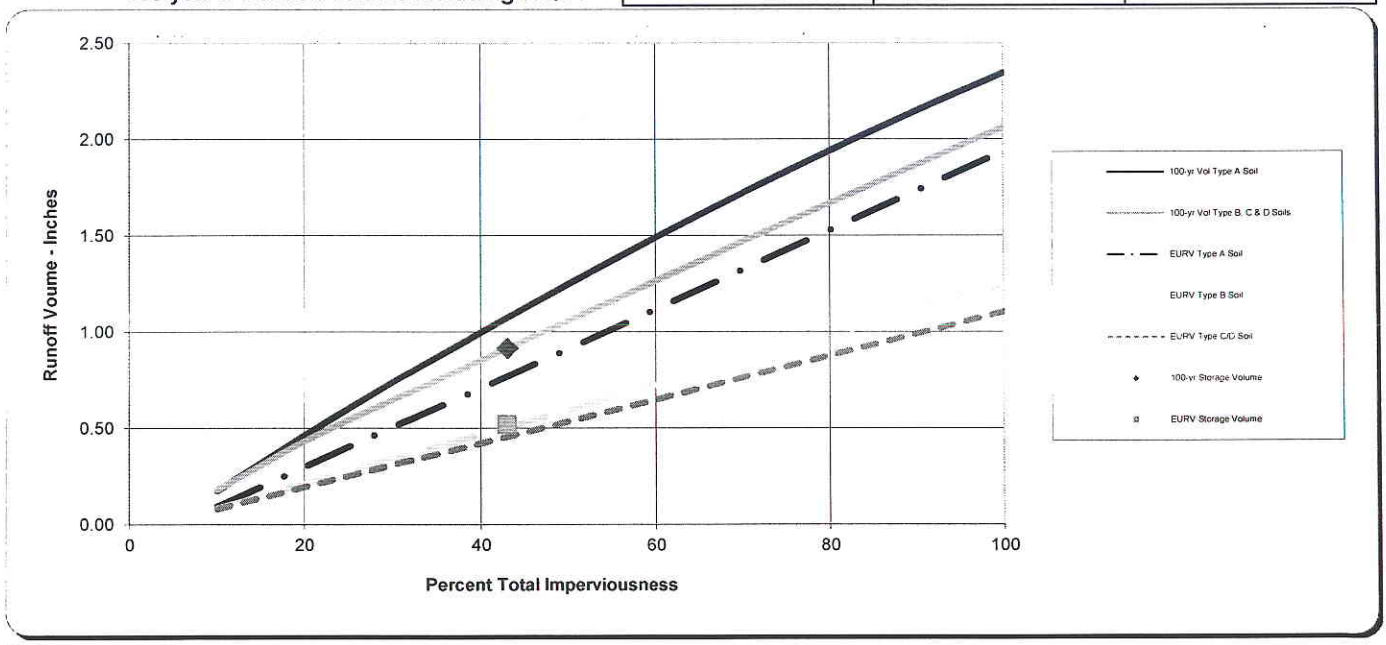
* User input data shown in blue.

Area of Watershed (acres)	26.47	
Subwatershed Imperviousness	43.0%	
Level of Minimizing Directly Connected Impervious Area (MDCIA)	0	0
Effective Imperviousness[1]	43.0%	

Hydrologic Soil Type	Percentage of Area	Area (acres)
Type A		0.0
Type B	30.0%	7.9
Type C or D	70.0%	18.5

Recommended Horton's Equation Parameters for CUHP		
Infiltration (inches per hour)		Decay Coefficient--α
Initial--f_i	Final--fo	
3.45	0.5	0.0018

	Detention Volumes [2,5]		Maximum Allowable Release Rate, cfs[3]
	(watershed inches)	(acre-feet)	
Excess Urban Runoff Volume[4]	0.52	1.14	Design Oulet to Empty EURV in 72 Hours
100-year Detention Volume Including WQCV [5]	0.92	2.02	25.28



Notes:

1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).

2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.

3) Maximum allowable release rates for 100-year event are based on Table SO-1. Outlet for the Excess Urban Runoff Volume (EURV) to be designed to empty out the EURV in 72 hours. Outlet design is similar to one for the WQCV outlet of an extended detention basin (i.e., perforated plate with a micro-pool) and extends to top of EURV water surface elevation.

4) EURV approximates the difference between developed and pre-developed runoff volume.

5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV

Design Procedure Form: Extended Detention Basin (EDB)

Designer:
Company:
Date: October 9, 2013
Project:
Location:

1. Basin Storage Volume	
A) Effective Imperviousness of Tributary Area, I_a	I_a = 39.9 %
B) Tributary Area's Imperviousness Ratio ($i = I_a / 100$)	i = 0.399
C) Contributing Watershed Area	Area = 18.970 ac
D) For Watersheds Outside of the Denver Region, Depth of Average Runoff Producing Storm	d_6 = ____ in
E) Design Concept (Select EURV when also designing for flood control)	Choose One: (●) Water Quality Capture Volume (WQCV) ( ) Excess Urban Runoff Volume (EURV)
F) Design Volume (1.2 WQCV) Based on 40-hour Drain Time ($V_{DESIGN} = (1.0 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12 * Area * 1.2$)	V_{DESIGN}= 0.341 ac-ft
G) For Watersheds Outside of the Denver Region, Water Quality Capture Volume (WQCV) Design Volume ($V_{WQCV\ OTHER} = (d_6 * (V_{DESIGN}/0.43))$)	$V_{DESIGN\ OTHER}$= ____ ac-ft
H) User Input of Water Quality Capture Volume (WQCV) Design Volume (Only if a different WQCV Design Volume is desired)	$V_{DESIGN\ USER}$= ____ ac-ft
I) Predominant Watershed NRCS Soil Group	Choose One: ( ) A (●) B ( ) C / D
2. Basin Shape: Length to Width Ratio (A basin length to width ratio of at least 2:1 will improve TSS reduction.)	L : W = 2.0 : 1
3. Basin Side Slopes	
A) Basin Maximum Side Slopes (Horizontal distance per unit vertical, 4:1 or flatter preferred)	Z = 4.00 ft / ft
4. Inlet	
A) Describe means of providing energy dissipation at concentrated inflow locations:	

Project: Erie Highlands Job #:

Client: By: Chk. By: Date:

Subject: Pond # 2. Sheet #: of

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Right. On Time.
Phone 303-703-4444 Fax 303-703-4530
www.eng-partners.com

Q_{TOTAL} = 69.6 cfs Allowable Release = 16.98 cfs

$WQCV_{req}$ = 0.341 ac-ft.

Emergency Spill req = $Q = 3.367 (L)(H)^{1.5}$

$L = 10.7'$

Outlet Control

$Q = A(.65)(\sqrt{2gh})$

$Q = 16.97$

$H = 7.75'$

$16.97 = A(.65)\sqrt{2(32.2)(7.75)}$

$16.97 = A(0.65)(22.34)$

$16.67 / 14.52 = A$

$1.148 = A = \pi r^2$

$0.365 = r^2$

$0.604 = r$

$D = 1.2'$ Outlet Plate

Required WQCV = 0.341 ac-ft ✓

Forebay / Micro Pool = 0.01 ac. ft. ✓

Pond #3 (Interim For Sediment)

DETENTION VOLUME BY THE FULL SPECTRUM METHOD

Project: _____

Basin ID: _____

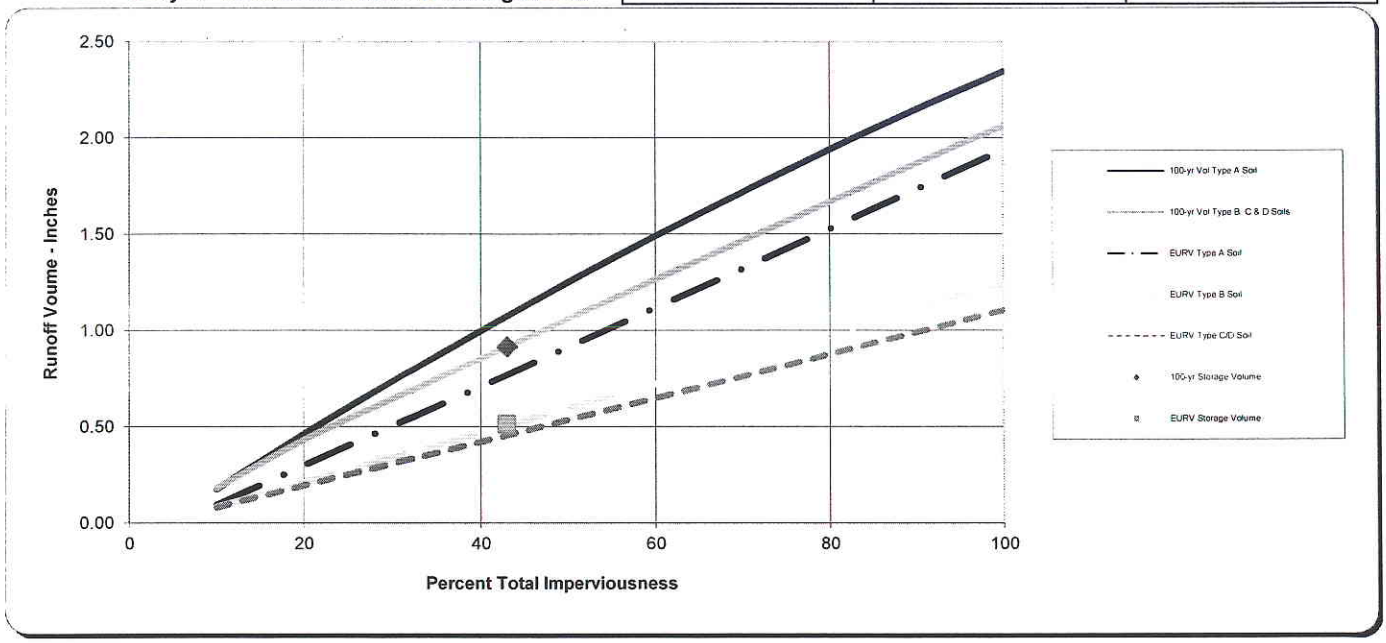
* User input data shown in blue.

Area of Watershed (acres)	29.10	
Subwatershed Imperviousness	43.0%	
Level of Minimizing Directly Connected Impervious Area (MDCIA)	0	0
Effective Imperviousness[1]	43.0%	

Hydrologic Soil Type	Percentage of Area	Area (acres)
Type A		0.0
Type B	19.0%	5.5
Type C or D	81.0%	23.6

Recommended Horton's Equation Parameters for CUHP		
Infiltration (inches per hour)		Decay Coefficient--α
Initial--f_i	Final--fo	
3.285	0.5	0.0018

	Detention Volumes [2,5]		
	(watershed inches)	(acre-feet)	Maximum Allowable Release Rate, cfs[3]
Excess Urban Runoff Volume[4]	0.51	1.24	Design Oulet to Empty EURV in 72 Hours
100-year Detention Volume Including WQCV [5]	0.92	2.22	28.27



Notes:

1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).

2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.

3) Maximum allowable release rates for 100-year event are based on Table SO-1. Outlet for the Excess Urban Runoff Volume (EURV) to be designed to empty out the EURV in 72 hours. Outlet design is similar to one for the WQCV outlet of an extended detention basin (i.e., perforated plate with a micro-pool) and extends to top of EURV water surface elevation.

4) EURV approximates the difference between developed and pre-developed runoff volume.

5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV

DETENTION VOLUME BY THE FULL SPECTRUM METHOD

Project: _____

Basin ID: _____

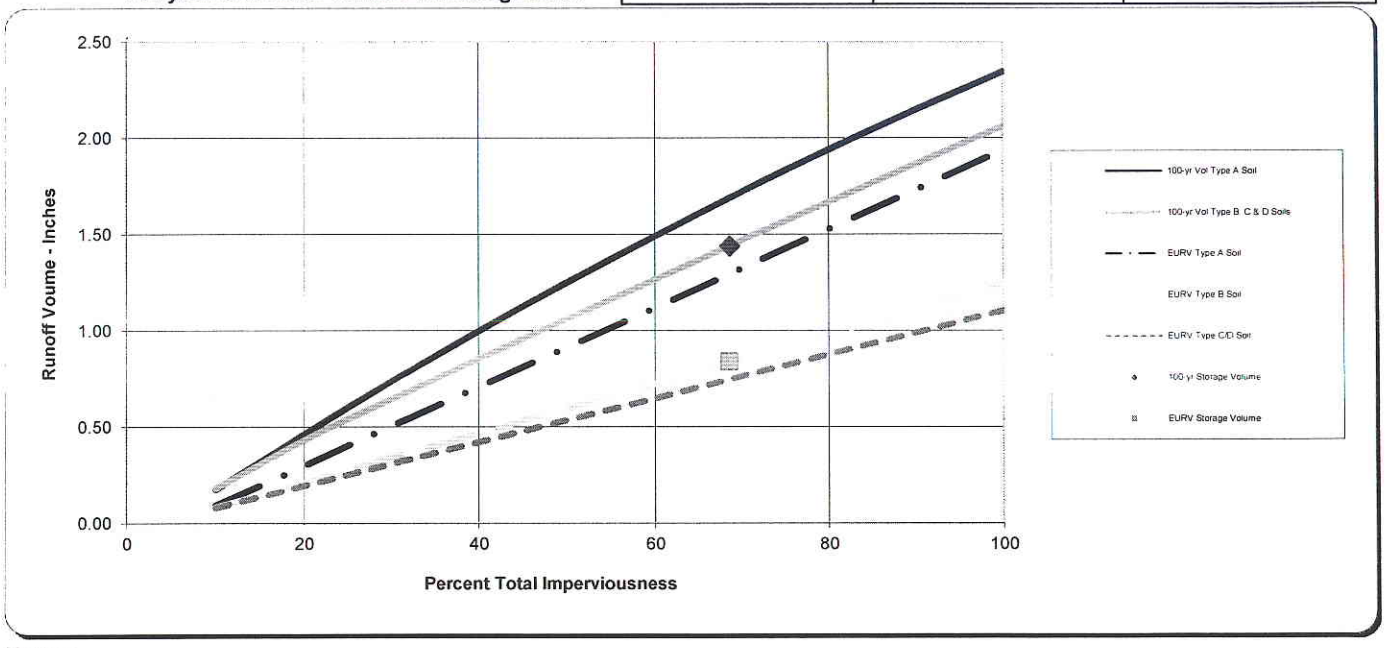
* User input data shown in blue.

Area of Watershed (acres)	72.23	
Subwatershed Imperviousness	68.6%	
Level of Minimizing Directly Connected Impervious Area (MDCIA)	0	0
Effective Imperviousness[1]	68.6%	

Hydrologic Soil Type	Percentage of Area	Area (acres)
Type A		0.0
Type B	16.0%	11.6
Type C or D	84.0%	60.7

Recommended Horton's Equation Parameters for CUHP		
Infiltration (inches per hour)		Decay Coefficient--α
Initial--f_i	Final--fo	
3.24	0.5	0.0018

	Detention Volumes [2,5]		
	(watershed inches)	(acre-feet)	Maximum Allowable Release Rate, cfs[3]
Excess Urban Runoff Volume[4]	0.84	5.04	Design Oulet to Empty EURV in 72 Hours
100-year Detention Volume Including WQCV [5]	1.44	8.67	70.50



Notes:

1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).

2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.

3) Maximum allowable release rates for 100-year event are based on Table SO-1. Outlet for the Excess Urban Runoff Volume (EURV) to be designed to empty out the EURV in 72 hours. Outlet design is similar to one for the WQCV outlet of an extended detention basin (i.e., perforated plate with a micro-pool) and extends to top of EURV water surface elevation.

4) EURV approximates the difference between developed and pre-developed runoff volume.

5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV

DP 21 Flows
Worksheet for Trapezoidal Channel

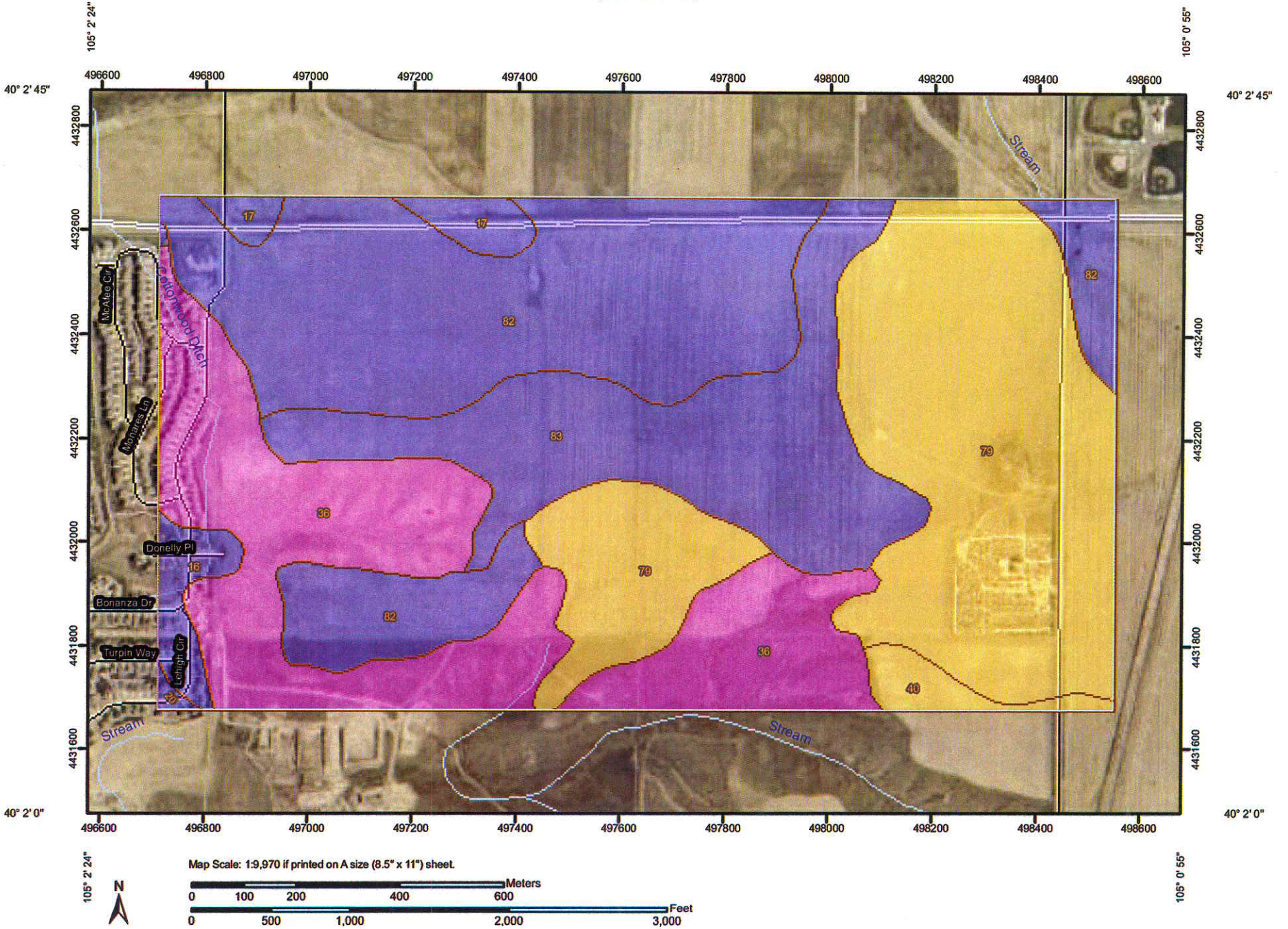
Verify Emergency Capacity.

Project Description	
Project File	x:\13-000-erie\drainage\emergenc.fm2
Worksheet	DP 21 Emergency Flows
Flow Element	Trapezoidal Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Mannings Coefficient	0.030	
Channel Slope	0.020000	ft/ft
Depth	1.00	ft
Left Side Slope	3.000000	H : V
Right Side Slope	3.000000	H : V
Bottom Width	5.00	ft

Results		
Discharge	44.45	cfs
Flow Area	8.00	ft²
Wetted Perimeter	11.32	ft
Top Width	11.00	ft
Critical Depth	1.08	ft
Critical Slope	0.014861	ft/ft
Velocity	5.56	ft/s
Velocity Head	0.48	ft
Specific Energy	1.48	ft
Froude Number	1.15	
Flow is supercritical.		

Hydrologic Soil Group—Weld County, Colorado, Southern Part
(Dearmin Soils)



MAP LEGEND

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

Soils
- Soil Map Units

Soil Ratings
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Political Features
- Cities

Water Features
- Streams and Canals

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

MAP INFORMATION

Map Scale: 1:9,980 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 13N NAD83

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

Soil Survey Area: Weld County, Colorado, Southern Part
Survey Area Data: Version 11, Aug 27, 2009

Date(s) aerial images were photographed: 8/6/2005

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.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Weld County, Colorado, Southern Part (CO618)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
16	Colby loam, 3 to 5 percent slopes	B	7.8	1.7%
17	Colby loam, 5 to 9 percent slopes	B	7.6	1.7%
20	Colombo clay loam, 1 to 3 percent slopes	B	0.8	0.2%
36	Midway-Shingle complex, 5 to 20 percent slopes	D	98.2	21.8%
40	Nunn loam, 1 to 3 percent slopes	C	6.8	1.5%
79	Weld loam, 1 to 3 percent slopes	C	130.1	28.9%
82	Wiley-Colby complex, 1 to 3 percent slopes	B	128.3	28.5%
83	Wiley-Colby complex, 3 to 5 percent slopes	B	70.4	15.6%
Totals for Area of Interest			**450.1**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Aggregation is the process by which a set of component attribute values is reduced to a single value that represents the map unit as a whole.

A map unit is typically composed of one or more "components". A component is either some type of soil or some nonsoil entity, e.g., rock outcrop. For the attribute being aggregated, the first step of the aggregation process is to derive one attribute value for each of a map unit's components. From this set of component attributes, the next step of the aggregation process derives a single value that represents the map unit as a whole. Once a single value for each map unit is derived, a thematic map for soil map units can be rendered. Aggregation must be done because, on any soil map, map units are delineated but components are not.

For each of a map unit's components, a corresponding percent composition is recorded. A percent composition of 60 indicates that the corresponding component typically makes up approximately 60% of the map unit. Percent composition is a critical factor in some, but not all, aggregation methods.

The aggregation method "Dominant Condition" first groups like attribute values for the components in a map unit. For each group, percent composition is set to the sum of the percent composition of all components participating in that group. These groups now represent "conditions" rather than components. The attribute value associated with the group with the highest cumulative percent composition is returned. If more than one group shares the highest cumulative percent composition, the corresponding "tie-break" rule determines which value should be returned. The "tie-break" rule indicates whether the lower or higher group value should be returned in the case of a percent composition tie.

The result returned by this aggregation method represents the dominant condition throughout the map unit only when no tie has occurred.

Component Percent Cutoff: None Specified

Components whose percent composition is below the cutoff value will not be considered. If no cutoff value is specified, all components in the database will be considered. The data for some contrasting soils of minor extent may not be in the database, and therefore are not considered.

Tie-break Rule: Higher

The tie-break rule indicates which value should be selected from a set of multiple candidate values, or which value should be selected in the event of a percent composition tie.

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

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

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

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

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

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

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

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

Base map information shown on this FIRM was provided by the FEMA Map Service Centerand the Boulder Area Spatial Data Cooperative (BASIC). Additional input was provided by the Town of Erie and the City of Longmont. These data are current as of 2004

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

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

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

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

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

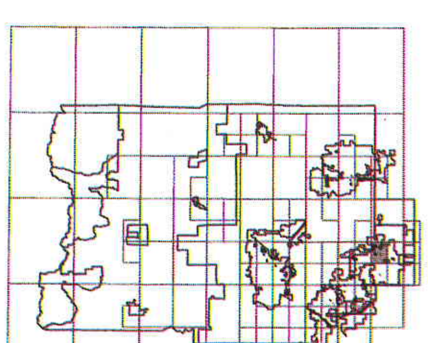
Accredited Levee Notes to Users: Check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at http://www.fema.gov/business/nfip.index.htm

Boulder County Vertical Datum Offset Table

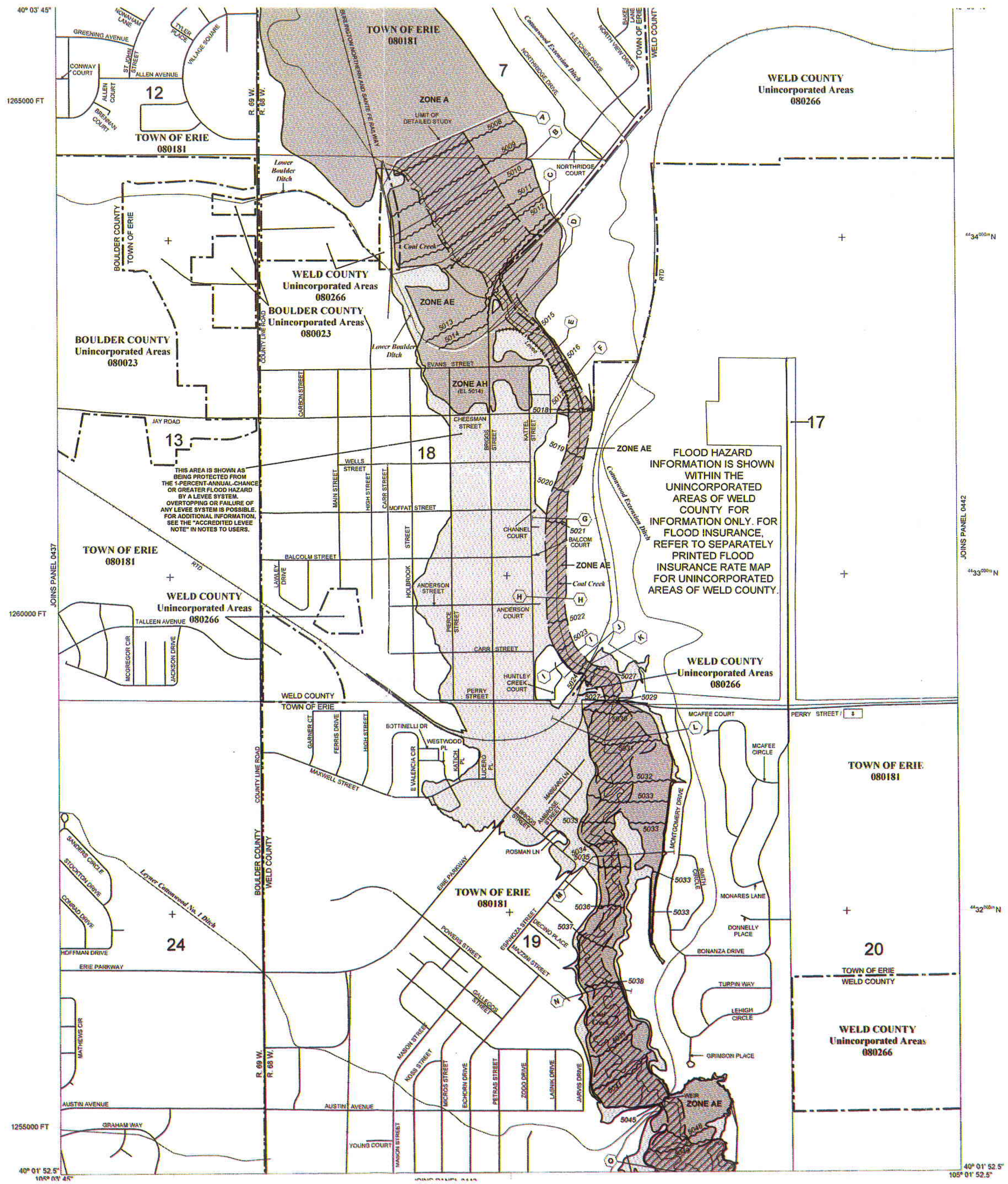
Flooding Source	Vertical Datum Offset (ft)
Coal Creek (within Town of Erie)	3.0

Example: To convert Coal Creek elevations to NAVD 88, 3.0 feet were added to the NGVD 29 elevations.

Panel Location Map



This digital Flood Insurance Rate map (FIRM) was produced through a cooperative partnership between the State of Colorado Water Conservation Board, the Urban Drainage and Flood Control District, and the Federal Emergency Management Agency (FEMA). The State of Colorado Water Conservation Board and the Urban Drainage and Flood Control District have implemented a long-term approach of floodplain management to reduce the costs associated with flooding. As part of this effort, both the State of Colorado and the Urban Drainage and Flood Control District have joined in Cooperating Technical Partner agreements with FEMA to produce this digital FIRM.



the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

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

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

ZONE X — Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D — Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

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

*Referenced to the North American Vertical Datum of 1988

(A)———(A)	Cross section line
(23) - - - - - (23)	Transect line
45° 02' 08", 93° 02' 12"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
$^{42}89^{000m}$ N	1000-meter Universal Transverse Mercator grid values, zone 13
3180000 FT	5000-foot ticks: Colorado State Plane North Zone (FIPS Zone 0501), Lambert Conformal Conic projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
•M1.5	River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
June 2, 1995

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

May 6, 1998 - to incorporate previously issued Letters of Map Revision; to add roads and road names; and to update corporate limits.
October 4, 2002 - to change base flood elevations; to change special flood hazard areas; to change zone designations; to update roads and road names; to reflect updated topographic information; to incorporate previously issued Letters of Map Revision; and to change floodway.
December 18, 2012 - to update corporate limits; to update roads and road names; to add Special Flood Hazard Areas previously shown on Town of Erie, Colorado Flood Insurance Rate Map dated December 2, 2004; and to incorporate previously issued Letters of Map Revision

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

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

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0441J

FIRM
FLOOD INSURANCE RATE MAP
BOULDER COUNTY, COLORADO
AND INCORPORATED AREAS

PANEL 441 OF 615

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
BOULDER COUNTY	080023	0441	J
ERIE, TOWN OF	080181	0441	J

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

MAP NUMBER
08013C0441J

TABLE 800-4
ALLOWABLE RELEASE RATES FOR DETENTION PONDS - CFS/ACRE

	SCS SOIL GROUP*		
CONTROL FREQUENCY	A	B	C & D
2-year	0.02	0.04	0.06
5-year	0.07	0.13	0.17
10-year	0.13	0.23	0.30
25-year	0.24	0.41	0.52
100-year	0.5	0.85	1.00

*SCS soil groups are classified according to their infiltration and transmission rates. The hydrologic soil groups are:

A. - Soils having high infiltration rates even when thoroughly wetted. These consist chiefly of deep, well to excessively drained sands or gravel. These soils have a high rate of water transmission.

B. - Soils having moderate infiltration rates when thoroughly wetted. These consist chiefly of moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission.

C & D. - Soils having slow infiltration rates when thoroughly wetted. These consist chiefly of soils with a layer that impeded downward movement of water or soils with moderately fine to fine texture. These soils have a slow rate of water transmission.

814.08 Minimum Detention Volume

The minimum required detention volumes should be determined using the following equations (Refer to Urban Storm Drainage Criteria Manual Volume III for water quality release rates):

V= KA, (Equation 801)

For the 100-year,
$K_{100} = (1.78I-0.002I^2- 3.56)/1000$ (Equation 802)

For the 10-year,

$K_{10} = (0.95I – 1.90)/1000$ (Equation 803)

Where V = required volume for the 100 or 10-year storm (acre-feet),
I = Developed basin impervious (%)
A = Tributary area (Acres)

814.09 Compensating Detention Procedure

Detention facilities with drainage areas less than 160 acres are to be designed using the compensating detention procedure if any runoff is to flow undetained from the subject property. There may be more than one local detention facility on site. The compensating detention procedure requires that the release rates from the detained and undetained areas be equal to the allowable release rates from the total site. Therefore, the more undetained runoff, the less the allowable detention facility release rate. The limit on the undetained area is 5% or 5 acres, whichever is less.

Table RO-3—Recommended Percentage Imperviousness Values

Land Use or Surface Characteristics	Percentage Imperviousness
Business:	
Commercial areas	95
Neighborhood areas	85
Residential:	
Single-family	*
Multi-unit (detached)	60
Multi-unit (attached)	75
Half-acre lot or larger	*
Apartments	80
Industrial:	
Light areas	80
Heavy areas	90
Parks, cemeteries	5
Playgrounds	10
Schools	50
Railroad yard areas	15
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	0
Lawns, clayey soil	0

Table RO-5

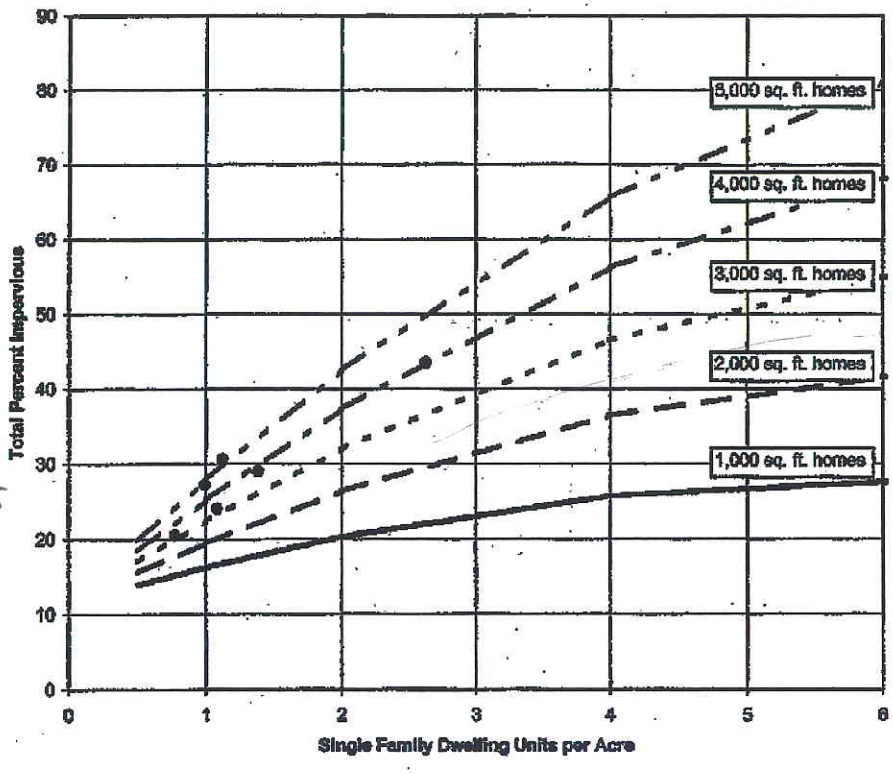
* See Figures RO-3 through RO-5 for percentage imperviousness.

$$C_A = K_A + \left(1.31i^3 - 1.44i^2 + 1.135i - 0.12\right) \text{ for } C_A \geq 0, \text{ otherwise } C_A = 0 \qquad \text{(RO-6)}$$

$$C_{CD} = K_{CD} + \left(0.858i^3 - 0.786i^2 + 0.774i + 0.04\right) \qquad \text{(RO-7)}$$

$$C_B = \left(C_A + C_{CD}\right)/2$$

Single Family
Pond 1
Density @ 3.5
Pond 2
Density @ 4.5
Pond 3
Density @ 1.0
Pond 4 & Pond 5
Density @ 4.5
Pond 6
Density @ 7.5



Oakwood
Average S.F.
@ 2,500 sf.

Figure RO-5—Watershed Imperviousness, Single-Family Residential Two-Story Houses

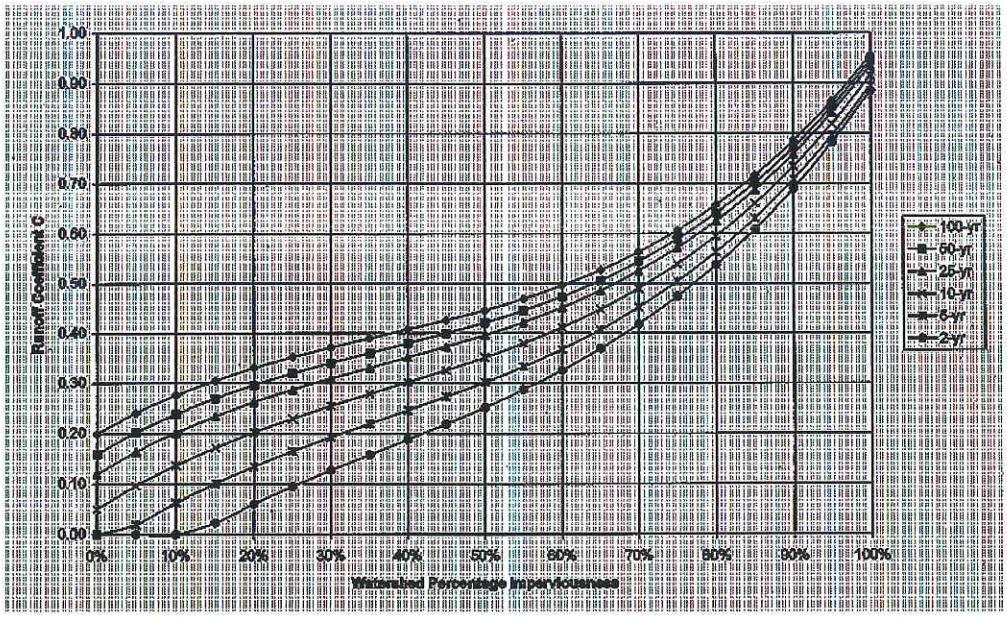


Figure RO-6—Runoff Coefficient, *C*, vs. Watershed Percentage Imperviousness NRCS Hydrologic Soil Group A

Table RO-5— Runoff Coefficients, *C*

Percentage Imperviousness	Type C and D NRCS Hydrologic Soil Groups					
	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
0%	0.04	0.15	0.25	0.37	0.44	0.50
5%	0.08	0.18	0.28	0.39	0.46	0.52
10%	0.11	0.21	0.30	0.41	0.47	0.53
15%	0.14	0.24	0.32	0.43	0.49	0.54
20%	0.17	0.26	0.34	0.44	0.50	0.55
25%	0.20	0.28	0.36	0.46	0.51	0.56
30%	0.22	0.30	0.38	0.47	0.52	0.57
35%	0.25	0.33	0.40	0.48	0.53	0.57
40%	0.28	0.35	0.42	0.50	0.54	0.58
45%	0.31	0.37	0.44	0.51	0.55	0.59
50%	0.34	0.40	0.46	0.53	0.57	0.60
55%	0.37	0.43	0.48	0.55	0.58	0.62
60%	0.41	0.46	0.51	0.57	0.60	0.63
65%	0.45	0.49	0.54	0.59	0.62	0.65
70%	0.49	0.53	0.57	0.62	0.65	0.68
75%	0.54	0.58	0.62	0.66	0.68	0.71
80%	0.60	0.63	0.66	0.70	0.72	0.74
85%	0.66	0.68	0.71	0.75	0.77	0.79
90%	0.73	0.75	0.77	0.80	0.82	0.83
95%	0.80	0.82	0.84	0.87	0.88	0.89
100%	0.89	0.90	0.92	0.94	0.95	0.96
	TYPE B NRCS HYDROLOGIC SOILS GROUP					
0%	0.02	0.08	0.15	0.25	0.30	0.35
5%	0.04	0.10	0.19	0.28	0.33	0.38
10%	0.06	0.14	0.22	0.31	0.36	0.40
15%	0.08	0.17	0.25	0.33	0.38	0.42
20%	0.12	0.20	0.27	0.35	0.40	0.44
25%	0.15	0.22	0.30	0.37	0.41	0.46
30%	0.18	0.25	0.32	0.39	0.43	0.47
35%	0.20	0.27	0.34	0.41	0.44	0.48
40%	0.23	0.30	0.36	0.42	0.46	0.50
45%	0.26	0.32	0.38	0.44	0.48	0.51
50%	0.29	0.35	0.40	0.46	0.49	0.52
55%	0.33	0.38	0.43	0.48	0.51	0.54
60%	0.37	0.41	0.46	0.51	0.54	0.56
65%	0.41	0.45	0.49	0.54	0.57	0.59
70%	0.45	0.49	0.53	0.58	0.60	0.62
75%	0.51	0.54	0.58	0.62	0.64	0.66
80%	0.57	0.59	0.63	0.66	0.68	0.70
85%	0.63	0.66	0.69	0.72	0.73	0.75
90%	0.71	0.73	0.75	0.78	0.80	0.81
95%	0.79	0.81	0.83	0.85	0.87	0.88
100%	0.89	0.90	0.92	0.94	0.95	0.96

TABLE 800-3

RUNOFF COEFFICIENTS (C) FOR RATIONAL METHOD

LAND USE OR SURFACE CHARACTERISTICS	PERCENT IMPERVIOUS	FREQUENCY 2	5	10	100
Business					
Commercial Areas	95	.87	.87	.88	.89
Neighborhood Areas	70	.60	.65	.70	.80
Residential					
Single-Family	*	.40	.45	.50	.60
Multi-Unit (detached)	50	.45	.50	.60	.70
Multi-Unit (attached)	70	.60	.65	.70	.80
1/2 Acre Lot or Larger	*	.30	.35	.40	.60
Apartments	70	.65	.70	.70	.80
Industrial					
Light Areas	80	.71	.72	.76	.82
Heavy Areas	90	.80	.80	.85	.90
Parks, Cemeteries	7	.10	.18	.25	.45
Playgrounds	13	.15	.20	.30	.50
Schools	50	.45	.50	.60	.70
Railroad Yard Areas	20	.20	.25	.35	.45
Undeveloped Areas					
Historic Flow Analysis	2	(See "Lawns")			
Greenbelts, Agricultural					
Offsite Flow Analysis					
(when land use not defined)	45	.43	.47	.55	.65
Streets					
Paved	100	.87	.88	.90	.93
Gravel	40	.40	.45	.50	.60
Drives and Walks	96	.87	.87	.88	.89
Roofs	90	.80	.85	.90	.90
Lawns, Sandy Soil	0	.00	.01	.05	.20
Lawns, Clay Soil	0	.05	.15	.25	.50

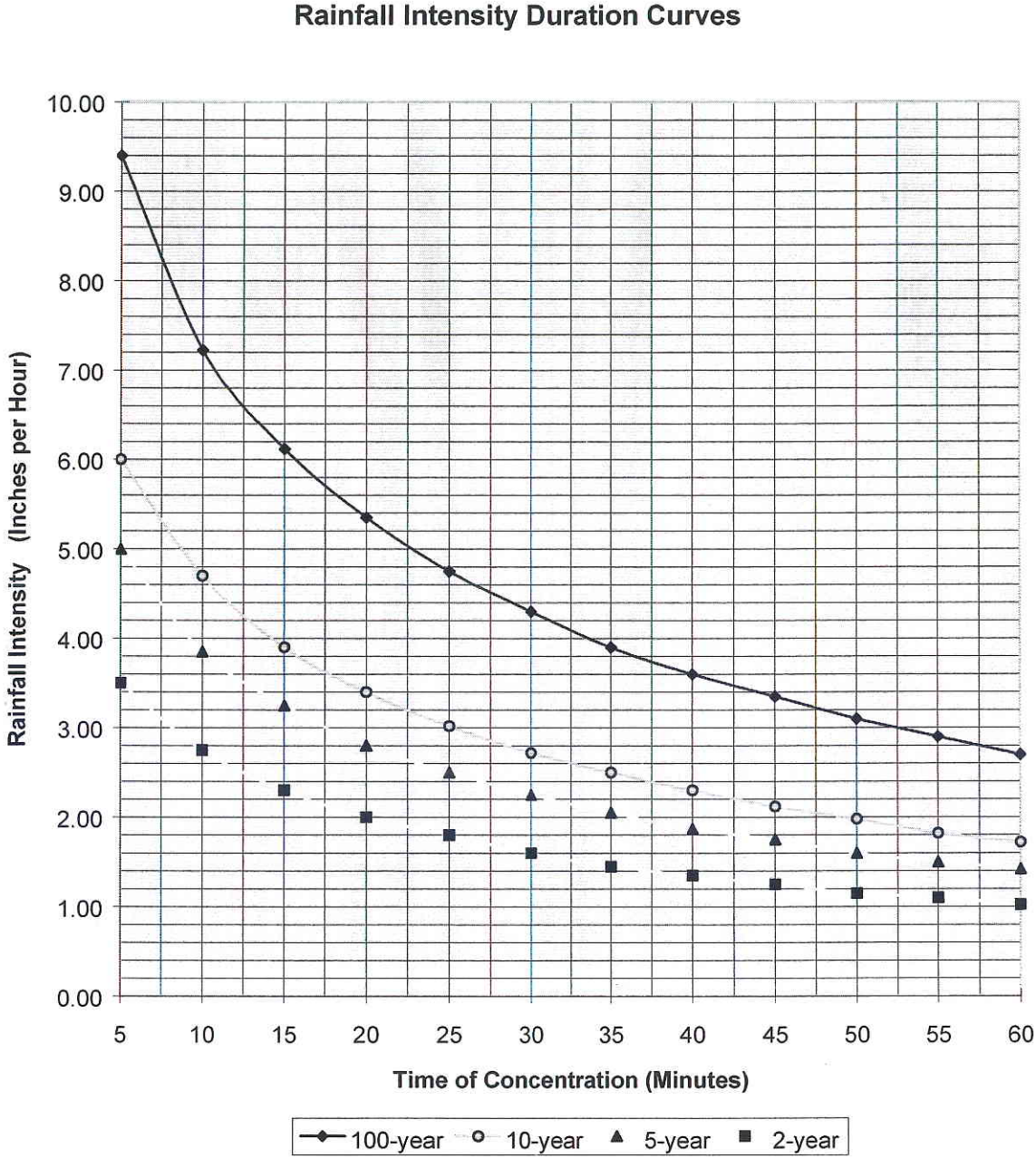
** Use Table RO-5, Drainage Criteria Manual. (V.1)

Note: These Rational Formula coefficients may not be valid for large basins.

* Refer to Urban Storm Drainage Criteria Manual for percent impervious values.

813.06 Rainfall Intensities

The rainfall intensities to be used in the computation of runoff using the Rational Method shall be obtained from the Rainfall Intensity Duration Curves for the Town of Erie, included in these STANDARDS AND SPECIFICATIONS.



814.00 Detention

814.01 General

On site detention is required for all new development, expansion, and redevelopment. The required minimum detention volume and maximum release rates at these volumes for the 10-year and 100-year storms shall be determined in accordance with the procedure and data set forth in this criteria.

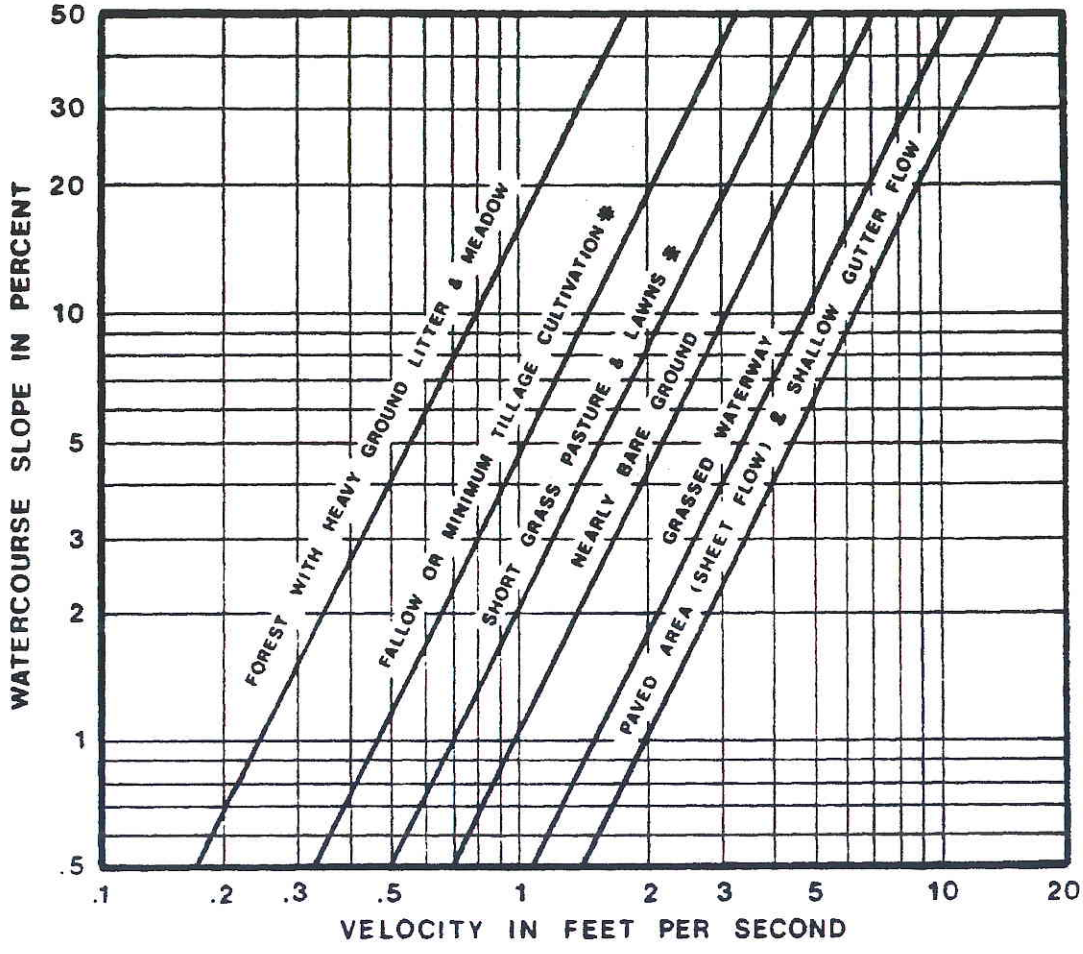


Figure RO-1—Estimate of Average Overland Flow Velocity for Use With the Rational Formula

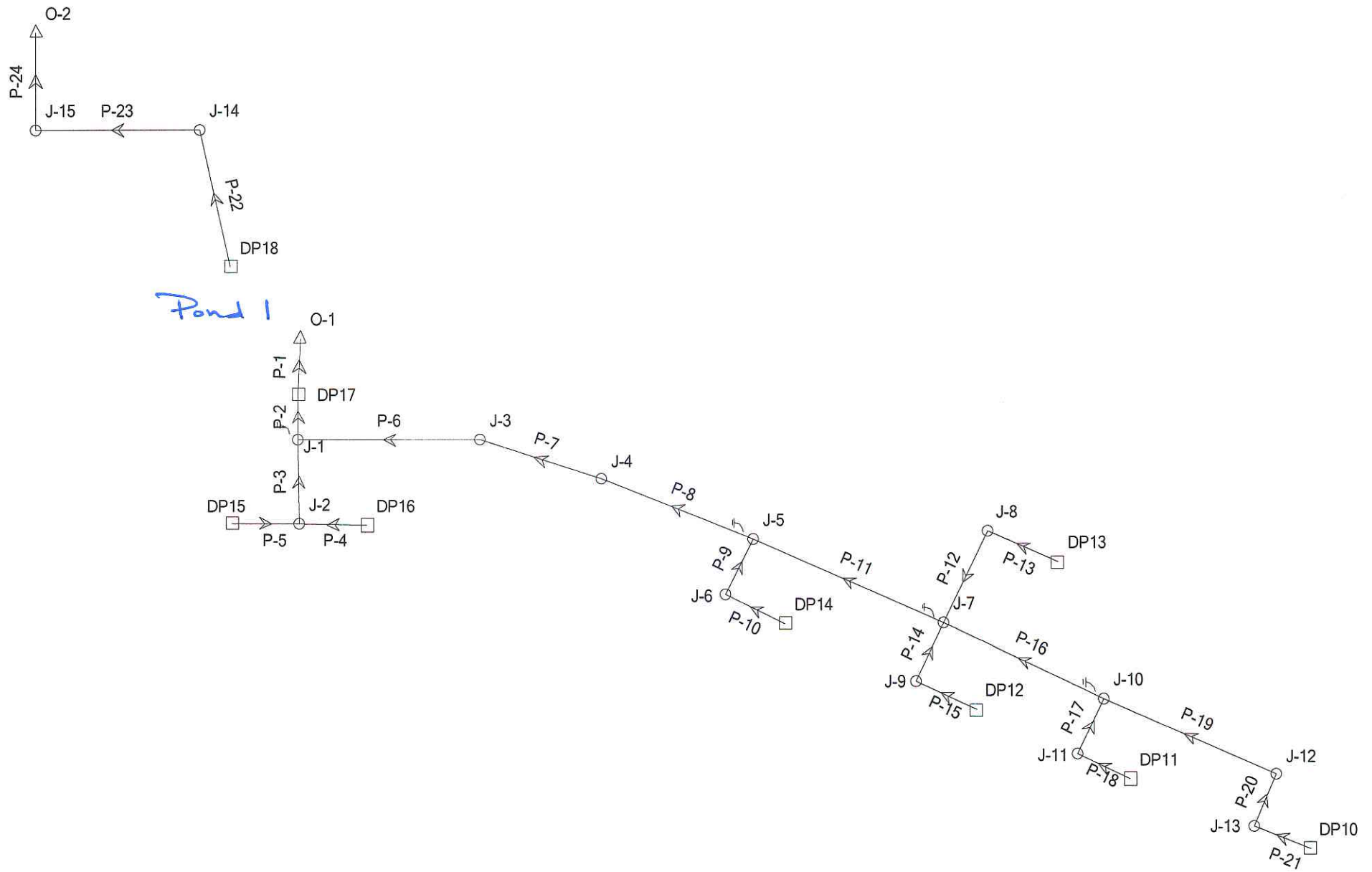
3% of 100-Year
Worksheet for Rectangular Channel

Project Description	
Project File	x:\13-000-erie\drainage\trickle .fm2
Worksheet	Trickle Channel 3% of 100-yr
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Mannings Coefficient	0.013	
Channel Slope	0.010000	ft/ft
Depth	0.50	ft
Bottom Width	3.00	ft

Results		
Discharge	8.92	cfs
Flow Area	1.50	ft^2
Wetted Perimeter	4.00	ft
Top Width	3.00	ft
Critical Depth	0.65	ft
Critical Slope	0.004594	ft/ft
Velocity	5.94	ft/s
Velocity Head	0.55	ft
Specific Energy	1.05	ft
Froude Number	1.48	
Flow is supercritical.		

Scenario: 5 YR / 100 - YR



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Scenario: 5 YR

Pipe Report

Label	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size	Full Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Velocity In (ft/s)	Velocity Out (ft/s)	Average Velocity (ft/s)
P-1	35.50	21.45	0.009790	48 inch	142.12	5,102.21	5,102.00	5,103.98	5,103.52	6.60	8.12	9.40
P-2	30.20	22.11	0.004975	48 inch	101.31	5,102.42	5,102.31	5,104.29	5,104.32	5.22	4.77	7.03
P-3	10.80	48.67	0.006164	36 inch	52.36	5,102.82	5,102.52	5,104.59	5,104.59	2.50	2.07	5.83
P-4	8.80	19.00	0.010000	30 inch	41.01	5,103.11	5,102.92	5,104.63	5,104.64	2.82	2.44	6.65
P-5	2.00	19.00	0.010000	18 inch	10.50	5,103.61	5,103.42	5,104.64	5,104.64	1.54	1.30	4.58
P-6	21.60	275.00	0.014109	36 inch	79.22	5,106.80	5,102.92	5,108.29	5,104.59	6.14	5.34	9.54
P-7	21.60	158.00	0.035253	36 inch	125.22	5,112.57	5,107.00	5,114.06	5,108.59	6.14	5.69	13.26
P-8	21.60	209.40	0.030611	36 inch	116.69	5,119.18	5,112.77	5,120.67	5,114.36	6.14	5.69	12.61
P-9	3.60	46.20	0.009957	18 inch	10.48	5,121.14	5,120.68	5,121.86	5,121.29	4.26	5.38	5.38
P-10	3.60	18.90	0.010053	18 inch	10.53	5,121.53	5,121.34	5,122.25	5,122.09	4.26	4.07	5.40
P-11	18.29	270.00	0.016037	30 inch	51.94	5,124.01	5,119.68	5,125.46	5,120.70	6.20	9.66	9.66
P-12	4.90	51.20	0.019922	24 inch	31.93	5,125.73	5,124.71	5,126.51	5,125.82	4.32	2.75	7.36
P-13	4.90	27.90	0.010036	24 inch	22.66	5,126.21	5,125.93	5,126.99	5,126.58	4.32	5.58	5.76
P-14	3.90	46.20	0.009957	24 inch	22.57	5,125.17	5,124.71	5,125.86	5,125.82	4.04	2.19	5.38
P-15	3.90	18.90	0.010053	24 inch	22.68	5,125.56	5,125.37	5,126.25	5,125.95	4.04	5.16	5.40
P-16	9.94	280.00	0.017786	30 inch	54.70	5,129.19	5,124.21	5,130.24	5,125.82	5.06	2.98	8.47
P-17	3.50	46.20	0.009957	18 inch	10.48	5,130.65	5,130.19	5,131.36	5,130.79	4.22	5.34	5.34
P-18	3.50	18.90	0.010053	18 inch	10.53	5,131.04	5,130.85	5,131.75	5,131.59	4.22	4.06	5.36
P-19	6.60	280.00	0.040393	24 inch	45.46	5,141.00	5,129.69	5,141.91	5,130.20	4.74	10.31	10.31
P-20	6.60	46.00	0.008696	18 inch	9.79	5,141.60	5,141.20	5,142.59	5,142.10	5.31	5.95	5.95
P-21	6.60	19.00	0.010526	18 inch	10.78	5,142.00	5,141.80	5,142.99	5,142.94	5.31	4.56	6.40
P-22	79.00	103.66	0.026047	54 inch	317.35	5,097.20	5,094.50	5,099.80	5,097.43	8.30	7.19	16.57
P-23	79.00	264.00	0.027652	54 inch	326.99	5,094.30	5,087.00	5,096.90	5,090.00	8.30	7.01	16.93
P-24	79.00	50.00	0.006000	54 inch	152.32	5,086.80	5,086.50	5,089.40	5,088.86	8.30	9.34	9.66

Scenario: 5 YR

Junction Report

Label	Rim Elevation (ft)	Structure Diameter (ft)	Headloss Coefficient	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Total System Flow (cfs)
J-1	5,108.64	6.00	0.70	5,104.59	5,104.29	30.20
J-2	5,108.12	5.00	0.60	5,104.64	5,104.59	10.80
J-3	5,112.33	5.00	0.50	5,108.59	5,108.29	21.60
J-4	5,118.41	5.00	0.50	5,114.36	5,114.06	21.60
J-5	5,126.84	5.00	0.60	5,121.03	5,120.67	21.60
J-6	5,126.13	4.00	0.80	5,122.09	5,121.86	3.60
J-7	5,131.92	5.00	0.60	5,125.82	5,125.46	18.29
J-8	5,131.97	4.00	0.60	5,126.68	5,126.51	4.90
J-9	5,131.29	4.00	0.50	5,125.99	5,125.86	3.90
J-10	5,136.37	5.00	0.60	5,130.48	5,130.24	9.94
J-11	5,135.56	4.00	0.80	5,131.59	5,131.36	3.50
J-12	5,147.00	5.00	0.60	5,142.12	5,141.91	6.60
J-13	5,147.00	4.00	0.80	5,142.94	5,142.59	6.60
J-14	5,105.00	6.00	0.50	5,097.43	5,096.90	79.00
J-15	5,090.00	6.00	0.80	5,090.26	5,089.40	79.00

Scenario: 5 YR

Inlet Report

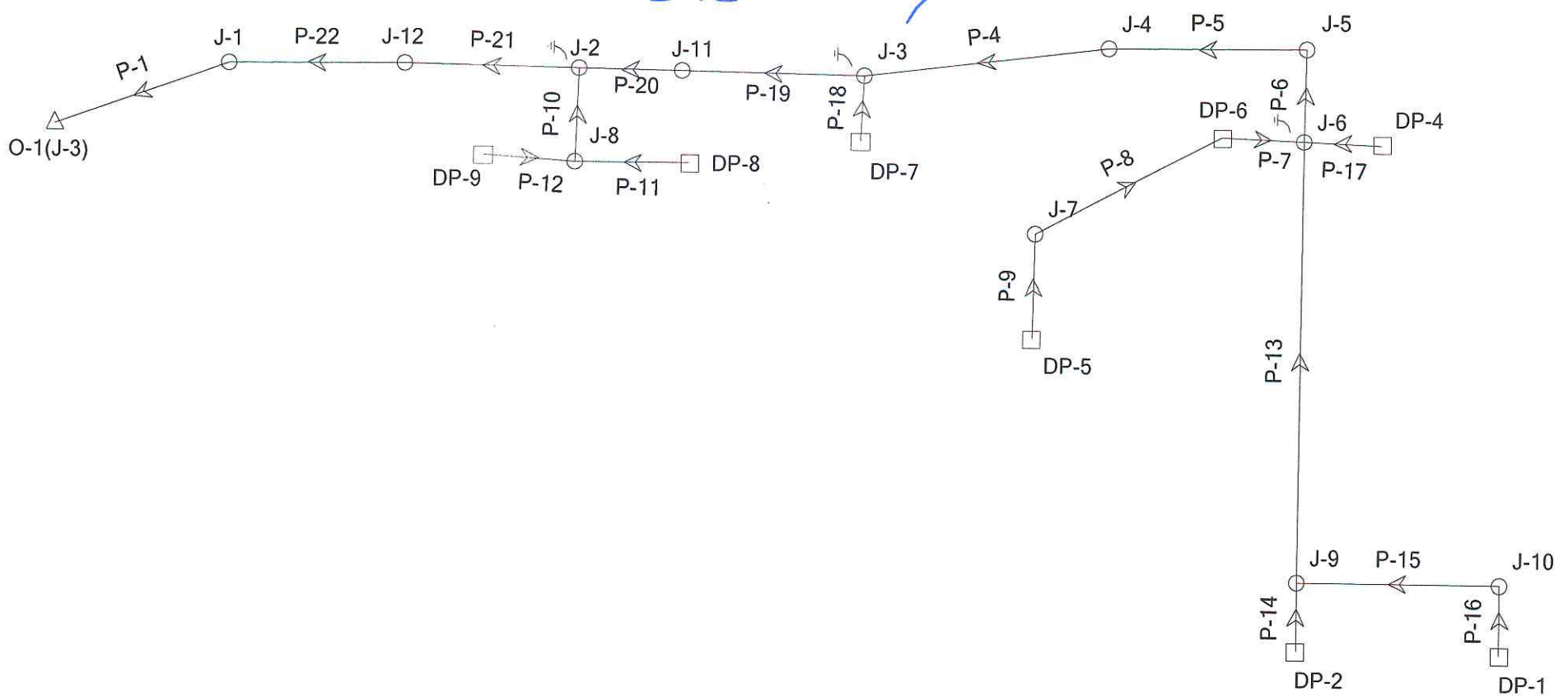
Label	Rim Elevation (ft)	Additional Flow (cfs)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
DP10	5,147.00	6.60	5,143.21	5,142.99
DP11	5,135.29	3.50	5,131.89	5,131.75
DP12	5,130.31	3.90	5,126.38	5,126.25
DP13	5,130.95	4.90	5,127.13	5,126.99
DP14	5,125.78	3.60	5,122.40	5,122.25
DP15	5,107.95	2.00	5,104.66	5,104.64
DP16	5,107.95	8.80	5,104.69	5,104.63
DP17	5,108.08	5.30	5,104.32	5,103.98
DP18	5,100.00	79.00	5,099.80	5,099.80

Pipe Report

Label	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size	Full Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Velocity In (ft/s)	Velocity Out (ft/s)	Average Velocity (ft/s)
P-1	99.10	21.45	0.009790	48 inch	142.12	5,102.21	5,102.00	5,105.23	5,104.73	9.75	10.86	12.23
P-2	91.50	22.11	0.004975	48 inch	101.31	5,102.42	5,102.31	5,106.03	5,105.97	7.67	7.60	9.13
P-3	33.30	48.67	0.006164	36 inch	52.36	5,102.82	5,102.52	5,106.79	5,106.67	4.71	4.71	4.71
P-4	24.00	19.00	0.010000	30 inch	41.01	5,103.11	5,102.92	5,107.06	5,107.00	4.89	4.89	4.89
P-5	9.30	19.00	0.010000	18 inch	10.50	5,103.61	5,103.42	5,107.14	5,107.00	5.26	5.26	5.26
P-6	60.50	275.00	0.014109	36 inch	79.22	5,106.80	5,102.92	5,109.31	5,106.67	9.58	8.56	12.34
P-7	60.50	158.00	0.035253	36 inch	125.22	5,112.57	5,107.00	5,115.08	5,110.02	9.58	8.56	17.56
P-8	60.50	209.40	0.030611	36 inch	116.69	5,119.18	5,112.77	5,121.69	5,115.79	9.58	8.56	16.66
P-9	11.60	46.20	0.009957	18 inch	10.48	5,121.14	5,120.68	5,123.11	5,122.55	6.56	6.56	6.56
P-10	11.60	18.90	0.010053	18 inch	10.53	5,121.53	5,121.34	5,123.88	5,123.64	6.56	6.56	6.56
P-11	52.20	270.00	0.016037	30 inch	51.94	5,124.01	5,119.68	5,126.92	5,122.55	10.63	10.63	10.63
P-12	9.10	51.20	0.019922	24 inch	31.93	5,125.73	5,124.71	5,128.06	5,127.97	2.90	2.90	2.90
P-13	9.10	27.90	0.010036	24 inch	22.66	5,126.21	5,125.93	5,128.18	5,128.13	2.91	2.90	6.82
P-14	13.00	46.20	0.009957	24 inch	22.57	5,125.17	5,124.71	5,128.13	5,127.97	4.14	4.14	4.14
P-15	13.00	18.90	0.010053	24 inch	22.68	5,125.56	5,125.37	5,128.32	5,128.26	4.14	4.14	4.14
P-16	31.40	280.00	0.017786	30 inch	54.70	5,129.19	5,124.21	5,131.10	5,127.97	7.81	6.40	11.53
P-17	14.70	46.20	0.009957	18 inch	10.48	5,130.65	5,130.19	5,132.58	5,131.67	8.32	8.34	8.32
P-18	14.70	18.90	0.010053	18 inch	10.53	5,131.04	5,130.85	5,133.81	5,133.44	8.32	8.32	8.32
P-19	17.20	280.00	0.040393	24 inch	45.46	5,141.00	5,129.69	5,142.50	5,131.67	6.83	5.49	13.47
P-20	17.20	46.00	0.008696	18 inch	9.79	5,141.60	5,141.20	5,144.16	5,142.93	9.73	9.73	9.73
P-21	17.20	19.00	0.010526	18 inch	10.78	5,142.00	5,141.80	5,145.85	5,145.34	9.73	9.73	9.73
P-22	79.00	103.66	0.026047	54 inch	317.35	5,097.20	5,094.50	5,099.80	5,097.43	8.30	7.19	16.57
P-23	79.00	264.00	0.027652	54 inch	326.99	5,094.30	5,087.00	5,096.90	5,090.00	8.30	7.01	16.93
P-24	79.00	50.00	0.006000	54 inch	152.32	5,086.80	5,086.50	5,089.40	5,088.86	8.30	9.34	9.66

Scenario: 5 yr /100-yr

Erie Parkway



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

Scenario: 5 yr

Pipe Report

Label	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size	Full Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Velocity In (ft/s)	Velocity Out (ft/s)	Average Velocity (ft/s)
P-1	49.70	80.32	0.005603	48 inch	107.51	5,105.71	5,105.26	5,107.82	5,107.18	7.37	8.32	8.39
P-4	40.40	200.00	0.017500	42 inch	133.09	5,129.00	5,125.50	5,130.98	5,127.90	7.21	5.74	12.13
P-5	40.40	535.00	0.020561	42 inch	144.26	5,140.00	5,129.00	5,141.98	5,131.38	7.21	5.80	12.86
P-6	40.40	55.00	0.018182	42 inch	135.65	5,141.00	5,140.00	5,142.98	5,142.46	7.21	5.59	12.30
P-7	4.70	20.00	0.025000	24 inch	35.77	5,141.50	5,141.00	5,143.47	5,143.46	1.50	1.50	7.88
P-8	1.30	260.00	0.003846	18 inch	6.51	5,142.50	5,141.50	5,143.52	5,143.49	1.01	0.74	2.88
P-9	1.30	155.00	0.100000	18 inch	33.22	5,158.00	5,142.50	5,158.43	5,143.53	3.14	1.01	9.11
P-10	5.70	24.87	0.147165	36 inch	255.86	5,115.00	5,111.34	5,115.75	5,112.76	4.13	1.73	14.81
P-11	5.00	40.17	0.021907	24 inch	33.48	5,116.88	5,116.00	5,117.67	5,116.54	4.35	7.34	7.66
P-12	0.70	39.07	0.027899	18 inch	17.54	5,117.59	5,116.50	5,117.90	5,116.70	2.65	4.84	4.84
P-13	20.40	740.00	0.022297	30 inch	61.24	5,157.50	5,141.00	5,159.03	5,143.46	6.46	4.17	11.22
P-14	9.80	20.00	0.025000	24 inch	35.77	5,158.00	5,157.50	5,159.30	5,159.42	4.53	3.16	9.71
P-15	10.60	510.00	0.014706	24 inch	27.43	5,165.00	5,157.50	5,166.17	5,159.42	5.57	3.42	8.17
P-16	10.60	20.00	0.025000	24 inch	35.77	5,165.50	5,165.00	5,166.67	5,166.46	5.57	4.33	9.92
P-17	16.30	20.00	0.025000	36 inch	105.45	5,141.50	5,141.00	5,143.40	5,143.46	3.45	2.63	10.82
P-18	4.60	50.00	0.010000	24 inch	22.62	5,126.00	5,125.50	5,127.92	5,127.90	1.48	1.46	5.65
P-19	45.00	530.00	0.011887	48 inch	156.60	5,125.50	5,119.20	5,127.51	5,121.40	7.13	6.35	10.77
P-20	45.00	345.91	0.025035	48 inch	227.27	5,119.00	5,110.34	5,121.01	5,112.76	7.13	5.66	14.08
P-21	49.70	250.00	0.010600	48 inch	147.88	5,110.14	5,107.49	5,112.25	5,109.83	7.37	6.52	10.61
P-22	49.70	276.23	0.004996	48 inch	101.52	5,107.29	5,105.91	5,109.40	5,108.25	7.37	6.52	8.04

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Scenario: Base-100

Pipe Report 100 YR

Label	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size	Full Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Velocity In (ft/s)	Velocity Out (ft/s)	Average Velocity (ft/s)
P-1	148.50	80.32	0.005603	48 inch	107.51	5,105.71	5,105.26	5,109.92	5,108.84	11.82	12.51	11.82
P-4	114.60	200.00	0.017500	42 inch	133.09	5,129.00	5,125.50	5,132.51	5,129.91	11.91	11.91	11.91
P-5	114.60	535.00	0.020561	42 inch	144.26	5,140.00	5,129.00	5,143.21	5,133.61	12.40	11.91	16.64
P-6	114.60	55.00	0.018182	42 inch	135.65	5,141.00	5,140.00	5,145.36	5,144.64	11.91	11.91	11.91
P-7	17.40	20.00	0.025000	24 inch	35.77	5,141.50	5,141.00	5,146.80	5,146.68	5.54	5.54	5.54
P-8	4.20	260.00	0.003846	18 inch	6.51	5,142.50	5,141.50	5,147.45	5,147.04	2.38	2.38	2.38
P-9	4.20	155.00	0.100000	18 inch	33.22	5,158.00	5,142.50	5,158.79	5,147.50	4.48	2.38	12.87
P-10	33.30	24.87	0.147165	36 inch	255.86	5,115.00	5,111.34	5,119.08	5,119.02	4.71	4.71	4.71
P-11	29.80	40.17	0.021907	24 inch	33.48	5,116.88	5,116.00	5,119.98	5,119.29	9.49	9.49	9.49
P-12	3.50	39.07	0.027899	18 inch	17.54	5,117.59	5,116.50	5,119.33	5,119.29	1.98	1.98	1.98
P-13	46.10	740.00	0.022297	30 inch	61.24	5,157.50	5,141.00	5,159.74	5,146.68	9.93	9.39	13.70
P-14	20.00	20.00	0.025000	24 inch	35.77	5,158.00	5,157.50	5,160.82	5,160.66	6.37	6.37	6.37
P-15	26.10	510.00	0.014706	24 inch	27.43	5,165.00	5,157.50	5,167.45	5,160.66	8.31	8.31	8.31
P-16	26.10	20.00	0.025000	24 inch	35.77	5,165.50	5,165.00	5,168.36	5,168.10	8.31	8.31	8.31
P-17	56.90	20.00	0.025000	36 inch	105.45	5,141.50	5,141.00	5,146.83	5,146.68	8.05	8.05	8.05
P-18	17.70	50.00	0.010000	24 inch	22.62	5,126.00	5,125.50	5,130.22	5,129.91	5.63	5.63	5.63
P-19	129.60	530.00	0.011887	48 inch	156.60	5,125.50	5,119.20	5,128.91	5,123.41	11.36	10.31	13.93
P-20	129.60	345.91	0.025035	48 inch	227.27	5,119.00	5,110.34	5,122.41	5,119.02	11.36	10.31	18.68
P-21	148.50	250.00	0.010600	48 inch	147.88	5,110.14	5,107.49	5,117.72	5,115.04	11.82	11.82	11.82
P-22	148.50	276.23	0.004996	48 inch	101.52	5,107.29	5,105.91	5,113.96	5,111.01	11.82	11.82	11.82

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Scenario: Base-100

Junction Report 100 YR

Label	Rim Elevation (ft)	Structure Diameter (ft)	Headloss Coefficient	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Total System Flow (cfs)
J-1	5,116.94	6.00	0.50	5,111.01	5,109.92	148.50
J-2	5,122.02	6.00	0.60	5,119.02	5,117.72	148.50
J-3	5,132.00	5.00	0.50	5,129.91	5,128.91	129.60
J-4	5,136.50	5.00	0.50	5,133.61	5,132.51	114.60
J-5	5,147.25	5.00	0.60	5,144.64	5,143.21	114.60
J-6	5,148.00	6.00	0.60	5,146.68	5,145.36	114.60
J-7	5,153.00	4.00	0.50	5,147.50	5,147.45	4.20
J-8	5,123.33	5.00	0.60	5,119.29	5,119.08	33.30
J-9	5,164.50	5.00	0.60	5,160.66	5,159.74	46.10
J-10	5,172.50	5.00	0.60	5,168.10	5,167.45	26.10
J-11	5,127.70	5.00	0.50	5,123.41	5,122.41	129.60
J-12	5,119.00	6.00	0.50	5,115.04	5,113.96	148.50

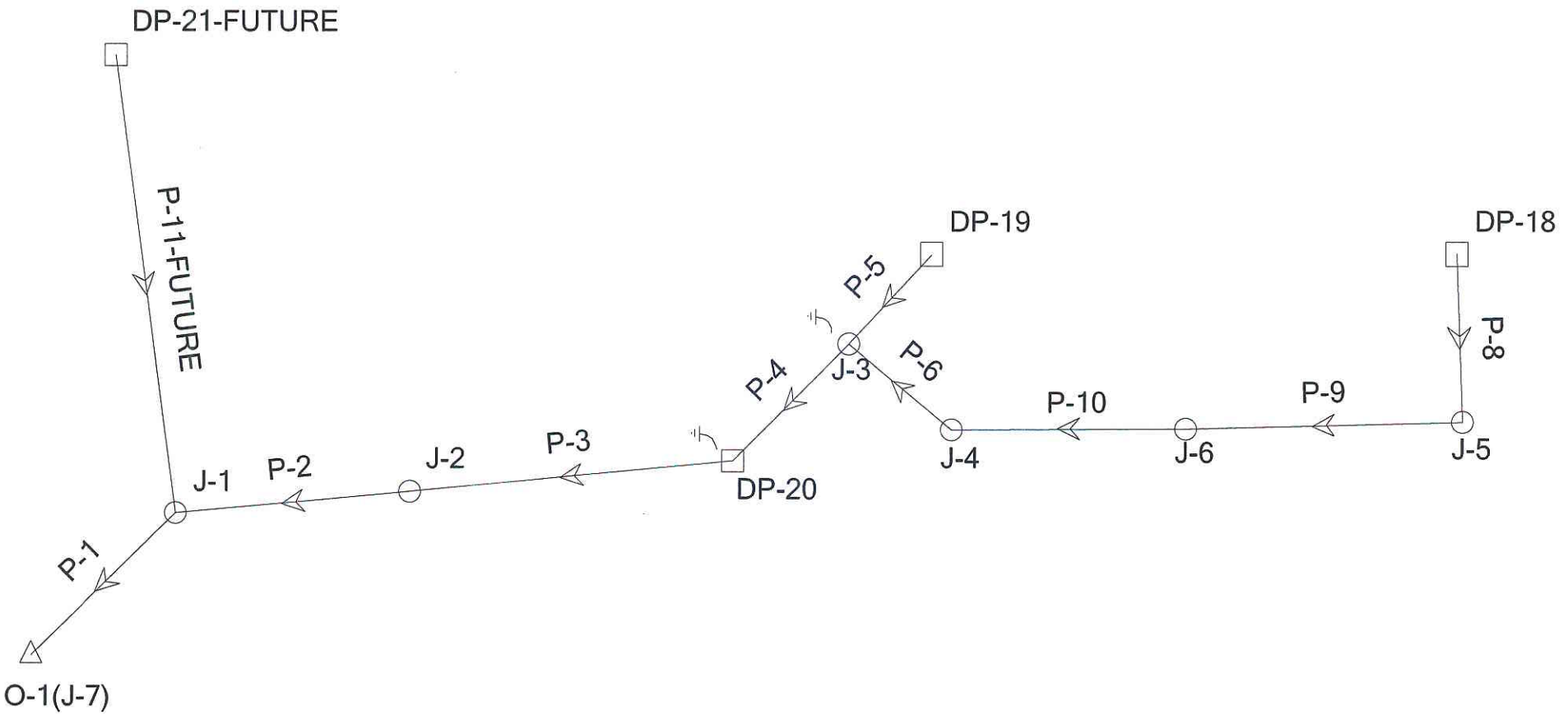
Scenario: Base-100

Inlet Report 100 YR

Label	Rim Elevation (ft)	Additional Flow (cfs)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
DP-9	5,122.34	3.50	5,119.36	5,119.33
DP-8	5,123.36	29.80	5,120.68	5,119.98
DP-7	5,132.50	17.70	5,130.46	5,130.22
DP-4	5,147.80	56.90	5,147.33	5,146.83
DP-1	5,171.50	26.10	5,168.90	5,168.36
DP-2	5,165.80	20.00	5,161.13	5,160.82
DP-5	5,164.90	4.20	5,158.94	5,158.79
DP-6	5,147.80	13.20	5,147.04	5,146.80

S-4

Scenario: Base-100



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Scenario: 5YR

Pipe Report

Label	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size	Full Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Velocity In (ft/s)	Velocity Out (ft/s)	Average Velocity (ft/s)
P-1	20.70	30.90	0.004854	36 inch	46.47	5,105.44	5,105.29	5,106.90	5,106.69	6.06	6.38	6.38
P-2	18.60	103.90	0.005005	36 inch	47.18	5,106.16	5,105.64	5,107.54	5,107.19	5.85	5.06	6.28
P-3	18.60	137.80	0.064151	36 inch	168.92	5,115.20	5,106.36	5,116.58	5,107.81	5.85	5.51	15.72
P-4	13.80	44.90	0.018931	24 inch	31.12	5,117.05	5,116.20	5,118.39	5,117.19	6.18	8.93	9.61
P-5	5.90	8.20	0.009756	24 inch	22.34	5,117.33	5,117.25	5,118.36	5,118.39	3.62	3.20	6.00
P-6	7.90	34.30	0.009913	24 inch	22.52	5,118.09	5,117.75	5,119.09	5,118.59	5.03	6.34	6.54
P-8	7.90	35.00	0.011143	24 inch	23.88	5,128.94	5,128.55	5,129.94	5,129.59	5.03	4.81	6.82
P-9	7.90	289.17	0.026732	24 inch	36.99	5,128.35	5,120.62	5,129.35	5,121.25	5.03	9.36	9.36
P-10	7.90	212.49	0.010024	24 inch	22.65	5,120.42	5,118.29	5,121.42	5,119.33	5.03	4.81	6.56
P-11-FUTUR	2.10	335.00	0.034507	18 inch	19.51	5,117.00	5,105.44	5,117.55	5,107.19	3.60	1.19	7.21

Scenario: 5YR

Junction Report

Label	Rim Elevation (ft)	Structure Diameter (ft)	Headloss Coefficient	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Total System Flow (cfs)
J-1	5,110.17	5.00	0.50	5,107.19	5,106.90	20.70
J-2	5,114.04	5.00	0.50	5,107.81	5,107.54	18.60
J-3	5,122.32	5.00		5,118.39	5,118.39	13.80
J-4	5,122.64	5.00	0.60	5,119.33	5,119.09	7.90
J-5	5,134.73	5.00	0.60	5,129.59	5,129.35	7.90
J-6	5,127.34	5.00		5,121.42	5,121.42	7.90

Scenario: 5YR

Inlet Report

Label	Rim Elevation (ft)	Additional Flow (cfs)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
DP-19	5,122.08	5.90	5,118.46	5,118.36
DP-20	5,121.70	4.80	5,116.85	5,116.58
DP-18	5,134.19	7.90	5,130.14	5,129.94
DP-21-FUTURE	5,121.00	2.10	5,117.55	5,117.55

Scenario: Base-100

Pipe Report

Label	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size	Full Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Velocity In (ft/s)	Velocity Out (ft/s)	Average Velocity (ft/s)
P-1	61.90	30.90	0.004854	36 inch	46.47	5,105.44	5,105.29	5,108.29	5,107.82	8.93	9.72	8.76
P-2	55.40	103.90	0.005005	36 inch	47.18	5,106.16	5,105.64	5,109.62	5,108.91	7.84	7.84	7.84
P-3	55.40	137.80	0.064151	36 inch	168.92	5,115.20	5,106.36	5,117.62	5,110.10	9.08	7.84	21.40
P-4	37.40	44.90	0.018931	24 inch	31.12	5,117.05	5,116.20	5,119.48	5,118.26	11.90	11.90	11.90
P-5	22.00	8.20	0.009756	24 inch	22.34	5,117.33	5,117.25	5,119.56	5,119.48	7.00	7.00	7.00
P-6	24.50	34.30	0.009913	24 inch	22.52	5,118.09	5,117.75	5,119.93	5,119.50	8.09	8.41	7.80
P-8	24.50	35.00	0.011143	24 inch	23.88	5,128.94	5,128.55	5,131.17	5,130.76	7.80	7.80	7.80
P-9	24.50	289.17	0.026732	24 inch	36.99	5,128.35	5,120.62	5,130.10	5,123.04	8.41	7.80	12.59
P-10	24.50	212.49	0.010024	24 inch	22.65	5,120.42	5,118.29	5,123.04	5,120.54	7.80	7.80	7.80
P-11-FUTUR	6.50	335.00	0.034507	18 inch	19.51	5,117.00	5,105.44	5,117.99	5,108.91	5.28	3.68	9.93

Scenario: Base-100

Junction Report

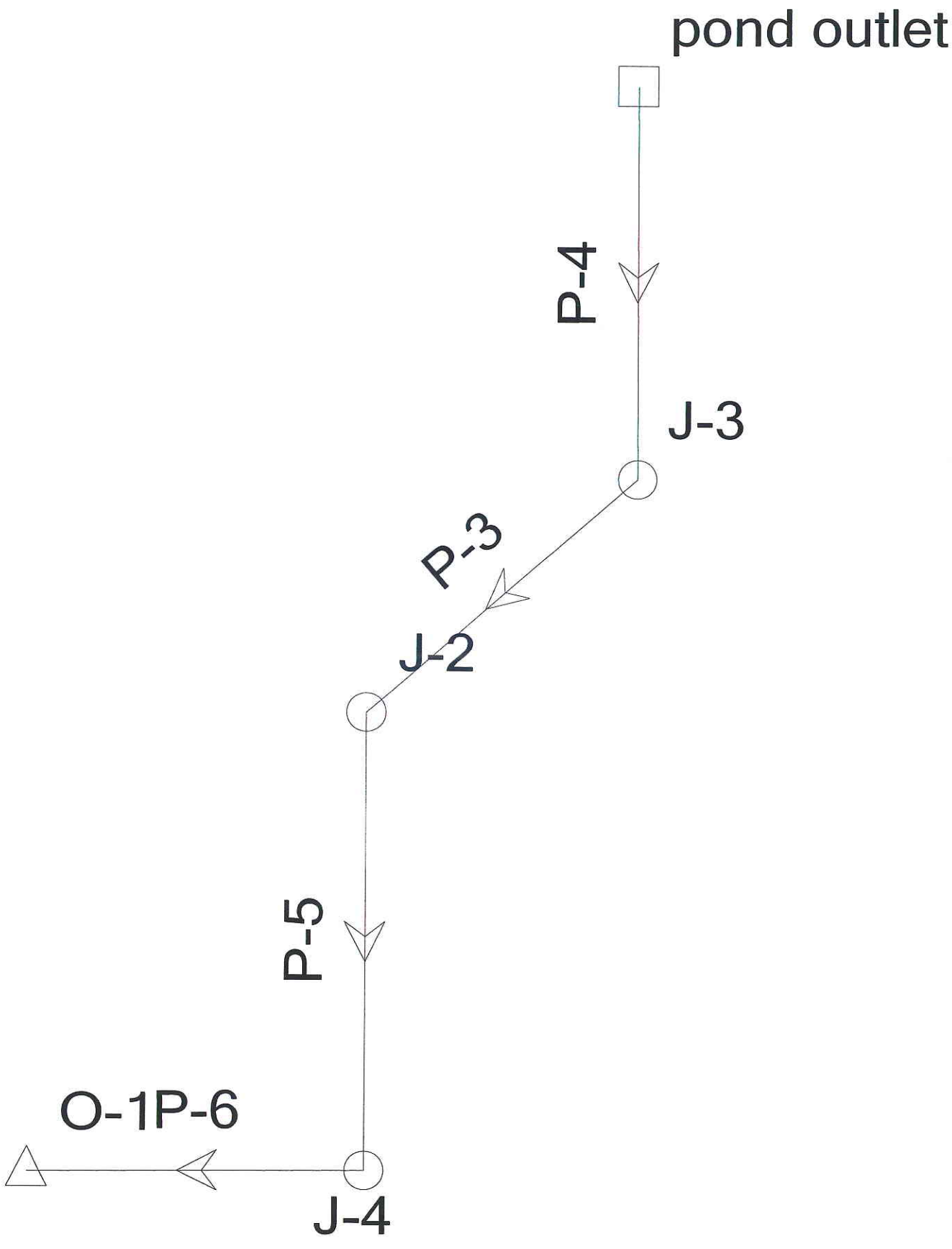
Label	Rim Elevation (ft)	Structure Diameter (ft)	Headloss Coefficient	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Total System Flow (cfs)
J-1	5,110.17	5.00	0.50	5,108.91	5,108.29	61.90
J-2	5,114.04	5.00	0.50	5,110.10	5,109.62	55.40
J-3	5,122.32	5.00		5,119.48	5,119.48	37.40
J-4	5,122.64	5.00	0.60	5,120.54	5,119.93	24.50
J-5	5,134.73	5.00	0.60	5,130.76	5,130.10	24.50
J-6	5,127.34	5.00		5,123.04	5,123.04	24.50

Scenario: Base-100

Inlet Report

Label	Rim Elevation (ft)	Additional Flow (cfs)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
DP-19	5,122.08	22.00	5,119.94	5,119.56
DP-20	5,121.70	19.00	5,118.26	5,117.62
DP-18	5,134.19	24.50	5,131.64	5,131.17
DP-21-FUTURE	5,121.00	6.50	5,117.99	5,117.99

Scenario: 5-yr / 100-yr



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Scenario: 5-yr

Pipe Report

Label	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size	Full Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Velocity In (ft/s)	Velocity Out (ft/s)	Average Velocity (ft/s)
P-3	5.50	150.99	0.052984	18 inch	24.18	5,085.00	5,077.00	5,085.90	5,077.49	4.94	11.08	11.08
P-4	5.50	144.15	0.103920	18 inch	33.86	5,101.98	5,087.00	5,102.88	5,087.41	4.94	14.10	14.10
P-5	5.50	215.18	0.048796	18 inch	23.20	5,075.00	5,064.50	5,075.90	5,065.00	4.94	10.75	10.75
P-6	5.50	84.78	0.026421	36 inch	108.41	5,061.09	5,058.85	5,061.83	5,059.31	4.09	8.03	8.03

Scenario: 5-yr

Junction Report

Label	Rim Elevation (ft)	Structure Diameter (ft)	Headloss Coefficient	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Total System Flow (cfs)
J-2	5,081.00	4.00	0.50	5,076.09	5,075.90	5.50
J-3	5,093.00	4.00	0.50	5,086.09	5,085.90	5.50
J-4	5,069.00	5.00	0.60	5,061.98	5,061.83	5.50

Scenario: 5-yr

Inlet Report

Label	Rim Elevation (ft)	Additional Flow (cfs)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
pond outlet	5,107.98	5.50	5,103.07	5,102.88

Scenario: Base

Pipe Report 100 YR

Label	Total System Flow (cfs)	Length (ft)	Constructed Slope (ft/ft)	Section Size	Full Capacity (cfs)	Upstream Invert Elevation (ft)	Downstream Invert Elevation (ft)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Velocity In (ft/s)	Velocity Out (ft/s)	Average Velocity (ft/s)
P-3	17.16	150.99	0.052984	18 inch	24.18	5,085.00	5,077.00	5,086.44	5,077.93	9.84	14.85	14.85
P-4	17.16	144.15	0.103920	18 inch	33.86	5,101.98	5,087.00	5,103.42	5,087.76	9.84	19.23	19.23
P-5	17.16	215.18	0.048796	18 inch	23.20	5,075.00	5,064.50	5,076.44	5,065.46	9.84	14.37	14.37
P-6	17.16	84.78	0.026421	36 inch	108.41	5,061.09	5,058.85	5,062.41	5,059.68	5.70	10.78	11.20

Scenario: Base

Junction Report 100 YR

Label	Rim Elevation (ft)	Structure Diameter (ft)	Headloss Coefficient	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)	Total System Flow (cfs)
J-2	5,081.00	4.00	0.50	5,077.19	5,076.44	17.16
J-3	5,093.00	4.00	0.50	5,087.19	5,086.44	17.16
J-4	5,069.00	5.00	0.60	5,062.72	5,062.41	17.16

Scenario: Base

Inlet Report 100 yr

Label	Rim Elevation (ft)	Additional Flow (cfs)	Hydraulic Grade Line In (ft)	Hydraulic Grade Line Out (ft)
pond outlet	5,107.98	17.16	5,104.17	5,103.42

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Inlet Design

Subdivision ERIE HIGHLANDS
Location ERIE, Colorado

Project Name: ERIE HIGHLANDS
Project No. 13-000
Calculated By: DCF
Checked By:
Date: 11/15/2013

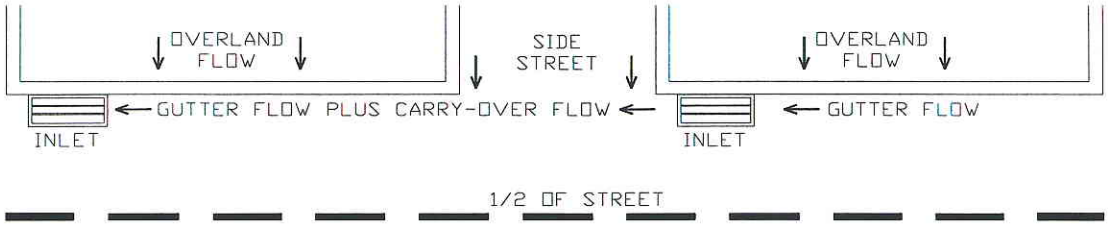
Design Point	5-Year Flow (cfs)	100-Year Flow (cfs)	5- or 100-Year Inlet	Inlet Type	Sump (S) or On-Grade (G)	Max. Sump Depth (ft)	Intercepted (cfs)	Bypass (cfs)
2(future)	9.4	30	100	15'Type R	S	0.48	20	10.0
4(future)	4.6	22.6	100	15'Type R	S	1	20	2.6
8	5.0	29.8	100	15' Type R	S	0.74	29.8	0.6
9	0.7	3.5	100	10' Type R	S	0.17	3.5	0.0
10(future)	6.6	20.7	100	15'Type R	S	0.47	17.2	3.5
11	3.5	14.7	100	10' Type R	S	0.47	14.7	0.8
12	3.9	13.0	100	10' Type R	S	0.47	13.0	0.0
13	4.9	15.7	100	15' Type R	ON GRADE	NA	9.1	6.6
14	3.6	11.6	100	10' Type R	S	0.47	11.6	0.0
15	2.0	9.3	100	10' Type R	S	1.26	9.3	0.0
16	8.8	26.9	100	10' Type R	S	1.26	24.0	2.9
17	2.5	8.1	100	10' Type R	S	0.60	8.1	0.0
18	7.9	24.5	100	15' Type R	S	0.47	17.5	7.0
19	6.5	27.0	100	10' Type R	S	1.00	22.0	5.0
20	4.8	19.0	100	10' Type R	S	1.00	19.0	0.0
21	2.1	6.5	100	10' Type R	S	1.00	6.1	0.4

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

Erie Highlands- Phase 1

DP-2

Design Flow = Gutter Flow + Carry-over Flow



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

	Minor Storm	Major Storm	
*Q =	9.40	30.00	cfs

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

Subcatchment Area =	0.00	Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site: (Check One Box Only)	
Site is Urban:	X
Site Is Non-Urban:	

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Gutter Flow =		

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

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

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

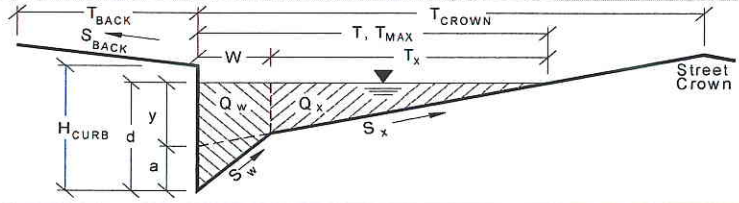
	Minor Storm	Major Storm	
Calculated Design Storm Runoff Coefficient, C =	N/A	N/A	
Calculated 5-yr. Runoff Coefficient, C5 =	N/A	N/A	
Overland Flow Velocity, V_O =	N/A	N/A	fps
Gutter Flow Velocity, V_G =	N/A	N/A	fps
Overland Flow Time, t_O =	N/A	N/A	minutes
Gutter Flow Time, t_G =	N/A	N/A	minutes
Calculated Time of Concentration, T_c =	N/A	N/A	minutes
Time of Concentration by Regional Formula, T_c =	N/A	N/A	minutes
Recommended T_c =	N/A	N/A	minutes
Time of Concentration Selected by User, T_c =	**N/A**	**N/A**	**minutes**
Design Rainfall Intensity, I =	N/A	N/A	inch/hr
Calculated Local Peak Flow, Q_p =	N/A	N/A	cfs
Total Design Peak Flow, Q =	**9.40**	**30.00**	**cfs**

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

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

Project: Erie Highlands- Phase 1

Inlet ID: DP-2



Gutter Geometry (Enter data in the blue cells)			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.0200	ft. vert. / ft. horiz
Manning's Roughness Behind Curb	n_{BACK} =	0.0350	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	20.0	ft
Gutter Depression	a =	2.00	inches
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.0200	ft. vert. / ft. horiz
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.0000	ft. vert. / ft. horiz
Manning's Roughness for Street Section	n_{STREET} =	0.0150	

		Minor Storm	Major Storm	
Max. Allowable Water Spread for Minor & Major Storm	T_{MAX} =	15.0	20.0	ft
Max. Allowable Depth at Gutter Flow Line for Minor & Major Storm	d_{MAX} =	5.20	6.40	inches
Allow Flow Depth at Street Crown (leave blank for no)				X = yes

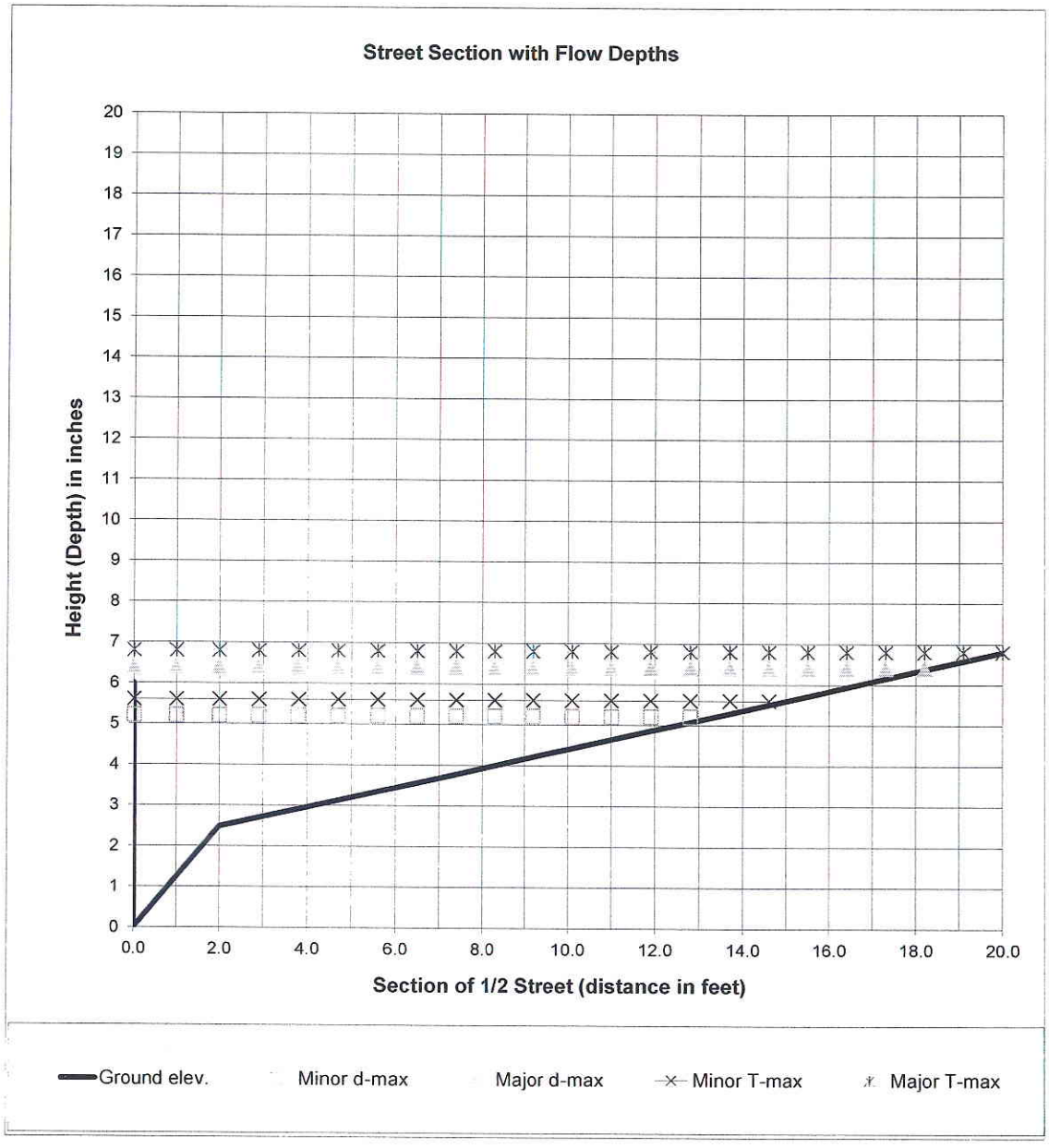
Maximum Gutter Capacity Based On Allowable Water Spread		Minor Storm	Major Storm	
Gutter Cross Slope (Eq. ST-8)	S_W =	0.1033	0.1033	ft/ft
Water Depth without Gutter Depression (Eq. ST-2)	y =	3.60	4.80	inches
Water Depth with a Gutter Depression	d =	5.60	6.80	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	13.0	18.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.421	0.313	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Water Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Gutter Capacity Based on Allowable Gutter Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	13.3	18.3	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	11.3	16.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.473	0.343	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm	**Q =**	**0.0**	**0.0**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	SUMP	SUMP	
Max Flow Based on Allow. Gutter Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

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

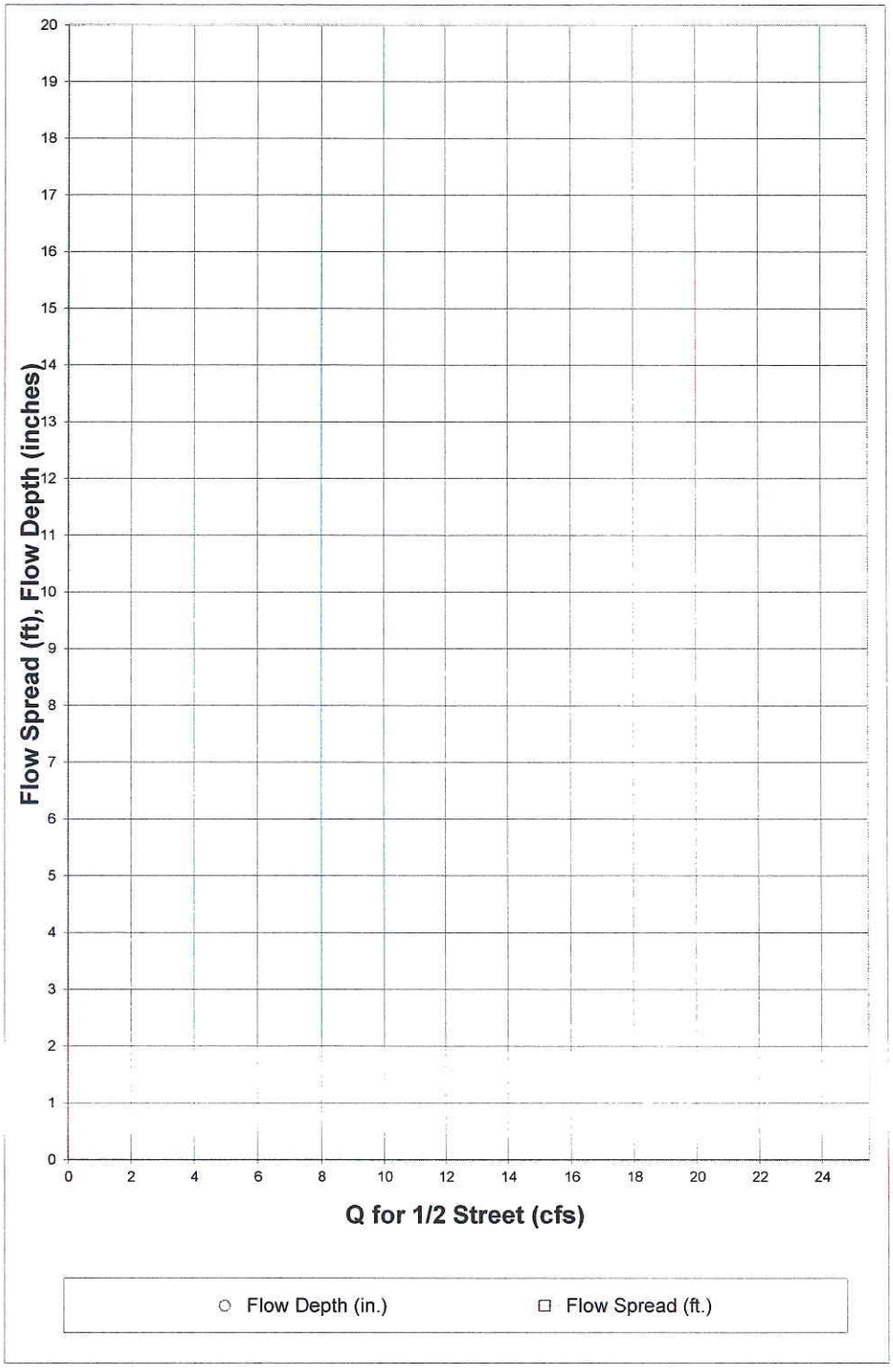
MINOR STORM max. allowable capacity OK - greater than flow given on sheet 'Q-Peak'

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



$$Q_x = \frac{0.56}{n} S_x^{5/3} S_L^{1/2} T_x^{8/3} \qquad E_o = \frac{1}{1 + \dfrac{S_w / S_x}{\left[1 + \dfrac{S_w / S_x}{(T/W) - 1}\right]^{8/3} - 1}}$$

$$Q = \frac{Q_x}{1 - E_o}; \; Q_w = Q - Q_x$$



Q for 1/2 Street (cfs)	Flow Depth (in.)	Flow Spread (ft.)
0.00		
0.25		
0.50		
0.75		
1.00		
1.25		
1.50		
1.75		
2.00		
2.25		
2.50		
2.75		
3.00		
3.25		
3.50		
3.75		
4.00		
4.25		
4.50		
4.75		
5.00		
5.25		
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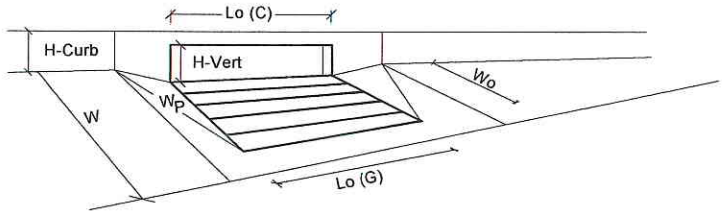
5.75		
6.00		
6.25		
6.50		
6.75		
7.00		
7.25		
7.50		
7.75		
8.00		
8.25		
8.50		
8.75		
9.00		
9.25		
9.50		
9.75		
10.00		
10.25		
10.50		
10.75		
11.00		
11.25		
11.50		
11.75		
12.00		
12.25		
12.50		

INLET IN A SUMP OR SAG LOCATION

Project = Erie Highlands- Phase 1

Inlet ID = DP-2

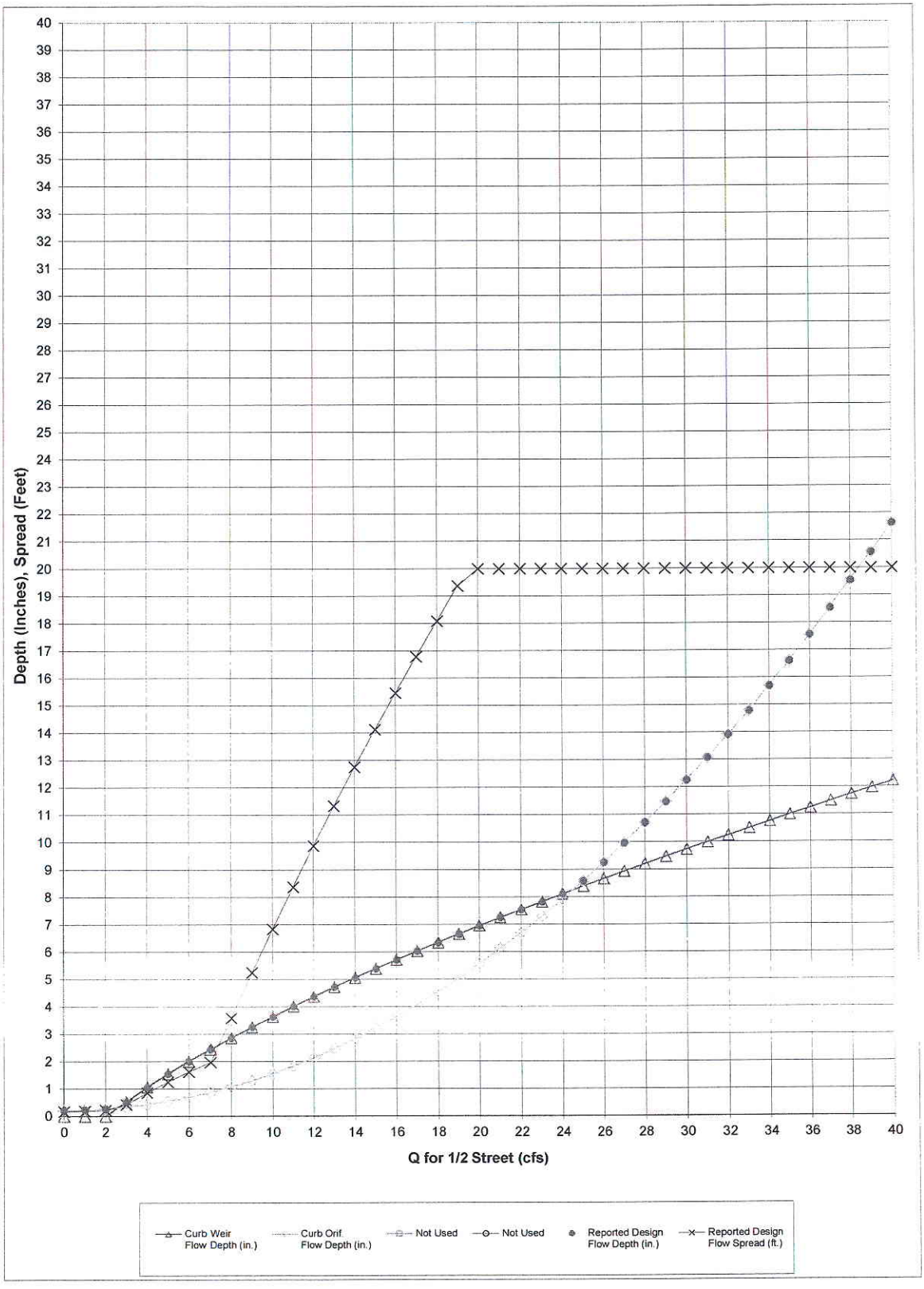


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 3.00)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.67)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	5.00	5.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	4.95	4.95	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.4	63.4	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.30-3.00)	C_w (C) =	2.30	2.30	
Curb Opening Orifice Coefficient (typical value 0.67)	C_o (C) =	0.67	0.67	

Resulting Gutter Flow Depth for Grate Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate as a Weir				
Flow Depth at Local Depression without Clogging (0 cfs grate, 9.4 cfs curb)	d_{wi} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}un}$ =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 9.4 cfs curb)	d_{wa} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}cl}$ =	N/A	N/A	inches
Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 9.4 cfs curb)	d_{oi} =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 9.4 cfs curb)	d_{oa} =	N/A	N/A	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Grate}$ =**	**N/A**	**N/A**	**inches**

Resulting Gutter Flow Depth for Curb Opening Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Curb as a Weir, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 9.4 cfs curb)	d_{wi} =	5.04	10.93	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 9.4 cfs curb)	d_{wa} =	5.41	11.73	inches
Curb as an Orifice, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 9.4 cfs curb)	d_{oi} =	3.17	11.97	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 9.4 cfs curb)	d_{oa} =	3.40	14.26	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Curb}$ =**	**3.41**	**12.26**	**inches**

Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	15.0	15.0	feet
Total Inlet Interception Capacity (Design Discharge from *Q-Peak*)	Q_a =	9.4	30.0	cfs
Resultant Gutter Flow Depth (based on sheet *Q-Allow* geometry)	**d =**	**3.41**	**12.26**	**inches**
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	**T =**	**5.9**	**20.0**	**ft. >T-Crown**
Resultant Flow Depth at Street Crown	**d_{CROWN} =**	**0.00**	**5.52**	**inches**


Depth (Inches), Spread (Feet)
Q for 1/2 Street (cfs)
Curb Weir Flow Depth (in.)
Curb Orif. Flow Depth (in.)
Not Used
Not Used
Reported Design Flow Depth (in.)
Reported Design Flow Spread (ft.)

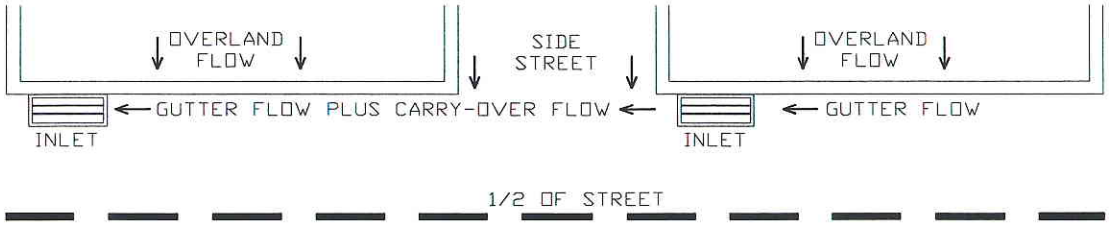
Q Intercepted (cfs)	Curb Weir Flow Depth (in.)	Curb Orif. Flow Depth (in.)	Not Used	Not Used	Reported Design Flow Depth (in.)	Reported DesignFlow Spread (ft.)
0.00	0.00	0.21			0.21	0.17
1.00	0.00	0.23			0.23	0.19
2.00	0.00	0.27			0.27	0.22
3.00	0.53	0.33			0.53	0.43
4.00	1.06	0.43			1.06	0.85
5.00	1.55	0.55			1.55	1.25
6.00	2.01	0.69			2.01	1.62
7.00	2.44	0.87			2.44	1.97
8.00	2.86	1.07			2.86	3.58
9.00	3.26	1.30			3.26	5.25
10.00	3.64	1.55			3.64	6.83
11.00	4.01	1.83			4.01	8.37
12.00	4.37	2.14			4.37	9.87
13.00	4.72	2.47			4.72	11.33
14.00	5.06	2.84			5.06	12.75
15.00	5.39	3.22			5.39	14.12
16.00	5.71	3.64			5.71	15.46
17.00	6.03	4.08			6.03	16.79
18.00	6.34	4.55			6.34	18.08
19.00	6.65	5.04			6.65	19.37
20.00	6.95	5.57			6.95	20.00
21.00	7.25	6.12			7.25	20.00
22.00	7.54	6.69			7.54	20.00
23.00	7.82	7.29			7.82	20.00
24.00	8.11	7.92			8.11	20.00
25.00	8.39	8.58			8.58	20.00
26.00	8.66	9.26			9.26	20.00
27.00	8.93	9.97			9.97	20.00
28.00	9.20	10.71			10.71	20.00
29.00	9.47	11.47			11.47	20.00
30.00	9.73	12.26			12.26	20.00
31.00	9.99	13.08			13.08	20.00
32.00	10.24	13.92			13.92	20.00
33.00	10.50	14.79			14.79	20.00
34.00	10.75	15.69			15.69	20.00
35.00	11.00	16.61			16.61	20.00
36.00	11.24	17.56			17.56	20.00
37.00	11.49	18.54			18.54	20.00
38.00	11.73	19.54			19.54	20.00
39.00	11.97	20.57			20.57	20.00
40.00	12.21	21.63			21.63	20.00

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

Erie Highlands- Phase 1

DP-4

Design Flow = Gutter Flow + Carry-over Flow



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

	Minor Storm	Major Storm	
*Q =	4.60	22.60	cfs

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

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site: (Check One Box Only)	
Site is Urban:	X
Site Is Non-Urban:	

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Gutter Flow =		

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

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

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

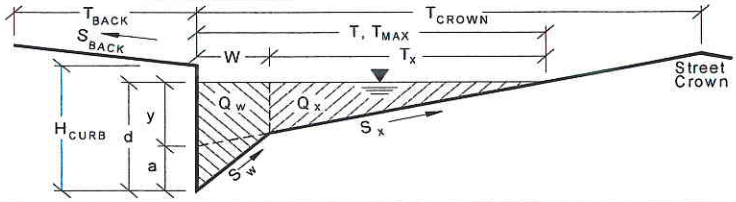
	Minor Storm	Major Storm	
Calculated Design Storm Runoff Coefficient, C =	N/A	N/A	
Calculated 5-yr. Runoff Coefficient, C5 =	N/A	N/A	
Overland Flow Velocity, V_O =	N/A	N/A	fps
Gutter Flow Velocity, V_G =	N/A	N/A	fps
Overland Flow Time, t_O =	N/A	N/A	minutes
Gutter Flow Time, t_G =	N/A	N/A	minutes
Calculated Time of Concentration, T_c =	N/A	N/A	minutes
Time of Concentration by Regional Formula, T_c =	N/A	N/A	minutes
Recommended T_c =	N/A	N/A	minutes
Time of Concentration Selected by User, T_c =	**N/A**	**N/A**	**minutes**
Design Rainfall Intensity, I =	N/A	N/A	inch/hr
Calculated Local Peak Flow, Q_p =	N/A	N/A	cfs
Total Design Peak Flow, Q =	**4.60**	**22.60**	**cfs**

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

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

Project: Erie Highlands- Phase 1

Inlet ID: DP-4



Gutter Geometry (Enter data in the blue cells)			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.0200	ft. vert. / ft. horiz
Manning's Roughness Behind Curb	n_{BACK} =	0.0350	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	20.0	ft
Gutter Depression	a =	2.00	inches
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.0200	ft. vert. / ft. horiz
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.0000	ft. vert. / ft. horiz
Manning's Roughness for Street Section	n_{STREET} =	0.0150	

		Minor Storm	Major Storm	
Max. Allowable Water Spread for Minor & Major Storm	T_{MAX} =	15.0	20.0	ft
Max. Allowable Depth at Gutter Flow Line for Minor & Major Storm	d_{MAX} =	5.20	6.40	inches
Allow Flow Depth at Street Crown (leave blank for no)				X = yes

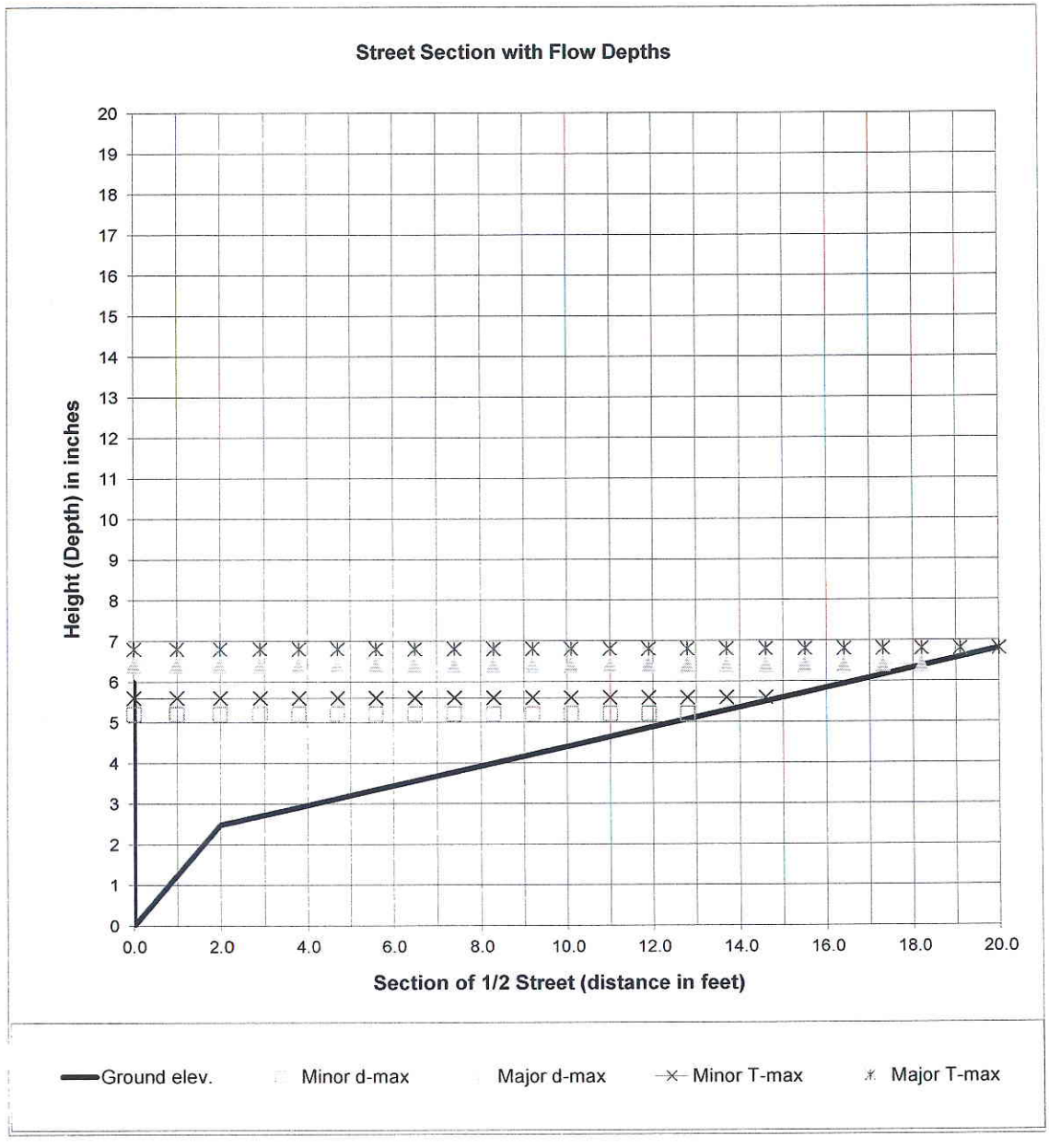
Maximum Gutter Capacity Based On Allowable Water Spread		Minor Storm	Major Storm	
Gutter Cross Slope (Eq. ST-8)	S_W =	0.1033	0.1033	ft/ft
Water Depth without Gutter Depression (Eq. ST-2)	y =	3.60	4.80	inches
Water Depth with a Gutter Depression	d =	5.60	6.80	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	13.0	18.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.421	0.313	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Water Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Gutter Capacity Based on Allowable Gutter Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	13.3	18.3	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	11.3	16.3	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.473	0.343	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm	**Q =**	**0.0**	**0.0**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	SUMP	SUMP	
Max Flow Based on Allow. Gutter Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

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

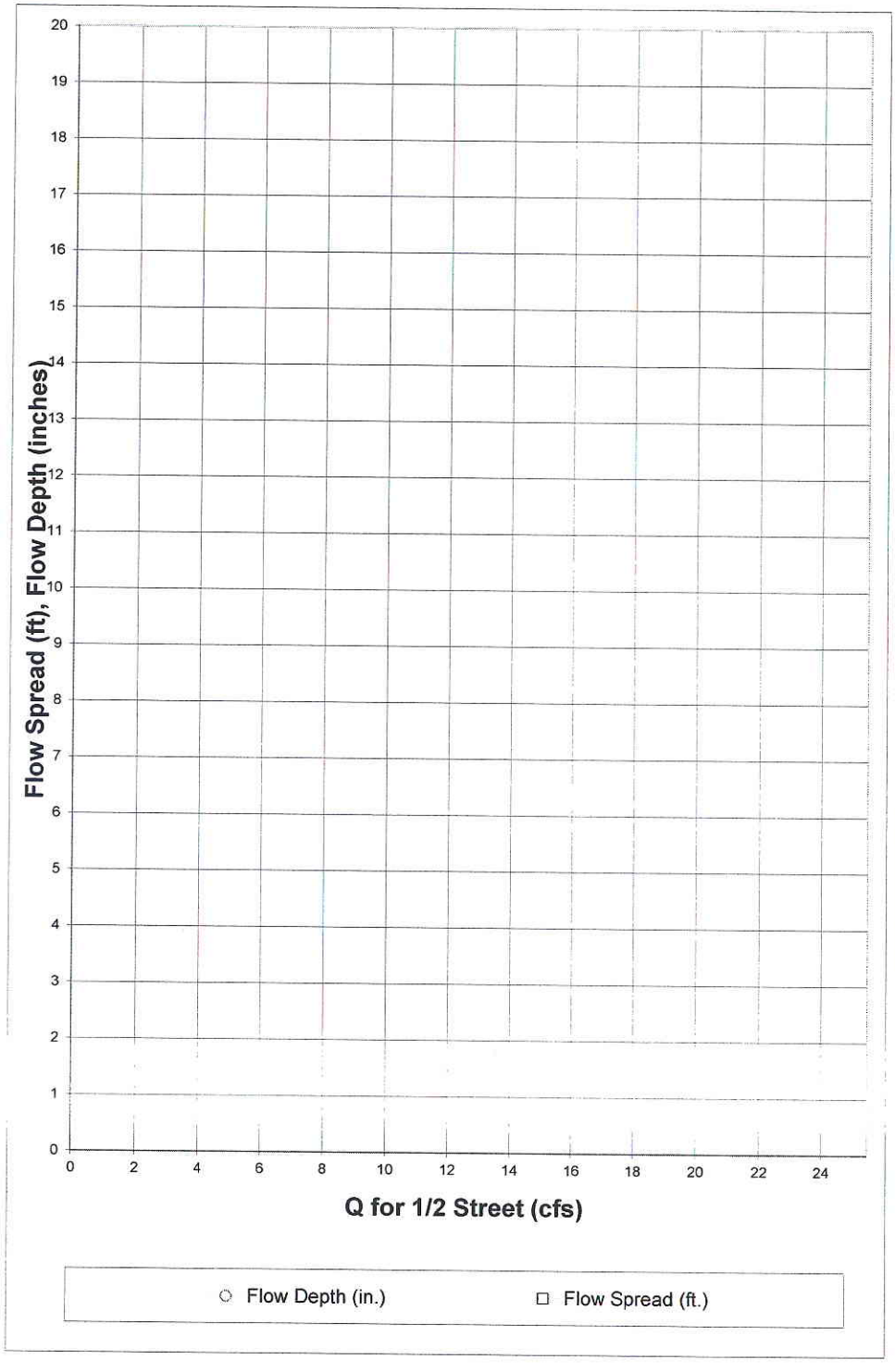
MINOR STORM max. allowable capacity OK - greater than flow given on sheet 'Q-Peak'

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



$$Q_x = \frac{0.56}{n} S_x^{5/3} S_L^{1/2} T_x^{8/3} \qquad E_o = \frac{1}{1 + \dfrac{S_w / S_x}{\left[1 + \dfrac{S_w / S_x}{(T/W) - 1}\right]^{8/3} - 1}}$$

$$Q = \frac{Q_x}{1 - E_o}; \; Q_w = Q - Q_x$$



Q for 1/2 Street (cfs)	Flow Depth (in.)	Flow Spread (ft.)
0.00		
0.25		
0.50		
0.75		
1.00		
1.25		
1.50		
1.75		
2.00		
2.25		
2.50		
2.75		
3.00		
3.25		
3.50		
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11.00		
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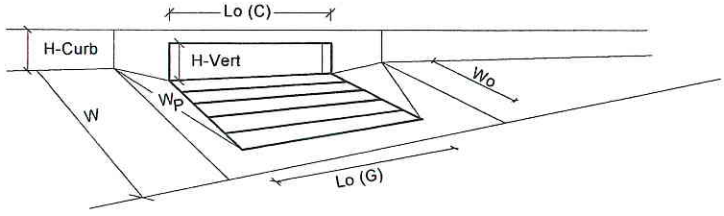
11.50		
11.75		
12.00		
12.25		
12.50		

INLET IN A SUMP OR SAG LOCATION

Project = Erie Highlands- Phase 1

Inlet ID = DP-4

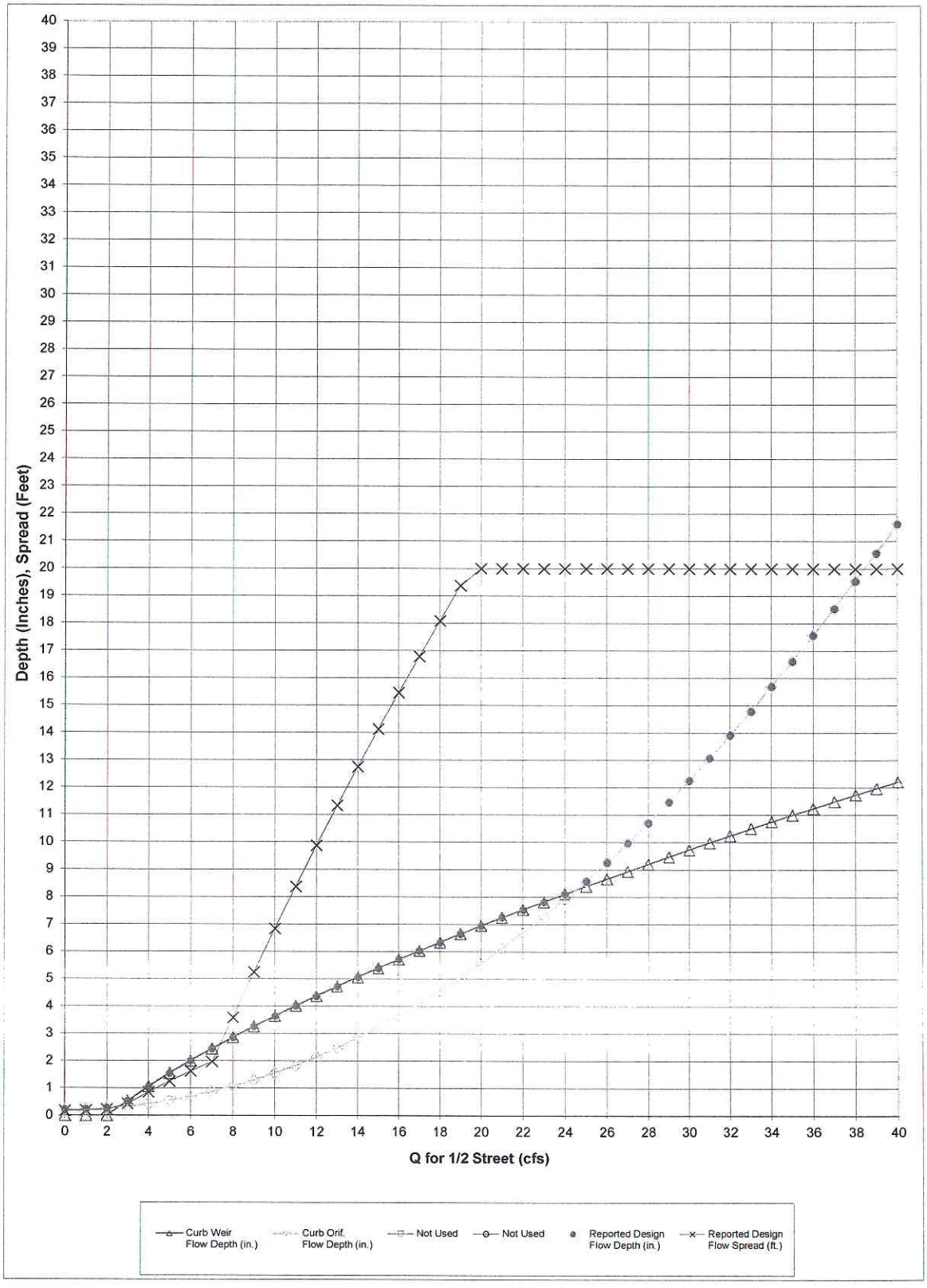


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 3.00)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.67)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	5.00	5.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	4.95	4.95	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.4	63.4	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.30-3.00)	C_w (C) =	2.30	2.30	
Curb Opening Orifice Coefficient (typical value 0.67)	C_o (C) =	0.67	0.67	

Resulting Gutter Flow Depth for Grate Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate as a Weir				
Flow Depth at Local Depression without Clogging (0 cfs grate, 4.6 cfs curb)	d_{wi} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}un}$ =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 4.6 cfs curb)	d_{wa} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}cl}$ =	N/A	N/A	inches
Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 4.6 cfs curb)	d_{oi} =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 4.6 cfs curb)	d_{oa} =	N/A	N/A	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Grate}$ =**	**N/A**	**N/A**	**inches**

Resulting Gutter Flow Depth for Curb Opening Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Curb as a Weir, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 4.6 cfs curb)	d_{wi} =	3.13	9.05	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 4.6 cfs curb)	d_{wa} =	3.36	9.71	inches
Curb as an Orifice, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 4.6 cfs curb)	d_{oi} =	2.44	7.75	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 4.6 cfs curb)	d_{oa} =	2.50	9.05	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Curb}$ =**	**1.36**	**7.71**	**inches**

Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	15.0	15.0	feet
Total Inlet Interception Capacity (Design Discharge from *Q-Peak*)	Q_a =	4.6	22.6	cfs
Resultant Gutter Flow Depth (based on sheet *Q-Allow* geometry)	**d =**	**1.36**	**7.71**	**inches**
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	**T =**	**1.1**	**20.0**	**ft. >T-Crown**
Resultant Flow Depth at Street Crown	**d_{CROWN} =**	**0.00**	**0.96**	**inches**


Depth (Inches), Spread (Feet)
Q for 1/2 Street (cfs)
Curb Weir Flow Depth (in.)
Curb Orif. Flow Depth (in.)
Not Used
Not Used
Reported Design Flow Depth (in.)
Reported Design Flow Spread (ft.)

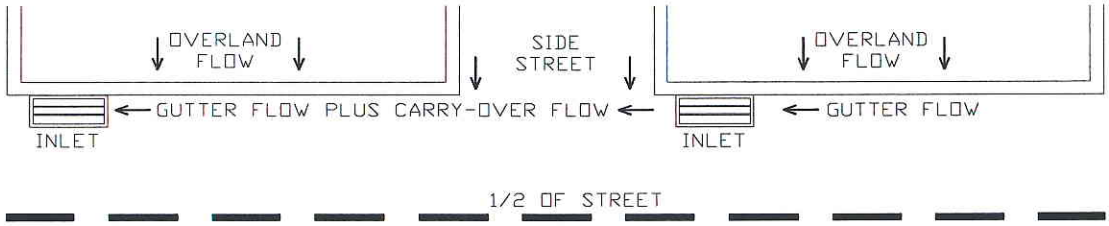
Q Intercepted (cfs)	Curb Weir Flow Depth (in.)	Curb Orif. Flow Depth (in.)	Not Used	Not Used	Reported Design Flow Depth (in.)	Reported DesignFlow Spread (ft.)
0.00	0.00	0.21			0.21	0.17
1.00	0.00	0.23			0.23	0.19
2.00	0.00	0.27			0.27	0.22
3.00	0.53	0.33			0.53	0.43
4.00	1.06	0.43			1.06	0.85
5.00	1.55	0.55			1.55	1.25
6.00	2.01	0.69			2.01	1.62
7.00	2.44	0.87			2.44	1.97
8.00	2.86	1.07			2.86	3.58
9.00	3.26	1.30			3.26	5.25
10.00	3.64	1.55			3.64	6.83
11.00	4.01	1.83			4.01	8.37
12.00	4.37	2.14			4.37	9.87
13.00	4.72	2.47			4.72	11.33
14.00	5.06	2.84			5.06	12.75
15.00	5.39	3.22			5.39	14.12
16.00	5.71	3.64			5.71	15.46
17.00	6.03	4.08			6.03	16.79
18.00	6.34	4.55			6.34	18.08
19.00	6.65	5.04			6.65	19.37
20.00	6.95	5.57			6.95	20.00
21.00	7.25	6.12			7.25	20.00
22.00	7.54	6.69			7.54	20.00
23.00	7.82	7.29			7.82	20.00
24.00	8.11	7.92			8.11	20.00
25.00	8.39	8.58			8.58	20.00
26.00	8.66	9.26			9.26	20.00
27.00	8.93	9.97			9.97	20.00
28.00	9.20	10.71			10.71	20.00
29.00	9.47	11.47			11.47	20.00
30.00	9.73	12.26			12.26	20.00
31.00	9.99	13.08			13.08	20.00
32.00	10.24	13.92			13.92	20.00
33.00	10.50	14.79			14.79	20.00
34.00	10.75	15.69			15.69	20.00
35.00	11.00	16.61			16.61	20.00
36.00	11.24	17.56			17.56	20.00
37.00	11.49	18.54			18.54	20.00
38.00	11.73	19.54			19.54	20.00
39.00	11.97	20.57			20.57	20.00
40.00	12.21	21.63			21.63	20.00

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

Erie Highlands- Phase 1

DP-8

Design Flow = Gutter Flow + Carry-over Flow



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

	Minor Storm	Major Storm	
*Q =	5.00	29.80	cfs

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

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site: (Check One Box Only)	
Site is Urban:	X
Site Is Non-Urban:	

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Gutter Flow =		

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

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

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

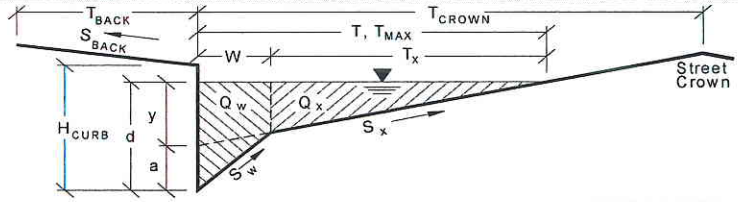
	Minor Storm	Major Storm	
Calculated Design Storm Runoff Coefficient, C =	N/A	N/A	
Calculated 5-yr. Runoff Coefficient, C5 =	N/A	N/A	
Overland Flow Velocity, V_O =	N/A	N/A	fps
Gutter Flow Velocity, V_G =	N/A	N/A	fps
Overland Flow Time, t_O =	N/A	N/A	minutes
Gutter Flow Time, t_G =	N/A	N/A	minutes
Calculated Time of Concentration, T_c =	N/A	N/A	minutes
Time of Concentration by Regional Formula, T_c =	N/A	N/A	minutes
Recommended T_c =	N/A	N/A	minutes
Time of Concentration Selected by User, T_c =	**N/A**	**N/A**	**minutes**
Design Rainfall Intensity, I =	N/A	N/A	inch/hr
Calculated Local Peak Flow, Q_p =	N/A	N/A	cfs
Total Design Peak Flow, Q =	**5.00**	**29.80**	**cfs**

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

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

Project: Erie Highlands- Phase 1

Inlet ID: DP-8



Gutter Geometry (Enter data in the blue cells)			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.0200	ft. vert. / ft. horiz
Manning's Roughness Behind Curb	n_{BACK} =	0.0350	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	26.0	ft
Gutter Depression	a =	2.00	inches
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.0260	ft. vert. / ft. horiz
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.0000	ft. vert. / ft. horiz
Manning's Roughness for Street Section	n_{STREET} =	0.0150	

		Minor Storm	Major Storm	
Max. Allowable Water Spread for Minor & Major Storm	T_{MAX} =	21.0	26.0	ft
Max. Allowable Depth at Gutter Flow Line for Minor & Major Storm	d_{MAX} =	6.00	10.30	inches
Allow Flow Depth at Street Crown (leave blank for no)			X	X = yes

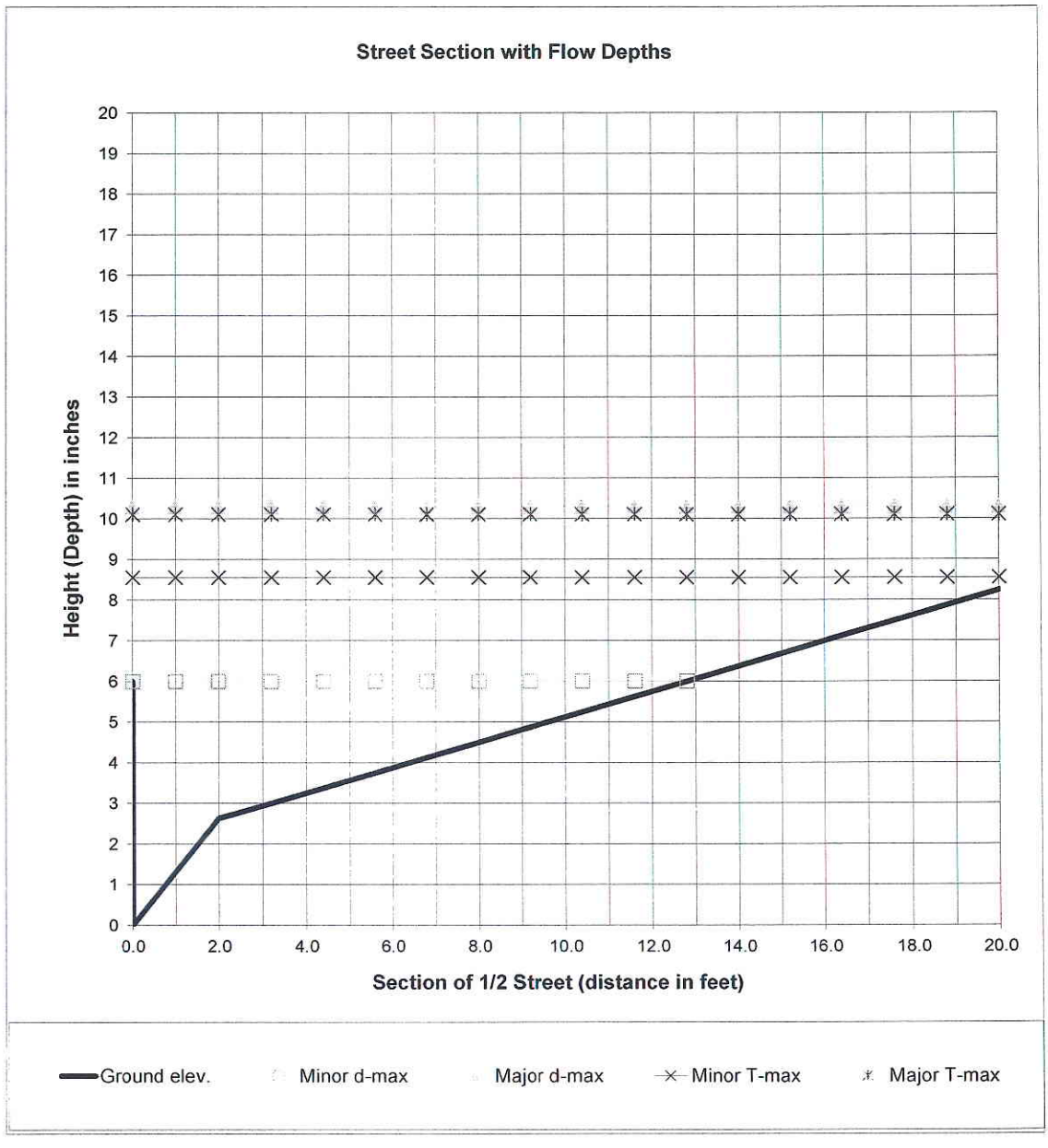
Maximum Gutter Capacity Based On Allowable Water Spread		Minor Storm	Major Storm	
Gutter Cross Slope (Eq. ST-8)	S_W =	0.1093	0.1093	ft/ft
Water Depth without Gutter Depression (Eq. ST-2)	y =	6.55	8.11	inches
Water Depth with a Gutter Depression	d =	8.55	10.11	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	19.0	24.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.283	0.226	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Water Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Gutter Capacity Based on Allowable Gutter Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	12.8	26.6	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	10.8	24.6	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.464	0.221	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm	**Q =**	**0.0**	**0.0**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	SUMP	SUMP	
Max Flow Based on Allow. Gutter Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

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

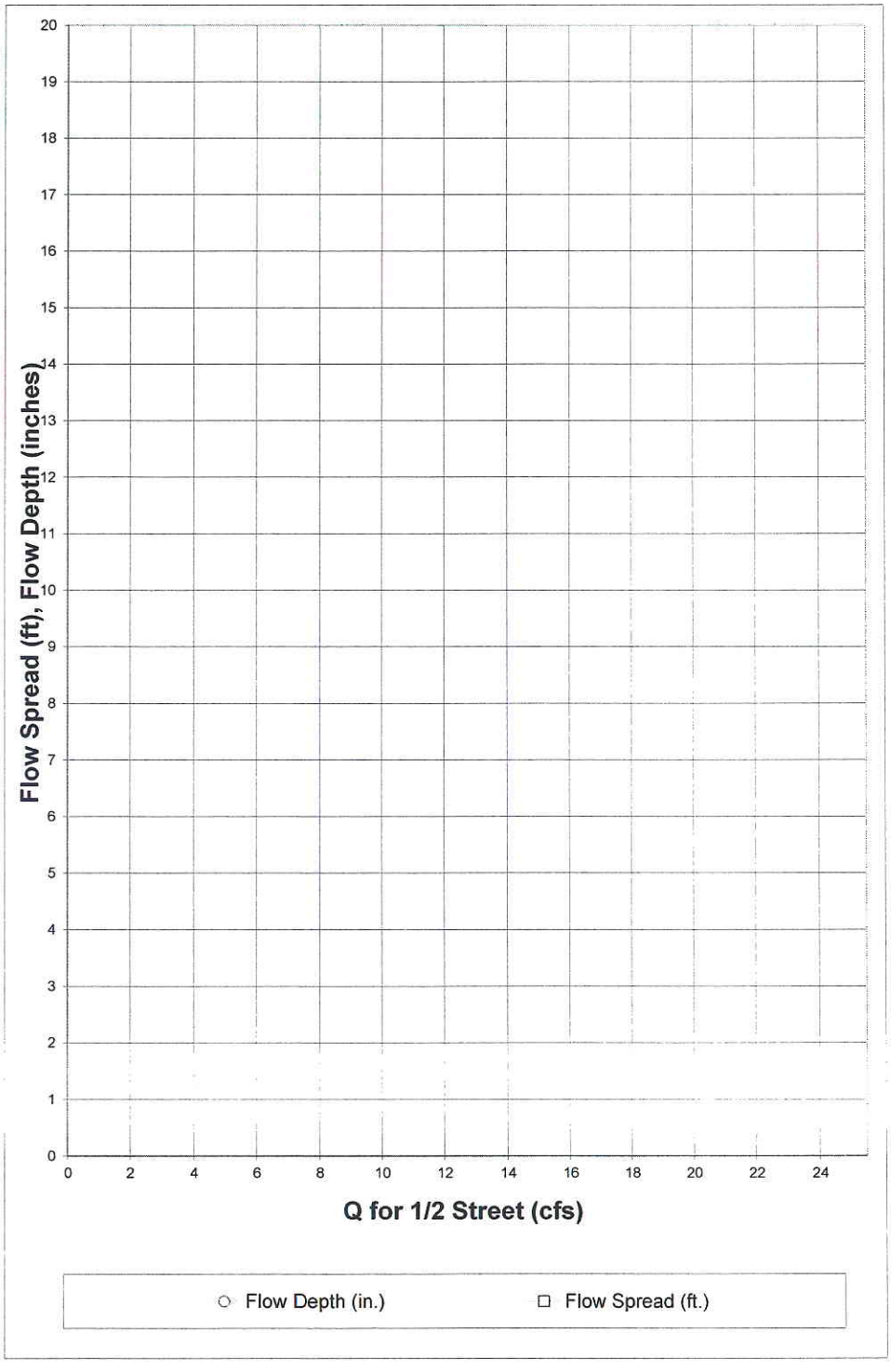
MINOR STORM max. allowable capacity OK - greater than flow given on sheet 'Q-Peak'

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



$$Q_x = \frac{0.56}{n} S_x^{5/3} S_L^{1/2} T_x^{8/3} \qquad E_o = \frac{1}{1 + \dfrac{S_w / S_x}{\left[1 + \dfrac{S_w / S_x}{(T/W) - 1}\right]^{8/3} - 1}}$$

$$Q = \frac{Q_x}{1 - E_o}; \; Q_w = Q - Q_x$$

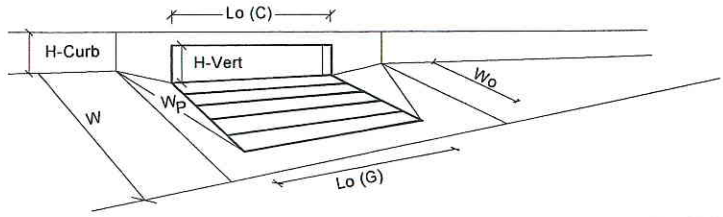


Q for 1/2 Street (cfs)	Flow Depth (in.)	Flow Spread (ft.)
0.00		
0.25		
0.50		
0.75		
1.00		
1.25		
1.50		
1.75		
2.00		
2.25		
2.50		
2.75		
3.00		
3.25		
3.50		
3.75		
4.00		
4.25		
4.50		
4.75		
5.00		
5.25		
5.50		
5.75		
6.00		
6.25		
6.50		
6.75		
7.00		
7.25		
7.50		
7.75		
8.00		
8.25		
8.50		
8.75		
9.00		
9.25		
9.50		
9.75		
10.00		
10.25		
10.50		
10.75		
11.00		
11.25		
11.50		
11.75		
12.00		
12.25		
12.50		

INLET IN A SUMP OR SAG LOCATION

Project = Erie Highlands- Phase 1

Inlet ID = DP-8

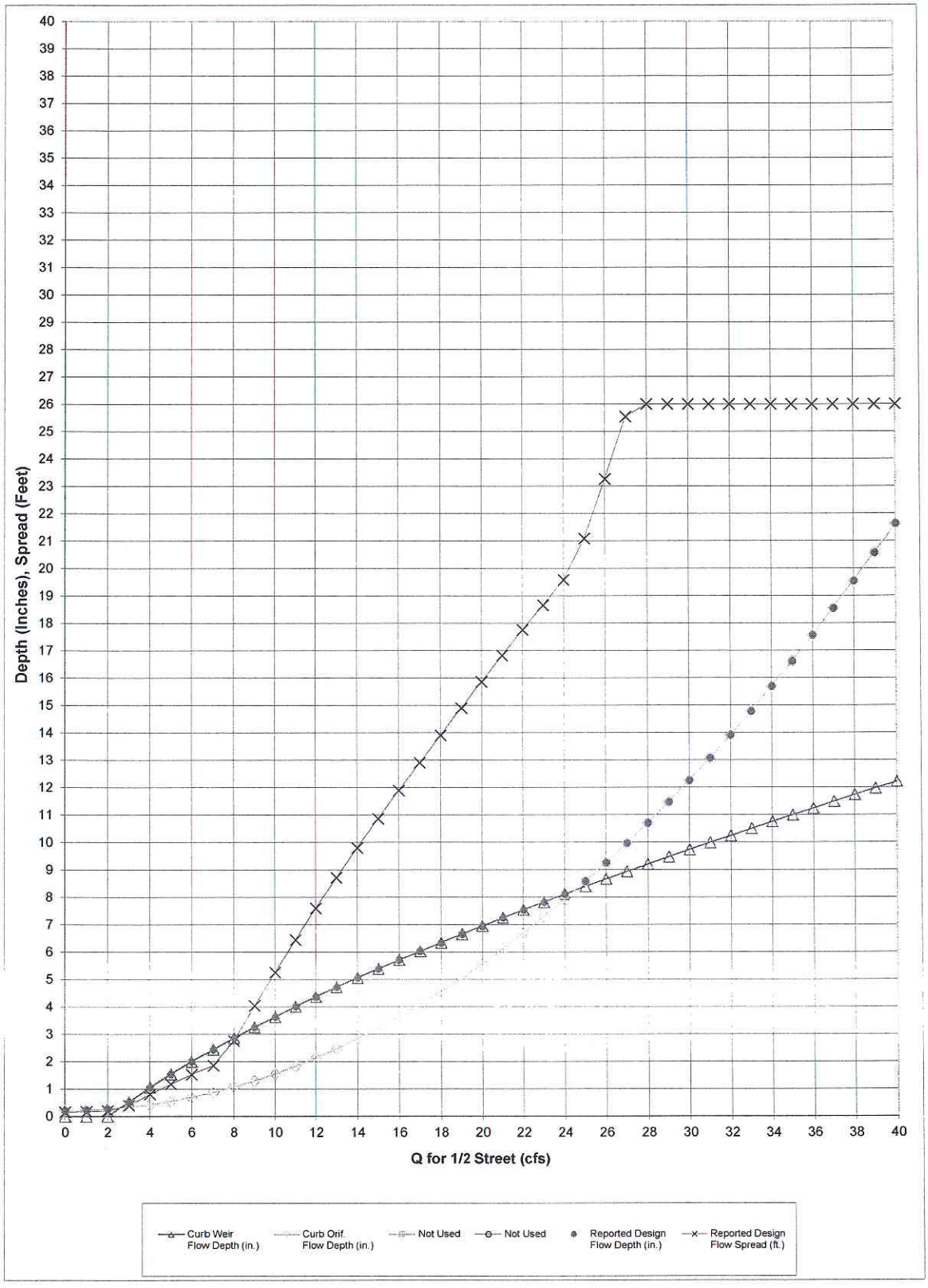


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 3.00)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.67)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	5.00	5.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	4.95	4.95	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.4	63.4	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.30-3.00)	C_w (C) =	2.30	2.30	
Curb Opening Orifice Coefficient (typical value 0.67)	C_o (C) =	0.67	0.67	

Resulting Gutter Flow Depth for Grate Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate as a Weir				
Flow Depth at Local Depression without Clogging (0 cfs grate, 5 cfs curb)	d_{wi} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}un}$ =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 5 cfs curb)	d_{wa} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}cl}$ =	N/A	N/A	inches
Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 5 cfs curb)	d_{oi} =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 5 cfs curb)	d_{oa} =	N/A	N/A	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Grate}$ =**	**N/A**	**N/A**	**inches**

Resulting Gutter Flow Depth for Curb Opening Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Curb as a Weir, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 5 cfs curb)	d_{wi} =	3.31	10.88	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 5 cfs curb)	d_{wa} =	3.55	11.68	inches
Curb as an Orifice, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 5 cfs curb)	d_{oi} =	2.48	11.84	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 5 cfs curb)	d_{oa} =	2.55	14.10	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Curb}$ =**	**1.55**	**12.10**	**inches**

Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	15.0	15.0	feet
Total Inlet Interception Capacity (Design Discharge from *Q-Peak*)	Q_a =	5.0	29.8	cfs
Resultant Gutter Flow Depth (based on sheet *Q-Allow* geometry)	**d =**	**1.55**	**12.10**	**inches**
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	**T =**	**1.2**	**26.0**	**ft. >T-Crown**
Resultant Flow Depth at Street Crown	**d_{CROWN} =**	**0.00**	**2.04**	**inches**


Depth (Inches), Spread (Feet)
Q for 1/2 Street (cfs)
Curb Weir Flow Depth (in.)
Curb Orif. Flow Depth (in.)
Not Used
Not Used
Reported Design Flow Depth (in.)
Reported Design Flow Spread (ft.)

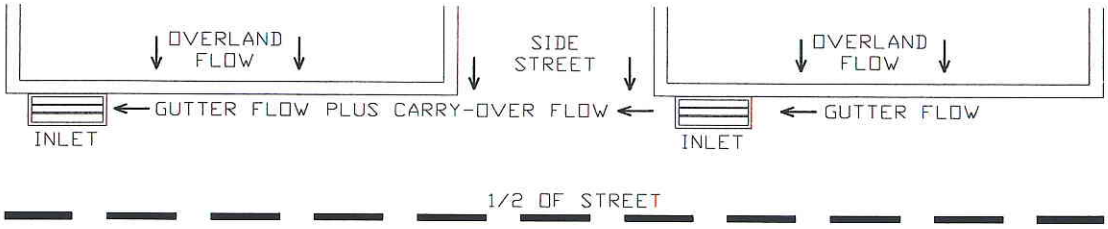
Q Intercepted (cfs)	Curb Weir Flow Depth (in.)	Curb Orif. Flow Depth (in.)	Not Used	Not Used	Reported Design Flow Depth (in.)	Reported DesignFlow Spread (ft.)
0.00	0.00	0.21			0.21	0.16
1.00	0.00	0.23			0.23	0.18
2.00	0.00	0.27			0.27	0.21
3.00	0.53	0.33			0.53	0.40
4.00	1.06	0.43			1.06	0.81
5.00	1.55	0.55			1.55	1.18
6.00	2.01	0.69			2.01	1.53
7.00	2.44	0.87			2.44	1.86
8.00	2.86	1.07			2.86	2.76
9.00	3.26	1.30			3.26	4.04
10.00	3.64	1.55			3.64	5.26
11.00	4.01	1.83			4.01	6.44
12.00	4.37	2.14			4.37	7.59
13.00	4.72	2.47			4.72	8.72
14.00	5.06	2.84			5.06	9.81
15.00	5.39	3.22			5.39	10.86
16.00	5.71	3.64			5.71	11.89
17.00	6.03	4.08			6.03	12.92
18.00	6.34	4.55			6.34	13.91
19.00	6.65	5.04			6.65	14.90
20.00	6.95	5.57			6.95	15.86
21.00	7.25	6.12			7.25	16.83
22.00	7.54	6.69			7.54	17.76
23.00	7.82	7.29			7.82	18.65
24.00	8.11	7.92			8.11	19.58
25.00	8.39	8.58			8.58	21.09
26.00	8.66	9.26			9.26	23.27
27.00	8.93	9.97			9.97	25.54
28.00	9.20	10.71			10.71	26.00
29.00	9.47	11.47			11.47	26.00
30.00	9.73	12.26			12.26	26.00
31.00	9.99	13.08			13.08	26.00
32.00	10.24	13.92			13.92	26.00
33.00	10.50	14.79			14.79	26.00
34.00	10.75	15.69			15.69	26.00
35.00	11.00	16.61			16.61	26.00
36.00	11.24	17.56			17.56	26.00
37.00	11.49	18.54			18.54	26.00
38.00	11.73	19.54			19.54	26.00
39.00	11.97	20.57			20.57	26.00
40.00	12.21	21.63			21.63	26.00

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

Erie Highlands- Phase 1

DP-9

Design Flow = Gutter Flow + Carry-over Flow



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

	Minor Storm	Major Storm	
*Q =	0.70	3.50	cfs

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

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site: (Check One Box Only)

Site is Urban:	X
Site Is Non-Urban:	

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Gutter Flow =		

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

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

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

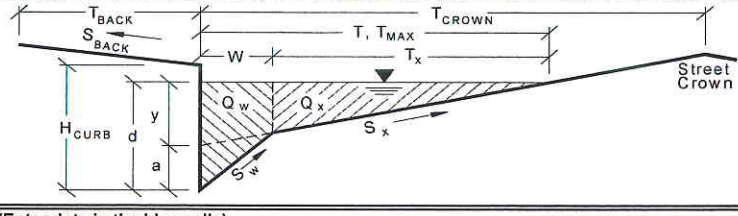
	Minor Storm	Major Storm	
Calculated Design Storm Runoff Coefficient, C =	N/A	N/A	
Calculated 5-yr. Runoff Coefficient, C5 =	N/A	N/A	
Overland Flow Velocity, V_O =	N/A	N/A	fps
Gutter Flow Velocity, V_G =	N/A	N/A	fps
Overland Flow Time, t_O =	N/A	N/A	minutes
Gutter Flow Time, t_G =	N/A	N/A	minutes
Calculated Time of Concentration, T_c =	N/A	N/A	minutes
Time of Concentration by Regional Formula, T_c =	N/A	N/A	minutes
Recommended T_c =	N/A	N/A	minutes
Time of Concentration Selected by User, T_c =	**N/A**	**N/A**	**minutes**
Design Rainfall Intensity, I =	N/A	N/A	inch/hr
Calculated Local Peak Flow, Q_p =	N/A	N/A	cfs
Total Design Peak Flow, Q =	**0.70**	**3.50**	**cfs**

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

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

Project: Erie Highlands- Phase 1

Inlet ID: DP-9



Gutter Geometry (Enter data in the blue cells)			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.0200	ft. vert. / ft. horiz
Manning's Roughness Behind Curb	n_{BACK} =	0.0350	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	26.0	ft
Gutter Depression	a =	2.00	inches
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.0200	ft. vert. / ft. horiz
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.0000	ft. vert. / ft. horiz
Manning's Roughness for Street Section	n_{STREET} =	0.0150	

		Minor Storm	Major Storm	
Max. Allowable Water Spread for Minor & Major Storm	T_{MAX} =	21.0	26.0	ft
Max. Allowable Depth at Gutter Flow Line for Minor & Major Storm	d_{MAX} =	2.10	2.10	inches
Allow Flow Depth at Street Crown (leave blank for no)			X	X = yes

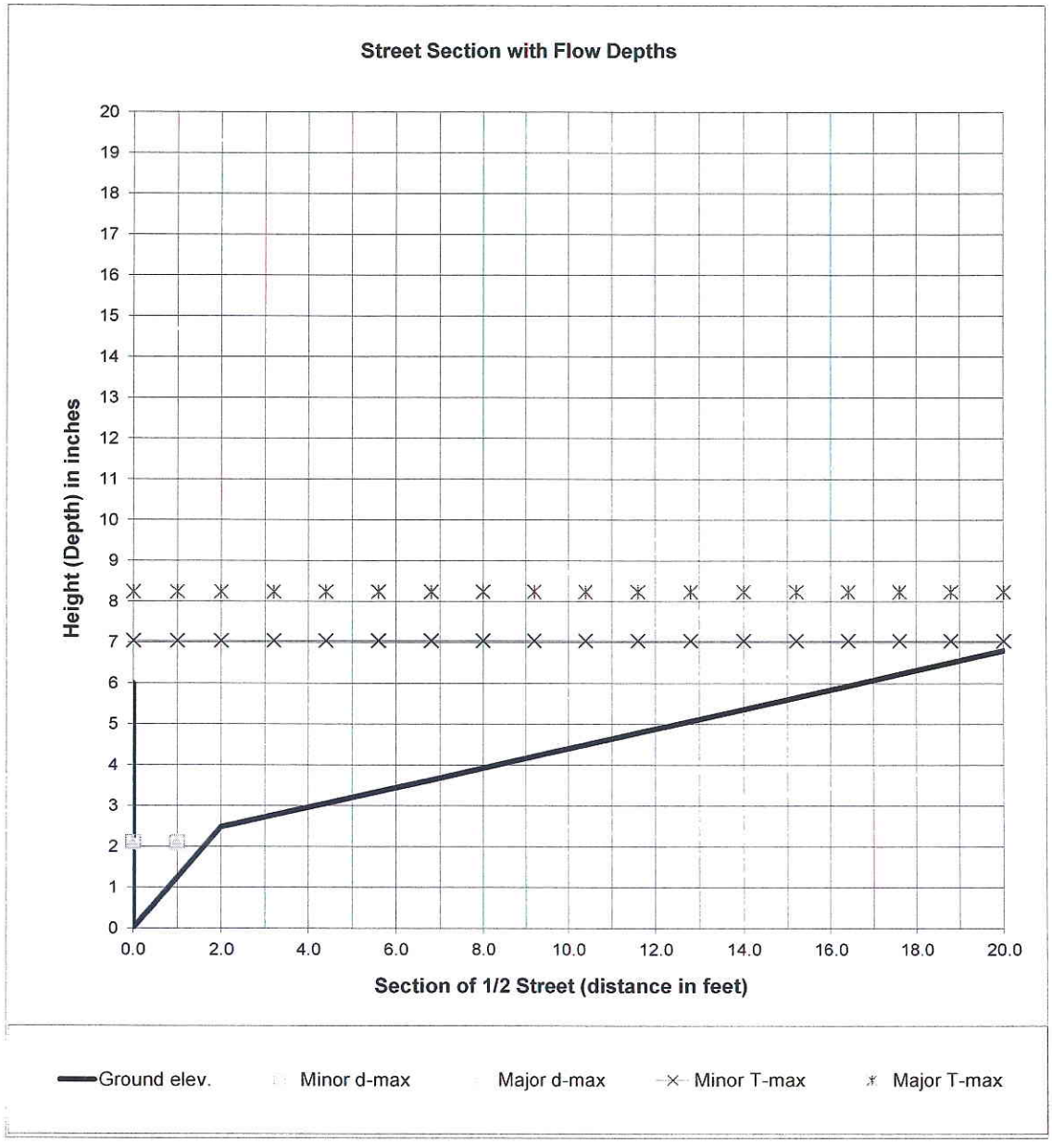
Maximum Gutter Capacity Based On Allowable Water Spread		Minor Storm	Major Storm	
Gutter Cross Slope (Eq. ST-8)	S_W =	0.1033	0.1033	ft/ft
Water Depth without Gutter Depression (Eq. ST-2)	y =	5.04	6.24	inches
Water Depth with a Gutter Depression	d =	7.04	8.24	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	19.0	24.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.297	0.236	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Water Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Gutter Capacity Based on Allowable Gutter Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	0.4	0.4	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	0.0	0.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	1.000	1.000	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	#DIV/0!	#DIV/0!	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm	**Q =**	**0.0**	**0.0**	**cfs**
Flow Velocity Within the Gutter Section	V =	#DIV/0!	#DIV/0!	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	#DIV/0!	#DIV/0!	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	SUMP	SUMP	
Max Flow Based on Allow. Gutter Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

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

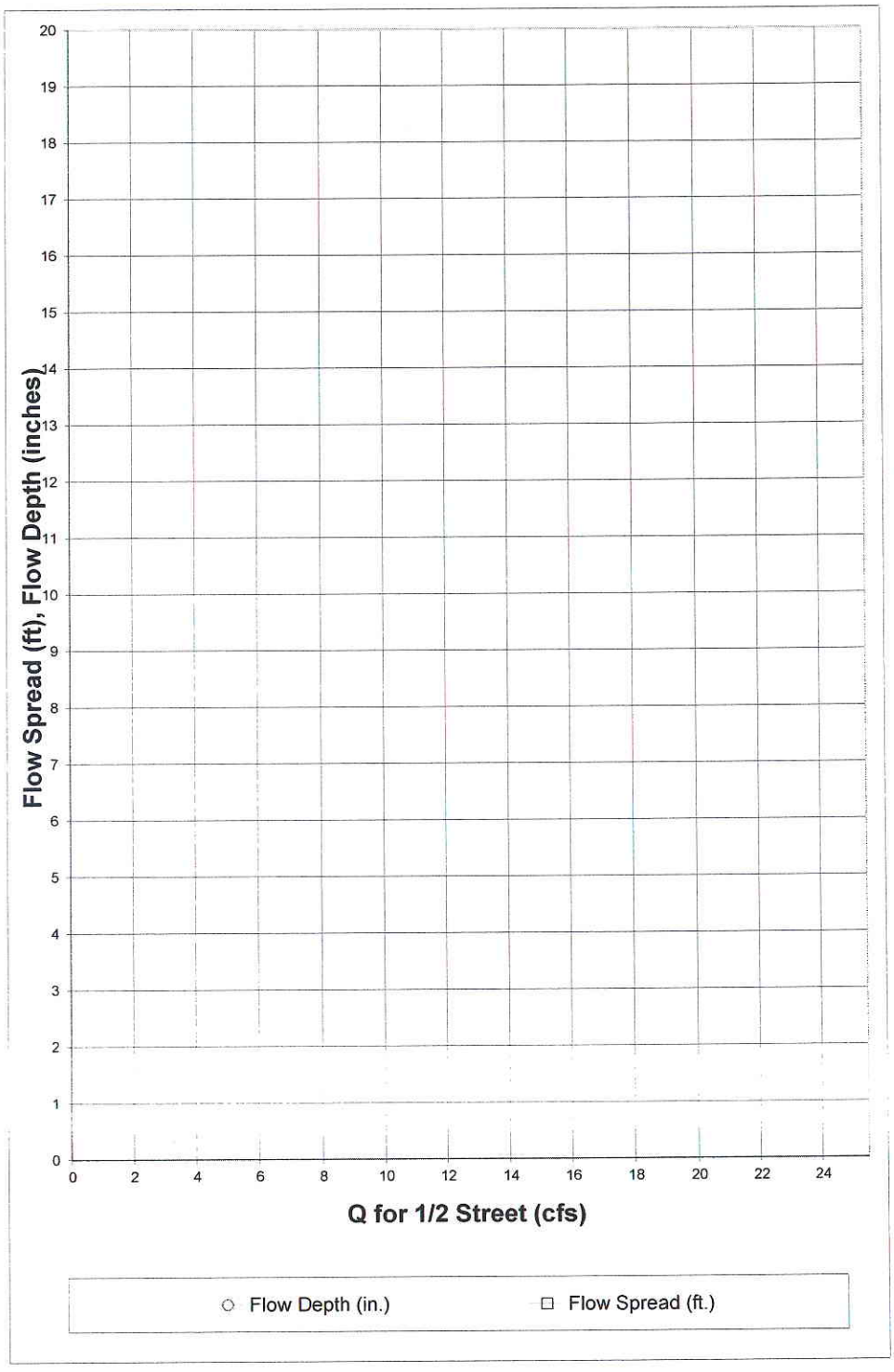
MINOR STORM max. allowable capacity OK - greater than flow given on sheet 'Q-Peak'

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



$$Q_x = \frac{0.56}{n} S_x^{5/3} S_L^{1/2} T_x^{8/3} \qquad E_o = \frac{1}{1 + \dfrac{S_w / S_x}{\left[1 + \dfrac{S_w / S_x}{(T/W) - 1}\right]^{8/3} - 1}}$$

$$Q = \frac{Q_x}{1 - E_o}; \; Q_w = Q - Q_x$$



Q for 1/2 Street (cfs)	Flow Depth (in.)	Flow Spread (ft.)
0.00		
0.25		
0.50		
0.75		
1.00		
1.25		
1.50		
1.75		
2.00		
2.25		
2.50		
2.75		
3.00		
3.25		
3.50		
3.75		
4.00		
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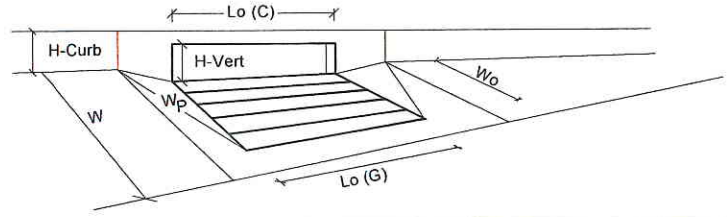
7.75		
8.00		
8.25		
8.50		
8.75		
9.00		
9.25		
9.50		
9.75		
10.00		
10.25		
10.50		
10.75		
11.00		
11.25		
11.50		
11.75		
12.00		
12.25		
12.50		

INLET IN A SUMP OR SAG LOCATION

Project = Erie Highlands- Phase 1

Inlet ID = DP-9

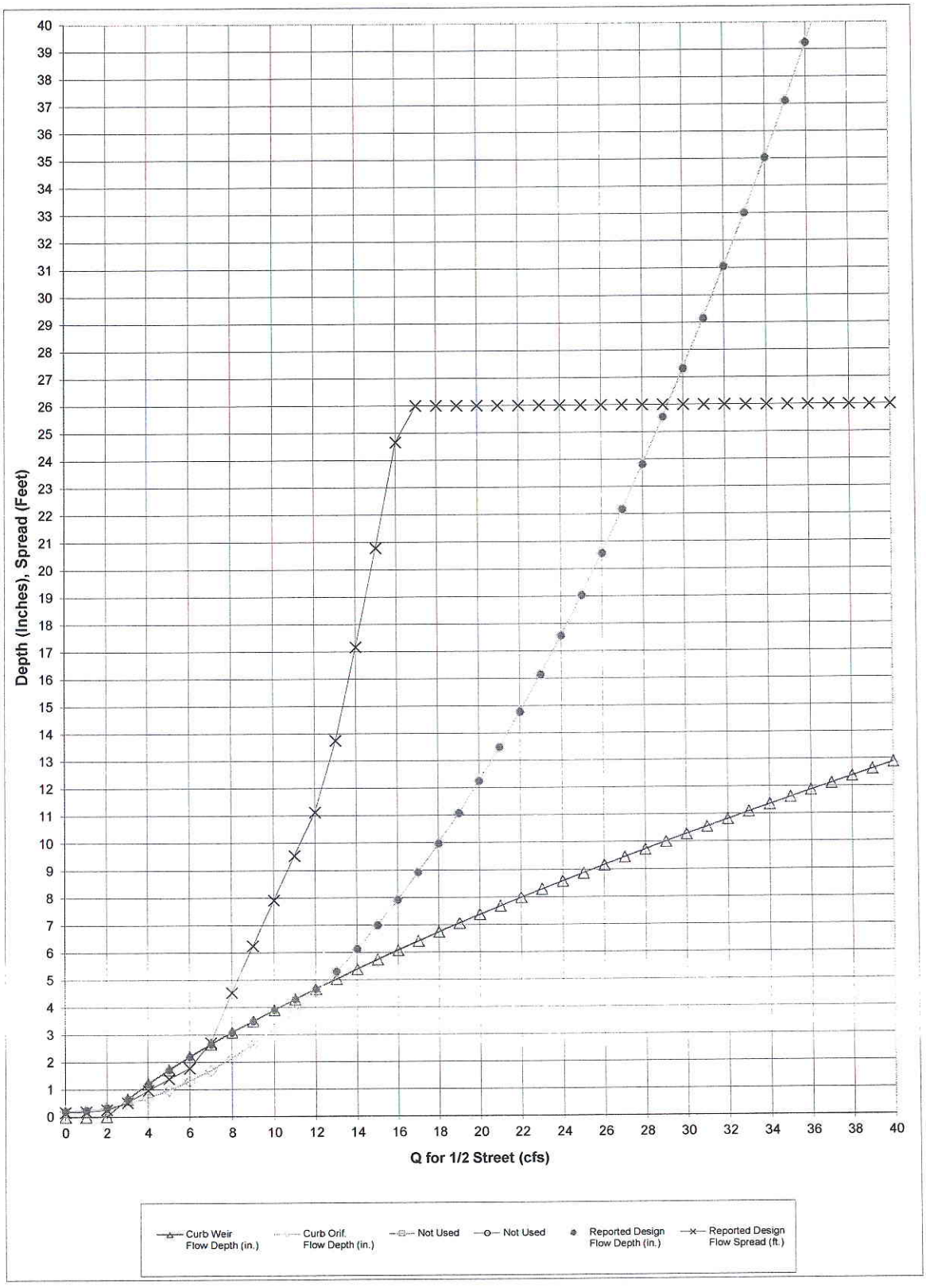


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 3.00)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.67)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	5.00	5.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	4.95	4.95	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.4	63.4	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.30-3.00)	C_w (C) =	2.30	2.30	
Curb Opening Orifice Coefficient (typical value 0.67)	C_o (C) =	0.67	0.67	

Resulting Gutter Flow Depth for Grate Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate as a Weir				
Flow Depth at Local Depression without Clogging (0 cfs grate, 0.7 cfs curb)	d_{wi} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}un}$ =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 0.7 cfs curb)	d_{wa} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}cl}$ =	N/A	N/A	inches
Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 0.7 cfs curb)	d_{oi} =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 0.7 cfs curb)	d_{oa} =	N/A	N/A	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Grate}$ =**	**N/A**	**N/A**	**inches**

Resulting Gutter Flow Depth for Curb Opening Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Curb as a Weir, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 0.7 cfs curb)	d_{wi} =	0.95	2.79	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 0.7 cfs curb)	d_{wa} =	1.00	2.93	inches
Curb as an Orifice, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 0.7 cfs curb)	d_{oi} =	2.22	2.51	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 0.7 cfs curb)	d_{oa} =	2.23	2.58	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Curb}$ =**	**0.23**	**0.93**	**inches**

Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	10.0	10.0	feet
Total Inlet Interception Capacity (Design Discharge from *Q-Peak*)	Q_a =	0.7	3.5	cfs
Resultant Gutter Flow Depth (based on sheet *Q-Allow* geometry)	**d =**	**0.23**	**0.93**	**inches**
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	**T =**	**0.2**	**0.8**	**feet**
Resultant Flow Depth at Street Crown	**d_{CROWN} =**	**0.00**	**0.00**	**inches**


Depth (Inches), Spread (Feet)
Q for 1/2 Street (cfs)
Curb Weir Flow Depth (in.)
Curb Orif. Flow Depth (in.)
Not Used
Not Used
Reported Design Flow Depth (in.)
Reported Design Flow Spread (ft.)

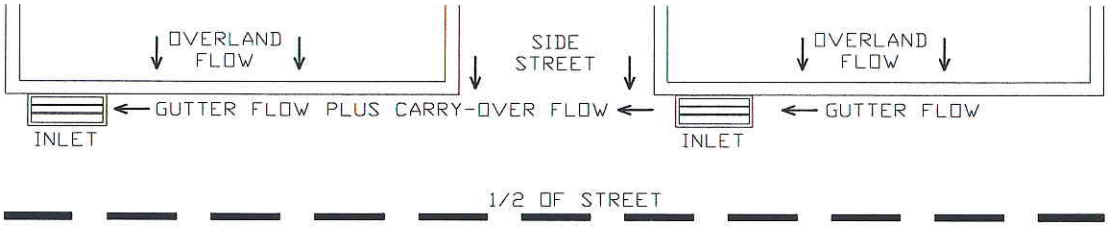
Q Intercepted (cfs)	Curb Weir Flow Depth (in.)	Curb Orif. Flow Depth (in.)	Not Used	Not Used	Reported Design Flow Depth (in.)	Reported DesignFlow Spread (ft.)
0.00	0.00	0.21			0.21	0.17
1.00	0.00	0.24			0.24	0.19
2.00	0.02	0.33			0.33	0.27
3.00	0.65	0.48			0.65	0.52
4.00	1.20	0.69			1.20	0.97
5.00	1.72	0.97			1.72	1.39
6.00	2.20	1.30			2.20	1.77
7.00	2.65	1.69			2.65	2.71
8.00	3.09	2.14			3.09	4.54
9.00	3.50	2.65			3.50	6.25
10.00	3.90	3.22			3.90	7.92
11.00	4.29	3.86			4.29	9.54
12.00	4.67	4.55			4.67	11.12
13.00	5.03	5.30			5.30	13.75
14.00	5.39	6.12			6.12	17.17
15.00	5.74	6.99			6.99	20.79
16.00	6.08	7.92			7.92	24.67
17.00	6.41	8.92			8.92	26.00
18.00	6.74	9.97			9.97	26.00
19.00	7.06	11.08			11.08	26.00
20.00	7.37	12.26			12.26	26.00
21.00	7.68	13.49			13.49	26.00
22.00	7.99	14.79			14.79	26.00
23.00	8.29	16.14			16.14	26.00
24.00	8.58	17.56			17.56	26.00
25.00	8.87	19.04			19.04	26.00
26.00	9.16	20.57			20.57	26.00
27.00	9.45	22.17			22.17	26.00
28.00	9.73	23.82			23.82	26.00
29.00	10.01	25.54			25.54	26.00
30.00	10.28	27.32			27.32	26.00
31.00	10.55	29.15			29.15	26.00
32.00	10.82	31.05			31.05	26.00
33.00	11.09	33.01			33.01	26.00
34.00	11.35	35.03			35.03	26.00
35.00	11.61	37.11			37.11	26.00
36.00	11.87	39.24			39.24	26.00
37.00	12.12	41.44			41.44	26.00
38.00	12.38	43.70			43.70	26.00
39.00	12.63	46.02			46.02	26.00
40.00	12.88	48.40			48.40	26.00

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

Erie Highlands- Phase 1

DP-10

Design Flow = Gutter Flow + Carry-over Flow



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

	Minor Storm	Major Storm	
*Q =	6.60	20.70	cfs

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

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site: (Check One Box Only)

Site is Urban:	X
Site Is Non-Urban:	

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Gutter Flow =		

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

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

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

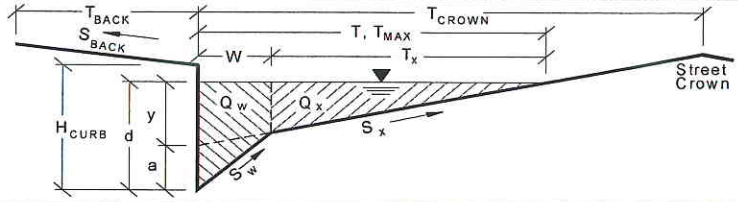
	Minor Storm	Major Storm	
Calculated Design Storm Runoff Coefficient, C =	N/A	N/A	
Calculated 5-yr. Runoff Coefficient, C5 =	N/A	N/A	
Overland Flow Velocity, V_O =	N/A	N/A	fps
Gutter Flow Velocity, V_G =	N/A	N/A	fps
Overland Flow Time, t_O =	N/A	N/A	minutes
Gutter Flow Time, t_G =	N/A	N/A	minutes
Calculated Time of Concentration, T_c =	N/A	N/A	minutes
Time of Concentration by Regional Formula, T_c =	N/A	N/A	minutes
Recommended T_c =	N/A	N/A	minutes
Time of Concentration Selected by User, T_c =	**N/A**	**N/A**	**minutes**
Design Rainfall Intensity, I =	N/A	N/A	inch/hr
Calculated Local Peak Flow, Q_p =	N/A	N/A	cfs
Total Design Peak Flow, Q =	**6.60**	**20.70**	**cfs**

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

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

Project: Erie Highlands- Phase 1

Inlet ID: DP-10



Gutter Geometry (Enter data in the blue cells)			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.0200	ft. vert. / ft. horiz
Manning's Roughness Behind Curb	n_{BACK} =	0.0350	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Depression	a =	2.00	inches
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.0200	ft. vert. / ft. horiz
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.0000	ft. vert. / ft. horiz
Manning's Roughness for Street Section	n_{STREET} =	0.0150	

		Minor Storm	Major Storm	
Max. Allowable Water Spread for Minor & Major Storm	T_{MAX} =	12.0	17.0	ft
Max. Allowable Depth at Gutter Flow Line for Minor & Major Storm	d_{MAX} =	6.00	18.00	inches
Allow Flow Depth at Street Crown (leave blank for no)				X = yes

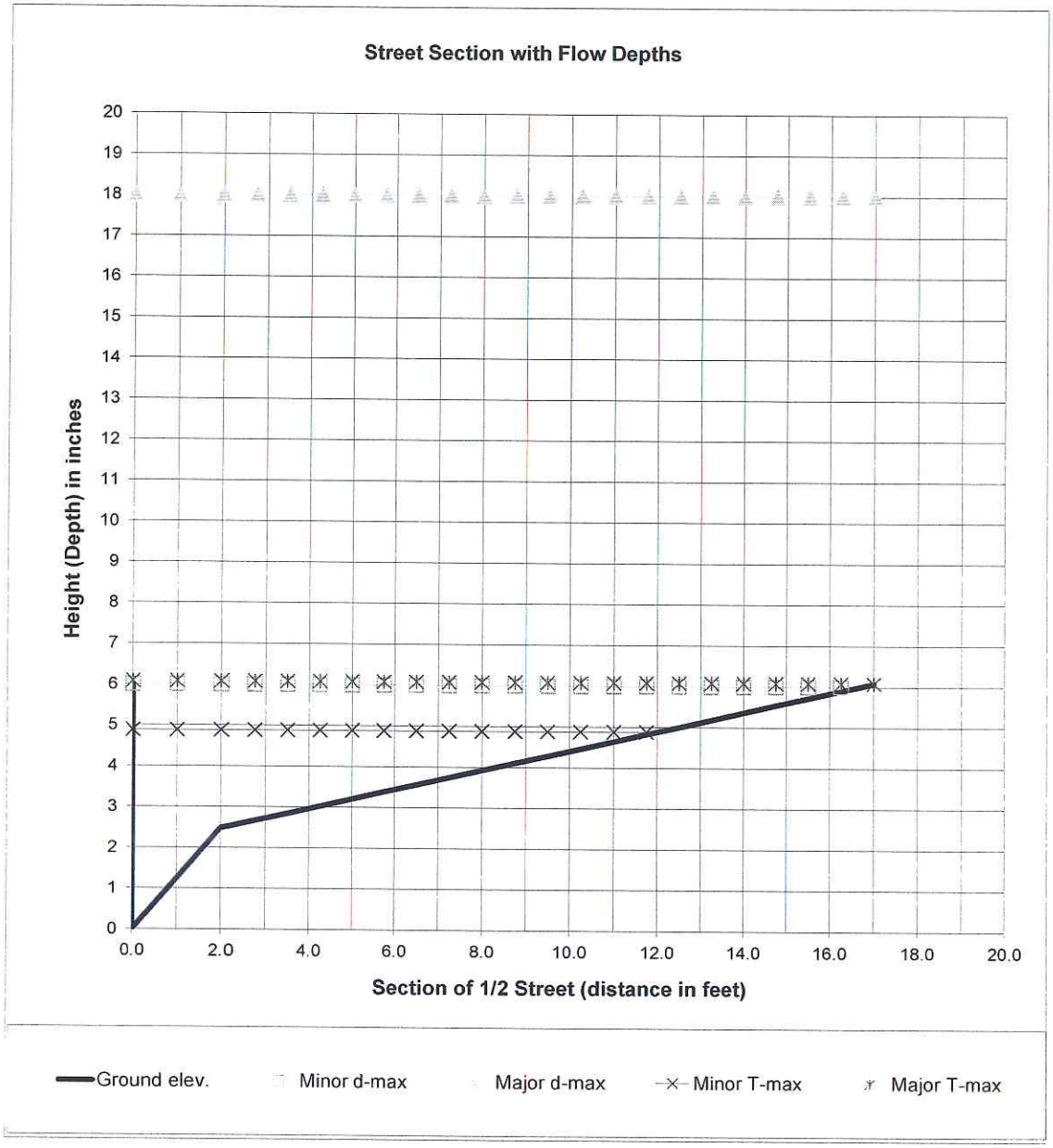
Maximum Gutter Capacity Based On Allowable Water Spread		Minor Storm	Major Storm	
Gutter Cross Slope (Eq. ST-8)	S_W =	0.1033	0.1033	ft/ft
Water Depth without Gutter Depression (Eq. ST-2)	y =	2.88	4.08	inches
Water Depth with a Gutter Depression	d =	4.88	6.08	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	10.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.522	0.371	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Water Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Gutter Capacity Based on Allowable Gutter Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	16.7	66.7	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	14.7	64.7	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.378	0.086	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm	**Q =**	**0.0**	**0.0**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	SUMP	SUMP	
Max Flow Based on Allow. Gutter Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

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

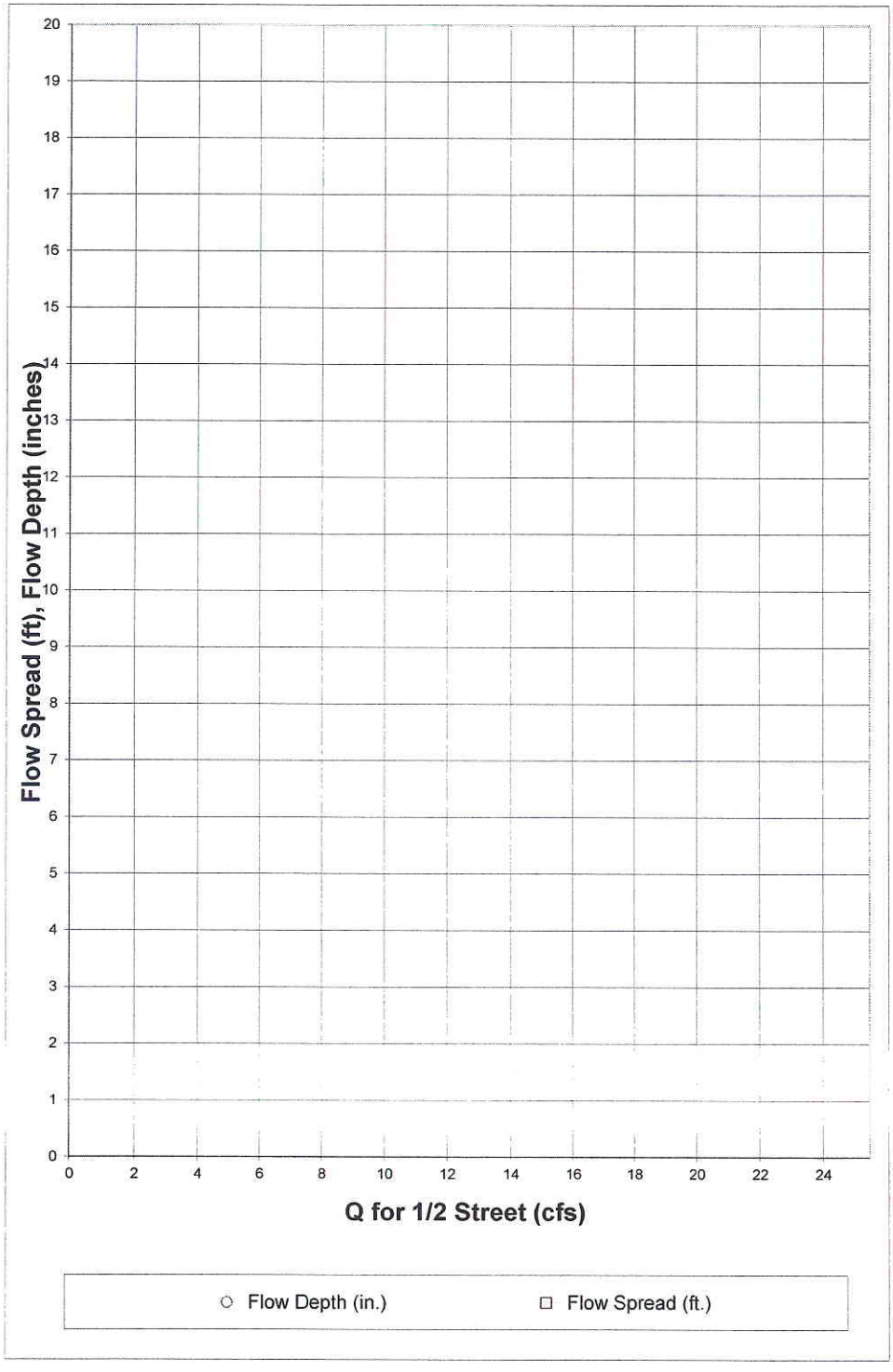
MINOR STORM max. allowable capacity OK - greater than flow given on sheet 'Q-Peak'

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



$$Q_x = \frac{0.56}{n} S_x^{5/3} S_L^{1/2} T_x^{8/3} \qquad E_o = \frac{1}{1 + \frac{S_w / S_x}{\left[1 + \frac{S_w / S_x}{(T/W) - 1}\right]^{8/3} - 1}}$$

$$Q = \frac{Q_x}{1 - E_o}; \; Q_w = Q - Q_x$$



Q for 1/2 Street (cfs)	Flow Depth (in.)	Flow Spread (ft.)
0.00		
0.25		
0.50		
0.75		
1.00		
1.25		
1.50		
1.75		
2.00		
2.25		
2.50		
2.75		
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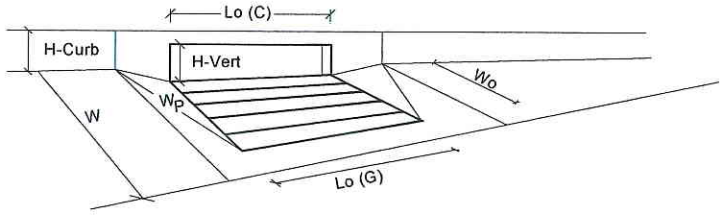
11.25		
11.50		
11.75		
12.00		
12.25		
12.50		

INLET IN A SUMP OR SAG LOCATION

Project = Erie Highlands- Phase 1

Inlet ID = DP-10

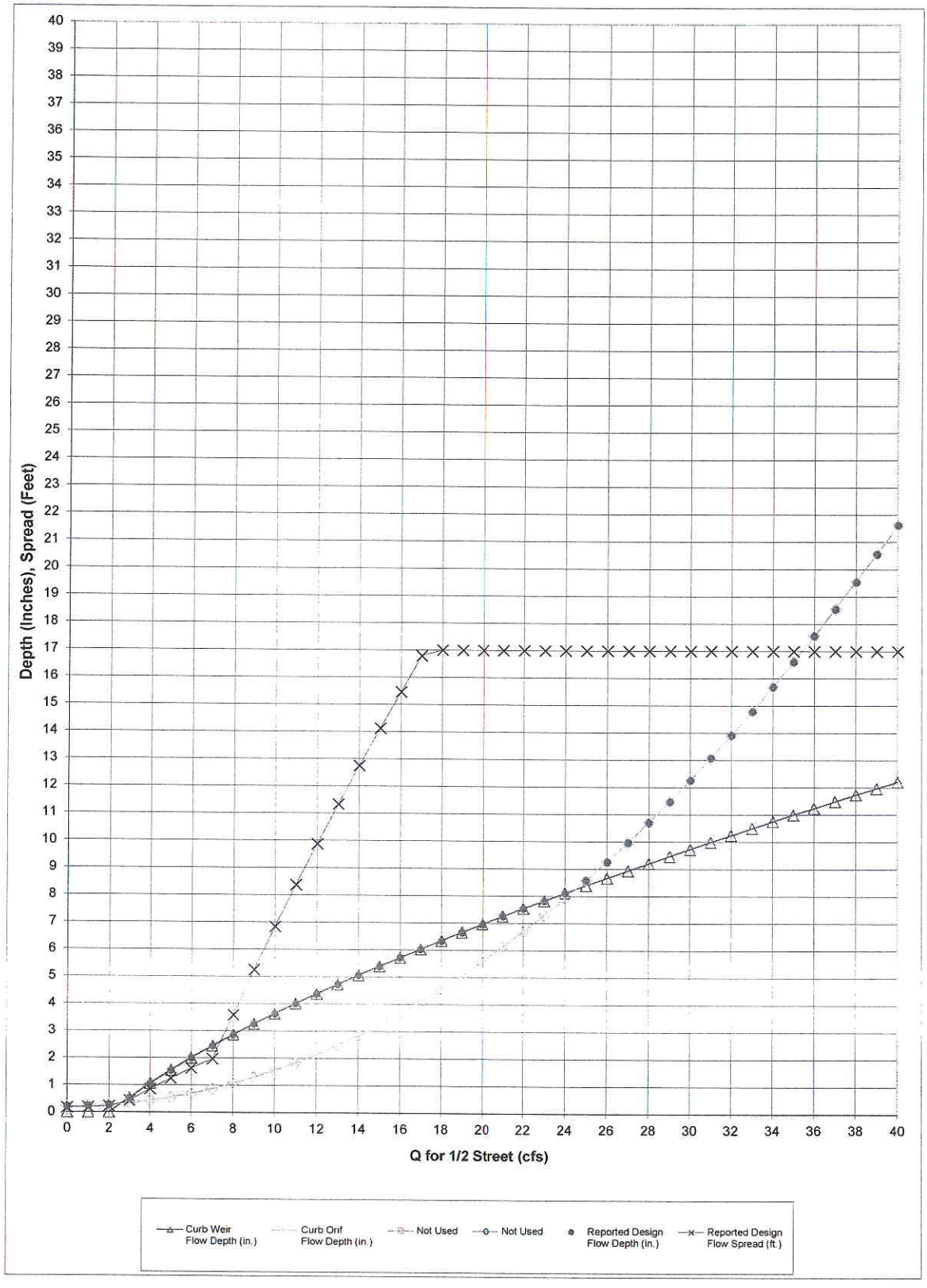


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 3.00)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.67)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	5.00	5.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	4.95	4.95	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.4	63.4	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.30-3.00)	C_w (C) =	2.30	2.30	
Curb Opening Orifice Coefficient (typical value 0.67)	C_o (C) =	0.67	0.67	

Resulting Gutter Flow Depth for Grate Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate as a Weir				
Flow Depth at Local Depression without Clogging (0 cfs grate, 6.6 cfs curb)	d_{wi} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}un}$ =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 6.6 cfs curb)	d_{wa} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}cl}$ =	N/A	N/A	inches
Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 6.6 cfs curb)	d_{oi} =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 6.6 cfs curb)	d_{oa} =	N/A	N/A	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Grate}$ =**	**N/A**	**N/A**	**inches**

Resulting Gutter Flow Depth for Curb Opening Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Curb as a Weir, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 6.6 cfs curb)	d_{wi} =	3.98	8.54	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 6.6 cfs curb)	d_{wa} =	4.27	9.16	inches
Curb as an Orifice, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 6.6 cfs curb)	d_{oi} =	2.69	6.86	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 6.6 cfs curb)	d_{oa} =	2.80	7.95	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Curb}$ =**	**2.27**	**7.16**	**inches**

Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	15.0	15.0	feet
Total Inlet Interception Capacity (Design Discharge from *Q-Peak*)	Q_a =	6.6	20.7	cfs
Resultant Gutter Flow Depth (based on sheet *Q-Allow* geometry)	**d =**	**2.27**	**7.16**	**inches**
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	**T =**	**1.8**	**17.0**	**ft. >T-Crown**
Resultant Flow Depth at Street Crown	**d_{CROWN} =**	**0.00**	**1.08**	**inches**


Depth (Inches), Spread (Feet)
Q for 1/2 Street (cfs)
Curb Weir Flow Depth (in.)
Curb Orif Flow Depth (in.)
Not Used
Not Used
Reported Design Flow Depth (in.)
Reported Design Flow Spread (ft.)

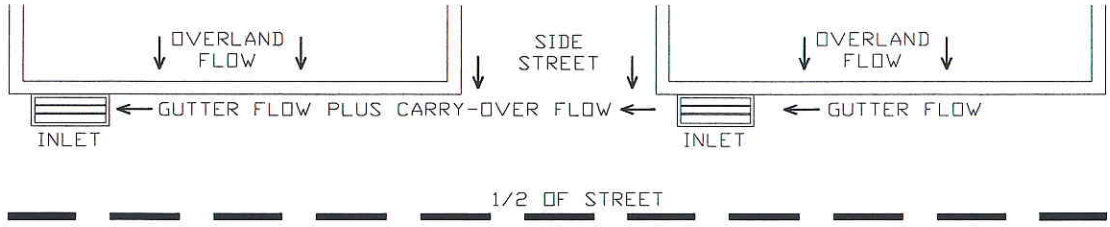
Q Intercepted (cfs)	Curb Weir Flow Depth (in.)	Curb Orif. Flow Depth (in.)	Not Used	Not Used	Reported Design Flow Depth (in.)	Reported DesignFlow Spread (ft.)
0.00	0.00	0.21			0.21	0.17
1.00	0.00	0.23			0.23	0.19
2.00	0.00	0.27			0.27	0.22
3.00	0.53	0.33			0.53	0.43
4.00	1.06	0.43			1.06	0.85
5.00	1.55	0.55			1.55	1.25
6.00	2.01	0.69			2.01	1.62
7.00	2.44	0.87			2.44	1.97
8.00	2.86	1.07			2.86	3.58
9.00	3.26	1.30			3.26	5.25
10.00	3.64	1.55			3.64	6.83
11.00	4.01	1.83			4.01	8.37
12.00	4.37	2.14			4.37	9.87
13.00	4.72	2.47			4.72	11.33
14.00	5.06	2.84			5.06	12.75
15.00	5.39	3.22			5.39	14.12
16.00	5.71	3.64			5.71	15.46
17.00	6.03	4.08			6.03	16.79
18.00	6.34	4.55			6.34	17.00
19.00	6.65	5.04			6.65	17.00
20.00	6.95	5.57			6.95	17.00
21.00	7.25	6.12			7.25	17.00
22.00	7.54	6.69			7.54	17.00
23.00	7.82	7.29			7.82	17.00
24.00	8.11	7.92			8.11	17.00
25.00	8.39	8.58			8.58	17.00
26.00	8.66	9.26			9.26	17.00
27.00	8.93	9.97			9.97	17.00
28.00	9.20	10.71			10.71	17.00
29.00	9.47	11.47			11.47	17.00
30.00	9.73	12.26			12.26	17.00
31.00	9.99	13.08			13.08	17.00
32.00	10.24	13.92			13.92	17.00
33.00	10.50	14.79			14.79	17.00
34.00	10.75	15.69			15.69	17.00
35.00	11.00	16.61			16.61	17.00
36.00	11.24	17.56			17.56	17.00
37.00	11.49	18.54			18.54	17.00
38.00	11.73	19.54			19.54	17.00
39.00	11.97	20.57			20.57	17.00
40.00	12.21	21.63			21.63	17.00

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

Erie Highlands- Phase 1

DP-11

Design Flow = Gutter Flow + Carry-over Flow



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

	Minor Storm	Major Storm	
*Q =	3.50	14.70	cfs

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

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site: (Check One Box Only)	
Site is Urban:	X
Site Is Non-Urban:	

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Gutter Flow =		

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

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

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

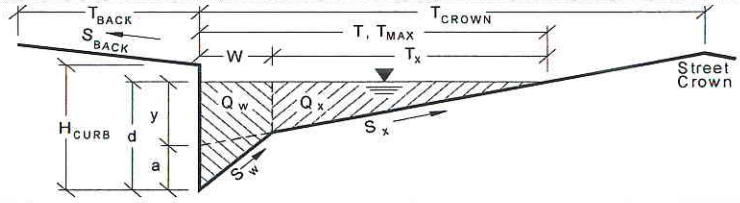
	Minor Storm	Major Storm	
Calculated Design Storm Runoff Coefficient, C =	N/A	N/A	
Calculated 5-yr. Runoff Coefficient, C5 =	N/A	N/A	
Overland Flow Velocity, V_O =	N/A	N/A	fps
Gutter Flow Velocity, V_G =	N/A	N/A	fps
Overland Flow Time, t_O =	N/A	N/A	minutes
Gutter Flow Time, t_G =	N/A	N/A	minutes
Calculated Time of Concentration, T_c =	N/A	N/A	minutes
Time of Concentration by Regional Formula, T_c =	N/A	N/A	minutes
Recommended T_c =	N/A	N/A	minutes
Time of Concentration Selected by User, T_c =	**N/A**	**N/A**	**minutes**
Design Rainfall Intensity, I =	N/A	N/A	inch/hr
Calculated Local Peak Flow, Q_p =	N/A	N/A	cfs
Total Design Peak Flow, Q =	**3.50**	**14.70**	**cfs**

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

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

Project: Erie Highlands- Phase 1

Inlet ID: DP-11



Gutter Geometry (Enter data in the blue cells)			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.0200	ft. vert. / ft. horiz
Manning's Roughness Behind Curb	n_{BACK} =	0.0350	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Depression	a =	2.00	inches
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.0200	ft. vert. / ft. horiz
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.0000	ft. vert. / ft. horiz
Manning's Roughness for Street Section	n_{STREET} =	0.0150	

		Minor Storm	Major Storm	
Max. Allowable Water Spread for Minor & Major Storm	T_{MAX} =	12.0	17.0	ft
Max. Allowable Depth at Gutter Flow Line for Minor & Major Storm	d_{MAX} =	6.00	18.00	inches
Allow Flow Depth at Street Crown (leave blank for no)				X = yes

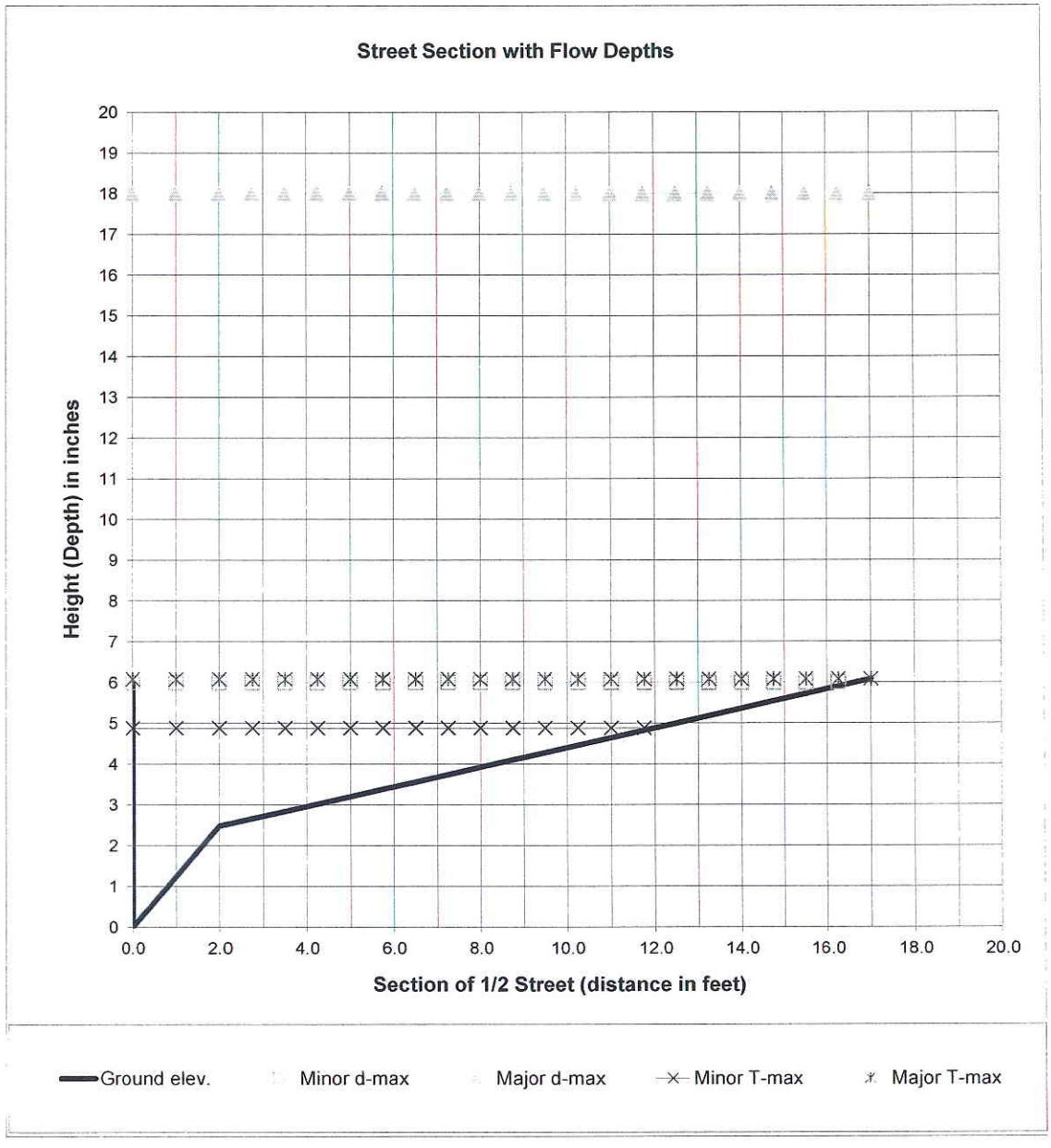
Maximum Gutter Capacity Based On Allowable Water Spread		Minor Storm	Major Storm	
Gutter Cross Slope (Eq. ST-8)	S_W =	0.1033	0.1033	ft/ft
Water Depth without Gutter Depression (Eq. ST-2)	y =	2.88	4.08	inches
Water Depth with a Gutter Depression	d =	4.88	6.08	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	10.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.522	0.371	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Water Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Gutter Capacity Based on Allowable Gutter Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	16.7	66.7	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	14.7	64.7	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.378	0.086	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm	**Q =**	**0.0**	**0.0**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	SUMP	SUMP	
Max Flow Based on Allow. Gutter Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

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

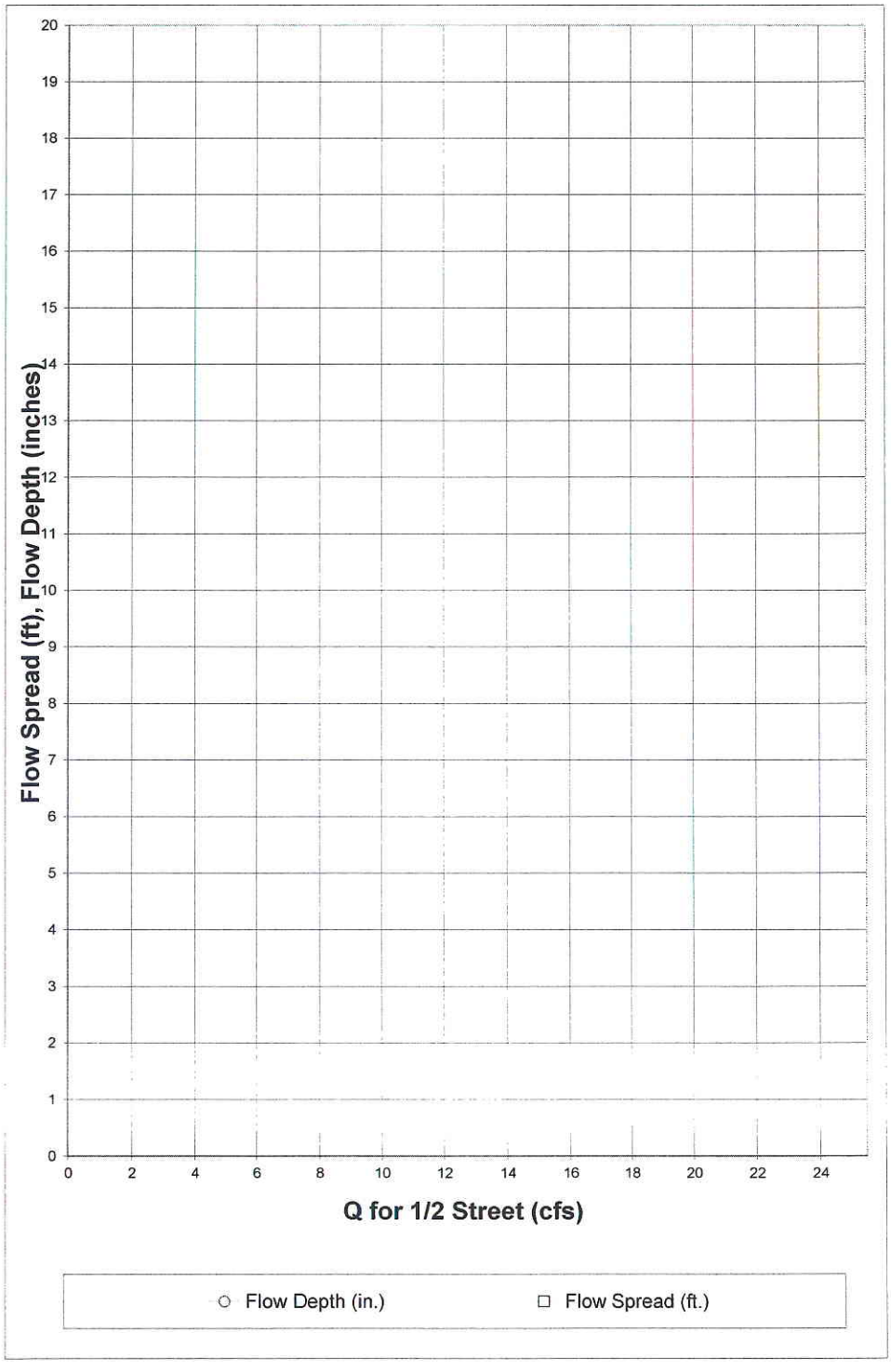
MINOR STORM max. allowable capacity OK - greater than flow given on sheet 'Q-Peak'

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



$$Q_x = \frac{0.56}{n} S_x^{5/3} S_L^{1/2} T_x^{8/3} \qquad E_o = \frac{1}{1 + \frac{S_w / S_x}{\left[1 + \frac{S_w / S_x}{(T/W) - 1}\right]^{8/3} - 1}}$$

$$Q = \frac{Q_x}{1 - E_o}; \; Q_w = Q - Q_x$$



Q for 1/2 Street (cfs)	Flow Depth (in.)	Flow Spread (ft.)
0.00		
0.25		
0.50		
0.75		
1.00		
1.25		
1.50		
1.75		
2.00		
2.25		
2.50		
2.75		
3.00		
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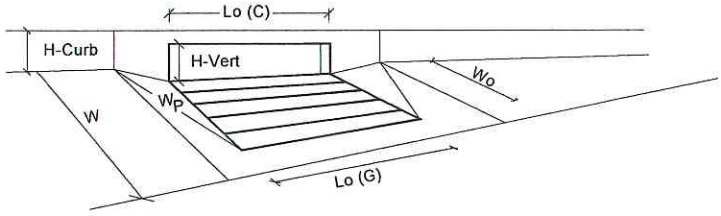
12.00		
12.25		
12.50		

INLET IN A SUMP OR SAG LOCATION

Project = Erie Highlands- Phase 1

Inlet ID = DP-11

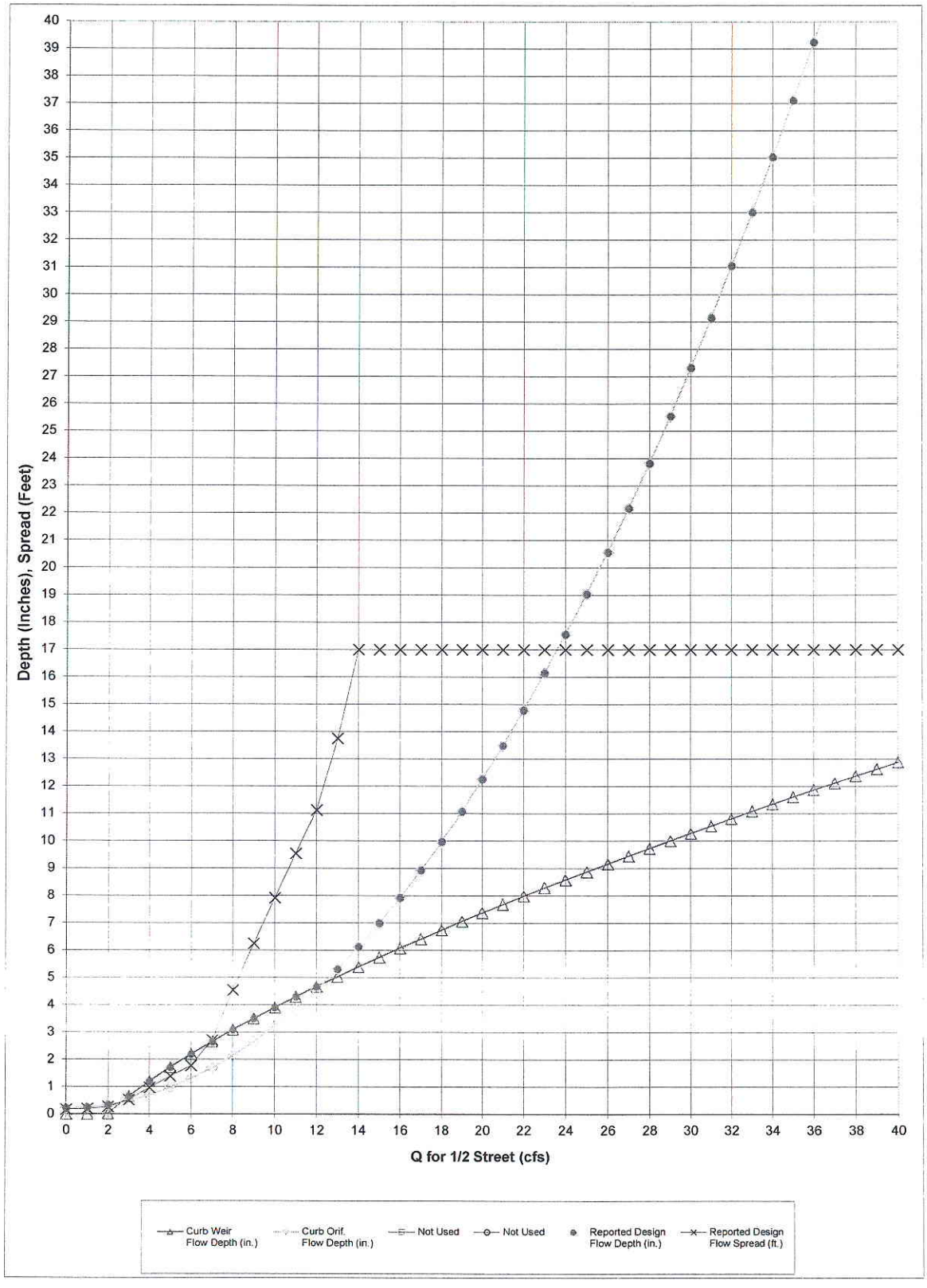


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 3.00)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.67)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	5.00	5.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	4.95	4.95	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.4	63.4	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.30-3.00)	C_w (C) =	2.30	2.30	
Curb Opening Orifice Coefficient (typical value 0.67)	C_o (C) =	0.67	0.67	

Resulting Gutter Flow Depth for Grate Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate as a Weir				
Flow Depth at Local Depression without Clogging (0 cfs grate, 3.5 cfs curb)	d_{wi} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}un}$ =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 3.5 cfs curb)	d_{wa} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}cl}$ =	N/A	N/A	inches
Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 3.5 cfs curb)	d_{oi} =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 3.5 cfs curb)	d_{oa} =	N/A	N/A	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Grate}$ =**	**N/A**	**N/A**	**inches**

Resulting Gutter Flow Depth for Curb Opening Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Curb as a Weir, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 3.5 cfs curb)	d_{wi} =	2.79	7.25	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 3.5 cfs curb)	d_{wa} =	2.93	7.63	inches
Curb as an Orifice, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 3.5 cfs curb)	d_{oi} =	2.51	7.48	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 3.5 cfs curb)	d_{oa} =	2.58	8.72	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Curb}$ =**	**0.93**	**6.72**	**inches**

Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	10.0	10.0	feet
Total Inlet Interception Capacity (Design Discharge from *Q-Peak*)	Q_a =	3.5	14.7	cfs
Resultant Gutter Flow Depth (based on sheet *Q-Allow* geometry)	**d =**	**0.93**	**6.72**	**inches**
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	**T =**	**0.8**	**17.0**	**ft. >T-Crown**
Resultant Flow Depth at Street Crown	**d_{CROWN} =**	**0.00**	**0.60**	**inches**


Depth (Inches), Spread (Feet)
Q for 1/2 Street (cfs)
Curb Weir Flow Depth (in.)
Curb Orif. Flow Depth (in.)
Not Used
Not Used
Reported Design Flow Depth (in.)
Reported Design Flow Spread (ft.)

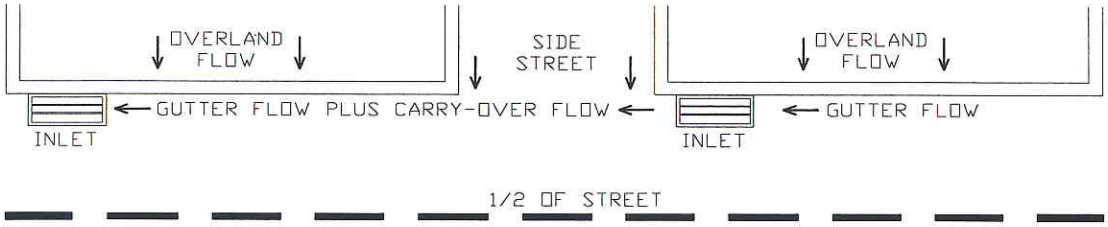
Q Intercepted (cfs)	Curb Weir Flow Depth (in.)	Curb Orif. Flow Depth (in.)	Not Used	Not Used	Reported Design Flow Depth (in.)	Reported DesignFlow Spread (ft.)
0.00	0.00	0.21			0.21	0.17
1.00	0.00	0.24			0.24	0.19
2.00	0.02	0.33			0.33	0.27
3.00	0.65	0.48			0.65	0.52
4.00	1.20	0.69			1.20	0.97
5.00	1.72	0.97			1.72	1.39
6.00	2.20	1.30			2.20	1.77
7.00	2.65	1.69			2.65	2.71
8.00	3.09	2.14			3.09	4.54
9.00	3.50	2.65			3.50	6.25
10.00	3.90	3.22			3.90	7.92
11.00	4.29	3.86			4.29	9.54
12.00	4.67	4.55			4.67	11.12
13.00	5.03	5.30			5.30	13.75
14.00	5.39	6.12			6.12	17.00
15.00	5.74	6.99			6.99	17.00
16.00	6.08	7.92			7.92	17.00
17.00	6.41	8.92			8.92	17.00
18.00	6.74	9.97			9.97	17.00
19.00	7.06	11.08			11.08	17.00
20.00	7.37	12.26			12.26	17.00
21.00	7.68	13.49			13.49	17.00
22.00	7.99	14.79			14.79	17.00
23.00	8.29	16.14			16.14	17.00
24.00	8.58	17.56			17.56	17.00
25.00	8.87	19.04			19.04	17.00
26.00	9.16	20.57			20.57	17.00
27.00	9.45	22.17			22.17	17.00
28.00	9.73	23.82			23.82	17.00
29.00	10.01	25.54			25.54	17.00
30.00	10.28	27.32			27.32	17.00
31.00	10.55	29.15			29.15	17.00
32.00	10.82	31.05			31.05	17.00
33.00	11.09	33.01			33.01	17.00
34.00	11.35	35.03			35.03	17.00
35.00	11.61	37.11			37.11	17.00
36.00	11.87	39.24			39.24	17.00
37.00	12.12	41.44			41.44	17.00
38.00	12.38	43.70			43.70	17.00
39.00	12.63	46.02			46.02	17.00
40.00	12.88	48.40			48.40	17.00

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

Erie Highlands- Phase 1

DP-12

Design Flow = Gutter Flow + Carry-over Flow



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

	Minor Storm	Major Storm	
*Q =	3.90	13.00	cfs

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

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site: (Check One Box Only)

Site is Urban:	X
Site Is Non-Urban:	

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Gutter Flow =		

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

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

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

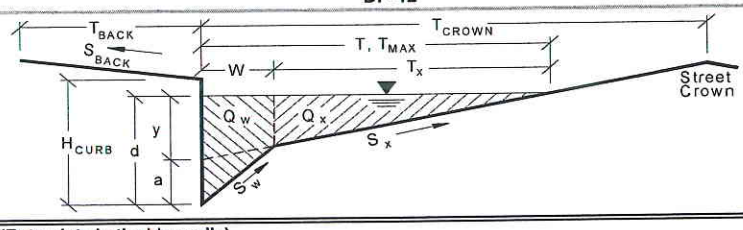
	Minor Storm	Major Storm	
Calculated Design Storm Runoff Coefficient, C =	N/A	N/A	
Calculated 5-yr. Runoff Coefficient, C5 =	N/A	N/A	
Overland Flow Velocity, V_O =	N/A	N/A	fps
Gutter Flow Velocity, V_G =	N/A	N/A	fps
Overland Flow Time, t_O =	N/A	N/A	minutes
Gutter Flow Time, t_G =	N/A	N/A	minutes
Calculated Time of Concentration, T_c =	N/A	N/A	minutes
Time of Concentration by Regional Formula, T_c =	N/A	N/A	minutes
Recommended T_c =	N/A	N/A	minutes
Time of Concentration Selected by User, T_c =	**N/A**	**N/A**	**minutes**
Design Rainfall Intensity, I =	N/A	N/A	inch/hr
Calculated Local Peak Flow, Q_p =	N/A	N/A	cfs
Total Design Peak Flow, Q =	**3.90**	**13.00**	**cfs**

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

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

Project: Erie Highlands- Phase 1

Inlet ID: DP-12



Gutter Geometry (Enter data in the blue cells)			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.0200	ft. vert. / ft. horiz
Manning's Roughness Behind Curb	n_{BACK} =	0.0350	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Depression	a =	2.00	inches
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.0200	ft. vert. / ft. horiz
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.0000	ft. vert. / ft. horiz
Manning's Roughness for Street Section	n_{STREET} =	0.0150	

		Minor Storm	Major Storm	
Max. Allowable Water Spread for Minor & Major Storm	T_{MAX} =	12.0	17.0	ft
Max. Allowable Depth at Gutter Flow Line for Minor & Major Storm	d_{MAX} =	6.00	18.00	inches
Allow Flow Depth at Street Crown (leave blank for no)				X = yes

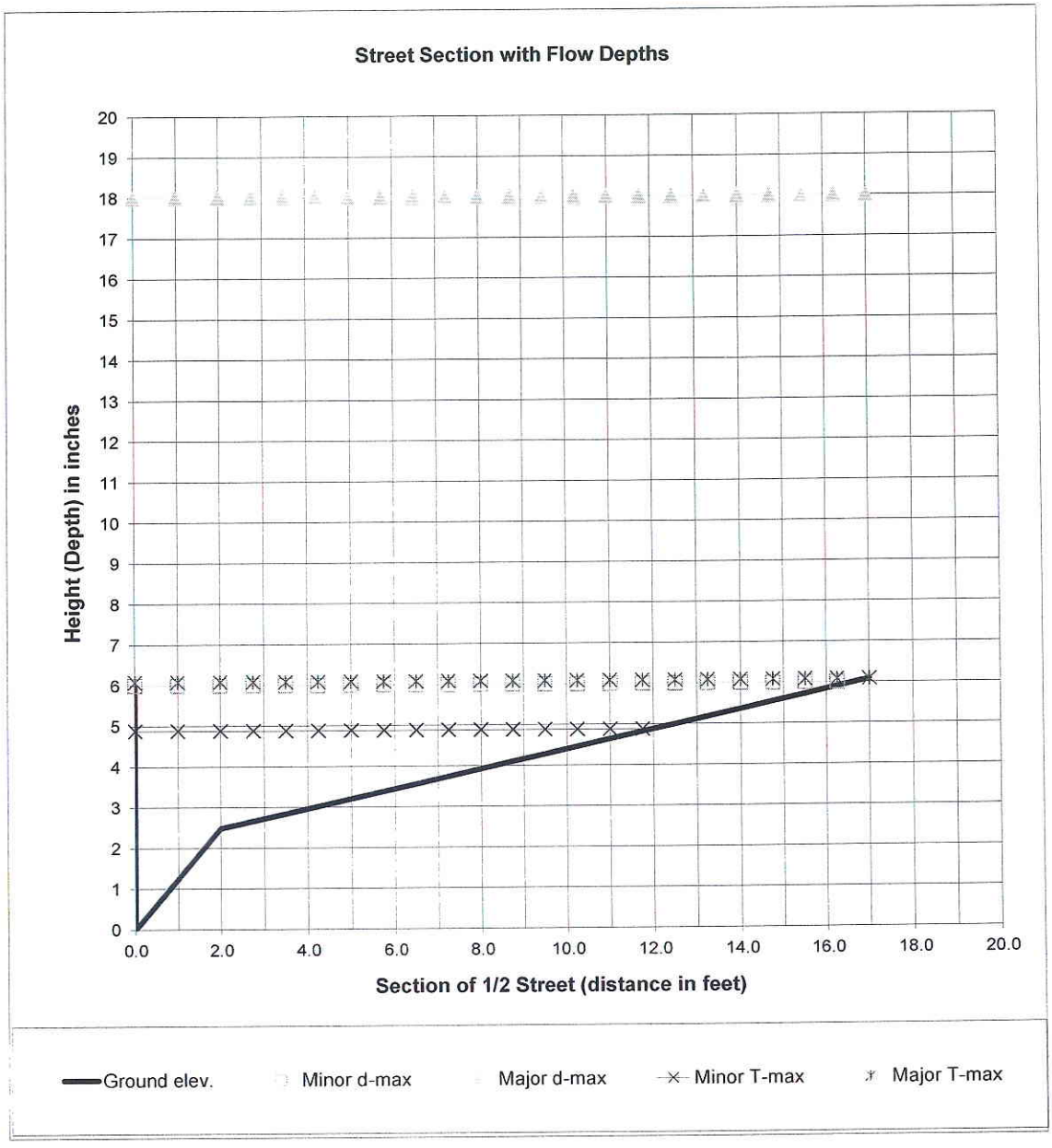
Maximum Gutter Capacity Based On Allowable Water Spread		Minor Storm	Major Storm	
Gutter Cross Slope (Eq. ST-8)	S_W =	0.1033	0.1033	ft/ft
Water Depth without Gutter Depression (Eq. ST-2)	y =	2.88	4.08	inches
Water Depth with a Gutter Depression	d =	4.88	6.08	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	10.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.522	0.371	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Water Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Gutter Capacity Based on Allowable Gutter Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	16.7	66.7	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	14.7	64.7	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.378	0.086	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm	**Q =**	**0.0**	**0.0**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	SUMP	SUMP	
Max Flow Based on Allow. Gutter Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

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

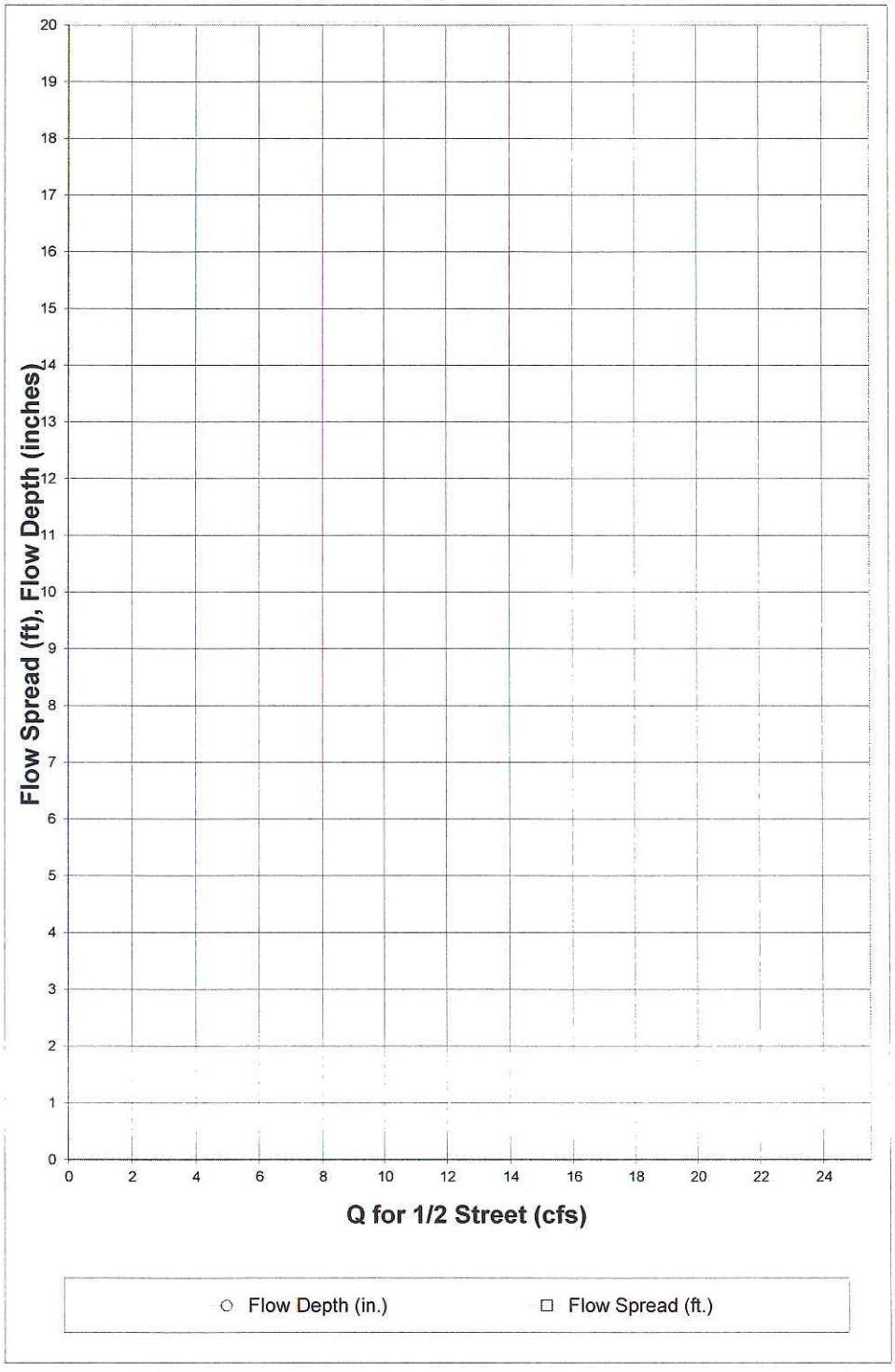
MINOR STORM max. allowable capacity OK - greater than flow given on sheet 'Q-Peak'

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



$$Q_x = \frac{0.56}{n} S_x^{5/3} S_L^{1/2} T_x^{8/3} \qquad E_o = \frac{1}{1 + \dfrac{S_w / S_x}{\left[1 + \dfrac{S_w / S_x}{(T/W) - 1}\right]^{8/3} - 1}}$$

$$Q = \frac{Q_x}{1 - E_o}; \; Q_w = Q - Q_x$$

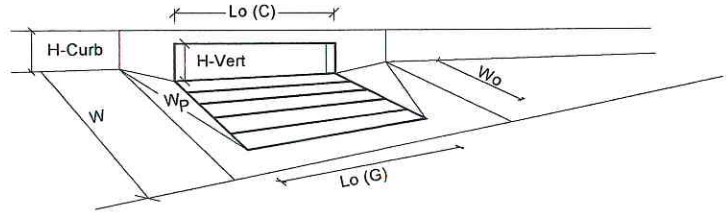


Q for 1/2 Street (cfs)	Flow Depth (in.)	Flow Spread (ft.)
0.00		
0.25		
0.50		
0.75		
1.00		
1.25		
1.50		
1.75		
2.00		
2.25		
2.50		
2.75		
3.00		
3.25		
3.50		
3.75		
4.00		
4.25		
4.50		
4.75		
5.00		
5.25		
5.50		
5.75		
6.00		
6.25		
6.50		
6.75		
7.00		
7.25		
7.50		
7.75		
8.00		
8.25		
8.50		
8.75		
9.00		
9.25		
9.50		
9.75		
10.00		
10.25		
10.50		
10.75		
11.00		
11.25		
11.50		
11.75		
12.00		
12.25		
12.50		

INLET IN A SUMP OR SAG LOCATION

Project = Erie Highlands- Phase 1

Inlet ID = DP-12

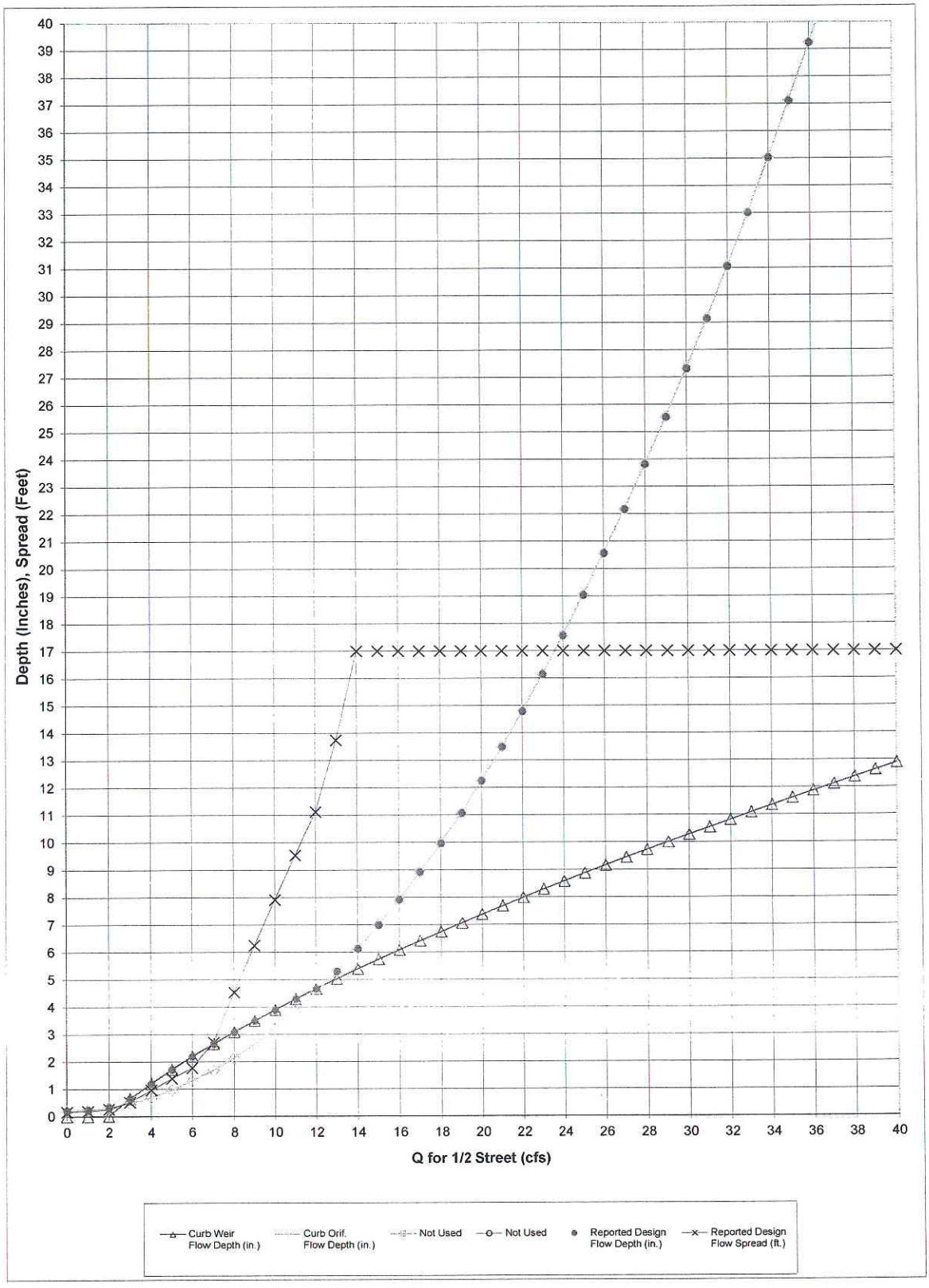


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 3.00)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.67)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	5.00	5.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	4.95	4.95	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.4	63.4	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.30-3.00)	C_w (C) =	2.30	2.30	
Curb Opening Orifice Coefficient (typical value 0.67)	C_o (C) =	0.67	0.67	

Resulting Gutter Flow Depth for Grate Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate as a Weir				
Flow Depth at Local Depression without Clogging (0 cfs grate, 3.9 cfs curb)	d_{wi} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}un}$ =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 3.9 cfs curb)	d_{wa} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}cl}$ =	N/A	N/A	inches
Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 3.9 cfs curb)	d_{oi} =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 3.9 cfs curb)	d_{oa} =	N/A	N/A	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Grate}$ =**	**N/A**	**N/A**	**inches**

Resulting Gutter Flow Depth for Curb Opening Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Curb as a Weir, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 3.9 cfs curb)	d_{wi} =	2.99	6.68	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 3.9 cfs curb)	d_{wa} =	3.15	7.03	inches
Curb as an Orifice, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 3.9 cfs curb)	d_{oi} =	2.58	6.34	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 3.9 cfs curb)	d_{oa} =	2.67	7.30	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Curb}$ =**	**1.15**	**5.30**	**inches**

Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	10.0	10.0	feet
Total Inlet Interception Capacity (Design Discharge from *Q-Peak*)	Q_a =	3.9	13.0	cfs
Resultant Gutter Flow Depth (based on sheet *Q-Allow* geometry)	**d =**	**1.15**	**5.30**	**inches**
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	**T =**	**0.9**	**13.8**	**feet**
Resultant Flow Depth at Street Crown	**d_{CROWN} =**	**0.00**	**0.00**	**inches**


Depth (Inches), Spread (Feet)
Q for 1/2 Street (cfs)
Curb Weir Flow Depth (in.)
Curb Orif. Flow Depth (in.)
Not Used
Not Used
Reported Design Flow Depth (in.)
Reported Design Flow Spread (ft.)

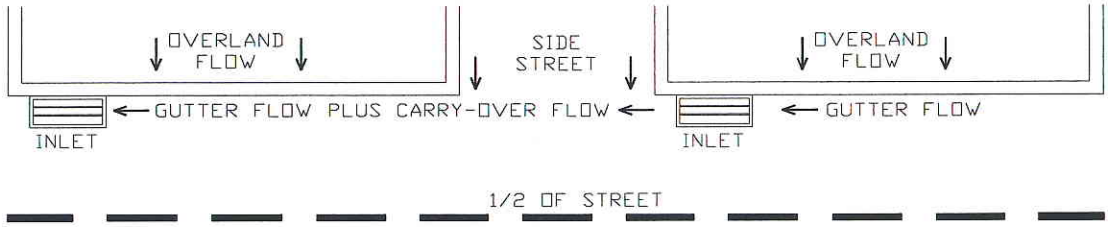
Q Intercepted (cfs)	Curb Weir Flow Depth (in.)	Curb Orif. Flow Depth (in.)	Not Used	Not Used	Reported Design Flow Depth (in.)	Reported DesignFlow Spread (ft.)
0.00	0.00	0.21			0.21	0.17
1.00	0.00	0.24			0.24	0.19
2.00	0.02	0.33			0.33	0.27
3.00	0.65	0.48			0.65	0.52
4.00	1.20	0.69			1.20	0.97
5.00	1.72	0.97			1.72	1.39
6.00	2.20	1.30			2.20	1.77
7.00	2.65	1.69			2.65	2.71
8.00	3.09	2.14			3.09	4.54
9.00	3.50	2.65			3.50	6.25
10.00	3.90	3.22			3.90	7.92
11.00	4.29	3.86			4.29	9.54
12.00	4.67	4.55			4.67	11.12
13.00	5.03	5.30			5.30	13.75
14.00	5.39	6.12			6.12	17.00
15.00	5.74	6.99			6.99	17.00
16.00	6.08	7.92			7.92	17.00
17.00	6.41	8.92			8.92	17.00
18.00	6.74	9.97			9.97	17.00
19.00	7.06	11.08			11.08	17.00
20.00	7.37	12.26			12.26	17.00
21.00	7.68	13.49			13.49	17.00
22.00	7.99	14.79			14.79	17.00
23.00	8.29	16.14			16.14	17.00
24.00	8.58	17.56			17.56	17.00
25.00	8.87	19.04			19.04	17.00
26.00	9.16	20.57			20.57	17.00
27.00	9.45	22.17			22.17	17.00
28.00	9.73	23.82			23.82	17.00
29.00	10.01	25.54			25.54	17.00
30.00	10.28	27.32			27.32	17.00
31.00	10.55	29.15			29.15	17.00
32.00	10.82	31.05			31.05	17.00
33.00	11.09	33.01			33.01	17.00
34.00	11.35	35.03			35.03	17.00
35.00	11.61	37.11			37.11	17.00
36.00	11.87	39.24			39.24	17.00
37.00	12.12	41.44			41.44	17.00
38.00	12.38	43.70			43.70	17.00
39.00	12.63	46.02			46.02	17.00
40.00	12.88	48.40			48.40	17.00

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

Erie Highlands- Phase 1

DP-13

Design Flow = Gutter Flow + Carry-over Flow



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

	Minor Storm	Major Storm	
*Q =	4.90	15.70	cfs

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

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site: (Check One Box Only)	
Site is Urban:	X
Site Is Non-Urban:	

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Gutter Flow =		

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

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

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

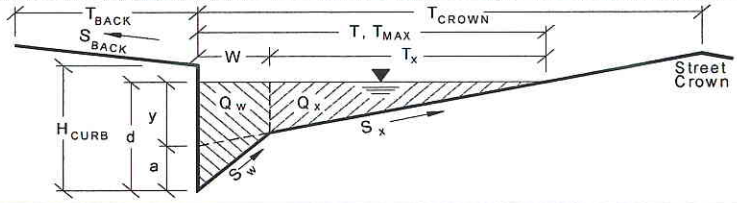
	Minor Storm	Major Storm	
Calculated Design Storm Runoff Coefficient, C =	N/A	N/A	
Calculated 5-yr. Runoff Coefficient, C5 =	N/A	N/A	
Overland Flow Velocity, V_O =	N/A	N/A	fps
Gutter Flow Velocity, V_G =	N/A	N/A	fps
Overland Flow Time, t_O =	N/A	N/A	minutes
Gutter Flow Time, t_G =	N/A	N/A	minutes
Calculated Time of Concentration, T_c =	N/A	N/A	minutes
Time of Concentration by Regional Formula, T_c =	N/A	N/A	minutes
Recommended T_c =	N/A	N/A	minutes
Time of Concentration Selected by User, T_c =	**N/A**	**N/A**	**minutes**
Design Rainfall Intensity, I =	N/A	N/A	inch/hr
Calculated Local Peak Flow, Q_p =	N/A	N/A	cfs
Total Design Peak Flow, Q =	**4.90**	**15.70**	**cfs**

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

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

Project: Erie Highlands- Phase 1

Inlet ID: DP-13



Gutter Geometry (Enter data in the blue cells)			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.0200	ft. vert. / ft. horiz
Manning's Roughness Behind Curb	n_{BACK} =	0.0350	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	25.0	ft
Gutter Depression	a =	2.00	inches
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.0200	ft. vert. / ft. horiz
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.0280	ft. vert. / ft. horiz
Manning's Roughness for Street Section	n_{STREET} =	0.0150	

		Minor Storm	Major Storm	
Max. Allowable Water Spread for Minor & Major Storm	T_{MAX} =	20.0	25.0	ft
Max. Allowable Depth at Gutter Flow Line for Minor & Major Storm	d_{MAX} =	6.00	18.00	inches
Allow Flow Depth at Street Crown (leave blank for no)			X	X = yes

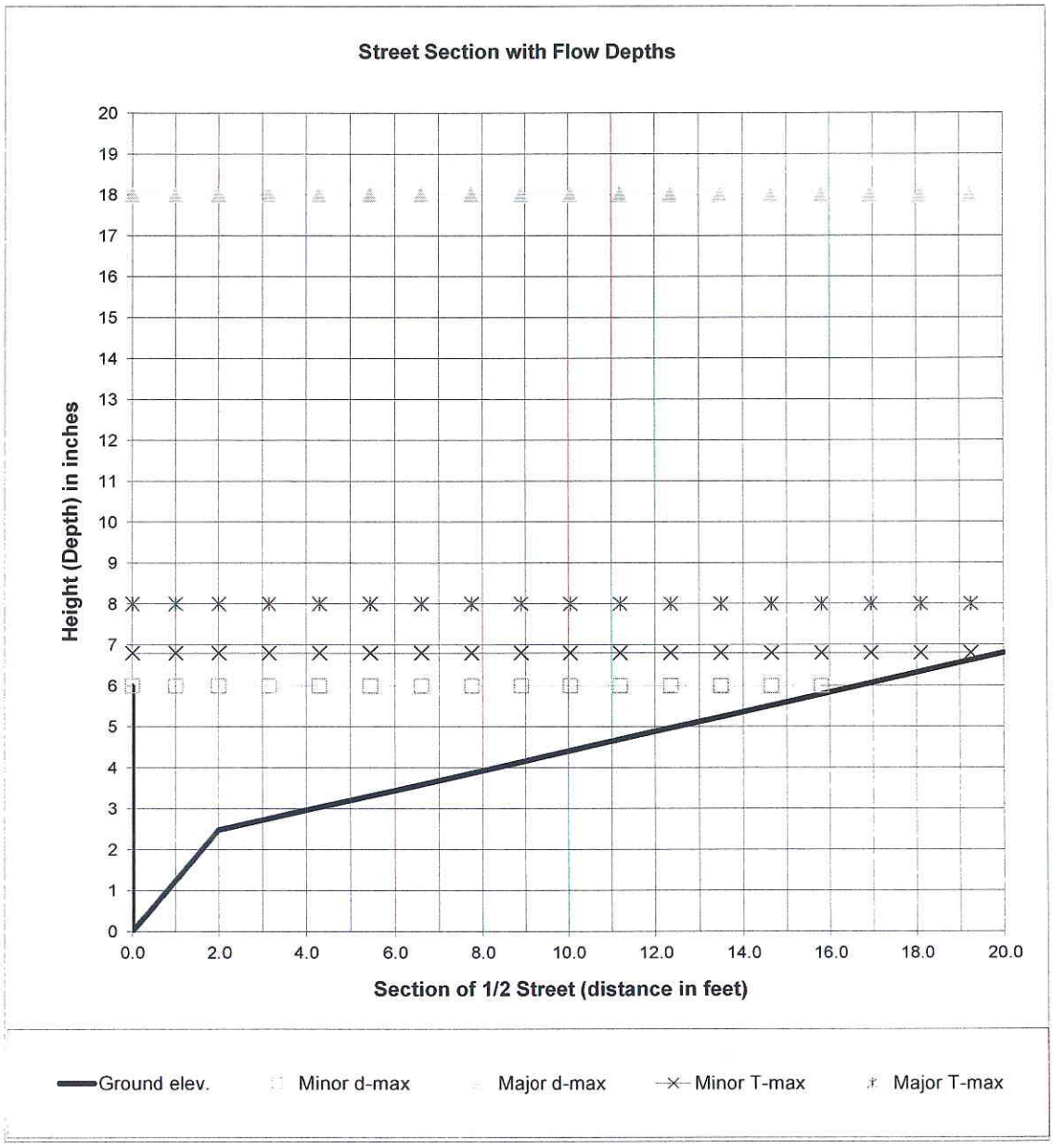
Maximum Gutter Capacity Based On Allowable Water Spread		Minor Storm	Major Storm	
Gutter Cross Slope (Eq. ST-8)	S_W =	0.1033	0.1033	ft/ft
Water Depth without Gutter Depression (Eq. ST-2)	y =	4.80	6.00	inches
Water Depth with a Gutter Depression	d =	6.80	8.00	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	18.0	23.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.313	0.246	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	20.5	39.4	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	9.3	12.9	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.1	1.1	cfs
Maximum Flow Based On Allowable Water Spread	**Q_T =**	**29.9**	**53.4**	**cfs**
Flow Velocity Within the Gutter Section	V =	10.1	11.4	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	5.7	7.6	

Maximum Gutter Capacity Based on Allowable Gutter Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	16.7	66.7	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	14.7	64.7	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.378	0.086	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	11.9	620.2	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	11.9	428.1	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	7.2	58.2	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	60.0	cfs
Total Discharge for Major & Minor Storm	**Q =**	**19.1**	**546.4**	**cfs**
Flow Velocity Within the Gutter Section	V =	9.1	20.8	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	4.6	31.3	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	0.79	0.64	
Max Flow Based on Allow. Gutter Depth (Safety Factor Applied)	**Q_d =**	**15.0**	**348.2**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =	5.62	14.93	inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =	0.00	6.93	inches

		Minor Storm	Major Storm	
Max. Allowable Gutter Capacity Based on Minimum of Q_T or Q_d	**Q_{allow} =**	**15.0**	**348.2**	**cfs**

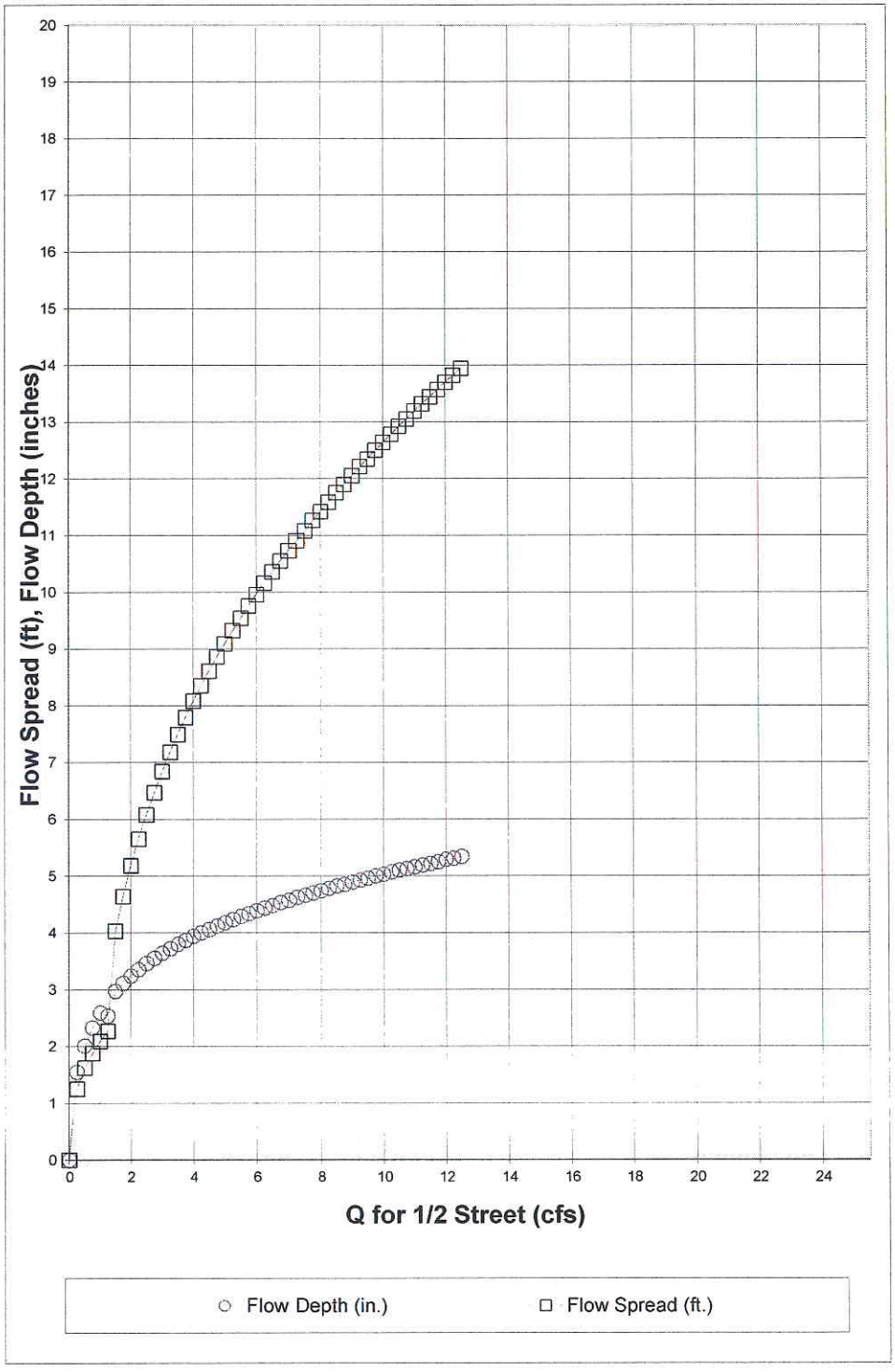
MINOR STORM max. allowable capacity OK - greater than flow given on sheet 'Q-Peak'

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



$$Q_x = \frac{0.56}{n} S_x^{5/3} S_L^{1/2} T_x^{8/3} \qquad E_o = \frac{1}{1 + \frac{S_w / S_x}{\left[1 + \frac{S_w / S_x}{(T/W) - 1}\right]^{8/3} - 1}}$$

$$Q = \frac{Q_x}{1 - E_o}; \; Q_w = Q - Q_x$$

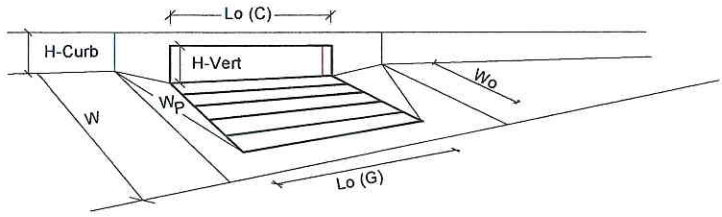


Q for 1/2 Street (cfs)	Flow Depth (in.)	Flow Spread (ft.)
0.00	0.00	0.00
0.25	1.55	1.25
0.50	2.01	1.62
0.75	2.33	1.88
1.00	2.59	2.09
1.25	2.54	2.27
1.50	2.97	4.03
1.75	3.11	4.64
2.00	3.24	5.18
2.25	3.35	5.65
2.50	3.46	6.08
2.75	3.55	6.47
3.00	3.64	6.84
3.25	3.72	7.18
3.50	3.80	7.49
3.75	3.87	7.79
4.00	3.94	8.08
4.25	4.00	8.35
4.50	4.06	8.61
4.75	4.12	8.86
5.00	4.18	9.09
5.25	4.23	9.32
5.50	4.29	9.54
5.75	4.34	9.76
6.00	4.39	9.96
6.25	4.44	10.16
6.50	4.48	10.36
6.75	4.53	10.55
7.00	4.57	10.73
7.25	4.62	10.91
7.50	4.66	11.08
7.75	4.70	11.26
8.00	4.74	11.42
8.25	4.78	11.59
8.50	4.82	11.75
8.75	4.85	11.90
9.00	4.89	12.05
9.25	4.93	12.21
9.50	4.96	12.35
9.75	5.00	12.50
10.00	5.03	12.64
10.25	5.07	12.78
10.50	5.10	12.92
10.75	5.13	13.05
11.00	5.16	13.19
11.25	5.19	13.32
11.50	5.22	13.44
11.75	5.25	13.57
12.00	5.29	13.70
12.25	5.31	13.82
12.50	5.34	13.94

INLET IN A SUMP OR SAG LOCATION

Project = Erie Highlands- Phase 1

Inlet ID = DP-13

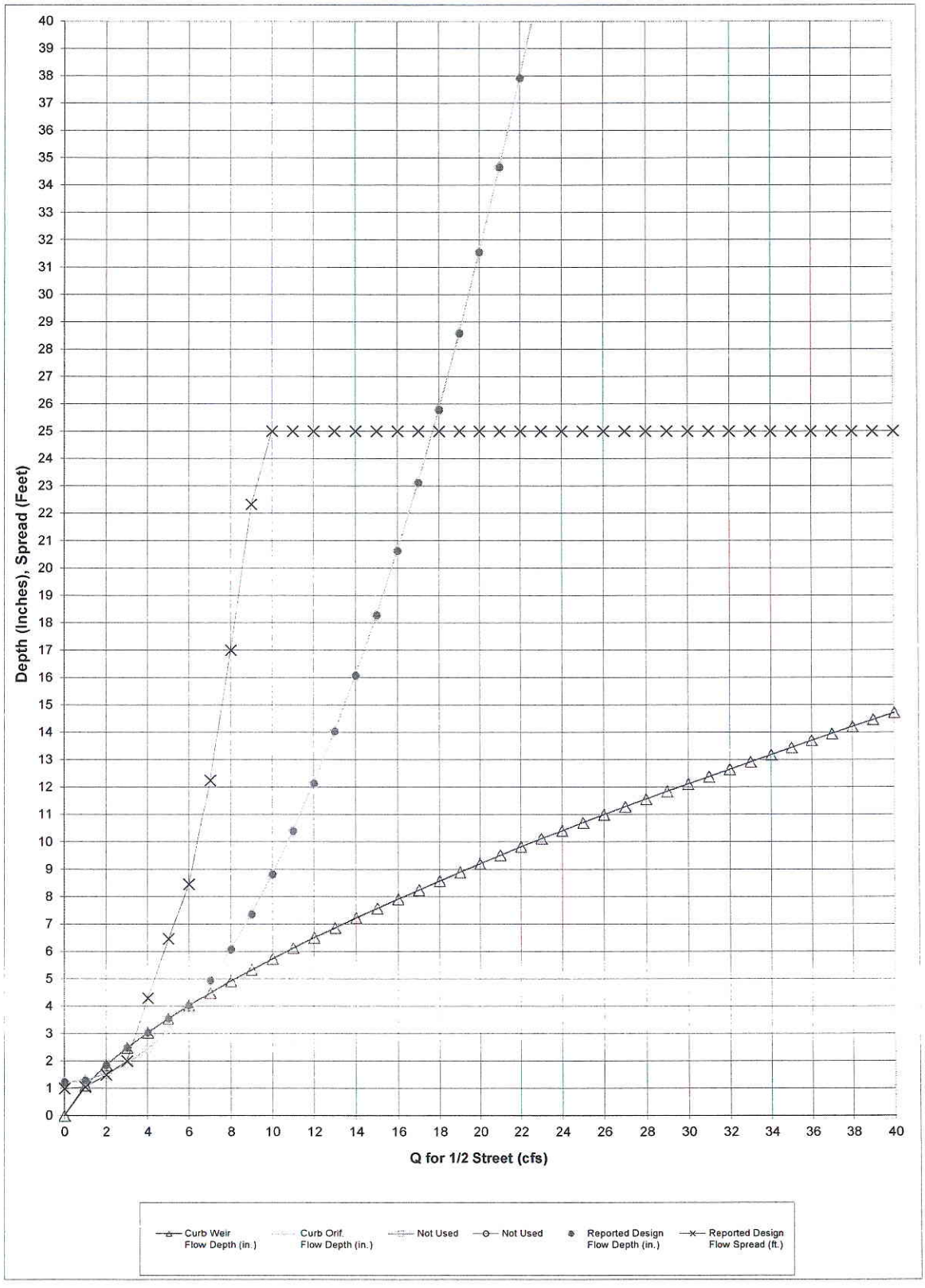


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	0.17	0.17	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 3.00)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.67)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	3.17	3.17	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	3.12	3.12	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.4	63.4	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.30-3.00)	C_w (C) =	2.30	2.30	
Curb Opening Orifice Coefficient (typical value 0.67)	C_o (C) =	0.67	0.67	

Resulting Gutter Flow Depth for Grate Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate as a Weir				
Flow Depth at Local Depression without Clogging (0 cfs grate, 4.9 cfs curb)	d_{wi} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}un}$ =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 4.9 cfs curb)	d_{wa} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}cl}$ =	N/A	N/A	inches
Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 4.9 cfs curb)	d_{oi} =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 4.9 cfs curb)	d_{oa} =	N/A	N/A	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Grate}$ =**	**N/A**	**N/A**	**inches**

Resulting Gutter Flow Depth for Curb Opening Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Curb as a Weir, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 4.9 cfs curb)	d_{wi} =	3.49	7.58	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 4.9 cfs curb)	d_{wa} =	3.67	7.97	inches
Curb as an Orifice, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 4.9 cfs curb)	d_{oi} =	2.87	16.53	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 4.9 cfs curb)	d_{oa} =	3.22	20.08	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Curb}$ =**	**3.50**	**19.91**	**inches**

Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	10.0	10.0	feet
Total Inlet Interception Capacity (Design Discharge from *Q-Peak*)	Q_a =	4.9	15.7	cfs
Resultant Gutter Flow Depth (based on sheet *Q-Allow* geometry)	**d =**	**3.50**	**19.91**	**inches**
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	**T =**	**6.3**	**25.0**	**ft. >T-Crown**
Resultant Flow Depth at Street Crown	**d_{CROWN} =**	**0.00**	**11.88**	**inches**


Depth (Inches), Spread (Feet)
Q for 1/2 Street (cfs)
Curb Weir Flow Depth (in.)
Curb Orif. Flow Depth (in.)
Not Used
Not Used
Reported Design Flow Depth (in.)
Reported Design Flow Spread (ft.)

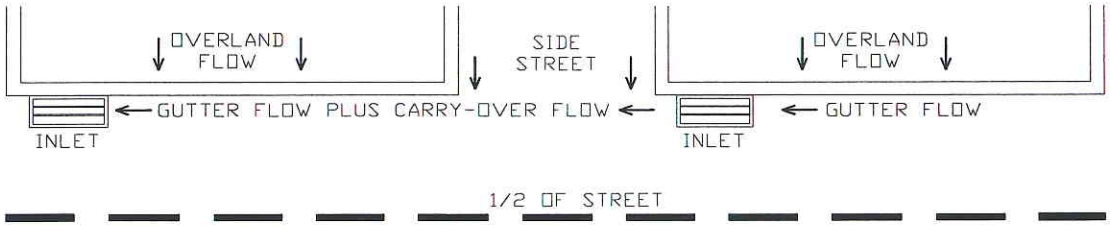
Q Intercepted (cfs)	Curb Weir Flow Depth (in.)	Curb Orif. Flow Depth (in.)	Not Used	Not Used	Reported Design Flow Depth (in.)	Reported DesignFlow Spread (ft.)
0.00	0.00	1.22			1.22	0.98
1.00	1.10	1.30			1.30	1.05
2.00	1.85	1.53			1.85	1.49
3.00	2.48	1.91			2.48	2.00
4.00	3.03	2.44			3.03	4.29
5.00	3.55	3.12			3.55	6.46
6.00	4.03	3.95			4.03	8.46
7.00	4.48	4.94			4.94	12.25
8.00	4.92	6.08			6.08	17.00
9.00	5.33	7.36			7.36	22.33
10.00	5.73	8.81			8.81	25.00
11.00	6.12	10.40			10.40	25.00
12.00	6.50	12.14			12.14	25.00
13.00	6.86	14.04			14.04	25.00
14.00	7.22	16.08			16.08	25.00
15.00	7.57	18.28			18.28	25.00
16.00	7.91	20.63			20.63	25.00
17.00	8.24	23.13			23.13	25.00
18.00	8.57	25.79			25.79	25.00
19.00	8.89	28.59			28.59	25.00
20.00	9.20	31.55			31.55	25.00
21.00	9.51	34.66			34.66	25.00
22.00	9.82	37.92			37.92	25.00
23.00	10.12	41.33			41.33	25.00
24.00	10.41	44.89			44.89	25.00
25.00	10.70	48.60			48.60	25.00
26.00	10.99	52.47			52.47	25.00
27.00	11.28	56.49			56.49	25.00
28.00	11.56	60.66			60.66	25.00
29.00	11.84	64.98			64.98	25.00
30.00	12.11	69.45			69.45	25.00
31.00	12.38	74.08			74.08	25.00
32.00	12.65	78.85			78.85	25.00
33.00	12.92	83.78			83.78	25.00
34.00	13.18	88.86			88.86	25.00
35.00	13.44	94.09			94.09	25.00
36.00	13.70	99.47			99.47	25.00
37.00	13.95	105.00			105.00	25.00
38.00	14.21	110.69			110.69	25.00
39.00	14.46	116.53			116.53	25.00
40.00	14.71	122.52			122.52	25.00

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

Erie Highlands- Phase 1

DP-14

Design Flow = Gutter Flow + Carry-over Flow



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

	Minor Storm	Major Storm	
*Q =	3.60	11.60	cfs

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

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site: (Check One Box Only)	
Site is Urban:	X
Site Is Non-Urban:	

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Gutter Flow =		

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

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

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

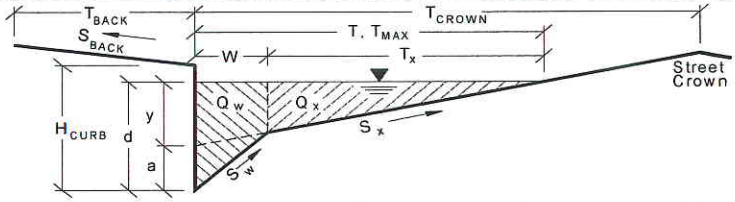
	Minor Storm	Major Storm	
Calculated Design Storm Runoff Coefficient, C =	N/A	N/A	
Calculated 5-yr. Runoff Coefficient, C5 =	N/A	N/A	
Overland Flow Velocity, V_O =	N/A	N/A	fps
Gutter Flow Velocity, V_G =	N/A	N/A	fps
Overland Flow Time, t_O =	N/A	N/A	minutes
Gutter Flow Time, t_G =	N/A	N/A	minutes
Calculated Time of Concentration, T_c =	N/A	N/A	minutes
Time of Concentration by Regional Formula, T_c =	N/A	N/A	minutes
Recommended T_c =	N/A	N/A	minutes
Time of Concentration Selected by User, T_c =	**N/A**	**N/A**	**minutes**
Design Rainfall Intensity, I =	N/A	N/A	inch/hr
Calculated Local Peak Flow, Q_p =	N/A	N/A	cfs
Total Design Peak Flow, Q =	**3.60**	**11.60**	**cfs**

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

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

Project: Erie Highlands- Phase 1

Inlet ID: DP-14



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.0200	ft. vert. / ft. horiz
Manning's Roughness Behind Curb	n_{BACK} =	0.0350	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Depression	a =	2.00	inches
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.0200	ft. vert. / ft. horiz
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.0000	ft. vert. / ft. horiz
Manning's Roughness for Street Section	n_{STREET} =	0.0150	

		Minor Storm	Major Storm	
Max. Allowable Water Spread for Minor & Major Storm	T_{MAX} =	12.0	17.0	ft
Max. Allowable Depth at Gutter Flow Line for Minor & Major Storm	d_{MAX} =	6.00	18.00	inches
Allow Flow Depth at Street Crown (leave blank for no)				X = yes

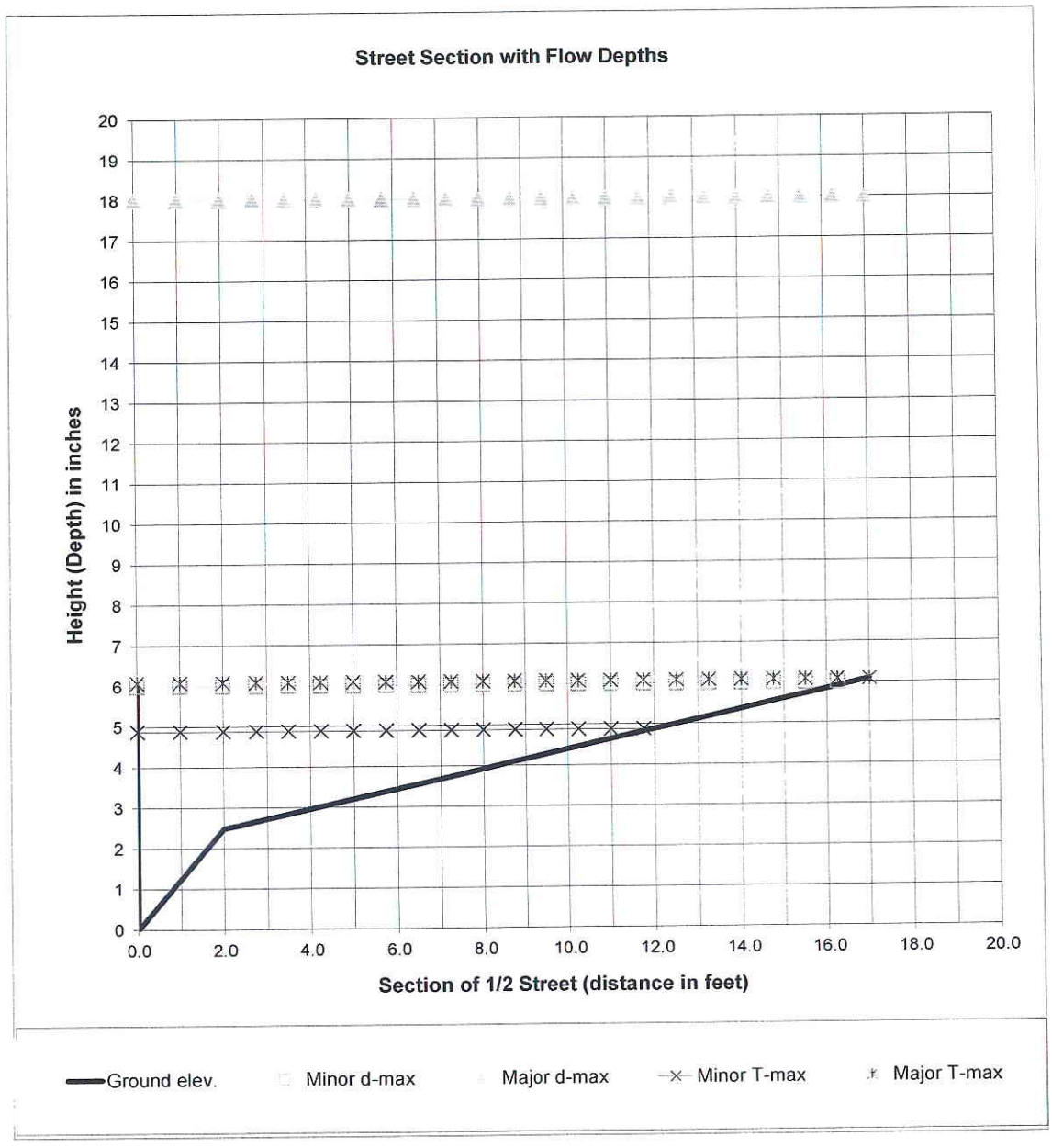
Maximum Gutter Capacity Based On Allowable Water Spread		Minor Storm	Major Storm	
Gutter Cross Slope (Eq. ST-8)	S_W =	0.1033	0.1033	ft/ft
Water Depth without Gutter Depression (Eq. ST-2)	y =	2.88	4.08	inches
Water Depth with a Gutter Depression	d =	4.88	6.08	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	10.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.522	0.371	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Water Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Gutter Capacity Based on Allowable Gutter Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	16.7	66.7	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	14.7	64.7	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.378	0.086	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm	**Q =**	**0.0**	**0.0**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	SUMP	SUMP	
Max Flow Based on Allow. Gutter Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

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

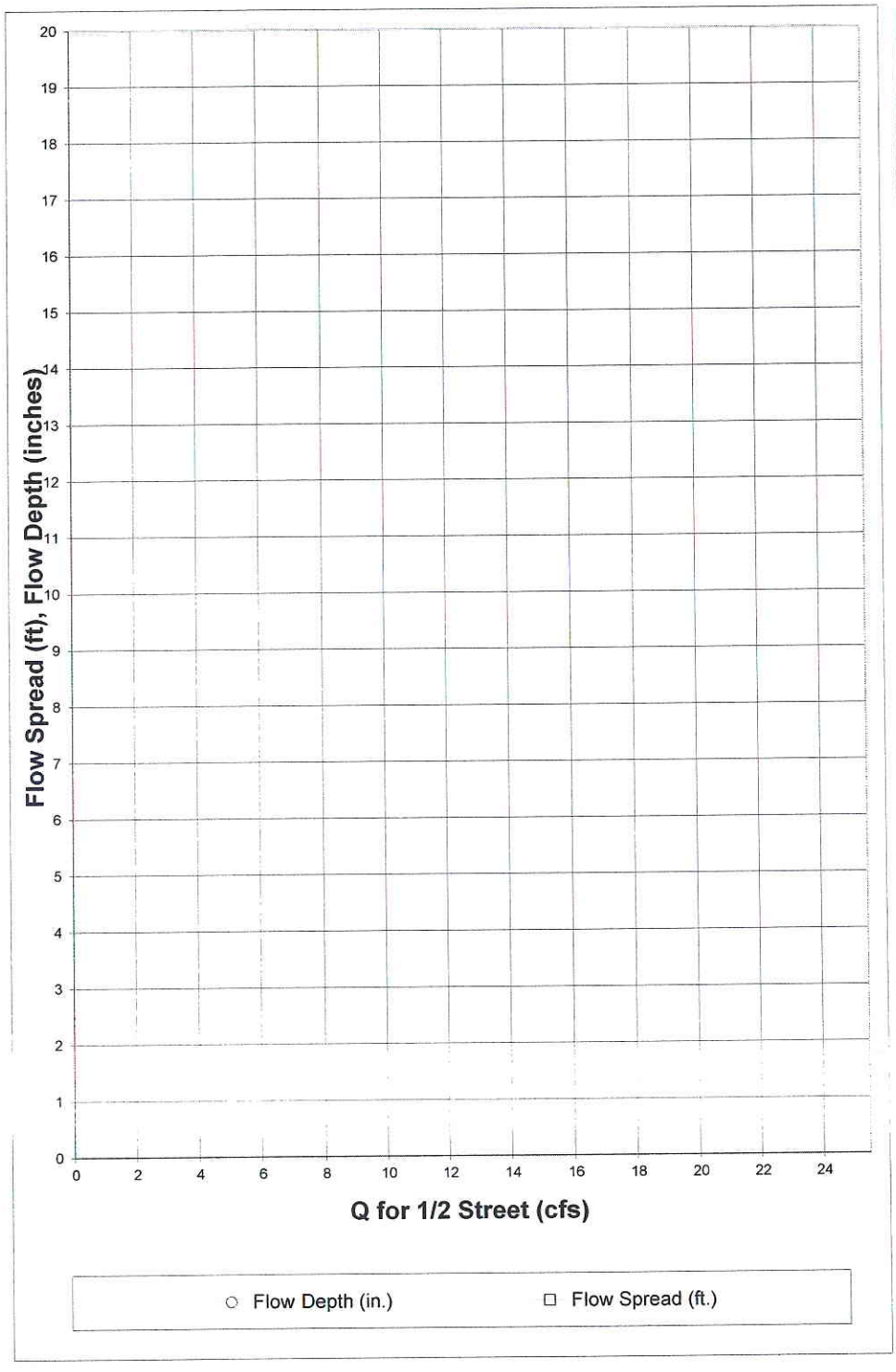
MINOR STORM max. allowable capacity OK - greater than flow given on sheet 'Q-Peak'

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



$$Q_x = \frac{0.56}{n} S_x^{5/3} S_L^{1/2} T_x^{8/3} \qquad E_o = \frac{1}{1 + \dfrac{S_w / S_x}{\left[1 + \dfrac{S_w / S_x}{(T/W) - 1}\right]^{8/3} - 1}}$$

$$Q = \frac{Q_x}{1 - E_o}; \; Q_w = Q - Q_x$$



Q for 1/2 Street (cfs)	Flow Depth (in.)	Flow Spread (ft.)
0.00		
0.25		
0.50		
0.75		
1.00		
1.25		
1.50		
1.75		
2.00		
2.25		
2.50		
2.75		
3.00		
3.25		
3.50		
3.75		
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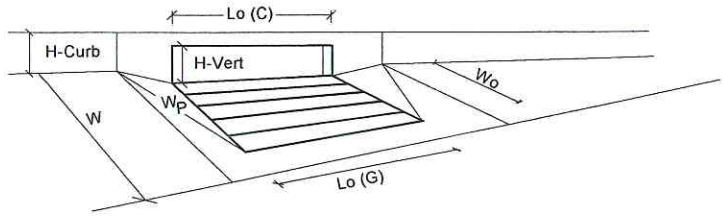
9.75		
10.00		
10.25		
10.50		
10.75		
11.00		
11.25		
11.50		
11.75		
12.00		
12.25		
12.50		

INLET IN A SUMP OR SAG LOCATION

Project = Erie Highlands- Phase 1

Inlet ID = DP-14

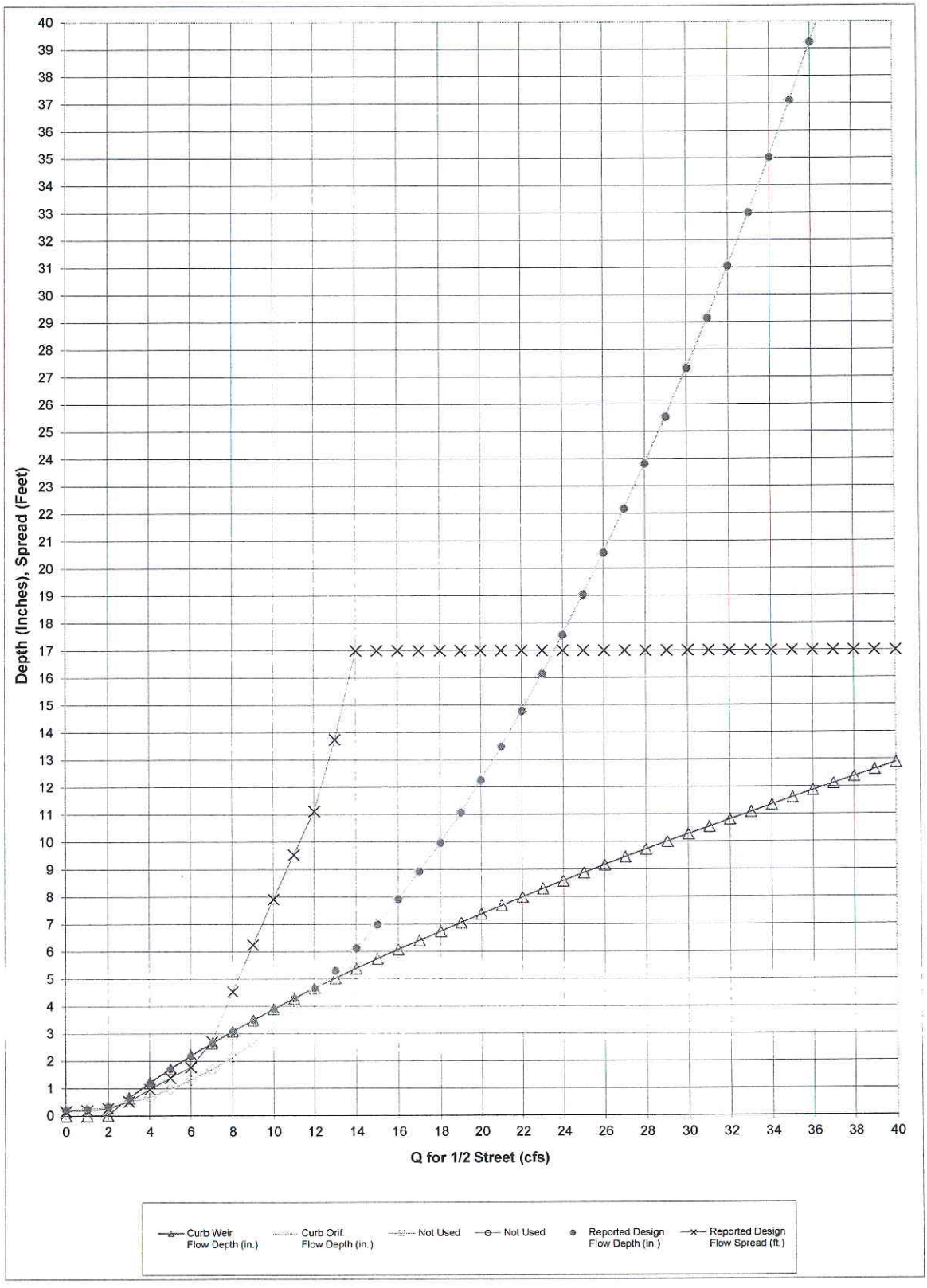


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 3.00)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.67)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	5.00	5.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	4.95	4.95	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.4	63.4	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.30-3.00)	C_w (C) =	2.30	2.30	
Curb Opening Orifice Coefficient (typical value 0.67)	C_o (C) =	0.67	0.67	

Resulting Gutter Flow Depth for Grate Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate as a Weir				
Flow Depth at Local Depression without Clogging (0 cfs grate, 3.6 cfs curb)	d_{wi} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}un}$ =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 3.6 cfs curb)	d_{wa} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}cl}$ =	N/A	N/A	inches
Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 3.6 cfs curb)	d_{oi} =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 3.6 cfs curb)	d_{oa} =	N/A	N/A	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Grate}$ =**	**N/A**	**N/A**	**inches**

Resulting Gutter Flow Depth for Curb Opening Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Curb as a Weir, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 3.6 cfs curb)	d_{wi} =	2.84	6.19	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 3.6 cfs curb)	d_{wa} =	2.99	6.52	inches
Curb as an Orifice, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 3.6 cfs curb)	d_{oi} =	2.53	5.50	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 3.6 cfs curb)	d_{oa} =	2.60	6.27	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Curb}$ =**	**0.99**	**4.52**	**inches**

Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	10.0	10.0	feet
Total Inlet Interception Capacity (Design Discharge from *Q-Peak*)	Q_a =	3.6	11.6	cfs
Resultant Gutter Flow Depth (based on sheet *Q-Allow* geometry)	**d =**	**0.99**	**4.52**	**inches**
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	**T =**	**0.8**	**10.5**	**feet**
Resultant Flow Depth at Street Crown	**d_{CROWN} =**	**0.00**	**0.00**	**inches**


Depth (Inches), Spread (Feet)
Q for 1/2 Street (cfs)
Curb Weir Flow Depth (in.)
Curb Orif. Flow Depth (in.)
Not Used
Not Used
Reported Design Flow Depth (in.)
Reported Design Flow Spread (ft.)

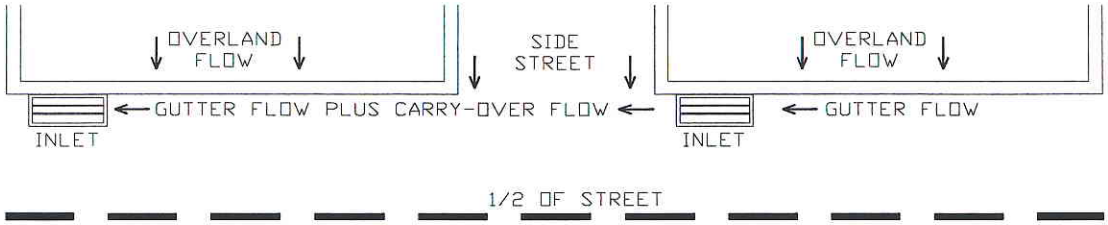
Q Intercepted (cfs)	Curb Weir Flow Depth (in.)	Curb Orif. Flow Depth (in.)	Not Used	Not Used	Reported Design Flow Depth (in.)	Reported DesignFlow Spread (ft.)
0.00	0.00	0.21			0.21	0.17
1.00	0.00	0.24			0.24	0.19
2.00	0.02	0.33			0.33	0.27
3.00	0.65	0.48			0.65	0.52
4.00	1.20	0.69			1.20	0.97
5.00	1.72	0.97			1.72	1.39
6.00	2.20	1.30			2.20	1.77
7.00	2.65	1.69			2.65	2.71
8.00	3.09	2.14			3.09	4.54
9.00	3.50	2.65			3.50	6.25
10.00	3.90	3.22			3.90	7.92
11.00	4.29	3.86			4.29	9.54
12.00	4.67	4.55			4.67	11.12
13.00	5.03	5.30			5.30	13.75
14.00	5.39	6.12			6.12	17.00
15.00	5.74	6.99			6.99	17.00
16.00	6.08	7.92			7.92	17.00
17.00	6.41	8.92			8.92	17.00
18.00	6.74	9.97			9.97	17.00
19.00	7.06	11.08			11.08	17.00
20.00	7.37	12.26			12.26	17.00
21.00	7.68	13.49			13.49	17.00
22.00	7.99	14.79			14.79	17.00
23.00	8.29	16.14			16.14	17.00
24.00	8.58	17.56			17.56	17.00
25.00	8.87	19.04			19.04	17.00
26.00	9.16	20.57			20.57	17.00
27.00	9.45	22.17			22.17	17.00
28.00	9.73	23.82			23.82	17.00
29.00	10.01	25.54			25.54	17.00
30.00	10.28	27.32			27.32	17.00
31.00	10.55	29.15			29.15	17.00
32.00	10.82	31.05			31.05	17.00
33.00	11.09	33.01			33.01	17.00
34.00	11.35	35.03			35.03	17.00
35.00	11.61	37.11			37.11	17.00
36.00	11.87	39.24			39.24	17.00
37.00	12.12	41.44			41.44	17.00
38.00	12.38	43.70			43.70	17.00
39.00	12.63	46.02			46.02	17.00
40.00	12.88	48.40			48.40	17.00

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

Erie Highlands- Phase 1

DP-15

Design Flow = Gutter Flow + Carry-over Flow



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

	Minor Storm	Major Storm	
*Q =	2.00	9.30	cfs

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

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site: (Check One Box Only)

Site is Urban:	X
Site Is Non-Urban:	

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Gutter Flow =		

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

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

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

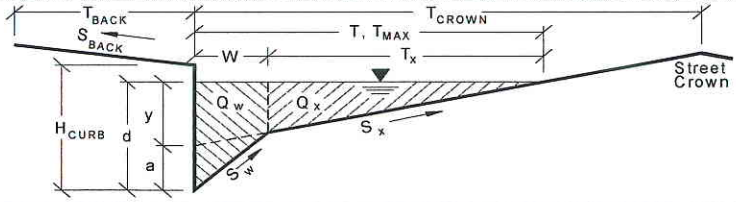
	Minor Storm	Major Storm	
Calculated Design Storm Runoff Coefficient, C =	N/A	N/A	
Calculated 5-yr. Runoff Coefficient, C5 =	N/A	N/A	
Overland Flow Velocity, V_O =	N/A	N/A	fps
Gutter Flow Velocity, V_G =	N/A	N/A	fps
Overland Flow Time, t_O =	N/A	N/A	minutes
Gutter Flow Time, t_G =	N/A	N/A	minutes
Calculated Time of Concentration, T_c =	N/A	N/A	minutes
Time of Concentration by Regional Formula, T_c =	N/A	N/A	minutes
Recommended T_c =	N/A	N/A	minutes
Time of Concentration Selected by User, T_c =	N/A	N/A	**minutes**
Design Rainfall Intensity, I =	N/A	N/A	inch/hr
Calculated Local Peak Flow, Q_p =	N/A	N/A	cfs
Total Design Peak Flow, Q =	2.00	9.30	**cfs**

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

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

Project: Erie Highlands- Phase 1

Inlet ID: DP-15



Gutter Geometry (Enter data in the blue cells)			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.0200	ft. vert. / ft. horiz
Manning's Roughness Behind Curb	n_{BACK} =	0.0350	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Depression	a =	2.00	inches
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.0200	ft. vert. / ft. horiz
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.0000	ft. vert. / ft. horiz
Manning's Roughness for Street Section	n_{STREET} =	0.0150	

		Minor Storm	Major Storm	
Max. Allowable Water Spread for Minor & Major Storm	T_{MAX} =	12.0	17.0	ft
Max. Allowable Depth at Gutter Flow Line for Minor & Major Storm	d_{MAX} =	6.00	18.00	inches
Allow Flow Depth at Street Crown (leave blank for no)			X	X = yes

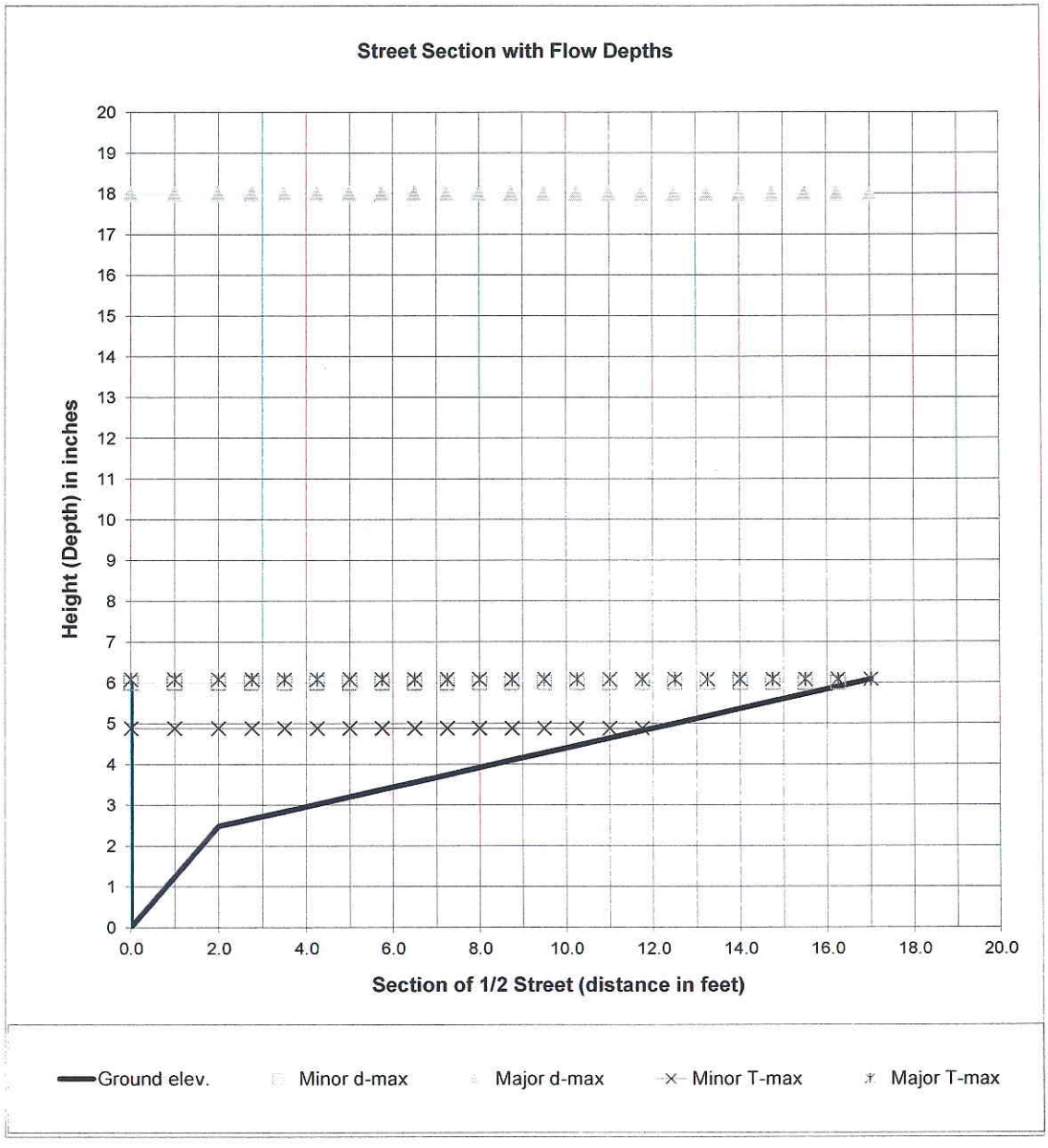
Maximum Gutter Capacity Based On Allowable Water Spread		Minor Storm	Major Storm	
Gutter Cross Slope (Eq. ST-8)	S_W =	0.1033	0.1033	ft/ft
Water Depth without Gutter Depression (Eq. ST-2)	y =	2.88	4.08	inches
Water Depth with a Gutter Depression	d =	4.88	6.08	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	10.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.522	0.371	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Water Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Gutter Capacity Based on Allowable Gutter Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	16.7	66.7	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	14.7	64.7	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.378	0.086	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm	**Q =**	**0.0**	**0.0**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	SUMP	SUMP	
Max Flow Based on Allow. Gutter Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

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

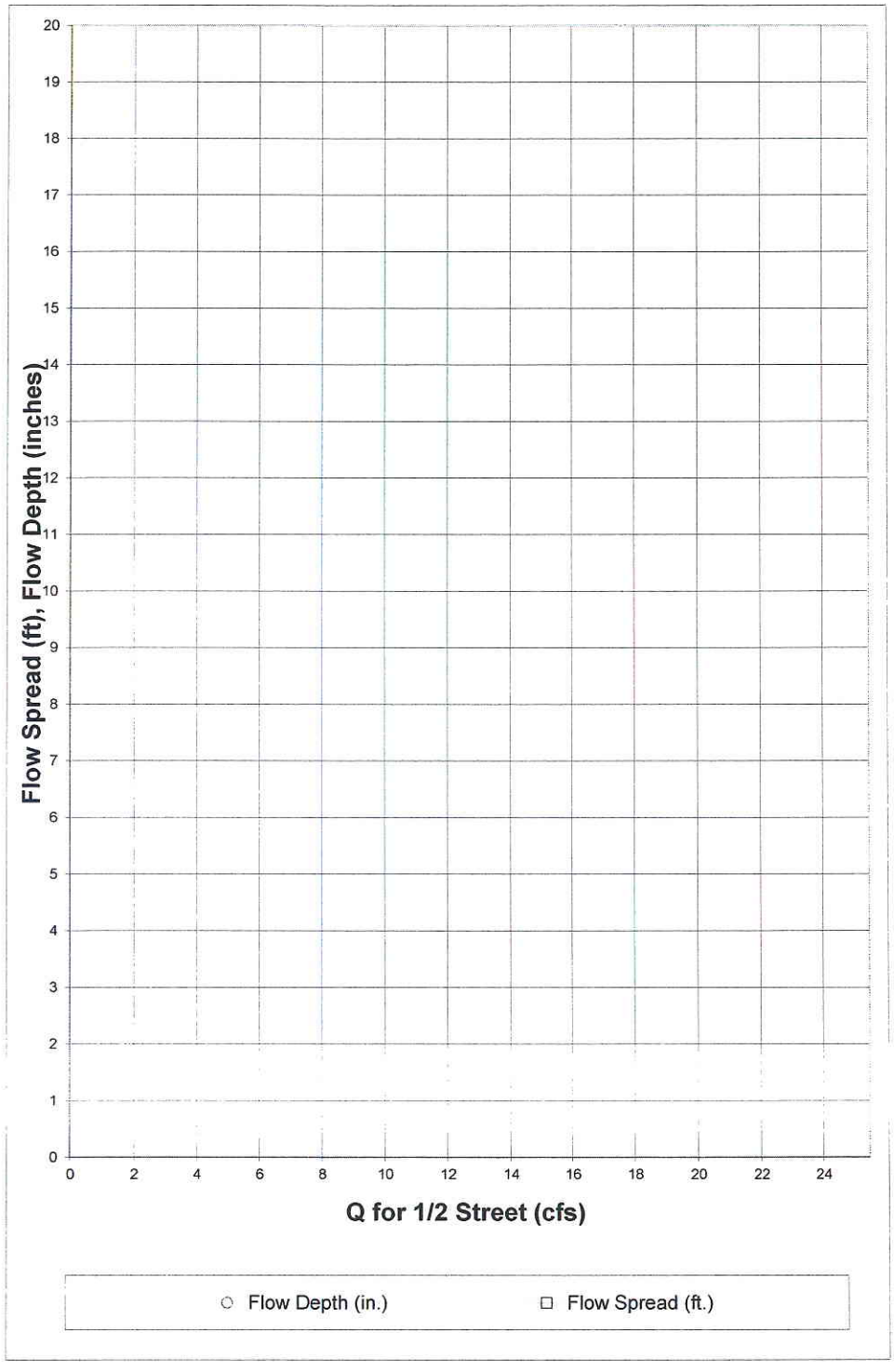
MINOR STORM max. allowable capacity OK - greater than flow given on sheet 'Q-Peak'

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



$$Q_x = \frac{0.56}{n} S_x^{5/3} S_L^{1/2} T_x^{8/3} \qquad E_o = \frac{1}{1 + \dfrac{S_w / S_x}{\left[1 + \dfrac{S_w / S_x}{(T/W) - 1}\right]^{8/3} - 1}}$$

$$Q = \frac{Q_x}{1 - E_o}; \; Q_w = Q - Q_x$$



Q for 1/2 Street (cfs)	Flow Depth (in.)	Flow Spread (ft.)
0.00		
0.25		
0.50		
0.75		
1.00		
1.25		
1.50		
1.75		
2.00		
2.25		
2.50		
2.75		
3.00		
3.25		
3.50		
3.75		
4.00		
4.25		
4.50		
4.75		
5.00		
5.25		
5.50		
5.75		
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6.75		
7.00		
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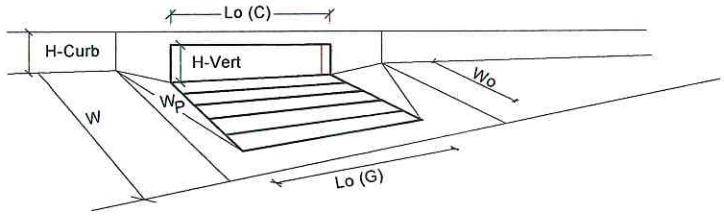
7.50		
7.75		
8.00		
8.25		
8.50		
8.75		
9.00		
9.25		
9.50		
9.75		
10.00		
10.25		
10.50		
10.75		
11.00		
11.25		
11.50		
11.75		
12.00		
12.25		
12.50		

INLET IN A SUMP OR SAG LOCATION

Project = Erie Highlands- Phase 1

Inlet ID = DP-15

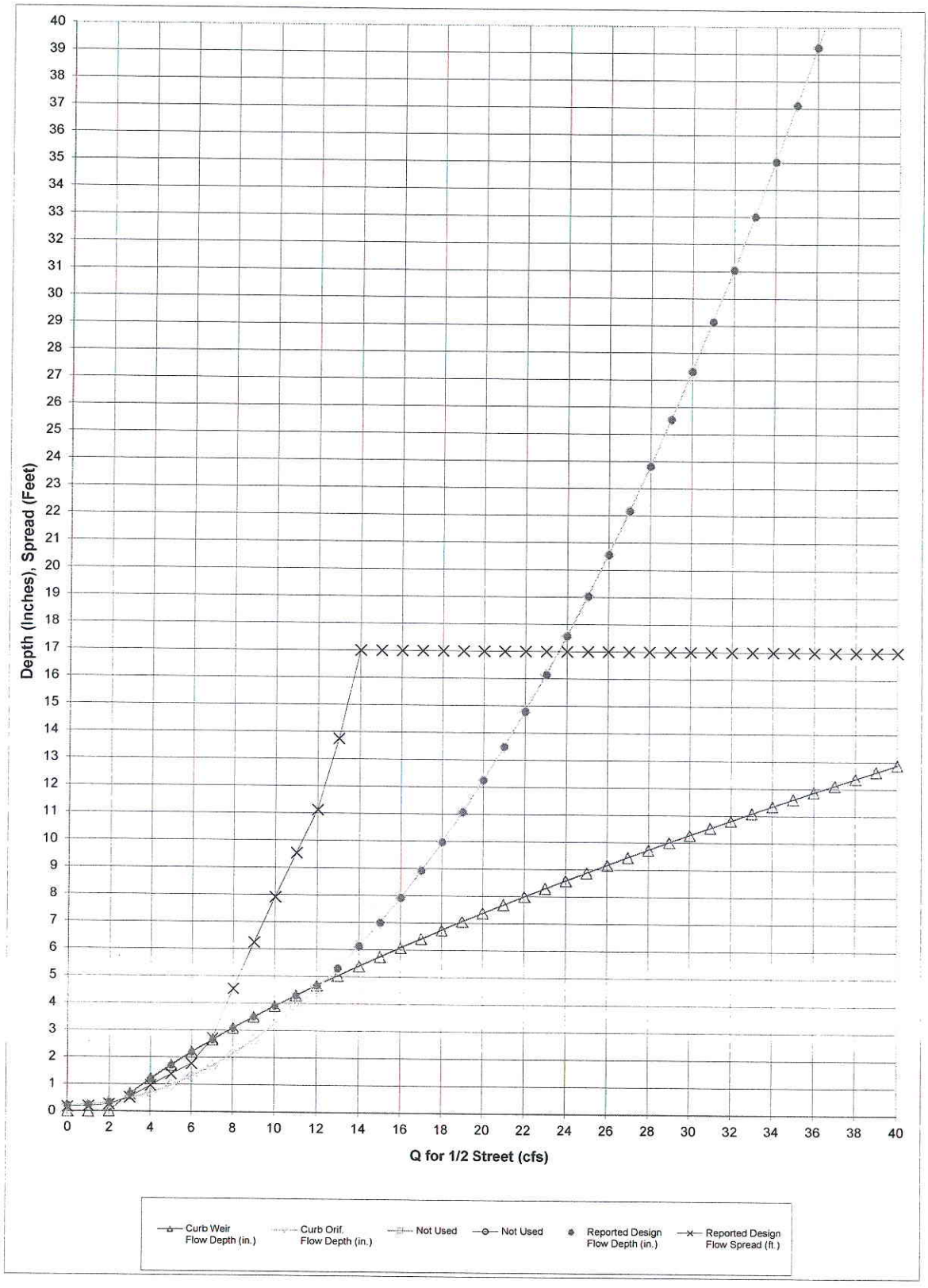


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 3.00)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.67)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	5.00	5.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	4.95	4.95	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.4	63.4	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.30-3.00)	C_w (C) =	2.30	2.30	
Curb Opening Orifice Coefficient (typical value 0.67)	C_o (C) =	0.67	0.67	

Resulting Gutter Flow Depth for Grate Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate as a Weir				
Flow Depth at Local Depression without Clogging (0 cfs grate, 2 cfs curb)	d_{wi} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}un}$ =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 2 cfs curb)	d_{wa} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}cl}$ =	N/A	N/A	inches
Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 2 cfs curb)	d_{oi} =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 2 cfs curb)	d_{oa} =	N/A	N/A	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Grate}$ =**	**N/A**	**N/A**	**inches**

Resulting Gutter Flow Depth for Curb Opening Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Curb as a Weir, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 2 cfs curb)	d_{wi} =	1.92	5.35	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 2 cfs curb)	d_{wa} =	2.02	5.62	inches
Curb as an Orifice, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 2 cfs curb)	d_{oi} =	2.31	4.32	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 2 cfs curb)	d_{oa} =	2.33	4.82	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Curb}$ =**	**0.33**	**3.62**	**inches**

Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	10.0	10.0	feet
Total Inlet Interception Capacity (Design Discharge from *Q-Peak*)	Q_a =	2.0	9.3	cfs
Resultant Gutter Flow Depth (based on sheet *Q-Allow* geometry)	**d =**	**0.33**	**3.62**	**inches**
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	**T =**	**0.3**	**6.8**	**feet**
Resultant Flow Depth at Street Crown	**d_{CROWN} =**	**0.00**	**0.00**	**inches**


Depth (Inches), Spread (Feet)
Q for 1/2 Street (cfs)
Curb Weir Flow Depth (in.)
Curb Orif. Flow Depth (in.)
Not Used
Not Used
Reported Design Flow Depth (in.)
Reported Design Flow Spread (ft.)

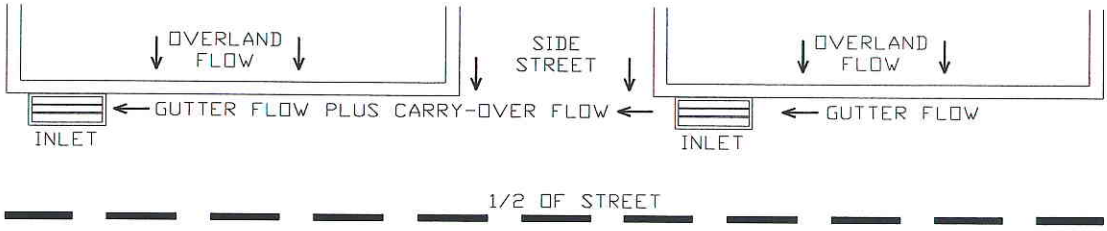
Q Intercepted (cfs)	Curb Weir Flow Depth (in.)	Curb Orif. Flow Depth (in.)	Not Used	Not Used	Reported Design Flow Depth (in.)	Reported DesignFlow Spread (ft.)
0.00	0.00	0.21			0.21	0.17
1.00	0.00	0.24			0.24	0.19
2.00	0.02	0.33			0.33	0.27
3.00	0.65	0.48			0.65	0.52
4.00	1.20	0.69			1.20	0.97
5.00	1.72	0.97			1.72	1.39
6.00	2.20	1.30			2.20	1.77
7.00	2.65	1.69			2.65	2.71
8.00	3.09	2.14			3.09	4.54
9.00	3.50	2.65			3.50	6.25
10.00	3.90	3.22			3.90	7.92
11.00	4.29	3.86			4.29	9.54
12.00	4.67	4.55			4.67	11.12
13.00	5.03	5.30			5.30	13.75
14.00	5.39	6.12			6.12	17.00
15.00	5.74	6.99			6.99	17.00
16.00	6.08	7.92			7.92	17.00
17.00	6.41	8.92			8.92	17.00
18.00	6.74	9.97			9.97	17.00
19.00	7.06	11.08			11.08	17.00
20.00	7.37	12.26			12.26	17.00
21.00	7.68	13.49			13.49	17.00
22.00	7.99	14.79			14.79	17.00
23.00	8.29	16.14			16.14	17.00
24.00	8.58	17.56			17.56	17.00
25.00	8.87	19.04			19.04	17.00
26.00	9.16	20.57			20.57	17.00
27.00	9.45	22.17			22.17	17.00
28.00	9.73	23.82			23.82	17.00
29.00	10.01	25.54			25.54	17.00
30.00	10.28	27.32			27.32	17.00
31.00	10.55	29.15			29.15	17.00
32.00	10.82	31.05			31.05	17.00
33.00	11.09	33.01			33.01	17.00
34.00	11.35	35.03			35.03	17.00
35.00	11.61	37.11			37.11	17.00
36.00	11.87	39.24			39.24	17.00
37.00	12.12	41.44			41.44	17.00
38.00	12.38	43.70			43.70	17.00
39.00	12.63	46.02			46.02	17.00
40.00	12.88	48.40			48.40	17.00

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

Erie Highlands- Phase 1

DP-16

Design Flow = Gutter Flow + Carry-over Flow



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

	Minor Storm	Major Storm	
*Q =	8.80	26.90	cfs

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

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site: (Check One Box Only)

Site is Urban:	X
Site Is Non-Urban:	

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Gutter Flow =		

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

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

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

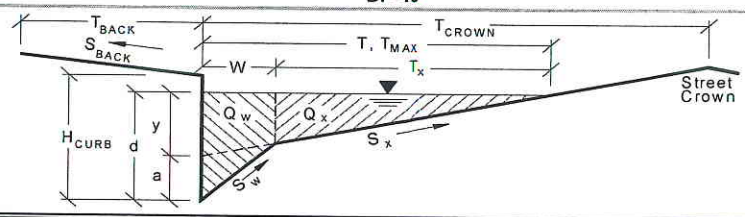
	Minor Storm	Major Storm	
Calculated Design Storm Runoff Coefficient, C =	N/A	N/A	
Calculated 5-yr. Runoff Coefficient, C5 =	N/A	N/A	
Overland Flow Velocity, V_O =	N/A	N/A	fps
Gutter Flow Velocity, V_G =	N/A	N/A	fps
Overland Flow Time, t_O =	N/A	N/A	minutes
Gutter Flow Time, t_G =	N/A	N/A	minutes
Calculated Time of Concentration, T_c =	N/A	N/A	minutes
Time of Concentration by Regional Formula, T_c =	N/A	N/A	minutes
Recommended T_c =	N/A	N/A	minutes
Time of Concentration Selected by User, T_c =	**N/A**	**N/A**	**minutes**
Design Rainfall Intensity, I =	N/A	N/A	inch/hr
Calculated Local Peak Flow, Q_p =	N/A	N/A	cfs
Total Design Peak Flow, Q =	**8.80**	**26.90**	**cfs**

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

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

Project: Erie Highlands- Phase 1

Inlet ID: DP-16



Gutter Geometry (Enter data in the blue cells)			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.0200	ft. vert. / ft. horiz
Manning's Roughness Behind Curb	n_{BACK} =	0.0350	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Depression	a =	2.00	inches
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.0200	ft. vert. / ft. horiz
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.0000	ft. vert. / ft. horiz
Manning's Roughness for Street Section	n_{STREET} =	0.0150	

		Minor Storm	Major Storm	
Max. Allowable Water Spread for Minor & Major Storm	T_{MAX} =	12.0	17.0	ft
Max. Allowable Depth at Gutter Flow Line for Minor & Major Storm	d_{MAX} =	6.00	18.00	inches
Allow Flow Depth at Street Crown (leave blank for no)			X	X = yes

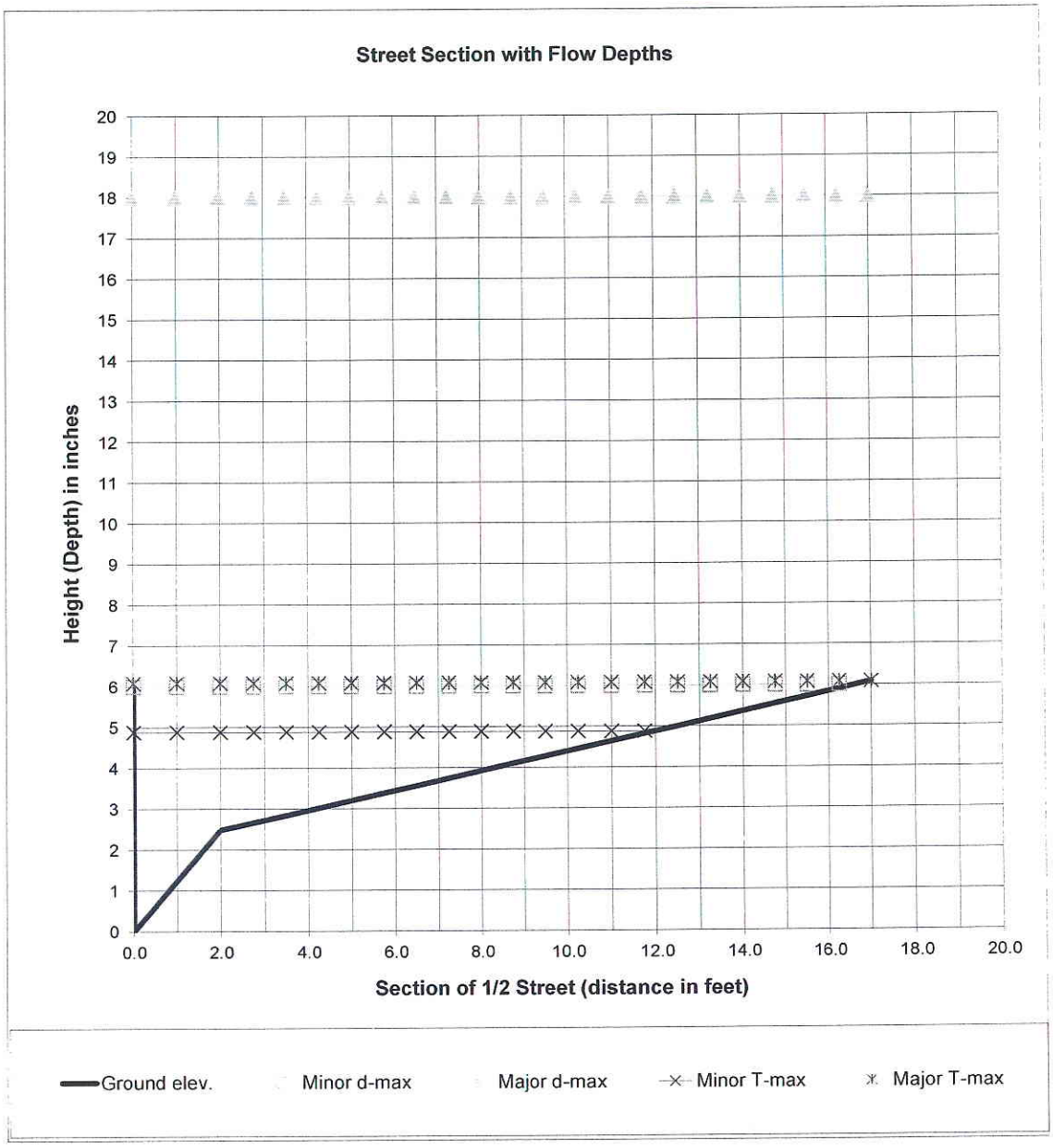
Maximum Gutter Capacity Based On Allowable Water Spread		Minor Storm	Major Storm	
Gutter Cross Slope (Eq. ST-8)	S_W =	0.1033	0.1033	ft/ft
Water Depth without Gutter Depression (Eq. ST-2)	y =	2.88	4.08	inches
Water Depth with a Gutter Depression	d =	4.88	6.08	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	10.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.522	0.371	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Water Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Gutter Capacity Based on Allowable Gutter Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	16.7	66.7	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	14.7	64.7	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.378	0.086	
Theoretical Discharge outside the Gutter Section W, carried in Section T_{XTH}	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm	**Q =**	**0.0**	**0.0**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	SUMP	SUMP	
Max Flow Based on Allow. Gutter Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

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

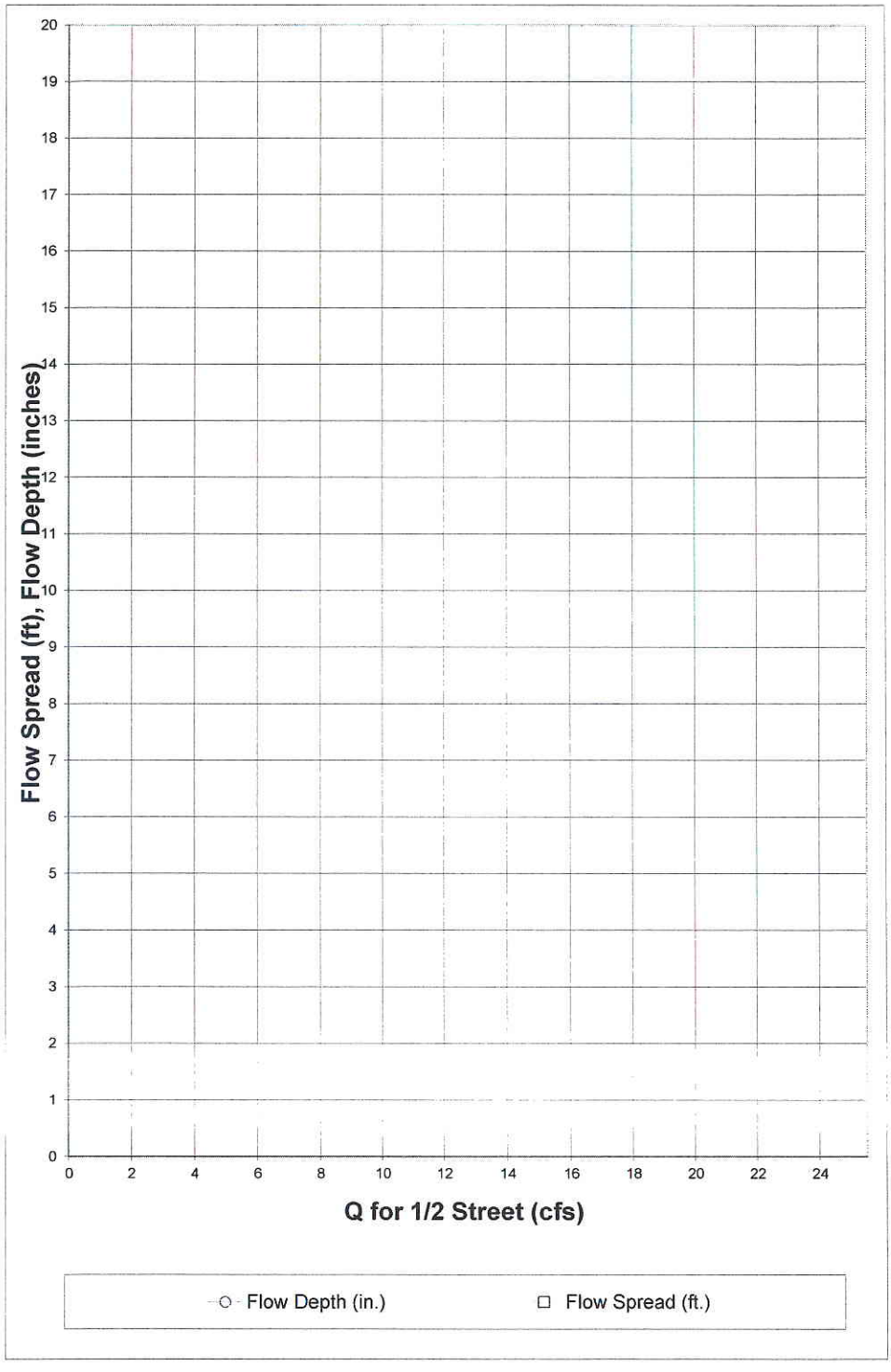
MINOR STORM max. allowable capacity OK - greater than flow given on sheet 'Q-Peak'

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



$$Q_x = \frac{0.56}{n} S_x^{5/3} S_L^{1/2} T_x^{8/3} \qquad E_o = \frac{1}{1 + \dfrac{S_w / S_x}{\left[1 + \dfrac{S_w / S_x}{(T/W) - 1}\right]^{8/3} - 1}}$$

$$Q = \frac{Q_x}{1 - E_o}; \; Q_w = Q - Q_x$$



Q for 1/2 Street (cfs)	Flow Depth (in.)	Flow Spread (ft.)
0.00		
0.25		
0.50		
0.75		
1.00		
1.25		
1.50		
1.75		
2.00		
2.25		
2.50		
2.75		
3.00		
3.25		
3.50		
3.75		
4.00		
4.25		
4.50		
4.75		
5.00		
5.25		
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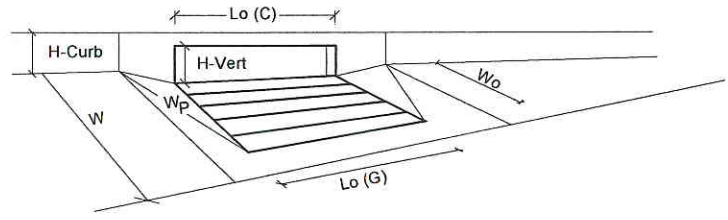
7.00		
7.25		
7.50		
7.75		
8.00		
8.25		
8.50		
8.75		
9.00		
9.25		
9.50		
9.75		
10.00		
10.25		
10.50		
10.75		
11.00		
11.25		
11.50		
11.75		
12.00		
12.25		
12.50		

INLET IN A SUMP OR SAG LOCATION

Project = Erie Highlands- Phase 1

Inlet ID = DP-16

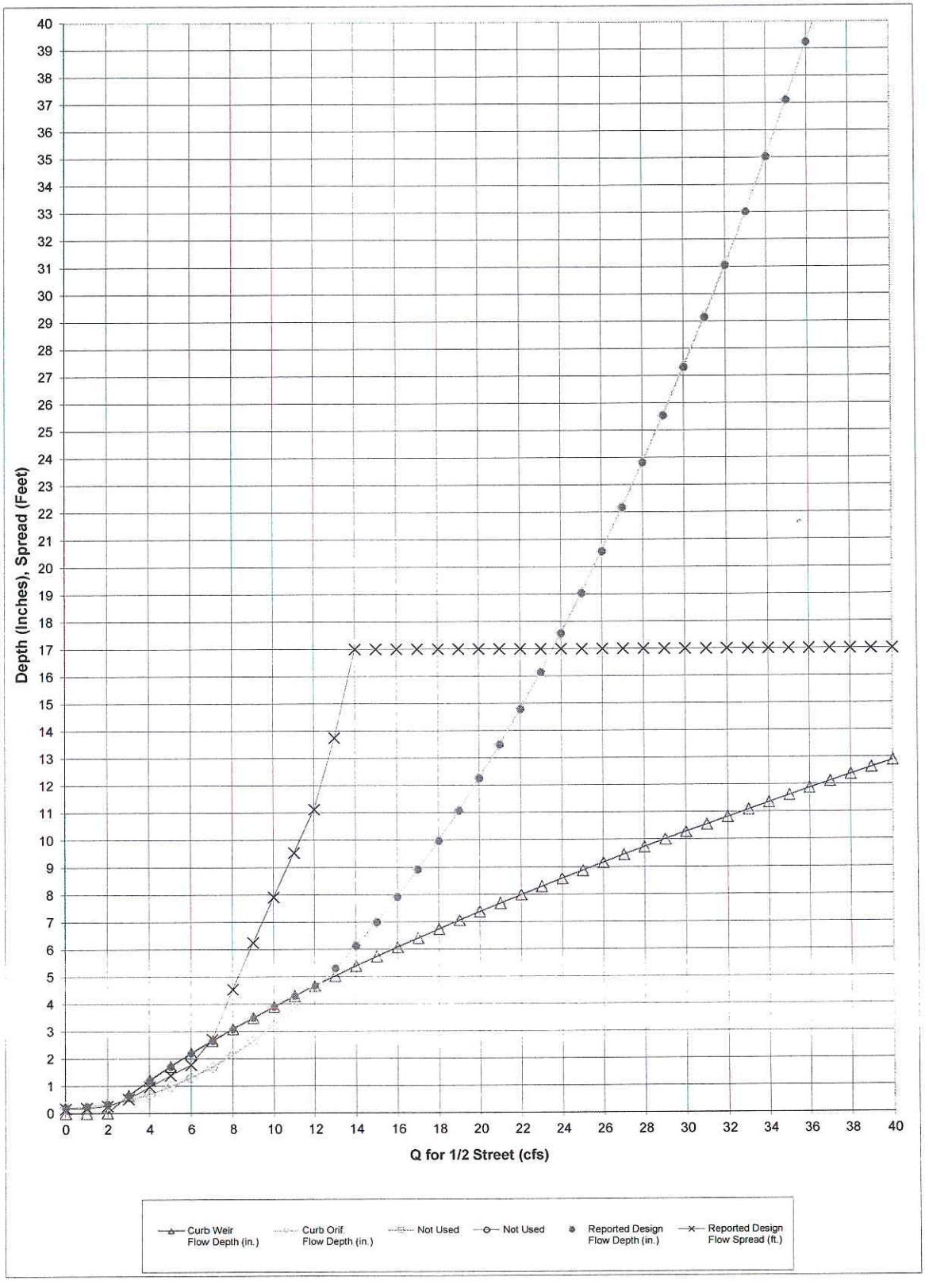


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 3.00)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.67)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	5.00	5.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	4.95	4.95	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.4	63.4	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.30-3.00)	C_w (C) =	2.30	2.30	
Curb Opening Orifice Coefficient (typical value 0.67)	C_o (C) =	0.67	0.67	

Resulting Gutter Flow Depth for Grate Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate as a Weir				
Flow Depth at Local Depression without Clogging (0 cfs grate, 8.8 cfs curb)	d_{wi} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}un}$ =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 8.8 cfs curb)	d_{wa} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}cl}$ =	N/A	N/A	inches
Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 8.8 cfs curb)	d_{oi} =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 8.8 cfs curb)	d_{oa} =	N/A	N/A	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Grate}$ =**	**N/A**	**N/A**	**inches**

Resulting Gutter Flow Depth for Curb Opening Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Curb as a Weir, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 8.8 cfs curb)	d_{wi} =	5.15	10.85	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 8.8 cfs curb)	d_{wa} =	5.42	11.42	inches
Curb as an Orifice, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 8.8 cfs curb)	d_{oi} =	4.10	19.86	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 8.8 cfs curb)	d_{oa} =	4.55	24.01	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Curb}$ =**	**3.42**	**22.01**	**inches**

Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	10.0	10.0	feet
Total Inlet Interception Capacity (Design Discharge from *Q-Peak*)	Q_a =	8.8	26.9	cfs
Resultant Gutter Flow Depth (based on sheet *Q-Allow* geometry)	**d =**	**3.42**	**22.01**	**inches**
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	**T =**	**5.9**	**17.0**	**ft. >T-Crown**
Resultant Flow Depth at Street Crown	**d_{CROWN} =**	**0.00**	**15.96**	**inches**


Depth (Inches), Spread (Feet)
Q for 1/2 Street (cfs)
Curb Weir Flow Depth (in.)
Curb Orif Flow Depth (in.)
Not Used
Not Used
Reported Design Flow Depth (in.)
Reported Design Flow Spread (ft.)

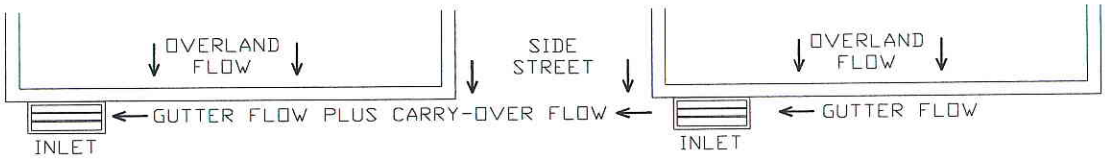
Q Intercepted (cfs)	Curb Weir Flow Depth (in.)	Curb Orif. Flow Depth (in.)	Not Used	Not Used	Reported Design Flow Depth (in.)	Reported DesignFlow Spread (ft.)
0.00	0.00	0.21			0.21	0.17
1.00	0.00	0.24			0.24	0.19
2.00	0.02	0.33			0.33	0.27
3.00	0.65	0.48			0.65	0.52
4.00	1.20	0.69			1.20	0.97
5.00	1.72	0.97			1.72	1.39
6.00	2.20	1.30			2.20	1.77
7.00	2.65	1.69			2.65	2.71
8.00	3.09	2.14			3.09	4.54
9.00	3.50	2.65			3.50	6.25
10.00	3.90	3.22			3.90	7.92
11.00	4.29	3.86			4.29	9.54
12.00	4.67	4.55			4.67	11.12
13.00	5.03	5.30			5.30	13.75
14.00	5.39	6.12			6.12	17.00
15.00	5.74	6.99			6.99	17.00
16.00	6.08	7.92			7.92	17.00
17.00	6.41	8.92			8.92	17.00
18.00	6.74	9.97			9.97	17.00
19.00	7.06	11.08			11.08	17.00
20.00	7.37	12.26			12.26	17.00
21.00	7.68	13.49			13.49	17.00
22.00	7.99	14.79			14.79	17.00
23.00	8.29	16.14			16.14	17.00
24.00	8.58	17.56			17.56	17.00
25.00	8.87	19.04			19.04	17.00
26.00	9.16	20.57			20.57	17.00
27.00	9.45	22.17			22.17	17.00
28.00	9.73	23.82			23.82	17.00
29.00	10.01	25.54			25.54	17.00
30.00	10.28	27.32			27.32	17.00
31.00	10.55	29.15			29.15	17.00
32.00	10.82	31.05			31.05	17.00
33.00	11.09	33.01			33.01	17.00
34.00	11.35	35.03			35.03	17.00
35.00	11.61	37.11			37.11	17.00
36.00	11.87	39.24			39.24	17.00
37.00	12.12	41.44			41.44	17.00
38.00	12.38	43.70			43.70	17.00
39.00	12.63	46.02			46.02	17.00
40.00	12.88	48.40			48.40	17.00

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

Erie Highlands- Phase 1

DP-17

Design Flow = Gutter Flow + Carry-over Flow



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

	Minor Storm	Major Storm	
*Q =	2.50	8.10	cfs

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

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site: (Check One Box Only)

Site is Urban:	X
Site Is Non-Urban:	

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Gutter Flow =		

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

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

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

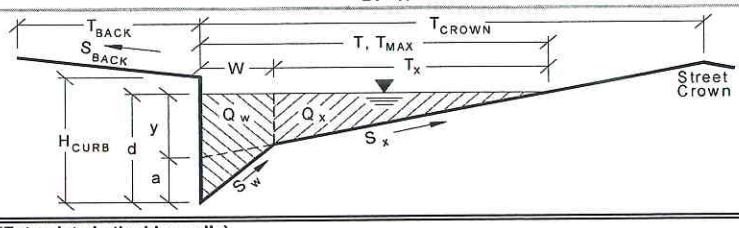
	Minor Storm	Major Storm	
Calculated Design Storm Runoff Coefficient, C =	N/A	N/A	
Calculated 5-yr. Runoff Coefficient, C5 =	N/A	N/A	
Overland Flow Velocity, V_O =	N/A	N/A	fps
Gutter Flow Velocity, V_G =	N/A	N/A	fps
Overland Flow Time, t_O =	N/A	N/A	minutes
Gutter Flow Time, t_G =	N/A	N/A	minutes
Calculated Time of Concentration, T_c =	N/A	N/A	minutes
Time of Concentration by Regional Formula, T_c =	N/A	N/A	minutes
Recommended T_c =	N/A	N/A	minutes
Time of Concentration Selected by User, T_c =	**N/A**	**N/A**	**minutes**
Design Rainfall Intensity, I =	N/A	N/A	inch/hr
Calculated Local Peak Flow, Q_p =	N/A	N/A	cfs
Total Design Peak Flow, Q =	**2.50**	**8.10**	**cfs**

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

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

Project: Erie Highlands- Phase 1

Inlet ID: DP-17



Gutter Geometry (Enter data in the blue cells)

Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.0200	ft. vert. / ft. horiz
Manning's Roughness Behind Curb	n_{BACK} =	0.0350	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Depression	a =	2.00	inches
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.0200	ft. vert. / ft. horiz
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.0000	ft. vert. / ft. horiz
Manning's Roughness for Street Section	n_{STREET} =	0.0150	

		Minor Storm	Major Storm	
Max. Allowable Water Spread for Minor & Major Storm	T_{MAX} =	12.0	17.0	ft
Max. Allowable Depth at Gutter Flow Line for Minor & Major Storm	d_{MAX} =	6.00	7.00	inches
Allow Flow Depth at Street Crown (leave blank for no)				X = yes

Maximum Gutter Capacity Based On Allowable Water Spread

		Minor Storm	Major Storm	
Gutter Cross Slope (Eq. ST-8)	S_W =	0.1033	0.1033	ft/ft
Water Depth without Gutter Depression (Eq. ST-2)	y =	2.88	4.08	inches
Water Depth with a Gutter Depression	d =	4.88	6.08	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	10.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.522	0.371	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Water Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	

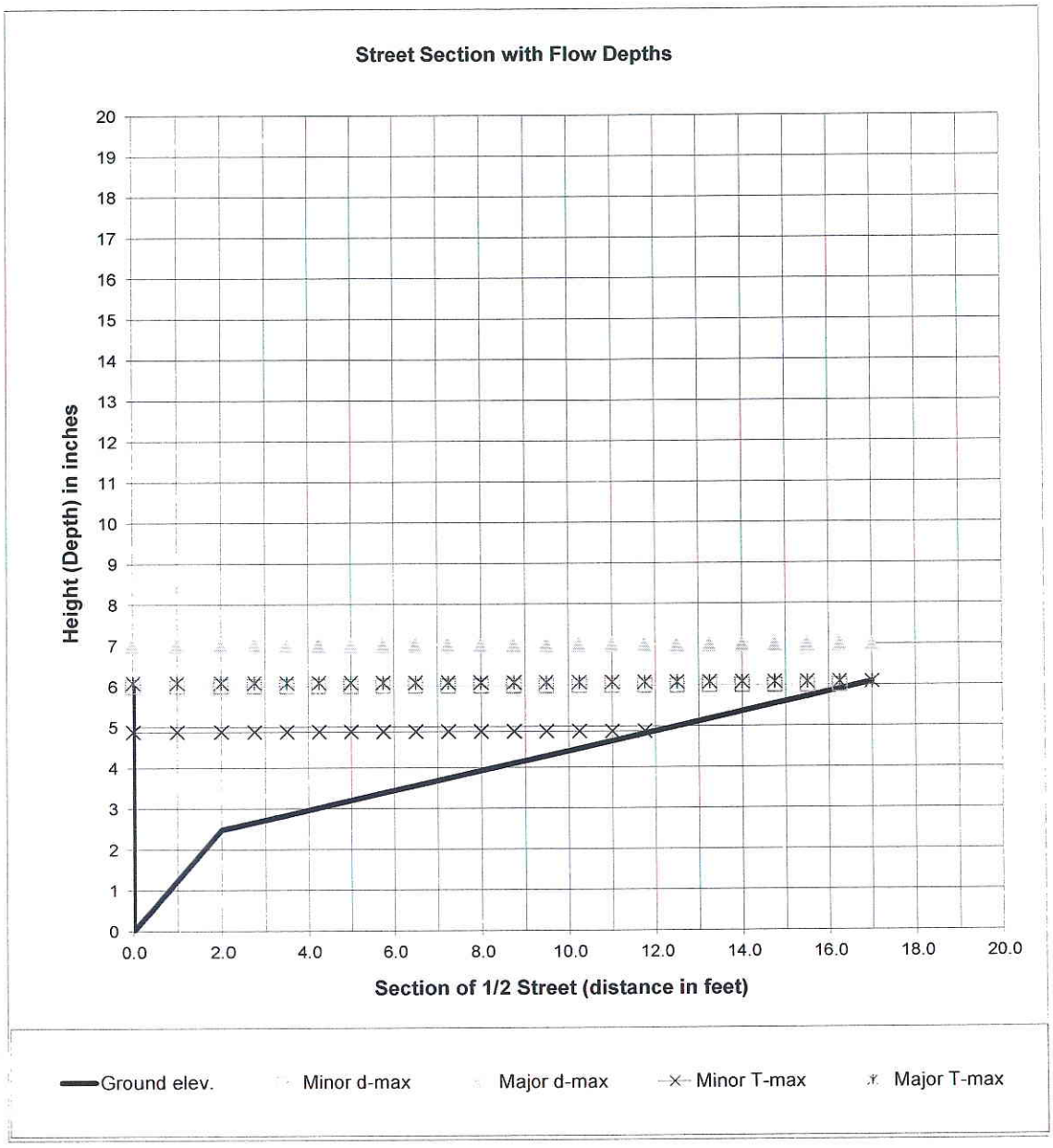
Maximum Gutter Capacity Based on Allowable Gutter Depth

		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	16.7	20.8	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	14.7	18.8	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.378	0.300	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm	**Q =**	**0.0**	**0.0**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	SUMP	SUMP	
Max Flow Based on Allow. Gutter Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

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

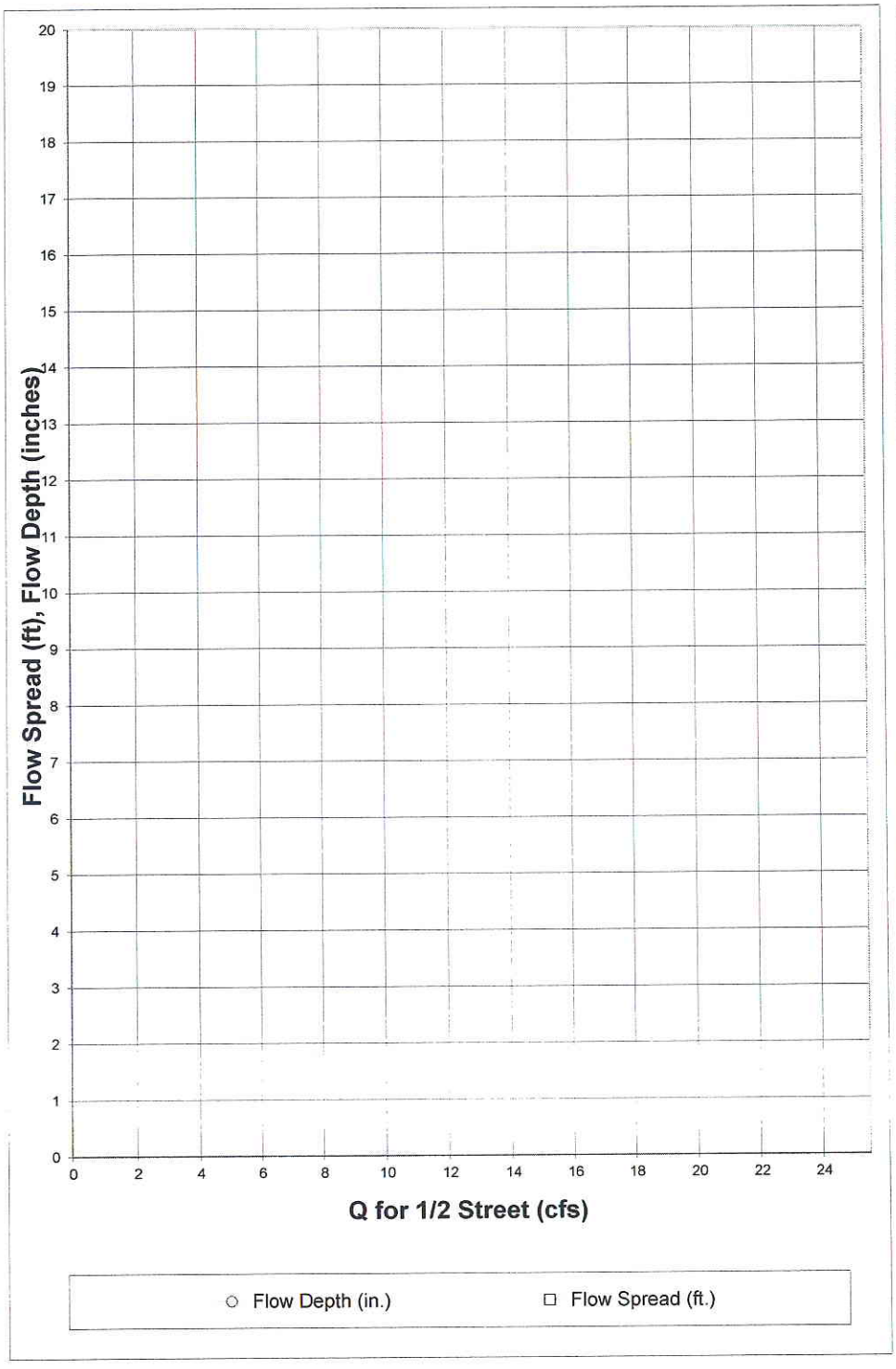
MINOR STORM max. allowable capacity OK - greater than flow given on sheet 'Q-Peak'

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



$$Q_x = \frac{0.56}{n} S_x^{5/3} S_L^{1/2} T_x^{8/3} \qquad E_o = \frac{1}{1 + \dfrac{S_w / S_x}{\left[1 + \dfrac{S_w / S_x}{(T/W) - 1}\right]^{8/3} - 1}}$$

$$Q = \frac{Q_x}{1 - E_o}; \; Q_w = Q - Q_x$$



Q for 1/2 Street (cfs)	Flow Depth (in.)	Flow Spread (ft.)
0.00		
0.25		
0.50		
0.75		
1.00		
1.25		
1.50		
1.75		
2.00		
2.25		
2.50		
2.75		
3.00		
3.25		
3.50		
3.75		
4.00		
4.25		
4.50		
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5.00		
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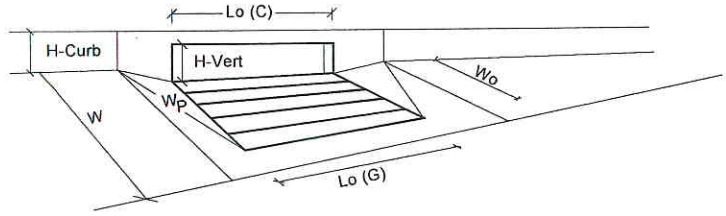
8.25		
8.50		
8.75		
9.00		
9.25		
9.50		
9.75		
10.00		
10.25		
10.50		
10.75		
11.00		
11.25		
11.50		
11.75		
12.00		
12.25		
12.50		

INLET IN A SUMP OR SAG LOCATION

Project = Erie Highlands- Phase 1

Inlet ID = DP-17

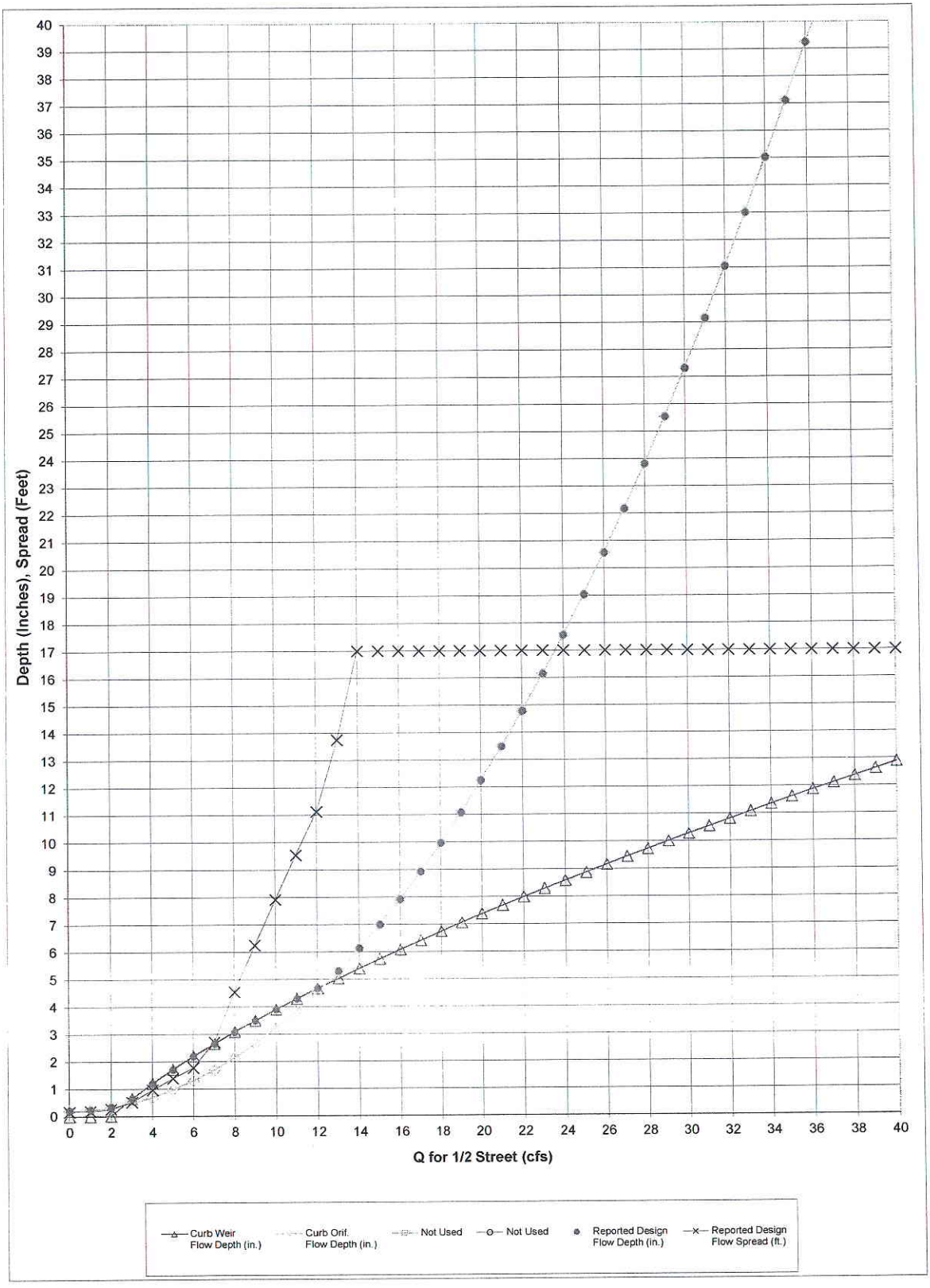


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 3.00)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.67)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	5.00	5.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	4.95	4.95	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.4	63.4	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.30-3.00)	C_w (C) =	2.30	2.30	
Curb Opening Orifice Coefficient (typical value 0.67)	C_o (C) =	0.67	0.67	

Resulting Gutter Flow Depth for Grate Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate as a Weir				
Flow Depth at Local Depression without Clogging (0 cfs grate, 2.5 cfs curb)	d_{wi} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb-un}$ =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 2.5 cfs curb)	d_{wa} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb-cl}$ =	N/A	N/A	inches
Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 2.5 cfs curb)	d_{oi} =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 2.5 cfs curb)	d_{oa} =	N/A	N/A	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a-Grate}$ =**	**N/A**	**N/A**	**inches**

Resulting Gutter Flow Depth for Curb Opening Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Curb as a Weir, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 2.5 cfs curb)	d_{wi} =	2.23	4.88	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 2.5 cfs curb)	d_{wa} =	2.34	5.13	inches
Curb as an Orifice, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 2.5 cfs curb)	d_{oi} =	2.37	3.81	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 2.5 cfs curb)	d_{oa} =	2.40	4.19	inches
Resulting Gutter Flow Depth Outside of Local Depression	**d_{a-Curb} =**	**0.40**	**3.13**	**inches**

Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	10.0	10.0	feet
Total Inlet Interception Capacity (Design Discharge from *Q-Peak*)	Q_a =	2.5	8.1	cfs
Resultant Gutter Flow Depth (based on sheet *Q-Allow* geometry)	**d =**	**0.40**	**3.13**	**inches**
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	**T =**	**0.3**	**4.7**	**feet**
Resultant Flow Depth at Street Crown	**d_{CROWN} =**	**0.00**	**0.00**	**inches**


Depth (Inches), Spread (Feet)
Q for 1/2 Street (cfs)
Curb Weir Flow Depth (in.)
Curb Orif. Flow Depth (in.)
Not Used
Not Used
Reported Design Flow Depth (in.)
Reported Design Flow Spread (ft.)

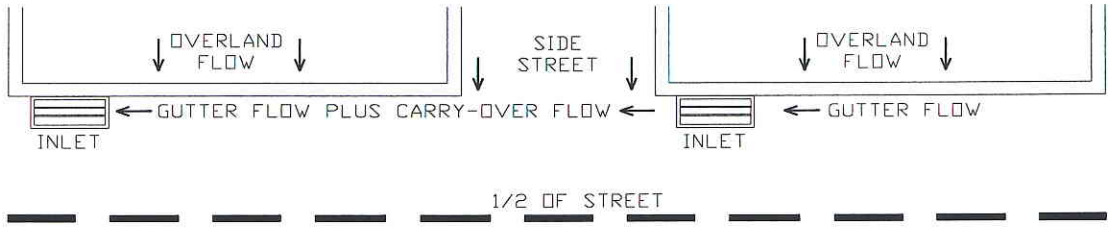
Q Intercepted (cfs)	Curb Weir Flow Depth (in.)	Curb Orif. Flow Depth (in.)	Not Used	Not Used	Reported Design Flow Depth (in.)	Reported DesignFlow Spread (ft.)
0.00	0.00	0.21			0.21	0.17
1.00	0.00	0.24			0.24	0.19
2.00	0.02	0.33			0.33	0.27
3.00	0.65	0.48			0.65	0.52
4.00	1.20	0.69			1.20	0.97
5.00	1.72	0.97			1.72	1.39
6.00	2.20	1.30			2.20	1.77
7.00	2.65	1.69			2.65	2.71
8.00	3.09	2.14			3.09	4.54
9.00	3.50	2.65			3.50	6.25
10.00	3.90	3.22			3.90	7.92
11.00	4.29	3.86			4.29	9.54
12.00	4.67	4.55			4.67	11.12
13.00	5.03	5.30			5.30	13.75
14.00	5.39	6.12			6.12	17.00
15.00	5.74	6.99			6.99	17.00
16.00	6.08	7.92			7.92	17.00
17.00	6.41	8.92			8.92	17.00
18.00	6.74	9.97			9.97	17.00
19.00	7.06	11.08			11.08	17.00
20.00	7.37	12.26			12.26	17.00
21.00	7.68	13.49			13.49	17.00
22.00	7.99	14.79			14.79	17.00
23.00	8.29	16.14			16.14	17.00
24.00	8.58	17.56			17.56	17.00
25.00	8.87	19.04			19.04	17.00
26.00	9.16	20.57			20.57	17.00
27.00	9.45	22.17			22.17	17.00
28.00	9.73	23.82			23.82	17.00
29.00	10.01	25.54			25.54	17.00
30.00	10.28	27.32			27.32	17.00
31.00	10.55	29.15			29.15	17.00
32.00	10.82	31.05			31.05	17.00
33.00	11.09	33.01			33.01	17.00
34.00	11.35	35.03			35.03	17.00
35.00	11.61	37.11			37.11	17.00
36.00	11.87	39.24			39.24	17.00
37.00	12.12	41.44			41.44	17.00
38.00	12.38	43.70			43.70	17.00
39.00	12.63	46.02			46.02	17.00
40.00	12.88	48.40			48.40	17.00

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

Erie Highlands- Phase 1

DP-18

Design Flow = Gutter Flow + Carry-over Flow



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

	Minor Storm	Major Storm	
*Q =	7.90	24.50	cfs

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

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site: (Check One Box Only)

Site is Urban:	X
Site Is Non-Urban:	

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Gutter Flow =		

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

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

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

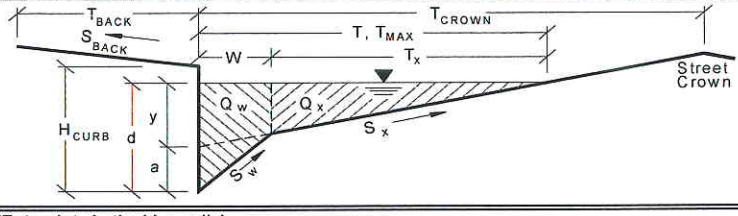
	Minor Storm	Major Storm	
Calculated Design Storm Runoff Coefficient, C =	N/A	N/A	
Calculated 5-yr. Runoff Coefficient, C5 =	N/A	N/A	
Overland Flow Velocity, V_O =	N/A	N/A	fps
Gutter Flow Velocity, V_G =	N/A	N/A	fps
Overland Flow Time, t_O =	N/A	N/A	minutes
Gutter Flow Time, t_G =	N/A	N/A	minutes
Calculated Time of Concentration, T_c =	N/A	N/A	minutes
Time of Concentration by Regional Formula, T_c =	N/A	N/A	minutes
Recommended T_c =	N/A	N/A	minutes
Time of Concentration Selected by User, T_c =	**N/A**	**N/A**	**minutes**
Design Rainfall Intensity, I =	N/A	N/A	inch/hr
Calculated Local Peak Flow, Q_p =	N/A	N/A	cfs
Total Design Peak Flow, Q =	**7.90**	**24.50**	**cfs**

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

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

Project: Erie Highlands- Phase 1

Inlet ID: DP-18



Gutter Geometry (Enter data in the blue cells)			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.0200	ft. vert. / ft. horiz
Manning's Roughness Behind Curb	n_{BACK} =	0.0350	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Depression	a =	2.00	inches
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.0300	ft. vert. / ft. horiz
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.0000	ft. vert. / ft. horiz
Manning's Roughness for Street Section	n_{STREET} =	0.0150	

		Minor Storm	Major Storm	
Max. Allowable Water Spread for Minor & Major Storm	T_{MAX} =	12.0	17.0	ft
Max. Allowable Depth at Gutter Flow Line for Minor & Major Storm	d_{MAX} =	6.00	10.00	inches
Allow Flow Depth at Street Crown (leave blank for no)				X = yes

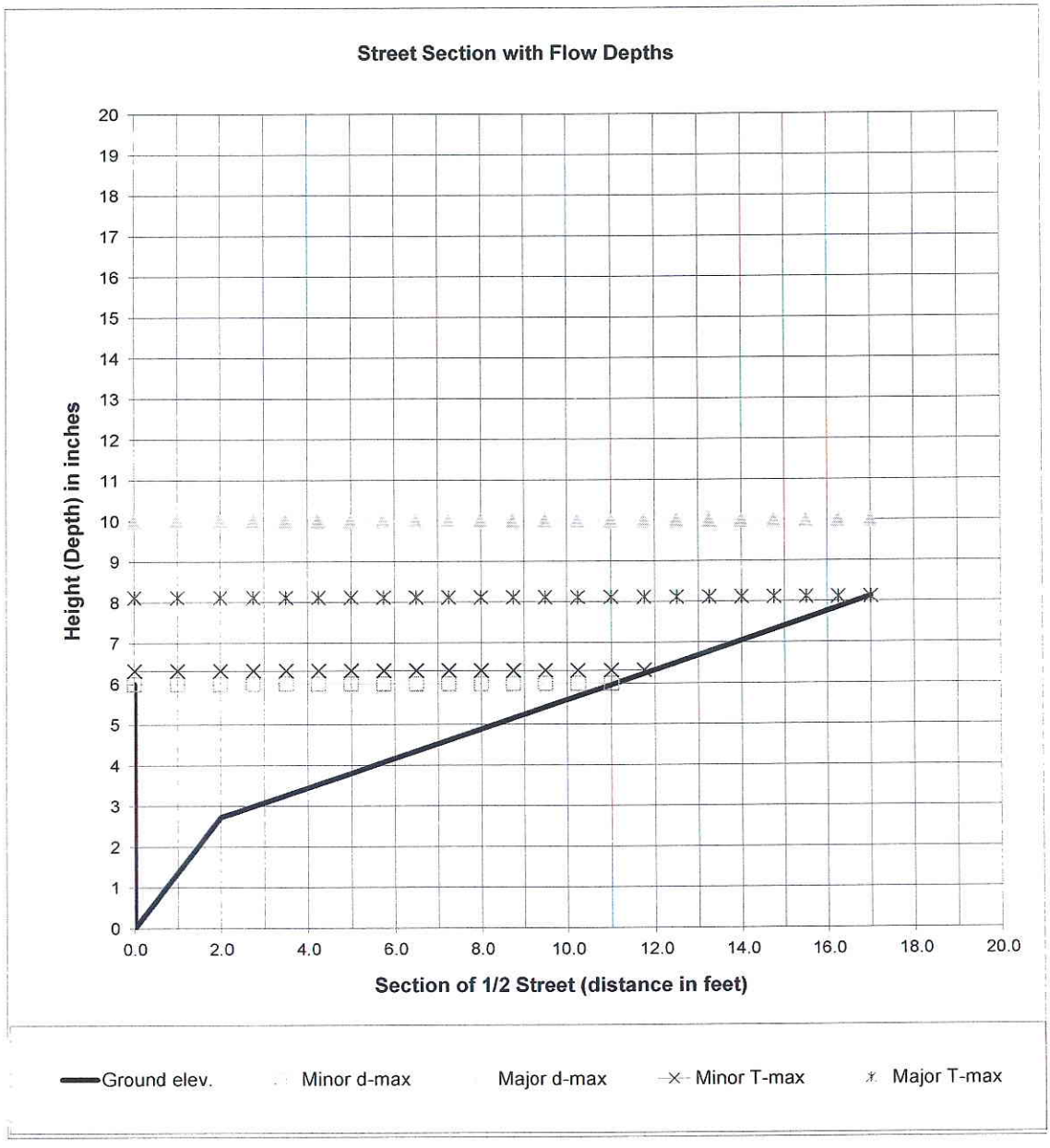
Maximum Gutter Capacity Based On Allowable Water Spread		Minor Storm	Major Storm	
Gutter Cross Slope (Eq. ST-8)	S_W =	0.1133	0.1133	ft/ft
Water Depth without Gutter Depression (Eq. ST-2)	y =	4.32	6.12	inches
Water Depth with a Gutter Depression	d =	6.32	8.12	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	10.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.480	0.342	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Water Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Gutter Capacity Based on Allowable Gutter Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	11.1	22.2	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	9.1	20.2	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.515	0.261	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm	**Q =**	**0.0**	**0.0**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	SUMP	SUMP	
Max Flow Based on Allow. Gutter Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

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

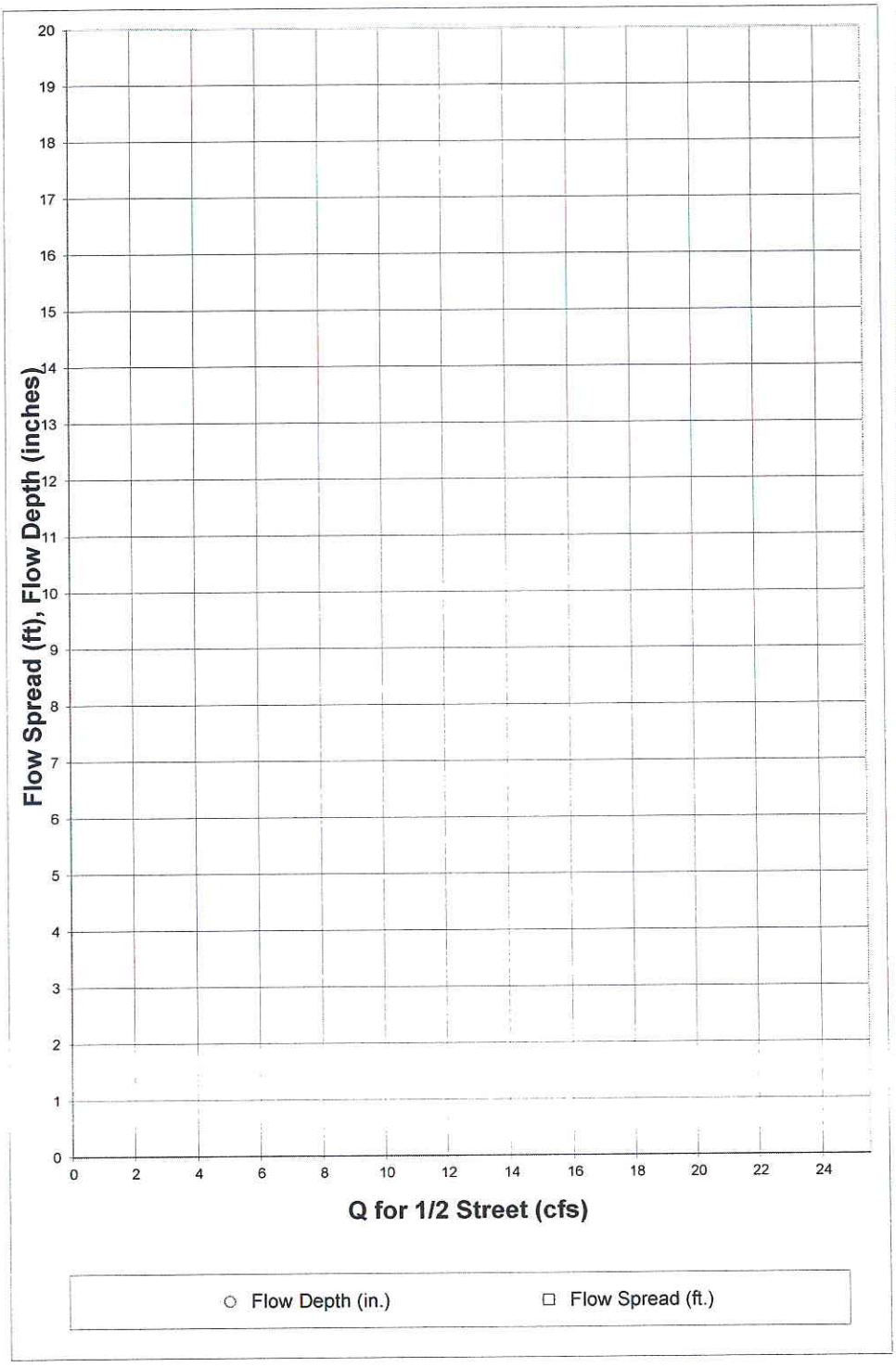
MINOR STORM max. allowable capacity OK - greater than flow given on sheet 'Q-Peak'

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



$$Q_x = \frac{0.56}{n} S_x^{5/3} S_L^{1/2} T_x^{8/3} \qquad E_o = \frac{1}{1 + \dfrac{S_w / S_x}{\left[1 + \dfrac{S_w / S_x}{(T/W) - 1}\right]^{8/3} - 1}}$$

$$Q = \frac{Q_x}{1 - E_o}; \; Q_w = Q - Q_x$$



Q for 1/2 Street (cfs)	Flow Depth (in.)	Flow Spread (ft.)
0.00		
0.25		
0.50		
0.75		
1.00		
1.25		
1.50		
1.75		
2.00		
2.25		
2.50		
2.75		
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11.00		
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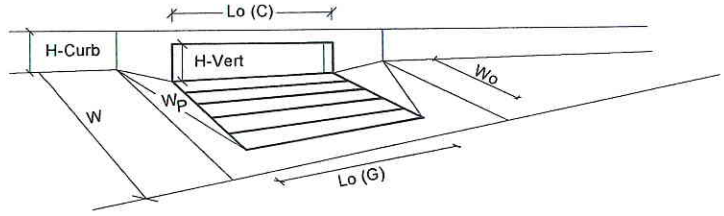
11.50		
11.75		
12.00		
12.25		
12.50		

INLET IN A SUMP OR SAG LOCATION

Project = Erie Highlands- Phase 1

Inlet ID = DP-18

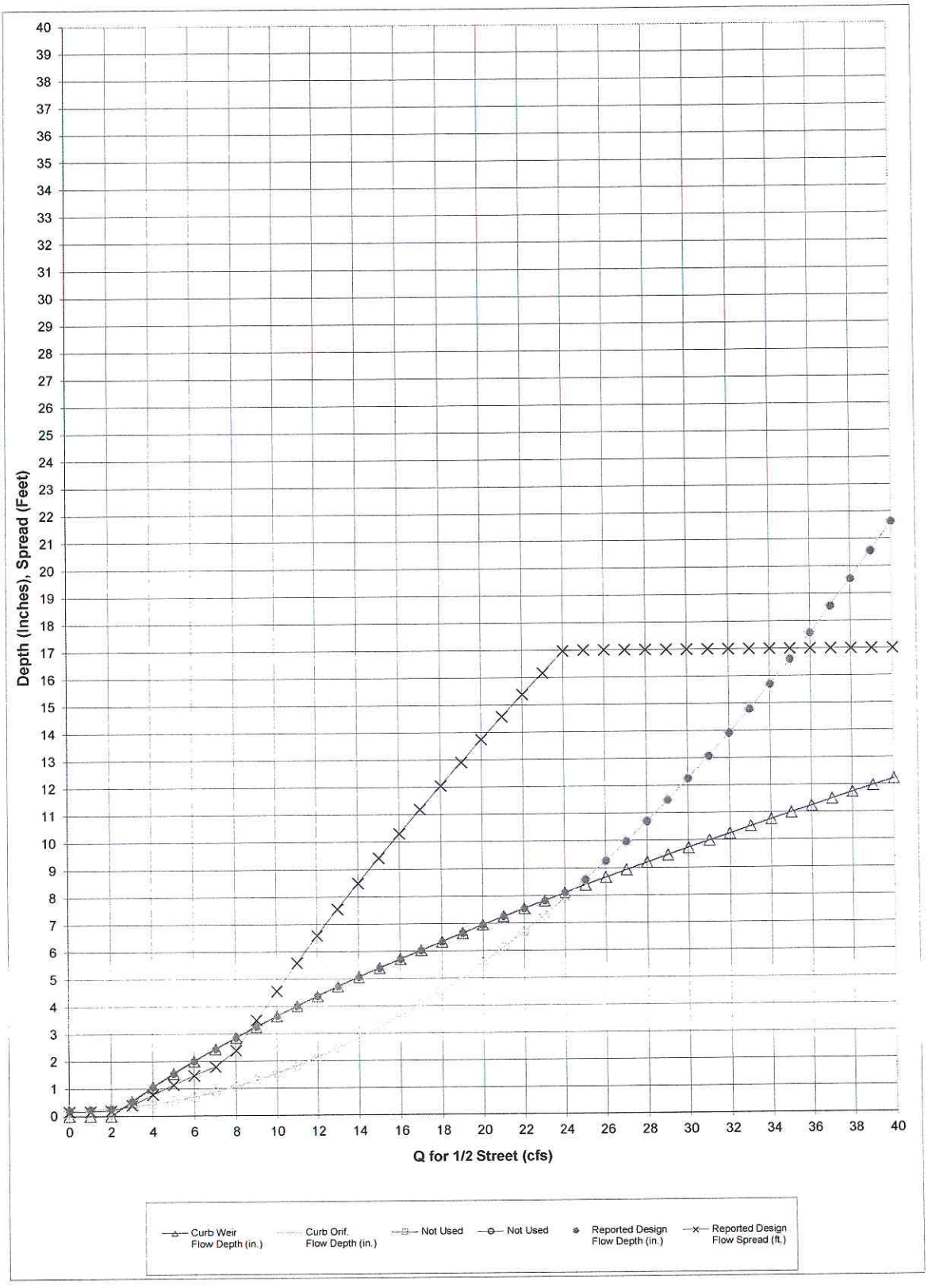


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 3.00)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.67)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	15.00	15.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	5.00	5.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	4.95	4.95	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.4	63.4	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.30-3.00)	C_w (C) =	2.30	2.30	
Curb Opening Orifice Coefficient (typical value 0.67)	C_o (C) =	0.67	0.67	

Resulting Gutter Flow Depth for Grate Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate as a Weir				
Flow Depth at Local Depression without Clogging (0 cfs grate, 7.9 cfs curb)	d_{wi} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb-un}$ =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 7.9 cfs curb)	d_{wa} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb-cl}$ =	N/A	N/A	inches
Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 7.9 cfs curb)	d_{oi} =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 7.9 cfs curb)	d_{oa} =	N/A	N/A	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a-Grate}$ =**	**N/A**	**N/A**	**inches**

Resulting Gutter Flow Depth for Curb Opening Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Curb as a Weir, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 7.9 cfs curb)	d_{wi} =	4.49	9.55	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 7.9 cfs curb)	d_{wa} =	4.82	10.25	inches
Curb as an Orifice, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 7.9 cfs curb)	d_{oi} =	2.89	8.72	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 7.9 cfs curb)	d_{oa} =	3.05	10.25	inches
Resulting Gutter Flow Depth Outside of Local Depression	**d_{a-Curb} =**	**2.82**	**8.25**	**inches**

Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	15.0	15.0	feet
Total Inlet Interception Capacity (Design Discharge from *Q-Peak*)	Q_a =	7.9	24.5	cfs
Resultant Gutter Flow Depth (based on sheet *Q-Allow* geometry)	**d =**	**2.82**	**8.25**	**inches**
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	**T =**	**2.3**	**17.0**	**ft. >T-Crown**
Resultant Flow Depth at Street Crown	**d_{CROWN} =**	**0.00**	**0.12**	**inches**


Depth (Inches), Spread (Feet)
Q for 1/2 Street (cfs)
Curb Weir Flow Depth (in.)
Curb Orif. Flow Depth (in.)
Not Used
Not Used
Reported Design Flow Depth (in.)
Reported Design Flow Spread (ft.)

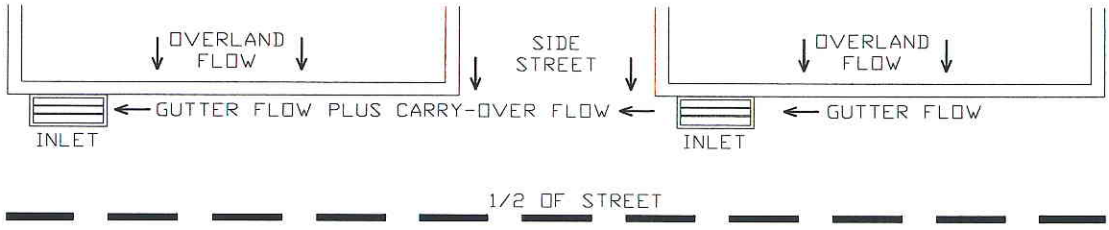
Q Intercepted (cfs)	Curb Weir Flow Depth (in.)	Curb Orif. Flow Depth (in.)	Not Used	Not Used	Reported Design Flow Depth (in.)	Reported DesignFlow Spread (ft.)
0.00	0.00	0.21			0.21	0.15
1.00	0.00	0.23			0.23	0.17
2.00	0.00	0.27			0.27	0.20
3.00	0.53	0.33			0.53	0.39
4.00	1.06	0.43			1.06	0.78
5.00	1.55	0.55			1.55	1.14
6.00	2.01	0.69			2.01	1.48
7.00	2.44	0.87			2.44	1.79
8.00	2.86	1.07			2.86	2.39
9.00	3.26	1.30			3.26	3.50
10.00	3.64	1.55			3.64	4.55
11.00	4.01	1.83			4.01	5.58
12.00	4.37	2.14			4.37	6.58
13.00	4.72	2.47			4.72	7.55
14.00	5.06	2.84			5.06	8.50
15.00	5.39	3.22			5.39	9.42
16.00	5.71	3.64			5.71	10.30
17.00	6.03	4.08			6.03	11.19
18.00	6.34	4.55			6.34	12.05
19.00	6.65	5.04			6.65	12.92
20.00	6.95	5.57			6.95	13.75
21.00	7.25	6.12			7.25	14.58
22.00	7.54	6.69			7.54	15.39
23.00	7.82	7.29			7.82	16.17
24.00	8.11	7.92			8.11	16.97
25.00	8.39	8.58			8.58	17.00
26.00	8.66	9.26			9.26	17.00
27.00	8.93	9.97			9.97	17.00
28.00	9.20	10.71			10.71	17.00
29.00	9.47	11.47			11.47	17.00
30.00	9.73	12.26			12.26	17.00
31.00	9.99	13.08			13.08	17.00
32.00	10.24	13.92			13.92	17.00
33.00	10.50	14.79			14.79	17.00
34.00	10.75	15.69			15.69	17.00
35.00	11.00	16.61			16.61	17.00
36.00	11.24	17.56			17.56	17.00
37.00	11.49	18.54			18.54	17.00
38.00	11.73	19.54			19.54	17.00
39.00	11.97	20.57			20.57	17.00
40.00	12.21	21.63			21.63	17.00

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

Erie Highlands- Phase 1

DP-19

Design Flow = Gutter Flow + Carry-over Flow



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

	Minor Storm	Major Storm	
*Q =	6.50	27.00	cfs

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

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site: (Check One Box Only)

Site is Urban:	X
Site Is Non-Urban:	

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Gutter Flow =		

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

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

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

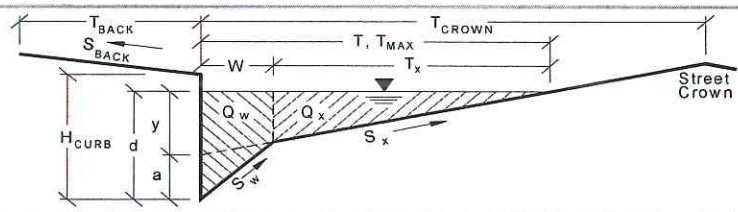
	Minor Storm	Major Storm	
Calculated Design Storm Runoff Coefficient, C =	N/A	N/A	
Calculated 5-yr. Runoff Coefficient, C5 =	N/A	N/A	
Overland Flow Velocity, V_O =	N/A	N/A	fps
Gutter Flow Velocity, V_G =	N/A	N/A	fps
Overland Flow Time, t_O =	N/A	N/A	minutes
Gutter Flow Time, t_G =	N/A	N/A	minutes
Calculated Time of Concentration, T_c =	N/A	N/A	minutes
Time of Concentration by Regional Formula, T_c =	N/A	N/A	minutes
Recommended T_c =	N/A	N/A	minutes
Time of Concentration Selected by User, T_c =	**N/A**	**N/A**	**minutes**
Design Rainfall Intensity, I =	N/A	N/A	inch/hr
Calculated Local Peak Flow, Q_p =	N/A	N/A	cfs
Total Design Peak Flow, Q =	**6.50**	**27.00**	**cfs**

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

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

Project: Erie Highlands- Phase 1

Inlet ID: DP-19



Gutter Geometry (Enter data in the blue cells)			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.0200	ft. vert. / ft. horiz
Manning's Roughness Behind Curb	n_{BACK} =	0.0350	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Depression	a =	2.00	inches
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.0200	ft. vert. / ft. horiz
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.0000	ft. vert. / ft. horiz
Manning's Roughness for Street Section	n_{STREET} =	0.0150	

		Minor Storm	Major Storm	
Max. Allowable Water Spread for Minor & Major Storm	T_{MAX} =	12.0	17.0	ft
Max. Allowable Depth at Gutter Flow Line for Minor & Major Storm	d_{MAX} =	6.00	12.00	inches
Allow Flow Depth at Street Crown (leave blank for no)				X = yes

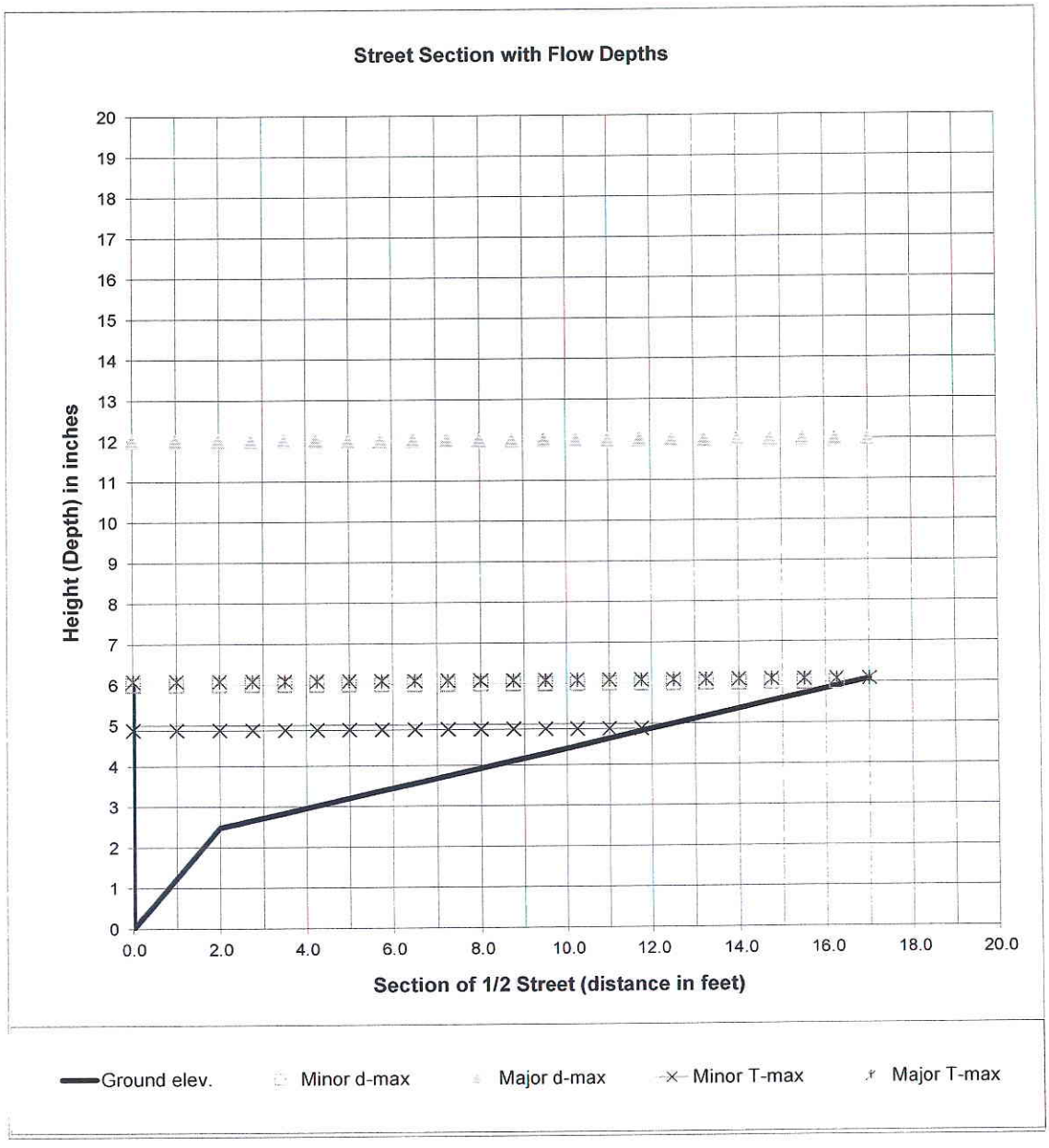
Maximum Gutter Capacity Based On Allowable Water Spread		Minor Storm	Major Storm	
Gutter Cross Slope (Eq. ST-8)	S_W =	0.1033	0.1033	ft/ft
Water Depth without Gutter Depression (Eq. ST-2)	y =	2.88	4.08	inches
Water Depth with a Gutter Depression	d =	4.88	6.08	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	10.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.522	0.371	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Water Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Gutter Capacity Based on Allowable Gutter Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	16.7	41.7	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	14.7	39.7	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.378	0.142	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm	**Q =**	**0.0**	**0.0**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	SUMP	SUMP	
Max Flow Based on Allow. Gutter Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

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

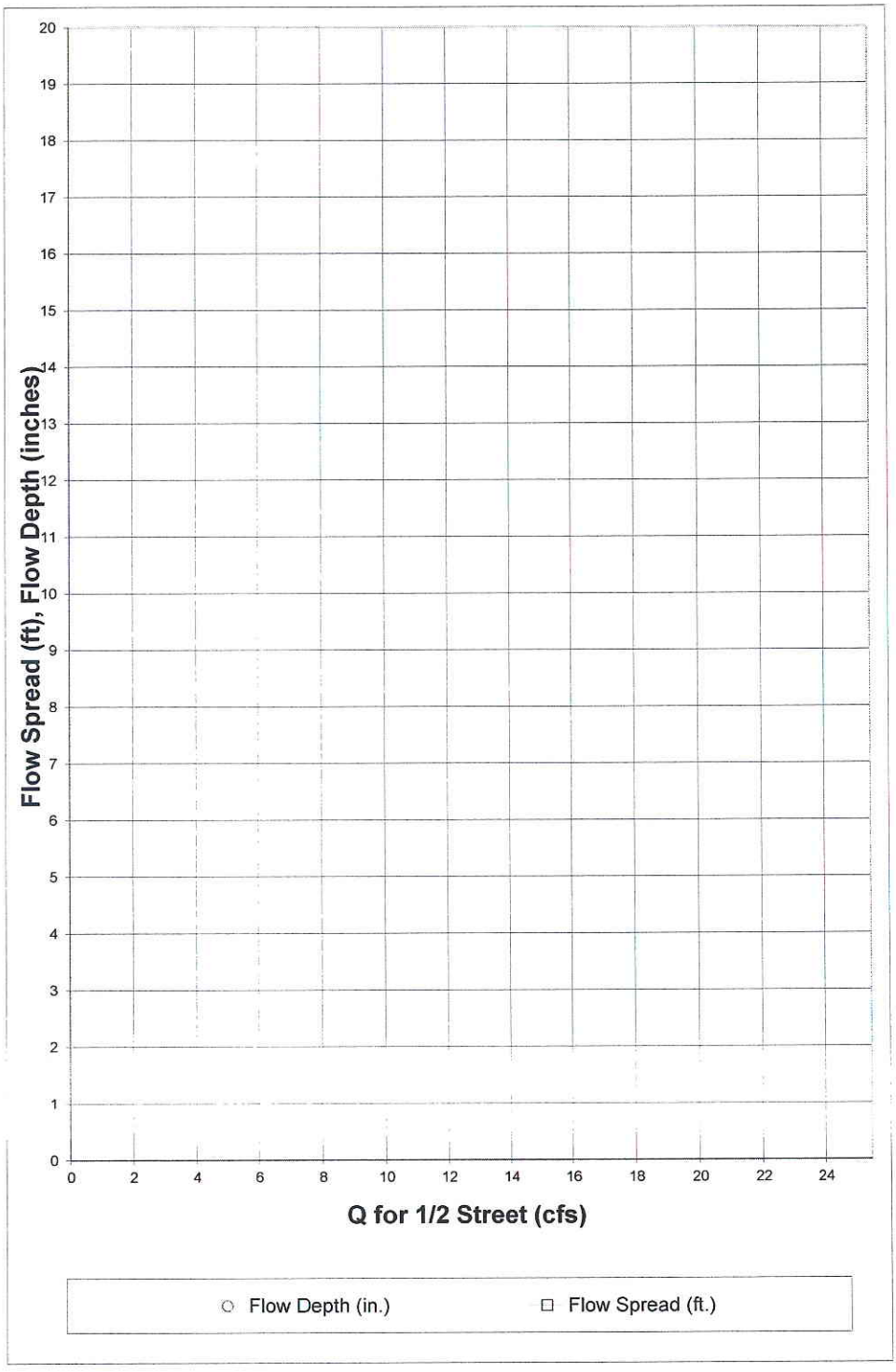
MINOR STORM max. allowable capacity OK - greater than flow given on sheet 'Q-Peak'

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



$$Q_x = \frac{0.56}{n} S_x^{5/3} S_L^{1/2} T_x^{8/3} \qquad E_o = \frac{1}{1 + \dfrac{S_w / S_x}{\left[1 + \dfrac{S_w / S_x}{(T/W) - 1}\right]^{8/3} - 1}}$$

$$Q = \frac{Q_x}{1 - E_o}; \; Q_w = Q - Q_x$$



Q for 1/2 Street (cfs)	Flow Depth (in.)	Flow Spread (ft.)
0.00		
0.25		
0.50		
0.75		
1.00		
1.25		
1.50		
1.75		
2.00		
2.25		
2.50		
2.75		
3.00		
3.25		
3.50		
3.75		
4.00		
4.25		
4.50		
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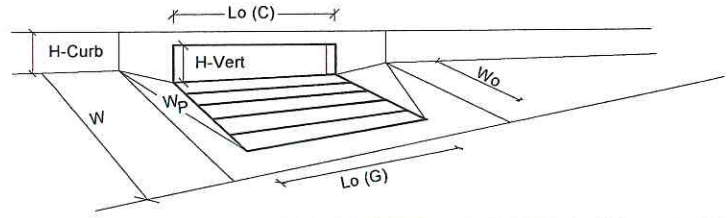
8.25		
8.50		
8.75		
9.00		
9.25		
9.50		
9.75		
10.00		
10.25		
10.50		
10.75		
11.00		
11.25		
11.50		
11.75		
12.00		
12.25		
12.50		

INLET IN A SUMP OR SAG LOCATION

Project = Erie Highlands- Phase 1

Inlet ID = DP-19

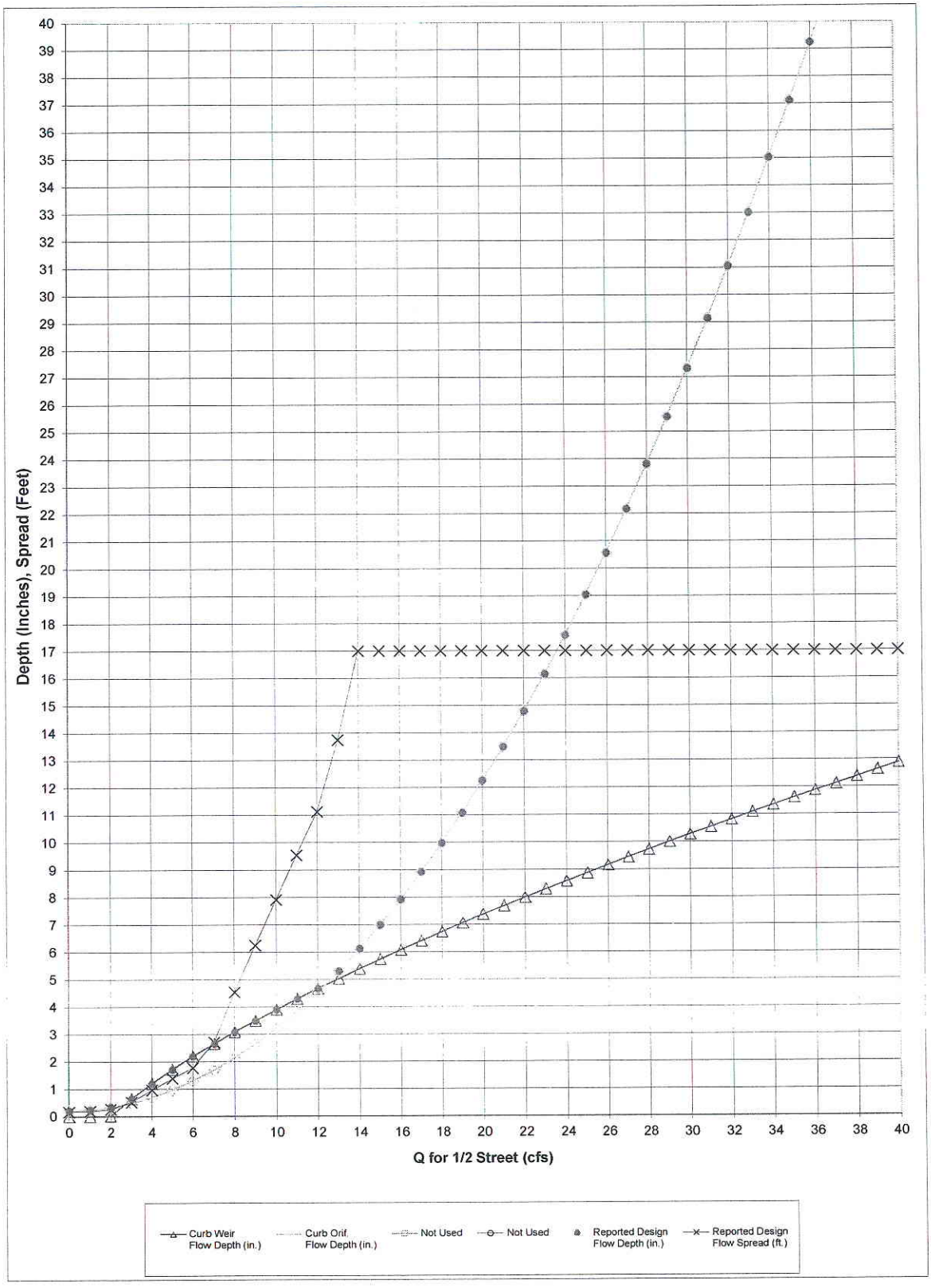


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 3.00)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.67)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	5.00	5.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	4.95	4.95	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.4	63.4	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.30-3.00)	C_w (C) =	2.30	2.30	
Curb Opening Orifice Coefficient (typical value 0.67)	C_o (C) =	0.67	0.67	

Resulting Gutter Flow Depth for Grate Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate as a Weir				
Flow Depth at Local Depression without Clogging (0 cfs grate, 6.5 cfs curb)	d_{wi} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}un}$ =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 6.5 cfs curb)	d_{wa} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}cl}$ =	N/A	N/A	inches
Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 6.5 cfs curb)	d_{oi} =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 6.5 cfs curb)	d_{oa} =	N/A	N/A	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Grate}$ =**	**N/A**	**N/A**	**inches**

Resulting Gutter Flow Depth for Curb Opening Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Curb as a Weir, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 6.5 cfs curb)	d_{wi} =	4.21	10.88	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 6.5 cfs curb)	d_{wa} =	4.43	11.45	inches
Curb as an Orifice, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 6.5 cfs curb)	d_{oi} =	3.24	20.00	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 6.5 cfs curb)	d_{oa} =	3.49	24.17	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Curb}$ =**	**2.43**	**22.17**	**inches**

Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	10.0	10.0	feet
Total Inlet Interception Capacity (Design Discharge from *Q-Peak*)	Q_a =	6.5	27.0	cfs
Resultant Gutter Flow Depth (based on sheet *Q-Allow* geometry)	**d =**	**2.43**	**22.17**	**inches**
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	**T =**	**2.0**	**17.0**	**ft. >T-Crown**
Resultant Flow Depth at Street Crown	**d_{CROWN} =**	**0.00**	**16.08**	**inches**


Depth (Inches), Spread (Feet)
Q for 1/2 Street (cfs)
Curb Weir Flow Depth (in.)
Curb Orif. Flow Depth (in.)
Not Used
Not Used
Reported Design Flow Depth (in.)
Reported Design Flow Spread (ft.)

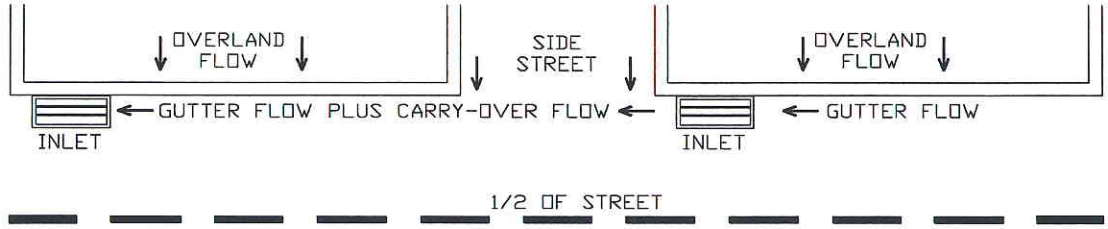
Q Intercepted (cfs)	Curb Weir Flow Depth (in.)	Curb Orif. Flow Depth (in.)	Not Used	Not Used	Reported Design Flow Depth (in.)	Reported DesignFlow Spread (ft.)
0.00	0.00	0.21			0.21	0.17
1.00	0.00	0.24			0.24	0.19
2.00	0.02	0.33			0.33	0.27
3.00	0.65	0.48			0.65	0.52
4.00	1.20	0.69			1.20	0.97
5.00	1.72	0.97			1.72	1.39
6.00	2.20	1.30			2.20	1.77
7.00	2.65	1.69			2.65	2.71
8.00	3.09	2.14			3.09	4.54
9.00	3.50	2.65			3.50	6.25
10.00	3.90	3.22			3.90	7.92
11.00	4.29	3.86			4.29	9.54
12.00	4.67	4.55			4.67	11.12
13.00	5.03	5.30			5.30	13.75
14.00	5.39	6.12			6.12	17.00
15.00	5.74	6.99			6.99	17.00
16.00	6.08	7.92			7.92	17.00
17.00	6.41	8.92			8.92	17.00
18.00	6.74	9.97			9.97	17.00
19.00	7.06	11.08			11.08	17.00
20.00	7.37	12.26			12.26	17.00
21.00	7.68	13.49			13.49	17.00
22.00	7.99	14.79			14.79	17.00
23.00	8.29	16.14			16.14	17.00
24.00	8.58	17.56			17.56	17.00
25.00	8.87	19.04			19.04	17.00
26.00	9.16	20.57			20.57	17.00
27.00	9.45	22.17			22.17	17.00
28.00	9.73	23.82			23.82	17.00
29.00	10.01	25.54			25.54	17.00
30.00	10.28	27.32			27.32	17.00
31.00	10.55	29.15			29.15	17.00
32.00	10.82	31.05			31.05	17.00
33.00	11.09	33.01			33.01	17.00
34.00	11.35	35.03			35.03	17.00
35.00	11.61	37.11			37.11	17.00
36.00	11.87	39.24			39.24	17.00
37.00	12.12	41.44			41.44	17.00
38.00	12.38	43.70			43.70	17.00
39.00	12.63	46.02			46.02	17.00
40.00	12.88	48.40			48.40	17.00

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

Erie Highlands- Phase 1

DP-20

Design Flow = Gutter Flow + Carry-over Flow



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

	Minor Storm	Major Storm	
*Q =	4.80	19.00	cfs

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

Subcatchment Area =		Acres
Percent Imperviousness =		%
NRCS Soil Type =		A, B, C, or D

Site: (Check One Box Only)

Site is Urban:	X
Site Is Non-Urban:	

	Slope (ft/ft)	Length (ft)
Overland Flow =		
Gutter Flow =		

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

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

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

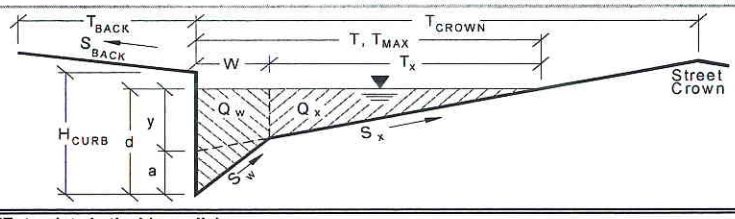
	Minor Storm	Major Storm	
Calculated Design Storm Runoff Coefficient, C =	N/A	N/A	
Calculated 5-yr. Runoff Coefficient, C5 =	N/A	N/A	
Overland Flow Velocity, V_O =	N/A	N/A	fps
Gutter Flow Velocity, V_G =	N/A	N/A	fps
Overland Flow Time, t_O =	N/A	N/A	minutes
Gutter Flow Time, t_G =	N/A	N/A	minutes
Calculated Time of Concentration, T_c =	N/A	N/A	minutes
Time of Concentration by Regional Formula, T_c =	N/A	N/A	minutes
Recommended T_c =	N/A	N/A	minutes
Time of Concentration Selected by User, T_c =	**N/A**	**N/A**	**minutes**
Design Rainfall Intensity, I =	N/A	N/A	inch/hr
Calculated Local Peak Flow, Q_p =	N/A	N/A	cfs
Total Design Peak Flow, Q =	**4.80**	**19.00**	**cfs**

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

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

Project: Erie Highlands- Phase 1

Inlet ID: DP-20



Gutter Geometry (Enter data in the blue cells)			
Maximum Allowable Width for Spread Behind Curb	T_{BACK} =	10.0	ft
Side Slope Behind Curb (leave blank for no conveyance credit behind curb)	S_{BACK} =	0.0200	ft. vert. / ft. horiz
Manning's Roughness Behind Curb	n_{BACK} =	0.0350	
Height of Curb at Gutter Flow Line	H_{CURB} =	6.00	inches
Distance from Curb Face to Street Crown	T_{CROWN} =	17.0	ft
Gutter Depression	a =	2.00	inches
Gutter Width	W =	2.00	ft
Street Transverse Slope	S_X =	0.0200	ft. vert. / ft. horiz
Street Longitudinal Slope - Enter 0 for sump condition	S_O =	0.0000	ft. vert. / ft. horiz
Manning's Roughness for Street Section	n_{STREET} =	0.0150	

		Minor Storm	Major Storm	
Max. Allowable Water Spread for Minor & Major Storm	T_{MAX} =	12.0	17.0	ft
Max. Allowable Depth at Gutter Flow Line for Minor & Major Storm	d_{MAX} =	6.00	12.00	inches
Allow Flow Depth at Street Crown (leave blank for no)				X = yes

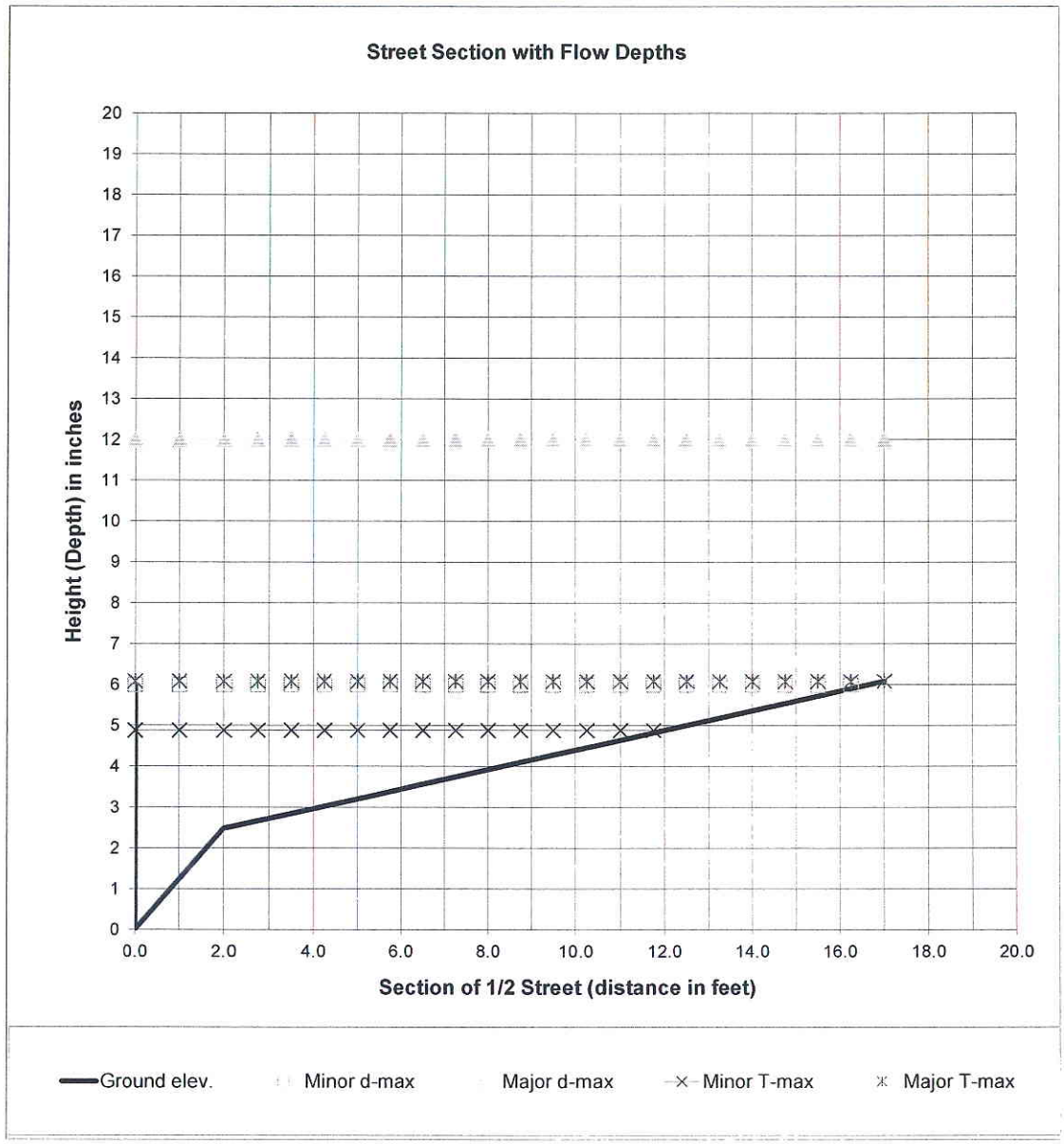
Maximum Gutter Capacity Based On Allowable Water Spread		Minor Storm	Major Storm	
Gutter Cross Slope (Eq. ST-8)	S_W =	0.1033	0.1033	ft/ft
Water Depth without Gutter Depression (Eq. ST-2)	y =	2.88	4.08	inches
Water Depth with a Gutter Depression	d =	4.88	6.08	inches
Allowable Spread for Discharge outside the Gutter Section W (T - W)	T_X =	10.0	15.0	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.522	0.371	
Discharge outside the Gutter Section W, carried in Section T_X	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_T - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Maximum Flow Based On Allowable Water Spread	**Q_T =**	**SUMP**	**SUMP**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	

Maximum Gutter Capacity Based on Allowable Gutter Depth		Minor Storm	Major Storm	
Theoretical Water Spread	T_{TH} =	16.7	41.7	ft
Theoretical Spread for Discharge outside the Gutter Section W (T - W)	$T_{X\,TH}$ =	14.7	39.7	ft
Gutter Flow to Design Flow Ratio by FHWA HEC-22 method (Eq. ST-7)	E_O =	0.378	0.142	
Theoretical Discharge outside the Gutter Section W, carried in Section $T_{X\,TH}$	$Q_{X\,TH}$ =	0.0	0.0	cfs
Actual Discharge outside the Gutter Section W, (limited by distance T_{CROWN})	Q_X =	0.0	0.0	cfs
Discharge within the Gutter Section W (Q_d - Q_X)	Q_W =	0.0	0.0	cfs
Discharge Behind the Curb (e.g., sidewalk, driveways, & lawns)	Q_{BACK} =	0.0	0.0	cfs
Total Discharge for Major & Minor Storm	**Q =**	**0.0**	**0.0**	**cfs**
Flow Velocity Within the Gutter Section	V =	0.0	0.0	fps
V*d Product: Flow Velocity Times Gutter Flowline Depth	V*d =	0.0	0.0	
Slope-Based Depth Safety Reduction Factor for Major & Minor (d ≥ 6") Storm	R =	SUMP	SUMP	
Max Flow Based on Allow. Gutter Depth (Safety Factor Applied)	**Q_d =**	**SUMP**	**SUMP**	**cfs**
Resultant Flow Depth at Gutter Flowline (Safety Factor Applied)	d =			inches
Resultant Flow Depth at Street Crown (Safety Factor Applied)	d_{CROWN} =			inches

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

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

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



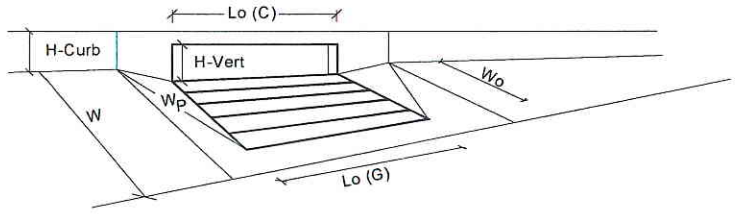
$$Q_x = \frac{0.56}{n} S_x^{5/3} S_L^{1/2} T_x^{8/3} \qquad E_o = \frac{1}{1 + \frac{S_w / S_x}{\left[1 + \frac{S_w / S_x}{(T/W) - 1}\right]^{8/3} - 1}}$$

$$Q = \frac{Q_x}{1 - E_o}; \; Q_w = Q - Q_x$$

INLET IN A SUMP OR SAG LOCATION

Project = Erie Highlands- Phase 1

Inlet ID = DP-20

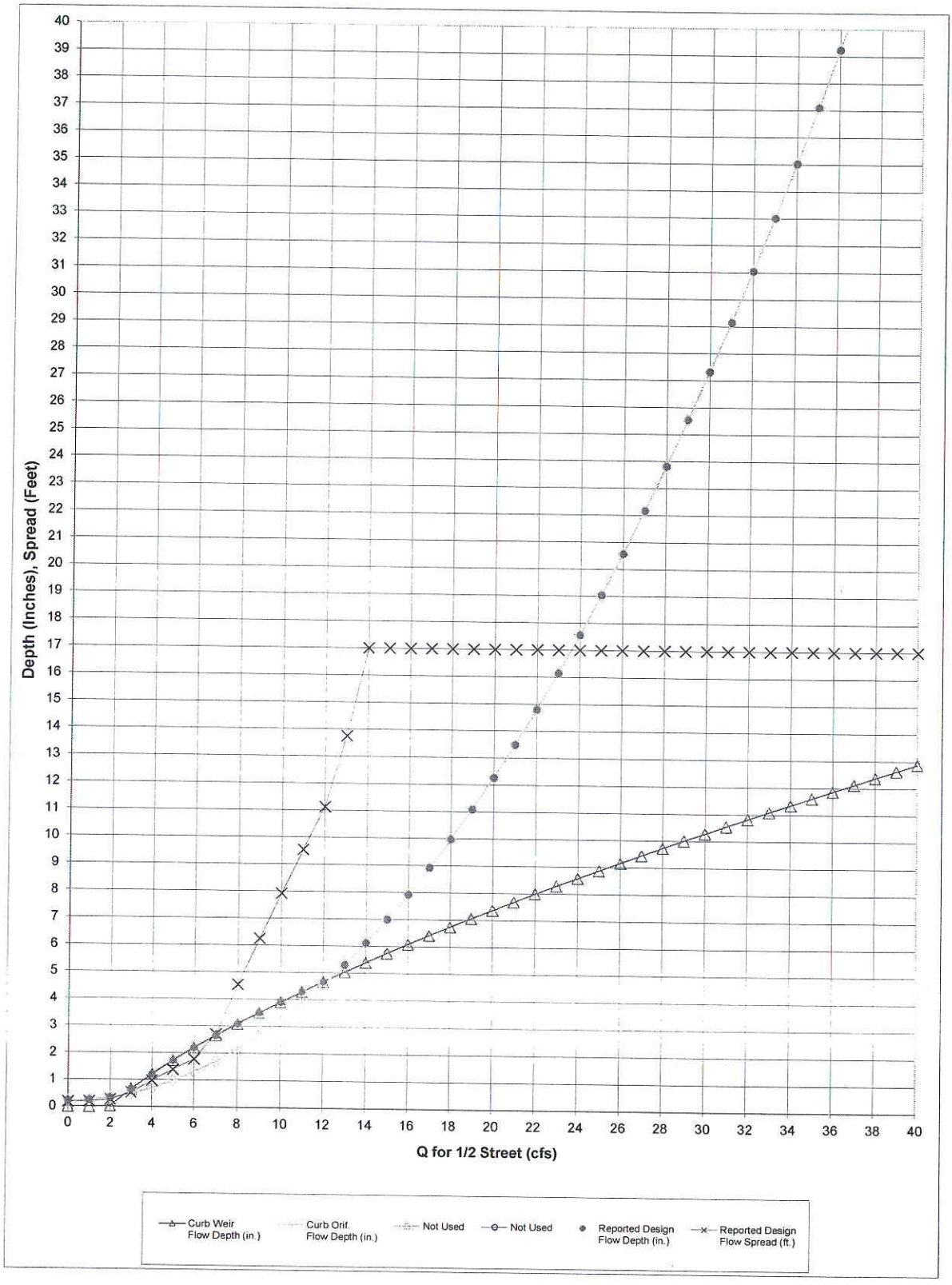


Design Information (Input)		MINOR	MAJOR	
Type of Inlet	Type =	CDOT Type R Curb Opening		
Local Depression (additional to continuous gutter depression 'a' from 'Q-Allow')	a_{local} =	2.00	2.00	inches
Number of Unit Inlets (Grate or Curb Opening)	No =	1	1	
Grate Information		MINOR	MAJOR	
Length of a Unit Grate	L_o (G) =	N/A	N/A	feet
Width of a Unit Grate	W_o =	N/A	N/A	feet
Area Opening Ratio for a Grate (typical values 0.15-0.90)	A_{ratio} =	N/A	N/A	
Clogging Factor for a Single Grate (typical value 0.50 - 0.70)	C_f (G) =	N/A	N/A	
Grate Weir Coefficient (typical value 3.00)	C_w (G) =	N/A	N/A	
Grate Orifice Coefficient (typical value 0.67)	C_o (G) =	N/A	N/A	
Curb Opening Information		MINOR	MAJOR	
Length of a Unit Curb Opening	L_o (C) =	10.00	10.00	feet
Height of Vertical Curb Opening in Inches	H_{vert} =	5.00	5.00	inches
Height of Curb Orifice Throat in Inches	H_{throat} =	4.95	4.95	inches
Angle of Throat (see USDCM Figure ST-5)	Theta =	63.4	63.4	degrees
Side Width for Depression Pan (typically the gutter width of 2 feet)	W_p =	2.00	2.00	feet
Clogging Factor for a Single Curb Opening (typical value 0.10)	C_f (C) =	0.10	0.10	
Curb Opening Weir Coefficient (typical value 2.30-3.00)	C_w (C) =	2.30	2.30	
Curb Opening Orifice Coefficient (typical value 0.67)	C_o (C) =	0.67	0.67	

Resulting Gutter Flow Depth for Grate Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	N/A	N/A	
Clogging Factor for Multiple Units	Clog =	N/A	N/A	
Grate as a Weir				
Flow Depth at Local Depression without Clogging (0 cfs grate, 4.8 cfs curb)	d_{wi} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}un}$ =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 4.8 cfs curb)	d_{wa} =	N/A	N/A	inches
This Row Used for Combination Inlets Only	$d_{curb\text{-}cl}$ =	N/A	N/A	inches
Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 4.8 cfs curb)	d_{oi} =	N/A	N/A	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 4.8 cfs curb)	d_{oa} =	N/A	N/A	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Grate}$ =**	**N/A**	**N/A**	**inches**

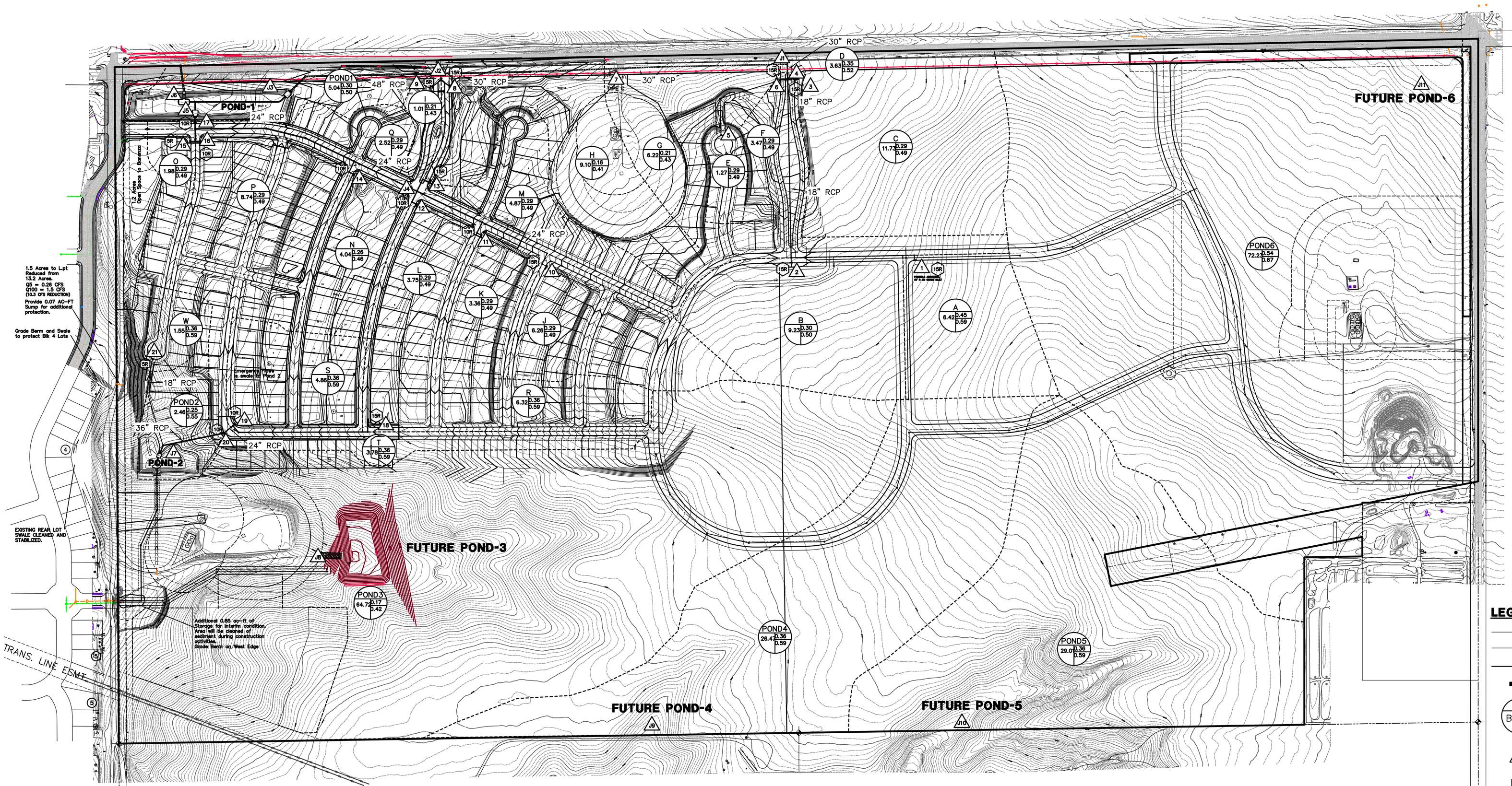
Resulting Gutter Flow Depth for Curb Opening Inlet Capacity in a Sump		MINOR	MAJOR	
Clogging Coefficient for Multiple Units	Coef =	1.00	1.00	
Clogging Factor for Multiple Units	Clog =	0.10	0.10	
Curb as a Weir, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 4.8 cfs curb)	d_{wi} =	3.44	8.61	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 4.8 cfs curb)	d_{wa} =	3.62	9.06	inches
Curb as an Orifice, Grate as an Orifice		MINOR	MAJOR	
Flow Depth at Local Depression without Clogging (0 cfs grate, 4.8 cfs curb)	d_{oi} =	2.78	11.02	inches
Flow Depth at Local Depression with Clogging (0 cfs grate, 4.8 cfs curb)	d_{oa} =	2.91	13.09	inches
Resulting Gutter Flow Depth Outside of Local Depression	**$d_{a\text{-}Curb}$ =**	**1.62**	**11.08**	**inches**

Resultant Street Conditions		MINOR	MAJOR	
Total Inlet Length	L =	10.0	10.0	feet
Total Inlet Interception Capacity (Design Discharge from *Q-Peak*)	Q_a =	4.8	19.0	cfs
Resultant Gutter Flow Depth (based on sheet *Q-Allow* geometry)	**d =**	**1.62**	**11.08**	**inches**
Resultant Street Flow Spread (based on sheet *Q-Allow* geometry)	**T =**	**1.3**	**17.0**	**ft. >T-Crown**
Resultant Flow Depth at Street Crown	**d_{CROWN} =**	**0.00**	**5.04**	**inches**


Depth (Inches), Spread (Feet)
Q for 1/2 Street (cfs)
Curb Weir Flow Depth (in.)
Curb Orif. Flow Depth (in.)
Not Used
Not Used
Reported Design Flow Depth (in.)
Reported Design Flow Spread (ft.)

Q Intercepted (cfs)	Curb Weir Flow Depth (in.)	Curb Orif. Flow Depth (in.)	Not Used	Not Used	Reported Design Flow Depth (in.)	Reported DesignFlow Spread (ft.)
0.00	0.00	0.21			0.21	0.17
1.00	0.00	0.24			0.24	0.19
2.00	0.02	0.33			0.33	0.27
3.00	0.65	0.48			0.65	0.52
4.00	1.20	0.69			1.20	0.97
5.00	1.72	0.97			1.72	1.39
6.00	2.20	1.30			2.20	1.77
7.00	2.65	1.69			2.65	2.71
8.00	3.09	2.14			3.09	4.54
9.00	3.50	2.65			3.50	6.25
10.00	3.90	3.22			3.90	7.92
11.00	4.29	3.86			4.29	9.54
12.00	4.67	4.55			4.67	11.12
13.00	5.03	5.30			5.30	13.75
14.00	5.39	6.12			6.12	17.00
15.00	5.74	6.99			6.99	17.00
16.00	6.08	7.92			7.92	17.00
17.00	6.41	8.92			8.92	17.00
18.00	6.74	9.97			9.97	17.00
19.00	7.06	11.08			11.08	17.00
20.00	7.37	12.26			12.26	17.00
21.00	7.68	13.49			13.49	17.00
22.00	7.99	14.79			14.79	17.00
23.00	8.29	16.14			16.14	17.00
24.00	8.58	17.56			17.56	17.00
25.00	8.87	19.04			19.04	17.00
26.00	9.16	20.57			20.57	17.00
27.00	9.45	22.17			22.17	17.00
28.00	9.73	23.82			23.82	17.00
29.00	10.01	25.54			25.54	17.00
30.00	10.28	27.32			27.32	17.00
31.00	10.55	29.15			29.15	17.00
32.00	10.82	31.05			31.05	17.00
33.00	11.09	33.01			33.01	17.00
34.00	11.35	35.03			35.03	17.00
35.00	11.61	37.11			37.11	17.00
36.00	11.87	39.24			39.24	17.00
37.00	12.12	41.44			41.44	17.00
38.00	12.38	43.70			43.70	17.00
39.00	12.63	46.02			46.02	17.00
40.00	12.88	48.40			48.40	17.00

DEVELOPED DRAINAGE PLAN
ERIE HIGHLANDS
ERIE, CO



SUMMARY RUNOFF TABLE

DESIGN POINT	CONTRIBUTING BASIN	CONTRIBUTING AREA (ACRES)	5-YR Q (CFS)	100-YR Q (CFS)	ACCUMULATIONS 5-YR Q (CFS)	ACCUMULATIONS 100-YR Q (CFS)
1	A	6.42	10.57	26.06		
2	B	9.23	9.44	30.00	20.37	56.30
3	C	11.73	11.69	36.93		
4	D	3.63	4.57	12.65		
5	E	1.27	1.34	4.23		
6	F	3.47	3.43	10.58	40.36	114.57
7	G	6.22	4.58	17.65	45.07	129.58
8	H	9.10	5.03	23.79		
9	I	1.01	0.75	2.88	49.67	148.46
10	J	6.26	6.57	20.74		
11	K	3.36	3.53	11.13	10.10	31.39
12	L	3.75	3.87	12.24		
13	M	4.87	4.92	15.70	18.44	58.81
14	N	4.04	3.59	11.56	21.6	67.15
15	O	1.98	2.03	6.44		
16	P	8.74	8.85	26.87	30.2	91.5
17	Q	2.52	2.55	8.12	35.5	99.1
J6 Pond 1	Pond 1	5.04	5.75	18.14	84.65	257.83
18	R	6.32	7.93	24.54		
19	S	4.86	6.46	19.99	13.83	42.38
20	T	3.78	4.75	13.99		
21	W	1.55	2.11	6.55		
J7 Pond 2	Pond 2	18.97	2.48	10.34	22.54	69.61
J8 Pond 3	Pond 3	64.72	44.51	197.85		
J9 Pond 4	Pond 4	26.47	32.86	102.14		
J10 Pond 5	Pond 5	29.01	36.41	112.62		
J11 Pond 6	Pond 6	72.23	125.20	597.62		

POND–1 WATER QUALITY/DETENTION

	VOL. REQ'D	VOL. PROV.	DEPTH	RELEASE RATE
EURV WATER QUALITY	3.67 AC–FT	3.67 AC–FT	6.1'	
DETENTION POND 100 YR	6.13 AC–FT	6.13 AC–FT	8.8'	78.74 CFS

POND–2 WATER QUALITY/DETENTION

	VOL. REQ'D	VOL. PROV.	DEPTH	RELEASE RATE
EURV WATER QUALITY	0.79 AC–FT	0.79 AC–FT	4.1	
DETENTION POND 100 YR	1.35 AC–FT	1.35 AC–FT	5.2	16.98 CFS

POND–3 WATER QUALITY/DETENTION

	VOL. REQ'D	VOL. PROV.	DEPTH	RELEASE RATE
EURV WATER QUALITY	0.86 AC–FT	0.86 AC–FT	TBD	
DETENTION POND 100 YR	1.8 AC–FT	2.0 AC–FT	TBD	60.74 CFS

POND–4 WATER QUALITY/DETENTION

	VOL. REQ'D	VOL. PROV.	DEPTH	RELEASE RATE
EURV WATER QUALITY	1.14 AC–FT	1.14 AC–FT	TBD	
DETENTION POND 100 YR	2.02 AC–FT	2.02 AC–FT	TBD	25.28 CFS

POND–5 WATER QUALITY/DETENTION

	VOL. REQ'D	VOL. PROV.	DEPTH	RELEASE RATE
EURV WATER QUALITY	1.24 AC–FT	1.24 AC–FT	TBD	
DETENTION POND 100 YR	2.22 AC–FT	2.22 AC–FT	TBD	28.28 CFS

POND–6 WATER QUALITY/DETENTION

	VOL. REQ'D	VOL. PROV.	DEPTH	RELEASE RATE
EURV WATER QUALITY	5.04 AC–FT	5.04 AC–FT	TBD	
DETENTION POND 100 YR	8.67 AC–FT	8.67 AC–FT	TBD	70.50 CFS

LEGEND

- 5665 EXISTING CONTOUR
- 5665 PROPOSED CONTOUR
- FLOWLINE
- DRAINAGE DIRECTION
- A – BASIN DESIGNATION
  B – BASIN AREA
  C – 5–YEAR RUNOFF COEFFICIENT
  D – 100–YEAR RUNOFF COEFFICIENT
- N – DESIGN POINT
- 5R 5' TYPE R INLET
- 10R 10' TYPE R INLET

DRAINAGE PLAN – DEVELOPED
ERIE HIGHLANDS
JOB NO. 13–000

SHEET 1 OF 1

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Littleton, CO 80120
main 303.703.4444
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HISTORIC DRAINAGE PLAN
ERIE HIGHLANDS
ERIE, CO

200 100 0 200 400

SCALE: 1" = 200

Ex. 45"x63" CMP

Ex. 36"x42" CMP

Ex. 18" RCP
Q5 = 12.1 CFS
Q100 = 79.4 CFS
1

Q5 = 12.1 CFS
Q100 = 70.9 CFS
6

H-1
93.4 | 0.01 | 0.20

H-2
13.2 | 0.01 | 0.20

H-3
68.6 | 0.01 | 0.20

H-4
26.5 | 0.15 | 0.50

H-5
29.0 | 0.15 | 0.50

H-6
70.9 | 0.15 | 0.50

Q5 = 1.9 CFS
Q100 = 11.8 CFS
2

Design Points 2 and 3 combine at Donnelly

Ex. 36" RCP
Q5 = 10.6 CFS
Q100 = 64.5 CFS
3

75' TRANS. LINE ESMT

Q5 = 4.5 CFS
Q100 = 26.5 CFS
4

Q5 = 4.9 CFS
Q100 = 29.0 CFS
5

LEGEND

- 5665 — EXISTING CONTOUR
- DRAINAGE DIRECTION
- A / B / C / D — A – BASIN DESIGNATION; B – BASIN AREA; C – 5-YEAR RUNOFF COEFFICIENT; D – 100-YEAR RUNOFF COEFFICIENT
- N — N – DESIGN POINT
- B — HYDROLOGIC SOIL GROUP
- DRAINAGE BASIN

DRAINAGE PLAN – HISTORIC
ERIE HIGHLANDS
JOB NO. 13-000

SHEET 1 OF 1

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January 25, 2013

Ms. Kristin Schwartz
A. G. Wassenaar, Inc.
2180 South Ivanhoe Street
Denver, Colorado 80221

Dear Ms. Schwartz:

The purpose of this letter is to describe the results of a reconnaissance-level cultural resource investigation of the Dearmin Property, which is a 300-acre parcel east of Erie in Weld County, Colorado (Figure 1). This report includes the results of a Class I investigation as well as an on-site examination of the parcel. It was prepared by Centennial Archaeology, Inc. (Centennial) for A.G. Wassenaar, Inc. The results of this report are provided as an in-house reconnaissance document, which will not be submitted to any federal, state, or local agencies for review. The proposed project area encompasses the north half of the following section (Figure 2):

Township 1 North – Range 68 West, Section 20

Centennial requested a file search of Section 20 through the Colorado Office of Archaeology and Historic Preservation/State Historic Preservation Office (SHPO). The results of this file search were received on January 22, 2013. Records included in the file search results consist of archaeological investigations that have been conducted in the area, cultural resources (prehistoric and historic archaeological sites) that have been recorded previously in the area, and GIS shapefiles of the cultural resources. Historic U.S. Geological Survey (USGS) maps were consulted for evidence of transportation routes, homesteads, or other resources that may have once been present. Additionally, General Land Office (GLO) records available through the Bureau of Land Management (BLM) – Colorado State Office website were examined to determine if homestead patents or other records of early historic use exist.

The Class I research revealed that two previous investigations have been undertaken, and that a single historic site has been recorded previously within the study area. The projects are a Class III (intensive field) survey of a transmission line, and an archeological inventory of farms and ranches in Weld and Broomfield Counties. The known site is the Hoyt to Terry Street Transmission Line (site No. 5WL3154.1), which has been officially evaluated as not eligible for the National Register of Historic Places. This transmission line traverses the extreme southwestern corner of the study parcel on a northwest/southeast axis.

A review of the 1967 Erie 7.5' USGS Quadrangle revealed the presence of an unnamed small mine or prospecting pit near the eastern boundary of the property. No other historic features are present within the project area on this map. The mine/prospecting pit does not appear in the 1904 Niwot 15' USGS Quadrangle, and is discussed further in the results of the on-site examination.

GLO land patent records indicate that the NW¼ of the section was patented by Robert George and the NE¼ was patented by Thomas Maguire. Both patents were issued on February 25, 1870. No further information regarding either of these individuals could be found. No historic buildings, roads, or other materials appear in this location on the 1864 GLO survey plat.

The on-site examination of the property was conducted by Kristin A. Gensmer on January 24, 2013. The majority of the property has been plowed, thus disturbing any surface-level manifestations of cultural resources in the project area. Reconnaissance consisted of a vehicular survey of the northern, eastern, and western property boundaries and pedestrian survey along the southern boundary and the drainages. No prehistoric cultural materials were observed.

Historic evidence includes the transmission line (Figure 3), the small mine or prospecting pit (Figures 4 and 5), and two sandstone outcrops on which historic and modern debris were observed (Figure 6). The mine or prospecting pit consists of a large, irregular hole that is estimated to be about 3 meters deep. It is bordered on the east and west by spoils heaps that range in height from 1 to 2 meters, and on the north by a spoils pile that is approximately 7 meters high. The pit appears to have been abandoned for many years. Russian thistle and assorted forbs grow in the pit and on the spoils piles, which are slumping into the pit. Low, concrete walls are present along the south side, suggesting that a barrier wall or concrete foundation was once present but has since been removed. The appearance of the pit suggests that it was associated with the coal mining industry, which dominated the Erie economy during the late 19th and early and middle 20th centuries (Town of Erie Historic Preservation Board 2009). The rock outcrops consist of two unplowed areas that are approximately 60 meters apart, and are situated along the drainage in the southwestern part of the property. Large sandstone slabs and historic debris including a corroded metal pipe, a sanitary can, and colorless and amber bottle glass that may have been removed from the surrounding agricultural field have been piled on the outcrops. All of these materials appear to be from the 20th century and are not likely to yield additional information regarding the history of the property. Additionally, a large, corroded metal box was observed in a drainage near the western boundary. No identifying markers were present on this item, and it may be associated with modern activities.

Reference Cited

Town of Erie Historic Preservation Board
2009 *A Selected Timeline of Erie's History.* Electronic document, www.erieco.gov/DocumentCenter/Home/View/176, accessed January 25, 2013.

Please contact me if you have questions or need any additional information.

Sincerely,

Kristin A. Gensmer
Historical Archaeologist

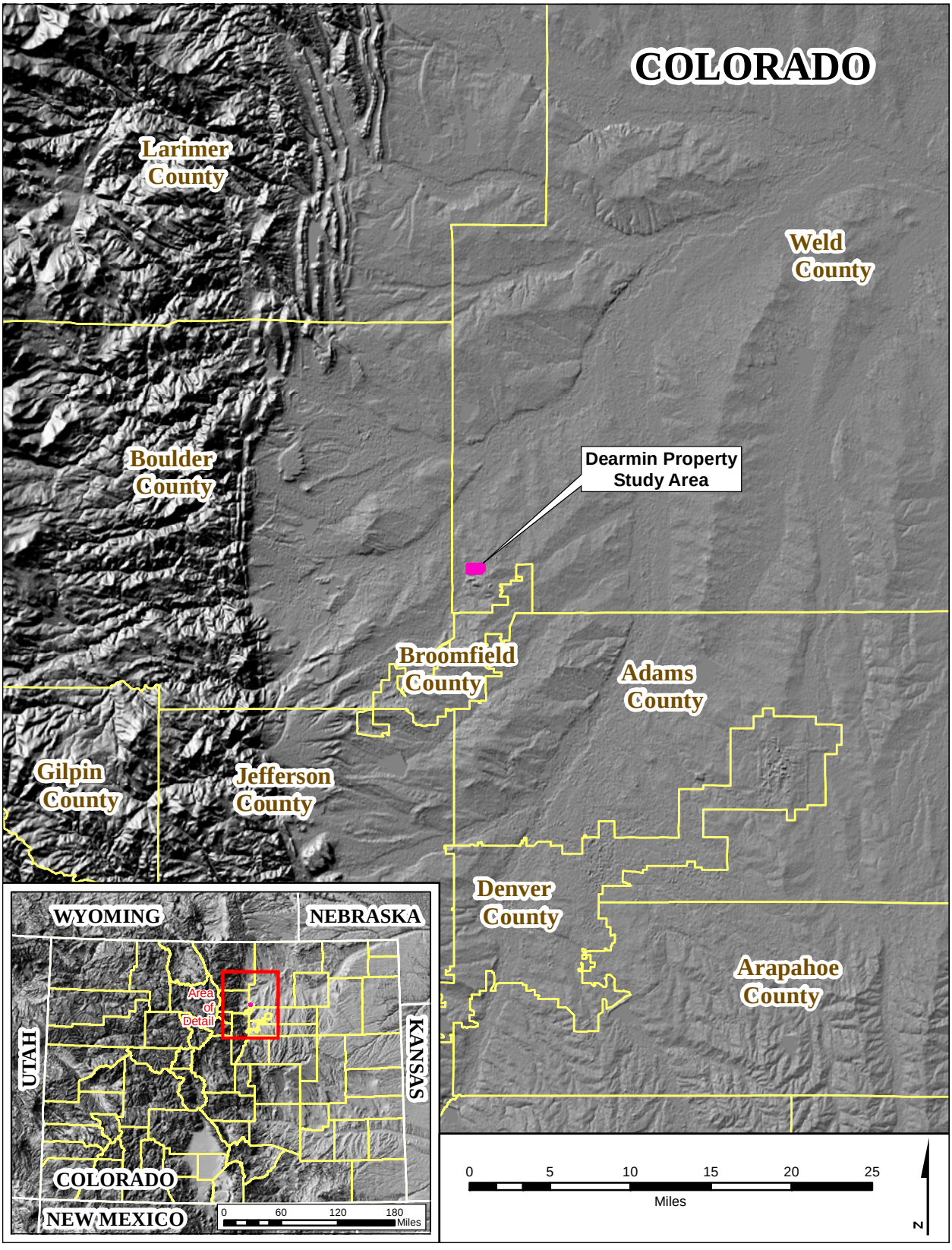

Figure 1. Study area overview map.

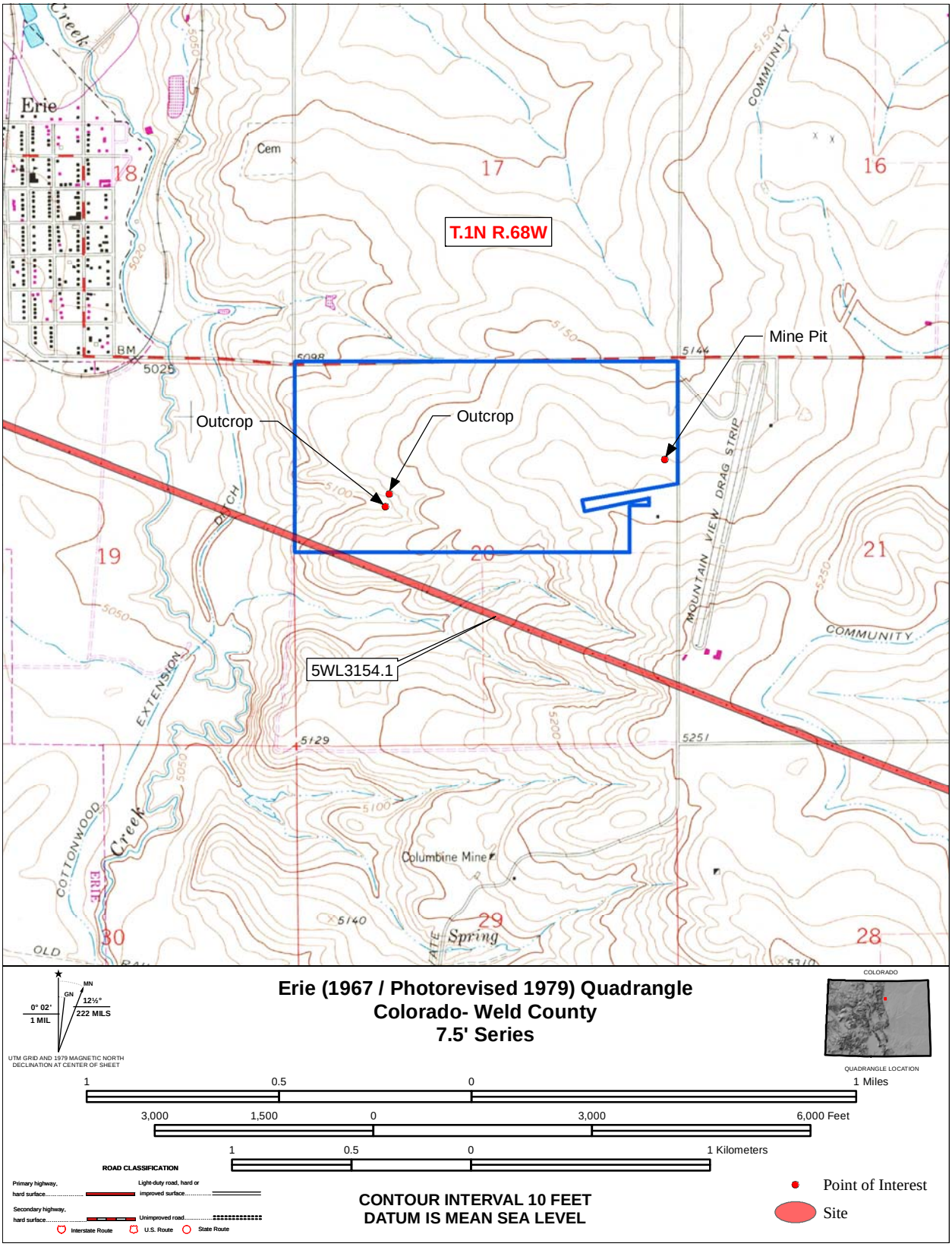

Figure 2. Map of study area at 1:24,000 scale showing previously recorded cultural materials and historic cultural resources within the study area.

Figure 3. View of site 5WL3154.1, looking southeast.

Figure 4. View of mine or prospecting pit, looking northwest.

Figure 5. View of spoils heap north of mine or prospecting pit, looking northwest.

Figure 6. View of sandstone outcrops, looking north.

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LIMITED SUBSURFACE INVESTIGATION REPORT

DEARMIN PROPERTY
ERIE, COLORADO

PREPARED FOR:

HC DEVELOPMENT AND MANAGEMENT SERVICES, INC.
4908 TOWER ROAD
DENVER, COLORADO 80237

JANUARY 2, 2013
PROJECT NUMBER: E12687.E2

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INTRODUCTION

As requested, A. G. Wassenaar, Inc. (AGW) conducted a limited subsurface investigation at the Dearmin Property in Erie, Colorado. The project was completed to evaluate the potential presence of common regulated petroleum compounds in soils and/or ground water in areas where petroleum production equipment operates or has operated in the past. Investigated areas included three tank batteries with associated natural gas wells near the east, north, and west boundaries of the property. In addition, the area adjacent to a plugged and abandoned production well at the east-central portion of the property was also investigated. Other portions of the property were not included in the study.

The subject property is generally undeveloped agricultural land, except for the equipment described above. Based on site observations and topographic information from the U.S. Geological Survey Quadrangle Map for this area, the investigated areas generally slope toward the northeast to northwest, except for the western tank battery area that slopes to the south to southwest. Figure 1 in Attachment A illustrates the site location and topography.

To conduct this investigation, AGW retained a drilling contractor to advance a total of twelve (12) boreholes for soil and/or ground water collection (three at each of the four areas investigated). Soils collected during the investigation were evaluated in the field by AGW and selected samples were forwarded to a laboratory for analytical testing. Ground water samples were also collected for laboratory analysis from boreholes that were not dry. Details regarding the methods used during the project, along with a summary of the field results, laboratory results, and conclusions are presented below.

PREPARATION FOR FIELD SOIL BORING

In accordance with Colorado laws, AGW and the drilling contractor, Drilling Engineers, Inc. (DEI) of Fort Collins, Colorado, contacted the Utility Notification Center of Colorado (UNCC) and associated utility/oil companies to locate subsurface utilities in the proposed boring areas prior to borehole advancement.

To locate potential private utilities or abandoned pipelines in proposed boring locations not covered by UNCC, AGW also retained Underground Consulting Solutions (UCS) of Englewood, Colorado.

On November 27, 2012, Mr. Joseph Pieterick of AGW held a site locate meeting with the UNCC associated locators and a UCS locator to mark buried pipelines in the proposed drilling areas. Based on the results of the locate meeting, no conflicting pipelines were present at the planned borehole locations.

As requested, AGW also contacted Mr. Travis Low of the property owners group, and Mr. Brian Murray of Encana Oil and Gas USA, Inc. (Encana), the operator of the tank batteries, prior to conducting field work. The purpose of these contacts was to determine potential borehole offset requirements from the tank battery equipment. Based on a conversation with Mr. Low, he had no specific offset requirements. Mr. Murray requested that Mr. Matthew Harrison of Encana be consulted regarding their requirements. Mr. Harrison indicated that the proposed boreholes needed to be outside of the gravel/road base covered portions of their tank battery lease areas. In addition, he indicated that an Encana Ground Disturbance Authorization (GDA) form needed to be completed for each drilling area. To comply with these requirements, Joseph Pieterick of AGW met with Mr. Scott Downey of Encana at the property on November 27, 2012, completed the GDA forms, and submitted the forms to Mr. Harrison for approval before the drilling activities began.

Prior to conducting the field activities, AGW prepared a Health and Safety Plan (HASP). In accordance with Encana requirements, AGW also prepared a Job Safety Analysis (JSA). Prior to beginning each day of field work, AGW and DEI employees involved in the activities conducted a review of the HASP and JSA to discuss potential project hazards and safety procedures.

DRILLING AND SOIL SAMPLING METHODS

On December 12 and 13, 2012, DEI utilized a CME-75 truck mounted auger rig to advance a total of twelve (12) boreholes and assist with soil sample collection. The borehole locations were selected to be adjacent to and generally downgradient of the production tank battery equipment and active and abandoned gas wells (based on USGS topographic map data and field observations). The boreholes were designated as A through D, D1, and E through K.

Boreholes A, B, and C were drilled north and east of Encana's William H. Peltier 1A-20H tank battery, along Weld County Road (WCR)-5. Boreholes D, D1, and E were placed north and northeast of the buried William H. Peltier #1 plugged and abandoned well head, based on GPS well location

data provided by the Colorado Oil and Gas Conservation Commission (COGCC). Boreholes F, G, and H were advanced west and north of Encana's William H. Peltier #2 production tank battery, along WCR-8 (also called Erie Parkway). The final three boreholes, I, J, and K, were placed west and south of Encana's William H. Peltier 12-20 production tank battery and production well, east of Green Mill Road. Figure 2 in Attachment A illustrates the tank battery and abandoned well areas that were investigated. Figures 3 through 6 identify the specific borehole locations.

To advance the boreholes, DEI utilized 4-inch outside diameter solid-stem augers. During drilling, AGW collected representative soil samples using a split-spoon core sampler and drill cuttings for field evaluation at approximate 5 foot intervals. The boreholes were advanced to depths ranging from 35.3 to 40.0 feet below ground surface (bgs). During drilling, ground water was encountered immediately at boreholes B and C, but not at the other ten boreholes.

To control potential cross-contamination, DEI utilized clean augers prior to drilling. In addition, AGW cleaned the split-spoon core samplers , the steel soil sampling scoop, and water level measuring equipment between uses with an Alconox® detergent and municipal water solution followed by a municipal water rinse. The AGW technicians also wore a new pair of disposable nitrile gloves at each location to control potential cross-contamination.

To allow for field screening of the soil samples with a photoionization detector (PID), AGW placed a portion of each soil sample into a new dedicated sealable plastic bag. Selected samples were also placed into new laboratory-supplied glass jars for potential analytical testing.

One soil sample from each of the areas investigated was submitted for analytical testing, except for the William H. Peltier #2 tank battery area where two samples were submitted. The samples forwarded for analytical testing were generally selected based on the highest PID results, typically from near the assumed ground water table depth. None of the soil samples collected exhibited obvious petroleum odors or staining. During the project, a total of five soil samples were submitted for laboratory analysis.

After collection, the jars containing the soil samples were immediately sealed, labeled, and placed into a cooler with ice (a preservative). AGW subsequently delivered them to an independent laboratory for analytical testing. During this project, AGW followed chain-of-custody procedures in general accordance with U.S. Environmental Protection Agency (EPA) guidelines. A discussion of the laboratory methods and results is presented later in this report.

Due to relatively slow ground water recharge into the boreholes following drilling and soil sampling, ground water sampling was delayed until December 17, 2012 (four to five days after drilling). To control potential collapsing soils and allow for subsequent ground water collection, dedicated temporary PVC well pipes and screens were placed into six of the boreholes, including B, D1, G, H, I and J. Other boreholes exhibiting stable soil conditions did not have temporary well pipe and screens inserted. The tops of all boreholes were sealed with a temporary plastic cover prior to ground water sampling to control potential addition of surface water or debris. The temporary well pipes were removed following ground water sampling and all of the boreholes were backfilled with soils not exhibiting evidence of contamination.

SOIL FIELD SCREENING METHODS AND RESULTS

A portion of each soil sample was transferred into a dedicated sealable plastic bag for field evaluation and screening with a PID. PID screening detects volatile organic compounds (VOCs) with an ionization potential of 10.6 electron volts (eV) or less, including many compounds found in crude oil, petroleum condensate, and refined petroleum products. This instrument provides a semi-quantitative analysis.

AGW accomplished the PID screening by inserting the PID probe into the individual sealed sample bags and recording the instrument response. Generally PID readings greater than 10 parts per million (ppm, based on calibration to isobutylene) suggest the presence of VOCs above natural background concentrations. However, PID readings can exceed that value due to variations in moisture, temperature, soil type, and the presence of natural organic materials in the soils or shallow bedrock (e.g. traces of coal). During this project, PID results ranged from 0.0 ppm to 30.8 ppm. PID readings above 10 ppm were identified in soil samples from boreholes D, E, F and H; however, none of the subject soil samples exhibited petroleum odors or staining. Therefore, it is likely that the readings are the result of vapors from natural organic materials in the soils, including fine layers of coal and organic-containing claystones and siltstones that were observed. The absence of significant petroleum

in these soils was verified through analytical testing discussed later in this report. The specific PID results are presented on the soil boring logs in Attachment B.

AGW also evaluated each soil sample to identify the general lithologic type, color, moisture content, and if present, evidence of suspect staining and/or odors. Soils observed during the project generally consisted of brown to gray silty to sandy clays with variable percentages of sand overlaying weathered claystone, with some interbedded weathered siltstones, and sandstone. Traces of coal, iron, and calcite were also present in the soils. As previously indicated, AGW did not observe obvious petroleum odors or staining in any of the soil samples.

Ground water was encountered during drilling at boreholes B and C at the William H. Peltier 1A-20H battery. Ground water also accumulated later at boreholes J and K at the William H. Peltier 12-20 battery, but not at the other sites. Individual boring logs describing the soils, PID readings, and ground water measurements (when present) in more detail are included in Attachment B.

SOIL ANALYTICAL METHODS AND RESULTS

Following collection, field evaluation, and PID screening, AGW delivered the five selected soil samples to Accutest® Mountain States Laboratory, Inc. (Accutest®) in Wheat Ridge, Colorado for analysis. Accutest® analyzed the soil samples for Gasoline Range Organics (GRO) by EPA Method 8260B, for Diesel Range Organics (DRO) by EPA Method 8015B, and for Benzene, Toluene, Ethylbenzene, and Total Xylenes (BTEX) following EPA Method 8260B. GRO and DRO analysis quantifies a wide range of petroleum compounds. The GRO and DRO results are generally added together to obtain a Total Petroleum Hydrocarbon (TPH) value for comparison to the TPH regulatory standard published by the COGCC. BTEX testing quantifies specific regulated compounds that are commonly present in crude oil, petroleum condensate, and refined petroleum products.

Tables 1, 2, 3, and 4, below, summarize the soil analytical results for the William H. Peltier 1A-20H tank battery, William H. Peltier #1 plugged and abandoned wellhead, William H. Peltier #2 tank battery, and William H. Peltier12-20 tank battery sites, respectively. Copies of the laboratory reports are included in Attachment C. The analytical results are also illustrated on Figure 7 in Attachment A.

Table 1
Soil Analytical Results
Dearmin Property, Erie, Colorado
William H. Peltier 1A-20H Tank Battery
December 12, 2012

Sample Number	Depth (Feet)	PID Result (ppm)	GRO (mg/kg)*	DRO (mg/kg)	TPH** (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes (mg/kg)
A-7	34-35	5.9	ND	4.98	4.98	ND	ND	ND	ND
COGCC Standards***	--	--	--	--	500	0.17	85	100	175

* mg/kg: Milligrams per kilogram (parts per million).
** GRO and DRO values are added to obtain the TPH value per COGCC rules.
*** Standards published by the COGCC in Table 910-1, effective May 30, 2011.
ND: Not detected.

Table 2
Soil Analytical Results
Dearmin Property, Erie, Colorado
William H. Peltier #1 Plugged and Abandoned Well Site
December 12, 2012

Sample Number	Depth (Feet)	PID Result (ppm)	GRO (mg/kg)*	DRO (mg/kg)	TPH** (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes (mg/kg)
D-5	24-25	11.3	ND	5.27	5.27	ND	ND	ND	ND
COGCC Standards***	--	--	--	--	500	0.17	85	100	175

* mg/kg: Milligrams per kilogram (parts per million).
** GRO and DRO values are added to obtain the TPH value per COGCC rules.
*** Standards published by the COGCC in Table 910-1, effective May 30, 2011.
ND: Not detected.

Table 3
Soil Analytical Results
Dearmin Property, Erie, Colorado
William H. Peltier #2 Tank Battery
December 13, 2012

Sample Number	Depth (Feet)	PID Result (ppm)	GRO (mg/kg)*	DRO (mg/kg)	TPH** (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes (mg/kg)
F-5	24-25	19.2	ND	ND	ND	ND	ND	ND	ND
F-8	39-40	30.8	ND	ND	ND	ND	ND	ND	ND
COGCC Standards***	--	--	--	--	500	0.17	85	100	175

* mg/kg: Milligrams per kilogram (parts per million).
** GRO and DRO values are added to obtain the TPH value per COGCC rules.
*** Standards published by the COGCC in Table 910-1, effective May 30, 2011.
ND: Not detected.

Table 4
Soil Analytical Results
Dearmin Property, Erie, Colorado
William H. Peltier 12-20 Tank Battery
December 13, 2012

Sample Number	Depth (Feet)	PID Result (ppm)	GRO (mg/kg)*	DRO (mg/kg)	TPH** (mg/kg)	Benzene (mg/kg)	Toluene (mg/kg)	Ethylbenzene (mg/kg)	Xylenes (mg/kg)
J-6	29-30	5.2	ND	ND	ND	ND	ND	ND	ND
COGCC Standards ***	--	--	--	--	500	0.17	85	100	175

* mg/kg: Milligrams per kilogram (parts per million).
** GRO and DRO values are added to obtain the TPH value per COGCC rules.
*** Standards published by the COGCC in Table 910-1, effective May 30, 2011.
ND: Not detected.

To evaluate soil analytical results, AGW compared identified concentrations to regulatory standards published on Table 910-1 of the COGCC 900 series rules, effective May 30, 2011. The results of the analytical results for each of the four areas investigated are discussed below.

William H. Peltier 1A-20H Tank Battery Soil Analytical Results

Analytical results from the sample A-7, collected from borehole A at a depth of 34 to 35 feet, identified a trace of DRO, but no GRO or BTEX compounds. The TPH concentration of 4.98 milligrams per kilogram (mg/kg) derived by adding DRO and GRO is significantly less than the COGCC regulatory standard of 500 mg/kg. The results are consistent with the low PID readings and physical observations.

William H. Peltier #1 Plugged and Abandoned Well Soil Analytical Results

Results from the sample D-5, collected from borehole D at a depth of 24 to 25 feet, identified a trace of DRO, but no GRO or BTEX compounds. The TPH concentration of 5.27 mg/kg (derived by adding DRO and GRO) is significantly less than the COGCC regulatory standard of 500 mg/kg. The results are consistent with the low PID readings and physical observations.

William H. Peltier #2 Tank Battery Soil Analytical Results

Analytical results from samples F-5 and F-8, collected from borehole F, at depths of 24 to 25 feet and 39 to 40 feet, respectively, did not contain any detected DRO, GRO, or BTEX compounds. Sample F-8 exhibited the highest PID reading measured during this project. The analytical results are consistent with physical observations which did not identify and petroleum odors or staining in any of the soils.

William H. Peltier 12-20 Tank Battery Soil Analytical Results

Analytical results from sample J-6, collected from borehole J at a depth of 29 to 30 feet, did not contain any detected DRO, GRO, or BTEX compounds. The analytical results are consistent with the low PID readings and physical observations which did not identify and petroleum odors or staining.

GROUND WATER SAMPLING METHODS

On the days of drilling, ground water only accumulated in two of the boreholes, B and C, so ground water sampling was postponed to allow additional time for recharge in the remaining boreholes. Consequently, AGW returned to the site on December 17, 2012 to conduct ground water sampling at the boreholes containing sufficient water.

Prior to sampling, AGW measured the depth to ground water (if present) in each borehole using a clean electronic water level indicator tape. Prior to use and between boreholes, the water level tape was cleaned in a solution of municipal water and Alconox® detergent followed by a municipal water rinse. During this project, ground water accumulated at boreholes B, C and J only. At boreholes B and C it was between 24.1 and 25.4 feet bgs. At borehole J it was 28.3 feet bgs.

To collect the ground water samples AGW utilized a new dedicated disposable plastic bailer attached to nylon cord at each borehole sampled. Following the depth measurements, the dedicated bailers were lowered into the subject boreholes to retrieve the water samples. Collected water was transferred into three acid-preserved glass vials supplied by the laboratory at each borehole. The

filled sample vials were immediately sealed, labeled, and placed into a cooler with ice (a preservative). On the day of collection, AGW delivered the samples to Accutest® for analytical testing. During this project, AGW followed chain-of-custody procedures in general accordance with EPA guidelines.

Following completion of the ground water sampling, AGW removed the temporary PVC well pipes and backfilled the boreholes to grade with the soil cuttings.

GROUND WATER ANALYTICAL METHODS AND RESULTS

Accutest® analyzed the ground water samples for BTEX using EPA Method 8021B. BTEX testing quantifies common regulated petroleum compounds.

Table 5, below, summarizes the ground water BTEX results. A copy of the laboratory report is included in Attachment C. The results are also illustrated on Figure 8 in Attachment A.

Table 5
Ground Water Analytical Results
Dearmin Property, Erie, Colorado
December 17, 2012

Borehole / Sample Number	Site Location	Benzene (ug/L)*	Toluene (ug/L)	Ethylbenzene (ug/L)	Xylenes (ug/L)
B	W. H. Peltier 1A-20H	ND	ND	ND	ND
C	W. H. Peltier 1A-20H	ND	ND	ND	ND
J	W. H. Peltier 12-20	ND	ND	ND	ND
K	W. H. Peltier 12-20	ND	ND	ND	ND
COGCC Standards**	--	5	560	700	1,400

* ug/L = Micrograms per liter (parts per billion).
** BTEX standards published by the COGCC in Table 910-1, effective May 30, 2011.
ND: Not detected above the laboratory Method detection limit.

To evaluate the ground water analytical results, AGW normally compares detected compound concentrations to the regulatory standards published by the COGCC in Table 910-1 of their 900 Series rules. However, based on the ground water analytical results, no BTEX compounds were identified above their respective detection limits or regulatory standards. As previously discussed, ground water did not accumulate in boreholes at the William H. Peltier #1 plugged and abandoned well site or at the William H. Peltier #2 tank battery.

CONCLUSIONS

Between December 12 and 17, 2012, AGW conducted a limited subsurface investigation at the Dearmin Property in Erie, Colorado. The project was completed to evaluate the potential presence of common regulated petroleum compounds in soils and/or ground water in four areas where petroleum production equipment is operating or has operated in the past. Investigated areas included three tank batteries and a plugged and abandoned production well. Other portions of the property were not included in the study.

To conduct the project, a total of twelve (12) boreholes were drilled for soil and ground water sampling adjacent to the tank battery related equipment and at the plugged and abandoned well (three boreholes in each area). Soil samples were collected at 5 foot intervals from each borehole for observation and screening with a PID meter. Selected soil samples were submitted for analytical testing (based on PID readings and proximity to the ground water table). Soil PID screening results ranged from 0.0 to 30.8 ppm, and none of the samples exhibited evidence of petroleum odors or staining.

Based on the soil analytical results, trace concentrations of DRO less than the respective COGCC regulatory standard for DRO/TPH were detected in soil samples from boreholes A and D at the William H. Peltier 1A-20H tank battery and William H. Peltier #1 plugged and abandoned gas well area. No GRO or BTEX compounds were detected in the soils from these two boreholes. In addition, none of the other analyzed soil samples from any of the areas investigated contained detected DRO, GRO, or BTEX, including the sample exhibiting the highest PID result. The detected DRO concentrations were consistent with field observations which did not identify petroleum odors or staining in any of the soil samples.

During drilling, ground water accumulated in two of the boreholes, B and C. Consequently, ground water sampling was postponed a minimum of four days to allow additional time for recharge in the remaining boreholes. When AGW returned to the site on December 17, 2012 to conduct ground water sampling, two additional boreholes, J and K, also contained sufficient water to sample. Boreholes B, C, J and K at the William H. Peltier 1A-20H tank battery and William H. Peltier 12-20 tank battery were sampled on that date for BTEX analysis. Based on the analytical results, none of the ground water samples contained detected BTEX. Ground water did not accumulate in boreholes at the William H. Peltier #1 plugged and abandoned well area or William H. Peltier #2 tank battery during this project.

The combined project results did not identify significant petroleum concentrations in soils or ground water (where present) at the four subject sampling areas on the Dearmin property. Consequently, no additional investigation is recommended at this time.

LIMITATIONS

This report summarizes AGW's findings associated with limited subsurface investigation at the subject portions of the Dearmin Property. Although AGW completes thorough studies, no warranty is made of its accuracy, completeness, and timeliness based on information obtained from third party sources. Findings are a reflection of, and within, the scope-of-work and limitations of the work performed. No parties, except the Clients, are authorized to review this report unless they agree to waive any possible claims against A. G. Wassenaar, Inc., arising from such use. If in the future, limited localized petroleum impacts are encountered, they should be addressed in accordance with applicable state and federal regulations.

Thank you for the opportunity to assist you with this project. If you have any questions regarding the contents of this report, or other environmental issues, please contact us at (303) 759-8373.

Sincerely,

A. G. WASSENAAR, INC.

Joseph D. Pieterick, P.G.
Senior Geologist

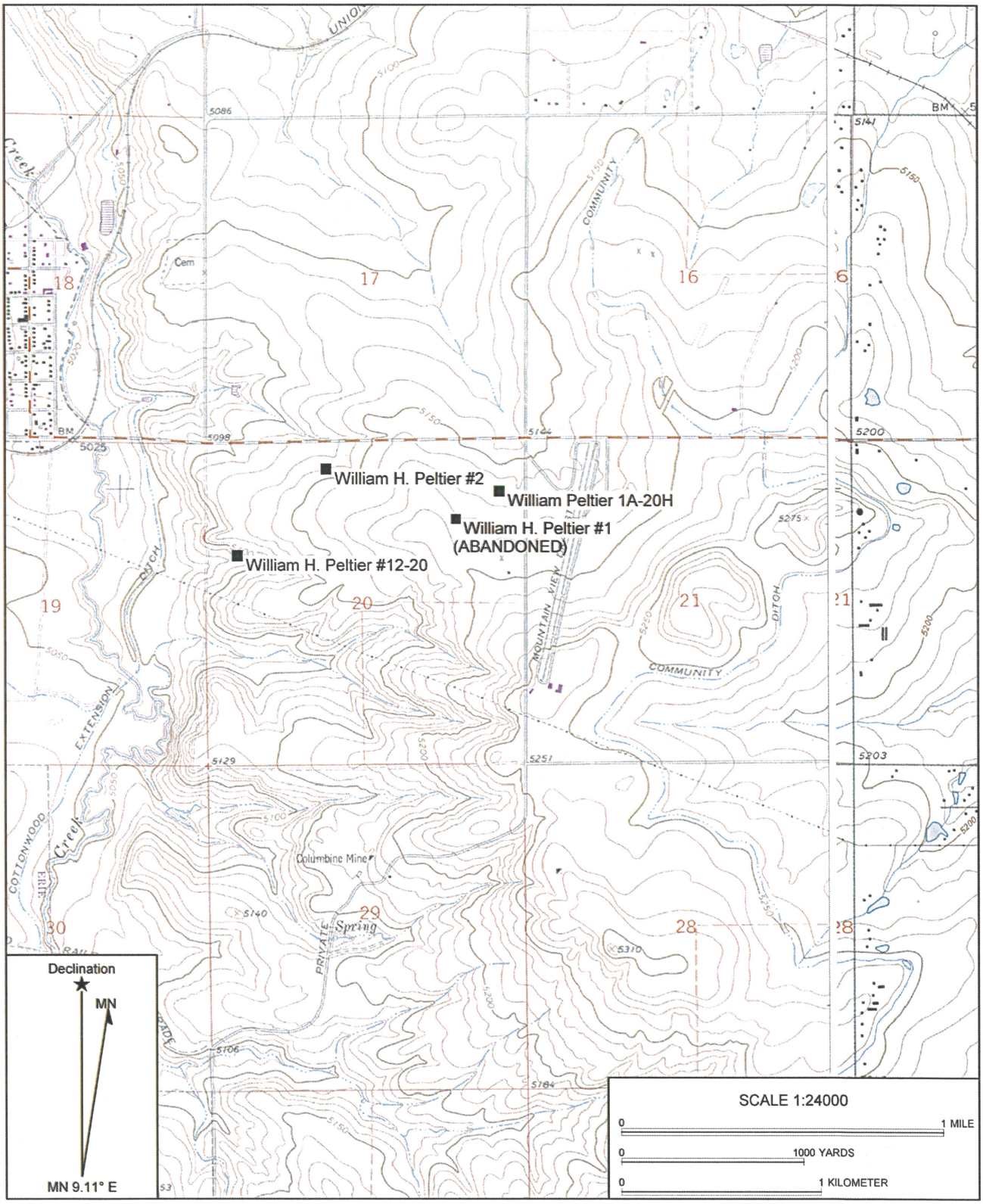
Brian J. Glade, P.E.
Vice President

JDP/BJG/dd

Attachments

ATTACHMENT A

FIGURES



LEGEND

■ SITE LOCATIONS

NOTE: ALL LOCATIONS ARE APPROXIMATE

A.G. Wassenaar Inc.
Geotechnical and Environmental Consultants

DEARMIN PROPERTY
ERIE, COLORADO
TOPOGRAPHIC MAP
DECEMBER 2012
FIGURE 1
AGW PROJECT NUMBER E12687.E2

LEGEND

- BOREHOLE LOCATIONS

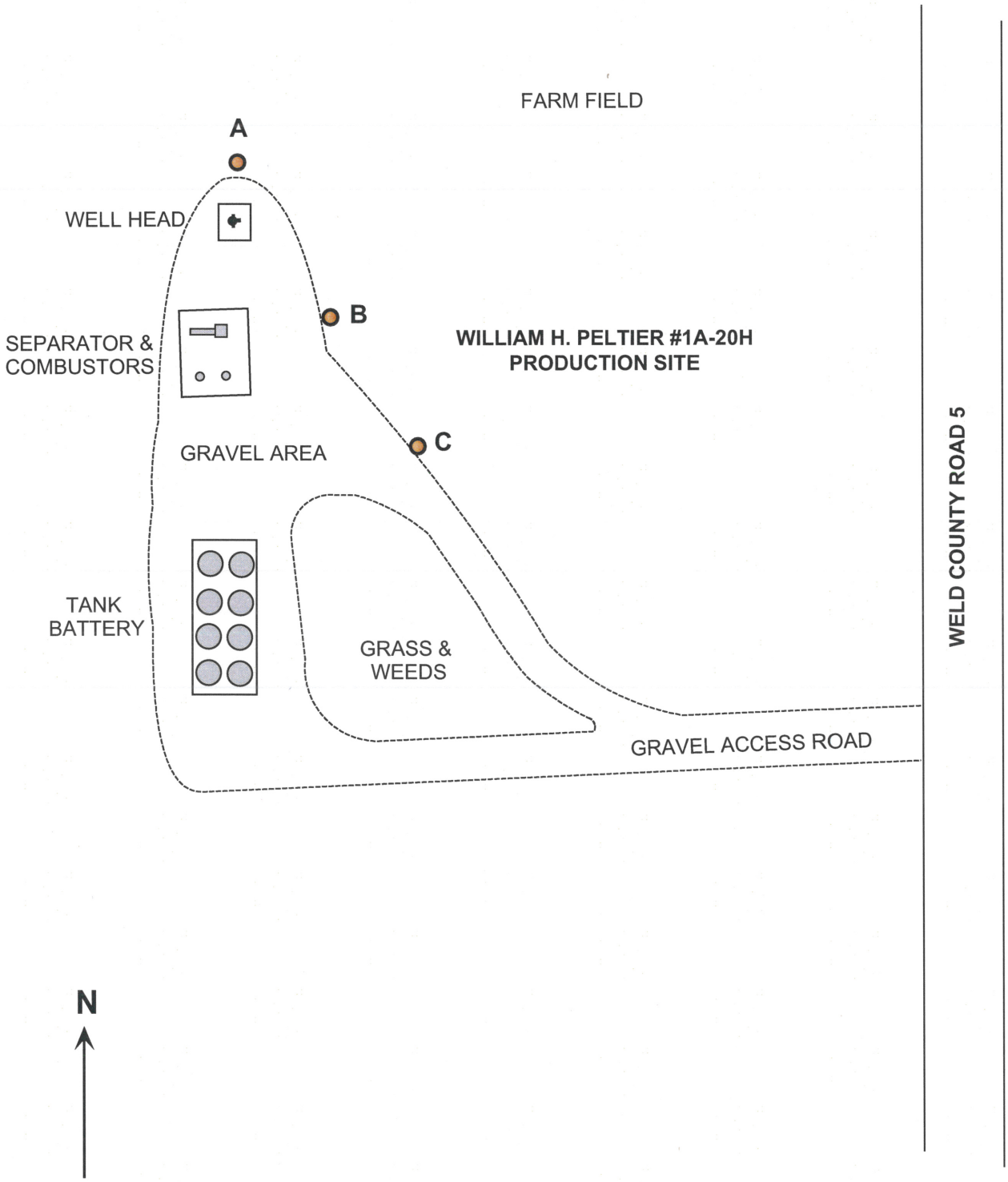
N

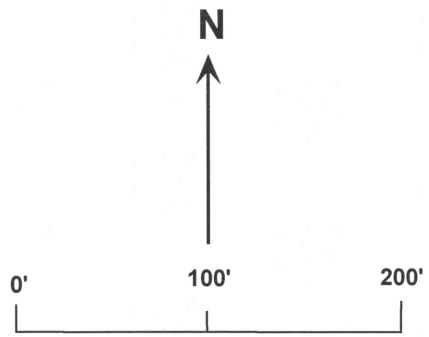
APPROXIMATE SCALE:
1" = 850'

A.G. Wassenaar Inc.
Geotechnical and Environmental Consultants

DEARMIN PROPERTY
ERIE, COLORADO
INVESTIGATION LOCATIONS
DECEMBER 2012
FIGURE 2
AGW PROJECT NUMBER E12687.E2

NOTE: ALL LOCATIONS ARE APPROXIMATE





APPROXIMATE SCALE:
1" = 100'

A.G. Wassenaar Inc.
Geotechnical and Environmental Consultants

WILLIAM H. PELTIER #1A-20H
PRODUCTION SITE
ERIE, COLORADO
BOREHOLE LOCATIONS
NOVEMBER 2012
FIGURE 3
AGW PROJECT NUMBER E12687.E2

LEGEND

BOREHOLE LOCATIONS

NOTE: ALL LOCATIONS ARE APPROXIMATE

LEGEND

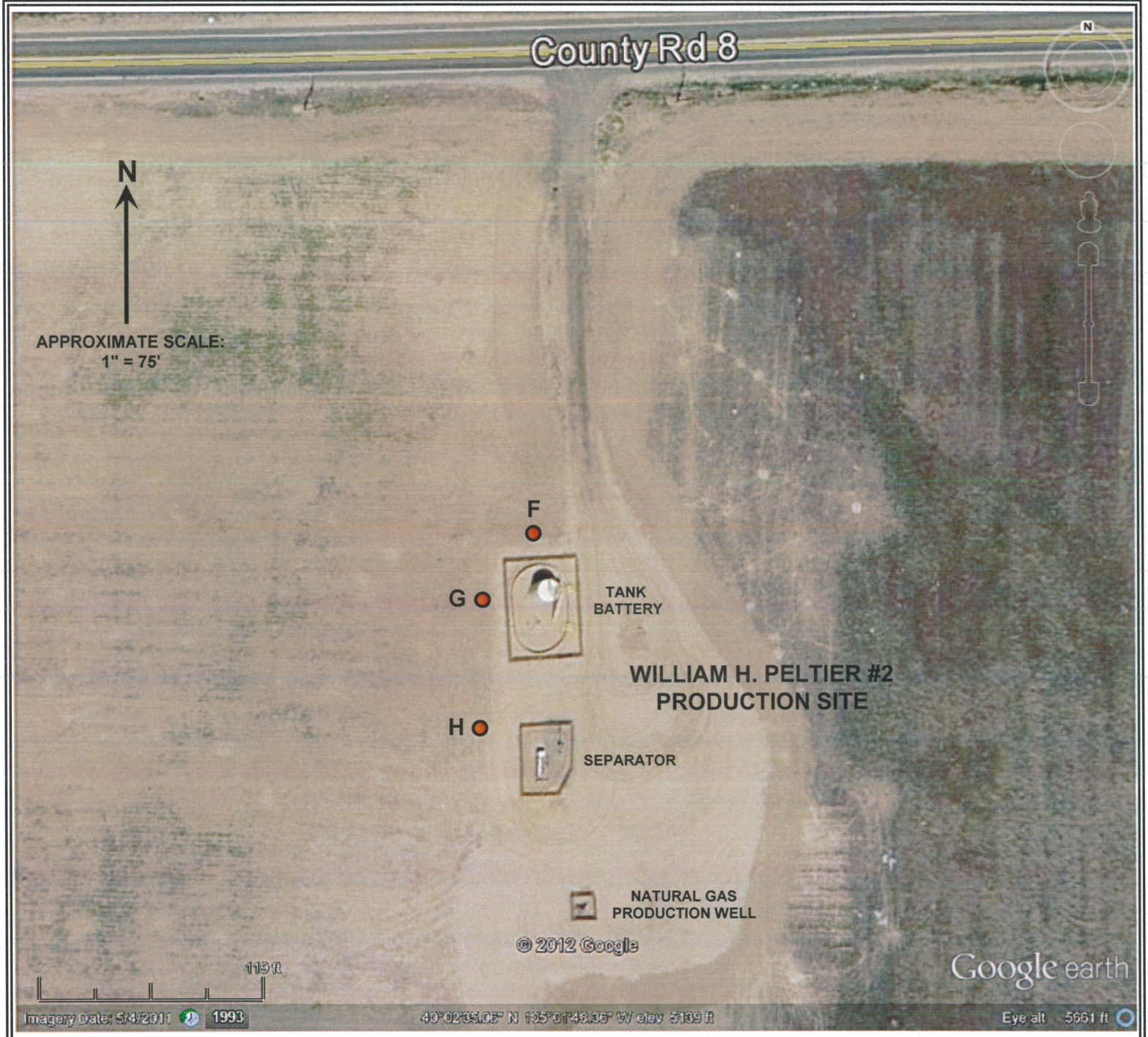
● BOREHOLE LOCATIONS

A.G. Wassenaar Inc.

Geotechnical and Environmental Consultants

WILLIAM H. PELTIER #1
PLUGGED & ABANDONED PRODUCTION WELL
ERIE, COLORADO
BOREHOLE LOCATIONS
DECEMBER 2012
FIGURE 4
AGW PROJECT NUMBER E12687.E2

NOTE: ALL LOCATIONS ARE APPROXIMATE



LEGEND

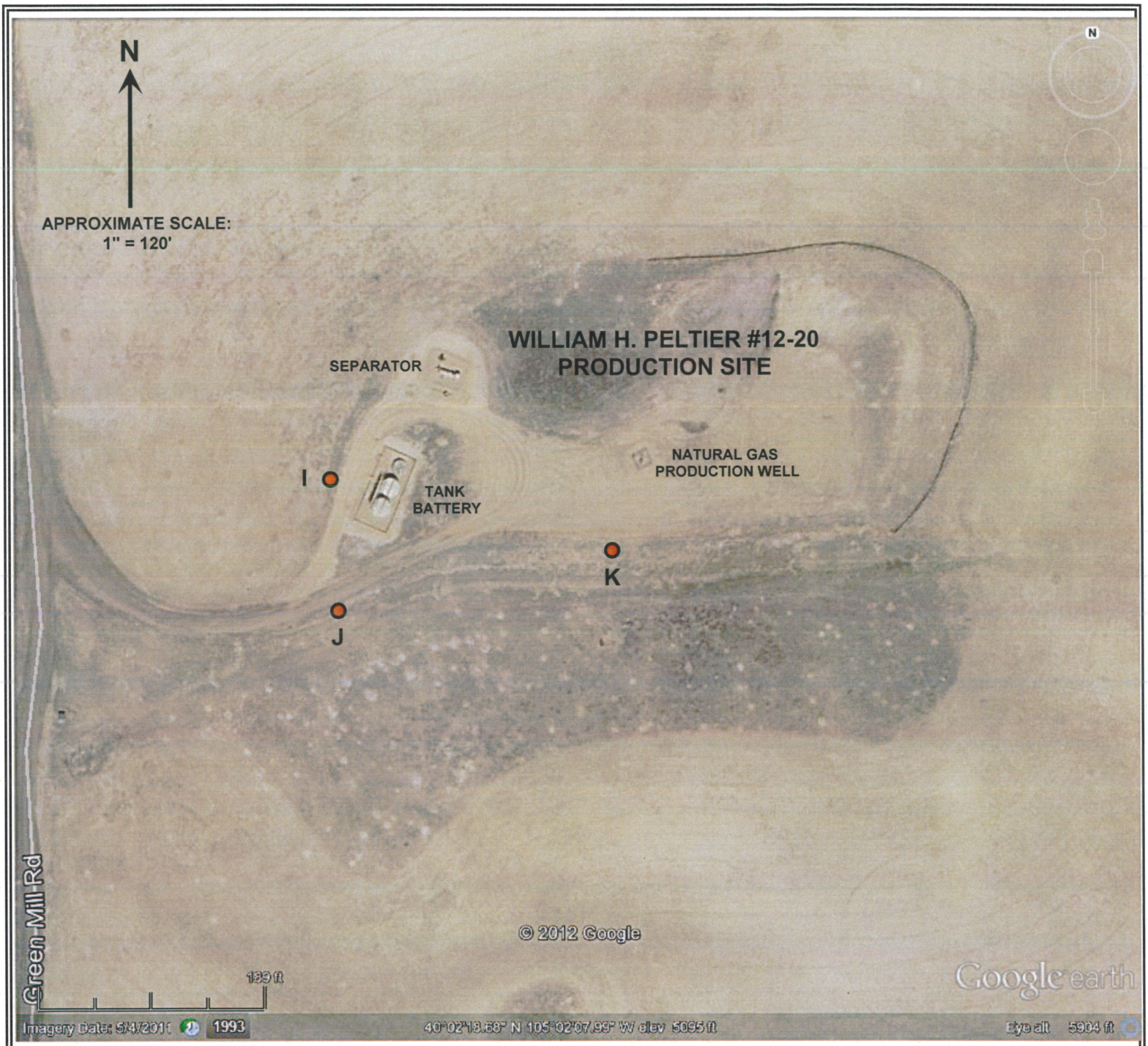
● BOREHOLE LOCATIONS

A.G. Wassenaar Inc.

Geotechnical and Environmental Consultants

WILLIAM H. PELTIER #2
PRODUCTION SITE
ERIE, COLORADO
BOREHOLE LOCATIONS
DECEMBER 2012
FIGURE 5
AGW PROJECT NUMBER E12687.E2

NOTE: ALL LOCATIONS ARE APPROXIMATE



LEGEND

● BOREHOLE LOCATIONS

A.G. Wassenaar Inc.

Geotechnical and Environmental Consultants

WILLIAM H. PELTIER #12-20
PRODUCTION SITE
ERIE, COLORADO
BOREHOLE LOCATIONS
DECEMBER 2012
FIGURE 6
AGW PROJECT NUMBER E12687.E2

NOTE: ALL LOCATIONS ARE APPROXIMATE

A.G. Wassenaar Inc.
Geotechnical and Environmental Consultants

LEGEND

- ● - BOREHOLE LOCATIONS
- TPH - TOTAL PETROLEUM HYDROCARBONS
- BTEX - BENZENE, TOLUENE, ETHYLBENZENE & XYLENES
- ND - NOT DETECTED

NOTE: VALUES ARE IN MILLIGRAMS PER KILOGRAM (mg/kg)

DEARMIN PROPERTY
ERIE, COLORADO
SOIL ANALYTICAL RESULTS
DECEMBER 2012
FIGURE 7
AGW PROJECT NUMBER E12687.E2

NOTE: ALL LOCATIONS ARE APPROXIMATE

A.G. Wassenaar Inc.
Geotechnical and Environmental Consultants

LEGEND

- ● - BOREHOLE LOCATIONS
- BTEX - BENZENE, TOLUENE, ETHYLBENZENE & XYLENES
- ND - NOT DETECTED

NOTE: NO BTEX COMPOUNDS WERE IDENTIFIED ABOVE THE LABORATORY DETECTION LIMITS OR COGCC REGULATORY STANDARDS.

DEARMIN PROPERTY
ERIE, COLORADO
GROUND WATER ANALYTICAL RESULTS
DECEMBER 2012
FIGURE 8
AGW PROJECT NUMBER E12687.E2

NOTE: ALL LOCATIONS ARE APPROXIMATE

ATTACHMENT B

SOIL BORING LOGS

A.G. Wassenaar Inc.
Geotechnical and Environmental Consultants

BORING NUMBER A

CLIENT HC Development and Management Services
PROJECT NAME Dearmin Property
PROJECT NUMBER E12687.E2
PROJECT LOCATION Erie, Colorado
DATE STARTED 12/12/12 **COMPLETED** 12/12/12
GROUND ELEVATION _____ **HOLE SIZE** 4 inch
DRILLING CONTRACTOR Drilling Engineers
GROUND WATER LEVELS:
DRILLING METHOD Solid Stem Augers
AT TIME OF DRILLING Dry
LOGGED BY BVL **CHECKED BY** JDP
AT END OF DRILLING Dry
NOTES W.H. Peltier #1A-20H Site
120hrs AFTER DRILLING Dry

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	PID (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	AU				Brown silty-sandy clay (fine grained sands), trace calcite, slightly moist	
5	AU A-1		1.1			
10	AU A-2		2.6			
15	AU A-3		2.4			
19.0						
20	AU A-4		3.5		Grey weathered silty claystone, moist	
21.5						
	AU				Red Brown weathered sandstone	
23.5						
25	AU A-5		1.3		Grey weathered silty claystone, trace fine sands, trace iron, slightly moist	
30	AU A-6		3.8			
35	AU A-7		5.9			
40	AU A-8		1.7			
40.0						
					Bottom of hole at 40.0 feet.	

ENVIRONMENTAL BH E12687.E2.GPJ GINT US.GDT 12/26/12

BORING NUMBER B

A.G. Wassenaar Inc.
Geotechnical and Environmental Consultants

CLIENT HC Development and Management Services
PROJECT NAME Dearmin Property
PROJECT NUMBER E12687.E2
PROJECT LOCATION Erie, Colorado
DATE STARTED 12/12/12 **COMPLETED** 12/12/12
GROUND ELEVATION _____ **HOLE SIZE** 4 inch
DRILLING CONTRACTOR Drilling Engineers
GROUND WATER LEVELS:
DRILLING METHOD Solid Stem Augers
▽ **AT TIME OF DRILLING** 27.0 ft
LOGGED BY BVL **CHECKED BY** JDP
▼ **AT END OF DRILLING** 24.4 ft
NOTES W.H. Peltier #1A-20H Site
▼ **120hrs AFTER DRILLING** 24.1 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	PID (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	SS B-1	5-9-9-9 (18)	0.0		Light brown silty- sandy clay (fine grained sands), damp	
	AU					
					4.0	
5	SS B-2	7-5-6-6 (11)	0.0		Tan silt with clay, dry	
	AU					
					9.0	
10	SS B-3	15-13-15-14 (28)	0.0		Brown silty clay, trace sand, calcareous, damp	
	AU					
					14.0	
15	SS B-4	13-21-35-45 (56)	0.0		Grey calcareous silty clay, trace iron, damp	
					16.0	
	AU				Grey weathered claystone with sand and slit, trace iron, trace coal, interbedded with weathered sandstone, damp	
20	SS B-5	11-17-50 (67)	0.0			
	AU					
25	SS B-6	22-50	0.0		▼	
	AU				27.0 ▽	
					Grey weathered sandy claystone, trace iron, trace coal, wet	
30	SS B-7	34-50	1.5			
	AU					
35	SS B-8	38-40-50/4"	0.2		35.3	
					Bottom of hole at 35.3 feet.	

ENVIRONMENTAL BH E12687.E2.GPJ GINT US.GDT 12/20/12

BORING NUMBER C

A.G. Wassenaar Inc.
Geotechnical and Environmental Consultants

CLIENT HC Development and Management Services
PROJECT NAME Dearmin Property
PROJECT NUMBER E12687.E2
PROJECT LOCATION Erie, Colorado
DATE STARTED 12/12/12 **COMPLETED** 12/12/12
GROUND ELEVATION _____ **HOLE SIZE** 4 inch
DRILLING CONTRACTOR Drilling Engineers
GROUND WATER LEVELS:
DRILLING METHOD Solid Stem Augers
AT TIME OF DRILLING Dry
LOGGED BY BVL **CHECKED BY** JDP
AT END OF DRILLING 28.4 ft
NOTES W.H. Peltier #1A-20H Site
120hrs AFTER DRILLING 25.1 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	PID (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	AU C-1		2.2		Light brown silty-sandy clay (fine grained sands), damp	
	AU					
5	AU C-2		2.2			
	AU					
					9.0	
10	AU C-3		1.2		Brown silty clay, trace sand, calcareous, damp	
	AU					
15	AU C-4		2.4			
	AU					
20	AU C-5		0.7		20.0	
	AU				Grey weathered claystone with sand and slit, trace iron, interbedded with weathered sandstone, slightly moist to damp	
25	AU C-6		0.0		▼	
	AU				▼	
30	AU C-7		1.2			
	AU				33.0	
					34.0 Sandstone	
35	AU C-8		1.3		Grey weathered claystone with sand and slit, trace iron, interbedded with weathered sandstone, slightly moist to damp	
	AU					
40	AU C-9		0.9		40.0	
					Bottom of hole at 40.0 feet.	

ENVIRONMENTAL BH E12687.E2.GPJ GINT US.GDT 12/20/12

A.G. Wassenaar Inc.
Geotechnical and Environmental Consultants

BORING NUMBER D

CLIENT HC Development and Management Services
PROJECT NAME Dearmin Property
PROJECT NUMBER E12687.E2
PROJECT LOCATION Erie, Colorado
DATE STARTED 12/12/12 **COMPLETED** 12/12/12
GROUND ELEVATION _____ **HOLE SIZE** 4 inch
DRILLING CONTRACTOR Drilling Engineers
GROUND WATER LEVELS:
DRILLING METHOD Solid Stem Augers
AT TIME OF DRILLING Dry
LOGGED BY BVL **CHECKED BY** JDP
AT END OF DRILLING Dry
NOTES W.H. Peltier #1 Abandoned Well Site
120hrs AFTER DRILLING Dry

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	PID (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					Brown silty-sandy clay (fine grained sands), calcareous, damp	
	AU					
5	AU D-1		0.0			
	AU					
10	AU D-2		0.8			
	AU					
15	AU D-3		3.2			
	AU					
					19.0	
20	AU D-4		4.5		Grey weathered silty claystone, trace fine sands, trace iron, dry to slightly moist	
	AU					
25	AU D-5		11.3			
	AU					
30	AU D-6		6.7			
	AU					
35	AU D-7		5.8			
	AU					
40	AU D-8		0.5		40.0	
					Bottom of hole at 40.0 feet.	

ENVIRONMENTAL BH E12687.E2.GPJ GINT US.GDT 12/20/12

A.G. Wassenaar Inc.
Geotechnical and Environmental Consultants

BORING NUMBER D1

CLIENT HC Development and Management Services
PROJECT NAME Dearmin Property
PROJECT NUMBER E12687.E2
PROJECT LOCATION Erie, Colorado
DATE STARTED 12/12/12 **COMPLETED** 12/12/12
GROUND ELEVATION _____ **HOLE SIZE** 4 inch
DRILLING CONTRACTOR Drilling Engineers
GROUND WATER LEVELS:
DRILLING METHOD Solid Stem Augers
AT TIME OF DRILLING Dry
LOGGED BY BVL **CHECKED BY** JDP
AT END OF DRILLING Dry
NOTES W.H. Peltier #1 Abandoned Well Site
120hrs AFTER DRILLING Dry

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	PID (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	SS D1-1	5-13-10-9 (23)	0.0		Brown silty-sandy clay (fine grained sands), calcareous, dry	
	AU				4.0	
5	SS D1-2	9-5-4-7 (9)	0.3		Light Brown very sandy clay, trace silt, calcareous, dry	
	AU					
10	SS D1-3	8-9-10-13 (19)	0.6		11.0	
	AU				Brown coarse sand with silt, calcareous, damp	
					14.0	
15	SS D1-4	20-27-34-50 (61)	1.4		15.0 Brown sandy-slity clay, calcareous, slightly moist	
	AU				Brown-grey weathered sandy claystone, calcareous, trace iron, slightly moist	
20	SS D1-5	23-32-36-50 (68)	0.2		21.0	
	AU				Light brown/white/grey weathered silty-clayey sandstone, calcareous, trace iron, slightly moist	
25	SS D1-6	18-50	1.1		25.0	
	AU				Grey weathered claystone with sand, calcareous, trace iron, slightly moist	
30	SS D1-7	14-35-50 (85)	0.5			
	AU					
35	SS D1-8	22-37-38-50 (75)	0.7		36.0	
	AU				Light grey weathered sandy claystone, calcareous, trace iron, slightly moist	
	SS D1-9	50			39.3 Bottom of hole at 39.3 feet.	

ENVIRONMENTAL BH E12687.E2.GPJ GINT US.GDT 12/20/12

BORING NUMBER E

A.G. Wassenaar Inc.
Geotechnical and Environmental Consultants

CLIENT HC Development and Management Services
PROJECT NAME Dearmin Property
PROJECT NUMBER E12687.E2
PROJECT LOCATION Erie, Colorado
DATE STARTED 12/12/12 **COMPLETED** 12/12/12
GROUND ELEVATION _____ **HOLE SIZE** 4 inch
DRILLING CONTRACTOR Drilling Engineers
GROUND WATER LEVELS:
DRILLING METHOD Solid Stem Augers
AT TIME OF DRILLING Dry
LOGGED BY BVL **CHECKED BY** JDP
AT END OF DRILLING Dry
NOTES W.H. Peltier #1 Abandoned Well Site
120hrs AFTER DRILLING Dry

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	PID (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					Brown sily-sandy clay (fine grained sands), calcareous, dry to slightly moist, trace of small gravel	
	AU					
5	AU E-1		1.2			
	AU					
10	AU E-2		0.4			
	AU					
15	AU E-3		0.4		15.0	
	AU				Grey weathered claystone, trace fine sands, trace iron, dry to slightly moist	
20	AU E-4		3.8			
	AU					
25	AU E-5		5.1			
	AU					
30	AU E-6		10.2		30.0	
	AU				Grey weathered claystone, trace iron, slightly moist	
35	AU E-7		7.9			
	AU					
40	AU E-8		3.4		40.0	
					Bottom of hole at 40.0 feet.	

ENVIRONMENTAL.BH E12687.E2.GPJ GINT US.GDT 12/20/12

A.G. Wassenaar Inc.
Geotechnical and Environmental Consultants

BORING NUMBER F

CLIENT HC Development and Management Services
PROJECT NAME Dearmin Property
PROJECT NUMBER E12687.E2
PROJECT LOCATION Erie, Colorado
DATE STARTED 12/13/12 **COMPLETED** 12/13/12
GROUND ELEVATION _____ **HOLE SIZE** 4 inch
DRILLING CONTRACTOR Drilling Engineers
GROUND WATER LEVELS:
DRILLING METHOD Solid Stem Augers
AT TIME OF DRILLING Dry
LOGGED BY BVL **CHECKED BY** JDP
AT END OF DRILLING Dry
NOTES W.H. Peltier #2 Site
120hrs AFTER DRILLING Dry

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	PID (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					Brown silty clay, trace fine sand, slightly moist	
	AU					
5	AU F-1		0.0			
	AU					
10	AU F-2		3.4			
	AU					
15	AU F-3		1.4			
	AU					
20	AU F-4		4.6			
	AU					
25	AU F-5		19.2		25.0	
	AU				Brown highly weathered claystone, slightly moist	
30	AU F-6		3.0			
	AU					
35	AU F-7		6.0		35.0	
	AU				Light brown weathered siltsone, dry	
40	AU F-8		30.8		40.0	
					Bottom of hole at 40.0 feet.	

A.G. Wassenaar Inc.
Geotechnical and Environmental Consultants

BORING NUMBER G

CLIENT HC Development and Management Services
PROJECT NAME Dearmin Property
PROJECT NUMBER E12687.E2
PROJECT LOCATION Erie, Colorado
DATE STARTED 12/13/12 **COMPLETED** 12/13/12
GROUND ELEVATION _____ **HOLE SIZE** 4 inch
DRILLING CONTRACTOR Drilling Engineers
GROUND WATER LEVELS:
DRILLING METHOD Solid Stem Augers
AT TIME OF DRILLING Dry
LOGGED BY BVL **CHECKED BY** JDP
AT END OF DRILLING Dry
NOTES W.H. Peltier #2 Site
120hrs AFTER DRILLING Dry

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	PID (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	SS G-1	3-4-2-2 (6)	0.0		Brown sandy clay, trace silt, slightly moist	
	AU					
5	SS G-2	2-2-2-2 (4)	0.2		4.0 Brown clayey sand, trace silt, slightly moist	
	AU					
10	SS G-3	2-2-4-14 (6)	0.6		9.0 Brown sandy-silty clay, trace iron, slightly moist	
	AU				11.0 Gray highly weathered claystone intermixed with light brown weathered sandstone, trace iron, dry to slightly moist	
15	SS G-4	10-23-50 (73)	0.1			
	AU					
20	SS G-5	50	0.8			
	AU					
25	SS G-6	50	0.7			
	AU				27.0 28.0 REFUSAL. HOLE MOVED APPROXIMATELY 10 FEET SOUTH.	
30	SS G-7	50	0.6		Light brown weathered silty sandstone (fine grained), dry	
	AU					
35	SS G-8	50	1.2			
	AU					
	SS G-9	50	1.1		39.2 Bottom of hole at 39.2 feet.	

ENVIRONMENTAL BH E12687.E2.GPJ GINT US.GDT 12/20/12

A.G. Wassenaar Inc.
Geotechnical and Environmental Consultants

BORING NUMBER H

CLIENT HC Development and Management Services
PROJECT NAME Dearmin Property
PROJECT NUMBER E12687.E2
PROJECT LOCATION Erie, Colorado
DATE STARTED 12/13/12 **COMPLETED** 12/13/12
GROUND ELEVATION _____ **HOLE SIZE** 4 inch
DRILLING CONTRACTOR Drilling Engineers
GROUND WATER LEVELS:
DRILLING METHOD Solid Stem Augers
AT TIME OF DRILLING Dry
LOGGED BY BVL **CHECKED BY** JDP
AT END OF DRILLING Dry
NOTES W.H. Peltier #2 Site
120hrs AFTER DRILLING Dry

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	PID (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					Brown silty clay, trace fine sand, calcareous, slightly moist	
	AU					
5	AU H-1		1.6			
	AU					
10	AU H-2		1.6			
	AU					
15	AU H-3		3.0			
	AU					
20	AU H-4		10.4		20.0	
	AU				Red-brown and brown weathered siltstone/claystone, dry	
25	AU H-5		1.2			
	AU					
30	AU H-6		5.4			
	AU					
35	AU H-7		4.0		35.0	
	AU				Light brown weathered siltstone/claystone, dry	
40	AU H-8		3.2		40.0	
					Bottom of hole at 40.0 feet.	

ENVIRONMENTAL BH E12687.E2.GPJ GINT US.GDT 12/20/12

A.G. Wassenaar Inc.
Geotechnical and Environmental Consultants

BORING NUMBER I

CLIENT HC Development and Management Services
PROJECT NAME Dearmin Property
PROJECT NUMBER E12687.E2
PROJECT LOCATION Erie, Colorado
DATE STARTED 12/13/12 **COMPLETED** 12/13/12
GROUND ELEVATION _____ **HOLE SIZE** 4 inch
DRILLING CONTRACTOR Drilling Engineers
GROUND WATER LEVELS:
DRILLING METHOD Solid Stem Augers
AT TIME OF DRILLING Dry
LOGGED BY BVL **CHECKED BY** JDP
AT END OF DRILLING Dry
NOTES W.H. Peltier #12-20 Site
120hrs AFTER DRILLING Dry

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	PID (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	SS I-1	6-5-6-6 (11)	0.0		Brown silty-sandy clay, dry	
	AU					
					4.0	
5	SS I-1	19-19-24-32 (43)	0.0		Light gray silty-clayey sand (fine-grained), trace iron, dry to slightly moist	
	AU					
10	SS I-3	25-42-50-14 (92)	0.0			
	AU					
					14.0	
15	SS I-4	24-14-11-34 (25)	0.9		Light gray, white, yellow and orange weathered fine-grained sandstone, slightly moist	
	AU					
					19.0	
20	SS I-5	27-50	0.6		Gray weathered claystone, trace iron, trace sand (fine-grained), trace coal, dry to slightly moist	
	AU					
25	SS I-6	31-38	0.6			
	AU					
30	SS I-7	34-50	0.5			
	AU					
35	SS I-8	50	0.0			
	AU					
					39.0	
	SS I-9	50	1.1		40.0 Yellow-brown weathered sandstone, trace iron, trace coal, dry to slightly moist	

Bottom of hole at 39.3 feet.

ENVIRONMENTAL BH E12687.E2.GPJ GINT US.GDT 12/20/12

BORING NUMBER J

A.G. Wassenaar Inc.
Geotechnical and Environmental Consultants

CLIENT HC Development and Management Services
PROJECT NAME Dearmin Property
PROJECT NUMBER E12687.E2
PROJECT LOCATION Erie, Colorado
DATE STARTED 12/13/12 **COMPLETED** 12/13/12
GROUND ELEVATION _____ **HOLE SIZE** 4 inch
DRILLING CONTRACTOR Drilling Engineers
GROUND WATER LEVELS:
DRILLING METHOD Solid Stem Augers
AT TIME OF DRILLING Dry
LOGGED BY BVL **CHECKED BY** JDP
AT END OF DRILLING Dry
NOTES W.H. Peltier #12-20 Site
96hrs AFTER DRILLING 28.3 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	PID (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					Brown sandy- clayey silt, dry	
	AU					
5	AU J-1		0.8			
	AU					
10	AU J-2		4.4			
	AU					
					14.0	
15	AU J-3		5.4		Brown sandy-silty clay, dry to slightly moist	
	AU					
20	AU J-4		6.2			
	AU					
25	AU J-5		6.0			
	AU					
					▼	
30	AU J-6		5.2			
	AU					
					34.0	
35	AU J-7		1.3		Brown highly weathered claystone, trace sand, trace silt, dry to slightly moist	
	AU					
					39.0	
40	AU J-8		4.8		40.0 Gray weathered sandy claystone, dry to slightly moist	
					Bottom of hole at 40.0 feet.	

ENVIRONMENTAL BH E12687.E2.GPJ GINT US.GDT 12/20/12

BORING NUMBER K

A.G. Wassenaar Inc.
Geotechnical and Environmental Consultants

CLIENT HC Development and Management Services
PROJECT NAME Dearmin Property
PROJECT NUMBER E12687.E2
PROJECT LOCATION Erie, Colorado
DATE STARTED 12/13/12 **COMPLETED** 12/13/12
GROUND ELEVATION _____ **HOLE SIZE** 4 inch
DRILLING CONTRACTOR Drilling Engineers
GROUND WATER LEVELS:
DRILLING METHOD Solid Stem Augers
AT TIME OF DRILLING Dry
LOGGED BY BVL **CHECKED BY** JDP
AT END OF DRILLING Dry
NOTES W.H. Peltier #12-20 Site
96hrs AFTER DRILLING 35.0 ft

DEPTH (ft)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	PID (ppm)	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	AU				Brown silty-sandy clay, dry	
5	AU K-1		0.0			
	AU					
10	AU K-2		1.0			
	AU					
					14.0	
15	AU K-3		0.0		Brown silty clay, dry to slightly moist	
	AU					
20	AU K-4		0.0			
	AU					
					24.0	
25	AU K-5		1.8		Gray and light gray weathered sandy (fine-grained) claystone, trace iron, dry to slightly moist	
	AU					
30	AU K-6		2.6			
	AU					
					34.0	
35	AU K-7		3.3		▼ Dark gray/black weathered silty claystone, dry to slightly moist	
	AU					
40	AU K-8		2.4		40.0	
					Bottom of hole at 40.0 feet.	

ENVIRONMENTAL BH E12687.E2.GPJ GINT US.GDT 12/20/12

ATTACHMENT C

LABORATORY REPORTS

Mountain States ACCUTEST LABORATORIES

12/21/12

Technical Report for

A.G. Wassenaar, Inc.

Dearmin Prop. - E12687.E2

Accutest Job Number: D41921

Sampling Dates: 12/12/12 - 12/13/12

Report to:

A.G. Wassenaar, Inc.
2180 S Ivanhoe Street Suite 5
Denver, CO 80222
pieterickj@agwassenaar.com

ATTN: Joseph Pieterick

Total number of pages in report: **29**

ACCREDITED IN ACCORDANCE WITH nelac

Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Conference and/or state specific certification programs as applicable.

Brad Madadian
Laboratory Director

Client Service contact: Renea Jackson 303-425-6021

Certifications: CO, ID, NE, NM, ND (R-027) (PW), UT (NELAP CO00049), TX (T104704511-12-1)

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Sample Summary

A.G. Wassenaar, Inc.

Job No: D41921

Dearmin Prop. - E12687.E2

Sample Number	Collected Date	Time By	Received	Matrix Code	Matrix Type	Client Sample ID
D41921-1	12/12/12	12:55 JP	12/17/12	SO	Soil	A-7
D41921-2	12/12/12	15:40 BL	12/17/12	SO	Soil	D-5
D41921-3	12/13/12	16:45 BL	12/17/12	SO	Soil	F-5
D41921-4	12/13/12	16:50 BL	12/17/12	SO	Soil	F-8
D41921-5	12/13/12	12:55 BL	12/17/12	SO	Soil	J-6

Soil samples reported on a dry weight basis unless otherwise indicated on result page.

CASE NARRATIVE / CONFORMANCE SUMMARY

Client: A.G. Wassenaar, Inc. **Job No** D41921

Site: Dearmin Prop. - E12687.E2 **Report Date** 12/21/2012 8:37:35 AM

On 12/17/2012, 5 sample(s), 0 Trip Blank(s), and 0 Field Blank(s) were received at Accutest Mountain States (AMS) at a temperature of 4 °C. The samples were intact and properly preserved, unless noted below. An AMS Job Number of D41921 was assigned to the project. The lab sample ID, client sample ID, and date of sample collection are detailed in the report's Results Summary.

Specified quality control criteria were achieved for this job except as noted below. For more information, please refer to the analytical results and QC summary pages.

Volatiles by GCMS By Method SW846 8260B

Matrix SO **Batch ID:** V5V1528

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D41921-1MS, D41921-1MSD were used as the QC samples indicated.

Extractables by GC By Method SW846-8015B

Matrix SO **Batch ID:** OP7116

- All samples were extracted within the recommended method holding time.
- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D41921-4MS, D41921-4MSD were used as the QC samples indicated.

Wet Chemistry By Method SM19 2540B M

Matrix SO **Batch ID:** GN18130

- The data for SM19 2540B M meets quality control requirements.

AMS certifies that data reported for samples received, listed on the associated custody chain or analytical task order, were produced to specifications meeting AMS's Quality System precision, accuracy and completeness objectives except as noted.

Estimated non-standard method measurement uncertainty data is available on request, based on quality control bias and implicit for standard methods. Acceptable uncertainty requires tested parameter quality control data to meet method criteria.

AMS is not responsible for data quality assumptions if partial reports are used and recommends that this report be used in its entirety. This report is authorized by AMS indicated via signature on the report cover.

Summary of Hits

Job Number: D41921
Account: A.G. Wassenaar, Inc.
Project: Dearmin Prop. - E12687.E2
Collected: 12/12/12 thru 12/13/12

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Lab Sample ID / Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method
D41921-1	A-7					
TPH-DRO (C10-C28)		4.98 J	7.6	4.5	mg/kg	SW846-8015B
D41921-2	D-5					
TPH-DRO (C10-C28)		5.27 J	7.5	4.5	mg/kg	SW846-8015B
D41921-3	F-5					
No hits reported in this sample.						
D41921-4	F-8					
No hits reported in this sample.						
D41921-5	J-6					
No hits reported in this sample.						

Mountain States ACCUTEST LABORATORIES

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Sample Results

Report of Analysis

Report of Analysis

Client Sample ID:	A-7		
Lab Sample ID:	D41921-1	Date Sampled:	12/12/12
Matrix:	SO - Soil	Date Received:	12/17/12
Method:	SW846 8260B	Percent Solids:	87.9
Project:	Dearmin Prop. - E12687.E2		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	5V25017.D	1	12/19/12	BD	n/a	n/a	V5V1528
Run #2							

	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.09 g	5.0 ml	100 ul
Run #2			

Purgeable Aromatics+ GRO

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	63	31	ug/kg	
108-88-3	Toluene	ND	130	63	ug/kg	
100-41-4	Ethylbenzene	ND	130	24	ug/kg	
1330-20-7	Xylene (total)	ND	250	130	ug/kg	
	TPH-GRO (C6-C10)	ND	13000	6300	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
2037-26-5	Toluene-D8	95%		64-130%
460-00-4	4-Bromofluorobenzene	100%		62-131%
17060-07-0	1,2-Dichloroethane-D4	102%		70-130%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	A-7		
Lab Sample ID:	D41921-1	Date Sampled:	12/12/12
Matrix:	SO - Soil	Date Received:	12/17/12
Method:	SW846-8015B SW846 3546	Percent Solids:	87.9
Project:	Dearmin Prop. - E12687.E2		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FD20689.D	1	12/19/12	AV	12/18/12	OP7116	GFD1036
Run #2							

	Initial Weight	Final Volume
Run #1	30.0 g	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	4.98	7.6	4.5	mg/kg	J

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	66%		35-130%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	D-5		
Lab Sample ID:	D41921-2	Date Sampled:	12/12/12
Matrix:	SO - Soil	Date Received:	12/17/12
Method:	SW846 8260B	Percent Solids:	88.6
Project:	Dearmin Prop. - E12687.E2		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	5V25022.D	1	12/19/12	BD	n/a	n/a	V5V1528
Run #2							

	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.02 g	5.0 ml	100 ul
Run #2			

Purgeable Aromatics+ GRO

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	63	31	ug/kg	
108-88-3	Toluene	ND	130	63	ug/kg	
100-41-4	Ethylbenzene	ND	130	24	ug/kg	
1330-20-7	Xylene (total)	ND	250	130	ug/kg	
	TPH-GRO (C6-C10)	ND	13000	6300	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
2037-26-5	Toluene-D8	95%		64-130%
460-00-4	4-Bromofluorobenzene	99%		62-131%
17060-07-0	1,2-Dichloroethane-D4	100%		70-130%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	D-5		
Lab Sample ID:	D41921-2	Date Sampled:	12/12/12
Matrix:	SO - Soil	Date Received:	12/17/12
Method:	SW846-8015B SW846 3546	Percent Solids:	88.6
Project:	Dearmin Prop. - E12687.E2		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FD20690.D	1	12/19/12	AV	12/18/12	OP7116	GFD1036
Run #2							

	Initial Weight	Final Volume
Run #1	30.0 g	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	5.27	7.5	4.5	mg/kg	J

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	63%		35-130%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	F-5		
Lab Sample ID:	D41921-3	Date Sampled:	12/13/12
Matrix:	SO - Soil	Date Received:	12/17/12
Method:	SW846 8260B	Percent Solids:	87.9
Project:	Dearmin Prop. - E12687.E2		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	5V25023.D	1	12/19/12	BD	n/a	n/a	V5V1528
Run #2							

	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.03 g	5.0 ml	100 ul
Run #2			

Purgeable Aromatics+ GRO

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	63	32	ug/kg	
108-88-3	Toluene	ND	130	63	ug/kg	
100-41-4	Ethylbenzene	ND	130	24	ug/kg	
1330-20-7	Xylene (total)	ND	250	130	ug/kg	
	TPH-GRO (C6-C10)	ND	13000	6300	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
2037-26-5	Toluene-D8	96%		64-130%
460-00-4	4-Bromofluorobenzene	99%		62-131%
17060-07-0	1,2-Dichloroethane-D4	101%		70-130%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	F-5		
Lab Sample ID:	D41921-3	Date Sampled:	12/13/12
Matrix:	SO - Soil	Date Received:	12/17/12
Method:	SW846-8015B SW846 3546	Percent Solids:	87.9
Project:	Dearmin Prop. - E12687.E2		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FD20692.D	1	12/19/12	AV	12/18/12	OP7116	GFD1036
Run #2							

	Initial Weight	Final Volume
Run #1	30.0 g	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	7.6	4.5	mg/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	66%		35-130%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	F-8		
Lab Sample ID:	D41921-4	Date Sampled:	12/13/12
Matrix:	SO - Soil	Date Received:	12/17/12
Method:	SW846 8260B	Percent Solids:	94.3
Project:	Dearmin Prop. - E12687.E2		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	5V25024.D	1	12/19/12	BD	n/a	n/a	V5V1528
Run #2							

	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.03 g	5.0 ml	100 ul
Run #2			

Purgeable Aromatics+ GRO

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	56	28	ug/kg	
108-88-3	Toluene	ND	110	56	ug/kg	
100-41-4	Ethylbenzene	ND	110	21	ug/kg	
1330-20-7	Xylene (total)	ND	220	110	ug/kg	
	TPH-GRO (C6-C10)	ND	11000	5600	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
2037-26-5	Toluene-D8	96%		64-130%
460-00-4	4-Bromofluorobenzene	97%		62-131%
17060-07-0	1,2-Dichloroethane-D4	100%		70-130%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	F-8		
Lab Sample ID:	D41921-4	Date Sampled:	12/13/12
Matrix:	SO - Soil	Date Received:	12/17/12
Method:	SW846-8015B SW846 3546	Percent Solids:	94.3
Project:	Dearmin Prop. - E12687.E2		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FD20668.D	1	12/19/12	AV	12/18/12	OP7116	GFD1036
Run #2							

	Initial Weight	Final Volume
Run #1	30.1 g	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	7.1	4.2	mg/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	73%		35-130%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	J-6		
Lab Sample ID:	D41921-5	Date Sampled:	12/13/12
Matrix:	SO - Soil	Date Received:	12/17/12
Method:	SW846 8260B	Percent Solids:	87.1
Project:	Dearmin Prop. - E12687.E2		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	5V25025.D	1	12/19/12	BD	n/a	n/a	V5V1528
Run #2							

	Initial Weight	Final Volume	Methanol Aliquot
Run #1	5.06 g	5.0 ml	100 ul
Run #2			

Purgeable Aromatics+ GRO

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	64	32	ug/kg	
108-88-3	Toluene	ND	130	64	ug/kg	
100-41-4	Ethylbenzene	ND	130	24	ug/kg	
1330-20-7	Xylene (total)	ND	260	130	ug/kg	
	TPH-GRO (C6-C10)	ND	13000	6400	ug/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
2037-26-5	Toluene-D8	94%		64-130%
460-00-4	4-Bromofluorobenzene	99%		62-131%
17060-07-0	1,2-Dichloroethane-D4	98%		70-130%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	J-6		
Lab Sample ID:	D41921-5	Date Sampled:	12/13/12
Matrix:	SO - Soil	Date Received:	12/17/12
Method:	SW846-8015B SW846 3546	Percent Solids:	87.1
Project:	Dearmin Prop. - E12687.E2		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	FD20693.D	1	12/19/12	AV	12/18/12	OP7116	GFD1036
Run #2							

	Initial Weight	Final Volume
Run #1	30.1 g	1.0 ml
Run #2		

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	7.6	4.6	mg/kg	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
84-15-1	o-Terphenyl	48%		35-130%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range

J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Mountain States ACCUTEST LABORATORIES

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

CHAIN OF CUSTODY

PAGE 1 OF 1

ACCUTEST LABORATORIES

Accutest Laboratories Mountain States
4036 Youngfield Street Wheat Ridge, Co 80033
TEL. 303-425-6021 877-737-4521
FAX 303-425-6021

FED-EX Tracking # | Bottle Order Control #
Accutest Quote # | Accutest Job # D41921

Client / Reporting Information

Company Name: A. G. WASSENAAR, INC.
Street Address: 2180 S. IVANHOE ST. #5
City State Zip: DENVER, CO 80222
Project Contact E-mail: JOE PIETERICK, pieterick@agwassenaar.com
Phone # Fax #: 303-217-5110, 303-759-4874
Sampler(s) Name(s) Phone #: JOE PIETERICK 303-981-2107

Project Information

Project Name: DEARMIN - E12687.E2
Street: —
City: —
Project#: E12687.E2
Client PO#: E12687.E2
Project Manager: JOE PIETERICK

Billing Information (if different from Report to)

Company Name
Street Address
City State Zip
Attention: PO#

Requested Analysis (see TEST CODE sheet)

Accutest Sample #	Field ID / Point of Collection	MEOH/DI Vial #	Collection Date	Collection Time	Sampled by	Matrix	# of bottles	Number of preserved Bottles: HCl	NaOH	HNO3	H2SO4	NONE	DI Water	MEOH	ENCORE	Bisulfite	BTEX (8260)	GRO (8260)	DRO (8015)	LAB USE ONLY
	A-7		12-12-12	12:55	JDP	SOIL	2										X	X	X	01
	D-5		12-12-12	3:40	BVL		2										X	X	X	02
	F-5		12-13-12	4:45	BVL		2										X	X	X	03
	F-8		12-13-12	4:50	BVL		2										X	X	X	04
	J-6		12-13-12	12:55	BVL		2										X	X	X	05

Matrix Codes

DW - Drinking Water
GW - Ground Water
WW - Water
SW - Surface Water
SO - Soil
SL- Sludge
SED-Sediment
OI - Oil
LIQ - Other Liquid
AIR - Air
SOL - Other Solid
WP - Wipe
FB-Field Blank
EB- Equipment Blank
RB- Rinse Blank
TB-Trip Blank

Turnaround Time (Business days)

Approved By (Accutest PM): / Date:

- [ ] Std. 10 Business Days
- [x] Std. 5 Business Days (By Contract only)
- [ ] 5 Day RUSH
- [ ] 3 Day EMERGENCY
- [ ] 2 Day EMERGENCY
- [ ] 1 Day EMERGENCY

Emergency & Rush T/A data available VIA Lablink

Data Deliverable Information

- [ ] Commercial "A" (Level 1)
- [ ] Commercial "B" (Level 2)
- [ ] Commercial "B" +Narrative
- [ ] FULLT1 (Level 3+4)
- [ ] State Forms
- [ ] EDD Format
- [ ] PDF

Commercial "A" = Results Only
Commercial "B" = Results + QC Summary

Comments / Special Instructions

Sample Custody must be documented below each time samples change possession, including courier delivery.

	Relinquished by Sampler:	Date Time:	Received By:	Relinquished By:	Date Time:	Received By:
1	Joel D Pieterick	12-17-12 4:06	1	2		2
3	Relinquished by Sampler:	Date Time:	Received By: 3	Relinquished By: 4	Date Time:	Received By: 4
5	Relinquished by:	Date Time:	Received By: 5	Custody Seal # HD	[x] Intact [ ] Not Intact	Preserved where applicable [ ]

On Ice [x] Cooler Temp. 4.0

5.1 5

D41921: Chain of Custody
Page 1 of 2

Accutest Laboratories Sample Receipt Summary

Accutest Job Number: D41921 **Client:** A.G WASSENAAR, INC **Immediate Client Services Action Required:** No

Date / Time Received: 12/17/2012 4:06:00 PM **No. Coolers:** 1 **Client Service Action Required at Login:** No

Project: DEARMIN - E12687.E2 **Airbill #'s:** HD

Cooler Security	Y	or	N		Y	or	N
1. Custody Seals Present:	☑		☐	3. COC Present:	☑		☐
2. Custody Seals Intact:	☑		☐	4. Smpl Dates/Time OK	☑		☐

Cooler Temperature	Y	or	N
1. Temp criteria achieved:	☑		☐
2. Cooler temp verification:	Infared gun		
3. Cooler media:	Ice (bag)		

Quality Control Preservation	Y	or	N	N/A
1. Trip Blank present / cooler:	☐		☐	
2. Trip Blank listed on COC:	☐		☐	
3. Samples preserved properly:	☑		☐	
4. VOCs headspace free:	☐		☐	☑

Sample Integrity - Documentation	Y	or	N
1. Sample labels present on bottles:	☑		☐
2. Container labeling complete:	☑		☐
3. Sample container label / COC agree:	☑		☐

Sample Integrity - Condition	Y	or	N
1. Sample recvd within HT:	☑		☐
2. All containers accounted for:	☑		☐
3. Condition of sample:	Intact		

Sample Integrity - Instructions	Y	or	N	N/A
1. Analysis requested is clear:	☑		☐	
2. Bottles received for unspecified tests	☐		☑	
3. Sufficient volume rec'd for analysis:	☑		☐	
4. Compositing instructions clear:	☐		☐	☑
5. Filtering instructions clear:	☐		☐	☑

Comments

Accutest Laboratories
V:(303) 425-6021

4036 Youngfield Street
F: (303) 425-6854

Wheat Ridge, CO
www/accutest.com

5.1

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D41921: Chain of Custody
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Mountain States ACCUTEST LABORATORIES

GC/MS Volatiles

QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Blank Spike Summaries
- Matrix Spike and Duplicate Summaries

Method Blank Summary

Job Number: D41921
Account: AGWCODN A.G. Wassenaar, Inc.
Project: Dearmin Prop. - E12687.E2

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
V5V1528-MB	5V25014.D	1	12/19/12	BD	n/a	n/a	V5V1528

The QC reported here applies to the following samples: Method: SW846 8260B

D41921-1, D41921-2, D41921-3, D41921-4, D41921-5

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	50	25	ug/kg	
100-41-4	Ethylbenzene	ND	100	19	ug/kg	
108-88-3	Toluene	ND	100	50	ug/kg	
1330-20-7	Xylene (total)	ND	200	100	ug/kg	
	TPH-GRO (C6-C10)	ND	10000	5000	ug/kg	

CAS No.	Surrogate Recoveries		Limits
2037-26-5	Toluene-D8	95%	64-130%
460-00-4	4-Bromofluorobenzene	93%	62-131%
17060-07-0	1,2-Dichloroethane-D4	102%	70-130%

Blank Spike Summary

Job Number: D41921
Account: AGWCODN A.G. Wassenaar, Inc.
Project: Dearmin Prop. - E12687.E2

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
V5V1528-BS	5V25015.D	1	12/19/12	BD	n/a	n/a	V5V1528

The QC reported here applies to the following samples: Method: SW846 8260B

D41921-1, D41921-2, D41921-3, D41921-4, D41921-5

CAS No.	Compound	Spike ug/kg	BSP ug/kg	BSP %	Limits
71-43-2	Benzene	50	44.0	88	70-130
100-41-4	Ethylbenzene	50	43.2	86	70-130
108-88-3	Toluene	50	43.1	86	70-130
1330-20-7	Xylene (total)	150	134	89	70-130

CAS No.	Surrogate Recoveries	BSP	Limits
2037-26-5	Toluene-D8	98%	64-130%
460-00-4	4-Bromofluorobenzene	97%	62-131%
17060-07-0	1,2-Dichloroethane-D4	97%	70-130%

* = Outside of Control Limits.

Blank Spike Summary

Job Number: D41921
Account: AGWCODN A.G. Wassenaar, Inc.
Project: Dearmin Prop. - E12687.E2

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
V5V1528-BS	5V25016.D	1	12/19/12	BD	n/a	n/a	V5V1528

The QC reported here applies to the following samples: Method: SW846 8260B

D41921-1, D41921-2, D41921-3, D41921-4, D41921-5

CAS No.	Compound	Spike ug/kg	BSP ug/kg	BSP %	Limits
	TPH-GRO (C6-C10)	2200	2010	91	58-130

CAS No.	Surrogate Recoveries	BSP	Limits
2037-26-5	Toluene-D8	99%	64-130%
460-00-4	4-Bromofluorobenzene	94%	62-131%
17060-07-0	1,2-Dichloroethane-D4	97%	70-130%

* = Outside of Control Limits.

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: D41921
Account: AGWCODN A.G. Wassenaar, Inc.
Project: Dearmin Prop. - E12687.E2

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
D41921-1MS	5V25018.D	1	12/19/12	BD	n/a	n/a	V5V1528
D41921-1MSD	5V25019.D	1	12/19/12	BD	n/a	n/a	V5V1528
D41921-1	5V25017.D	1	12/19/12	BD	n/a	n/a	V5V1528

The QC reported here applies to the following samples: Method: SW846 8260B

D41921-1, D41921-2, D41921-3, D41921-4, D41921-5

CAS No.	Compound	D41921-1 ug/kg	Q	Spike ug/kg	MS ug/kg	MS %	MSD ug/kg	MSD %	RPD	Limits Rec/RPD
71-43-2	Benzene	ND		3140	3600	115	3430	109	5	64-139/30
100-41-4	Ethylbenzene	ND		3140	3430	109	3300	105	4	68-136/30
108-88-3	Toluene	ND		3140	3380	108	3260	104	4	60-130/30
1330-20-7	Xylene (total)	ND		9420	10700	114	10300	109	4	58-142/30

CAS No.	Surrogate Recoveries	MS	MSD	D41921-1	Limits
2037-26-5	Toluene-D8	96%	97%	95%	64-130%
460-00-4	4-Bromofluorobenzene	104%	105%	100%	62-131%
17060-07-0	1,2-Dichloroethane-D4	97%	96%	102%	70-130%

* = Outside of Control Limits.

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: D41921
Account: AGWCODN A.G. Wassenaar, Inc.
Project: Dearmin Prop. - E12687.E2

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
D41921-1MS	5V25020.D	1	12/19/12	BD	n/a	n/a	V5V1528
D41921-1MSD	5V25021.D	1	12/19/12	BD	n/a	n/a	V5V1528
D41921-1	5V25017.D	1	12/19/12	BD	n/a	n/a	V5V1528

The QC reported here applies to the following samples: Method: SW846 8260B

D41921-1, D41921-2, D41921-3, D41921-4, D41921-5

CAS No.	Compound	D41921-1 ug/kg	Q	Spike ug/kg	MS ug/kg	MS %	MSD ug/kg	MSD %	RPD	Limits Rec/RPD
	TPH-GRO (C6-C10)	ND		138000	120000	87	122000	88	2	14-174/30

CAS No.	Surrogate Recoveries	MS	MSD	D41921-1	Limits
2037-26-5	Toluene-D8	98%	97%	95%	64-130%
460-00-4	4-Bromofluorobenzene	101%	101%	100%	62-131%
17060-07-0	1,2-Dichloroethane-D4	97%	96%	102%	70-130%

* = Outside of Control Limits.

Mountain States ACCUTEST LABORATORIES

GC Semi-volatiles

QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Blank Spike Summaries
- Matrix Spike and Duplicate Summaries

Method Blank Summary

Job Number: D41921
Account: AGWCODN A.G. Wassenaar, Inc.
Project: Dearmin Prop. - E12687.E2

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP7116-MB	FD20660.D	1	12/19/12	AV	12/18/12	OP7116	GFD1036

The QC reported here applies to the following samples: Method: SW846-8015B

D41921-1, D41921-2, D41921-3, D41921-4, D41921-5

CAS No.	Compound	Result	RL	MDL	Units	Q
	TPH-DRO (C10-C28)	ND	6.7	4.0	mg/kg	

CAS No.	Surrogate Recoveries		Limits
84-15-1	o-Terphenyl	90%	35-130%

7.1.1

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Blank Spike Summary

Job Number: D41921
Account: AGWCODN A.G. Wassenaar, Inc.
Project: Dearmin Prop. - E12687.E2

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP7116-BS	FD20662.D	1	12/19/12	AV	12/18/12	OP7116	GFD1036

The QC reported here applies to the following samples: Method: SW846-8015B

D41921-1, D41921-2, D41921-3, D41921-4, D41921-5

CAS No.	Compound	Spike mg/kg	BSP mg/kg	BSP %	Limits
	TPH-DRO (C10-C28)	667	617	93	48-130

CAS No.	Surrogate Recoveries	BSP	Limits
84-15-1	o-Terphenyl	92%	35-130%

* = Outside of Control Limits.

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: D41921
Account: AGWCODN A.G. Wassenaar, Inc.
Project: Dearmin Prop. - E12687.E2

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
OP7116-MS	FD20664.D	1	12/19/12	AV	12/18/12	OP7116	GFD1036
OP7116-MSD	FD20666.D	1	12/19/12	AV	12/18/12	OP7116	GFD1036
D41921-4	FD20668.D	1	12/19/12	AV	12/18/12	OP7116	GFD1036

The QC reported here applies to the following samples: Method: SW846-8015B

D41921-1, D41921-2, D41921-3, D41921-4, D41921-5

CAS No.	Compound	D41921-4 mg/kg	Q	Spike mg/kg	MS mg/kg	MS %	MSD mg/kg	MSD %	RPD	Limits Rec/RPD
	TPH-DRO (C10-C28)	ND		705	613	87	580	82	6	20-168/30

CAS No.	Surrogate Recoveries	MS	MSD	D41921-4	Limits
84-15-1	o-Terphenyl	84%	76%	73%	35-130%

* = Outside of Control Limits.

Mountain States ACCUTEST LABORATORIES

12/19/12

Technical Report for

A.G. Wassenaar, Inc.

Dearmin Prop. - E12687.E2

Accutest Job Number: D41920

Sampling Date: 12/17/12

Report to:

A.G. Wassenaar, Inc.
2180 S Ivanhoe Street Suite 5
Denver, CO 80222
pieterickj@agwassenaar.com

ATTN: Joseph Pieterick

Total number of pages in report: **17**

ACCREDITED IN ACCORDANCE WITH nelac

Test results contained within this data package meet the requirements of the National Environmental Laboratory Accreditation Conference and/or state specific certification programs as applicable.

Brad Madadian
Laboratory Director

Client Service contact: Renea Jackson 303-425-6021

Certifications: CO, ID, NE, NM, ND (R-027) (PW), UT (NELAP CO00049), TX (T104704511-12-1)

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Sample Summary

A.G. Wassenaar, Inc.

Job No: D41920

Dearmin Prop. - E12687.E2

Sample Number	Collected Date	Time	By	Received	Matrix Code	Matrix Type	Client Sample ID
D41920-1	12/17/12	08:57	JP	12/17/12	AQ	Ground Water	B
D41920-2	12/17/12	09:03	JP	12/17/12	AQ	Ground Water	C
D41920-3	12/17/12	11:15	JP	12/17/12	AQ	Ground Water	K
D41920-4	12/17/12	11:23	JP	12/17/12	AQ	Ground Water	J

CASE NARRATIVE / CONFORMANCE SUMMARY

Client:	A.G. Wassenaar, Inc.	**Job No**	D41920
Site:	Dearmin Prop. - E12687.E2	**Report Date**	12/19/2012 2:14:40 PM

On 12/17/2012, 4 sample(s), 0 Trip Blank(s), and 0 Field Blank(s) were received at Accutest Mountain States (AMS) at a temperature of 4 °C. The samples were intact and properly preserved, unless noted below. An AMS Job Number of D41920 was assigned to the project. The lab sample ID, client sample ID, and date of sample collection are detailed in the report's Results Summary.

Specified quality control criteria were achieved for this job except as noted below. For more information, please refer to the analytical results and QC summary pages.

Volatiles by GC By Method SW846 8021B

Matrix AQ **Batch ID:** GTA1018

- All samples were analyzed within the recommended method holding time.
- All method blanks for this batch meet method specific criteria.
- Sample(s) D41909-1MS, D41909-1MSD were used as the QC samples indicated.
- D41920-4: Sample was not preserved to a pH < 2.

AMS certifies that data reported for samples received, listed on the associated custody chain or analytical task order, were produced to specifications meeting AMS's Quality System precision, accuracy and completeness objectives except as noted.

Estimated non-standard method measurement uncertainty data is available on request, based on quality control bias and implicit for standard methods. Acceptable uncertainty requires tested parameter quality control data to meet method criteria.

AMS is not responsible for data quality assumptions if partial reports are used and recommends that this report be used in its entirety. This report is authorized by AMS indicated via signature on the report cover.

Summary of Hits

Job Number: D41920
Account: A.G. Wassenaar, Inc.
Project: Dearmin Prop. - E12687.E2
Collected: 12/17/12

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Lab Sample ID Analyte	Client Sample ID	Result/ Qual	RL	MDL	Units	Method

D41920-1 B

No hits reported in this sample.

D41920-2 C

No hits reported in this sample.

D41920-3 K

No hits reported in this sample.

D41920-4 J

No hits reported in this sample.

Mountain States ACCUTEST LABORATORIES

Sample Results

Report of Analysis

Accutest Laboratories

Report of Analysis

Client Sample ID:	B		
Lab Sample ID:	D41920-1	Date Sampled:	12/17/12
Matrix:	AQ - Ground Water	Date Received:	12/17/12
Method:	SW846 8021B	Percent Solids:	n/a
Project:	Dearmin Prop. - E12687.E2		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	TA17919.D	1	12/18/12	SK	n/a	n/a	GTA1018
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

Purgeable Aromatics

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	1.0	0.20	ug/l	
108-88-3	Toluene	ND	2.0	1.0	ug/l	
100-41-4	Ethylbenzene	ND	2.0	1.0	ug/l	
1330-20-7	Xylenes (total)	ND	2.0	2.0	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
120-82-1	1,2,4-Trichlorobenzene	91%		60-140%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Accutest Laboratories

Report of Analysis

Client Sample ID:	C		
Lab Sample ID:	D41920-2	Date Sampled:	12/17/12
Matrix:	AQ - Ground Water	Date Received:	12/17/12
Method:	SW846 8021B	Percent Solids:	n/a
Project:	Dearmin Prop. - E12687.E2		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	TA17920.D	1	12/18/12	SK	n/a	n/a	GTA1018
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

Purgeable Aromatics

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	1.0	0.20	ug/l	
108-88-3	Toluene	ND	2.0	1.0	ug/l	
100-41-4	Ethylbenzene	ND	2.0	1.0	ug/l	
1330-20-7	Xylenes (total)	ND	2.0	2.0	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
120-82-1	1,2,4-Trichlorobenzene	88%		60-140%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	K		
Lab Sample ID:	D41920-3	Date Sampled:	12/17/12
Matrix:	AQ - Ground Water	Date Received:	12/17/12
Method:	SW846 8021B	Percent Solids:	n/a
Project:	Dearmin Prop. - E12687.E2		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1	TA17921.D	1	12/18/12	SK	n/a	n/a	GTA1018
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

Purgeable Aromatics

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	1.0	0.20	ug/l	
108-88-3	Toluene	ND	2.0	1.0	ug/l	
100-41-4	Ethylbenzene	ND	2.0	1.0	ug/l	
1330-20-7	Xylenes (total)	ND	2.0	2.0	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
120-82-1	1,2,4-Trichlorobenzene	91%		60-140%

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Report of Analysis

Client Sample ID:	J		
Lab Sample ID:	D41920-4	Date Sampled:	12/17/12
Matrix:	AQ - Ground Water	Date Received:	12/17/12
Method:	SW846 8021B	Percent Solids:	n/a
Project:	Dearmin Prop. - E12687.E2		

	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
Run #1 [a]	TA17922.D	1	12/18/12	SK	n/a	n/a	GTA1018
Run #2							

	Purge Volume
Run #1	5.0 ml
Run #2	

Purgeable Aromatics

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	1.0	0.20	ug/l	
108-88-3	Toluene	ND	2.0	1.0	ug/l	
100-41-4	Ethylbenzene	ND	2.0	1.0	ug/l	
1330-20-7	Xylenes (total)	ND	2.0	2.0	ug/l	

CAS No.	Surrogate Recoveries	Run# 1	Run# 2	Limits
120-82-1	1,2,4-Trichlorobenzene	89%		60-140%

(a) Sample was not preserved to a pH < 2.

ND = Not detected MDL - Method Detection Limit
RL = Reporting Limit
E = Indicates value exceeds calibration range
J = Indicates an estimated value
B = Indicates analyte found in associated method blank
N = Indicates presumptive evidence of a compound

Mountain States ACCUTEST LABORATORIES

Misc. Forms

Custody Documents and Other Forms

Includes the following where applicable:

- Chain of Custody

CHAIN OF CUSTODY

PAGE ___ OF ___

ACCUTEST LABORATORIES

Accutest Laboratories Mountain States
4036 Youngfield Street Wheat Ridge, Co 80033
TEL. 303-425-6021 877-737-4521
FAX 303-425-6021

FED-EX Tracking #	Bottle Order Control #
Accutest Quote #	Accutest Job # D41920

Client / Reporting Information

Company Name: A.G. WASSENAAR, INC.
Street Address: 2180 S. IVANHOE ST. #5
City State Zip: DENVER, CO 80222
Project Contact: JOE PIETERICK E-mail: pieterickjp@agwassenaar.com
Phone #: 303-217-5110 Fax #: 303-759-4074
Sampler(s) Name(s): JOE PIETERICK Phone #:

Project Information

Project Name: DEARMIN PROP. – E12687.E2
Street:
City:
Project#: E12687.E2
Client PO#: E12687.E2
Project Manager: JOE PIETERICK

Billing Information (If different from Report to)

Company Name:
Street Address:
City State Zip:
Attention: PO#

Requested Analysis (see TEST CODE sheet)

Accutest Sample #	Field ID / Point of Collection	MEOH/DI Vial #	Collection Date	Collection Time	Sampled by	Matrix	# of bottles	Number of preserved Bottles: HCl	NaOH	HNO3	H2SO4	NONE	DI Water	MEOH	ENCORE	Bisulfate	(8021) BTEX	LAB USE ONLY
	B		12-17-12	8:57	JP	GW	3	✓									X	01
	C		12/17/12	9:03	BVL	GW	3	✓									X	02
	K		12/17/12	11:15	BVL	GW	3	✓									X	03
	J		12-17-12	11:23	JP	GW	3	✓									X	04

Matrix Codes

DW - Drinking Water
GW - Ground Water
WW - Water
SW - Surface Water
SO - Soil
SL- Sludge
SED-Sediment
OI - Oil
LIQ - Other Liquid
AIR - Air
SOL - Other Solid
WP - Wipe
FB-Field Blank
EB- Equipment Blank
RB- Rinse Blank
TB-Trip Blank

Turnaround Time (Business days)

Approved By (Accutest PM): / Date:

- ☐ Std. 10 Business Days
- ☒ Std. 5 Business Days (By Contract only)
- ☐ 5 Day RUSH
- ☐ 3 Day EMERGENCY
- ☐ 2 Day EMERGENCY
- ☐ 1 Day EMERGENCY

Emergency & Rush T/A data available VIA Lablink

Data Deliverable Information

- ☐ Commercial "A" (Level 1)
- ☐ Commercial "B" (Level 2)
- ☐ Commercial "B" +Narrative
- ☐ FULLT1 (Level 3+4)
- ☐ State Forms
- ☐ EDD Format _____
- ☐ PDF

Commercial "A" = Results Only
Commercial "B" = Results + QC Summary

Comments / Special Instructions

Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by Sampler:	Date Time:	Received By:	Relinquished By:	Date Time:	Received By:
1	12-17-12/4:05P	1	2		2
Relinquished by Sampler: 3	Date Time:	Received By: 3	Relinquished By: 4	Date Time:	Received By: 4
Relinquished by: 5	Date Time:	Received By: 5	Custody Seal # 140 ☑ Intact ☐ Not Intact	Preserved where applicable ☐	On Ice ☒ Cooler Temp. 4.0

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D41920: Chain of Custody
Page 1 of 2

Accutest Laboratories Sample Receipt Summary

Accutest Job Number: D41920 **Client:** A.G WASSENAAR, INC **Immediate Client Services Action Required:** No

Date / Time Received: 12/17/2012 4:05:00 PM **No. Coolers:** 1 **Client Service Action Required at Login:** No

Project: DEARMIN PROP. - E12687.E2 **Airbill #'s:** HD

Cooler Security	Y	or	N		Y	or	N
1. Custody Seals Present:	☑		☐	3. COC Present:	☑		☐
2. Custody Seals Intact:	☑		☐	4. Smpl Dates/Time OK	☑		☐

Cooler Temperature	Y	or	N
1. Temp criteria achieved:	☑		☐
2. Cooler temp verification:	Infared gun		
3. Cooler media:	Ice (bag)		

Quality Control Preservation	Y	or	N	N/A
1. Trip Blank present / cooler:	☐		☐	
2. Trip Blank listed on COC:	☐		☐	
3. Samples preserved properly:	☑		☐	
4. VOCs headspace free:	☐		☐	☑

Sample Integrity - Documentation	Y	or	N
1. Sample labels present on bottles:	☑		☐
2. Container labeling complete:	☑		☐
3. Sample container label / COC agree:	☑		☐

Sample Integrity - Condition	Y	or	N
1. Sample recvd within HT:	☑		☐
2. All containers accounted for:	☑		☐
3. Condition of sample:	Intact		

Sample Integrity - Instructions	Y	or	N	N/A
1. Analysis requested is clear:	☑		☐	
2. Bottles received for unspecified tests	☐		☑	
3. Sufficient volume rec'd for analysis:	☑		☐	
4. Compositing instructions clear:	☐		☐	☑
5. Filtering instructions clear:	☐		☐	☑

Comments

Accutest Laboratories
V:(303) 425-6021

4036 Youngfield Street
F: (303) 425-6854

Wheat Ridge, CO
www/accutest.com

5.1

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D41920: Chain of Custody
Page 2 of 2

Mountain States ACCUTEST LABORATORIES

GC Volatiles

QC Data Summaries

Includes the following where applicable:

- Method Blank Summaries
- Blank Spike Summaries
- Matrix Spike and Duplicate Summaries

Method Blank Summary

Job Number: D41920
Account: AGWCODN A.G. Wassenaar, Inc.
Project: Dearmin Prop. - E12687.E2

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
GTA1018-MB	TA17911.D	1	12/18/12	SK	n/a	n/a	GTA1018

The QC reported here applies to the following samples: Method: SW846 8021B

D41920-1, D41920-2, D41920-3, D41920-4

CAS No.	Compound	Result	RL	MDL	Units	Q
71-43-2	Benzene	ND	1.0	0.20	ug/l	
100-41-4	Ethylbenzene	ND	2.0	1.0	ug/l	
108-88-3	Toluene	ND	2.0	1.0	ug/l	
1330-20-7	Xylenes (total)	ND	2.0	2.0	ug/l	

CAS No.	Surrogate Recoveries		Limits
120-82-1	1,2,4-Trichlorobenzene	90%	60-140%

Blank Spike Summary

Job Number: D41920
Account: AGWCODN A.G. Wassenaar, Inc.
Project: Dearmin Prop. - E12687.E2

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
GTA1018-BS	TA17912.D	1	12/18/12	SK	n/a	n/a	GTA1018

The QC reported here applies to the following samples: Method: SW846 8021B

D41920-1, D41920-2, D41920-3, D41920-4

CAS No.	Compound	Spike ug/l	BSP ug/l	BSP %	Limits
71-43-2	Benzene	27.2	22.8	84	70-130
100-41-4	Ethylbenzene	45.6	38.0	83	70-130
108-88-3	Toluene	212	172	81	70-130
1330-20-7	Xylenes (total)	216	196	91	70-130

CAS No.	Surrogate Recoveries	BSP	Limits
120-82-1	1,2,4-Trichlorobenzene	95%	60-140%

* = Outside of Control Limits.

Matrix Spike/Matrix Spike Duplicate Summary

Job Number: D41920
Account: AGWCODN A.G. Wassenaar, Inc.
Project: Dearmin Prop. - E12687.E2

Sample	File ID	DF	Analyzed	By	Prep Date	Prep Batch	Analytical Batch
D41909-1MS	TA17914.D	1	12/18/12	SK	n/a	n/a	GTA1018
D41909-1MSD	TA17915.D	1	12/18/12	SK	n/a	n/a	GTA1018
D41909-1	TA17913.D	1	12/18/12	SK	n/a	n/a	GTA1018

The QC reported here applies to the following samples: Method: SW846 8021B

D41920-1, D41920-2, D41920-3, D41920-4

CAS No.	Compound	D41909-1 ug/l	Q	Spike ug/l	MS ug/l	MS %	MSD ug/l	MSD %	RPD	Limits Rec/RPD
71-43-2	Benzene	ND		27.2	23.7	87	23.3	86	2	55-133/30
100-41-4	Ethylbenzene	ND		45.6	38.2	84	37.7	83	1	63-130/30
108-88-3	Toluene	ND		212	173	82	171	81	1	70-130/30
1330-20-7	Xylenes (total)	ND		216	197	91	195	90	1	64-130/30

CAS No.	Surrogate Recoveries	MS	MSD	D41909-1	Limits
120-82-1	1,2,4-Trichlorobenzene	96%	97%	94%	60-140%

* = Outside of Control Limits.

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PHASE I ENVIRONMENTAL SITE ASSESSMENT

DEARMIN PROPERTY
WELD COUNTY, COLORADO

PREPARED FOR

HC DEVELOPMENT AND MANAGEMENT SERVICES, INC.
4908 TOWER ROAD
DENVER, COLORADO 80237

NOVEMBER 1, 2012
PROJECT NUMBER E12625.E1

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EXECUTIVE SUMMARY

As requested, A. G. Wassenaar, Inc. (AGW) has conducted a Phase I Environmental Site Assessment (ESA) for the subject property identified as the Dearmin Property located in Weld County, Colorado. The subject property was evaluated for potentially significant on-site environmental contamination through a property inspection, a review of historical property uses, interviews with individuals associated with the property, and a review of environmental records available from government agencies.

AGW's inspection included visual and physical observations of the subject property to identify possible contamination or contamination sources, and a drive-by survey of the nearby area. The site is positioned southwest of the intersection of County Road 8 and County Road 5 in Weld County, Colorado. The site is approximately 300 acres in size, and is rectangular in shape, with two excepted parcels at the southeast corner. The majority of the property is vacant and appears to be used for agricultural purposes. Three producing oil and gas wells; William H. Peltier #12-20, William H. Peltier #2, and William Peltier 1A-20H, are located on the subject property near the western boundary, northern boundary, and eastern boundary, respectively. Buried natural gas lines run along the western and northern site boundaries. Overhead utilities are positioned along the northern site boundary and traverse a portion of the southwest corner of the site. Pad mounted transformers were observed along the northern site boundary and near the southwest corner of the subject property. Buried water and sewer pipes were indicated to be present on the western site boundary. A historic mine shaft and associated air shaft and mine waste pile, are located near the southeast corner of the site, just north of the excluded parcel.

The subject property is positioned within a mixed use neighborhood. County Road 8 (Erie Parkway) delineates the northern property boundary, while vacant, agricultural fields are located further north. A radio tower and Erie High School were located northeast of the subject property. The Mountain View Drag Strip is located east of County Road 5 which is positioned along the eastern site boundary. A vehicle junkyard is positioned within the excepted parcel in the southeast corner of the site. The Green Mill shooting range and a cluster of landfills are positioned to the south of the site. The unimproved Green Mill Road is in place along the western site boundary while residential homes within the Grandview development and overhead utilities are in place immediately west of the property. Vacant land was observed to the north, east, and south of the site. Any releases that may have occurred at the vehicle junkyard within the excepted parcel near the southeast corner are likely to be: considered de minimus, in small quantities, and exclusively associated with surficial contamination. Therefore, AGW does not believe that the junkyard poses a significant environmental threat to the subject property.

Historical research for the vicinity of the subject property was conducted in order to identify any past uses that have or may have negatively impacted the natural resources of the subject property. Our review of historical resources revealed that coal mining activities have been conducted on the subject property since the early 1900s, including associated historical mining structures used for bookeeping. One oil and gas well historically operated on the eastern portion of the site, in addition to the three wells that are currently in use. Demolition records for the former historical mining structures are unavailable, however, based upon observations made during the site reconnaissance (i.e. no irregular mounds), and aerial photographs, it is assumed that the buildings were demolished and the associated building debris recycled or disposed of off-site. However, if future development

of the property unearths building debris, construction activities should be halted until a Colorado Department of Public Health and Environment (CDPHE) certified asbestos Building Inspector can assess the debris. Available reports, including Western Environment and Ecology Inc.'s "Mine Subsidence Investigation, Horst Property, Section 20, Township 1 North, Range 68 West, Erie, Colorado" dated April 4, 2000, should be reviewed regarding issues of subsidence on the property, prior to development of the site.

Records of the U. S. Environmental Protection Agency, the Colorado Department of Public Health & Environment, the Colorado Department of Labor and Employment, and the Colorado Oil and Gas Conservation Commission were evaluated for information on hazardous materials and land sources of pollutants/hazards of potential concern, including known complaints and spills. A review of public records maintained by these agencies revealed eight solid waste landfill sites within one-half mile of the subject property; and three producing oil and gas wells, one plugged and abandon oil and gas well, and five permitted locations were located on the subject property. Files were reviewed regarding the cluster of landfills located one-half mile to the south of the site, and based on available information, location on the opposite side of the drainage, the presence of deep ground water, and the low probability of hazardous materials migrating onto the subject property, it is the opinion of AGW that these landfill sites do not pose a significant environmental threat to the subject property. Records maintained by regulatory agencies were reviewed and **the producing William H. Peltier #12-20, William H. Peltier #2, and William Peltier 1A-20H oil and gas wells and associated tank batteries, in addition to the historic plugged and abandoned William H. Peltier #1 oil and gas well, are recognized environmental conditions in relation to the subject property.**

We have performed a Phase I ESA in general conformance with the scope-of-work and limitations of American Standard of Testing Materials (ASTM) Standard Practice Designation E 1527-05 for the property identified as the Dearmin Property located in Weld County, Colorado. Any exceptions, or deletions from this practice are described in Section 12.0 of this report.

This assessment has revealed no evidence of recognized environmental conditions in connection with the property with the exception of the following:

- **The on-site and producing William H. Peltier #12-20, William H. Peltier #2, and William Peltier 1A-20H oil and gas wells and associated tank batteries, in addition to the historic plugged and abandoned William H. Peltier #1 oil and gas well.**

The following items are not considered recognized environmental conditions; however, AGW has determined these issues to be important environmental considerations which should be understood in connection with the property:

- Oil and gas wells raise a concern from a land development standpoint. Structures should not be constructed within the required set back of operational wells and production equipment. Additionally, the five permitted locations will likely be drilled and have associated wells in the future. Based on this, if future development is planned for the subject property, AGW recommends that appropriate setbacks be placed from all oil and gas wells located on the property.

- An oil and gas pipeline runs below the ground surface along the western and northern boundaries of the site. Although AGW did not observe any environmental indicators (such as broken ground surface or soil staining) that a leak has occurred within this high pressure gas pipeline, it has the potential to leak in the future. If a leak occurs, appropriate remedial actions should be taken and AGW should be contacted immediately.
- While not an environmental concern, former underground coal mining operations in the area have led to subsidence issues across the subject property. AGW strongly recommends reviewing available reports such as: Western Environment and Ecology Inc.'s "Mine Subsidence Investigation, Horst Property, Section 20, Township 1 North, Range 68 West, Erie, Colorado" dated April 4, 2000 and CTL Thompson, Inc.'s "Geological and Preliminary Geotechnical Investigation, Horst Property, County Roads 5 and 8, Weld County, Colorado" dated June 1, 2000, regarding subsidence issues in the area.
- Demolition records for the historical mining structures are unavailable, but based on observations made during the site reconnaissance (i.e. no irregular mounds), it is assumed that the buildings were demolished and the associated building debris recycled or disposed of off-site. However, if future development of the property unearths building debris, construction activities should be halted until a Colorado Department of Health and Environment (CDPHE) certified asbestos Building Inspector can assess the debris.

This report was written to summarize AGW's findings during a Phase I ESA of the subject property. Although AGW completes thorough studies, no warranty is made of the accuracy, completeness, and timeliness of information obtained from government or third party sources. No parties, except the Client, are authorized to review this report unless they agree to waive any possible claims against A.G. Wassenaar, Inc., arising from such use.

Phase I Environmental Site Assessment
Dearmin Property
Weld County, Colorado
November 1, 2012

1.0 INTRODUCTION

As requested, A. G. Wassenaar, Inc. (AGW) has completed a Phase I Environmental Site Assessment (ESA) for the subject property, identified as the Dearmin Property in Weld County, Colorado. The project was conducted for HC Development and Management Services, Inc.

2.0 PURPOSE AND SCOPE OF WORK

AGW's assessment is designed to be in general accordance with Phase I ESAs as established by the American Society of Testing and Materials (ASTM), Standard Practice Designation E 1527-05. The assessment consists of a site reconnaissance to identify potential environmental problems; interviews with individuals having knowledge of the subject site; a review of publicly available records pertaining to environmental resources at the subject site; and a report documenting AGW's findings, opinion, and conclusions.

This report will identify *recognized environmental conditions* which have been identified in relation to the subject property (if any) and provide recommendations for any further action. The term recognized environmental condition is defined as the presence or likely presence of any hazardous substances or petroleum products on the property under conditions that indicate an existing release, past release, or material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, ground water, or surface water of the property. The term

includes hazardous substances or petroleum products even under conditions in compliance with laws. The term is not intended to include de minimus conditions that generally do not present a material risk of harm to public health or the environment and that generally would not be the subject of enforcement action if brought to the attention of appropriate government agencies.

3.0 SITE DESCRIPTION

The subject property can generally be described as a portion of the Northern 1/2 of Section 20; Township 1 North, Range 68 West of the Sixth Principal Meridian. The site is positioned southwest of the intersection of County Road 8 and County Road 5 in Weld County, Colorado. Physical setting information for the site is described in Table I below.

Table I
Physical Setting

Elevation of Subject Property	Approximately 5,100 to 5,200 feet above sea level	Source: USGS Topographic Map, Erie, Colorado, 1967 (revised 1979)
Topographic Gradient	Gentle slope to northwest.	
Closest Surface Water	Drainage located to the south	

4.0 SITE RECONNAISSANCE

The property was inspected by Ms. Kristin Schwartz on October 24, 2012. The inspection included a thorough visual survey of the subject property (including a physical inspection of the property grounds for visible signs of contamination or contamination sources), as well as a drive-by survey of the nearby area. Site maps of the property are included as Figures 1 and 2 in this report, and photographs taken during the site visit are included in Attachment A.

4.1 Property Grounds

The site is positioned southwest of the intersection of County Road 8 and County Road 5 in Weld County, Colorado. The site is approximately 300 acres in size, and is rectangular in shape, with two excepted parcels at the southeast corner. The majority of the property is vacant and appears to be used for agricultural purposes. Three producing oil and gas wells; William H. Peltier #12-20, William H. Peltier #2, and William Peltier 1A-20H, are located on the subject property near the western boundary, northern boundary, and eastern boundary, respectively. Buried natural gas lines run along the western and northern site boundaries. Although AGW did not observe any environmental indicators (such as broken ground surface or soil staining) that a leak has occurred within this high pressure gas pipeline, it has the potential to leak in the future. If a leak occurs, appropriate remedial actions should be taken and AGW should be contacted immediately. Overhead utilities are positioned along the northern site boundary and traverse a portion of the southwest corner of the site. Pad mounted transformers were observed along the northern site boundary and near the southwest corner of the subject property. Buried water and sewer pipes were indicated to be present on the western site boundary. A historic mine shaft and associated air shaft and mine waste pile, are located near the southeast corner of the site, just north of the excluded parcel. Acid mine drainage, and other common environmental concerns associated with former mining activities and waste piles, are unlikely to be a problem with coal mine waste piles, but rather with mineral mine waste piles. Therefore, the coal waste pile on the subject property is not a recognized environmental condition in relation to the subject property. **AGW identifies the William H. Peltier #12-20, William H. Peltier #2, and William Peltier 1A-20H oil and gas wells and tank batteries as recognized environmental conditions in relation to the subject property.** Further discussion of these, and former, on-site oil and gas wells can be found in Section 7.1 of this report.

Site reconnaissance observations are detailed in Table II below, and shown in Figure 1 and Attachment A of this report.

Table II

Site Reconnaissance Observations	
Current Use of Subject Property	The majority of the parcel is currently vacant and appears to be used primarily for agricultural purposes. One historic mine shaft and associated mine waste pile are located near the southeast site boundary. Three producing oil wells and associated tank batteries are in place at the western, northern, and eastern site boundaries. A natural gas pipeline runs along the western and northern site boundaries.
Configuration	Rectangular in shape with a two excepted parcels at the southeast corner.
Boundaries	North- Weld Country Road 8 (Erie Parkway), overhead electrical lines, pad mounted transformers, and agricultural land. A radio tower and Erie High School are in place to the northeast of the site. East- Weld County Road 5, Mountain View Drag Strip, and vacant land. South- Green Mill shooting range, a cluster of landfills, overhead utilities, and vacant land. A vehicle junkyard is located in the excepted parcel of land near the southeast corner of the property. West- Unimproved Green Mill Road, residential homes within the Grandview development, and a fire department.
Vegetation	Short grasses and weeds, mainly exposed soils.
Topography	Mild elevation changes throughout the site with a general slope to the south and west.
Structures or other improvements on the subject property	Three oil and gas wells with associated batteries and separators, overhead electrical lines, pad-mounted transformers, and buried natural gas pipelines.
Roads adjoining the property and roads, streets, parking facilities on subject property	Weld County Road 8 (Erie Parkway) to the north, Weld County Road 5 to the east, unimproved Green Mill Road to the west, unimproved roads extending from the property boundaries towards the oil wells, and an unimproved road in place north of the vehicle junkyard.
Debris	Inert debris observed in various locations on the subject property. Debris located near the mine shaft and mine waste pile includes, but is not limited to: a couch, tires, an empty 55 gallon drum, broken electrical equipment, abandoned motor boat, and wooden scraps.

Table II (continued)

Site Reconnaissance Observations	
Hazardous substances and petroleum products stored on the subject property	None observed
Storage Tanks	Storage / separation tanks in place adjacent to all three oil wells.
Vent pipes	None observed
Utility lines	Overhead utility lines are in place along the northern boundary and near the southwest corner of the site. Buried natural gas lines are present along the west and north property boundaries. Water and sewer pipelines were indicated to be in place at the western site boundary.
Odors	None observed
Pools of Liquid	None observed
Drums	An empty 55 gallon drum was observed near the historic mine shaft. No staining was observed near the drum and no liquids were present inside, therefore, it is not considered a recognized environmental condition.
Unidentified Substance Containers	None observed
PCBs	One pad mounted transformer is in place near the southwest portion of the site and several are in place along the northern boundary of the site. These appear to be relatively new and, therefore, are unlikely to contain PCBs.
Pits, ponds, or lagoons	None observed
Wetlands	None observed
Stained soil or pavement	Black colored soil was stockpiled near the historic coal mine shaft at the southeast portion of the site. Coal waste piles are not a concern in regards to acid mine drainage and other common environmental concerns associated with historical mining activities. Therefore, the coal waste pile is not a recognized environmental condition.
Stressed vegetation	None observed
Wells	Three oil wells and associated tank batteries are in place near the western, northern, and eastern site boundaries.

AGW recommends reviewing available files, including: Western Environment and Ecology Inc.'s "Mine Subsidence Investigation, Horst Property, Section 20, Township 1 North, Range 68 West, Erie, Colorado" dated April 4, 2000; CTL Thompson, Inc. "Geological and Preliminary Geotechnical Investigation, Horst Property, County Roads 5 and 8, Weld County, Colorado" dated June 1, 2000; A.G. Wassenaar's "Preliminary Geotechnical Study for Site Development Proposed 305 Acre Residential Development, Weld County Road 5 at Weld County Road 8, Erie, Colorado" dated December 30, 2004; Michael W. West and Associates, Inc. "Engineering Geology and Mine Subsidence Study, Highland Park Subdivision near Erie, Weld County, Colorado" dated March 23, 2005; and CTL Thompsons's "Subsidence Investigation, Highland Park Subdivision, Weld County, Colorado" dated August 25, 2005, regarding subsidence issues on the subject property.

4.2 Surrounding Properties

The subject property is positioned within a mixed use neighborhood. County Road 8 (Erie Parkway) delineates the northern property boundary, while vacant, agricultural fields are located further north. A radio tower and Erie High School were located northeast of the subject property. The Mountain View Drag Strip is located east of County Road 5 which is positioned along the eastern site boundary. A vehicle junkyard is positioned within the excepted parcel in the southeast corner of the site. The Green Mill shooting range and a cluster of landfills are positioned to the south of the site. The unimproved Green Mill Road is in place along the western site boundary while residential homes within the Grandview development and overhead utilities are in place immediately west of the property. Vacant land was observed to the north, east, and south of the site. Any releases that may have occurred at the vehicle junkyard within the excepted parcel near the southeast corner are likely to be: considered de minimus, in small quantities, and exclusively associated with surficial contamination.

Therefore, AGW does not believe that the junkyard poses a significant environmental threat to the subject property.

5.0 INTERVIEWS

James Dearmin, Property Owner

Mr. Dearmin was interviewed by telephone on October 26, 2012. Mr. Dearmin purchased the property around 1981 and has historically used the land for growing wheat. No significant use of pesticides, herbicides, or insecticides was reported by Mr. Dearmin nor were any of these chemicals ever stored on the property. He indicated that mining operations began on the property around the turn of the 19th century and ceased approximately 50-60 years ago. Mr. Dearmin believes buildings previously located on the subject property were used for mine bookkeeping, and were torn down in the 1930s. He stated that the mining shaft, located on the subject property, approximately 700 feet deep, was closed down by the State and testing regarding subsidence has been conducted on the site. According to Mr. Dearmin, the waste pile has been in place since the beginning of the mining operations. Mr. Dearmin stated that the subject property is a permitted, but never used, landfill site. Mr. Dearmin believes the vehicle junkyard adjacent to the site has been in operation for approximately 30 years, during which he has never witnessed any improper disposal of substances by the owner. Additionally, Mr. Dearmin acknowledged the three oil and gas wells currently operating on his property. He indicated that the well located near the northern boundary starting production in, approximately, 1956 and that the well located near the eastern boundary was drilled within the last year. Mr. Dearmin informed AGW that he is unaware of any dumping, hazardous waste disposal, or other environmental concerns on the subject property or within the surrounding area.

Douglas Ikenberry, Colorado Department of Public Health and Environment, Solid Waste Unit

AGW conducted an interview with Mr. Ikenberry on October 29, 2012. This interview is included in Section 7.1 of this report..

6.0 SITE HISTORY

The historic land use of the subject property and the surrounding areas were examined with the purpose of interpreting, where possible, the past activities that have or may have negatively impacted the natural resources of the site. The references reviewed included: USGS Topographic Maps of Niwot, Colorado, dated 1902; and Erie, Colorado, dated 1948, 1966, 1971, and 1978; and aerial photographs dated 1937, 1979, and 1985. Copies of Topographic Maps and Aerial Photographs are included in Attachment D.

6.1 USGS Topographical Maps

Table III
Topographical Maps

USGS Topographical Map	Direction	Description
Niwot Quadrangle, 15-minute map: 1902	Subject Property	Vacant land
	North	Downtown Erie positioned less than one mile northwest, several roads and drainages are in place less than one mile north. One structure is visible within a quarter mile northwest of the site.
	East	An improved road and unimproved road are in place to the east / northeast, abutting the northeast corner of the subject property. Otherwise, vacant land.
	South	Two drainages traverse from east to west, otherwise, vacant land.
	West	Two railroads, including the Burlington and Missouri River Railroad, and improved roads are in place less than one mile west, directly south of downtown Erie.

Table III (continued)

USGS Topographical Map	Direction	Description
Erie Quadrangle, 7.5-minute map: 1948	Subject Property	An inactive State Mine, dump, and two associated structures are positioned near the southeast corner of the property. Otherwise, vacant land.
	North	Weld County Road 8 in place at the northern boundary. A mine dump is in place within a quarter mile northwest of the property and the Clayton Mine (inactive) is located within a mile to the northeast. Roads no longer depicted and the Erie Cemetery is in place to the northwest.
	East	Weld County Road 5 in place at the eastern boundary, otherwise, vacant land.
	South	Pipeline traverses from northwest to southeast across the property to the south. The Columbine Mine (inactive), dump, and associated structures are positioned approximately one mile south of the subject property. One drainage outlet is located within a quarter mile south.
	West	The Cottonwood Extension Ditch in place to the west of the subject property, otherwise, vacant land.
Erie Quadrangle, 7.5-minute map: 1966	Subject Property	One structure and mine prospect/shaft is located near the southeast corner of the subject property. Otherwise, vacant land.
	North	Mine dump no longer depicted. One unimproved road and outbuilding are in place within a mile north of the property. Otherwise, no visible changes.
	East	Mountain View Drag Strip and associated building are place directly east of County Road 5. Otherwise, no visible changes.
	South	One additional drainage outlet in place and most of the structures associated with the Columbine Mine are no longer depicted. Otherwise, no visible changes.
	West	No visible changes
Erie Quadrangle, 7.5-minute map: 1971	Subject Property	No visible changes
	North	No visible changes
	East	No visible changes
	South	No visible changes
	West	No visible changes

Table III (continued)

USGS Topographical Map	Direction	Description
Erie Quadrangle, 7.5-minute map: 1978	Subject Property	No visible changes
	North	Additional structures visible in downtown Erie, northwest of the site. Unimproved road and outbuilding no longer depicted. Otherwise, no visible changes.
	East	Additional structures located south of the Mountain View Drag Strip.
	South	An unimproved road in place approximately one-half mile south.
	West	An unimproved road in place at the western boundary of the property and additional unimproved roads visible to the east.
Erie Quadrangle, 7.5-minute map: 1967 (revised 1979)	Subject Property	No visible changes
	North	No visible changes
	East	No visible changes
	South	No visible changes
	West	No visible changes

Historical research indicates that mining operations began on the subject property in the early 1900s. The mine reportedly produced 3,518,912 tons of sub-bituminous grade coal prior to its closure in 1946, according to a subsidence investigation report by Western Environment and Ecology, Inc. (Western Environment), dated April 4, 2000. Mining operations consisted of underground coal mining, and was classified as a modified room and pillar mine, with entries approximately ten feet wide and rooms approximately 20 feet wide and 150 feet long. Access to the mine was through a shaft, approximately 330 feet deep, according to Western Environment, and was located on the eastern portion of the subject property. AGW recommends reviewing Western Environment's report, as well as other available reports discussed in Section 4; prior to development regarding issues of subsidence in relation to the subject property.

6.2 Aerial Photographs

Table VI
Aerial Photographs

Aerial Photograph	Direction	Description
1937	Subject Property	Several structures and unimproved roads associated with the State Mine are present near the southeast corner of the site. Several drainages traverse the southern portion of the site. Weld County Road 8 is in place delineating the sites northern boundary. Otherwise, vacant land.
	North	Predominately vacant land with a drainages located directly north.
	East	Weld County Road 8 is in place along the eastern site boundary. An unimproved road is visible to the east originating from the mining activities on site.
	South	Vacant land with drainages traversing most of the land.
	West	A stream is present within a quarter mile east.
1979	Subject Property	One oil and gas well with associated unimproved road is visible on the eastern portion of the site. Some of the structures and unimproved roads associated with the mine are no longer depicted. Otherwise, vacant land.
	Surrounding Properties	Mountain View Drag Strip and associated buildings are in place to the east. County Road 3 is located on the western site boundary. Some grading activities are visible to the south.
1985	Subject Property	No significant changes.
	Surrounding Properties	Additional structures are in place along the drag strip to the east. Grading activities and agricultural land is present to the south of the property. An oil and gas well is located north of the property.

Demolition records for the former historical outbuilding are unavailable, however, based upon observations made during the site reconnaissance (i.e. no irregular mounds), and aerial photographs, it is assumed that the building was demolished and the associated building debris recycled or disposed of off-site. However, if future development of the property unearths building debris, construction activities should be halted until a Colorado Department of Public Health and Environment (CDPHE) certified asbestos Building Inspector can assess the debris.

7.0 PUBLIC RECORDS REVIEW

A review of public records was completed by Satisfi Environmental Information (Satisfi) of Castle Rock, Colorado. This record search was defined to meet or exceed the ASTM guidelines for a Phase I ESA records search. The search area defined by ASTM varies from adjacent properties to a maximum of a one mile radius.

The information reviewed for this assessment includes the following: National Priorities List (NPL) Superfund sites; State equivalent NPL sites (SPL); facilities investigated for potential releases of hazardous materials to the environment (Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS); hazardous waste facilities (RCRA); documented spills or hazardous releases; leaking underground storage tanks (LUST); registered USTs and ASTs; and solid or hazardous waste landfills. Summarized data follows with specific information and mapping details contained in Attachment E.

Table V
Summary of Publicly Available Environmental Records

Federal Databases		Approximate Minimum Search Distance	Results
NPL	The National Priorities List (NPL) is the USEPA's database of uncontrolled or abandoned hazardous waste facilities that have been listed for priority remedial actions under the Superfund Program.	1.0	0
CORRACT	The USEPA maintains a database of RCRA facilities that are undergoing "corrective action". A "corrective action" order is issued when there has been a release of hazardous waste or constituents into the environment from a RCRA facility.	1.0	0
TSD	The USEPA maintains a database of RCRA facilities associated with treatment, storage, or disposal (TSD) of hazardous waste.	0.50	0
CERCLIS	The CERCLIS database is a compilation of facilities that USEPA has or is currently investigating for a release or threatened release of hazardous substances subject to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980.	0.50	0
Spill	The Emergency Response Notification System (ERNS) is a listing compiled by the USEPA and the Coast Guard's National Response Center of reported releases of petroleum and hazardous substances to the air, soil and/or water.	0.25	0

Table V (continued)

Federal Databases		Approximate Minimum Search Distance	Results
Generator	The US EPA's Resource Conservation and Recovery Act (RCRA) database identifies facilities that generate hazardous waste. Large quantity generators (LQG) produce at least 1,000 kg/month of hazardous waste or 1 kg/ month of acutely hazardous waste. Small quantity generators (SQG) produce 100 to 1,000 kg/ month of hazardous waste. Conditionally exempt small quantity generators (CESQG) generate less than 100 kg/month of hazardous waste.	0.25	0
Other	The US EPA's Resource Conservation and Recovery Act (RCRA) database also identifies facilities that are transporters of hazardous waste, former generators, and suspected generators. Non-generators that have been inspected or have sent in notifications are also included.	0.25	0
State Databases			
VCL	State Voluntary Cleanup Lists include sites that are being cleaned up or that have applied for a No Action Determination from the State.	0.50	0
Solid Waste	State lists of solid waste facilities. This category also includes lists compiled from various local agencies.	0.50	8
Tank Leak	State list of leaking underground storage tanks (LUSTs) and above-ground tank leaks. This category also includes LUST Trust sites where no responsible party has been identified.	0.50	0
Tank	State list of registered underground storage tanks (USTs) and above-ground storage tanks (ASTs).	0.25	0
AUL	Activity and Use Limitations include sites with either Engineering Controls or Institutional Controls that are intended to prevent exposure to contamination that has been left in place.	0.25	0
Oil and Gas Wells	Colorado Oil and Gas Commission- In general, oil and gas production wells present an environmental hazard during all stages of their use, including: initial construction and development, production, and through underground or surface transport. At each stage of the process of oil and gas production, significant potential for hydrocarbon release is present	On Site	9

7.1 Solid or Hazardous Waste Landfill Sites

Table VI
Landfill Sites

Map ID	Site Name and Location	Distance (miles)	Recognized Environmental Condition?
1	Horst/Dearmin Historic Landfill	0.34 SE	No, based on available information
1	Horst SWDS (AKA Erie SWDS) 2240 Weld County Road 5	0.09 SE	No, based on available information

Table VI (continued)

Map ID	Site Name and Location	Distance (miles)	Recognized Environmental Condition?
2	Denver Regional Landfill / Denver Regional Landfil North and South 1441 Weld County Road 6	0.50 SE	No, based on location and available information
2	Colorado Landfill Historic Landfill	0.50 SE	No, based on location and available information
2	Laidlaw South 1441 Weld County Road 6	0.50 SE	No, based on location and available information
2	Laidlaw North Weld County Road 6	0.50 SE	No, based on location and available information
2	Laidlaw North Weld County Road 6	0.50 SE	No, based on location and available information
2	Erie Landfill Road 6 & 5 Address Not Reported	0.50 SE	No, based on location and available information

The Horst SWDS (Erie SWDS) located at 2240 Weld County Road 5 is listed as a registered landfill and is located on the subject property. During an interview with the property owner, included in Section 5.0 of this report, he explained that the subject property has received a permit to operate as a landfill, however, landfill activities have never taken place at this location due to subsidence issues. In addition, no evidence of landfill activities was noted during the site visit. Based on this information, it is the opinion of AGW that the natural resources of the subject property have not been compromised due to landfill activities at this location.

A cluster of landfills which have all changed names several times are located less than one mile south of the subject property. On October 29, 2012, AGW conducted an interview with Douglas Ikenberry of the Colorado Department of Public Health and Environment regarding these landfill sites. He stated that the Old Erie Landfill, located directly east of the Denver Regional Landfill, opened in the 1960s, and is now closed. Monitoring events at this site as well as at the Denver

Regional North Landfill, have indicated very low levels of volatile organic compounds (VOCs). These, in addition to the discovery of a sulfate leachate, led to the installation of a clay wall sump along the northern boundary of the landfill. Furthermore, Mr. Ikenberry indicated that the northern half of the Denver Regional Landfill was permitted in 1979, pre-dating RCRA Subtitle D, and therefore no liner is in place. The Denver Regional Landfill North is currently closed and post closure monitoring is being performed at this site.

Mr. Ikenberry reported that currently, monitored iron levels are exceeding the secondary standards at the Denver Regional North landfill and it is undergoing investigation. They believe that this exceedance is due to an alternate source demonstration and not resulting from the contents within the landfill. This alternate source is believed to be iron oxide contained with the Laramie rock formation, which the landfill sits on top of. Recent spikes in iron levels near the clay sump have led to the installation of two monitoring wells; one monitoring the top soil and the other monitoring deeper bedrock, to determine the source of these high iron levels. Mr. Ikenberry stated that all of the landfills in this vicinity are located within the Laramie Formation, enclosed in claystone, and that sand lenses in the area are not continuous. Additionally, he indicated that the landfills and subject property are on top of the Laramie Fox Hills aquifer which is located approximately 300 - 400 feet below ground surface, and that most of the ground water in the area, if encountered, would likely be perched groundwater entrained in pockets within the claystone or sandstone.

Based on available information, location on the opposite side of the drainage, the presence of deep ground water, and the low probability for hazardous materials migrating onto the subject property,

it is the opinion of AGW that these landfill sites do not pose a significant environmental threat to the subject property.

7.2 Oil and Gas Production Wells

The Colorado Oil and Gas Commission (COGCC) maintains a database record of all oil and gas wells located within the state. In general, oil and gas production wells present an environmental hazard during all stages of their use, including: initial construction and development, production, and through underground or surface transport. At each stage of the process of oil and gas production, significant potential for hydrocarbon release is present. Nine oil and gas wells; three currently active, one no longer in use, and five permitted locations, are documented on the subject property. The three producing oil and gas wells; William H. Peltier #12-20, William H. Peltier #2, and William Peltier 1A-20H, are located on the western, northern, and eastern site boundaries, respectively. The William Peltier well #1 while not currently active, was formerly located on the eastern portion of the site. The oil and gas wells on the subject property are summarized in Table VII below:

Table VII
Oil and Gas Wells

Map ID	Well Name	Location	Operator	Spud Date	Status
1	Williams H. Peltier #12-20	SWNW 20 1N 68W 6PM	Encana Oil and Gas (USA) Inc.	2007	PR- Producing
2	William Peltier #11-20	SWNW 20 1N 68W 6PM	Encana Oil and Gas (USA) Inc.	N/A	XX- Permit Location
3	William Peltier #2-0-20	SWNW 20 1N 68W 6PM	Encana Oil and Gas (USA) Inc.	N/A	XX- Permit Location

Table VII (continued)

Map ID	Well Name	Location	Operator	Spud Date	Status
4	William Peltier #4-2-20	SWNW 20 1N 68W 6PM	Encana Oil and Gas (USA) Inc.	N/A	XX- Permit Location
5	William Peltier #2-4-20	SWNW 20 1N 68W 6PM	Encana Oil and Gas (USA) Inc.	N/A	XX- Permit Location
6	William Peltier #22-20	SWNW 20 1N 68W 6PM	Encana Oil and Gas (USA) Inc.	N/A	XX- Permit Location
7	William H. Peltier #2	NENW 20 1N 68W 6PM	Encana Oil and Gas (USA) Inc.	1985	PR- Producing
8	William H. Peltier #1	NENE 20 1N 68W 6PM	Vessels Oil and Gas Co.	1974	PA- Plugged and Abandoned
9	William Peltier #1A-20H	NENE 20 1N 68W 6PM	Encana Oil and Gas (USA) Inc.	2011	PR- Producing

After review of the information contained within the COGCC including status, spud dates of the producing wells, and on-site locations, **AGW identifies the William Peltier #1 plugged and abandoned well and the William H. Peltier #12-20, William H. Peltier #2, and William Peltier 1A-20H producing wells and associated tank batteries as recognized environmental conditions in relation to the subject property.**

Oil and gas wells raise a concern from a land development standpoint. Structures should not be constructed within a certain distance of operational wells and production equipment. Additionally, the five permitted locations will likely be drilled and have associated wells in the future. Based on this, if future development is planned for the subject property, AGW recommends that appropriate setbacks be placed from all oil and gas wells located on the property.

7.3 Unmapped Sites

Five unmapped sites were listed during the Satisfi records search. This site could not be mapped accurately because of inadequate addresses or street maps. Unmapped listings are reported by Satisfi on the chance that their location might be revealed during the course of a site visit or other research. However, unless there is some specific reason to believe that a listing is nearby and of potential concern, there is no requirement in the ASTM standard to attempt to verify the location of these listings. Based on available information, there is no reason to believe this listing is within one mile of the subject property.

8.0 ENVIRONMENTAL LIENS

On October 29, 2012 AGW corresponded with Mr. Chad Ellington of HC Development and Management Services, Inc., to inquire about any known environmental liens associated with the subject property. Mr. Ellington indicated that he is unaware of any existing environmental liens associated with the subject property. A review of public records was completed by Satisfi. This record search was defined to meet or exceed the ASTM guidelines for a Phase I ESA record search. The search area defined by ASTM for activity and use limitations (AULs) is from adjacent properties to a maximum of a quarter-mile radius. The information reviewed for this assessment did not identify AULs associated with the subject property.

9.0 FINDINGS AND OPINION

- The site is positioned southwest of the intersection of County Road 8 and County Road 5 in Weld County, Colorado. The site is approximately 300 acres in size, and

is rectangular in shape, with two excepted parcels at the southeast corner. The majority of the property is vacant and appears to be used for agricultural purposes. Three producing oil and gas wells; William H. Peltier #12-20, William H. Peltier #2, and William Peltier 1A-20H, are located on the subject property near the western boundary, northern boundary, and eastern boundary, respectively. Buried natural gas lines run along the western and northern site boundaries. Overhead utilities are positioned along the northern site boundary and traverse a portion of the southwest corner of the site. Pad mounted transformers were observed along the northern site boundary and near the southwest corner of the subject property. Buried water and sewer pipes were indicated to be present on the western site boundary. A historic mine shaft and associated air shaft and mine waste pile, are located near the southeast corner of the site, just north of the excluded parcel.

- The subject property is positioned within a mixed use neighborhood. County Road 8 (Erie Parkway) delineates the northern property boundary, while vacant, agricultural fields are located further north. A radio tower and Erie High School were located northeast of the subject property. The Mountain View Drag Strip is located east of County Road 5 which is positioned along the eastern site boundary. A vehicle junkyard is positioned within the excepted parcel in the southeast corner of the site. The Green Mill shooting range and a cluster of landfills are positioned to the south of the site. The unimproved Green Mill Road is in place along the western site boundary while residential homes within the Grandview development and overhead utilities are in place immediately west of the property. Vacant land was observed to the north, east, and south of the site. Any releases that may have occurred at the

vehicle junkyard within the excepted parcel near the southeast corner are likely to be: considered de minimus, in small quantities, and exclusively associated with surficial contamination. Therefore, AGW does not believe that the junkyard poses a significant environmental threat to the subject property.

- Historical research for the vicinity of the subject property was conducted in order to identify any past uses that have or may have negatively impacted the natural resources of the subject property. Our review of historical resources revealed that coal mining activities have been conducted on the subject property since the early 1900s, including associated historical mining structures used for bookkeeping. One oil and gas well historically operated on the eastern portion of the site, in addition to the three wells that are currently in use. Demolition records for the former historical mining structures are unavailable, however, based upon observations made during the site reconnaissance (i.e. no irregular mounds), and aerial photographs, it is assumed that the buildings were demolished and the associated building debris recycled or disposed of off-site. However, if future development of the property unearths building debris, construction activities should be halted until a Colorado Department of Public Health and Environment (CDPHE) certified asbestos Building Inspector can assess the debris. Available reports, including Western Environment and Ecology Inc.'s "Mine Subsidence Investigation, Horst Property, Section 20, Township 1 North, Range 68 West, Erie, Colorado" dated April 4, 2000, should be reviewed regarding issues of subsidence on the property, prior to development of the site.

- Records of the U. S. Environmental Protection Agency, the Colorado Department of Public Health & Environment, the Colorado Department of Labor and Employment, and the Colorado Oil and Gas Conservation Commission were evaluated for information on hazardous materials and land sources of pollutants/hazards of potential concern, including known complaints and spills. A review of public records maintained by these agencies revealed eight solid waste landfill sites within one-half mile of the subject property; and three producing oil and gas wells, one plugged and abandon oil and gas well, and five permitted locations were located on the subject property. Files were reviewed regarding the cluster of landfills located one-half mile to the south of the site, and based on available information, location on the opposite side of the drainage, the presence of deep ground water, and the low probability of hazardous materials migrating onto the subject property, it is the opinion of AGW that these landfill sites do not pose a significant environmental threat to the subject property. Records maintained by regulatory agencies were reviewed and **the producing William H. Peltier #12-20, William H. Peltier #2, and William Peltier 1A-20H oil and gas wells and associated tank batteries, in addition to the historic plugged and abandoned William H. Peltier #1 oil and gas well, are recognized environmental conditions in relation to the subject property.**

10.0 CONCLUSION

We have performed a Phase I ESA in general conformance with the scope-of-work and limitations of American Standard of Testing Materials (ASTM) Standard Practice Designation E 1527-05 for

the property identified as the Dearmin Property located in Weld County, Colorado. Any exceptions, or deletions from this practice are described in Section 12.0 of this report.

This assessment has revealed no evidence of recognized environmental conditions in connection with the property with the exception of the following:

- **The on-site and producing William H. Peltier #12-20, William H. Peltier #2, and William Peltier 1A-20H oil and gas wells and associated tank batteries, in addition to the historic plugged and abandoned William H. Peltier #1 oil and gas well.**

The following items are not considered recognized environmental conditions; however, AGW has determined these issues to be important environmental considerations which should be understood in connection with the property:

- Oil and gas wells raise a concern from a land development standpoint. Structures should not be constructed within the required set back of operational wells and production equipment. Additionally, the five permitted locations will likely be drilled and have associated wells in the future. Based on this, if future development is planned for the subject property, AGW recommends that appropriate setbacks be placed from all oil and gas wells located on the property.
- An oil and gas pipeline runs below the ground surface along the western and northern boundaries of the site. Although AGW did not observe any environmental indicators (such as broken ground surface or soil staining) that a leak has occurred within this

high pressure gas pipeline, it has the potential to leak in the future. If a leak occurs, appropriate remedial actions should be taken and AGW should be contacted immediately.

- While not an environmental concern, former underground coal mining operations in the area have lead to subsidence issues across the subject property. AGW strongly recommends reviewing available reports such as: Western Environment and Ecology Inc.'s "Mine Subsidence Investigation, Horst Property, Section 20, Township 1 North, Range 68 West, Erie, Colorado" dated April 4, 2000 and CTL Thompson, Inc. "Geological and Preliminary Geotechnical Investigation, Horst Property, County Roads 5 and 8, Weld County, Colorado" dated June 1, 2000, regarding subsidence issues in the area.
- Demolition records for the historical outbuilding are unavailable, but based on observations made during the site reconnaissance (i.e. no irregular mounds), it is assumed that the building was demolished and the associated building debris recycled or disposed of off-site. However, if future development of the property unearths building debris, construction activities should be halted until a Colorado Department of Health and Environment (CDPHE) certified asbestos Building Inspector can assess the debris.

11.0 LIMITATIONS

The professional judgements expressed in this report meet the standard of care for our profession. Environmental issues (among others) not included in the scope of work for this project include radon, lead-based paint, and asbestos testing, and wetlands and endangered species evaluations. The

collection and specific laboratory analyses of environmental samples were not part of the scope of this Phase I ESA; therefore, no specific quantitative environmental data was generated.

AGW's assessment is limited to identifying potential environmental liabilities associated with the property of concern. Not identifying hazardous or toxic materials on the property should not be interpreted as a guarantee that these materials do not exist. It is merely a statement indicating that the probability of contamination on the subject property should be minimal based on site characteristics, and the historical and current uses of the site and surrounding areas. This opinion is rendered based upon property inspection, information from interviews with knowledgeable persons regarding property history, and information provided by governmental and regulatory agencies. Information is obtained on a reasonably ascertainable basis as it pertains to costs, timeliness, and availability, and is believed to be from reliable sources; however no responsibility is assumed for its accuracy since AGW was not retained to verify publicly available information.

12.0 DEVIATIONS

This Phase I ESA has been completed in general accordance with ASTM Practice E 1527-05. We are aware of no significant deviations from this standard.

Thank you for the opportunity to serve you on this project. If you have any questions regarding the contents of this report or should you require additional information, please do not hesitate to call.

Sincerely,

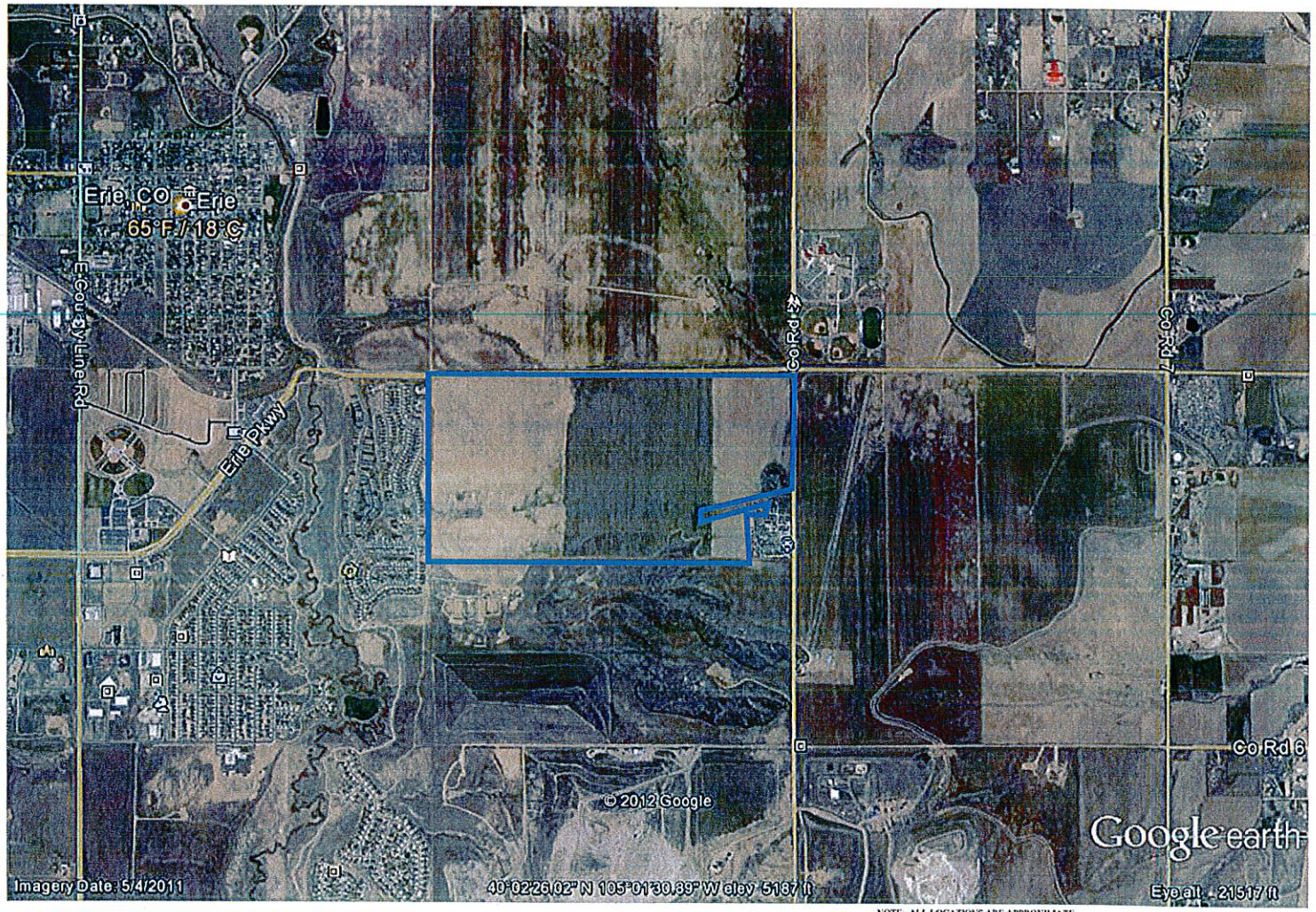
A. G. WASSENAAR, INC.

Kristin A. Schwartz
Environmental Scientist

Rachel A. Peterson, P.G.
Project Manager

I, Rachel A. Peterson, declare that, to the best of my professional knowledge and belief, I meet the definition of Environmental Professional as defined in 312.10 of 40 CFR 312 and I have specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject property. I have developed and performed the all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312.

KAS/RAP/dd

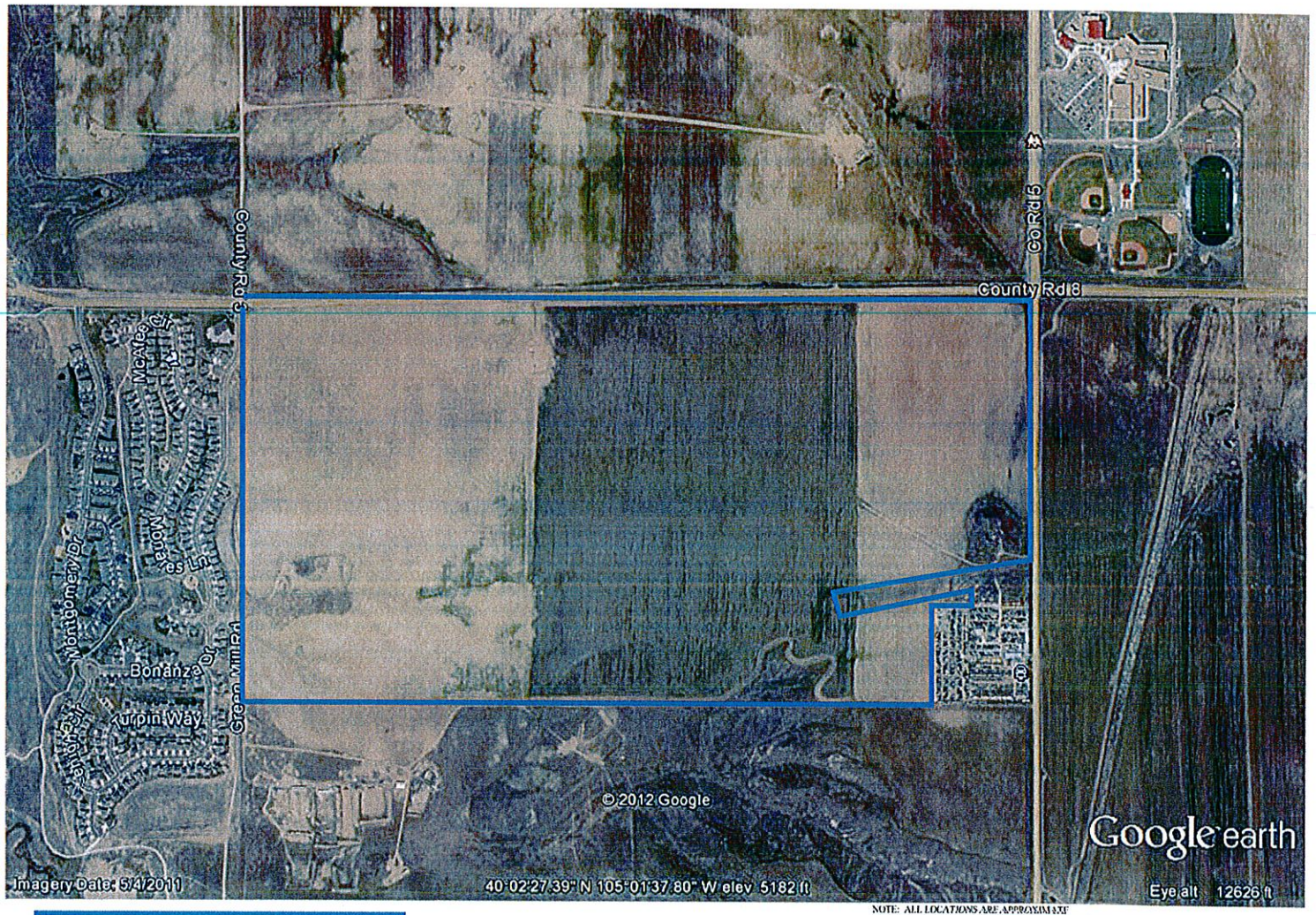


NOTE: ALL LOCATIONS ARE APPROXIMATE

Approximate Subject Property

N

A.G. Wassenaar Geotechnical and Environmental Consultants Inc.	
Dearmin Property Erie, Colorado	Project No. E12625.E1 Figure 1 Vicinity Map



NOTE: ALL LOCATIONS ARE APPROXIMATE

Approximate Subject Property

N

A.G. Wassenaar Geotechnical and Environmental Consultants Inc.	
Dearmin Property Erie, Colorado	Project No. E12625.E1 Figure 2 Site Map

ATTACHMENT A
PHOTOGRAPHS

William H. Peltier #12-20 oil and gas well location and tank battery depicted on the western portion of the site.

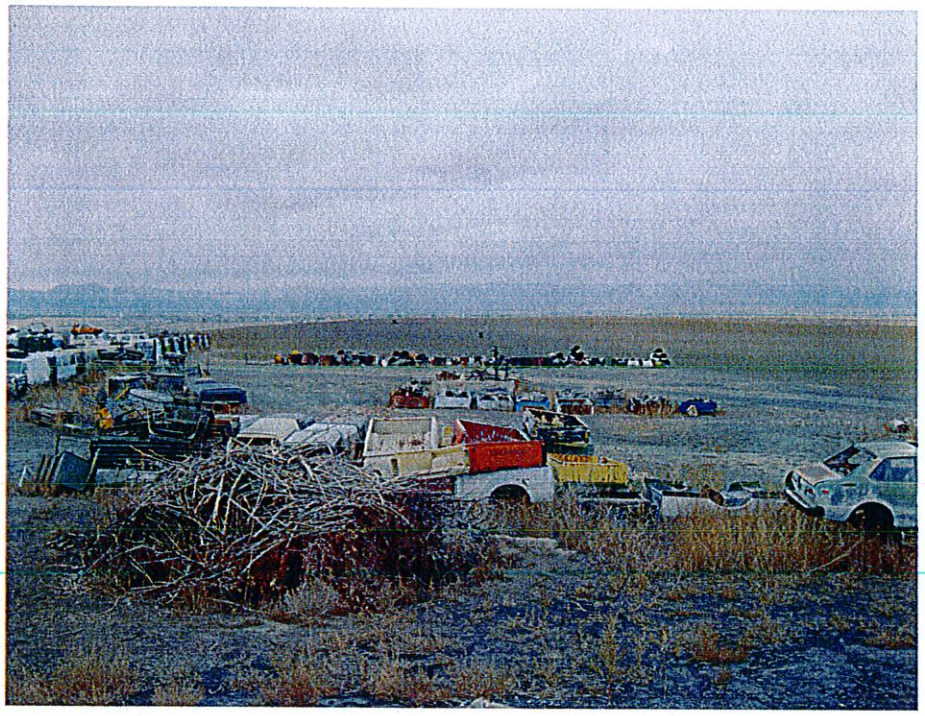
William H. Peltier #2 oil and gas well location and tank battery depicted on the northern portion of the site.

William Peltier #1A-20H oil and gas well, battery, and separator depicted on the eastern portion of the site.

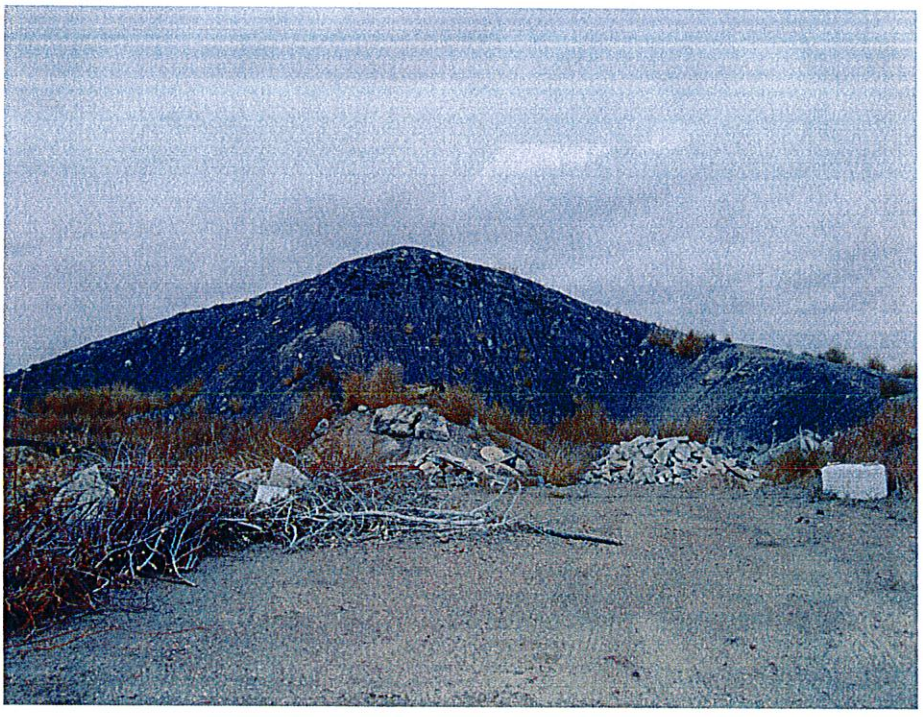
Looking towards the west across the majority of the site from the eastern boundary.

View to the north across the site from the central portion of the subject property.

Looking to the south across the western portion of the site from the northern boundary.



Various debris depicted north of the vehicle junkyard which is located in the excluded parcel near the southeast corner of the site.



Mine waste pile and various debris located near the southeast portion of the site is depicted.

ATTACHMENT B
USER QUESTIONNAIRE

A.G. Wassenaar, Inc.
Geotechnical and Environmental Consultants

2180 South Ivanhoe Street, Suite 5
Denver, Colorado 80222-5710
303-759-8373 Fax 303-759-4874
www.agwassenaar.com

USER QUESTIONNAIRE

INTRODUCTION

In order to qualify for on of the *Landowner Liability Protections (LLPs)*[35] offered by the Small Business Liability Relief and Brownfields Revitalization Act of 2001 (the "*Brownfields Amendments*"),[36] the *user* must provide the following information (if available) to the *environmental professional.* Failure to provide this information could result in a determination that *"all appropriate inquiry"* is not complete

(1.) **Environmental cleanup liens that are filed or recorded against the site (40 CFR 312.25).**
Are you aware of any environmental cleanup liens against the *property* that are filed or recorded under federal, tribal, state or local law? No

(2.) **Activity and land use limitations that are in place on the site or that have been filed or recorded in a registry (40 CFR 312.26).**
Are you aware of any AULs, such as *engineering controls*, land use restrictions or *institutional controls* that are in place at the site and/or have been filed or recorded in a registry under federal, tribal, state or local law?
No

(3.) **Specialized knowledge or experience of the person seeking to qualify for the LLP (40 CFR 312.28).**
As the user of this ESA do you have any specialized knowledge or experience related to the property or nearby properties? For example, are you involved in the same line of business as the current or former *occupants* of the *property* or an adjoining *property* so that you would have specialized knowledge of the chemicals and processes used by this type of business?
NO

(4.) **Relationship of the purchase price to the fair market value of the *property* if it were not contaminated (40 CFR 312.29).**
Does the purchase price being paid for this *property* reasonably reflect the fair market value of the *property*? If you conclude that there is a difference, have you considered whether the lower purchase price is because contamination is known or believed to be present at the *property*?
Yes, N/A

(5.) **Commonly known or reasonably ascertainable information about the *property* (40 CFR 312.30).**
Are you aware of commonly known or *reasonably ascertainable* information about the *property* that would help the *environmental professional* to identify conditions indicative of releases or threatened releases? For example, as *user*, No

(a.) Do you know the past uses of the *property*? No
(b.) Do you know of specific chemicals that are present or once were present at the *property*? No
(c.) Do you know of spills or other chemical releases that have taken place at the *property*? No
(d.) Do you know of any environmental cleanups that have taken place at the *property*? No

(6.) **The degree of obviousness of the presence of likely presence of contamination at the *property*, and the ability to detect the contamination by appropriate investigation (40 CFR 312.31).**
As the *user* of this ESA, based on your knowledge and experience related to the *property* are there any *obvious* indicators that point to the presence or likely presence of contamination at the *property*? No

COMPLETED BY: Chad M. Ellington, Oakwood Homes, LLC
DATE: 10/29/12

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[35] *Landowner Liability Protections*, or LLPs, is the term used to describe the three types of potential defenses to Superfund liability in EPA's *Interim Guidance Regarding Criteria Landowners Must Meet in Order to Qualify for Bona Fide Prospective Purchaser, Contiguous Property Owner, or Innocent Landowner Limitations on CERCLA Liability ("Common Elements"* Guide) issued on March 6, 2003.

[36] P.L. 107-118.

ATTACHMENT C
TOPOGRAPHIC MAPS AND AERIAL PHOTOGRAPHS

TOPOGRAPHIC MAPS

Subject Property

Dearmin Property
SW of County Road 5 & Erie Parkway
Erie, CO 80516

October 9, 2012

Performed For: A.G. Wassenaar, Inc
2180 S Ivanhoe Street
Denver, CO 80222
Attn: Kristin Schwartz
Ref: E12625.E1

The following maps were found:

Year	Map Name	Size	1:Scale	Note
1978	Erie	7.5'	24,000	
1971	Erie	7.5'	24,000	
1966	Erie	7.5'	24,000	
1948	Erie	7.5'	24,000	
1902	Niwot	15.'	62,500	Earliest found.

These 7.5' US Geological Survey maps covered most cities by the 1930's, and most remote areas by the 1960's. (Please note that maps are identified here by the year of the survey or aerial photo used to make or revise the map, rather than the year of publication.) Some maps changed names over time; to find them, a unique geographic index of the entire USGS collection is searched. If the 7.5' maps do not go back to 1940, earlier 15' maps are included. Any adjoining maps within 1/8 mile of the Subject Property are also included.

Please note that the accuracy and suitability of public and private records cannot be guaranteed, nor can this research. No warranty is made or implied. By using this report, the reader agrees to assume all related risk and to release Satisfi from liability for any damages. However, if this report is not 100% satisfactory, a full refund will be issued.

satisfi®
environmental information

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TOPOGRAPHIC MAPS SYMBOLS

This Key to Symbols is also available at http://mac.usgs.gov/isb/pubs/booklets/symbols/buildings.html

BUILDINGS AND RELATED FEATURES

- Building
- School; church
- Built-up Area
- Racetrack
- Airport
- Landing strip
- Well (other than water); windmill
- Tanks
- Covered reservoir
- Gaging station
- Landmark object (feature as labeled)
- Campground; picnic area
- Cemetery: small; large

MINES AND CAVES

- Quarry or open pit mine
- Gravel, sand, clay, or borrow pit
- Mine tunnel or cave entrance
- Prospect; mine shaft
- Mine dump
- Tailings

RIVERS, LAKES, AND CANALS

- Intermittent stream
- Intermittent river
- Disappearing stream
- Perennial stream
- Perennial river
- Small falls; small rapids
- Large falls; large rapids
- Masonry dam
- Dam with lock
- Dam carrying road
- Perennial lake; Intermittent lake or pond
- Dry lake
- Narrow wash
- Wide wash
- Canal, flume, or aqueduct with lock
- Elevated aqueduct, flume, or conduit
- Aqueduct tunnel
- Well or spring; spring or seep

ROADS AND RELATED FEATURES

Roads on Provisional edition maps are not classified as primary, secondary, or light duty. They are all symbolized as light duty roads.

- Primary highway
- Secondary highway
- Light duty road
- Unimproved road
- Trail
- Dual highway
- Dual highway with median strip
- Road under construction
- Underpass; overpass
- Bridge
- Drawbridge
- Tunnel

RAILROADS AND RELATED FEATURES

- Standard gauge single track; station
- Standard gauge multiple track
- Abandoned
- Under construction
- Narrow gauge single track
- Narrow gauge multiple track
- Railroad in street
- Juxtaposition
- Roundhouse and turntable

TRANSMISSION LINES AND PIPELINES

- Power transmission line: pole; tower
- Telephone line
- Aboveground oil or gas pipeline
- Underground oil or gas pipeline

CONTOURS

Topographic

- Intermediate
- Index
- Supplementary
- Depression
- Cut; fill

Bathymetric

- Intermediate
- Index
- Primary
- Index Primary
- Supplementary

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TOPOGRAPHIC MAPS SYMBOLS

This Key to Symbols is also available at http://mac.usgs.gov/isb/pubs/booklets/symbols/buildings.html

SUBMERGED AREAS AND BOGS

- Marsh or swamp
- Submerged marsh or swamp
- Wooded marsh or swamp
- Submerged wooded marsh or swamp
- Rice field
- Land subject to inundation

GLACIERS AND PERMANENT SNOWFIELDS

- Contours and limits
- Form lines

COASTAL FEATURES

- Foreshore flat
- Rock or coral reef
- Rock bare or awash
- Group of rocks bare or awash
- Exposed wreck
- Depth curve; sounding
- Breakwater, pier, jetty, or wharf
- Seawall

MARINE SHORELINE

Topographic maps

- Approximate mean high water
- Indefinite or unsurveyed

Topographic-bathymetric maps

- Mean high water
- Apparent (edge of vegetation)

BATHYMETRIC FEATURES

- Area exposed at mean low tide; sounding datum
- Channel
- Offshore oil or gas: well; platform
- Sunken rock

VEGETATION

- Woods
- Scrub
- Orchard
- Vineyard
- Mangrove

SURFACE FEATURES

- Levee
- Sand or mud area, dunes, or shifting sand
- Intricate surface area
- Gravel beach or glacial moraine
- Tailings pond

BOUNDARIES

- National
- State or territorial
- County or equivalent
- Civil township or equivalent
- Incorporated city or equivalent
- Park, reservation, or monument
- Small park

LAND SURVEY SYSTEMS

U.S. Public Land Survey System

- Township or range line
  - Location doubtful
- Section line
  - Location doubtful
- Found section corner; found closing corner
- Witness corner; meander corner

Other land surveys

- Township or range line
- Section line
- Land grant or mining claim; monument
- Fence line

CONTROL DATA AND MONUMENTS

- Aerial photograph roll and frame number* 3 - 20

Horizontal control

- Third order or better, permanent mark
- With third order or better elevation
- Checked spot elevation
- Coincident with section corner
- Unmonumented*

Vertical control

- Third order or better, with tablet
- Third order or better, recoverable mark
- Bench mark at found section corner
- Spot elevation

Boundary monument

- With tablet
- Without tablet
- With number and elevation
- U.S. mineral or location monument

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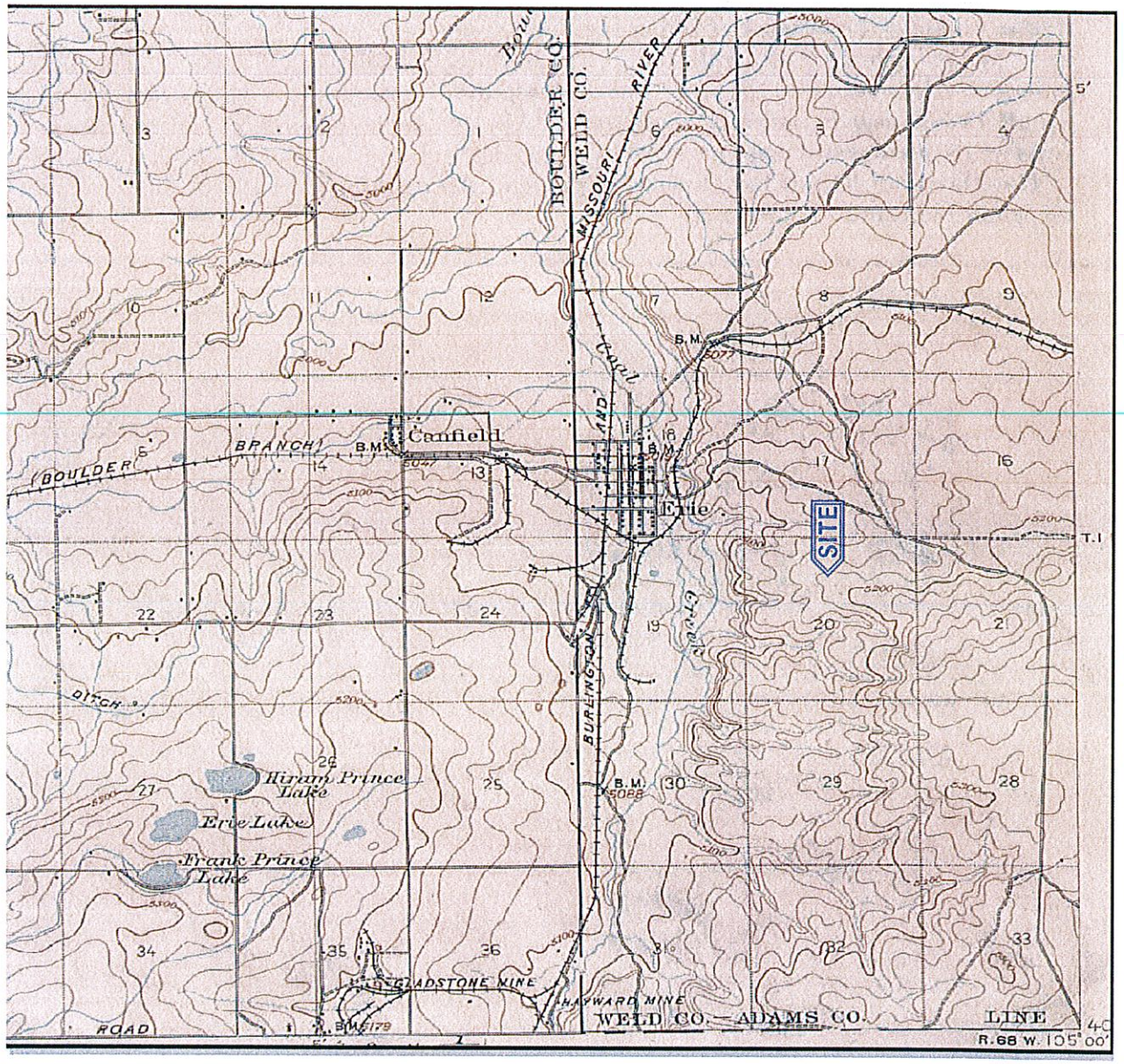
TOPOGRAPHIC MAPS 1902

1902 15' Niwot Quadrangle

Earliest found.



These 7.5' US Geological Survey maps covered most cities by the 1930's, and most remote areas by the 1960's. (Please note that maps are identified here by the year of the survey or aerial photo used to make or revise the map, rather than the year of publication.) Some maps changed names over time; to find them, a unique geographic index of the entire USGS collection is searched. If the 7.5' maps do not go back to 1940, earlier 15' maps are included. Any adjoining maps within 1/8 mile of the Subject Property are also included.

See Symbol Key Original scale = 1:62500 |------- ~1 mile -------| NORTH

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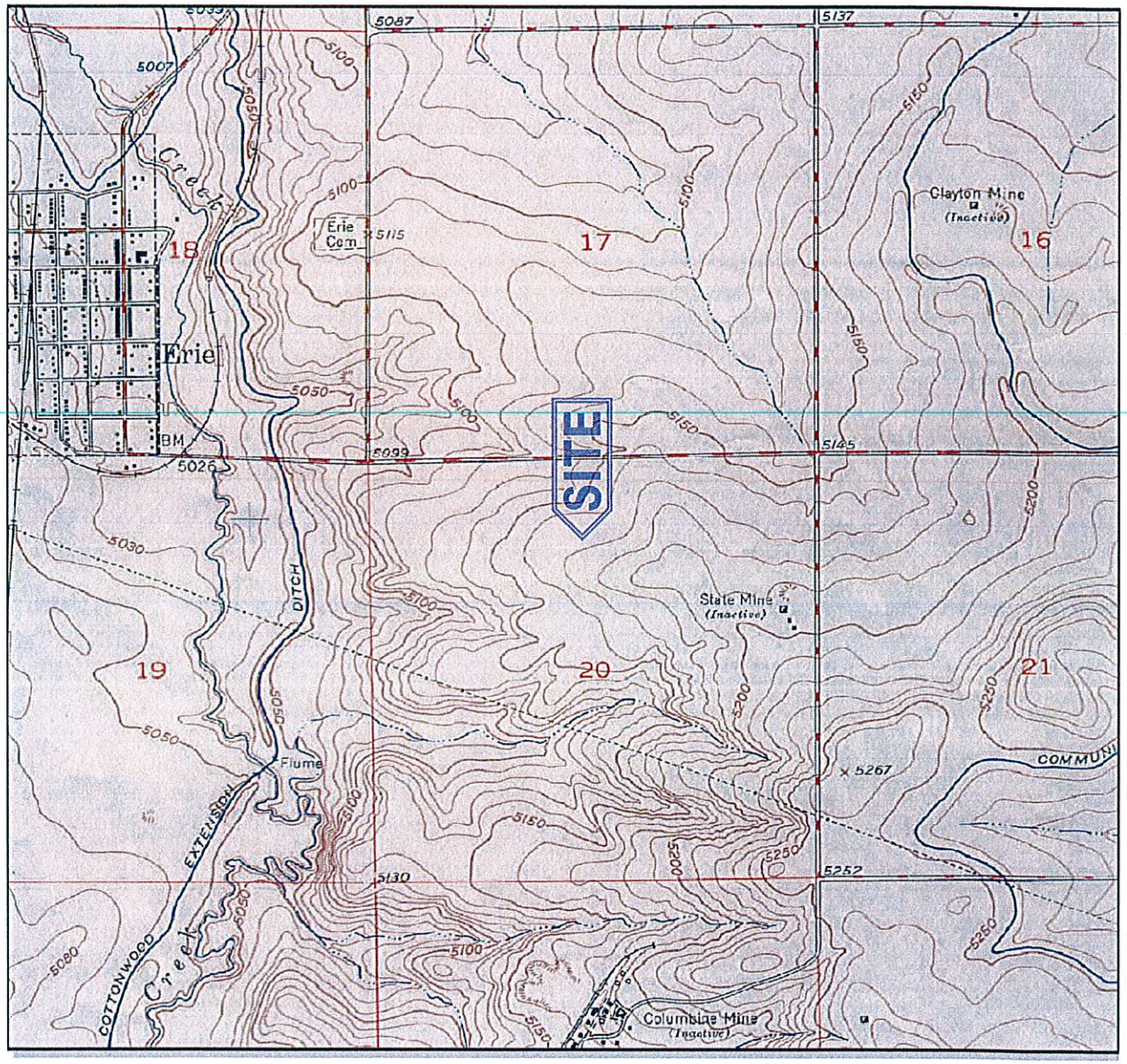
TOPOGRAPHIC MAPS 1948

1948 7.5' Erie Quadrangle



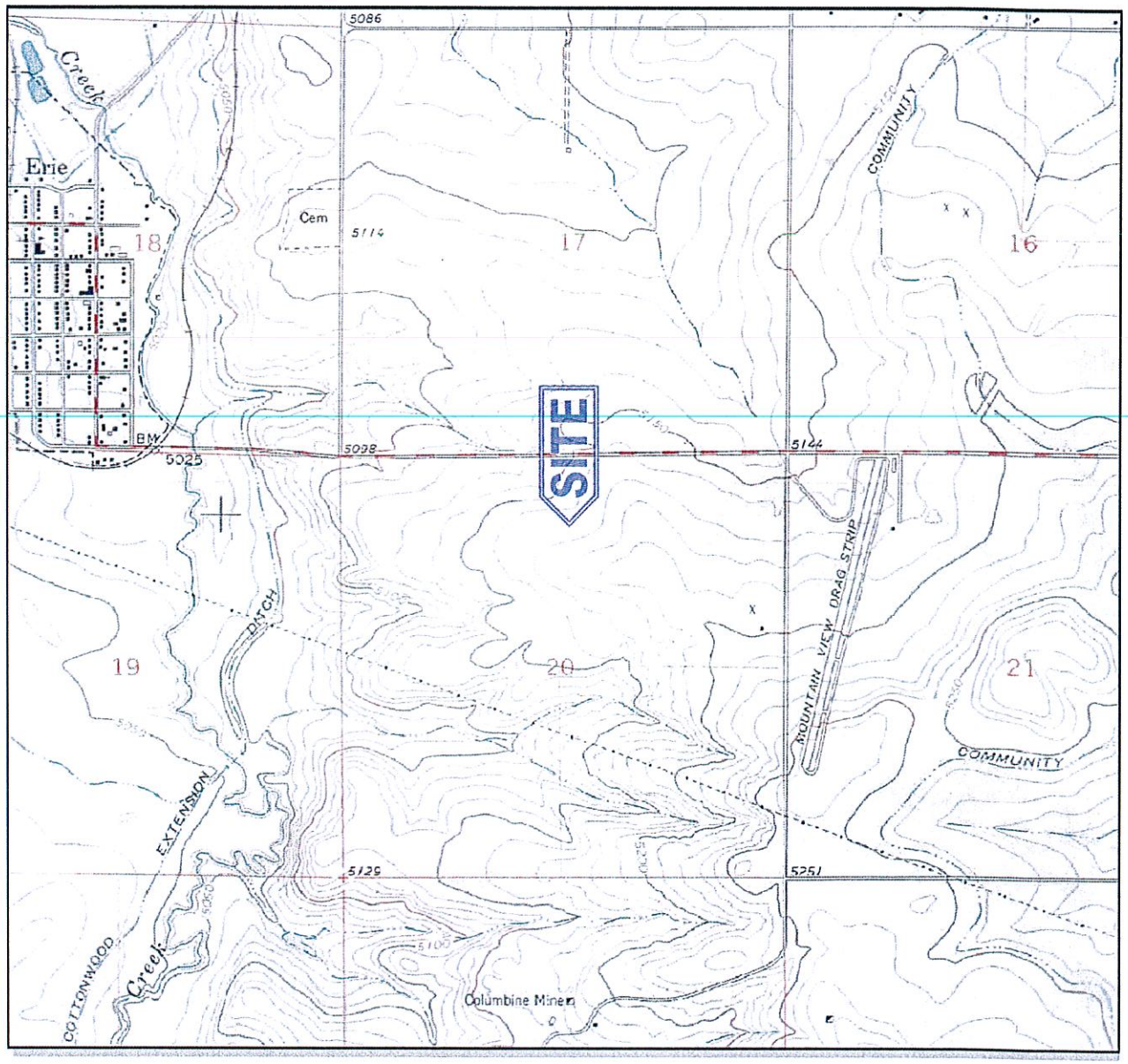
These 7.5' US Geological Survey maps covered most cities by the 1930's, and most remote areas by the 1960's. (Please note that maps are identified here by the year of the survey or aerial photo used to make or revise the map, rather than the year of publication.) Some maps changed names over time; to find them, a unique geographic index of the entire USGS collection is searched. If the 7.5' maps do not go back to 1940, earlier 15' maps are included. Any adjoining maps within 1/8 mile of the Subject Property are also included.

See Symbol Key Original scale = 1:24000 |---------- ~1 mile ----------| NORTH

© 2012 Satisfi Inc 720-200-9472

TOPOGRAPHIC MAPS 1966

1966 7.5' Erie Quadrangle



These 7.5' US Geological Survey maps covered most cities by the 1930's, and most remote areas by the 1960's. (Please note that maps are identified here by the year of the survey or aerial photo used to make or revise the map, rather than the year of publication.) Some maps changed names over time; to find them, a unique geographic index of the entire USGS collection is searched. If the 7.5' maps do not go back to 1940, earlier 15' maps are included. Any adjoining maps within 1/8 mile of the Subject Property are also included.

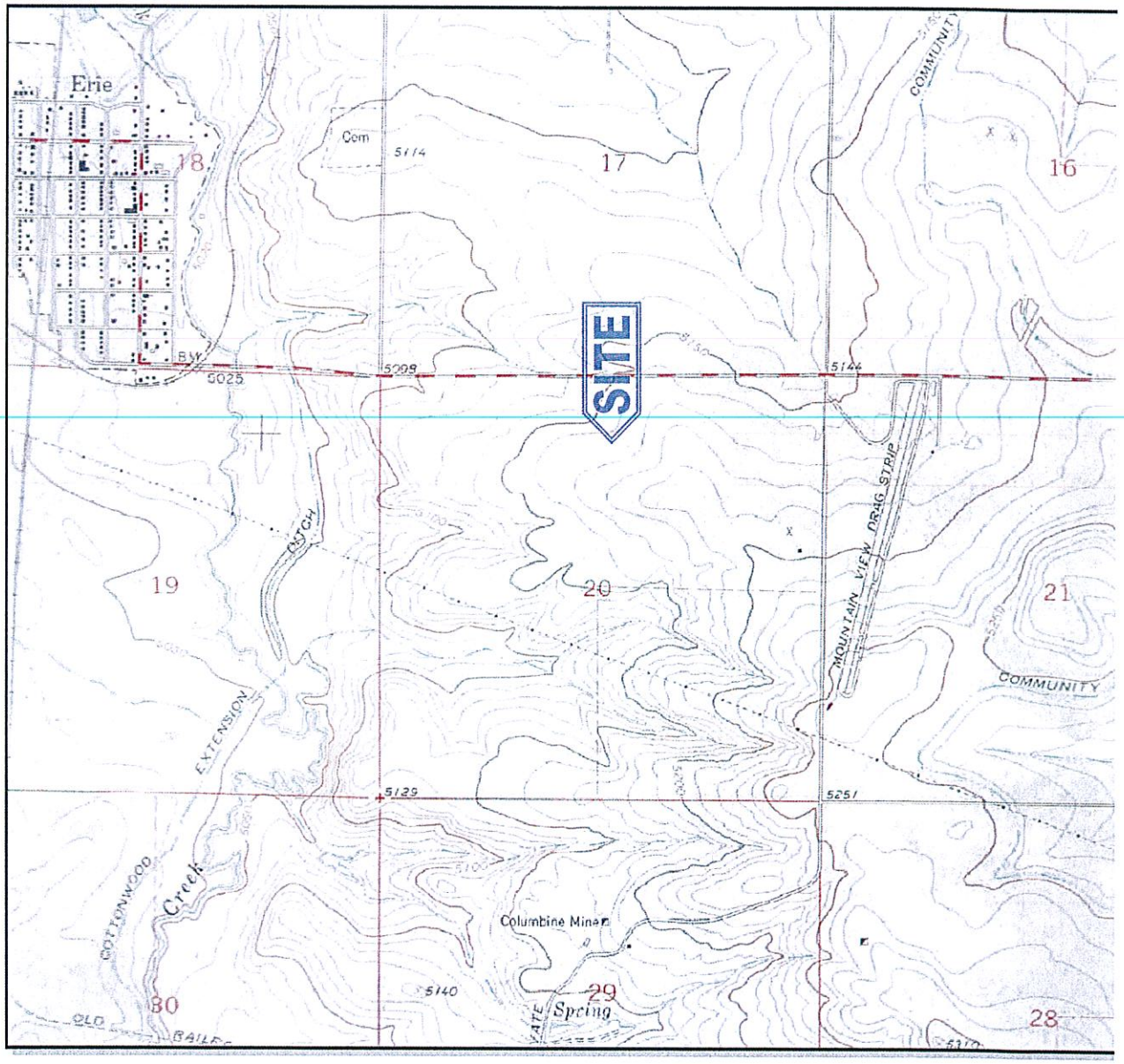
See Symbol Key Original scale = 1:24000 |---------- ~1 mile ----------| NORTH

© 2012 Satisfi Inc 720-200-9472

Dearmin Property, SW of County Road 5 & Erie Parkway, Erie, CO
For A.G. Wassenaar, Inc

TOPOGRAPHIC MAPS 1971

1971 7.5' Erie Quadrangle



These 7.5' US Geological Survey maps covered most cities by the 1930's, and most remote areas by the 1960's. (Please note that maps are identified here by the year of the survey or aerial photo used to make or revise the map, rather than the year of publication.) Some maps changed names over time; to find them, a unique geographic index of the entire USGS collection is searched. If the 7.5' maps do not go back to 1940, earlier 15' maps are included. Any adjoining maps within 1/8 mile of the Subject Property are also included.

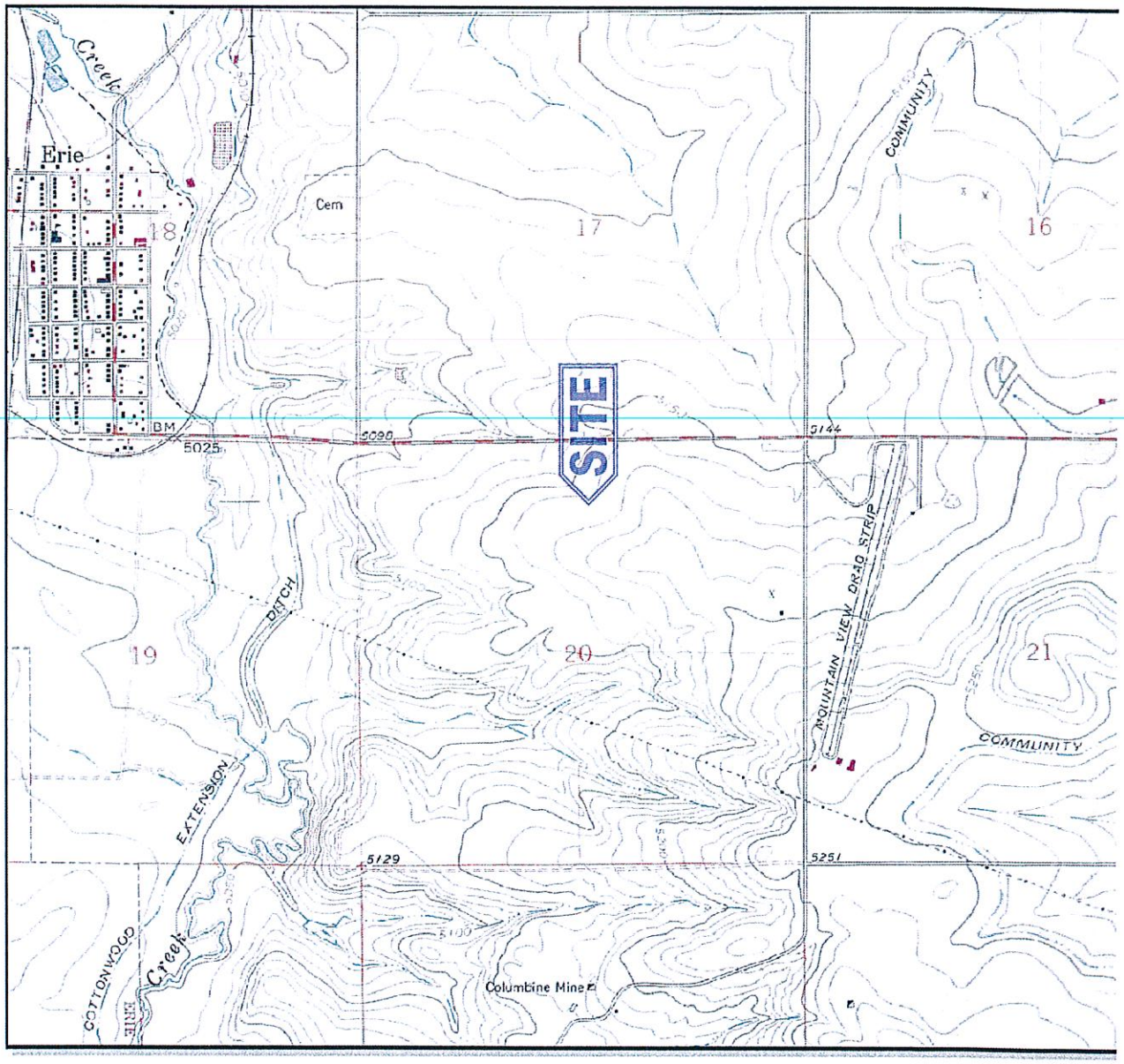
See Symbol Key Original scale = 1:24000 |---------- ~1 mile ----------| NORTH

© 2012 Satisfi Inc 720-200-9472

Dearmin Property, SW of County Road 5 & Erie Parkway, Erie, CO
For A.G. Wassenaar, Inc

TOPOGRAPHIC MAPS 1978

1978 7.5' Erie Quadrangle



These 7.5' US Geological Survey maps covered most cities by the 1930's, and most remote areas by the 1960's. (Please note that maps are identified here by the year of the survey or aerial photo used to make or revise the map, rather than the year of publication.) Some maps changed names over time; to find them, a unique geographic index of the entire USGS collection is searched. If the 7.5' maps do not go back to 1940, earlier 15' maps are included. Any adjoining maps within 1/8 mile of the Subject Property are also included.

See Symbol Key Original scale = 1:24000 |---------- ~1 mile ----------| NORTH

© 2012 Satisfi Inc 720-200-9472

Dearmin Property, SW of County Road 5 & Erie Parkway, Erie, CO
For A.G. Wassenaar, Inc

AERIAL PHOTOGRAPHS

Subject Property

Dearmin Property
SW of County Road 5 & Erie Parkway
Erie, CO 80516

October 9, 2012

Performed For: A.G. Wassenaar, Inc
2180 S Ivanhoe Street
Denver, CO 80222
Attn: Kristin Schwartz
Ref: E12625.E1

The following photos were ordered:

Year	Note
1985	
1979	
1937	Earliest found.

The Colorado Aerial Photo Service (CAPS) collection covers most developed areas of the Front Range annually from 1948. The originals are enlarged to a scale that is intended to show the Subject Property and the properties that surround it. The originals can be viewed in stereo and under high-power magnification at CAPS, 2757 W. Second Avenue in Denver, for a minimal handling fee. Call CAPS at 303-934-2419 or 800-215-2681 to have prints pulled and waiting.

Please note that the accuracy and suitability of public and private records cannot be guaranteed, nor can this research. No warranty is made or implied. By using this report, the reader agrees to assume all related risk and to release Satisfi from liability for any damages. However, if this report is not 100% satisfactory, a full refund will be issued.

satisfi
environmental information

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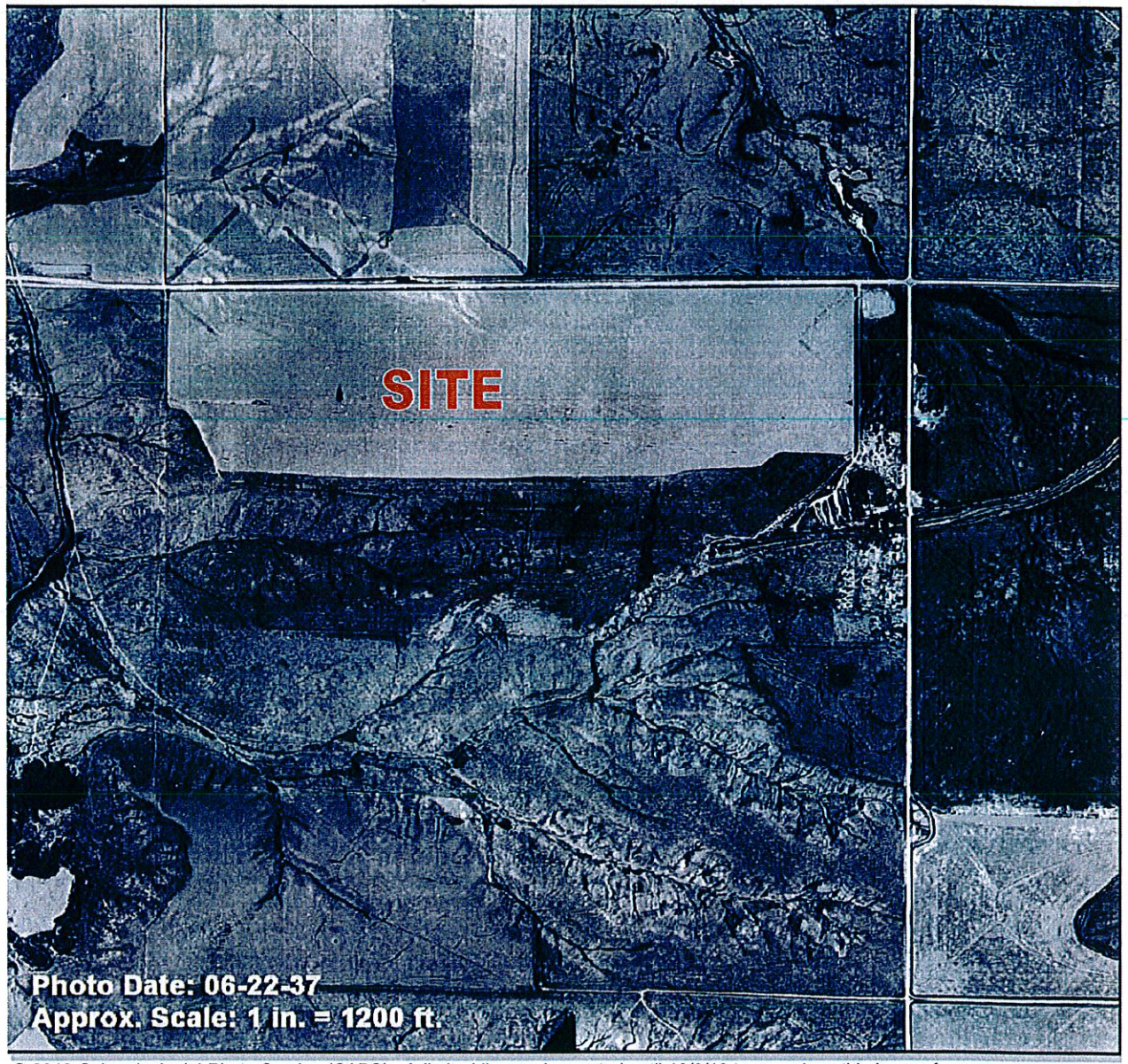
AERIAL PHOTOGRAPHS 1937

1937

Earliest found.



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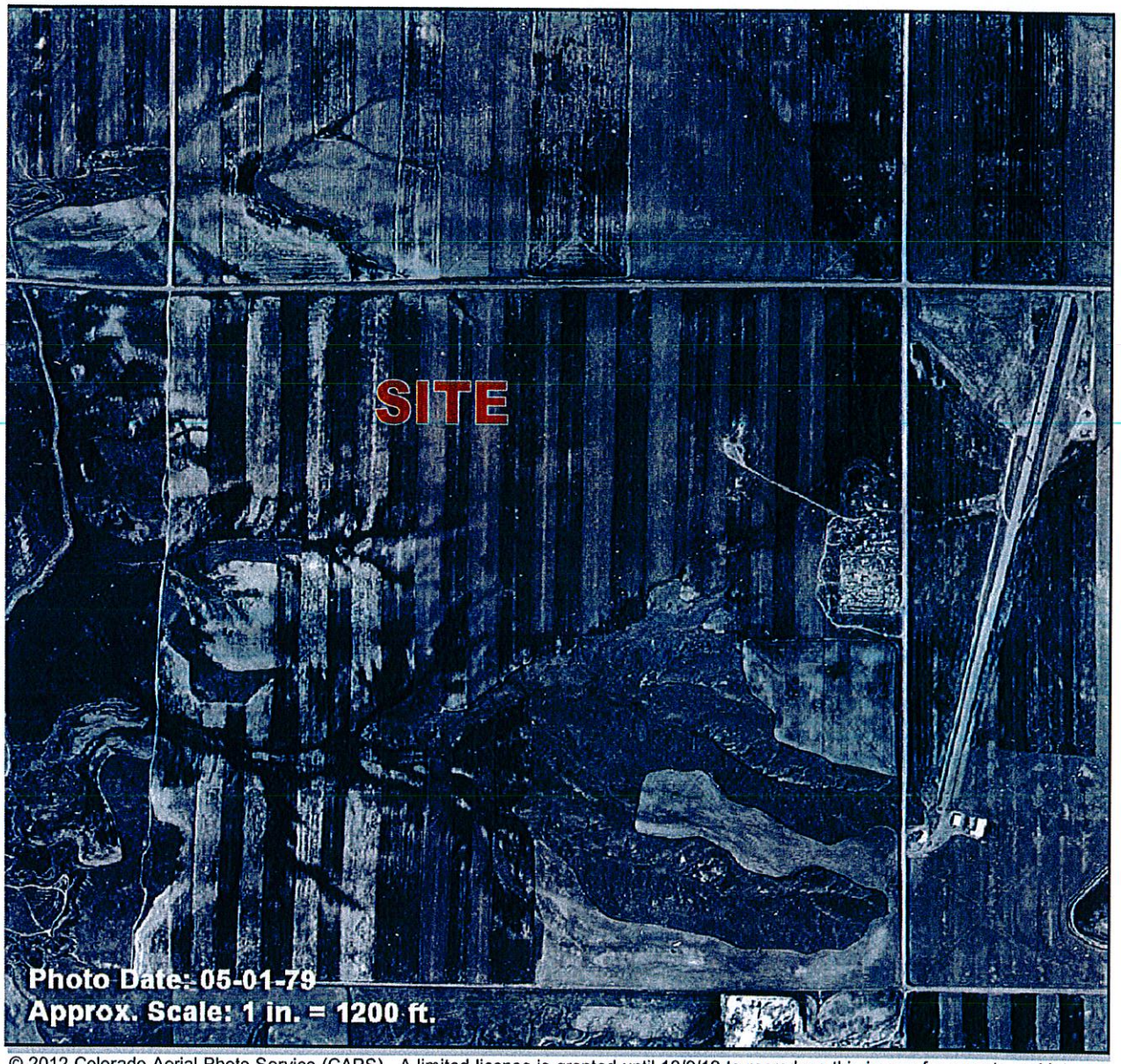
The Colorado Aerial Photo Service (CAPS) collection covers most developed areas of the Front Range annually from 1948. The originals are enlarged to a scale that is intended to show the Subject Property and the properties that surround it. The originals can be viewed in stereo and under high-power magnification at CAPS, 2757 W. Second Avenue in Denver, for a minimal handling fee. Call CAPS at 303-934-2419 or 800-215-2681 to have prints pulled and waiting.

NORTH

AERIAL PHOTOGRAPHS 1979

1979



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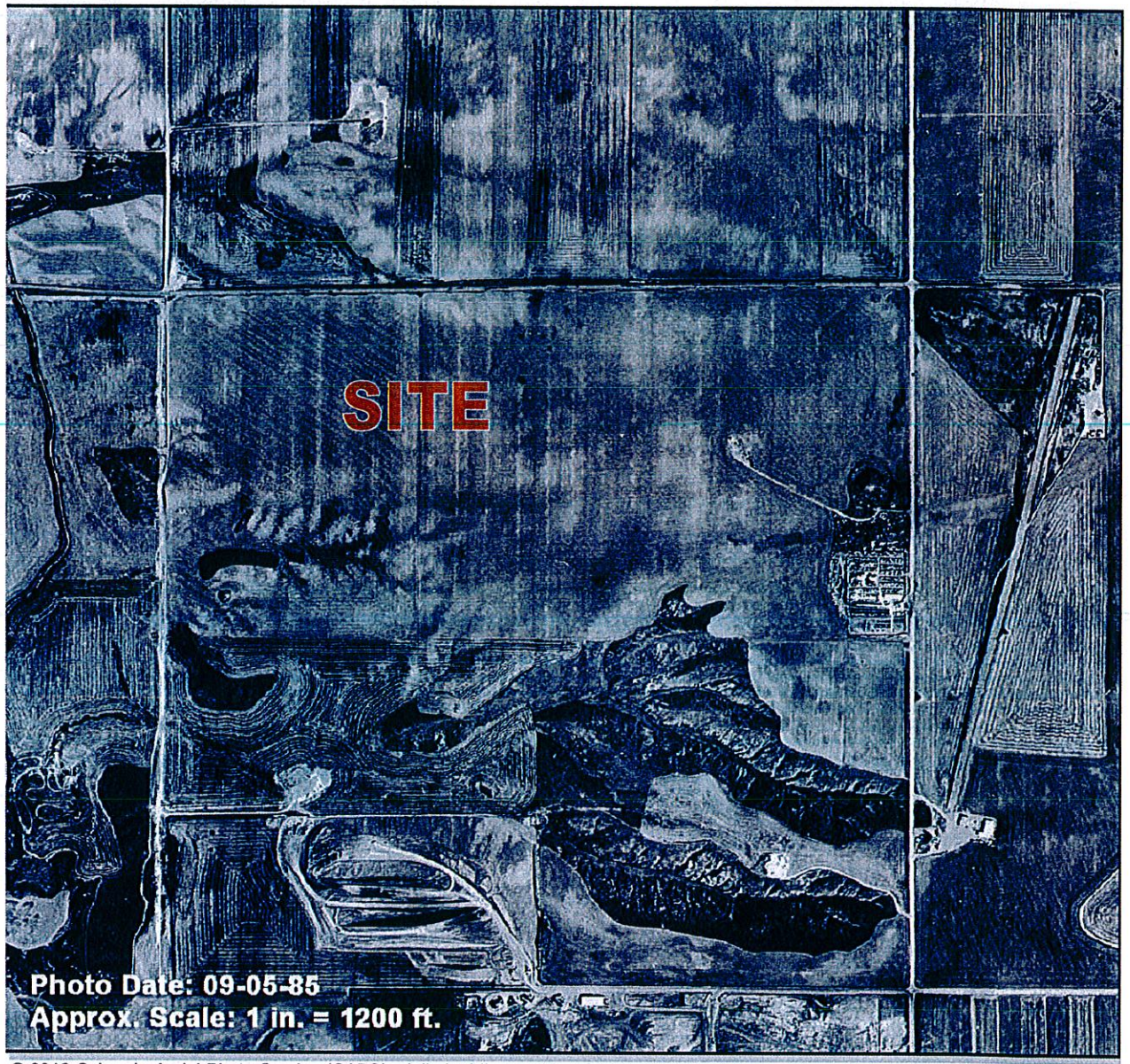
NORTH

AERIAL PHOTOGRAPHS 1985

1985



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The Colorado Aerial Photo Service (CAPS) collection covers most developed areas of the Front Range annually from 1948. The originals are enlarged to a scale that is intended to show the Subject Property and the properties that surround it. The originals can be viewed in stereo and under high-power magnification at CAPS, 2757 W. Second Avenue in Denver, for a minimal handling fee. Call CAPS at 303-934-2419 or 800-215-2681 to have prints pulled and waiting.

NORTH

ATTACHMENT D
PUBLIC RECORDS RESEARCH

InfoMap
Technologies Incorporated

Environmental FirstSearch ™ Report

Target Property: DEARMIN PROPERTY

ERIE CO 80516

Job Number: E12625.E1

PREPARED FOR:

A.G. Wassenaar, Inc

2180 S Ivanhoe Street

Denver, CO 80222

by Satisfi, Inc

720-200-9472

10-08-12

Tel: (610) 430-7530 *Fax: (610) 430-7535*

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Environmental FirstSearch
Site Information Report

Request Date:	10-08-12	**Search Type:**	AREA
Requestor Name:	Brian Peterson		0.46 sq mile(s)
Standard:	ASTM-05	**Job Number:**	E12625.E1
		Filtered Report	

Target Site:

ERIE CO 80516

Demographics

Sites:	13	**Non-Geocoded:**	5	**Population:**	NA
Radon:	NA				

Site Location

	Degrees (Decimal)	**Degrees (Min/Sec)**		**UTMs**
Longitude:	-105.027722	-105:1:40	**Easting:**	497634.984
Latitude:	40.0402	40:2:25	**Northing:**	4432009.292
Elevation:	N/A		**Zone:**	13

Comment

Comment:

Additional Requests/Services

Adjacent ZIP Codes: 0 Mile(s)

ZIP Code	City Name	ST	Dist/Dir	Sel

Services:

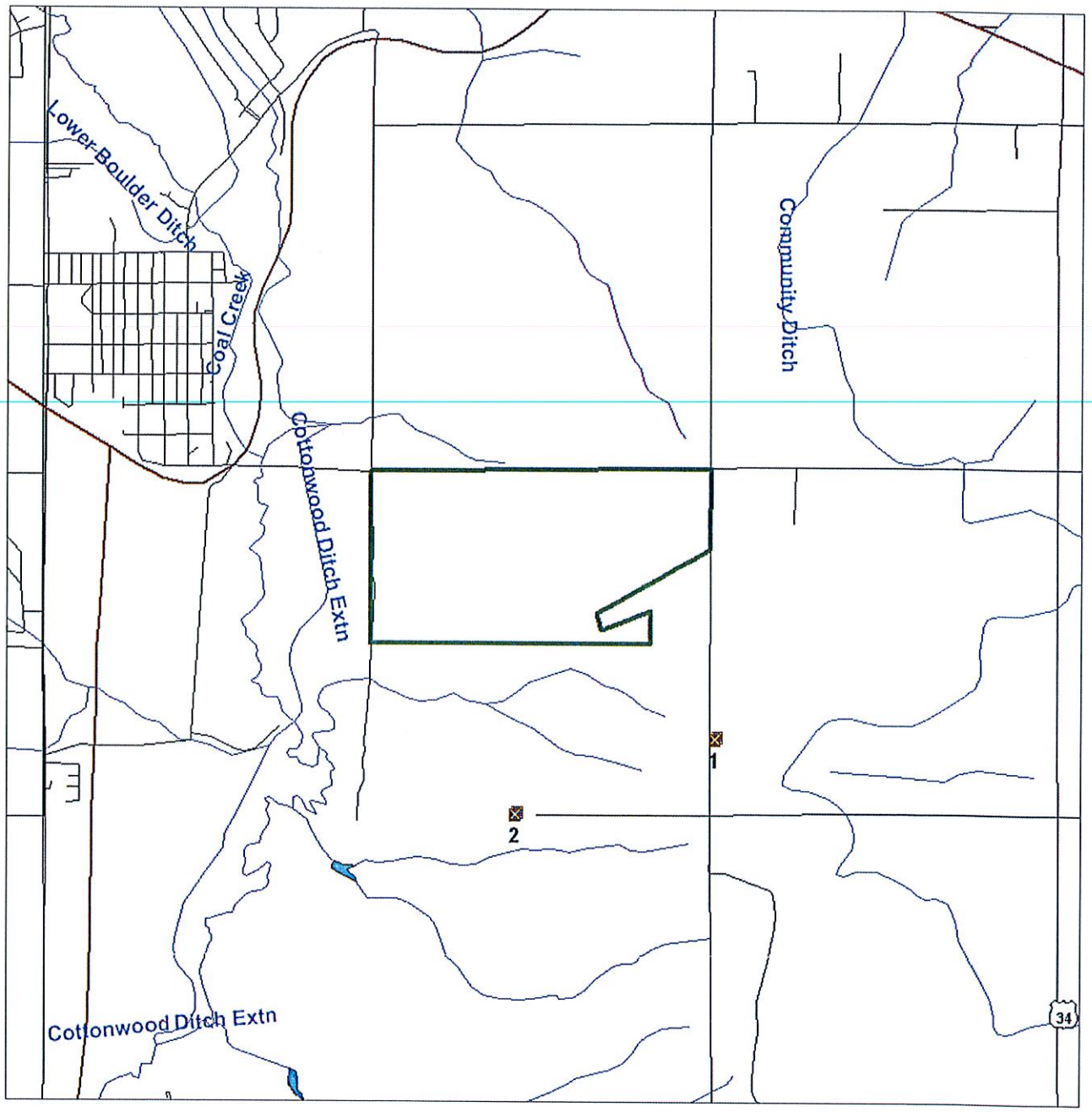
	Requested?	Date
Fire Insurance Maps	No	
Aerial Photographs	No	
Historical Topos	No	
City Directories	No	
Title Search/Env Liens	No	
Municipal Reports	No	
Online Topos	No	

Environmental FirstSearch

1 Mile Radius from Area

Single Map:

, ERIE CO 80516



Source: 2005 U.S. Census TIGER Files

Area Polygon .....

Identified Site, Multiple Sites, Receptor .....

NPL, DELNPL, Brownfield, Solid Waste Landfill (SWL), Hazardous Waste

Triballand.....

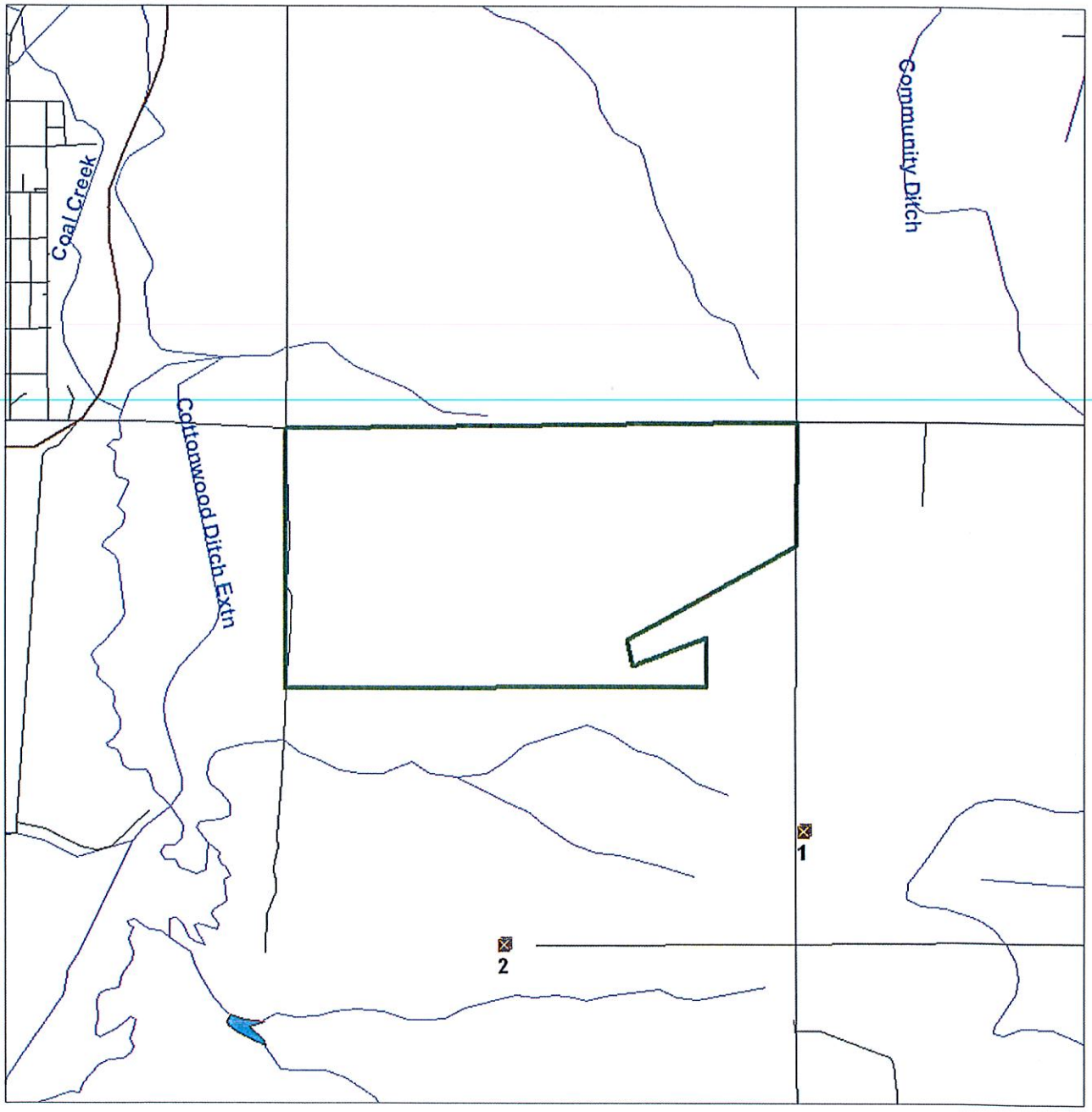
Railroads .....

Environmental FirstSearch

.5 Mile Radius from Area

Single Map:

, ERIE CO 80516



Source: 2005 U.S. Census TIGER Files

Area Polygon .....

Identified Site, Multiple Sites, Receptor .....

NPL, DELNPL, Brownfield, Solid Waste Landfill (SWL), Hazardous Waste

Triballand.....

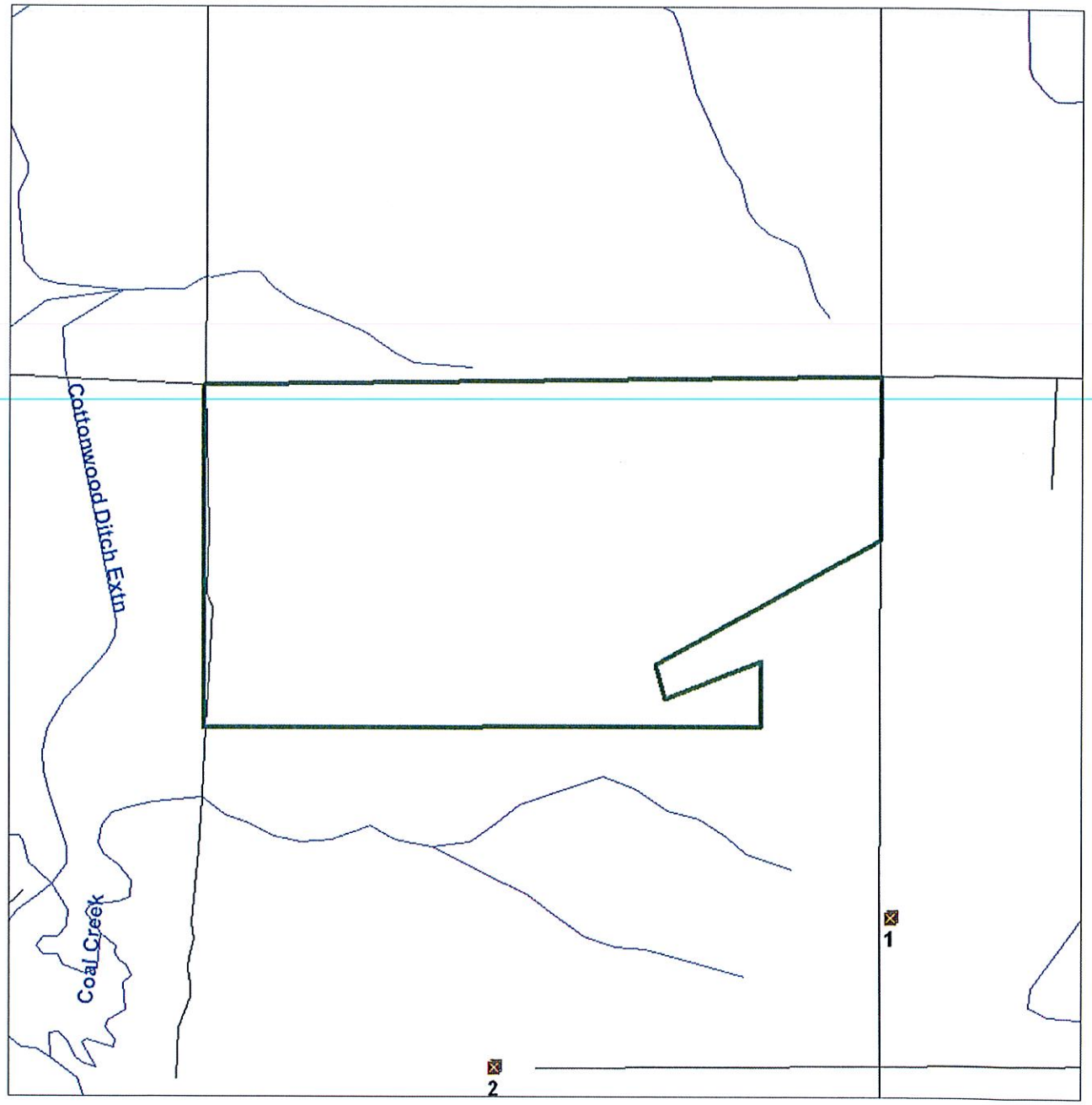
Railroads .....

Environmental FirstSearch

.25 Mile Radius from Area

Single Map:

, ERIE CO 80516



Source: 2005 U.S. Census TIGER Files

Area Polygon .....

Identified Site, Multiple Sites, Receptor .....

NPL, DELNPL, Brownfield, Solid Waste Landfill (SWL), Hazardous Waste

Triballand.....

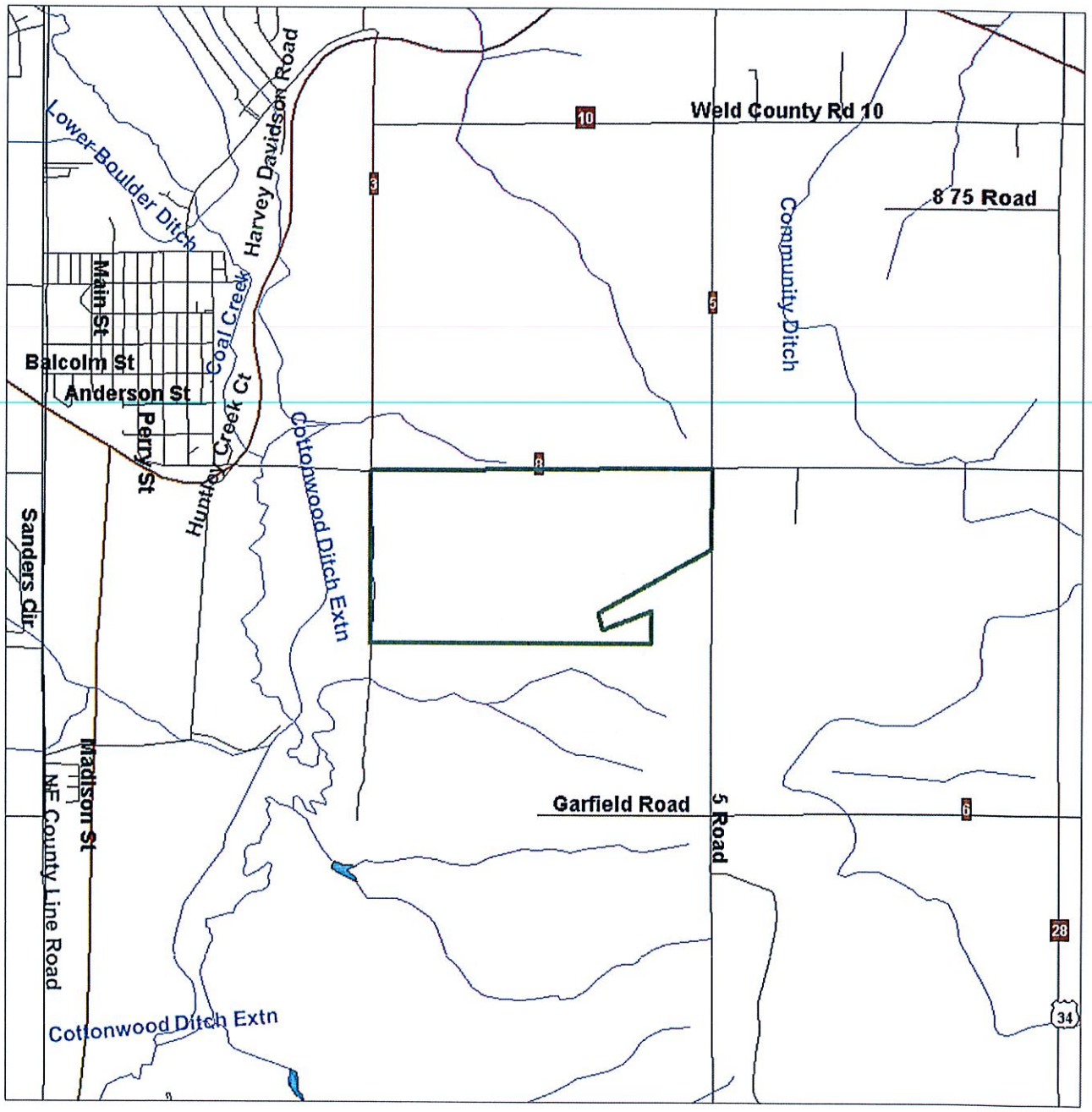
Railroads .....

Environmental FirstSearch

1 Mile Radius from Area

Site Locus Map:

, ERIE CO 80516



Source: 2005 U.S. Census TIGER Files

Area Polygon .....

Identified Site, Multiple Sites, Receptor .....

NPL, DELNPL, Brownfield, Solid Waste Landfill (SWL), Hazardous Waste

Triballand.....

Railroads .....

Environmental FirstSearch
Search Summary Report

Target Site:

ERIE CO 80516

FirstSearch Summary

Database	Sel	Updated	Radius	Site	1/8	1/4	1/2	1/2>	ZIP	TOTALS
NPL	Y	09-20-12	1.00	0	0	0	0	0	0	0
NPL Delisted	Y	09-20-12	0.50	0	0	0	0	-	0	0
CERCLIS	Y	08-01-12	0.50	0	0	0	0	-	0	0
NFRAP	Y	08-01-12	0.50	0	0	0	0	-	0	0
RCRA COR ACT	Y	09-11-12	1.00	0	0	0	0	0	0	0
RCRA TSD	Y	09-11-12	0.50	0	0	0	0	-	0	0
RCRA GEN	Y	09-11-12	0.25	0	0	0	-	-	0	0
RCRA NLR	Y	09-11-12	0.25	0	0	0	-	-	0	0
Federal Brownfield	Y	07-15-12	0.25	0	0	0	-	-	0	0
ERNS	Y	10-04-12	0.25	0	0	0	-	-	1	1
Tribal Lands	Y	12-15-08	1.00	0	0	0	0	0	0	0
State/Tribal Sites	Y	08-01-07	1.00	0	0	0	0	0	0	0
State Spills 90	Y	07-15-12	0.25	0	0	0	-	-	0	0
State/Tribal SWL	Y	07-01-11	0.50	0	1	0	7	-	4	12
State/Tribal LUST	Y	07-17-12	0.50	0	0	0	0	-	0	0
State/Tribal UST/AST	Y	07-17-12	0.25	0	0	0	-	-	0	0
State/Tribal EC	Y	04-24-12	0.25	0	0	0	-	-	0	0
State/Tribal VCP	Y	07-11-12	0.50	0	0	0	0	-	0	0
Federal IC/EC	Y	09-18-12	0.25	0	0	0	-	-	0	0
Meth Labs	Y	12-02-11	0.25	0	0	0	-	-	0	0
- TOTALS -				0	1	0	7	0	5	13

Notice of Disclaimer

Due to the limitations, constraints, inaccuracies and incompleteness of government information and computer mapping data currently available to InfoMap Technologies, certain conventions have been utilized in preparing the locations of all federal, state and local agency sites residing in InfoMap Technologies's databases. All EPA sites are depicted by a rectangle approximating their location and size. The boundaries of the rectangles represent NPL and state landfill the eastern and western most longitudes; the northern and southern most latitudes. As such, the mapped areas may exceed the actual areas and do not represent the actual boundaries of these properties. All other sites are depicted by a point representing their approximate address location and make no attempt to represent the actual areas of the associated property. Actual boundaries and locations of individual properties can be found in the files residing at the agency responsible for such information.

Waiver of Liability

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Environmental FirstSearch
Sites Summary Report

Target Property: ERIE CO 80516

JOB: E12625.E1

TOTAL: 13 **GEOCODED:** 8 **NON GEOCODED:** 5 **SELECTED:** 13

Map ID	Dist/Dir	DB Type	Site Name/ID/Status	Address	ElevDiff	Page No.
1	*0.34 SE*	*SWL*	*HORST/DEAMIN* *12-137/HISTORIC*	*UNKNOWN* *ERIE CO*	*N/A*	*1*
1	*0.09 SE*	*SWL*	*HORST SWDS (AKA ERIE SWDS)* *12-1366/HISTORIC*	*2240 WELD CTY 5* *ERIE CO*	*N/A*	*2*
2	*0.50 SE*	*SWL*	*DENVER REGIONAL LANDFILL, FKA-LAID* *4-05/HISTORIC*	*1441 WCR 6* *ERIE CO*	*N/A*	*3*
2	*0.50 SE*	*SWL*	*COLORADO LANDFILL* *5-04/HISTORIC*	*NO ADDRESS REPORTED* *ERIE CO*	*N/A*	*4*
2	*0.50 SE*	*SWL*	*LAIDLAW SOUTH* *12-14/HISTORIC*	*1441 WELD CO ROAD* *LAFAYETTE CO*	*N/A*	*5*
2	*0.50 SE*	*SWL*	*LAIDLAW NORTH* *12-1365/HISTORIC*	*1441 WELD 6 ROAD* *ERIE CO*	*N/A*	*6*
2	*0.50 SE*	*SWL*	*LAIDLAW NORTH* *123-LFL-020*	*1441 WELD COUNTY ROAD* *ERIE CO*	*N/A*	*7*
2	*0.50 SE*	*SWL*	*DENVER REGIONAL LANDFILL (SOUTH)* *123-LFL-025*	*1441 WELD COUNTY ROAD* *ERIE CO*	*N/A*	*7*

Environmental FirstSearch
Sites Summary Report

Target Property: ERIE CO 80516

JOB: E12625.E1

TOTAL: 13 **GEOCODED:** 8 **NON GEOCODED:** 5 **SELECTED:** 13

Map ID	Dist/Dir	DB Type	Site Name/ID/Status	Address	ElevDiff	Page No.
	NON GC	*SWL*	*OLD ERIE LANDFILL* *12-1367/HISTORIC*	*UNKNOWN* *ERIE CO*	*N/A*	*8*
	NON GC	*SWL*	*NEWHAUSER DUMP* *12-1371/HISTORIC*	*UNKNOWN* *ERIE CO*	*N/A*	*9*
	NON GC	*SWL*	*LANDFILL SYSTEMS, INC.* *5-05/HISTORIC*	*NO ADDRESS REPORTED* *ERIE CO*	*N/A*	*10*
	NON GC	*SWL*	*AL CARTON DUMP* *12-1368/HISTORIC*	*UNKNOWN* *ERIE CO*	*N/A*	*11*
	NON GC	*ERNS*	*ATLAS VAN LINES (ALLEGED PRP)* *224837*	*ERIE LANDFILL (POTENTIAL DU* *ERIE CO*	*N/A*	*12*

Environmental FirstSearch
Site Detail Report

Target Property: ERIE CO 80516

JOB: E12625.E1

SWL

SEARCH ID: 10 **DIST/DIR:** 0.34 SE **ELEVATION:** **MAP ID:** 1

NAME: HORST/DEAMIN
ADDRESS: UNKNOWN
ERIE CO
WELD
CONTACT:
SOURCE: CDPHE/COUNTY

REV: 12/01/08
ID1: 12-137
ID2: 00070-0002200
STATUS: HISTORIC
PHONE:

COLORADO HISTORIC LANDFILLS

STATUS : CO Old Waste Sites

; Acres- 50 - 100
Type- LANDFILL
Fill- REFUSE.
Oper/Ownr/Othr- , ,

Environmental FirstSearch
Site Detail Report

Target Property: ERIE CO 80516

JOB: E12625.E1

SWL

SEARCH ID: 2 **DIST/DIR:** 0.13 SE **ELEVATION:** **MAP ID:** 3

NAME: HORST SWDS (AKA ERIE SWDS)
ADDRESS: 2240 WELD CTY 5
ERIE CO
WELD
CONTACT:
SOURCE: CDPHE/COUNTY

REV: 12/01/08
ID1: 12-1366
ID2: 00070-0002196
STATUS: HISTORIC
PHONE:

COLORADO HISTORIC LANDFILLS

STATUS : CO Old Waste Sites

Type- LANDFILL
Oper/Ownr/Othr- LANDFILL SYSTEMS, INC./ /, DANIAL

Environmental FirstSearch
Site Detail Report

Target Property: ERIE CO 80516

JOB: E12625.E1

SWL

SEARCH ID: 9 **DIST/DIR:** 0.50 SE **ELEVATION:** **MAP ID:** 2

NAME:	DENVER REGIONAL LANDFILL, FKA-LAIDLAW	**REV:**	12/01/08
ADDRESS:	1441 WCR 6	**ID1:**	4-05
	ERIE CO	**ID2:**	00070-0000369
	WELD	**STATUS:**	HISTORIC
CONTACT:		**PHONE:**	
SOURCE:	CDPHE/COUNTY		

COLORADO HISTORIC LANDFILLS

STATUS : Weld County CO Recent Waste Sites

TRS- T1N/R68W/S29
TYPE- Landfills
REGUL D- Permit 972
CONTACT- Ron Pickett
303-673-9431, c303-884-8053

Environmental FirstSearch
Site Detail Report

Target Property: ERIE CO 80516

JOB: E12625.E1

SWL

SEARCH ID: 8 **DIST/DIR:** 0.50 SE **ELEVATION:** **MAP ID:** 2

NAME: COLORADO LANDFILL
ADDRESS: NO ADDRESS REPORTED
ERIE CO
WELD
CONTACT:
SOURCE: CDPHE/COUNTY

REV: 12/01/08
ID1: 5-04
ID2: 00070-0000396
STATUS: HISTORIC
PHONE:

COLORADO HISTORIC LANDFILLS

STATUS : Weld County CO Old Landfills

TRS- E2,NE4 1/68/29
No other details available

Target Property: ERIE CO 80516

JOB: E12625.E1

SWL

SEARCH ID: 5 **DIST/DIR:** 0.50 SE **ELEVATION:** **MAP ID:** 2

NAME: LAIDLAW SOUTH
ADDRESS: 1441 WELD CO ROAD
LAFAYETTE CO
WELD
CONTACT:
SOURCE: CDPHE/COUNTY

REV: 12/01/08
ID1: 12-14
ID2: 00070-0002230
STATUS: HISTORIC
PHONE:

COLORADO HISTORIC LANDFILLS

STATUS : CO Old Waste Sites

COVERED DAILY: YES. OPEN BURNING: NO. WASTE IMPOUNDMENT: NO. LEACHATE: YES. SLUDGE POND: NO. TIRE PILES: NO. ; TRS-T1N R68W SSW20; Acres- 160/; Volume- 300K CY/QTR; Opened- 1981; Last Inspn- 6/1/1988
Type- LANDFILL
Fill- FLY ASH: NO. BIOMEDICAL: NO. ASBESTOS: YES.
Monitored- GROUNDWATER: YES. METHANE: YES. LINER:

Target Property: ERIE CO 80516

JOB: E12625.E1

SWL

SEARCH ID: 4 **DIST/DIR:** 0.50 SE **ELEVATION:** **MAP ID:** 2

NAME: LAIDLAW NORTH
ADDRESS: 1441 WELD 6 ROAD
ERIE CO
WELD
CONTACT:
SOURCE: CDPHE/COUNTY

REV: 12/01/08
ID1: 12-1365
ID2: 00070-0002195
STATUS: HISTORIC
PHONE:

COLORADO HISTORIC LANDFILLS

STATUS : CO Old Waste Sites

COVERED DAILY: YES. OPEN BURNING: NO. WASTE IMPOUNDMENT: NO. LEACHATE: YES. SLUDGE POND: NO. TIRE PILES: NO. ; TRS-T1N R68W N29; Acres- 80/; Volume- 300K CY/QTR; Opened- 12/13/1984; Last Inspn- 6/1/1988
Type- LANDFILL
Fill- FLY ASH: YES. BIOMEDICAL: NO. ASBESTOS: NO.
Monitored- GROUNDWATER: YES. METHANE: YES. LINER:

Target Property: ERIE CO 80516

JOB: E12625.E1

SWL

SEARCH ID: 3 **DIST/DIR:** 0.50 SE **ELEVATION:** 5166 **MAP ID:** 2

NAME: LAIDLAW NORTH
ADDRESS: 1441 WELD COUNTY ROAD
ERIE CO
WELD
CONTACT:
SOURCE: CDPHE

REV: 07/01/11
ID1: 123-LFL-020
ID2: 798
STATUS:
PHONE:

STATUS : Per CDPHE: Closed, but date not reported.

Location Confirmed- + OR - 30 METERS, CENTRUS
Type- LANDFILL
Opened- 5/19/1999
Closed- Closed, but date not reported.
Mapped by Colorado Dept of Health and Environment
OPERATOR-LAIDLAW WASTE SYSTEMS 3036739431
OWNER-LAIDLAW WASTE SYSTEMS 3032885558

SWL

SEARCH ID: 1 **DIST/DIR:** 0.50 SE **ELEVATION:** 5166 **MAP ID:** 2

NAME: DENVER REGIONAL LANDFILL (SOUTH)
ADDRESS: 1441 WELD COUNTY ROAD
ERIE CO
CONTACT:
SOURCE: CDPHE

REV: 07/01/11
ID1: 123-LFL-025
ID2: 445
STATUS:
PHONE:

STATUS : Per CDPHE: Currently Open

Location Confirmed- + OR - 30 METERS, CENTRUS
Type- LANDFILL
Opened- 1/1/1979
Closed- Currently Open
Mapped by Colorado Dept of Health and Environment
OPERATOR-WASTE CONNECTIONS, INC 3036739431
OWNER-WASTE CONNECTIONS, INC

Target Property: ERIE CO 80516

JOB: E12625.E1

SWL

SEARCH ID: 13 **DIST/DIR:** NON GC **ELEVATION:** **MAP ID:**

NAME: OLD ERIE LANDFILL
ADDRESS: UNKNOWN
ERIE CO
WELD
CONTACT:
SOURCE: CDPHE/COUNTY

REV: 12/01/08
ID1: 12-1367
ID2: 00070-0002197
STATUS: HISTORIC
PHONE:

COLORADO HISTORIC LANDFILLS

STATUS : CO Old Waste Sites

AT FORMER LANDFILL NUMEROUS CHEMICALS. HAZARD TYPE: METHANE. IMPACT: GW.; Acres- 10 - 50
Type- LANDFILL
Fill- SLUDGE.
Oper/Ownr/Othr- / / PRATT PROPERTY LANDF, ,

Environmental FirstSearch
Site Detail Report

Target Property: ERIE CO 80516

JOB: E12625.E1

SWL

SEARCH ID: 12 **DIST/DIR:** NON GC **ELEVATION:** **MAP ID:**

NAME: NEWHAUSER DUMP
ADDRESS: UNKNOWN
ERIE CO
WELD
CONTACT:
SOURCE: CDPHE/COUNTY

REV: 12/01/08
ID1: 12-1371
ID2: 00070-0002201
STATUS: HISTORIC
PHONE:

COLORADO HISTORIC LANDFILLS

STATUS : CO Old Waste Sites

; Acres- 10 - 50
Type- LANDFILL
Fill- REFUSE.
Oper/Ownr/Othr- / / NEWHAUSER, ,

Target Property: ERIE CO 80516

JOB: E12625.E1

SWL

SEARCH ID: 11 **DIST/DIR:** NON GC **ELEVATION:** **MAP ID:**

NAME: LANDFILL SYSTEMS, INC.
ADDRESS: NO ADDRESS REPORTED
ERIE CO
WELD
CONTACT:
SOURCE: CDPHE/COUNTY

REV: 12/01/08
ID1: 5-05
ID2: 00070-0000397
STATUS: HISTORIC
PHONE:

COLORADO HISTORIC LANDFILLS

STATUS : Weld County CO Old Landfills

TRS- S2,SW4 1/68/20
No other details available

Target Property: ERIE CO 80516

JOB: E12625.E1

SWL

SEARCH ID: 7 **DIST/DIR:** NON GC **ELEVATION:** **MAP ID:**

NAME: AL CARTON DUMP
ADDRESS: UNKNOWN
ERIE CO
WELD
CONTACT:
SOURCE: CDPHE/COUNTY

REV: 12/01/08
ID1: 12-1368
ID2: 00070-0002198
STATUS: HISTORIC
PHONE:

COLORADO HISTORIC LANDFILLS

STATUS : CO Old Waste Sites

USED FOR SEPTIC TANK and GREASE TRAP CLE. IMPACT: SW.; Acres- 1 - 10
Type- LANDFILL
Fill- LIQUIDS.
Oper/Ownr/Othr- , ,

Target Property: ERIE CO 80516 **JOB:** E12625.E1

ERNS

SEARCH ID: 6 **DIST/DIR:** NON GC **ELEVATION:** **MAP ID:**

NAME: ATLAS VAN LINES (ALLEGED PRP)
ADDRESS: ERIE LANDFILL (POTENTIAL DUMPING SIT
ERIE CO
WELD
CONTACT:
SOURCE: EPA

REV: 7/10/91
ID1: 224837
ID2:
STATUS:
PHONE:

SPILL INFORMATION

DATE OF SPILL: 7/10/91 **TIME OF SPILL:** 0000

PRODUCT RELEASED (1): BLACK POWDER TONER
QUANTITY (1): 0
UNITS (1): UNK

PRODUCT RELEASED (2):
QUANTITY (2):
UNITS (2):

PRODUCT RELEASED (3):
QUANTITY (3):
UNITS (3):

MEDIUM/MEDIA AFFECTED

AIR:	NO	**GROUNDWATER:**	NO
LAND:	YES	**FIXED FACILITY:**	NO
WATER:	NO	**OTHER:**	NO

WATERBODY AFFECTED BY RELEASE: NONE

CAUSE OF RELEASE

DUMPING:	YES	**EQUIPMENT FAILURE:**	NO
NATURAL PHENOMENON:	NO	**OPERATOR ERROR:**	NO
OTHER CAUSE:	NO	**TRANSP. ACCIDENT:**	NO
UNKNOWN:	NO		

ACTIONS TAKEN: NOTIFIED STAN MAY - COLO DEPT OF HEALTH, CDH WILL NOTIFY COUNTIES.
RELEASE DETECTION: POTENTIAL RELEASE OF HAZARDOUS MATERIAL AT SOLID WASTE D FACILITY ALLEGED DUMPING - POTENTIAL
MISC. NOTES: AT THIS POINT, THIS IS STILL AT POTENTIAL DUMPING ONLY. STORED BLACK P OWDER TONER FROM STORAGE-TEK. TRANSFER BY WESTERN DISPOSAL FOR ATLAS VAN LINES FROM WAREHOUSE. THOUSANDS OF POUNDS CURRENTLY STORED.

DISCHARGER INFORMATION

DISCHARGER ID: 224837 **DUN and BRADSTREET :**
TYPE OF DISCHARGER:
NAME OF DISCHARGER: ATLAS VAN LINES (ALLEGED PRP)
ADDRESS: 111 S. PRATT PARKWAY
LONGMONT CO

Environmental FirstSearch Descriptions

NPL: *EPA* NATIONAL PRIORITY LIST - The National Priorities List is a list of the worst hazardous waste sites that have been identified by Superfund. Sites are only put on the list after they have been scored using the Hazard Ranking System (HRS), and have been subjected to public comment. Any site on the NPL is eligible for cleanup using Superfund Trust money.
A Superfund site is any land in the United States that has been contaminated by hazardous waste and identified by the Environmental Protection Agency (EPA) as a candidate for cleanup because it poses a risk to human health and/or the environment.
FINAL - Currently on the Final NPL
PROPOSED - Proposed for NPL

NPL DELISTED: *EPA* NATIONAL PRIORITY LIST Subset - Database of delisted NPL sites. The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.
DELISTED - Deleted from the Final NPL

CERCLIS: *EPA* COMPREHENSIVE ENVIRONMENTAL RESPONSE COMPENSATION AND LIABILITY INFORMATION SYSTEM (CERCLIS)- CERCLIS is a database of potential and confirmed hazardous waste sites at which the EPA Superfund program has some involvement. It contains sites that are either proposed to be or are on the National Priorities List (NPL) as well as sites that are in the screening and assessment phase for possible inclusion on the NPL.
PART OF NPL- Site is part of NPL site
DELETED - Deleted from the Final NPL
FINAL - Currently on the Final NPL
NOT PROPOSED - Not on the NPL
NOT VALID - Not Valid Site or Incident
PROPOSED - Proposed for NPL
REMOVED - Removed from Proposed NPL
SCAN PLAN - Pre-proposal Site
WITHDRAWN - Withdrawn

NFRAP: *EPA* COMPREHENSIVE ENVIRONMENTAL RESPONSE COMPENSATION AND LIABILITY INFORMATION SYSTEM ARCHIVED SITES - database of Archive designated CERCLA sites that, to the best of EPA's knowledge, assessment has been completed and has determined no further steps will be taken to list this site on the National Priorities List (NPL). This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.
NFRAP – No Further Remedial Action Plan
P - Site is part of NPL site
D - Deleted from the Final NPL
F - Currently on the Final NPL
N - Not on the NPL
O - Not Valid Site or Incident
P - Proposed for NPL
R - Removed from Proposed NPL
S - Pre-proposal Site
W – Withdrawn

RCRA COR ACT: *EPA* RESOURCE CONSERVATION AND RECOVERY INFORMATION SYSTEM SITES - Database of hazardous waste information contained in the Resource Conservation and Recovery Act Information (RCRAInfo), a national program management and inventory system about hazardous waste handlers. In general, all generators, transporters, treaters, storers, and disposers of hazardous waste are required to provide information about their activities to state environmental agencies. These agencies, in turn pass on the information to regional and national EPA offices. This regulation is governed by the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984.
RCRAInfo facilities that have reported violations and subject to corrective actions.

RCRA TSD: *EPA* RESOURCE CONSERVATION AND RECOVERY INFORMATION SYSTEM TREATMENT, STORAGE, and DISPOSAL FACILITIES. - Database of hazardous waste information contained in the Resource Conservation and Recovery Act Information (RCRAInfo), a national program management and inventory system about hazardous waste handlers. In general, all generators, transporters, treaters, storers, and disposers of hazardous waste are required to provide information about their activities to state environmental agencies. These agencies, in turn pass on the information to regional and national EPA offices. This regulation is governed by the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984.
Facilities that treat, store, dispose, or incinerate hazardous waste.

RCRA GEN: *EPA/MA DEP/CT DEP* RESOURCE CONSERVATION AND RECOVERY INFORMATION SYSTEM GENERATORS - Database of hazardous waste information contained in the Resource Conservation and Recovery Act Information (RCRAInfo), a national program management and inventory system about hazardous waste handlers. In general, all generators, transporters, treaters, storers, and disposers of hazardous waste are required to provide information about their activities to state environmental agencies. These agencies, in turn pass on the information to regional and national EPA offices. This regulation is governed by the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984.
Facilities that generate or transport hazardous waste or meet other RCRA requirements.
LGN - Large Quantity Generators
SGN - Small Quantity Generators
VGN – Conditionally Exempt Generator.
Included are RAATS (RCRA Administrative Action Tracking System) and CMEL (Compliance Monitoring & Enforcement List) facilities.
CONNECTICUT HAZARDOUS WASTE MANIFEST – Database of all shipments of hazardous waste within, into or from Connecticut. The data includes date of shipment, transporter and TSD info, and material shipped and quantity. This data is appended to the details of existing generator records.
MASSACHUSETTES HAZARDOUS WASTE GENERATOR – database of generators that are regulated under the MA DEP.
VQN-MA = generates less than 220 pounds or 27 gallons per month of hazardous waste or waste oil.
SQN-MA = generates 220 to 2,200 pounds or 27 to 270 gallons per month of waste oil.
LQG-MA = generates greater than 2,200 lbs of hazardous waste or waste oil per month.

RCRA NLR: *EPA* RESOURCE CONSERVATION AND RECOVERY INFORMATION SYSTEM SITES - Database of hazardous waste information contained in the Resource Conservation and Recovery Act Information (RCRAInfo), a national program management and inventory system about hazardous waste handlers. In general, all generators, transporters, treaters, storers, and disposers of hazardous waste are required to provide information about their activities to state environmental agencies. These agencies, in turn pass on the information to regional and national EPA offices. This regulation is governed by the Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984.
Facilities not currently classified by the EPA but are still included in the RCRAInfo database. Reasons for non classification:
Failure to report in a timely matter.
No longer in business.
No longer in business at the listed address.
No longer generating hazardous waste materials in quantities which require reporting.

ERNS: *EPA/NRC* EMERGENCY RESPONSE NOTIFICATION SYSTEM (ERNS) - Database of incidents reported to the National Response Center. These incidents include chemical spills, accidents involving chemicals (such as fires or explosions), oil spills, transportation accidents that involve oil or chemicals, releases of radioactive materials, sightings of oil sheens on bodies of water, terrorist incidents involving chemicals, incidents where illegally dumped chemicals have been found, and drills intended to prepare responders to handle these kinds of incidents. Data since January 2001 has been received from the National Response System database as the EPA no longer maintains this data.

Tribal Lands: *DOI/BIA* INDIAN LANDS OF THE UNITED STATES - Database of areas with boundaries established by treaty, statute, and (or) executive or court order, recognized by the Federal Government as territory in which American Indian tribes have primary governmental authority. The Indian Lands of the United States map layer shows areas of 640 acres or more, administered by the Bureau of Indian Affairs. Included are

Federally-administered lands within a reservation which may or may not be considered part of the reservation.
BUREAU OF INDIAN AFFIARS CONTACT - Regional contact information for the Bureau of Indian Affairs offices.

State/Tribal Sites: ***CDPHE*** CO SPL - Colorado does not have an official State Priority List (SPL). However, there are a number of sites that the state seems to place in this sort of category. Some are officially a Natural Resource Damages Site (NRDS) or Private Cleanup Site (Non-Superfund), but they're listed on the state's web page of Superfund sites (www.cdphe.state.co.us/hm/sf_sites.htm). Others are UMTRA (Uranium Mill Tailing Remedial Action) mill tailing cleanup sites (www.cdphe.state.co.us/hm/umsites.htm). Thousands of UMTRA "vicinity properties" have also been identified where mill tailings were used as sand in concrete, roadbase, trenches, bricks, etc. Such properties have been remediated in Durango, Grand Junction, Fruita, Palisade, Gunnison, Maybell, Naturita and Rifle, but some unidentified tailings may still remain in and around these communities. CDPHE's list of vicinity properties is not publicly available and was not searched for this report. Property-specific information is available through the CDPHE Grand Junction office. See www.cdphe.state.co.us/hm/rptailng.htm.

State Spills 90: ***CDPHE*** ENVIRONMENTAL RELEASE AND INCIDENT DATABASE - This is a database of reported spills in Colorado.

State/Tribal SWL: ***CDPHE*** DATABASE OF ACTIVE SOLID WASTE MANAGEMENT FACILITIES - Listing of Active solid waste facilities and transfer stations.
DATABASE OF ACTIVE SOLID WASTE MANAGEMENT FACILITIES - Listing of Active solid waste facilities and transfer stations.
CO Historic Landfills - This proprietary database represents a compilation of eleven local, regional and state agency sources. The agencies generated these lists on a one-time basis and do not expect to update them. A more detailed description of the applicable source is included with any findings reported from this database. The eleven sources are:
1. Adams County CO Old Landfills
2. Arapahoe County CO Old Landfills
3. Douglas County CO Old Landfills
4. Weld County CO Old Landfills
5. Boulder County CO Old Landfills
6. Jefferson County CO Old Landfills
7. Denver CO Methane Study
8. CO Methane Study
9. DRCOG Methane Study
10. Denver CO Old Fil Sites
11. CO Old Waste Sites

State/Tribal LUST: ***COSTIS*** DATABASE OF LEAKING UNDERGROUND STORAGE TANKS - Colorado Department of Labor and Employment's Colorado Storage Tank Information System (COSTIS) provides this data.
LUST Trust Tanks - This is an old list of locations where tank leaks were suspected and LUST (Leaking Underground Storage Tank) Trust funds were used in an effort to identify the source. Often, the facility responsible for the leak was found nearby, and that facility was then entered into the LUST database. In other cases, however, the source was never identified, and nothing was ever entered into the LUST database. When responsibility for the tank program was transferred from CDPHE (Colorado Department of Public Health & Environment) to CDLE (Colorado Department of Labor & Employment) in the '90s, this old LUST Trust list was never entered into the new COSTIS database (Colorado Storage Tank Information System). Few people at CDLE are aware of this old list, and any files associated with the listings have apparently been discarded or misplaced.

State/Tribal UST/AST: ***COSTIS*** DATABASE OF UNDERGROUND STORAGE TANKS - Colorado Department of Labor and Employment's Colorado Storage Tank Information System (COSTIS) provides this data.

State/Tribal EC: ***CDPHE*** ENVIRONMENTAL COVENANTS - Senate Bill 01-145 gave authority to the Colorado Department of Public Health and Environment to approve requests to restrict the future use of a property using an enforceable agreement called an environmental covenant. When a contaminated site is not cleaned up completely, land use restrictions may be used to ensure that the selected cleanup remedy is

adequately protective of human health and the environment.

State/Tribal VCP: ***CDPHE*** THE VOLUNTARY CLEANUP AND REDEVELOPMENT PROGRAM PROGRAM - The Voluntary Cleanup and Redevelopment program was created in 1994. The objective of the program is to facilitate the redevelopment and transfer of contaminated properties. Cleanup decisions are based on existing standards and the proposed use of the property. The actual cleanup and verification is the owner's responsibility.

RADON: ***NTIS*** NATIONAL RADON DATABASE - EPA radon data from 1990-1991 national radon project collected for a variety of zip codes across the United States.

Meth Labs: ***US DOJ*** NATIONAL CLANDESTINE LABORATORY REGISTER - Database of addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the U.S. Department of Justice ("the Department"), and the Department has not verified the entry and does not guarantee its accuracy. All sites that are included in this data set will have an id that starts with NCLR.

Environmental FirstSearch Database Sources

NPL: ***EPA*** Environmental Protection Agency

Updated quarterly

NPL DELISTED: ***EPA*** Environmental Protection Agency

Updated quarterly

CERCLIS: ***EPA*** Environmental Protection Agency

Updated quarterly

NFRAP: ***EPA*** Environmental Protection Agency.

Updated quarterly

RCRA COR ACT: ***EPA*** Environmental Protection Agency.

Updated quarterly

RCRA TSD: ***EPA*** Environmental Protection Agency.

Updated quarterly

RCRA GEN: ***EPA/MA DEP/CT DEP*** Environmental Protection Agency, Massachusetts Department of Environmental Protection, Connecticut Department of Environmental Protection

Updated quarterly

RCRA NLR: ***EPA*** Environmental Protection Agency

Updated quarterly

ERNS: ***EPA/NRC*** Environmental Protection Agency

Updated annually

Tribal Lands: ***DOI/BIA*** United States Department of the Interior

Updated annually

State/Tribal Sites: ***CDPHE*** The Colorado Department of Public Health and Environment Hazardous Materials and Waste Management Division

Updated annually

State Spills 90: ***CDPHE*** CDPHE Hazardous Materials and Waste Management Division

Updated annually

State/Tribal SWL: ***CDPHE*** The Colorado Department of Public Health and Environment Hazardous Materials and Waste Management DivisionPublic Safety

Updated annually

State/Tribal LUST: ***COSTIS*** The Colorado Department of Labor and Employment/Division of Oil and Public Safety

Updated semi-annually

State/Tribal UST/AST: ***COSTIS*** The Colorado Department of Labor and Employment/Division of Oil and Public Safety

Updated semi-annually

State/Tribal EC: ***CDPHE*** rado Department of Public Health and Environment Hazardous Materials and Waste Management Division

Updated annually

State/Tribal VCP: ***CDPHE*** The Colorado Department of Public Health and Environment Hazardous Materials and Waste Management Division

Updated annually

RADON: ***NTIS*** Environmental Protection Agency, National Technical Information Services

Updated periodically

Meth Labs: ***US DOJ*** U.S. Department of Justice

Updated when available

Environmental FirstSearch
Street Name Report for Streets within .5 Mile(s) of Target Property

Target Property: ERIE CO 80516

JOB: E12625.E1

Street Name	Dist/Dir	Street Name	Dist/Dir
8 Rd	0.43 NW		
Carr St	0.50 NW		
County Road 3	0.02 NW		
County Road 5	0.00 --		
County Road 6	0.50 SE		
County Road 8	0.00 --		
Garfield Rd	0.50 SE		
Huntley Creek Ct	0.46 NW		
Kattell St	0.49 NW		
Perry St	0.43 NW		
Weld Co Rd 8	0.00 --		
Weld County Rd 3	0.02 NW		
Weld County Rd 5	0.00 --		
Weld County Rd 8	0.00 --		

ATTACHMENT E
QUALIFICATIONS

A.G. Wassenaar
Geotechnical and Environmental Consultants
Inc.
2180 South Ivanhoe Street, Suite 5
Denver, Colorado 80222-5710
303-759-8373 Fax 303-759-4874
www.agwassenaar.com

RESUME

KRISTIN A. SCHWARTZ
Environmental Scientist

EDUCATION:

B.S., Environmental Engineering, University of Colorado at Boulder 2011.

EXPERIENCE:

Ms. Schwartz joined A.G. Wassenaar in July 2012 as a staff Environmental Scientist for the Environmental Department. Ms. Schwartz's field experience includes assisting with characterizing and monitoring surface water contamination due to acid mine draining; conducting site investigations to determine how to most effectively remediate abandon mine shafts and adits; and determining bioremdiation and chemical treatment solutions for wastewater treatment plants. This involves: water and soil sampling for identification and analysis, core sampling preparation, GPS site mapping, characterizing and measuring site specifications, oversight of remedial construction activities, and coordinating with landowners and contractors.

In addition to fieldwork, her responsibilities included technical report writing, review, and presentation, data analysis, analytical review and interpretation, proposal preparation, and regulatory compliance.

Previous to joining A.G. Wassenaar, Inc., Ms. Schwartz gained environmental remediation and government regulatory experience working as an Environmental Protection Specialist Intern for the Department of Natural Resources Inactive Mines program.

TRAINING:

40 Hour OSHA HAZWOPER certification
Engineer in Training (EIT) status awarded

MEMBERSHIPS:

American Water Works Association (AWWA)
World Environment Federation (WEF)

A.G. Wassenaar
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Denver, Colorado 80222-5710
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www.agwassenaar.com

RESUME

RACHEL A. PETERSON, P.G.
Environmental Geologist

EDUCATION:
B.S., Geology, University of Alaska Fairbanks, 2001

EXPERIENCE:
A.G. Wassenaar, Inc, Environmental Geologist, December 2002-present
Ms. Peterson has over nine years of experience in the environmental consulting industry, performing and managing diverse soil, ground water, and vapor investigation and remediation projects. Management duties include: the organization of project teams, planning, scheduling and coordination of geologic and hydrogeologic investigations and preparing proposals and technical reports.

Ms. Peterson's field experience includes conducting drilling, sampling, and testing programs to identify soil and ground water contamination; implementing bioremediation and chemical treatment technologies; and overseeing soil excavation projects. She conducts underground storage tank removal assessments, and has operated and maintained active remediation systems. Ms. Peterson also has experience performing ground water and risk assessment modeling. She is experienced in negotiating with government agencies to achieve project closure and has assisted clients in receiving several million dollars worth of state reimbursement funds for qualifying projects. Ms. Peterson also manages, conducts and reviews Phase I Environmental Site Assessments.

Ms. Peterson prepares Stormwater Management Plans (SWMP) and conducts SWMP inspections for construction sites in accordance with the Colorado Discharge Permit System. Ms. Peterson also has experience with baseline water well testing in accordance with Colorado Oil and Gas Conservation Commission (COGCC) Rule 318A. Ms. Peterson is a State of Colorado and federally licensed asbestos building inspector and has been involved in numerous comprehensive asbestos inspections.

Previous to joining A.G. Wassenaar, Inc., Ms. Peterson gained research experience working for the Alaska Division of Geological and Geophysical Surveys in collaboration with the Alaska Volcano Observatory.

TRAINING AND CERTIFICATIONS:
State of Wyoming - Licensed Professional Geologist, No. PG-3747
EPA AHERA, Colorado Asbestos Building Inspector
40 Hour OSHA Environmental Health and Safety for Hazardous Waste Site Operations
American Red Cross and National Safety Council standard first aid and CPR training
Oilfield safety training

MEMBERSHIPS:
Rocky Mountain Association of Environmental Professionals: Board Member and Past President
Colorado Hazardous Waste Management Society
National Ground Water Association
Colorado Oil and Gas Association (COGA)

ATTACHMENT F
REFERENCES

REFERENCES

Colorado Oil and Gas Conservation Commission. COGCC GIS Online. <http://www.oil-gas.state.co.us/>

CTL/Thompson, Inc. "Geologic and Preliminary Geotechnical Investigation, Horst Property, County Roads 5 and 8, Weld County, Colorado". 1 June 2000.

CTL/Thompson, Inc. "Phase I Environmental Site Assessment, Horst Property, Section 20 Parcel, Weld County Road 5 and Weld County Road 6, Erie, Colorado". 5 November 1999.

CTL/Thompson, Inc. "Phase II Environmental Site Assessment, Horst Property, West Parcel, Southwest of Weld County Roads 5 & 8, Erie, Colorado, Job No. 31,288". 1 June 2000.

Dearmin, James. Property Owner. Personal Interview. 29 October 2012.

Ikenberry, Douglas. Colorado Department of Public Health and Environment- Solid Waste Unit. Telephone Interview. 29 October 2012.

Satisfi Environmental Information. Environmental Database Search. "Dearmin Property, Erie, CO 80516". 8 October 2012.

Satisfi Environmental Information. Aerial Photographs. Dated 1937, 1979, and 1985.

Satisfi Environmental Information. Topographic Maps, Erie Quadrangle dated 1948, 1966, 1971, and 1978. 9 October 2012.

Satisfi Environmental Information. Topographic Maps, Niwot Quadrangle dated 1902. 9 October 2012.

United States Department of the Interior, Geological Survey (USGS) Topographic Map, Erie, Colorado Quadrangle:1967 (revised 1979).

Western Environment and Ecology, Inc. "Mine Subsidence Investigation, Horst Property, Section 20, Township 1 North, Range 68 West, Erie, Colorado". 4 April 2000.

PHASE I DRAINAGE REPORT
FOR
ERIE HIGHLANDS
PLANNING AREAS 5 AND 6
ERIE, CO
PROJECT NO. 15-023

PREPARED FOR:

OAKWOOD HOMES
4908 TOWER ROAD
DENVER, CO 80249

PREPARED BY:

CORE CONSULTANTS, INC.
1950 W. LITTLETON BOULEVARD, SUITE 109
LAKEWOOD, CO 80228
PHONE: 303-825-7100
CONTACT: DAVID FORBES
CORE PROJECT NUMBER: 15-023

JULY 30, 2015

APPROVAL BLOCKS

I. ENGINEER'S STATEMENT:

I affirm that this report and plan for the Phase I Drainage design of Erie Highlands, Planning Areas 5 and 6 was prepared by me (or under my direct supervision) in accordance with the provisions of the Town of Erie Standards and Specifications for Design and Construction for the owners thereof. I understand that the Town of Erie does not and will not assume liability for drainage facilities designed by others.

_____

David Forbes, P.E.
Colorado Professional Engineer
License #36130

II. OWNER/DEVELOPER'S STATEMENT:

Oakwood Homes hereby certifies that the drainage facilities for Erie Highlands, Planning Areas 5 and 6 shall be constructed according to the design presented in this report. I understand that the Town of Erie does not and will not assume liability for the drainage facilities designed and/or certifies by my engineer and that the Town of Erie review drainage plans pursuant to the Municipal Code; but cannot, on behalf of Erie Highlands, Planning Area 6, guarantee that final drainage design review will absolve Oakwood Homes and/or their successors and/or assigns of future liability for improper design.

_____

OAKWOOD HOMES

_____

PRINTED NAME

1950 W Littleton Blvd | Suite 109 | Littleton CO 80120 | 303.703.4444

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REFERENCE MATERIAL
DETAILED DRAINAGE PLAN

I. GENERAL LOCATION AND DESCRIPTION

A. SITE LOCATION

This Phase I Drainage Report provides remediation for changes in the drainage patterns resulting from the development of the proposed Erie Highlands Planning Areas 5 and 6. The site is bound by Erie Highlands filings to the north, junkyard to the east, future Sunset subdivision to the south and, and oil and gas facilities to the west. The site located in Section 20, Township 1 North, Range 68 West of the 6th Principal Meridian, Town of Erie, Weld County, Colorado. A vicinity map for the site can be found in Appendix A. The site has no major drainageways or storm drainage facilities within these planning areas.

B. DESCRIPTION OF PROPERTY

Planning Areas 5 and 6 are currently undeveloped old-farmland, and total approximately 93.2 acres. A portion of Planning Area 5 was overlot graded with a temporary sediment pond. The site has naturally occurring slopes ranging from 1 to 20 percent and is covered with native vegetation. Soil types consist of Colby loam, Midway-Shingle complex, Weld loam and Wiley-Colby complex. These soils are classified as hydrologic group B, D and C. A soils map can be found in Appendix A.

II. DRAINAGE BASINS AND SUB-BASINS

A. MAJOR DRAINAGE BASINS

The site will follow the historic drainage patterns for the site with some minor rerouting due to the proposed roadways and residential lots. The proposed improvements to the site include single-family detached lots, roadways, open space, and associated infrastructure. Runoff will generally drain south and west toward proposed detention ponds. The site drainage will not be impacted by any irrigation facilities.

The site falls within Zone X, as shown on the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) panels 08013C0441J and 08013C0442J. A map is not printed for panel 08013C0442J, but has been confirmed to be Zone X. A copy of the FEMA FIRM maps can be found in Appendix A.

B. MINOR DRAINAGE BASINS

This Phase I report will upgrade the drainage patters as outlined Phase III drainage report for Erie Highlands Filing 1. Minor Drainage Basins for Planning Areas 5-6 will be delineated using the proposed site plan and grading. The developed minor basins will include overland flow, and storm sewer collection systems which will direct stormwater to the proposed outfall points. Flows will be released at historic rates. Details will be given in the Phase II report.

III. DRAINAGE FACILITY DESIGN

A. GENERAL CONCEPT

This Phase I Drainage Report is in accordance with the *Town of Erie Standards and Specifications* (Reference A), and the *Urban Drainage and Flood Control District (UDFCD) Storm Drainage Criteria Manual* (Reference B). These manuals were used as a basis of design for the site. Planning Area 5 will discharge into Pond 3. Presently Pond 3 is being used as a temporary sediment pond. This pond will be redesigned to accommodate developed flow per Town standards for release rates and open space. Planning Area 6 will discharge to the south by means of a new pond located in the Pond 4 area. Size and limits will be detailed in the Phase II report. Preliminary sizes are included for all ponds.

The site will follow the historic drainage patterns for the site with some minor rerouting due to the proposed roadways and residential lots. Runoff will generally drain south and west toward proposed detention ponds. The site drainage will not be impacted by any irrigation facilities. Flows will be released at historic rates.

Water quality measures will be included in the design of the proposed detention ponds for the site. The ponds will be designed as an extended detention basin which will incorporate structures which will release flows for the excess urban runoff volume (EURV), and the 100-year storm event. Water quality storage volume will be provided in each detention pond.

The general concept for the drainage design is to maintain the historic drainage patterns and release rates for the site. By doing this, it reduces the impact to the existing channels.

B. SPECIFIC DETAILS

Drainage sub-basins for the site are less than 160 acres, so the Rational Method can be used in determining the flow rates for the site in the future Phase III drainage reports for the site. The sub-basins will be delineated based on the existing and proposed topography developed for the project.

The intensity-frequency curves to be used in the Rational Method calculations were taken from the Town of Erie Standards and Specifications. All drainage facilities will be analyzed and designed for both the minor (5-year, I=1.43 in) and major (100-year, I=2.70 in) storm events. Time of concentration calculations were used to determine the rainfall intensity

Hydraulic calculations for street and inlet capacity will be based on the design charts in Section 815 of the Town of Erie Standards and Specifications, and design spreadsheets provided by the Urban Drainage. Complete Hydraulic calculations will be provided in the Phase III drainage report for the site. Hydraulic Grade Lines (HGL) will be calculated using the Bentley program StormCAD.

ADAPTATIONS FROM CRITERIA

There will be no requested adaptations.

IV. Summary

The drainage design for Erie Highlands Planning Area 6 conform to The Town of Erie Standards and Specifications, and Urban Flood Control Districts' Drainage Criteria Manual where applicable.

V. REFERENCES

A. Town of Erie, Standards and Specifications, January 2015.

B. Drainage Criteria Manual, Volumes 1, 2, & 3, Urban Drainage and Flood Control District, June 2001, Revised April 2008, Updated November 2010.

C. Phase III Drainage Report for Erie Highlands, Erie, Colorado, November 2013, by Engineering Partners, Inc.

APPENDIX A
HYDROLOGIC CALCULATIONS

VICINITY MAP

FIRM MAP

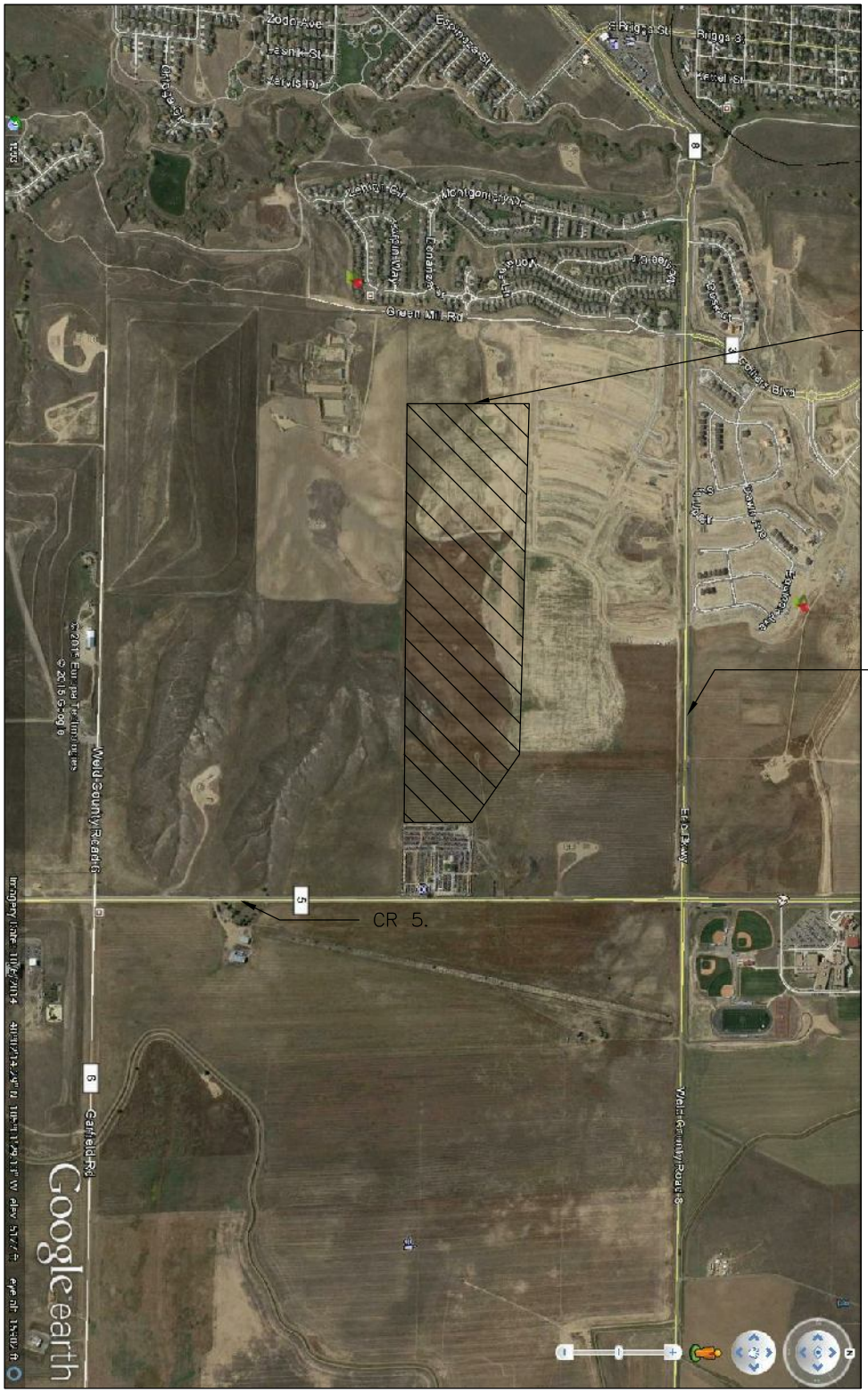
SOILS MAP

PERCENT IMPERVIOUSNESS CALCULATIONS

RUNOFF COEFFICIENT CALCULATIONS

DETENTION STORAGE CALCULATIONS

VICINITY MAP
ERIE HIGHLANDS
PLANNING AREAS 5–6



PROJECT: ERIE HIGHLANDS
PLANNING AREAS 5- 6
VICINITY MAP
DATE: 7/29/15

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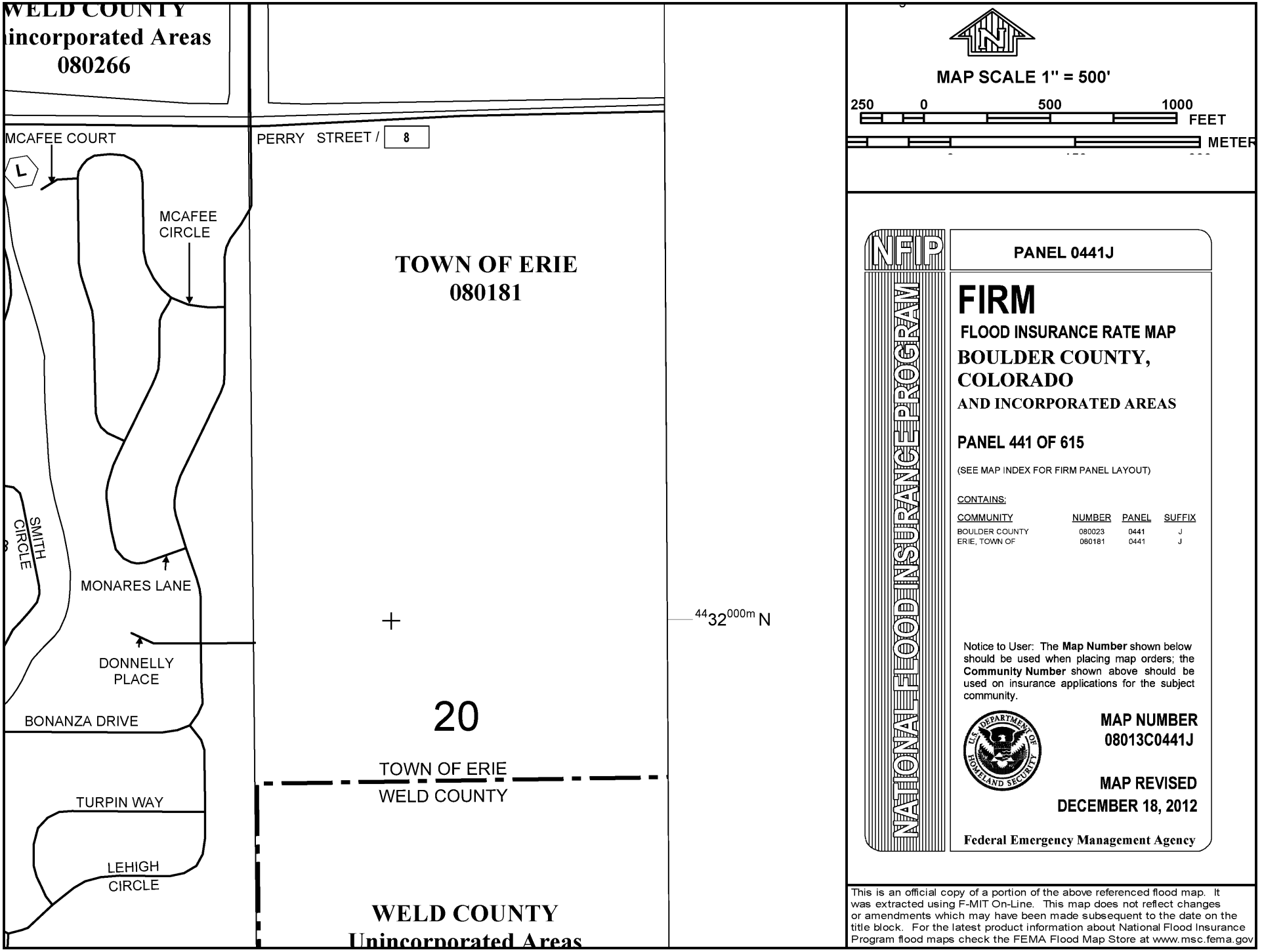
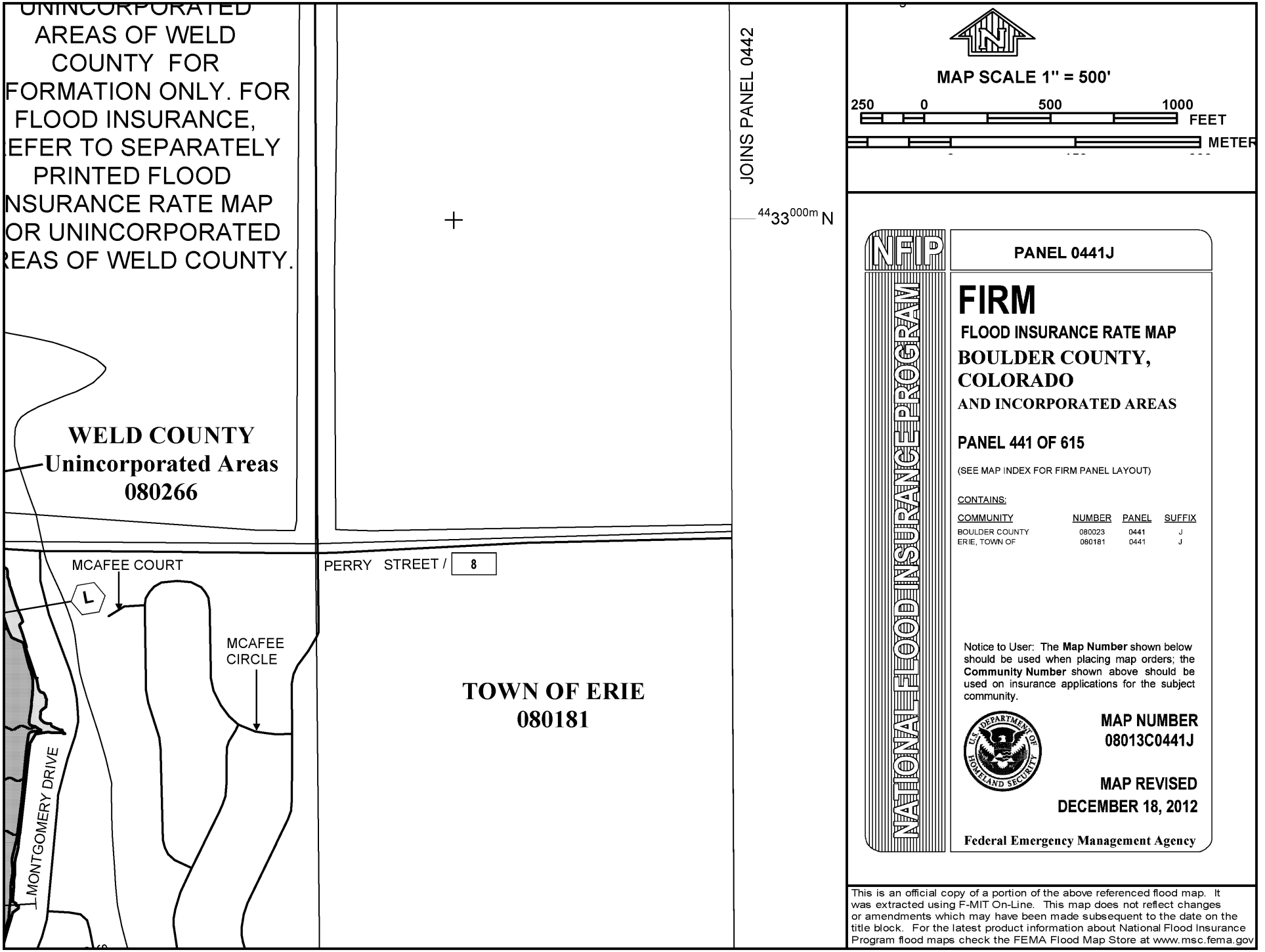

WELD COUNTY
Unincorporated Areas
080266
MCAFEE COURT
PERRY STREET / 8
L
MCAFEE CIRCLE
TOWN OF ERIE
080181
SMITH CIRCLE
MONARES LANE
DONNELLY PLACE
BONANZA DRIVE
TURPIN WAY
LEHIGH CIRCLE
44 32 000m N
20
TOWN OF ERIE
WELD COUNTY
WELD COUNTY
Unincorporated Areas
MAP SCALE 1" = 500'
250 0 500 1000
FEET
METER
NFIP
NATIONAL FLOOD INSURANCE PROGRAM
PANEL 0441J
FIRM
FLOOD INSURANCE RATE MAP
BOULDER COUNTY, COLORADO
AND INCORPORATED AREAS
PANEL 441 OF 615
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
BOULDER COUNTY 080023 0441 J
ERIE, TOWN OF 080181 0441 J
Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.
MAP NUMBER
08013C0441J
MAP REVISED
DECEMBER 18, 2012
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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AREAS OF WELD
COUNTY FOR
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FLOOD INSURANCE,
EFER TO SEPARATELY
PRINTED FLOOD
NSURANCE RATE MAP
OR UNINCORPORATED
REAS OF WELD COUNTY.
WELD COUNTY
Unincorporated Areas
080266
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MAP SCALE 1" = 500'
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NATIONAL FLOOD INSURANCE PROGRAM
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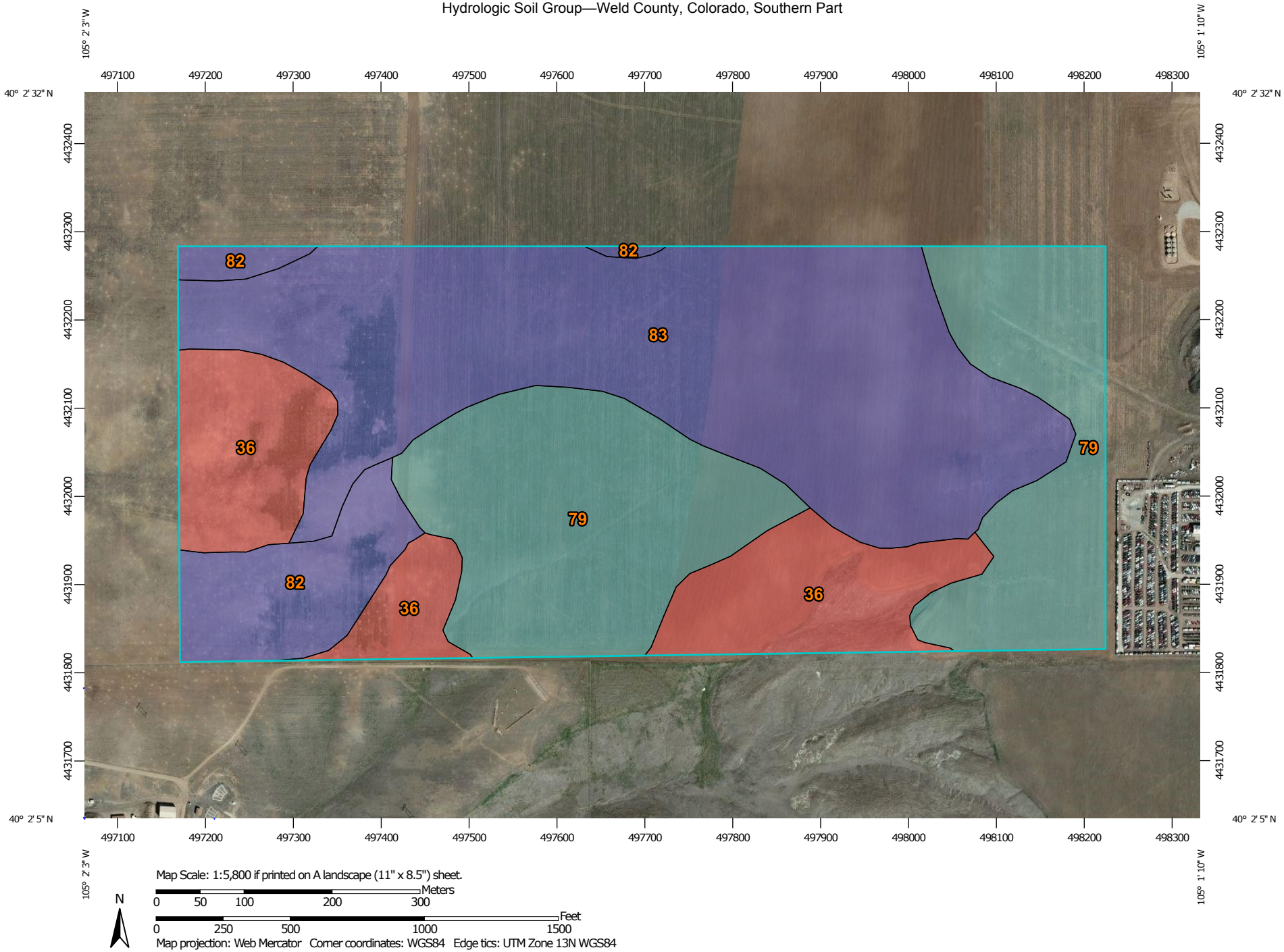
Hydrologic Soil Group—Weld County, Colorado, Southern Part



Map Scale: 1:5,800 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 50 100 200 300

Feet
0 250 500 1000 1500

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

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

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Weld County, Colorado, Southern Part
Survey Area Data: Version 13, Sep 23, 2014

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

Date(s) aerial images were photographed: Mar 16, 2012—Apr 13, 2012

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.

Hydrologic Soil Group

Hydrologic Soil Group— Summary by Map Unit — Weld County, Colorado, Southern Part (CO618)				
Map unit symbol	**Map unit name**	**Rating**	**Acres in AOI**	**Percent of AOI**
36	Midway-Shingle complex, 5 to 20 percent slopes	D	21.7	17.9%
79	Weld loam, 1 to 3 percent slopes	C	39.4	32.5%
82	Wiley-Colby complex, 1 to 3 percent slopes	B	9.8	8.0%
83	Wiley-Colby complex, 3 to 5 percent slopes	B	50.5	41.6%
Totals for Area of Interest			**121.4**	**100.0%**

Planning Areas 5-6
Proposed Conditions
Composite Percent Imperviousness

CORE Project # 15-023
7/30/2015
dcf

COMPOSITE BASIN -WEIGHTED "C" CALCULATIONS

-REFERENCE USDCM Volume 1 - Figures RO-3 thorough RO-5

	Residential							Lawns				
	Single Family		Multi-Unit	Multi-Unit				Clay Soil				
	3.8 DU's/Ac	4.6 DU's/Ac	(detached)	(attached)	School	Streets: Paved	Parks	2-7% Slope	>7% Slope	Historic		
% Imperv.	40.00%	45.00%	60.00%	75.00%	50.00%	100.00%	5.00%	5.00%	5.00%	2.00%		
											Total	Percent
BASIN	**Area**	**Area**	**Area**	**Area**		**Area**	**Area**	**Area**	**Area**	**Area**	**Area**	**Impervious**
PA5		23.85			3.85		6.70			6.20	40.60	32.3%
POND 4		2.30								6.50	8.80	13.2%
PA 6		31.30								8.10	39.40	36.2%
OS		1.90								2.50	4.40	20.6%

COMPOSITE DEVELOPED BASIN -WEIGHTED "C" CALCULATIONS
-REFERENCE UDFCD V.1 RUNOFF 2.7

$C_A = K_A + (1.31i^3 - 1.44i^2 + 1.135i - 0.12)$ for C_A > or + 0, otherwise $C_A = 0$ (RO-6)
$C_B = (C_A + C_{CD})/2$
$C_{CD} = K_{CD} + (0.858i^3 - 0.786i^2 + 0.774i + 0.04)$ (RO-7)
i = % imperviousness/100 expressed as a decimal
K_A = Correction factor for Type A soils
K_{CD} = Correction factor for Type C and Type D soils

Correction Factors, K_A & K_{CD}

Soil Type	Storm Return Period		
	5-year	25-Year	100-Year
A	-0.08i + 0.09	-0.19i + 0.24	-0.25i + 0.32
C or D	-0.10i + 0.11	-0.28i + 0.33	-0.39i + 0.46

Basin ID	% Imperv.	*i*	Soil Type	Correction Factors, K_A & K_{CD}			Runoff Coefficients, C			Basin Area	Total Area	Weighted Runoff Coefficients, C		
				5-Year	25-Year	100-Year	5-Year	25-Year	100-Year			5-Year	25-Year	100-Year
PA5	32.31%	0.32	A	0.06	0.18	0.24	0.20	0.32	0.38		40.6	0.29	0.45	0.53
			B	-	-	-	0.26	0.40	0.48	16.20				
			C or D	0.08	0.24	0.33	0.31	0.48	0.57	24.40				
POND 4	13.24%	0.13	A	0.08	0.21	0.29	0.09	0.22	0.29		8.8	0.23	0.42	0.54
			B	-	-	-	0.16	0.32	0.42					
			C or D	0.10	0.29	0.41	0.23	0.42	0.54	8.80				
PA 6	36.16%	0.36	A	0.06	0.17	0.23	0.23	0.34	0.39		39.4	0.33	0.49	0.58
			B	-	-	-	0.28	0.41	0.49					
			C or D	0.07	0.23	0.32	0.33	0.49	0.58	39.40				
OS	20.57%	0.21	A	0.07	0.20	0.27	0.14	0.26	0.33		4.4	0.26	0.45	0.55
			B	-	-	-	0.20	0.36	0.44					
			C or D	0.09	0.27	0.38	0.26	0.45	0.55	4.40				

EXCESS URBAN RUNOFF CONTROL (FULL-SPECTRUM) DETENTION SIZING

Project: Erie Highlands PA5
Basin ID: Pond 3

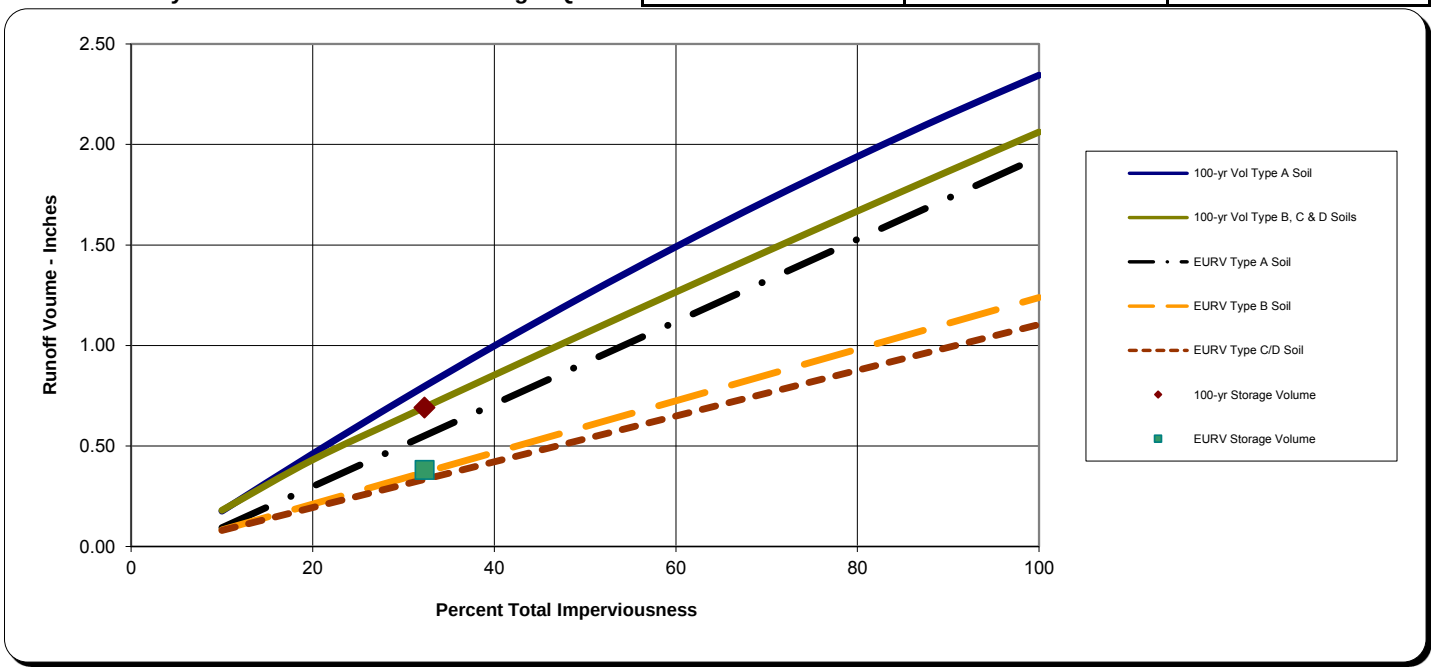
* User input data shown in blue.

Area of Watershed (acres)	40.60	
Subwatershed Imperviousness	32.3%	
Level of Minimizing Directly Connected Impervious Area (MDCIA)	0	0
Effective Imperviousness[1]	32.3%	

Hydrologic Soil Type	Percentage of Area	Area (acres)
Type A	0.0%	0.0
Type B	40.0%	16.2
Type C or D	60.0%	24.4

Recommended Horton's Equation Parameters for CUHP		
Infiltration (inches per hour)		Decay Coefficient--α
Initial--f_i	Final--fo	
3.6	0.5	0.0018

	Detention Volumes [2,5]		Maximum Allowable Release Rate, cfs[3]
	(watershed inches)	(acre-feet)	
Excess Urban Runoff Volume[4]	0.38	1.2942	Design Oulet to Empty EURV in 72 Hours
100-year Detention Volume Including WQCV [5]	0.69	2.34	38.16



Notes:

1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).

2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.

3) Maximum allowable release rates for 100-year event are based on Table SO-1. Outlet for the Excess Urban Runoff Volume (EURV) to be designed to empty out the EURV in 72 hours. Outlet design is similar to one for the WQCV outlet of an extended detention basin (i.e., perforated plate with a micro-pool) and extends to top of EURV water surface elevation.

4) EURV approximates the difference between developed and pre-developed runoff volume.

5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV

EXCESS URBAN RUNOFF CONTROL (FULL-SPECTRUM) DETENTION SIZING

Project: Erie Highlands PA6
Basin ID: Pond 4

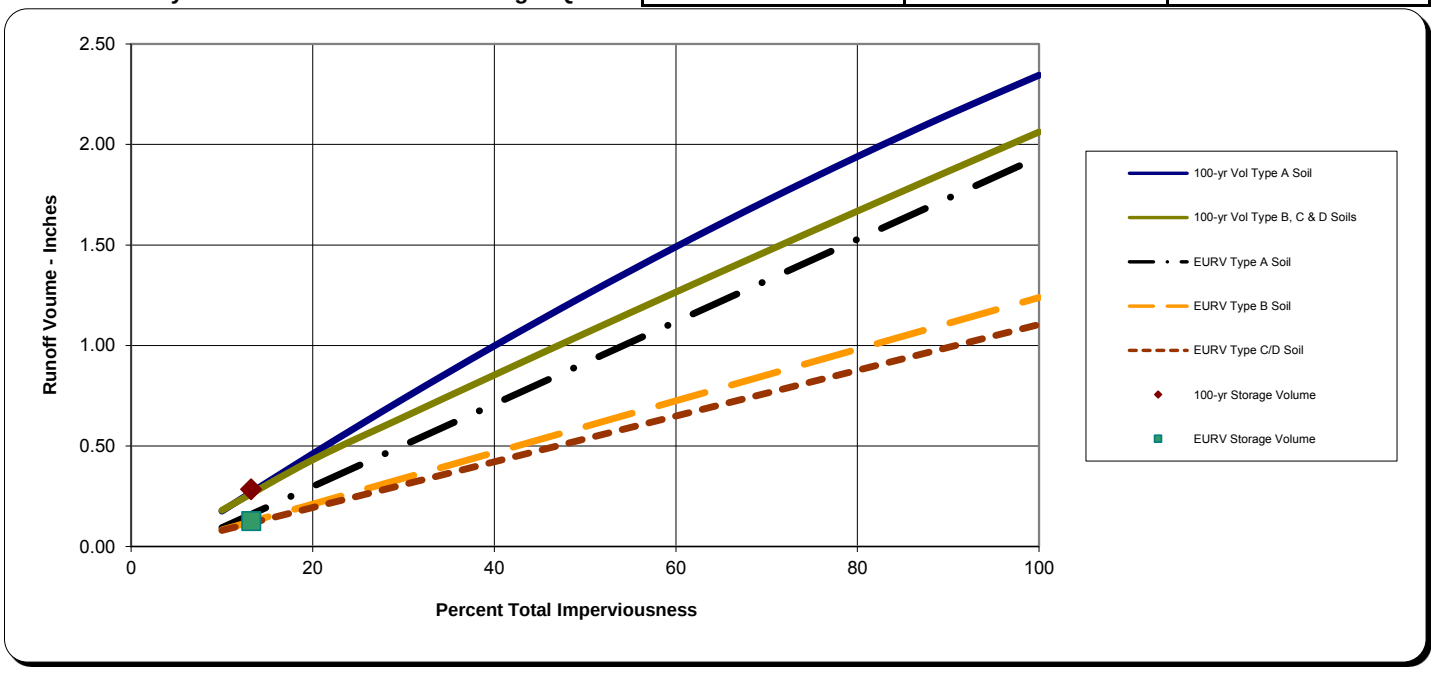
* User input data shown in blue.

Area of Watershed (acres)	8.80	
Subwatershed Imperviousness	13.2%	
Level of Minimizing Directly Connected Impervious Area (MDCIA)	0	0
Effective Imperviousness[1]	13.2%	

Hydrologic Soil Type	Percentage of Area	Area (acres)
Type A	0.0%	0.0
Type B	0.0%	0.0
Type C or D	100.0%	8.8

Recommended Horton's Equation Parameters for CUHP		
Infiltration (inches per hour)		Decay Coefficient--α
Initial--f_i	Final--fo	
3	0.5	0.0018

	Detention Volumes [2,5]		
	(watershed inches)	(acre-feet)	Maximum Allowable Release Rate, cfs[3]
Excess Urban Runoff Volume[4]	0.13	0.0938	Design Oulet to Empty EURV in 72 Hours
100-year Detention Volume Including WQCV [5]	0.29	0.21	8.80



Notes:

1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).

2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.

3) Maximum allowable release rates for 100-year event are based on Table SO-1. Outlet for the Excess Urban Runoff Volume (EURV) to be designed to empty out the EURV in 72 hours. Outlet design is similar to one for the WQCV outlet of an extended detention basin (i.e., perforated plate with a micro-pool) and extends to top of EURV water surface elevation.

4) EURV approximates the difference between developed and pre-developed runoff volume.

5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV

EXCESS URBAN RUNOFF CONTROL (FULL-SPECTRUM) DETENTION SIZING

Project: Erie Highlands PA6
Basin ID: PA 6

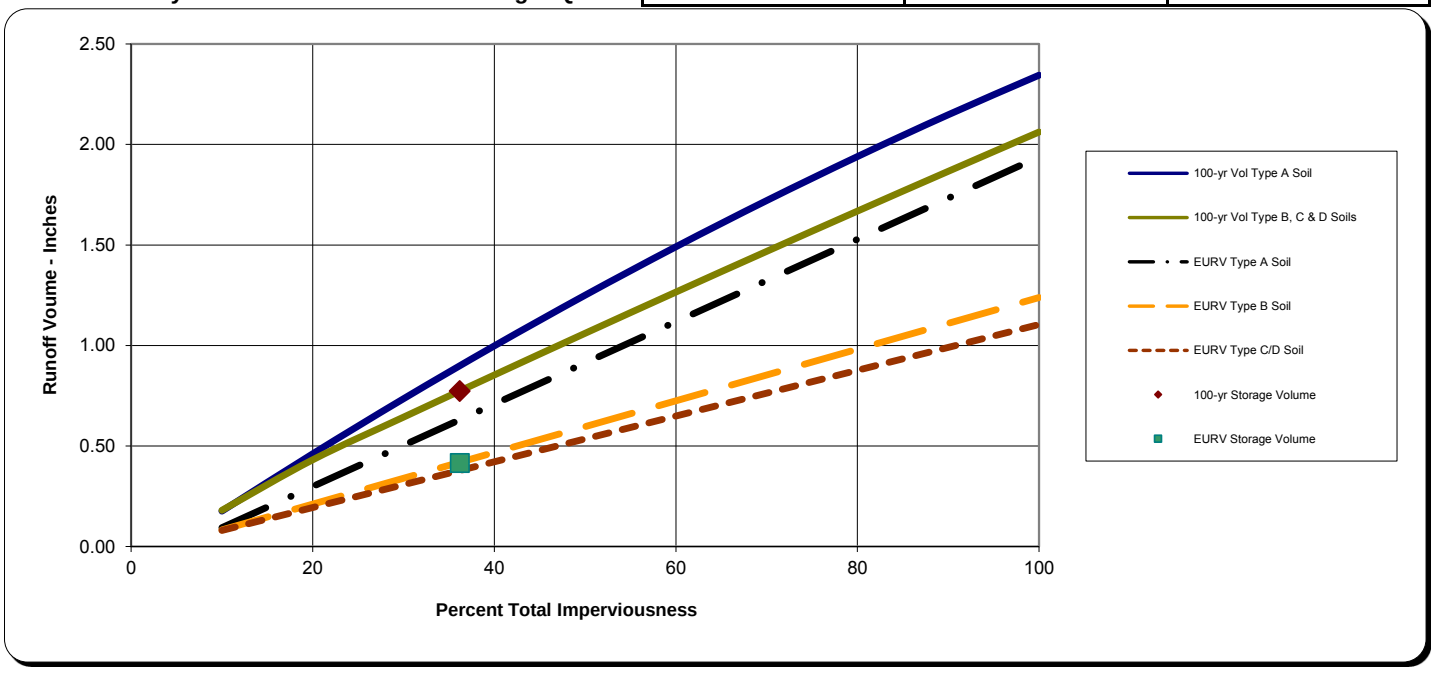
* User input data shown in blue.

Area of Watershed (acres)	39.40	
Subwatershed Imperviousness	36.2%	
Level of Minimizing Directly Connected Impervious Area (MDCIA)	0	0
Effective Imperviousness[1]	36.2%	

Hydrologic Soil Type	Percentage of Area	Area (acres)
Type A	0.0%	0.0
Type B	0.0%	0.0
Type C or D	100.0%	39.4

Recommended Horton's Equation Parameters for CUHP		
Infiltration (inches per hour)		Decay Coefficient--α
Initial--f_i	Final--fo	
3	0.5	0.0018

	Detention Volumes [2,5]		
	(watershed inches)	(acre-feet)	Maximum Allowable Release Rate, cfs[3]
Excess Urban Runoff Volume[4]	0.42	1.3655	Design Oulet to Empty EURV in 72 Hours
100-year Detention Volume Including WQCV [5]	0.77	2.54	39.40



Notes:

1) Effective imperviousness is based on Figure ND-1 of the Urban Storm Drainage Criteria Manual (USDCM).

2) Results shown reflect runoff reduction from Level 1 or 2 MDCIA and are plotted at the watershed's total imperviousness value; the impact of MDCIA is reflected by the results being below the curves.

3) Maximum allowable release rates for 100-year event are based on Table SO-1. Outlet for the Excess Urban Runoff Volume (EURV) to be designed to empty out the EURV in 72 hours. Outlet design is similar to one for the WQCV outlet of an extended detention basin (i.e., perforated plate with a micro-pool) and extends to top of EURV water surface elevation.

4) EURV approximates the difference between developed and pre-developed runoff volume.

5) 100-yr detention volume includes EURV. No need to add more volume for WQCV or EURV

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

APPENDIX B

MAPS

REFERENCE MATERIAL

DRAINAGE MAPS

HISTORIC DRAINAGE PLAN
ERIE HIGHLANDS
ERIE, CO

200 100 0 200 400

SCALE: 1" = 200

Ex. 45"x63" CMP

Ex. 36"x42" CMP

Ex. 18" RCP
Q5 = 12.1 CFS
Q100 = 79.4 CFS
1

Q5 = 12.1 CFS
Q100 = 70.9 CFS
6

H-1
93.4 | 0.01 | 0.20

H-2
13.2 | 0.01 | 0.20

H-3
68.6 | 0.01 | 0.20

H-4
26.5 | 0.15 | 0.50

H-5
29.0 | 0.15 | 0.50

H-6
70.9 | 0.15 | 0.50

Q5 = 1.9 CFS
Q100 = 11.8 CFS
2

Design Points 2 and 3 combine at Donnelly

Ex. 36" RCP
Q5 = 10.6 CFS
Q100 = 64.5 CFS
3

75' TRANS. LINE ESMT

Q5 = 4.5 CFS
Q100 = 26.5 CFS
4

Q5 = 4.9 CFS
Q100 = 29.0 CFS
5

LEGEND

- 5665 — EXISTING CONTOUR
- DRAINAGE DIRECTION
- A / B / C / D — A – BASIN DESIGNATION; B – BASIN AREA; C – 5-YEAR RUNOFF COEFFICIENT; D – 100-YEAR RUNOFF COEFFICIENT
- N — N – DESIGN POINT
- B — HYDROLOGIC SOIL GROUP
- DRAINAGE BASIN

DRAINAGE PLAN – HISTORIC
ERIE HIGHLANDS
JOB NO. 13-000

SHEET 1 OF 1

Engineering Partners, Inc
Right. On Time.
1950 W. Littleton Blvd., Suite 109
Littleton, CO 80120
main 303.703.4444
www.eng-partners.com

LEGEND

- BASIN DESIGNATION
- BASIN AREA — 5 YEAR COEFFICIENTS / 100 YEAR COEFFICIENTS
- BASIN BOUNDARY
- DIRECTIONAL FLOW ARROW
- DESIGN POINT
- 5665 EXISTING CONTOUR

0 75 150 300

1 inch = ft. 75

TO EX POND 1

ERIE HIGHLANDS FILINGS 1-8

FUTURE SCHOOL AND PARK

POND-3

J8

2.3 AC-FT

PA5 40.6 0.29 0.53

UNDISTURBED

POND4 8.8 0.23 0.54

PA6 39.4 0.33 0.58

2.54 AC-FT

OS 4.4 0.26 0.55

POND-4 0.21 AC-FT

2.75 AC-FT

J9

DRAINAGE TO SUNSET

J10

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CALL 2 BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE, OR EXCAVATE FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES

CORE ASSUMES NO RESPONSIBILITY FOR ACTUAL UTILITY LOCATIONS OR COMPLETENESS OF THE UTILITY INFORMATION SHOWN ON THIS DRAWING AND THAT IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO FIELD VERIFY LOCATIONS OF ALL UTILITIES AFFECTED BY HIS WORK PRIOR TO COMMENCEMENT OF ANY CONSTRUCTION ACTIVITIES.

Know what's below. Call before you dig. 811

REVISIONS

#	DESCRIPTION	DATE	BY

PHASE I DRAINAGE PLAN FOR

ERIE HIGHLANDS PLANNING AREAS 5-6

TOWN OF ERIE, COLORADO

INITIAL PLAN
RELEASE: 7/29/2015
DESIGNED BY: DCF
DRAWN BY: DCF
CHECKED BY: DCF

JOB NO. 15-023

SHEET 1 OF 1

SUBSIDENCE INVESTIGATION
ERIE HIGHLANDS
WELD COUNTY, COLORADO

Prepared For:

OAKWOOD HOMES, LLC
4908 Tower Road
Denver, Colorado 80249

Attention: Mr. Jerry Jacobs

Project No. DN40,851-110

August 25, 2005
(Updated July 9, 2013)

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EXECUTIVE SUMMARY

We investigated conditions and developed opinions regarding subsidence risk for the subject property. The Boulder Valley #1 Mine is located below the site. A rock tunnel was constructed to connect the west portion of the mine to the east portion of the mine. The mines are separated by a fault. The mine was operated between 1917 and 1947 and is located under areas planned for residential and commercial development.

Mine conditions were explored by reviewing previously performed investigations and drilling 7 borings. The floor of the coal seam was found at depths ranging from 199 to 325 feet. Three shafts were identified from Colorado Geologic Survey (CGS) maps that lie on or adjacent to the property. The main shaft is located near the southeastern boundary of the site. One air shaft lies off the property near the southeast portion of the site and one air shaft is located on the western portion of the site.

Our analysis indicates the risk of future subsidence propagating to the surface is low for areas where the thickness of bedrock above the mine coal seam is greater than 90 feet. The three shafts located on or adjacent to the property, and a 200 feet radius around each shaft will be classified as significant risk. The remaining mine areas have adequate bedrock thickness and were classified as low risk (Figure 2). We have located the shafts. If development is planned in the shaft areas, we recommend mitigation be conducted or the areas avoided. If mitigation of the shafts is planned, we also recommend the State of Colorado and governing municipality be presented with the mitigation plan for review prior to construction.

Based upon our analysis we believe residential or commercial construction is feasible in areas rated low risk. No restrictions or special building requirements are necessary. We believe the risk of caving or trough subsidence affecting overlying development in these areas is low.

Development in mined areas rated as significant is not recommended without mitigation. Mitigation would involve a drilling and grouting program.

SCOPE

This report presents the results of our Subsidence Investigation for the Erie Highlands in Weld County, Colorado (Figure 1). The purpose of this investigation was to evaluate the condition and extent of mining and analyze the risk of subsidence. A portion of the Boulder Valley #1 Mine, which lies beneath the property, was investigated. The report includes the results of our historical research, field investigation, discussions of the extent of mining, subsidence mechanisms, and engineering analyses of subsidence risk. A discussion of practical mitigation methods is also included. Our investigation was performed in general conformance with our proposal (No. DN 05-0641 dated July 6, 2005).

PREVIOUS INVESTIGATION

We reviewed previous investigations and considered them in our evaluation. These included:

1. "Mine Subsidence Investigation Horst Property Sec. 20 Township 1 North Range 68 West Erie, Colorado," by Western Environment and Ecology, Inc., Project No. 167-003-02, dated April 4, 2000.

2. "Engineering Geology and Mine Subsidence Study, Proposed Residential Development near Erie, Weld County, Colorado," by Michael W. West and Associates, Inc., Project No. 04624, dated January 10, 2005.

3. Draft Report – "Engineering Geology and Mine Subsidence Study Highland Park Subdivision, Near Erie, Weld County, Colorado," by Michael W. West and Associates, Inc., Project No. 04624, dated March 23, 2005.

HISTORICAL RESEARCH

Mining began in the Boulder-Weld coal field in the late 1800s. We researched available Mine maps from the CGS. Existing maps indicate the Boulder Valley #1 Mine is below a portion of the site (Figure 1). Mines in the area were typically accessed by vertical hoist shafts. Air shafts were also typically excavated parallel to the entry and possibly at other locations depending upon the size of the mine. Once the entry and shaft penetrated the mineable coal layer, motor roads or haulways were cut parallel and perpendicular to the strike of the seam. Rooms typically 20 feet wide and 100 to 300 feet long were cut with pillars approximately 15 to 40 feet wide between rooms for support. Typically about 30 to 60 percent extraction was achieved by room and pillar mining.

Upon completion of the room and pillar operation, pillars were partially or fully removed using retreat mining techniques. Typically, 15 to 25-foot wide sections of support pillars were removed leaving “stump” pillars. After retreat mining, the remaining pillars and roof coal were shaved resulting in 75 to 85 percent extraction in a given panel. However, barrier pillars left to protect haulways resulted in overall extractions on the order of 50 to 70 percent.

MINE	OPERATION YEARS	REPORTED PRODUCTION
Boulder Valley #1	1910 - 1947	3,518,912

INVESTIGATION

Our investigation was developed to evaluate the potential for surface subsidence resulting from abandoned underground coal mining. After reviewing available information the investigation plan was developed to:

1. Obtain geologic data on lithology and stratigraphy of the mine overburden;

2. Explore mine conditions: mine locations, depth to mining, seam thickness, mine extraction, voids and rubble zones;

3. Analyze subsidence potential; and

4. Formulate recommendations for development.

Seven exploratory borings were drilled using rotary drilling techniques. Drilling was conducted by N.R. Bideau Drilling of Casper, Wyoming. Boring locations and elevations were surveyed in the field by Carroll and Lange. Borings were logged using gamma, density, and a borehole caliper. Geophysical logging was conducted by Colog of Golden, Colorado. The location of exploratory borings is shown on Figure 1. Boring logs and a summary of conditions found are presented in Appendix A.

SUBSURFACE CONDITIONS

Bedrock of the Laramie Formation is present under the overburden soils and consist of claystone, shale and scattered beds of sandstone and lignite. The Laramie Formation produced economically important beds of coal. Locations of coal deposits are controlled by faulting. Mining within these coal beds has been documented in surrounding areas.

Surficial Soils

The alluvium consists of sandy clays. The depth of alluvium varied from nine to twenty-two feet at our boring locations.

Neither the natural alluvium nor the fill have substantial strength. Experience indicates the alluvium tends to flow into mine voids and will not arch to resist subsidence forces. For analysis purposes, the strengths of the surficial soils are assumed to be nil.

Bedrock

The surficial soils are underlain by bedrock consisting of interbedded claystones and shales. The stratigraphy of the bedrock was erratic across the site. The bedrock above the coal seam consisted of claystone and shale of varying thickness.

Coal Seam

The roof of the mineable coal seam was encountered at depths ranging from 199 to 325 feet below the ground surface. The coal seam thickness ranged from 5 to 8 feet.

MINE CONDITIONS

A general picture of the subsurface was developed by researching available mine records, previous subsidence investigations and previous geologic and geotechnical studies. Additional field explorations by our firm were performed to better define the subsurface conditions and subsidence hazard.

The depth of mining reported on existing mine maps appears to be fairly accurate. We found a 5 to 8 foot thick coal seam, which would have been the likely mineable seam, at depths ranging from 199 to 325 feet. Additional thinner seams (coal riders) were found throughout. The relative thinness and poor quality coal lead us to believe mining of these seams was not done. The results of our borings and geophysical logging showed the over bearing bedrock to be intact.

The thickness of bedrock above the mined seam ranged from 173 to 306 feet. The thickness of bedrock was over 90 feet above undermined areas within this property.

The locations of the mined areas were estimated considering the mine maps, drilling results, and geologic conditions. An accurate extent of mining cannot be determined without a more extensive drilling program than was conducted for this

investigation. Mine maps can be inaccurate due to pillar robbing or surveying discrepancies. We used a combination of methods to estimate the extent of mining with a sufficient degree of confidence to formulate development recommendations. The location/extent of the Boulder Valley #1 Mine is discussed below.

Boulder Valley #1 Mine: The mine maps show some detail including an outline of the mine area, haulways and extraction zones. The maps show the main shaft for this mine in the southeast corner of the investigation area. There are two mapped air shafts for this mine. One air shaft is located off of the property, southeast of the site. The other air shaft was located in the field by using a front end loader. It is located in the western portion of the site. The mine appears to extend across the eastern two-thirds of the property, with a smaller part of the mine in the western portion of the site. The smaller mine is connected to the larger mine by a rock tunnel. The rock tunnel extends through a fault to connect the two mines. The mine had between 173 and 306 feet of bedrock cover.

SUBSIDENCE MECHANISMS

When coal is mined underground, the rock overlying the extraction is stressed and will subside into the extraction. The occurrence of subsidence and the mechanisms by which the overburden rock is distressed and displaced depend upon physical properties of the overburden, coal and floor materials, the size of individual extractions and extraction ratios achieved. Subsidence may be caused as a result of failure of the mine roof, coal pillars or mine floor materials. Subsidence may take the form of sinkholes or a chimney-type cave, a gently sagging or trough-type subsidence, or settlement of backfill materials in entry or air shafts. The following paragraphs discuss potential subsidence mechanisms.

Caving Subsidence

Subsidence can produce sinkholes or depressions at the ground surface by caving of materials overlying comparatively shallow mine working. Caving occurs as

the roof over an opening begins to fracture and collapse into the space where the extraction has occurred. This process continues until the space is either occupied by debris or the caving continues to the surface. Caving is more common over room and pillar operations. The depth to mining is important when determining whether or not the subsidence feature will reach the surface. Also important are the thickness of the extraction and bulking and strength characteristics of the overburden rock.

The size of sinkholes caused by caving is controlled by the geometry of the mine and properties of the overburden. The depth of the sinkholes depends on the depth to mining, thickness of the extraction, and bulking properties of the overburden. The areal extent of surface depressions is largely controlled by the size of the mine opening. Research has found that sinkholes typically are circular or elliptical in shape and usually not larger than the size of the extraction causing them.

Trough Subsidence

Trough-type subsidence is a sagging of the overburden triggered where large extraction ratios and panel sizes are achieved, both in areas of room and pillar mining and longwall mining. This generally occurs as a caving of the immediate roof followed by sagging of overlying strata. Trough-type subsidence is the common mechanism over longwall mines in the United States and Europe. However, troughs which develop over partial extractions differ greatly from those which occur over longwall mining. Oravecz (1977) found the magnitude of subsidence above partial extractions is considerably smaller than subsidence which develops over total extraction mines. The presence of internal barriers and the low width to depth ratios helps reduce the magnitude of displacement.

Trough-type subsidence over room and pillar mining will be localized as compared to the area-wide troughs developed by longwall mining. As with sinkholes, the depth and areal extent of troughs will depend on the depth to mining, physical properties of the overburden, and extraction ratios achieved. The shape of depressions will be irregular due to the presence of remnant pillars. Like longwall

mining, subsidence over retreat mining will develop rapidly due to recompression of rubble or re-orientation of beds which have sagged.

Shaft Collapse

The subsidence hazard associated with entry or air shafts is high because of the sudden and significant nature of movement. Although small in area, shafts can be dangerous because of the haphazard way in which they were backfilled in the past. Typically, shafts were filled with debris left over from the mining operation, including timbers, mine waste, and trash. Over a period of time, the debris plugged in the shaft can loosen and settle, leading to dramatic subsidence at the surface.

EVALUATION OF SUBSIDENCE POTENTIAL

Our investigation furthered the understanding of the subsidence potential in this area by providing detailed information regarding the existing subsurface conditions and mine locations. Our analysis was intended to determine a minimum bedrock thickness above the coal seam beyond which caving subsidence would not be expected to reach the surface. We used three analysis methods which included mine geometry, bulking factor and computer modeling.

Mine Geometry

One method of evaluating whether caving subsidence will propagate to the surface can be addressed through the mine geometry. The critical dimensions effecting subsidence are the thickness of cover or overburden height (H) and the extraction thickness (h). Piggot and Eynon (1977) suggest subsidence will not propagate to the ground surface over room and pillar workings where the overburden to extraction thickness ratio (H/h) exceeds 10. The overburden alluvium is primarily clayey sands and sandy clays and possess very little strength to prevent caving, therefore, only the bedrock thickness is considered. Using a coal seam extraction thickness of 8 feet, caving is not expected to propagate through more than 80 feet of bedrock.

Bulking Factor

Caving of the roof above a mine can continue until the extraction and collapse area is filled with broken and bulked rock or the caving reaches the surface. The height to which caving can occur is based on the coal seam thickness and the bulking of the collapsed rock. The increase in the volume of the collapsed rock is referred to in terms of its "Bulking Factor" (Piggot and Eynon, 1977). The Bulking Factor was calculated in terms of thickness and defined as the original extraction height minus any remaining void divided by the height of the rubble zone above the mine roof. Typical bulking factors for this coal strata range from 30% to 50% (Piggot 1997). Assuming a conical shaped collapse with a conservative Bulking Factor of 40%, as measured from old mine maps, results in a collapse height of 60 feet. Applying a factor of safety of 1.5 results in a bedrock thickness of 90 feet.

H = 3h/B for conical collapse

H = Collapse height above mined coal seam roof.

B = Bulking Factor (0.40)

h = Original extraction thickness (8.0 feet)

Computer Modeling

The Finite Element Method (FEM) program Adina was used. The model was based on typical physical properties representative of the strata to simulate the process of roof failure and void propagation independent of the bulking process. Our analysis supported that underground subsidence would not propagate to the surface in areas of greater than 90 feet of bedrock cover.

SUBSIDENCE POTENTIAL

As discussed previously, analysis methods included mine geometry, bulking factors, computer modeling and evaluation of historical events. Analysis results are summarized below.

Our investigation and analysis indicates there is risk of caving subsidence reaching surface in areas where the bedrock above the coal seam is less than 80 to 90 feet thick. Undermined areas with a bedrock thickness in excess of 90 feet are judged to have a low risk of caving subsidence. This is a conservative choice based upon the methods used. A map showing estimated areas of low and significant subsidence risk is presented on Figure 2.

Mine Geometry	80-foot bedrock thickness
Bulking Factor	90-foot bedrock thickness

Considering the nature of sinkhole subsidence, we believe the potential damage to building, roadways and utilities are likely to be high in significant risk areas (areas with less than 90 feet of bedrock cover). The surface effects of subsidence can result in property damage from vertical settlement, horizontal ground strain, and tilt or rotation. Severe ground movements from sinkhole subsidence can destroy building foundations and disrupt utilities.

Our study of available mine maps and investigation at the site indicate the presence of three shafts on or adjacent to the site that effect subsidence risk on the subject property. Shaft collapse does pose a risk, and the hazard associated with shafts should be considered high. We recommend a 200 foot radius be extended from the location of the shafts, and the area be classified as “significant” subsidence potential. If development is planned near the shafts, we recommend subsidence mitigation be performed. We also recommend that prior to any construction, the State of Colorado and any governing municipality be given the mitigation plans for review.

DEVELOPMENT CONSIDERATIONS AND MITIGATION ALTERNATIVES

The following is a discussion of development and/or mitigation alternatives for the identified risk areas.

Low Risk Areas

The subsidence risk is judged low for most of the site with the exception of shaft areas. We believe residential or commercial construction is feasible in areas rated as low risk. No extraordinary restrictions or special building requirements are necessary. Typical building code requirements for foundation walls to be reinforced to simply span a minimum of 15 feet should apply. If shafts are located and mitigated (grouted) then these areas will revert to a low risk category with no restrictions.

In areas where bedrock is near the minimum thickness care must be taken that the bedrock is not disturbed during construction, such as during basement construction, utility installation or deep sub-excavation. Any excavation into the bedrock surface will decrease the bedrock thickness and could change the subsidence potential from low to significant. If development approaches any high risk zone additional drilling should be performed to verify adequate bedrock thickness.

Placing lots or building envelopes over grouted shaft areas is considered safe from an engineering viewpoint. We anticipate notifying homeowners through the Soils and Foundation Summary report of undermined areas and shafts. You may consider locating building areas and/or lots outside of shaft areas to reduce homeowner concerns as much as practical. Construction over mitigated shafts should be feasible in roadway, detention ponds or commercial areas provided the owner is aware of the condition.

There is a small possibility that unmapped air shafts exist. Considering the information available we believe the risk of this condition occurring and causing a future subsidence event is small. The risk is not eliminated. Grading above the mined areas should be observed to attempt to identify any shafts to reduce the risk as much as possible. If a shaft subsidence event occurs in the future then filling and grouting would be required.

Significant Risk Areas

We do not recommend buildings, roads or major utilities be constructed over significant risk areas. Shaft areas should be avoided (200 foot radius) or mitigated as discussed below. This property does not appear to have any significant risk areas except for those around the shafts.

Shaft Areas

Three shafts are located on or adjacent to the property. These three shafts were the only shafts found on mine maps. Full depth grouting is the recommended mitigation method for these shafts. Concrete plugs or slabs at the ground surface are not recommended since overburden soils could flow into the shaft areas if it subsides. Depending on the size/location of the shafts we anticipate 1 to 4 grout columns, full depth will be required. The grout is intended to fill voids and compact the backfill material. We are available to assist in preliminary pricing and monitoring during grouting, if desired.

LIMITATIONS

Our investigation was planned to obtain a level of information necessary to perform an analysis and evaluation of the subsidence hazard. Our conclusions regarding the risk of future subsidence were based on our investigation and analysis, a review of available mine records, previous studies and our experience. However, there is no guarantee that the government agencies will allow development in these areas. Based on data from other reports and our investigation, they may deny any development of the area, limit development type or require additional investigation and analysis prior to approval. There is no method, to our knowledge, of eliminating all risk of subsidence effects. If additional data becomes available concerning unreported mining or additional subsidence features develop in the area, we should be contacted to evaluate the situation.

We believe this investigation was conducted with that level of skill and care ordinarily used by geotechnical engineers practicing in this area at this time. No warranty, express or implied, is made. We appreciate the opportunity to provide this service. If we can further explain our opinions and conclusions as contained in this report, please contact us.

CTL | THOMPSON, INC.

Matthew A. Best
Engineering Technician

Reviewed by:

Gregg M. Tateyama
Project Engineer

Reviewed by:

Damon B. Thomas, P.E.
Project Manager
7-9-13

MAB:DBT/mab/bg
(7 copies sent)

APPENDIX A
DRILL LOG SUMMARY

Table A-1
EXPLORATORY DRILLING
Highland Park Subdivision
CTL | T Project No. DN40,851

Boring No.	Depth of Bedrock	Depth of Void	Depth of Rubble	Depth of Coal	Depth of Floor	Bedrock Thickness	Total Depth
1	9	255	257	-	273	256	280
2	14	-	-	320	325	306	340
3	12	235	244	-	253	233	260
4	22	-	-	250	258	-	280
5	18	-	-	152	157	-	260
6	18	-	-	201	207	183	240
7	18	184	195	-	199	173	220

APPENDIX B
BOREHOLE AND ELECTRIC LOGS

PROJECT NO. DN40,851-110

PROJECT NAME HIGHLAND PARK SUBDIVISION

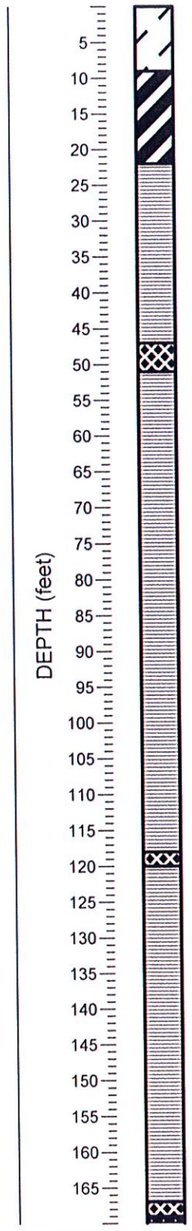
CTL/THOMPSON, INC. (303) 825-0777

1971 WEST 12TH AVENUE DENVER, COLORADO 80204

BORING NUMBER TH-1

ELEVATION	TESTING BY: MB	ENGINEER: MB

TH-1



ELEVATION (feet)

DESCRIPTION

ALLUVIUM (CLAY, SANDY-BROWN, RUST, GRAY).

WEATHERED SHALE - RUST, GRAY, BROWN.

SHALE-GRAY.

COAL - BLACK, SOFT - MODERATE QUALITY

SHALE-GRAY.

COAL - BLACK, SOFT - MODERATE QUALITY

SHALE-GRAY.

COAL - BLACK, SOFT - MODERATE QUALITY

CPT_DN40851-110-G1.GPJ_CPT.GDT_8/16/05

PROJECT NO. DN40,851-110

PROJECT NAME HIGHLAND PARK SUBDIVISION

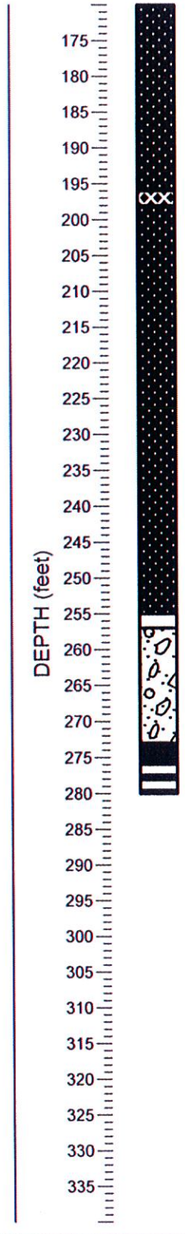
CTL/THOMPSON, INC. (303) 825-0777

1971 WEST 12TH AVENUE DENVER, COLORADO 80204

BORING NUMBER TH-1

ELEVATION	TESTING BY: MB	ENGINEER: MB

TH-1



ELEVATION (feet)

DESCRIPTION

SHALE - GRAY.

COAL - BLACK, SOFT - MODERATE QUALITY.

SHALE - GRAY.

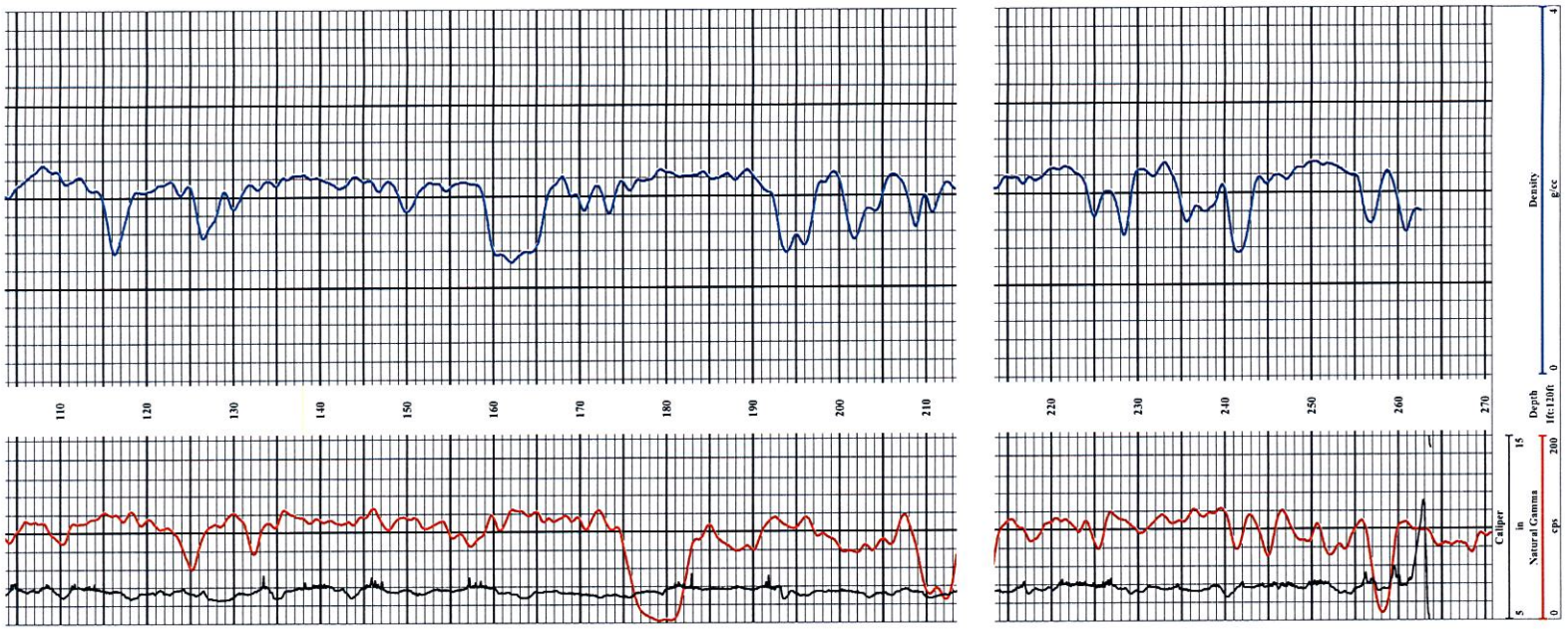
VOID-RETURNS LOST.

RUBBLE.

FLOOR.

CPT_DN40851-110-G1.GPJ_CPT.GDT_8/16/05

FIG. B- 1



COLOG
BOREHOLE GEOPHYSICS & HYDROPHYSICS
A DIVISION OF LAYNE CHRISTENSEN COMPANY

810 Quail Street
Suite E
Lakewood, Colorado
80215
Office: 303.279.0171
FAX: 303.278.0135
www.colog.com

Natural Gamma
Caliper
Density

Company CTL Thompson
Well TH-1
Field Highland Park
County Weld
State Colorado

COMPANY CTL Thompson
WELL TH-1
FIELD Highland Park
COUNTY Weld **STATE** Colorado

LOCATION **OTHER SERVICES**

QTR SEC TWP RGE

PERMANENT DATUM GROUND LEVEL **ELEVATION** NA

LOG MEAS. FROM GROUND LEVEL 0.0 ft **ABOVE PERMINANT DATUM**

DRILLING MEAS. FROM GROUND LEVEL

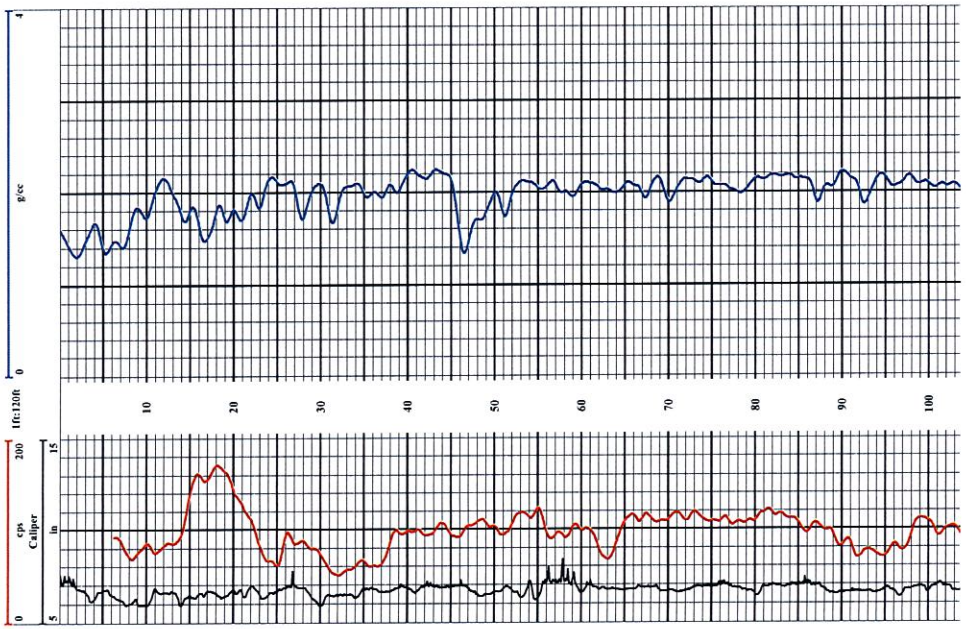
DATE ACQUIRED	25 July, 2005				
RUN NUMBER	1				
LOG TYPE	Natural Gamma				
DEPTH-DRILLER	280'				
DEPTH-LOGGER	271'				
BTM LOG INTERVAL	271'				
TOP LOG INTERVAL	0'				
RECORDED BY	G. Samchuck				
WITNESSED BY	M. Best				
PROBE TYPE, S/N	RABEPF UPM 1483				
LOGGING SPEED	10 ft/min				
A.S.D.E.	1.2				
SAMPLE INTERVAL	0.2'				

BOREHOLE RECORD				**CASING RECORD**			
RUN No.	**BIT**	**FROM**	**TO**	**SIZE**	**WGT.**	**FROM**	**TO**
1	4"	20'	T.D.				
	6"	G.L.	20'				

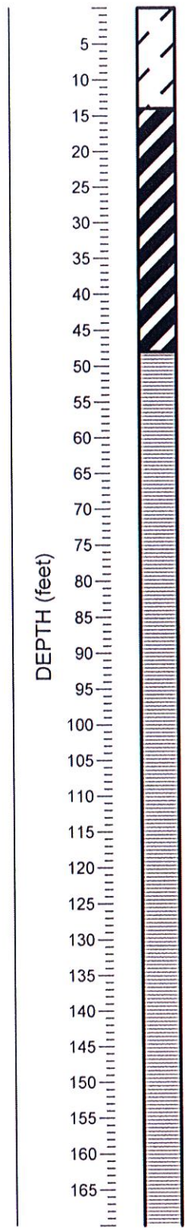
NA - Not Available, N/A - Not Applicable

COMMENTS

Density
Depth
Natural Gamma



PROJECT NO. DN40,851-110 PROJECT NAME HIGHLAND PARK SUBDIVISION	CTL/THOMPSON, INC. (303) 825-0777 1971 WEST 12TH AVENUE DENVER, COLORADO 80204	
BORING NUMBER TH-2		
ELEVATION	TESTING BY: MB	ENGINEER: MB



DESCRIPTION

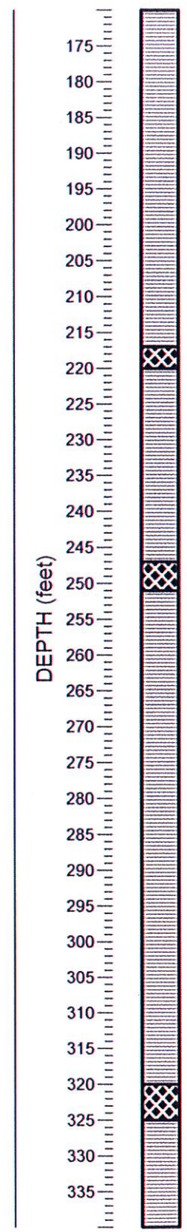
ALLUVIUM (CLAY, SANDY - BROWN, RUST, GRAY).

WEATHERED SHALE - RUST, GRAY, BROWN.

SHALE - GRAY.

CPT_DN40851-110-G1.GPJ_CPT.GDT_8/16/05

PROJECT NO. DN40,851-110 PROJECT NAME HIGHLAND PARK SUBDIVISION	CTL/THOMPSON, INC. (303) 825-0777 1971 WEST 12TH AVENUE DENVER, COLORADO 80204	
BORING NUMBER TH-2		
ELEVATION	TESTING BY: MB	ENGINEER: MB



DESCRIPTION

SHALE - GRAY.

COAL - BLACK, SOFT - MODERATE QUALITY.

SHALE - GRAY.

COAL - BLACK, SOFT - MODERATE QUALITY.

SHALE - GRAY.

COAL - BLACK, SOFT - MODERATE QUALITY.

SHALE - GRAY.

CPT_DN40851-110-G1.GPJ_CPT.GDT_8/16/05

FIG. B- 2

Natural Gamma
Caliper
Density

COLOG
810 Quail Street
Suite E
Lakewood, Colorado
80215
Office: 303.279.0171
FAX: 303.278.0135
www.colog.com

Company CTI Thompson
Well TH-2
Field Highland Park
County Weld
State Colorado

COMPANY CTL Thompson
WELL TH-2
FIELD Highland Park
COUNTY Weld STATE Colorado
LOCATION
QTR SEC TWP RGE
OTHER SERVICES

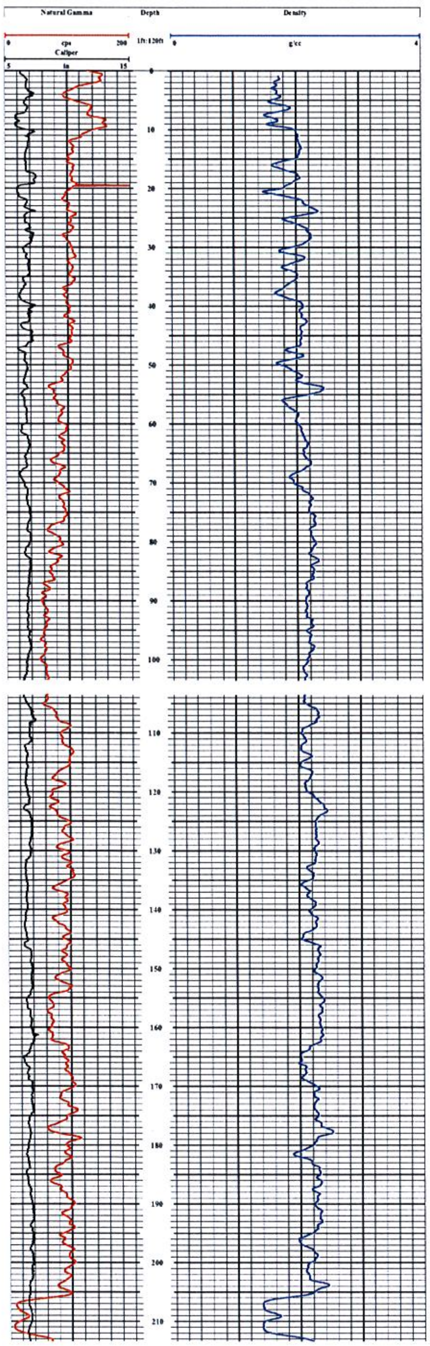
PERMANENT DATUM GROUND LEVEL ELEVATION NA
LOG MEAS. FROM GROUND LEVEL 0.0 ft ABOVE PERMANANT DATUM
DRILLING MEAS. FROM GROUND LEVEL

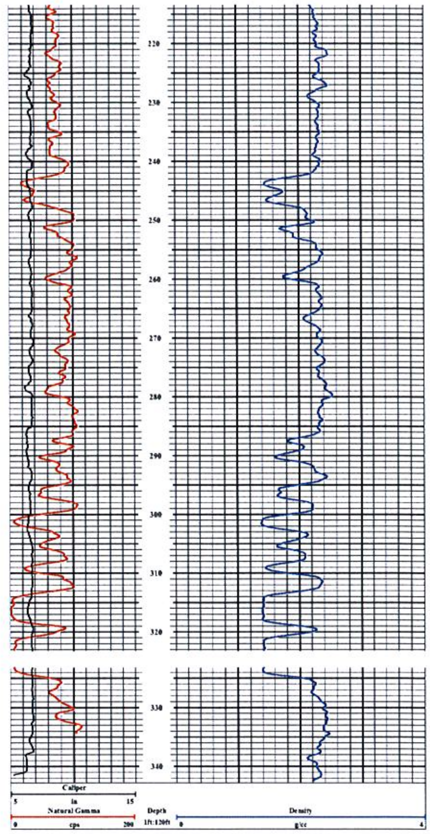
DATE ACQUIRED	25 July, 2005		
RUN NUMBER	1		
LOG TYPE	Natural Gamma	Density	Caliper
DEPTH-DRILLER	360'		
DEPTH-LOGGER	342'		
BTM LOG INTERVAL	343'	342'	343'
TOP LOG INTERVAL	0'	0'	0'
RECORDED BY	G. Samchuck		
WITNESSED BY	M. Best		
PROBE TYPE, SN	RAHUPF 1383		
LOGGING SPEED	10 ft/min		
A.N.D.E.	1.2		
SAMPLE INTERVAL	0.2'		

BOREHOLE RECORD				CASING RECORD			
RUN No.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
1	8"	G.L.	30'				
	6"	30'	T.D.				

COMMENTS

NA - Not Available, N/A - Not Applicable





PROJECT NO. DN40,851-110

PROJECT NAME HIGHLAND PARK SUBDIVISION

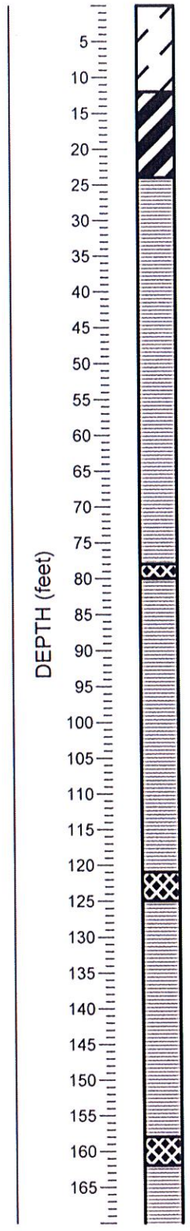
CTL/THOMPSON, INC. (303) 825-0777

1971 WEST 12TH AVENUE DENVER, COLORADO 80204

BORING NUMBER TH-3

ELEVATION	TESTING BY: MB	ENGINEER: MB

TH-3



ELEVATION (feet)

DESCRIPTION

ALLUVIUM (CLAY, SANDY - BROWN, RUST, GRAY).

WEATHERED SHALE - RUST, GRAY, BROWN.

SHALE - GRAY.

COAL - BLACK, SOFT - MODERATE QUALITY.

SHALE - GRAY.

COAL - BLACK, SOFT - MODERATE QUALITY.

SHALE - GRAY.

COAL - BLACK, SOFT - MODERATE QUALITY.

CPT_DN40851-110-G1.GPJ CPT.GDT 8/16/05

PROJECT NO. DN40,851-110

PROJECT NAME HIGHLAND PARK SUBDIVISION

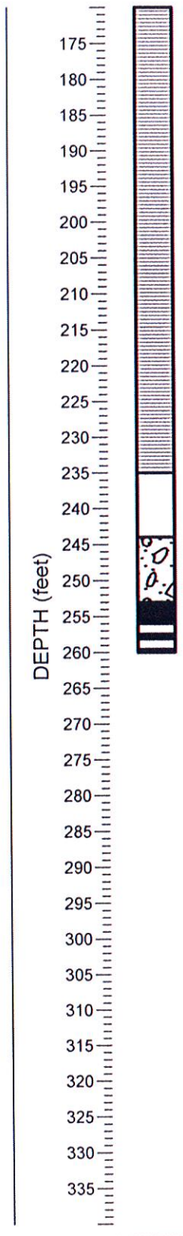
CTL/THOMPSON, INC. (303) 825-0777

1971 WEST 12TH AVENUE DENVER, COLORADO 80204

BORING NUMBER TH-3

ELEVATION	TESTING BY: MB	ENGINEER: MB

TH-3



ELEVATION (feet)

DESCRIPTION

SHALE - GRAY.

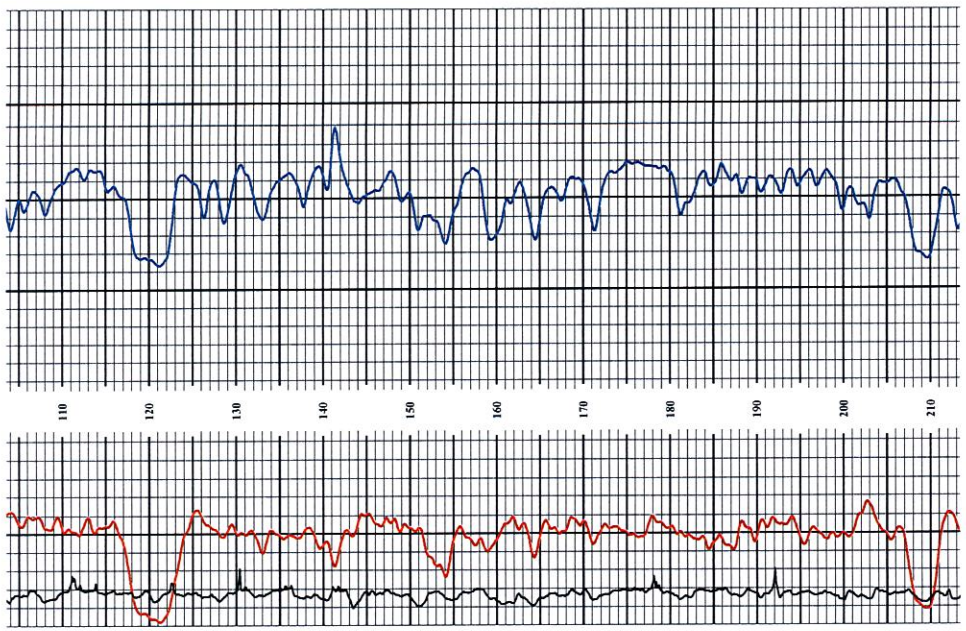
VOID - RETURNS LOST.

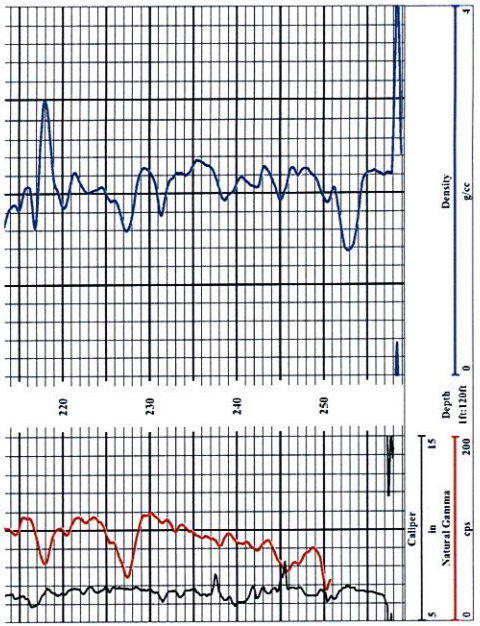
FIRM RUBBLE.

FLOOR.

CPT_DN40851-110-G1.GPJ CPT.GDT 8/16/05

FIG. B- 3





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Natural Gamma
Caliper
Density

Company CTI Thompson
Well TH-3
Field Highland Park
County Weld
State Colorado

COMPANY CTL Thompson
WELL TH-3
FIELD Highland Park
COUNTY Weld **STATE** Colorado

LOCATION **OTHER SERVICES**

QTR SEC TWP RGE

PERMANENT DATUM GROUND LEVEL **ELEVATION** NA
LOG MEAS. FROM GROUND LEVEL 0.0 ft **ABOVE PERMINANT DATUM**
DRILLING MEAS. FROM GROUND LEVEL

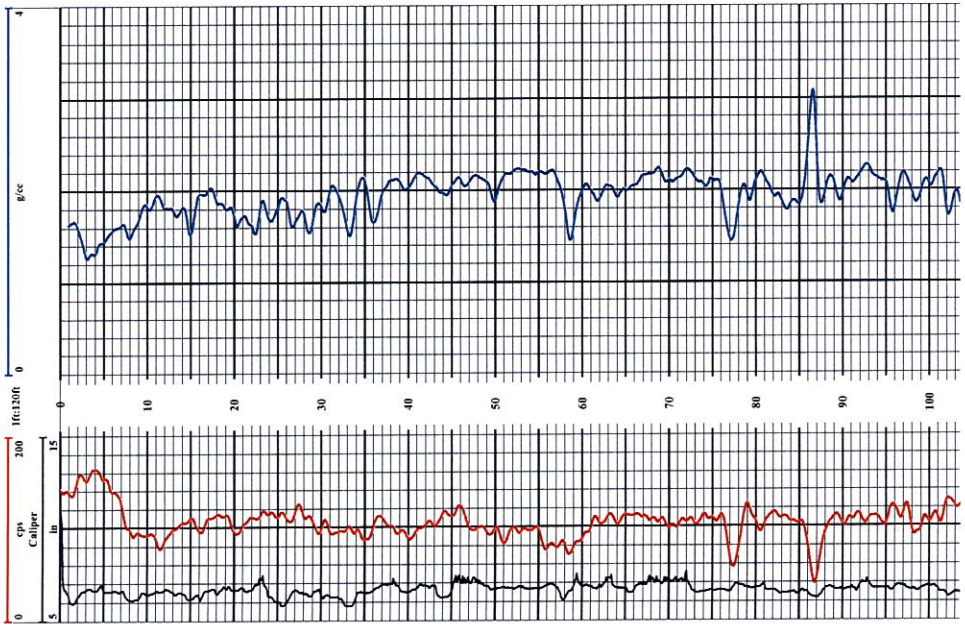
DATE ACQUIRED	25 July, 2005		
RUN NUMBER	1		
LOG TYPE	Natural Gamma	Density	Caliper
DEPTH-DRILLER	280'		
DEPTH-LOGGER	259'		
BTM LOG INTERVAL	250'	259'	258'
TOP LOG INTERVAL	0'	0'	0'
RECORDED BY	G. Samchuck		
WITNESSED BY	M. Best		
PROBE TYPE, S/N	RABEPF 1483		
LOGGING SPEED	10 ft/min		
A.S.D.E.	1.2		
SAMPLE INTERVAL	0.2'		

BOREHOLE RECORD				CASING RECORD			
RUN No.	**BIT**	**FROM**	**TO**	**SIZE**	**WGT.**	**FROM**	**TO**
1	6"	G.L.	20'				
	4"	20'	T.D.				

NA - Not Available, N/A - Not Applicable

COMMENTS

Density
Depth
Natural Gamma



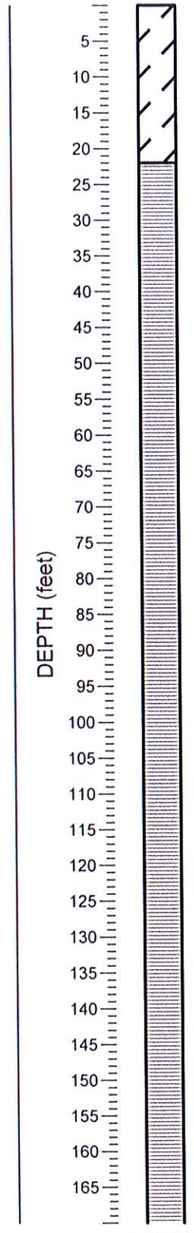
PROJECT NO. DN40,851-110
PROJECT NAME HIGHLAND PARK SUBDIVISION

CTL/THOMPSON, INC. (303) 825-0777
1971 WEST 12TH AVENUE DENVER, COLORADO 80204

BORING NUMBER TH-4

ELEVATION	TESTING BY: MB	ENGINEER: MB

TH-4



ELEVATION (feet)

DESCRIPTION

ALLUVIUM (CLAY, SANDY, BROWN, RUST, GRAY).

SHALE, RUST, GRAY, CEMENTED SANDSTONE LAYERS THROUGHOUT.

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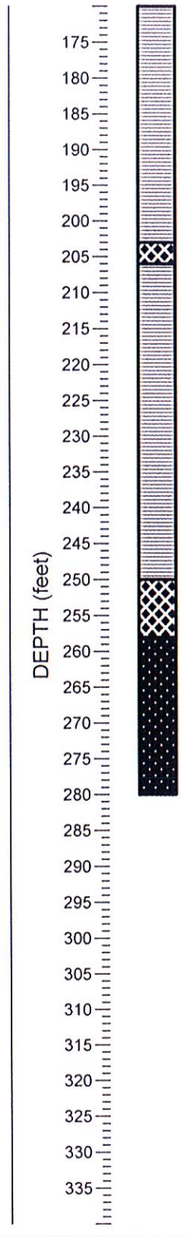
PROJECT NO. DN40,851-110
PROJECT NAME HIGHLAND PARK SUBDIVISION

CTL/THOMPSON, INC. (303) 825-0777
1971 WEST 12TH AVENUE DENVER, COLORADO 80204

BORING NUMBER TH-4

ELEVATION	TESTING BY: MB	ENGINEER: MB

TH-4



ELEVATION (feet)

DESCRIPTION

COAL, BLACK, SOFT, LOW QUALITY.

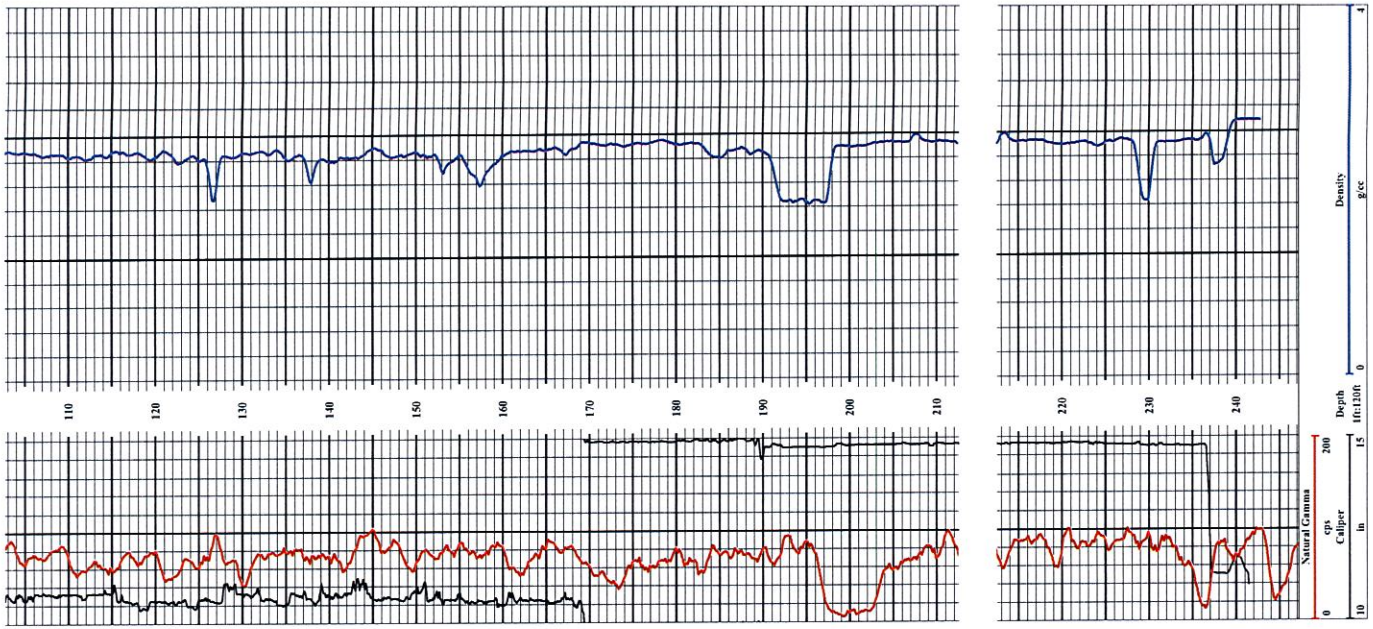
SHALE, GRAY.

COAL, BLACK, SOFT, LOW QUALITY.

SANDSTONE, GRAY, TAN.

CPT_DN40851-110-G1.GPJ CPT.GDT 8/24/05

FIG. B- 4



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Natural Gamma
Caliper
Density

Company CTL Thompson
Well TH-7
Field Highland Park
County Weld
State Colorado

COMPANY CTL Thompson
WELL TH-4
FIELD Highland Park
COUNTY Weld **STATE** Colorado

LOCATION **OTHER SERVICES**

QTR SEC TWP RGE

PERMANENT DATUM GROUND LEVEL **ELEVATION** NA
LOG MEAS. FROM GROUND LEVEL 0.0 ft **ABOVE PERMINANT DATUM**
DRILLING MEAS. FROM GROUND LEVEL

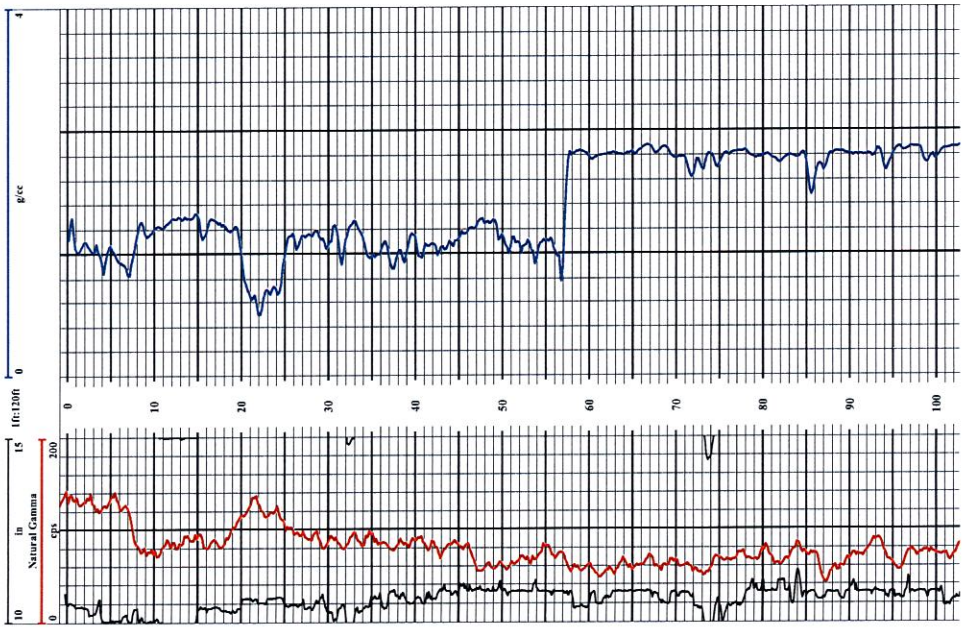
DATE ACQUIRED	29 July, 2005		
RUN NUMBER	1	2	3
LOG TYPE	Natural Gamma	Density	Caliper
DEPTH-DRILLER	280'		
DEPTH-LOGGER	249'		
BTM LOG INTERVAL	248'	243'	242'
TOP LOG INTERVAL	0'	0'	0'
RECORDED BY	M. Culig		
WITNESSED BY	M. Best		
PROBE TYPE, S/N	KLP, MGX II		
LOGGING SPEED	15 ft/min		
A.S.D.E.	1.2		
SAMPLE INTERVAL	0.2'		

BOREHOLE RECORD				CASING RECORD			
RUN No.	**BIT**	**FROM**	**TO**	**SIZE**	**WGT.**	**FROM**	**TO**
1	6"	0'	T.D.				

NA - Not Available, N/A - Not Applicable

COMMENTS

Density
Depth
Caliper



PROJECT NO. DN40,851-110

PROJECT NAME HIGHLAND PARK SUBDIVISION

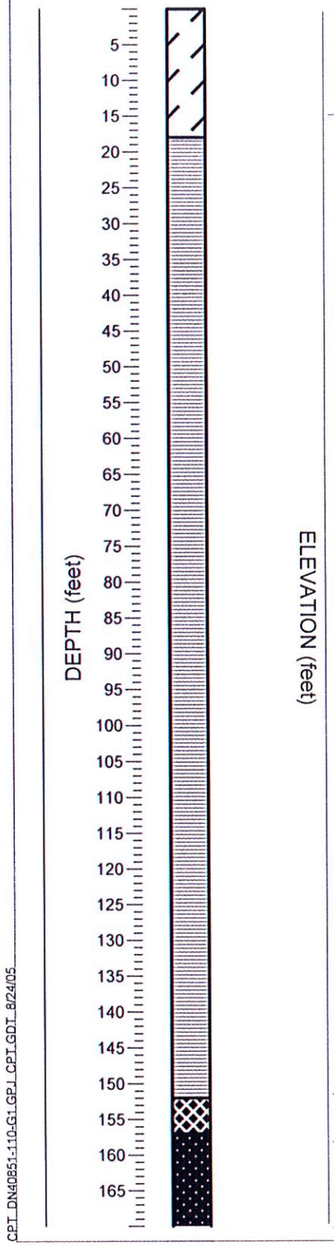
CTL/THOMPSON, INC. (303) 825-0777

1971 WEST 12TH AVENUE DENVER, COLORADO 80204

BORING NUMBER TH-5

ELEVATION	TESTING BY: MB	ENGINEER: MB

TH-5



ELEVATION (feet)

DESCRIPTION

ALLUVIUM (CLAY, SANDY, BROWN, RUST, GRAY).

SHALE, BROWN, GRAY.

COAL, BLACK, SOFT, LOW QUALITY.

SANDSTONE, GRAY, TAN.

CPT_DN40851-110-G1.GPJ_CPT.GDT_8/24/05

PROJECT NO. DN40,851-110

PROJECT NAME HIGHLAND PARK SUBDIVISION

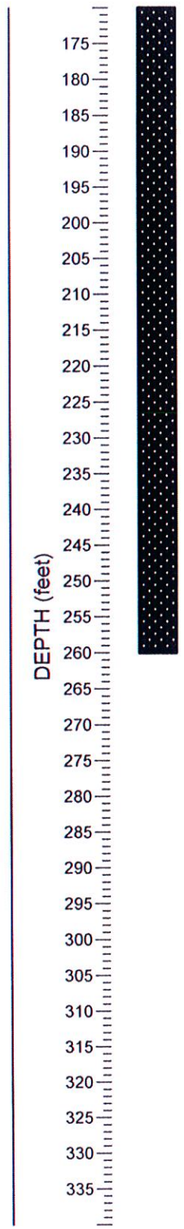
CTL/THOMPSON, INC. (303) 825-0777

1971 WEST 12TH AVENUE DENVER, COLORADO 80204

BORING NUMBER TH-5

ELEVATION	TESTING BY: MB	ENGINEER: MB

TH-5



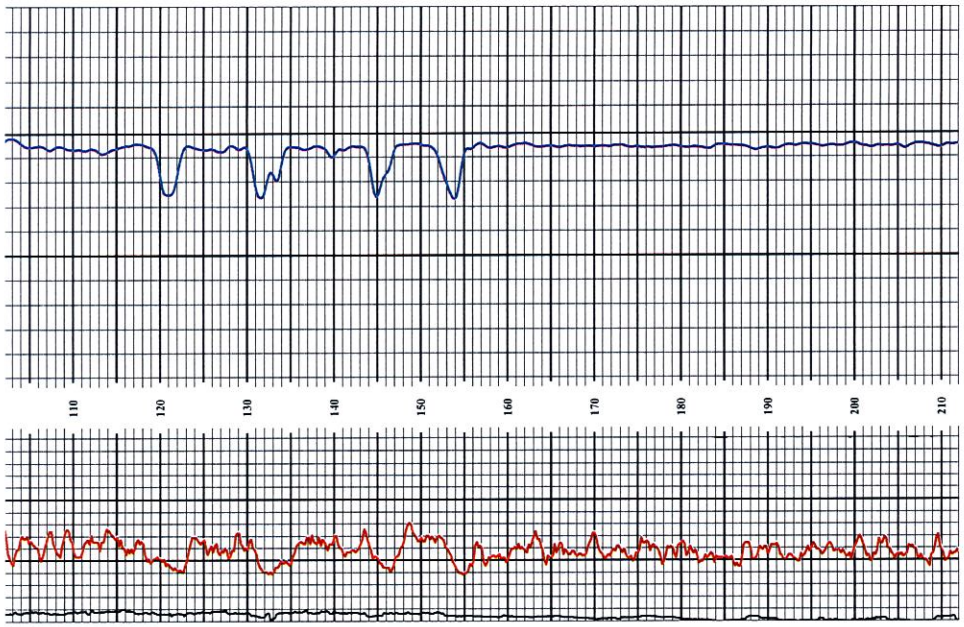
ELEVATION (feet)

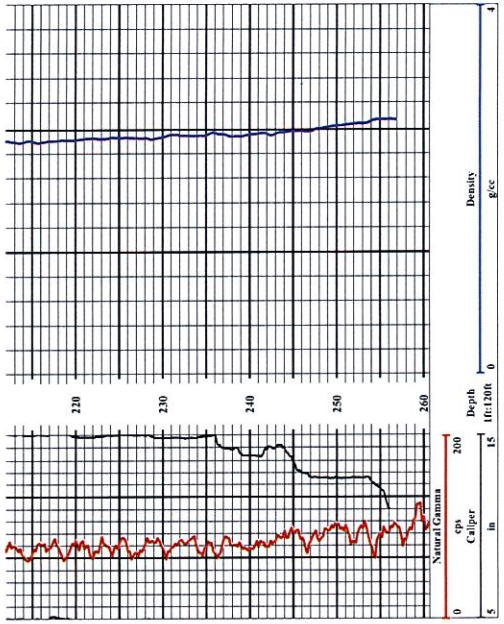
DESCRIPTION

SANDSTONE, GRAY, TAN.

CPT_DN40851-110-G1.GPJ_CPT.GDT_8/24/05

FIG. B- 5





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Caliper
Density

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Field Highland Park
County Weld
State Colorado

COMPANY CTL Thompson
WELL TH-5
FIELD Highland Park
COUNTY Weld **STATE** Colorado

LOCATION QTR SEC TWP RGE

OTHER SERVICES

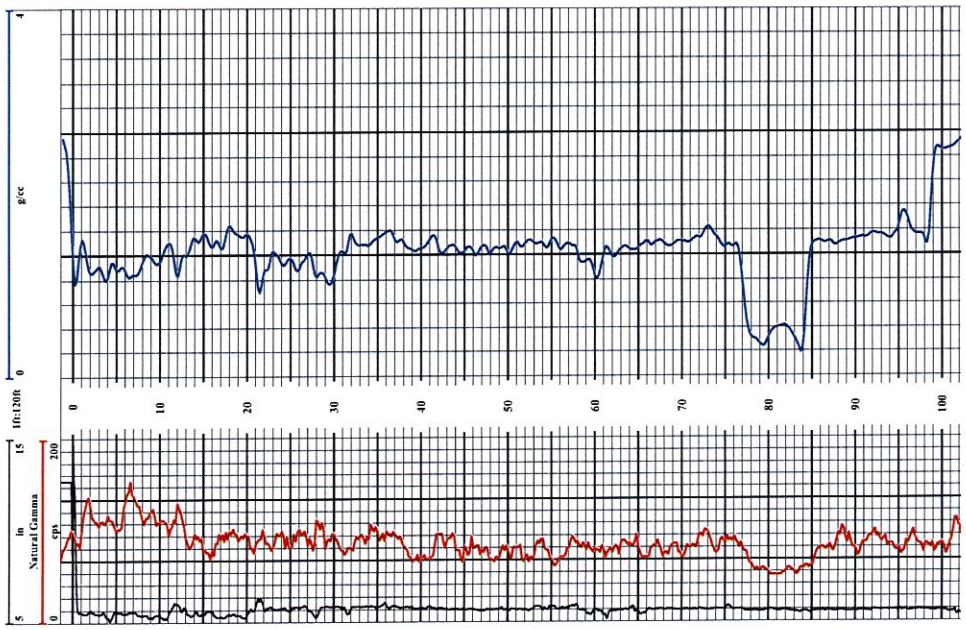
PERMANENT DATUM GROUND LEVEL **ELEVATION** NA
LOG MEAS. FROM GROUND LEVEL 0.0 ft **ABOVE PERMINANT DATUM**
DRILLING MEAS. FROM GROUND LEVEL

DATE ACQUIRED	29 July, 2005		
RUN NUMBER	1	2	3
LOG TYPE	Natural Gamma	Density	Caliper
DEPTH-DRILLER	261'		
DEPTH-LOGGER	261'		
BTM LOG INTERVAL	261'	257'	244.3'
TOP LOG INTERVAL	0'	0'	0'
RECORDED BY	G. Bauer		
WITNESSED BY	M. Best		
PROBE TYPE, S/N	CLP 1976		
LOGGING SPEED	15 ft/min		
A.S.D.E.	1.2		
SAMPLE INTERVAL	0.2'		

BOREHOLE RECORD				CASING RECORD			
RUN No.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
1	6"	0'	T.D.				

COMMENTS
NA - Not Available, N/A - Not Applicable

Density
Depth
Caliper



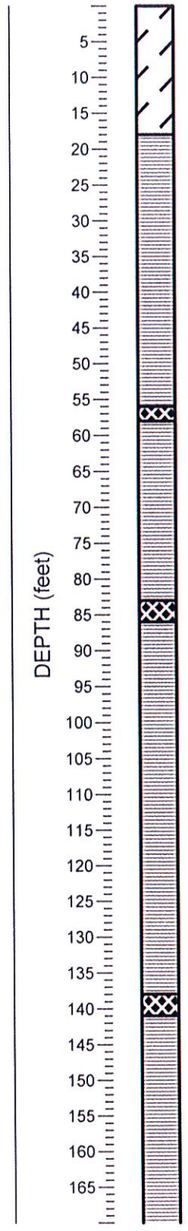
PROJECT NO. DN40,851-110
PROJECT NAME HIGHLAND PARK SUBDIVISION

CTL/THOMPSON, INC. (303) 825-0777
1971 WEST 12TH AVENUE DENVER, COLORADO 80204

BORING NUMBER TH-6

ELEVATION	TESTING BY: MB	ENGINEER: MB

TH-6



ELEVATION (feet)

DESCRIPTION

ALLUVIUM (CLAY, SAND, BROWN, RUST, GRAY).

SHALE, RUST, GRAY.

COAL, BLACK, SOFT, MODERATE QUALITY.

SHALE, RUST, GRAY.

COAL, BLACK, SOFT, MODERATE QUALITY.

SHALE, RUST, GRAY.

COAL, BLACK, SOFT, MODERATE QUALITY.

SHALE, RUST, GRAY.

CPT_DN40851-110-G1.GPJ_CPT.GDT_8/24/05

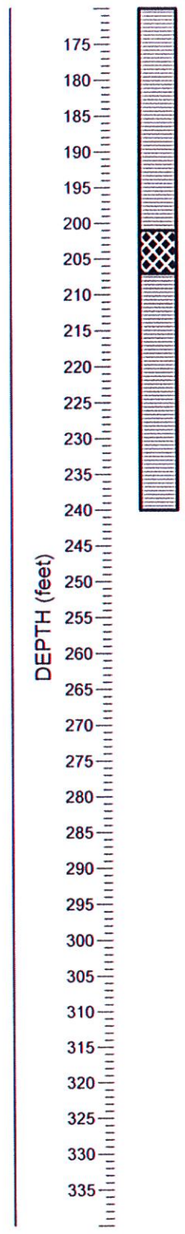
PROJECT NO. DN40,851-110
PROJECT NAME HIGHLAND PARK SUBDIVISION

CTL/THOMPSON, INC. (303) 825-0777
1971 WEST 12TH AVENUE DENVER, COLORADO 80204

BORING NUMBER TH-6

ELEVATION	TESTING BY: MB	ENGINEER: MB

TH-6



ELEVATION (feet)

DESCRIPTION

SHALE, GRAY.

COAL, BLACK, GOOD QUALITY.

SHALE, GRAY.

CPT_DN40851-110-G1.GPJ_CPT.GDT_8/24/05

FIG. B- 6

PROJECT NO. DN40,851-110

PROJECT NAME HIGHLAND PARK SUBDIVISION

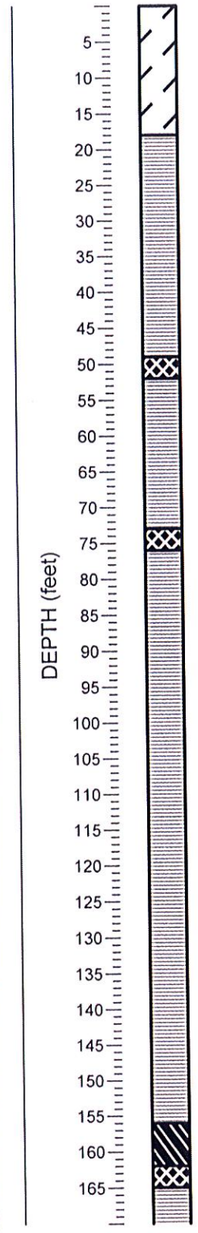
CTL/THOMPSON, INC. (303) 825-0777

1971 WEST 12TH AVENUE DENVER, COLORADO 80204

BORING NUMBER TH-7

ELEVATION	TESTING BY: MB	ENGINEER: MB

TH-7



ELEVATION (feet)

DESCRIPTION

ALLUVIUM (CLAY, SANDY, BROWN, RUST, GRAY).

SHALE, BROWN, GRAY, RUST.

COAL, BLACK, SOFT, LOW QUALITY.

SHALE, GRAY, RUST.

COAL, BLACK, SOFT, LOW QUALITY.

SHALE, BROWN, GRAY, RUST.

INTERBEDDED SHALE/SANDSTONE, GRAY.

COAL, BLACK, SOFT, LOW QUALITY.

SHALE, GRAY.

CPT_DN40851-110-G1.GPJ_CPT.GDT_8/24/05

PROJECT NO. DN40,851-110

PROJECT NAME HIGHLAND PARK SUBDIVISION

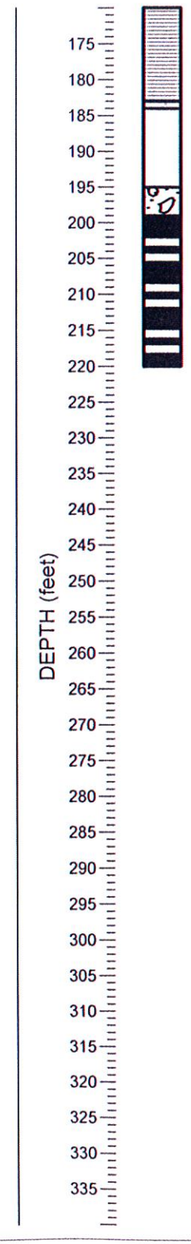
CTL/THOMPSON, INC. (303) 825-0777

1971 WEST 12TH AVENUE DENVER, COLORADO 80204

BORING NUMBER TH-7

ELEVATION	TESTING BY: MB	ENGINEER: MB

TH-7



ELEVATION (feet)

DESCRIPTION

SHALE, GRAY.

CEMENTED SANDSTONE, RUST.

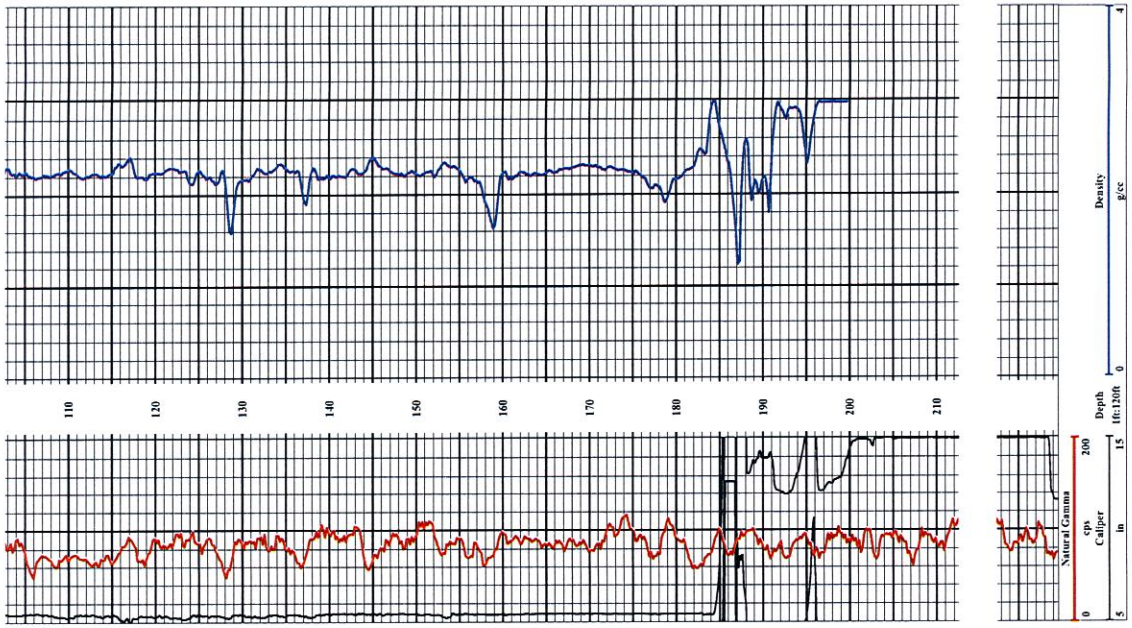
VOID, RETURNS LOST.

FIRM RUBBLE.

FLOOR.

CPT_DN40851-110-G1.GPJ_CPT.GDT_8/24/05

FIG. B- 7



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Density

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WELL TH-7
FIELD Highland Park
COUNTY Weld **STATE** Colorado

Company CTL Thompson
Well TH-7
Field Highland Park
County Weld
State Colorado

LOCATION **OTHER SERVICES**

QTR SEC TWP RGE

PERMANENT DATUM GROUND LEVEL **ELEVATION** NA
LOG MEAS. FROM GROUND LEVEL 0.0 ft **ABOVE PERMINANT DATUM**
DRILLING MEAS. FROM GROUND LEVEL

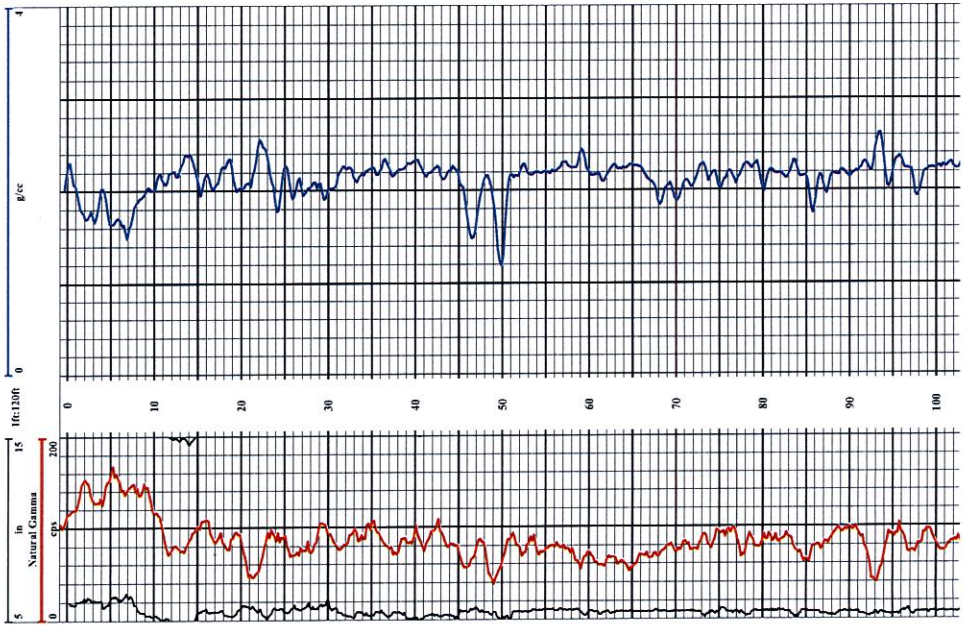
DATE ACQUIRED	29 July, 2005		
RUN NUMBER	1	2	3
LOG TYPE	Natural Gamma	Density	Caliper
DEPTH-DRILLER	220'		
DEPTH-LOGGER	220'		
BTM LOG INTERVAL	219'	200'	219'
TOP LOG INTERVAL	0'	0'	0'
RECORDED BY	G. Bauer		
WITNESSED BY	M. Best		
PROBE TYPE, S/N	RABEPF 2021		
LOGGING SPEED	15 ft/min		
A.S.D.E.	1.2		
SAMPLE INTERVAL	0.2'		

BOREHOLE RECORD				CASING RECORD			
RUN No.	BIT	FROM	TO	SIZE	WGT.	FROM	TO
1	6"	0'	T.D.				

COMMENTS

NA - Not Available, N/A - Not Applicable

Density
Depth
Caliper



APPENDIX C

PHOTOLOG

Coal Waste Stockpile Near Main Shaft

Concrete Structures and Machinery from Coal Mine

PHOTOLOG

ERIE HIGHLANDS

Project No. DN40,851-110

FIG. C-1

Overview of Air Shaft - 1

Mined Land Reclamation Marker - Boulder Valley #1 Air Shaft - 1

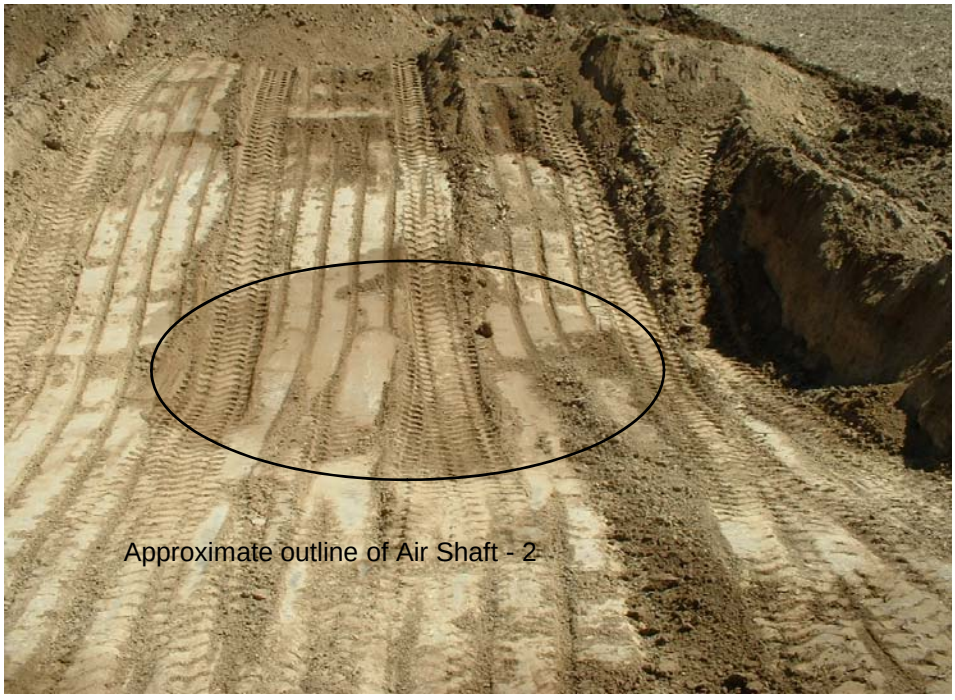
PHOTOLOG

ERIE HIGHLANDS

Project No. DN40,851-110

FIG. C-2

Closeup view of the Air Shaft - 1 Marker



Overview of the location of Air Shaft - 2 at 4 feet below grade

PHOTOLOG

ERIE HIGHLANDS

Project No. DN40,851-110

FIG. C-3

Overivew of Air Shaft - 2 at 13 feet deep

Debris found in backfill material of Air Shaft - 2

PHOTOLOG

ERIE HIGHLANDS

Project No. DN40,851-110

FIG. C-4

LEGEND:

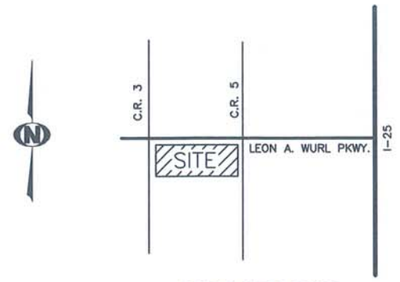
TH–2 ● INDICATES APPROXIMATE LOCATION OF EXPLORATORY BORING WHERE COAL WAS ENCOUNTERED

TH–1 ○ INDICATES APPROXIMATE LOCATION OF EXPLORATORY BORING WHERE MINE WORKINGS WERE ENCOUNTERED

INDICATES UNDERMINED AREA

INDICATES AREA NOT INCLUDED IN THIS INVESTIGATION

SCALE: 1"= 400'



VICINITY MAP
NOT TO SCALE

NW COR. NE 1/4 SEC. 20, TIN, R68W

NE COR. NE 1/4 SEC. 20, TIN, R68W

SW COR. NE 1/4 SEC. 20, TIN, R68W

SE COR. NE 1/4 SEC. 20, TIN, R68W

MAIN SHAFT

AIR SHAFT 1

OAKWOOD HOMES, LLC
ERIE HIGHLANDS
Project No. DN40,851-110

Locations of Exploratory Borings

Fig. 1

T:\40's\DN40851.000\110\2. Reports\R1 REV June 2013\DN40851-110-R1-Rev june 2013-F1.dwg, 7/22/2013 9:44:26 AM, rstanisic
DN40851-110_F1-R1-0 8/22/05 BP/MAB

LEGEND:

TH–2 ● INDICATES APPROXIMATE LOCATION OF EXPLORATORY BORING WHERE COAL WAS ENCOUNTERED

TH–1 ○ INDICATES APPROXIMATE LOCATION OF EXPLORATORY BORING WHERE MINE WORKINGS WERE ENCOUNTERED

LOW RISK

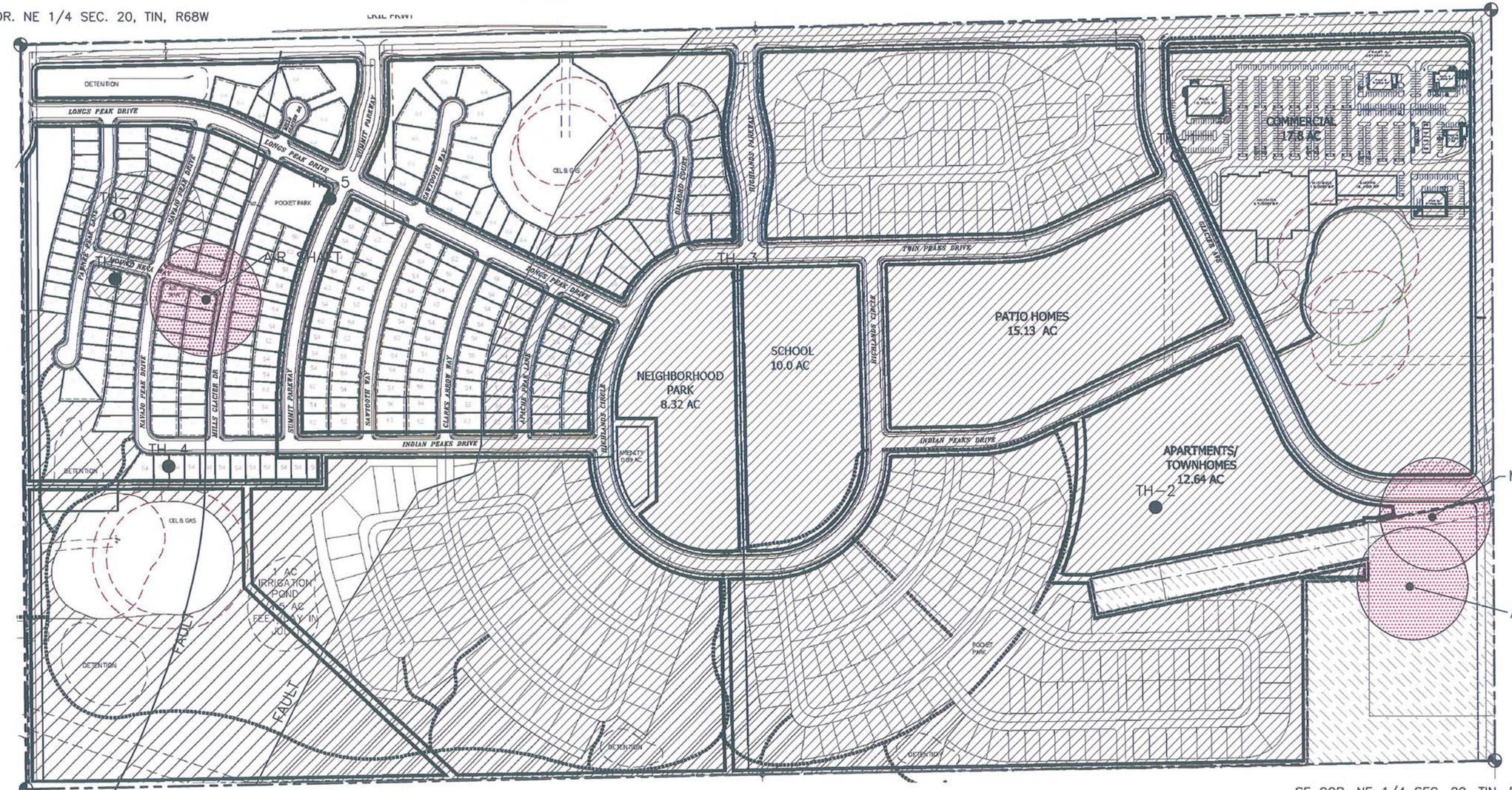
SIGNIFICANT RISK

INDICATES AREA NOT INCLUDED IN THIS INVESTIGATION

SCALE: 1"= 400'

NW COR. NE 1/4 SEC. 20, TIN, R68W

NE COR. NE 1/4 SEC. 20, TIN, R68W



SW COR. NE 1/4 SEC. 20, TIN, R68W

SE COR. NE 1/4 SEC. 20, TIN, R68W

OAKWOOD HOMES, LLC
ERIE HIGHLANDS
Project No. DN40,851-110

Subsidence Potential

Fig. 2

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Dearmin Property
Ecological Site Assessment-
Vegetation, Wildlife, Wetlands, Special Status Species

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Dearmin Property, Ecological Site Assessment- Vegetation, Wildlife, Wetlands, Special Status Species

1.0 Introduction

The Dearmin site is located just southeast of the original Erie townsite, within the Erie city limits. The site includes approximately 300 acres of undeveloped land. County Road 8 runs along the north boundary, County Road 5 along the east, Green Mill Road along the west, and undeveloped land (and a shooting range) borders the south boundary. Attachment A includes a Site Inventory Map showing site location and site photos.

Wildland Consultants, Inc. (WCI) completed an Ecological Assessment of the site to determine if the project area supports important plant communities, wetlands, wildlife habitat, or potential habitat for special status species. Mr. Eric Berg of WCI completed a field review and literature review to complete this assessment. Mr. Berg is a Certified Wildlife Biologist and Certified Professional Wetland Scientist with over 20 years of experience working in Colorado.

2.0 Site Description, Vegetation, Wildlife

WCI completed a field review of the site on January 20th, 2013. A formal wetland delineation was not completed. No surveys for special status species were completed. The field review was designed to identify potential ecological issues that may need to be addressed as the project is developed.

2.1 General Site Description and Plant Communities

The dominant existing land-use on the development site is open space/fallow farm land used for growing winter wheat. There appears to be an abandoned underground coal mine in the southeast site corner. There are 3 oil and gas well pads on the site.

There are 2 small remnant native grassland communities on the site, associated with 2 small steep drainage basins. These small native grassland areas are in poor condition. The dominant plant community on the site is agricultural land. Weedy plants are found along field margins and

roads(kochia, sunflower, cheatgrass, Canada thistle, and cheatgrass). Invasive and noxious weeds present include: Canada thistle and field bindweed.

There are no streams, defined drainages, or riparian habitat on the site. (Attachment A, site photos).

2.2 Wetlands and Waters of the United States

Regulatory Background-

Wetlands and waters of the United States are protected under the Section 404 of the Clean Water Act (CWA). Discharge of fill or dredged materials to wetlands is regulated by the CWA. A permit from the Army Corps of Engineers (ACOE) may be needed for any discharge of any fill materials into wetlands. To be considered jurisdictional by the ACOE a wetland needs to have a nexus or connection to other wetlands and waters. Only jurisdictional wetlands require permits for fill.

Site Conditions-

There are no National Wetland Inventory (NWI) mapped wetlands on the site (NWI 2013). During the field reconnaissance WCI did not locate any other wetland areas or potential wetland areas on the site. The nearest wetlands are along Coal Creek approximately 0.4 miles to the west. The site does support 2 drainage swales with steeper slopes that have not been farmed. There are no wetlands or defined stream channels in these 2 swales.

2.3 Threatened, Endangered and Special Status Species

WCI reviewed habitat conditions on the site to determine if the area provides potential habitat to any federally listed species that are protected under the Endangered Species Act (ESA). Species that are federally listed (formerly listed as Endangered or Threatened) are protected by the ESA. The U.S. Fish and Wildlife Service (USFWS) is the federal agency responsible for administering the ESA. Based on a search of the USFWS database there are several listed species that have the potential to occur in Boulder County (USFWS 2013). WCI reviewed this list prior to completing the field review. Based on habitat and site conditions the following species have the potential to occur in the general region of the proposed development.

Plants-

Two federally listed (Threatened) plant species, the Ute ladies' tresses orchid (*Spiranthes diluvialis*) and the Colorado butterfly plant (*Guara neomexicana*) have potential to occur in the general region.

The Ute ladies'-tresses orchid has been documented in areas with seasonally wet soils and wet meadows nears springs, lakes, or perennial streams and their associated flood plains below 6,500 feet above sea level in the South Platte River Drainage (USFWS 1992a). Known populations of this species occur in Nevada, Utah, and eastern and western Colorado (USFWS 1992b). Several historically documented populations are known to occur along the Front Range and in Boulder County in Colorado.

The Colorado butterfly plant is a perennial plant endemic to moist and mesic areas in southeastern Wyoming, north-central Colorado, and western Nebraska (USFWS 2000). It typically grows on sub-irrigated alluvial soils at elevations between 5000 and 6400 feet. Populations are commonly found in floodplains and drainage bottoms and in depressions along slow-moving streams (Fertig 2000, O'Kane 1988a). Populations are known to occur in Weld and Larimer Counties, Colorado (Floyd 1995, USFWS 2010).

No known populations of either species are located near the development site. The site does not support any wetlands, wet meadows, or streams or other potential habitat areas. Impacts to listed plant species are not expected.

Wildlife-

The only Federally listed wildlife species that has the potential to occur in the region of the development site is the Preble's meadow jumping mouse (*Zapus hudsonius preblei*). Preferred habitat for the Preble's meadow jumping mouse includes thick shrubby riparian habitat along regional streams and rivers (Armstrong et al. 1997). Critical habitat has been established for this species in Boulder County. The development site is not within or near a Critical Habitat area. There are no known populations of Preble's meadow jumping mouse anywhere near the development site.

The development site is dominated by tilled lands. There is no potential habitat (riparian zones, streams, drainages) for the Preble's meadow jumping mouse within or near the site. The nearest potential habitat is along Coal Creek approximately 0.4 miles west of the site.

2.4 Other Wildlife Species

WCI did not locate any raptor stick nests (nests in trees) on the site. There are no large trees present.

There are no known bald eagle nests or bald eagle roost on or near the site (NDIS 2013). There are no known great blue heron or other communal nesting waterbird rookeries located on or near the site. There are a few other migratory birds potentially present on and adjacent to the site (meadow larks are likely common breeders on the site during the spring and summer). The site is not mapped as being critical or crucial wildlife habitat (NDIS 2013).

Even thought the site is tilled the site does support a large and diffuse/low density black-tailed prairie dog colony. The colony density is higher along the western 1/3 but prairie dogs are present scattered through the site. This colony extends onto other adjacent properties. This

colony provides potential nesting habitat to the burrowing owl. The colony also provides foraging habitat to area raptors. Two ferruginous hawks (a relatively rare species in Boulder County) and an immature bald eagle were observed foraging on the site during the January field review.

The development site does not provide a wildlife movement corridor.

3.0 Conclusions and Recommendations

Wetlands-

Development of the site will not impact wetlands. Permits should not be required from the ACOE for site development.

Threatened and Endangered Species-

Preble's Meadow Jumping Mouse-

The project will not impact potential habitat for the Prebles' meadow jumping mouse.

Ute Ladies' Tresses Orchid, Colorado Butterfly Plant-

The project will not impact potential habitat for the Ute ladies' tresses orchid or Colorado butterfly plant.

Wildlife-

The site will not impact any key wildlife habitat areas, migration corridors, or raptor nesting sites.

Black-Tailed Prairie Dog Colony-

Prairie dog colonies provide raptor foraging areas, potential nesting sites for the burrowing owl, and always seem to be of public interest/concern for development projects in the Boulder County area. Prior to development the prairie dog colony would have to be removed or the prairie dogs would have to be trapped and relocated. Live trapping and relocating prairie dogs is difficult. There are currently no agencies, or landowners who are accepting prairie dogs for release in the area. Removal should only be completed by a licensed control company. There could be an option to donate humanely killed prairie dogs to a local raptor rehabilitation center to be used as food. The local public may comment on any project where a prairie dog colony has to be removed.

A nest survey for burrowing owls should be completed prior to any prairie dog control, or site grading (within the prairie dog colony) if that activity is proposed for the period of burrowing owl activity (March 1 to October 31). This survey should be completed according to standard CDOW protocol.

Town of Erie Requirements-

The Town of Erie has specific code/development environmental review requirements however there are no wetlands, or other areas that should require buffers or site avoidance. The Town will likely require that prairie dog control be completed by a licensed and approved contractor.

4.0 Literature Cited

Armstrong, D.M., M.E. Bakeman, N.W. Clippinger, A. Deans, M. Marguiles, C.A. Meaney, C. Miller, M. O'Shea-Stone, T.R. Ryon, and M. Sanders. 1997. Report on Habitat Findings of the Preble's Meadow Jumping Mouse. Presented to the U.S. Fish and Wildlife Service, and Colorado Division of Wildlife.

Colorado Division of Wildlife. 2013. Natural Diversity Information Source. http://ndis.nrel.colostate.edu/ Site accessed January 2013.

Fertig, W. 2000. Status Review of the Colorado butterfly plant (*Gaura neomexicana* ssp. *coloradensis*). Report prepared for the Wyoming Cooperative Fish and Wildlife Unit, U.S. Fish and Wildlife Service, and Wyoming Game and Fish Department by the Wyoming Natural Diversity Database, Laramie, WY.

National Wetland Inventory Mapping. 2013. U.S. Fish and Wildlife Service, NWI GIS Data.

O'Kane, S.L. 1988. Colorado's rare flora. Great Basin Naturalist 48(4):434-484.

Spackman, S., B. Jennings, J. Coles, C. Dawson, M. Minton, A. Kratz, and C. Spurrier. 1997. Colorado Rare Plant Field Guide. Colorado Natural Heritage Program.

USFWS 2013. Mountain and Prairie Website.

USFWS. 1992a. Interim Survey Requirements for Spiranthes diluvialis. 8 pp.

___. 1992b. Final Rule to List the Plant *Spiranthes diluvialis* (Ute ladies'-tresses orchid) as a Threatened Species. CFR 50 Part 17. 7 pp.

Attachment A- Site Photos, Site Inventory Map

Photo 1. View from NW corner to east, tilled land

Photo 2. View to east from west edge of site, prairie dogs and tilled land

Photo 3. View to east from west edge, drainage swale, poor quality grassland, prairie dogs

Photo 4. View to east from SW corner, tilled land, shooting range fence.

Photo 5. View to west from NE project corner.

Photo 6. View to south from NE project corner.

Photo 7. View to the west along southern site boundary.

Photo 8. Old coal mine along eastern site edge.

Photo 10. View to west from site center, fallow land.

Photo 11. Drainage swale along south site boundary, native grassland.

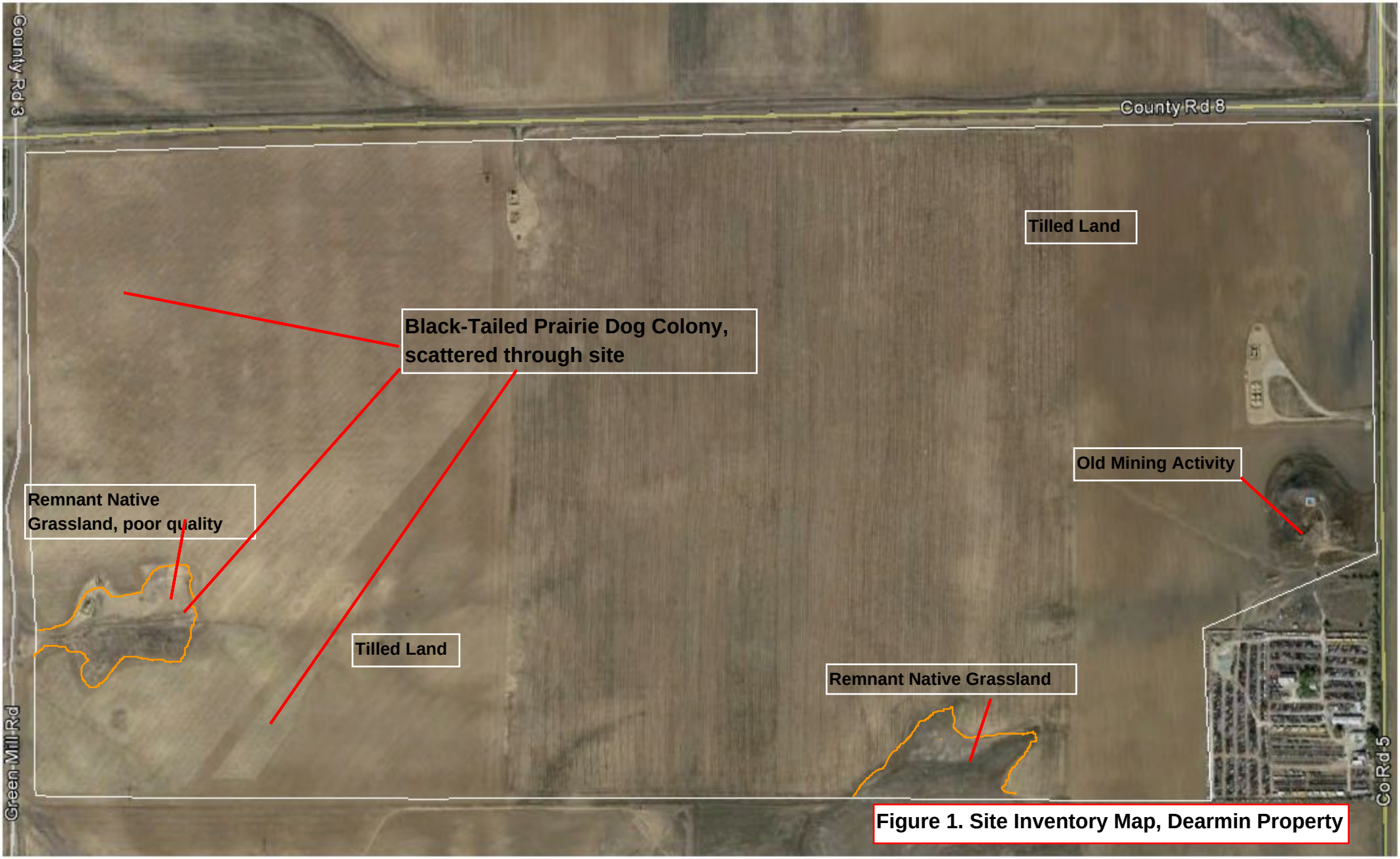

Figure 1. Site Inventory Map, Dearmin Property

ALDRIDGE TRANSPORTATION CONSULTANTS, LLC
Advanced Transportation Planning and Traffic Engineering

TRAFFIC IMPACT STUDY

for

ERIE HIGHLANDS

ERIE, COLORADO

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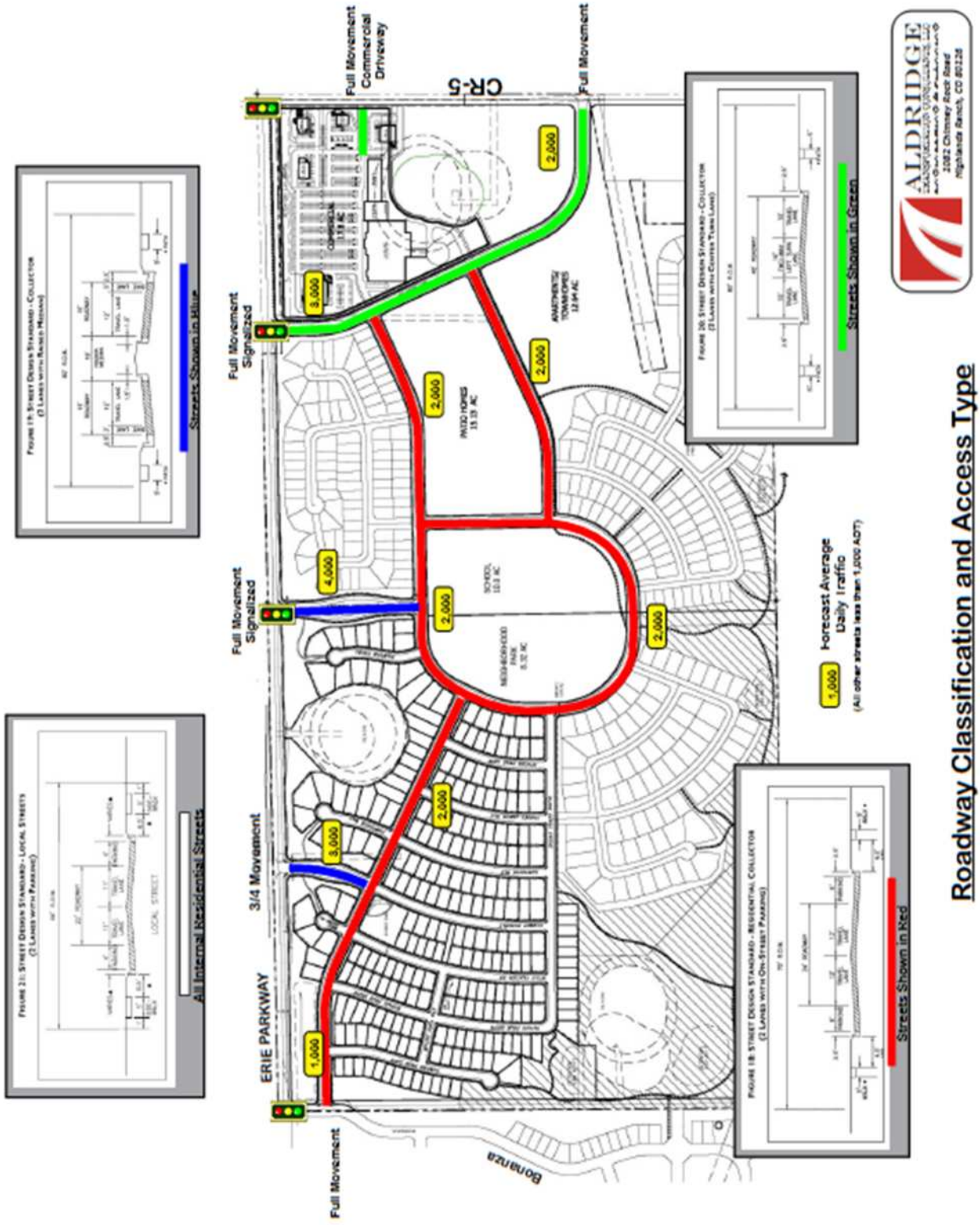
August 22, 2013

1. INTRODUCTION

This report examines the traffic impact associated with the construction of Erie Highlands in Erie, Colorado. The project is located on the south side of Erie Parkway between CR-3/Bonanza and CR-5. An aerial photo below shows the location and general vicinity of the project.

The proposed project is a new mixed-use residential and neighborhood commercial center featuring 791 single-family homes, 203 townhomes, and 100,000 square feet of commercial/shopping center uses. The project proposes three primary accesses from the one-mile stretch of Erie Parkway. The access directly east of CR-3 (Summit Blvd.) will be a 3/4 movement, the center access (Highlands Blvd.) will be a full-movement and signalized when warranted, and the access to the west of CR-5 (Glacier Drive) will be full-movement and signalized when the commercial area is developed. There will be one full-movement access from Bonanza (Longs Peak Drive) and two full-movements (yet named) accesses from CR-5. One will serve the commercial area and the other the southeast section of the property. The following graphic shows the access locations and type, forecast average daily traffic, and cross-sections.


Roadway Classification and Access Type
ALDRIDGE
Full Movement Commercial Driveway
CR-5
Full Movement
Full Movement Signalized
3/4 Movement
Full Movement Signalized
ERIE PARKWAY
Full Movement
Bonanza
2,000
3,000
4,000
1,000
Forecast Average Daily Traffic
Streets Shown in Green
Streets Shown in Red
Streets Shown in Blue
All Internal Residential Streets

Erie Parkway is a two-lane roadway that carries approximately 7,500 ADT in this section of the roadway. It is designated as a Principal Arterial (NR-A per CDOT Access Code) in the Town's 2008 transportation plan. The intersection of CR-3/Bonanza and Erie Parkway is two-way stop sign controlled. At CR-5 and Erie Parkway, the intersection is all-way stop sign controlled.

The traffic operations analysis herein examined a Filing 1 2016 scenario with the proposed initial development, and a 20-year horizon 2035 scenario with full build out of the property. Filing 1 contains 251 single-family homes in Planning Areas 1, 2, 3, and 4. The assumptions made on background traffic volumes are from the 2015 and 2030 growth forecasts in the **Town of Erie Transportation Master Plan (2008)** and the **Traffic Impact Analysis for Bridgewater Phase 1** prepared by LSC in October 2011. In addition data was gleaned, particularly trip distribution and assignment factors, from a traffic impact study prepared by Delich Associates in August 2007. The property was then known as the Emerson Development.

Note that the master plan growth projections assumed development of this property according to the **Town of Erie Comprehensive Plan** and the Town's **Land Use and Zoning Map**. The background volumes in the Bridgewater report, which have been approved by the Town, included projections from this project as well as from Erie Commons, Sunset, Tallgrass North, and Morgan Hill. For consistency, the forecast 2035 traffic volumes in the Bridgewater report were incorporated into this report.

In summary, this analysis demonstrates that the recommended access control and the proposed roadway improvements provide safe and convenient access and will function harmoniously with traffic flow on the adjacent streets and intersections.

2. PROJECT TRIP GENERATION AND DESIGN HOUR VOLUMES

The project's trip generation calculates from rates and values found in the ***ITE Trip Generation Manual, 9th Edition.*** The PUD plan has 994 residences, 100,000 square feet of commercial/shopping center use, and a 750-student elementary school. The chart below shows the trip generation for average weekday (ADT) and AM and PM peak hours for each of the planning areas, school, and the total of them.

Trip Generation Worksheet for Erie Highlands

					Average Weekday			
					AM		PM	
ITE Code	Land Use	Unit	Quantity	ADT	In	Out	In	Out
210	PA 1	DU	7	*9.52*	*0.19*	*0.56*	*0.63*	*0.37*
	SFD			**67**	**1**	**4**	**4**	**3**
210	PA-2	DU	112	*9.52*	*0.19*	*0.56*	*0.63*	*0.37*
	SFD			**1,066**	**21**	**63**	**71**	**41**
210	PA-3	DU	37	*9.52*	*0.19*	*0.56*	*0.63*	*0.37*
	SFD			**352**	**7**	**21**	**23**	**14**
210	PA-4	DU	95	*9.52*	*0.19*	*0.56*	*0.63*	*0.37*
	SFD			**904**	**18**	**53**	**60**	**35**
210	PA-5	DU	95	*9.52*	*0.19*	*0.56*	*0.63*	*0.37*
	SDF			**904**	**18**	**53**	**60**	**35**
210	PA-6	DU	155	*9.52*	*0.19*	*0.56*	*0.63*	*0.37*
	SFD			**1,476**	**29**	**87**	**98**	**57**
210	PA-7			*n/a*	*n/a*	*n/a*	*n/a*	*n/a*
	Amenity							
210	PA-8	DU	120	*9.52*	*0.19*	*0.56*	*0.63*	*0.37*
	SFD			**1,142**	**23**	**68**	**76**	**44**
230	PA-9	DU	170	*9.52*	*0.19*	*0.56*	*0.63*	*0.37*
	SFD			**1,618**	**32**	**95**	**107**	**63**
230	PA-10	DU	203	*5.81*	*0.07*	*0.37*	*0.35*	*0.17*
	TH/APT			**1,179**	**15**	**74**	**71**	**35**
210	PA-11	KSF	100	*equation*	*equation*	*equation*	*equation*	*equation*
	COMM			**6,791**	**96**	**59**	**287**	**311**
520	PA-12	Students	750	*1.29*	*0.25*	*0.20*	*0.07*	*0.08*
	Elementary			**968**	**186**	**152**	**55**	**57**
Total Trips				16,468	446	730	911	696

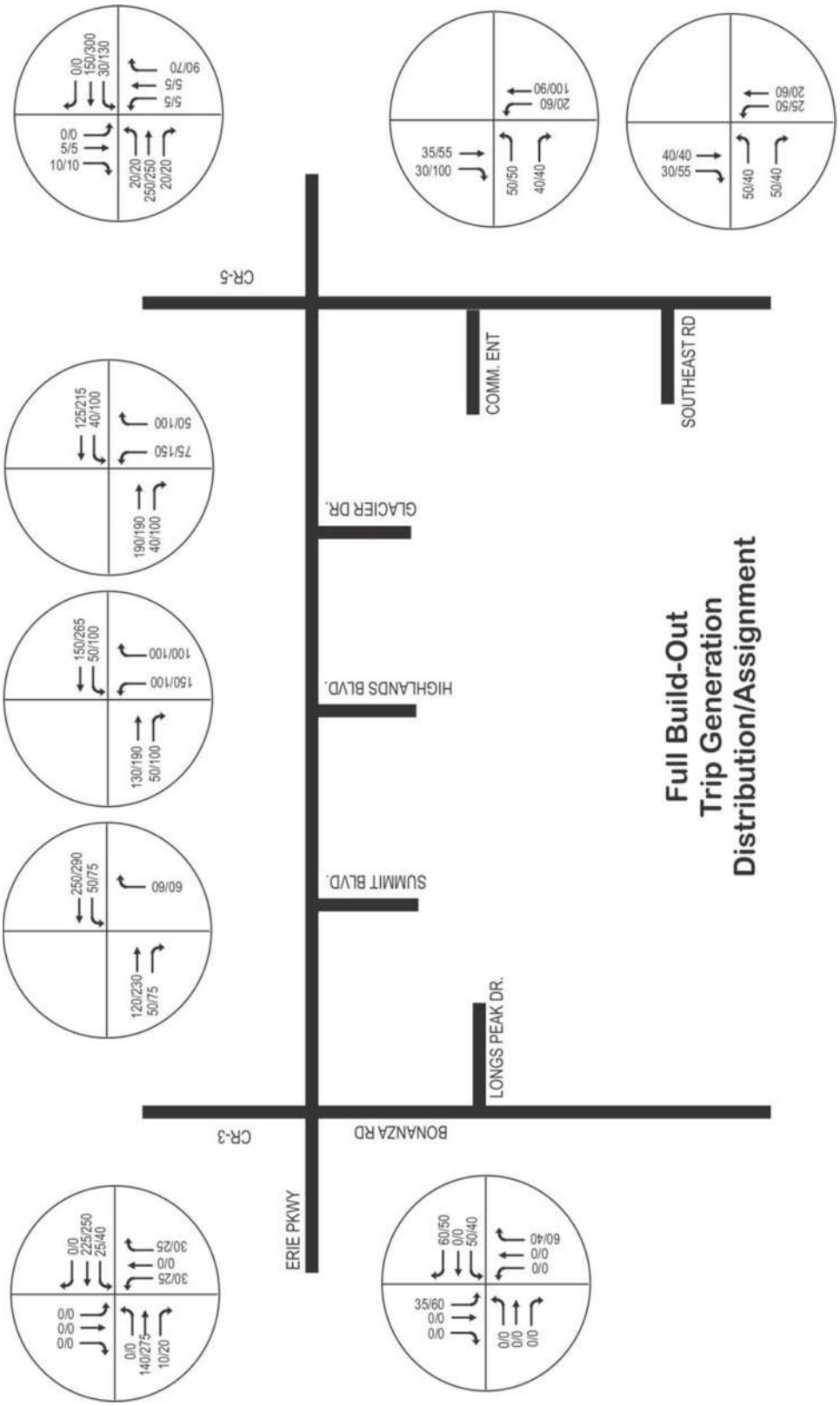
As the PM peak hour trips are considerably higher than the AM peak hour, the PM peak hour is the design hour volume (DHV). An analysis of the AM peak hour impacts was prepared to review and check the proposed intersection design and traffic control. Although there will be internal trips of approximately 10 percent and pass-by trips associated with the commercial area, to be conservative in the analysis these reductions were not taken.

3. TRIP DISTRIBUTION AND ASSIGNMENT

The trip distribution is based on the locations of streets and highways (including the easy access to I-25) and employment and shopping in the surrounding area. The assumption is that 50 percent will originate from the west, and 40 percent from the east. The remaining 10 percent will orient north and south on CR-5, which provides access south to SH-7 via Sheridan Parkway and to the north to SH-52.

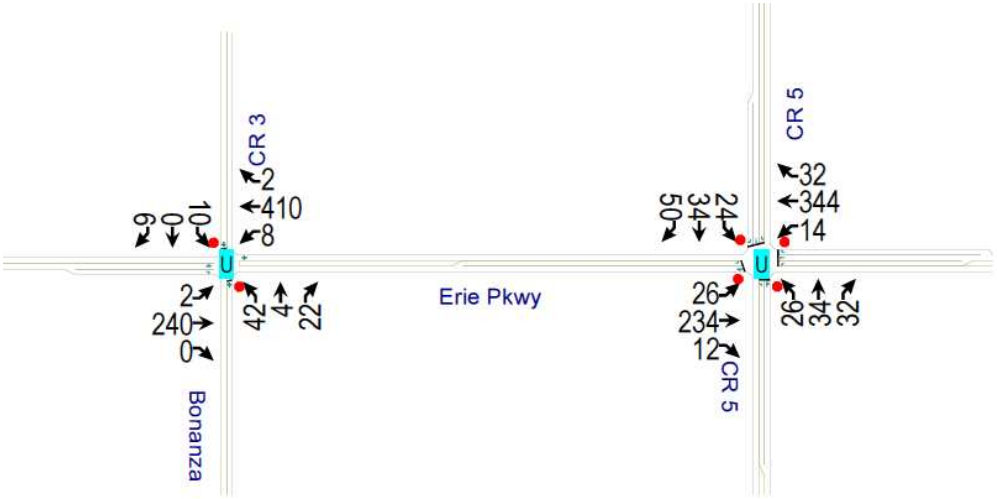
The majority of the school traffic will be internal with the exception of the Grandview area on the west side of Bonanza. It is estimated, based on the number of homes in Grandview (approximately 340), that one-third of the school traffic will come from Grandview and will access the school via Bonanza and Longs Peak Drive. The park and amenity traffic will be primarily internal trips.

The distribution and assignment of site-generated trips for the AM and PM peak hours are shown on graphics provided on the following pages for the Full Build-Out in the AM/PM peak hours. Chapter 6 contains an analysis of the initial 2016 development Filing 1 including a graphic of the trip distribution and assignment.

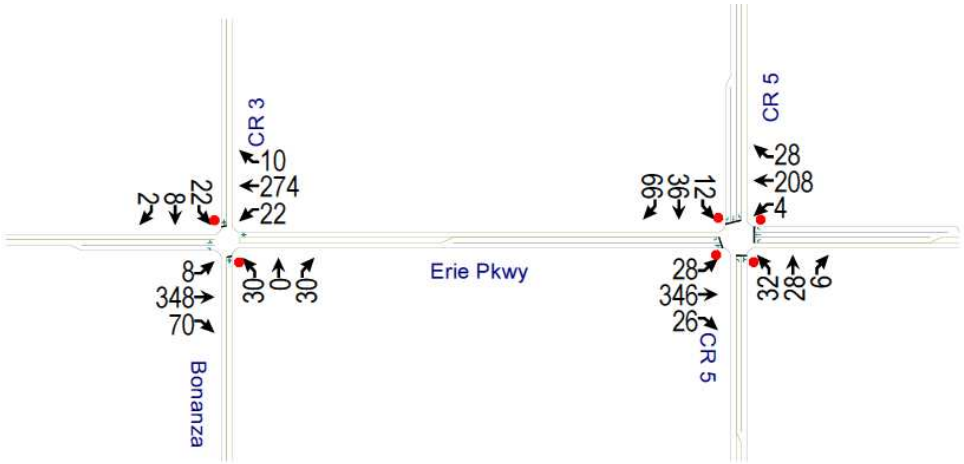

Full Build-Out
Trip Generation
Distribution/Assignment
CR-5
COMM. ENT
SOUTHEAST RD
GLACIER DR.
HIGHLANDS BLVD.
SUMMIT BLVD.
LONGS PEAK DR.
CR-3
BONANZA RD
ERIE PKWY

4. EXISTING AND PROJECTED TRAFFIC VOLUMES

Traffic counts at the intersections of CR-3/Erie Parkway and CR-5/Erie Parkway by ATC on January 17, 2013. The counts for the existing AM and PM peak hours are provided below and on the Synchro graphics in the appendix. Operations models were prepared using Synchro v8. The existing LOS at each intersection is C in both the AM and PM peak hours.



AM Peak Hour



PM Peak Hour

Two scenarios were prepared for the future conditions. The first is the 20-year or the 2035 design horizon. The second scenario is Filings 1 development expected by 2016. This scenario examines the impact of the development of 251 homes in the northwest portion of the property. Chapter 6 contains a separate analysis of Filing 1.

The **Town of Erie Transportation Master Plan (2008)** provides forecasts for 2015, 2030, and 2060 (highly speculative full build-out of the Town and not used in this analysis). The forecast volumes in the master plan provided control points for this analysis. The current volume is approximately 7,500 ADT.

The 2015 forecast daily volume in the master plan is 10,000 ADT on a 2-lane roadway with a LOS D capacity of 14,400 ADT. The 2030 forecast volume is 17,000 ADT on the west end and 23,000 ADT on the east end. In that time, the master plan anticipates a 4-lane with center median roadway that has an LOS D capacity of 36,000 ADT.

The projected daily volume of the Erie Highlands in 2016 is 11,500 ADT inclusive of the Bridgewater Phase 1 development. In 2035, the projected daily volume is 35,000 ADT. These numbers are consistent with the Bridgewater TIA, but are far more than the master plan, which shows 21,000 by 2030[1]. Even though we find reason to disagree with the Bridgewater projections per the footnote, both indicate that a four-lane facility will be necessary in future. In the 2016 short-term scenario the existing two-lane facility is sufficient to handle the additional traffic at LOS C according to the master plan.[2]

[1] Upon review of the Bridgewater TIA it is apparent that the projected traffic from other area developments was double counted. The TIA increases the traffic volume from 2011 with a DRCOG factor of 2.46, which is inclusive of traffic generated by the TAZs, and then layers on traffic generated by the other area developments.
[2] Town of Erie Transportation Master Plan, Table 2: Roadway LOS Thresholds by Functional Classification, Page 15.

5. CAPACITY AND LEVEL OF SERVICE (LOS) ANALYSIS

A series of Synchro v8 traffic operations and SimTraffic simulation models were prepared to analyze the traffic operations of each scenario. The operations analysis is used to determine the veracity of access locations, type of traffic control, and intersection geometry. It also provides several key indicators on arterial traffic flow, level of service, signal coordination, and queuing data.

Synchro v8 is based on procedures and methodologies referenced from the **Highway Capacity Manual 2010 (HCM).** It rates intersection operations using a determination of level of service (LOS). LOS is letter rating from A to F. LOS A indicates free-flow traffic conditions and no delay at intersections. LOS F is heavy traffic congestion with significant delay. LOS is provided for the overall operations at signalized intersections. LOS D is generally the benchmark for acceptable signalized intersection operations during the weekday AM/PM peak hours. The LOS rating for unsignalized intersections is provided by the critical movement - not the overall -, which is generally a left turn out from the minor street. Caution must be used when evaluating the LOS at unsignalized intersections particularly when LOS F is shown. In case of an LOS F, the HCM[3] suggests that other evaluation measures should be considered such as the control delay, volume over capacity ratio, and the 95th percentile queue length to make the most effective traffic control decision. LOS F at unsignalized intersections is often normal for the weekday peak hour. The operations analysis data are presented on Synchro graphics in the appendix along with the Synchro worksheet reports.

The table on the next page provides a Level of Service summary of the unsignalized and signalized intersections. Where an LOS F appears, the control delay in seconds per vehicle and the 95th percentile queue length is shown as well.

[3] Highway Capacity Manual 2010 page 19-40

Unsignalized Intersection Level of Service Summary						
	Existing		2016		2035	
Intersection	AM	PM	AM	PM	AM	PM
Erie Parkway/CR-3	C	C	SIG	SIG	SIG	SIG
Erie Pkwy/Summit Blvd.	N/A	N/A	C	D	C	D
Erie Pkwy/Highlands Blvd.	N/A	N/A	N/A	N/A	SIG	SIG
Erie Pkwy/Glacier Dr.	N/A	N/A	N/A	N/A	SIG	SIG
Erie Parkway/CR-5	C	C	SIG	SIG	SIG	SIG
Bonanza/Longs Peak Dr.	N/A	N/A	A	A	B	A
CR-5/Commerical Ent.	N/A	N/A	N/A	N/A	C	D
CR-5/Southeast Rd.	N/A	N/A	N/A	N/A	D	D

Signalized Intersection Level of Service Summary						
	Existing		2016		2035	
Intersection	AM	PM	AM	PM	AM	PM
Erie Parkway/CR-3	UNSIG	UNSIG	B	C	B	D
Erie Pkwy/Highlands Blvd.	N/A	N/A	A	A	A	A
Erie Pkwy/Glacier Dr.	N/A	N/A	B	A	A	B
Erie Parkway/CR-5	UNSIG	UNSIG	D	E	C	E

The summary chart shows that all the signalized intersections will operate acceptably. The unsignalized intersections also will operate acceptably. An animation of the traffic movement throughout the project and on the adjacent streets and intersections is available via the SimTraffic software.

SIGNAL PROGRESSION

The signal progression efficiency was examined in 2035 AM and PM peak hours considering signals at CR-3, Glacier Drive, and CR-5. Signal progression efficiency is determined by adding the EB and WB bandwidths and dividing the product by 2 times the cycle length. 30 percent efficiency is considered good and 35 percent is considered excellent. The following table provides the signal progression efficiency.

Signal Progession Efficiency Analysis						
Period	EB Band	WB Band	Total	Cycle	Efficiency	Rating
2035 AM	42	24	66	100	33%	Good
2035 PM	30	50	80	120	33%	Good

The analysis shows that the proposed signal array in 2035 will function with good to excellent progression efficiency. The time/space diagrams are appended for reference.

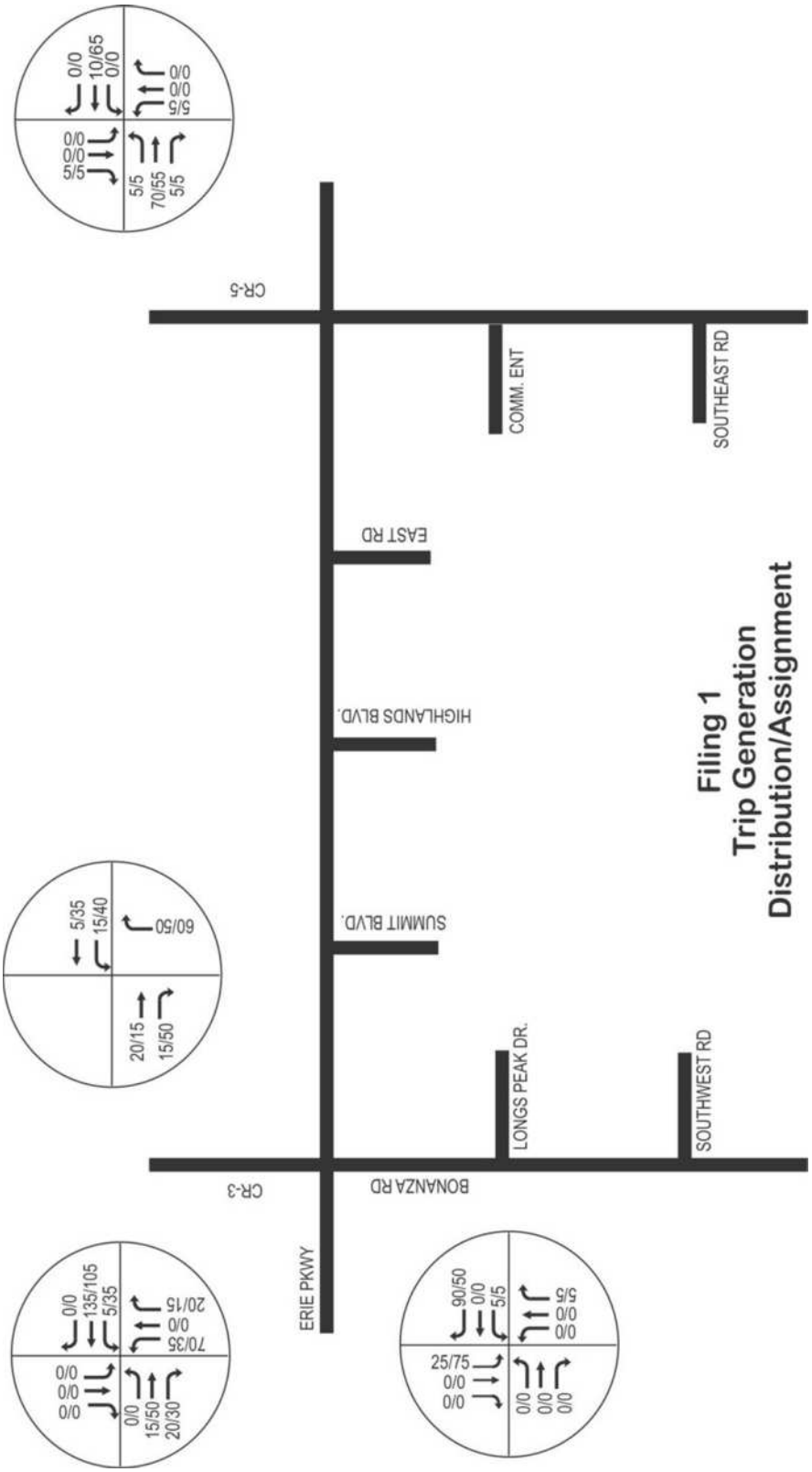
6. ANALYSIS OF FILING 1 DEVELOPMENT

The initial phase of the Erie Highlands development program plans to construct the northwest portion of the property in Planning Areas 1, 2, 3, and 4. The number of homes in these areas is 251. Street connection to Erie Parkway will be at Summit Blvd. initially. In addition, there will be a connection to Bonanza in the northwest corner of the property near Erie Parkway. The chart below shows the daily (ADT), and AM/PM peak-hour trip generation for Filing 1.

Trip Generation Worksheet for Dearmin Property - Filing 1

					AVERAGE WEEKDAY			
					AM		PM	
ITE CODE	LAND USE	UNIT	QUANTITY	ADT	IN	OUT	IN	OUT
210	PA 1	DU	7	*9.52*	*0.19*	*0.56*	*0.63*	*0.37*
	SFD			**67**	**1**	**4**	**4**	**3**
210	PA-2	DU	112	*9.52*	*0.19*	*0.56*	*0.63*	*0.37*
	SDF			**1,066**	**21**	**63**	**71**	**41**
210	PA-3	DU	37	*9.52*	*0.19*	*0.56*	*0.63*	*0.37*
	SDF			**352**	**7**	**21**	**23**	**14**
210	PA-4	DU	95	*9.52*	*0.19*	*0.56*	*0.63*	*0.37*
	SDF			**904**	**18**	**53**	**60**	**35**
	TOTAL TRIPS		251	2,390	47	141	158	93

The following graphic shows the trip distribution and assignment. For Filing 1 the directional split is 55/45 west into Erie and east to I-25, respectively.


Filing 1
Trip Generation
Distribution/Assignment
CR-5
COMM. ENT
SOUTHEAST RD
EAST RD
HIGHLANDS BLVD.
SUMMIT BLVD.
LONGS PEAK DR.
SOUTHWEST RD
CR-3
BONANZA RD
ERIE PKWY
0/0
10/65
0/0
0/0
0/0
5/5
0/0
0/0
0/0
5/5
5/5
70/55
5/5
5/35
15/40
60/50
20/15
15/50
0/0
135/105
5/35
70/35
0/0
20/15
0/0
0/0
0/0
0/0
0/0
15/50
20/30
90/50
0/0
5/5
5/5
0/0
0/0
25/75
0/0
0/0
0/0
0/0
0/0

A traffic operations analysis of Filing 1 indicates that the traffic impact is relatively minor. The LOS at Erie/CR-5 will drop from C to D with the additional traffic. Additionally, it is not necessary at this time to widen Erie Parkway to a fully developed four-lane facility. Improvements to Erie Parkway will be coordinated with the Bridgewater development. The appendix contains the Synchro graphics and worksheets for this scenario.

Unsignalized Intersection Level of Service Summary Filing 1				
	Existing		2016	
Intersection	AM	PM	AM	PM
Erie Parkway/CR-3	C	C	D	E
Erie Parkway/Summit Blvd.	N/A	N/A	C	C
Bonanza/Longs Peak Dr.	N/A	N/A	A	A
Erie Parkway/CR-5	C	C	E	F/.9/12.7*

*signalization of intersection is eminent.

7. ROADWAY DESIGN AND TRAFFIC CONTROL

The **Town of Erie Transportation Master Plan** provides recommended cross-sections for Erie Parkway and internal streets within the Erie Highlands. It also provides a generalized schedule for installation of traffic signal control at intersections throughout the Town. This analysis and recommendations are consistent with the master plan roadway design requirements and schedule for traffic signal installation.

The following cross-sections from the master plan, Figures 15 and 16 are recommended for this section of Erie Parkway. Figure 15 is for a six-lane Principal Arterial with 140 feet of right-of-way. However, this cross-section may not be required until past 2035. Figure 16 is consistent with the existing four-lane median divided roadway that currently terminates and reduces to a two-lane roadway at approximately one-half mile west of CR-3.

FIGURE 15: STREET DESIGN STANDARD - PRINCIPAL ARTERIAL (6 LANES WITH MEDIAN)

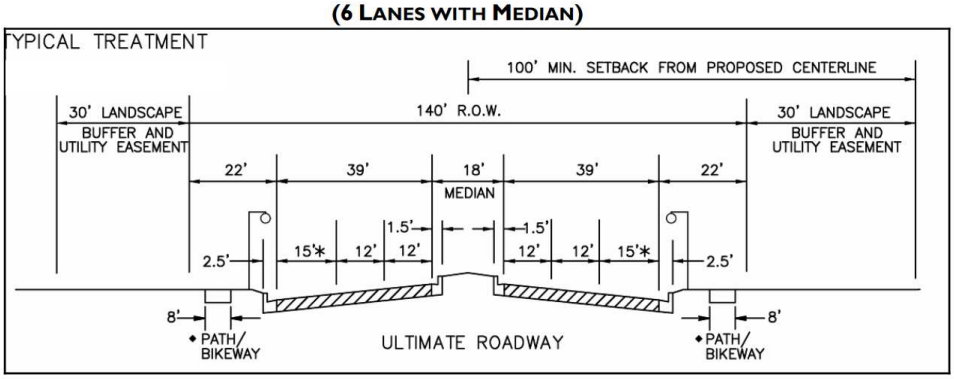
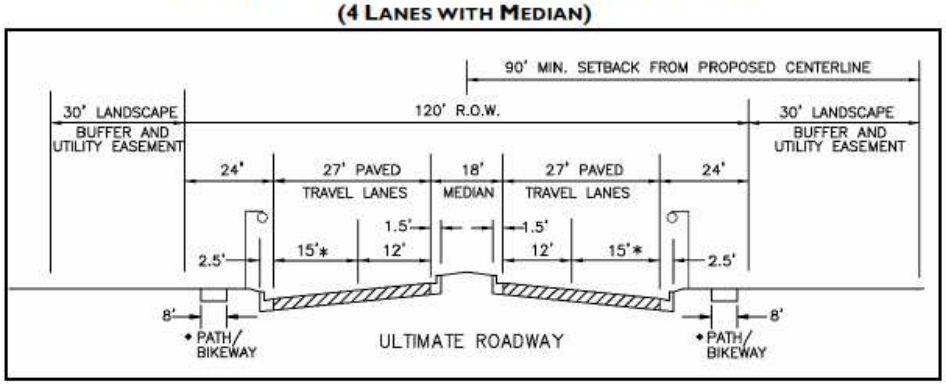


FIGURE 16: STREET DESIGN STANDARD - MINOR ARTERIAL (4 LANES WITH MEDIAN)



For the internal streets, four of the cross-sections in the master plan are appropriate. A local street cross-section as illustrated in the master plan's Figure 21 would serve the streets internal to the planning areas that have residential driveways fronting the street. This section is specifically designed to provide access to properties.

.

FIGURE 21: STREET DESIGN STANDARD - LOCAL STREETS (2 LANES WITH PARKING)

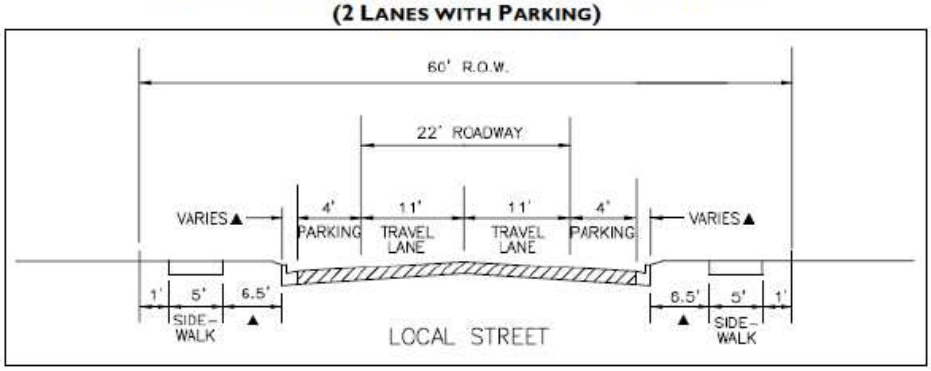
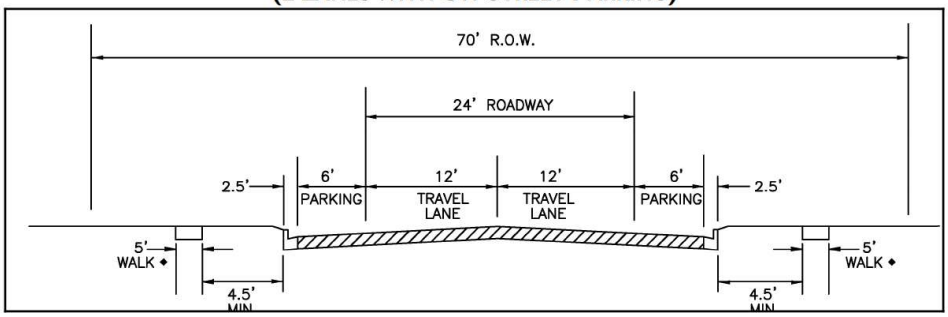


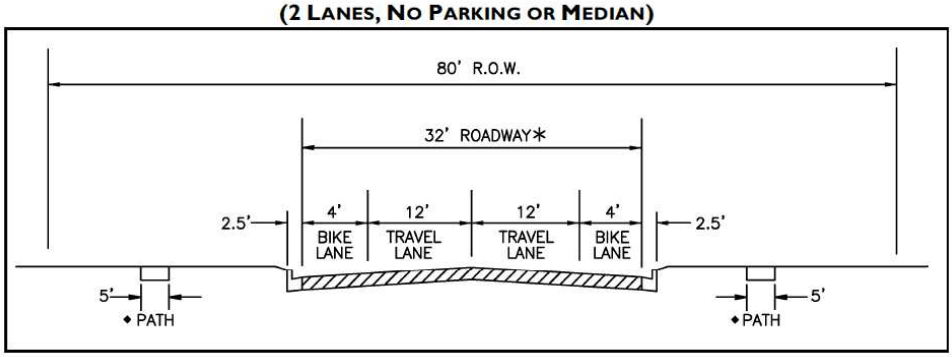
Figure 18 shows a residential collector type street that is appropriate for connectivity of the local streets to the entry streets and the streets serving the commercial area. The cross-section features 12-foot travel lanes and on-street parking on both sides.

FIGURE 18: STREET DESIGN STANDARD - RESIDENTIAL COLLECTOR (2 LANES WITH ON-STREET PARKING)



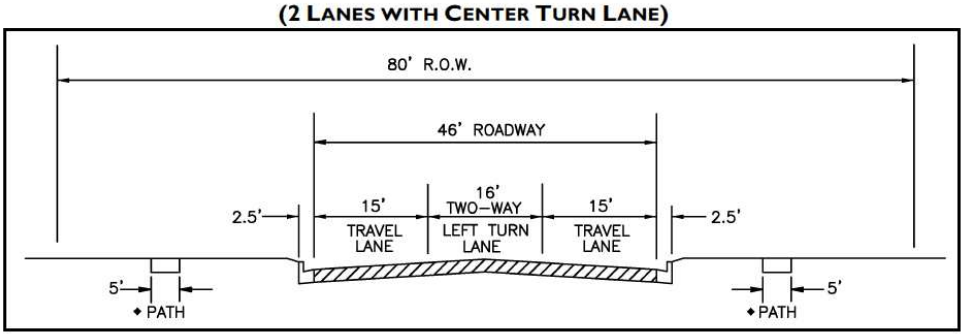
For the collector type streets, the cross-section in the master plan shown in Figure 17 below would serve as the connector between the arterial and local streets. This type of street is without parking and does not provide direct access to property.

FIGURE 17: STREET DESIGN STANDARD - COLLECTOR (2 LANES, NO PARKING OR MEDIAN)



For the collector type streets in the commercial area and the commercial entrance from CR-5, the cross-section in the master plan shown in Figure 20 on the next page includes a center turn lane for direct access to commercial property. Adjustments to this cross-section can be made to add on street parking where desired.

FIGURE 20: STREET DESIGN STANDARD - COLLECTOR (2 LANES WITH CENTER TURN LANE)



With regard to traffic control and intersection geometrics, the intersections serving the Erie Highlands will a 3/4 movement at Summit Blvd. full-movement and signalized when warranted at Highlands Blvd., and an interim full-movement at Glacier Drive until the commercial area is developed. At that time, it will be signalized.

The analysis of the CR-3 and CR-5 intersections with Erie Parkway indicates that traffic signal control is warranted at CR-5 in the 2016 scenario. The master plan has CR-5 warrants in 2030 and CR-3 in 2060.

AUXILIARY LANE DESIGN REQUIREMENTS

Erie Parkway is categorized as an NR-A and the auxiliary lane design requirements are specified in the State Highway Access Code. Posted at 40 mph the deceleration lane length is 370 feet including a 12:1 taper. The left turn lanes require additional length for storage.

CR-5 is a categorized as a NR-B highway. It is posted at 45 mph. The required lane length is 435 feet and there is no additional storage

requirement. The following table summarizes the required lane lengths on Erie Parkway and CR-5.

Auxiliary Lane Lengths

Intersection	Movement	
	EBR	WBL
Erie Parkway/Summit Blvd.	370	420
Erie Parkway/Highlands Blvd	370	470
Erie Parkway/Glacier Peak	370	470
	SBR	NBL
CR-5/Comm. Ent.	435	435
CR-5/Comm. Ent.	435	435

No auxiliary lanes are necessary at the intersection on Bonanza Dr. On the internal road approaches, the auxiliary lanes should be designed to fit with a recommended minimum of 100 feet.

8. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This traffic analysis demonstrates that the traffic generated by Erie Highlands can be accommodated within acceptable operating parameters provided the recommended improvements below are made.

1) No improvements to Erie Parkway as an NR-A type roadway are necessary until approximately 60 homes in Filing 1 are constructed. When that occurs then a left in at the Summit Blvd. intersection should be installed. The lane should be 420 feet long inclusive of a 12:1 taper and 50 feet of additional storage. The lane can tie into the improvements at CR-3 soon to be constructed by the Bridgewater development. A transition taper of 360 feet from the PC of the left turn taper to the existing roadway would be required per the Code. A right turn lane of 370 feet including taper into the property at the Summit Blvd. would be warranted with construction of approximately 125 homes in Filing 1. This lane would be converted to the second eastbound through lane when Erie Parkway is fully built out.

2) Coordinate the widening of Erie Parkway with the Bridgewater property owner to the north and plans to extend the four-lane roadway from its current terminus (1/2 mile west of CR-3) and reconstruction of the CR-3/Erie Parkway intersection including auxiliary turn lanes. The Town has indicated that the Erie Highlands would be responsible for 25 percent of the signal costs at CR-3 when warranted.

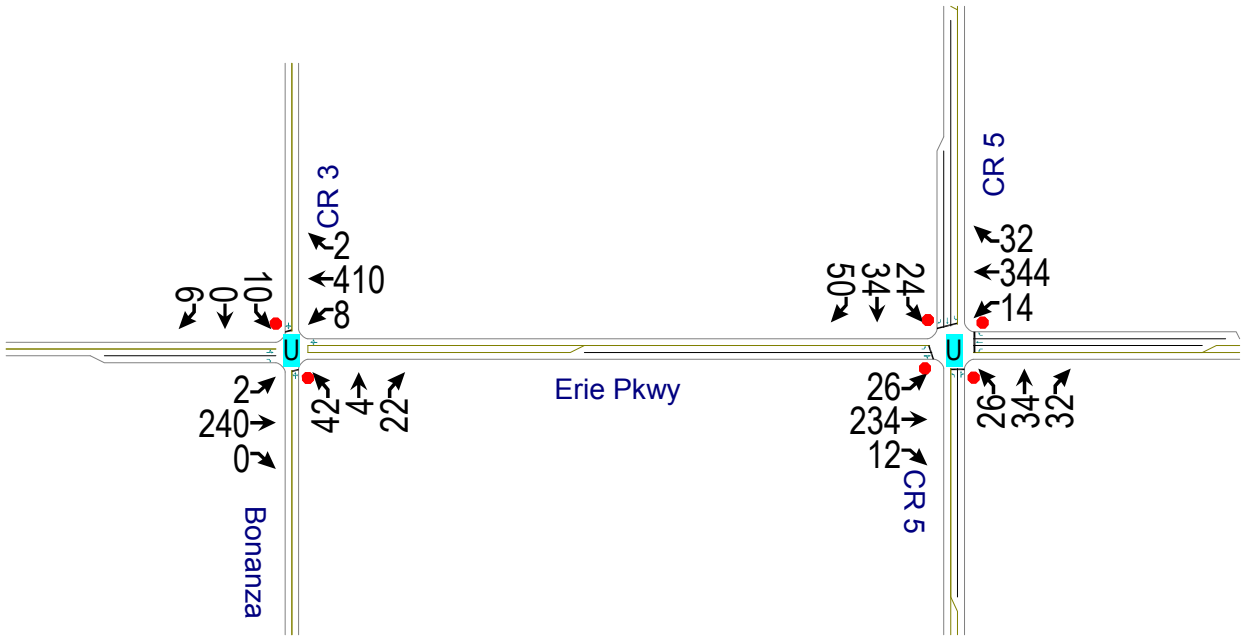
3) Construct the intersections with Erie Parkway when needed for each subsequent filing. The intersections should include right and left turn lanes with tapers of 12:1. The intersections will be two-way stop sign controlled in the initial Filing 1 2016 scenario. Convert the stop signs to traffic signal control at Highlands Blvd. when warranted. The Town has indicated that the signal costs would be fully absorbed by Erie Highlands.

4) If traffic signal control at CR-5/Erie Parkway meets warrants prior to the completion and extension of improvements to Erie Parkway, then coordinate with the Town to insure a proper fit with development plans for Erie Highlands. The Town has indicated that the Erie Highlands would be responsible for 25 percent of the signal costs at this locations

5) Construct the internal roads consistent with the Town's cross-sections in the master plan. Local roads within the planning areas are recommended for direct access to properties. Collector type roads are recommended for the road connecting to Erie Parkway and CR-5. Within the commercial area, a collector type roadway with center turn lane and optional parking is recommended.

In conclusion, this report finds that the roadway layout in the site plan and the recommended accesses will operate at an acceptable level of service and that overall traffic flow on the adjacent streets and intersections would be efficiently served by the proposed improvements.

APPENDIX


CR 3
2
410
8
9
0
10
2
240
0
42
4
22
Bonanza
Erie Pkwy
CR 5
32
344
14
50
34
24
26
234
12
26
34
32
CR 5
U
U

Intersection	
Intersection Delay, s/veh	1.8

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	2	240	0	8	410	2	42	4	22	10	0	6
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	300	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	261	0	9	446	2	46	4	24	11	0	7

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	448	0	0	261	0	0	732	730	261	743	729	447
Stage 1	-	-	-	-	-	-	265	265	-	464	464	-
Stage 2	-	-	-	-	-	-	467	465	-	279	265	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1112	-	-	1303	-	-	337	349	778	331	350	612
Stage 1	-	-	-	-	-	-	740	689	-	578	564	-
Stage 2	-	-	-	-	-	-	576	563	-	728	689	-
Time blocked-Platoon, %		-	-		-	-						
Mov Capacity-1 Maneuver	1112	-	-	1303	-	-	331	345	778	315	346	612
Mov Capacity-2 Maneuver	-	-	-	-	-	-	331	345	-	315	346	-
Stage 1	-	-	-	-	-	-	739	688	-	577	559	-
Stage 2	-	-	-	-	-	-	565	558	-	700	688	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.1	15.8	14.8
HCM LOS			C	B

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	408	1112	-	-	1303	-	-	385
HCM Lane V/C Ratio	0.181	0.002	-	-	0.007	-	-	0.045
HCM Control Delay (s)	15.8	8.244	0	-	7.781	0	-	14.8
HCM Lane LOS	C	A	A		A	A		B
HCM 95th %tile Q(veh)	0.653	0.006	-	-	0.02	-	-	0.141

Notes
~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection	
Intersection Delay, s/veh	14.8
Intersection LOS	B

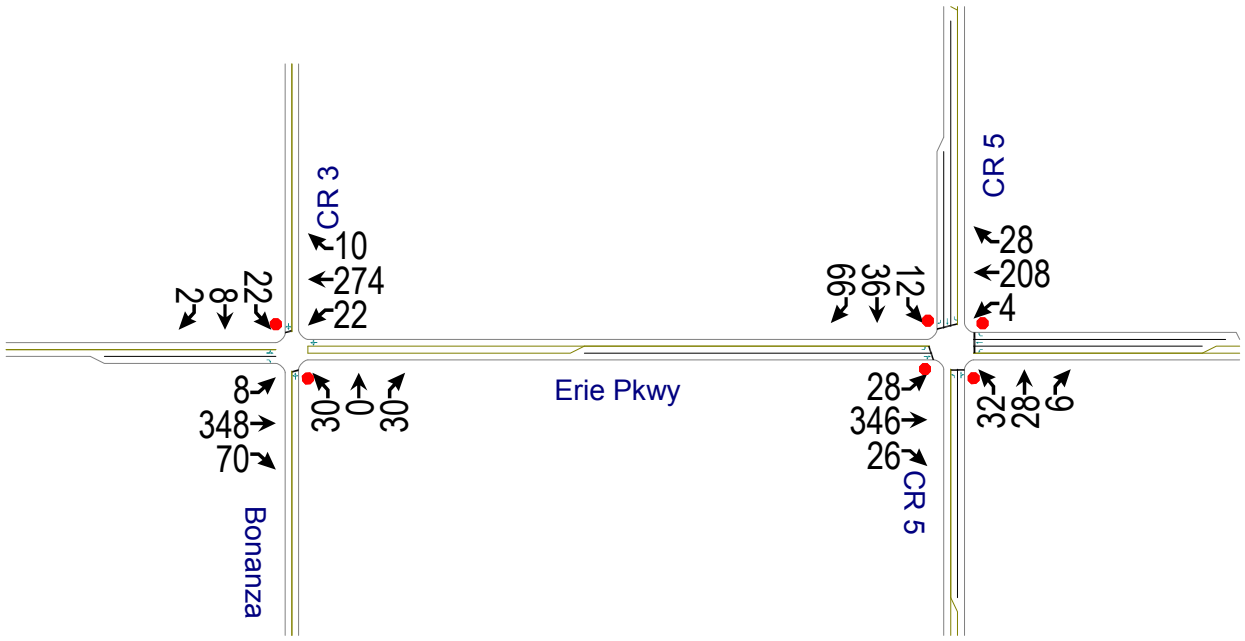
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	26	234	12	14	344	32	26	34	32	24	34	50
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	28	254	13	15	374	35	28	37	35	26	37	54
Number of Lanes	1	1	0	1	1	1	1	1	0	1	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	3	2	3	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	3	2	2	3
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	3	3	2
HCM Control Delay	14.1	17.6	10.7	10.2
HCM LOS	B	C	B	B

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	WBLn2	WBLn3	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	100%	0%	100%	0%	0%	100%	0%	0%
Vol Thru, %	0%	52%	0%	95%	0%	100%	0%	0%	100%	0%
Vol Right, %	0%	48%	0%	5%	0%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	26	66	26	246	14	344	32	24	34	50
LT Vol	0	34	0	234	0	344	0	0	34	0
Through Vol	0	32	0	12	0	0	32	0	0	50
RT Vol	26	0	26	0	14	0	0	24	0	0
Lane Flow Rate	28	72	28	267	15	374	35	26	37	54
Geometry Grp	8	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.06	0.134	0.054	0.467	0.028	0.632	0.052	0.055	0.073	0.096
Departure Headway (Hd)	7.597	6.746	6.827	6.289	6.591	6.087	5.382	7.579	7.073	6.364
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	469	529	523	572	542	591	663	471	504	560
Service Time	5.374	4.523	4.586	4.048	4.343	3.839	3.134	5.354	4.847	4.138
HCM Lane V/C Ratio	0.06	0.136	0.054	0.467	0.028	0.633	0.053	0.055	0.073	0.096
HCM Control Delay	10.9	10.6	10	14.5	9.5	18.8	8.4	10.8	10.4	9.8
HCM Lane LOS	B	B	A	B	A	C	A	B	B	A
HCM 95th-tile Q	0.2	0.5	0.2	2.5	0.1	4.4	0.2	0.2	0.2	0.3

Notes

~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined


CR 3
10
274
22
22
8
2
Erie Pkwy
8
348
70
30
0
30
Bonanza
CR 5
28
208
4
12
36
99
28
346
26
CR 5
32
28
6

Intersection	
Intersection Delay, s/veh	2.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	8	348	70	22	274	10	30	0	30	22	8	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	300	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	9	378	76	24	298	11	33	0	33	24	9	2

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	309	0	0	378	0	0	753	753	378	763	747	303
Stage 1	-	-	-	-	-	-	396	396	-	351	351	-
Stage 2	-	-	-	-	-	-	357	357	-	412	396	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.518	4.018	3.318	3.518	4.018	3.318
Pot Capacity-1 Maneuver	1252	-	-	1180	-	-	326	339	669	321	341	737
Stage 1	-	-	-	-	-	-	629	604	-	666	632	-
Stage 2	-	-	-	-	-	-	661	628	-	617	604	-
Time blocked-Platoon, %		-	-		-	-						
Mov Capacity-1 Maneuver	1252	-	-	1180	-	-	310	327	669	297	329	737
Mov Capacity-2 Maneuver	-	-	-	-	-	-	310	327	-	297	329	-
Stage 1	-	-	-	-	-	-	623	598	-	659	616	-
Stage 2	-	-	-	-	-	-	634	612	-	581	598	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0.1	0.6	15	17.8
HCM LOS			C	C

Minor Lane / Major Mvmt	NBLn1	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1
Capacity (veh/h)	424	1252	-	-	1180	-	-	317
HCM Lane V/C Ratio	0.154	0.007	-	-	0.02	-	-	0.11
HCM Control Delay (s)	15	7.896	0	-	8.114	0	-	17.8
HCM Lane LOS	C	A	A		A	A		C
HCM 95th %tile Q(veh)	0.539	0.021	-	-	0.062	-	-	0.366

Notes
~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection	
Intersection Delay, s/veh	14.8
Intersection LOS	B

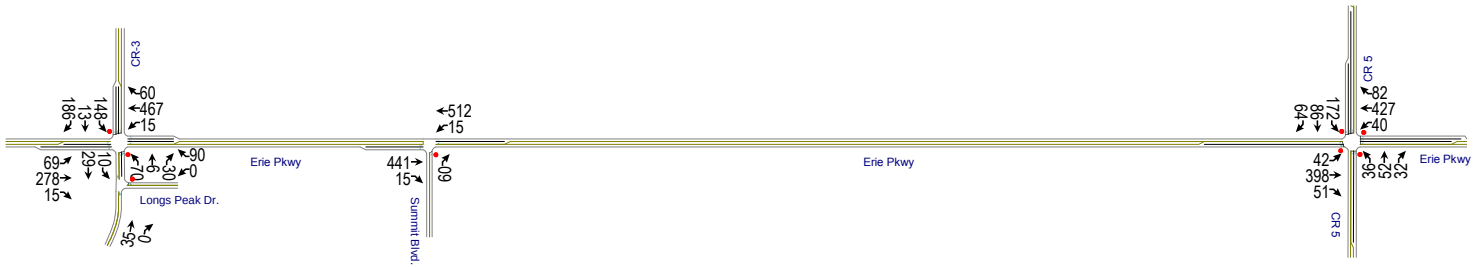
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	28	346	26	4	208	28	32	28	6	12	36	66
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	30	376	28	4	226	30	35	30	7	13	39	72
Number of Lanes	1	1	0	1	1	1	1	1	0	1	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	3	2	3	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	3	2	2	3
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	3	3	2
HCM Control Delay	18.3	12.5	10.5	10
HCM LOS	C	B	B	A

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	WBLn2	WBLn3	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	100%	0%	100%	0%	0%	100%	0%	0%
Vol Thru, %	0%	82%	0%	93%	0%	100%	0%	0%	100%	0%
Vol Right, %	0%	18%	0%	7%	0%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	32	34	28	372	4	208	28	12	36	66
LT Vol	0	28	0	346	0	208	0	0	36	0
Through Vol	0	6	0	26	0	0	28	0	0	66
RT Vol	32	0	28	0	4	0	0	12	0	0
Lane Flow Rate	35	37	30	404	4	226	30	13	39	72
Geometry Grp	8	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.072	0.071	0.054	0.654	0.008	0.394	0.047	0.027	0.075	0.123
Departure Headway (Hd)	7.503	6.872	6.378	5.827	6.781	6.277	5.571	7.394	6.888	6.181
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	477	520	562	619	527	572	641	483	519	578
Service Time	5.264	4.633	4.118	3.567	4.53	4.025	3.319	5.153	4.647	3.939
HCM Lane V/C Ratio	0.073	0.071	0.053	0.653	0.008	0.395	0.047	0.027	0.075	0.125
HCM Control Delay	10.9	10.2	9.5	19	9.6	13.1	8.6	10.4	10.2	9.8
HCM Lane LOS	B	B	A	C	A	B	A	B	B	A
HCM 95th-tile Q	0.2	0.2	0.2	4.8	0	1.9	0.1	0.1	0.2	0.4

Notes

~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined


CR-3
60
467
15
186
148
13
69
278
15
110
29
70
6
30
90
0
Erie Pkwy
Longs Peak Dr.
35
0
512
15
441
15
60
Summit Blvd.
Erie Pkwy
CR 5
82
427
40
172
89
64
42
398
51
36
52
32
Erie Pkwy
CR 5

Intersection	
Intersection Delay, s/veh	14.1

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	69	278	15	15	467	60	70	6	30	148	13	186
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	200	-	300	200	-	200	0	-	-	200	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	0	0	0	0	0	0
Mvmt Flow	75	302	16	16	508	65	76	7	33	161	14	202

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	508	0	0	302	0	0	999	992	302	1012	992	508
Stage 1	-	-	-	-	-	-	452	452	-	540	540	-
Stage 2	-	-	-	-	-	-	547	540	-	472	452	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.5	4	3.3	3.5	4	3.3
Pot Capacity-1 Maneuver	1057	-	-	1259	-	-	224	248	742	220	248	569
Stage 1	-	-	-	-	-	-	591	574	-	530	524	-
Stage 2	-	-	-	-	-	-	525	524	-	576	574	-
Time blocked-Platoon, %		-	-		-	-						
Mov Capacity-1 Maneuver	1057	-	-	1259	-	-	129	227	742	193	227	569
Mov Capacity-2 Maneuver	-	-	-	-	-	-	129	227	-	193	227	-
Stage 1	-	-	-	-	-	-	549	533	-	492	517	-
Stage 2	-	-	-	-	-	-	325	517	-	505	533	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1.7	0.2	36.2	41.9
HCM LOS			E	E

Minor Lane / Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2	SBLn3
Capacity (veh/h)	129	239	1057	-	-	1259	-	-	193	227	569
HCM Lane V/C Ratio	0.393	0.27	0.071	-	-	0.013	-	-	0.834	0.062	0.355
HCM Control Delay (s)	49.9	25.5	8.666	-	-	7.897	-	-	77.8	21.9	14.8
HCM Lane LOS	E	D	A			A			F	C	B
HCM 95th %tile Q(veh)	1.662	1.057	0.229	-	-	0.039	-	-	6.014	0.198	1.598

Notes

~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection	
Intersection Delay, s/veh	49.1
Intersection LOS	E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	42	398	51	40	427	82	36	52	32	172	86	64
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	46	433	55	43	464	89	39	57	35	187	93	70
Number of Lanes	1	1	0	1	1	1	1	1	0	1	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	3	2	3	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	3	2	2	3
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	3	3	2
HCM Control Delay	67.2	58.9	15	17.7
HCM LOS	F	F	B	C

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	WBLn2	WBLn3	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	100%	0%	100%	0%	0%	100%	0%	0%
Vol Thru, %	0%	62%	0%	89%	0%	100%	0%	0%	100%	0%
Vol Right, %	0%	38%	0%	11%	0%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	36	84	42	449	40	427	82	172	86	64
LT Vol	0	52	0	398	0	427	0	0	86	0
Through Vol	0	32	0	51	0	0	82	0	0	64
RT Vol	36	0	42	0	40	0	0	172	0	0
Lane Flow Rate	39	91	46	488	43	464	89	187	93	70
Geometry Grp	8	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.112	0.242	0.111	1	0.106	1	0.188	0.494	0.234	0.161
Departure Headway (Hd)	10.297	9.539	8.922	8.305	8.787	8.288	7.59	9.52	9.022	8.325
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	349	378	404	439	409	441	473	380	399	433
Service Time	8.02	7.263	6.622	6.045	6.522	6.023	5.325	7.241	6.743	6.046
HCM Lane V/C Ratio	0.112	0.241	0.114	1.112	0.105	1.052	0.188	0.492	0.233	0.162
HCM Control Delay	14.3	15.3	12.7	72.3	12.6	72.2	12.1	21.2	14.5	12.6
HCM Lane LOS	B	C	B	F	B	F	B	C	B	B
HCM 95th-tile Q	0.4	0.9	0.4	12.7	0.4	12.7	0.7	2.6	0.9	0.6

Notes

~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection	
Intersection Delay, s/veh	0.8

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	441	15	15	512	0	60
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	250	300	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	479	16	16	557	0	65

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	479	0	1068	479
Stage 1	-	-	-	-	479	-
Stage 2	-	-	-	-	589	-
Follow-up Headway	-	-	2.218	-	3.518	3.318
Pot Capacity-1 Maneuver	-	-	1083	-	245	587
Stage 1	-	-	-	-	623	-
Stage 2	-	-	-	-	554	-
Time blocked-Platoon, %	-	-		-		
Mov Capacity-1 Maneuver	-	-	1083	-	241	587
Mov Capacity-2 Maneuver	-	-	-	-	241	-
Stage 1	-	-	-	-	623	-
Stage 2	-	-	-	-	546	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.2	11.9
HCM LOS			B

Minor Lane / Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	587	-	-	1083	-
HCM Lane V/C Ratio	0.111	-	-	0.015	-
HCM Control Delay (s)	11.9	-	-	8.375	-
HCM Lane LOS	B			A	
HCM 95th %tile Q(veh)	0.373	-	-	0.046	-

Notes
~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection	
Intersection Delay, s/veh	5.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	0	90	35	0	10	29
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	0	98	38	0	11	32

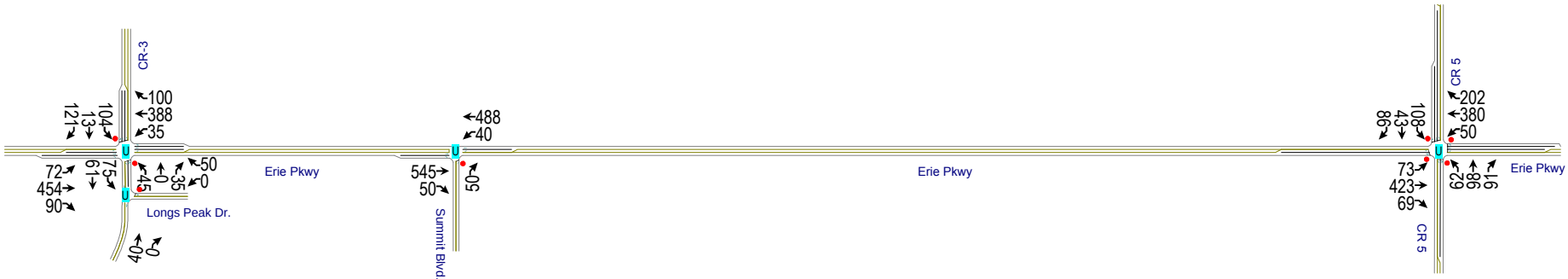
Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	91	38	0	0	38	0
Stage 1	38	-	-	-	-	-
Stage 2	53	-	-	-	-	-
Follow-up Headway	3.5	3.3	-	-	2.2	-
Pot Capacity-1 Maneuver	914	1040	-	-	1585	-
Stage 1	990	-	-	-	-	-
Stage 2	975	-	-	-	-	-
Time blocked-Platoon, %			-	-		-
Mov Capacity-1 Maneuver	908	1040	-	-	1585	-
Mov Capacity-2 Maneuver	908	-	-	-	-	-
Stage 1	990	-	-	-	-	-
Stage 2	968	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.8	0	1.9
HCM LOS	A		

Minor Lane / Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	1040	1585	-
HCM Lane V/C Ratio	-	-	0.094	0.007	-
HCM Control Delay (s)	-	-	8.8	7.287	0
HCM Lane LOS			A	A	A
HCM 95th %tile Q(veh)	-	-	0.311	0.021	-

Notes

~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined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Erie Pkwy
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488
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545
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Summit Blvd.
Erie Pkwy
CR 5
202
380
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108
43
86
73
423
69
29
88
91
Erie Pkwy
CR 5

Intersection	
Intersection Delay, s/veh	9.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	72	454	90	35	388	100	45	0	35	104	13	121
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	200	-	300	200	-	200	0	-	-	200	-	200
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	92	92	92	92	92	92	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2	0	0	0	0	0	0
Mvmt Flow	78	493	98	38	422	109	49	0	38	113	14	132

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	422	0	0	493	0	0	1155	1148	493	1167	1148	422
Stage 1	-	-	-	-	-	-	650	650	-	498	498	-
Stage 2	-	-	-	-	-	-	505	498	-	669	650	-
Follow-up Headway	2.218	-	-	2.218	-	-	3.5	4	3.3	3.5	4	3.3
Pot Capacity-1 Maneuver	1137	-	-	1071	-	-	175	200	580	172	200	636
Stage 1	-	-	-	-	-	-	461	468	-	558	548	-
Stage 2	-	-	-	-	-	-	553	548	-	450	468	-
Time blocked-Platoon, %		-	-		-	-						
Mov Capacity-1 Maneuver	1137	-	-	1071	-	-	120	180	580	148	180	636
Mov Capacity-2 Maneuver	-	-	-	-	-	-	120	180	-	148	180	-
Stage 1	-	-	-	-	-	-	429	436	-	520	529	-
Stage 2	-	-	-	-	-	-	412	529	-	392	436	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	1	0.6	30.7	43.4
HCM LOS			D	E

Minor Lane / Major Mvmt	NBLn1	NBLn2	EBL	EBT	EBR	WBL	WBT	WBR	SBLn1	SBLn2	SBLn3
Capacity (veh/h)	120	270	1137	-	-	1071	-	-	148	180	636
HCM Lane V/C Ratio	0.272	0.201	0.069	-	-	0.036	-	-	0.764	0.079	0.207
HCM Control Delay (s)	45.8	21.7	8.4	-	-	8.485	-	-	81.9	26.7	12.1
HCM Lane LOS	E	C	A			A			F	D	B
HCM 95th %tile Q(veh)	1.024	0.736	0.221	-	-	0.11	-	-	4.683	0.252	0.773

Notes
~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection	
Intersection Delay, s/veh	47.6
Intersection LOS	E

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	73	423	69	50	380	202	62	98	91	108	43	86
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	79	460	75	54	413	220	67	107	99	117	47	93
Number of Lanes	1	1	0	1	1	1	1	1	0	1	1	1

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	3	2	3	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	3	2	2	3
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	3	3	2
HCM Control Delay	67.6	51.7	21.4	16.6
HCM LOS	F	F	C	C

Lane	NBLn1	NBLn2	EBLn1	EBLn2	WBLn1	WBLn2	WBLn3	SBLn1	SBLn2	SBLn3
Vol Left, %	100%	0%	100%	0%	100%	0%	0%	100%	0%	0%
Vol Thru, %	0%	52%	0%	86%	0%	100%	0%	0%	100%	0%
Vol Right, %	0%	48%	0%	14%	0%	0%	100%	0%	0%	100%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	62	189	73	492	50	380	202	108	43	86
LT Vol	0	98	0	423	0	380	0	0	43	0
Through Vol	0	91	0	69	0	0	202	0	0	86
RT Vol	62	0	73	0	50	0	0	108	0	0
Lane Flow Rate	67	205	79	535	54	413	220	117	47	93
Geometry Grp	8	8	8	8	8	8	8	8	8	8
Degree of Util (X)	0.195	0.547	0.212	1	0.14	1	0.491	0.342	0.13	0.241
Departure Headway (Hd)	10.414	9.585	9.61	8.997	9.242	8.743	8.045	10.59	10.092	9.396
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cap	346	378	376	406	387	413	446	342	358	384
Service Time	8.114	7.285	7.3	6.704	7.015	6.516	5.818	8.29	7.792	7.096
HCM Lane V/C Ratio	0.194	0.542	0.21	1.318	0.14	1	0.493	0.342	0.131	0.242
HCM Control Delay	15.6	23.3	14.9	75.4	13.5	74.5	18.4	18.7	14.3	15.1
HCM Lane LOS	C	C	B	F	B	F	C	C	B	C
HCM 95th-tile Q	0.7	3.2	0.8	12.2	0.5	12.4	2.6	1.5	0.4	0.9

Notes

~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection	
Intersection Delay, s/veh	0.9

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	545	50	40	488	0	50
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	200	200	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	592	54	43	530	0	54

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	592	0	1209	592
Stage 1	-	-	-	-	592	-
Stage 2	-	-	-	-	617	-
Follow-up Headway	-	-	2.218	-	3.518	3.318
Pot Capacity-1 Maneuver	-	-	984	-	202	506
Stage 1	-	-	-	-	553	-
Stage 2	-	-	-	-	538	-
Time blocked-Platoon, %	-	-		-		
Mov Capacity-1 Maneuver	-	-	984	-	193	506
Mov Capacity-2 Maneuver	-	-	-	-	193	-
Stage 1	-	-	-	-	553	-
Stage 2	-	-	-	-	514	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.7	13
HCM LOS			B

Minor Lane / Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	506	-	-	984	-
HCM Lane V/C Ratio	0.107	-	-	0.044	-
HCM Control Delay (s)	13	-	-	8.828	-
HCM Lane LOS	B			A	
HCM 95th %tile Q(veh)	0.359	-	-	0.139	-

Notes
~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection	
Intersection Delay, s/veh	4.4

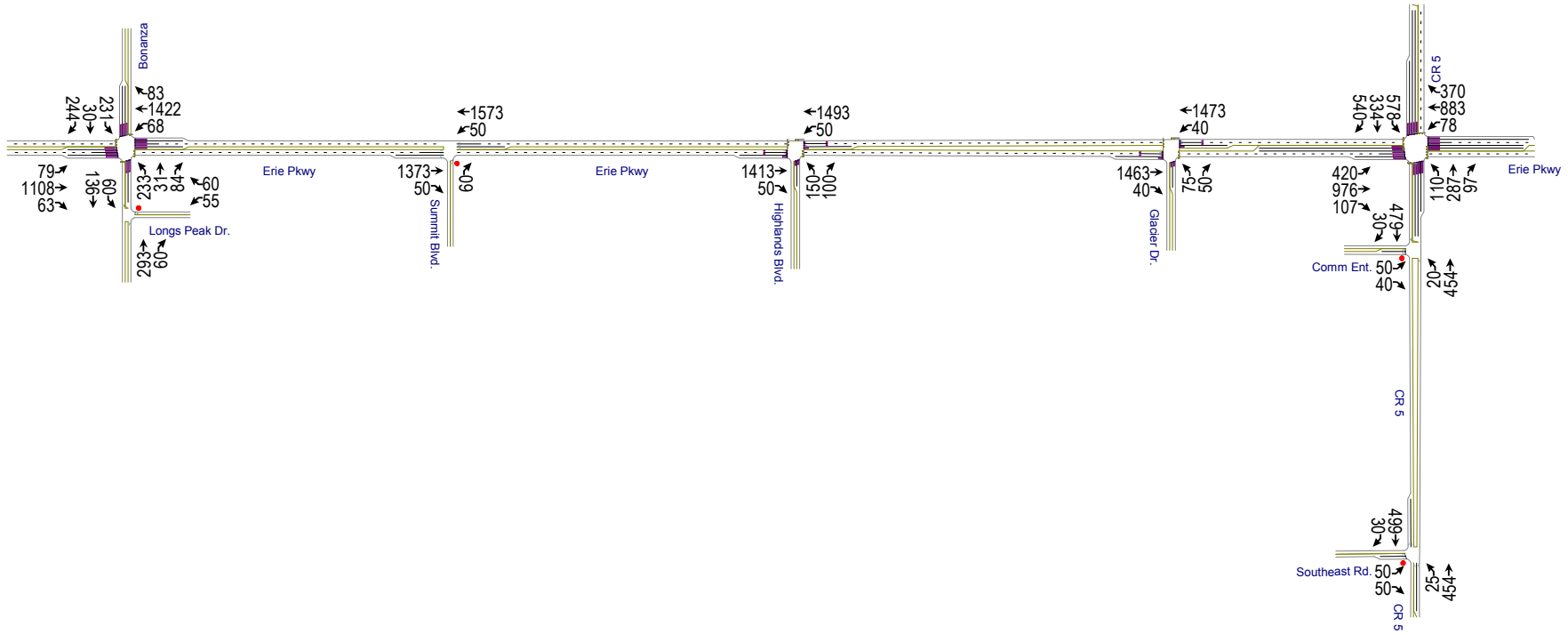
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	0	50	40	0	75	61
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	0	54	43	0	82	66

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	272	43	0	0	43	0
Stage 1	43	-	-	-	-	-
Stage 2	229	-	-	-	-	-
Follow-up Headway	3.5	3.3	-	-	2.2	-
Pot Capacity-1 Maneuver	722	1033	-	-	1579	-
Stage 1	985	-	-	-	-	-
Stage 2	814	-	-	-	-	-
Time blocked-Platoon, %			-	-		-
Mov Capacity-1 Maneuver	683	1033	-	-	1579	-
Mov Capacity-2 Maneuver	683	-	-	-	-	-
Stage 1	985	-	-	-	-	-
Stage 2	770	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.7	0	4.1
HCM LOS	A		

Minor Lane / Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	1033	1579	-
HCM Lane V/C Ratio	-	-	0.053	0.052	-
HCM Control Delay (s)	-	-	8.7	7.404	0
HCM Lane LOS			A	A	A
HCM 95th %tile Q(veh)	-	-	0.166	0.163	-

Notes
~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

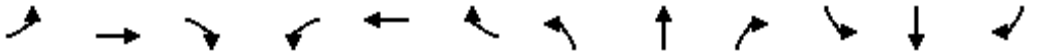

Bonanza
Erie Pkwy
Longs Peak Dr.
Summit Blvd.
Highlands Blvd.
Glacier Dr.
CR 5
Comm Ent.
Southeast Rd.
CR 5
CR 5
Erie Pkwy

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	79	1108	63	68	1422	83	233	31	84	231	30	244
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	186.3	186.3	186.3	186.3	186.3	186.3	186.3	186.3	190.0	186.3	186.3	186.3
Lanes	1	2	1	1	2	1	1	1	0	1	1	1
Cap, veh/h	265	2212	940	257	2212	940	408	141	377	408	584	496
Arrive On Green	0.59	0.59	0.59	1.00	1.00	1.00	0.31	0.31	0.31	0.31	0.31	0.31
Sat Flow, veh/h	306	3725	1583	434	3725	1583	1077	449	1202	1261	1863	1583
Grp Volume(v), veh/h	86	1204	68	74	1546	90	253	0	125	251	33	265
Grp Sat Flow(s),veh/h/ln	306	1863	1583	434	1863	1583	1077	0	1651	1261	1863	1583
Q Serve(g_s), s	13.7	16.7	1.6	6.7	0.0	0.0	18.5	0.0	4.8	15.9	1.1	11.9
Cycle Q Clear(g_c), s	13.7	16.7	1.6	23.5	0.0	0.0	19.6	0.0	4.8	20.7	1.1	11.9
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.73	1.00		1.00
Lane Grp Cap(c), veh/h	265	2212	940	257	2212	940	408	0	517	408	584	496
V/C Ratio(X)	0.32	0.54	0.07	0.29	0.70	0.10	0.62	0.00	0.24	0.62	0.06	0.53
Avail Cap(c_a), veh/h	314	2812	1195	327	2812	1195	408	0	517	408	584	496
HCM Platoon Ratio	1.00	1.00	1.00	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	9.9	10.5	7.4	3.8	0.0	0.0	27.5	0.0	22.0	29.7	20.7	24.4
Incr Delay (d2), s/veh	0.7	0.2	0.0	0.6	0.6	0.0	6.9	0.0	1.1	6.8	0.2	4.1
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	0.9	6.4	0.5	0.4	0.2	0.0	5.7	0.0	2.1	5.7	0.5	5.2
Lane Grp Delay (d), s/veh	10.6	10.7	7.5	4.4	0.6	0.0	34.4	0.0	23.1	36.5	20.8	28.4
Lane Grp LOS	B	B	A	A	A	A	C		C	D	C	C
Approach Vol, veh/h		1358			1710			378			549	
Approach Delay, s/veh		10.5			0.7			30.7			31.7	
Approach LOS		B			A			C			C	

Timer												
Assigned Phs		4			8			2			6	
Phs Duration (G+Y+Rc), s		55.1			55.1			31.0			31.0	
Change Period (Y+Rc), s		4.0			4.0			4.0			4.0	
Max Green Setting (Gmax), s		65.0			65.0			27.0			27.0	
Max Q Clear Time (g_c+I1), s		18.7			25.5			21.6			22.7	
Green Ext Time (p_c), s		28.3			25.7			2.1			1.7	

Intersection Summary												
HCM 2010 Ctrl Delay			11.1									
HCM 2010 LOS			B									

Notes



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	420	976	107	78	883	370	110	287	97	578	334	540
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	186.3	186.3	186.3	186.3	186.3	186.3	186.3	186.3	186.3	186.3	186.3	186.3
Lanes	2	2	1	2	2	1	2	1	1	2	1	1
Cap, veh/h	524	1173	499	471	1109	471	555	895	761	855	895	761
Arrive On Green	0.19	0.63	0.63	0.08	0.30	0.30	0.48	0.48	0.48	0.48	0.48	0.48
Sat Flow, veh/h	3442	3725	1583	3442	3725	1583	1141	1863	1583	1873	1863	1583
Grp Volume(v), veh/h	457	1061	116	85	960	402	120	312	105	628	363	587
Grp Sat Flow(s),veh/h/ln	1721	1863	1583	1721	1863	1583	570	1863	1583	937	1863	1583
Q Serve(g_s), s	6.7	23.4	3.0	0.0	23.3	22.9	7.3	10.0	3.5	30.1	12.0	29.3
Cycle Q Clear(g_c), s	6.7	23.4	3.0	0.0	23.3	22.9	19.3	10.0	3.5	40.1	12.0	29.3
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	524	1173	499	471	1109	471	555	895	761	855	895	761
V/C Ratio(X)	0.87	0.90	0.23	0.18	0.87	0.85	0.22	0.35	0.14	0.73	0.41	0.77
Avail Cap(c_a), veh/h	588	1479	629	471	1207	513	555	895	761	855	895	761
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.60	0.60	0.60	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	36.0	16.5	12.7	39.1	31.8	31.6	22.3	15.5	13.8	28.0	16.0	20.5
Incr Delay (d2), s/veh	8.1	4.4	0.1	0.2	6.4	12.3	0.9	1.1	0.4	5.6	1.4	7.4
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	5.5	6.6	1.0	1.0	11.5	10.4	1.1	4.7	1.3	7.6	5.7	12.0
Lane Grp Delay (d), s/veh	44.1	20.9	12.8	39.3	38.2	44.0	23.1	16.6	14.2	33.6	17.4	28.0
Lane Grp LOS	D	C	B	D	D	D	C	B	B	C	B	C
Approach Vol, veh/h		1634			1447			537			1578	
Approach Delay, s/veh		26.8			39.9			17.6			27.8	
Approach LOS		C			D			B			C	

Timer												
Assigned Phs	7	4		3	8			2			6	
Phs Duration (G+Y+Rc), s	13.2	34.1		11.6	32.5			50.0			50.0	
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0			4.0			4.0	
Max Green Setting (Gmax), s	11.0	38.0		4.0	31.0			46.0			46.0	
Max Q Clear Time (g_c+I1), s	8.7	25.4		2.0	25.3			21.3			42.1	
Green Ext Time (p_c), s	0.5	4.7		0.5	3.2			12.2			3.1	

Intersection Summary												
HCM 2010 Ctrl Delay			29.8									
HCM 2010 LOS			C									

Notes

Intersection	
Intersection Delay, s/veh	0.5

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	1373	50	50	1573	0	60
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	200	200	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1492	54	54	1710	0	65

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	1492	0	2456	746
Stage 1	-	-	-	-	1492	-
Stage 2	-	-	-	-	964	-
Follow-up Headway	-	-	2.22	-	3.52	3.32
Pot Capacity-1 Maneuver	-	-	446	-	25	356
Stage 1	-	-	-	-	173	-
Stage 2	-	-	-	-	331	-
Time blocked-Platoon, %	-	-		-		
Mov Capacity-1 Maneuver	-	-	446	-	22	356
Mov Capacity-2 Maneuver	-	-	-	-	22	-
Stage 1	-	-	-	-	173	-
Stage 2	-	-	-	-	291	-

Approach	EB	WB	NB
HCM Control Delay, s	0	0.4	17.4
HCM LOS			C

Minor Lane / Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	356	-	-	446	-
HCM Lane V/C Ratio	0.183	-	-	0.122	-
HCM Control Delay (s)	17.4	-	-	14.189	-
HCM Lane LOS	C			B	
HCM 95th %tile Q(veh)	0.661	-	-	0.413	-

Notes
~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1413	50	50	1493	150	100
Number	4	14	3	8	5	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	186.3	186.3	186.3	186.3	186.3	186.3
Lanes	2	1	1	2	1	1
Cap, veh/h	2519	1070	267	2519	416	371
Arrive On Green	0.90	0.90	0.90	0.90	0.23	0.23
Sat Flow, veh/h	3725	1583	320	3725	1774	1583
Grp Volume(v), veh/h	1536	54	54	1623	163	109
Grp Sat Flow(s),veh/h/ln	1863	1583	320	1863	1774	1583
Q Serve(g_s), s	8.2	0.3	4.4	9.3	6.9	5.1
Cycle Q Clear(g_c), s	8.2	0.3	12.6	9.3	6.9	5.1
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	2519	1070	267	2519	416	371
V/C Ratio(X)	0.61	0.05	0.20	0.64	0.39	0.29
Avail Cap(c_a), veh/h	2954	1256	304	2954	416	371
HCM Platoon Ratio	1.33	1.33	1.33	1.33	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.69	0.69	1.00	1.00
Uniform Delay (d), s/veh	1.9	1.5	3.3	1.9	28.9	28.2
Incr Delay (d2), s/veh	0.3	0.0	0.3	0.3	2.8	2.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	1.6	0.1	0.2	1.7	3.4	2.2
Lane Grp Delay (d), s/veh	2.2	1.5	3.5	2.2	31.6	30.2
Lane Grp LOS	A	A	A	A	C	C
Approach Vol, veh/h	1590			1677	272	
Approach Delay, s/veh	2.1			2.2	31.1	
Approach LOS	A			A	C	

Timer						
Assigned Phs	4			8		
Phs Duration (G+Y+Rc), s	64.5			64.5		
Change Period (Y+Rc), s	4.0			4.0		
Max Green Setting (Gmax), s	71.0			71.0		
Max Q Clear Time (g_c+I1), s	10.2			14.6		
Green Ext Time (p_c), s	48.8			45.9		

Intersection Summary						
HCM 2010 Ctrl Delay			4.4			
HCM 2010 LOS			A			

Notes

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1463	40	40	1473	75	50
Number	4	14	3	8	5	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	186.3	186.3	186.3	186.3	186.3	186.3
Lanes	2	1	1	2	1	1
Cap, veh/h	1767	751	270	2141	531	474
Arrive On Green	0.95	0.95	0.07	1.00	0.30	0.30
Sat Flow, veh/h	3725	1583	1774	3725	1774	1583
Grp Volume(v), veh/h	1590	43	43	1601	82	54
Grp Sat Flow(s),veh/h/ln	1863	1583	1774	1863	1774	1583
Q Serve(g_s), s	9.5	0.1	0.0	0.0	2.2	1.6
Cycle Q Clear(g_c), s	9.5	0.1	0.0	0.0	2.2	1.6
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	1767	751	270	2141	531	474
V/C Ratio(X)	0.90	0.06	0.16	0.75	0.15	0.11
Avail Cap(c_a), veh/h	3755	1596	343	4283	531	474
HCM Platoon Ratio	2.00	2.00	2.00	2.00	1.00	1.00
Upstream Filter(I)	0.72	0.72	0.55	0.55	1.00	1.00
Uniform Delay (d), s/veh	1.1	0.9	15.8	0.0	16.3	16.1
Incr Delay (d2), s/veh	1.4	0.0	0.1	0.3	0.6	0.5
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	0.9	0.0	0.5	0.1	1.0	0.6
Lane Grp Delay (d), s/veh	2.5	0.9	16.0	0.3	17.0	16.6
Lane Grp LOS	A	A	B	A	B	B
Approach Vol, veh/h	1633			1644	136	
Approach Delay, s/veh	2.4			0.7	16.8	
Approach LOS	A			A	B	

Timer				
Assigned Phs	4		3	8
Phs Duration (G+Y+Rc), s	34.1		6.4	40.5
Change Period (Y+Rc), s	4.0		4.0	4.0
Max Green Setting (Gmax), s	64.0		5.0	73.0
Max Q Clear Time (g_c+I1), s	11.5		2.0	2.0
Green Ext Time (p_c), s	18.6		2.5	20.1

Intersection Summary	
HCM 2010 Ctrl Delay	2.2
HCM 2010 LOS	A

Notes

Intersection	
Intersection Delay, s/veh	1.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	50	50	25	454	499	30
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	100	200	-	-	200
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	54	54	27	493	542	33

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1090	542	542	0	-	0
Stage 1	542	-	-	-	-	-
Stage 2	548	-	-	-	-	-
Follow-up Headway	3.518	3.318	2.218	-	-	-
Pot Capacity-1 Maneuver	238	540	1027	-	-	-
Stage 1	583	-	-	-	-	-
Stage 2	579	-	-	-	-	-
Time blocked-Platoon, %				-	-	-
Mov Capacity-1 Maneuver	232	540	1027	-	-	-
Mov Capacity-2 Maneuver	232	-	-	-	-	-
Stage 1	583	-	-	-	-	-
Stage 2	564	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	18.8	0.4	0
HCM LOS	C		

Minor Lane / Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1027	-	232	540	-	-
HCM Lane V/C Ratio	0.026	-	0.234	0.101	-	-
HCM Control Delay (s)	8.601	-	25.2	12.4	-	-
HCM Lane LOS	A		D	B		
HCM 95th %tile Q(veh)	0.081	-	0.883	0.334	-	-

Notes
~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection	
Intersection Delay, s/veh	3.1

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	55	60	293	60	60	136
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	60	65	318	65	65	148

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	629	351	0	0	384	0
Stage 1	351	-	-	-	-	-
Stage 2	278	-	-	-	-	-
Follow-up Headway	3.518	3.318	-	-	2.218	-
Pot Capacity-1 Maneuver	446	692	-	-	1174	-
Stage 1	713	-	-	-	-	-
Stage 2	769	-	-	-	-	-
Time blocked-Platoon, %			-	-		-
Mov Capacity-1 Maneuver	419	692	-	-	1174	-
Mov Capacity-2 Maneuver	419	-	-	-	-	-
Stage 1	713	-	-	-	-	-
Stage 2	723	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	13.9	0	2.5
HCM LOS	B		

Minor Lane / Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	528	1174	-
HCM Lane V/C Ratio	-	-	0.237	0.056	-
HCM Control Delay (s)	-	-	13.9	8.247	0
HCM Lane LOS			B	A	A
HCM 95th %tile Q(veh)	-	-	0.914	0.176	-

Notes
~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection	
Intersection Delay, s/veh	1.8

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	50	40	20	454	479	30
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	100	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	54	43	22	493	521	33

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1074	537	553	0	-	0
Stage 1	537	-	-	-	-	-
Stage 2	537	-	-	-	-	-
Follow-up Headway	3.518	3.318	2.218	-	-	-
Pot Capacity-1 Maneuver	243	544	1017	-	-	-
Stage 1	586	-	-	-	-	-
Stage 2	586	-	-	-	-	-
Time blocked-Platoon, %				-	-	-
Mov Capacity-1 Maneuver	236	544	1017	-	-	-
Mov Capacity-2 Maneuver	236	-	-	-	-	-
Stage 1	586	-	-	-	-	-
Stage 2	568	-	-	-	-	-

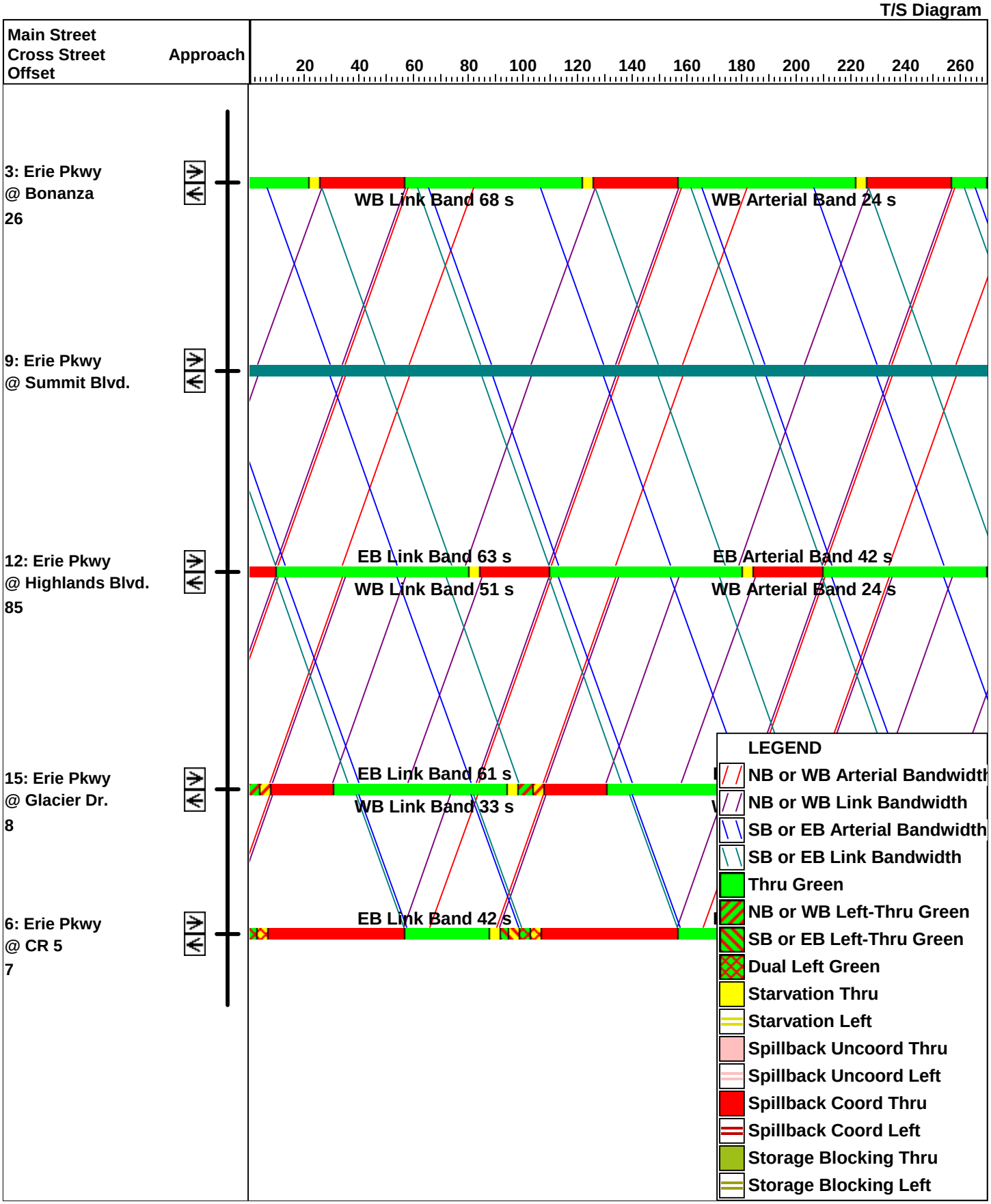
Approach	EB	NB	SB
HCM Control Delay, s	19.2	0.4	0
HCM LOS	C		

Minor Lane / Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1017	-	236	544	-	-
HCM Lane V/C Ratio	0.021	-	0.23	0.08	-	-
HCM Control Delay (s)	8.617	0	24.8	12.2	-	-
HCM Lane LOS	A	A	C	B		
HCM 95th %tile Q(veh)	0.065	-	0.865	0.26	-	-

Notes
~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

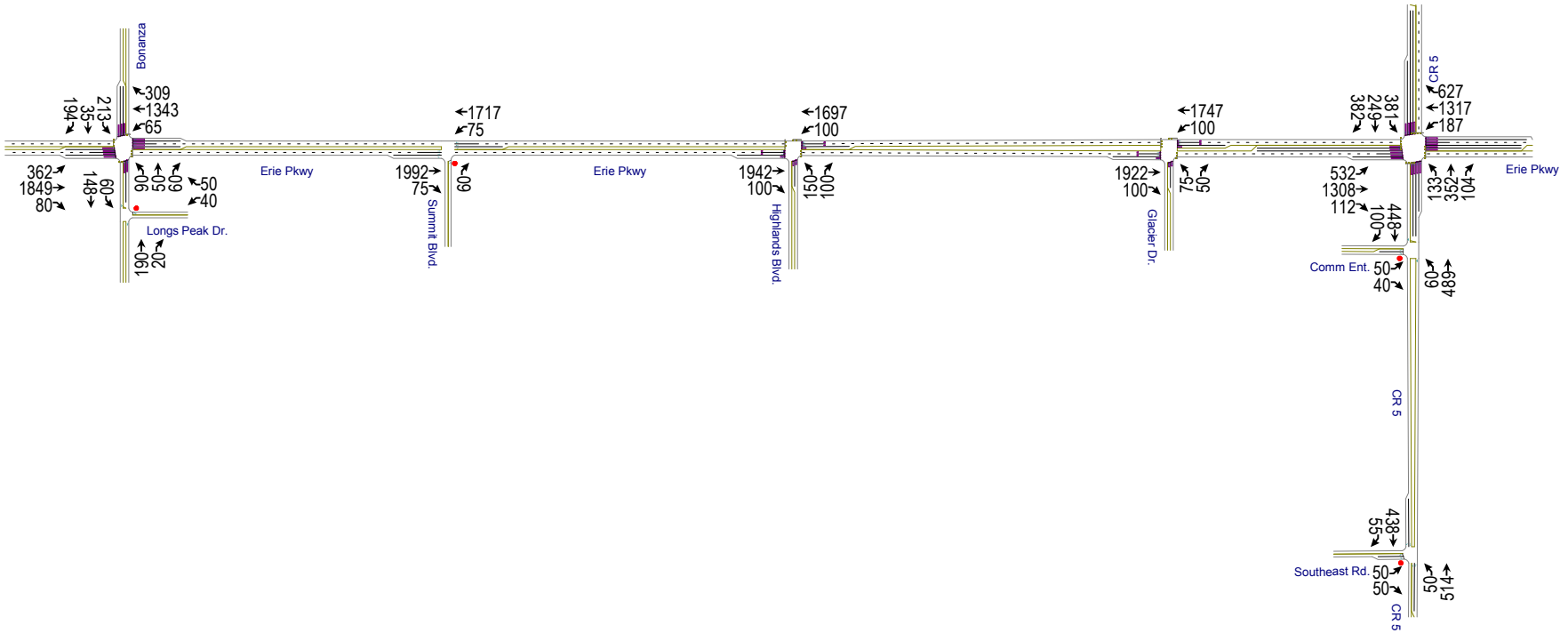
Erie Highlands

2035 AM Peak Hour
T/S Diagram



JMWA
Aldridge Transportation Consultants, LLC

8/22/2013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489
438
55
50
50
50
514

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	362	1849	80	65	1343	309	90	50	60	213	35	194
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	186.3	186.3	186.3	186.3	186.3	186.3	186.3	186.3	190.0	186.3	186.3	186.3
Lanes	1	2	1	1	2	1	1	1	0	1	1	1
Cap, veh/h	214	2794	1188	149	2794	1188	247	141	170	214	342	290
Arrive On Green	0.75	0.75	0.75	0.75	0.75	0.75	0.18	0.18	0.18	0.18	0.18	0.18
Sat Flow, veh/h	262	3725	1583	195	3725	1583	1126	771	928	1268	1863	1583
Grp Volume(v), veh/h	393	2010	87	71	1460	336	98	0	119	232	38	211
Grp Sat Flow(s),veh/h/ln	262	1863	1583	195	1863	1583	1126	0	1699	1268	1863	1583
Q Serve(g_s), s	70.7	35.2	1.7	37.3	19.3	8.1	9.5	0.0	7.4	14.6	2.0	15.1
Cycle Q Clear(g_c), s	90.0	35.2	1.7	72.5	19.3	8.1	11.6	0.0	7.4	22.0	2.0	15.1
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.55	1.00		1.00
Lane Grp Cap(c), veh/h	214	2794	1188	149	2794	1188	247	0	311	214	342	290
V/C Ratio(X)	1.84	0.72	0.07	0.48	0.52	0.28	0.40	0.00	0.38	1.08	0.11	0.73
Avail Cap(c_a), veh/h	214	2794	1188	149	2794	1188	247	0	311	214	342	290
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	34.6	8.1	4.0	27.8	6.2	4.8	45.7	0.0	43.0	54.7	40.9	46.2
Incr Delay (d2), s/veh	393.6	0.9	0.0	2.3	0.2	0.1	4.7	0.0	3.5	85.0	0.7	14.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	30.0	12.9	0.5	1.9	7.0	2.5	3.1	0.0	3.5	11.7	1.0	7.3
Lane Grp Delay (d), s/veh	428.2	9.1	4.0	30.2	6.3	4.9	50.4	0.0	46.6	139.7	41.5	60.9
Lane Grp LOS	F	A	A	C	A	A	D		D	F	D	E
Approach Vol, veh/h		2490			1867			217			481	
Approach Delay, s/veh		75.0			7.0			48.3			97.4	
Approach LOS		E			A			D			F	

Timer												
Assigned Phs		4			8			2			6	
Phs Duration (G+Y+Rc), s		94.0			94.0			26.0			26.0	
Change Period (Y+Rc), s		4.0			4.0			4.0			4.0	
Max Green Setting (Gmax), s		90.0			90.0			22.0			22.0	
Max Q Clear Time (g_c+I1), s		92.0			74.5			13.6			24.0	
Green Ext Time (p_c), s		0.0			14.8			2.0			0.0	

Intersection Summary												
HCM 2010 Ctrl Delay			50.9									
HCM 2010 LOS			D									

Notes

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	532	1308	112	187	1317	627	133	352	104	381	249	382
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	186.3	186.3	186.3	186.3	186.3	186.3	186.3	186.3	186.3	186.3	186.3	186.3
Lanes	2	2	1	2	2	1	2	1	1	2	1	1
Cap, veh/h	545	1740	740	257	1428	607	201	388	330	402	497	422
Arrive On Green	0.32	0.93	0.93	0.07	0.38	0.38	0.06	0.21	0.21	0.12	0.27	0.27
Sat Flow, veh/h	3442	3725	1583	3442	3725	1583	3442	1863	1583	3442	1863	1583
Grp Volume(v), veh/h	578	1422	122	203	1432	682	145	383	113	414	271	415
Grp Sat Flow(s),veh/h/ln	1721	1863	1583	1721	1863	1583	1721	1863	1583	1721	1863	1583
Q Serve(g_s), s	19.0	12.8	0.6	7.0	46.0	32.3	5.0	24.6	7.3	14.0	15.0	31.3
Cycle Q Clear(g_c), s	19.0	12.8	0.6	7.0	46.0	32.3	5.0	24.6	7.3	14.0	15.0	31.3
Prop In Lane	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Lane Grp Cap(c), veh/h	545	1740	740	257	1428	607	201	388	330	402	497	422
V/C Ratio(X)	1.06	0.82	0.16	0.79	1.00	1.12	0.72	0.99	0.34	1.03	0.55	0.98
Avail Cap(c_a), veh/h	545	1740	740	258	1428	607	201	388	330	402	497	422
HCM Platoon Ratio	2.00	2.00	2.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	0.43	0.43	0.43	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Uniform Delay (d), s/veh	41.0	2.5	1.2	54.6	37.0	18.3	55.5	47.3	40.5	53.0	37.8	43.7
Incr Delay (d2), s/veh	43.2	1.4	0.0	15.2	24.5	75.5	12.0	42.5	2.8	53.1	4.3	39.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	10.2	1.7	0.2	3.6	25.7	24.4	2.6	16.3	3.1	9.2	7.7	17.0
Lane Grp Delay (d), s/veh	84.2	3.9	1.3	69.8	61.5	93.8	67.6	89.9	43.3	106.1	42.0	83.5
Lane Grp LOS	F	A	A	E	F	F	E	F	D	F	D	F
Approach Vol, veh/h		2122			2317			641			1100	
Approach Delay, s/veh		25.6			71.7			76.6			81.8	
Approach LOS		C			E			E			F	

Timer												
Assigned Phs	7	4		3	8		5	2		1	6	
Phs Duration (G+Y+Rc), s	23.0	60.0		13.0	50.0		11.0	29.0		18.0	36.0	
Change Period (Y+Rc), s	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Max Green Setting (Gmax), s	19.0	56.0		9.0	46.0		7.0	25.0		14.0	32.0	
Max Q Clear Time (g_c+I1), s	21.0	14.8		9.0	48.0		7.0	26.6		16.0	33.3	
Green Ext Time (p_c), s	0.0	15.6		0.0	0.0		0.0	0.0		0.0	0.0	

Intersection Summary	
HCM 2010 Ctrl Delay	58.2
HCM 2010 LOS	E

Notes

Intersection	
Intersection Delay, s/veh	1

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Vol, veh/h	1992	75	75	1717	0	60
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	200	200	-	-	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2165	82	82	1866	0	65

Major/Minor	Major1		Major2		Minor1	
Conflicting Flow All	0	0	2165	0	3261	1083
Stage 1	-	-	-	-	2165	-
Stage 2	-	-	-	-	1096	-
Follow-up Headway	-	-	2.22	-	3.52	3.32
Pot Capacity-1 Maneuver	-	-	244	-	7	213
Stage 1	-	-	-	-	73	-
Stage 2	-	-	-	-	282	-
Time blocked-Platoon, %	-	-		-		
Mov Capacity-1 Maneuver	-	-	244	-	5	213
Mov Capacity-2 Maneuver	-	-	-	-	5	-
Stage 1	-	-	-	-	73	-
Stage 2	-	-	-	-	187	-

Approach	EB	WB	NB
HCM Control Delay, s	0	1.1	29.2
HCM LOS			D

Minor Lane / Major Mvmt	NBLn1	EBT	EBR	WBL	WBT
Capacity (veh/h)	213	-	-	244	-
HCM Lane V/C Ratio	0.306	-	-	0.334	-
HCM Control Delay (s)	29.2	-	-	26.982	-
HCM Lane LOS	D			D	
HCM 95th %tile Q(veh)	1.241	-	-	1.408	-

Notes
~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1942	100	100	1697	150	100
Number	4	14	3	8	5	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	186.3	186.3	186.3	186.3	186.3	186.3
Lanes	2	1	1	2	1	1
Cap, veh/h	2927	1244	200	2927	253	226
Arrive On Green	1.00	1.00	1.00	1.00	0.14	0.14
Sat Flow, veh/h	3725	1583	173	3725	1774	1583
Grp Volume(v), veh/h	2111	109	109	1845	163	109
Grp Sat Flow(s),veh/h/ln	1863	1583	173	1863	1774	1583
Q Serve(g_s), s	0.0	0.0	0.0	0.0	9.7	7.1
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	9.7	7.1
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	2927	1244	200	2927	253	226
V/C Ratio(X)	0.72	0.09	0.55	0.63	0.64	0.48
Avail Cap(c_a), veh/h	3193	1357	212	3193	253	226
HCM Platoon Ratio	2.00	2.00	2.00	2.00	1.00	1.00
Upstream Filter(I)	1.00	1.00	0.69	0.69	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	0.0	0.0	45.3	44.2
Incr Delay (d2), s/veh	0.7	0.0	1.8	0.2	11.9	7.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	0.3	0.0	0.1	0.1	5.3	3.3
Lane Grp Delay (d), s/veh	0.7	0.0	1.8	0.2	57.2	51.4
Lane Grp LOS	A	A	A	A	E	D
Approach Vol, veh/h	2220			1954	272	
Approach Delay, s/veh	0.7			0.3	54.9	
Approach LOS	A			A	D	

Timer						
Assigned Phs	4			8		
Phs Duration (G+Y+Rc), s	92.0			92.0		
Change Period (Y+Rc), s	4.0			4.0		
Max Green Setting (Gmax), s	96.0			96.0		
Max Q Clear Time (g_c+I1), s	2.0			2.0		
Green Ext Time (p_c), s	86.0			86.0		

Intersection Summary						
HCM 2010 Ctrl Delay			3.9			
HCM 2010 LOS			A			

Notes

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Volume (veh/h)	1922	100	100	1747	75	50
Number	4	14	3	8	5	12
Initial Q (Qb), veh	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)		1.00	1.00		1.00	1.00
Parking Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow veh/h/ln	186.3	186.3	186.3	186.3	186.3	186.3
Lanes	2	1	1	2	1	1
Cap, veh/h	2156	916	300	2625	356	318
Arrive On Green	1.00	1.00	0.16	1.00	0.20	0.20
Sat Flow, veh/h	3725	1583	1774	3725	1774	1583
Grp Volume(v), veh/h	2089	109	109	1899	82	54
Grp Sat Flow(s),veh/h/ln	1863	1583	1774	1863	1774	1583
Q Serve(g_s), s	0.0	0.0	0.0	0.0	3.3	2.4
Cycle Q Clear(g_c), s	0.0	0.0	0.0	0.0	3.3	2.4
Prop In Lane		1.00	1.00		1.00	1.00
Lane Grp Cap(c), veh/h	2156	916	300	2625	356	318
V/C Ratio(X)	0.97	0.12	0.36	0.72	0.23	0.17
Avail Cap(c_a), veh/h	3655	1553	328	4183	356	318
HCM Platoon Ratio	2.00	2.00	2.00	2.00	1.00	1.00
Upstream Filter(I)	0.61	0.61	0.22	0.22	1.00	1.00
Uniform Delay (d), s/veh	0.0	0.0	20.4	0.0	28.3	28.0
Incr Delay (d2), s/veh	4.0	0.0	0.2	0.1	1.5	1.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0
%ile Back of Q (50%), veh/ln	1.2	0.0	1.9	0.0	1.6	1.0
Lane Grp Delay (d), s/veh	4.0	0.0	20.5	0.1	29.8	29.1
Lane Grp LOS	A	A	C	A	C	C
Approach Vol, veh/h	2198			2008	136	
Approach Delay, s/veh	3.8			1.2	29.5	
Approach LOS	A			A	C	

Timer						
Assigned Phs	4		3	8		
Phs Duration (G+Y+Rc), s	48.5		10.6	59.2		
Change Period (Y+Rc), s	4.0		4.0	4.0		
Max Green Setting (Gmax), s	83.0		8.0	95.0		
Max Q Clear Time (g_c+I1), s	2.0		2.0	2.0		
Green Ext Time (p_c), s	38.1		5.2	31.7		

Intersection Summary	
HCM 2010 Ctrl Delay	3.4
HCM 2010 LOS	A

Notes

Intersection	
Intersection Delay, s/veh	2.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	50	50	50	514	438	55
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	100	200	-	-	200
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	54	54	54	559	476	60

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1143	476	476	0	-	0
Stage 1	476	-	-	-	-	-
Stage 2	667	-	-	-	-	-
Follow-up Headway	3.518	3.318	2.218	-	-	-
Pot Capacity-1 Maneuver	221	589	1086	-	-	-
Stage 1	625	-	-	-	-	-
Stage 2	510	-	-	-	-	-
Time blocked-Platoon, %				-	-	-
Mov Capacity-1 Maneuver	210	589	1086	-	-	-
Mov Capacity-2 Maneuver	210	-	-	-	-	-
Stage 1	625	-	-	-	-	-
Stage 2	485	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	19.9	0.8	0
HCM LOS	C		

Minor Lane / Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	1086	-	210	589	-	-
HCM Lane V/C Ratio	0.05	-	0.259	0.092	-	-
HCM Control Delay (s)	8.489	-	28	11.7	-	-
HCM Lane LOS	A		D	B		
HCM 95th %tile Q(veh)	0.158	-	0.996	0.304	-	-

Notes
~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection	
Intersection Delay, s/veh	3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	40	50	190	20	60	148
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	43	54	207	22	65	161

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	508	217	0	0	228	0
Stage 1	217	-	-	-	-	-
Stage 2	291	-	-	-	-	-
Follow-up Headway	3.518	3.318	-	-	2.218	-
Pot Capacity-1 Maneuver	525	823	-	-	1340	-
Stage 1	819	-	-	-	-	-
Stage 2	759	-	-	-	-	-
Time blocked-Platoon, %			-	-		-
Mov Capacity-1 Maneuver	497	823	-	-	1340	-
Mov Capacity-2 Maneuver	497	-	-	-	-	-
Stage 1	819	-	-	-	-	-
Stage 2	719	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	11.7	0	2.3
HCM LOS	B		

Minor Lane / Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	637	1340	-
HCM Lane V/C Ratio	-	-	0.154	0.049	-
HCM Control Delay (s)	-	-	11.7	7.824	0
HCM Lane LOS			B	A	A
HCM 95th %tile Q(veh)	-	-	0.54	0.153	-

Notes
~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Intersection	
Intersection Delay, s/veh	2.2

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Vol, veh/h	50	40	60	489	448	100
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	100	0	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	54	43	65	532	487	109

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	1203	541	596	0	-	0
Stage 1	541	-	-	-	-	-
Stage 2	662	-	-	-	-	-
Follow-up Headway	3.518	3.318	2.218	-	-	-
Pot Capacity-1 Maneuver	204	541	980	-	-	-
Stage 1	583	-	-	-	-	-
Stage 2	513	-	-	-	-	-
Time blocked-Platoon, %				-	-	-
Mov Capacity-1 Maneuver	185	541	980	-	-	-
Mov Capacity-2 Maneuver	185	-	-	-	-	-
Stage 1	583	-	-	-	-	-
Stage 2	465	-	-	-	-	-

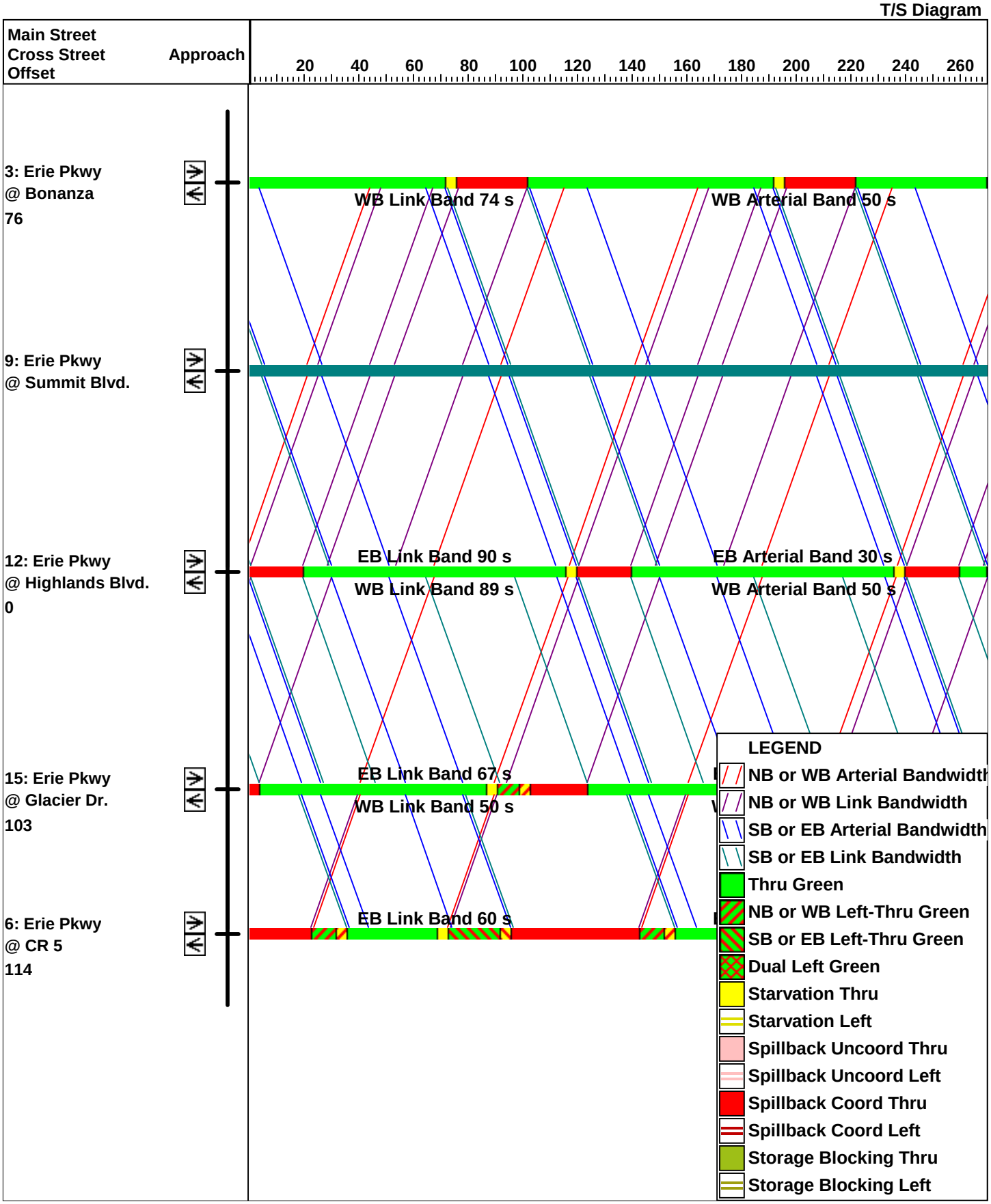
Approach	EB	NB	SB
HCM Control Delay, s	23.4	1	0
HCM LOS	C		

Minor Lane / Major Mvmt	NBL	NBT	EBLn1	EBLn2	SBT	SBR
Capacity (veh/h)	980	-	185	541	-	-
HCM Lane V/C Ratio	0.067	-	0.294	0.08	-	-
HCM Control Delay (s)	8.935	0	32.4	12.2	-	-
HCM Lane LOS	A	A	D	B		
HCM 95th %tile Q(veh)	0.213	-	1.165	0.261	-	-

Notes
~ : Volume Exceeds Capacity; $: Delay Exceeds 300 Seconds; Error : Computation Not Defined

Erie Highlands

2035 PM Peak Hour
T/S Diagram



JMWA
Aldridge Transportation Consultants, LLC

8/22/2013

EXHIBIT E

Town of Erie
Open Space and Trails Advisory Board

From: Town of Erie Open Space and Trails Advisory Board (OSTAB)
To: Deborah Bachelder, Senior Planner, Community Development
Date: September 1, 2015

Subject: Erie Highlands Planning Areas 5, 6 & 14: Sketch Plan
Location: South of Erie Parkway, between WCR 5 and WCR 3

OSTAB has reviewed the package materials, compared them to Town planning documents, and has prepared the following comments, questions, and recommendations for consideration in evaluating this project.

The Natural Areas Inventory (NAI):

Discussion: In 2008, the Town engaged Walsh Environmental Scientists and Engineers of Boulder, Colorado, to identify and evaluate the natural areas within the Town's planning area. Over 125 areas were evaluated. Based upon a variety of characteristics, a numerical "summary rating" was calculated, and the habitat quality of each site was categorized as high, medium, or low. There are no NAI sites located within this application.

Recommendations: None

Open Space:

Discussion:. Paragraph C of Section 10.6.3 of the Unified Development Code (UDC) defines the open space requirements for residential development, including not less than 17 acres of open space land shall be dedicated for each 1,000 ultimate residents. The UDC also defines standard criteria for open space, and areas not eligible. Standard criteria include:

1. "A minimum of 10 contiguous acres";
2. "A parcel that is no less than 300 feet wide at the narrowest width, unless the Town approves a lesser amount for a trail";
3. "Typically, open space shall be owned and maintained by the Town. The Town may consider a conservation easement as an alternative".

Areas not eligible include:

1. "Oil and gas well sites and required buffers";
2. "Storm water channels, detention and water quality ponds greater than 5 feet deep with slopes greater than 5:1."

Sheet 2 of the PUD indicates that the required open space is 47.15 acres, and the acres to be provided is 32.65 plus fee-in-lieu. It appears that some of the proposed open space in both PA 5 and PA 6 does not meet the 300 foot width requirement. There are also 4 proposed detention basins: PA 2/14, PA 5/14, PA 5 and PA 6. We do not know if these proposed deletion basins meet the slope requirements stated above.

Sheet 3 of the Sketch Plan has both an overlay and a chart comparing the open space areas in the PUD and this Sketch Plan. There are both inconsistencies and confusing issues in these comparisons:

1. The chart indicates that PA 14-B is public open space in the PUD, but the Sketch Plan overlay shows that this will NOT be public open space. Which is correct?

2. The overlay shows that the SW corner of PA 2 is public open space in the PUD, but the Sketch Plan overlay shows that this will NOT be public open space. Which is correct?
3. The Sketch Plan does not show if there is a detention basin in PA 2/14, and eliminates the detention basin in PA 6. Is this correct?
4. The Sketch Plan changes the configuration of the open space in PA 6, which appears to increase the amount of open space that does not meet the 300 minimum width defined in the UDC. We are against any reduction in qualified open space.

Recommendations:

1. Resolve all inconsistencies between the PUD and the Sketch Plan as described above in the Discussion section;
2. Do not reduced the amount of public open space that meets all the requirements in the UDC.

Trails:

Discussion: The Narrative (section h) states that "Trails connecting to regional connections and throughout the community will be included in the open space areas being dedicated to the town". Both Sheet 2 of the PUD Plan and the Concept Plan have a connector trail at the west end of PA 14 to Grandview, and a connector trail at the southern end of PA 6 to Sunset. However, neither Sheets 2 (Land Use Plan) nor Sheet 3 (Open Space Plan) in this Sketch Plan have any connecting trails to adjacent properties. That must be corrected.

Both Sheet 2 of the PUD Plan and the Concept Plan have a trail on the south side of Indian Peaks Drive in PA 6 that will be a primary walkway to the school-park site. However, neither Sheets 2 nor Sheet 3 in this Sketch Plan have this trail. For reasons of safety and usability, that trail should be paved, 8 feet wide, and separated from the street by a landscaped strip.

The Narrative (section a) states that "The neighborhood is organized around the south side of the school-park site with trail connectors through the open space corridor. The PUD plan has more connectors from the trail in the open space areas to various streets than Sheets 2 and 3 of the Sketch Plan. The following connectors in the PUD Plan are omitted from this Sketch Plan:

1. PA 5, NW portion, connector to Indian Peaks Drive;
2. PA 5, south central portion, connector in the middle of an unnamed street with roughly a dozen lots;
3. PA 6, SW portion, connector at the intersection of 2 unnamed streets.

The Sketch Plan should not eliminate any trails that are in the PUD.

Recommendations:

1. Add trail connections to adjacent properties to the west of PA 14 and the south of PA 6, to match the PUD;
2. Add a trail along the south side of Indian Peaks Drive as described above in the Discussion;
3. Add trail connections from the trail in the open space to adjacent streets to match the PUD, as described above in the Discussion.

Please pass this referral letter to the Applicant, and appropriate town departments, boards, and commissions. Thank you for your attention to these matters. OSTAB is available to discuss any of the above in more detail as needed.

Sincerely,

Open Space and Trails Advisory Board

Denise Brady
Kevin Chard
Dawn Fraser
Monica Kash

Nicole Littman
Ken Martin (Chair)
Joe Martinez