DRAINAGE MASTER PLAN
FOR
VISTA DEL NORTE SUBDIVISION

Prepared for:
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D-14/D002

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INTRODUCTION AND SITE LOCATION

The proposed Vista del Norte Subdivision, located in the lower northeast heights, is zoned SU-1 for mixed uses including single family residential, townhomes, multi-family residential, commercial, industrial, and neighborhood park uses (see Figure 1). The 408 acre subdivision is bounded by Osuna Road and developed commercial properties (Sego-Cox subdivision) on the south; primarily developed residential and industrial properties on the west; Paseo Del Norte and Way-Cor concrete plant on the north; and the AMAFCA North Diversion Channel on the east. This report will serve as the Drainage Master Plan for the entire subdivision and specific drainage plan for Phase 1, identifying major infrastructure required to handle the 100-year storm runoff so that the subdivision can be developed. As each tract develops, individual drainage reports, following the concepts described in this report, will be submitted for approval.

This report addresses the ultimate drainage solution and major drainage infrastructure as well as the phasing of the development and required drainage improvements for each phase of development. Included with this report is a mass grading plan for the entire property that will be used to rough grade the site.

METHODOLOGY

The hydrologic and hydraulic criteria in Section 22 of the City of Albuquerque Development Process Manual (DPM), entitled "Drainage, Flood Control, and Erosion Control," was followed to perform the analyses given in this report. The design storm used for both the existing undeveloped and fully developed conditions of Vista del Norte is the 100-year, 24-hour storm event for peak flow computations and for ponding volume calculations.

A hydrologic computer model using AHYMO 194 was developed for both existing and fully developed conditions to determine both the peak flows and peak volume expected for the development. A detailed sediment analysis was performed for both existing conditions and fully developed conditions following the methods described in Section 3.3 of the "Sediment and Erosion Design Guide" by AMAFCA. Finally, a hydraulic grade line (HGL) analysis of the entire storm sewer collection system was performed to assist in the sizing of the infrastructure.

EXISTING DRAINAGE CONDITIONS

INTRODUCTION

The Vista del Norte subdivision site is currently zoned SU-1. Presently Cal-Mat leases the site and utilizes it as an open-pit sand and gravel mine. All runoff generated on-site is

LAND USE	ACRES
RA-2 uses (3 du/ac)	20.0
R-1 uses (4 du/ac)	182.0
Mixed Residential uses (R-T, R-LT, and R-2)	122.5
C-2 uses	29.0
I-P uses	25.0
Neighborhood Park	6.5
Landscape Trail Easement	7.0
Setback Area	3.0
Drainage Pond (I-P uses)	10.0
TOTAL ACRES/DU'S	406.0

Park dedication required - 6.5 Acres

Landscape Trail Easement shall be 25' in width

Setback Area shall be a minimum of 15' in width

NOTES

1. Tracts B, C, D, E, F, K, and I: Uses permissive and as regulated by the R-1 zone, except that a 5' sideyard setback is permitted regardless of lot orientation.
2. Tracts L, G, H, and J: A mix of uses permissive and as regulated by the R-T, R-LT, and R-2 zones. Maximum of 50 acres of R-2.
3. Tract M: Uses permissive and as regulated in the C-2 zone, except that alcoholic drink sales for consumption off-premise within 500 feet of a residentially zoned property shall be permissive with the following exception:
   A. No drive-up liquor sales shall be allowed

   Tract N: Uses permissive and as regulated in the C-2 zone, except that alcoholic drink sales for consumption off-premise within 500 feet of a residentially zoned property shall be permissive with the following exceptions:
   A. No drive-up or drive-thru windows are permitted
   B. Liquor sales from gas stations or convenience stores are not permitted
4. Tracts O, Q, R, and S: Uses permissive and as regulated in the I-P zone, except no uses requiring air pollution control permits shall be allowed.
5. Tract P: Uses permissive and as regulated in the I-P zone, except no uses requiring air pollution control permits shall be allowed.
6. Zoning of the entire 406 acre site is "SU-1 for Limited Mixed Uses" to include sand and gravel extraction under specific restrictions, followed by the phasing-in of other land uses as shown on this Plan.

Land Use and Zoning Plan

Vista del Norte

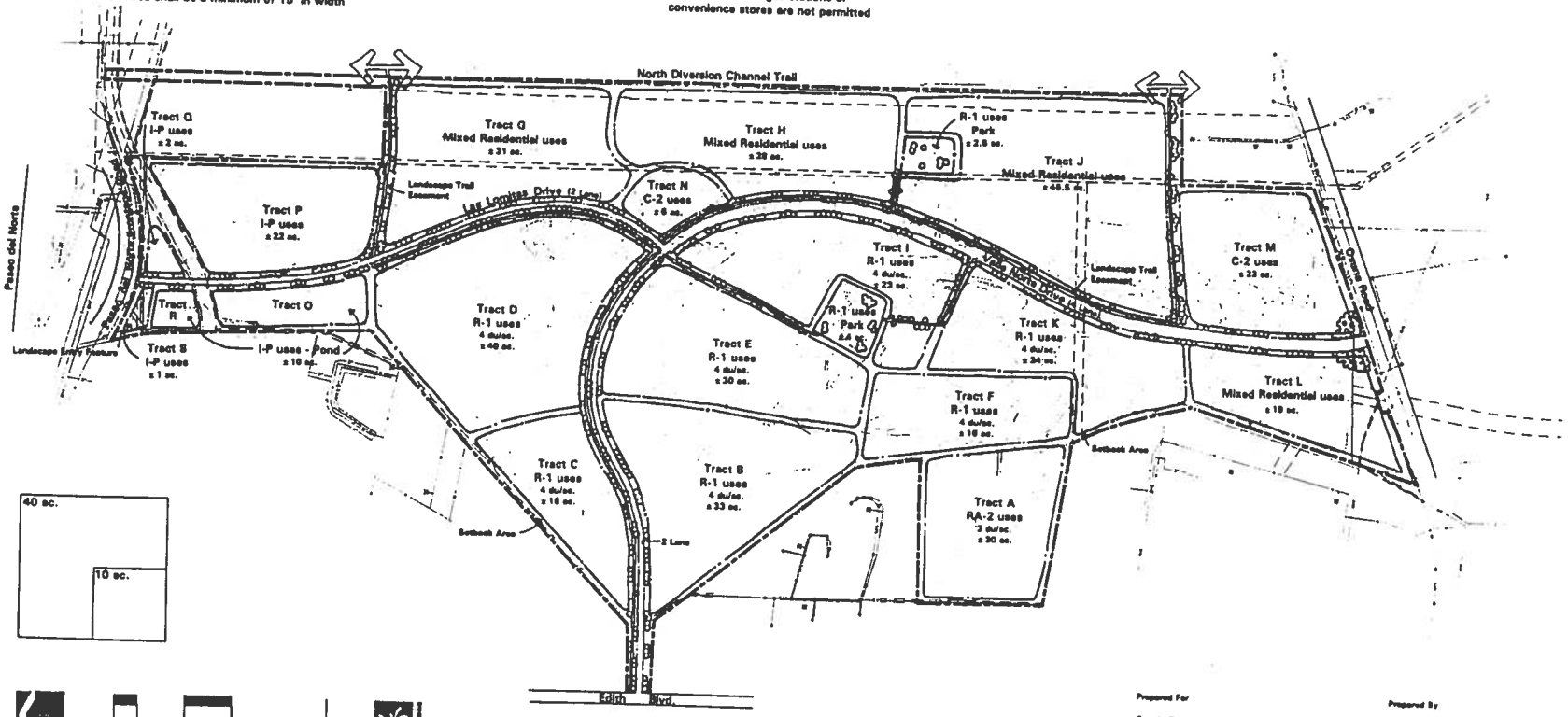

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FIGURE 1.

retained by an earth berm that is constructed along the perimeter of the property. The open-pit mining operation has excavated several holes in the site topography. Due to the nature of the site's present use, vegetation is scarce. Once the site is mass-graded, the property will be reclaimed. The AMAFCA North Diversion Channel adjacent to the east property line diverts off-site runoff from the site's historic arroyo's. As a result, no significant drainage courses traverse the site.

OFF-SITE FLOWS

Two tracts of land contribute off-site flows to Vista del Norte. These properties are the Sego-Cox commercial subdivision to the southeast corner of the property and the Way-Cor concrete plant located at the northeast corner of site. First, the 10 acre Sego-Cox subdivision adjacent to the southeast corner of the site discharges 47 cfs peak flows, contributing a total runoff volume of 2 acre-feet. This flow rate and volume were calculated by assigning 92% of the site to a type "D" land treatment (impermeable), with the remaining 8% assigned to a type "B" land treatment. Additionally, the 22.4 acre site of the Way-Cor concrete plant discharges 99.45 cfs peak flows contributing a total runoff volume of 4.1 cfs acre-feet from the 100-year storm event. This flow rate and volume were calculated treating the property as an industrial site with 80% type "D" and 20% type B land treatment.

ON-SITE FLOWS

For the existing conditions hydrologic analysis, a type "C" land treatment was used to determine peak flows and peak volumes. The on-site drainage basin boundaries coincide with each tract boundary so that peak flows from each tract can be determined. Table 1 shows the peak flows and volumes for each basin under existing conditions. All peak flows include sediment bulking.

Table 1 Existing Drainage Conditions

BASINS	Area (acres)	100yr-24hr Peak Flow (cfs)	100yr- 24hr Runoff Volume (acre-ft)	Sediment Bulking Factor	Land Treatment
A	19.94	66.30	1.97	1.07	100%C
B-1	17.92	60.43	1.82	1.10	100%C
B-2	17.28	58.27	1.75	1.10	100%C
C	17.06	56.21	1.67	1.06	100%C
D	42.67	141.78	4.21	1.07	100%C
E-1	17.60	59.35	1.78	1.10	100%C
E-2	17.00	57.41	1.72	1.10	100%C
F	17.43	58.71	1.76	1.09	100%C
G	31.63	105.95	3.14	1.08	100%C
H	24.06	80.41	2.42	1.09	100%C
I	17.28	58.28	1.75	1.10	100%C
J	48.17	169.19	5.01	1.13	100%C
K	15.74	52.61	1.58	1.09	100%C
L	19.16	66.50	1.97	1.09	100%C
M	23.71	80.09	2.38	1.12	100%C
N	6.54	21.28	.63	1.05	100%C
O	7.93	25.86	.77	1.05	100%C
P	23.96	78.73	2.34	1.06	100%C
Q	3.14	10.81	.32	1.11	100%C
R	2.55	8.75	.26	1.10	100%C
S	1.27	4.26	.13	1.07	100%C
Park "A"	2.50	8.14	.24	1.05	100%C
Park "B"	4.00	13.14	.39	1.05	100%C
Sego-Cox	10.00	46.92	1.96	1.06	8%B, 92%D
Way-Cor site	22.41	99.45	4.09	1.07	20%C, 80%D
West	1.60	5.17	.15	1.04	100%C

SEDIMENT ANALYSIS

A detailed sediment analysis was performed for existing conditions following the methods described in Section 3.3 of the "Sediment and Erosion Design Guide" by AMAFCA. First, the sediment wash load was computed for each basin using the Modified Universal Soil Loss Equation (MUSLE) as shown in the AMAFCA Sediment Guide. Input parameters of the MUSLE equation were determined for each basin following the procedure given in Appendix B of the AMAFCA Sediment Guide. Next, the coefficients and exponents for the unit bed load power function equation (equation 3.41 in the AMAFCA Sediment Guide) were determined using Figure 3.10 in the AMAFCA Sediment Guide inputting an average D_{50} for the site. Table 1 shows the results of the sediment analysis under existing conditions. Peak bulking factors range from 1.04 to 1.13 under existing conditions.

Figure 2 is a reproduction of the SCS soils maps showing the location of the various soils units within the subdivision. The FEMA floodplain maps, shown in Figure 3, do not indicate the presence of any floodplains on or near the site, other than the North Diversion Channel east of the site.

DEVELOPED DRAINAGE CONDITIONS

DRAINAGE BASIN DELINEATION

The site is divided into three major drainage basins, a north basin, a middle basin, and a south basin (see Plate 1). Each of the major basins drain to a detention pond. The north basin detention pond outlets to the North Diversion Channel east of the property via a stormwater pump station. The middle basin detention pond drains by gravity through a stormsewer system to the middle basin detention pond, which in turn drains to the south detention pond via a stormsewer. The south basin detention pond, located offsite to the west of the development within Bernalillo County, discharges to the Edith Boulevard Detention Pond No. 6 located near Bear Canyon Lane. These major basins are divided into several subbasins that generally follow the layout of the tracts. Generally, each subbasin fronting a major street (Valle Norte Drive and Las Lomitas Drive) includes one-half of the street right-of-way for the basin characteristics. Park "A" and Park "B" basins are the two exceptions. These two park basins comprise 6.5 acres that will be dedicated as neighborhood parks. Plate 1 displays the major basins and each of their subbasins.

The north basin consists of the on-site parcels north of Valle Norte Drive and includes the off-site subbasin of the Way-Cor concrete plant. The middle basin mostly includes the tracts south of Valle Norte Drive and west of Vista del Norte Drive in the middle of the development. The south basin includes most of the tracts at the south end of the development and the off-site basin of the Sego-Cox subdivision. There is one basin, the west basin, where on-site ponding will be allowed. The west basin, which is the west entrance from Edith Boulevard, is located mostly in Bernalillo County and is much lower in elevation than the rest of the development. Therefore, the west basin will pond the runoff adjacent to the entrance road just east of Edith Boulevard.

HYDROLOGIC ANALYSIS

To determine the peak flows and runoff volumes of each subbasin an AHYMO analysis was performed in accordance to section 22.2 of the Development Process Manual (DPM.) The analysis included the 100-year 24-hour storm. The 100-year 24-hour storm was the basis for determining peak flows to size the storm sewer collection system and was used to determine the required capacity of the detention and retention ponds. The design storm values are based on Tables C-1, C-2, and C-3 of the DPM's section 22.2. The Vista del Norte subdivision site is contained within sections D-16-Z and E-16-Z of the City of

Albuquerque Zone Atlas Map. The location of the site results in the following design storms:

100-year 1-hour event -- 2.00 inches,
100-year 6-hour event -- 2.30 inches,
100-year 24-hour event -- 2.60 inches.

Subbasins were assigned land treatment values in accordance with Tables A-4 and A-5 of the DPM's section 22.2. The off-site basins were assigned the land treatments discussed in the existing drainage conditions. The Vista del Norte subdivision consists of many tracts with a variety of land uses. Mixed residential tracts are governed by R-T, R-LT, and R-2 zoning, with a maximum of 50 acres zoned R-2. Since R-2 has a high percentage of land treatment type "D" (impervious), it was assigned to the mixed residential tracts at the upstream end of the stormsewer where it would have the greatest impact to the stormsewer collection system. The remaining mixed residential land was proportioned one-half R-LT and one-half R-T. A second analysis with the 50 acres of R-2 placed downstream near the ponding site required nearly the same pipe sizes throughout the stormsewer system. Table 2 shows the land treatments and areas for each subbasin within the north, middle, and south basins.

For basins smaller than 40 acres, the time of concentration was determined according to subsection A.6 of the DPM section 22.2. All of the basins, except for basins B and D, are smaller than 40 acres; therefore, they were assigned a time of concentration of 0.20 hr. The time of concentration for basins B and D was calculated using the SCS Upland Method Calculated outlined in subsection B.2 of DPM section 22.2. Appendix B presents these calculations.

SEDIMENT ANALYSIS

After the subbasin peak flows were calculated a sediment analysis in accordance with AMAFCA's Sediment and Erosion Design Guide was performed for each subbasin. The same procedure that was described earlier for existing conditions was followed for the developed conditions. The bulking factor applied to the subbasin peak flows (shown in Table 2) ranged from 1.03 on the smaller flatter subbasins to a high of 1.13 on the larger steeper subbasins. These values are conservative considering bed material load is unlikely to occur in fully developed tracts with stormsewer systems. The calculations leading to these bulking factors are in Appendix A.

Table 2 Developed Drainage Conditions

BASINS	Area (acres)	100yr-24hr Peak Flow (cfs)	.100yr-24hr Runoff Volume (acre-ft)	Sediment Bulking Factor	Land Treatment
North Basin Subbasin	---	---	---	---	---
C	17.06	61.68	2.25	1.06	58%B, 42%D
D	42.67	134.85	5.68	1.07	58%B, 42%D
G	31.63	123.48	4.77	1.09	44%B, 56%D
H	24.06	94.85	3.66	1.10	44%B, 56%D
N	6.54	30.07	1.26	1.05	10%B, 90%D
O	7.93	22.80	0.75	1.05	80%B, 20%D
P	23.96	105.28	4.33	1.06	20%B, 80%D
Q	3.14	14.46	0.59	1.11	20%B, 80%D
R	2.55	11.70	0.48	1.10	20%B, 80%D
S	1.27	5.70	0.23	1.07	20%B, 80%D
Way-Cor site	22.41	99.45	4.09	1.07	20%B, 80%D
Middle Basin Subbasins	---	---	---	---	---
B-1	17.92	63.42	2.36	1.10	58%B, 42%D
B-2	17.28	61.15	2.27	1.10	58%B, 42%D
E-1	17.60	62.29	2.31	1.10	58%B, 42%D
E-2	17.00	60.25	2.24	1.10	58%B, 42%D
F	17.43	61.61	2.29	1.10	58%B, 42%D
I	17.28	61.18	2.27	1.10	58%B, 42%D
½ J	24.09	110.35	4.54	1.13	23%B, 77%D
Park "A"	2.50	7.08	0.23	1.04	80%B, 20%D
Park "B"	4.00	11.59	0.38	1.05	80%B, 20%D
South Basin Subbasins	---	---	---	---	---
A	19.94	65.37	2.33	1.06	65%B, 35%D
½ J	24.09	110.35	4.54	1.13	23%B, 77%D
K	15.74	55.21	2.05	1.09	58%B, 42%D
L	19.16	81.63	3.28	1.09	20%B, 80%D
M	23.71	116.30	4.88	1.12	10%B, 90%D
Sego-Cox	10.00	46.92	1.98	1.06	8%B, 92%D
Other Basins	---	---	---	---	---
West	1.60	6.85	0.28	1.03	20%B, 80%D

DRAINAGE MASTERPLAN CONCEPT

Introduction

This drainage report addresses the drainage concept for the fully developed condition of Vista del Norte. Also, this report addresses the interim drainage concepts and infrastructure required for each phase of development of the project.

The ultimate drainage masterplan concept for the Vista del Norte subdivision is to collect storm water runoff from each basin in a stormsewer system and discharge the stormwater into detention ponds, which are either discharged into the North Diversion Channel through a stormwater pump station or discharged to the County Maintained Edith Boulevard Drainage System (see Plate 1, Drainage Plan). There is one basin, the west basin, where the 100-year, 10-day storm will be allowed to pond on-site with no outlet. Runoff from the west basin, located mostly in Bernalillo County, will be retained in a pond located along the north side of the entrance road. The 100-year, 10-day storm for the west basin is 0.58 acre-feet.

As mentioned previously, the site is divided into three major drainage basins, the north basin, the middle basin, and south basin. These major basins have separate stormsewer systems draining into detention ponds. A stormwater pump station, constructed to City of Albuquerque standards, will evacuate the north detention pond within 24 hours by discharging approximately 16 cfs into the North Diversion Channel. Preliminary discussions with AMAFCA have indicated that discharging the stormwater into the North Diversion Channel is feasible, but will need to be approved by both AMAFCA and the Corps of Engineers. City of Albuquerque stormwater pump maintenance personnel have indicated that if the proposed pump station is designed and constructed to City of Albuquerque criteria, the City will take over maintenance of the facility.

The middle basin detention pond, located on Tract B-2, drains to the south basin detention pond through a 24" stormsewer. The south basin detention pond, which accepts flows from both the middle detention pond and directly from the south drainage basins, is located west of Vista del Norte within Bernalillo County. The south basin detention ponds are discharged through a 24" stormsewer in Edith Boulevard at a rate of 7.5 cfs to the Edith Boulevard Detention Pond No. 6. According to the "Edith Boulevard Drainage Analysis Report" by Boyle Engineering, the Edith Boulevard Detention Pond No. 6 has a discharge of 7.5 cfs to the Alameda Drain adjacent to 2nd Street.

The South Detention Pond is a series of five detention ponds that are connected through an 18 inch pipe with stand pipe inlets in each pond. Each of the five detention ponds has an overflow spillway, sized to pass the 100-year peak flow, to the next pond down stream. The most downstream pond has a stand pipe that drains to a 24 inch stormsewer, located in the Edith Boulevard Right-of-Way on the east side of the road, which drains to Edith Boulevard Detention Pond No. 6.

An AHYMO analysis of the Edith Boulevard Detention Pond No. 6 was completed. According to the Boyle report, Basin 13 drains directly into Pond 6. The analysis indicated that the pond did not have enough capacity to detain the runoff from Basin 13. Therefore, the capacity of Pond 6 was increased to accommodate the additional runoff volume that drains to the pond using AHYMO instead of the HEC-1 hydrologic model, which was used by Boyle. The pond will require regrading to allow for the detention of additional stormwater volume without overtopping the emergency spillway (see Plate 4).

Storm Sewer Hydraulics Analysis

Once the hydrologic and sediment analysis were completed, a hydraulic grade line (HGL) analysis was performed to size the proposed stormsewer pipes. The HGL was analyzed in accordance with the DPM's criteria for the hydraulic design of closed conduits. The control water surface at the outfall of the stormsewer was equal to the 100-year water surface elevation of each of the detention ponds. The stormsewer sizes are shown on the Drainage Plan. The HGL analysis is shown in Appendix B.

Detention Pond Analysis

The next step was to analyze the outfall of the stormsewer system. The north, middle, and south drainage basins each drain to their own detention pond. The middle and south ponds are linked together with a 24 inch diameter stormsewer conveying runoff volume from the middle basin to the south pond. The pumping station in the North Detention Pond will be designed to release 16 cfs into the North Diversion Channel. The required capacity of the detention ponding system was taken from the overall site runoff volume of the 100-year 24-hour storm calculated with AHYMO. Each pond will be fenced and have 3:1 side slopes. The middle and north detention ponds do not include an overflow spillway because the available ponding volume is much greater than the 100-year, 24-hour volume for each basin. The detention pond designs will be submitted to the State Engineers Office for their review and approval. Table 4 illustrates the capacities of the detention ponds.

Stormwater Pump Station

The proposed stormwater pump station will be designed and constructed to City of Albuquerque criteria. The Claremont stormwater pump station and the Osage/La Media stormwater pump station will be used as models for the design of the Vista del Norte pump station. The proposed pump station will have redundant main pumps and sump pumps, a climber screen, a radio telemetry system, above ground control building, and one power source. The north detention pond will act as the wet well for the pump station. The north detention pond will have enough volume to store the 100-year, 24-hour volume with no outfall. The pond and pump station will be fenced and access will be obtained from Las Lomitas Drive. Prior to the design of the pump station, a Design Analysis

Report will be prepared to size all of the mechanical and electrical equipment for the pump station.

Table 3 Detention Pond Capacities

Drainage Basin	100yr-24hr Runoff Volume (acre-ft)	Pond Capacity (acre-ft)	100yr-24hr Water Surface Elevation	Comments
North	23.5	62.4	5016.10	Pump Station at Pond discharges within 24 hours.
Middle	15.4	22.4	5026.50	Discharges to South Pond.
South	18.9	38.1	Varies from 5005 to 5025	Discharges to Edith Blvd. Detention Pond No. 6.
Total Site	57.8	122.9	---	

Offsite South Detention Basin

It is proposed that Tracts 9 and 10A3, MRGCD Map 29, be constructed as a joint-use storm drainage/ park facility for the County of Bernalillo (see Plate 3, South Detention Basin Area). On January 7, 1998, a Special Use Permit was approved with conditions by the Bernalillo County Planning Commission for Recreation and Drainage Facilities. The proposed park area would include three youth soccer fields that double as storm water detention facilities during larger more infrequent storms. In addition, one small bio-filter area and three separate detention facilities would be constructed within the property that would detain the majority of storm flows from the Vista del Norte development located east of the property. The proposed plan provides a unique opportunity for the County to obtain some much-needed youth soccer fields while providing detention facilities for storm water runoff from Vista del Norte.

The property is located just north of Tyler Road between Edith Boulevard and the proposed Vista del Norte development. The plan, which is modeled after the City's Osage/La Media bio-filter and low flow ponds near Central and the Rio Grande, includes constructing a bio-filter area and as many as five storm water detention areas along the length of the property with three of the detention areas serving as youth soccer fields. The sedimentation/detention basin and bio-filter area will be maintained by the City of Albuquerque and the control release pond and three athletic fields/detention ponds will be maintained by Bernalillo County.

Storm runoff from the Vista del Norte project will be discharged into the sedimentation basin through underground storm sewers. Low flows and nuisance flows will be captured

in the sedimentation basin to drop out sediment before discharging to the bio-filter area. Flows from frequent storms will filter through the rock dam between the sedimentation pond and the upper detention basin. From the upper detention basin, a 18 inch pipe with a stand pipe inlet to control the discharge, will convey flows to the lower control release pond adjacent to Edith Boulevard, bypassing the middle three ponds/ athletic fields. The sedimentation basin, upper detention pond, and lower control release pond will detain the volume from more frequent storm events. Runoff from larger more infrequent storms will spill into the middle three ponds/ athletic fields through hard-lined emergency spillways sized to pass the 100-year storm.

The middle three ponds will have standpipes connected to the 18 inch drain pipe which drains to the control release pond. Stormwater from the control release area, located adjacent to Edith Boulevard, will be discharged via a standpipe into a 24 inch outlet pipe at a rate of about 7.5 cfs. The outlet pipe, located within the Edith Boulevard right-of-way, will run south until it discharges to the existing Edith Boulevard Pond No. 6. Edith Boulevard Pond No. 6 discharges through a pipe and natural channel to the Alameda Drain located west of Second Street. In preliminary discussions with Bernalillo County Public Works, they indicated that the Edith Pond No. 6 has plenty of capacity to accept flows from this system. It is proposed that the City would maintain the sedimentation basin, detention basin, and the bio-filter area, and the County would maintain the three detention ponds/ athletic fields, and the control release pond.

A parking area would be located approximately 1000 feet east of Edith Boulevard with access to Tyler Road through an existing 30 foot access easement. Also, a 15 foot-wide, gravel-surfaced maintenance road will be located along the north side of the detention ponds. Ramps into the sedimentation basin and into the control release pond will be constructed for access into the ponds for maintenance. The sedimentation basin and detention pond are separated by a 4 foot high rock filter dam. The rock filter dam will retain the sediment and allow the stormwater to filter through the dam. A 6 inch diameter pipe will connect the sedimentation basin at the upstream side of the facility with the bio-filter area, which is similar to the Osage/La Media bio-filter area. The bio-filter area will be planted with vegetation as suggested by Mr. Loren Meinz with City Hydrology to assist in removing pollutants in the storm water. The bio-filter area, which will be lined, will have a 2 foot deep pool of standing water. An overflow pipe will discharge out of the bio-filter area into the 18 inch drain pipe connecting the detention basins.

A geotechnical investigation was completed by Vinyard & Associates, Inc. for the offsite south detention pond area (see Appendix C). There was some concern about lateral migration of water from the detention ponds. As a result of the geotechnical investigation, it is recommended by Vinyard to line the bio-filter area with an impervious liner since it will have water most of the time. Vinyard also recommended that the bottom four feet and a ten foot thickness of the sideslopes of the detention pond areas be over-excavated and reconstructed and compacted with structural fill composed of site soils.

Phasing of Drainage Improvements

The Vista del Norte subdivision will be developed in three phases. Phase 1 will require the construction of the middle detention pond and the south detention pond and associated stormsewer system for Tracts A, F, J, K, L, and M included in Phase 1. During Phase 1, the entire site will be mass graded and reclaimed. Interim detention ponds sized to retain the 100-year 10-day storm volume from the basins not included in Phase 1 will be constructed (see Plate 2). Table 4 shows the required volume to be retained in the interim drainage ponds. Each interim drainage pond will have one foot of freeboard. The north detention pond, the stormwater pump station, and associated stormsewer system will be required to be constructed in Phase 2. Only the stormsewer system will be required to be constructed in Phase 3. A preliminary infrastructure list for Phase 1 is included in Appendix B showing the required drainage improvements.

Table 4 Interim Retention Pond Volumes

Interim Pond	Basins Draining to Each Pond	100yr-10-day Volume (ac-ft)	100yr-10-day Water Surface Elevation	Comments
Number 1	B-1, B-2, E-1, E-2, I	9.21	5029.9	3.9 foot depth
Number 2	C	1.67	5028.9	3.9 foot depth
Number 3	0.2D, 0.33G, H,N	4.91	5031.0	4 foot depth
Number 4	0.8D, 0.67G,O,P,Q, R,S,Way Cor	12.60	5027.1	7.1 foot depth (location of north detention pond)

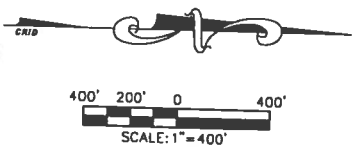
CURVE DATA

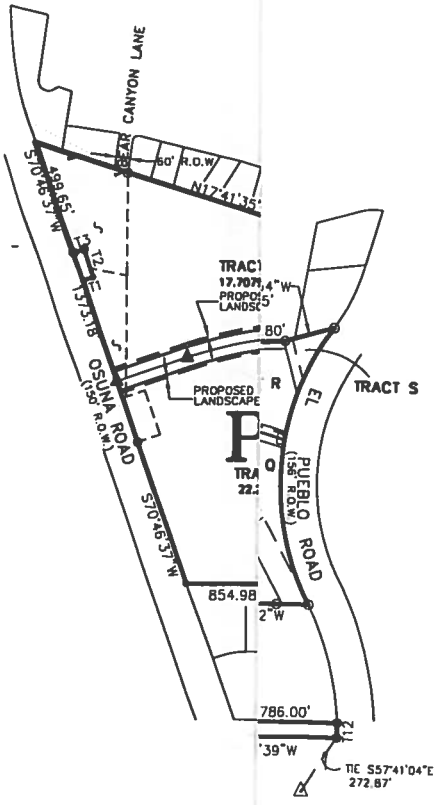
CURVE	RADIUS	LENGTH	CHORD	BEARING
C1	1600.00'	1265.68'	1232.94'	N03°26'20"E
C2	1100.00'	1396.79'	1304.82'	N10°15'36"W
C3	1100.00'	1279.21'	1208.33'	N79°58'08"W
C4	1600.00'	1007.68'	991.11'	S84°45'30"W
C5	750.00'	862.18'	815.48'	N10°24'48"E
C6	1987.54'	1499.32'	1464.02'	S02°53'03"E
C7	1104.70'	1233.12'	1170.09'	S86°39'52"E

E

TANGENT DATA

LINE	DIRECTION	DISTANCE
T1	N19°13'23"W	45.00'
T2	S70°46'37"W	125.99'
T3	S19°13'23"E	45.00'
T4	N13°01'35"W	525.66'
T5	N26°15'18"W	293.13'
T6	N08°19'01"W	412.43'
T7	N08°02'07"W	38.26'
T8	N81°30'22"W	464.11'
T9	N12°48'03"E	164.01'
T10	S80°19'14"E	405.59'
T11	N09°09'38"W	5.06'
T12	S89°32'50"E	63.92'





LEGEND

- △ FND. CITY OF ALBUQUERQUE CONTROL SURVEY MONUMENT
- ▲
- ◎ FND. 2" ALUM. CAP STAMPED "AGP" OR "AAR"
- ● FND. PROPERTY CORNER
- ○ #5 REBAR W/CAP STAMPED "AVID ENG. INC. NMPS 11462" TO BE SET.

DATE: JANUARY 1998
AVID JOB No. 6012.06

AVID ENGINEERING, INC.
Civil • Structural • Transportation
5801 Osuna Rd. NE - Suite 200
Albuquerque, NM 87109 - (505) 881-3357

SHEET NO. 1 OF 1

EXISTING SEDIMENT
ANALYSIS USING MUSLE EQUATION

BASIN	AREA SQ MI				PERCENT IMPERV	QP CFS	VOL AC-FT	WGHTD K	C	GAMMA	SLOPE %	N	LS	YS TONS	YS' TONS	CS PPM	QFS WASH LOAD
A	0.03120				0%	61.96	1.840	0.100	0.45	400	0.50	0.3	0.15	27.12	27.12	10728	0.25
K	0.04000				0%	79.43	2.359	0.100	0.45	400	0.83	0.3	0.18	42.97	42.97	13225	0.40
F	0.02530				0%	50.24	1.492	0.100	0.45	400	1.00	0.3	0.20	28.06	28.06	13650	0.26
PARK B	0.00630				0%	12.52	0.371	0.100	0.45	400	0.63	0.3	0.16	4.86	4.86	9555	0.05
I	0.04480				0%	88.97	2.642	0.100	0.45	400	0.90	0.3	0.19	50.59	50.59	13894	0.47
E	0.03940				0%	78.24	2.323	0.100	0.45	400	0.31	0.3	0.13	31.42	31.42	9853	0.29
B	0.04790				0%	95.12	2.824	0.100	0.45	400	0.16	0.3	0.12	35.53	35.53	9173	0.33
L	0.02990				0%	59.38	1.763	0.100	0.45	400	0.92	0.3	0.19	32.49	32.49	13380	0.30
M	0.03700				0%	73.48	2.182	0.100	0.45	400	1.76	0.3	0.28	60.64	60.64	20040	0.57
CIBOLA	0.01560				92%	44.05	1.632	0.100	0.45	400	0.50	0.3	0.15	20.95	1.68	755	0.01
J	0.07530				0%	149.72	4.440	0.100	0.45	400	2.00	0.3	0.30	148.14	148.14	23962	1.39
PARK A	0.00390				0%	7.75	0.230	0.100	0.45	400	0.67	0.3	0.16	2.91	2.91	9219	0.03
H	0.03760				0%	74.67	2.217	0.100	0.45	400	2.10	0.3	0.32	70.71	70.71	22929	0.66
N	0.01020				0%	20.26	0.601	0.100	0.45	400	0.46	0.3	0.15	7.57	7.57	9183	0.07
D	0.06670				0%	132.51	3.933	0.100	0.45	400	0.41	0.3	0.14	60.23	60.23	11143	0.56
G	0.04940				0%	98.10	2.913	0.100	0.45	400	2.10	0.3	0.32	95.99	95.99	23673	0.90
N.E.	0.03500				0%	69.51	2.064	0.100	0.45	400	0.50	0.3	0.15	30.84	30.84	10876	0.29
P	0.03740				0%	74.27	2.205	0.100	0.45	400	0.94	0.3	0.19	42.17	42.17	13878	0.39
S	0.00200				0%	3.98	0.118	0.100	0.45	400	2.00	0.3	0.30	2.55	2.55	15639	0.02
Q	0.00490				0%	9.74	0.289	0.100	0.45	400	3.00	0.3	0.43	9.92	9.92	24637	0.09
R	0.00400				0%	7.95	0.236	0.100	0.45	400	2.90	0.3	0.42	7.65	7.65	23296	0.07
C	0.02670				0%	53.03	1.574	0.100	0.45	400	0.57	0.3	0.16	23.71	23.71	10961	0.22
O	0.01240				0%	24.63	0.731	0.100	0.45	400	0.50	0.3	0.15	9.65	9.65	9617	0.09
WEST FR.	0.00250				0%	4.97	0.147	0.100	0.45	400	0.50	0.3	0.15	1.60	1.60	7961	0.02

BED MATERIAL AND TOTAL SEDIMENT YIELD ANALYSIS

a = 1.20E-02 n = 0.042
b = 2.50
c = 0.70
d = 1.80

BASIN	AREA SQ MI	QP CFS	VOL AC-FT	YS' TONS	SED. VOL AC-FT	Cfs PPM	q unit width	AVG SLOPE	VEL	DEPTH	WD	qs (unit width bed load)	QS BED LOAD	QS TOTAL	BF	Q BULK	SED VOL AC-FT
A	0.03120	61.96	1.840	27.12	0.0125	10728	4.92	0.005	3.28	1.50	12.6	0.30	3.83	4.09	1.07	66.05	0.12
K	0.04000	79.43	2.359	42.97	0.0197	13225	5.71	0.0079	3.99	1.43	13.9	0.48	6.67	7.07	1.09	86.50	0.21
F	0.02530	50.24	1.492	28.06	0.0129	13650	4.34	0.01	3.84	1.13	11.6	0.37	4.26	4.53	1.09	54.77	0.13
PARK B	0.00630	12.52	0.371	4.86	0.0022	9555	1.89	0.0063	2.39	0.79	6.6	0.09	0.59	0.63	1.05	13.15	0.02
I	0.04480	88.97	2.642	50.59	0.0232	13894	6.11	0.009	4.27	1.43	14.6	0.57	8.24	8.71	1.10	97.68	0.26
E	0.03940	78.24	2.323	31.42	0.0144	9853	5.66	0.0022	2.71	2.09	13.8	0.24	3.30	3.59	1.05	81.83	0.11
B	0.04790	95.12	2.824	35.53	0.0163	9173	6.36	0.0016	2.58	2.46	14.9	0.24	3.55	3.89	1.04	99.01	0.12
L	0.02990	59.38	1.763	32.49	0.0149	13380	4.80	0.0087	3.83	1.25	12.4	0.39	4.88	5.18	1.09	64.56	0.15
M	0.03700	73.48	2.182	60.64	0.0278	20040	5.45	0.014	4.65	1.17	13.5	0.60	8.14	8.70	1.12	82.18	0.26
CIBOLA	0.01560	44.05	1.632	1.68	0.0008	755	4.01	0.005	3.02	1.33	11.0	0.23	2.55	2.56	1.06	46.61	0.09
J	0.07530	149.72	4.440	148.14	0.0680	23962	8.36	0.012	5.27	1.59	17.9	1.01	18.12	19.51	1.13	169.23	0.58
PARK A	0.00390	7.75	0.230	2.91	0.0013	9219	1.41	0.0063	2.13	0.66	5.5	0.06	0.32	0.35	1.05	8.10	0.01
H	0.03760	74.67	2.217	70.71	0.0325	22929	5.50	0.0075	3.87	1.42	13.6	0.43	5.90	6.56	1.09	81.23	0.19
N	0.01020	20.26	0.601	7.57	0.0035	9183	2.52	0.0046	2.45	1.03	8.1	0.11	0.91	0.98	1.05	21.24	0.03
D	0.06670	132.51	3.933	60.23	0.0277	11143	7.77	0.0038	3.62	2.14	17.1	0.50	8.56	9.12	1.07	141.63	0.27
G	0.04940	98.10	2.913	95.99	0.0441	23673	6.48	0.0057	3.81	1.70	15.1	0.47	7.14	8.04	1.08	106.14	0.24
N.E.	0.03500	69.51	2.064	30.84	0.0142	10876	5.27	0.005	3.37	1.56	13.2	0.34	4.43	4.71	1.07	74.22	0.14
P	0.03740	74.27	2.205	42.17	0.0194	13878	5.49	0.0031	2.97	1.85	13.5	0.27	3.69	4.09	1.06	78.36	0.12
S	0.00200	3.98	0.118	2.55	0.0012	15639	0.95	0.02	2.57	0.37	4.2	0.06	0.26	0.28	1.07	4.26	0.01
Q	0.00490	9.74	0.289	9.92	0.0046	24637	1.62	0.03	3.60	0.45	6.0	0.16	0.97	1.06	1.11	10.80	0.03
R	0.00400	7.95	0.236	7.65	0.0035	23296	1.44	0.029	3.39	0.42	5.5	0.13	0.74	0.81	1.10	8.76	0.02
C	0.02670	53.03	1.574	23.71	0.0109	10961	4.48	0.0047	3.10	1.45	11.8	0.26	3.05	3.27	1.06	56.30	0.10
O	0.01240	24.63	0.731	9.65	0.0044	9617	2.83	0.005	2.63	1.08	8.7	0.14	1.21	1.30	1.05	25.93	0.04
WEST FR.	0.00250	4.97	0.147	1.60	0.0007	7961	1.08	0.005	1.79	0.61	4.6	0.04	0.16	0.18	1.04	5.15	0.01

FUTURE SEDIMENT
ANALYSIS USING MUSLE EQUATION

BASIN	AREA SQ MI				PERCENT IMPERV	QP CFS	VOL AC-FT	WGHTD K	C	GAMMA	SLOPE %	N	LS	YS TONS	YS' TONS	CS PPM	QFS WASH LOAD
A	0.03120				35%	61.67	2.025	0.100	0.45	400	0.50	0.3	0.15	28.54	18.55	6695	0.16
K	0.04000				42%	83.28	2.791	0.100	0.45	400	1.00	0.3	0.20	52.89	30.67	8022	0.25
F	0.02530				42%	52.68	1.765	0.100	0.45	400	1.00	0.3	0.20	31.66	18.36	7597	0.15
PARK B	0.00630				20%	11.04	0.343	0.100	0.45	400	0.63	0.3	0.16	4.34	3.47	7390	0.03
I	0.04480				42%	93.72	3.126	0.100	0.45	400	0.75	0.3	0.17	52.89	30.68	7169	0.26
E	0.03940				42%	82.03	2.749	0.100	0.45	400	0.50	0.3	0.15	39.73	23.04	6130	0.19
B	0.04790				42%	99.72	3.342	0.100	0.45	400	0.16	0.3	0.12	40.09	23.25	5094	0.19
L	0.02990				70%	74.89	2.670	0.100	0.45	400	1.00	0.3	0.20	48.61	14.58	4003	0.11
M	0.03700				90%	103.84	3.820	0.100	0.45	400	2.50	0.3	0.37	133.72	13.37	2569	0.10
CIBOLA	0.01560				92%	44.26	1.632	0.100	0.45	400	0.50	0.3	0.15	21.00	1.68	757	0.01
J	0.07530				65%	182.93	6.462	0.100	0.45	400	5.00	0.5	1.07	719.18	251.71	27863	1.98
PARK A	0.00390				20%	6.84	0.212	0.100	0.45	400	0.63	0.3	0.16	2.53	2.03	6988	0.02
H	0.03760				56%	86.23	2.991	0.100	0.45	400	8.50	0.5	2.16	620.98	273.23	62983	2.19
N	0.01020				90%	28.64	1.053	0.100	0.45	400	0.50	0.3	0.15	12.88	1.29	899	0.01
D	0.06670				42%	138.91	4.654	0.100	0.45	400	0.50	0.3	0.15	71.66	41.56	6528	0.34
G	0.04940				56%	113.28	3.929	0.100	0.45	400	7.80	0.5	1.91	745.89	328.19	57903	2.63
N.E.	0.03500				80%	92.95	3.370	0.100	0.45	400	0.50	0.3	0.15	47.76	9.55	2081	0.07
P	0.03740				80%	99.32	3.601	0.100	0.45	400	6.30	0.5	1.43	493.38	98.68	19764	0.76
S	0.00200				80%	5.33	0.193	0.100	0.45	400	2.10	0.3	0.32	4.11	0.82	3123	0.01
Q	0.00490				80%	13.03	0.472	0.100	0.45	400	3.00	0.3	0.43	15.37	3.07	4769	0.02
R	0.00400				80%	10.64	0.385	0.100	0.45	400	1.80	0.3	0.28	7.91	1.58	3014	0.01
C	0.02670				42%	55.59	1.863	0.100	0.45	400	0.50	0.3	0.15	25.70	14.90	5852	0.12
O	0.01240				20%	21.71	0.675	0.100	0.45	400	0.50	0.3	0.15	8.60	6.88	7441	0.06
WEST FR.	0.00250				80%	6.65	0.241	0.100	0.45	400	0.50	0.3	0.15	2.49	0.50	1518	0.00

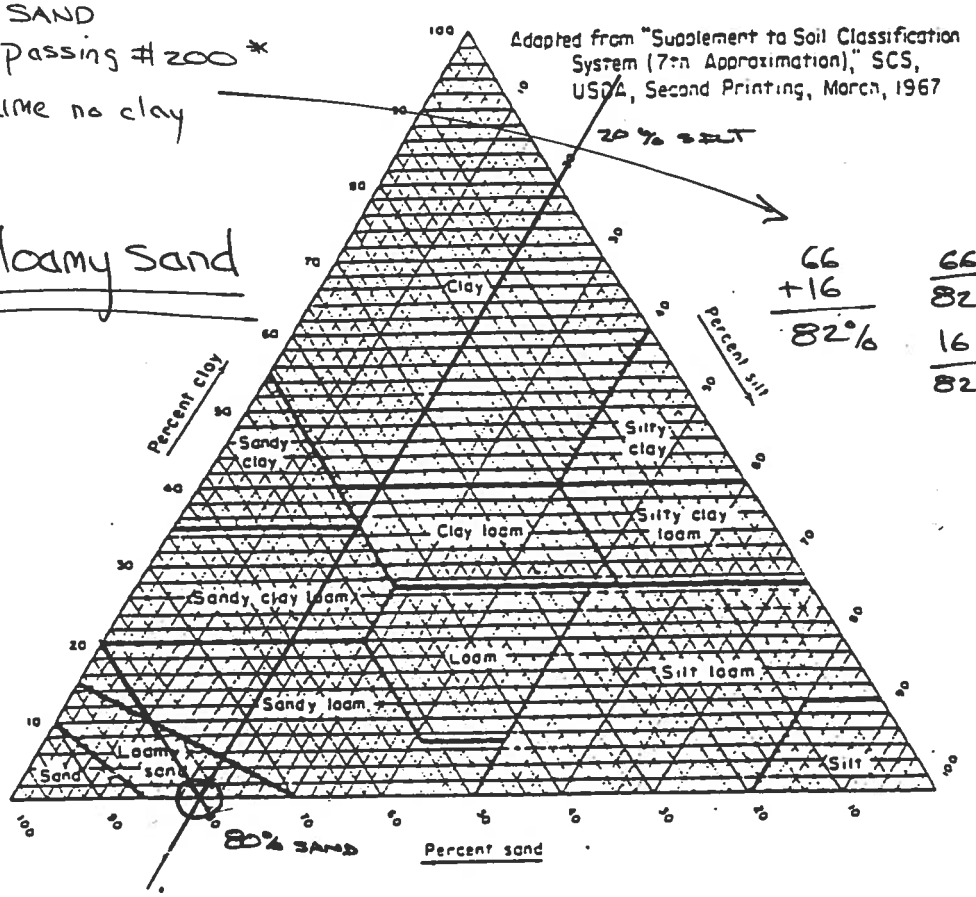
BED MATERIAL AND TOTAL SEDIMENT YIELD ANALYSIS

a = 1.20E-02 n = 0.042
b = 2.50
c = 0.70
d = 1.80

BASIN	AREA SQ MI	QP CFS	VOL AC-FT	YS' TONS	SED. VOL. AC-FT	Cts PPM	q unit width	AVG. SLOPE	VEL	DEPTH	WD	qs (unit width bed load)	QS BED LOAD	QS TOTAL	BF	Q BULK	SED VOL AC-FT
A	0.03120	61.96	1.840	18.55	0.0085	7363	4.92	0.005	3.28	1.50	12.6	0.31	3.86	4.01	1.06	65.97	0.12
K	0.04000	79.43	2.359	30.67	0.0141	9477	5.71	0.0079	3.99	1.43	13.9	0.48	6.71	6.97	1.09	86.40	0.21
F	0.02530	50.24	1.492	18.36	0.0084	8974	4.34	0.01	3.84	1.13	11.6	0.37	4.30	4.45	1.09	54.69	0.13
PARK B	0.00630	12.52	0.371	3.47	0.0016	6836	1.89	0.0063	2.39	0.79	6.6	0.09	0.59	0.62	1.05	13.14	0.02
I	0.04480	88.97	2.642	30.68	0.0141	8472	6.11	0.009	4.27	1.43	14.6	0.57	8.32	8.57	1.10	97.54	0.25
E	0.03940	78.24	2.323	23.04	0.0106	7246	5.66	0.0022	2.71	2.09	13.8	0.24	3.32	3.51	1.04	81.75	0.10
B	0.04790	95.12	2.824	23.25	0.0107	6022	6.36	0.0016	2.58	2.46	14.9	0.24	3.57	3.77	1.04	98.89	0.11
L	0.02990	59.38	1.763	14.58	0.0067	6050	4.80	0.0087	3.83	1.25	12.4	0.40	4.94	5.06	1.09	64.44	0.15
M	0.03700	73.48	2.182	13.37	0.0061	4489	5.45	0.014	4.65	1.17	13.5	0.62	8.37	8.47	1.12	81.95	0.25
CIBOLA	0.01560	44.05	1.632	1.68	0.0008	757	4.01	0.005	3.02	1.33	11.0	0.23	2.55	2.56	1.06	46.61	0.09
J	0.07530	149.72	4.440	251.71	0.1156	40044	8.36	0.012	5.27	1.59	17.9	0.98	17.59	19.57	1.13	169.29	0.58
PARK A	0.00390	7.75	0.230	2.03	0.0009	6444	1.41	0.0063	2.13	0.66	5.5	0.06	0.32	0.34	1.04	8.09	0.01
H	0.03760	74.67	2.217	273.23	0.1255	83143	5.50	0.0075	3.87	1.42	13.6	0.39	5.26	7.44	1.10	82.11	0.22
N	0.01020	20.26	0.601	1.29	0.0006	1574	2.52	0.0046	2.45	1.03	8.1	0.11	0.92	0.93	1.05	21.19	0.03
O	0.06670	132.51	3.933	41.56	0.0191	7716	7.77	0.0038	3.62	2.14	17.1	0.50	8.61	8.95	1.07	141.46	0.27
G	0.04940	98.10	2.913	328.19	0.1507	76552	6.48	0.0057	3.81	1.70	15.1	0.43	6.46	9.09	1.09	107.19	0.27
N.E.	0.03500	69.51	2.064	9.55	0.0044	3394	5.27	0.005	3.37	1.56	13.2	0.34	4.49	4.56	1.07	74.07	0.14
P	0.03740	74.27	2.205	98.68	0.0453	31878	5.49	0.0031	2.97	1.85	13.5	0.26	3.57	4.33	1.06	78.60	0.13
S	0.00200	3.98	0.118	0.82	0.0004	5098	0.95	0.02	2.57	0.37	4.2	0.06	0.26	0.27	1.07	4.25	0.01
Q	0.00490	9.74	0.289	3.07	0.0014	7765	1.62	0.03	3.60	0.45	6.0	0.17	1.00	1.02	1.11	10.76	0.03
R	0.00400	7.95	0.236	1.58	0.0007	4907	1.44	0.029	3.39	0.42	5.5	0.14	0.77	0.78	1.10	8.73	0.02
C	0.02670	53.03	1.574	14.90	0.0068	6919	4.48	0.0047	3.10	1.45	11.8	0.26	3.07	3.20	1.06	56.23	0.09
D	0.01240	24.63	0.731	6.88	0.0032	6875	2.83	0.005	2.63	1.08	8.7	0.14	1.22	1.28	1.05	25.91	0.04
WEST FR.	0.00250	4.97	0.147	0.50	0.0002	2486	1.08	0.005	1.79	0.61	4.6	0.04	0.17	0.17	1.03	5.14	0.01

18% Gravel
66% SAND
16% passing #200 *
* assume no clay

∴ use loamy Sand



66 + 16 = 82%

66/82 = 80% sand

16/82 = 20% silt

COMPARISON OF PARTICLE-SIZE SCALES

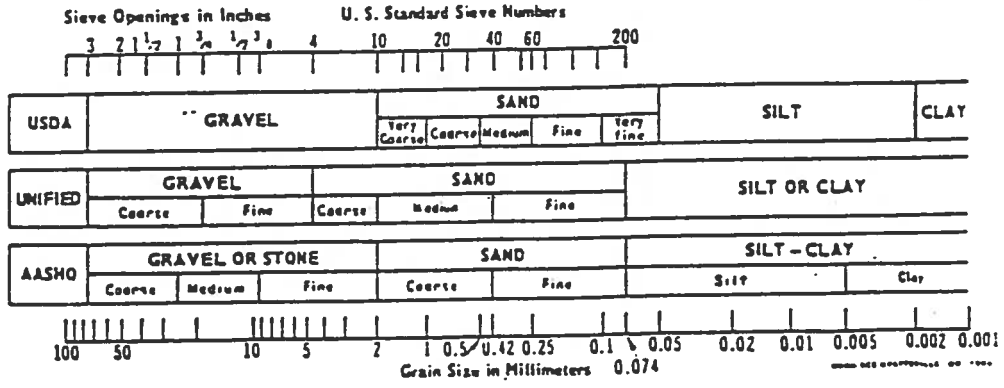
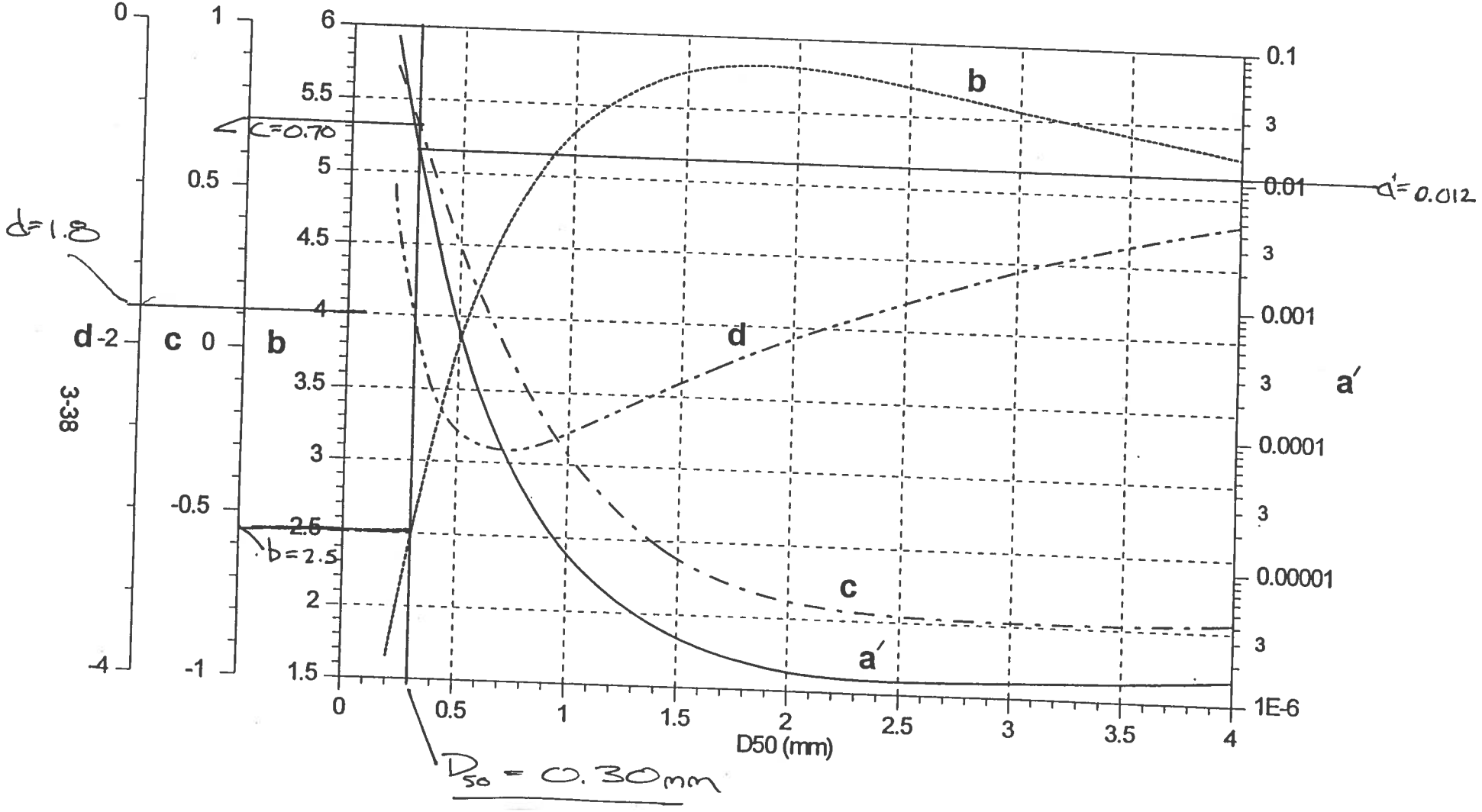


Figure B.1. Guide for the textural classification of soil.

$D_{50} = 0.30mm$

USE → $a' = 0.012$, $b = 2.5$, $c = 0.70$, $d = 1.8$



USDA

USE K = 0.10

Table B.1. Soil Erodibility Factor K Based on USDA Texture.				
	Estimated K Factor[1]			
USDA Texture	Normal[2]	Gravelly[2]	Very Gravelly[2]	Extremely Gravelly[2]
Coarse Sand	0.10	0.05	0.02	0.02
Sand	0.10	0.05	0.02	0.02
Fine Sand	0.17	0.10	0.05	0.02
Very Coarse Sand	0.10	0.05	0.02	0.02
Loamy Coarse Sand	0.15	0.10	0.05	0.02
Loamy Sand	0.17	0.10	0.05	0.02
Loamy Fine Sand	0.20	0.10	0.05	0.02
Loamy Very Fine Sand	0.49	0.28	0.15	0.05
Coarse Sandy Loam	0.20	0.10	0.05	0.02
Sandy Loam	0.24	0.15	0.10	0.05
Fine Sandy Loam	0.28	0.15	0.10	0.05
Very Fine Sandy Loam	0.55	0.28	0.17	0.10
Loam	0.37	0.20	0.10	0.05
Silt Loam	0.43	0.24	0.15	0.05
Silt	0.64	0.37	0.20	0.10
Sandy Clay Loam	0.32	0.15	0.10	0.05
Clay Loam	0.32	0.15	0.10	0.05
Silty Clay Loam	0.37	0.20	0.10	0.05
Sandy Clay	0.32	0.15	0.10	0.05
Silty Clay	0.24	0.15	0.10	0.05
Clay	0.20	0.10	0.05	0.02

[1]Where a Soils Survey Interpretation Sheet, SOILS-5, is available for a soil, the K Factor listed will be more accurate than the factor provided by this table.

[2]Total rock fragments are included in these figures, not just gravel. Normal = 0-15 percent, gravelly = 15-35 percent, very gravelly = 35-60 percent, and extremely gravelly = over 60 percent.

Table B.2. Cover and Management Factor C for Permanent Pasture, Range, and Idle Land.[1]

Vegetative Canopy		Cover that contacts the soil surface						
Type and Height[2]	Percent Cover[3]	Type[4]	Percent ground cover					
			0	20	40	60	80	95+
No appreciable canopy		G	0.45	0.20	0.10	0.042	0.013	0.003
		W	0.45	0.24	0.15	0.091	0.043	0.011
Tall weeds or short brush with average drop fall height of 20 inches	25	G	0.36	0.17	0.09	0.038	0.013	0.003
		W	0.36	0.20	0.13	0.083	0.041	0.011
	75	G	0.26	0.13	0.07	0.035	0.012	0.003
		W	0.26	0.16	0.11	0.076	0.039	0.011
Appreciable brush or brushes with average drop fall height of 6-1/2 ft	25	G	0.40	0.18	0.09	0.040	0.13	0.003
		W	0.40	0.22	0.14	0.087	0.42	0.011
	50	G	0.34	0.16	0.08	0.038	0.012	0.003
		W	0.34	0.19	0.13	0.082	0.041	0.011
	75	G	0.28	0.14	0.08	0.036	0.012	0.003
		W	0.28	0.17	0.12	0.078	0.040	0.011
Trees, but no appreciable low brush. Average drop fall height of 13 ft	25	G	0.42	0.19	0.10	0.041	0.013	0.003
		W	0.42	0.23	0.14	0.089	0.042	0.011
	50	G	0.39	0.18	0.09	0.040	0.013	0.003
		W	0.39	0.21	0.14	0.087	0.042	0.011
	75	G	0.36	0.17	0.09	0.039	0.012	0.003
		W	0.36	0.20	0.13	0.084	0.041	0.011

use C = 0.45

[1]The listed C values assumes that the vegetation and mulch are randomly distributed over the entire area.

[2]Canopy height is measured as the average fall height of water drops falling from the canopy to the ground. Canopy effect is inversely proportional to drop fall height and is negligible is fall height exceeds 33 ft.

[3]Portion of total-area surface that would be hidden from view by canopy in a vertical projection (a bird's eye view).

[4]G = Cover at surface is grass, grasslike plants, decaying compacted duff, or liter 2 in. deep. W = Cover at surface is mostly broadleft herbaceaous plants (as weeds with little lateral-root network near the surface) or undecayed residues or both.

VDN

SCS-ENG-353 (REV. 3-70)
FILE CODE ENG-22

LABORATORY NO _____

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	SOIL CLASSIFICATION

PROJECT and STATE: Vista Del Norte | SAMPLE LOCATION:

FIELD SAMPLE NO.: 10 | DEPTH: 2' | GEOLOGIC ORIGIN:

TYPE OF SAMPLE: | TESTED AT: | APPROVED BY: | DATE:

SYMBOL: SP-SM | DESCRIPTION: SAND, silty, gravelly

GRAIN SIZE DISTRIBUTION

C_c | C_u | D_{MAX} | D_{85} | D_{60} | D_{50} = .48mm | D_{30} | D_{15} | D_{10}

COBBLES | GRAVELS | SANDS | FINES

SIEVE OPENING, (mm) | U.S STANDARD SIEVE SIZE

GRAIN SIZE IN MILLIMETERS

PERCENT FINER BY DRY WEIGHT

UNDISTURBED CONDITION: MOISTURE (%) | DRY UNIT WEIGHT (g/cc, pcf)

SOLUBLE SALTS (%) | SHRINKAGE LIMIT (%)

ATTERBERG LIMITS: NATURAL MOISTURE (LL, PI) | AIR DRY (LL, PI) | OVEN DRY (LL, PI)

SPECIFIC GRAVITY (G_s): (+) #4 | (-) #4

REMARKS

% Sand = 81-15 = 66
% silt - 15

USDA SCS HYAT SVILLE MD 1966

SCS-ENG-353 (REV. 3-70)
FILE CODE ENG-22

LABORATORY NO _____

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	SOIL CLASSIFICATION

PROJECT and STATE		SAMPLE LOCATION
Vista Del Norte		
FIELD SAMPLE NO. 9	DEPTH 2'	GEOLOGIC ORIGIN
TYPE OF SAMPLE	TESTED AT	APPROVED BY / DATE
SYMBOL SM	DESCRIPTION SAND, silty, very gravelly	

GRAIN SIZE DISTRIBUTION

C_c | C_u | D_{MAX} | D_{85} | D_{60} | D_{50} = .18mm | D_{30} | D_{15} | D_{10}

COBBLES | GRAVELS | SANDS | FINES

SIEVE OPENING, (mm)

U.S. STANDARD SIEVE SIZE

12" (304.8) | 6" (152.2) | 3" (76.1) | 2" (50.8) | 1½" (38.1) | 1" (25.4) | ¾" (19.0) | ½" (12.7) | ⅜" (9.50) | #4 (4.76) | #8 (2.38) | #10 (2.00) | #16 (1.19) | #20 (0.841) | #30 (0.595) | #40 (0.420) | #50 (0.297) | #60 (0.250) | #100 (0.149) | #140 (0.105) | #200 (0.074)

PERCENT FINER BY DRY WEIGHT

GRAIN SIZE IN MILLIMETERS

4000 | 3000 | 2000 | 1000 | 500 | 400 | 300 | 200 | 100 | 50 | 40 | 30 | 20 | 10 | 8 | 6 | 4 | 3 | 2 | 1 | .8 | .6 | .4 | .3 | .2 | .1 | .08 | .06 | .04 | .03 | .02 | .01 | .008 | .006 | .004 | .003 | .002 | .001

UNDISTURBED CONDITION

MOISTURE %	DRY UNIT WEIGHT g/cc	DRY UNIT WEIGHT pcf

SHRINKAGE LIMIT %

SOLUBLE SALTS %

ATTERBERG LIMITS

	NATURAL MOISTURE LL	NATURAL MOISTURE PI	AIR DRY LL	AIR DRY PI	OVEN DRY LL	OVEN DRY PI

SPECIFIC GRAVITY (G_s)

(+) #4	(-) #4

REMARKS

% Sand = 75 - 13 = 62
% Silt = 13

USDA SCS HYATTSVILLE MD 1966

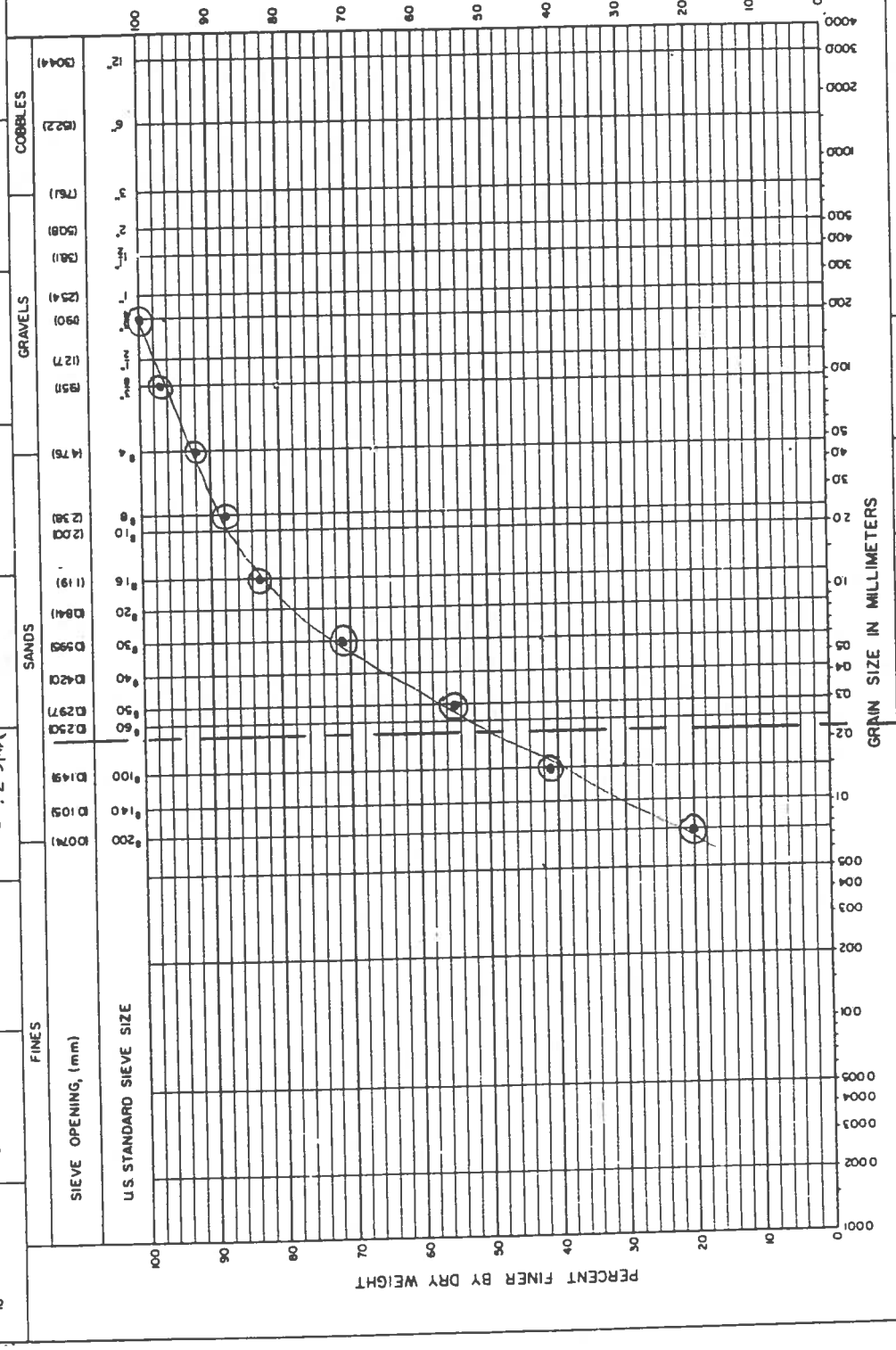
SCS-ENG-353 (REV. 3-70)
FILE CODE ENG-22

LABORATORY NO

MATERIALS TESTING REPORT	U. S. DEPARTMENT of AGRICULTURE SOIL CONSERVATION SERVICE	SOIL CLASSIFICATION

PROJECT and STATE: Vista del Norte		SAMPLE LOCATION:	
FIELD SAMPLE NO.: 5	DEPTH: 2'	GEOLOGIC ORIGIN:	
TYPE OF SAMPLE:	TESTED AT:	APPROVED BY:	DATE:
SYMBOL: SM	DESCRIPTION: SAND, silty, slc. gravelly		

GRAIN SIZE DISTRIBUTION



C_c | C_u | D_{MAX} | D_{85} | D_{60} | D_{50} = .25mm | D_{30} | D_{15} | D_{10}

UNDISTURBED CONDITION: MOISTURE %; DRY UNIT WEIGHT g/cc, pcf

SHRINKAGE LIMIT %

SOLUBLE SALTS %

ATTERBERG LIMITS: NATURAL MOISTURE — LL, PI; AIR DRY — LL, PI; OVEN DRY — LL, PI

SPECIFIC GRAVITY (G_s): (+) #4 — LL, PI; (-) #4

% sand - 90 - 20 = 70

% silt = 20

REMARKS:

USDA SCS HYATTSVILLE MD 1966

AVID ENGINEERING, INC.

$$\text{Ave } D_{50} = \frac{\sum_{i=1}^{n} D_{50}}{n}$$

$$D_{50\,AVE} = \frac{.48 + .18 + .23}{3} = \boxed{.30mm = \bar{D}_{50}}$$

$$\overline{\%\ sand} = \frac{66 + 62 + 70}{3} = 66$$

$$\overline{\%\ silt}^{*} = \frac{15 + 13 + 20}{3} = 16$$

* assumes no clay in #200 + passing

PROJECT NAME _____ SHEET _____ OF _____

PROJECT NO. _____ BY _____ DATE _____

SUBJECT _____ CH'D _____ DATE _____

AVID ENGINEERING, INC.

Time of Concentration Calculations

Basin D

subbasin reach length is less than 4000 ft

∴ Compute time of concentration, t_c (hours), for the entire (pervious & impervious) watershed by the SCS Upland Method.

$$t_c = (L_1/V_1 + L_2/V_2 + \ldots L_x/V_x) / 3600 \text{ sec/hr}$$

&

$$(L_1 + L_2 + \cdots + L_x) < 4000 \text{ ft.}$$

where L_x is the subreach length & V is the velocity (feet/sec) in that subreach, as determined by the following equation:

$$V = K * \sqrt{(S * 100)} = 10 * K * \sqrt{S}$$

where S is the slope in foot per foot, and K depends upon the conveyance condition, as shown in Table B-1 OF DPM section 22.2. If t_c is computed to be less than 0.2 hrs., use t_c = 0.2 hours.

$L_1 = 2000'$ $S_1 = 0.005$ ft/ft $K_1 = 3$ (street flow & storm sewers)

$$V_1 = 10 * 3 * 0.005^{1/2} = 2.12$$

$$t_c = \left(\frac{2000}{2.12}\right) / 3600 = .26 \text{ hr}$$

PROJECT NAME _____ SHEET _____ OF _____

PROJECT NO _____ BY _____ DATE _____

SUBJECT _____ CH'D _____ DATE _____

AVID ENGINEERING, INC.

Basin J – reach < 4000'

$L_1 = 1500$ $S_1 = 0.012$ $K = 3.0$

$L_2 = 400$ $S_2 = 0.05$ $K = 0.7$

$V_1 = 10 * 3 * 0.012^{1/2} = 3.29$

$V_2 = 10 * 0.7 * 0.05^{1/2} = 1.57$

$t_c = \left(\frac{1500}{3.29} + \frac{400}{1.57} \right) / 3600 \text{ s/hrs} = 0.197$

use $t_c = 0.20$

PROJECT NAME _____ SHEET _____ OF _____

PROJECT NO. _____ BY _____ DATE _____

SUBJECT _____ CH'D _____ DATE _____

AVID ENGINEERING, INC.

Basin A - Ponding Requirements

$V_{360} = 2.33$ ac-ft

$V_{10day} = V_{360} + A_D * (P_{10days} - P_{360}) / 12in/ft$

$A_D = (35\%$ Land Treatment D$)(19.94$ acres$)$

$A_D = 6.98$ acres

$P_{10day} = 3.95"$, $P_{360} = 2.35"$ (from Table A-2 DPM 22.2)

$V_{10\,day} = 2.33 + 6.98$ ac. $(3.95" - 2.35") / 12in/ft$

$V_{10\,day} = 3.26$ ac-ft

PROJECT NAME _____ SHEET _____ OF _____

PROJECT NO. _____ BY _____ DATE _____

SUBJECT _____ CH'D _____ DATE _____

AVID ENGINEERING, INC.

WEST BASIN – PONDING REQUIREMENTS

SITE RUNOFF —

From AHYMO 194 analysis

$Q_{100yr-6hr}$ on-site runoff = 0.248 Ac-ft

OFF-SITE RUNOFF —

The grade transition from Tracts "B" & "C" to the west Tract fronting Edith Blvd. contributes off site flows.

Contributing Area: 2 – 25' wide x 300' length Landscape Esmts.
1 – 68' wide x 300' Length ROW

∴ 1) .34 acres Landscape Easement with
7% Type D Land Treatment
93% Type B Land Treatment

2) :4.7 acres ROW with
90% Type D Land Treatment
10% Type B Land Treatment

Equivalent site
.81 acres 55.2% Type D (0.45 Ac)
44.8% Type B

USING PRECIPITATION ZONE II
Excess Runoff Type D Land Treatment = 2.12"
" " " B " " 0.78"

WEIGHTED EXCESS RUNOFF:

$E_W = 55.2\%(2.12") + 44.8\%(0.78")$

$E_W = 1.52"$

DETERMINE RUNOFF VOLUME FROM OFFSITE FLOWS FOR 100-year SIX-HOUR STORM.

$V_{360} = (1.52" \text{ Excess})(\frac{1'}{12"})(.81 \text{ acres})$

$V_{360} = 0.10 \text{ Ac-ft}$

PROJECT NAME _____ SHEET _____ OF _____
PROJECT NO. _____ BY _____ DATE _____
SUBJECT _____ CH'D _____ DATE _____

AVID ENGINEERING, INC.

Adjust off-site runoff for sediment using Basin C & B sediment values.

Basin C = 1.06 Basin B = 1.04 USE 1.05

$V_{360} = 1.05 \times (0.10 ac-ft) = 0.105 ac-ft$

TOTAL 100yr - 6 hr RUNOFF

TOTAL = SITE + OFFSITE

TOTAL RUNOFF = 0.298 + 0.105 = 0.386 ac-ft

$V_{T\,360} = 0.353$ ac-ft

$V_{10\,day} = V_{360} + A_D * (P_{10\,days} - P_{360}) / 12\ in/ft$

$P_{10\,days} = 3.95$, $P_{360} = 2.35$ (Table A-2 DPM 22.2)

$A_D = (80\%D)(1.60ac) + (55.2\%D)(.81ac)$

%D WEST BASIN %D OFFSITE

$A_D = 1.73$ AC

$V_{10\,day} = 0.353 ac-ft + 1.73AC(3.95 - 2.35)/12\ in/ft$

$V_{10\,day} = 0.58$ ac-Ft

PROJECT NAME _____ SHEET _____ OF _____

PROJECT NO. _____ BY _____ DATE _____

SUBJECT _____ CH'D _____ DATE _____

EXHIBIT A
TO SUBDIVISION IMPROVEMENT AGREEMENT
DEVELOPMENT REVIEW BOARD
REQUIRED INFRASTRUCTURE LISTING

VISTA DEL NORTE

DRB Case No.: DRB-98-71
DRC Project No.: _____
Prelim. Plat Approved: _____
Prelim. Plat Expires: _____
Site Plan Approved: _____
Date Submitted: 3 / 17 / 98

Following is a summary of PUBLIC/PRIVATE Infrastructure required to be constructed or financially guaranteed for the above development. This summary is not necessarily a complete listing. During CPC, BCC, the design process and/or in the preparation of the construction drawings, if the City, County, and/or AMAFCA determines that appurtenant items have not been included in the summary, those items will be included in the listing and related financial guarantee, if the items normally are the Subdivider's responsibility. In addition, any unforeseen items which arise during construction which are necessary to complete the project and which normally are the Subdivider's responsibility are the responsibility of the Subdivider and will be included in the financial guarantee provided to the City, County, and/or AMAFCA.

ITEM	LOCATION	FROM	TO
PHASE 1 (Tracts A, F, J, K, L, M)			
PAVING			
2-25' F-F Arterial Paving w/standard C&G, median C&G 6' sidewalk east side, and 10' Bicycle/Pedestrian Trail west side	Vista del Norte Drive	Osuna Rd.	North Property Line of Tract F
2-16' F-F Arterial Paving w/standard C&G, 4' sidewalk east side, and 10' Bicycle/Pedestrian Trail west side	Vista del Norte Drive	North Property Line of Tract F	North Property Line of Tract J
12'x150' Arterial Paving deceleration lane	Osuna Road On Westbound Approach	Vista del Norte Dr. Intersection	
12' Wide Arterial Paving 2nd left-turn lane	Vista del Norte Drive On Southbound Approach	Osuna Road Intersection	

ITEM	LOCATION	FROM	TO
PAVING (continued)			
12' Wide Arterial Paving left-turn lane	Osuna Road On Eastbound Approach	Vista Del Norte Dr. Intersection	
24' Wide Temporary Paving	Tract F	Vista del Norte Dr.	Tract A
Signalization	Vista Del Norte/Osuna Intersection		
Residential Street Lights per DPM			
SANITARY SEWER			
8" SAS	Vista del Norte Drive	North Property Line of Tract F	North Property Line of Tract J
8" SAS	Vista del Norte Drive	North Property Line of Tract F	North Property Line of Tract M
8" SAS	North and East Property Line of Tract A	West Property Line of Tract A (existing 36" line)	North and West Property Line of Tract F
8" SAS	North Property Line of Tract F	East Property line of Tract A	Vista del Norte Dr.
WATER			
16" Waterline	Vista Del Norte Drive	Osuna Rd.	Las Lomitas Dr.
12" Waterline	Osuna Road	Existing 10" Line at Tokay Court connecting at south side of Osuna Blvd.	Vista del Norte Dr.
8" Waterline	North Property Line of Tract F	Vista del Norte Dr.	Tract A

ITEM	LOCATION	FROM	TO
WATER (continued)			
18" Waterline	Las Lomitas Drive	El Pueblo Rd.	1600 feet south
16" Waterline	Las Lomitas Drive	1600 feet south of El Pueblo Rd.	Vista del Norte Dr.
10" Waterline	Within 25' Public Utility Easement 1600 feet south of El Pueblo Rd.	Las Lomitas Dr.	Existing 6" waterline in Ranchitos Rd.
DRAINAGE			
City of Albuquerque			
Drainage Pond	Tract T		
Drainage Ponds	Tracts 9 and 10A3 MRGCD Map No. 29	West Property Line of Tract K	Edith Blvd.
30" RCP	Tract J	East Property Line of Tract M	Vista del Norte Dr.
48" RCP	Vista del Norte Drive	North Property Line of Tract M	550 feet north of Tract M
48" RCP	Vista del Norte Drive	550 feet north of Tract M	750 feet north of Tract M
66" RCP	30' Drainage Easement in Tract K	Vista del Norte Dr.	West Property Line of Tract K
42" RCP	Vista del Norte Drive	North Property Line of Tract J	North Property Line of Tract F
42" RCP	50' Access, Drainage, & Utility Easement in Tract F	Vista del Norte Dr.	600 feet west

ITEM	LOCATION	FROM	TO
DRAINAGE (continued)			
48" RCP	50' Access, Drainage, & Utility Easement in Tract F	600 feet west of Vista del Norte Dr.	Tract T Drainage Pond
30" RCP	West Property Lines of Tracts F and K	Tract T Drainage Pond	Tracts 9 and 10A3 MRGCD Map No. 29 Drainage Pond
Bernalillo County			
Drainage Ponds	Tracts 9 and 10A3 MRGCD Map No. 29	West Property Line of Tract K	Edith Blvd.
24" RCP	Edith Blvd.	Tracts 9 and 10A3 MRGCD Map No. 29 Drainage Pond	Edith Blvd. Detention Basin No. 6 (County Facility)

Grading and Drainage Certification is required prior to release of Financial Guarantees

NOTES:
1) Waterlines include valves, fittings and services.
2) Storm Drain includes catch basins, connector pipes, manholes and outlet structures.
3) Sanitary Sewer Lines include manholes and services.
4) Paving Items include street lighting and sidewalks.

Signed By:_____
Print Name:_____
Firm:_____

ITEM	LOCATION	FROM	TO

DEVELOPMENT REVIEW BOARD MEMBERS

Traffic	Date	AMAFCA	Date
City Engineer	Date	DRB Chairperson	Date
Utility Development	Date	BCPWD DRE	Date
Parks & General Services	Date	BCPWD DRAN	Date

n = 0.013

1	2		24
STATION	STRUC	V.	COMMENT
SOUTH	POND		
	OUTFAL	00	
	MH	00	
	MH/B/J	00	
	MH/B/J	00	
	MH	00	
	MH/J	00	
	MH/B	00	
	INLET	00	
	TIE-IN	00	
	MH/B	00	
	OUTFAL	00	
	INLET	00	
MIDDLE	POND		
	OUTFAL	00	
	MH/J	00	
	MH/J	00	
	MH	00	
	MH	00	
	MH	00	
	OUTFAL	00	
	MH/B	00	
	OUTFAL	00	
	MH/B	00	
	MH/B	00	
	INLET	00	
PIPE BETWEEN PON			
	OUTFAL	00	
	MH/B	00	
	INLET	50	

n = 0.013

1	2	3	4	23	24
STATION	STRUCT	D	Q	GROUND ELEV.	COMMENT
NORTH	POND		0		
	OUTFALL		0	5030.00	
		84.00	44		
	MH/B/J/J/J		6	5030.00	
		48.00	16		
	MH		5	5030.00	
		48.00	16		
	INLET		3	5030.00	
		48.00			
			5		
	TIE-IN		5	5030.00	
		66.00	23		
	MH		2	5030.50	
		66.00	25		
	MH/B		1	5033.00	
		54.00	11		
	MH/B		5	5036.00	
		54.00	15		
	MH/B		3	5037.50	
		54.00	17		
	MH/B/J		1	5037.50	
		48.00	9		
	MH/B		1	5040.00	
		48.00	9		
	INLET		3	5043.00	
		48.00			
			0		
	OUTFALL		0	5030.00	
		42.00	12		
	INLET		3	5030.00	
		42.00			
			0		
	OUTFALL		0	5030.00	
		36.00	59.		
	MH/B		1	5030.00	
		36.00	59.		
	MH		3	5029.00	
		36.00	59.		
	INLET		1	5028.00	
		36.00			
			0		
	OUTFALL		0	5030.00	
		24.00	32.		
	MH/B		1	5033.50	
		24.00	32.		
	MH/J/J		3	5037.50	
		24.00	5.7		
	INLET		1	5039.00	
		24.00			

Vinyard & Associates, Inc.

8916-A Adams Street, NE
Albuquerque, New Mexico 87113
(505) 797-9743 • Fax: (505) 797-9749

Geotechnical Engineering • Materials Testing • Environmental Engineering

GEOTECHNICAL INVESTIGATION
VISTA DEL NORTE
DETENTION PONDS AND PARK

Prepared for:
Sundt Corporation

Project No.: 98-1-24
January 22, 1998

1.0 INTRODUCTION

This report presents the results of our geotechnical investigation for the proposed detention ponds and park to be located west of the Vista Del Norte Development.

The investigation was performed to determine site subsurface conditions and based upon the conditions observed in the test holes to develop geotechnical recommendations for: design and construction of the proposed detention ponds.

The conclusions and recommendations presented are based on information provided to us regarding the proposed development, on subsurface conditions disclosed by the test holes, on laboratory testing, and upon the local standards of our profession at the time this report was prepared.

This investigation was not performed to determine the presence of potentially hazardous waste or radon gas. Determination of the presence of potentially hazardous materials was beyond the scope of this investigation and requires the use of exploration techniques and analytic testing which were not appropriate for this investigation. If desired, Vinyard & Associates, Inc. will perform an environmental audit of the site.

2.0 PROPOSED CONSTRUCTION

Based upon information obtained from personnel with Sundt Corp. and AVID Engineering, Inc., we anticipate the site will be developed with a series of stormwater detention ponds and a wetlands pond. The proposed ponds will receive stormwater from the Vista Del Norte Development. Configuration of the proposed ponds and wetlands is indicated on Figure 1.

The wetlands pond will contain some water at all times. The remaining ponds will receive water only during storm events. Anticipated times required for the ponds to drain is summarized below:

Event	Hours to Evacuate
2 year storm	18
5 year storm	27
10 year storm	35
100 year storm	62

Maximum water depth in the various ponds will range from 3 feet to 7 feet. The ponds will be excavated below the level of the surrounding ground surface.

We anticipate the western ponds will be utilized as athletic fields.

Final site grading plans were not available during preparation of this report. We anticipate that substantial cut/fill earthwork will be required to develop the site.

3.0 SITE CONDITIONS

The relatively flat lying site is bound on the north by a residential development and vacant land, on the south by the Osuna Nursery, vacant land, and a residential development, on the west by Edith Boulevard, and on the east by vacant land. The topography of the eastern most 500 feet of the site is defined by a roughly circular depression, which is approximately 20 to 25 feet deep.

Vegetation at the site consists of a moderate to heavy growth of shrubs, grasses, weeds, and cactus. There is a moderate amount of concrete debris, building debris, and trash scattered about the surface of the site.

4.0 SITE SUBSURFACE CONDITIONS

To explore the site subsurface conditions, five test holes were drilled at the approximate locations shown on the Site Plan, Figure 1. Logs of the Test Holes are presented on Figures 2 through 6. The soil profile encountered in the test holes typically consisted of a surficial layer of silty fine to medium sand which extended to a depth of five to ten feet. At greater depths the test holes typically encountered

sandy silt which extended to an average depth of seventeen feet. At greater depths sandy clay and clayey sand was encountered.

Neither flowing groundwater nor bedrock was encountered in the test holes to a depth of thirty feet, the maximum depth of exploration. However groundwater conditions may change with time due to precipitation, variations in groundwater level, seepage from ponding areas or leaking utilities.

The sandy silt and sandy clay soils encountered in the test holes will consolidate substantially upon an increase in moisture content. Additionally layers of loose soil were encountered at the following locations:

Test Hole	Depth of Loose Soil Layer
1	5', 10', 15'
2	2', 10, 15'
3	10'
4	15'
5	10', 15'

The above loose layers are particularly susceptible to moisture induced settlement.

The site soils are deposited by an ancestral Rio Grande. Therefore the soils are horizontally stratified. Due to this depositional process we anticipate fairly

similar soil conditions below the parcels adjacent to the site.

The test holes allow observation of a very small portion of the soils below the site. Significant variations in subsurface conditions may occur across the site which were not disclosed by the test holes.

5.0 LABORATORY TESTING

A laboratory testing program was performed on samples obtained during the field investigation which appeared representative of the soils encountered in the test holes. The laboratory testing program was structured to determine the physical properties of the soils encountered in the test holes necessary for development of geotechnical recommendations.

The laboratory testing program included:

- Moisture Content;
- Dry Density;
- Sieve Analysis; and
- Atterberg Limits.

Moisture Content and Dry Density tests were performed to evaluate the in-place soil density and moisture content. Test results help to evaluate settlement potential. Test results indicate the soils encountered in the test holes are loose to

medium dense with an average dry density of approximately 95 pcf. Natural moisture content averaged approximately four percent. Test results are presented on the Logs of Test Holes, Figures 2 through 6 and are summarized on Table 1.

Sieve Analysis and Atterberg Limits tests were performed to confirm field soil classifications and to provide information on general physical soil properties. Test results are presented on Table 1.

6.0 CONCUSIONS AND RECOMMENDATIONS

6.1 General

Our study indicates the site is compatible with the proposed development. However the site soils are very moisture sensitive and will consolidate upon an increase in moisture content. Therefore it is necessary to control offsite migration of water to prevent moisture induced settlement of the adjoining property.

6.2 Wetlands

We anticipate the wetlands will always retain some water to keep the vegetation alive. To control offsite migration of water an impermeable synthetic liner should be installed in the wetlands ponds. The liner may be overlain with as much soil as necessary to support the proposed vegetation.

Side slopes of the wetlands should be no steeper than 3:1 (horizontal:vertical). The impermeable membrane should be installed as specified by the material supplier.

6.3 Detention Ponds

The proposed detention ponds will retain water for a very brief period. These ponds should be designed and constructed to drain completely within the design detention period. A synthetic liner is not considered necessary for the proposed detention ponds. However a compacted soil liner should be placed on the sides and bottom of the proposed ponds.

The sides of the proposed ponds should be lined with compacted structural fill. The thickness of the fill, measured horizontally should be a minimum of ten feet. Fill should be placed and compacted as detailed in the attached Appendix. Fill should be compacted using a sheepsfoot type compactor.

If pipes will be placed in the berms between ponds consideration should be given to placing antiseep collars on the pipes if there is a significant head difference between the ponds.

The bottom of the proposed ponds should also be lined with compacted structural fill. A minimum of four feet of structural fill should be placed in the bottom of the ponds.

Side slopes of the proposed ponds should be no steeper than 3:1 (horizontal:vertical). Crest width of the berm between ponds should be no less than ten feet.

6.4 EARTHWORK

6.4.1 General

The recommendations presented in this report are based upon the assumption that site earthwork will be performed as recommended in this report and the attached Appendix. Presented below is a summary of the site earthwork recommendations. Detailed earthwork procedures are presented in the attached Appendix.

6.4.2 Clearing and Grubbing

Prior to placing structural fill, all borrow and fill areas should be stripped of vegetation and deleterious materials. All strippings should be hauled offsite or utilized in landscaped areas.

6.4.3 Excavation

We anticipate that on site soils can be excavated with conventional earthwork equipment. Occasional cobbles or boulders may be encountered during excavation.

Cobbles and boulders should be disposed of off site or utilized for landscaping. Cobbles and boulders should not be placed within structural fills.

6.4.4 Natural Ground Preparation

Prior to placing structural fill and subsequent to final grading in cut areas, the exposed soils should be scarified to a depth of eight inches and moisture conditioned to a near optimum (±3%) moisture content. The exposed soils should then be compacted to a minimum of 95% of maximum density as determined by ASTM D-1557. A sheepsfoot type compactor should be utilized to compact the pond liners. If vibratory compaction poses a threat to nearby structures, static compaction should be utilized.

6.4.5 Fill Placement and Compaction

Structural fill should be placed in horizontal lifts a maximum of eight inches in loose thickness, moisture conditioned to a near optimum moisture content and mechanically compacted. Fill for the pond liners should be compacted to a minimum of 95% of maximum dry density as determined by ASTM D-1557. Fill for general site grading should be compacted to a minimum of 90% of maximum dry density as determined by ASTM D-1557. Fill above the synthetic liner should be compacted to within 85% to 90% of maximum dry density as determined by ASTM D-1557.

6.4.6 Fill Material

Fill material for the earthen pond liners may be composed of on site soils. Fill material should be well blended and should conform to the following gradations:

Sieve Size	Percent Passing By Weight
4"	100
1"	90-100
No. 4	70-100
No. 200	35-70

Fill material over the pond liner should conform to the vendors specifications.

6.4.7 Observation and Testing

Placement and compaction of structural fill should be observed and tested by a qualified Geotechnical Engineer or his representative. The purpose of the observation and testing is to confirm that the recommendations presented herein are followed and to provide supplemental recommendations if subsurface conditions differ from those anticipated.

6.5 TRENCHES AND EXCAVATIONS

All trenches greater than four feet in depth must be sloped, shored or braced or otherwise supported according to OSHA Construction and Safety Standards. Material excavated from the trench or spoil must be placed a minimum of two feet from the edge of the excavation. The spoil should be retained in an effective manner such that no loose material can fall into the excavation.

Temporary construction excavations less than eight feet deep should be sloped no steeper than 1-1/2:1 (horizontal:vertical). If deeper excavations are required, this office should be contacted for supplemental recommendations. Limited raveling of slopes will occur particularly as the exposed soils dry out. Heavy equipment and material stockpiles should be located a minimum of five feet from the top of slope.

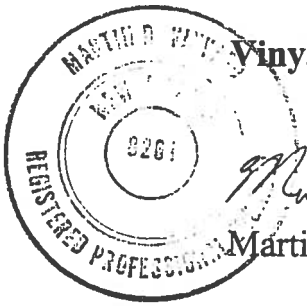
7.0 CLOSURE

The recommendations presented in this report are based upon the subsurface conditions disclosed by the test holes. Soil and groundwater conditions may vary between test holes and with time.

If conditions are encountered during construction which differ from those presented herein, this office should be contacted for supplemental

recommendations. The staff of **Vinyard & Associates, Inc.** is available for supplemental consultation as necessary.

This office would be pleased to review site grading and drainage plans to evaluate conformance with the recommendations presented herein. All site earthwork should be observed by a qualified geotechnical engineer or his representative. **Vinyard & Associates, Inc.** would be pleased to provide these services.



Vinyard & Associates, Inc.

Martin D. Vinyard, P. E.

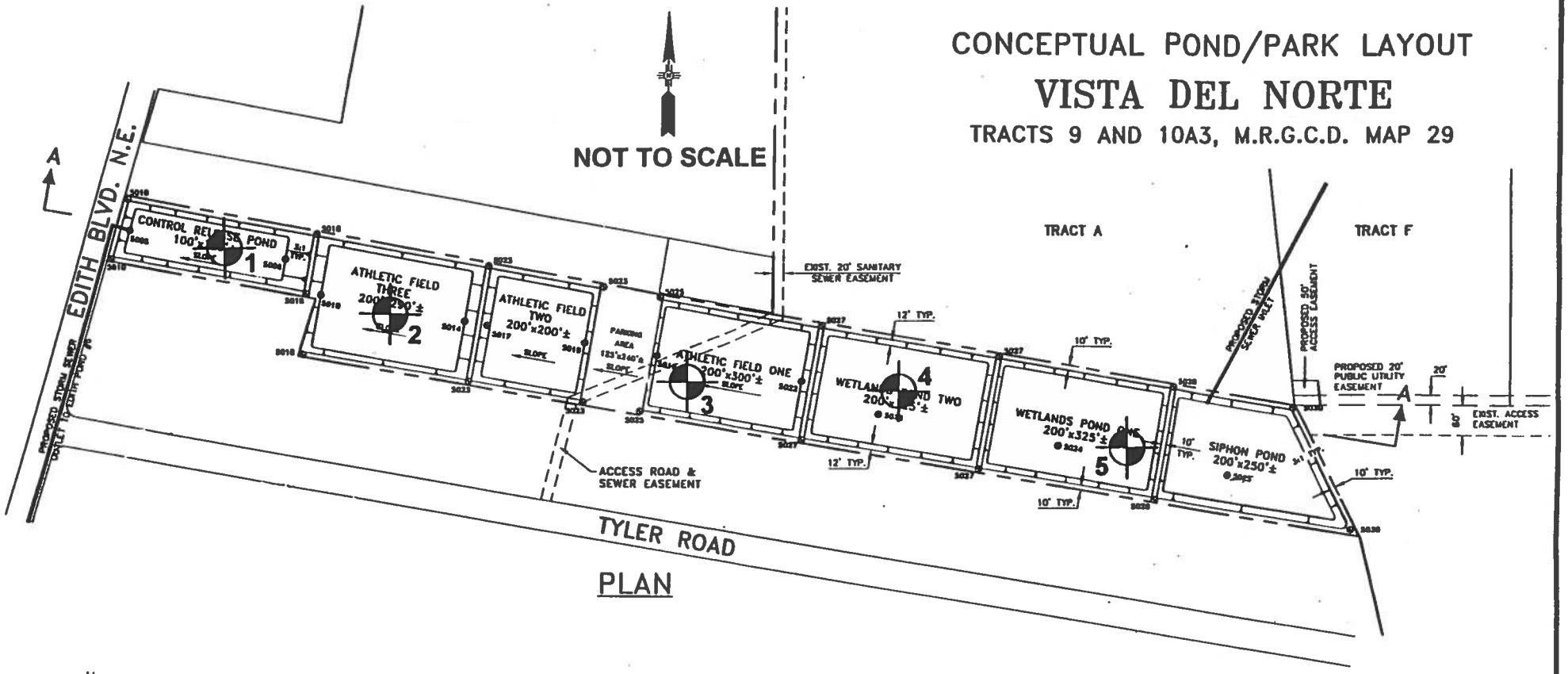
SITE PLAN

CONCEPTUAL POND/PARK LAYOUT

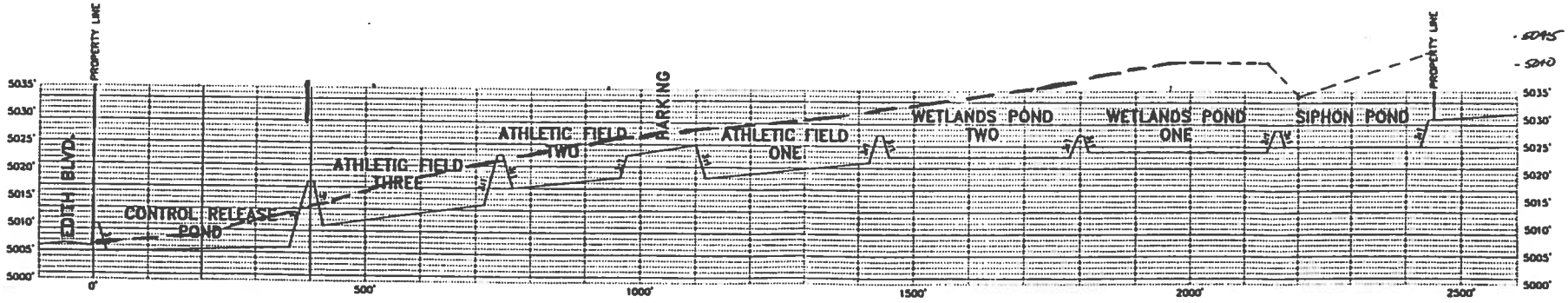
VISTA DEL NORTE

TRACTS 9 AND 10A3, M.R.G.C.D. MAP 29

NOT TO SCALE



PLAN



PROFILE A–A

LOCATION OF TEST HOLE

VINYARD & ASSOCIATES, INC.

FIGURE 1.

V & A

LOG OF TEST HOLE NO. 1

Project: Vista del Norte — Project No.: 98-1-24
Elevation - Top of Test Hole: n/a — Date Drilled: 1/17/98
Depth to Groundwater: not encountered — Drilling Method: 6" H.S.A.

Depth, feet	Blows/Foot	Sample Type	Dry Density pcf	Water Content, %	Additional Testing	Unified Classification	Material Description
5	12	R	93	4.6	1	SM	SAND, silty to very silty, fine to medium-grained, medium dense, slightly moist, brown
	9	R	82	14	1,2	ML	SILT, sandy to slightly sandy, fine sand, stiff, slightly moist, brown, contains layers of very silty sand
10	6	S		5	1		Layers of silty to very silty sand
							Occasional layers of slightly silty, medium sand
15	6	S		7.3	1,2		Increase silt, with layers of very sandy silt, very silty sand
20	22	S		5.7	1,2	CL	CLAY, sandy, fine-grained sand, very stiff, slightly moist, brown
25							
30	77	S		11.9			Becomes sandier, hard
35							Bottom of hole at 31-1/2'

ADDITIONAL TESTS: 1= Sieve Analysis 2= Atterberg Limits 3=Direct Shear 4=R-Value 5=Other

Figure: 2

V & A

LOG OF TEST HOLE NO. 2

Project: Vista del Norte
Elevation - Top of Test Hole: n/a
Depth to Groundwater: not encountered
Project No.: 98-1-24
Date Drilled: 1/17/98
Drilling Method: 6" H.S.A.

Depth, feet	Blows/Foot	Sample Type	Dry Density pcf	Water Content, %	Additional Testing	Unified Classification	Material Description
	5	R	100	3.5	1	SM	SAND, silty to very silty, fine to medium-grained, loose, moist, brown
5	16	R					Gravel layer, 5 to 6-1/2'
10	4	S		5.3			Occasional layers of very sandy silt
15	12	S		4.1	1		Medium dense, occasional layers of very silty coarse sand and gravel and very sandy silt
20	17	S		1.4			Increase gravel, gravel to 2"
25							
30	14	S		2			
35							Bottom of hole at 31-1/2'

ADDITIONAL TESTS: 1= Sieve Analysis 2= Atterberg Limits 3=Direct Shear 4=R-Value 5=Other

Figure: 3

V & A

LOG OF TEST HOLE NO. 3

Project: Vista del Norte
Project No.: 98-1-24
Elevation - Top of Test Hole: n/a
Date Drilled: 1/17/98
Depth to Groundwater: not encountered
Drilling Method: 6" H.S.A.

Depth, feet	Blows/Foot	Sample Type	Dry Density pcf	Water Content, %	Additional Testing	Unified Classification	Material Description
	8	R		8.9	1	SP-SM	SAND, silty to slightly silty, fine to coarse-grained with gravel to 1", loose, moist, brown
							Occasional layers of silty sand
5	15	R		2.6	1		Medium dense
							Increase silt and clay
10	5	S		5.9	1,2	ML	SILT, very sandy, fine sand, medium stiff, slightly moist, brown, contains stringers and layers of very silty sand
15							
	14	S		2.7	1	SM	SAND, silty, fine to coarse-grained, medium dense, slightly moist, brown
20	16	S		1			Layers of poorly graded, fine sand
25							
30	21	S		3.5	1		Occasional layers of very sandy silt
35							Bottom of hole at 31-1/2'

ADDITIONAL TESTS: 1= Sieve Analysis 2= Atterberg Limits 3=Direct Shear 4=R-Value 5=Other

Figure: 4

V & A

LOG OF TEST HOLE NO. 5

Project: Vista del Norte — Project No.: 98-1-24

Elevation - Top of Test Hole: n/a — Date Drilled: 1/17/98

Depth to Groundwater: not encountered — Drilling Method: 6" H.S.A.

Depth, feet	Blows/Foot	Sample Type	Dry Density pcf	Water Content, %	Additional Testing	Unified Classification	Material Description
5	11	R	89	3.6	1	SM	SAND, very silty, fine-grained, medium dense, moist, brown, contains layers of silty fine and coarse sand and very sandy silt, roots to 2' depth
	13	R	102	2.2	1		
10	8	S		2.9	1	SM-ML	SILT, very sandy to sand, very silty, fine sand, loose to soft, slightly moist, brown, contains layers of very sandy silt
15	2	S		2.4		SM	SAND, very silty, fine-grained, loose, slightly moist, brown
20	20	S		4.1			Becomes medium dense with layers of sandy silt to 2" thick and gravel layers to 2" thick, gravel to 1"
25							
30	39	S		6.4	1	SC-CL	CLAY, very sandy to sand, very clayey, fine sand, hard, slightly moist, brown
35							Bottom of hole at 31-1/2'

ADDITIONAL TESTS: 1= Sieve Analysis 2= Atterberg Limits 3=Direct Shear 4=R-Value 5=Other

Figure: 6

TABLE 1 - SUMMARY OF LABORATORY TEST DATA

Test Hole	Depth (feet)	Unified Classification	Natural Dry Density (pcf)	Natural Moisture Content (%)	Atterberg Limits		SIEVE ANALYSIS-% PASSING BY WEIGHT										Description
					LL	PI	1 1/2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	
1	2	SM	93.0	4.6				100	96	96	95	95	95	92	76	42.8	Sand, Very Silty, Trace Gravel
1	5	ML	81.5	14.0	26	6						100	99	98	95	90.8	Silt, Slightly Sandy
1	10	ML		5.0					100	99	98	97	96	90	78	53.5	Silt, Very Sandy
1	15	ML		7.3	22	NP							100	99	96	83.0	Silt, Sandy
1	20	CL		5.7	22	NP						100	99	99	97	88.8	Clay, Sandy
1	30			11.9													
2	2	SM	99.9	3.5					100	98	91	83	78	73	65	44.8	Sand, Very Silty, Trace Gravel
2	10			5.3													
2	15	ML		4.1					100	99	98	97	96	95	89	65.3	Silt, Very Sandy, Trace Gravel
2	20			1.4													
2	30			2.0													
3	2	SM		8.9				100	98	94	83	72	65	59	50	34.6	Sand, Very Silty, Slightly Gravelly
3	5	SP/SM		2.6				100	98	93	79	48	30	20	15	12.0	Sand, Slightly Silty, Very Gravelly
3	10	ML		5.9	25	5							100	99	96	83.3	Silt, Sandy
3	15	SM		2.7					100	96	90	82	74	63	53	35.6	Sand, Very Silty, Trace Gravel
3	20			1.0													
3	30	SM		3.5					100	96	86	75	66	57	47	34.9	Sand, Very Silty, Trace Gravel
4	2	ML	96.2	6.6							100	99	95	86	73	50.9	Silt, Very Sandy
4	5	SM	97.5	6.2				100	88	86	84	81	78	73	64	44.1	Sand, Very Silty, Gravelly

TABLE 1 - SUMMARY OF LABORATORY TEST DATA

Test Hole	Depth (feet)	Unified Classification	Natural Dry Density (pcf)	Natural Moisture Content (%)	Atterberg Limits		SIEVE ANALYSIS-% PASSING BY WEIGHT										Description
					LL	PI	1 1/2"	3/4"	3/8"	No. 4	No. 8	No. 16	No. 30	No. 50	No. 100	No. 200	
4	10			2.0													
4	15	SM		1.9			100	95	93	84	75	66	56	44	35	23.0	Sand, Very Silty, Gravelly
4	20			4.2													
4	30	SM		1.6				100	98	87	65	44	34	27	21	14.3	Sand, Silty, Gravelly
5	2	SM	88.8	3.6					100	98	97	95	93	86	67	35.8	Sand, Very Silty, Trace Gravel
5	5	SM	101.6	2.2					100	98	94	87	82	74	56	34.5	Sand, Very Silty, Trace Gravel
5	10	ML		2.9				100	99	96	94	93	91	87	78	54.9	Silt, Very Sandy, Trace Gravel
5	15			2.4													
5	20			4.1													
5	30	SC		6.4						100	99	97	93	84	71	48.4	Sand, Very Clayey

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Appendix

EARTHWORK PROCEDURES

General

The Geotechnical Engineer shall be the Owner's representative to observe and evaluate the earthwork operations. The Contractor shall cooperate with the Geotechnical Engineer in the performance of the Engineer's duties.

Clearing and Grubbing

Prior to placing structural fill all borrow areas and areas to receive structural fill shall be stripped of vegetation and deleterious materials. Strippings shall be hauled offsite or stockpiled for subsequent use in landscaped areas or non structural fill areas as designated by the Owner or his representative and approved by the Geotechnical Engineer.

Site Preparation - Fill Areas

Prior to placing structural fill the areas to be filled shall be scarified to a depth of eight inches and moisture conditioned as described below. The area to be filled shall then be compacted to a minimum of 95 percent of maximum density as determined by ASTM D-1557. If vibratory compaction techniques pose a threat to the structural integrity of near by facilities a static compactor shall be used. Any soft or "spongy" areas shall be removed as directed by the Geotechnical Engineer and replaced with structural fill as described herein.

Site Preparation - Cut Areas

Following excavation to rough grade all building and pavement areas shall be scarified to a depth of eight inches and moisture conditioned as described below. All building and paved areas shall be compacted to a minimum of 95 percent of maximum density as determined by ASTM D-1557. If vibratory compaction techniques pose a threat to the structural integrity of near by facilities a static

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Moisture Conditioning

Fill material shall be dried or moistened as necessary, prior to compacting, to within ± three percent of optimum moisture content as determined by ASTM D-1557. Moisture shall be distributed uniformly throughout each lift.

Compaction

Structural fill shall be mechanically compacted to the following:

	Minimum Compaction ASTM D-1557
Earthen Liner	95%
General Site Grading	90%

Fill for the earthen liner shall be compacted using a sheepsfoot type compactor.

Compaction by flooding and jetting is specifically prohibited unless authorized in advance by the Owner or his representative and the Geotechnical Engineer.

Observation and Testing

The Geotechnical Engineer or his representative shall perform field density tests with a frequency and at the locations he feels appropriate. The Geotechnical Engineer or his representative will perform Proctor tests on representative samples of all fill material. To minimize delays the Earthwork Contractor is encouraged to submit soil samples prior to use for proctor testing.