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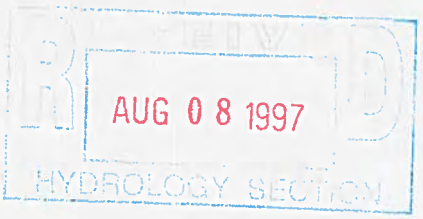
GRADING AND DRAINAGE PLAN

FOR

PRAXAIR NITROGEN PLANT

ALBUQUERQUE, NEW MEXICO

AUGUST, 1997



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APPENDIX A

LOCATION

This site is located on the north side of San Diego Avenue between San Mateo Boulevard and the Interstate 25 southbound frontage road in an area zoned IP. Just south of San Diego Avenue is the concrete-lined North La Cueva Channel. The Philips Semiconductor facility is situated south of this arroyo. The surrounding area, from San Diego north to Tramway Blvd., is undeveloped. It is all zoned IP (Industrial Park), but none of it has been developed yet.

FLOOD HAZARD ZONES

As shown by Panel 350002004 of the National Flood Insurance Rate Maps for the City of Albuquerque, dated October 14, 1983, the site is in a designated flood zone AO. This flood zone indicates flood depths of between one and three feet. The flood hazard map was prepared prior to the construction of an upstream diversion that effectively removed this area from the floodplain. Due to the unmanned, industrial nature of this development, there is no reason to remove the floodplain at this time. As long as the structures are raised above any potential flood hazard, the site will operate fine.

EXISTING SITE CONDITIONS AND DRAINAGE PATTERN

As shown on the Basin Boundary Map, runoff currently discharges to the west via sheet flow across the site, and across the three undeveloped basins at slopes between 1% and 2%. The runoff is currently prevented from discharging farther south than San Diego Avenue by the raised roadway improvements in the right-of-way. Likewise, it is prevented from discharging farther west than San Mateo by the raised roadway improvements in that right-of-way. The result is that runoff presently ponds at the northeast corner of the San Mateo/San Diego intersection, as shown on Figure 1. As computed on pages A-1 and A-3, this runoff (Basins A, B, and C, and D) is quantified at a 29.39 cfs peak rate, with a volume of 38275 cu.ft. (0.879 ac-ft).

Nothing presently prevents runoff from discharging across lot lines. Thus Basin A-3 runoff from off-site discharges onto this site. Similarly, Basin B runoff from on-site discharges off-site to the west.

The entire watershed is protected from upstream inundation by the South El Camino Diversion built in 1994-1995. This diversion captures runoff that discharges under I-25 from the east, and directs it south into the North La Cueva channel via a large box culvert.

There is an existing storm drainage system that extends from the North La Cueva Channel to the intersection of San Mateo Boulevard and San Diego Avenue. This system has not yet been fully built, and no storm inlets are noticeable on the surface at the northwest corner of that intersection.

RELATED DRAINAGE REPORTS

According to the Sumitomo Site Development Plan, developed by Bohannan-Huston in 1993, a storm drain that was installed from the North La Cueva channel to the intersection of San Diego Avenue and San Mateo Boulevard was designed to collect runoff from an area of 17.2 acres, which includes the subject watershed. The storm drain was sized to carry runoff under fully developed conditions.

Twelve existing 48" culverts cross under Interstate 25 from the east to the west side and discharge to a detention structure, which diverts the runoff into the North La Cueva channel. According to the Design Report for South El Camino Diversion, written by Bohannan-Huston in 1994, the diversion intercepts all 100-year runoff from upstream and redirects it to the arroyo.

PROPOSED SITE CONDITIONS AND DRAINAGE PATTERN

A nitrogen production facility will be installed on the site. The facility will consist of industrial process equipment on concrete pads, with piping running between the pieces of equipment. The site will be graded as minimally as possible, and the pads will be elevated so that they will not be endangered by storm runoff. A gravel access road will be provided on-site. Other than the gravel road, there are no plans to pave the site. As shown on the grading plan, the site will be graded in such a way as to direct all developed on-site runoff into a new storm drain connecting to the North La Cueva channel. The remainder of the on-site runoff is undeveloped and will be intercepted by a berm constructed along the west property line. This runoff will be directed to the south into the existing roadside ditch in the San Diego right-of-way. From there, it will continue to the west to its current ponding location at the northeast corner of San Mateo/San Diego.

Developed runoff from off-site Basins A-3 and C were computed using an 80% impervious area. This is in accordance with the Heavy Industrial classification shown in Table A-5 of Section 22.2 of the DPM and allows for future unrestricted development of these off-site lots.

Runoff was analyzed at five points. Analysis Points A,B,C, and D are indicated on Figure 1, and analysis point A2 is indicated on the grading plan. These points were analyzed under three conditions: existing, interim, and ultimate. The interim condition is the condition that will exist after this site is 100% developed, and none of the surrounding area is developed. The ultimate condition is the condition that will exist when the entire watershed is 100% developed.

Analysis Point A2 is located at the entrance to the new 15" CMP under the eastern access road to the site. These culverts will convey the runoff from Basins A-1, and A-2 to the 24" storm drain (pages A-6 and A-8).

Analysis Point A is located at the entrance to the new 24" RCP. Basins A-1, A-2, and A-3 will be diverted into this pipe, which was designed to accommodate the ultimate developed flow (pages A-5, A-7).

Analysis Point B is in the San Diego right-of-way at the downstream edge of the site. The interim runoff at this point is less than the undeveloped existing runoff. The reason it is less is because Basins A-1, A-2, and A-3 will be diverted to the channel, decreasing the discharge at Analysis Point B to less than existing. Per Page A-6, the capacity of the existing unlined channel in the right-of-way is much greater than the interim and ultimate design flow. Therefore, the interim runoff will discharge down to the intersection of San Mateo/San Diego in the right-of-way, and then pond at that point (Analysis Point C).

Two new storm inlets will eventually be constructed at Analysis Points C and D, and tied into the San Mateo storm drain system. This construction will be done at the time San Diego is widened. It will not be necessary to extend the storm drain further east on San Diego because these two inlets in a sump condition will discharge the 100-year flow into the storm drain system (page A-12). San Diego is a collector street. Per Section 22.3.E of the DPM, the 100-year flow depth in collector streets must not exceed 0.87'. Per page A-11, the 100-year flow depth is 0.47', so this condition is met. No inlets will be required upstream of the intersection.

When San Diego Avenue is widened, future inlets will be needed to carry the developed flow of 22.79 cfs from Basin A to the 24" storm drain. With a 2% road cross slope, inlet capacity requirements at Analysis Point A call for two double "C" inlets and a double "A" inlet on the north side of San Diego Avenue as shown on pages A-9 and A-10. These future inlets are shown on the grading and drainage plan.

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RUNOFF CALCULATIONS - SIMPLIFIED PROCEDURE

By: Joe Kelley Date: June 18, 1997

Project: Praxair Nitrogen Plant Zone Atlas: B-18

This procedure is in accordance with the City of Albuquerque Development Process Manual, Volume 2, Section 22.2 "Hydrology", peak discharge rate for small watersheds less than forty acres in size.

Precipitation Zone from Figure A-1: 3

Land treatment descriptions are in Table A-4.

1. RUNOFF RATE COMPUTATION

Use Equation a-10: $Q_P = Q_{PA} A_A + Q_{PB} A_B + Q_{PC} A_C + Q_{PD} A_D$

Values of Q_{pi} are from Table A-9, and are in CFS/acre. Area values are in acres.

BASIN	Q_{PA}	A_A	Q_{PB}	A_B	Q_{PC}	A_C	Q_{PD}	A_D	Q_P
EXISTING BASIN RATE OF RUNOFF (CFS)									
Basin A-3	1.87	4.63	2.60	0.00	3.45	0.00	5.02	0.00	8.66
Basin A-2	1.87	0.38	2.60	0.00	3.45	0.00	5.02	0.00	0.71
Basin A-1	1.87	0.23	2.60	0.00	3.45	0.00	5.02	0.00	0.43
Subtotal A									9.80
Basin B	1.87	1.24	2.60	0.00	3.45	0.00	5.02	0.00	2.32
Basin C	1.87	4.09	2.60	0.00	3.45	0.00	5.02	0.00	7.65
Basin D	1.87	0.00	2.60	3.16	3.45	0.00	5.02	0.28	9.62
Total									29.39

INTERIM BASIN RATE OF RUNOFF (CFS)									
Basin A-3	1.87	4.63	2.60	0.00	3.45	0.00	5.02	0.00	8.66
Basin A-2	1.87	0.00	2.60	0.31	3.45	0.00	5.02	0.07	1.16
Basin A-1	1.87	0.00	2.60	0.18	3.45	0.05	5.02	0.00	0.64
Subtotal A									10.46
Basin B	1.87	0.00	2.60	0.22	3.45	0.20	5.02	0.82	5.38
Basin C	1.87	4.09	2.60	0.00	3.45	0.00	5.02	0.00	7.65
Basin D	1.87	0.00	2.60	3.16	3.45	0.00	5.02	0.28	9.62
Total									33.11
FULLY DEVELOPED BASIN RATE OF RUNOFF (CFS)									
Basin A-3	1.87	0.00	2.60	0.93	3.45	0.00	5.02	3.70	20.99
Basin A-2	1.87	0.00	2.60	0.31	3.45	0.00	5.02	0.07	1.16
Basin A-1	1.87	0.00	2.60	0.18	3.45	0.05	5.02	0.00	0.64
Subtotal A									22.79
Basin B	1.87	0.00	2.60	0.22	3.45	0.20	5.02	0.82	5.38
Basin C	1.87	0.00	2.60	0.67	3.45	0.00	5.02	3.42	18.91
Basin D	1.87	0.00	2.60	2.99	3.45	0.00	5.02	0.45	10.03
Total									57.11

2. RUNOFF VOLUME COMPUTATION

Use Equation a-5 to compute weighted excess precipitation:

Weighted E = "E" = $(E_A A_A + E_B A_B + E_C A_C + E_D A_D)/(A_A + A_B + A_C + A_D)$

$(A_A + A_B + A_C + A_D) = \sum A_i$

Use Equation a-6 to compute the volume:

V_{360} = "E" x $(A_A + A_B + A_C + A_D)$ x 3630 feet^3/acre·inch

Values of E_i are from Table A-8, and are in inches. Area values are in acres.

BASIN	E_A	A_A	E_B	A_B	E_C	A_C	E_D	A_D	$\sum A_i$	"E"	V_{360}
EXISTING BASIN VOLUME OF RUNOFF (CUBIC FEET)											
Basin A-3	0.66	4.63	0.92	0.00	1.29	0.00	2.36	0.00	4.63	0.66	11093
Basin A-2	0.66	0.38	0.92	0.00	1.29	0.00	2.36	0.00	0.38	0.66	910
Basin A-1	0.66	0.23	0.92	0.00	1.29	0.00	2.36	0.00	0.23	0.66	551
Subtot. A											12554
Basin B	0.66	1.24	0.92	0.00	1.29	0.00	2.36	0.00	1.24	0.66	2971
Basin C	0.66	4.09	0.92	0.00	1.29	0.00	2.36	0.00	4.09	0.66	9799
Basin D	0.66	0.00	0.92	3.16	1.29	0.00	2.36	0.28	3.44	1.04	12952
Total											38275
INTERIM BASIN VOLUME OF RUNOFF (CUBIC FEET)											
Basin A-3	0.66	4.63	0.92	0.00	1.29	0.00	2.36	0.00	4.63	0.66	11093
Basin A-2	0.66	0.00	0.92	0.31	1.29	0.00	2.36	0.07	0.38	1.19	1635
Basin A-1	0.66	0.00	0.92	0.18	1.29	0.05	2.36	0.00	0.23	1.00	835
Subtot. A											13563
Basin B	0.66	0.00	0.92	0.22	1.29	0.20	2.36	0.82	1.24	1.93	8696
Basin C	0.66	4.09	0.92	0.00	1.29	0.00	2.36	0.00	4.09	0.66	9799
Basin D	0.66	0.00	0.92	3.16	1.29	0.00	2.36	0.28	3.44	1.04	12952
Total											45009

FULLY DEVELOPED BASIN VOLUME OF RUNOFF (CUBIC FEET)											
Basin A-3	0.66	0.00	0.92	0.93	1.29	0.00	2.36	3.70	4.63	2.07	34803
Basin A-2	0.66	0.00	0.92	0.31	1.29	0.00	2.36	0.07	0.38	1.19	1635
Basin A-1	0.66	0.00	0.92	0.18	1.29	0.05	2.36	0.00	0.23	1.00	835
Subtot. A											37273
Basin B	0.66	0.00	0.92	0.22	1.29	0.20	2.36	0.82	1.24	1.93	8696
Basin C	0.66	0.00	0.92	0.67	1.29	0.00	2.36	3.42	4.09	2.12	31536
Basin D	0.66	0.00	0.92	2.99	1.29	0.00	2.36	0.45	3.44	1.11	13840
Total											91346

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SHEET NO. _____ OF _____
JOB PRAXAIR NITROGEN PLANT
SUBJECT DRAINAGE CAPACITIES
CLIENT _____
JOB NO. _____
BY JK DATE 12/28/96

CAPACITY OF PIPE AT ANALYSIS POINT A

1) PIPE CAPACITY PER MANNING'S EQUATION:

$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$ 24" RCPC 1.40%

WHERE: $n = .013$ FOR RCP
$A = \pi r^2 = 3.14$ SF
$R = r/2 = 0.50'$
$S = .014$

$Q = 26.69$ CFS > $Q_{100} = 22.79$ CFS (ULTIMATE)

2) Entrance Hydraulics per Bureau of Public Roads, 1963 (page A-7)

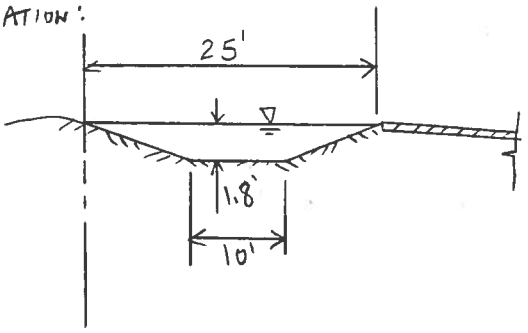
$HW = 3'$
$D = 2'$
$\rightarrow HW/D = 1.5$
$\rightarrow Q_{CAPACITY} = 22.8$ CFS > 22.79 CFS (ULTIMATE) > 10.46 CFS (INTERIM)

CAPACITY OF CHANNEL AT ANALYSIS POINT B

1) CHANNEL CAPACITY PER MANNING'S EQUATION:

$Q = \frac{1.486}{n} A R^{2/3} S^{1/2}$

WHERE: $n = .030$
$A = 1.8' \cdot 1/2(25' + 10') = 31.5$ SF
$P \approx 25'$
$R = A/P = 1.26'$
$S = .02$



$Q = 257$ CFS >> $Q_{100} = 5.38$ CFS (ULTIMATE)

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SHEET NO. _____ OF _____
JOB _____
SUBJECT _____
CLIENT _____
JOB NO. _____
BY _____ DATE _____

CAPACITY OF PIPE AT ANALYSIS POINT A2

1) ENTRANCE HYDRAULICS PER BUREAU OF PUBLIC ROADS, 1963 (PAGE A-8)

HW = 2.7', D = 15" = 1.25'

→ HW/D = 2.16

→ $Q_{CAPACITY}$ = 7.0 CFS

x2 PIPES = 14.0 CFS > 9.82 CFS (INTERIM) > 1.16 CFS (ULTIMATE)

2) PIPE CAPACITY PER MANNING'S EQ'N:

n = .024 FOR CMP

A = πr^2 = 1.23 SF

R = r/2 = .3125'

S = .02 ft/ft

Q = 4.96 CFS

x2 PIPES = 9.92 CFS CAPACITY > 9.82 CFS (INTERIM) > 1.16 CFS (ULTIMATE)