FINAL DRAINAGE LETTER

FOR

LOT 35, CLAREMONT BUSINESS PARK FILING NO. 2 EL PASO COUNTY, COLORADO

OCTOBER 2017

Prepared for:

Hammers Construction, Inc.
1411 Woolsey Heights
Colorado Springs, CO 80915

Prepared by:

CIVIL CONSULTANTS, INC.

20 Boulder Crescent, Suite 110
Colorado Springs, CO 80903
(719) 955-5485

Project #44-029
PCD Project No. PPR-17-000

PPR-17-056

Replace with the County standard statement:
The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the applicable master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report

Lot 1

DRAINAGE PLAN STATEMENTS

ENGINEERS STATEMENT

The attached drainage plan and report was prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria acceptable to the City of Colorado Springs. I accept responsibility for any liability caused by any negligent acts, errors of omission on my part in preparing this report.

_____
Virgil A. Sanchez, P.E. #37160
For and on Behalf of M&S Civil Consultants, Inc

DEVELOPER'S STATEMENT

I, the developer have read and will comply with all the requirements specified in this drainage report and plan.

BY:_____

TITLE:_____
DATE:_____

ADDRESS: Hammers Construction, LLC
1411 Woolsey Heights
Colorado Springs, CO 80915

El Paso County Criteria Manual

EL PASO COUNTY'S STATEMENT

Filed in accordance with the requirements of El Paso County Land Development Code, Drainage Criteria Manual Volumes 1 and 2, and the Engineering Manual, as amended.

BY:_____ DATE:_____
Jennifer Irvine, P.E.
County Engineer / ECM Administrator

CONDITIONS:

CIVIL CONSULTANTS, INC.

20 Boulder Crescent, Suite 110
Colorado Springs, CO 80903
Mail to: P.O. Box 1360
Colorado Springs, CO 80901
719.955.5485

October 30, 2017

Attn: Jennifer Irvine, P.E.
El Paso County Engineer
2880 International Circle
Colorado Springs, Colorado 80910

RE: Final Drainage Letter for Lot 35, Claremont Business Park Filing No. 2, in El Paso County, Colorado.

Dear Jennifer,

The purpose of this letter is to show that there shall be no negative drainage effects associated with the proposed development of Lot 35 within the Claremont Business Park Filing No. 2, recorded January 4, 2007 under Reception No. 207712506 of the El Paso County Records. This final drainage letter is being submitted concurrently with the improvement construction plans proposing a 6,250 SF building and the associated parking improvements.

Property Description:

The proposed project site is within the Northeast Quarter of Section 8, Township 14 South, Range 65 West of the 6th Principal Meridian. Lot 35 consist of 0.5 acres and is currently vacant. The proposed project consist of all infrastructure typically associated with a 6,250 SF building structure. The majority of the site will consist of asphalt, curb, lighting, a Storm Water Quality Facility (Permeable Pavement System) and landscaping.

Existing Drainage Characteristics:

The site, which is located West of Meadowbrook Parkway, within an established commercial / light industrial neighborhood is bound to the Southeast by Cole View private roadway, and then to the Northeast and Southwest by commercial Lots 34 and 36, and then to the Northwest by the existing East Fork Sand Creek Channel. The site is currently vacant land with a relatively new roadway infrastructure and associated utilities with slopes ranging between 0-4% from East to West. Flows from the site run in a sheet-flow manner from East to West to the West property line to an existing curb where flows continue southerly through an existing curb chase onto Lot 34 and then eventually ou
Southwest corner of Lot 33 and ultimately di

Update and include the LOMR:
... and as amended by the FEMA approved Letter of Map Revsion (LOMR) case number _____ dated _____...

Floodplain Statement:

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) No. 08041C0756 F, dated March 17, 1997, none of the site lies in a designated flood plain. The nearest major drainage way is East Fork Sand Creek just Northwest of the commercial business park.

Proposed drainage characteristics:

The proposed project consist of all infrastructure typically associated with a 6,250 SF building structure. The majority of the site will consist of asphalt, curb, lighting, a Storm Water Quality Facility (Permeable Pavement System) and landscaping. The subject site was previously analyzed within the Final Drainage Report for Claremont Business Park Filing No. 2 prepared by Matrix Design Group approved April 24, 2007. On-site WQCV is required but on-site stormwater detention is not required per the FDR for Claremont Business Park Fil. 2.

The post-developed flows from Lot 35 (to include the North half of the building roof) shall be directed to a Storm Water Quality Facility (Permeable Pavement System) at the West property line. (See grading plan included within this report).

Flows released from the Storm Water Quality Facility and any additional overflow shall outfall to a 3' wide curb opening at the West corner of the site and then continue along the existing curb line along the West property line of Lots 34 & 33 and eventually outfalls to an existing storm sewer collection system at the Southwest corner of Lot 33 then ultimately discharges to the East Fork Sand Creek.

Pre-developed flows from the currently vacant Lot 36 (Northeast) shall flow via the existing curb along the West property line and outfall through the 3' wide curb opening at the West property corner of Lot 35. Upon the time of development of Lot 36, post-developed flows shall be analyzed and shall be designed to ensure there are no adverse effects to the improvements to Lot 35.

FOUR STEP PROCESS

Step1 Employ Runoff Reduction Practices – The project does not provide any runoff reduction practices.

Step 2 Stabilize Drainageways – The site is directly adjacent to the Sand Creek Channel. The Lot 35 site proposed a Storm Water Quality Facility (Permeable Pavement System) before discharging East Fork Sand Creek. The proposed WQ system has been designed to drain a peak event within 12 hours, therefore is not anticipated to have negative effects on downstream drainageways.

Step 3 Provide Water Quality Capture Volume – A Storm Water Quality Facility (Permeable Pavement System) is proposed to provide WQCV.

Step4 Consider Need for Industrial and Commercial BMP's – This submittal provides a final grading and erosion control plans with BMPs in place. The proposed project will use silt fence, a vehicle tracking control pad, a concrete washout area, mulching and reseeding to mitigate the potential for erosion across the site.

Water Quality Provisions:

Does not match the plans.

Lot 35's on-site WQCV shall be directed to a Storm Water Quality Facility (Permeable Pavement System) as detailed within the grading plans. (See grading plan included within this report). The percolation test findings per the Percolation Test by Geoquest, LLC dated October 13, 2016 (included within the report), conclude that the test holes drained at a rate of 16-20 minutes per inch. Using the conservative 16.0min/in for the 24 inches of permeable pavement storage the detention should drain in 3.5 hours

The proposed Water Quality Facility is a Full Infiltration section as detailed in the UDFCD Permeable Pavement Systems; and therefore no underdrain system is required. Flows released from the Storm Water Quality Facility and any additional overflow shall outfall to a 3' wide curb opening at the West corner of the site and then continue along the existing curb line along the West property line of Lots 34 & 33 and eventually outfalls to an existing storm sewer collection system at the Southwest corner of Lot 33 then ultimately discharges to the East Fork Sand Creek.

Private Water Quality Facility - Cost Estimate:

Private Water Quality Facility (Permeable Pavement System): **$8,000.00**

Drainage fees:

No drainage fees are due as the site has been previous platted.

Conclusion:

No negative drainage effects associated with the proposed development of Lot 35 within the Claremont Business Park Filing No. 2.

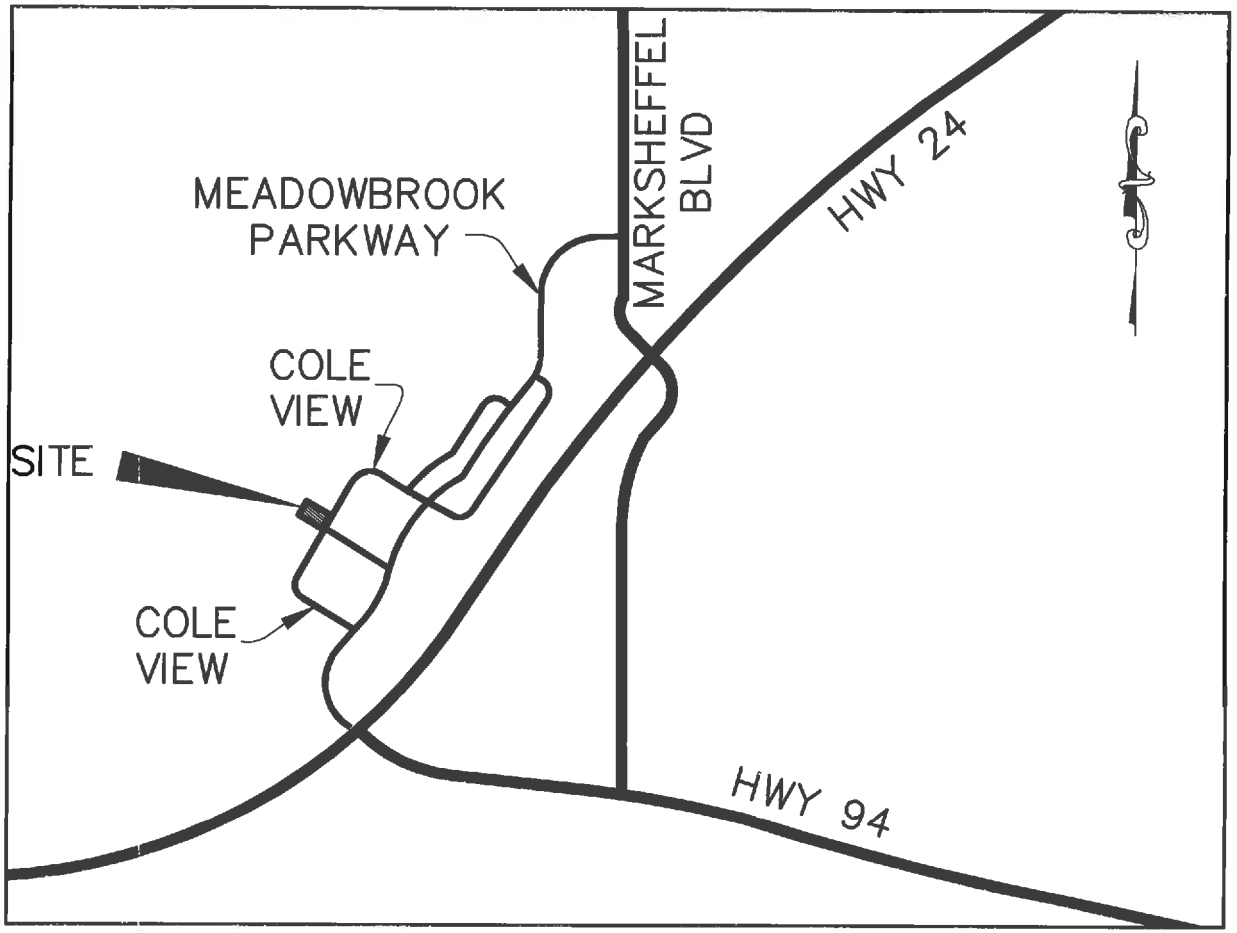
This proposal does not conflict or change the specifications as previously detailed within the "Final Drainage Report for Claremont Business Park Filing No. 2" prepared by Matrix Design Group approved April 24, 2007.

This letter has been prepared according to the County drainage criteria and is being submitted for approval. If you have any question about this submittal, please feel free to call me at 719-491-0818 or email me at Virgils@mscivil.com

Sincerely,

Virgil A. Sanchez

VICINITY MAP



VICINITY MAP

N.T.S.

PERMEABLE PAVEMENT SYSTEM

Permeable Pavement Systems T-10

Description

The term *Permeable Pavement System*, as used in this manual, is a general term to describe any one of several pavements that allow movement of water into the layers below the pavement surface. Depending on the design, permeable pavements can be used to promote volume reduction, provide treatment and slow release of the water quality capture volume (WQCV), and reduce effective imperviousness. Use of permeable pavements is a common Low Impact Development (LID) practice and is often used in combination with other BMPs to provide full treatment and slow release of the WQCV. A number of installations within the UDFCD boundary have also been designed with an increased depth of aggregate material in order to provide storage for storm events in excess of the water quality (80th percentile) storm event. This requires some additional design considerations, which are discussed within this BMP Fact Sheet.

Photograph PPS-1. The reservoir layer of a permeable pavement provides storage volume for the WQCV. Photo courtesy of Muller Engineering and Jefferson County Open Space.

Permeable Pavement	
Functions	
LID/Volume Red.	Yes
WQCV	Yes
WQCV+Flood Control	Yes
Fact Sheet Includes EURV Guidance	No
Typical Effectiveness for Targeted Pollutants[3]	
Sediment/Solids	Very Good[1]
Nutrients	Good
Total Metals	Good
Bacteria	Unknown
Other Considerations	
Life-cycle Costs[4]	High[2]

[1] Not recommended for watersheds with high sediment yields (unless pretreatment is provided).

[2] Does not consider the life cycle cost of the conventional pavement that it replaces.

[3] Based primarily on data from the International Stormwater BMP Database (www.bmpdatabase.org).

[4] Based primarily on BMP-REALCOST available at www.udfcd.org. Analysis based on a single installation (not based on the maximum recommended watershed tributary to each BMP).

Site Selection

This infiltrating BMP requires consultation with a geotechnical engineer when proposed near a structure. In addition to providing the pavement design, a geotechnical engineer can assist with evaluating the suitability of soils, identifying potential impacts, and establishing minimum distances between the BMP and structures.

Permeable pavement systems provide an alternative to conventional pavement in pedestrian areas and lower-speed vehicle areas. They are not appropriate where sediment-laden runoff could clog the system (e.g., near loose material storage areas).

This BMP is not appropriate when erosive conditions such as steep slopes and/or sparse vegetation drain to the permeable pavement. The sequence of construction is also important to preserve pavement infiltration. Construction of the pavement should take place only after construction in the watershed is complete.

For sites where land uses or activities can cause infiltrating stormwater to contaminate groundwater, special design requirements are required to ensure no-infiltration from the pavement section.

Permeable pavements and other BMPs used for infiltration that are located adjacent to buildings, hardscape or conventional pavement areas can adversely impact those structures if protection measures are not provided. Wetting of subgrade soil underlying those structures can cause the structures to settle or result in other moisture-related problems. Wetting of potentially expansive soils or bedrock can cause those materials to swell, resulting in structure movements. In general, a geotechnical engineer should evaluate the potential impact of the BMP on adjacent structures based on an evaluation of the subgrade soil, groundwater, and bedrock conditions at the site. In addition, the following minimum requirements should be met:

- In locations where subgrade soils do not allow infiltration, the pavement section should include an underdrain system.
- Where infiltration can adversely impact adjacent structures, the filter layer should be underlain by an underdrain system designed to divert water away from the structure.
- In locations where potentially expansive soils or bedrock exist, placement of permeable pavement adjacent to structures and conventional pavement should only be considered if the BMP includes an underdrain designed to divert water away from the structure and is lined with an essentially impermeable geomembrane liner designed to restrict seepage.

Designing for Maintenance

Recommended ongoing maintenance practices for all BMPs are provided in the BMP Maintenance chapter of this manual. During design and construction, the following should be considered to ensure ease of maintenance over the long-term:

- Hold a pre-construction meeting to ensure that the contactor has an understanding of how the pavement is intended to function. Discuss the contractor's proposed sequence of construction and look for activities that may require protection of the permeable pavement system.
- Ensure that the permeable pavement is protected from construction activities following pavement construction (e.g., landscaping operations). This could include covering areas of the pavement, providing alternative construction vehicle access, and providing education to all parties working on-site.
- Include an observation well to monitor the drain time of the pavement system over time. This will assist with determining the required maintenance needs. See Figure PPS-8.

Benefits

- Permeable pavement systems provide water quality treatment in an area that serves more than one purpose. The depth of the pavement system can also be increased to provide flood control.
- Permeable pavements can be used to reduce effective imperviousness or alleviate nuisance drainage problems.
- Permeable pavements benefit tree health by providing additional air and water to nearby roots.
- Permeable pavements are less likely to form ice on the surface than conventional pavements.
- Some permeable pavements can be used to achieve LEED credits.

Limitations

- Additional design and construction steps are required for placement of any ponding or infiltration area near or upgradient from a building foundation, particularly when potentially expansive soils exist. This is discussed in the design procedure section.
- In developing or otherwise erosive watersheds, high sediment loads can clog the facility.

- Call for construction fence on the plans around pervious areas where infiltration rates need to be preserved and could be reduced by compaction from construction traffic or storage of materials.

Example Construction Drawing Notes

- Excavation of subgrade shall not commence until after the pre-construction meeting.
- Subgrade shall be excavated using low ground pressure (LGP) track equipment to minimize over compaction of the subgrade. [1]
- Grading and compaction equipment used in the area of the permeable pavement should be approved by the engineer prior to use.
- Loose materials shall not be stored on the permeable pavement area.
- The contractor shall, at all times during and after system installation, prevent sediment, debris, and dirt from any source from entering the permeable pavement system.
- Placement of the wearing course shall be performed after fine grading and landscaping in adjacent areas is complete. If the wearing course becomes clogged due to construction activities, clean the surface with a vacuum machine to restore the infiltration rate after construction is complete.

[1] For partial and full infiltration sections only.

Add these notes in the GEC plan set.

Design Procedure and Criteria

Note: This manual includes a variety of specific pavements, which are discussed and distinguished in supplemental BMP Fact Sheets T-10.1, T-10.2, etc. This BMP Fact Sheet outlines the design procedure and other design components and considerations that are common to all of the systems. Review of the supplemental Fact Sheets is recommended to determine the appropriate pavement for a specific site or use.

1. **Subsurface Exploration and Determination of a No-Infiltration, Partial Infiltration, or Full Infiltration Section**: Permeable pavements can be designed with three basic types of sections. The appropriate section will depend on land use and activities, proximity to adjacent structures and soil characteristics. Sections of each installation type are shown in Figure PPS-1.

   - **No-Infiltration Section**: This section includes an underdrain and an impermeable liner that prevents infiltration of stormwater into the subgrade soils. Consider using this section when any of the following conditions exist:

     - Land use or activities could contaminate groundwater if stormwater is allowed to infiltrate.
     - Permeable pavement is located over potentially expansive soils or bedrock that could swell due to infiltration and potentially damage the permeable pavement system or adjacent structures (e.g., building foundation or conventional pavement).

- **Partial Infiltration Section**: This section does not include an impermeable liner, and allows some infiltration. Stormwater that does not infiltrate is collected and removed by an underdrain system.

- **Full Infiltration Section**: This section is designed to infiltrate the water stored in the voids of the pavement into the subgrade below. UDFCD recommends a minimum infiltration rate of 2 times the rate needed to drain the WQCV over 12 hours.

Subsurface Exploration and Testing for all Sections: A geotechnical engineer should scope and perform a subsurface study. Typical geotechnical investigation needed to select and design the pavement system for handling anticipated traffic loads includes:

- Prior to exploration review geologic and geotechnical information to assess near-surface soil, bedrock and groundwater conditions that may be encountered and anticipated ranges of infiltration rate for those materials. For example, if the site is located in a general area of known shallow, potentially expansive bedrock, a no-infiltration section will likely be required. It is also possible that this BMP may be infeasible, even with a liner, if there is a significant potential for damage to the pavement system or adjacent structures (e.g., areas of dipping bedrock).

- Drill exploratory borings or exploratory pits to characterize subsurface conditions beneath the subgrade and develop requirements for subgrade preparation. Drill at least one boring or pit for every 40,000 ft^2, and at least two borings or pits for sites between 10,000 ft^2 and 40,000 ft^2. The boring or pit should extend at least 5 feet below the bottom of the base, and at least 20 feet in areas where there is a potential of encountering potentially expansive soils or bedrock. More borings or pits at various depths may be required by the geotechnical engineer in areas where soil types may change, in low-lying areas where subsurface drainage may collect, or where the water table is likely within 8 feet below the planned bottom of the base or top of subgrade. Installation of temporary monitoring wells in selected borings or pits for monitoring groundwater levels over time should be considered where shallow groundwater that could impact the pavement system area is encountered.

- Perform laboratory tests on samples obtained from the borings or pits to initially characterize the subgrade, evaluate the possible section type, and to assess subgrade conditions for supporting traffic loads. Consider the following tests: moisture content (ASTM D 2216); dry density (ASTM D 2936); Atterberg limits (ASTM D 4318); gradation (ASTM D 6913); swell-consolidation (ASTM D 4546); subgrade support testing (R-value, CBR or unconfined compressive strength); and hydraulic conductivity. A geotechnical engineer should determine the appropriate test method based on the soil type.

- For sites where a full infiltration section may be feasible, perform on-site infiltration tests using a double-ring infiltrometer (ASTM D 3385). Perform at least one test for every 160,000 ft^2 and at least two tests for sites between 40,000 ft^2 and 160,000 ft^2. The tests should be located near completed borings or pits so the test results and subsurface conditions encountered in the borings can be compared, and at least one test should be located near the boring or pit showing the most unfavorable infiltration condition. The test should be performed at the planned top of subgrade underlying the permeable pavement system, and that subgrade should be prepared similar to that required for support of the permeable pavement system.

- Be aware that actual infiltration rates are highly variable dependent on soil type, density and moisture content and degree of compaction as well as other environmental and construction influences. Actual rates can differ an order of magnitude or more from those indicated by

infiltration or permeability testing. Selection of the section type should be based on careful assessment of the subsurface exploration and testing data.

2. **Required Storage Volume**: Provide the WQCV based on a 12-hour drain time.

   - Find the required WQCV (watershed inches of runoff). Using the effective impervious area of the watershed area, use Figure 3-2 located in Chapter 3 to determine the WQCV based on a 12-hour drain time. The maximum recommended ratio for tributary impervious area to permeable pavement area is 2.0. Higher loading is not recommended, as it may increase the required maintenance interval.

   - Calculate the design volume as follows:

$$V = \left[\frac{\text{WQCV}}{12}\right] A \qquad \text{Equation PPS-1}$$

   Where:

   A = watershed area tributary to the permeable pavement (ft^2)

   V = design volume (ft^3)

   - Add flood control volume if desired. When designing for flood control volumes, provide an overflow that will convey runoff in excess of the WQCV directly into the reservoir. A gravel strip or inlet that is connected to the reservoir can provide this overflow.

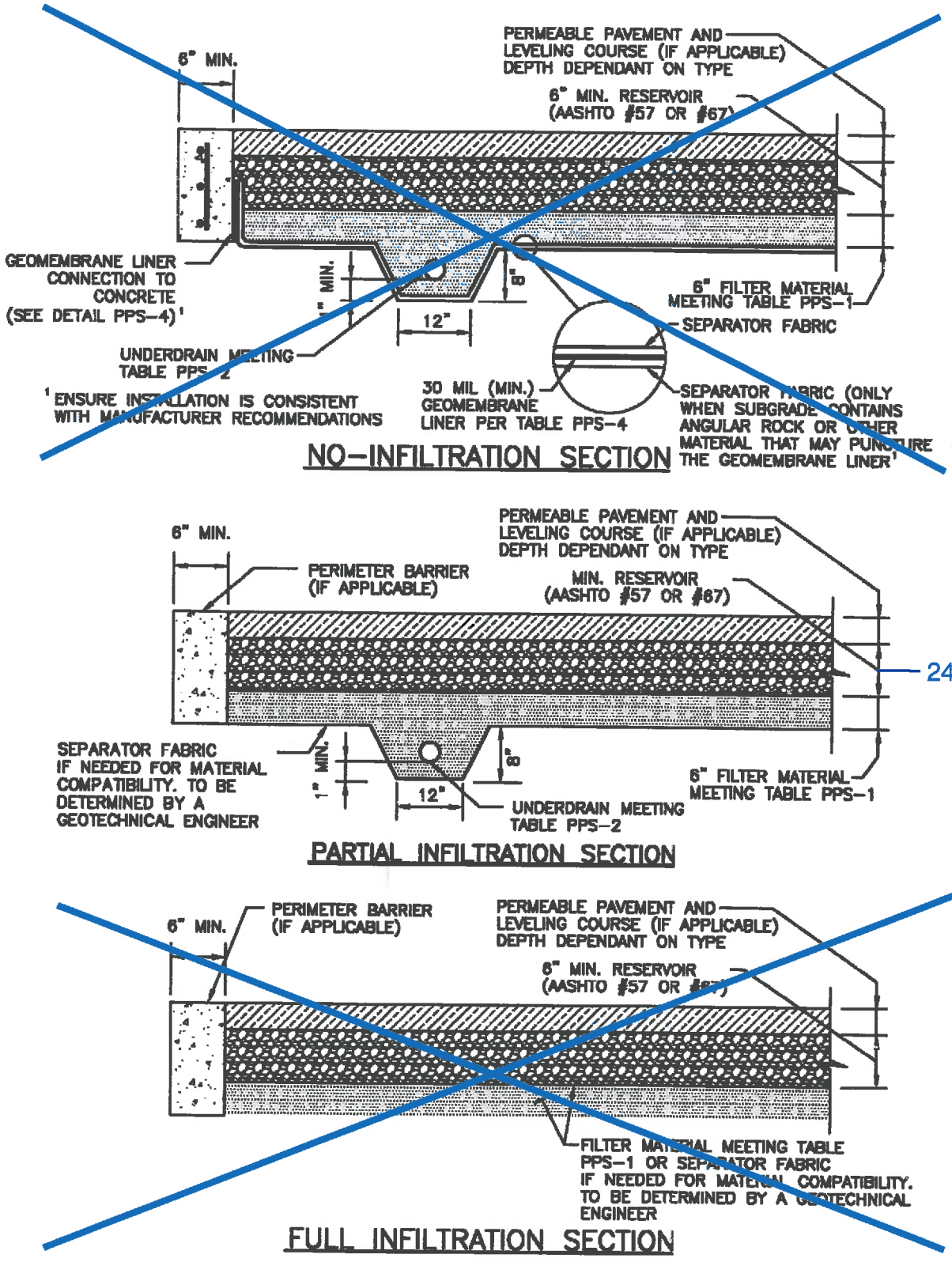


Figure PPS-1. Permeable Pavement Sections

MODIFIED

3. **Depth of Reservoir**: The minimum recommended depth of AASHTO No. 57 or No. 67 coarse aggregate is 6 inches. Additional depth may be required to support anticipated loads or to provide additional storage, (i.e., for flood control). This material should have all fractured faces. UDFCD recommends that void storage be calculated only for the reservoir, assuming the aggregate filter layer is saturated. With the exception of porous gravel pavement, use a porosity of 40% or less for both No. 57 and No. 67 coarse aggregate. For porous gravel pavement use a porosity of 30% or less to account for reduced volume due to sediment. Porous gravel pavements typically allow greater sediment volumes to enter the pavement. See Figures PPS-2 and PPS-3 for alternative pavement profiles. Calculate available storage using equation PPS-2 for a flat subgrade installation, and PPS-3 for a sloped subgrade installation. These equations allow for one inch of freeboard. Flat installations are preferred as the design spreads infiltration evenly over the subgrade. For sloped subgrade installations, the increased storage depth located upstream of the lateral barrier (see step 7) can increase lateral movement (parallel to the flow barrier) of water into areas adjacent to the pavement section.

   When used for vehicular traffic, a pavement design should be performed by a qualified engineer experienced in the design of permeable pavements and conventional asphalt and concrete pavements. The permeable pavement should be adequately supported by a properly prepared subgrade, properly compacted filter material and reservoir material.

   Reservoir aggregate should have all fractured faces. Place the aggregate in 6-inch (maximum) lifts, compacting each lift by using a 10-ton, or heavier, vibrating steel drum roller. Make at least four passes with the roller, with the initial passes made while vibrating the roller and the final one to two passes without vibration.

   - For flat or stepped installations (0% slope at the reservoir/subgrade interface):

$$V = P\left[\frac{D-1}{12}\right]A \qquad \text{Equation PPS-2}$$

   Where:

   V = volume available in the reservoir (ft^3)

   P = porosity, ≤0.30 for porous gravel, ≤0.4 for all other pavements using AASHTO No. 57 or No. 67 coarse aggregate in the reservoir

   D = depth of reservoir (in)

   A = area of the permeable pavement (ft^2)

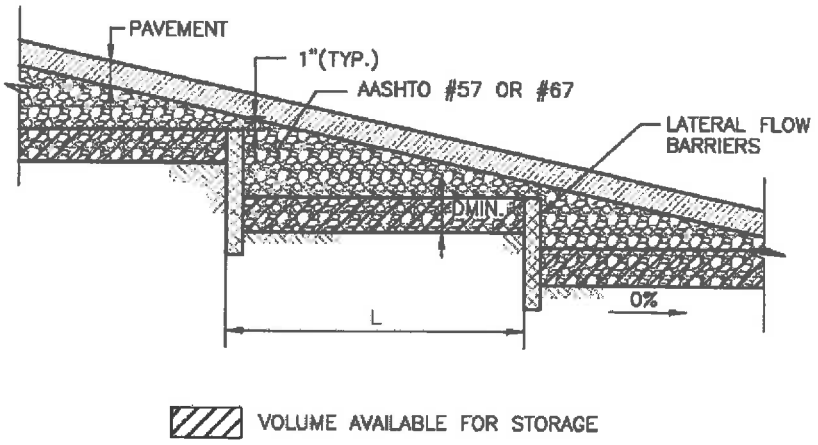


Figure PPS-2. Permeable Pavement Profile, Stepped Installation

- For sloped installations (slope of the reservoir/subgrade interface > 0%):

$$V = P\left[\frac{D - 6sL - 1}{12}\right]A \qquad \text{Equation PPS-3a}$$

While:

$$L < \frac{2\,\text{WQCV}}{sAP} \qquad \text{Equation PPS-3b}$$

Where:

V = volume available in the reservoir (ft^3)

P = porosity, ≤0.30 for porous gravel, ≤0.4 for all other pavements using AASHTO No. 57 or No. 67 coarse aggregate in the reservoir

s = slope of the reservoir/subgrade interface (ft/ft)

D = depth of the reservoir (in)

L = length between lateral flow barriers (see step 4) (ft)

A = area of the permeable pavement (ft^2)

WQCV = water quality capture volume (ft^3)

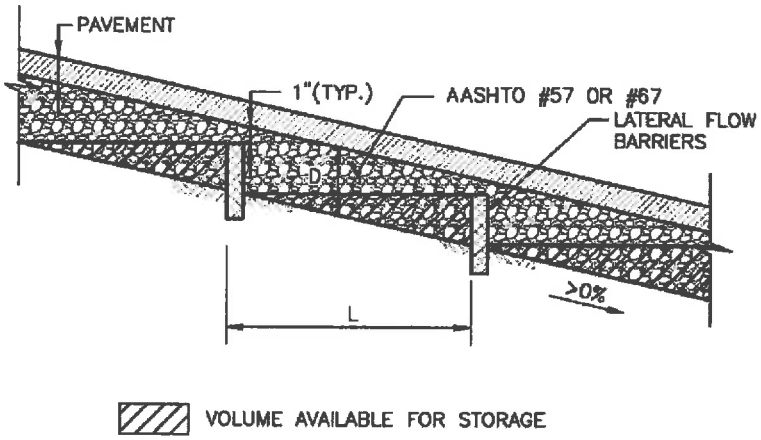


Figure PPS-3. Permeable Pavement Profile, Sloped Installation.

4. **Lateral Flow Barriers:** Construct lateral flow cutoff barriers using concrete walls or a 30 mil (minimum) PVC geomembrane. Lateral flow barriers should be placed parallel to contours (normal to flow). This will preserve the volume available for storage and ensure that stormwater will not resurface, washing out infill material. See Figure PPS-6 and Table PPS-4 when using a PVC geomembrane for this purpose. Also include a separator fabric, per Table PPS-3, between the geomembrane and all aggregate materials. Lateral flow barriers should be installed in all permeable pavement installations that have a reservoir/subgrade interface greater than 0%. Lateral flow barriers should be spaced, as necessary, to satisfy equations PPS-3a and PPS-3b. One exception is reinforced grass pavement. Infill washout is not a concern with reinforced grass pavement.

5. **Perimeter Barrier:** For all no-infiltration sections, provide a reinforced concrete barrier on all sides of the pavement system. Perimeter barriers may also be recommended for other permeable pavement installations depending on the type or use of the pavement. For PICP and concrete grid pavement, a barrier is required to restrain movement of the pavers or grids. Precast, cast-in-place concrete or cut stone barriers are required for commercial vehicular areas. For residential use and commercial pedestrian use, a metal or plastic edge spiked with 3/8-inch-diameter, 10-inch-long nails provides a less expensive alternative for edge restraint.

   For all pavements, consider the section beyond the permeable pavement when evaluating the perimeter design. The perimeter barrier helps force water into the underdrain and reduces lateral flow of water. Lateral flow can negatively impact the adjacent conventional pavement section, structure, or embankment (especially when the subgrade is sloped). Also consider material separation. Consider construction of the interface between the permeable pavement and the adjacent materials and how the design will prevent adjacent materials from entering the permeable pavement section. Depending on the soils, depth of pavement, and other factors, this may be achieved with fabric or may require a more formalized barrier.

   When a permeable pavement section is adjacent to conventional pavement, a vertical liner may be required to separate the reservoir of the permeable pavement system from dense-graded aggregates and soils within the conventional pavement. An impermeable linear can be used to provide this vertical barrier and separate these two pavement systems.

   No-Infiltration Section: For this type of section, the perimeter barrier also serves to attach the impermeable membrane. The membrane should extend up to the top of the filter layer and be firmly

attached to the concrete perimeter barrier using batten bars to provide a leak-proof seal. A nitrile-based vinyl adhesive can be used when the need for an impermeable liner is less critical. See Figures PPS-4 and PPS-5 for installation details. For ease of construction, including the placement of geotextiles, it is suggested that the barrier extend to the bottom of the filter layer.

Partial and Full Infiltration Section: The perimeter barrier for these sections also restricts lateral flow to adjacent areas of conventional pavement or other structures where excessive moisture and/or hydrostatic pressure can cause damage. When this is of particular concern, the perimeter barrier should be extended to a depth 12 inches or more below the underdrain. Otherwise, extend the barrier to the bottom of the filter layer.

6. **Filter Material and Underdrain System**: An aggregate filter layer and underdrain are required for all partial and no-infiltration sections. Without this filter layer, the section will not provide adequate pollutant removal. This is based on research performed by UDFCD monitoring sites with and without this component. A filter or separator fabric may also be necessary under the reservoir in a full infiltration section if the subgrade is not filter compatible with the reservoir material such that finer subgrade soils could enter into the voids of the reservoir.

   In previous versions of the USDCM, UDFCD recommended that the underdrain be placed in an aggregate drainage layer and that a geotextile separator fabric be placed between this drainage and the filter layer. This version of the USDCM replaces that fabric, which could more easily plug or be damaged during construction, with aggregate filter material that is filter-compatible with the reservoir, and a drainpipe with perforations that are filter-compatible with the filter material. This eliminates the need for a separator fabric between the reservoir and the underdrain layer. The filter material provided below should only be used with the underdrain pipe specified within this section.

   The underdrain should be placed below a 6-inch-thick layer of CDOT Class C filter material meeting the gradation in Table PPS-1. Extend the filter material around and below the underdrain as shown in Figure PPS-1.

   Provide clean-outs to allow inspection (by camera) of the drainpipe system during and after construction to ensure that the pipe was not crushed or disconnected during construction and to allow for maintenance of the underdrain.

   Use of Class C Filter material with a slotted PVC pipe that meets the slot dimensions provided in Table PPS-2 will eliminate the need for an aggregate layer wrapped geotextile fabric.

Design Opportunity

Pollutant removal occurs in the filter material layer of the section. The basic permeable pavement section may be considered with other wearing courses to provide water quality as long as:

- the filter layer is included in the section,
- the wearing course provides adequate permeability, and
- the new section does not introduce new pollutants to the runoff.

Table PPS-1. Gradation Specifications for Class C Filter Material (Source: CDOT Table 703-7)

Sieve Size	Mass Percent Passing Square Mesh Sieves
19.0 mm (3/4")	100
4.75 mm (No. 4)	60 – 100
300 µm (No. 50)	10 – 30
150 µm (No. 100)	0 – 10
75 µm (No. 200)	0 - 3

Table PPS-2. Dimensions for Slotted Pipe

Pipe Diameter	Slot Length[1]	Maximum Slot Width	Slot Centers[1]	Open Area[1] (per foot)
4"	1-1/16"	0.032"	0.413"	1.90 in^2
6"	1-3/8"	0.032"	0.516"	1.98 in^2

[1] Some variation in these values is acceptable and is expected from various pipe manufacturers. Be aware that both increased slot length and decreased slot centers will be beneficial to hydraulics but detrimental to the structure of the pipe.

Compact the filter layer using a vibratory drum roller or plate. The top of each layer below the leveling course must be uniform and should not deviate more than a ½ inch when a 10-foot straight edge is laid on its surface. The top of the leveling course should not deviate more than 3/8 inch in 10 feet.

7. **Impermeable Geomembrane Liner and Geotextile Separator Fabric:** For no-infiltration sections, install a 30 mil (minimum) PVC geomembrane liner, per Table PPS-4, on the bottom and sides of the basin, extending up at least to the top of the filter layer. Provide at least 9 inches (12 inches if possible) of cover over the membrane where it is attached to the wall to protect the membrane from UV deterioration. The geomembrane should be field-seamed using a dual track welder, which allows for non-destructive testing of almost all field seams. A small amount of single track and/or adhesive seaming should be allowed in limited areas to seam around pipe perforations, to patch seams removed for destructive seam testing, and for limited repairs. The liner should be installed with slack to prevent tearing due to backfill, compaction, and settling. Place CDOT Class B geotextile separator fabric, per Table PPS-3, above the geomembrane to protect it from being punctured during the placement of the filter material above the liner. If the subgrade contains angular rocks or other material that could puncture the geomembrane, smooth-roll the surface to create a suitable surface. If smooth-rolling the surface does not provide a suitable surface, also place the separator fabric between the geomembrane and the underlying subgrade. This should only be done when necessary because fabric placed under the geomembrane can increases seepage losses through pinholes or other geomembrane defects. Connect the geomembrane to perimeter concrete walls around the basin perimeter, creating a watertight seal between the geomembrane and the walls using a continuous batten bar and anchor connection (see Figure PPS-5). Where the need for the impermeable

membrane is not as critical, the membrane can be attached with a nitrile-based vinyl adhesive. Use watertight PVC boots for underdrain pipe penetrations through the liner (see Figure PPS-4).

Table PPS-3. Physical Requirements for Separator Fabric[1]

Property	Class B		Test Method
	Elongation < 50%[2]	Elongation > 50%[2]	
Grab Strength, N (lbs)	800 (180)	510 (115)	ASTM D 4632
Puncture Resistance, N (lbs)	310 (70)	180 (40)	ASTM D 4833
Trapezoidal Tear Strength, N (lbs)	310 (70)	180 (40)	ASTM D 4533
Apparent Opening Size, mm (US Sieve Size)	AOS < 0.3mm (US Sieve Size No. 50)		ASTM D 4751
Permittivity, sec^{-1}	0.02 default value, must also be greater than that of soil		ASTM D 4491
Permeability, cm/sec	k fabric > k soil for all classes		ASTM D 4491
Ultraviolet Degradation at 500 hours	50% strength retained for all classes		ASTM D 4355

[1] Strength values are in the weaker principle direction
[2] As measured in accordance with ASTM D 4632

Table PPS-4. Physical Requirements for Geomembrane

Property	Thickness 0.76 mm (30 mil)	Test Method
Thickness, % Tolerance	±5	ASTM D 1593
Tensile Strength, kN/m (lbs/in) width	12.25 (70)	ASTM D 882, Method B
Modulus at 100% Elongation, kN/m (lbs/in)	5.25 (30)	ASTM D 882, Method B
Ultimate Elongation, %	350	ASTM D 882, Method A
Tear Resistance, N (lbs)	38 (8.5)	ASTM D 1004
Low Temperature Impact, °C (°F)	-29 (-20)	ASTM D 1790
Volatile loss, % max.	0.7	ASTM D 1203, Method A
Pinholes, No. Per 8 m^2 (No. per 10 sq. yds.) max.	1	N/A
Bonded Seam Strength, % of tensile strength	80	N/A

8. **Outlet**: The portion of the WQCV in each cell should be slowly released to drain in approximately 12 hours. An orifice at the outlet of the underdrain can be used for each cell to provide detention and slow release of the WQCV to offset hydromodification. Use a minimum orifice size of 3/8 inch to avoid clogging. If lateral walls are required, each cell should be considered a separate system and be

controlled independently. See Figure PPS-6 for underdrain system layout and outlet details showing a multi-cell configuration. Equations PPS-4 and PPS-5 can be used to determine the depth of the WQCV within the pavement section (based either on the stepped/flat installation shown in Figure PPS-2 or the sloped installation shown in Figure PPS-3) and Equation PPS-6 can be used to size the WQCV orifice. If the design includes multiple cells, these calculations should be performed for each cell substituting WQCV and V_{Total} with the volumes provided in each cell. The UD-BMP workbook available at www.udfcd.org can be used when multiple cells are similar in area. The workbook assumes that the WQCV is distributed evenly between each cell.

For calculating depth of the WQCV using a flat/stepped installation, see Figure PPS-2:

$$d = \frac{12\ WQCV}{PA}$$ Equation PPS-4

Where:

d = depth of WQCV storage in the reservoir (in)

P = porosity, ≤0.30 for porous gravel, ≤0.4 for all other pavements using AASHTO No. 57 or No. 67 coarse aggregate in the reservoir

A = area of permeable pavement system (ft^2)

WQCV = water quality capture volume (ft^3)

For calculating depth of the WQCV using a sloped installation, see Figure PPS-3:

$$d = 6\left[\frac{2\ WQCV}{PA}\right] + sL$$ Equation PPS-5

Where:

d = depth of WQCV storage in the reservoir (in)

A = area of permeable pavement system (ft^2)

s = slope of the reservoir/subgrade interface (ft/ft)

L = length between lateral flow barriers (see step 4) (ft)

For calculating the diameter of the orifice for a 12-hour drain time (Use a minimum orifice size of 3/8 inch to avoid clogging.):

$$D_{12\text{ hour drain time}} = \sqrt{\frac{V}{1414\ y^{0.41}}} \qquad \text{Equation PPS-6}$$

Where:

D = diameter of the orifice to drain a volume in 12 hours (in)

Y = distance from the lowest elevation of the storage volume (i.e. the bottom of the reservoir) to the center of the orifice (ft)

V = volume (WQCV or the portion of the WQCV in the cell) to drain in 12 hours (ft^3)

Additional Design Considerations

Subgrade Preparation

Partial Infiltration and Full Infiltration Installations: The subgrade should be stripped of topsoil or other organics and either excavated or filled to the final subgrade level. Unnecessary compaction or over-compaction will reduce the subgrade infiltration rate. However, a soft or loosely compacted subgrade will settle, adversely impacting the performance of the entire permeable pavement system. The following recommendations for subgrade preparation are intended to strike a balance between those competing objectives:

- For sites, or portions thereof, requiring excavation to the final subgrade level, compaction of the subgrade may not be needed, provided that loose materials are removed from the excavation, and a firm subgrade is provided for the support of the pavement system. A geotechnical engineer should observe the prepared subgrade. Local soft areas should be excavated and replaced with properly compacted fill. As an alternative to excavating and replacing material, stabilization consisting of geogrid and compacted granular fill material can be used to bridge over the soft area. Fill material should be free draining and have a hydraulic conductivity significantly higher than the subgrade soil. Fill is typically compacted to a level equivalent to 95% Standard Proctor compaction (ASTM D 698). The designer should specify the level of compaction required to support the pavement system.

- For sites (or portions thereof), requiring placement of fill above the existing subgrade to reach the final subgrade level, the fill should be properly compacted. Specify the hydraulic conductivity for the material that is to be placed. This should be at least one order of magnitude higher than the native material. If the type or level of compaction of fill material available for construction is different than that considered in design, additional testing should be performed to substantiate that the design infiltration rate can be met. However, additional infiltrometer testing may not be necessary, provided that it can be demonstrated by other means that the compacted fill material is more permeable than that considered for design.

- Low ground pressure (LGP) track equipment should be used within the pavement area to limit over-compacting the subgrade. Wheel loads should not be allowed.

No-Infiltration Sections: Unless otherwise indicated by the geotechnical engineer, the subgrade for this section should be scarified and properly compacted to support the liner and pavement system. A level of compaction equivalent to 95% of the Standard Proctor density (ASTM D 698) is typically used. The designer should specify the level of compaction. No-infiltration sections should be smooth rolled with a roller compactor, and the prepared subgrade surface should be free of sharp objects that could puncture the liner. Both the designer and the liner installer should inspect the subgrade for acceptance prior to liner placement.

Filter and Reservoir Layer Compaction

Filter material placed above the prepared subgrade should be compacted to a relative density between 70% and 75% (ASTM D4253 and ASTM D4254) using a walk-behind vibratory roller, vibratory plate compactor or other light compaction equipment. Do not over-compact; this will limit unnecessary infiltration into the underlying subgrade. The reservoir layer may not be testable for compaction using a method based on specified density (e.g., nuclear density testing). The designer should consider a method specification (e.g., number of passes of a specified vibratory compactor) for those materials. The number of passes appropriate is dependent on the type of equipment and depth of the layer.

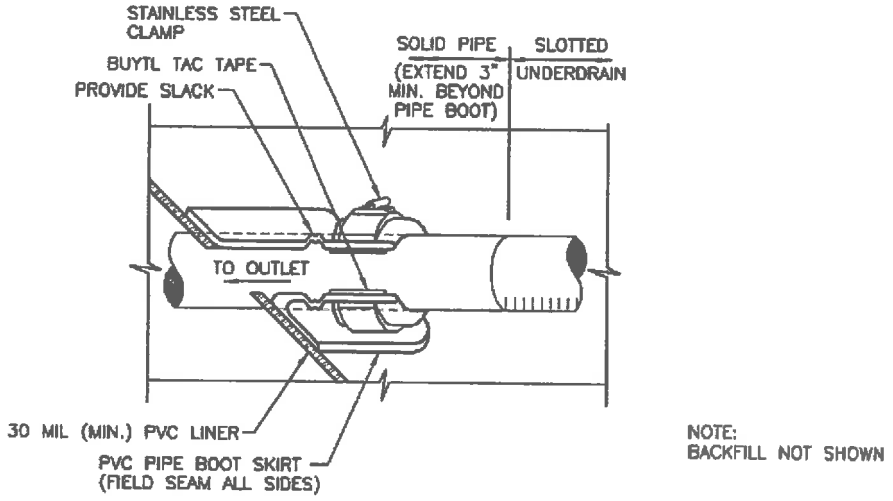


Figure PPS-4. Geomembrane Liner/Underdrain Penetration Detail

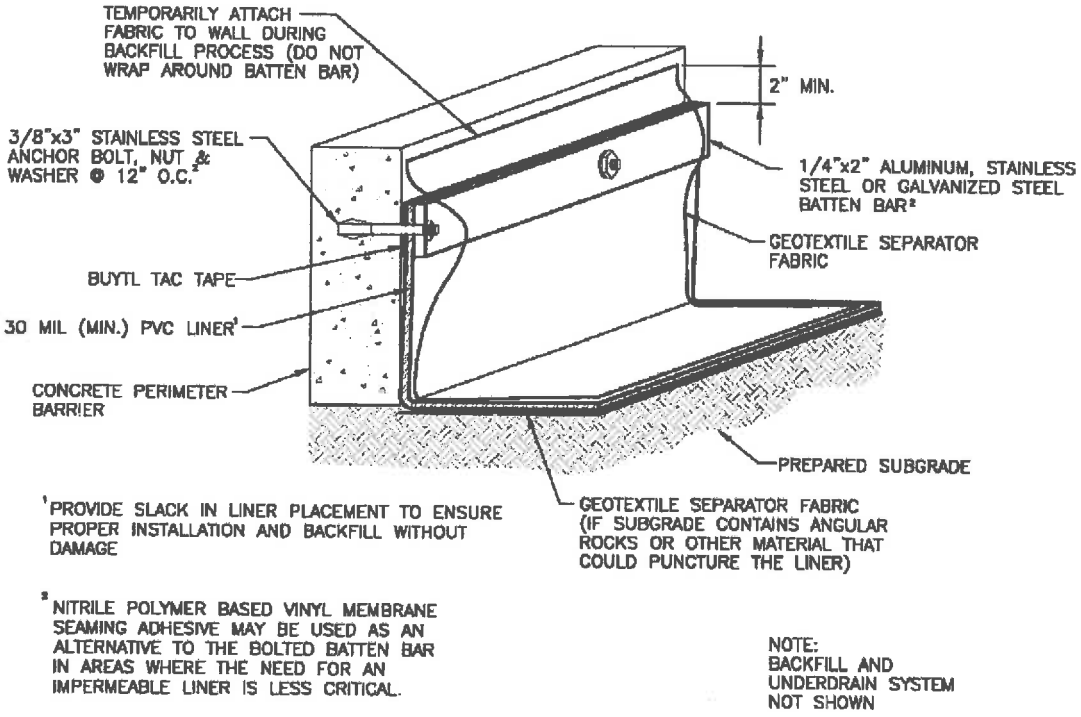


Figure PPS-5. Geomembrane Liner/Concrete Connection Detail

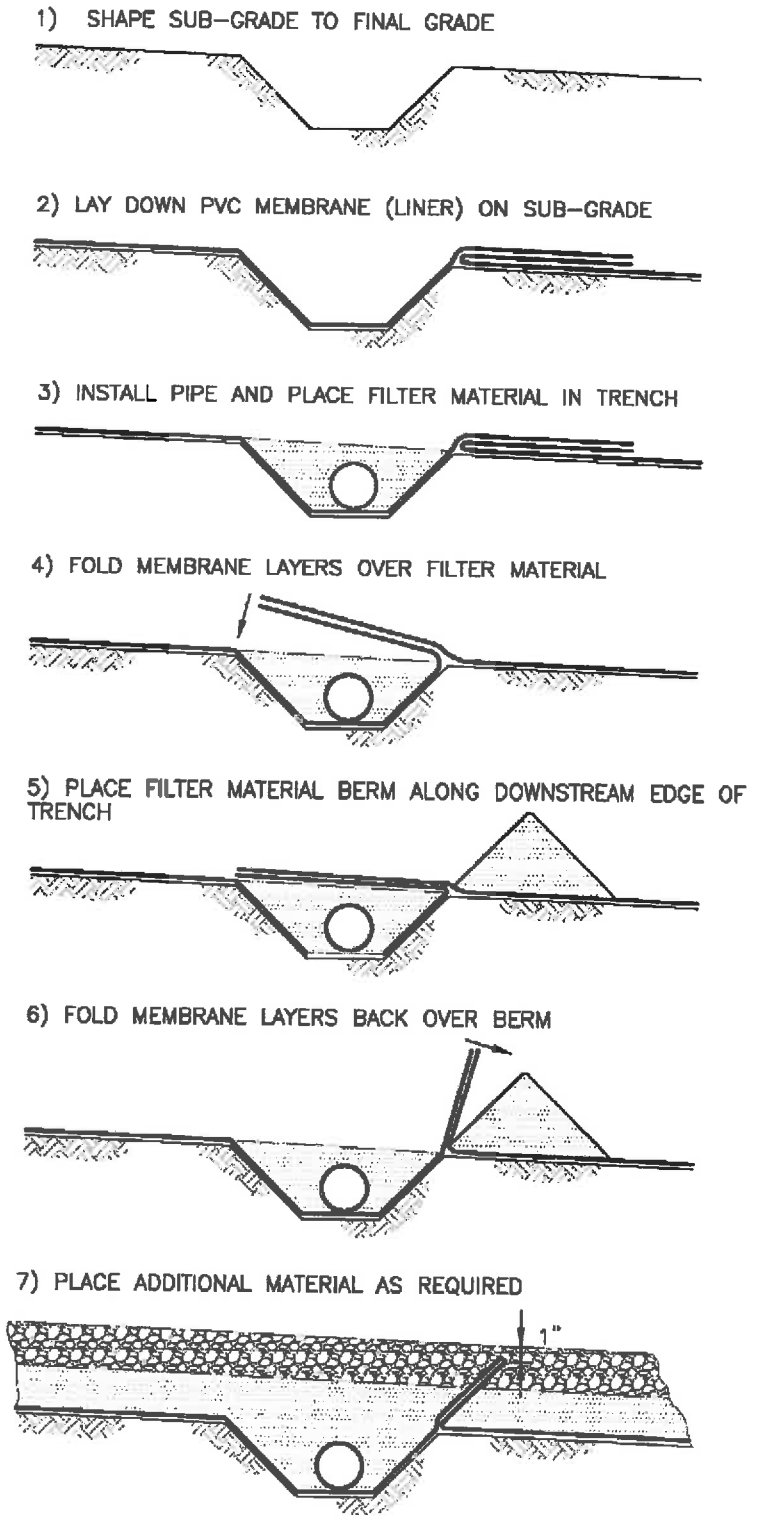


Figure PPS-6. Lateral Barrier Installation

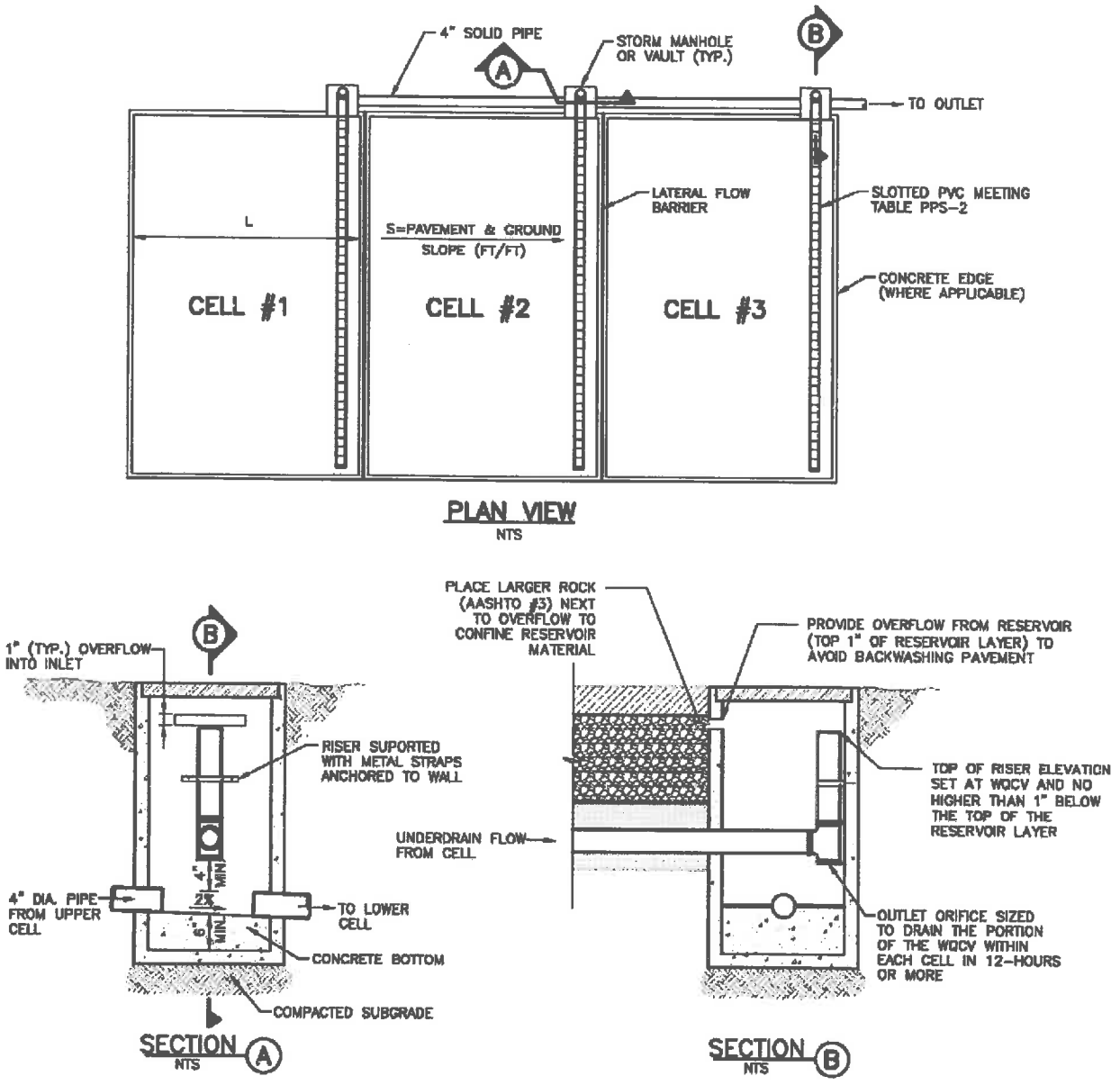
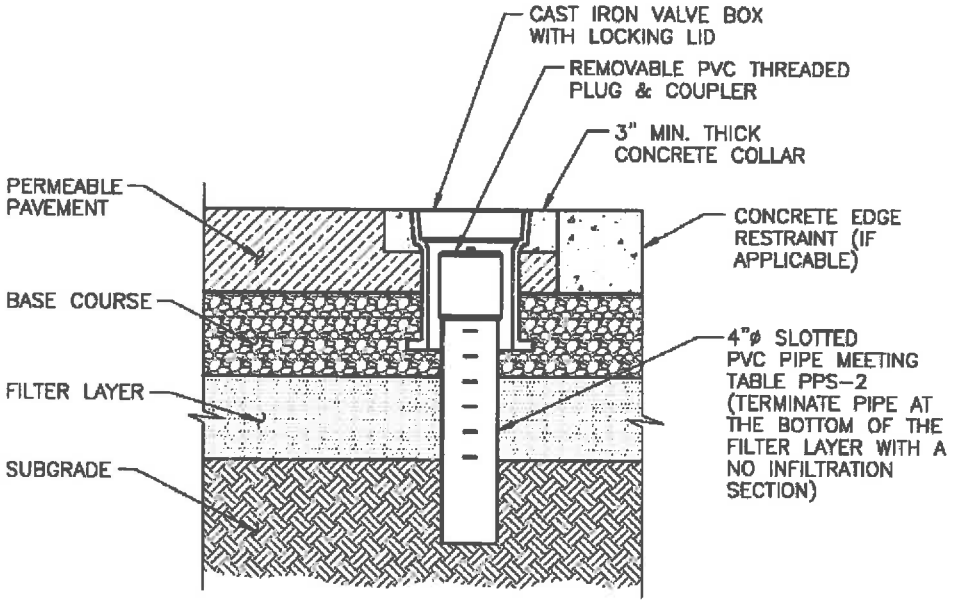


Figure PPS-7. Underdrain System Layout and Outlet Details



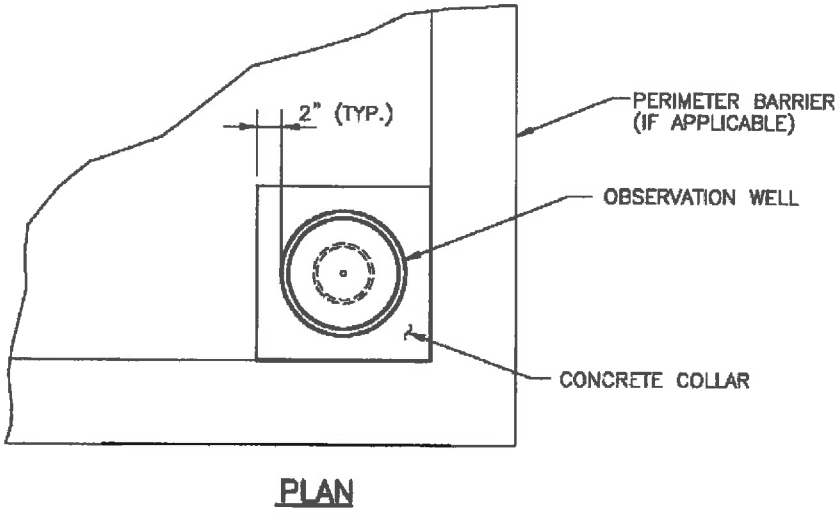


Figure PPS-8. Observation Well

Construction Considerations

Proper construction of permeable pavement systems requires measures to preserve natural infiltration rates (for full and partial infiltration sections) prior to placement of the pavement, as well as measures to protect the system from the time that pavement construction is complete to the end of site construction. Supplemental Fact Sheets on the specific pavements provide additional construction considerations. The following recommendations apply to all permeable pavement systems:

- When using an impermeable liner, ensure enough slack in the liner to allow for backfill, compaction, and settling without tearing the liner.
- Provide necessary quality assurance and quality control (QA/QC) when constructing an impermeable geomembrane liner system, including, but not limited to fabrication testing, destructive and non-destructive testing of field seams, observation of geomembrane material for tears or other defects, and air lace testing for leaks in all field seams and penetrations. QA/QC should be overseen by a professional engineer. Consider requiring field reports or other documentation from the engineer.
- Keep mud and sediment-laden runoff away from the pavement area.
- Temporarily divert runoff or install sediment control measures as necessary to reduce the amount of sediment run-on to the pavement.
- Cover surfaces with a heavy impermeable membrane when construction activities threaten to deposit sediment onto the pavement area.

Design Example

The *UD-BMP* workbook, designed as a tool for both designer and reviewing agency is available at www.udfcd.org. This section provides a completed design form from this workbook as an example.

HYDRAULIC CALCULATIONS

LOT 35 CLAREMONT BUSINESS PARK FIL. NO. 2
FINAL DRAINAGE REPORT DRAINAGE CALCULATIONS
(Area Runoff Coefficient Summary)

			DEVELOPED			*UNDEVELOPED*			*WEIGHTED*	
BASIN	**TOTAL AREA (Sq Ft)**	**TOTAL AREA *(Acres)***	**AREA *(Acres)***	**C_5**	**C_{100}**	**AREA *(Acres)***	**C_5**	**C_{100}**	**C_5**	**C_{100}**
A	*16000*	0.37	0.32	0.90	0.96	0.05	0.15	0.20	***0.80***	***0.86***
B	*2500*	0.06	0.03	0.90	0.96	0.02	0.15	0.20	***0.52***	***0.57***

LOT 35 CLAREMONT BUSINESS PARK FIL. NO. 2
FINAL DRAINAGE REPORT DRAINAGE CALCULATIONS
(Area Drainage Summary)

From Area Runoff Coefficient Summary				*OVERLAND*				*STREET / CHANNEL FLOW*				*Time of Travel*		*INTENSITY **		*TOTAL FLOWS*	
BASIN	AREA TOTAL *(Acres)*	C_5	C_{100}	C_5	Length *(ft)*	Height *(ft)*	T_C *(min)*	Length *(ft)*	Slope *(%)*	Velocity *(fps)*	T_t *(min)*	TOTAL *(min)*	CHECK *(min)*	I_5 *(in/hr)*	I_{100} *(in/hr)*	Q_5 *(c.f.s.)*	Q_{100} *(c.f.s.)*
Proposed Area Drainage Summary																	
A	0.37	0.80	0.86	0.80	10	1	0.8	146	2.4%	5.4	0.5	5.0	10.9	5.2	8.7	*1.5*	*2.8*
B	0.06	0.52	0.57	0.52	10	1	1.5	52	1.6%	4.4	0.2	5.0	10.5	5.2	8.7	*0.2*	*0.3*

Calculated by: GW
Date: 10/28/2017
Checked by: VAS

Design Procedure Form: Permeable Pavement Systems (PPS)

UD-BMP (Version 3.06, November 2016)

Designer: GW
Company: M&S Civil Consultants
Date: October 28, 2017
Project: Lot 35 - Claremeont Business Park
Location: 7259 Cole View

1. Type of Permeable Pavement Section

A) What type of section of permeable pavement is used?
(Based on the land use and activities, proximity to adjacent structures and soil characteristics.)

Choose One
- ○ No Infiltration
- ○ Partial Infiltration Section
- ◉ Full Infiltration Section

B) What type of wearing course?

Choose One
- ◉ PICP
- ○ Concrete Grid Pavement
- ○ Pervious Concrete
- ○ Porous Gravel

2. Required Storage Volume

A) Effective Imperviousness of Area Tributary to Permeable Pavement, I_a — I_a = 90.0 %

B) Tributary Area's imperviousness Ratio ($I = I_a / 100$) — I = 0.900

C) Tributary Watershed Area (including area of permeable pavement system) — A_{Total} = 16,000 sq ft

D) Area of Permeable Pavement System (Minimum recommended permeable pavement area = 4966 sq ft) — A_{PPS} = 750 sq ft

E) Impervious Tributary Ratio (Contributing Impervious Area / Permeable Pavement Ratio) — R_T = 18.3

IMPERVIOUS TRIBUTARY RATIO EXCEEDS 2.0

F) Water Quality Capture Volume (WQCV) Based on 12-hour Drain Time ($WQCV = (0.8 * (0.91 * i^3 - 1.19 * i^2 + 0.78 * i) / 12) * Area$) — WQCV = 428 cu ft

G) Is flood control volume being added?

Choose One
- ○ YES
- ◉ NO

H) Total Volume Needed — $V_{...}$ = _____ cu ft

Revise the area of permeable pavement system to reduce the impervious tributary ratio.

3. Depth of Reservoir

A) Minimum Depth of Reservoir (Minimum recommended depth is 6 inches) — D_{min} = 24.0 inches

B) Is the slope of the reservoir/subgrade interface equal to 0%?

Choose One
- ◉ YES- Flat or Stepped Installation
- ○ NO- Sloped Installation

C) Porosity (Porous Gravel Pavement ≤ 0.3, Others ≤ 0.40) — P = 0.30

D) Slope of the Base Course/Subgrade Interface — S = _____ ft / ft

E) Length Between Lateral Flow Barriers — L = _____ ft

F) Volume Provided Based on Depth of Base Course
Flat or Stepped: $V = P * ((D_{min-1})/12) * Area$
Sloped: $V = P * [(D_{min} - (D_{min} - 6*SL-1)) / 12] * Area$ — V = 431 cu ft

4. Lateral Flow Barriers

A) Type of Lateral Flow Barriers

Choose One
- ○ Concrete Walls
- ○ PVC geomembrane installed normal to flow
- ◉ N/A- Flat installation
- ○ Other (Describe):

B) Number of Permeable Pavement Cells — Cells = _____

5. Perimeter Barrier

A) Is a perimeter barrier provided on all sides of the pavement system?
(Recommeded for PICP, concrete grid pavement, or for any no-infiltration section.)

Choose One
- ○ YES
- ◉ NO

Design Procedure Form: Permeable Pavement Systems (PPS)

Designer: GW
Company: M&S Civil Consultants
Date: October 28, 2017
Project: Lot 35 - Claremeont Business Park
Location: 7287 Cole View

C. Filter Material and Underdrain System A) Is the underdrain placed below a minimum thickness of CDOT Class C filter material?	Choose One ○ YES ○ NO ◉ N/A
B) Diameter of Slotted Pipe (slot dimensions per Table PPS-7)	Choose One ○ 4-inch ○ 6-inch
C) Distance from the Lowest Elevation of the Storage Volume (i.e. the bottom of the base course) to the center of the orifice	h_o = _____ ft
D. Impermeable Geomembrane Liner and Geotextile Separator Fabric A) Is there a minimum 30 mil thick impermeable EPDM geomembrane liner on the bottom and sides of the basin, extending up to the top of the base course?	Choose One ○ YES ◉ NO
B) CDOT Class B Separator Fabric	Choose One ○ Placed above the liner ○ Placed above and below the liner
E. Outlet (Assumes each cell has similar area, subgrade slope, and length between lateral barriers (unless subgrade is flat). Calculate cells individually where this varies.) A) Depth of WQCV in the Reservoir (Elevation of the Flood Control Outlet)	D_{WQCV} = _____ inches
B) Diameter of Orifice for 12-Hour Drain Time (Use a minimum orifice diameter of 3/8-inches)	$D_{orifice}$ = _____ inches

Notes: _____

6825 Silver Ponds Heights #101
Colorado Springs, CO 80908
(719) 481-4560

PERCOLATION TEST

FOR

HAMMERS CONSTRUCTION

JOB #16-0787

Lot 11, Filing 2,
Claremont Business Park Subdivision,
7176 Cole View,
El Paso County,
Colorado

Respectfully submitted,

Charles E. Milligan, P.E.
Civil Engineer

COLORADO REGISTERED
CHARLES E. MILLIGAN
34608
PROFESSIONAL ENGINEER
12 OCT 16

PERCOLATION TEST FINDINGS

Enclosed are the results of the percolation test for the retention pond to be installed at **Lot 11, Filing 2, Claremont Business Park Subdivision, 7176 Cole View, El Paso County, Colorado.** The locations of the percolation test borings were determined by Hammers Construction. The commercial structure will not be on a public water system. Due to the natural slope of the property, the entire system will feed to the west to northwest at 2% approximately 50 feet. All applicable regulations of the El Paso County Health Department ISDS Regulations must be complied with for the installation of the disposal system.

The percolation test was performed on October 6, 2016, in accordance with **E.P.C.P.H. OWS Regulations.** The field data and results of the percolation test are as follows:

PERC. TEST @ TIME	PERC HOLE #1 @ 34" DEPTH DROP (IN INCHES)	PERC HOLE #2 @ 34" DEPTH DROP (IN INCHES)	PERC HOLE #3 @ 34" DEPTH DROP (IN INCHES)
12:24	1-3/4	4-1/4	2
12:34	3/4	1-7/8	5/8
12:44	3/4	1	5/8
12:54	11/16	13/16	9/16
1:04	5/8	5/8	9/16
1:14	5/8	5/8	1/2
Rate/Hole	16.0	16.0	20.0

The average of the test holes is 17.3 minutes per inch.

Blow counts at the depth of 3 feet was 31/12.

The soil profile for the disposal system is as follows:

0 to 6" - Sand- fine to coarse grain, high density, low moisture content, low cohesion, low plasticity, brown in color.

6" to 8' - Sand- fine to coarse grain, moderate density, moderate moisture content, low clay content, low cohesion, low plasticity, brown in color.

No water was encountered during the drilling of all holes. Bedrock was not encountered during the drilling of the test borings. No known wells were observed within 100 feet of the proposed system. **All setbacks shall conform to county regulations.**

If during construction of the field itself, subsurface conditions change considerably or if the location of the proposed field changes, this office shall be notified to determine whether the conditions are adequate for the system as designed or whether a new system needs to be designed.

Weather conditions at the time of the test consisted of partly cloudy skies with cold temperatures.

DRILL LOGS

JOB #: 16-0787

TEST BORING NO.: TH-1

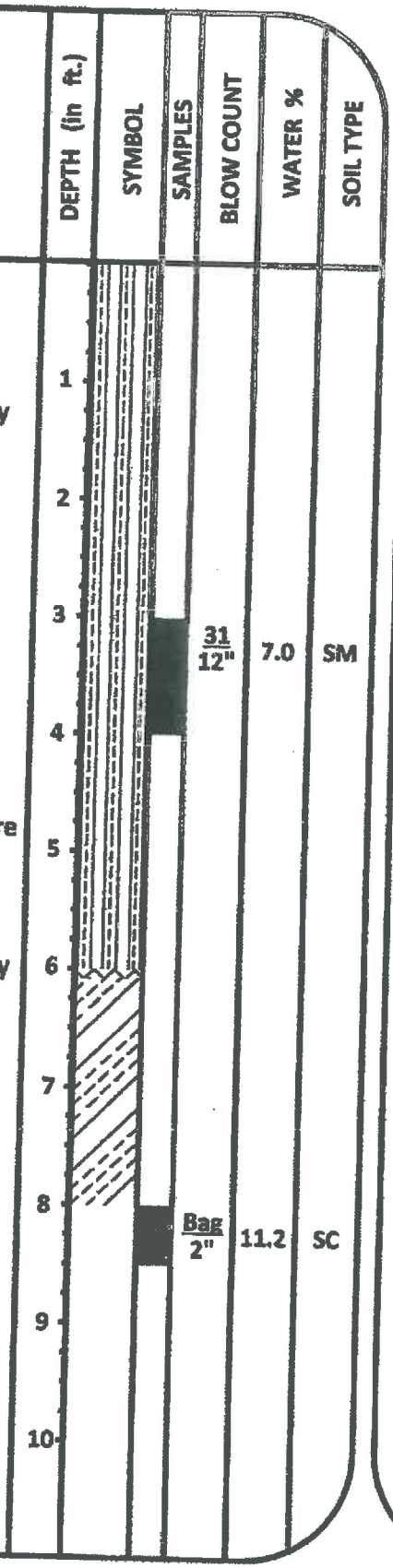
DATE: 10/6/2016

0"-6' Sand (SM)

Fine-coarse grained
Moderate-high density
Moderate moisture content
Low-moderate clay content
Low plasticity
Light Brown color

6'- 8' Sand (SC)

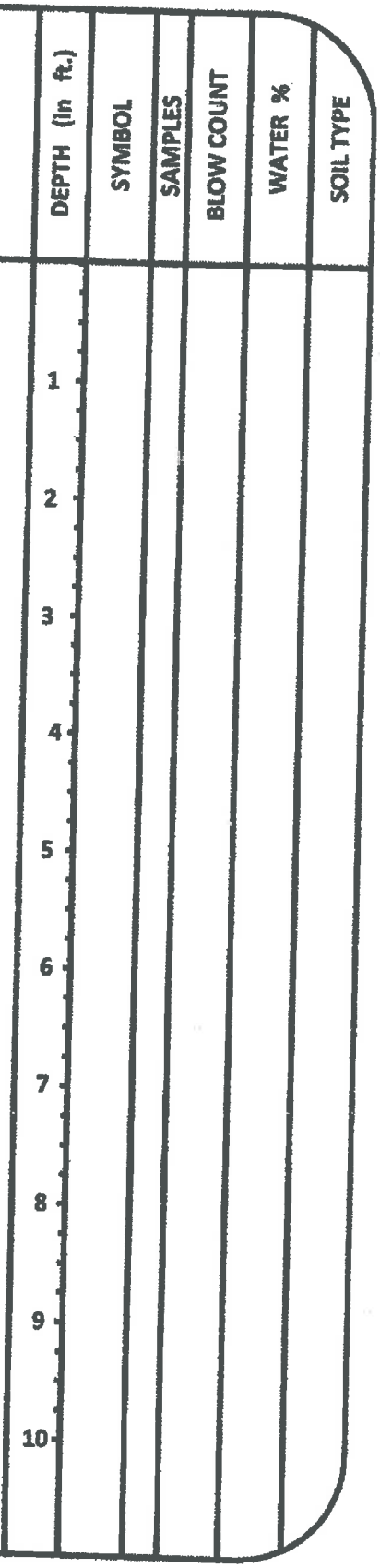
Fine-coarse grained
Moderate-high density
Moderate-high moisture content
Low-moderate clay content
Low-moderate plasticity
Greyisih Brown color



JOB #:

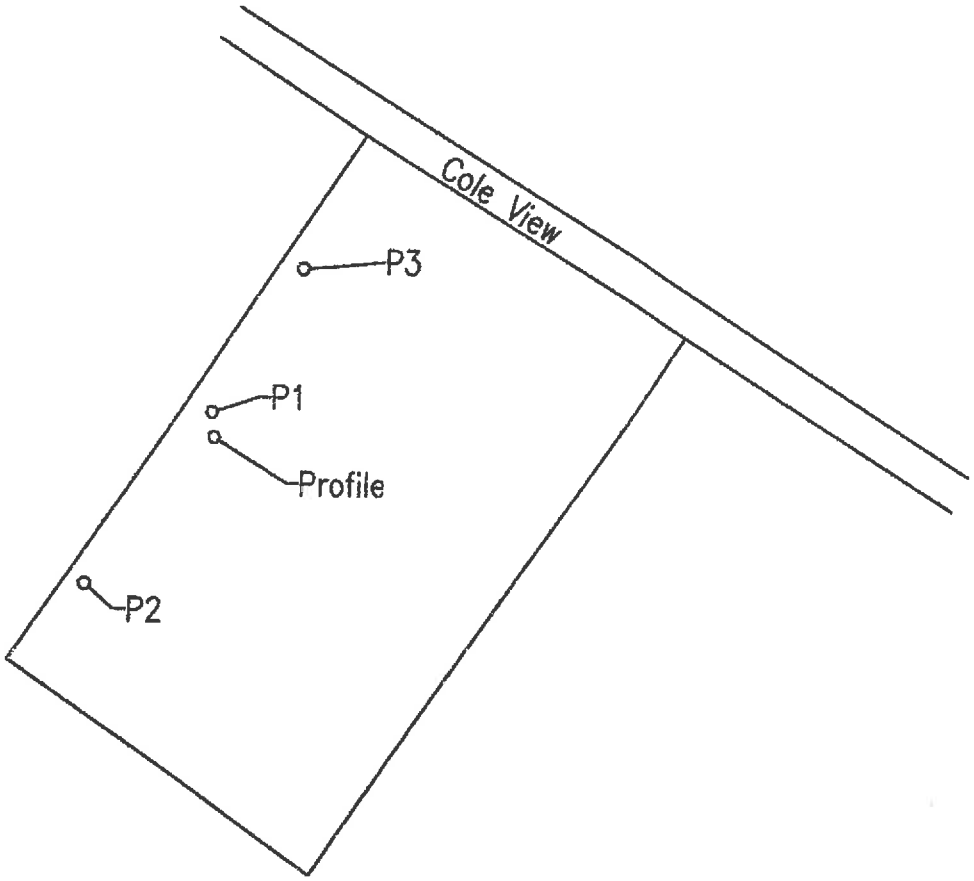
TEST BORING NO.: TH-

DATE:

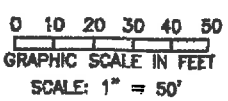


SITE MAP

Lot 11, Filing 2
Claremont Business Park
7176 Cole View
El Paso County,
Colorado
Job #16-0787

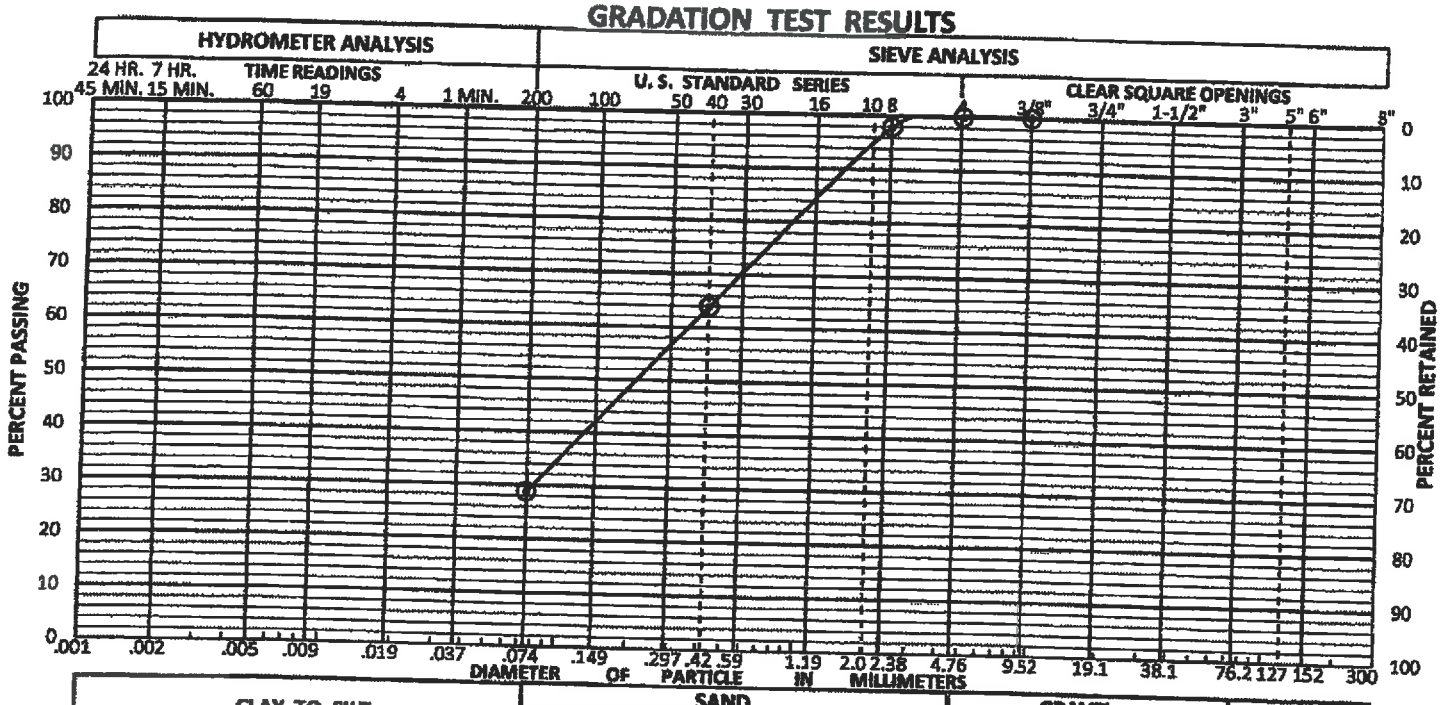


Location from Southwest Lot Corner to Profile:
N. 41° E. – 78'
Location from Profile to:
P1: S. 78° E. – 3'
P2: S. 32° W. – 54'
P3: N. 35° E. – 45'
GPS coordinates:
N. 38° 50' 55.05"
W. 104° 41' 22.66"



GEOQUEST LLC

GRADATION TEST RESULTS



CLASSIFICATION SM

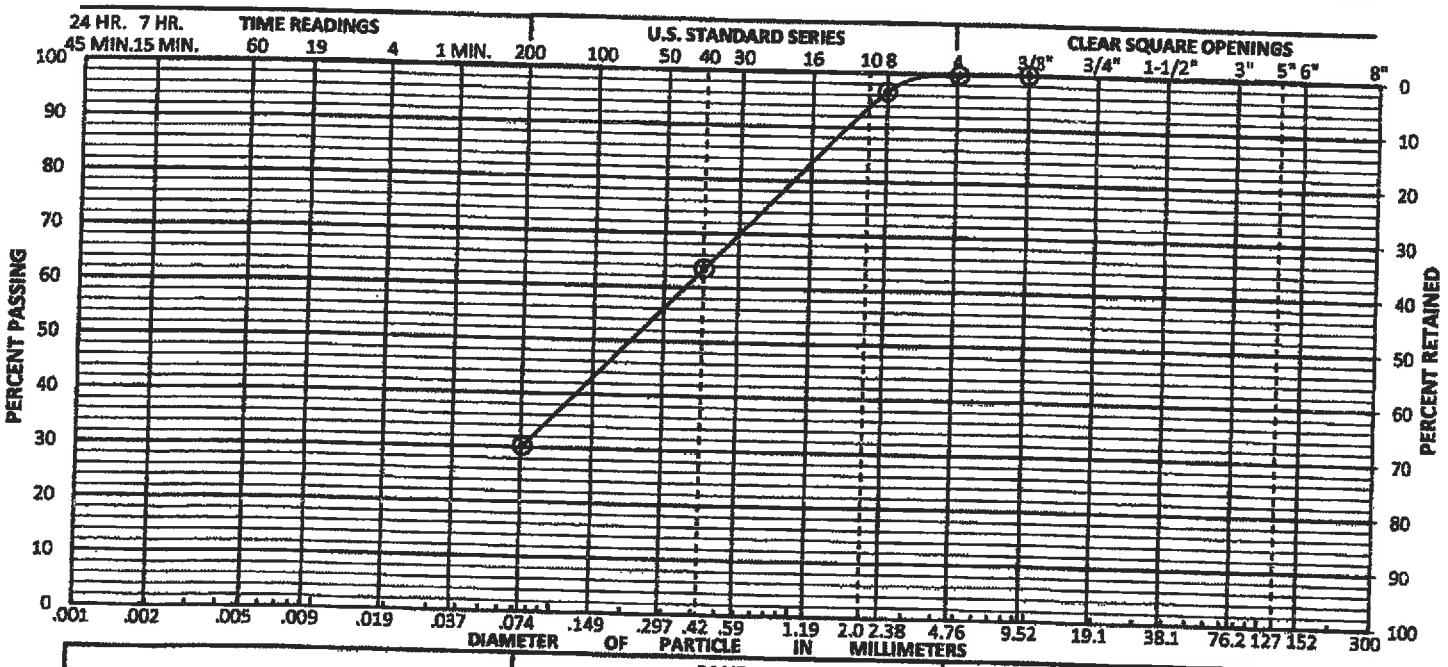
GRAVEL 0.0 %

SAND 71.2 %

FINES 28.8 %

SAMPLE # 1 HOLE # TH-1 DEPTH 3 FEET

NOTES: 7.0 % Moisture Content



CLASSIFICATION SC

GRAVEL 0.2 %

SAND 69.5 %

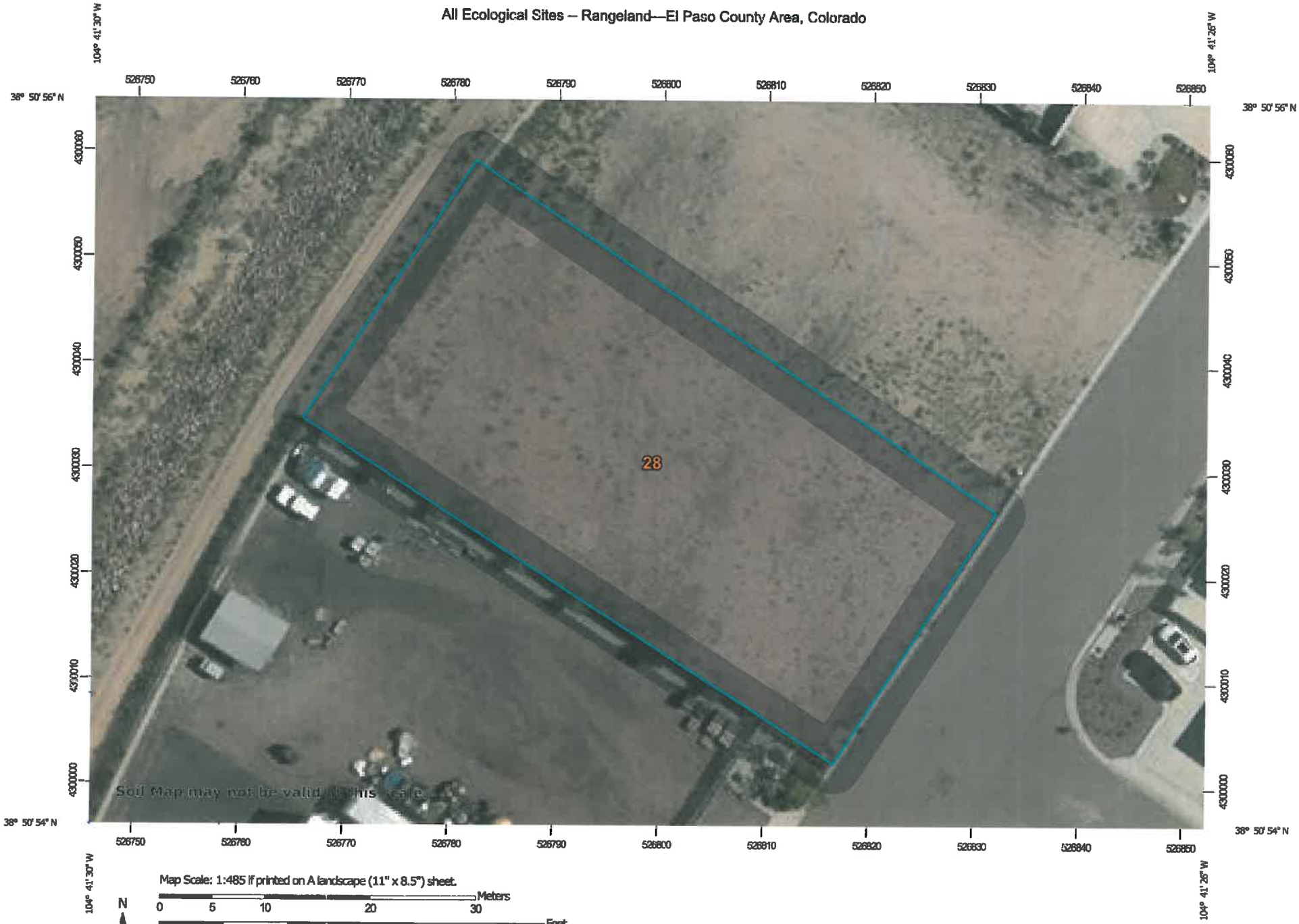
FINES 30.3 %

SAMPLE # 1 HOLE # TH- 1 DEPTH 8 FEET

NOTES: 11.2% Moisture Content

Job #: 16-0787 By: DM 10/6/2016

SOIL SURVEY


104° 41' 30" W
104° 41' 26" W
38° 50' 56" N
38° 50' 54" N
526750
526760
526770
526780
526790
526800
526810
526820
526830
526840
526850
4300060
4300050
4300040
4300030
4300020
4300010
4300000
28
Soil Map may not be valid at this scale.
Map Scale: 1:485 if printed on A landscape (11" x 8.5") sheet.
N
Meters
0 5 10 20 30
Feet
0 20 40 80 120
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

- R069XY031CO
- Not rated or not available

Soil Rating Lines

- R069XY031CO
- Not rated or not available

Soil Rating Points

- R069XY031CO
- 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:
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: El Paso County Area, Colorado
Survey Area Data: Version 14, Sep 23, 2016

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

Date(s) aerial images were photographed: Jun 3, 2014—Jun 17, 2014

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.

All Ecological Sites — Rangeland

Map unit symbol	Map unit name	Component name (percent)	Ecological site	Acres in AOI	Percent of AOI
28	Ellicott loamy coarse sand, 0 to 5 percent slopes	Ellicott (85%)	R069XY031CO — Sandy Bottomland LRU's A & B	0.4	100.0%
		Fluvaquentic haplaquoll			
		Other soils			
		Pleasant			
Totals for Area of Interest				0.4	100.0%

El Paso County Area, Colorado

28—Ellicott loamy coarse sand, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: 3680
Elevation: 5,500 to 6,500 feet
Mean annual precipitation: 13 to 15 inches
Mean annual air temperature: 47 to 50 degrees F
Frost-free period: 125 to 145 days
Farmland classification: Not prime farmland

Map Unit Composition

Ellicott and similar soils: 85 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Ellicott

Setting

Landform: Flood plains, stream terraces
Landform position (three-dimensional): Tread
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Sandy alluvium

Typical profile

A - 0 to 4 inches: loamy coarse sand
C - 4 to 60 inches: stratified coarse sand to sandy loam

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Somewhat excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: Frequent
Frequency of ponding: None
Available water storage in profile: Low (about 4.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7w
Hydrologic Soil Group: A
Ecological site: Sandy Bottomland LRU's A & B (R069XY031CO)
Other vegetative classification: SANDY BOTTOMLAND (069AY031CO)
Hydric soil rating: No

Minor Components

Fluvaquentic haplaquoll

Percent of map unit:
Landform: Swales
Hydric soil rating: Yes

Other soils

Percent of map unit:
Hydric soil rating: No

Pleasant

Percent of map unit:
Landform: Depressions
Hydric soil rating: Yes

FEMA MAP / LOMR

Federal Emergency Management Agency

Washington, D.C. 20472

NOV 13 2006

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

The Honorable Sallie Clark
Chair, El Paso County
Board of Commissioners
27 East Vermijo Avenue
Colorado Springs, CO 80903

IN REPLY REFER TO:
Case No.: 06-08-B137P
Follows Conditional
Case No.: 04-08-0469R
Community Name: El Paso County, CO
Community No.: 080059
Effective Date of
This Revision: DEC 13 2006

Dear Ms. Clark:

The Flood Insurance Study Report and Flood Insurance Rate Map for your community have been revised by this Letter of Map Revision (LOMR). Please use the enclosed annotated map panel(s) revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals issued in your community.

Additional documents are enclosed which provide information regarding this LOMR. Please see the List of Enclosures below to determine which documents are included. Other attachments specific to this request may be included as referenced in the Determination Document. If you have any questions regarding floodplain management regulations for your community or the National Flood Insurance Program (NFIP) in general, please contact the Consultation Coordination Officer for your community. If you have any technical questions regarding this LOMR, please contact the Director, Federal Insurance and Mitigation Division of the Department of Homeland Security's Federal Emergency Management Agency (FEMA) in Denver, Colorado, at (303) 235-4830, or the FEMA Map Assistance Center, toll free, at 1-877-336-2627 (1-877-FEMA MAP). Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Sincerely,

Kevin C. Long

Kevin C. Long, CFM, Project Engineer
Engineering Management Section
Mitigation Division

For: William R. Blanton Jr., CFM, Chief
Engineering Management Section
Mitigation Division

List of Enclosures:

Letter of Map Revision Determination Document
Annotated Flood Insurance Rate Map
Annotated Flood Insurance Study Report

cc: Mr. Kevin Stilson, P.E., CFM
Regional Floodplain Administrator

[redacted]
Central Marksheffel Business District

[redacted]
Matrix Design Group

 | Issue Date: NOV 1 3 2006 | Effective Date: NOV 1 3 2006 | Case No.: 06-08-B137P | LOMR-APP

Follows Conditional Case No.: 04-08-0469R

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT

COMMUNITY AND REVISION INFORMATION		PROJECT DESCRIPTION	BASIS OF REQUEST
COMMUNITY	El Paso County Colorado (Unincorporated Areas)	CHANNELIZATION	FLOODWAY HYDRAULIC ANALYSIS NEW TOPOGRAPHIC DATA
	COMMUNITY NO.: 080059		
IDENTIFIER	Marksheffel Business District	APPROXIMATE LATITUDE & LONGITUDE: 38.863, -104.674 SOURCE: USGS QUADRANGLE DATUM: NAD 27	

ANNOTATED MAPPING ENCLOSURES			ANNOTATED STUDY ENCLOSURES
TYPE: FIRM*	NO.: 08041C0752F	DATE: March 17, 1997	DATE OF EFFECTIVE FLOOD INSURANCE STUDY: August 23, 1999 PROFILE: 212P FLOODWAY DATA TABLE 5
TYPE: FIRM*	NO.: 08041C0756F	DATE: March 17, 1997	

Enclosures reflect changes to flooding sources affected by this revision.
* FIRM - Flood Insurance Rate Map; ** FBFM - Flood Boundary and Floodway Map; *** FHBM - Flood Hazard Boundary Map

FLOODING SOURCE(S) & REVISED REACH(ES)

East Fork Sand Creek - from approximately 5,250 feet downstream to just upstream of Marksheffel Road

SUMMARY OF REVISIONS

Flooding Source	Effective Flooding	Revised Flooding	Increases	Decreases
East Fork Sand Creek	Floodway	Floodway	YES	YES
	Zone AE	Zone AE	YES	YES
	BFEs	BFEs	NONE	YES
	Zone X (Shaded)	Zone X (Unshaded)	NONE	YES

* BFEs - Base Flood Elevations

DETERMINATION

This document provides the determination from the Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding a request for a Letter of Map Revision (LOMR) for the area described above. Using the information submitted, we have determined that a revision to the flood hazards depicted in the Flood Insurance Study (FIS) report and/or National Flood Insurance Program (NFIP) map is warranted. This document revises the effective NFIP map, as indicated in the attached documentation. Please use the enclosed annotated map panels revised by this LOMR for floodplain management purposes and for all flood insurance policies and renewals in your community.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Kevin C. Long

Kevin C. Long, CFM, Project Engineer
Engineering Management Section
Mitigation Division

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

COMMUNITY INFORMATION

APPLICABLE NFIP REGULATIONS/COMMUNITY OBLIGATION

We have made this determination pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (P.L. 93-234) and in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, P.L. 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65. Pursuant to Section 1361 of the National Flood Insurance Act of 1968, as amended, communities participating in the NFIP are required to adopt and enforce floodplain management regulations that meet or exceed NFIP criteria. These criteria, including adoption of the FIS report and FIRM, and the modifications made by this LOMR, are the minimum requirements for continued NFIP participation and do not supersede more stringent State/Commonwealth or local requirements to which the regulations apply.

We provide the floodway designation to your community as a tool to regulate floodplain development. Therefore, the floodway revision we have described in this letter, while acceptable to us, must also be acceptable to your community and adopted by appropriate community action, as specified in Paragraph 60.3(d) of the NFIP regulations.

NFIP regulations Subparagraph 60.3(b)(7) requires communities to ensure that the flood-carrying capacity within the altered or relocated portion of any watercourse is maintained. This provision is incorporated into your community's existing floodplain management ordinances; therefore, responsibility for maintenance of the altered or relocated watercourse, including any related appurtenances such as bridges, culverts, and other drainage structures, rests with your community. We may request that your community submit a description and schedule of maintenance activities necessary to ensure this requirement.

COMMUNITY REMINDERS

We based this determination on the 1-percent-annual-chance flood discharges computed in the FIS for your community without considering subsequent changes in watershed characteristics that could increase flood discharges. Future development of projects upstream could cause increased flood discharges, which could cause increased flood hazards. A comprehensive restudy of your community's flood hazards would consider the cumulative effects of development on flood discharges subsequent to the publication of the FIS report for your community and could, therefore, establish greater flood hazards in this area.

Your community must regulate all proposed floodplain development and ensure that permits required by Federal and/or State/Commonwealth law have been obtained. State/Commonwealth or community officials, based on knowledge of local conditions and in the interest of safety, may set higher standards for construction or may limit development in floodplain areas. If your State/Commonwealth or community has adopted more restrictive or comprehensive floodplain management criteria, those criteria take precedence over the minimum NFIP requirements.

We will not print and distribute this LOMR to primary users, such as local insurance agents or mortgage lenders; instead, the community will serve as a repository for the new data. We encourage you to disseminate the information in this LOMR by preparing a news release for publication in your community's newspaper that describes the revision and explains how your community will provide the data and help interpret the NFIP maps. In that way, interested persons, such as property owners, insurance agents, and mortgage lenders, can benefit from the information.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Kevin C. Long

Kevin C. Long, CFM, Project Engineer
Engineering Management Section
Mitigation Division

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION
DETERMINATION DOCUMENT (CONTINUED)

We have designated a Consultation Coordination Officer (CCO) to assist your community. The CCO will be the primary liaison between your community and FEMA. For information regarding your CCO, please contact:

Ms. Jeanine D. Petterson
Director, Federal Insurance and Mitigation Division
Federal Emergency Management Agency, Region VIII
Denver Federal Center, Building 710
P.O. Box 25267
Denver, CO 80225-0267
(303) 235-4830

STATUS OF THE COMMUNITY NFIP MAPS

We will not physically revise and republish the FIRM and FIS report for your community to reflect the modifications made by this LOMR at this time. When changes to the previously cited FIRM panel(s) and FIS report warrant physical revision and republication in the future, we will incorporate the modifications made by this LOMR at that time.

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional Information about the NFIP is available on our website at http://www.fema.gov/nfip.

Kevin C. Long

Kevin C. Long, CFM, Project Engineer
Engineering Management Section
Mitigation Division

Federal Emergency Management Agency

Washington, D.C. 20472

LETTER OF MAP REVISION DETERMINATION DOCUMENT (CONTINUED)

PUBLIC NOTIFICATION OF REVISION

PUBLIC NOTIFICATION

FLOODING SOURCE	LOCATION OF REFERENCED ELEVATION	BFE (FEET NGVD 29)		MAP PANEL NUMBER(S)
		EFFECTIVE	REVISED	
East Fork Sand Creek	Approximately 5,150 feet downstream of Marksheffel Road	6,316	6,315	08041C0752F
	Approximately 210 feet downstream of Marksheffel Road	6,381	6,379	08041C0756F

Within 90 days of the second publication in the local newspaper, a citizen may request that we reconsider this determination. Any request for reconsideration must be based on scientific or technical data. This revision will become effective 30 days from the date of this letter. However, until the 90-day period has elapsed, the revised BFEs presented in this LOMR may be changed.

A notice of changes will be published in the *Federal Register*. This information also will be published in your local newspaper on or about the dates listed below.

LOCAL NEWSPAPER Name: *El Paso County News*
Dates: 11/29/2006 and 12/06/2006

This determination is based on the flood data presently available. The enclosed documents provide additional information regarding this determination. If you have any questions about this document, please contact the FEMA Map Assistance Center toll free at 1-877-336-2627 (1-877-FEMA MAP) or by letter addressed to the LOMR Depot, 3601 Eisenhower Avenue, Alexandria, VA 22304. Additional information about the NFIP is available on our website at http://www.fema.gov/nfip.

Kevin C. Long

Kevin C. Long, CFM, Project Engineer
Engineering Management Section
Mitigation Division

CHANGES ARE MADE IN DETERMINATIONS OF BASE FLOOD ELEVATIONS FOR THE UNINCORPORATED AREAS OF EL PASO COUNTY, COLORADO, UNDER THE NATIONAL FLOOD INSURANCE PROGRAM

On March 17, 1997, the Department of Homeland Security's Federal Emergency Management Agency identified Special Flood Hazard Areas (SFHAs) in the unincorporated areas of El Paso County, Colorado, through issuance of a Flood Insurance Rate Map (FIRM). The Mitigation Division has determined that modification of the elevations of the flood having a 1-percent chance of being equaled or exceeded in any given year (base flood) for certain locations in this community is appropriate. The modified Base Flood Elevations (BFEs) revise the FIRM for the community.

The changes are being made pursuant to Section 206 of the Flood Disaster Protection Act of 1973 (Public Law 93-234) and are in accordance with the National Flood Insurance Act of 1968, as amended (Title XIII of the Housing and Urban Development Act of 1968, Public Law 90-448), 42 U.S.C. 4001-4128, and 44 CFR Part 65.

A hydraulic analysis was performed to incorporate the effects of channel improvements along Sand Creek East Fork from approximately 5,250 feet downstream to just upstream of Marksheffel Road, and has resulted in a revised delineation of the regulatory floodway, an increase in SFHA width, a decrease in SFHA width, and decreased BFEs for Sand Creek East Fork. The aforementioned channelized portion of Sand Creek East Fork contains the base flood. The table below indicates existing and modified BFEs for selected locations along the affected lengths of the flooding source(s) cited above.

Location	Existing BFE (feet)*	Modified BFE (feet)*
Sand Creek East Fork		
Approximately 5,150 feet downstream of Marksheffel Road	6,316	6,315
Approximately 210 feet downstream of Marksheffel Road	6,381	6,379

*National Geodetic Vertical Datum, rounded to nearest whole foot

Under the above-mentioned Acts of 1968 and 1973, the Mitigation Division must develop criteria for floodplain management. To participate in the National Flood Insurance Program (NFIP), the community must use the modified BFEs to administer the floodplain management measures of the NFIP. These modified BFEs will also be used to calculate the appropriate flood insurance premium rates for new buildings and their contents and for the second layer of insurance on existing buildings and contents.

Upon the second publication of notice of these changes in this newspaper, any person has 90 days in which he or she can request, through the Chief Executive Officer of the community, that the Mitigation Division reconsider the determination. Any request for reconsideration must be based on knowledge of changed conditions or new scientific or technical data. All interested parties are on notice that until the 90-day period elapses, the Mitigation Division's determination to modify the BFEs may itself be changed.

Any person having knowledge or wishing to comment on these changes should immediately notify:

The Honorable Sallie Clark
Chair, El Paso County
Board of Commissioners
27 East Vermijo Avenue
Colorado Springs, CO 80903

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						FEET (NGVD)		
Sand Creek East Fork					REVISED BY LOMR DATED OCTOBER 07, 2004			
A	1,100	100	455	11.9	6,038.7	6,038.7	6,038.7	0.0
B	2,400	100	446	12.2	6,054.3	6,054.3	6,054.3	0.0
C	3,330	100	450	12.0	6,069.9	6,069.9	6,069.9	0.0
D	4,240	100	449	12.1	6,085.1	6,085.1	6,085.1	0.0
E	4,870	100	451	12.0	6,095.2	6,095.2	6,095.2	0.0
F	5,820	250	602	8.9	6,118.4	6,118.4	6,118.9	0.5
G	6,690	150	518	10.3	6,128.1	6,128.1	6,129.1	1.0
H	7,795	125	477	11.2	6,155.2	6,155.2	6,155.2	0.0
I	8,665	150	505	10.6	6,168.8	6,168.8	6,168.8	0.0
J	9,675	100	443	12.0	6,188.4	6,188.4	6,188.4	0.0
K	10,565	115	465	11.5	6,196.2	6,196.2	6,196.2	0.0
L	11,325	166	525	10.2	6,207.3	6,207.3	6,207.3	0.0
M	11,375	173	632	8.4	6,207.9	6,207.9	6,207.9	0.0
N	12,610	367	699	7.6	6,228.8	6,228.8	6,228.8	0.1
O	13,720	188	570	10.0	6,241.7	6,241.7	6,241.7	0.0
P	14,805	125	479	11.1	6,257.9	6,257.9	6,257.9	0.0
Q	14,885	125	601	8.9	6,259.9	6,259.9	6,259.9	1.0
R	15,850	228	582	9.2	6,268.7	6,268.7	6,268.7	0.0
S	16,325	300	678	7.9	6,277.3	6,277.3	6,277.5	0.2
T	16,995	321	690	7.7	6,291.4	6,291.4	6,292.0	0.6
U	17,065	326	667	8.0	6,291.4	6,291.4	6,292.1	0.7
V	17,915	388	1,598	3.3	6,293.4	6,293.4	6,294.0	0.6
W	18,995	367	683	7.8	6,307.2	6,307.2	6,307.6	0.4
X	20,730	103	575	11.7	6,327.8	6,327.8	6,328.4	0.6
Y	22,560	142	506	11.0	6,348.8	6,348.8	6,349.4	0.6
Z	23,060	145	503	11.0	6,358.0	6,358.0	6,358.0	0.0
AA	24,835	418	3,156	7.0	6,383.5	6,383.5	6,383.5	0.0
AB	26,470	132	452	10.0	6,402.7	6,402.7	6,402.7	0.0
AC	27,715	112	419	10.8	6,416.6	6,416.6	6,416.6	0.0

REVISED AREA

[1]Feet Above Confluence With Sand Creek

REVISED BY LOMR DATED OCTOBER 30, 2006

REVISED TO REFLECT LOMR EFFECTIVE DEC 13 2006

TABLE 5

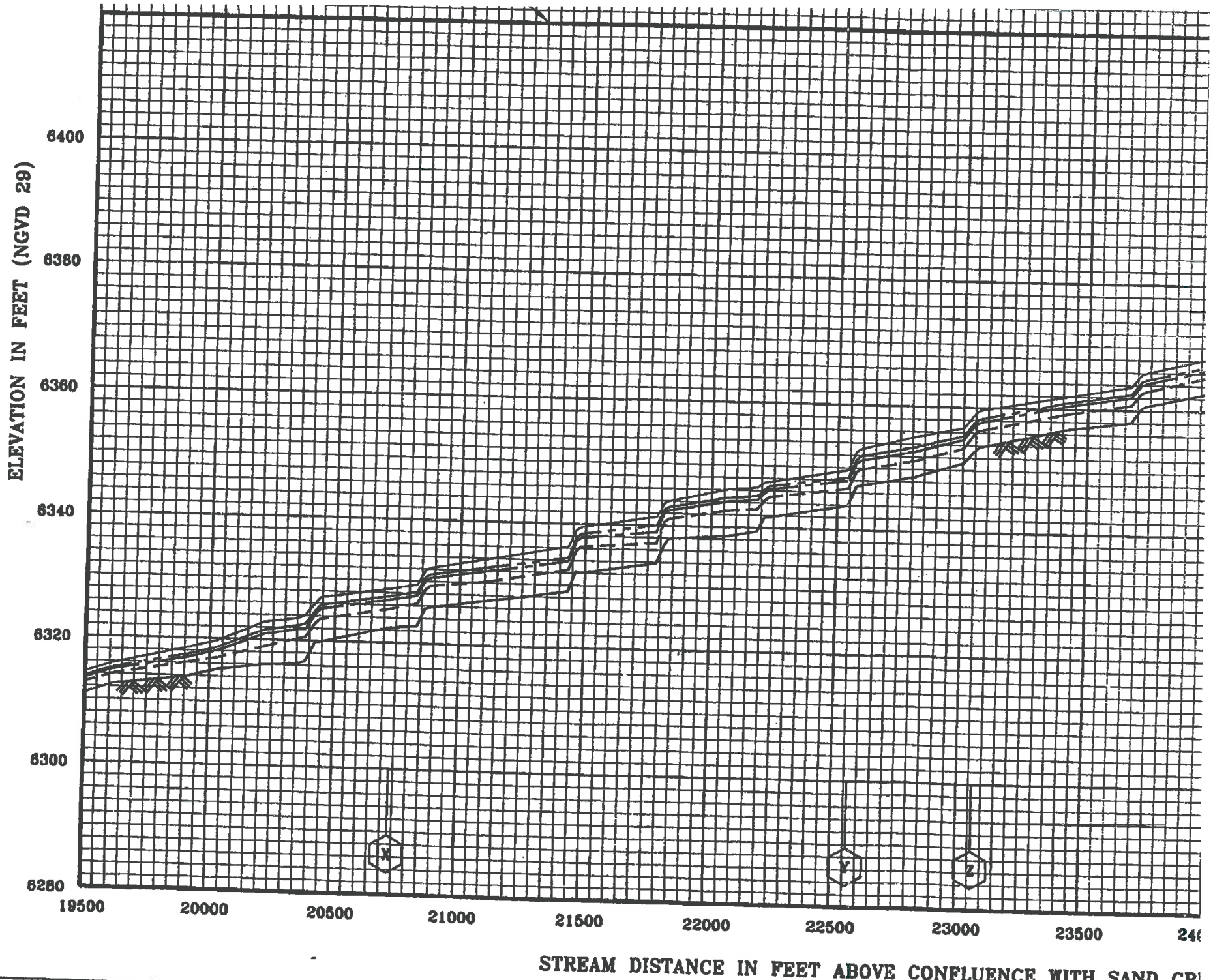
FEDERAL EMERGENCY MANAGEMENT AGENCY

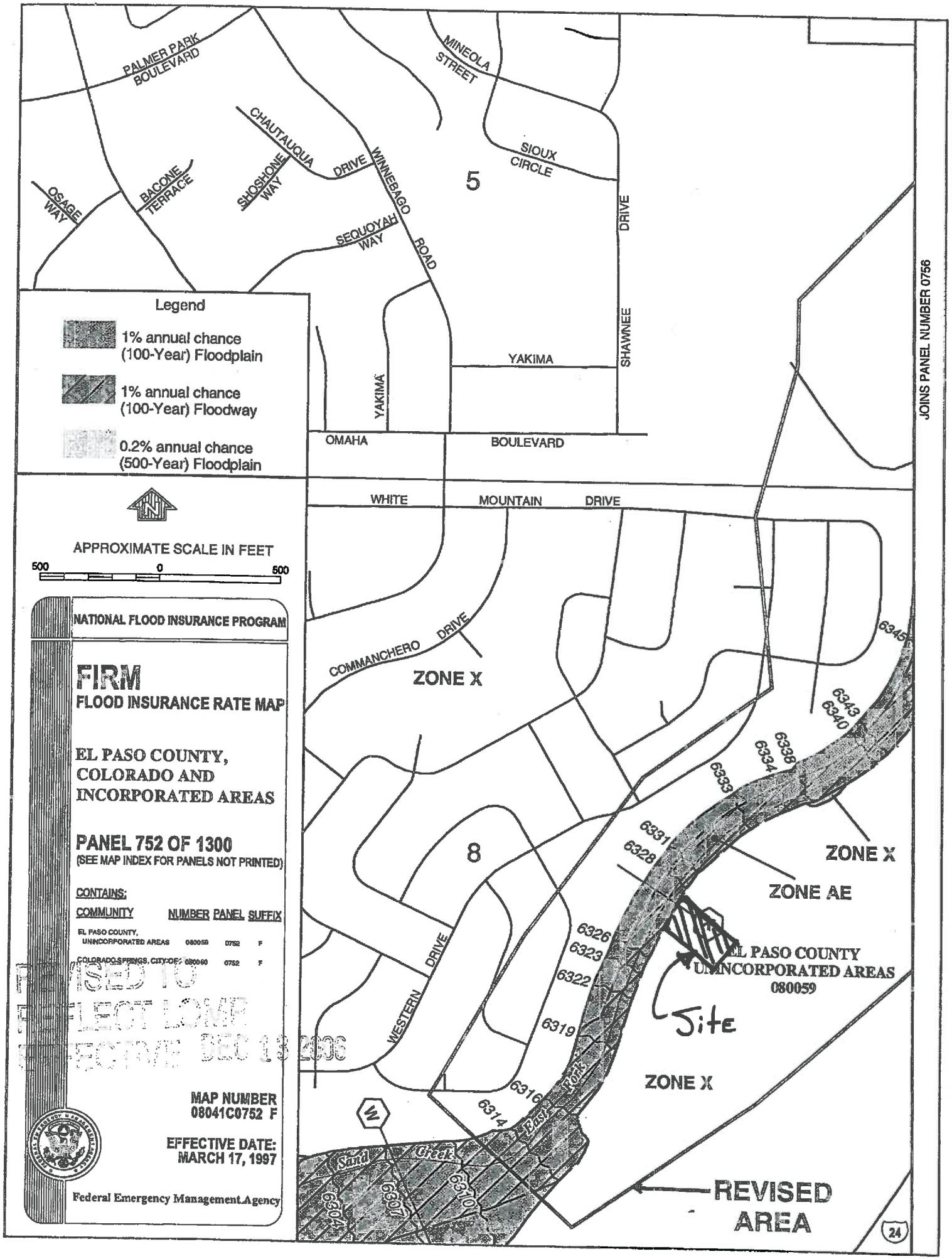
EL PASO COUNTY, CO

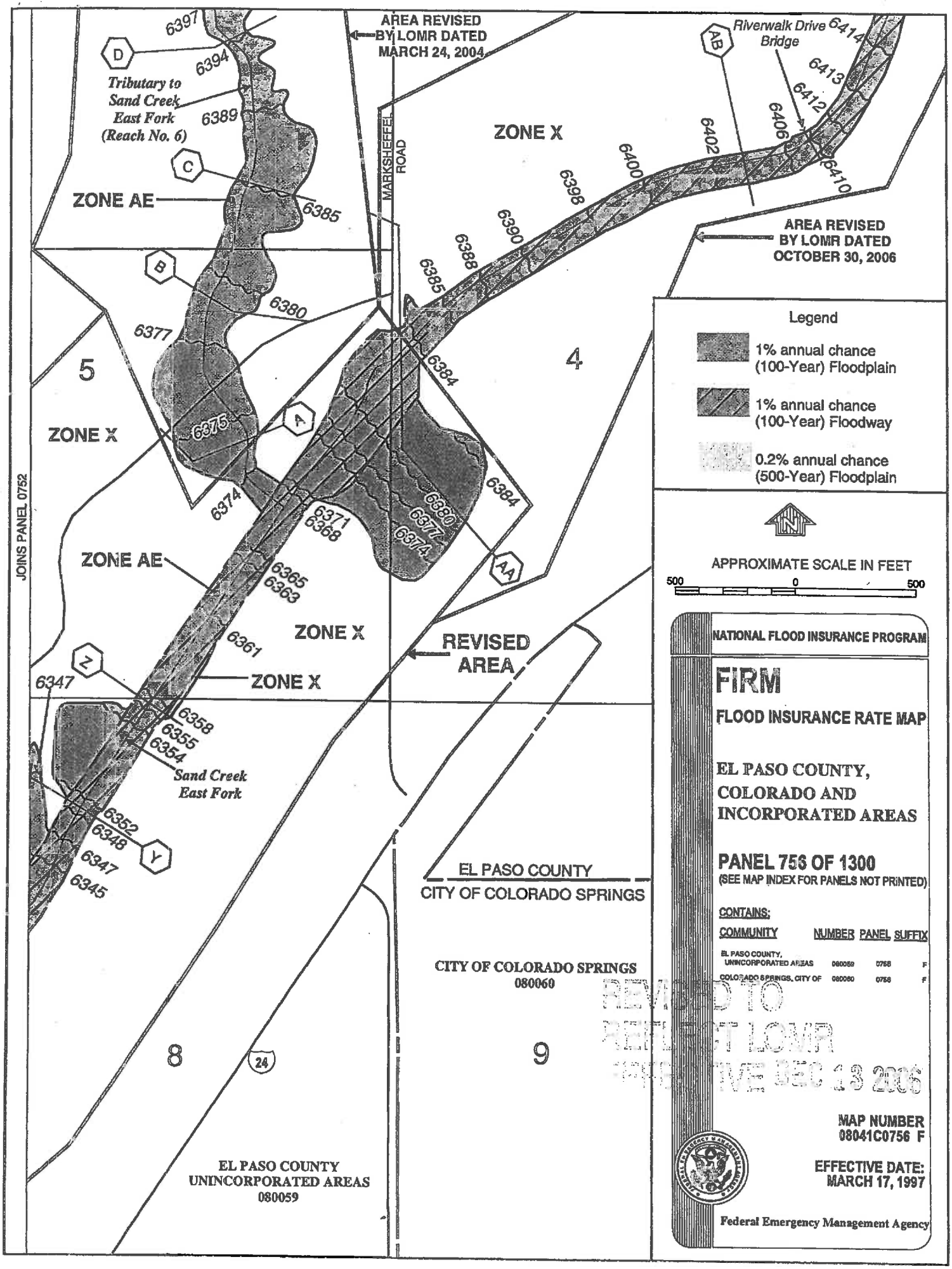
AND INCORPORATED AREAS

FLOODWAY DATA

SAND CREEK EAST FORK


ELEVATION IN FEET (NGVD 29)
6400
6380
6360
6340
6320
6300
6280
19500
20000
20500
21000
21500
22000
22500
23000
23500
X
Y
Z
STREAM DISTANCE IN FEET ABOVE CONFLUENCE WITH SAND CR


PALMER PARK BOULEVARD
MINEOLA STREET
CHAUTAUQUA DRIVE
WINNEBAGO ROAD
SIOUX CIRCLE
DRIVE
OSAGE WAY
BACONE TERRACE
SHOSHONE WAY
SEQUOYAH WAY
5
SHAWNEE
YAKIMA
YAKIMA
OMAHA BOULEVARD
JOINS PANEL NUMBER 0756
Legend
1% annual chance (100-Year) Floodplain
1% annual chance (100-Year) Floodway
0.2% annual chance (500-Year) Floodplain
APPROXIMATE SCALE IN FEET
500 0 500
WHITE MOUNTAIN DRIVE
COMMANCHERO DRIVE
ZONE X
6345
6343
6340
6338
6334
6333
6331
6328
8
ZONE X
ZONE AE
6326
6323
6322
6319
WESTERN DRIVE
EL PASO COUNTY
UNINCORPORATED AREAS
080059
Site
6316
6314
ZONE X
Sand Creek
East Fork
6310
6307
6304
REVISED AREA
24
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO AND INCORPORATED AREAS
PANEL 752 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
EL PASO COUNTY, UNINCORPORATED AREAS 080059 0752 F
COLORADO SPRINGS, CITY OF 080060 0752 F
REVISED TO REFLECT LOMR EFFECTIVE DEC 13 2006
MAP NUMBER 08041C0752 F
EFFECTIVE DATE: MARCH 17, 1997
Federal Emergency Management Agency

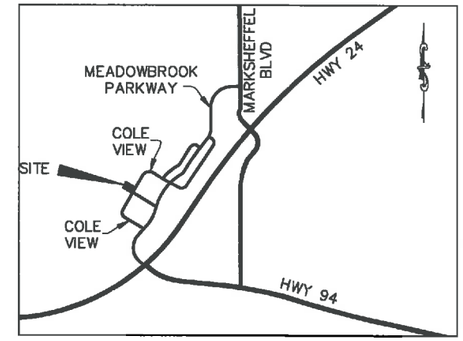

AREA REVISED BY LOMR DATED MARCH 24, 2004
AREA REVISED BY LOMR DATED OCTOBER 30, 2006
Riverwalk Drive Bridge
Tributary to Sand Creek East Fork (Reach No. 6)
MARKSHEFFEL ROAD
ZONE X
ZONE AE
ZONE X
ZONE AE
ZONE X
ZONE X
REVISED AREA
5
4
8
9
24
JOINS PANEL 0752
Sand Creek East Fork
EL PASO COUNTY
CITY OF COLORADO SPRINGS
CITY OF COLORADO SPRINGS
080060
EL PASO COUNTY
UNINCORPORATED AREAS
080059
Legend
1% annual chance (100-Year) Floodplain
1% annual chance (100-Year) Floodway
0.2% annual chance (500-Year) Floodplain
APPROXIMATE SCALE IN FEET
500 0 500
NATIONAL FLOOD INSURANCE PROGRAM
FIRM
FLOOD INSURANCE RATE MAP
EL PASO COUNTY, COLORADO AND INCORPORATED AREAS
PANEL 756 OF 1300
(SEE MAP INDEX FOR PANELS NOT PRINTED)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
EL PASO COUNTY, UNINCORPORATED AREAS 080059 0756 F
COLORADO SPRINGS, CITY OF 080060 0756 F
REVISED TO REFLECT LOMR EFFECTIVE DEC 13 2006
MAP NUMBER 08041C0756 F
EFFECTIVE DATE: MARCH 17, 1997
Federal Emergency Management Agency

DRAINAGE MAP / GRADING PLANS

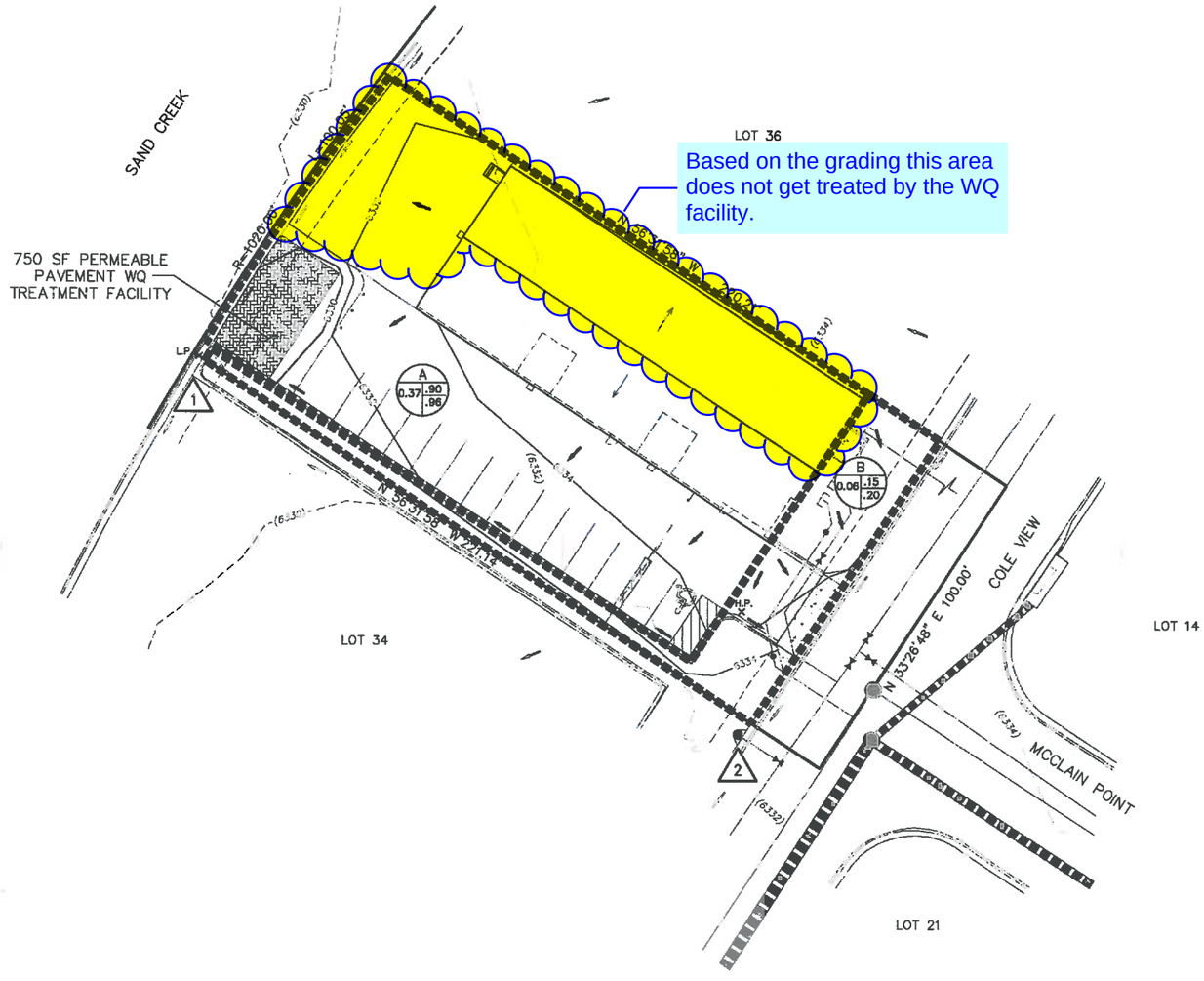
MASTER BLASTER

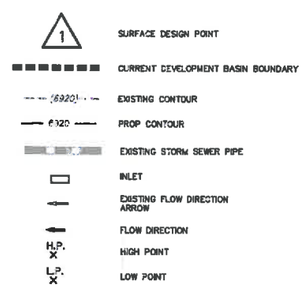
EL PASO COUNTY, STATE OF COLORADO
LOT 35 OF CLAREMONT BUSINESS PARK FIL. NO. 2

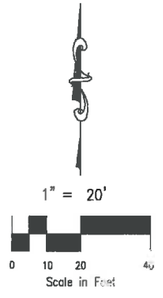
PROPOSED DRAINAGE MAP



VICINITY MAP
N.T.S.







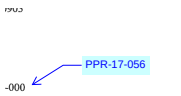
DRAINAGE MAP
MASTER BLASTER
JOB NO. 44-029
DATE PREPARED: OCTOBER 27, 2017
DATE REVISED:

EL PASO COUNTY FILE NO. PPR 17-000

20 BOULDER CRESCENT, SUITE 110
COLORADO SPRINGS, CO 80903
PHONE: 719.955.5485
CIVIL CONSULTANTS, INC.

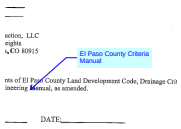
Markup Summary

dsdlaforce (10)



Subject: Callout
Page Label: 1
Lock: Locked
Author: dsdlaforce

PPR-17-056



Subject: Callout
Page Label: 2
Lock: Locked
Author: dsdlaforce

El Paso County Criteria Manual

Subject: Cloud+
Page Label: 2
Lock: Locked
Author: dsdlaforce

Replace with the County standard statement:
The attached drainage plan and report were prepared under my direction and supervision and are correct to the best of my knowledge and belief. Said drainage report has been prepared according to the criteria established by the County for drainage reports and said report is in conformity with the applicable master plan of the drainage basin. I accept responsibility for any liability caused by any negligent acts, errors or omissions on my part in preparing this report

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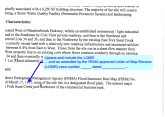
Subject: Callout
Page Label: 2
Lock: Locked
Author: dsdlaforce



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Page Label: 3
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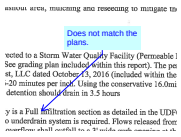
Author: dsdlaforce

Update and include the LOMR:
... and as amended by the FEMA approved Letter of Map Revsion (LOMR) case number _____ dated _____...



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Page Label: 4
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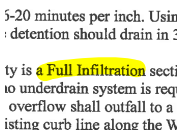
Does not match the plans.



Subject: Highlight
Page Label: 4
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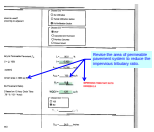
Author: dsdlaforce

Subject: Cloud+
Page Label: 11
Lock: Locked
Author: dsdlaforce

Add these notes in the GEC plan set.



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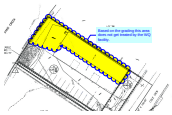
Author: dsdlaforce

Revise the area of permeable pavement system to reduce the impervious tributary ratio.



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Page Label: 57
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Author: dsdlaforce

Based on the grading this area does not get treated by the WQ facility.