HYDROLOGY L22/D10 ONE PLAN

L 22/D 10

1 PLAN

# DRAINAGE STUDY
# for
# FOUR HILLS MOBILE HOME PARK

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Date: June 30, 1969

DRAINAGE STUDY
FOUR HILLS MOBILE HOME PARK

INTRODUCTION:

The following drainage analysis concerns those areas identified as "Phase I and Phase II" of Four Hills Mobile Home Park, an area slightly exceeding 80 acres, located in the Southeast Heights area of Albuquerque, New Mexico; more particularly situate in portions of the NW¼ and SW¼ of Section 27, T.10 N., R. 4 E., N.M.P.M. The portion of this area identified as "Phase I" Unit 1., is already nearly fully-developed, with paved, utility improved lots presently containing a large number of mobile home units. The portion identified as "Phase I" Unit 2., is at this time in early stages of construction, including mobile home tracts, recreational facilities, etc. To the East of this development, approximately 121 acres of land in the subdivision known as Canada Village, drain toward the proposed project. At present, Canada Village is undeveloped, containing low, rolling terrain and native grass cover. Undoubtedly, future improvement of this area will bring buildings and paved street surfacing which will increase storm runoff; therefore, forthcoming calculations will take into effect such items, in determining water-carrying capacities of the streets within Units 1 and 2 of the Mobile Park development.

The attached contour map, on a 1":400' scale with 5' contour intervals, shows the relationship of the proposed Mobile Home Park development to surrounding terrain; the various tributary drainage areas being outlined as a series of dotted lines. It may be determined from observation, which areas will actually drain to this development:

Note that Area (1) will not contribute drainage, as it is most conveniently cut off at Western Skies Drive, in the replat of Unit 1 of Canada Village. Area (2), however, contains 63.81 acres, all of which drain to Singing Arrow Ave. which acts as the collector street for that area and also continues as an extension into Phase II of Four Hills Mobile Home Park. Area (3), containing approximately 48.92 acres, also feeds Phase II of this development, entering from the extreme Southeast corner. Drainage area (5), containing approximately 41.68 acres, lies generally within Phase II of the project and also contributes to the combined flow on the main collector street for the entire Phase II development. This is the most critical flow condition within the entire development. Area (4), containing 8.26 acres, may be only externally-contributing area for Units 1 and 2 of Phase I, the balance of runoff coming from Area (6), 21.27 acres more or less, lying all within the Phase I area of development. Area (7), Phase I Unit 1., 20.82 Ac., drains away from Horseshoe Tr. The following calculations will show anticipated runoff, with conclusions as to its effect, and recommendations for handling same.

## DRAINAGE STUDY (Cont'd.)

### CRITERIA:

Area..... Measurement by Planimeter
Runoff Coefficient (c)..... ~~0.50~~ 0.65
Intensity (i)..... calculated in inches/hr., based on intensity-duration curves for the Albuquerque area (Sandia Conserv. Dist. 1954) for a 100-year frequency storm.

Equations used:

For area runoff, the "Rational" Formula: $Q = Aci$.
For street and channel carrying capacities, Manning's Equation: $Q = a \cdot \frac{1.486}{N} \cdot R^{2/3} \cdot S^{\frac{1}{2}}$

Additional references: Nomograph, SEELYE'S "DESIGN", Pg. 5-00.

### CALCULATIONS:

Area (1) : No effect. Intercepted East of project by Western Skies Ave.

Area (2) : A = 63.81 ac.; c = ~~0.50~~ 0.65 Safety factor based on actual field obs. of runoff in Hts. areas) (recommended for developed areas, which will eventually be the case. Intensity (i) based on inlet concentration time, or "Duration", a combination of Overland Flow Time, plus Channel Flow Time.

Overland Flow = 2,050 ft.@ 3.04% grade; mod. grass cover. Time = 32.0 min. approx.

Channel flow time (Singing Arrow Ave.):
2,100 ft. at 1.48% grade (0.0148).
From Manning: $V = \frac{1.486}{0.020} \cdot .925^{2/3} \cdot 0.0148^{\frac{1}{2}} = 8.5$'/sec

Length of paved area = 2,100 ft., hence flow time on paving = $\frac{2,100}{8.5 \times 60} = 4.1$ min.

Tot. combined flow time = 32.0 + 4.1 = 36.1 min.

From Intens.-Duration Curves, Albuq. Area, a 100-year storm with duration of 36.1 min. has an intensity (i) of 2.98 in./hr.

From Rational Formula, $Q = Aci$; $Q = 63.81 \cdot \overset{0.65}{\cancel{0.50}} \cdot 2.98$
$=$
~~95.0 cfs~~ 123.4 cfs (Runoff, Area 2.) " " " using c=0.65

Area (3) : A = 48.92 ac.; c = 0.50; Intensity based on tot. flow time, or Duration, as calculated above.

CALCULATIONS, Cont'd.:

Area (3) : Overland flow = 2,860 ft. @ 1.54 % grade; mod. grass cover. Time = 52.0 min. approx.
Channel flow time = 0 ; no well-defined channel, only overland flow.
Total flow time, then, = 52.0 min.

From Intens.-Duration Curves, Albuq. Area, a 100-year storm with duration of 52.0 min. has an intensity (i) of 2.23 in./hr.

From Rational Formula, $Q = Aci$; $Q = 48.92 \cdot 0.50 \cdot 2.23$ (C = 0.65)
$= 54.6$ cfs (Runoff, Area 3.)
70.8 cfs " " " using C = 0.65

Area (5) : Since the runoff from area 5, within the project, combines with the flows from Areas (2) and (3), this area is taken next in sequence, instead of area (4).

Overland flow = 200 ft. @ 1.67 % grade; mod. grass cover. Time = 17.6 min. approx.
Channel flow time (all on 32' paved streets, 6" curb; to outlet of project on Juan Tabo Blvd.): 1,170 ft. at 1.625% grade

From Manning: $V = \frac{1.486}{0.020} \cdot 0.925^{2/3} \cdot 0.01625^{\frac{1}{2}} = 9.0$'/sec

Length of paved area = 1,170 ft., hence flow time on streets within Phase II Area = $\frac{1,170}{9.0 \times 60} = 2.17$ min.

Tot. Combined flow time = 2.17 + 17.6 = 19.77 min.

From Intens.-Duration Curves, Albuq. Area, a 100-year storm with duration of 19.77 min. has an intensity (i) of 4.04 in./hr.

From Rational Formula, $Q = Aci$; $Q = 41.68 \cdot 0.50 \cdot 4.04$ (C = 0.65)
$= 84.2$ cfs (Runoff, Area 5.) using C = 0.65
169.5 cfs 70.8

With external flows of 95.0 cfs from Area (2) and 54.6 cfs from Area (3), the combined maximum flow on the diagonal street in the Phase II Area running from the Southeast corner to the middle of the West boundary, will be 95.0 + 54.6 + 84.2 or approx. 233.8 cfs. This is by far the heaviest runoff which may be expected on any street in either Phase I or Phase II of the proposed development. A paved street on a 1.625% grade, to crown, with a width of 48 ft. and 8" curbing will carry approx. 240 cfs.
304.2 cfs

## DRAINAGE STUDY (Cont'd.)

CALCULATIONS, Cont'd.:

Area (4) : Overland flow = 330 ft. @ 2.12 % grade; mod. grass cover. Time = 20.6 min. approx.
Channel flow time (Indian Hills Dr.):
830 ft. at 0.723% grade (0.00723).

From Manning: $V = \frac{1.486}{0.020} \cdot 0.925^{2/3} \cdot 0.00723^{\frac{1}{2}}$
$= 5.74'/sec.$

Length of paved area = 830 ft., hence flow time on paving = $\frac{830}{5.74 \times 60}$ = 2.42 min.

Tot. combined flow time = 20.6 + 2.42 = 23.02 min.

From Intens.-Duration curves, Albuq. Area, a 100-year storm with duration of 23.02 min. has an intensity (i) of 3.71 in./hr.

From Rational Formula, Q = Aci; Q = 8.26 · ~~0.50~~ 0.65 · 3.71
= 19.94
~~15.34~~ cfs (Runoff, Area 4.) using C = 0.65
(Actually not applicable; should be diverted to North.)

Area (6) : Overland flow = 100 ft. @ 1.67 % grade; mod. grass cover. Time = 12.7 min. approx.
Channel flow time (32' paved loop street running from Southeast corner of Phase I, Unit 1, North and West, returning to Horseshoe Trail and continuing to "outlet" at Horseshoe Trail and Juan Tabo Blvd.):
2,210 ft. at 0.770% grade (0.0077).

From Manning: $V = \frac{1.486}{0.020} \cdot 0.925^{2/3} \cdot 0.0077^{\frac{1}{2}}$
$= 5.86'/sec.$

Length of paved area = 2210 ft., hence flow time on paving = $\frac{2,210}{5.86 \times 60}$ = 6.28 min.

Tot. combined flow time = 12.7 + 6.28 = 18.98 min.

From Intens.-Duration Curves, Albuq. Area, a 100-year storm with duration of 18.98 min. has an intensity (i) of 4.15 in./hr.

From Rational Formula, Q = Aci; Q = 21.27 · ~~0.50~~ 0.65 · 4.15
= 57.5
~~44.3~~ cfs (Runoff, Area 6.) using C = 0.65

CALCULATIONS, Cont'd.:

With no external flows entering the project, the total runoff which would drain to the collector street, Horseshoe Trail, where it enters Juan Tabo Blvd., would be approximately 44.2 cfs. Horseshoe Trail, presently paved to 48 feet width with a 3" inverted crown, on a street grade of 1.357%, is capable of carrying only 13 cfs within confines of the paving. However, by building up the shoulders of this street only 6", it could be made to carry well over 100 cfs without flooding adjacent property.

Area (7), already paved and developed, is so graded as to drain away from Horseshoe Trail, toward the North boundary of Unit 1, Phase I, where a drainage ditch carries all runoff from this area out of the project. The drainageway is privately maintained, and is not a dedicated easement.

CONCLUSIONS AND RECOMMENDATIONS:

From the above calculations, it may be concluded that it is economically feasible to construct this development in such manner that, all runoff reaching the project from external sources as well as runoff from rainfall within the project, can be contained and carried on paved streets through the area, without resort to special drainage easements. When Phase II of this project is fully developed and paved, the main water-carrying street through this portion of the development will discharge a rather sizeable quantity of water; as much as 254 cfs onto Juan Tabo Blvd. during a period of peak runoff. However, it can be seen that this collector street follows the original land drainage pattern and hence does not constitute a diversion, in any case. Juan Tabo Blvd. is on too flat a grade (less than 1%) to carry such flow. (Would take 4.5% grade on 86' width paving.) It is, therefore, recommended that before Phase II reaches full development, the City should make provisions to intercept at least 100 cfs of this flow by means of storm drain collection, or obtain a replat of Manzano Mesa Addition, wherein either a street or easement running west from Juan Tabo at the location of existing drainage swale, would be dedicated and so sized as to carry at least 150 cfs of the flow from the Mobile Home Park and Canada Village plus additional accumulated flows within Manzano Mesa. It is further recommended that this main water-carrier in Phase II (Area 5) be constructed no less than 48 ft. in width; flat section, plus 8" curbing. If the developer should choose to construct a 32 ft. street with 6" curbing, then it should be understood that finished(pad) grades of all lots must be 2 ft. above top of curb. The street should be located approximately as shown on the Phase II plan in order to meet the existing natural drainage channel. Furthermore, a street must be platted or designated in Phase II, which will meet the extension of Singing Arrow Ave., from the Replat of Unit 1, Canada Village Subdivision.

DRAINAGE STUDY (Cont'd.)

CONCLUSIONS AND RECOMMENDATIONS, Cont'd.:

Since Singing Arrow Ave. as platted in the Replat of Unit I, Canada Village, becomes the main "water-carrying" for that portion of Canada Village designated as "Area 2" on the accompanying Drainage Map, it is obvious that such a continuation would be needed in Phase II of the Four Hills Mobile Home Park, to avert serious drainage problems. Not so, for Indian Hills Dr. in Area (4): This street drains water for a mere 8.26 acres; carries only ~~15.34~~ 9.84 cfs at maximum anticipated peak runoff and could easily be dead-ended at the East boundary of Four Hills Mobile Home Park, with a small rear-lot swale along the Westerly Property Line of Canada Village Unit I, to carry this drainage North. It would also prevent outside traffic from congesting the tight loop streets already developed in Unit 1. of Phase I, of this Mobile Home Park, which would be most desirable from a safety standpoint. Therefore, it is recommended that neither Indian Hills Dr., nor the small unnamed street which heads West from it at about mid-block, be extended into Four Hills Mobile Home Park; nor should any streets be extended Easterly in Phase I of this development to meet any corresponding streets in Canada Village Subdivision. Finally, it is recommended that, wherever possible, the grading of streets in both Phase II and the remaining (Unit 2.) portion of Phase I, be accomplished so that drainage will follow the general guide-lines established by the flow arrows on each street of this proposed development, as shown on the Drainage Map included with this report.

Respectfully Submitted,

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