

Capital City Crushing, LLC

Drainage Analysis

Barr Lane Concrete Recycling

10506 Barr Lane

Austin, Texas 78754

Submitted to: City of Austin

Prepared By:



Boerne, Texas

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Project No. 11034-008

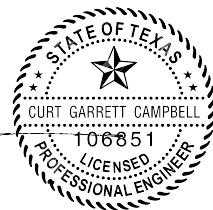
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Date: 1/29/2021



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This document is released for the purpose of review. It is not to be used for construction.

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1.0 Introduction

Westward Environmental, Inc. (Westward) has been retained by Capital City Crushing, LLC (the applicant) to submit an application for a Development Permit to authorize a proposed concrete recycling facility at their 119-acre tract located at 10506 Barr Lane, Austin, Texas 78754. The proposed facility includes construction of an office building with parking space, a plant work pad, select fill removal (pit) and operation of a concrete crushing and a recycling plant located at their site; hereafter referred to as the subject site. The proposed facility and office space include the addition of 12.7 acres of impervious cover to the site. Stormwater runoff generated from the plant pad will be graded to two wet ponds stormwater runoff generated from the office area will be graded to two natural vegetated filter strips. A select fill removal pit will also be excavated west of the proposed pad.

1.1 Purpose

The purpose of this drainage report is to demonstrate compliance with City of Austin Drainage Policy, by addressing how the site will contain any increased runoff resulting from the addition of the proposed 12.7 acres of impervious cover as well as provide water quality treatment.

1.2 Drainage Area Characteristics

The subject site totals 119 acres. On this site, 12.7 acres of proposed impervious cover will be added. Prior to any impervious cover being added, the project area will be cleared. Two stormwater ponds (wet ponds) will be constructed before the plant area is graded and two natural vegetated filter strips will be established for the proposed office area. The impervious cover will include roads and a pad constructed of compacted base/gravel and/or pavement, two portable buildings, an office and adjoining parking spaces. For purposes of this report, the total impervious area shall be called the “plant area” and “office area”. The plant area will be graded as two watersheds and drain to two, separate permanent BMPs, the proposed wet ponds. The office area will be graded the direction as the existing natural grade to, the natural vegetated filter strip in the same which will act as the permanent BMP proposed road to the office will drain to its own natural vegetated filter strip.

An initial pit covering approximately 5 acres and at least 5 feet deep will be sufficient contain a 100-year storm without runoff. The pit is self-contained and will not accept stormwater flow from proposed development. Since the pit will contain the 100-year frequency storm, the 2-year, and 10-year and 50-year storm will not be included for the storage calculation in the HydroCAD report.

1.3 General Analysis Assumptions

The proposed impervious cover will be approximately 12.7 acres.

Sections 1.2.2 (B), (C), (E), and (G) of the City of Austin Drainage Criteria Manual are not applicable to the site.

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2.0 City of Austin Drainage Criteria Manual

No street curbs, gutters, inlets and storm drains are proposed for this site.

The Land Development Code Section 25-8-211 – Water Quality Control Requirements states that if the total of new and redeveloped impervious cover exceeds 8,000 square feet, then the water quality controls are required for development including providing for removal of floating debris from stormwater runoff. In compliance with Section 25-8-213 – Water Quality Control Standards, two lined wet ponds are proposed as the water quality control for surface runoff from the plant area and two natural vegetated filter strips for surface runoff from the office area.

The proposed office area is divided by the parking area and the new road into two drainage areas: DA-1A and DA-1B. Drainage area DA-1A, will consist of 0.58 acres total and 0.21 acres of impervious cover. This area will drain to the natural vegetated filter strip. Drainage area DA-1B, will consist of 0.38 acres total and 0.31 acres of impervious cover. The proposed elevated pad area is divided into two drainage areas: DA-2A and DA-2B. Drainage area DA-2A will consist of 6.52 acres total and 4.86 acres of impervious cover. This area will drain to Pond A). Drainage area (DA-2B) will consist of 11.79 acres total and 7.29 acres of impervious cover. This area will drain to Pond B. The required capture volumes for the two ponds were calculated as in accordance with Section 1.6.6 of the City of Austin Environmental Criteria Manual, consisting of a permanent pool, extended detention, and flood control.

The areas upgradient of the pit are not proposed to be developed, thus stormwater upgradient will be retained in the pit. Drainage area DA-2C is associated with the pit does not receive runoff from any proposed impervious cover.

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2.1 Methodology

The property is within two major basins, which extend offsite. Off-site area ODA-1 drains through with DA-1 on-site. Offsite area ODA-2 drains through with DA-2 on-site. The proposed development would carve out five additional drainage areas on-site; DA-1A and DA-1B which will be treated by natural vegetated filter strips, DA-2A which will be treated by Pond A, DA-2B which will be treated by Pond B and DA-2C which consists only of the pit and no development upgradient.

Analysis was done using the TR-20 method (with HydroCAD) and was used to calculate the peak runoff from the 25-year and 100-year storm frequencies. The site as a whole was analyzed, first with the existing impervious cover (road and house) and then with the added proposed impervious cover and pit. The pit will retain all stormwater captured from its drainage area (DA-2C) for the 100-year 24-hour storm event.

Plant Area

The two water quality treatment ponds were designed to be wet ponds. The permanent pool volume (PPV) was calculated using methods from Section 1.6.6-A.1. ($0.162 \times \text{runoff rainfall ratio } R_v \times \text{drainage area } DA$). The rainfall runoff ratios (from Table 1-9 of the CoA Environmental Criteria Manual) were 0.602 for Pond A and 0.508 for Pond B as demonstrated below.

DA-2A (Pond A) Impervious Cover Ratio = $4.861 \text{ ac} / (1.664 \text{ ac} + 4.861 \text{ ac}) \times 100\% = 75\%$

$R_v = 0.602$ (from Table 1-9 of the CoA ECM); and

DA-2B (Pond B) Impervious Cover Ratio = $7.291 \text{ ac} / (7.291 \text{ ac} + 4.495 \text{ ac}) \times 100\% = 62\%$

$R_v = (0.53 - 0.494) \times (62 - 60) / (65 - 60) + 0.494 = 0.508$ (from Table 1-9 of the CoA ECM)

Calculate the Permanent Pool Volume of each pond.

$PPV = 0.162 \times R_v \times DA$

Pond A PPV: $0.162 \text{ ft} \times 0.602 \times 6.525 \text{ acres} = 0.636 \text{ acre-feet}$; and

Pond B PPV: $0.162 \text{ ft} \times 0.508 \times 11.786 \text{ acres} = 0.970 \text{ acre-feet}$

The two wet basins were sized to hold the minimum required PPV. For Pond A, the permanent pool will be set at elevation 576.0 ft. amsl. and a volume of 2.429 ac-ft, which greater than required. For Pond B, the permanent pool will be set at elevation 584.50 ft. amsl. and a volume of 1.904 ac-ft., which is greater than the required.

The natural ground was determined to be a woods and grass combination in good condition within a Hydrologic Soil Group D. The Curve Number (CN) value selected for these areas is 79 (Table 2-7, City of Austin Drainage Criteria Manual). Impervious cover, including the pad for the plant area and the road is assumed to have a CN value of 98 (Table 2-7, City of Austin Drainage Criteria Manual). The ponds are assumed full of water and have a CN value of 100. The CN values were calculated (as RCN) using a weighted average of the areas within each watershed based on their condition.

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Tables 1: DA-2A (Pond A) Weighted Curved Number

Area, ac	Cover Description	CN	Weighted CN
4.861	Paved, D*	98	-
1.664	Woods-grass combo, good, D*	79	93

Tables 2: DA-2B (Pond B) Weighted Curved Number

Area, ac	Cover Description	CN	Weighted CN
7.291	Paved, D*	98	-
4.495	Woods-grass combo, good, D*	79	91

The extended detention volume is calculated using the 1-year 3-hour storm event. Following the steps given in Section 1.6.10(E) of the City of Austin Environmental Criteria Manual, the extended detention volume was calculated as follows.

Rainfall, P = 1.93 inches

Potential Maximum Retention after rainfall begins,

$S = 1000/RCN - 10$, where:

$RCN = 93$ for Pond A $\rightarrow S = 1000/93 - 10 = \underline{0.752 \text{ inches}}$; and

$RCN = 91$ for Pond B $\rightarrow S = 1000/91 - 10 = \underline{0.989 \text{ inches}}$

Initial Abstraction, $I_a = 0.2S$, thus

$I_a = 0.2(0.752) = \underline{0.150 \text{ inches}}$ for Pond A; and

$I_a = 0.2(0.989) = \underline{0.198 \text{ inches}}$ for Pond B

Runoff, $Q = (P - I_a)^2 / [(P - I_a) + S]$, thus

$Q = (1.93 - 0.150)^2 / [(1.93 - 0.150) + 0.752] = 3.168/2.532 = \underline{1.251 \text{ inches}}$ for Pond A; and

$Q = (1.93 - 0.198)^2 / [(1.93 - 0.198) + 0.989] = 3.176/2.771 = \underline{1.146 \text{ inches}}$ for Pond B

Determine Extended Detention Volume (EDV)

$EDV = DA \times Q / 12$;

Pond A EDV = $6.525 \times 1.251 / 12 = \underline{0.680 \text{ ac-ft}}$ minimum required; and

Pond B EDV = $11.786 \times 1.146 / 12 = \underline{1.126 \text{ ac-ft}}$ minimum required

The two wet basins were sized to hold the minimum EDV. For Pond A, the design volume will be 0.702 ac-ft with the spillway invert set at 577.20 ft. amsl. For Pond B, the design volume will be 1.384 ac-ft. with the spillway invert set at 584.75 ft. amsl.

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Each pond will be equipped with a steel plate over the EDV inverted pipe outlet with an orifice size of 3 inches in diameter. This will allow the minimum 76 hours drawdown for the 1-year 3-hour storm (see attached HydroCAD report).

Tables 3 and 4: Sediment Basin Stage Storage

Pond A Stage-Storage			
Stage (ft)	Sediment Forebay Volume (ac-ft)	Main Pool Volume (ac-ft)	Total Volume (ac-ft)
570.00	0.000	0.000	0.000
571.00	0.000	0.240	0.240
572.00	0.012	0.559	0.576
573.00	0.052	0.909	0.961
574.00	0.105	1.293	1.398
575.00	0.172	1.715	1.888
576.00	0.254	2.175	2.429
577.00	0.347	2.667	3.014
578.00	0.453	3.192	3.644

Pond B Stage-Storage			
Stage	Sediment Forebay Volume (ac-ft)	Main Pool Volume (ac-ft)	Total Volume (ac-ft)
580.00	0.000	0.000	0.000
581.00	0.044	0.289	0.333
582.00	0.077	0.610	0.687
583.00	0.171	0.783	1.136
584.00	0.282	1.353	1.635
585.00	0.410	1.778	2.188
586.00	0.555	2.241	2.796
587.00	0.716	2.736	3.452
588.00	0.894	3.265	4.159

2.2 BMP Characteristics

The water quality attenuation for this property will be accomplished via the installation of two wet detention ponds and the pit. The proposed berms will be made with native soils and compacted to 3:1 side slope. The wet ponds will be designed to pass a 25-year and 100-year 24-hour storm.

2.3 Hydrology Calculation Check

The time of concentrations for the pre-and post-conditions analysis were calculated from City of Austin Drainage Design Criteria. Using the TR-20 method (with HydroCAD software), the discharges were calculated for the 2-year, 10-year, 25-year, and 100-year 24-hour storms. The peak discharges from the ponds and the full retention of the pit were included in the calculations.

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Table 5 and 6 (below) gives a summation of the pre- and post- conditions peak discharges. Off-site conditions are assumed to be the same, pre- and post- conditions.

Table 5: Pre-Conditions Existing Off-site Peak Discharge

Watershed ID	Q2, cfs	Q10, cfs	Q25, cfs	Q100, cfs
ODA-1	286	725	993	1442
ODA-2	262	662	905	1,312
Sum	548	1,387	1,898	2,754

Table 6: Pre-Conditions Existing On-Site Peak Discharge

Watershed ID	Q2, cfs	Q10, cfs	Q25, cfs	Q100, cfs
DA-1	69	174	236	341
DA-2	105	264	360	521
Sum	174	438	596	862

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Table 7: Post-Conditions Proposed On-site Peak Discharge (Off-site no change)

Watershed ID	Q2, cfs	Q10, cfs	Q25, cfs	Q100, cfs
DA-1	58	146	199	287
DA-1A	1	1	1	2
DA-1B	1	2	3	4
DA-2	65	164	223	322
DA-2A	21	40	50	68
DA-2B	35	69	89	121
DA-2C	24	47	60	823
Sum	205	469	625	1,627
DA-2A (Pond)	5	31	40	55
DA-2B (Pond)	5	52	72	100
DA-2C (Pit)	0	0	0	0
Adjusted Sum	135	396	538	770

Table 8: Total On-site and on-site Pre vs. Post Conditions Peak Discharge

Total Site	Q2, cfs	Q10, cfs	Q25, cfs	Q100, cfs
Pre-Conditions	722	1,825	2,494	3,616
Post-Conditions	753	1,856	2,523	4,381
Increased Q	31	31	29	765
Attenuated Post Conditions	683	1,783	2,436	3,524
Decreased Q	-39	-42	-58	-92

Office Area

The office area will be treated by natural vegetated filter strips. Attenuation of peak runoff from the two ponds at the plant area and the pit will make up for any increased in runoff from the office area (see Table 6).

The vegetated filter strips have been designed in accordance with the City of Austin Environmental Criteria Manual Section 1.6.7(B). Since natural conditions allow for minimum criteria, the strips will be designed as natural vegetated filter strips, or NVFS.

DA-1A consists of the road leading from existing Barr Lane, on-site, to the office parking area. The area is mostly located on a hill ridge with some runoff from Barr Lane. To minimize the area of the filter strip, a swale upgradient of Barr Lane will keep further run-on from entering this drainage area. The total area is equal to the impervious cover which is 0.16 acres.

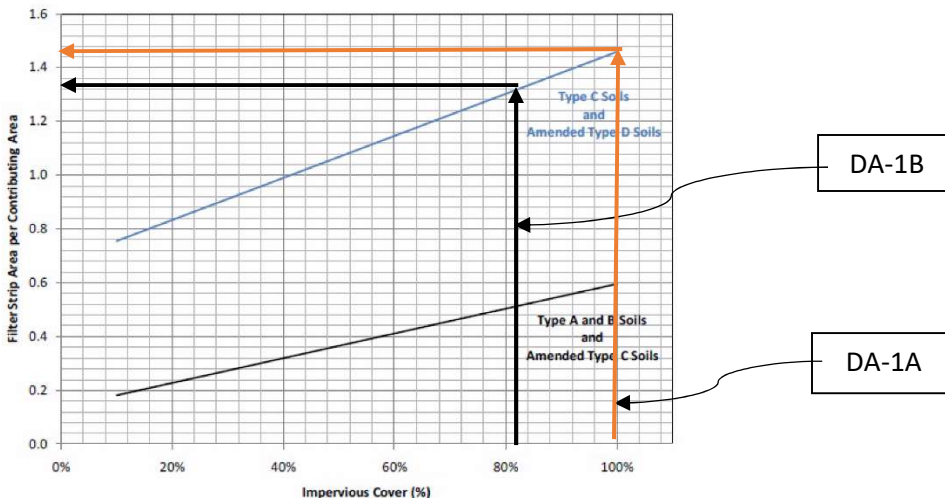
DA-1B includes the office building and a parking lot. The basin will be isolated from run-on utilizing curbing around the parking lot. The total area is 0.38 acres, and the impervious cover is 0.31 acres.

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To determine the size of the filter strips, Figure 1.6.7.B-1 was used. The soils in the area were determined to be of Type D Hydrologic Soil Group, based on the USDA NRCS Web Soil Survey.

The impervious cover percentages for DA-1A and 1B are 100% and 82% respectively. Using the chart below, the filter strip area was estimated.

Figure 1.6.7.B-1 (ECM 1.6.7)(B)(3)



The filter strip areas were calculated as follows:

DA-1A: Area x factor = 0.16 acres x 1.45 = 0.232 acres; and

DA-1B: Area x factor = 0.38 acres x 1.33 = 0.505 acres

Flow slopes for the NVFS range from 3% to 9% grade, less than the allowed maximum average slope of 10%. The flow length of the drainage areas are 20 feet for DA-1A and 70 feet for DA-1B, less than the maximum 150-foot flow length allowed. In keeping a sheet flow over the NVFS, level spreaders will be constructed along the upgradient edges between the drainage areas and the strips. To keep flow from becoming concentrated, the level spreaders will be spaced a maximum 25 feet apart.

3.0 Summary

The proposed 12.7 acres of impervious cover treated by two separate stormwater ponds and two separate natural vegetated filter strips. No development will occur upgradient of the pit and the pit will retain any captured stormwater runoff. With the proposed pit and two wet ponds, the total runoff discharge of the site for the 25-year and 100-year 24-hour storms will not exceed the pre-conditions runoff in the post-developed conditions in accordance with Section 1.2.2(D) of the Drainage Criteria Manual.

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I. HYDROCAD REPORT

1. OFFSITE AREAS
2. ON-SITE PRE-CONDITIONS AREAS
3. ON-SITE POST-CONDITIONS AREAS (UNDISTURBED)
4. ON-SITE POST-CONDITIONS AREAS (TREATED AREAS / PONDS)
5. ON-SITE POST-CONDITIONS AREAS (PIT)
6. ON-SITE POST-CONDITIONS AREAS (1-YEAR 3-HOUR STORM PONDS)