

CITY OF ANAHEIM

CITY OF ANAHEIM DEPARTMENT OF PUBLIC WORKS SUBDIVISION SECTION

SEWER DESIGN MANUAL

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EXHIBIT “A” WATER ENGINEERING STANDARD NO. W-130

REFERENCE: CLAY PIPE ENGINEERING MANUAL

September 2009

SEWER DESIGN MANUAL

Sanitary sewers are designed primarily to carry to a satisfactory point of treatment and ultimate disposal the spent water supply of a community, industrial wastes and unavoidable amounts of ground water infiltration. All waters not containing impurities which are actually or potentially objectionable should be excluded as far as possible from the sanitary sewer system. The flow rates of sewage for which sewer capacity should be provided must be determined from careful considerations of the present and probable future quantities of domestic sewage and commercial and industrial wastes.

The objective of the Sewer Design Manual is to provide a concise guide for the analysis and design of sewer facilities in the City of Anaheim. This guide is intended to be used by design engineers for development projects. Plan preparation and submittal requirements are provided in a separate document "[Improvement Procedures](#)" available online at:

1. SIZING

Since the quantity of domestic sewage is a function of the population and of water consumption, lateral and sub main sewers should be designed for the saturation density of population expected in the areas served. The sewer system should be designed for tributary areas, land use and population estimated based on the Anaheim General Plan and Master Plan of Sanitary Sewers.

All sewers shall be designed based on the peak flow rate and the following criteria.

A minimum pipe size of 8" shall be used for all public sewers and private sewers within street.

Design flows:

The average daily flow of sewage and ground water is the average 24-hour discharge during a period of a year. The peak flow determines the hydraulic capacity of sewers.

Residential:

| | |
|--------------------|---------------------------------------|
| Average flow: | 105 gpcd (gallons per capita per day) |
| Per capita factor: | 3.3 people per household |
| Peak factor: | 3.25 |

Non-Residential:

| | |
|----------------|----------------|
| Commercial: | 2,262 gpd/acre |
| Industrial: | 3,167 gpd/acre |
| Institutional: | 2,715 gpd/acre |
| Peak factor: | 1.7 |

Lot coverage varies from 40 to 70% depending upon location.

Roughness coefficient (n):

R.C.P., A.C.P., V.C.P., A.B.S., D.I.P.: 0.013
P.V.C.: 0.010

Velocity (Average flow):

Minimum: 2 fps
Maximum: 10 fps

Maximum depth of flow (at peak flow condition):

10" and smaller: $\frac{2}{3} D$, $d/D = 0.67$ (d: depth of flow)
12" and larger: $\frac{3}{4} D$, $d/D = 0.75$ (D: diameter of sewer pipe)

Lateral sizes:

Minimum lateral pipe size is 4".

2. MODELING

Modeling of the sewer system is required when proposed development intensifies the land use from the existing development on the site or proposed development requires a general plan amendment to a more intense use.

The following three scenarios must be modeled:

- **Existing Condition** – to identify existing deficiencies in the system
- **Existing Condition with Proposed Development** – to identify additional deficiencies created by the proposed development
- **General Plan Build Out Condition** – to identify the ultimate pipe size for improvements

Sewer modeling shall be performed by the City's on-call consultant for Sewer Studies for Private Development where available at the cost of the Developer. Developer will deposit the estimated amount for the proposed sewer study and City will contract the consultant to perform the study. City's consultant will input the developer's project parameters into the Master Sewer Study to identify the project's impact to the sewer system.

Development in areas with a downstream deficient sewer will be restricted. Where uses are discontinued on a property to allow for new development, new development up to the sewer generation rate of the previous use on the property will be allowed in sewer deficient areas.

Developer may make the needed improvements to the sewer system at his/her own cost and request a reimbursement agreement to recover a portion of the costs from other developments that tie into the system and benefit from the improvements. Reimbursement agreements run a term of twenty years and are not guaranteed to be paid in full.

3. ALIGNMENT

Sewer shall be located in the street, not in the parkway. Sewer trench shall not extend under edge of gutter.

A minimum radius of 150' shall be used for any horizontal bend. Maximum deflection at any joint shall not exceed two (2) degrees.

Connection:

| | |
|---------------------------------|-------------|
| 4" to main line (8" or larger): | saddle |
| 6" to main line (8" or larger): | snap-in wye |
| 8" to main line (8" or larger): | manhole |

When jacking is required, details to be shown on plans. 18" minimum diameter C.I.P. with 3/8" wall thickness required for 8" V.C.P. Jacking may be required by the City Engineer when crossing arterial highways.

Minimum horizontal spacing between sewer line and water line is 11'.

Provide lateral for each lot per Standard Detail No's. [222-1](#) and [223-1](#).

4. GRADE

Sewer shall be normally 7' to 8' deep (to soffit of pipe).

Mainline minimum depth at manhole shall be 5.67 ft (5'- 8").

Minimum slope:

| | |
|--------|------------|
| d= 8" | s = 0.0036 |
| d= 10" | s = 0.0030 |
| d= 12" | s = 0.0024 |
| d= 15" | s = 0.0020 |

Indicate slope in terms of $s = 0.002$, not $s = 0.2\%$.

Avoid vertical curves. Straight grade from manhole to manhole. Use of vertical curve must be approved by the Development Services Manager.

Elevation drop thru manhole:

| | |
|----------------|---|
| Straight thru: | no change in pipe size, |
| Match soffit: | right angle turns and change in pipe size, |
| 0.10' drop: | turns and no change in pipe size, |
| 0.20' drop: | right angle turns and no change in pipe size. |

Avoid drop manholes. Use of drop manholes to be approved by the Development Services Manager.

Encasement is required when clearance between pipes is less than 18" and where required per

[Water Engineering Standard](#) No. W-130 (See Exhibit “A”)

Encase sewer line per Standard Detail No. [225-1](#) when:

- Top of bell of sewer is less than 3' from bottom of water line,
- Storm drain is within 1.5' (18") above sewer line, or
- Sewer line is above water line.

Slope anchors and backfill stabilizers are required where pipe slope exceeds 30%. Slope anchors shall be placed per Standard Detail No. [221-1](#).

5. MATERIALS

Main line sewer pipe shall be V.C.P.

Sewer pipe under median to be D.I.P. epoxylined, polylined D.I.P. or V.C.P. encased.

A.B.S. and P.V.C. solid wall pipe and A.B.S. composite pipe may be used as an alternate to V.C.P. as approved by the City Engineer. Use shall be limited to local interior streets and private streets tributary to residential flows only. Sizes shall not exceed 10" in diameter. Pipe characteristics and installation shall be per the Standard Specifications for Public Works Construction and a Bedding Detail shall be provided.

V.C.P. joints shall be mechanical compression or Band seal type.

6. BEDDING

V.C.P. and D.I.P. – Per Standard Specifications for Public Works Construction (“[Greenbook](#)”) for cover between 3' and 15', for cover less than 3' and greater than 15' special bedding is required. Calculations and supporting soils reports to be provided by the Design Engineer. Use a soil weight of 130 lbs/cf (unless soils reports state otherwise) and a safety factor of 1.5. Details of bedding shall be shown on plan.

A.B.S. and P.V.C. - Details of bedding shall be shown on plan. Supporting calculations are required.

7. MANHOLES

Manholes to be constructed at intersecting mains, B.C., E.C., angle points and change in pipe size or grade. Only one manhole at B.C. or E.C. is acceptable for a short length curve (Maximum 100') with a central angle less than 45 degrees.

Maximum manhole spacing is 300'.

Manhole shall be constructed at the end of construction with 4' stub out for future connection. Stub shall be plugged with brick and mortar.

In unpaved areas where there is a danger of the manhole becoming lost, set the top of cover elevation so as not to be less than 1' above existing ground.

8. EASEMENTS

When sewer cannot be located within the street, it shall be located in an approved easement.

Easements parallel to lot line shall be on one lot only.

Sewer easement shall be a minimum 15 ft. in width. For deep pipe the easement shall be 2 x depth - O.D. to a maximum 25 ft.

Access for maintenance of a public sewer shall be 12' wide and must be paved with 0.25' of A.C. over 0.35' of B.M. Location of access to be approved by the Streets and Sanitation Division.

Easement for public sewers shall be dedicated to the City on a recorded map or by a separate deed with the approved easement sketch and the legal description (including closure calculations).

9. PRIVATE SEWER

Private on-site sewers designed to meet the California Plumbing Code will be reviewed, permitted and inspected by the [Building Division](#). These plans will not be reviewed by the Public Works Department, but must meet all requirements of the California Plumbing Code and the Building Division. Contact the City of Anaheim Building Division at (714) 765-5153 for plumbing plan check requirements.

Engineered Sewers (i.e. those within a private street or on-site systems that do not meet Plumbing Code) may be drawn in plan view only, however they must show rates of grade, direction of flow, size of pipe, invert and finish surface elevations at cleanouts, manholes and grade breaks, location and elevation of all adjacent or crossing underground facilities, sufficient horizontal controls to permit the system to be located in the field, and any other information which may be required to adequately check, construct and inspect the system.

- A. The size of all sewers shall be designed based on the following desirable engineering considerations, peak rate of flow with a minimum velocity of 2 fps, a minimum depth of flow of 1 inch and a maximum ratio of depth of flow to the diameter of pipe of 0.75. In addition, the minimum sizes shall be used:
- a. Mains:
 - Residential development: 6" min.
 - Commercial development: 6" min.
 - Industrial development: 4" min.
 - c. Laterals:
 - 4" min. when serving 1 thru 6 living units in a single building,
 - 6" min. when serving more than 6 living units in a single building or more than one (1) building.
- B. Cleanouts may be provided in lieu of manholes at a maximum spacing of 100 feet. They shall also be provided at vertical grade break of more than one-half percent (1/2%) or for horizontal deflection angle of more than forty five (45) degrees. All cleanouts shall be brought to finished grade.

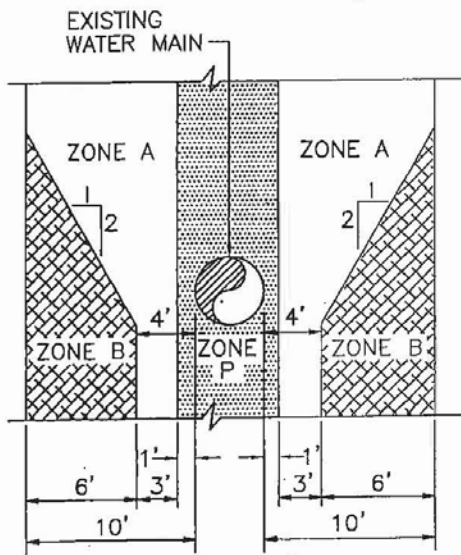
Standard manholes may be required when deemed necessary by the City Engineer.

- C. Add note to each sheet:

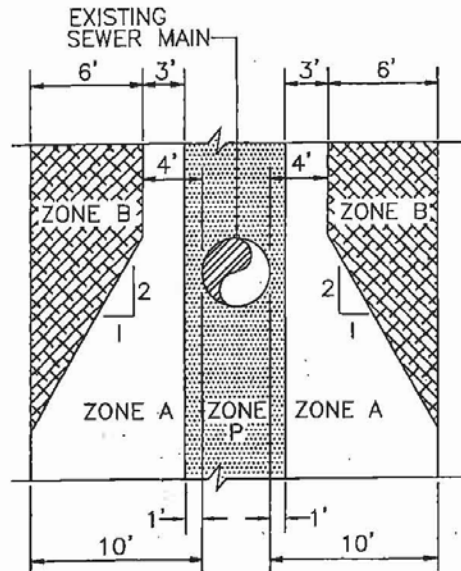
APPROVED ONLY FOR INSPECTION OF WORKMANSHIP AND
MATERIALS ON PRIVATE PROPERTY

Exhibit A

| ZONE | NEW SEWER CONSTRUCTION | NEW WATER MAIN CONSTRUCTION |
|------|---|---|
| B | SEWER PIPE SHALL BE EXTRA STRENGTH V.C.P. WITH COMPRESSION JOINTS OR ALTERNATE MATERIAL AS APPROVED BY PUBLIC WORKS AND PUBLIC UTILITIES DEPARTMENT | WATER PIPE SHALL BE DIP, CLASS 52, WITH HOT DIP BITUMINOUS COATING PER SECT. 2-01 OR, UPON APPROVAL, PVC PIPE, CLASS 305 (DR 14 AWWA C900), SEE NOTE 4 ON W-130 SHEET 2 OF 4 |
| A | NO CONSTRUCTION WITHOUT APPROVAL OF WATER UTILITY AND DEPARTMENT OF HEALTH SERVICES | |
| P | PROHIBITED ZONE PER SECTION 64630 (E) (2), CALIFORNIA ADMINISTRATIVE CODE, TITLE 22 | |



ZONES INDICATING LOCATIONS
OF NEW SEWER



ZONES INDICATING LOCATIONS
OF NEW WATER MAIN

PARALLEL CONSTRUCTION

NOTE: SEE NOTES ON SHEET 2 OF 4 FOR ADDITIONAL REQUIREMENTS

WATER AND SEWER SEPARATION REQUIREMENTS

| PUBLIC UTILITIES DEPARTMENT | | | | CITY OF ANAHEIM | | STD. NO. |
|-----------------------------|----------|-----------------|---|-----------------|-----------------|----------------------------|
| WATER SERVICES | | | | | | W-130 |
| DRAWN | BY TL | DATE 3-12-09 | APPROVED CIVIL ENGINEER-WATER SERVICES | | DATE 6-11-09 | |
| CHECKED | LOC | 3-19-09 | APPROVED | | DATE 6-12-09 | |
| RECOMMENDED | MF | 3-19-09 | ASST. GEN. MGR.-WATER SERVICES | | | |
| | | | | | | SHEET <u>1</u> OF <u>4</u> |

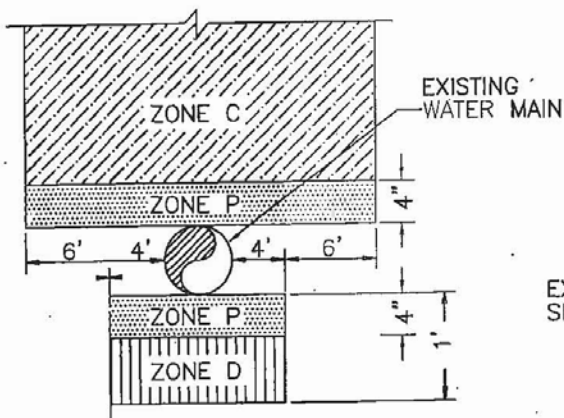
NOTES:

1. DEPARTMENT OF PUBLIC HEALTH (DPH) REGULATIONS REQUIRE THAT THE HORIZONTAL DISTANCE BETWEEN THE WATER MAIN AND THE SANITARY SEWER MAIN SHALL BE A MINIMUM OF 10-FT FROM OUTSIDE WALL-TO-OUTSIDE WALL.
2. FOR SITUATIONS IN WHICH THERE IS NO ALTERNATIVE BUT TO INSTALL WATER MAINS, SANITARY SEWER MAINS OR OTHER NON-POTABLE PIPELINES AT A DISTANCE LESS THAN THAT REQUIRED BY THE DPH REGULATIONS, THEN SPECIAL CONSTRUCTION WILL BE REQUIRED AS SHOWN ON SHEET 1 OF 4 OF W-130.
3. FORCE SEWER MAINS ARE NOT PERMITTED IN ZONES A OR B.
4. PVC WATER MAIN CONSTRUCTION SHALL BE PRE-APPROVED BY THE UTILITY PER SECTION 2-02. PVC PIPE LARGER THAN 12-INCH IN DIAMETER IS NOT ALLOWED.
5. INSTALLATION OF WATER MAINS, SANITARY SEWER MAINS, OR OTHER NON-POTABLE PIPELINES THAT DO NOT MEET THE MINIMUM DPH SEPARATION CRITERIA AND ARE 24-INCHES IN DIAMETER OR LARGER SHALL BE REVIEWED AND APPROVED IN WRITING BY THE DEPARTMENT OF PUBLIC HEALTH ON A CASE-BY-CASE BASIS PRIOR TO CONSTRUCTION.

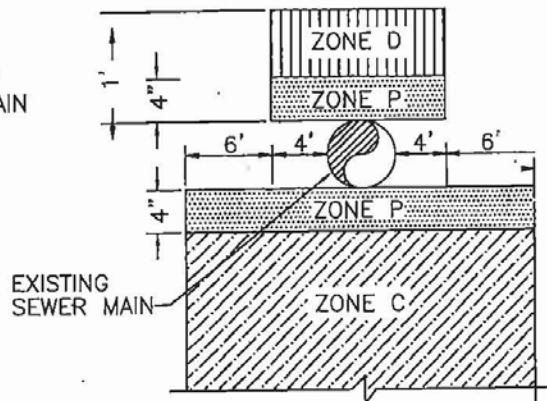
WATER AND SEWER SEPARATION REQUIREMENTS

| WATER SERVICES | | | | PUBLIC UTILITIES DEPARTMENT | | CITY OF ANAHEIM | | STD. NO. |
|----------------|----------|-----------------|--------------------------------|-----------------------------|--|-----------------|---------|--------------|
| DRAWN | BY TL | DATE 3-12-09 | APPROVED | | | DATE | 6-11-09 | W-130 |
| CHECKED | LOC | 3-19-09 | CML ENGINEER-WATER SERVICES | | | | | |
| RECOMMENDED | MF | 3-19-09 | ASST. GEN. MGR.-WATER SERVICES | | | DATE | 6-12-09 | |

| ZONE | NEW SEWER CONSTRUCTION | NEW WATER MAIN CONSTRUCTION |
|------|---|---|
| C | NEW SEWER PIPE SHALL BE CENTERED OVER THE EXISTING WATER PIPE BEING CROSSED; SEWER PIPE SHALL BE A CONTINUOUS FULL LENGTH OF DIP WITH CERAMIC EPOXY LINING (PROTECTO 401 OR APPROVED EQUAL), OR, ALTERNATIVELY, ANY APPROVED SEWER PIPE MATERIAL WITHIN A CONTINUOUS CASING AS APPROVED BY PUBLIC WORKS | NEW WATER PIPE SHALL BE CENTERED UNDER THE EXISTING SEWER PIPE BEING CROSSED; WATER PIPE SHALL BE A CONTINUOUS FULL LENGTH OF DIP, CLASS 52, OR, UPON APPROVAL, A CONTINUOUS FULL LENGTH OF PVC PIPE, CLASS 305 (DR 14 AWWA C900), SEE NOTE 5 ON W-130, SHEET 4 OF 4 |
| D | SEWER PIPE SHALL NOT HAVE JOINTS WITHIN 4-FT FROM EITHER SIDE OF WATER PIPE BEING CROSSED; SEWER PIPE SHALL BE A CONTINUOUS SECTION OF DIP WITH CERAMIC EPOXY LINING (PROTECTO 401 OR APPROVED EQUAL) | WATER PIPE SHALL HAVE NO JOINTS WITHIN 4-FT FROM EITHER SIDE OF SEWER PIPE BEING CROSSED; WATER PIPE SHALL BE A CONTINUOUS FULL LENGTH OF DIP, CLASS 52, OR UPON APPROVAL, A CONTINUOUS FULL LENGTH OF PVC PIPE, CLASS 305 (DR 14 AWWA C900), SEE NOTE 5 ON W-130, SHEET 4 OF 4 |
| P | PROHIBITED ZONE PER SECTION 64630 (E) (2), CALIFORNIA ADMINISTRATIVE CODE, TITLE 22. | |



ZONES INDICATING LOCATIONS
OF NEW SEWER



ZONES INDICATING LOCATIONS
OF NEW WATER MAIN

PERPENDICULAR CONSTRUCTION (CROSSING)

NOTE: SEE NOTES ON SHEET 4 OF 4 FOR ADDITIONAL REQUIREMENTS

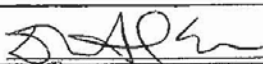
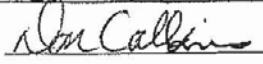
WATER AND SEWER SEPARATION REQUIREMENTS

| WATER SERVICES | | PUBLIC UTILITIES DEPARTMENT | | CITY OF ANAHEIM | | STD. NO. |
|----------------|----------|-----------------------------|---|--------------------|-----------------|--|
| DRAWN | BY TL | DATE 3-13-09 | APPROVED CIVIL ENGINEER-WATER SERVICES | <i>[Signature]</i> | DATE 6-11-09 | W-130 SHEET <u>3</u> OF <u>4</u> |
| CHECKED | LOO | 3-20-08 | APPROVED | <i>[Signature]</i> | DATE 6-12-09 | |
| RECOMMENDED | MF | 3-20-09 | ASST. GEN. MGR.-WATER SERVICES | <i>[Signature]</i> | DATE 6-12-09 | |

NOTES :

1. DEPARTMENT OF PUBLIC HEALTH (DPH) REGULATIONS REQUIRE THAT WATER MAINS BE INSTALLED A MINIMUM OF ONE (1) FOOT VERTICALLY ABOVE THE SANITARY SEWER MAINS.
2. FOR SITUATIONS IN WHICH THERE IS NO ALTERNATIVE BUT TO INSTALL WATER MAINS, SANITARY SEWER MAINS OR OTHER NON-POTABLE PIPELINES AT A DISTANCE LESS THAN THAT REQUIRED BY THE DPH REGULATIONS, THEN SPECIAL CONSTRUCTION WILL BE REQUIRED AS SHOWN ON SHEET 3 OF 4 W-130.
3. FORCE SEWER MAINS ARE NOT PERMITTED IN ZONE C, AND IN ZONE D ONLY WITH SPECIAL CONSTRUCTION AS DETERMINED BY DEPARTMENT OF PUBLIC HEALTH.
4. ALL WATER MAIN PIPE SHALL BE D.I.P. PER SECTION 2-01 AND SHALL RECEIVE A HOT DIP BITUMINOUS COATING.
5. PVC WATER MAIN CONSTRUCTION SHALL BE PRE-APPROVED BY THE UTILITY PER SECTION 2-02. PVC PIPE LARGER THAN 12-INCH DIAMETER IS NOT ALLOWED.
6. SEWER HOUSE LATERAL REPAIR CROSSING ABOVE A WATER MAIN SHALL BE CONTINUOUS 5-FT LENGTH VCP PIPE WITH FERNCO COUPLING OR APPROVED EQUAL.
7. WATER MAIN CROSSING BELOW AN EXISTING SEWER HOUSE LATERAL SHALL BE A CONTINUOUS FULL LENGTH PIPE CENTERED BELOW THE LATERAL.
8. INSTALLATION OF WATER MAINS, SANITARY SEWER MAINS, OR OTHER NON-POTABLE PIPELINES THAT DO NOT MEET THE MINIMUM DPH SEPARATION CRITERIA AND ARE 24-INCHES IN DIAMETER OR LARGER SHALL BE REVIEWED AND APPROVED IN WRITING BY THE DEPARTMENT OF PUBLIC HEALTH ON A CASE-BY-CASE BASIS PRIOR TO CONSTRUCTION.

WATER AND SEWER SEPARATION REQUIREMENTS

| | | | | | | |
|----------------|----------|-----------------|---|--|-----------------|--------------|
| WATER SERVICES | | | PUBLIC UTILITIES DEPARTMENT | | CITY OF ANAHEIM | STD. NO. |
| DRAWN | BY TL | DATE 3-12-08 | APPROVED CIVIL ENGINEER-WATER SERVICES |  | DATE 6-11-09 | W-130 |
| CHECKED | LOC | 3-19-09 | APPROVED |  | DATE 6-12-09 | |
| RECOMMENDED | MF | 3-19-09 | ASST. GEN. MGR.-WATER SERVICES | | | |
| | | | | | | SHEET 4 OF 4 |