IMPROVEMENT

STANDARDS

OF

TULARE COUNTY

County Civic Center
Visalia, California

IMPROVEMENT

STANDARDS

OF

TULARE COUNTY

STANDARDS ADOPTED ON THE 16TH DAY OF JANUARY, 1973, BY THE TULARE COUNTY BOARD OF SUPERVISORS FOR CONSTRUCTION OF IMPROVEMENTS IN SUBDIVISIONS, ROAD RIGHTS-OF-WAY, AND AT OTHER LOCATIONS WHERE SPECIFIED BY ORDINANCE.

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(Fire Flow and Protection)

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SECTION I

GENERAL PROVISIONS

A. STANDARDS

Required improvement work shall be done in accordance with the applicable sections of these Improvement Standards including the California Standard Specifications, (hereinafter called the "Standard Specifications"); Sections 7000 - 7126 of the Tulare County Ordinance Code; and such other special provisions prepared by the developer's engineer and approved by the County Public Works Director that are necessary for the successful completion of the required work.

In case of conflict between the approved Special Provisions prepared by the design engineer and these Improvement Standards and/or the Standard Specifications, the approved Special Provisions shall take precedence over and be used in lieu of such conflicting portions of these Improvement Standards and/or the Standard Specifications. To supplement the above, the design engineer shall prepare necessary plans and profiles using accepted principles of civil engineering using, wherever applicable, the Standard Plates found in Section IV of these Improvement Standards.

B. DEFINITIONS

When used for the construction of any improvements required by these Improvement Standards, the definitions and terms listed in Section 1 of the Standard Specifications shall apply with the following exceptions:

<u>Contractor</u> - The person or persons, firm, partnership, corporation or combination thereof, private or municipal, or his or their legal representative, who have entered into an agreement with the County of Tulare for the construction of improvements in accordance with these Improvement Standards. Also a developer performing work under these Improvement Standards.

Department of Public Works - The Board of Supervisors of Tulare County.

Director of Public Works - Chairman of the Board of the Tulare County Board of Supervisors.

Department of Transportation - The Tulare County Public Works Department and/or Road Department.

Engineer - Tulare County Road Commissioner and County Public Works Director, acting either directly or through the properly authorized agents, such agents acting within the scope of the particular duties entrusted to them.

Laboratory - The laboratory of the Tulare County Road Department or any other laboratory approved by the Tulare County Road Department to test materials and work performed under these Improvement Standards.

Plans - The project plans and Standard Plates, profiles, typical cross sections, general cross sections, working drawings and supplemental drawings, or reproductions thereof, approved by the Engineer, which show the location, character, dimensions and details of the work to be performed. All such documents are to be considered as part of the plans whether or not reproduced in the special provisions.

In the above definitions, the following terms are defined as follows:

Standard Plates - The plates contained in Section IV of these Improvement Standards.

Project Plans - The project plans are specific details and dimensions peculiar to the work and are supplemented by the Standard Plates insofar as the same may apply.

Specifications - The directions, provisions and requirements contained herein as supplemented by the Standard Specifications and by such approved special provisions as may be necessary pertaining to the method and manner of performing the work or to the quantities

and qualities of the materials involved.

Special Provisions - The special provisions are specific clauses or instructions setting forth conditions or requirements peculiar to the project under consideration and covering work or materials not satisfactorily covered by these Improvement Standards and the Standard Specifications. Only those special provisions approved by the Engineer shall be applicable to the work.

State - The County of Tulare except where the word "State" refers to the laws of the State of California.

Work - All the work specified, indicated, shown or contemplated in the improvement, including all alterations, amendments or extensions thereto authorized by the Engineer.

In addition to the definitions and terms of Section I of the Standard Specifications, whenever in these improvement standards, the specifications or on the plans, the following terms are used or pronouns used in place of them, the intent and meaning shall be as follows:

Design Engineer - The Civil Engineer retained by a subdivider or other developer to prepare the plans and specifications and to provide general supervision of the construction of the required improvement work.

Developer - A subdivider or other party who undertakes work by agreement or permit governed by these Improvement Standards.

Improvement Plans - Plans prepared for the developer by his design engineer and approved by the County Public Works Director and Road Commissioner.

State Responsibility Area (SRA) - That area or those areas within the definition of a "State Responsibility Area" as set forth in the Zoning Ordinance of Tulare County, Tulare County Ordinance No. 352, as amended from time to time.

C. SUBDIVISION PLANS AND SPECIFICATIONS

All improvement plans, specifications, and special provi-

sions shall comply with the requirements of the approved or conditionally approved subdivision tentative map and these Improvement Standards. Prior to beginning any construction and at least 14 days prior to the date on which a developer desires the County Public Works Director to present his final

map of the development to the Board of Supervisors, his engineer shall present completed improvement plans and specifications along with any required special provisions, to the County Public Works Director for his approval.

Construction changes from the approved Improvement Plans shall be permitted only upon approval of the County Public Works Director. As built plans shall be furnished to the County Public Works Director upon completion of the work and shall be a prerequisite to acceptance of the work.

SECTION II

DESIGN

A. STREETS AND HIGHWAYS

1. Road Classification

a. Class 1 Roads - A cul-de-sac or minor residential street so designed that it cannot serve more than 50 lots, the primary function of which is to provide access to abutting property.

b. Class 2 Roads - A minor residential street so designed that it cannot serve more than 120 lots, the primary function of which is to provide access to abutting property.

c. Class 3 Roads - A minor residential collector street that has or is expected to have the dual purpose of providing access to abutting property and of carrying traffic from Class 1 and Class 2 Roads to roads in the County Select System.

d. Select System Roads - All State Highways, Federal Aid Secondary Routes, arterials and collector roads existing or unconstructed, that are designated for inclusion in the Select System by the Board of Supervisors with the approval of the State Department of Transportation.

2. Geometric Design

a. Road Widths - The road widths shall comply with the applicable geometric section shown on Plate No.s A-1, A-2,

A-3, A-1M, A-2M and A-3M of these Improvement Standards.

b. Design Speeds - The minimum design speed shall comply with the applicable design velocities shown on Plate No.s A-1, A-2, A-1M, A-2M and A-3M of these Improvement Standards.

c. Grades - Road grade shall not be less than 0.15%. Maximum allowable grades shall comply with the applicable grades shown on Plate No.s A-1, A-2, A-3, A-1M, A-2M and A-3M.

d. Superelevation - Superelevations shall comply with Plate No. A-5.

e. Sight Distance - Vertical curves shall be constructed to provide the following stopping sight distance or headlight sight distances.

Design Speed, MPH	Sight Distance - Feet
20	120
25	160
30	200
35	240
40	275
50	350
60	475

f. Horizontal Alignment - The curve radii, curve or arc length, and the minimum tangent length between superelevated curves shall be determined from Plate No. A-4.

g. Intersections - Street intersections shall be as near right angles as practical. In no case shall the angle of intersection be less than seventy degrees nor shall the tangent distance measured from the intersection be less than 35 feet. Streets located on opposite sides of an intersecting street shall have their centerlines directly opposite each other or their centerlines shall be separated by not less than 150 feet.

In mountainous areas where a minor residential street or cul-de-sac connects to a minor residential collector street and adequate signing for a full stop is provided, the radius of curvature and sight distance for the minor residential street may be reduced to 50 feet and 85 feet respectively within 150

feet of the intersection.

The centerline grades of intersecting streets shall not exceed 6 percent for a distance measured from the intersection of:

1. 50 feet on Class 1 and 2 roads (Minor Residential Street).
2. 70 feet on Class 3 (Minor Residential Collector Street).

h. Slopes and Clearing - The limits of clearing on all roads shall be not less than 2 feet outside excavation and embankment slopes and not less than 5 feet from the edge of pavement.

Embankment slopes shall be 1 1/2:1 or flatter. Excavation slopes shall not be steeper than 1:1 for cuts less than 15 feet high nor shall they be steeper than 1 1/2:1 for cuts greater than 15 feet high unless evidence satisfactory to the Road Department is submitted that indicates steeper slopes would be stable.

i. Industrial Streets - The geometric design of roads in industrial areas will be based upon the specific traffic requirements of the area served but shall have the following minimums:

Travel lane widths	12 feet
Parking lane widths	10 feet
Border widths(sidewalk areas)	8 feet

The design velocity, maximum grade, maximum superelevation and minimum right of way widths shall generally not be less than those specified for Select Roads as shown on Plates A-1, A-2 and A-3 of Section IV of the Improvement Standards.

3. Structural Design-Roads

The R-value design method used by the California State Department of Transportation shall be used to determine the thickness of the various structural elements of the roadway. A 10 year design life shall be used. The gravel equivalents and minimum thickness of the various structural layers shall be obtained from Plate A-9, Section IV of these

Improvement Standards.

The Traffic Index, T.I., shall be determined from Plate No. A-6 where traffic estimates can be made by conventional means. If traffic estimates cannot be made, the T.I. shall be determined from Plate No. A-7. Commercial and Industrial Streets and alleys shall use a minimum traffic index of 6.0.

The number of dwellings served by a road, including loop roads, shall be the number of dwellings fronting the entire road plus the number of dwellings fronting any other lesser street connected to it that would logically be served by the road under consideration.

4. Structure Design-Bridges

All bridges and culverts shall be designed for the following minimum design loads:

Road Class	AASHTO Design Load
1 & 2	H 15 - 44
3	HS 15 - 44
Select System Roads and All Roads in the SRA	HS 20 - 44

In mountainous areas the minimum clear width of bridges shall not be less than the paved width plus four feet on each side.

In valley areas the width of the bridge shall be sufficient for the full curb to curb width plus standard sidewalk areas and railings on each side of the bridge.

5. Curbs, Gutters and Sidewalks

In valley areas curbs and gutters shall be required on all lots within a subdivision if a majority of the lots contain less than 2.5 acres and/or have less than 200 feet average widths.

Sidewalks, where provided, shall have a minimum width of four (4) feet and shall be located adjacent to the curb unless approved by the Engineer.

6. Auxiliary Drainage Facilities

Culverts, ditches at the bottom of cut slopes, and other such drainage facilities shall be designed for a flood frequency of 10 years or more with inlet not submerged, and a

frequency of 50 years or more without overtopping the roadway fill.

Down flumes or other overside drains shall be spaced so as to drain no more than 300 feet of roadway.

Energy dissipators or other suitable forms of erosion protection shall be placed at culvert outlets where the Road Department determines such measures are needed for erosion control.

7. Cul-de-Sacs

Cul-de-sacs in valley areas shall not be more than six hundred and sixty (660) feet in length and shall terminate with a circular turnaround constructed as shown on Plate A-20 of Section IV.

The maximum length of cul-de-sacs in mountainous areas shall be 1,000 feet, except in the SRA where cul-de-sacs serving parcels zoned for less than one acre maximum length shall be 800 feet. The minimum radius of the cul-de-sacs right of way in mountainous areas shall be 45 feet and the minimum radius of the pavement edge shall be 37 feet, except in the SRA where the minimum radius of the cul-de-sacs right of way shall be 48 feet and the minimum radius of the pavement edge shall be 40 feet.

The minimum distance from the centerline of the road to the right of way in mountainous areas may be reduced 5 feet (Distance B, Plate No. A-1M and Plate No. A-2M.)

The maximum paved slope across the bulb of a cul-de-sac shall be 6 percent.

In mountainous areas the sight distance may be reduced to 85 feet within 150 feet of the center of the bulb.

8. Stub Roads

Stub roads shall be completely improved to the subdivision boundary and such boundaries shall not be distorted to specifically exclude the stub road.

Temporary turn-arounds on stub roads exceeding one lot in depth shall be constructed using a pavement radius of 30 feet.

9. Alleys in Valley Areas

If alleys are provided, they shall be a minimum of twenty (20) feet in width and shall be constructed as shown on Plate A-3, Section IV.

If two alleys intersect, the corners shall be cut either on a twenty (20) foot radius to which the lot boundaries are

tangent or on a straight line connecting points on both lot lines fifteen (15) feet from the corner of the lot at the intersection of the alleys.

Alleys thirty (30) feet or more in width may be required at the rear of lots in areas zoned for commercial and industrial use and in unzoned areas proposed for commercial and industrial use.

10. Private Drives in Mountainous Areas

Where reasonable access to abutting property cannot be provided within one lot, the driveway shall be constructed together with other subdivision improvements and the easements for such joint drives shall be shown on the improvement plans.

Joint driveways shall not serve more than 4 lots and shall be surfaced within the public road right of way and the entire driveway shall be constructed to prevent eroded material from being deposited on the public road.

11. Signs

At locations where steep cut or fill slopes prohibit parking off the pavement, "No Parking" signs shall be installed and charged to the developer. The subdivision plans shall clearly indicate such locations so that approval of no parking zones by the Board of Supervisors can be obtained.

12. Redwood Headers

2" X 6" redwood headers shall be installed to protect all edges of asphalt concrete where streets are partially completed prior to placing A.C. surfacing. Header shall be held in place with 2" X 3" stakes 18" long which shall be driven vertically and securely nailed to the headers. The backfill on the unimproved side of the headers shall be compacted to the density of the undisturbed earth.

B. DRAINAGE

1. General

All drainage design shall be done in accordance with the accepted principles of Civil Engineering and these Improvement Standards.

a. Closed Conduits - Waterways whose design dis-

charge may reasonably be conveyed in a 48-inch diameter or smaller concrete pipe shall be placed underground in a closed conduit, except for natural waterways.

2. Hydrologic Design

Hydrologic Design shall be based upon anticipated full development of the tributary watershed.

Average recurrence interval is defined as the average number of years, over a long period of time, in which a given rate of flow is equalled or exceeded in magnitude. Flood flows to be used for the design of waterways, channels and closed conduits shall have minimum average recurrence intervals as follows:

a. Major Waterways having a drainage area of over four square miles shall be designed for an average recurrence interval of 50 years or more.

b. Secondary Waterways having a drainage area of between one and four square miles, and drainage facilities for subdivisions, shall be designed for an average recurrence interval of 10 years or more.

c. Minor Waterways having a drainage area of less than one square mile shall be designed for an average recurrence interval of 5 years or more.

A given waterway, therefore, may be classed as minor in its upper reaches, then change to the secondary classification at a point where the drainage area exceeds one square mile and then change again to the major classification at a point where the drainage area exceeds four square miles.

In the absence of stream gages or other recorded information on major, secondary and minor waterways, the design discharge shall be determined by the use of the following modified rational formula:

$$Q = KCIA$$

in which:

Q = design discharge, cubic feet per second

C = runoff coefficient (from Plate No. B-1, based upon anticipated full development.)

I = intensity of rainfall, inches per hour (from Plate No. B-2.)

A = tributary watershed area, acres.

K = factor related to annual average rainfall from Plate No.s B-3 and B-4.

Time of concentration shall be based on an initial lot to street time of 10 minutes for lots smaller than 1/2 acre, and 15 minutes for lots of 1/2 acre and larger, plus water travel time.

Where the size of a watershed is too large for application of the rational method in one step, the waterway shall be subdivided into reaches of reasonable length and the rational formula applied to each, step-by-step, properly accumulating the parameters unless another accepted engineering procedure for determining the design discharge is approved by the Engineer.

3. Hydraulic Design

a. General - Minor waterways discharging into major or secondary waterways shall be designed to operate against a 5 year flow in the major or secondary waterways, provided that the ground elevation along the minor system shall be above the 50 year water surface elevation in the major or secondary waterway.

If a secondary or minor waterway is placed in a closed conduit, sufficient additional surface routes for flood flows shall be made available to carry the added flow increment up to the 50 year design discharge with no more than nuisance damage to improvements or projected improvements and with no inundation of present or future buildings. If such surface routes cannot be made available, the secondary or minor waterway shall be designed to carry the 50 year design discharge.

Design depth of flow in gutters shall not exceed 0.4 feet for the 5 year flow, provided the 10 year flow shall be contained within the right-of-way. Roadside ditches are allowed where lot frontage is greater than 200 feet, except that they shall not be used where the design flow is greater

than that which could be carried in a standard gutter flowing 0.4 feet deep on the same slope as the road profile slope. Where the discharge exceeds such gutter capacity, or the length of open flow exceeds 1,500 feet, a closed conduit system shall be provided. The minimum size of cross drains, storm sewer mains and laterals over twenty feet in length shall be 15 inches in diameter. The minimum size of any such line twenty feet or less in length shall be 12 inches in diameter.

Open channels shall be constructed to carry the design discharge with 1.5 feet of freeboard. Protective lining may be required when velocity of flow exceeds 3 feet per second and soil conditions would present erosion problems. Fencing of open channels may be required.

b. Manning's "n" values - Manning's "n" value for design shall be as follows:

1. Concrete Pipe 24" and greater	n = 0.012
Concrete Pipe less than 24"	n = 0.015
2. Concrete, wood float or broomed finish	n = 0.015
3. Asphaltic Concrete	n = 0.017
4. Corrugated Metal Pipe	n - 0.024

c. Conduit System - Major and secondary waterways placed within a closed conduit system shall have a minimum 1 foot clearance between the design water surface and the soffit of the conduit. The design depth in circular conduits shall not exceed 0.80 of the diameter of the conduit for major and secondary waterways. Minor waterways placed in closed conduit systems may be designed for full conduit capacity and pressure flow. At inlets and non-pressure type manholes within a closed conduit system, the hydraulic grade line shall be not less than 0.5 foot below the gutter or inlet surface elevation.

d. Alignment and Structures - The alignment of closed conduits shall be as nearly straight as practicable. Manholes shall be provided at all junctions, at all bends which are sharper than those formed by standard single bevel concrete pipe, at intervals not to exceed 500 feet along 21-inch and

smaller conduits, at intervals not to exceed 1000 feet along 24-inch and larger conduits, and at the junction of trunk lines with catch basin laterals where the length of the catch basin lateral is greater than 4-feet.

e. Ponding Lots - Ponding lots will be permissible if connection to an existing drainage system is not feasible. The location of a ponding lot shall be located adjacent to a logical storm drain route.

Ponding lot areas are to be established on the basis of one (1) lot for each twenty (20) for 1/2 acre lots and smaller and one (1) lot for each thirty (30) for lots larger than 1/2 acre. Where the ratio requires more than one-half of a lot, a full additional lot will be required. The minimum ponding lot area shall be one lot area (based on the average lot area).

Ponding lots shall have a 1.5 foot minimum freeboard, a 3.0 foot maximum water depth and a water surface elevation of 0.5 foot or more below the grate elevation of the lowest catch basin in the system. Ponding lot construction shall conform to the details shown on Plates B-5 and B-6 in Section IV.

f. Pumping Systems - Pumping systems shall be of sufficient capacity to discharge the peak design flow. Pumping systems on major and secondary systems shall consist of two pumps whose combined capacity equals the total expected peak design flow. The sump shall be designed to provide a minimum storage, in gallons, of one and one-half times the rated capacity of the pumping system in gallons per minute.

All switches and control mechanisms, except for reset switches, shall be enclosed or placed in lockable boxes or buildings so that operation by unauthorized personnel can be prevented. All pumping systems shall be enclosed with standard six foot chain link fence.

g. Irrigation Channels - When disposal of storm waters is proposed to be into an irrigation channel the developer shall first secure written consent of the owner or the operating authority to the discharge of storm waters into irrigation facilities, together with the right to assign such

privilege at no cost to the County. At the conclusion of the improvement work and prior to acceptance of the improvements, the developer shall assign the privilege to the County.

The design engineer representing the developer shall evaluate and certify as to the adequacy of the irrigation facility as a disposal system.

C. WATER SYSTEMS

1. Source of Water

When the source of water is other than an existing system approved by either the State Department of Health Services or the County Department of Health Services, construction of the source facilities shall comply with the requirements of Bulletin No. 74, Water Well Standards, State of California, Department of Water Resources.

2. Quantity of Water

The quantity of water delivered to the distribution system within a subdivision from all source and storage facilities for a period of two (2) hours shall be the maximum domestic demand plus a fire flow quantity of not less than 500 gpm for single family residential, 1500 gpm for multi-family residential-commercial-light manufacturing, and 2500 gpm for heavy manufacturing. For systems up to 625 customer units the domestic quantity shall not be less than $Q = 100$ plus $25\sqrt{N}$, and $Q = 100$ plus N for more than 625 customer units at sufficient pressure to provide a minimum pressure of 25 p.s.i.g. to each lot served; where Q equals the rate of flow in gallons per minute delivered from the combined source facilities to the distribution system, and N equals the total number of customer units where each customer unit is equivalent to one for a single family dwelling on a normal subdivision lot. Other types of development shall be assigned appropriate customer unit values by the Engineer as experience with the distribution system or locality indicates. The minimum source and domestic demand storage design requirements shall be in accordance with Plate No. WS-11 of Section IV.

3. Quality of Water

The quality of water supplied for human consumption shall conform to Sections 3, 4 and 5 of the latest United States Public Health Service Drinking Water Standards.

Samples will be taken and tests made by the County Department of Health Services for bacteriological determination of potability.

Chemical and physical tests for potability shall be performed by a commercial laboratory certified by the State Department of Health Services for performance of chemical and physical analysis, and the costs thereof shall be borne by the subdivider.

Construction plans shall show provision for adequately treating the water in order to meet water quality requirements of this section; or before the Engineer shall approve and sign the plans, the Tulare County Health Officer shall certify that the water supply meets the quality requirements of this section.

Installation of water treatment or water conditioning equipment will be accomplished by personnel properly licensed by the State of California.

4. Use of Water

Connection of house services to service laterals and subsequent use of water, either temporarily or permanently, shall not be allowed prior to approval of the distribution system by the County Health Officer and County Public Works Director.

5. Piping and Appurtenances

a. General - The design of water systems shall be based on good engineering practice and the requirements of these Standards, and shall be approved by the Engineer prior to any construction. If the design engineer of the water system can provide satisfactory information and calculations to substantiate that reduced sizes and substitute material will meet the quantity and quality requirements of these standards, the County Public Works Director may allow use of alternate methods

and materials. All distribution systems shall be designed to permit circulation of water flows throughout, except where impractical because of a cul-de-sac, or like conditions, or the incomplete development of a grid system. All dead end runs shall be provided with a means of flushing.

b. Water Main Size - The water mains shall be of adequate size and so designed in conjunction with related facilities to maintain a minimum operating pressure of 25 p.s.i.g. for each customer at the time of maximum domestic and fire flow demands in the system.

All water mains in valley subdivisions shall have a minimum nominal diameter of six (6) inches for single-family residential, ten (10) inches for multi-family - commercial - light manufacturing, and twelve (12) inches for heavy manufacturing except cul-de-sacs or other streets not required to have a fire hydrant, and serving six (6) lots or less, in which case a minimum size of four (4) inches nominal diameter shall be permitted. Water mains for mountainous areas shall have a minimum nominal diameter of four (4) inches and shall be designed to provide a loop system to maintain adequate pressure for fire protection. Any stub line over 660 feet in length or supporting more than one fire hydrant shall be 6 inches. A four (4) inch waterline from the street main shall be provided to the hydrant outlet.

c. Location - In general, when mains are to be placed in the traveled portion of streets, they shall be as parallel as possible to, and between four (4) and fourteen (14) feet from street centerline, but shall in no case be closer than three (3) feet from the lip of the gutter or edge of pavement.

Street mains shall be laid in the streets on which the property to be served fronts, and in subdivisions such mains shall be run to the limits of the subdivision on stub roads so that adjacent future development will not require excavation of the improved street within the subdivision.

The mains shall be kept a minimum of ten (10) feet from

the sewers.

d. Gate Valves - Gate valves shall be of the same size as the pipeline in which they are installed and a minimum of three valves shall be placed at a cross and two valves at a tee and shall be placed on the projection of the edge of pavement or lip of gutter. Valves on distribution systems shall be so located that any single break, accident, or repair will not necessitate shutting off from service a length of main greater than 800 feet for the valley and 1320 feet in the mountainous areas, except that in commercial or industrial areas, the Engineer may require a maximum length of 500 feet.

e. Air and Vacuum Valves - Air release and vacuum valves of adequate size shall be provided where necessary at all high points on mains. Suitable housing and protection for valves shall be provided and a shut off valve shall be provided in conjunction with each air release and vacuum valve to permit removal of valves for maintenance and servicing.

f. Flexible Couplings - Sufficient flexible couplings shall be provided in all piping adjacent to structures to permit differential settling of the foundations of piping and structures without damage to the piping.

g. Service Laterals - A service lateral shall be provided to each lot in the subdivision. Main water pressure, type of development and expected rate of water consumption shall determine the size of the service lateral, but in no case shall said lateral be smaller than a nominal diameter of 3/4-inch. Service laterals shall be placed perpendicular to the main and within the limits of the projection of the property lines of the property to be served. A "T" lateral may be allowed for two adjacent lots if the design engineer can provide calculations and information that the minimum pressure and volume can be maintained.

h. Fire Hydrants - Spacing of said hydrants shall be uniform throughout the subdivision with maximum spacing such that the maximum run of hose required between any hydrant and

the nearest available point on the extreme lot shall not exceed 330 feet for single family and 150 feet for other types of development.

In the SRA, fire hydrants serving any building shall be not less than 50 feet nor more than one-half mile by road from the building it is to serve and located at a turnout or turnaround along the driveway to that building or along the road that intersects with that driveway.

Fire hydrants in valley areas shall be placed with the centerline of the hydrant 18 inches behind the face of the curb. If sidewalk is to be constructed or if the subdivision is within an Urban Improvement Area, then hydrants shall be located at the back edge of the sidewalk. For mountainous areas, the hydrants shall be located between 2 and 5 feet beyond the edge of pavement. Hydrants shall be located at street intersections in conformance with Standard Drawings with additional hydrants located at sufficient intervals along the streets to comply with the spacing requirements of these Standards.

In the SRA, fire hydrants shall be 8 feet from flammable vegetation, between 4 and 5 feet beyond the edge of pavement, and in a location where fire apparatus using it will not block the roadway. Furthermore, within a SRA hydrants located along a road or private vehicular access shall be required to have a reflectorized blue marker, with a minimum dimension of 3 inches, mounted on a fire retardant post. Said post shall be within 3 feet of the hydrant with the marker no less than 5 feet above established grade in a position visible from the roadway.

i. <u>Thrust Blocks</u> - All tees, bends, plugs, fire hydrants and other sections of piping and appurtenances that might be capable of being displaced by the action of either working pressures or test pressures within the water system shall be anchored in place by the use of thrust blocks, thrust backing or harnesses as shown on the standard drawings. The bearing areas of thrust blocking on the supporting soil shall

not exceed that allowable for the soil involved. The pressure used to determine the required size of thrust blocks bearing area shall be no less than the test pressure required in Section III herein. Required thrust block bearing areas shall be in accordance with Plates WS-6 and WS-8 in Section IV.

SECTION III

CONSTRUCTION

A. CONTROL OF THE WORK

All work accomplished and all materials furnished under these Improvement Standards shall be subject to the inspection and approval of the Engineer. Such inspection and approval of work and materials shall not relieve the developer of any of his obligations to complete the work as specified. Work and materials not meeting these requirements shall be made good and

unsuitable work and materials shall be rejected.

The Engineer shall have access to the work at all times and shall be furnished every reasonable facility for ascertaining that the methods, materials and workmanship are in accordance with the requirements and intent of these Improvement Standards. The developer or his authorized agent shall be in charge of, and responsible for all phases of the work while it is in progress.

The Engineer shall be notified at least twenty-four hours prior to beginning any of the following stages of work, shall be notified when each of the stages has been completed, and subsequent stages shall not be begun without approval of the Engineer. Should the developer fail to so notify the Engineer, the cost of all subsequent inspection and testing necessary to ascertain if the work has met all the specified requirements shall be borne by the developer or the work shall not be approved.

1. Roadway and ditch excavation, including the preparation of embankment areas and the placement of embankment material.
2. Structure Excavation.
3. Placing culvert pipes and storm drains.
4. Placing structure backfill material.
5. Construction of forms for all concrete work including concrete curbs.
6. Placing Concrete.
7. Placement of any layer of subbase, base or surfacing material including the preparation of the subgrade therefore.
8. Final Cleanup.

In addition to the above, the developer shall notify the Engineer whenever improvement work is to be performed on Saturdays, Sundays or holidays or during hours of the day when such work is normally not performed so that inspection may be provided.

The source of materials used for work performed under

these Improvement Standards shall be approved by the Engineer before delivery is made. The developer shall give the Engineer sufficient notice of sources of material so that such tests and inspections as the Engineer deems necessary can be performed to determine that the materials comply to the specifications. If the source is not already approved the notice shall not be less than 10 working days prior to delivery of the material to the project. Only approved material shall be used in the work. If it is found that sources of supply which have previously been approved do not furnish a uniform product or if the product proves unacceptable at any time, the developer shall furnish acceptable material from another approved source. No material which after approval has in any way become unfit for use shall be used in the work.

All tests of materials and work to determine compliance with the approved specifications shall be in accordance with the methods and procedures in use by the Department of Transportation and defined in Section 6-3.01 of the Standard Specifications or as they may be amended in these Improvement Standards or by the Special Provisions. Should the work not be performed by contract, the test method shall be the test method in effect on the first day of the month preceeding the month in which work is first begun on the project. The developer shall furnish to the Engineer, without charge, samples of all materials to be used in the work. Samples of material from which tests are to be made shall be taken under the supervision of the Engineer, by a recognized laboratory or by the Design Engineer retained by the developer.

In lieu of prior sampling and testing of certain manufactured products such as reinforcing and structural steel, culvert pipe, paint, cement and asphalt products, the Engineer may permit or require certificates of compliance from the supplier of such products before such materials can be used in the work.

Preliminary sampling and testing of the improvement site or sources of materials that are to be made prior to construc-

tion may, at the option of the Engineer, be performed by the Laboratory of the Tulare County Road Department, by a recognized commercial laboratory or by the Design Engineer retained by the developer. Construction control testing of materials entering the work shall be performed by the Engineer or by a commercial laboratory retained by the County of Tulare. The cost of all preliminary testing not performed by the Laboratory of the Tulare County Road Department shall be paid by the developer. Costs of all preliminary testing performed by the County Laboratory under the direction of the Engineer and all construction control testing performed by the Engineer or laboratory retained by the County shall be paid by the County except as follows:

Whenever a specified percent relative compaction is required and the material or portion thereof so tested fails to meet or exceed the relative compaction specified, the first retest shall be performed at no expense to the contractor. Should the first retest also fail, a charge of $30.00 for each additional retest performed by the County shall be charged the developer. Failure of the developer to comply with the approved plans and specifications and the procedures specified herein shall be deemed sufficient cause for the rejection by the County of all or any portion of the work. The Engineer may cause rejected work to be remedied, removed or replaced all at the expense of the developer.

B. STREETS AND HIGHWAYS

1. General

The construction of all streets, highways, drainage structures, and their auxiliary facilities shall comply with the requirements of the following portions of the Standard Specifications, except as such portions shall be amended by these Improvement Standards and/or the special provisions, excluding therefrom all reference to measurement and payment. Measurement and payment for improvement work performed under Division Seven or Twelve of the Streets and Highways Code of

the State of California shall be as specified in the Special Provisions. Measurement and payment for other work performed under these improvement standards shall be the responsibility of the developer.

Applicable Sections:

1. Definition and Terms
5. Control of Work
6. Control of Materials
10. Dust Control
15. Existing Highway Facilities
16. Clearing and Grubbing
17. Watering
18. Dust Palliative
19. Earth Work
20. Erosion Control and Landscaping
22. Finishing Roadway
24. Lime Treatment
25. Aggregate Subbase
26. Aggregate Bases
27. Road Mixed Cement Treated Bases
36. Penetration Treatment
37. Bituminous Seals
38. Road Mix Asphalt Surfacing
39. Asphalt Concrete
51. Concrete Structures
52. Reinforcement
53. Air-blown Mortar
60. Rubble Masonry
64. Asbestos Cement Pipe
65. Reinforced Concrete Pipe
66. Corrugated Metal Pipe
67. Structural Plate Pipe, Arches, and Pipe Arches
68. Sub-surface Drains
69. Over-side Drains
70. Miscellaneous Facilities
72. Slope Protection

73. Concrete Curb and Sidewalks

80. Fences

83. Railings and Barriers

Applicable Sub-Sections:

4-1.01 Intent of Plans and Specifications

4-1.02 Final Cleanup

4-1.04 Detours

4-1.05 Use of Materials Found on the Work

7-1.01 Laws to be Observed, excepting sub-sections 7-1.01A through 7-1.01L; In lieu of these excepted sub-sections, the Developer shall comply with all applicable local, State and Federal laws, and shall hold the County of Tulare harmless from any breach of said laws.

7-1.02 Weight Limitations

7-1.04 Permits and Licenses

7-1.05 Patents

7-1.06 Safety Provisions

7-1.07 Sanitary Provisions

7-1.08 Public Convenience

7-1.09 Public Safety

7-1.10 Use of Explosives

7-1.11 Preservation of Property

7-1.12 Responsibility for Damage

7-1.13 Disposal of Material Outside the Highway Right of Way

7-1.14 Cooperation

7-1.16 Contractors Responsibility for the Work and Materials

8-1.10 Utility and Non Highway Facilities

2. <u>Earthwork</u>

The earthwork shall conform to the requirements of Section 19 of the Standard Specifications and the following provisions.

All unsuitable or surplus material excavated shall become the property of the Contractor and shall be disposed of in accordance with the provisions in Section 7-1.13 of the Standard Specifications. Such material encountered in subdivision improvements may be used to regrade lots within the sub-

division with the approval of the developer and the Engineer provided such regrading is done in a manner which will not prohibit the proper drainage of lots or property within or adjacent to the subdivision.

Selected material for use in subdivision improvements may be obtained from material excavated from a location outside the right of way but within the subdivision when specified in the special provisions, shown on the plans, or designated by the Engineer.

The trench for pipe culverts shall be excavated a minimum depth of 3 inches below the bells or couplings for the full length of the trench under ordinary circumstances and if solid rock or other unyielding material is encountered the material shall be removed to a depth of one-fourth the nominal diameter of the pipe below the couplings or bells but not less than 4 inches. If the foundation is soft, spongy, or unstable, the trench shall be excavated to a stable soil or 1 foot below the bells or couplings, whichever is the least, and the excavation backfilled with structure backfill material of a quality and gradation specified herein.

Below an elevation of 12-inches above the top of the pipe backfill material shall have a sand equivalent of 30 and shall meet the following gradation requirements.

Sieve Size	Percent Passing
3"	100
No. 4	35-100

Backfill around the pipe and to an elevation of 12 inches above the pipe shall be placed carefully to provide uniform support for the pipe and in such a manner as not to injure or disturb the pipe.

Backfill material above an elevation of 12 inches above the pipe may be material from excavation, free from stones or lumps exceeding 3 inches in greatest dimension, vegetable matter, or other unsatisfactory material and shall be compacted to a relative compaction of not less than 90 percent. Backfill material placed below the roadway surfacing or other paved area

shall be compacted to a relative compaction of 95 percent to a depth of 1.5 feet below finished grade or to a depth of 0.5 foot below the lowest layer of surfacing, base or subbase whichever is the greatest.

Surfacing, base or subbase removed during the trenching operations shall be replaced with material equal or better than the material so removed. However, the surfacing replaced shall have a minimum depth of not less than 3 inches.

Jetting may be permitted under favorable conditions with prior approval of the Engineer. Mechanically operated tamping machines employing the impact principal will not be permitted at locations where, in the opinion of the Engineer, their use could cause damage to the pipe being backfilled.

Excavation for compaction of original ground as provided in Section 19-5.02 of the Standard Specifications shall not be required, but this provision will not preclude the necessity of compacting subgrade. The subgrade shall be prepared and compacted as provided in Section 19-1.03 of the Standard Specifications.

The relative compaction of each layer of embankment beneath the surfacing to a depth of 1.5 feet from finished grade or to a depth of 0.5 foot below the lowest layer of pavement, base or subbase, whichever is the greatest, shall not be less than 95 percent. The relative compaction of all other embankment material shall be not less than 90 percent.

3. Aggregate Subbase

Aggregate subbase shall conform to the requirements of Section 25 of the Standard Specifications and the following provisions.

Aggregate Subbase shall be Class 4 and the percentage composition by weight shall conform to the following grading when determined by Test Method No. Calif. 202.

Sieve Sizes	Percentage Passing
2 1/2 inches	100
No. 4	50-100
No. 200	0-25

Class 4 aggregate subbase shall also conform to the following minimum quality requirements:

Tests	Test Method No.	Requirements
Sand Equivalent	217	20
Resistance (R-Value)	301	50

The R-Value requirement will be waived provided the aggregate subbase conforms to the specified grading and has a Sand Equivalent of 25 or more.

Where the required thickness is 0.67 foot or less, the aggregate subbase may be spread and compacted in one layer. Where the required thickness is more than 0.67 foot, the aggregate subbase shall be spread and compacted in 2 or more layers of approximately equal thickness, and the maximum compacted thickness of any one layer shall not exceed 0.67 foot. Each layer shall be compacted in a similar manner.

4. Lime Treatment

Lime Treatment shall conform to the requirements in Section 24 of the Standard Specifications and these provisions.

Lime treated material may be used in place of aggregate subbase provided the minimum thickness of aggregate base and paving is provided.

Lime for use in lime treatment may be a granular quicklime which when sampled at the point of delivery shall conform to the following requirements.

1. Free lime, expressed as calcium hydroxide, $Ca(OH)_2$, shall not be less than 95 percent as determined by Test Method No. Calif. 414-A.
2. Granular Quicklime shall meet the following dry mechanical grading analysis.

Sieve Size	Percentage Passing
No. 4	100
No. 100	10 maximum

3. Lime reactivity shall be not less than 25° C. Lime reactivity shall be expressed as the slaking rate of quicklime after 30 seconds in accordance with ASTM designation C110.

5. Aggregate Base

Aggregate base shall conform with the requirements of Section 26 of the Standard Specifications and the following provisions.

Aggregate base shall be Class 2, 3/4 inch maximum in the valley areas.

Aggregate base may be either Class 2, 3/4 inch maximum or Class 3 aggregate base in the mountain areas.

Class 3 aggregate base shall be free from vegetable matter and other deleterious substances and shall be of such nature that it can be compacted readily under watering and rolling to form a firm, stable base.

Aggregate for Class 3 aggregate base shall consist of any one or a mixture of broken or crushed stone, crushed gravel, or natural materials that will meet the specified quality requirements when combined within the specified limits of grading.

The percentage composition by weight of Class 3 aggregate base shall conform to one of the following gradings when determined by Test Method No. Calif. 202.

	Percentage Passing		
Sieve Sizes	3/4" max.	1/2" max.	3/8" max.
1"	100	-	-
3/4"	85-100	100	-
1/2"	-	90-100	100
3/8"	-	-	95-100
No. 4	35-65	50-75	-
No. 8	-	35-60	60-85
No. 30	10-30	15-35	25-45
No. 200	2-10	4-12	6-15

Class 3 aggregate base shall also conform to the following quality requirements:

Tests	Test Method No. Calif.	Requirements
Resistance (R-Value)*	301	65 min.

Sand Equivalent	217	25 min.

* The R-Value requirement will be waived provided the aggregate base conforms to the specified grading and has a Sand Equivalent value of 35 or more.

In lieu of the requirements of Section 26-1.04B, aggregate base may be spread in accordance with the requirements of spreading aggregate subbase as specified in Section 25-1.04 of the Standard Specifications.

In mountain areas the finished aggregate base may vary up to 0.08 foot above or below the grade established by the Engineer.

6. Road-Mixed Asphalt Surfacing - Road-mixed asphalt surfacing shall conform with the following provisions.

Road-mixed asphalt surfacing shall only be used in mountain areas approved by the County Public Works Director.

The bituminous binder to be mixed with the aggregate shall be liquid asphalt conforming to the provisions in Section 93 of the Standard Specifications and shall be of a grade approved by the Engineer. The amount of liquid asphalt to be mixed with the aggregate shall be determined by the Engineer.

Aggregate may be imported material, selected material, local borrow material, or combination of such materials and shall consist of any one or a mixture of the following materials:

1. Broken or crushed stone, or crushed gravel.
2. Natural material having sufficient roughness to meet the specified stabilometer requirements when combined within the specified limits of grading.

The percentage composition by weight of the aggregate shall conform to one of the following gradings when determined by Test Method No. Calif. 202.

	Percentage Passing		
Sieve Sizes	3/4" max.	1/2" max.	3/8" max.
1"	100	-	-
3/4"	85-100	100	-

1/2"	-	90-100	100
3/8"	-	-	95-100
No. 4	35-65	50-75	-
No. 8	-	35-60	60-85
No. 30	10-30	15-35	25-45
No. 200	2-10	4-12	6-15

The combined aggregate shall also conform to the following quality requirements immediately prior to mixing with asphalt binder:

Tests	Test Method No. Calif.	Requirements
Both K_c and K_f - Factors (obtained from C.K.E. Test)	303	1.8 Max.
Sand Equivalent	217	35 Min.

The combined aggregate shall also conform to the following quality requirements when mixed with the amount of asphalt determined to be optimum by Test Method No. Calif. 304 which in no case shall be less than 3.8 percent by weight of the dry aggregates:

Tests	Test Method No. Calif.	Requirements
Stabilometer Value	304	30 Min.
Moisture Vapor Susceptibility (Stabilometer Value)	307	20 Min.
Swell	305	0.030 Max.

7. Asphalt Concrete

Asphalt Concrete shall comply with the requirements of Section 39 of the Standard Specifications and the following provisions.

In valley areas the asphalt binder to be mixed with the aggregate shall be a paving asphalt, the grade to be approved by the Engineer.

In mountain areas the asphalt binder to be mixed with the aggregate shall be a paving asphalt or a liquid asphalt of a grade approved by the Engineer.

Aggregate for asphalt concrete shall be Type B, the percentage composition by weight conforming to one of the

following gradings:

3/4" Maximum (Medium)

3/4" Maximum (Fine)

1/2" Maximum (Coarse)

A prime coat or paint binder meeting the requirements in Section 39-4.02 of the Standard Specifications shall be applied to all areas to be surfaced with asphalt concrete.

When specified by the Engineer, a Fog Seal complying with the requirements of Section 37 of the Standard Specifications shall be applied to the finished surface of the asphalt concrete. The combined mixture of asphaltic emulsion and water shall be applied at the rate of 0.10 gallon per square yard unless a lesser rate of application is required by the Engineer.

In lieu of the requirements in Sections 39-5.03A and 39-5.03B, the minimum rolling equipment specified may be reduced to one 2-axle tandem roller, weighing at least 8 tons, when asphalt concrete is placed at a rate of 100 tons, or less, per hour at any location provided it is demonstrated to the satisfaction of the Engineer that one roller can perform the work.

In mountainous areas, when approved by the Engineer, any course or layer of asphalt concrete may be spread with pneumatic tired motor graders meeting the requirements specified in Section 39-5.01 of the Standard Specifications provided segregation can be avoided and a uniform, smooth pavement obtained.

In mountainous areas the allowable surface tolerance may be increased to the maximum permissible for road-mixed asphalt surfacing as specified in Section 38-4.07 of the Standard Specifications.

8. <u>Concrete Structures</u>

Concrete structures shall be constructed in accordance with the requirements in Section 51 of the Standard Specifications and the following provisions.

When approved by the Engineer concrete may be designated

by 28 day comprehensive strength without reference to the class designation referred to in Section 90 of the Standard Specifications. If designated by compressive strength, the Contractor shall be responsible for furnishing concrete which contains not less than 5.5 sacks nor more than 8.5 sacks of cement per cubic yard of concrete which is workable, and which conforms to the strengths shown on the plans or specified by the Engineer. Unless approved by the Engineer the compressive strength specified shall be obtained without the use of admixtures. The weigh-batch proportions for concrete designated by compressive strength shall be determined by the Contractor.

Concrete may be mixed by hand where the batch size is less than 1/2 cubic yard and the concrete is mixed in accordance with the provisions in Section 90-6.05 of the Standard Specifications.

If approved by the Engineer in advance of mixing, where a truck mixer or agitator is used for transporting concrete, discharge of the concrete may be completed after more than $1\frac{1}{2}$ hours or after 250 revolutions of the drum or blades following the introduction of the cement. The amount of additional time or number of revolutions permitted shall be determined by the Engineer.

The method used for curing concrete shall be determined by the Engineer and shall comply to the provisions in Section 90-7 of the Standard Specifications for the method selected.

A Class 1 surface finish may be waived for certain surfaces designated in Section 51-1.18B where shown on the plans or approved by the Engineer. However, an ordinary surface finish shall be required.

9. <u>Reinforcement</u>

Bar reinforcement, mesh reinforcement, and reinforcing wire shall conform to the requirements in Section 52 of the Standard Specifications and the following provisions.

Steel lists as specified in Section 52-1.03 shall not be required unless requested by the Engineer.

Samples of reinforcing steel to be used in the work may be

taken at the site of the work after delivery of the steel. The number and size of samples to be furnished the Engineer by the Contractor will be determined by the Engineer but shall not exceed two samples 2.5 feet in length from each size in each heat or melt.

10. Drainage and Irrigation Pipe

Pipe and pipe arch for use in drainage and irrigation facilities shall conform to the requirements in Sections 63, 64, 65, 66 and 67 of the Standard Specifications and the following provisions.

The type of pipe specified for work governed by these Improvement Standards may be selected by the developer or the design engineer provided the pipe is of sufficient strength to withstand the loading imposed, has a minimum service life of 50 years, and meets the quality requirements specified in the above named sections of the Standard Specifications. Soil tests may be required by the Engineer where the chemical composition of the soil may be detrimental to certain types of pipes proposed for use.

The strength of the pipe required within the road right of way shall be determined by the design procedure used by the State Department of Transportation.

Non-reinforced concrete pipe up to 18 inches in diameter and reinforced concrete pipe up to 24 inches in diameter that meet the D-load, minimum shell thickness, and minimum reinforcement shown in Plate A-24 of Section IV of these Improvement Standards may be used in lieu of pipe conforming to the quality requirements in said Section 65 provided the pipe can withstand the loading imposed.

Corrugated aluminum pipe and pipe arch shall conform to the provisions in Section 62-1.02C of the Standard Specifications.

Band couplers for corrugated pipe shall have the following minimum widths:

Nominal Pipe Diameter	Minimum Band Width
Under 15"	7"
15" thru 48"	12"
Over 48"	24"

Helically corrugated pipe shall be connected to annular corrugated pipe using a universal coupling band having a minimum width of 12 inches. The coupling of the two types of pipes at locations where a firm, positive connection is desired shall be avoided.

The hydrostatic test specified for siphon and pressure pipe in Sections 65-1.08 and 66-1.09D of the Standard Specifications may be waived by the Engineer under field conditions that he determines make the tests unnecessary or impractical to conduct.

11. Subsurface Drains

Subsurface drains shall conform to the requirements in Section 68 of the Standard Specifications and these provisions.

Permeable material may be either Class 1 or Class 2 material at the option of the Contractor unless otherwise specified on the plans or in the special provisions.

Trenches for underdrains shall be excavated to the width shown on the plans or directed by the Engineer. However, said width shall not be less than 2.0 feet. The trench shall also be excavated to a minimum depth of 6 inches below the grade established for the bottom of the drain line. The height to which the filter material is placed shall be as shown on the plans or as directed by the Engineer, which height shall generally be 6 inches below the natural ground outside the roadway or to the elevation of the grading plane within the roadway.

12. Overside Drains

Overside drains shall conform to the requirements in Section 69 of the Standard Specifications and these provisions.

Overside drains shall be limited to the tapered inlet and flume downdrain type of either ferrous metal or aluminum, except that asphalt concrete may be used where the slope is 4:1 or flatter and the length required is less than 10 feet.

Where soil conditions at the end of the downdrain are subject to erosion; rock, asphalt concrete or other material shall be placed to inhibit erosion.

When there is a question as to the ability of the downdrain to function properly, the Engineer may require water to be deposited on the finished roadway in such a manner that the operation of the downdrain may be tested. Inadequacies determined by such tests shall be corrected.

13. Miscellaneous Facilities

Miscellaneous facilities shall conform to the requirements in Section 70 of the Standard Specifications and these provisions.

The pressure tests specified in Sections 70-1.02B and 70-1.02K of the Standard Specifications may be waived by the Engineer under field conditions that he determines make the tests unnecessary or impractical to conduct.

Driveway culvert pipe placed within the right of way shall have a nominal diameter of not less than 12 inches.

14. Slope Protection

Slope protection shall conform to the requirements in Section 72 of the Standard Specifications and these provisions.

Unless shown on the plans or approved by the Engineer rock slope protection, grouted or ungrouted, shall be placed by Method A Placement. However, the local surface irregularities may vary up to two feet from the planned slope measured at right angles to the slope.

The slopes on which sacked concrete slope protection is to be placed may vary up to 0.5 foot of the planned slope measured at right angles to the slope.

15. Concrete Curbs and Sidewalks

Concrete curbs, sidewalks and gutter depressions shall conform to the requirements in Section 73 of the Standard

Specifications and the following provisions.

Either the 1" or 1 1/2" maximum aggregate grading specified in Section 90-3.04 of the Standard Specifications may be used.

16. Fences

Fences shall conform to the requirements in Section 80 of the Standard Specifications and these provisions.

Fences for ponding basins or lots shall be chain link fence, Type CL-6 constructed as shown on Plate No. B-6, Section IV of these Improvement Standards.

Fences adjacent to freeways or limited access expressways shall be of a type approved by the Engineer.

Property fences not adjacent to freeways or limited access expressways may be of any type and material selected by the developer that does not conflict with State and local ordinances or codes.

C. DRAINAGE

1. Pipelines

Pipe and pipe arch shall conform to item number 10 of Subsection B (Streets and Highways) of this section.

2. Earthwork

Trench compaction and backfill material shall conform to item number 2 of Subsection B (Streets and Highways) of this section.

3. Pumping Plant Equipment

a. General - The drainage pumping equipment and the pumping plant electrical equipment shall conform to the provisions in Section 74, "Pumping Plant Equipment", of the Standard Specifications and these special provisions.

The data required in Section 74-1.04, "Data to be Furnished", of the Standard Specifications shall be limited to 3 copies of the following material:

1. The name of manufacturer, catalog number, size, capacity and all pertinent power ratings of the pump.

2. Pump performance curves.

3. Assembly plans showing the pump, pipes and fittings and any bracing to be installed.

In addition to the above data any parts lists and service instructions packaged with or accompanying the drainage pumping equipment and pumping plant electrical equipment shall be delivered to the Engineer.

b. Drainage Pumping Equipment - The pumping unit shall be suitable for outdoor installation, consisting of a vertical-shaft, single propeller-type pump, direct connected to a vertical shaft induction motor. The unit shall be designed to operate safely in the reverse direction of rotation due to water returning through the pump. The weight of the revolving parts of the pump, including the unbalanced hydraulic thrust of the propeller, shall be carried by a thrust bearing in the motor. The pump shall be supported from a base plate and channels by means of a vertical column having a horizontal discharge located as specified.

The vertical pump supporting column and discharge elbow shall be made of welded plate steel with a minimum wall thickness of 10 gage from 8" through 14" columns and 1/4" for 16" columns and larger in lieu of the 3/8" minimum specified in Section 74-2.04 of the Standard Specifications. The discharge opening shall be plain end, fitted with a Dresser type coupling suitable for connection to the discharge pipe. The discharge elbow shall be as shown on the plans.

The suction bell and pump bowl shall be made of close-grained cast iron and shall be designed for easy removal of the propeller and bearings. The suction bell shall have a flared inlet designed to reduce entrance losses and a sufficient number of vanes to support the lower guide bearings as well as to sustain the weight of propeller and pump shaft when dismantling the pump.

The pump propellers shall be made of bronze or stainless steel and shall be fastened to the shaft in such a manner as to be removed readily. They shall be balanced statically and dynamically to reduce vibration and wear.

The shaft of the pumping unit shall be of ample size to operate without objectionable distortion or vibration at maximum speed in both the forward and reverse direction of rotation. The pump-bowl shaft shall be made of stainless steel and the line shaft shall be made of carbon or alloy steel. The shaft couplings shall be of the threaded type. Provision shall be made at the top of the motor shaft for adjusting the elevation of the propeller with reference to the bowls. If water lubricated lineshaft is supplied, it shall be furnished with a stainless steel shaft sleeve, mechanically replaceable in the field.

All oil-lubricated lineshaft bearings shall be protected from water and foreign matter by an enclosing tube. A shaft seal shall be provided immediately above the top propeller. By-pass ports to drain excess oil from the shaft enclosing tube shall be provided above the seal. All bearings shall be easily replaceable, and spaced not more than five feet apart. All water-lubricated lineshaft bearings shall be furnished of rubber, and installed in bearing retainers spaced at the minimum distance required by good practice in the field. All bearings shall be easily replaceable.

If oil-lubricated, the pump shall be equipped with a solenoid operated lubricating system which shall supply lubricant to each lineshaft bearing. The solenoid-operated oiler shall be designed for outdoor operation and shall have a lockable metal oil reservoir with a capacity of not less than one gallon. If water lubricated, the pump shall be furnished with a deep packing box designed to effectively reduce leakage. The packing box shall have not less than 6 packing rings and shall have a provision for grease lubrication of the packing.

The packing gland shall be of the split type.

The pump shall be controlled by a float type switch as shown on the plans.

The pump stand shall be constructed from information given on plans.

The motor shall be of the 3-phase, 60-cycle, drop-proof,

vertical, ball-bearing, squirrelcage, induction type for outdoor service. It shall be suitable for operation at (220) (440) (2300) volts, and shall be of the low starting current type suitable for across-the-line starting service. The thrust bearing shall be of proper design to carry the weight of the rotating parts of the pump, including the unbalanced thrust of the propeller. Motor conduit box shall be suitable for accommodating leads from solenoid-operated oiler. The unit shall meet applicable requirements of the latest National Electrical Manufacturer's Association standards. The horsepower rating shall be such that the motor will not be overloaded beyond the service factor under the maximum pumping load possible to develop under the range of pumping heads specified.

The maximum pumping capacity, total dynamic head and maximum relative speed shall be shown on the plans and be approved by the Engineer.

D. WATER SYSTEMS

1. Pipe and Fittings

a. Cast Iron - All cast iron pipe shall be cement lined and conform to A.W.W.A. Standard Specifications C 102, C 106 and C 108. Cement lining shall conform to A.W.W.A. Standard Specifications C 104.

The minimum pressure class allowable shall be Class 150. Where necessary, pipe of a higher pressure rating shall be used to give the proper factor of safety. Cast iron fittings shall be of the proper class for the intended use and in no case shall they be of a lower pressure rating than the pipe to which attached.

Cast iron pipe and fittings shall be joined by any of the methods generally accepted in water works practice, including bell and spigot joints, flagged joints, mechanical joints and sleeve type coupling joints. Any newly developed joints not generally accepted in the water works industry must have the approval of the Engineer prior to use.

Where caulked bell and spigot joints are used they shall be made up of the following materials:

(1) Caulking or packing material shall consist of (a) molded or tubular rubber rings, or (b) asbestos rope, or (c) treated paper rope.

(2) Lead shall be hot poured into the joint and shall contain not less than 99.73 percent pure lead. The producer's name or the mark of Lead Industries shall be clearly cast or stamped upon each piece of lead.

b. Asbestos-Cement - Asbestos-cement pipe shall conform to A.W.W.A. Standard Specifications C 400.

The minimum pressure class allowable shall be Class 150. Where necessary, pipe of a higher pressure rating shall be used to the proper factor of safety.

Fittings for asbestos-cement pipe shall be of cast iron and shall be of the proper pressure rating for the intended use and in no case shall they be of a lower pressure rating than the pipe to which attached.

Asbestos-cement pipe and cast iron fittings shall be joined by any of the methods generally accepted in water works practice, including continuous bell ring joints and lead caulking. Any newly developed joints not generally accepted in the water works industry must have the approval of the Engineer prior to use.

c. Copper Pipe - Copper pipe for service laterals shall conform to A.S.T.M. Designation B 88 for "Type K Copper Water Tube".

d. Other Types of Pipe and Fittings - Pipe and fittings of any material other than those herein set forth shall have the specific approval of the Engineer prior to their use.

e. Valves

(1) Gate Valves - All gate valves larger than four (4) inches shall conform to A.W.W.A. Standards C 500 when standard operating conditions are encountered. Where