



GEO-ENVIRONMENTAL, INC.

Caltrans Certified
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GEOTECHNICAL INVESTIGATION REPORT

**Slope Stabilization at Entradero Basin
City of Torrance, Los Angeles County, California**



Prepared for

**John C. Dettle, P.E.
Engineering Manager
City of Torrance
Public Works Department
20500 Madrona Avenue
City of Torrance, California 90503**

November 20, 2012

**Prepared by
Geo-Environmental, Inc.**
2691 Richter Avenue, Suite 127, Irvine, CA 92606
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November 20, 2012

John C. Dettle, P.E.
Engineering Manager
City of Torrance
Public Works Department
20500 Madrona Avenue
City of Torrance, California 90503

Subject: Slope Stabilization at Entradero Basin
Slope located on the northeast corner and east side of the baseball fields situated on
the northeast corner of Entradero Basin
City of Torrance, Los Angeles County, California

GEI Project No. 172-52

Dear Mr. Dettle:

Geo-Environmental, Inc. (GEI) presents in this letter report the needed recommendations for the repair of the portions of the slope located on the northeast corner and east side of the baseball fields situated on the northeast corner of Entradero Basin located in the City of Torrance (City), County of Los Angeles, California (Figure 1). The recommendations provided in this report are based on the existing site conditions observed during a site reconnaissance performed by GEI's Principal Engineer and you on Tuesday, November 13, 2012 and a site inspection performed by GEI's Senior Project Engineer on November 16, 2012. During these site inspections it was observed that some portions of the slope adjacent to the baseball fields located on the northeast corner of Entradero Basin have deteriorated by erosion and slumping resulting from some unknown human activity which involved excavations on the slope by chisling and other means of excavations. The slopes located on the eastside of the baseball fields have eroded from the shear stresses caused by the water flow as is evident from the formation of gullies. In addition to the site inspections performed by the Principal Engineer and the Senior Project Engineer, GEI reviewed pertinent information presented in the report entitled "City of Torrance Stormwater Basin Enhancement Project, Design Information Memorandum, Amie, Henrietta, and Entradero Basins" dated September 10, 2012 and prepared by CWE of Anaheim, California.

SITE DESCRIPTION AND SOIL CONDITIONS

As described in CWE's report, Entradero Basin is commonly known as Entradero Park. It is enclosed by Towers Street, Sturgess Drive, Entradero Avenue, Halison Street, and Ronald Avenue. The basin is surrounded by low density residential housing, Sunnyglen Park to the southwest, and Dominguez Park to the northwest. The site is located approximately 2,500 feet northwest of the intersection of Del Amo Boulevard and Anza Avenue.

The Entradero Basin is a mixed use facility where surface flows from the local subwatersheds are detained during storm events. The basin is used for recreational purposes during non-flooding periods. The 25.63 acre basin provides six (6) baseball fields of various sizes, two (2) sand pits each with a playground set, a dog training park, and one basketball court.

Residential properties enclosing the Entradero Basin are situated on terrain with slopes ranging up to 2.5%. The detention basin has a total of five (5) outlets draining into the basin, which collect flows from the approximately 450 acres Entradero Subwatershed.

Based on information provided in CWE's report, the site is underlain by young and old alluvial flood plain deposits. These deposits consist of layers of loose to very dense silty sand and poorly-graded sand with silt. Also, based on the information contained in the Open File Report No. 98-26 entitled "Seismic Hazard Evaluation of the 7.5-Minute Quadrangle, Los Angeles County, California (1998)" prepared by Department of Conservation, Division of Mines and Geology, the site is comprised by Older Eolian deposits (Qoe) generally described as dense to very dense sands and silty sands. Typically the soil erodibility potential of these soils is considered to be high due to the fact that the sand particles have less ability to bind together.

CONCLUSIONS

We believe that the observed eroded and slumped areas of the slope (See Panoramic View 1 & 2) have not in any way compromised the gross stability of the slope; however, mitigation measures should be taken as soon as practical to prevent further slippage of the surficial soils towards the baseball fields and the snack bar. In order to repair the damaged portions of the slope, the original slope inclinations of these areas should be restored. The slope restoration should involve re-grading the damaged areas of the slope following the recommendations provided below:

RECOMMENDATIONS

The following recommendations along with Figures 2 and 3 are presented for the restoration of slope.

- The restoration of the damaged areas of the slope will require the re-grading of the disturbed areas. Before the placement of the engineered fill as described below, the disturbed areas will require cleaning and removal of all existing vegetation and debris to expose competent soil material approved by GEI's Soils Engineer or his representative.

- During the excavation of materials in the areas designated for restoration, the adjacent slopes should be protected.
- The compacted fill should be placed on a series of level benches as shown on the Construction Plan (Figure 3). At the base of the fill area, a slightly larger bench should be excavated in order to create a keyway for the fill. As shown in the Construction Plan (Figure 3), the fill benches should be approximately the size of the slope failure in width, excavated into competent soil material approved by GEI's Soils Engineer or his representative, and tilted back into the slope at a minimum gradient of two (2) percent.
- A variety of methods and equipment can be employed to obtain compaction of the replaced soils. Selection of the equipment and method should be done at the discretion of the Contractor; however, it appears that the use of small grading equipment is the most feasible and economic method for the slope reconstruction. Acceptable compaction can also be attained using a backhoe-mounted, segmented-wheel compactor or vibrating plate, or a small segmented sheep-foot drum roller and hand held compactor. Nevertheless, care should be taken to properly compact the fill materials all the way to the slope surface to ensure that the finished surface remains surficially stable.
- The fill materials should be placed in 8 to 10-inch lifts, watered or aerated as necessary to achieve near-optimum moisture conditions, and then compacted in place to a minimum relative compaction of 95 percent as determined from ASTM D 1557-12 Testing Procedures. If import material is needed for restoring the slope areas, then the imported soils should meet the specifications provided in Figure 3. The import material should be approved by GEI's Soils Engineer or his representative prior to importation.
- After restoration, the slope should be landscaped with deep-rooted plant material requiring minimal cultivation and irrigation in order to thrive. The existing irrigation system should be connected with the repaired area to ensure plant growth; however, over watering and subsequent saturation of the slope surface should be avoided. The completed graded slope should be landscaped as soon as practical after completion of the repairs. If permanent landscaping cannot be provided within a reasonable period of time, either jute matting or a spray-on product designed to seal the slope surface should be considered as a temporary measure to inhibit surficial erosion.

It should be noted that due to the steep slope ratio, the repaired area, as well as the surrounding undisturbed areas, may be subject to surficial failures if soils become saturated; however, if the toe of the slope is re-established and slope landscaping is properly planted and maintained, the potential for future failures may be reduced considerably. Furthermore, the drainage should be modified and maintained such that the surface runoffs do not cause future problems with erosion and/or slumping of the new fill material.

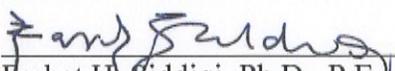
CLOSURE

We hope this letter report provides you with the information that you need at this time. If you have any questions regarding this correspondence or need further information, please do not hesitate to contact the undersigned at (949) 263-8334.

Sincerely,

Geo-Environmental, Inc.




Farhat H. Siddiqi, Ph.D., P.E.
Principal Engineer


Roberto C. Flores, M.S.
Senior Project Engineer

Attachments: Figure 1 – Vicinity Map
 Figure 2 – Construction Plan (Top View)
 Figure 3 – Construction Plan (Cross-Section)
 Panoramic View 1 & 2



FIGURE 1

DRAWN BY:	RCF
APPROVED BY:	FHS
PROJECT NO.:	172-52
DATE:	11/14/12

VICINITY MAP

Slope Stabilization at Entradero Basin
 City of Torrance, Los Angeles County, California

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Imagery Date: Mar 8, 2011

5006 ft

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33°51'19.79" N 118°21'46.89" W elev 0 ft

Eye alt 17320 ft

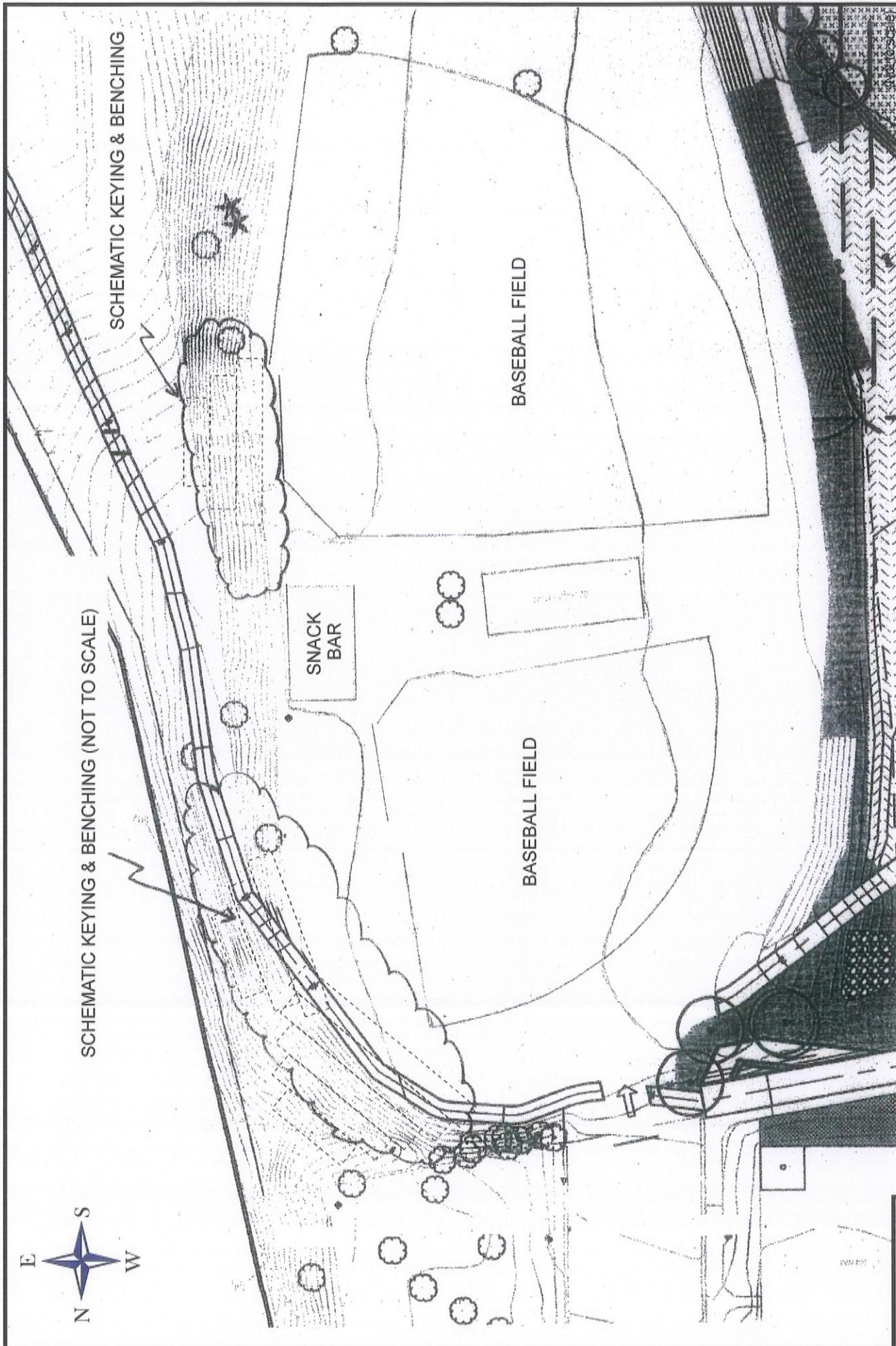


FIGURE 2

DRAWN BY:	RCF
APPROVED BY:	FHS
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DATE:	11/14/12

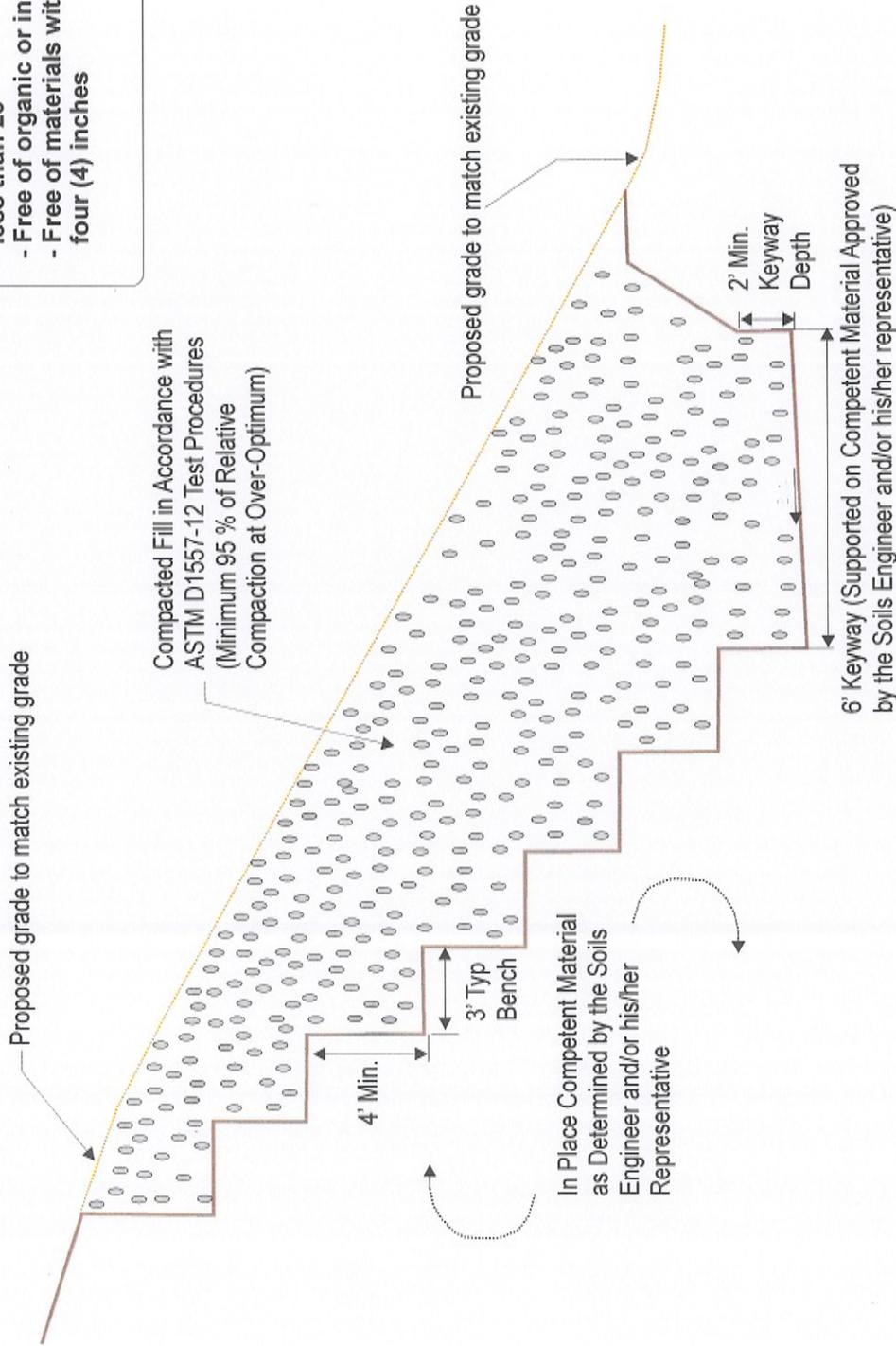
CONSTRUCTION PLAN (TOP VIEW)
 Slope Stabilization at Entradero Basin.
 City of Torrance, Los Angeles County, California

NOTE:
 Extent of Lateral Slope Excavation to be Determined
 by the Soils Engineer and/or his/her Representative.

EEI
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SPECIFICATIONS FOR FILL MATERIAL:

- Plasticity index less than 12 or expansion index less than 20
- Free of organic or inorganic debris
- Free of materials with any dimension larger than four (4) inches



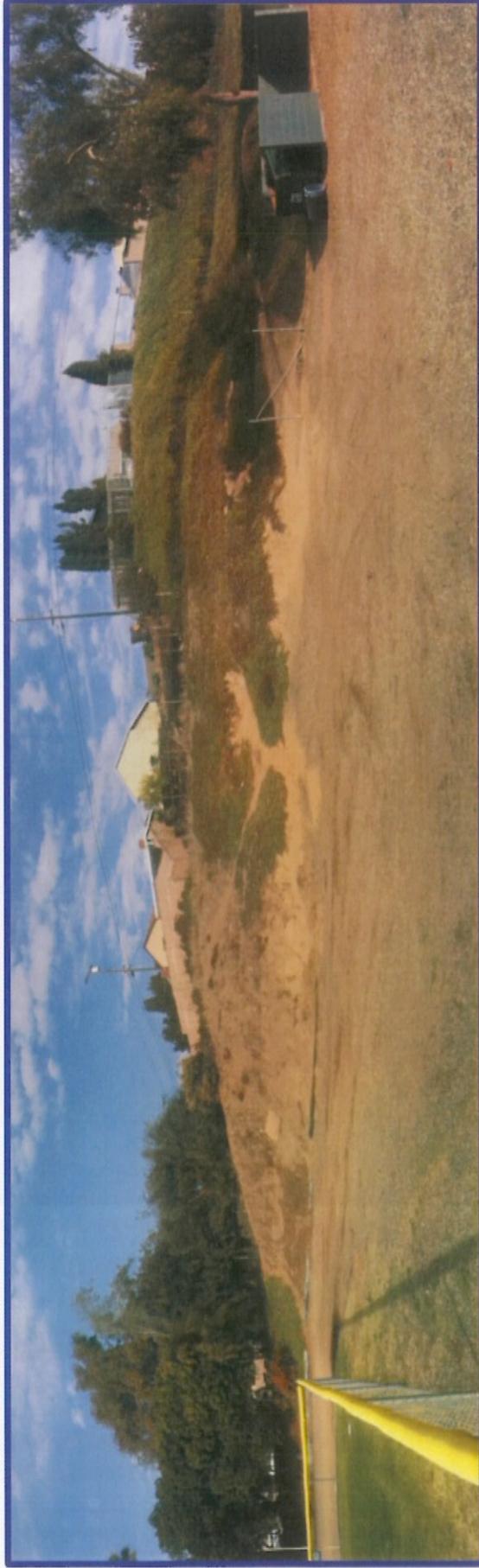
(Not to scale)

FIGURE 3	
DRAWN BY:	RCF
APPROVED BY:	FHS
PROJECT NO.:	172-52
DATE:	11/14/12

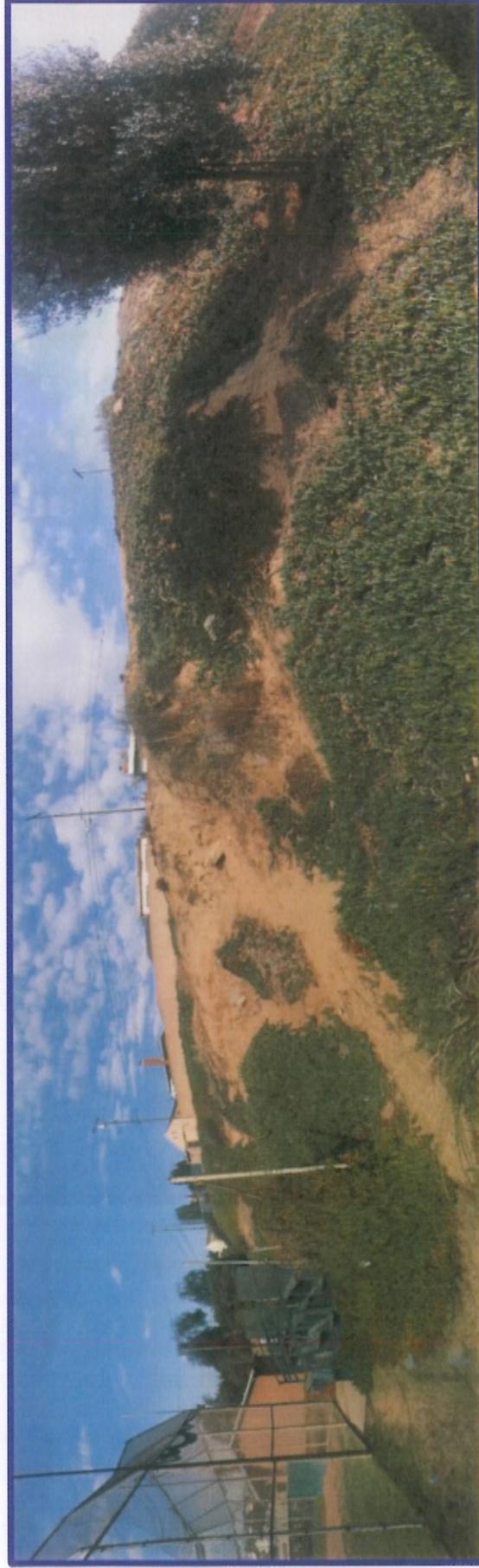
CONSTRUCTION PLAN
 Slope Stabilization at Entradero Basin,
 City of Torrance, Los Angeles County, California

NOTE:
 Extent of Lateral Slope Excavation to be Determined
 by the Soils Engineer and/or his/her Representative.

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Panoramic View 1: Picture showing slope located on the northeast corner of the baseball fields located on the northeast corner of Entradero Basin. The slope shows signs of erosion, slumping, and surface degradation by some unknown human activity.



Panoramic View 2: Picture showing slope located on the east side of the baseball fields located on the northeast corner of Entradero Basin where the slope has eroded and slumped due to some unknown human activity.

