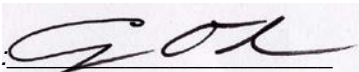



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CITY OF SUNNYVALE
WATER POLLUTION CONTROL PLANT
DESIGN STANDARDS
CIVIL

June 2014



CITY OF SUNNYVALE
WATER POLLUTION CONTROL PLANT DESIGN STANDARDS

CIVIL

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1.0 PURPOSE AND CONTENT

This document describes the civil engineering design standards to be used for improvement projects at the City of Sunnyvale's (City) Water Pollution Control Plant (WPCP) located at 1444 Borregas Ave., Sunnyvale, CA. Civil Engineering standards cover yard piping, grading, paving, drainage, erosion control, fencing, demolition and fire protection.

These standards will be used for preliminary and final design of the WPCP improvements.

2.0 STANDARD DEFINITIONS AND ABBREVIATIONS

ADA	American with Disabilities Act
ANSI	American National Standards Institute
City	City of Sunnyvale
Drainage Manual	Santa Clara County Drainage Manual, latest edition
CLSM	Controlled Low Strength Material
NAD 83	North American Datum 1983
NAVD 88	North American Vertical Datum of 1988
OSHA	Occupational Safety and Health Administrations
TI	Traffic Index
WPCP	Water Pollution Control Plant

Note: Standard Piping System abbreviations are located in Table 4 of these civil design standards.

3.0 CODES AND STANDARDS

Designers shall follow the latest edition of codes and standards as adopted by the City including but not limited to:

- City of Sunnyvale Standard Details
- City of Sunnyvale Municipal Code

- City of Sunnyvale Consolidated General Plan
- City of Sunnyvale Building Division Requirements
- Standard Specifications for Public Works Construction (SSPWC or “Greenbook”) or latest adopted edition
- Standard Details for Public Works Construction (SSPWC or “Greenbook”) or latest adopted edition
- Santa Clara County Drainage Design Manual
- 2013 California Building Code with California amendments and errata or latest adopted edition
- State of California Occupational Safety and Health Administration (CAL/OSHA) General Industry Safety Orders
- 2013 California Plumbing Code with State amendments and errata or latest adopted edition
- 2013 California Fire Code with State amendments and errata or latest adopted edition
- National Fire Protection Association Codes and Standard
- ADA Accessibility Guidelines for Buildings and Facilities
- Federal Occupational Safety and Health Administration (OSHA)
- American National Standards Institute (ANSI)
- American Society for Testing and Materials (ASTM)
- State of California Department of Health Services
- AASHTO Green Book

4.0 GUIDELINES AND PROCEDURES

4.1 Site Layout

4.1.1 Existing Topographic Survey

Base maps for the WPCP utilize aerial topographic survey of the WPCP that was performed by Mark Thomas & Company in July 2013. Additional supplemental ground survey information was gathered in September 2013. Supplemental ground survey included dipping drain inlets and manholes for piping invert elevations, as well as, identification of vaults, manholes or piping

types as possible from visual confirmation. The established survey was performed on the following datums:

- Horizontal datum: California Coordinates System Zone 3, North American Datum of 1983 (NAD83).
- Vertical datum: North American Vertical Datum of 1988 (NAVD 1988) plus 100-feet to avoid negative elevations.

Table 1 provides the datum adjustments used during the existing utilities Master Plan effort to correct WPCP record and design drawings to the current NAVD 1988 vertical datum in the existing utilities plans (see section 4.8.1 for more details on these plans). These datum adjustments were developed through reviewing record and design plan sets for listed survey datums and elevations information. This information was gathered to develop datum shift adjustments based on elevation differences and datum notes (Note: Many of the existing record/design drawings in Table 1 did not specify which datum the work was conducted on or the datum shift for the specified datum is unknown).

Table 1 Existing Record and Design Drawing Datum Information Civil Design Standards City of Sunnyvale			
Year	Project Number	Project Name	Datum Adjustment (in feet) to Current WPCP Datum²
1955	STP-1955	Sewage Treatment Works	-2.05
1961	STP-1961	Sewage Treatment Plant Enlargement	-2.05
1969	PR-69-5	Sewage Treatment Works 1969 Enlargements and Modifications	-2.05
1973	PR-73-2	WPCP - Tertiary Facilities	-2.05
1973	PR-73-2b	WPCP - Tertiary Chlorination Facilities	-2.05
1979		WPCP Primary Effluent Pipeline	-2.05
1980	PR-80-16	WPCP Addition of Dual Media Filter No. 4	-2.05
1982	PR-82-4	WPCP Capacity Expansion and Process Improvements - C1	-2.05
1982	PR-82-6	WPCP Capacity Expansion and Process Improvements - Primary Facilities - C2	-2.05
1982		Oxidation Pond Improvements (Design Markups) - C3	
1995	PR-95-02	WPCP - Power Generation Facility	-2.47
1995	UW-95-02	Polymer Feed System Improvements	-2.05
1996	UW-96-01	Tertiary Plant Improvements	-2.05
2002	UY-02-02-03	WPCP Chemical System Improvements	-2.05
2003	UY-03-01-05	WPCP Digester Lid and Drain Line Rehabilitation Digester No. 3 Record Drawings	-2.47
2008	UY-05-04-06	Tertiary Plant Tank Drainage System Modifications	-2.05

Table 1 Existing Record and Design Drawing Datum Information Civil Design Standards City of Sunnyvale			
2009	UY-08-01-09	Rehabilitation of WPCP Digester No. 4	-2.47
2012	UY-08/03-09	Emergency Bypass Pipeline Project 90%	-2.05
NA	NA	City Sewer Map at WPCP	-2.05

Notes:

(1) WPCP project record or design drawings that are not listed in Table 1 do not include elevation information on any datum or do not provide sufficient information to determine the appropriate vertical datum adjustment or do not include datum elevation.

(2) Generally record drawings from 1955 through 2010 were discovered to be on one of two datums. The 1954 releveling of the US Coast and Geodetic Survey datum and the 1929 North Geodetic Vertical Datum (NGVD). The datum shift used for both datums is -2.05 with the exception of a few drawing sets that required a larger datum shift (-2.47) based on elevations of structures in the drawing sets (i.e. an elevation of 110.0 on 1973 record drawings with a -2.05 datum shift would become $110 + (-2.05) = 107.95$ on the current NAVD 1988 datum).

4.1.2 Existing Geotechnical Investigations

A geotechnical report was completed by Fugro as a part of the WPCP Master Plan project. This report includes the following components:

- Compilation and review available geotechnical and geologic data from previous investigations performed in the site vicinity.
- Field investigation (11 borings and 6 CPTs) and laboratory testing programs to confirm and supplement the existing information.
- Geologic hazard evaluation of the plant, expansion area and Ponds 1 and 2.
- Detailed evaluation of settlement and development of earthwork and foundation parameters for the headworks and primary treatment areas (Phase 1 of Construction).
- The geotechnical report includes the results of the current and previous field investigations, laboratory-testing program, discussion of geologic and seismic hazards, recommendations for foundation design and other associated improvements within the headworks and primary treatment areas.
- General discussion and recommendation for the proposed improvements for areas outside of the headworks and primary treatment areas, including the oxidation ponds areas.

4.1.3 Site Layout

The site layout for facilities at the WPCP was completed as a part of the WPCP’s master planning effort. The following items shall be considered when designing facilities on the site and will be reviewed by the City during detailed design:

- Provide adequate space for future expansion of facilities. Refer to the WPCP Master Plan Site Layout TM for the planned locations of WPCP future facilities. The designer shall coordinate with the City for review of space requirements and layout during the design process.
- Allow adequate access for trucks to enter, maneuver and leave the site and access all the facilities. It is important to consider all types of trucks that will need access to each area. Provide crane access as required. Typical truck dimensions and turning radii are shown in Table 2.

Table 2 Truck Dimensions and Turning Radii Civil Design Standards City of Sunnyvale					
Vehicle	Description	Width	Length	Radius⁽¹⁾	Turning Template⁽²⁾
California Legal Design Vehicle 50'	Truck tractor-semitrailer allowed on all state roads. 50' radius is tightest turn that the vehicle can navigate assuming a speed of less than 10 mph.	8.5	65	49.4	404.5D
California Legal Design Vehicle 60'	Truck tractor-semitrailer allowed on all state roads. 60' radius is more conservative, vehicle is not required to stop before entering intersection.	8.5	65	60	404.5E
40' bus Design Vehicle	Applicable to 3-axle delivery trucks, 40-ft Bus Design Vehicle	8.5	40	42.4	404.5F
Notes:					
(1) Radius to outside wheel at beginning of curve.					
(2) Caltrans Highway Design Manual Turning Template Figure Number. These figures are included in Appendix A.					

- Provide sidewalks as needed for plant personnel. See City of Sunnyvale standard detail for Curb, Gutter & Sidewalk section detail 9C and 17C.
- Access to the Administration Building shall be ADA compliant. Any public route (i.e. tour route) through the WPCP also shall be ADA compliant. Treatment areas that do not have

public access do not require ADA accessibility; however, these areas should be designed according to the latest adopted edition of the California Building Code.

- ADA compliant routes shall be identified on design drawings.
- Building locations shall maintain minimum requirements for setbacks from property lines and for fire code distances between buildings.
- Provide adequate space for pipes, pumps, duct banks both for initial use and future expansion use.
- See the WPCP Master Plan Site Layout TIM for detailed site layout information.

4.1.4 Temporary Construction Facilities

Design Engineers need to work with the City to incorporate temporary construction requirements into each design package. At a minimum, this will include:

- Identification of areas that are off limits to the contractor, such as wetlands, raptor nesting areas, heritage trees (if any exist) or existing WPCP areas that need to be protected from construction equipment.
- Identification of Contractor staging areas, field office areas and utilities and storage areas. Identify Contractor's access point(s) into the plant and access roads within plant.
 - Note that Contractor will be responsible for all power needed for their facilities and for construction.
- Identification of Contractor's source of construction water and location where dewatering water can be discharged.
- Identification of areas of known contaminated soils or hazardous materials.
- Identification of access routes that need to be maintained during construction for operations staff or the public.
- Identification of allowable soils stockpiling areas.

4.2 Street Design

4.2.1 Pavement

Structural section (asphalt concrete and aggregate based type and thicknesses) shall be calculated by the Geotechnical Engineer based on "R" value and Traffic Index (TI).

Geotechnical Engineer shall determine "R" value using California Test Method No 301. The minimum acceptable TI values for pavement design are shown in Table 3. These values are in line with TI values in the WPCP Master Plan Geotechnical Report.

Table 3 Traffic Index for Pavement Section Design Civil Design Standards City of Sunnyvale	
Type of Pavement	Traffic Index
Access Corridors and Truck Paths	7
Automobile Parking Areas	4.5

- All paved streets shall include concrete curb and gutter. Vertical curb and gutter shall be used unless rolled curb is desired to allow vehicle access. See City of Sunnyvale Standard Detail sheet 15C-1 for vertical curb and gutter detail.
- Pavement adjacent to landscape areas shall have plastic moisture cut offs around base material or a full depth curb that extends four inches or more into the soil subgrade to prevent irrigation water from migrating under pavement.
- Unpaved streets shall be 12 inches of aggregate base over a layer of geotextile fabric placed over compacted subgrade. Compaction requirements of subgrade shall be per project geotechnical report recommendations.

4.2.2 Street Grades

- The minimum profile grade on streets shall be 0.50 percent and the minimum cross slope shall be two percent in accordance with City of Sunnyvale Standard Detail 1C for a two lane street.
- When widening existing streets the cross slope shall match existing as much as possible, but in no case shall the cross slope be less than the existing cross slope. Pavement overlay of the existing street may be required to provide a consistent cross slope.
- Surface grades of the asphalt concrete pavement within new intersections shall be designed to provide continuous positive drainage. No slope within the intersection shall be less than 1.5% or greater than 4%.
- The minimum vertical curve length allowable at the intersection of two grades shall be 50 feet. Vertical curves on all streets may be omitted where the algebraic difference in grades does not exceed two percent.

4.2.3 Street Layout

- All streets, driveways, parking areas and access road shall allow adequate room for truck turning movements. Typical turning radii are shown in Table 2.

- According to Section 503 of the CA Fire Code, the minimum street width shall be 20 feet and the minimum unobstructed vertical clearance shall be 13 feet 6 inches for fire access roads.
- An 18-inch minimum clearance shall be provided between the edge of roadways and any obstruction. Obstructions include poles, signage, rails, etc.

4.3 Sidewalks

4.3.1 General

- The preferred sidewalk width is 10-feet wide. If the site layout and access requirements do not permit this sidewalk width, sidewalk width may be reduced with City Approval.
- Where obstructions are located within sidewalk areas a minimum of 48 inches of clear sidewalk space shall be provided to the furthest extent possible. The widened area shall extend around the obstruction as shown in City of Sunnyvale Standard Detail 11C.
- Sidewalks shall be reinforced concrete, a minimum of four inches thick in conformance with City of Sunnyvale Standard Details 9C through 9C-5.
- Driveway approaches shall be a minimum of 6 inches thick in conformance with City of Sunnyvale Standard details 6C-1 through 6C-3.

4.3.2 Accessibility

- Curb Ramps shall be installed at all intersections with sidewalks and at all sidewalks providing access to accessible buildings.
- Any part of an accessible route with a slope greater than 5% is considered a ramp according to section 106.5 of the ADA accessibility guidelines and shall comply with ADA accessibility guidelines for ramps.
- The maximum cross slope of ramp surfaces shall be no greater than 1:48, the maximum longitudinal slope of an ADA ramp in new construction shall be 1:12, and the maximum rise for any run shall be 30 inches per Section 405 of the 2010 ADA accessibility guidelines, higher rises will require landings conforming to the following:
 - The landing shall be at least as wide as the ramp run leading to it.
 - The landing length shall be a minimum of 60 inches clear.
 - If ramps change direction at landings, the minimum landing size shall be 60 inches by 60 inches.
 - If a doorway is located at a landing, then the area in front of the doorway shall comply with ADA requirements for maneuvering clearances at doorways.

- Changes in level up to 1/4 inch may be vertical and without edge treatment. Changes in level between 1/4 inch and 1/2 inch shall be beveled with a slope no greater than 1 vertical to 2 horizontal. Changes in level greater than 1/2 inch shall be accomplished by means of a ramp in accordance with section 405 of the ADA accessibility guidelines.
- Truncated dome inserts shall be used where accessible routes transition from sidewalks to AC pavement.

4.4 Parking

4.4.1 General

- The maximum slope in a parking lot shall be 4.5% and the minimum slope shall be 2%.
- The desired predominate slope in a parking lot shall be 2% minimum.
- The minimum slope of concrete gutters shall be 0.5% per the City's Storm Drain Design Standards (adopted 8/13).
- Coordinate the locations of special truck parking and loading areas with the City.
- In accordance with City Municipal Code Section 19.46.120:
 - A minimum of 20% of the parking lot area is required to be landscaped.
 - 50% of entire parking lots shall be shaded within 15 years. Up to 25% of this requirement may be met with the installation of solar energy systems rather than trees. (Note: Solar energy systems shall be approved by the City prior to designing any such facilities.)
 - Wheel stops are required for all parking spaces.
 - Parking spaces are to be 8.5-feet wide minimum and 16-feet long minimum.
 - Landscape islands are to be a minimum of 6-feet wide for interior islands in the parking lot and 4-feet wide with perimeter landscaping.
- Provide bike racks inside and outside of the WPCP secured fence area.
- The following items should be considered during design:
 - Electric Car Charging Stations
 - Covered Parking Spaces and photovoltaic energy production.
 - Permeable paving design (not in process areas)
- See the WPCP Master Plan Site Layout TM for additional information related to parking areas at the WPCP.

4.4.2 Accessible Parking

- Accessible parking spaces shall be designed in accordance with ADA requirements.
- Accessible parking shall be signed and striped.
- Two accessible parking spaces may share a common access aisle.
- Access aisles shall be part of an accessible route to the building or facility entrance.

4.5 Horizontal and Vertical Control

4.5.1 General

- Horizontal and vertical datum shall be as shown on the existing site survey. This information shall be presented on the cover of the design drawings. See section 4.1.1. for horizontal and vertical datum information.

4.5.2 Locating New Improvements

- Locate all new structures with a minimum of two coordinates on the opposite outside face of the wall or on column lines.
- Locate circular structures with a coordinate at the center point.
- Provide coordinates for the centerline of road and provide details for all curves.
- Describe the location of all control points in addition to including their coordinates in a table.
- Coordinates and/or dimensions shall be provided to edge of pavements, parking spaces, fences and grading control points to provide sufficient information for construction staking to control the work.

4.6 Grading

4.6.1 General

- Minimum Design Slopes
 - 2% slopes in gravel paved areas.
 - 2% slopes in asphalt paved areas.
 - 0.5% slopes in concrete gutters or concrete paved areas in accordance with the City's Storm System Design Standards (adopted 8/13).
- Maximum Design Slopes
 - 4.5% in parking areas and streets.

- 10% for driving ramps.
 - 2:1 horizontal to vertical at pond slopes and unpaved cut and fill slopes provided a lower maximum slope is not dictated in the geotechnical report.
 - 4:1 horizontal to vertical for mowable grass slopes provided a lower maximum slope is not dictated in the geotechnical report.
- Temporary excavation slopes to conform to recommendations of the geotechnical engineer.
 - Clearing, grubbing, stripping, scarifying, and re-compacting shall conform to the recommendations of the geotechnical report for each design project.
 - Allow for six inches between the pavement finish grade and elevation of slabs or finish floor elevations.
 - Guardrails are required along open sided walking surfaces, equipment pads, stairways, ramps and landings that are located more than 30 inches above the adjacent grade. Guardrails shall be 3-rail with a kick plate and comply with the latest OSHA regulations.
 - Open water retaining structures shall have guardrails unless the perimeter wall is a minimum of 42 inches above grade or retaining structure has sloped sides.

4.7 Drainage

4.7.1 General

- Direct surface drainage away from pedestrian walkways, buildings and the top of cut and fill slopes.
- Plant storm drainage flow shall be directed to on-site detention facilities capable of being drained to the WPCP headworks. Storm drainage from developed areas of the plant shall not flow off site.

4.7.2 Conveyance Facility Design

- Closed conduits shall be designed to convey the 10-year design storm event as defined in the Santa Clara County Drainage Design Manual while maintaining 1-foot of freeboard between the hydraulic grade lines and drain inlet grates or gutter flow.
- The 100-year design storm event as defined in the Santa Clara County Drainage Design Manual shall be conveyed while maintaining 1-foot of freeboard between the hydraulic grade line and building finished floors.

4.7.3 Drainage Runoff Calculations

- Calculations shall be in accordance with the methods outlined in the most current edition of Santa Clara County Drainage Manual.
- Under this criterion, hydrologic design for watersheds less than 200 acres shall be based on the Rational Method or Unit Hydrograph Method. Table 2-2 in the Santa Clara County Drainage manual shall be utilized to determine the proper hydrologic design method. Standard inputs for the Rational Method, $Q=CiA$ is as follows:
 - Runoff coefficients, C, shall be as shown in Table 3-1 of the Santa Clara County Drainage Manual.
 - The land area, A, shall include all areas that will contribute to runoff.
 - Rainfall intensity, i, in inches per hour is determined using the IDF curves provided in Appendix B of the Santa Clara County Drainage Manual. Use a mean annual precipitation (MAP) of 14 inches, as determined by the location of the WPCP and Appendix A of the Santa Clara County Drainage Manual.

4.8 Yard Piping

4.8.1 Existing Utilities Plans

The Existing Utilities TM dated May 2014 was prepared in the WPCP master planning effort. These utility plans were established to be used as a preliminary base file for yard piping for future projects. These drawings were developed by consolidating utility information at the WPCP from record drawings, design drawings, WPCP staff input, and potholing records. These existing utilities plans are not record drawings and existing yard piping shall be field verified by project design engineers. The existing utilities plans will require updates with new yard piping information for projects completed after the completion date of the existing utilities TM and plans. These drawings do not substitute for field verification of existing utilities during design.

4.8.2 Drawing Requirements

- Provide profiles for all gravity lines 6 inches or greater in diameter and for pressure lines 18 inches or greater in diameter. Additionally, all piping in congested areas or where crossing clearances are critical will require piping profiles.
- All yard piping shall be identified with the size of pipe and intended use. A pipe schedule shall be provided in the project specifications designating pipe materials.
- The yard piping sheets shall be drawn at a 1 inch equals 20 feet maximum scale.

4.8.3 Pipe Materials Schedule

- The WPCP standard pipe system abbreviations and pipe materials are provided in a table format in Appendix B.

4.8.4 General Piping Requirements

- Gravity pipelines six inches and less in diameter shall have cleanouts to grade located at changes in direction and at no less than 300 feet intervals in straight section of pipe. Gravity pipelines greater than six inches in diameter shall have manholes located at changes in direction and slope, and at no less than 300 feet intervals of straight sections of pipe.
- Gravity pipelines shall have a minimum velocity of two feet per second.
- Pressure pipelines shall have restrained joints to avoid large thrust blocks. Smaller diameter pressure pipelines shall have pressure cleanouts at grade, spaced at appropriate intervals to allow access. Avoid high and low points in pressure pipelines. When they are unavoidable, air and vacuum relief valves shall be provided at high points and drains or blowoffs shall be provided at low points.
- Piping shall be laid out in corridors allowing sufficient space to fit future piping and to allow for performance of pipe maintenance. Refer to the WPCP Master Plan Site Layout TM for additional information on pipeline corridors.
- Perform piping calculations using a coefficient for both a new pipe and an old pipe. Piping capacity shall be calculated in conjunction with the plant hydraulic profile to ensure reasonable headloss allowances have been made in capacity determinations.
- All piping shall be pressure tested. Pressure testing shall be performed at designer recommended test pressure and test medium.
- Stormdrain and Sewer piping shall be inspected by closed circuit television after completion of trench backfill and finished grading in accordance with the requirements of section 500-1.1.5 of the Greenbook. Videotape shall be submitted on a CD or DVD disc.
- All piping greater than 2-inches shall have a plastic non-metallic backfill tape placed in trench. Backfill tape shall be labeled, "BURIED (NAME OF PIPE SYSTEM) PIPE BELOW".
- All non-metallic piping greater than 2-inches in diameter shall have underground tracer wire.
- Chemical piping shall be designed with secondary containment.
- Corrosion protection shall be provided as recommended in project specific geotechnical report and the Corrosion Design Standard. Additional information on corrosion is available in the WPCP Master Plan Site Investigation Analysis performed by HDR dated April 2014 and the WPCP Master Plan Geotechnical Report performed by Fugro.

4.8.5 Pipe Trenches

It should be noted that tunnels, utilidors, and direct bury of utilities were considered in the Site Layout TM. Refer to this TM for more information on this topic, including any proposed locations of tunnels or utilidors on the WPCP site. For pipe trenches the following guidelines shall be followed:

- Pipe trench material shall be designed to suit soil conditions and depth of cover.
- Pipe bedding material shall be selected as is suitable for pipe material.
- Compaction requirements of pipe trench shall comply with the project geotechnical report.

4.8.6 Piping at Structures

- Piping under structures shall be concrete encased when inside the zone of influence of the structure. The zone of influence extends beneath the structure and out from the bottom outside edge of the structure footing at a 45 degree angle from vertical.
- Immediately outside a structure or encasement, two flexible joints shall be provided to allow for the differential settlement minimum.
 - For pressure lines, the joints shall include mechanical restraint to prevent the joint from separating due to lateral or longitudinal thrust. The first flexible joint shall be two feet from the structure, manhole or encasement. The second flexible joint shall be approximately three feet from the first, but can be adjusted based on the diameter of the pipe and differential settlement criteria for the structure.
 - For gravity lines, the flexible joint can be a regular push-on joint. The first flexible joint shall be one foot from the structure, manhole or encasement. The second flexible joint shall be approximately four feet from the first, but can be adjusted based on the diameter of the pipe and differential settlement criteria for the structure.
 - Provide seismic restraint if recommended by the Geotechnical Engineer.
- Flexible pipe connection adaptors such as Kor-n-seal or A-lok shall be provided at manholes and catch basins.
- Use mechanical joints on all pressure lines.
- Gravity lines shall use push-on joints with an adaptor cast into the structure to receive pipes with rubber gaskets.

4.8.7 Sanitary Sewer Piping

- Sanitary sewer pipe material shall be resistant to hydrogen sulfide corrosion. Appropriate linings or coatings shall be applied to structures, such as manholes and wetwells, where hydrogen sulfide gasses will likely occur.

- In accordance with the City Sanitary Design Standards (adopted 8/13):
 - No horizontal or vertical curved piping permitted, unless otherwise approved by the City.
 - The minimum pipe size shall be 8-inches.
 - The minimum slope shall be 0.50% for 8-inch diameter piping and 0.40% for 10-inch and larger diameter piping.

4.8.8 Storm Drain

4.8.8.1 *Storm Drain Piping*

- The minimum allowable pipe diameter shall be 12 inches according to the Santa Clara County Drainage Manual.
- The minimum pipe slope shall be 0.5%. The City may approve flatter slopes where no other practical solution is available according to the City Storm Drain System Design Standards (adopted 8/13).
- A minimum of 1-foot vertical clearance and 5-feet horizontal clearance between storm drain piping and all other utilities shall be maintained to the furthest extent possible in accordance with the City's Storm Drain System Design Criteria.
- No storm drain pipe shall have less than 30 inches of cover below street subgrade per City Storm Drain System Design Guidelines (adopted 8/13).
- Manning's Equation shall be used to determine the capacity of all drainage pipelines. Values for the Manning's roughness coefficient are given in the Drainage Manual. In addition to normal friction losses, energy losses due to entrance/exit conditions and manhole/inlet structures shall be considered.

4.8.8.2 *Storm Drain Structures*

- Manholes shall be located at the following points and only where it is not practical to use a drain inlet:
 - Changes in pipe size
 - Changes in pipe slope
 - Intersections of pipe lines
 - and angle points in horizontal alignment
- The distance between manholes or drain inlets shall not exceed 400 feet.
- Drain inlets shall be located in the curb and gutter at the following locations:
 - All low points

- Intermediate points such that the length of storm water flow in the gutter does not exceed 400 feet
- Drain inlets shall not be located within a curb return or within the limits of accessible ramps.
- Drain inlets shall incorporate weep holes to allow any accumulated water to drain from beneath the pavement.
- Storm Drain manholes and drain inlets shall conform to City Standard details.

4.8.9 Water Piping

- Design water lines as a loop when possible to minimize dead ends, increase reliability and reduce the size of pipe needed.
- Provide isolation valves on all tees (one on each downstream pipe).
- Per City Design Guidelines Section X for Water Systems, tracer wire shall be used on all non-metallic water service piping.
 - 10-gauge, insulated tracing wire shall be applied to mains and service lines. Tracer wire shall be blue and suitable for direct burial and wet conditions.
 - Tracer wire shall be continuous and splices shall be made with two copper or brass split bolt fasteners without encapsulation in epoxy. Continuity testing may be required by the City Engineer.
 - Wire shall be continuous between main line valve boxes, tees, crosses and fire hydrants.
 - Tracing wire through valve boxes shall be placed outside of riser but inside box.
- Maintain a minimum separation for 1-foot between potable water and all sewer and process lines to the furthest extent possible within the WPCP site.
- There are three water systems at the WPCP:
 - Potable water (PW) is for human use, including sinks, drinking fountains, bathrooms, showers and emergency eyewash showers. The PW system is supplied from the City of Sunnyvale water main located in Carl Road. All potable water pipe greater than 2-inches shall have a blue, plastic non-metallic backfill tape marked “BURIED POTABLE WATER PIPE BELOW” placed in trench. Tape coverage shall equal the full width of the pipe and span the full length of the pipe.
 - Nonpotable, Utility (UW) is recycled water from the treatment plant chlorinated effluent (withdrawn prior to Dechlorination). UW can also be supplied from a reclaimed water main in Carl Road that is connected to the existing Chlorine Contact Basins. UW is used for process water, hose bibs and irrigation. Piping for UW service shall have purple pigment. All nonpotable water pipe greater than 2-

inches shall have a purple, plastic non-metallic backfill tape marked "BURIED NONPOTABLE WATER PIPE BELOW" placed in trench. Tape coverage shall equal the full width of the pipe and span the full length of the pipe.

- Fire Water (FW) is supplied from the City of Sunnyvale Potable Water Main in Carl Road. All fire water pipe greater than 2-inches shall have a blue, plastic non-metallic backfill tape marked "BURIED FIRE WATER PIPE BELOW" placed in trench. Tape coverage shall equal the full width of the pipe and span the full length of the pipe.
- Size water mains using the Hazen-Williams or Darcy-Weisbach formula.
- Design flow for UW system shall be for maximum day demand.
- Design flow for PW water systems shall be for maximum day demand.
- Design flow for the FW system shall be according to the Sunnyvale Department of Public Safety Fire Service Bureau Requirements.
- Maximum velocity in water mains shall be ten feet per second during maximum day and fire flow conditions.

4.9 Fire Protection

- Provide fire hydrants conforming to City of Sunnyvale Standard Details 2B and 2B-2 and City of Sunnyvale Standard Specification sections 207-9.2.1.1 and 208-7.2.7.
- Fire hydrants shall be installed according the AWWA Manual M-17 for the installation of Fire Hydrants.
- Fire flows shall be according to the Sunnyvale Department of Public Safety Fire Service Bureau Requirements.

4.10 Security Fencing and Gates

- Fencing shall be six feet high chain link fence with 3-strand barb wire around the WPCP perimeter.
- During construction, the Contractor shall provide temporary security fencing to maintain plant security. The Contractor shall also provide temporary construction fencing to separate the construction area from personnel operating the existing plant.
- Access gates shall be set back from the property line a sufficient distance to allow backup of arriving traffic without blocking the public street.
- Access gates shall be sliding type unless impractical at installation location.

- Refer to the Site Safety and Security TM for additional security fencing and gate requirements.

4.11 Noise Restrictions at Property Lines

City of Sunnyvale municipal code section 19.42.030 regarding Noise or Sound Level provides the following noise restrictions any property lines:

- Maximum Operational Noise at any point on property lines: 75 dBA
- Maximum Operational Noise at any point on property lines at nighttime: 50 dBA
- Maximum Operational Noise at any point on property lines adjacent to residentially zoned property: 60 dBA
- Maximum Operational Noise at any point on property lines at nighttime hours and determined that the noise involves a steady audible tone such as a whine, screech or hum, or is staccato or intermittent noise (e.g., hammering) or includes music or speech: 45 dBA

Designer should confirm municipal code section requirements prior to designing to the listed noise levels in this section.

4.12 Structure Height Restrictions at Property Lines

According to the FAR Part 77 Surfaces Figure 6 the height elevation above mean sea level for any structure on the WPCP site is 182-feet.

4.13 Demolition

4.13.1 Pipeline Demolition

- Demolition extent requirements at the WPCP shall be coordinated with the City and the City of Sunnyvale's WPCP Master Plan for future site use. Pipelines shall be completely removed. If complete removal is not practical, with City approval, the following sub bullets outline the minimum requirements:
 - Abandoned pipelines smaller than 12 inches to be left in place and shall be plugged at each end with at least 12 inches of concrete.
 - Abandoned pipelines 12 inches and greater shall be plugged at each end with 12 inches of concrete, broken into every 50 feet and filled completely with controlled low strength material (CLSM).

4.13.2 Building Demolition

- Demolition extent requirements at the WPCP shall be coordinated with the City and the City of Sunnyvale's WPCP Master Plan Site Layout TM for future site use. A hazardous

materials survey shall be completed for asbestos and lead, at a minimum, prior to demolition of any structure. The City prefers complete removal of structures. However, if complete removal would be detrimental to existing or new construction, with City approval, the following sub bullets outline the minimum requirements. Building demolition will be evaluated on a case by case basis.

- Demolish and remove facilities to five feet below finished grade.
 - Demolish and remove all piping, equipment and items other than structural concrete from remaining below grade structure.
 - Cut holes in the base slabs so that the water table can move freely through the remainder of the structure left below grade.
 - Compact granular backfill inside and over the remaining structure to finished grade. Utilize lightweight granular backfill as required to prevent additional structure settlement.
- Demolition plan shall show the following:
 - Allowable method of demolition.
 - Limits of demolition.
 - Location of salvageable materials and equipment.
 - Condition of structure, site and remaining equipment after demolition is complete.

4.13.3 Salvage

- Plans and specifications shall clearly show:
 - Ownership of salvageable materials.
 - Delivery and storage of salvageable material and equipment.
 - A complete list of salvageable material and equipment scheduled for reuse in the project or retention by the City.
- The City may opt to use its own staff for salvaging material and equipment prior to the Contractor's demolition or the City may require the Contractor to do this work.

4.14 Erosion and Sediment Control

- The Contractor shall prepare a plan showing temporary erosion control facilities during construction as a part of preparing the Storm Water Pollution Prevention Plan required by the project specifications.
- Coordinate with the Landscape Architect to show permanent erosion and sediment control planting and devices on the landscape plans.

5.0 REFERENCES

The following WPCP documents may be useful in the civil design of WPCP facilities. A complete list of 2014 WPCP Master Plan documents and record drawings can be requested from the City.

1. Existing WPCP design and record drawings from 1955 to present day

WPCP record drawings for over 90 projects from 1955 to present day are available as request from the City. These projects range from the initial WPCP construction and significant plant upgrade projects to minor repair and rehabilitation projects.

2. Existing Utilities TM dated May 2014

The Existing Utilities plans consolidate site utility information from the City WPCP from existing record drawings, existing design drawings, potholing records and plant operations staff knowledge. The intended use of the utilities plans is for City to provide to design engineers and contractors of future projects. This Existing Utilities TM summarizes the work that went into the creating of the utility plans and the intended use of the mapping. Note that the existing utilities plans are not record drawings.

3. WPCP Master Plan Site Layout TM

The WPCP Master Plan Site Layout TM outlines the locations of planned facilities at the WPCP site. Additional, the Site Layout TM includes constructability and phasing, site access, conceptual utilities, sea level rise, landscaping, safety & security, and lighting recommendations and finding.

4. WPCP Survey Information from July and August 2013

Base maps for the WPCP utilize aerial topographic survey of the WPCP that was performed by Mark Thomas & Company in July 2013. Additional supplemental ground survey information was gathered in September 2013. Supplemental ground survey included dipping drain inlets and manholes for piping invert elevations, as well as, identification of vaults, manholes or piping types as possible from visual confirmation. The established survey was performed on California Coordinates System Zone 3, NAD83 and NAVD 1988 plus 100-feet to avoid negative elevations.

5. WPCP Master Plan Site Investigation Analysis TM

This TM was prepared to document soil and groundwater sampling conducted at the WPCP. This sampling was conducted to evaluate chemical concentrations in soil and groundwater to identify potential hazards to worker health from exposure to chemicals in soil.

6. WPCP Master Plan Hydrology Report TM

The purpose of the Hydrology TM is to summarize the level of potential inundation in and around the WPCP under current conditions based upon recent studies performed in the San Francisco South Bay Area as well as to address on-going design projects that will impact the level of protection of the WPCP. The TM also provides recommendations for how to address the potential inundation, the details of which will be addressed in a separate site TM.

7. WPCP Master Plan Safety & Security TM

The WPCP Master Plan Safety and Security TM outline Safety and Security measures for the WPCP site.

8. WPCP Master Plan Geotechnical Report

Fugro completed a geotechnical report as a part of the WPCP Master Plan project. This report includes a compilation and review available geotechnical and geologic data from previous investigations performed in the site vicinity, field investigation (11 borings and 6 CPTs), geologic hazard evaluation of the plant, expansion area and Ponds 1 and 2, and a detailed evaluation of settlement and development of earthwork and foundation parameters for the headworks and primary treatment areas. Additionally, the report includes results of the current and previous field investigations, laboratory-testing program, discussion of geologic and seismic hazards, recommendations for foundation design and other associated improvements within the headworks and primary treatment areas and general discussion and recommendation for the proposed improvements for areas outside of the headworks and primary treatment areas, including the oxidation ponds areas.

9. Other Design Standards

Design standard documents have also been prepared for mechanical, corrosion, electrical, I&C, odor control, architectural, and landscaping. These documents shall be used in conjunction with the civil design standards by future designers for projects at the WPCP.

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APPENDIX A – HIGHWAY DESIGN MANUAL FIGURES

Highway Design Manual Figure 404.5D 50-Foot Radius

Highway Design Manual Figure 404.5E 60-Foot Radius

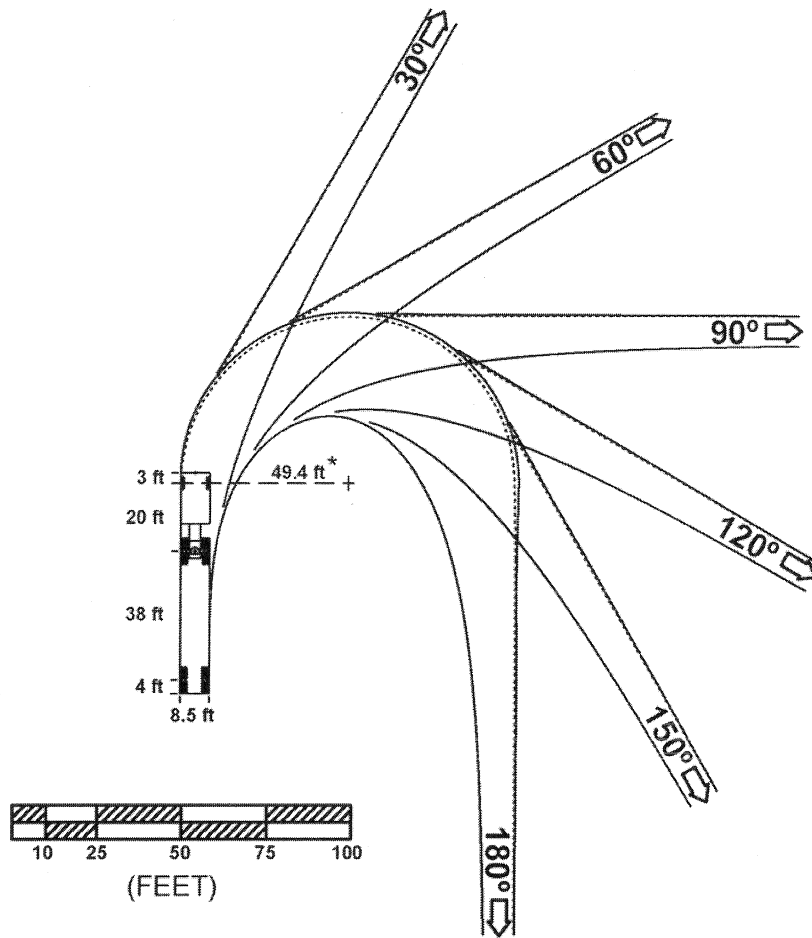
Highway Design Manual Figure 404.5F 40-Foot Bus Design Vehicle

June 2014– FINAL

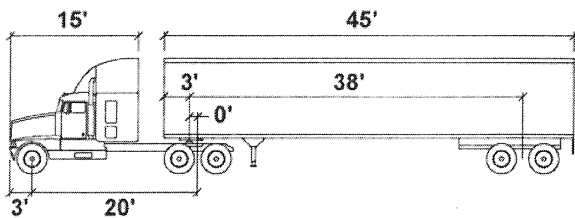
pw://Carollo/Documents/Client/CA/Sunnyvale/9265A00/Deliverables/DS_Civil 2004-06-05.doc

Figure 404.5D

California Legal Design Vehicle
50-Foot Radius



* Radius to outside wheel at beginning of curve.



LEGEND

—————	Swept Width (Body)
.....	Tracking Width (Tires)

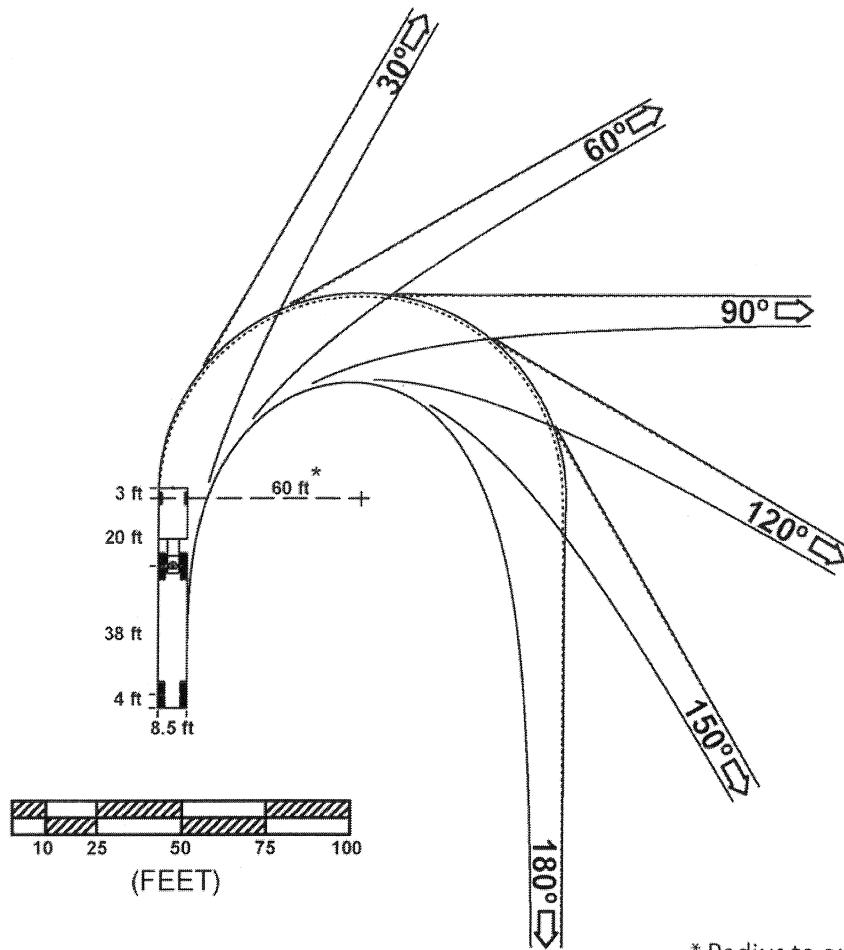
CA LEGAL - 65-Foot

Tractor Width	: 8.5'	Lock to Lock Time	: 6 seconds
Trailer Width	: 8.5'	Steering Lock Angle	: 26.3 degrees
Tractor Track	: 8.5'	Articulating Angle	: 70 degrees
Trailer Track	: 8.5'		

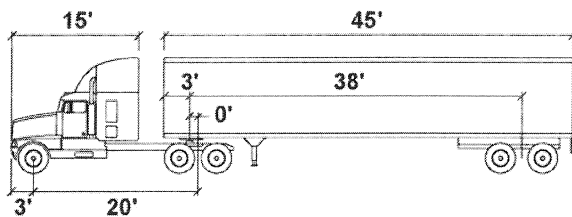
Note: For definitions, see Indexes 404.1 and 404.5.

Figure 404.5E

California Legal Design Vehicle
60-Foot Radius



* Radius to outside wheel at beginning of curve.



LEGEND

	Swept Width (Body)
	Tracking Width (Tires)

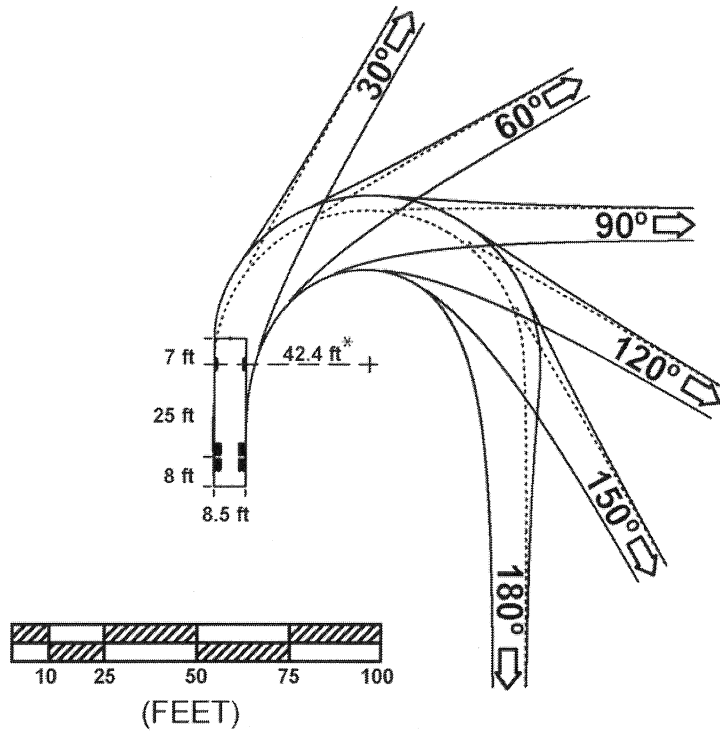
CA LEGAL - 65-Foot

Tractor Width	: 8.5'	Lock to Lock Time	: 6 seconds
Trailer Width	: 8.5'	Steering Lock Angle	: 26.3 degrees
Tractor Track	: 8.5'	Articulating Angle	: 70 degrees
Trailer Track	: 8.5'		

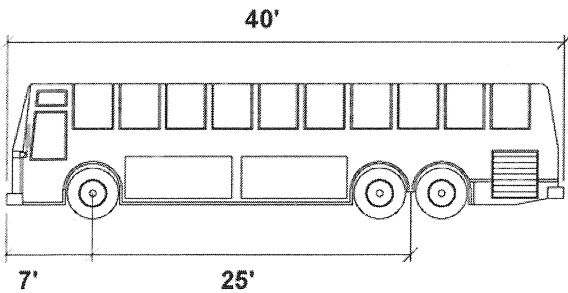
Note: For definitions, see Indexes 404.1 and 404.5.

Figure 404.5F

40-Foot Bus Design Vehicle



* Radius to outside wheel at beginning of curve.



LEGEND

	Swept Width (Body)
	Tracking Width (Tires)

40-Foot BUS

- Width : 8.5'
- Track : 8.5'
- Lock to Lock Time : 6 seconds
- Steering Lock Angle: 41.0 degrees

Note: For definitions, see Indexes 404.1 and 404.5.

APPENDIX B – PIPING MATERIALS SCHEDULE

June 2014– FINAL

pw://Carollo/Documents/Client/CA/Sunnyvale/9265A00/Deliverables/DS_Civil 2004-06-05.doc

**WPCP Approved Pipe Materials Table
Civil Design Standards
City of Sunnyvale**

Pipe System	Pipe Abbreviation	Pipe Size							
		< 3"		3" – 12"		14" – 36"		> 36"	
		Buried	Exposed	Buried	Exposed	Buried	Exposed	Buried	Exposed
Aluminum Sulphate (Alum)	AL	PVC	PVC, CPVC	PVC	PVC, CPVC	--	--	--	--
Applied Water (Filter Influent)	AP	--	--	DIP, RCP	DIP, RCP	DIP, RCP	DIP, RCP	DIP, Steel, RCP	DIP, Steel, RCP
Backwash Air	BA	Steel	Steel	Steel	Steel	--	--	--	--
Chlorine Gas	CL	Steel	Steel	Steel	Steel	--	--	--	--
Chlorine Gas under Vacuum	CLV	PVC	PVC	PVC	PVC	--	--	--	--
Circulated Sludge	CS	--	--	Steel, DIP	Steel, DIP	Steel, DIP	Steel, DIP	--	--
Digester Gas	DG	--	--	Steel, DIP	Steel, DIP	Steel, DIP	Steel, DIP	--	--
Digested Sludge	DS	--	--	Steel, DIP	Steel, DIP	Steel, DIP	Steel, DIP	--	--
Equipment Drain	ED	--	--	HDPE, PVC, DIP	HDPE, PVC, DIP	HDPE, PVC, DIP	HDPE, PVC, DIP	HDPE, PVC	HDPE, PVC
Ferric Chloride	FC	PVC, CPVC	CPVC	PVC, CPVC	CPVC	--	--	--	--
Filtered Water	FW	PVC, DIP	Copper, PVC, DIP	PVC, DIP	PVC, DIP	--	--	--	--
Final Effluent	FE	--	--	--	--	DIP, RCP, Steel	DIP, RCP, Steel	DIP, RCP, Steel	DIP, RCP, Steel
Fixed Growth Reactor Effluent	FGRE	--	--	--	--	DIP, RCP, Steel	DIP, RCP, Steel	DIP, RCP, Steel	DIP, RCP, Steel
Fire Water	FW	Steel	Steel, Copper	Steel, DIP, PVC	Steel, DIP	Steel, DIP, PVC	Steel, DIP	--	--
Foundation Drain	FOD	--	--	PE	--	PE	--	--	--
Grit	GR	--	--	DIP	DIP	--	--	--	--
Hot Water Supply and return	HWS/HWR	Steel	Steel	Steel	Steel	--	--	--	--
Instrument Air	IA	--	SST	--	--	--	--	--	--
Liquid Gas Flare	LGF	Steel, PE	Steel, PE	Steel, PE	Steel, PE	--	--	--	--

**WPCP Approved Pipe Materials Table
Civil Design Standards
City of Sunnyvale**

Pipe System	Pipe Abbreviation	Pipe Size							
		< 3"		3" – 12"		14" – 36"		> 36"	
		Buried	Exposed	Buried	Exposed	Buried	Exposed	Buried	Exposed
Low Pressure Air	LPA	Steel	SST	Steel	SST	Steel	SST	Steel	SST
Mixed Gas	MG	Steel, PE	Steel, PE	Steel, PE	Steel, PE	--	--	--	--
Natural Gas	NG	Steel, PE	Steel, PE	Steel, PE	Steel, PE	--	--	--	--
Overflow, Outfall	OF	--	--	DIP, RCP	DIP, RCP	DIP, RCP	DIP, RCP	DIP, RCP	DIP, RCP
Polymer	POLY	PVC	PVC	PVC	PVC	--	--	--	--
Potable Water ²	PW	PVC, DIP	Copper, PVC, DIP	PVC, DIP	PVC, DIP	PVC, DIP	--	--	--
Pumped Drain	PD	Steel	Steel	DIP, Steel	DIP, Steel	DIP, Steel	DIP, Steel	--	--
Primary Effluent	PE	--	--	DIP, RCP	DIP, RCP	DIP, RCP	DIP, RCP	DIP, Steel, RCP	DIP, Steel, RCP
Primary Scum	PSC	--	--	Steel, DIP	Steel, DIP	Steel, DIP	Steel, DIP	--	--
Return Activated Sludge	RAS	--	--	Steel, DIP	Steel, DIP	Steel, DIP	Steel, DIP	--	--
Raw Sludge	RS	--	--	Steel, DIP	Steel, DIP	Steel, DIP	Steel, DIP	--	--
Service Air	SA	Steel	Steel	Steel	Steel	--	--	--	--
Sanitary Drain ²	SD	PVC	Copper Iron, PVC	HDPE, PVC	--	HDPE, PVC	--	HDPE, PVC	--
Sanitary Forcemain	SFM	--	DIP	DIP	DIP	DIP	DIP	--	--
Secondary Effluent	SE	--	DIP, RCP	DIP, RCP	DIP, RCP	DIP, RCP	DIP, RCP	DIP, Steel, RCP	DIP, Steel, RCP
Secondary Scum	SSC	--	--	Steel, DIP	Steel, DIP	Steel, DIP	Steel, DIP	--	--
Sodium Hypochlorite	SH	PVC	PVC, CPVC	PVC	PVC, CPVC	--	--	--	--
Supernatant	SN	--	DIP	DIP	DIP	DIP	DIP	--	--
Sanitary Sewer ²	SS	HDPE, PVC	HDPE, PVC	HDPE, PVC	HDPE, PVC	HDPE, PVC	HDPE, PVC	HDPE, PVC	HDPE, PVC
Storm Drain ²	STD	--	--	--	--	RCP, PVC	--	RCP, PVC	--
Tank Drain	TD	--	--	--	--	HDPE,	--	HDPE,	--

**WPCP Approved Pipe Materials Table
Civil Design Standards
City of Sunnyvale**

Pipe System	Pipe Abbreviation	Pipe Size							
		< 3"		3" – 12"		14" – 36"		> 36"	
		Buried	Exposed	Buried	Exposed	Buried	Exposed	Buried	Exposed
Utility Water ²	UW	PVC	Copper, PVC	PVC, DIP	PVC, DIP	PVC	--	PVC	--
Vent	V	PVC	Cast Iron, PVC	PVC	--	HDPE, PVC	--	HDPE, PVC	--
Waste Activated Sludge	WAS	--	--	Steel, DIP	Steel, DIP	Steel, DIP	Steel, DIP	--	--
Waste Water	WW	--	--	DIP, RCP	DIP, RCP	DIP, RCP	DIP, RCP	DIP, RCP	DIP, RCP

1. “—“ denotes a material application that is atypical and does not fit under the standard pipe materials table. Pipe materials for these applications to be determined during detailed design.
2. Pipe materials from City of Sunnyvale Standards
3. The design engineer shall review the information included and confirm the pipe materials listed are appropriate for individual projects. If the design engineer disagrees with the information contained within the table or wishes to propose an alternative, the City should be notified and the design engineer’s recommendation discussed prior to implementation.