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October 24, 2019

Lee Alverson  
Commerce City – Public Works  
8602 Rosemary Street  
Commerce City, CO 80022

RE: Crystal Packaging – 9155 Boston Street – Drainage Conformance Letter

Dear Mr. Alverson,

This drainage conformance letter has been prepared for the Crystal Packaging development at the southwest corner of E. 92<sup>nd</sup> Avenue and Boston Street at 9155 Boston Street in Commerce City, Colorado. This project is located within the Irondale Industrial District Filing No. 3. The objective of this letter is to show that the proposed drainage for the site conforms to the current Commerce City *Storm Drainage Design and Technical Criteria Manual*, the current Urban Drainage and Flood Control District *Urban Storm Drainage Criteria Manual, Volumes 1, 2, & 3*, and the approved *Final Drainage Report for Irondale Industrial District Filing No. 3* prepared by Merrick & Company in March 1981.

The project site is approximately 6.91 acres of industrial development. It consists of a 70,915 SF commercial distribution warehouse, loading docks, outdoor tank storage field, and dirt parking lot. A portion of the site is undeveloped and consists of native grasses. Proposed improvements consist of new landscaping along Boston Street and installing crushed asphalt over the existing dirt parking lot. These improvements will account for approximately 1.96 acres of land disturbance for this project. The project site is bounded by E. 92<sup>nd</sup> Avenue to the north, Boston Street to the east, an existing railroad track to the south, and vacant land to the west.

Regional water quality and stormwater detention is provided with the Irondale Industrial District Filing No. 3 development and neither on-site water quality nor stormwater detention are required to be constructed for this site. The crushed asphalt is assumed to be equivalent to packed gravel in the hydrology calculations. Both crushed asphalt and packed gravel are less densely packed than asphalt pavement and have similarly higher porosity and void spaces, allowing more stormwater infiltration. The *Urban Storm Drainage Criteria Manual* Table 6-3 showing recommended percentage imperviousness values is included with this letter for reference.

Per the hydrologic calculations included with this letter the new composite site imperviousness is 57.15%. The approved *Final Drainage Report for Irondale Industrial District Filing No. 3* provided a CUHP runoff analysis for the regional stormwater pond that assumed a composite imperviousness of 88.06% for the Irondale Industrial District Filing No. 3. As such, the Crystal Packaging site is compliant with the original drainage design and will not have an adverse impact on the regional stormwater pond.

I affirm that the proposed drainage design for Crystal Packaging in Commerce City, Colorado is in conformance with existing site grading and drainage conditions, the current Commerce City *Storm Drainage Design and Technical Criteria Manual*, the current Urban Drainage and Flood Control District *Urban Storm Drainage Criteria Manual, Volumes 1, 2, & 3*, and the approved *Final Drainage Report for Irondale Industrial District Filing No. 3* prepared by Merrick & Company in March 1981.

Sincerely,  
**GALLOWAY**

Adam Koester, PE  
Civil Engineering Project Manager  
[AdamKoester@gallowayus.com](mailto:AdamKoester@gallowayus.com)



## COMPOSITE % IMPERVIOUS CALCULATIONS

Subdivision: 9155 Boston Street  
Location: CO, Commerce City

Project Name: Crystal Packaging  
Project No.: CPK000001.20  
Calculated By: JKG  
Checked By: ARK  
Date: 10/21/19

Basin ID	Total Area (ac)	Paved Roads			Gravel (Packed)			Lawns			Roofs			Basins Total Weighted % Imp.
		% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	% Imp.	Area (ac)	Weighted % Imp.	
Site	6.91	100	2.42	34.95	40	0.97	5.64	2	1.85	0.50	90	1.67	21.70	57.15

**Table 6-3. Recommended percentage imperviousness values**

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

← Crushed asphalt

FINAL DRAINAGE REPORT  
for  
IRONDALE INDUSTRIAL DISTRICT  
FILING NO. 3

March, 1981

Prepared for  
Burlington Northern

by  
Merrick & Company  
Engineers and Architects  
P. O. Box 22026  
(10855 E. Bethany Drive)  
Denver, Colorado 80222

Job No. 329-3243

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### ADDENDUM:

Letter from Urban Drainage and Flood Control District, dated April 9, 1981, to  
Adams County Planning Department regarding Preliminary Drainage Report.

Response to Letter.

## DESCRIPTION

Burlington Northern's Irondale Industrial District Filing No. 3 is located in Adams County, in the southern one-half of Sections 21 and 22 of Township 2 South, Range 67 West. The physical limits of the property are 88th Avenue to the south, the O'Brian Canal and the centerline of Sections 21 and 22 on the north, the Union Pacific Railroad right-of-way on the west and Burlington Northern Railroad right-of-way on the east. The only exceptions within this area are Irondale Industrial District Filings No. 1 and No. 2. Filing No. 1 is a 510 foot wide piece of land extending from 750 feet west of Yosemite Street to the Burlington Northern right-of-way line. This property is owned by Ralston-Purina. A strip of land 70 feet wide running along the northern boundary of Ralston-Purina property is known as Irondale Industrial District Filing No. 2. This 70 foot wide piece is leased to Ralston-Purina by the owner, Burlington Northern.

Burlington Northern's Irondale Industrial District Filing No. 3 consists of 278 acres of land zoned I-3. Burlington Northern proposes to maintain this zoning and develop the park for rail-serviced industries.

The Irondale Industrial District Filing No. 3 is bounded to the north and west by agricultural land which is zoned A-3, I-1 and I-3, to the east by the Rocky Mountain Arsenal and to the south by Irondale Subdivision. The Irondale Subdivision consists of zonings A-1, PUD and a mobile home park.

## DRAINAGE BASINS

### Offsite Drainage:

The Irondale Industrial District Filing No. 3 and its two tributary basins are located in two drainage basins defined in the Drainage Basin Descriptions part of the "Project Reuse" publications. The southwest corner of the site is located in Irondale Gulch Major Drainage Basin, while the rest of the site lies in the South Platte River Direct Flow Area 0055.

Two basins have been identified as contributing off-site flows to the proposed subdivision. The basin named North Basin, part of DFA 0055, consists of 0.60 square miles with a percent impervious of 5%. This entire basin lies within the Rocky Mountain

Arsenal. The South Basin, part of Irondale Gulch, contains 3.44 square miles of land with a percent impervious of 10%. Most of this basin is located within the Rocky Mountain Arsenal; however, a small portion of the basin lies between the Burlington Northern Railroad tracks and 88th Avenue. This segment includes part of the Irondale Subdivision and is partially developed at this time. It was assumed that the Rocky Mountain Arsenal will not be developed in the future and is currently at the full stage of development.

The North Basin develops flows which enter the Irondale Industrial District Filing No. 3 via a 36 inch pipe under the Burlington Northern Railroad tracks south of the Ralston-Purina property. The flows entering the site through this pipe flow west across Yosemite Street and then north to the O'Brian Canal at a point between Wabash Street and Yosemite Street. Prior to construction of the O'Brian canal, this flow would have continued overland in a northwesterly direction. After leaving the site, the flow would continue flowing overland, eventually reaching the South Platte River.

The South Basin contributes stormwater flows to 88th Avenue where they flow west to Ulster Street. Runoff then enters the site and flows to the northwest into the site and then southwest along the Union Pacific Railroad tracks back to 88th Avenue. These flows pond behind 88th Avenue and eventually overtop 88th Avenue and flow to the west along 88th Avenue.

After the development and improvement of 88th Avenue, all flows from the south will be directed west along 88th. The existing sumps in 88th and to the south of 88th will be eliminated to insure continuous flow to the west.

#### Onsite Drainage Historic:

The entire Irondale Industrial District Filing No. 3 is presently undeveloped and being used for agricultural purposes. The Ralston-Purina property is the only developed area within the onsite drainage basins.

The onsite area, in its undeveloped condition, was divided into four sub-basins named for their relative geographic locations. These basins and the offsite historic basins are shown on the Historic Drainage Basins plan (Sheet 1). These basins were used to determine historic flow rates.

Basin NE lies in the northeastern corner of the site and contains 0.048 square miles of land (30.7 acres). Runoff generated in this area leaves the property at the centerline of Section 22 between Yosemite Street and the Burlington Northern Railroad tracks. This runoff continues to the northwest to a point along the O'Brian Canal which lies outside the property.

Basin ME borders on Basin NE and the Burlington Northern Railroad tracks on the east side and extends to just west of the proposed location of Wabash Street. It includes some area north of the property. This basin consists of 0.261 square miles (167.0 acres) and accepts runoff from the offsite North Basin. The combined flows go in an easterly direction across Yosemite Street and then to the north to a point along the O'Brian Canal between Wabash Street and Yosemite Street. Before construction of the canal, stormwater flow would have continued flowing overland in a northwesterly direction eventually reaching the South Platte River.

Basin MW extends from Basin ME in a northwesterly direction to the O'Brian Canal. The basin consists of 0.102 square miles (65.3 acres) of area and appears to accept no offsite runoff. Stormwater flow travels to the northwest eventually ponding behind the O'Brian Canal at approximately the location of the intersection of Ulster Street and the canal. As with Basin ME, were the canal not there, the runoff would continue to the northwest and would eventually reach the South Platte River. Presently the flow ponds behind the canal.

Basin SW lies in the southwestern corner of the property and contains 0.074 square miles (47.4 acres). Runoff generated by this basin, and flow entering it from the offsite South Basin initially flow to the northwest and then to the southwest eventually leaving the site at 88th Avenue and the Union Pacific Railroad track intersection. After leaving the site the stormwater flows travel to the west along 88th Avenue.

#### Onsite Drainage Developed:

The developed site is graded to insure that drainage reaches detention ponds on the north and west edges of the site. The site consists of six basins (A, B, C, D, E and F), all of which contribute flows to the ponds. We propose to construct two ponds on the site, one in the southwestern corner and one on the north of the site adjacent to the O'Brian Canal.



The developed site was divided into sub-basins as shown on the Onsite Developed Drainage Plan (Sheet 2). Flows were determined for the initial storm (2-year event) and the 100-year event. Flows are directed to the two ponds and are retained in these ponds.

The ponds are retention ponds because no existing storm sewer system or drainage channels service the area of the site. The ponds are sized to retain the 100-year runoff events with adequate freeboard. In the event of a storm larger than the 100-year storm, the overflow from the ponds will be over 88th Avenue or the O'Brian Canal.

The ponds will be interconnected with a pipe system in order to facilitate future conversion to a detention system when an outfall system to the South Platte River or another drainageway is installed.

The initial system is designed to convey flows in a pipe system and by street flows. Street flow was limited by the requirement of the Urban Drainage Criteria Manual that there be no curb overtopping. The streets and pipes direct flow to the ponds. Inlets to the storm sewer system will be curb opening inlets located primarily in sumps with some continuous grade inlets and some specially designed inlets to collect street flow and ditch flow.

Flows entering the site from the offsite North Basin will be conveyed to the ponds via a pipe. The 36 inch diameter pipe under the Burlington Northern tracks has a capacity of 50 cfs. These 50 cfs were included in both the major and initial system and will be contained by the underground system. The pipe will be connected to the initial storm sewer system along 88th Avenue.

The pipe system including inlets and the flows for the 2-year and 100-year storm are shown on Sheet 3 of the Drainage Report Plan Set.

The major storm will be conveyed to the ponds via the street system and the underground storm sewer provided for the initial storm. Street flows are limited to the capacity established by the Urban Drainage Criteria Manual of an 18 inch maximum flow depth at the gutter flowline.

The major storm drainage system is designed to insure that all 100-year flows are confined to areas within 10 feet of the street right-of-way or along the railroad tracks. All lots are positively graded to insure that flow reaches either the streets or the ditches located along the railroad tracks. All streets are positive draining toward the ponds except for shallow sumps at the locations of the inlets for the initial system.

Pond A will store all 100-year developed flows from basins designated with the letters "A" and "F" at an approximate depth of 5.9 feet and Pond B will collect and retain all flow from the other basins at a depth of approximately 5.6 feet. The depth is more than adequate to store the flow as the pipe inverts directing inflow to the ponds will control the depth. As mentioned previously, the overflow will be over 88th or the O'Brian Canal as no outflow system presently services the site.

### HYDROLOGY

The offsite drainage basins contributing flow to the site were analyzed using the Colorado Urban Hydrograph procedure. This analysis provided the storm hydrograph and the volume of flow. This procedure was also used to determine the volume of inflow into the ponds from the developed onsite basin. Peak flows for the major storm and the initial storm were determined using the Rational Method. Rainfall values were obtained from Project Reuse tables. Field reconnaissance, aerial photography and proposed land use and setback requirements were considered in estimating impervious areas.

The calculations for the Drainage Plan are included in this report.

U.D.F.C.D. CUMP RUNOFF ANALYSIS  
DEVELOPED BASIN

EXECUTED 80/03/13. 15 HRS 4 MINS-MTN. TIME

DEVELOPED BASIN

AREA OF BASIN (SQMI)	LENGTH OF BASIN (MI)	DIST TO CENTROID (MI)	IMPERVIOUS AREA (PCT)	UNIT DURATION (MIN)
.48	.99	.57	88.00	5.00

COEFFICIENT (REFLECTING TIME TO PEAK)	COEFFICIENT (RELATED TO PEAK RATE OF RUNOFF)
.238	.460

CALCULATED UNIT HYDROGRAPH

TIME TO PEAK (MIN)	PEAK RATE OF RUNOFF (CFS/SQMI)	UNIT HYDROGRAPH PEAK (CFS)	VOLUME OF RUNOFF (AF)
14.51	1470.50	713.19	25.87

WIDTH AT 50 = 20 MIN. WIDTH AT 75 = 11 MIN. K50 = .35 K75 = .45

RAINFALL LOSSES INPUT W/ BASIN DATA

MAX. PERVIOUS RET. = .40 IN. MAX. IMPERVIOUS RET. = .10 IN.  
INFILTRATION = 3.00 IN./HR. DECAY = .00180/SECOND FNINFL = .50 IN./HR.

TIME	UNIT HYDROGRAPH	*	TIME	UNIT HYDROGRAPH	*	TIME	UNIT HYDROGRAPH	*
0	0	*	35	242	*	70	37	*
5	197	*	40	185	*	75	28	*
10	555	*	45	141	*	80	22	*
15	712	*	50	108	*	85	16	*
20	553	*	55	83	*	90	13	*
25	423	*	60	63	*	95	10	*
30	316	*	65	48	*	100	0	*

# DEVELOPED BASIN

\*\*\*\* STORM NO. = 1 \*\*\*\* DATE OF RETURN PERIOD = 100-YEAR

/=====PERVIOUS AREA =====/===== IMPERVIOUS AREA =====/									
TIME	REARRAN. INCREMENT. PRECIP.	MAXIMUM RETENTION INFIL. AND DEPR. STORAGE	EFFECT PRECIP	12 PC EFFECT PRECIP	RETENTION AND DEPR. STORAGE	LOSS	EFFECT PRECIP	88 PC EFFECT PRECIP	TOTAL EXCESS PRECIP
5	.00	.04	.00	.00	.00	.00	.00	.00	.000
10	.04	.04	.00	.00	.04	.00	.00	.00	.000
15	.04	.04	.00	.00	.04	.00	.00	.00	.000
20	.05	.04	.01	.00	.02	.00	.03	.03	.029
25	.05	.04	.01	.00	.00	.00	.05	.05	.046
30	.17	.04	.13	.00	.00	.01	.17	.15	.146
35	.17	.04	.13	.00	.00	.01	.17	.15	.146
40	.44	.04	.11	.29	.03	.02	.42	.37	.403
45	.44	.04	.00	.40	.00	.02	.42	.37	.416
50	.13	.04	.00	.03	.01	.01	.13	.11	.124
55	.13	.04	.00	.03	.01	.01	.13	.11	.124
60	.04	.04	.00	.00	.00	.00	.04	.04	.038
65	.04	.04	.00	.00	.00	.00	.04	.04	.038
70	.03	.04	.00	.00	.00	.00	.03	.03	.029
75	.03	.04	.00	.00	.00	.00	.03	.03	.025
80	.03	.04	.00	.00	.00	.00	.03	.03	.025
85	.03	.04	.00	.00	.00	.00	.03	.03	.025
90	.03	.04	.00	.00	.00	.00	.03	.03	.025
95	.03	.04	.00	.00	.00	.00	.02	.02	.021
100	.03	.04	.00	.00	.00	.00	.02	.02	.021
105	.03	.04	.00	.00	.00	.00	.02	.02	.021
110	.03	.04	.00	.00	.00	.00	.02	.02	.021
115	.03	.04	.00	.00	.00	.00	.02	.02	.021
120	.03	.04	.00	.00	.00	.00	.02	.02	.021
125	.03	.04	.00	.00	.00	.00	.02	.02	.021
TOTALS	2.12	.40	.88	.11	.10	.10	1.92	1.69	1.795

VOLUME OF EXCESS PRECIP = 46 ACRE-FFET  
INFILT. = .051IN/HR DECAY = .00180 FNINF = .50IN/HR

TIME (MIN.)	STORM HYDROGRAPH	TIME (MIN.)	STORM HYDROGRAPH	TIME (MIN.)	STORM HYDROGRAPH
5	0	70	456	135	73
10	0	75	379	140	53
15	0	80	314	145	39
20	0	85	264	150	29
25	25	90	224	155	22
30	75	95	194	160	16
35	159	100	169	165	12
40	327	105	149	170	9
45	519	110	133	175	7
50	705	115	120	180	5
55	737	120	110	185	4
60	659	125	102	190	3
65	541	130	91	195	2