

APPENDIX G

SANITARY SEWER MASTER PLAN

CREEKVIEW SPECIFIC PLAN
PLACER COUNTY, CALIFORNIA

SANITARY SEWER MASTER PLAN
FINAL REPORT

Prepared for:

City of Roseville

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Attachment 2 – Technical Memorandum No. 2b – Dry Weather Flow Projections for Ultimate Service Area (w/ UGAs). Appendix D of the South Placer Regional Wastewater and Recycled Water Systems Evaluation prepared by: RMC Water and Environment

Attachment 3 – Cumulative Analysis of UGA Impacts on Water Quality and Aquatic Resources in Pleasant Grove Creek, Roseville, California
Technical Memorandum prepared by: Merritt Smith Consulting

I. INTRODUCTION

LOCATION

The Creekview Specific Plan Area consists of approximately 501 acres of land located in the southwestern corner of Placer County adjacent to the western boundary of the City of Roseville. The Specific Plan Area is generally bound by the City of Roseville city limit line / West Roseville Specific Plan Area to the east, the City of Roseville city limit line / West Roseville Specific Plan Area to the south, the City of Roseville Panhandle Property to the west, and the proposed Brookfield Specific Plan Area to the north. The Creekview Specific Plan (CVSP) area is currently situated in Placer County but is anticipated to be annexed into the City of Roseville.

The Specific Plan Area is identified as an Urban Growth Area (UGA) in the South Placer Regional Wastewater and Recycled Water Systems Evaluation prepared by RMC Water and Environment (RMC) for the South Placer Wastewater Authority (SPWA), an entity comprised of the City of Roseville, Placer County, and the South Placer Municipal Utility District (SPMUD). As defined by the Systems Evaluation the CVSP will be tributary to the Pleasant Grove Wastewater Treatment Plant (PGWWTP). Although the Specific Plan Area is within the Ultimate SPWA Service Area it is outside of the SPWA 2005 Service Area Boundary and approval will be required to join the Service Area and discharge to the PGWWTP.

Please refer to Figure 1, which depicts the location of the Plan Area as well as the 2005 Service Area Boundary.

PURPOSE

The purpose of this master plan study is to provide preliminary design and analysis for the sanitary sewer infrastructure to serve the Creekview Specific Plan Area. The design and analysis presented in this report will also be used to support the environmental review process and utility demand planning by the City of Roseville. Background information including wastewater generation rates, peaking factors, proposed plan area land uses, and tributary areas will be used to plan the location and size of proposed sanitary sewer facilities for the CVSP. Existing topography will be utilized to determine whether the Specific Plan Area can deliver wastewater flows to the Pleasant Grove Wastewater Treatment Plant via gravity transmission pipes or whether it will be necessary to utilize a lift station and force main to carry wastewater to the gravity sewer system for delivery to the treatment plant.

PHASING

The Creekview Specific Plan is designed to allow the sewer backbone infrastructure, defined as the pipe network within this report, to be installed in different construction phases. Phases may be developed in any sequence provided public safety, health, and welfare issues are addressed and will be subject to the approval of the City of Roseville. Parcel Specific Improvements will be determined with Small Lot Tentative Maps or subsequent entitlements.

II. PROJECT DESCRIPTION

PLAN AREA DESCRIPTION

The Creekview Specific Plan Area currently consists of sparsely developed land characterized by grasslands and riparian areas adjacent to Pleasant Grove Creek which passes diagonally through the CVSP, entering the Plan Area at its southeast corner and exiting near the middle of the westerly boundary. An unnamed branch of Pleasant Grove Creek also meanders over the northerly portion of the Plan Area. The topography within the Plan Area varies from flat to gently rolling hills with ground elevations ranging from 75 to 100 feet, with the lower elevations occurring adjacent to Pleasant Grove Creek and its unnamed branch.

The Specific Plan Area is proposed to be divided into multiple parcels with a variety of land uses including residential, commercial mixed use, open space, schools, and parks. The proposed project land use plan is depicted on Figure 2. A summary of the proposed land use acreages and residential unit counts that generate wastewater flows is shown on Table 2.

One major wastewater shed will encompass the entire Creekview Specific Plan Area. Based on site topography the major shed is divided into two primary wastewater subsheds, the first lying north of Pleasant Grove Creek, the northern subshed, and the second lying south of Pleasant Grove Creek, the southern subshed. Each primary subshed is further divided into secondary wastewater sheds. Each primary subshed can be served entirely by a gravity sanitary sewer pipe system, with each pipe system flowing to a permanent sewer lift station to be constructed on the south side of Pleasant Grove Creek, adjacent to the western edge of Westbrook Boulevard. A force main will transport wastewater flows from the lift station to a gravity pipe system which will carry the flows to the Pleasant Grove Wastewater Treatment Plant (PGWWTP). The CVSP primary wastewater sheds and subsheds are shown on Figure 3.

A portion of the Specific Plan Area has been designated with an Urban Reserve land use. The Urban Reserve land use carries no development rights. Future entitlement requests and environmental review will be required prior to development of land with this designation. However, in order to adequately size sanitary sewer infrastructure within the Plan Area that serves areas with and without the urban reserve designation, future land use designations have been assumed for the Urban Reserve parcel. A summary of these assumed future land use acreages and residential unit counts is shown on Table 5. Table 7 summarizes the combined CVSP and Urban Reserve land use acreages and residential unit counts.

An area identified for future development, known as the Brookfield Urban Growth Area, lies adjacent to the northern boundary of the Creekview Specific Plan Area. It is anticipated that future wastewater flows from Brookfield will be delivered to the sanitary sewer system constructed for the CVSP. In order to size the sewer infrastructure that will carry the CVSP, Urban Reserve, and Brookfield wastewater flows, future land uses have been assumed for the Brookfield UGA. A summary of the assumed land use acreages and residential unit counts that generate wastewater flows within Brookfield is shown on Table 10.

Table 12 shows a summary of the “CVSP Base + Urban Reserve + Brookfield” land use acreages and unit counts. The summary combines the “CVSP Base” land use acreages and residential unit counts with the land use acreages and residential unit counts assumed for future development of the Urban Reserve parcel and Brookfield UGA.

Wastewater flows for three development scenarios will be analyzed in this master plan study. In the study the scenario for the Plan Area without development of the Urban Reserve parcel or Brookfield UGA will be referred to as the “CVSP Base” condition. The development scenario representing the cumulative development of the Plan Area and the Urban Reserve Parcel, when both the “CVSP Base” and future land uses on the Urban Reserve parcel are considered, will be referred to as the “CVSP Base + Urban Reserve” condition.

The third scenario, representing the cumulative development of the Plan Area, the Urban Reserve Parcel, and the Brookfield UGA, will be referred to as the “CVSP Base + Urban Reserve + Brookfield” condition. The sanitary sewer infrastructure within the Creekview Specific Plan will be sized to carry the “CVSP Base + Urban Reserve + Brookfield” wastewater flows.

TREATMENT PLANT DESCRIPTION

Wastewater flows from the Creekview Specific Plan will be conveyed by new onsite and offsite transmission facilities, as well as offsite facilities installed as part of the Westpark Community Funding District Phase 4, to the Pleasant Grove Wastewater Treatment Plant. The PGWWTP is owned and operated by the City of Roseville for the benefit of the South Placer Wastewater Authority. The locations of the PGWWTP and offsite transmission facilities are shown on Figure 4, which is Figure 9-2 from the West Roseville Specific Plan.

The City of Roseville uses average dry weather flow volumes when analyzing wastewater treatment plant capacity. According to the South Placer Regional Wastewater and Recycled Water Systems Evaluation prepared by RMC, the current average dry weather flow capacity of the PGWWTP is 12.0 MGD. The measured dry weather flow in 2007 was 7.1 MGD. The ultimate buildout dry weather flow projection for the PGWWTP is 24 MGD.

In Technical Memorandum No. 2b from Appendix D of the South Placer Regional Wastewater and Recycled Water Systems Evaluation, included as Attachment 2 in this master plan, an estimated ADWF of 1.06 MGD would be tributary to the PGWWTP from buildout of the Creekview UGA and Panhandle property. The portion of the flow attributable to the Creekview UGA, which represents a development scenario similar to the “CVSP Base + Urban Reserve” condition considered in this study, is 0.503 MGD. The flow projected in the Technical Memorandum exceeds the 0.433 MGD calculated for the “CVSP Base + Urban Reserve” condition in this master plan. The minor difference in

the flow calculations can be attributed primarily to minor differences in the number of residential units assumed in each projection, with the Technical Memorandum assuming a slightly greater number of high density residential units.

The balance of the estimated 1.06 MGD calculated for the Creekview UGA and Panhandle property, approximately 0.557 MGD, is attributable to the City of Roseville's Panhandle property. Because land uses other than open space and agricultural are no longer proposed for the Panhandle property this master plan assumes that no future wastewater flows will be generated from the Panhandle property.

In Technical Memorandum No. 2b, an estimated ADWF of 0.73 MGD would be tributary to the PGWWTP from buildout of the Brookfield UGA. This flow exceeds the 0.621 MGD dry weather flow calculated for the Brookfield UGA in this master plan. The difference in the flow calculations is primarily due to the difference in residential units counts used in each study. The cumulative number of 2,785 low, medium, and high density residential units used in this study compares to 4,174 residential units used in the RMC Technical Memorandum.

A comparison between the average dry weather flows calculated in this master plan and the flows calculated in Technical Memorandum No. 2b is shown in Table 16. Although the average dry weather flow generated by the CVSP as calculated in this report is slightly less than the flow considered in the Systems Evaluation the conclusions and projections discussed in the Evaluation remain valid. The Systems Evaluation and related Technical Memorandum updates should be reviewed for information related to any required PGWWTP expansions necessary to provide service to the CVSP.

III. SEWER MASTER PLAN METHODOLOGY

ANALYSIS PROCEDURE

The following procedure was used for the preliminary design and analysis of the sanitary sewer system proposed in the CVSP Sewer Master Plan:

- The primary wastewater subsheds within the plan area were delineated.
- A sewer trunk system alignment was defined to collect wastewater flows within the Creekview Specific Plan Area. The gravity sewer system was placed within the proposed road system shown on the Specific Plan Land Use Map wherever feasible.
- Node points were inserted into the sewer system alignment to define flow collection points within the sewer system.
- The primary wastewater subsheds were subdivided into secondary sheds to determine tributary areas into the trunk system node points.
- Proposed land use acreages and residential unit counts within each secondary wastewater shed were tabulated.
- Wastewater flows, including average dry weather flows, factored flows, and peak wet weather flows were calculated at each node point using the design methodology defined in Section 9 – Sanitary Sewer Design, of the City of Roseville Design and Construction Standards dated March 2007.
- Average dry weather flows were calculated using the Average Dry Weather Unit Flow Factors for the land use types within each secondary wastewater shed.
- Factored flows were calculated by multiplying average dry weather flows by a factor of safety of 2.0.
- Peak wet weather flows within the trunk system were calculated by summing factored flows at the nodes along the trunk system alignment and applying appropriate peaking factors from the Peaking Factor Curve shown in Figure SS-1 of Section 9 of the Design Standards.
- Trunk system pipe sizes were initially sized based on peak wet weather flows and pipe capacities based on minimum pipe slopes.

- Trunk sewer pipes initially calculated to be 18” or larger were reexamined using hydraulic modeling and resized as appropriate. The hydraulic modeling results can be found in Attachment 1 – Trunk Sewer Model for Creekview prepared by RMC.
- Preliminary pipe inverts were calculated and compared to existing ground grades and conceptual finished grades to check the ability to serve the secondary sheds with gravity sewer pipe systems.

PIPELINE DESIGN

The proposed pipe size diameters were selected using the following pipe criteria:

- A Manning’s “n” value of 0.013 was used for all pipe-sizing calculations.
- Pipes 10 inches and less in diameter and pipes with lateral connections are designed to have a maximum depth of flow 70% of the pipe diameter.
- Pipes 12 inches and larger with no lateral connections are designed to flow full.
- Pipe sizes have been selected assuming pipes will be installed at minimum slopes. The minimum slope for a pipe is a slope that yields a minimum 2 feet per second velocity when flowing at design capacity.
- Pipes proposed to be placed deeper than 20 feet shall conform to the pipe manufacturer’s construction recommendations and comply with the City of Roseville improvement standards.

IV. WASTEWATER FLOWS

AVERAGE DRY WEATHER FLOWS

Average Dry Weather Flows (ADWF) within the Creekview Specific Plan Area have been calculated using the Average Dry Weather Unit Flow Factors shown in Table 1 and the residential unit counts and non-residential acreages for the Plan Area parcels within the wastewater sheds.

The Specific Plan Area, as currently proposed under the “CVSP Base” condition, will generate an ADWF of 0.370 MGD. A summary of the average dry weather flow from the proposed “CVSP Base” is shown in Table 3. Table 4 identifies the ADWF at each node in the wastewater shed.

On oversized Exhibit 1 the average dry weather flows for the “CVSP Base” condition at each node are depicted graphically on an exhibit showing the proposed sanitary sewer pipe layout within the Plan Area. The proposed land use parcels, the primary subsheds, and the secondary wastewater shed boundaries are also delineated on the exhibit.

Additional dry weather flows will be generated when the Plan Area parcel currently designated with an Urban Reserve land use is developed in the future. An average dry weather flow of 0.063 MGD will be generated by development of the Urban Reserve parcel. A summary of the flows from the parcel is shown on Table 6.

The cumulative average dry weather flow for the “CVSP Base + Urban Reserve” condition is calculated to be 0.433 MGD. A summary of these cumulative flows is shown on Table 8. Table 9 identifies the ADWF at each node in the wastewater shed for the “CVSP Base + Urban Reserve” condition. On oversized Exhibit 2 the “CVSP Base + Urban Reserve” average dry weather flows at each node are depicted graphically on an exhibit showing the proposed sanitary sewer pipe layout within the Plan Area.

Future development of the Brookfield UGA will also generate additional wastewater Flows. The future average dry weather flow from the Brookfield UGA is estimated to be 0.621 MGD and is summarized by assumed land use in Table 11.

The cumulative average dry weather flow for the “CVSP Base + Urban Reserve + Brookfield” condition is calculated to be 1.054 MGD. A summary of these cumulative flows is shown on Table 13. Table 14 identifies the ADWF at each node in the wastewater shed for the “CVSP Base + Urban Reserve + Brookfield” condition. On oversized Exhibit 3 the “CVSP Base + Urban Reserve + Brookfield” average dry weather flows at each node are depicted graphically on an exhibit showing the proposed sanitary sewer pipe layout within the Plan Area. A summary of the average dry weather flow from each development condition is shown on Table 15.

FACTORED FLOWS

Factored wastewater flows are used in the design process to calculate peak wet weather flows. Factored flows are determined by multiplying average dry weather flows by a factor of 2.0 as stated in the City of Roseville Design and Construction Standards. The factored flows are then multiplied by peaking factors to obtain peak wet weather flows.

PEAK WET WEATHER FLOWS

Peak wet weather flows have been calculated to size trunk sewer pipelines in the Creekview Specific Plan Area sanitary sewer system. Peak flows have been calculated for the “CVSP Base,” “CVSP Base + Urban Reserve,” and “CVSP Base + Urban Reserve + Brookfield” conditions.

The “CVSP Base” peak wet weather flows for each node in the wastewater shed are shown on Table 4. The “CVSP Base + Urban Reserve” peak wet weather flows for each node in wastewater shed are shown on Table 9. The “CVSP Base + Urban Reserve + Brookfield” peak wet weather flows for each node are shown on Table 14.

On oversized Exhibits 1, 2, and 3 the peak wet weather flows at each node of the sanitary sewer pipe system serving the Plan Area are depicted graphically for the “CVSP Base,” “CVSP Base + Urban Reserve,” and “CVSP Base + Urban Reserve + Brookfield” conditions respectively.

For pipes up to 15” in diameter the peak wet weather flows have been determined using average dry weather flows, factored flows, and peaking factors as outlined in the City of Roseville Design and Construction Standards. For pipes with diameters 15” and larger the peak wet weather flows have been calculated using hydraulic modeling.

Hydraulic modeling was prepared by RMC for each of the three development scenarios, the “CVSP Base” condition, the “CVSP Base + Urban Reserve” condition, and the “CVSP Base + Urban Reserve + Brookfield” condition. The results of the hydraulic modeling are presented in Attachment 1.

OFFSITE CONNECTIONS

The sanitary sewer trunk pipe system from the Creekview Specific Plan ultimately discharges to existing and proposed sewer pipes to be constructed as a part of the Westpark CFD Phase 4 improvements. The West Roseville Specific Plan (WRSP) Master Sewer Plan anticipated wastewater flows from the CVSP entering the WRSP sewer system at a manhole to be placed at the future intersection of Westside Drive (now renamed as Westbrook Boulevard) and Blue Oaks Boulevard. This manhole is identified as Node W34 in the WRSP Master Sewer Plan. This manhole / node would be just south of Node 350 of this master plan.

From Node W34 the WRSP Master Sewer Plan proposed construction of an 18” gravity sewer pipe southerly in Westside Drive to Node W36 at the intersection of Westside Drive and Phillip Road. Node W36 corresponds to Node 370 in this master plan. According to the WRSP master plan a 24” gravity pipe would then be constructed easterly in Phillip

Road from Node W36 to Node W37, a manhole at the intersection of Phillip Road and Westpark Drive in the West Roseville Specific Plan Area.

The construction of these 18” and 24” sewer pipes was to be included in the Westpark CFD Phase 4 improvements. However, due to the slowdown in construction the 24” gravity sewer pipeline in Phillip Road has only been extended to a point approximately 800 feet east of the proposed intersection of Westside Drive and Phillip Road. This point is identified as Node 390 in this sewer master plan and is the proposed point of connection for the Creekview sanitary sewer system.

The hydraulic modeling performed by RMC included the modeling of the offsite wastewater transmission pipes in West Roseville, downstream from the offsite connection point, Node 390, that will deliver flows from the Creekview Specific Plan to the Pleasant Grove Wastewater Treatment Plant. As stated in the RMC Final Technical Memorandum in Attachment 1: “The model results indicate that the modeled pipes downstream from the Creekview UGA, including the recently constructed pipes in West Roseville, have sufficient capacity to handle PWWF from Creekview under the “Base,” “Base + Urban Reserve,” and “Base + Urban Reserve + Brookfield” buildout scenarios.”

V. WASTEWATER INFRASTRUCTURE IMPROVEMENTS

COLLECTION AND TRANSMISSION

A sanitary sewer system comprised of gravity trunk pipelines, a lift station, and a force main was defined to collect wastewater flows within the Creekview Specific Plan Area. The gravity pipelines and force main were placed within the proposed road system serving the Plan Area wherever feasible. The sewer system designed to serve the Plan Area using the “CVSP Base” development scenario is shown on oversized Exhibit 1. The sewer system designed to serve the Plan Area using the “CVSP Base + Urban Reserve” scenario when future land uses have been assumed for Urban Reserve parcel is shown on oversized Exhibit 2. The sewer system designed to serve the Plan Area using the “CVSP Base + Urban Reserve + Urban Reserve” scenario when future land uses have been assumed for the Urban Reserve parcel and Brookfield UGA is shown on oversized Exhibit 3.

Five sewer pipe segments are required to be upsized from the “CVSP Base” condition to serve the Plan Area when the Urban Reserve parcel is developed, four segments in the road providing access to the Urban Reserve parcel and one segment in Westbrook Boulevard. These pipe segments are depicted on Figure 6. Two of the pipe segments in the access road must be upsized from an 8” to 10” diameter pipe, one segment from an 8” to 12” diameter pipe, and one segment from a 10” to 12” diameter pipe. The segment in Westbrook Boulevard must be upsized from a 12” to a 15” pipe.

One new sewer pipe segment is required to be added and two sewer pipe segments are required to be upsized from the “CVSP Base + Urban Reserve” condition to serve the “CVSP Base + Urban Reserve + Brookfield” condition when the Brookfield UGA is developed, each of the segments is in Westbrook Boulevard. These pipe segments are depicted on Figure 7. A new 10” force main is required between the southern boundary of the proposed Brookfield UGA and the force main exiting from the sewer lift station serving the Creekview Specific Plan Area. The segments requiring upsizing consist of a force main segment and a gravity pipe segment. The force main pipe must be upsized

from a 10” to a 12” pipe. The gravity pipe segment must be upsized from an 18” pipe to a 21” diameter pipe.

It should be noted that the offsite 18” and 24” gravity sewer pipes in Westbrook Boulevard and Phillip Road as proposed in the West Roseville Specific Plan Master Sewer Plan are not required to be upsized to serve the “CVSP Base” and “CVSP Base + Urban Reserve” conditions. However the 18” pipe proposed in Westbrook Boulevard by the WRSP Master Sewer Plan is required to be upsized to a 21” pipe to serve the “CVSP Base + Urban Reserve + Brookfield” condition.

The sanitary sewer system constructed to serve the Creekview Specific Plan Area will be sized to serve the “CVSP Base + Urban Reserve + Brookfield” condition. This sewer system is depicted on oversized Exhibit 3. Preliminary pipe inverts and manhole rim grades for this condition are shown on oversized Exhibit 4.

EFFLUENT / DISPOSAL

Effluent from the PGWWTP is released through an outfall structure into Pleasant Grove Creek. The current plant NPDES permit allows for a maximum of 12 MGD average dry weather flow (which may be increased to 15 MGD upon completion of upgrades to the PGWWTP) to be discharged to Pleasant Grove Creek. The outfall location is shown on Figure 6.

Information regarding the impacts of the disposal of treated effluent from the Creekview Specific Plan Area into Pleasant Grove Creek is provided in the Technical Memorandum prepared by Merritt Smith Consulting, included as Attachment 3 in this master plan

RECYCLED WATER

The Creekview Specific Plan anticipates receiving a commitment for recycled water from the City of Roseville for an amount equal to the average daily dry weather wastewater flow generated and conveyed by the CVSP to the Pleasant Grove Wastewater Treatment

Plant. As estimated in this master plan, the CVSP will generate an ADWF of 0.370 MGD and would anticipate receiving this volume of recycled water from the city.

FORCE MAIN AND LIFT STATIONS

Conveyance of the wastewater flows from the Creekview Specific Plan Area requires the use of a permanent sanitary sewer lift station and a force main to convey flows from the lift station to be placed at the low point of the onsite sewer system to the gravity pipe sewer system which will transport flows to the Pleasant Grove Wastewater Treatment Plant. The lift station is proposed to be constructed at the southwest corner of the Pleasant Grove Creek / Westbrook Boulevard crossing as depicted in Figure 2 and the oversized exhibits. The proposed lift station will be constructed above and outside the 100-year flood plain of Pleasant Grove Creek and will be accessible from Westbrook Boulevard. A preliminary site plan for the proposed lift station is depicted on Figure 8.

A 12” force main will carry flows from the lift station southerly along Westbrook Boulevard to a 72” transition manhole which will discharge to a gravity pipe system which will convey flows to the offsite connection point.

ALTERNATIVE DESIGN FOR FORCE MAIN AND LIFT STATION

The sanitary sewer system proposed to carry the combined flows from the Brookfield and Creekview Urban Growth Areas is patterned after the system envisioned in RMC Technical Memorandum 11a contained in Appendix Y of the South Placer Regional Wastewater and Recycled Water Systems Evaluation. During the final design of the CVSP Area sanitary sewer system, an alternate method of conveying the combined flows from the CVSP Area and the proposed Brookfield UGA may be evaluated. The Alternative Method would generally consist of a system in which flows from the future Brookfield UGA lift station would discharge to a transition manhole in Westbrook Boulevard near the boundary between the two projects and be conveyed through a gravity trunk sewer pipe, which would also carry flows from the CVSP, to the Creekview sewer lift station. The Creekview sewer lift station would pump the combined Creekview and Brookfield flows

through a force main located in Westbrook Boulevard to a transition manhole located just north of Blue Oaks Boulevard and discharge through the transition manhole to a gravity pipe system which would convey the flows to the offsite connection pipe. A schematic drawing of this Alternative method is shown in Figure 9.

INTERIM IMPROVEMENTS/SUBSHED BOUNDARY MODIFICATIONS

Interim sanitary sewer improvements will be allowed on a temporary basis to provide sewer service for parcel development within the Plan Area. Interim improvements may include pipe alignments or points of connection that differ from those shown in the master plan for individual land use parcels, temporary sewer lift stations for individual land use parcels to provide sewer service until permanent infrastructure is constructed, as well as other types of interim improvements. All interim improvements shall be designed and constructed per City of Roseville standards and Department of Health Regulations.

During the final grading and utility design process for individual development projects within the Plan Area, it may become apparent that there is a more efficient method of delivering wastewater flows to the sanitary sewer trunk system than at the node defined in the sewer master plan. Minor wastewater shed boundary adjustments may be necessary during the final design process.

All interim sanitary sewer improvements and wastewater shed adjustments will be subject to the review and approval of the City of Roseville Environmental Utilities Department.

VI. REFERENCES

Central Valley RWQCB – Waste Discharge Requirements For The City of Roseville
Pleasant Grove Wastewater Treatment Plant, Placer County
Order No. R5-2008-0079, NPDES No. CA0084573

Creekview Specific Plan – Preliminary Land Use Plan & Tables for June 11, 2010
Land Use Plan

South Placer Regional Wastewater and Recycled Water Systems Evaluation
Updated Final Report – December 2009

West Roseville Specific Plan
February 04, 2004

West Roseville Specific Plan – Master Sewer Plan
April 12, 2005

VII. ABBREVIATIONS

AC	Acres
ADW	Average Dry Weather
ADWF	Average Dry Weather Flow
CC	Community Commercial
CC/BP	Community Commercial/Business Park
CFD	Community Funding District
CMU	Commercial Mixed Use
DU	Dwelling Unit
EDU	Equivalent Dwelling Unit
GPD	Gallons per Day
HDR	High Density Residential
LDR	Low Density Residential
M&S	MacKay & Somps
MDR	Medium Density Residential
MGD	Million Gallons per Day
NPDES	National Pollution Discharge Elimination System
PGWWTP	Pleasant Grove Wastewater Treatment Plan
PQP	Public Quasi Public
PQPS	Public Quasi Public Schools
PR	Park Reserve
SPMUD	South Placer Municipal Utility District
SPWA	South Placer Wastewater Authority
UR	Urban Reserve
UGA	Urban Growth Area
WRSP	West Roseville Specific Plan

TABLES

TABLE 1
AVERAGE DRY WEATHER UNIT FLOW FACTORS
CREEKVIEW SPECIFIC PLAN

LAND USE	FLOW RATE ⁽¹⁾
LDR - Low Density Residential	190 gpd/du
MDR - Medium Density Residential	190 gpd/du
HDR - High Density Residential	130 gpd/du
CMU - Commercial Mixed Use	2300 gpd/ac
CC - Community Commercial	850 gpd/ac
CC/BP - Community Commercial / Business Park	850 gpd/ac
PARK - Parks > 10 Acres	10 gpd/ac
PQP-PUB - Public Facilities and Services	660 gpd/ac
PQP-REL - Religious Facilities	660 gpd/ac
PQP-SCHOOLS - Schools	170 gpd/ac

Notes:

1. Per Table 1 - Average Dry Weather Unit Flow Factors, shown in Section 9 - Sanitary Sewer Design of the City of Roseville Design and Construction Standards dated March 2007

TABLE 2
LAND USE SUMMARY
CVSP BASE CONDITION
CREEKVIEW SPECIFIC PLAN

LAND USE	AREA SIZE (Acres)	UNITS
LDR - Low Density Residential	155.8	836
MDR - Medium Density Residential	64.3	655
HDR - High Density Residential	17.1	520
CMU - Commercial Mixed Use		
CC - Community Commercial	15.5	
CC/BP - Community Commercial / Business Park	3.8	
PARK - Parks > 10 Acres		
PQP-PUB - Public Facilities and Services	2.6	
PQP-REL - Religious Facilities		
PQP-SCHOOLS - Schools	7.0	
UR - Urban Reserve	39.9	
TOTAL	306.0	2,011

TABLE 3
WASTEWATER FLOW SUMMARY
CVSP BASE CONDITION
CREEKVIEW SPECIFIC PLAN

LAND USE	AREA SIZE (Acres)	UNITS	ADWF (MGD)
LDR - Low Density Residential	155.8	836	0.159
MDR - Medium Density Residential	64.3	655	0.124
HDR - High Density Residential	17.1	520	0.068
CMU - Commercial Mixed Use			0.000
CC - Community Commercial	15.5		0.013
CC/BP - Community Commercial / Business Park	3.8		0.003
PARK - Parks > 10 Acres			0.000
PQP-PUB - Public Facilities and Services	2.6		0.002
PQP-REL - Religious Facilities			0.000
PQP-SCHOOLS - Schools	7.0		0.001
UR - Urban Reserve	39.9		0.000
TOTAL	306.0	2,011.0	0.370

TABLE 4
WASTEWATER FLOWS BY NODE
CVSP BASE CONDITION
CREEKVIEW SPECIFIC PLAN

REFERENCE NODE	CONTRIBUTING NODE	LDR / MDR			HDR			CMU			SCHOOL			CC, CC/BP, LI			PQP-PUB, PQP-REL			PARK - Parks > 10 Acres			TOTAL Q(ADWF) MGD	FACTORED FLOW MGD	PEAKING FACTOR	TOTAL Q(PWWF) MGD	PIPE SIZE IN.	PIPE SLOPE FT/FT	% FULL Q(PWWF) (d/D)
		DU	CUM. DU	Q(ADWF) MGD	DU	CUM. DU	Q(ADWF) MGD	DU	CUM. DU	AREA ACRE	CUM. AREA ACRE	Q(ADWF) MGD	AREA ACRE	CUM. AREA ACRE	Q(ADWF) MGD	AREA ACRE	CUM. AREA ACRE	Q(ADWF) MGD	AREA ACRE	CUM. AREA ACRE	Q(ADWF) MGD	AREA ACRE							
10					385	385	0.050																0.050	0.100	3.21	0.321	8	0.0035	59
20	10	50	50	0.010		385	0.050																0.060	0.119	3.15	0.375	8	0.0035	69
30		30	30	0.006																			0.006	0.011	3.58	0.041	8	0.0035	8
40	20, 30	25	105	0.020		385	0.050																0.070	0.140	3.10	0.434	10	0.0025	52
50		40	40	0.008																			0.008	0.015	3.55	0.054	8	0.0035	10
60	50	75	115	0.022																			0.022	0.044	3.43	0.150	8	0.0035	28
70		55	55	0.010																			0.010	0.021	3.52	0.074	8	0.0035	14
80		105	105	0.020																			0.020	0.040	3.46	0.138	8	0.0035	25
90	70, 80	35	195	0.037																			0.037	0.074	3.31	0.245	8	0.0035	45
100	90	10	205	0.039																			0.039	0.078	3.30	0.257	8	0.0035	47
105	100	30	235	0.045																			0.045	0.089	3.27	0.292	8	0.0035	54
110	40, 60, 105		455	0.086		385	0.050																0.137	0.273	2.72	0.743	12	0.0020	74
120		40	40	0.008										11.0	11.0	0.009	1.1	1.1	0.001				0.018	0.035	3.48	0.123	8	0.0035	23
130	120	40	80	0.015										11.0	11.0	0.009	1.1	1.1	0.001				0.025	0.051	3.40	0.172	8	0.0035	32
135	130	65	145	0.028										8.3	19.3	0.016	1.1	1.1	0.001				0.045	0.089	3.27	0.292	8	0.0035	54
140	135		600	0.114		385	0.050							19.3	19.3	0.016	1.1	1.1	0.001				0.181	0.362	2.59	0.939	15	0.0015	59
150		20	20	0.004																			0.004	0.008	3.65	0.028	8	0.0035	5
160	150	180	200	0.038																			0.038	0.076	3.30	0.251	8	0.0035	46
170	160	20	220	0.042																			0.042	0.084	3.28	0.274	8	0.0035	51
180	170	85	305	0.058																			0.058	0.116	3.17	0.367	8	0.0035	68
190	180	40	345	0.066																			0.066	0.131	3.11	0.408	10	0.0025	49
200	190		345	0.066													0.9	0.9	0.001				0.066	0.132	3.10	0.410	10	0.0025	49
210		170	170	0.032																			0.032	0.065	3.35	0.216	8	0.0035	40
230		35	35	0.007																			0.007	0.013	3.56	0.047	8	0.0035	9
220		91	91	0.017																			0.017	0.035	3.48	0.120	8	0.0035	22
240	200, 220, 230		471	0.089													0.9	0.9	0.001				0.090	0.180	2.98	0.537	10	0.0025	65
250	Urban Reserve																						0.000	0.000		0.000			0
260	250	110	110	0.021		0	0.000																0.021	0.042	3.43	0.143	8	0.0035	26
270	260	35	145	0.028		0	0.000																0.028	0.055	3.39	0.187	8	0.0035	34
280	270	105	250	0.048		0	0.000					7.0	7.0	0.001									0.049	0.097	3.22	0.314	8	0.0035	58
290	280		250	0.048	135	135	0.018						7.0	7.0	0.001								0.066	0.132	3.11	0.412	10	0.0025	50
300	210, 240, 290		891	0.169		135	0.018						7.0	7.0	0.001			0.9	0.9	0.001			0.189	0.377	2.57	0.970	12	0.0020	97
310	140, 300		1491	0.283		520	0.068						7.0	7.0	0.001	19.3	19.3	0.016	2.0	2.0	0.001	0.370	N/A	N/A	0.850	15	0.0015	51	
320	310		1491	0.283		520	0.068						7.0	7.0	0.001	19.3	19.3	0.016	0.6	2.6	0.002	0.370	N/A	N/A	0.850	FM			
330	Brookfield																						0.000	0.000		0.000	N/A		
340	320, 330		1491	0.283		520	0.068						7.0	7.0	0.001	19.3	19.3	0.016	2.6	0.002		0.370	N/A	N/A	0.850	FM			
350	340		1491	0.283		520	0.068						7.0	7.0	0.001	19.3	19.3	0.016	2.6	0.002		0.370	N/A	N/A	0.850	15	0.0015	51	
360	WRSP	405	405	0.077	252	252	0.033						8.2	8.2	0.001	74.6	74.6	0.063				0.175	0.349	2.60	0.907	15	0.0015	57	
370	350, 360		1896	0.360		772	0.100	0		0.0	0.000		15.2	15.2	0.003	93.9	93.9	0.080	2.6	0.002		0.545	N/A	N/A	1.190	18	0.0012	50	
380	370		1896	0.360		772	0.100	0		0.0	0.000		15.2	15.2	0.003	9.6	103.5	0.088	2.6	0.002		0.553	N/A	N/A	1.180	18	0.0012	50	
390	380		1896	0.360		772	0.100	0		0.0	0.000		15.2	15.2	0.003	103.5	103.5	0.088	2.6	0.002		0.553	N/A	N/A	1.180	EXIST 24			
TOTAL			1896	0.360		772	0.100	0		0	0.000		15.2	15.2	0.003	103.5	103.5	0.088	2.6	0.002		0.553	N/A	N/A	1.180	EXIST 24			

NOTES:
1 Peak Transmission Flow and Pipe Diameter based on hydraulic modeling prepared by RMC. (Please refer to Attachment 1.)
2 Land use unit counts and aceages based on October 26, 2010 Creekview Specific Plan Land Use Plan.

TABLE 5
LAND USE SUMMARY
URBAN RESERVE - FUTURE CONDITION
CREEKVIEW SPECIFIC PLAN

LAND USE	AREA SIZE (Acres)	UNITS
LDR - Low Density Residential		
MDR - Medium Density Residential	16.7	167
HDR - High Density Residential	11.9	238
CMU - Commercial Mixed Use		
CC - Community Commercial		
CC/BP - Community Commercial / Business Park		
PARK - Parks > 10 Acres		
PQP-PUB - Public Facilities and Services		
PQP-REL - Religious Facilities		
PQP-SCHOOLS - Schools		
TOTAL	28.6	405

TABLE 6
WASTEWATER FLOW SUMMARY
URBAN RESERVE - FUTURE CONDITION
CREEKVIEW SPECIFIC PLAN

LAND USE	AREA SIZE (Acres)	UNITS	ADWF (MGD)
LDR - Low Density Residential			0.000
MDR - Medium Density Residential	16.7	167	0.032
HDR - High Density Residential	11.9	238	0.031
CMU - Commercial Mixed Use			0.000
CC - Community Commercial			0.000
CC/BP - Community Commercial / Business Park			0.000
PARK - Parks > 10 Acres			0.000
PQP-PUB - Public Facilities and Services			0.000
PQP-REL - Religious Facilities			0.000
PQP-SCHOOLS - Schools			0.000
TOTAL	28.6	405.0	0.063

TABLE 7
LAND USE SUMMARY
CVSP BASE + URBAN RESERVE CONDITION
CREEKVIEW SPECIFIC PLAN

LAND USE	AREA SIZE (Acres)	UNITS
LDR - Low Density Residential	155.8	836
MDR - Medium Density Residential	81.0	822
HDR - High Density Residential	28.8	758
CMU - Commercial Mixed Use		
CC - Community Commercial	15.5	
CC/BP - Community Commercial / Business Park	3.8	
PARK - Parks > 10 Acres		
PQP-PUB - Public Facilities and Services	2.6	
PQP-REL - Religious Facilities		
PQP-SCHOOLS - Schools	7.0	
UR - Urban Reserve		
TOTAL	294.5	2,416

TABLE 8
WASTEWATER FLOW SUMMARY
CVSP BASE + URBAN RESERVE CONDITION
CREEKVIEW SPECIFIC PLAN

LAND USE	AREA SIZE (Acres)	UNITS	ADWF (MGD)
LDR - Low Density Residential	155.8	836	0.159
MDR - Medium Density Residential	81.0	822	0.156
HDR - High Density Residential	28.8	758	0.099
CMU - Commercial Mixed Use			0.000
CC - Community Commercial	15.5		0.013
CC/BP - Community Commercial / Business Park	3.8		0.003
PARK - Parks > 10 Acres			0.000
PQP-PUB - Public Facilities and Services	2.6		0.002
PQP-REL - Religious Facilities			0.000
PQP-SCHOOLS - Schools	7.0		0.001
UR - Urban Reserve			0.000
TOTAL	294.5	2,416.0	0.433

TABLE 9
WASTEWATER FLOWS BY NODE
CVSP BASE + URBAN RESERVE CONDITION
CREEKVIEW SPECIFIC PLAN

REFERENCE NODE #	CONTRIBUTING NODE #	(190 GPD / DU)			(130 GPD / DU)			(2300 GPD / ACRE)			(170 GPD / ACRE)			(850 GPD / AC)			(660 GPD / AC)			(10 GPD / ACRE)			TOTAL Q(ADWF)	FACTORED FLOW	PEAKING FACTOR	TOTAL Q(PWWF)	PIPE SIZE IN.	PIPE SLOPE FT/FT	% FULL Q(PWWF)
		DU #	CUM. DU #	Q(ADWF) MGD	DU #	CUM. DU #	Q(ADWF) MGD	DU #	CUM. DU #	AREA ACRE	CUM. AREA ACRE	Q(ADWF) MGD	AREA ACRE	CUM. AREA ACRE	Q(ADWF) MGD	AREA ACRE	CUM. AREA ACRE	Q(ADWF) MGD	AREA ACRE	CUM. AREA ACRE	Q(ADWF) MGD	AREA ACRE	CUM. AREA ACRE	Q(ADWF) MGD	MGD	MGD	MGD	MGD	MGD
10					385	385	0.050																0.050	0.100	3.21	0.321	8	0.0035	59
20	10	50	50	0.010		385	0.050																0.060	0.119	3.15	0.375	8	0.0035	69
30		30	30	0.006																			0.006	0.011	3.58	0.041	8	0.0035	8
40	20, 30	25	105	0.020		385	0.050																0.070	0.140	3.10	0.434	10	0.0025	52
50		40	40	0.008																			0.008	0.015	3.55	0.054	8	0.0035	10
60	50	75	115	0.022																			0.022	0.044	3.43	0.150	8	0.0035	28
70		55	55	0.010																			0.010	0.021	3.52	0.074	8	0.0035	14
80		105	105	0.020																			0.020	0.040	3.46	0.138	8	0.0035	25
90	70, 80	35	195	0.037																			0.037	0.074	3.31	0.245	8	0.0035	45
100	90	10	205	0.039																			0.039	0.078	3.30	0.257	8	0.0035	47
105	100	30	235	0.045																			0.045	0.089	3.27	0.292	8	0.0035	54
110	40, 60, 105		455	0.086		385	0.050																0.137	0.273	2.72	0.743	12	0.0020	74
120		40	40	0.008										11.0	11.0	0.009	1.1	1.1	0.001				0.018	0.035	3.48	0.123	8	0.0035	23
130	120	40	80	0.015											11.0	0.009	1.1	1.1	0.001				0.025	0.051	3.40	0.172	8	0.0035	32
135	130	65	145	0.028										8.3	19.3	0.016	1.1	0.001					0.045	0.089	3.27	0.292	8	0.0035	54
140	135		600	0.114		385	0.050							19.3	0.016	1.1	0.001						0.181	0.362	2.59	0.939	15	0.0015	59
150		20	20	0.004																			0.004	0.008	3.65	0.028	8	0.0035	5
160	150	180	200	0.038																			0.038	0.076	3.30	0.251	8	0.0035	46
170	160	20	220	0.042																			0.042	0.084	3.28	0.274	8	0.0035	51
180	170	85	305	0.058																			0.058	0.116	3.17	0.367	8	0.0035	68
190	180	40	345	0.066																			0.066	0.131	3.11	0.408	10	0.0025	49
200	190		345	0.066												0.9	0.9	0.001					0.066	0.132	3.10	0.410	10	0.0025	49
210		170	170	0.032																			0.032	0.065	3.35	0.216	8	0.0035	40
230		35	35	0.007																			0.007	0.013	3.56	0.047	8	0.0035	9
220		91	91	0.017																			0.017	0.035	3.48	0.120	8	0.0035	22
240	200, 220, 230		471	0.089													0.9	0.001					0.090	0.180	2.98	0.537	10	0.0025	65
250	Urban Reserve	167	167	0.032	238	238	0.031																0.063	0.125	3.13	0.392	8	0.0035	72
260	250	110	277	0.053		238	0.031																0.084	0.167	3.01	0.503	10	0.0025	61
270	260	35	312	0.059		238	0.031																0.090	0.180	2.98	0.538	10	0.0025	65
280	270	105	417	0.079		238	0.031			7.0	7.0	0.001											0.111	0.223	2.86	0.637	12	0.0020	64
290	280		417	0.079	135	373	0.048					7.0	0.001										0.129	0.258	2.78	0.717	12	0.0020	72
300	210, 240, 290		1058	0.201		373	0.048					7.0	0.001				0.9	0.001					0.251	0.503	2.45	1.231	15	0.0015	77
310	140, 300		1658	0.315		758	0.099					7.0	0.001		19.3	0.016		2.0	0.001				0.432	N/A	N/A	0.980	15	0.0015	56
320	310		1658	0.315		758	0.099					7.0	0.001		19.3	0.016	0.6	2.6	0.002				0.433	N/A	N/A	0.980	FM		
330	Brookfield																						0.000	0.000		0.000	N/A		
340	320, 330		1658	0.315		758	0.099					7.0	0.001		19.3	0.016		2.6	0.002				0.433	N/A	N/A	0.980	FM		
350	340		1658	0.315		758	0.099					7.0	0.001		19.3	0.016		2.6	0.002				0.433	N/A	N/A	0.980	15	0.0015	56
360	WRSP	405	405	0.077	252	252	0.033					8.2	8.2	0.001	74.6	74.6	0.063						0.175	0.349	2.60	0.907	15	0.0015	57
370	350, 360		2063	0.392		1010	0.131						15.2	0.003		93.9	0.080		2.6	0.002			0.607	N/A	N/A	1.310	18	0.0012	53
380	370		2063	0.392		1010	0.131						15.2	0.003	9.6	103.5	0.088		2.6	0.002			0.616	N/A	N/A	1.310	18	0.0012	53
390	380		2063	0.392		1010	0.131						15.2	0.003		103.5	0.088		2.6	0.002			0.616	N/A	N/A	1.310	EXIST 24		
TOTAL			2063	0.392		1010	0.131						15.2	0.003		103.5	0.088		2.6	0.002			0.616	N/A	N/A	1.310	EXIST 24		

NOTES:
1 Peak Transmission Flow and Pipe Diameter based on hydraulic modeling prepared by RMC. (Please refer to Attachment 1.)
2 Land use unit counts and aceages based on October 26, 2010 Creekview Specific Plan Land Use Plan.

TABLE 10
LAND USE SUMMARY
BROOKFIELD - FUTURE CONDITION
CREEKVIEW SPECIFIC PLAN

LAND USE	AREA SIZE (Acres)	UNITS
LDR - Low Density Residential	298.9	1694
MDR - Medium Density Residential	40.8	482
HDR - High Density Residential	25.9	577
CMU - Commercial Mixed Use	55.2	32
CC - Community Commercial		
CC/BP - Community Commercial / Business Park		
PARK - Parks > 10 Acres	10.2	
PQP-PUB - Public Facilities and Services	6.7	
PQP-REL - Religious Facilities		
PQP-SCHOOLS - Schools	7.0	
UR - Urban Reserve		
TOTAL	444.7	2,785

TABLE 11
WASTEWATER FLOW SUMMARY
BROOKFIELD - FUTURE CONDITION
CREEKVIEW SPECIFIC PLAN

LAND USE	AREA SIZE (Acres)	UNITS	ADWF (MGD)
LDR - Low Density Residential	298.9	1694	0.322
MDR - Medium Density Residential	40.8	482	0.092
HDR - High Density Residential	25.9	577	0.075
CMU - Commercial Mixed Use	55.2	32	0.127
CC - Community Commercial			0.000
CC/BP - Community Commercial / Business Park			0.000
PARK - Parks > 10 Acres	10.2		0.000
PQP-PUB - Public Facilities and Services	6.7		0.004
PQP-REL - Religious Facilities			0.000
PQP-SCHOOLS - Schools	7.0		0.001
UR - Urban Reserve			0.000
TOTAL	444.7	2,785.0	0.621

TABLE 12
LAND USE SUMMARY
CVSP BASE + URBAN RESERVE + BROOKFIELD CONDITION
CREEKVIEW SPECIFIC PLAN

LAND USE	AREA SIZE (Acres)	UNITS
LDR - Low Density Residential	454.7	2530
MDR - Medium Density Residential	121.8	1304
HDR - High Density Residential	54.7	1335
CMU - Commercial Mixed Use	55.2	32
CC - Community Commercial	15.5	
CC/BP - Community Commercial / Business Park	3.8	
PARK - Parks > 10 Acres	10.2	
PQP-PUB - Public Facilities and Services	9.3	
PQP-REL - Religious Facilities		
PQP-SCHOOLS - Schools	14.0	
UR - Urban Reserve		
TOTAL	739.2	5,201

TABLE 13
WASTEWATER FLOW SUMMARY
CVSP BASE + URBAN RESERVE + BROOKFIELD CONDITION
CREEKVIEW SPECIFIC PLAN

LAND USE	AREA SIZE (Acres)	UNITS	ADWF (MGD)
LDR - Low Density Residential	454.7	2530	0.481
MDR - Medium Density Residential	121.8	1304	0.248
HDR - High Density Residential	54.7	1335	0.174
CMU - Commercial Mixed Use	55.2	32	0.127
CC - Community Commercial	15.5		0.013
CC/BP - Community Commercial / Business Park	3.8		0.003
PARK - Parks > 10 Acres	10.2		0.000
PQP-PUB - Public Facilities and Services	9.3		0.006
PQP-REL - Religious Facilities			0.000
PQP-SCHOOLS - Schools	14.0		0.002
UR - Urban Reserve			0.000
TOTAL	739.2	5,201.0	1.054

TABLE 14
WASTEWATER FLOWS BY NODE
CVSP BASE + URBAN RESERVE + BROOKFIELD CONDITION
CREEKVIEW SPECIFIC PLAN

REFERENCE NODE #	CONTRIBUTING NODE #	(190 GPD / DU)			(130 GPD / DU)			(2300 GPD / ACRE)			(170 GPD / ACRE)			(850 GPD / AC)			(660 GPD / AC)			(10 GPD / ACRE)			TOTAL	FACTORED	PEAKING	TOTAL	PIPE	PIPE	% FULL	
		DU	CUM. DU	Q(ADWF)	DU	CUM. DU	Q(ADWF)	DU	CUM. DU	AREA	CUM. AREA	Q(ADWF)	AREA	CUM. AREA	Q(ADWF)	AREA	CUM. AREA	Q(ADWF)	AREA	CUM. AREA	MGD	AREA	CUM. AREA	Q(ADWF)	MGD	MGD	MGD	MGD	IN.	SLOPE
10					385	385	0.050																0.050	0.100	3.21	0.321	8	0.0035	59	
20	10	50	50	0.010		385	0.050																0.060	0.119	3.15	0.375	8	0.0035	69	
30		30	30	0.006																			0.006	0.011	3.58	0.041	8	0.0035	8	
40	20, 30	25	105	0.020		385	0.050																0.070	0.140	3.10	0.434	10	0.0025	52	
50		40	40	0.008																			0.008	0.015	3.55	0.054	8	0.0035	10	
60	50	75	115	0.022																			0.022	0.044	3.43	0.150	8	0.0035	28	
70		55	55	0.010																			0.010	0.021	3.52	0.074	8	0.0035	14	
80		105	105	0.020																			0.020	0.040	3.46	0.138	8	0.0035	25	
90	70, 80	35	195	0.037																			0.037	0.074	3.31	0.245	8	0.0035	45	
100	90	10	205	0.039																			0.039	0.078	3.30	0.257	8	0.0035	47	
105	100	30	235	0.045																			0.045	0.089	3.27	0.292	8	0.0035	54	
110	40, 60, 105		455	0.086		385	0.050																0.137	0.273	2.72	0.743	12	0.0020	74	
120		40	40	0.008											11.0	11.0	0.009	1.1	1.1	0.001				0.018	0.035	3.48	0.123	8	0.0035	23
130	120	40	80	0.015												11.0	0.009		1.1	0.001				0.025	0.051	3.40	0.172	8	0.0035	32
135	130	65	145	0.028											8.3	19.3	0.016		1.1	0.001				0.045	0.089	3.27	0.292	8	0.0035	54
140	135		600	0.114		385	0.050									19.3	0.016		1.1	0.001				0.181	0.362	2.59	0.939	15	0.0015	59
150		20	20	0.004																			0.004	0.008	3.65	0.028	8	0.0035	5	
160	150	180	200	0.038																			0.038	0.076	3.30	0.251	8	0.0035	46	
170	160	20	220	0.042																			0.042	0.084	3.28	0.274	8	0.0035	51	
180	170	85	305	0.058																			0.058	0.116	3.17	0.367	8	0.0035	68	
190	180	40	345	0.066																			0.066	0.131	3.11	0.408	10	0.0025	49	
200	190		345	0.066													0.9	0.9	0.001				0.066	0.132	3.10	0.410	10	0.0025	49	
210		170	170	0.032																			0.032	0.065	3.35	0.216	8	0.0035	40	
230		35	35	0.007																			0.007	0.013	3.56	0.047	8	0.0035	9	
220		91	91	0.017																			0.017	0.035	3.48	0.120	8	0.0035	22	
240	200, 220, 230		471	0.089															0.9	0.001				0.090	0.180	2.98	0.537	10	0.0025	65
250	Urban Reserve	167	167	0.032	238	238	0.031																0.063	0.125	3.13	0.392	8	0.0035	72	
260	250	110	277	0.053		238	0.031																0.084	0.167	3.01	0.503	10	0.0025	61	
270	260	35	312	0.059		238	0.031																0.090	0.180	2.98	0.538	10	0.0025	65	
280	270	105	417	0.079		238	0.031					7.0	7.0	0.001									0.111	0.223	2.86	0.637	12	0.0020	64	
290	280		417	0.079	135	373	0.048						7.0	0.001									0.129	0.258	2.78	0.717	12	0.0020	72	
300	210, 240, 290		1058	0.201		373	0.048						7.0	0.001					0.9	0.001				0.251	0.503	2.45	1.231	15	0.0015	77
310	140, 300		1658	0.315		758	0.099						7.0	0.001		19.3	0.016		2.0	0.001			0.432	N/A	N/A	0.980	15	0.0015	56	
320	310		1658	0.315		758	0.099						7.0	0.001		19.3	0.016	0.6	2.6	0.002			0.433	N/A	N/A	0.980	FM			
330	Brookfield	2176	2176	0.413	577	577	0.075	32	32	55.2	55.2	0.127	7.0	7.0	0.001			6.7	6.7	0.004	10.2	10.2	0.000	0.621	N/A	N/A	1.190	FM		
340	320, 330		3834	0.728		1335	0.174						32		55.2	0.127		14.0	0.002				1.054	N/A	N/A	2.170	FM			
350	340		3834	0.728		1335	0.174						32		55.2	0.127		14.0	0.002				1.054	N/A	N/A	2.160	21	0.0010	60	
360	WRSP	405	405	0.077	252	252	0.033						8.2	8.2	0.001	74.6	74.6	0.063					0.175	0.349	2.60	0.907	15	0.0015	57	
370	350, 360		4239	0.805		1587	0.206						32		55.2	0.127		22.2	0.004				1.229	N/A	N/A	2.460	24	0.0008	55	
380	370		4239	0.805		1587	0.206						32		55.2	0.127		22.2	0.004	9.6	103.5	0.088		1.237	N/A	N/A	2.460	24	0.0008	55
390	380		4239	0.805		1587	0.206						32		55.2	0.127		22.2	0.004				1.237	N/A	N/A	2.460	EXIST 24			
TOTAL			4239	0.805		1587	0.206						32		55.2	0.127		22.2	0.004				1.237	N/A	N/A	2.460	EXIST 24			

NOTES:
1 Peak Transmission Flow and Pipe Diameter based on hydraulic modeling prepared by RMC. (Please refer to Attachment 1.)
2 Land use unit counts and aceages based on October 26, 2010 Creekview Specific Plan Land Use Plan.

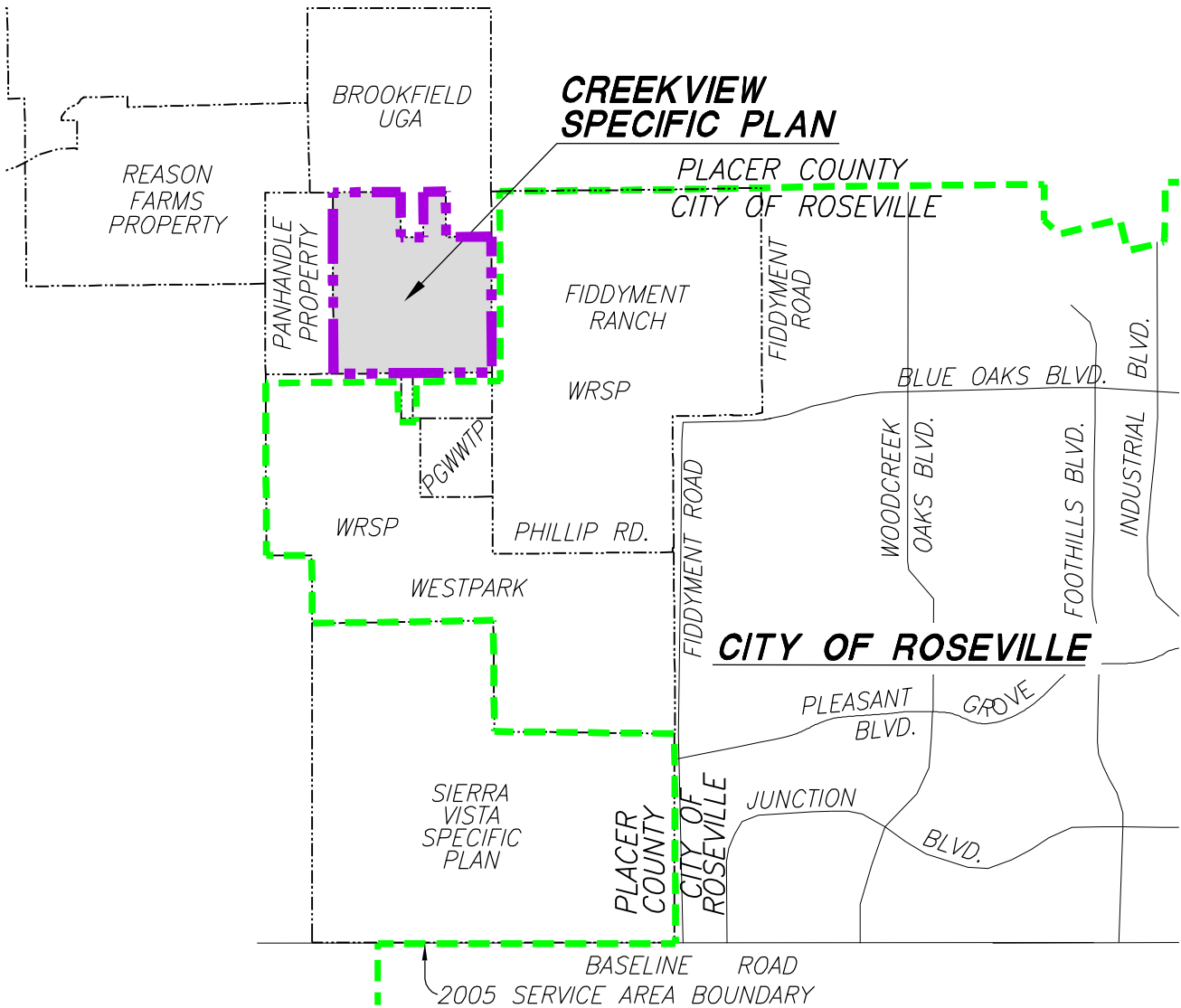
TABLE 15
WASTEWATER FLOW SUMMARY
ALTERNATIVE DEVELOPMENT CONDITIONS
CREEKVIEW SPECIFIC PLAN

AVERAGE DRY WEATHER FLOW AT PLEASANT GROVE WASTEWATER TREATMENT PLANT		
DEVELOPMENT CONDITION	ADWF (MGD)	TOTAL RESIDENTIAL UNITS (DU)
CVSP Base Condition	0.370	2011
Urban Reserve - Future Condition	0.063	405
CVSP Base + Urban Reserve Condition	0.433	2416
Brookfield - Future Condition	0.621	2785
CVSP Base + Urban Reserve + Brookfield Condition	1.054	5201



**TABLE 16
WASTEWATER FLOW COMPARISON
CREEKVIEW SPECIFIC PLAN**

AVERAGE DRY WEATHER FLOW COMPARISON AT PLEASANT GROVE WASTEWATER TREATMENT PLANT				
WASTEWATER STUDY	DEVELOPMENT AREA			
	CVSP BASE+ URBAN RESERVE ADWF	PANHANDLE ADWF	BROOKFIELD ADWF	TOTAL ADWF
SOUTH PLACER REGIONAL WASTEWATER AND RECYCLED WATER SYSTEMS EVALUATION - UPDATED FINAL REPORT (APPENDIX D - TECH MEMO 2b) DECEMBER 2009	0.503 MGD	0.557 MGD	0.730 MGD	1.790 MGD
CREEKVIEW SPECIFIC PLAN SANITARY SEWER MASTER PLAN NOVEMBER 2010	0.433 MGD	0.000 MGD	0.621 MGD	1.054 MGD
DIFFERENCE	(0.070 MGD)	(0.557 MGD)	(0.109 MGD)	(0.736 MGD)

FIGURES



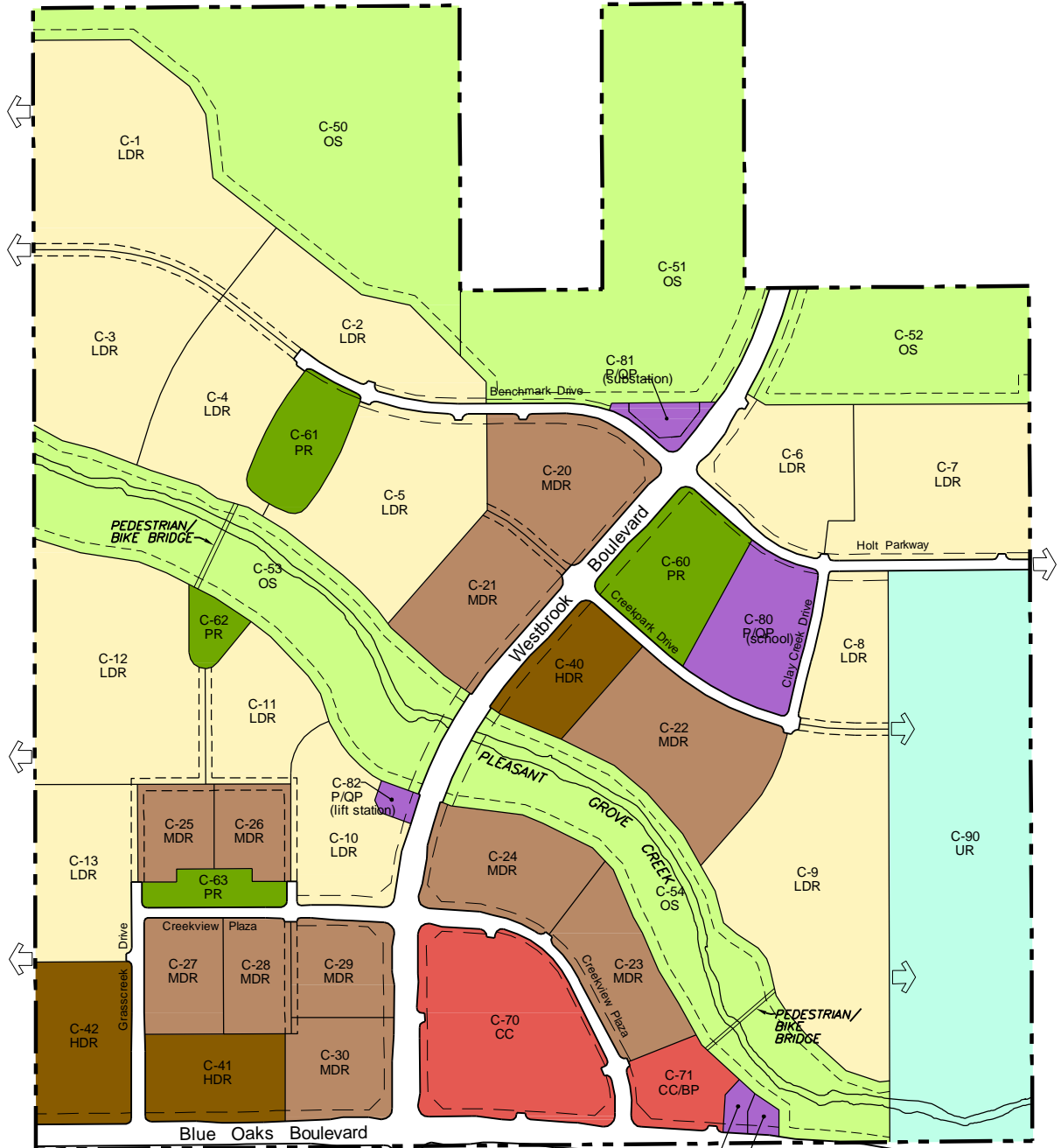
LEGEND

	SPECIFIC PLAN BOUNDARY
	2005 SERVICE AREA BOUNDARY

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FIGURE 1
CREEKVIEW SPECIFIC PLAN
VICINITY MAP
 NOT TO SCALE NOVEMBER 30, 2010

BROOKFIELD SPECIFIC PLAN (FUTURE)



West Roseville Specific Plan Area (WestPark)

Roseville Energy Park

existing Phillip Road

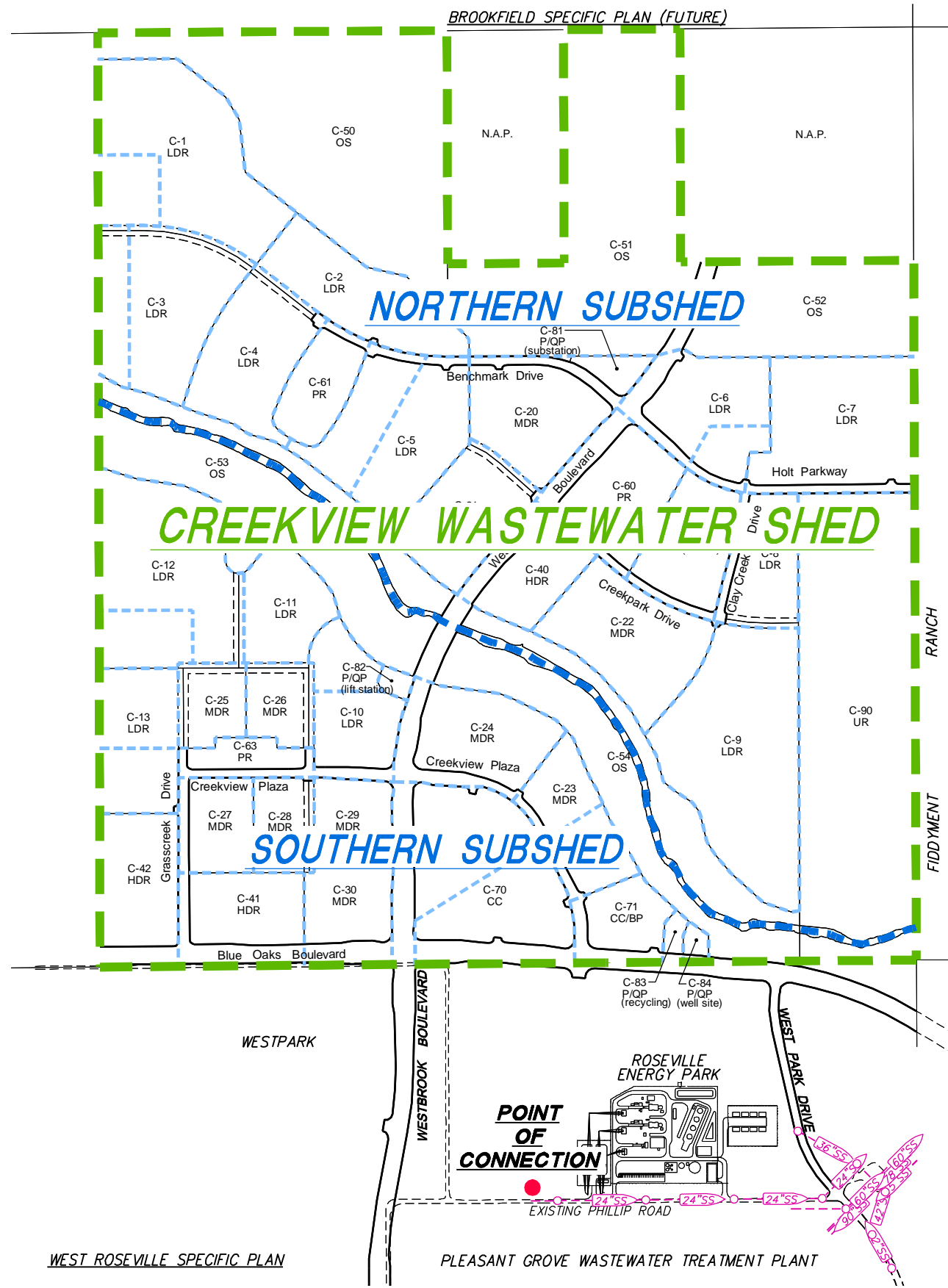
PLEASANT GROVE WASTEWATER TREATMENT PLANT

LAND USE SUMMARY	
Land Use	Acres
Low Density Residential	155.8
Medium Density Residential	64.3
High Density Residential	17.1
subtotal	237.2
Commercial	19.3
P/QP School	7.0
P/QP Electrical Substation/Well/Lift Station/Recycling Center	2.6
subtotal - P/QP	9.5
Open Space	136.2
Park	15.7
Urban Reserve	39.9
Major Roads & Medians	43.4
TOTAL	501.3



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ENGINEERS PLANNERS SURVEYORS

FIGURE 2
CREEKVIEW SPECIFIC PLAN
LAND USE PLAN
CVSP BASE CONDITION
NOT TO SCALE NOVEMBER 30, 2010



LEGEND

- - - - - SPECIFIC PLAN/WASTEWATER SHED BOUNDARY
- - - - - WASTEWATER SUBSHED BOUNDARY
- - - - - SECONDARY WASTEWATER SHED BOUNDARY
- POINT OF CONNECTION



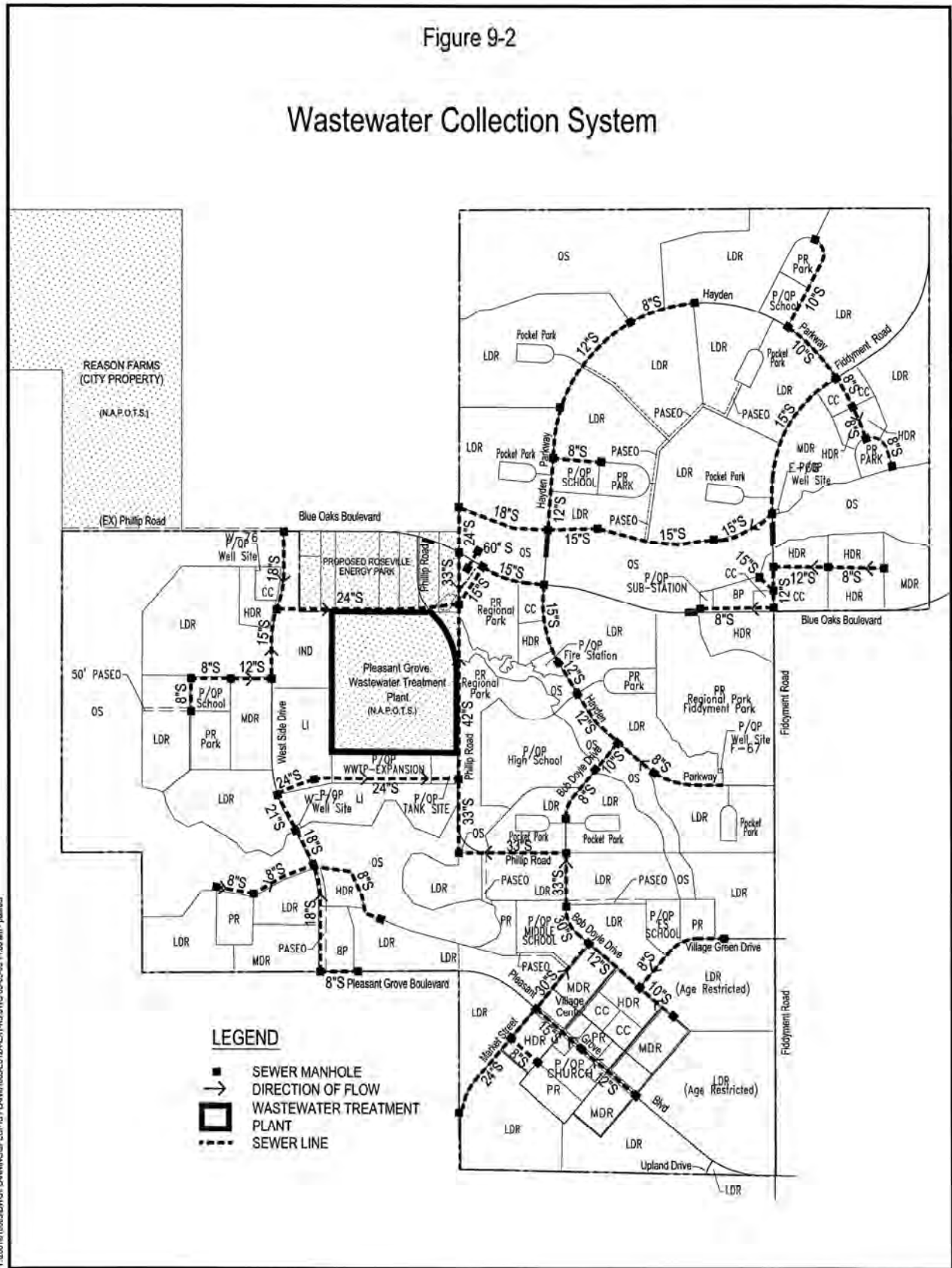
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FIGURE 3
CREEKVIEW SPECIFIC PLAN
SPECIFIC PLAN WASTEWATER SHEDS
 NOT TO SCALE
 NOVEMBER 30, 2010

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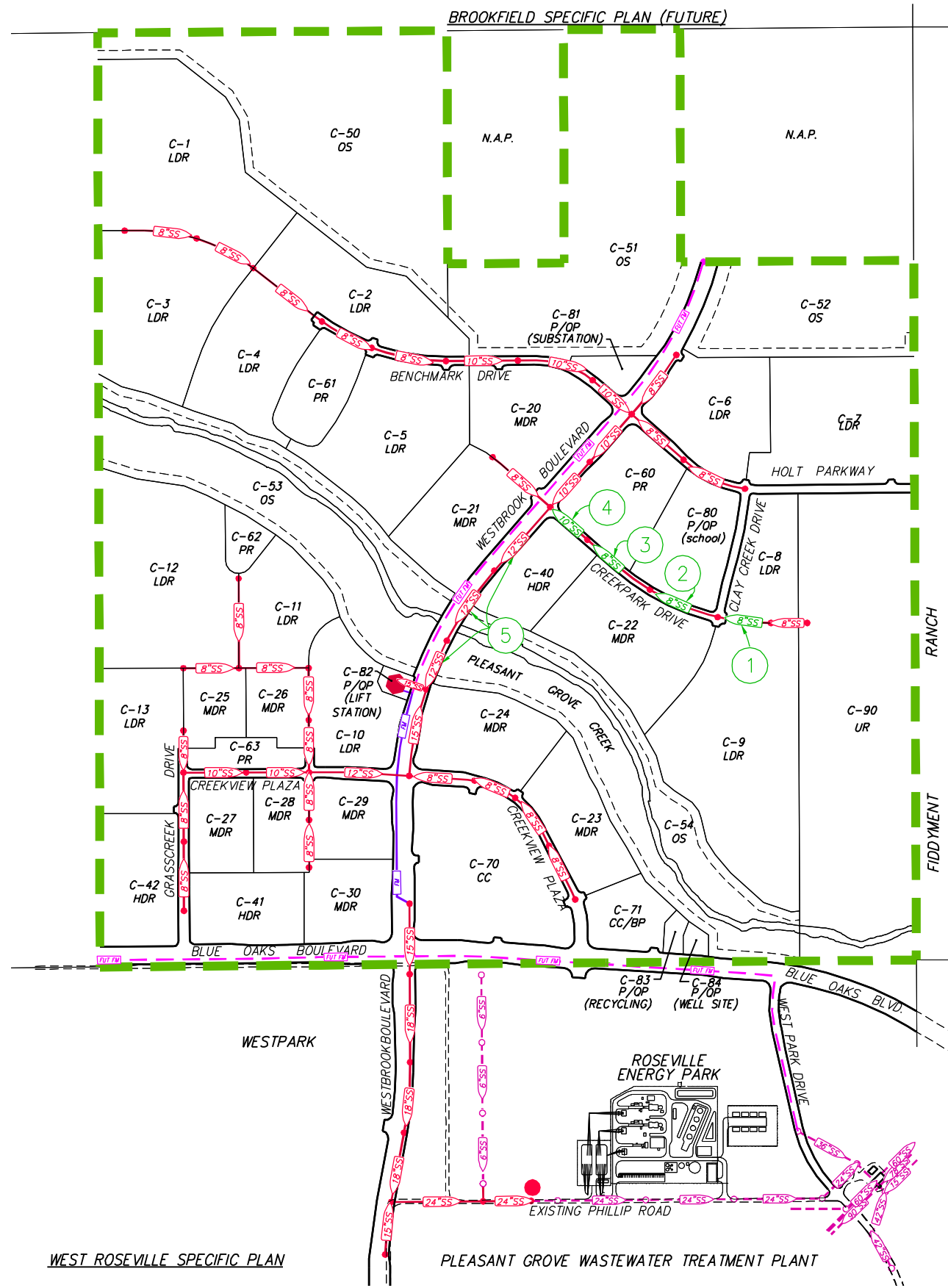
Figure 9-2

Wastewater Collection System



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**FIGURE 4
OFFSITE WASTEWATER COLLECTION SYSTEM**



LEGEND

- SPECIFIC PLAN BOUNDARY
- PIPES REQUIRING UPSIZING
- POINT OF CONNECTION

NOTES:

1. THE GRAVITY SEWER PIPE SHOWN CROSSING PLEASANT GROVE CREEK ON THIS FIGURE IS SCHEMATIC AND IS SHOWN SOLELY TO DEPICT THE CROSSING OF THE CREEK BY THE SEWER SYSTEM. DURING FINAL DESIGN, THE SANITARY SEWER ALIGNMENT AT THE CREEK CROSSING WILL BE ESTABLISHED SUBJECT TO THE REVIEW AND APPROVAL OF THE CITY OF ROSEVILLE. THE FINAL PIPE ALIGNMENT, WHICH WILL NOT LIE BENEATH THE ROADWAY / CREEK CROSSING, WILL INSTEAD BE PLACED ADJACENT TO THE ROADWAY CROSSING, EITHER JUST UPSTREAM OR DOWNSTREAM OF THE DRAINAGE STRUCTURE OR BRIDGE AT THE CREEK CROSSING.

PIPES REQUIRING UPSIZING

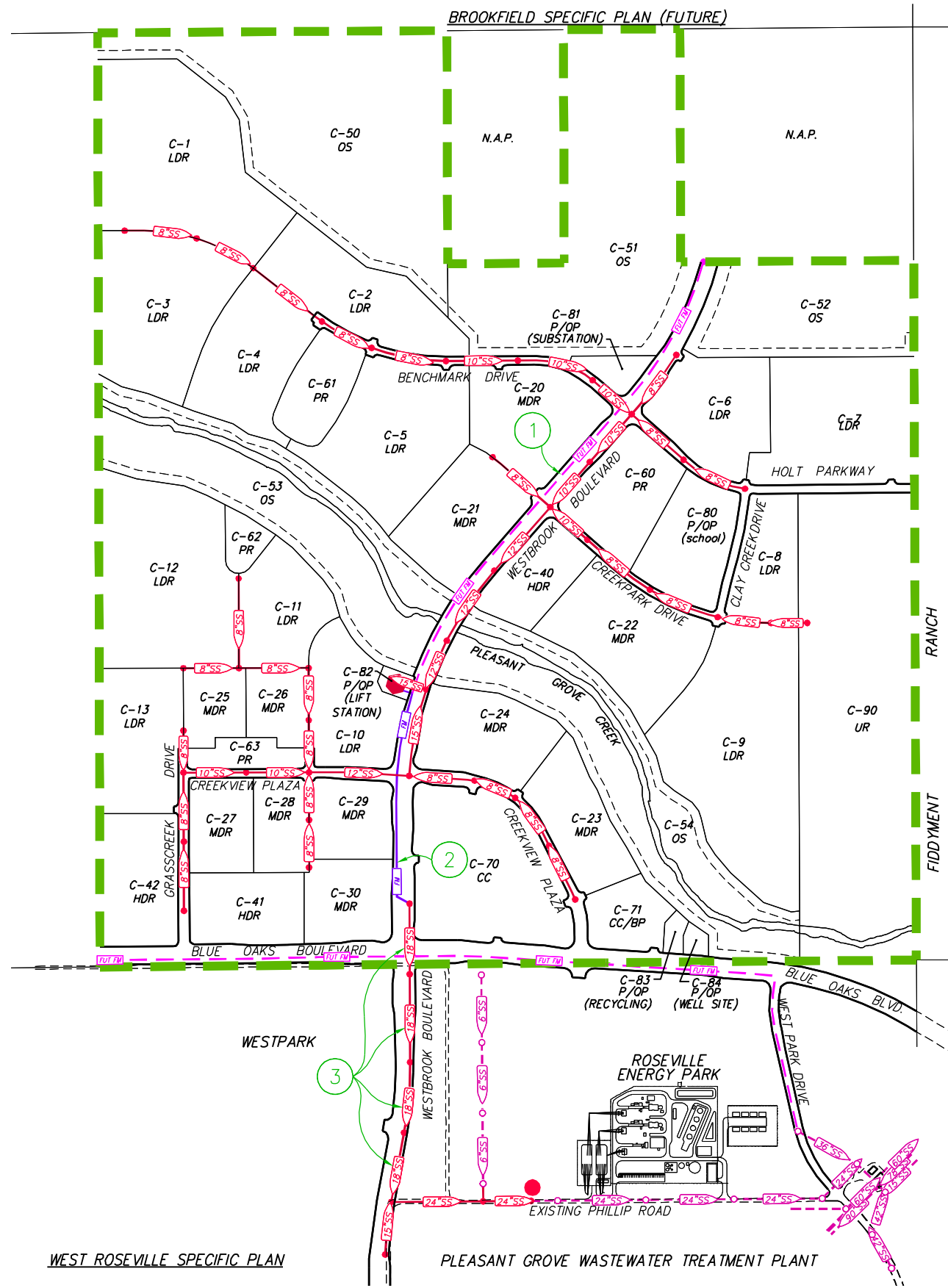
PIPE	UPSTREAM NODE	DOWNSTREAM NODE	PIPE DIAMETER PER CVSP BASE CONDITION	PIPE DIAMETER PER CVSP BASE + URBAN RESERVE CONDITION
1	260	270	8"	10"
2	270	280	8"	10"
3	280	290	8"	12"
4	290	300	10"	12"
5	300	310	12"	15"

FIGURE 6
CREEKVIEW SPECIFIC PLAN
PIPE UPSIZING
CVSP BASE + URBAN RESERVE CONDITION
 NOT TO SCALE
 NOVEMBER 30, 2010

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LEGEND

- SPECIFIC PLAN BOUNDARY
- 1 PIPES REQUIRING UPSIZING
- POINT OF CONNECTION

NOTES:

1. THE GRAVITY SEWER PIPE SHOWN CROSSING PLEASANT GROVE CREEK ON THIS FIGURE IS SCHEMATIC AND IS SHOWN SOLELY TO DEPICT THE CROSSING OF THE CREEK BY THE SEWER SYSTEM. DURING FINAL DESIGN, THE SANITARY SEWER ALIGNMENT AT THE CREEK CROSSING WILL BE ESTABLISHED SUBJECT TO THE REVIEW AND APPROVAL OF THE CITY OF ROSEVILLE. THE FINAL PIPE ALIGNMENT, WHICH WILL NOT LIE BENEATH THE ROADWAY / CREEK CROSSING, WILL INSTEAD BE PLACED ADJACENT TO THE ROADWAY CROSSING, EITHER JUST UPSTREAM OR DOWNSTREAM OF THE DRAINAGE STRUCTURE OR BRIDGE AT THE CREEK CROSSING.

PIPES REQUIRING UPSIZING

PIPE	UPSTREAM NODE	DOWNSTREAM NODE	PIPE DIAMETER PER CVSP BASE CONDITION	PIPE DIAMETER PER CVSP BASE + URBAN RESERVE + BROOKFIELD CONDITION
1	330	340	N/A	10"FM
2	340	350	10"FM	12"FM
3	350	370	18"	21"

**FIGURE 7
CREEKVIEW SPECIFIC PLAN
PIPE UPSIZING**

CVSP BASE + URBAN RESERVE + BROOKFIELD CONDITION

NOT TO SCALE

NOVEMBER 30, 2010

LEGEND

- (A) WET WELL - 10' DIAMETER
- (B) VALVE VAULT
- (C) PUMP CONTROL BUILDING
- (D) STANDBY GENERATOR
- (E) TRANSFORMER PAD
- (F) MASONRY WALL - 6' HEIGHT
- (G) ACCESS GATE
- (H) PAVED ACCESS - 20' WIDE

NOTES

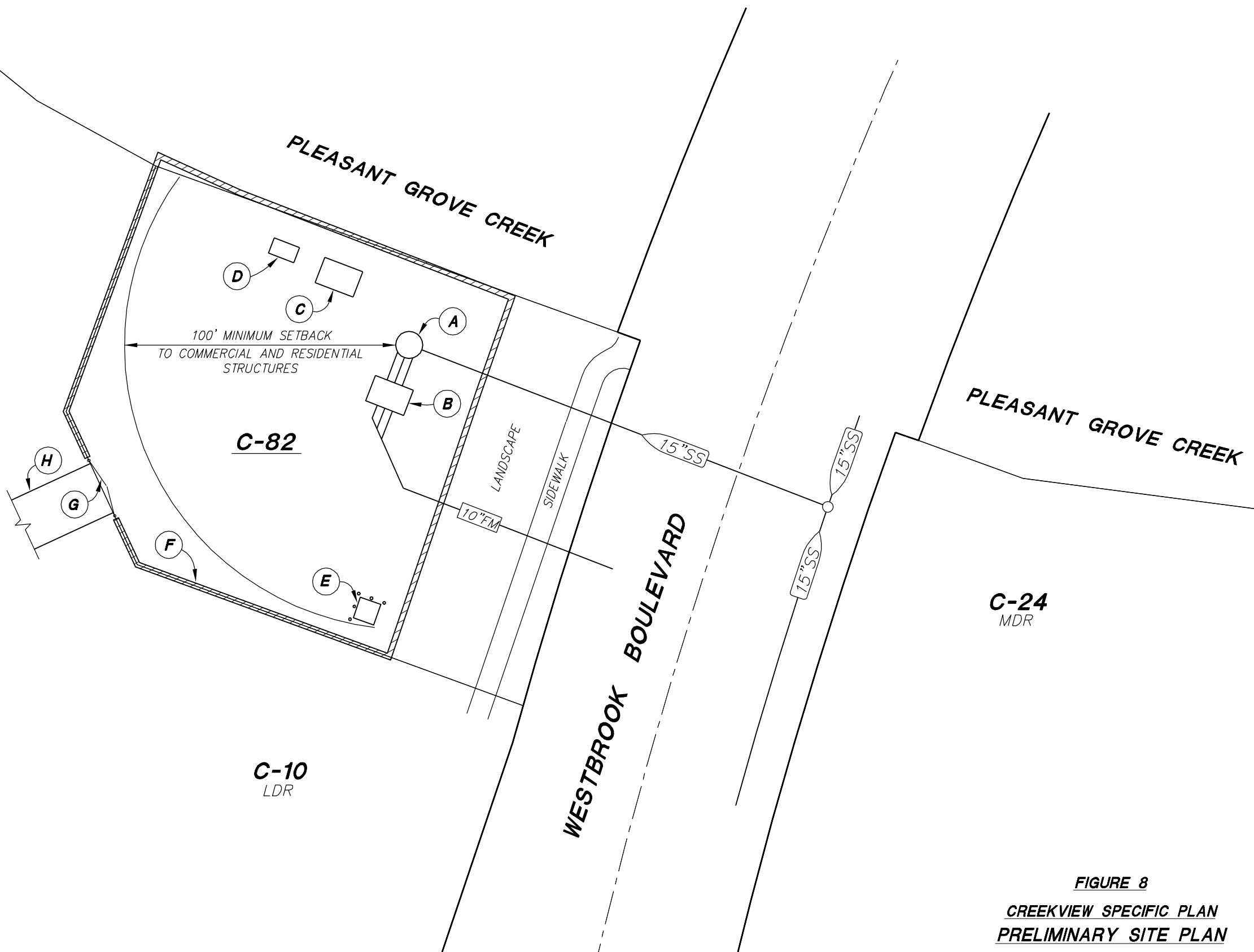
1. ACCESS TO THE SEWER LIFT STATION SITE SHALL BE THROUGH PARCEL C-10. THE ACCESS LOCATION SHOWN ON THIS FIGURE IS PRELIMINARY AND MAY BE CHANGED DURING THE DESIGN OF THE LAND USE PLAN FOR PARCEL C-10. THE FINAL LOCATION OF THE ACCESS ROAD SERVING THE LIFT STATION SITE IS SUBJECT TO REVIEW AND APPROVAL OF THE CITY OF ROSEVILLE.

C-10
LDR

C-82

C-10
LDR

C-24
MDR

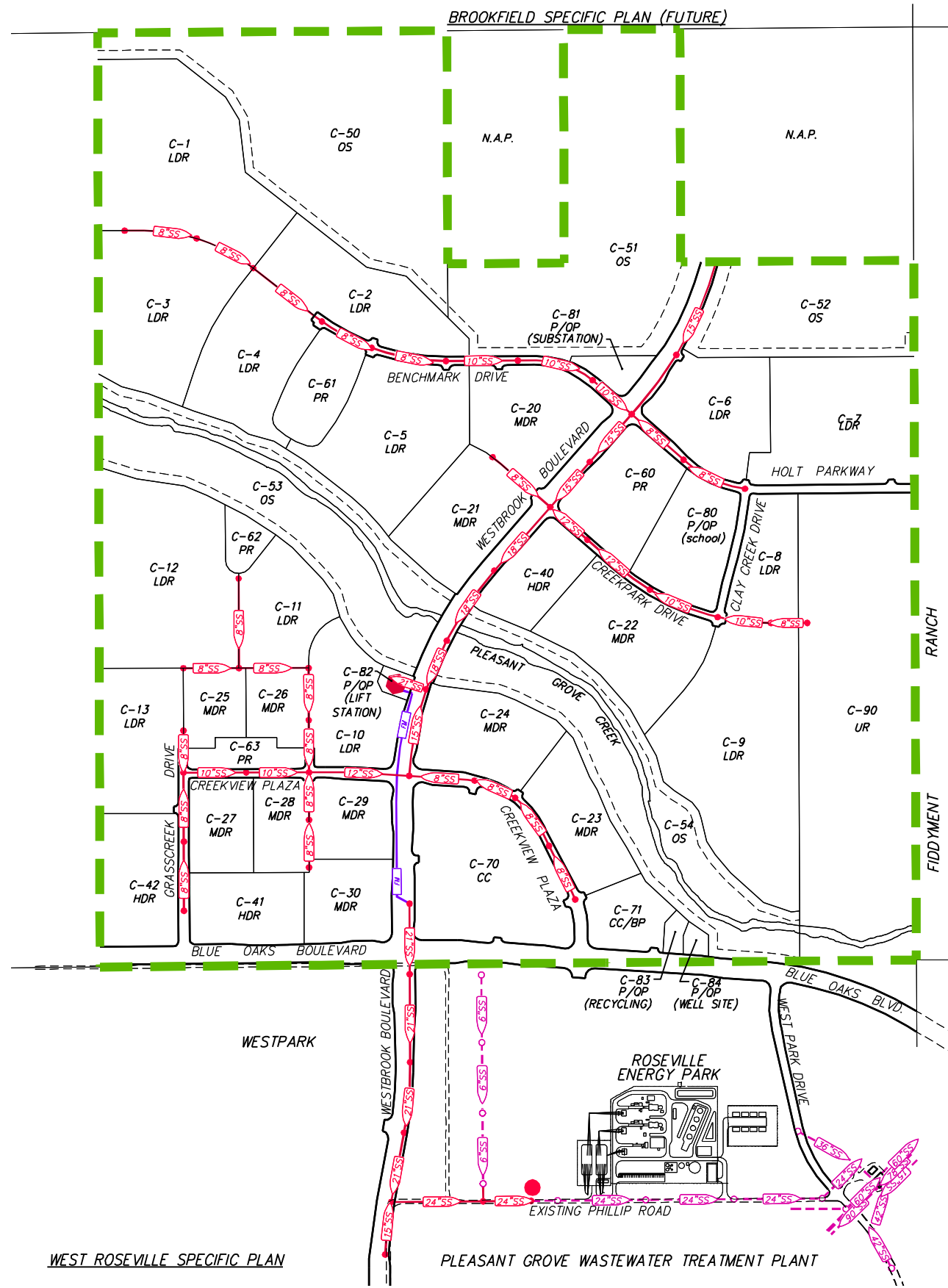


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FIGURE 8
CREEKVIEW SPECIFIC PLAN
PRELIMINARY SITE PLAN
SEWER LIFT STATION

SCALE: 1" = 40' NOVEMBER 30, 2010

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LEGEND

-  SPECIFIC PLAN BOUNDARY
-  SEWER FORCE MAIN
-  SEWER TRUNK LINE
-  POINT OF CONNECTION

NORTH



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FIGURE 9
CREEKVIEW SPECIFIC PLAN
ALTERNATIVE DESIGN
FOR FORCE MAIN AND LIFT STATIONS

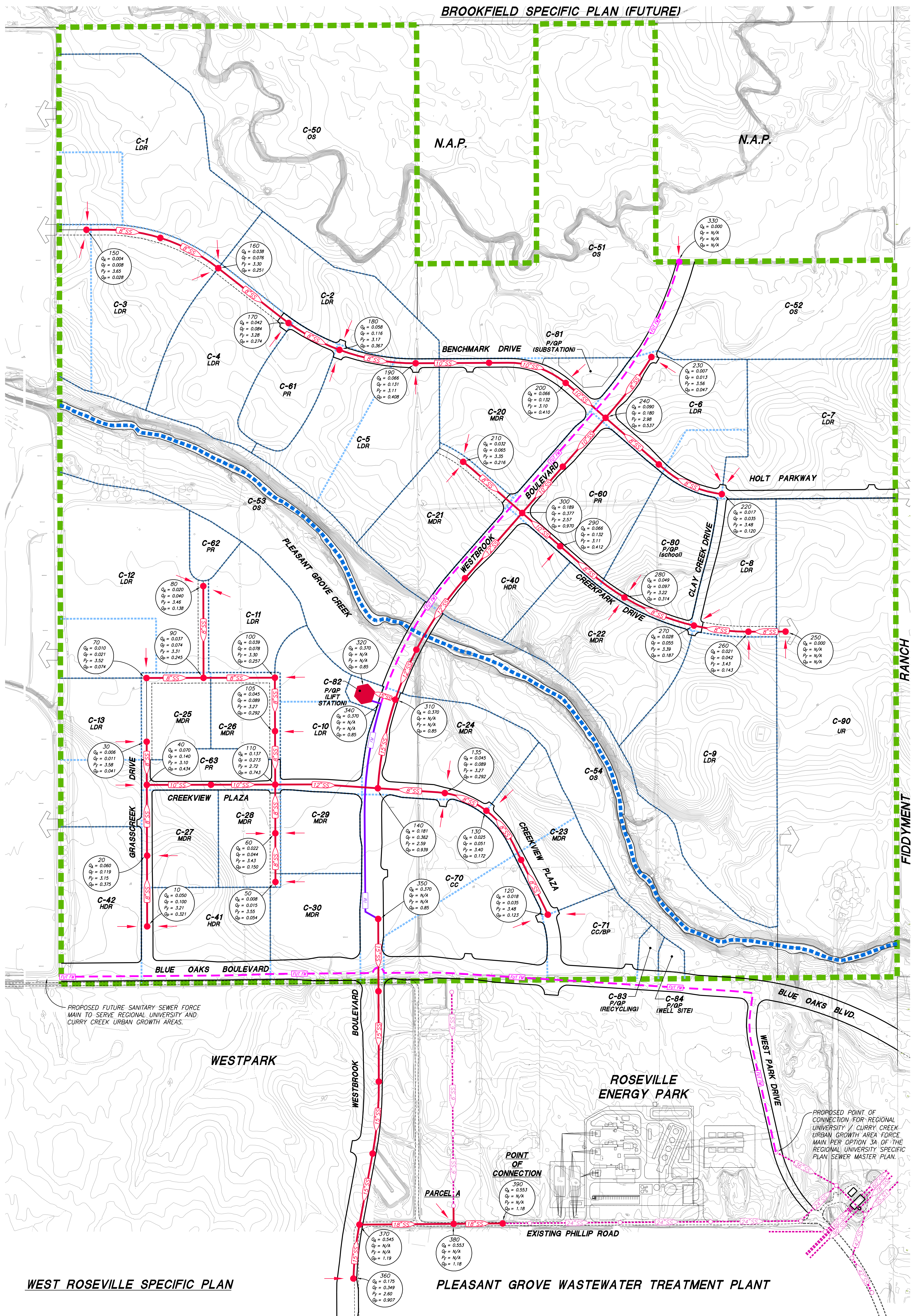
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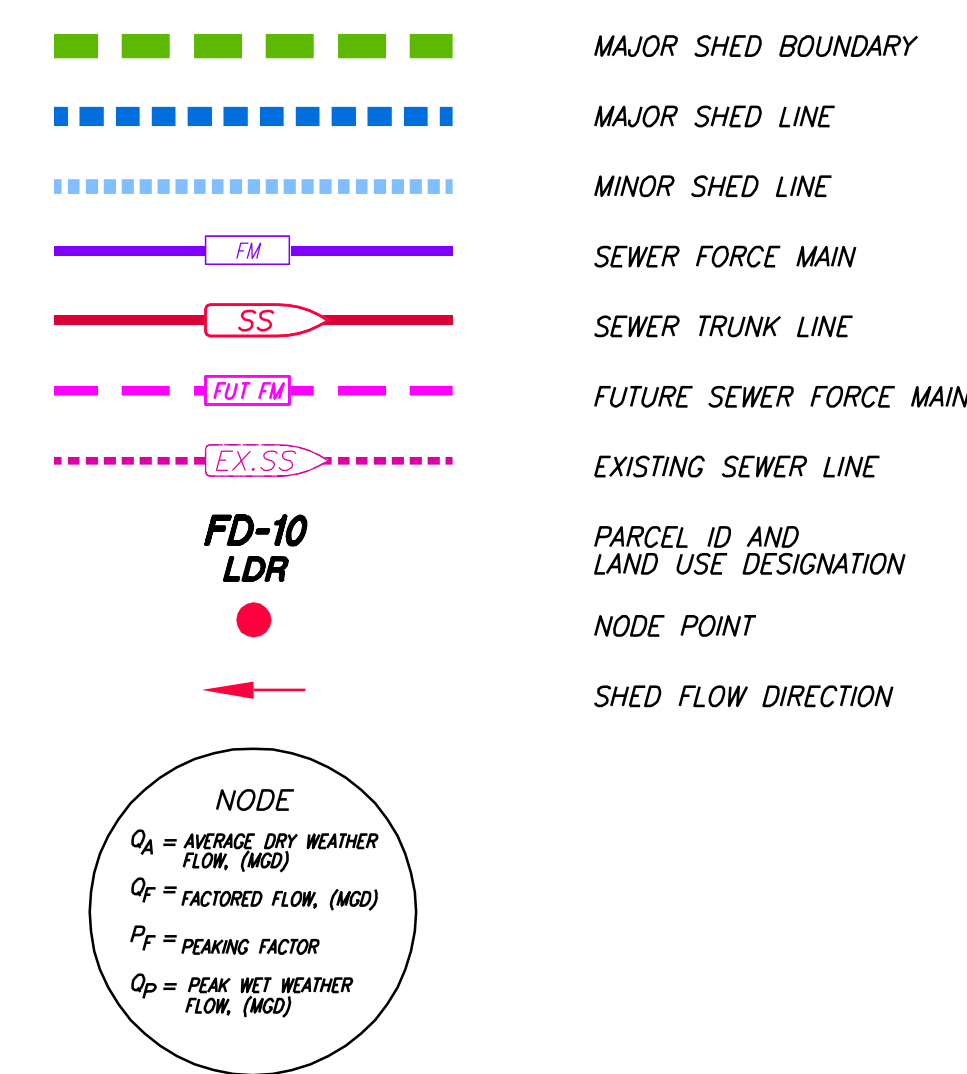
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OVERSIZED EXHIBITS

BROOKFIELD SPECIFIC PLAN (FUTURE)



LEGEND



NODE DATA			
PARCEL	AREA	PROJECTED DU	TRIBUTARY TO NODE
C-1 (LDR)	19.8	95	150, 160
C-2 (LDR)	9.8	50	180
C-3 (LDR)	13.9	70	150, 160
C-4 (LDR)	9.7	55	160, 170
C-5 (LDR)	13.0	75	180, 190
C-6 (LDR)	7.8	46	220, 230
C-7 (LDR)	13.5	80	220
C-8 (LDR)	5.5	35	270
C-9 (LDR)	22.0	110	260
C-10 (LDR)	7.0	40	100, 105
C-11 (LDR)	6.9	35	80
C-12 (LDR)	18.2	90	70, 80
C-13 (LDR)	8.7	55	30, 40
C-20 (MDR)	8.0	75	210
C-21 (MDR)	7.7	95	210
C-22 (MDR)	11.4	105	280
C-23 (MDR)	6.2	80	120, 130
C-24 (MDR)	7.1	65	135
C-25 (MDR)	3.5	35	70
C-26 (MDR)	3.5	35	90
C-27 (MDR)	4.5	50	20
C-28 (MDR)	3.9	35	60
C-29 (MDR)	4.1	40	60
C-30 (MDR)	4.4	40	50
C-40 (HDR)	4.5	135	290
C-41 (HDR)	5.4	165	10
C-42 (HDR)	7.2	220	10
C-70 (CC)	15.5	120, 135	
C-71 (CC/BP)	3.8		120
C-80 (PUB)	7.0		280
C-81 (PUB)	0.9		200
C-82 (PUB)	0.6		320
C-83 (PUB)	0.6		120
C-84 (PUB)	0.5		120
C-90 (UR)	39.9	405	250
BROOKFIELD	444.7	2785	330
WRSP		657	360
PARCEL A (CC)	9.6		380

TABLE 1 - PIPELINE CAPACITY SUMMARY			
PIPE DIAMETER	MINIMUM SLOPE	0.7 FULL FLOW	1.0 FULL FLOW
6"	0.005	0.21	0.25
8"	0.0035	0.38	0.46
10"	0.0025	0.59	0.70
12"	0.002	0.86	1.02
15"	0.0015	1.35	1.61
18"	0.0012	1.96	2.35
21"	0.001	2.71	3.23
24"	0.0008	3.46	4.13

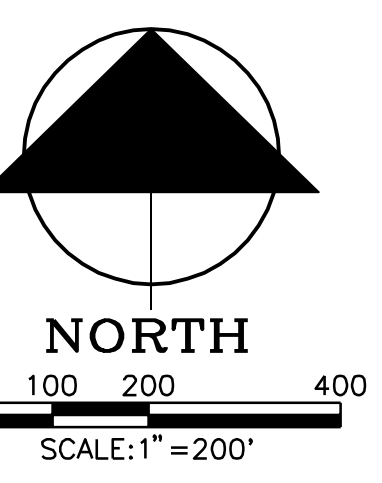
= USED FOR PRELIMINARY DESIGN

NOTES:

- COVER FROM TOP OF PIPE TO FLOW LINE OF CREEK CROSSINGS IS 3.0' MIN.
- PEAK WET WEATHER FLOWS AT NODES 310, 320, 330, 340, 350, 370, 380, AND 390 HAVE BEEN CALCULATED BASED ON HYDRAULIC MODELING.
- PIPES DOWN STREAM FROM NODES 310, 320, 330, 340, 350, 370, 380, AND 390 HAVE BEEN SIZED BASED ON HYDRAULIC MODELING.
- MINOR WASTEWATER SHED BOUNDARY ADJUSTMENTS MAY BE NECESSARY DURING FINAL UTILITY AND GRADING DESIGN, SUBJECT TO THE REVIEW AND APPROVAL OF THE CITY OF ROSEVILLE.
- THE GRAVITY SEWER PIPE SHOWN CROSSING PLEASANT GROVE CREEK ON THIS EXHIBIT IS SCHEMATIC AND IS SHOWN SOLELY TO DEPICT THE CROSSING OF THE CREEK BY THE SEWER SYSTEM. DURING FINAL DESIGN, THE SANITARY SEWER ALIGNMENT AT THE CREEK CROSSING WILL BE ESTABLISHED SUBJECT TO THE REVIEW AND APPROVAL OF THE CITY OF ROSEVILLE. THE FINAL PIPE ALIGNMENT, WHICH WILL NOT LIE BENEATH THE ROADWAY / CREEK CROSSING, WILL INSTEAD BE PLACED ADJACENT TO THE ROADWAY CROSSING, EITHER JUST UPSTREAM OR DOWNSTREAM OF THE DRAINAGE STRUCTURE OR BRIDGE AT THE CREEK CROSSING.

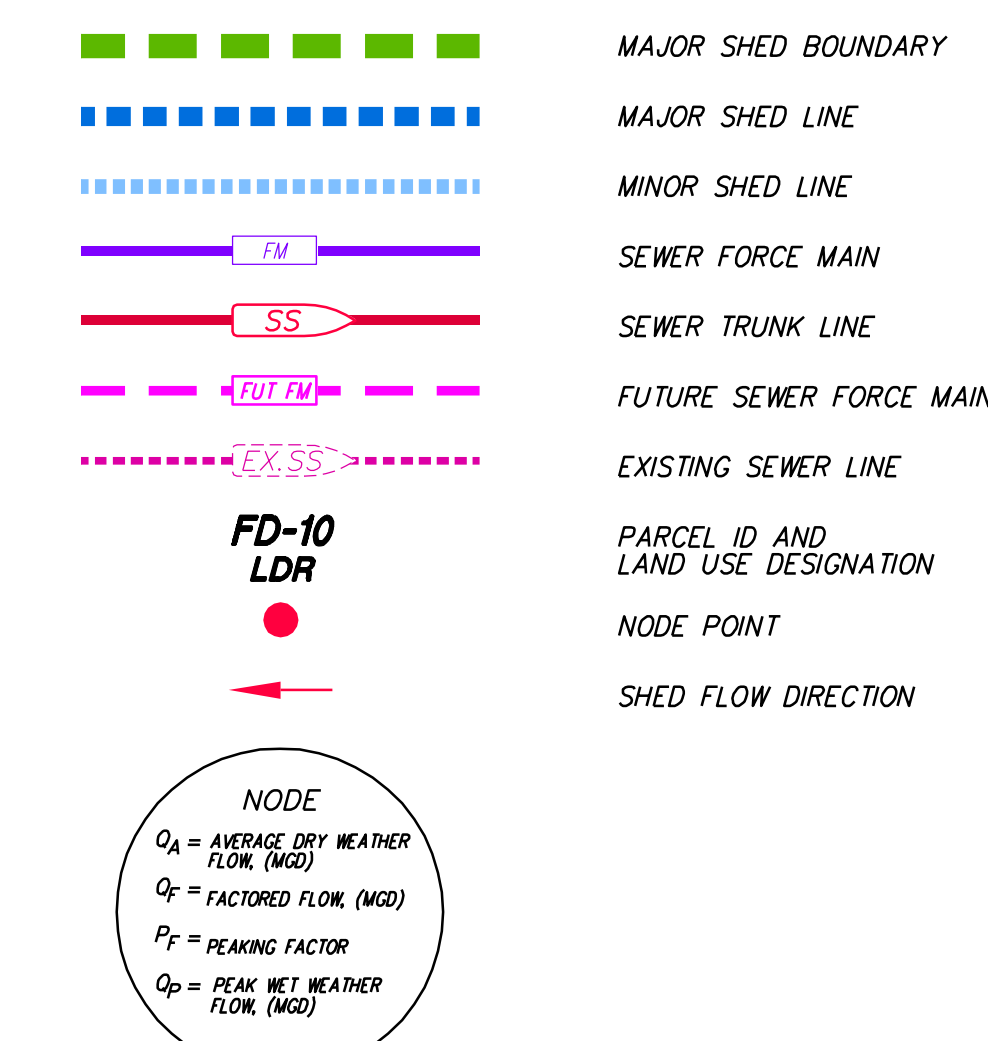
CREEKVIEW SPECIFIC PLAN
SANITARY SEWER MASTER PLAN
 CVSP BASE CONDITION

SCALE: 1"=200' NOVEMBER 30, 2010



BROOKFIELD SPECIFIC PLAN (FUTURE)

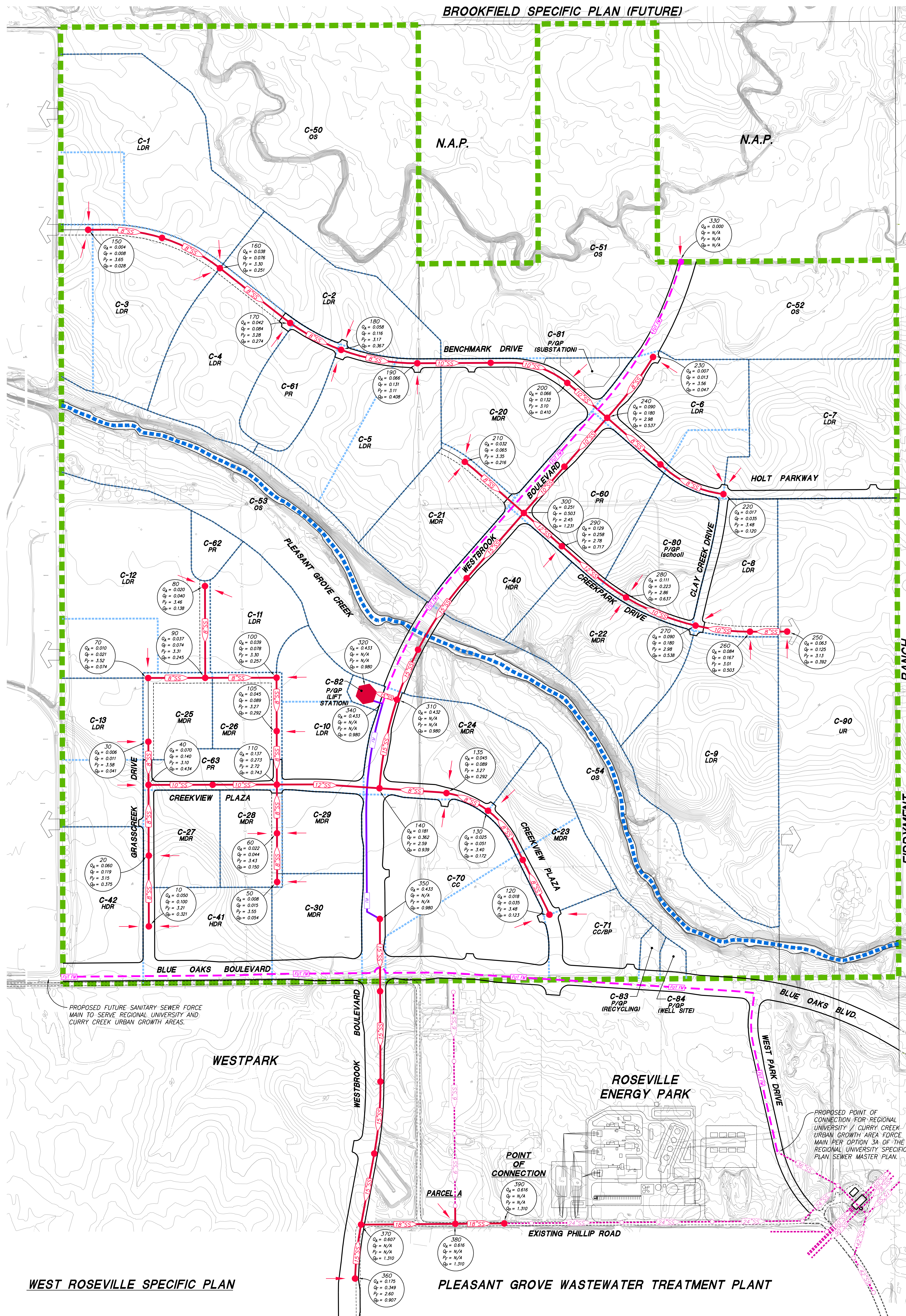
LEGEND



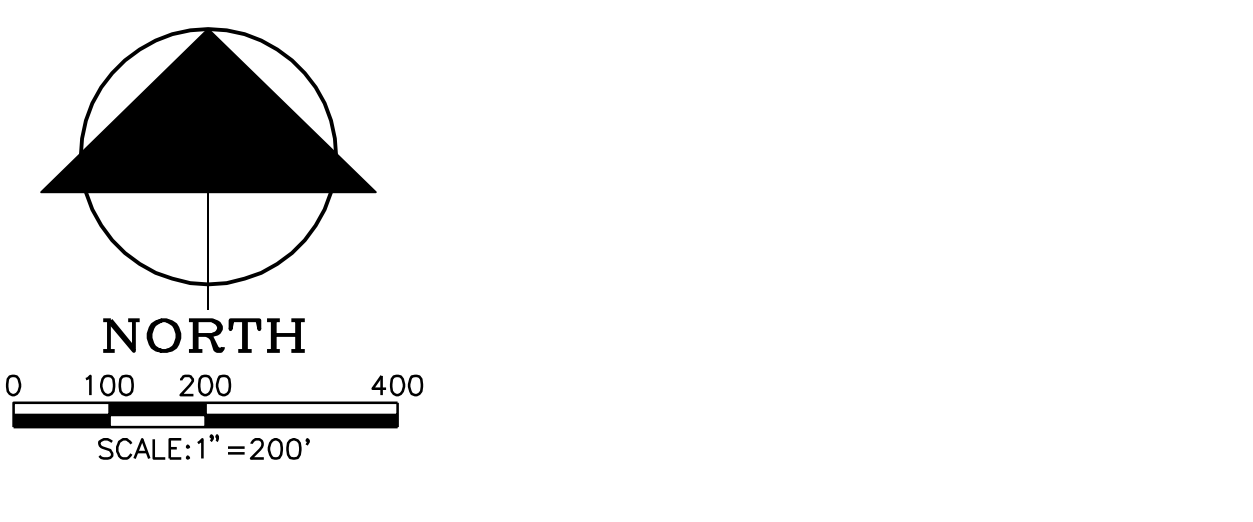
PARCEL	AREA	PROJECTED DU	TRIBUTARY TO NODE
C-1 (LDR)	19.8	95	150, 160
C-2 (LDR)	9.8	50	180
C-3 (LDR)	13.9	70	150, 160
C-4 (LDR)	9.7	55	160, 170
C-5 (LDR)	13.0	75	180, 190
C-6 (LDR)	7.8	46	220, 230
C-7 (LDR)	13.5	80	220
C-8 (LDR)	5.5	35	270
C-9 (LDR)	22.0	110	260
C-10 (LDR)	7.0	40	100, 105
C-11 (LDR)	6.9	35	80
C-12 (LDR)	18.2	90	70, 80
C-13 (LDR)	8.7	55	30, 40
C-20 (MDR)	8.0	75	210
C-21 (MDR)	7.7	95	210
C-22 (MDR)	11.4	105	280
C-23 (MDR)	6.2	80	120, 130
C-24 (MDR)	7.1	65	135
C-25 (MDR)	3.5	35	70
C-26 (MDR)	3.5	35	90
C-27 (MDR)	4.5	50	20
C-28 (MDR)	3.9	35	60
C-29 (MDR)	4.1	40	60
C-30 (MDR)	4.4	40	50
C-40 (HDR)	4.5	135	290
C-41 (HDR)	5.4	165	10
C-42 (HDR)	7.2	220	10
C-70 (CC)	15.5	125	120, 135
C-71 (CC/BP)	3.8		120
C-80 (PUB)	7.0		280
C-81 (PUB)	0.9		200
C-82 (PUB)	0.6		320
C-83 (PUB)	0.6		120
C-84 (PUB)	0.5		120
C-90 (UR)	39.9	405	250
BROOKFIELD	444.7	2785	330
WRSP		657	360
PARCEL A (CC)	9.6		380

PIPE DIAMETER	MINIMUM SLOPE	0.7 FULL	1.0 FULL
6"	0.005	0.21	0.25
8"	0.0035	0.38	0.46
10"	0.0025	0.59	0.70
12"	0.002	0.86	1.02
15"	0.0015	1.35	1.61
18"	0.0012	1.96	2.35
21"	0.001	2.71	3.23
24"	0.0008	3.46	4.13

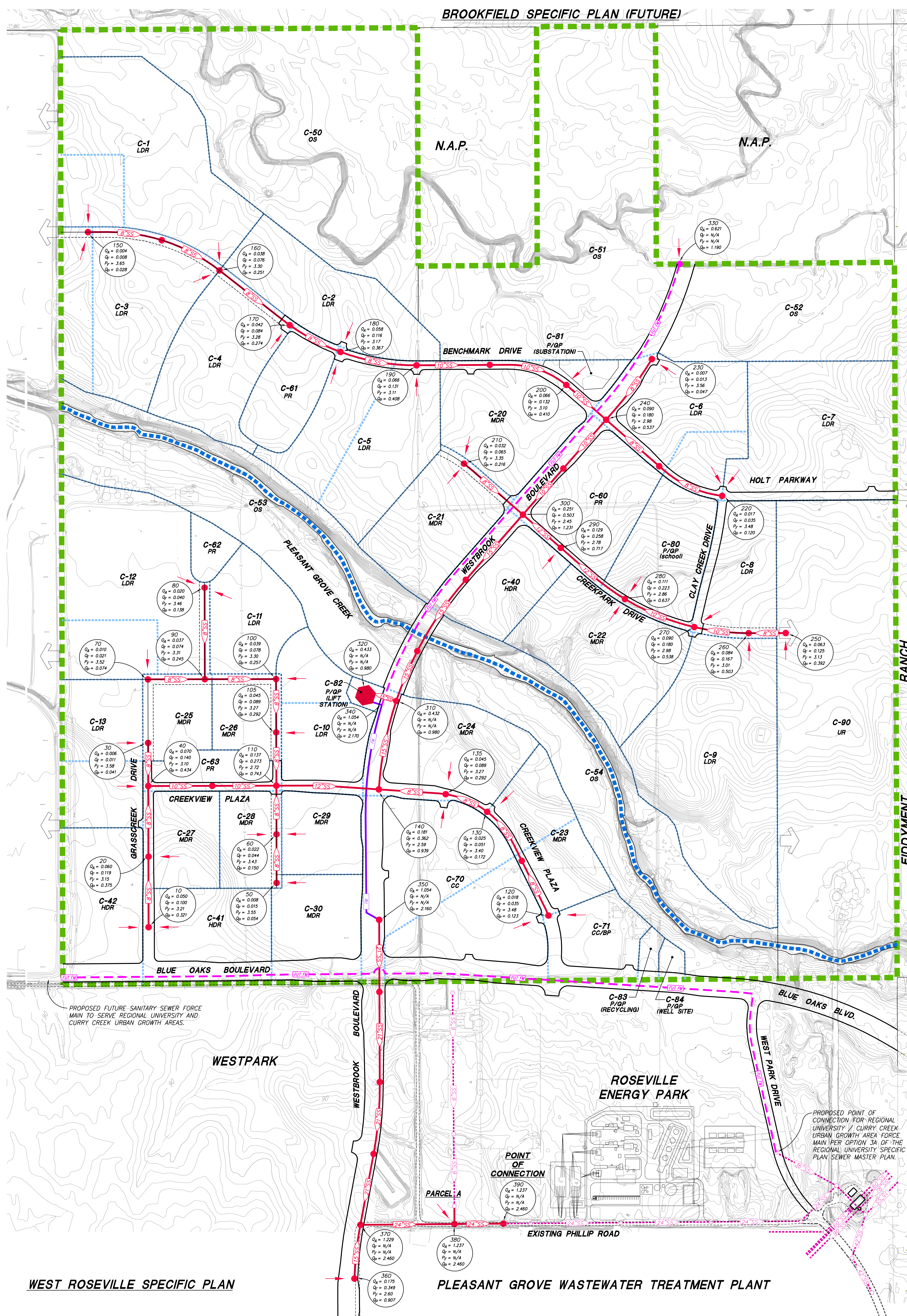
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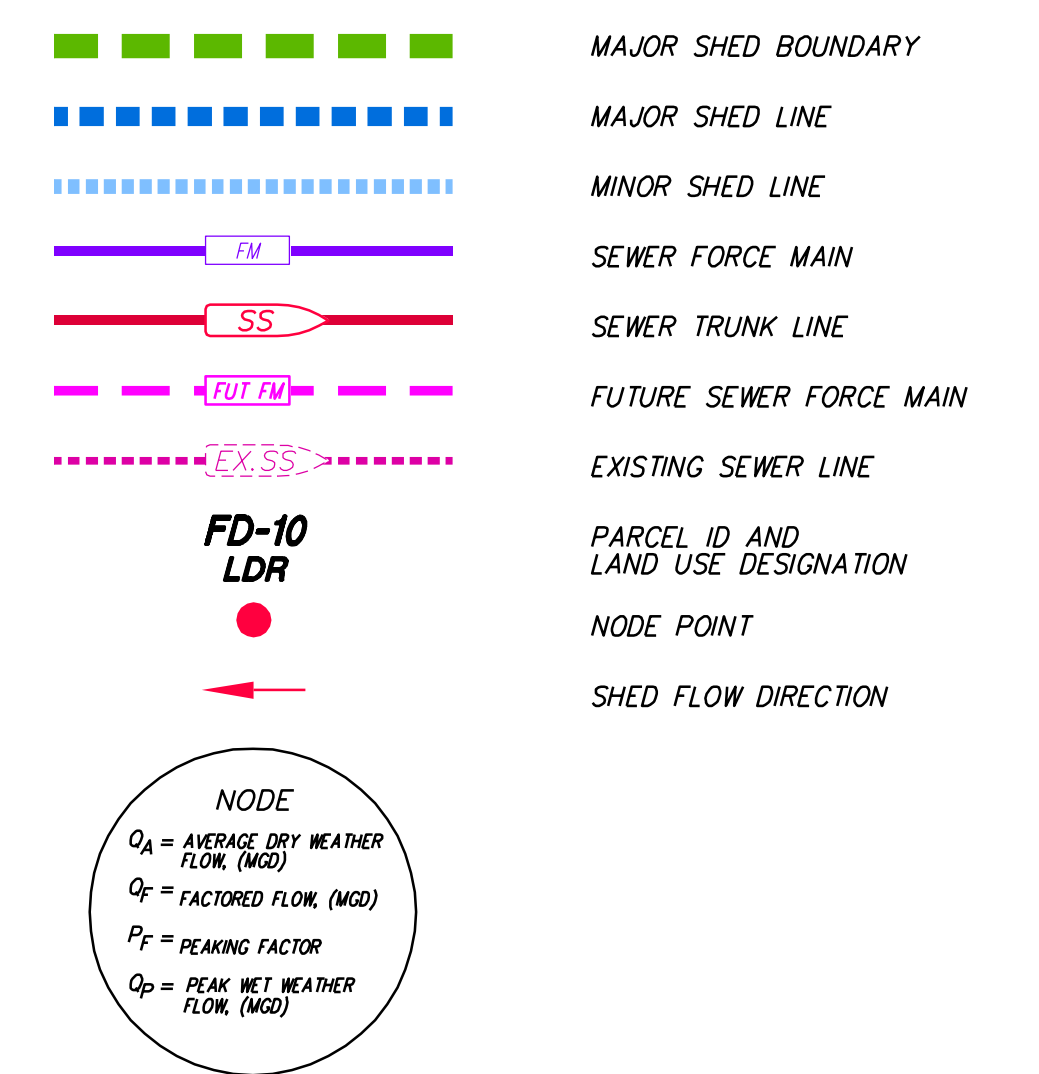
- NOTES:
- COVER FROM TOP OF PIPE TO FLOW LINE OF CREEK CROSSINGS IS 3.0' MIN.
 - PEAK WET WEATHER FLOWS AT NODES 310, 320, 330, 340, 350, 370, 380, AND 390 HAVE BEEN CALCULATED BASED ON HYDRAULIC MODELING.
 - PIPES DOWN STREAM FROM NODES 310, 320, 330, 340, 350, 370, 380, AND 390 HAVE BEEN SIZED BASED ON HYDRAULIC MODELING.
 - THE 167 UNITS OF MEDIUM DENSITY RESIDENTIAL AND 238 UNITS OF HIGH DENSITY RESIDENTIAL FUTURE LAND USE ON C-90 (URBAN RESERVE) ARE INCLUDED IN THE HYDRAULIC MODELING.
 - MINOR WASTEWATER SHED BOUNDARY ADJUSTMENTS MAY BE NECESSARY DURING FINAL UTILITY AND GRADING DESIGN. SUBJECT TO THE REVIEW AND APPROVAL OF THE CITY OF ROSEVILLE.
 - THE GRAVITY SEWER PIPE SHOWN CROSSING PLEASANT GROVE CREEK ON THIS EXHIBIT IS SCHEMATIC AND IS SHOWN SOLELY TO DEPICT THE CROSSING OF THE CREEK BY THE SEWER SYSTEM. DURING FINAL DESIGN, THE SANITARY SEWER ALIGNMENT AT THE CREEK CROSSING WILL BE ESTABLISHED SUBJECT TO THE REVIEW AND APPROVAL OF THE CITY OF ROSEVILLE. THE FINAL PIPE ALIGNMENT, WHICH WILL NOT LIE BENEATH THE ROADWAY / CREEK CROSSING, WILL INSTEAD BE PLACED ADJACENT TO THE ROADWAY CROSSING, EITHER JUST UPSTREAM OR DOWNSTREAM OF THE DRAINAGE STRUCTURE OR BRIDGE AT THE CREEK CROSSING.



CREEKVIEW SPECIFIC PLAN
SANITARY SEWER MASTER PLAN
 CVSP BASE + URBAN RESERVE CONDITION
 SCALE: 1"=200' NOVEMBER 30, 2010



LEGEND



NODE DATA

PARCEL	AREA	PROJECTED	TRIBUTARY TO NODE
C-1 (LDR)	19.8	95	150, 160
C-2 (LDR)	9.8	50	180
C-3 (LDR)	13.9	70	150, 160
C-4 (LDR)	9.7	55	160, 170
C-5 (LDR)	13.0	75	180, 190
C-6 (LDR)	7.8	46	220, 230
C-7 (LDR)	13.5	80	220
C-8 (LDR)	5.5	35	270
C-9 (LDR)	22.0	110	260
C-10 (LDR)	7.0	40	100, 105
C-11 (LDR)	6.9	35	80
C-12 (LDR)	18.2	90	70, 80
C-13 (LDR)	8.7	55	30, 40
C-20 (MDR)	8.0	75	210
C-21 (MDR)	7.7	95	210
C-22 (MDR)	11.4	105	280
C-23 (MDR)	6.2	80	120, 130
C-24 (MDR)	7.1	65	135
C-25 (MDR)	3.5	35	70
C-26 (MDR)	3.5	35	90
C-27 (MDR)	4.5	50	20
C-28 (MDR)	3.9	35	60
C-29 (MDR)	4.1	40	60
C-30 (MDR)	4.4	40	50
C-40 (HDR)	4.5	135	290
C-41 (HDR)	5.4	165	10
C-42 (HDR)	7.2	220	10
C-70 (CC)	15.5	155	120, 135
C-71 (CC/BP)	3.8		120
C-80 (PUB)	7.0		280
C-81 (PUB)	0.9		200
C-82 (PUB)	0.6		320
C-83 (PUB)	0.6		120
C-84 (PUB)	0.5		120
C-90 (UR)	39.9	405	250
BROOKFIELD	444.7	2785	330
WRSP		657	360
PARCEL A (CC)	9.6		380

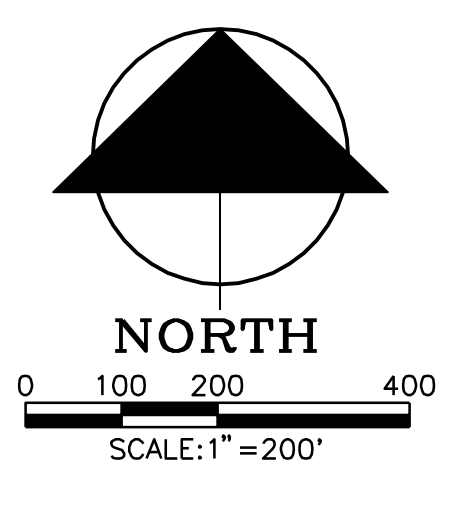
TABLE 1 - PIPELINE CAPACITY SUMMARY

PIPE DIAMETER	MINIMUM SLOPE	0.7 FULL	1.0 FULL
6"	0.005	0.21	0.25
8"	0.0035	0.38	0.46
10"	0.0025	0.59	0.70
12"	0.002	0.86	1.02
15"	0.0015	1.35	1.61
18"	0.0012	1.96	2.35
21"	0.001	2.71	3.23
24"	0.0008	3.46	4.13

= USED FOR PRELIMINARY DESIGN

NOTES:

- COVER FROM TOP OF PIPE TO FLOW LINE OF CREEK CROSSINGS IS 3.0' MIN.
- PEAK WET WEATHER FLOWS AT NODES 310, 320, 330, 340, 350, 370, 380, AND 390 HAVE BEEN CALCULATED BASED ON HYDRAULIC MODELING.
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CREEKVIEW SPECIFIC PLAN
SANITARY SEWER MASTER PLAN
 CVSP BASE + URBAN RESERVE + BROOKFIELD CONDITION
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MACKAY & SOMPS
 ENGINEERS PLANNERS SURVEYORS
 1022 Lurline Road, Suite 100, Roseville, CA 95661 (916) 773-1188

ATTACHMENTS

ATTACHMENT #1

Final Technical Memorandum



Creekview Sewer Modeling

Subject: Trunk Sewer Model for Creekview
Prepared For: Mike Smith, MacKay and Somsps
Prepared by: Chris van Lienden, RMC
Reviewed by: Glenn Hermanson, RMC
Date: August 10, 2010
Reference: 0201-004

1 Introduction

The purpose of this technical memorandum (TM) is to describe the sanitary sewer hydraulic modeling conducted for the Creekview urban growth area (UGA) near the City of Roseville in Placer County. This TM was prepared for MacKay and Somsps Civil Engineers, Inc (MacKay and Somsps).

The Creekview UGA is within the ultimate service area of the South Placer Wastewater Authority (SPWA). As such, MacKay and Somsps was asked by SPWA to add portions of the planned Creekview sanitary sewer system to an existing hydraulic model of the SPWA trunk sewer system. Prior to the preparation of this TM, a Sanitary Sewer Master Plan had been prepared by MacKay and Somsps for the Creekview UGA. The Sanitary Sewer Master Plan provides the basis for the modeling described in this TM.

As part of the South Placer Regional Wastewater and Recycled Water Systems Evaluation (Systems Evaluation), a TM titled *Unit Flow Factor Sets and Sewer Design Criteria* (TM 3a) was prepared by SPWA to provide criteria for the sizing of sewers for new developments. TM 3a states that for the sizing of future infrastructure facilities, the hydraulic model of the trunk sewer system should be used for pipes 15 to 18 inches in diameter and larger. TM 3a is attached to this TM (Attachment B).

Three alternatives were evaluated corresponding to three different potential loading scenarios: Base, Base plus Urban Reserve, Base plus Urban Reserve plus Brookfield UGA. Loading and pipeline invert information for these scenarios was provided by Mackay and Somsps.

1.1 Information Source

The alignments, diameters, inverts, and slopes of modeled sewers, as well as the locations, rim elevations, tributary areas and wastewater flow information associated with the modeled manholes for the proposed infrastructure were provided by MacKay and Somsps. A summary of this information is provided in Attachment A.

2 Hydraulic Model

Pipes 18 inches in diameter and larger in the Creekview UGA sanitary sewer system were added to an existing SPWA trunk sewer model. The SPWA trunk sewer model was designed to function as an extended period simulation, and features land use-specific diurnal curves, a design storm, and unit hydrographs for the purpose of simulating time-varying wastewater flows in the trunk sewer system during a design storm event. These same features were applied to the modeled Creekview trunk sewers. For more information on the development of the SPWA trunk sewer model, refer to the SPWA TM titled

Trunk Sewer Hydraulic Analysis (TM 3b). Since the publication of TM 3b, the city of Roseville has constructed a number of pipes in West Roseville, including a 24 inch pipe on Phillip Road which would serve Creekview, a portion of West Roseville, and potentially Brookfield. These newly constructed pipes have been added to the SPWA trunk sewer model for the current analysis. This analysis uses the Buildout PWWF model described in TM 3b. The RDI/I and GWI rate parameters used were the same as surrounding UGAs (GWI: 100 gpad for the Pleasant Grove basin).

The pipe segment from Node 310 to Node 320 (Lift Station C-43) was not modeled as proposed inverts were not available and will depend on pump station design. Predicted flow through this pipe segment is expected to be the same as between Node 320 and Node 340. The design of Lift Station C-43 and the lift station in Brookfield should ensure that the instantaneous pumping rate is less than the capacity of the downstream sewers. Three nodes between 350 and 370 were not assigned node IDs in the Sanitary Sewer Master Plan. For the purposes of this study, they have been assigned IDs 350A, 350B and 350C.

2.1 Model Software

The software used to model the Creekview trunk sewers was H2OMap Sewer Professional Suite 9.0 (H2OMap Sewer), a product of MWH Soft, Inc. This software is widely used for hydraulic analysis of collection systems.

2.2 Model Results

Model results for the three scenarios are described below. The modeled Creekview trunk sewers were evaluated using the same criteria used by SPWA (and presented in TM 3b) to evaluate other existing and planned trunk sewers in the SPWA service area. The surcharge criterion used for this analysis requires that under design flow conditions, trunk sewers shall not be allowed to surcharge.

2.2.1 Base

This alternative includes only the base Creekview development. According to the hydraulic model results, all of the Creekview trunk sewers sized 18 inches in diameter and larger have ample capacity as sized to convey the modeled peak wet weather flows (PWWF). The sizes of these trunk sewers were adjusted, as appropriate, to achieve the minimum size necessary to convey the PWWF without surcharging.

Table 1 summarizes the modeled pipes and PWWF using the pipe sizes.

The model results indicate that the modeled pipes downstream from the Creekview UGA, including the recently constructed pipes in West Roseville, have sufficient capacity to handle PWWF from Creekview under the Base buildout scenario. The maximum q/Q at PWWF in the newly constructed pipes downstream of Creekview is 0.29, including flow from Creekview.

Table 1: Base Modeled Pipe Summary

U/S Node ID	D/S Node ID	Dia-meter (in)	Length (ft)	Slope (ft/ft)	PWWF (mgd)	Velocity at PWWF (ft/s)	d/D at PWWF	q/Q at PWWF	Headloss (ft/1k ft)
330 ^a	340	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
320 ^b	340	10	50	N/A	0.85	2.4	N/A	N/A	2.7
340 ^b	350	10	1250	N/A	0.85	2.4	N/A	N/A	2.7
350	350A	15	400	0.0015	0.85	2.1	0.51	0.53	N/A
350A	350B	15	500	0.0015	0.83	2.1	0.51	0.51	N/A
350B	350C	15	400	0.0015	0.81	2.0	0.50	0.50	N/A
350C	370	15	400	0.0015	0.81	2.0	0.50	0.50	N/A
370	380	18	525	0.0012	1.19	2.1	0.50	0.51	N/A
380	390	18	275	0.0012	1.18	2.1	0.50	0.50	N/A

Footnotes:

- a. Force Main from Brookfield not included in this model.
- b. Force main.

2.2.2 Base + Urban Reserve

This alternative includes the Urban Reserve in addition to base Creekview. According to the hydraulic model results, all of the Creekview trunk sewers sized 18 inches in diameter and larger have ample capacity as sized to convey the modeled peak wet weather flows (PWWF). The sizes of these trunk sewers were adjusted, as appropriate, to achieve the minimum size necessary to convey the PWWF without surcharging.

Table 2 summarizes the modeled pipes and PWWF using the pipe sizes.

The model results indicate that the modeled pipes downstream from the Creekview UGA, including the recently constructed pipes in West Roseville, have sufficient capacity to handle PWWF from Creekview under the Base plus Urban Reserve buildout scenario. The maximum q/Q at PWWF in the newly constructed pipes downstream of Creekview is 0.32, including flow from Creekview.

Table 2: Base + Urban Reserve Modeled Pipe Summary

U/S Node ID	D/S Node ID	Dia-meter (in)	Length (ft)	Slope (ft/ft)	PWWF (mgd)	Velocity at PWWF (ft/s)	d/D at PWWF	q/Q at PWWF	Headloss (ft/1k ft)
330 ^a	340	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
320 ^b	340	10	50	N/A	0.98	4.4	N/A	N/A	3.5
340 ^b	350	10	1250	N/A	0.98	2.8	N/A	N/A	3.5
350	350A	15	400	0.0015	0.98	2.1	0.56	0.61	N/A
350A	350B	15	500	0.0015	0.96	2.1	0.55	0.59	N/A
350B	350C	15	400	0.0015	0.94	2.1	0.55	0.58	N/A
350C	370	15	400	0.0015	0.94	2.1	0.55	0.58	N/A
370	380	18	525	0.0012	1.31	2.1	0.53	0.55	N/A
380	390	18	275	0.0012	1.31	2.1	0.53	0.55	N/A

Footnotes:

- a. Force Main from Brookfield not included in this model.
- b. Force main.

2.2.3 Base + Urban Reserve + Brookfield

This alternative includes the Brookfield UGA in addition to base Creekview and the Urban Reserve. According to the hydraulic model results, all of the Creekview trunk sewers sized 18 inches in diameter and larger have ample capacity as sized to convey the modeled peak wet weather flows (PWWF). The sizes of these trunk sewers were adjusted, as appropriate, to achieve the minimum size necessary to convey the PWWF without surcharging.

Table 3 summarizes the modeled pipes and PWWF.

The model results indicate that the modeled pipes downstream from the Creekview UGA, including the recently constructed pipes in West Roseville, have sufficient capacity to handle PWWF from Creekview under the Base plus Urban Reserve plus Brookfield buildout scenario. The maximum q/Q at PWWF in the newly constructed pipes downstream of Creekview is 0.59, including flow from Creekview.

Table 3: Base + Urban Reserve + Brookfield Modeled Pipe Summary

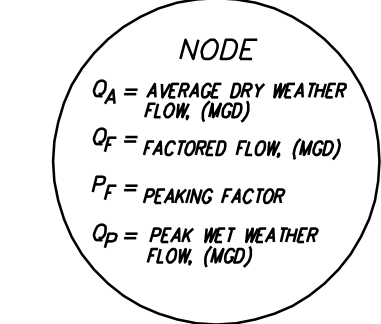
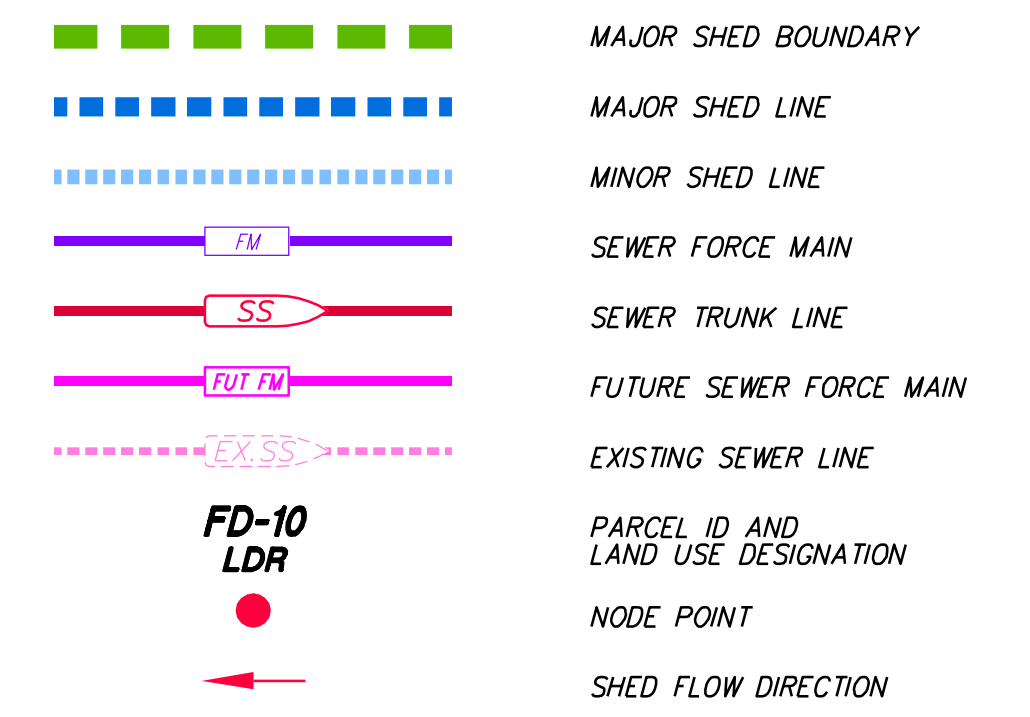
U/S Node ID	D/S Node ID	Dia-meter (in)	Length (ft)	Slope (ft/ft)	PWWF (mgd)	Velocity at PWWF (ft/s)	d/D at PWWF	q/Q at PWWF	Headloss (ft/1k ft)
330 ^a	340	10	3000	N/A	1.19	3.4	N/A	N/A	5.0
320 ^a	340	10	50	N/A	0.98	4.4	N/A	N/A	3.5
340 ^a	350	12	1250	N/A	2.17	4.3	N/A	N/A	6.3
350	350A	21	400	0.001	2.16	2.2	0.60	0.67	N/A
350A	350B	21	500	0.001	2.14	2.2	0.59	0.66	N/A
350B	350C	21	400	0.001	2.11	2.2	0.59	0.65	N/A
350C	370	21	400	0.001	2.08	2.2	0.58	0.64	N/A
370	380	24	525	0.0008	2.46	2.1	0.55	0.58	N/A
380	390	24	275	0.0008	2.46	2.1	0.55	0.58	N/A

Footnotes:

- a. Force Main.

Attachment A

LEGEND



NODE DATA

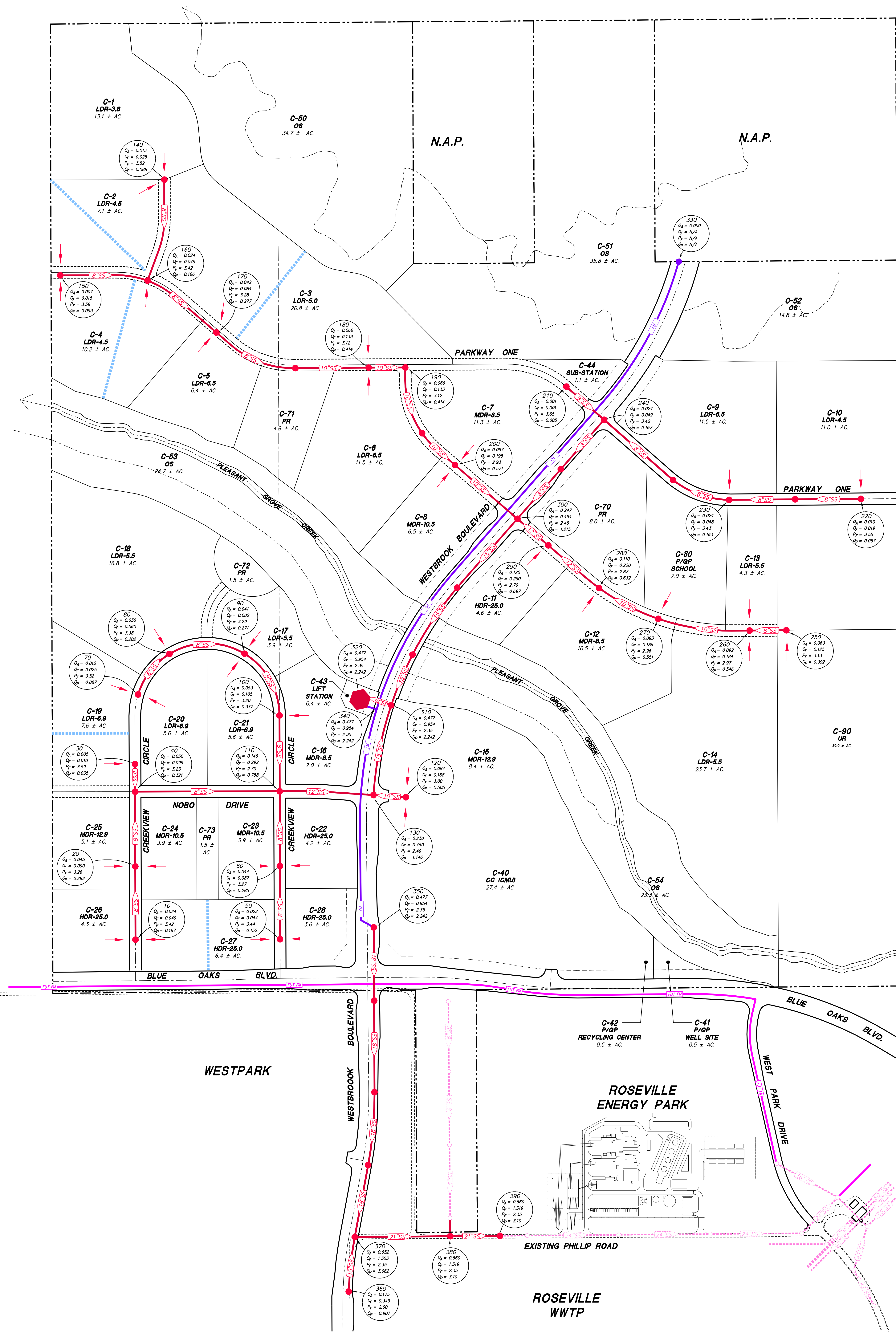
PARCEL	AREA	PROJECTED DU	TRIBUTARY TO NODE
C-1 (LDR)	13.1	50	140
C-2 (LDR)	7.1	32	140, 150
C-3 (LDR)	20.8	104	170, 180
C-4 (LDR)	10.2	46	150, 160
C-5 (LDR)	6.4	42	170
C-6 (LDR)	11.5	75	180
C-7 (MDR)	11.3	96	200
C-8 (MDR)	6.5	68	200
C-9 (LDR)	11.5	75	230
C-10 (LDR)	11.0	50	220
C-11 (HDR)	4.6	115	290
C-12 (MDR)	10.5	89	280
C-13 (LDR)	4.3	24	260
C-14 (LDR)	23.7	130	260
C-15 (MDR)	8.4	108	120
C-16 (MDR)	7.0	60	100
C-17 (LDR)	3.9	21	90
C-18 (LDR)	16.8	92	80
C-19 (LDR)	7.6	52	30, 70
C-20 (LDR)	5.6	39	70
C-21 (LDR)	5.6	39	90
C-22 (HDR)	4.2	105	60
C-23 (MDR)	3.9	41	60
C-24 (MDR)	3.9	41	20
C-25 (MDR)	5.1	66	20
C-26 (HDR)	4.3	108	10
C-27 (HDR)	6.4	160	10, 50
C-28 (HDR)	3.6	90	50
C-40 (CMU)	27.4	80	120
C-41 (PUB)	0.5		120
C-42 (PUB)	0.5		120
C-43 (PUB)	0.4		210
C-44 (PUB)	1.1		
C-71 (PARK)	4.9		
C-72 (PARK)	1.5		
C-73 (PARK)	1.5		
C-90 (UR)	39.9	405	250
BROOKFIELD	1	1	330
WRSP	1	1	360
PARCEL A	9.6		380

TABLE 1 - PIPELINE CAPACITY SUMMARY

PIPE DIAMETER	MINIMUM SLOPE	0.7 FULL mgd	1.0 FULL mgd
6"	0.005	0.21	0.25
8"	0.0035	0.38	0.46
10"	0.0025	0.59	0.70
12"	0.002	0.86	1.02
15"	0.0015	1.35	1.61
18"	0.0012	1.96	2.35
21"	0.001	2.71	3.23
24"	0.0008	3.46	4.13

= USED FOR PRELIMINARY DESIGN

RANCH FIDDYMENT

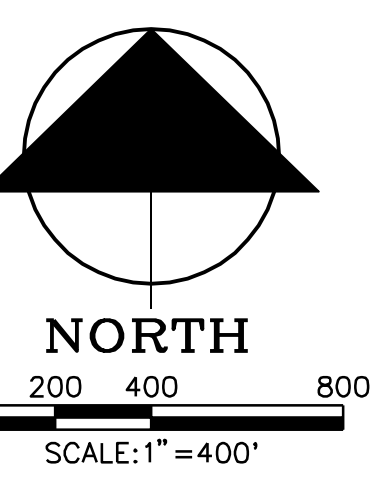


NOTES:

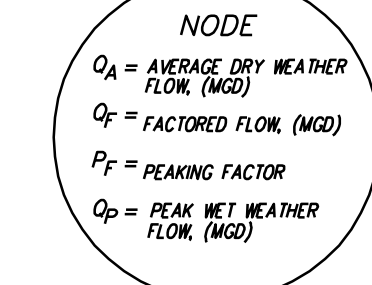
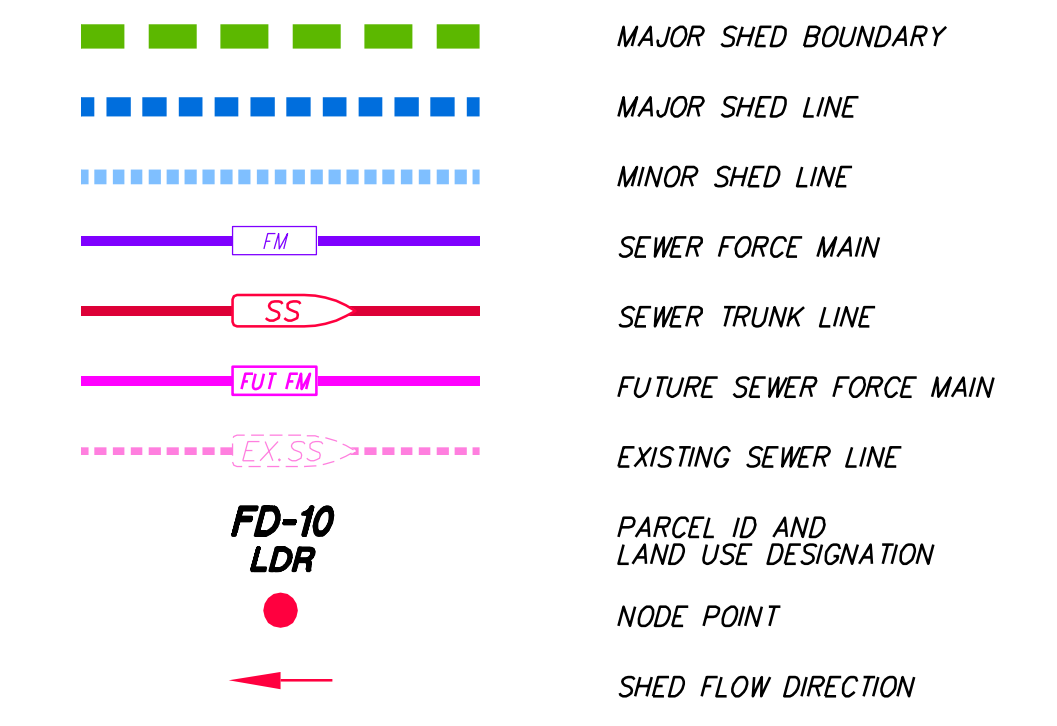
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CREEKVIEW SPECIFIC PLAN
SANITARY SEWER MASTER PLAN
 CVSP BASE + URBAN RESERVE CONDITION

SCALE: 1"=200' AUGUST 9, 2010



LEGEND



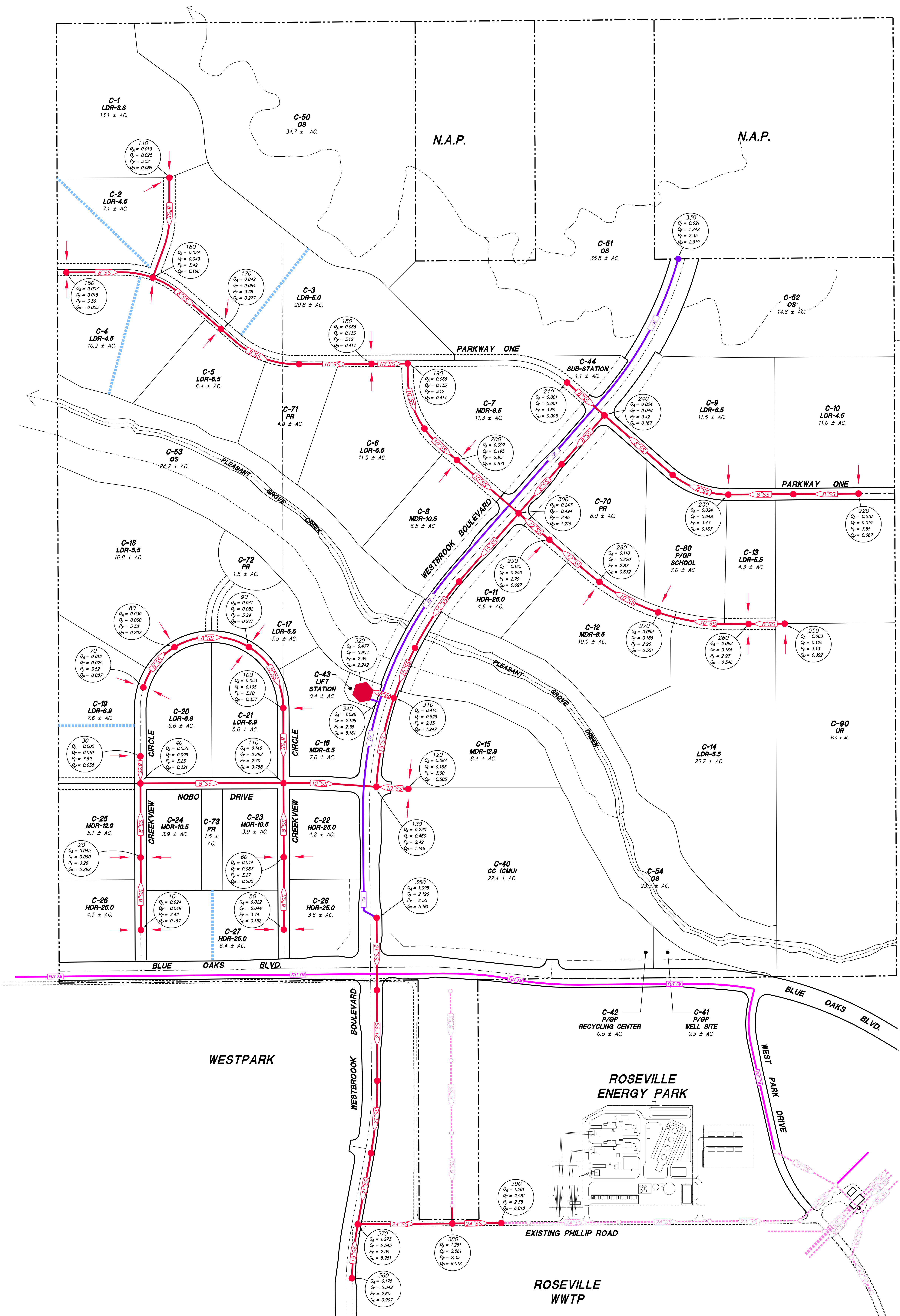
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C-6 (LDR)	11.5	75	180
C-7 (MDR)	11.3	96	200
C-8 (MDR)	6.5	68	200
C-9 (LDR)	11.5	75	230
C-10 (LDR)	11.0	50	220
C-11 (HDR)	4.6	115	290
C-12 (MDR)	10.5	89	280
C-13 (LDR)	4.3	24	260
C-14 (LDR)	23.7	130	260
C-15 (MDR)	8.4	108	120
C-16 (MDR)	7.0	60	100
C-17 (LDR)	3.9	21	90
C-18 (LDR)	16.8	92	80
C-19 (LDR)	7.6	52	30, 70
C-20 (LDR)	5.6	39	70
C-21 (LDR)	5.6	39	90
C-22 (HDR)	4.2	105	60
C-23 (MDR)	3.9	41	60
C-24 (MDR)	3.9	41	20
C-25 (MDR)	5.1	66	20
C-26 (HDR)	4.3	108	10
C-27 (HDR)	6.4	160	10, 50
C-28 (HDR)	3.6	90	50
C-40 (CMU)	27.4	80	120
C-41 (PUB)	0.5		120
C-42 (PUB)	0.5		120
C-43 (PUB)	0.4		210
C-44 (PUB)	1.1		
C-71 (PARK)	4.9		
C-72 (PARK)	1.5		
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15"	0.0015	1.35	1.61
18"	0.0012	1.96	2.35
21"	0.001	2.71	3.23
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RANCH FIDDYMENT



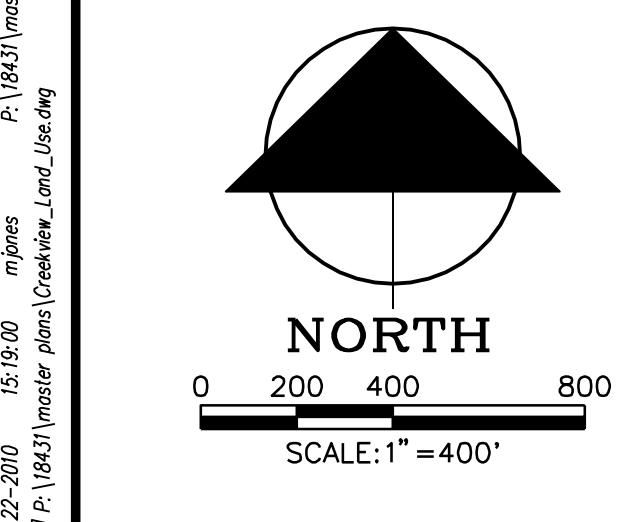
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 CVSP BASE + URBAN RESERVE + BROOKFIELD CONDITION
 SCALE: 1"=200'

MACKAY & SOMPS
 ENGINEERS PLANNERS SURVEYORS
 1022 Lumina Road, Suite 100, Roseville, CA 95661 (916) 773-1169

AUGUST 9, 2010

EXHIBIT 3
 SHEET 1 OF 1



7-22-2010 05:16:00 m:\p\1\18441\master\plans\CVSP\Master_SS_EXHIBIT3.dwg
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TABLE 8
WASTEWATER FLOWS BY NODE
BASE CONDITION
CREEKVIEW SPECIFIC PLAN

REFERENCE NODE	CONTRIBUTING NODE	LDR / MDR			HDR			CMU			SCHOOL			CC, CC/BP, LI			PQP-PUB, PQP-REL			PARK - Parks > 10 Acres			TOTAL	FACTORED	PEAKING	TOTAL	PIPE	PIPE	% FULL
		DU	CUM. DU	Q(ADWF)	DU	CUM. DU	Q(ADWF)	DU	CUM. DU	AREA	CUM. AREA	Q(ADWF)	AREA	CUM. AREA	Q(ADWF)	AREA	CUM. AREA	Q(ADWF)	AREA	CUM. AREA	Q(ADWF)	AREA	CUM. AREA	Q(ADWF)	MGD	MGD	FACTOR	MGD	SIZE
#	#	#	#	MGD	#	MGD	#	MGD	ACRE	ACRE	MGD	ACRE	ACRE	MGD	ACRE	ACRE	MGD	ACRE	ACRE	MGD	ACRE	ACRE	MGD	MGD	MGD	MGD	IN.	FT/FT	Q(PWWF)
10					188	188	0.024																0.024	0.049	3.42	0.167	8	0.0035	31
20	10	107	107	0.020		188	0.024																0.045	0.090	3.26	0.292	8	0.0035	54
30		26	26	0.005																			0.005	0.010	3.59	0.035	8	0.0035	7
40	20, 30		133	0.025		188	0.024																0.050	0.099	3.23	0.321	8	0.0035	59
50					170	170	0.022																0.022	0.044	3.44	0.152	8	0.0035	28
60	50	41	41	0.008	105	275	0.036																0.044	0.087	3.27	0.285	8	0.0035	52
70		65	65	0.012																			0.012	0.025	3.52	0.087	8	0.0035	16
80	70	92	157	0.030																			0.030	0.060	3.38	0.202	8	0.0035	37
90	80	60	217	0.041																			0.041	0.082	3.29	0.271	8	0.0035	50
100	90	60	277	0.053																			0.053	0.105	3.20	0.337	8	0.0035	62
110	40, 60, 100		451	0.086		463	0.060																0.146	0.292	2.70	0.788	12	0.0020	79
120		108	108	0.021				80	80	27.4	27.4	0.063					1.0	1.0	0.001				0.084	0.168	3.00	0.505	10	0.0025	61
130	110, 120		559	0.106		463	0.060		80		27.4	0.063						1.0	0.001				0.230	0.460	2.49	1.146	15	0.0015	72
140		66	66	0.013																			0.013	0.025	3.52	0.088	8	0.0035	16
150		39	39	0.007																			0.007	0.015	3.56	0.053	8	0.0035	10
160	140, 150	23	128	0.024																			0.024	0.049	3.42	0.166	8	0.0035	31
170	160	94	222	0.042																			0.042	0.084	3.28	0.277	8	0.0035	51
180	170	127	349	0.066																			0.066	0.133	3.12	0.414	10	0.0025	50
190	180		349	0.066																			0.066	0.133	3.12	0.414	10	0.0025	50
200	190	164	513	0.097																			0.097	0.195	2.93	0.571	10	0.0025	69
210																	1.1	1.1	0.001				0.001	0.001	3.65	0.005	8	0.0035	1
220		50	50	0.010																			0.010	0.019	3.55	0.067	8	0.0035	12
230	220	75	125	0.024																			0.024	0.048	3.43	0.163	8	0.0035	30
240	210, 240		125	0.024													1.1	0.001					0.024	0.049	3.42	0.167	8	0.0035	31
250	Urban Reserve																						0.000	0.000		0.000			0
260	250	154	154	0.029																			0.029	0.059	3.39	0.198	8	0.0035	37
270	260		154	0.029									7.0	7.0	0.001								0.030	0.061	3.37	0.205	8	0.0035	38
280	270	89	243	0.046									7.0	0.001									0.047	0.095	3.25	0.308	8	0.0035	57
290	280		243	0.046	115	115	0.015						7.0	0.001									0.062	0.125	3.14	0.391	10	0.0025	47
300	200, 240, 290		881	0.167		115	0.015						7	0.001			1.1	0.001					0.184	0.369	2.58	0.951	12	0.0020	95
310	130, 300		1440	0.274		578	0.075		80		27.4	0.063		7	0.001			2.1	0.001				0.414	0.829	2.35	1.947	18	0.0012	83
320	310		1440	0.274		578	0.075		80		27.4	0.063		7.0	0.001			2.1	0.001				0.414	0.829	2.35	1.947	FM		
330	Brookfield																						0.000	0.000		0.000	FM		
340	320, 330		1440	0.274		578	0.075		80		27.4	0.063		7.0	0.001		0.0	0.000					0.414	0.829	2.35	1.947	FM		
350	340		1440	0.274		578	0.075		80		27.4	0.063		7.0	0.001		0.0	0.000					0.414	0.829	2.35	1.947	18	0.0012	
360	WRSP	405	405	0.077	252	252	0.033						8.2	8.2	0.001	74.6	74.6	0.063					0.175	0.349	2.60	0.907	15	0.0015	57
370	350, 360		1845	0.351		830	0.108		80		27.4	0.063		15.2	0.003		74.6	0.063		2.1	0.001		0.589	1.178	2.35	2.768	21	0.0010	
380	370		1845	0.351		830	0.108		80		27.4	0.063		15.2	0.003	9.6	84.2	0.072		2.1	0.001		0.597	1.194	2.35	2.806	21	0.0010	
390	380		1845	0.351		830	0.108		80		27.4	0.063		15.2	0.003		84.2	0.072		2.1	0.001		0.597	1.194	2.35	2.806	21	0.0010	
TOTAL			1845	0.351		830	0.108		80		27.4	0.063		15.2	0.003		84.2	0.072		2.1	0.001		0.597	1.194	2.35	2.806	21	0.0001	

NOTES:

- 1 Peak Transmission Flow and Pipe Diameter based on hydraulic modeling prepared by RMC. (Please refer to Attachment 2.)
- 2 The 167 units of medium density residential and 238 units of high density residential future land uses on C-90 (Urban Reserve) are included in the hydraulic modeling.
- 3 Land use unit counts and acreages based on June 10, 2010 Creekview Specific Plan Land Use Plan.

TABLE 9
WASTEWATER FLOWS BY NODE
INCLUDES URBAN RESERVE AREA
CREEKVIEW SPECIFIC PLAN

REFERENCE NODE	CONTRIBUTING NODE	LDR / MDR			HDR			CMU			SCHOOL			CC, CC/BP, LI			PQP-PUB, PQP-REL			PARK - Parks > 10 Acres			TOTAL Q(ADWF) MGD	FACTORED FLOW MGD	PEAKING FACTOR	TOTAL Q(PWWF) MGD	PIPE SIZE IN.	PIPE SLOPE FT/FT	% FULL Q(PWWF) (d/D)
		DU	CUM. DU	Q(ADWF) MGD	DU	CUM. DU	Q(ADWF) MGD	DU	CUM. DU	Q(ADWF) MGD	AREA ACRE	CUM. AREA ACRE	Q(ADWF) MGD	AREA ACRE	CUM. AREA ACRE	Q(ADWF) MGD	AREA ACRE	CUM. AREA ACRE	Q(ADWF) MGD	AREA ACRE	CUM. AREA ACRE	Q(ADWF) MGD							
10					188	188	0.024															0.024	0.049	3.42	0.167	8	0.0035	31	
20	10	107	107	0.020		188	0.024															0.045	0.090	3.26	0.292	8	0.0035	54	
30		26	26	0.005																		0.005	0.010	3.59	0.035	8	0.0035	7	
40	20, 30		133	0.025		188	0.024															0.050	0.099	3.23	0.321	8	0.0035	59	
50					170	170	0.022															0.022	0.044	3.44	0.152	8	0.0035	28	
60	50	41	41	0.008	105	275	0.036															0.044	0.087	3.27	0.285	8	0.0035	52	
70		65	65	0.012																		0.012	0.025	3.52	0.087	8	0.0035	16	
80	70	92	157	0.030																		0.030	0.060	3.38	0.202	8	0.0035	37	
90	80	60	217	0.041																		0.041	0.082	3.29	0.271	8	0.0035	50	
100	90	60	277	0.053																		0.053	0.105	3.20	0.337	8	0.0035	62	
110	40, 60, 100		451	0.086		463	0.060															0.146	0.292	2.70	0.788	12	0.0020	79	
120		108	108	0.021				80	80	27.4	27.4	0.063					1.0	1.0	0.001			0.084	0.168	3.00	0.505	10	0.0025	61	
130	110, 120		559	0.106		463	0.060		80	27.4	0.063						1.0	0.001			0.230	0.460	2.49	1.146	15	0.0015	72		
140		66	66	0.013																		0.013	0.025	3.52	0.088	8	0.0035	16	
150		39	39	0.007																		0.007	0.015	3.56	0.053	8	0.0035	10	
160	140, 150	23	128	0.024																		0.024	0.049	3.42	0.166	8	0.0035	31	
170	160	94	222	0.042																		0.042	0.084	3.28	0.277	8	0.0035	51	
180	170	127	349	0.066																		0.066	0.133	3.12	0.414	10	0.0025	50	
190	180		349	0.066																		0.066	0.133	3.12	0.414	10	0.0025	50	
200	190	164	513	0.097																		0.097	0.195	2.93	0.571	10	0.0025	69	
210																	1.1	1.1	0.001			0.001	0.001	3.65	0.005	8	0.0035	1	
220		50	50	0.010																		0.010	0.019	3.55	0.067	8	0.0035	12	
230	220	75	125	0.024																		0.024	0.048	3.43	0.163	8	0.0035	30	
240	210, 240		125	0.024													1.1	0.001				0.024	0.049	3.42	0.167	8	0.0035	31	
250	Urban Reserve	167	167	0.032	238	238	0.031															0.063	0.125	3.13	0.392	8	0.0035	72	
260	250	154	321	0.061		238	0.031															0.092	0.184	2.97	0.546	10	0.0025	66	
270	260		321	0.061		238	0.031						7.0	7.0	0.001							0.093	0.186	2.96	0.551	10	0.0025	67	
280	270	89	410	0.078		238	0.031						7.0	7.0	0.001							0.110	0.220	2.87	0.632	12	0.0020	63	
290	280		410	0.078	115	353	0.046						7.0	7.0	0.001							0.125	0.250	2.79	0.697	12	0.0025	70	
300	200, 240, 290		1048	0.199		353	0.046						7.0	7.0	0.001			1.1	0.001			0.247	0.494	2.46	1.215	15	0.0015	76	
310	130, 300		1607	0.305		816	0.106		80	27.4	0.063		7.0	7.0	0.001			2.1	0.001		0.477	0.954	2.35	2.242	18	0.0012			
320	310		1607	0.305		816	0.106		80	27.4	0.063		7.0	7.0	0.001			2.1	0.001		0.477	0.954	2.35	2.242	FM				
330	Brookfield																					0.000	0.000		0.000	FM			
340	320, 330		1607	0.305		816	0.106		80	27.4	0.063		7.0	7.0	0.001	0.0	0.000		2.1	0.001		0.477	0.954	2.35	2.242	FM			
350	340		1607	0.305		816	0.106		80	27.4	0.063		7.0	7.0	0.001	0.0	0.000		2.1	0.001		0.477	0.954	2.35	2.242	18	0.0012		
360	WRSP	405	405	0.077	252	252	0.033						8.2	8.2	0.001	74.6	74.6	0.063				0.175	0.349	2.60	0.907	15	0.0015	57	
370	350, 360		2012	0.382		1068	0.139		80	27.4	0.063		15.2	15.2	0.003	74.6	0.063		2.1	0.001		0.652	1.303	2.35	3.062	21	0.0010		
380	370		2012	0.382		1068	0.139		80	27.4	0.063		15.2	15.2	0.003	9.6	84.2	0.072		2.1	0.001		0.660	1.319	2.35	3.100	21	0.0010	
390	380		2012	0.382		1068	0.139		80	27.4	0.063		15.2	15.2	0.003		84.2	0.072		2.1	0.001		0.660	1.319	2.35	3.100	21	0.0010	
TOTAL			2012	0.382		1068	0.139		80	27.4	0.063		15.2	15.2	0.003	84.2	0.072		2.1	0.001		0.660	1.319	2.35	3.100	21	0.0010		

NOTES:

- 1 Peak Transmission Flow and Pipe Diameter based on hydraulic modeling prepared by RMC. (Please refer to Attachment 2.)
- 2 The 167 units of medium density residential and 238 units of high density residential future land uses on C-90 (Urban Reserve) are included in the hydraulic modeling.
- 3 Land use unit counts and acreages based on June 10, 2010 Creekview Specific Plan Land Use Plan.

TABLE 10
WASTEWATER FLOWS BY NODE
INCLUDES URBAN RESERVE AREA AND BROOKFIELD
CREEKVIEW SPECIFIC PLAN

REFERENCE NODE	CONTRIBUTING NODE	LDR / MDR			HDR			CMU			SCHOOL			CC, CC/BP, LI			PQP-PUB, PQP-REL			PARK - Parks > 10 Acres			TOTAL Q(ADWF) MGD	FACTORED FLOW MGD	PEAKING FACTOR	TOTAL Q(PWWF) MGD	PIPE SIZE IN.	PIPE SLOPE FT/FT	% FULL Q(PWWF) (d/D)
		DU	CUM. DU	Q(ADWF) MGD	DU	CUM. DU	Q(ADWF) MGD	DU	CUM. DU	Q(ADWF) MGD	AREA ACRE	CUM. AREA ACRE	Q(ADWF) MGD	AREA ACRE	CUM. AREA ACRE	Q(ADWF) MGD	AREA ACRE	CUM. AREA ACRE	Q(ADWF) MGD	AREA ACRE	CUM. AREA ACRE	Q(ADWF) MGD							
10					188	188	0.024															0.024	0.049	3.42	0.167	8	0.0035	31	
20	10	107	107	0.020		188	0.024															0.045	0.090	3.26	0.292	8	0.0035	54	
30		26	26	0.005																		0.005	0.010	3.59	0.035	8	0.0035	7	
40	20, 30		133	0.025		188	0.024															0.050	0.099	3.23	0.321	8	0.0035	59	
50					170	170	0.022															0.022	0.044	3.44	0.152	8	0.0035	28	
60	50	41	41	0.008	105	275	0.036															0.044	0.087	3.27	0.285	8	0.0035	52	
70		65	65	0.012																		0.012	0.025	3.52	0.087	8	0.0035	16	
80	70	92	157	0.030																		0.030	0.060	3.38	0.202	8	0.0035	37	
90	80	60	217	0.041																		0.041	0.082	3.29	0.271	8	0.0035	50	
100	90	60	277	0.053																		0.053	0.105	3.20	0.337	8	0.0035	62	
110	40, 60, 100		451	0.086		463	0.060															0.146	0.292	2.70	0.788	12	0.0020	79	
120		108	108	0.021				80	80	27.4	27.4	0.063					1.0	1.0	0.001			0.084	0.168	3.00	0.505	10	0.0025	61	
130	110, 120		559	0.106		463	0.060		80	27.4	0.063						1.0	0.001			0.230	0.460	2.49	1.146	15	0.0015	72		
140		66	66	0.013																		0.013	0.025	3.52	0.088	8	0.0035	16	
150		39	39	0.007																		0.007	0.015	3.56	0.053	8	0.0035	10	
160	140, 150	23	128	0.024																		0.024	0.049	3.42	0.166	8	0.0035	31	
170	160	94	222	0.042																		0.042	0.084	3.28	0.277	8	0.0035	51	
180	170	127	349	0.066																		0.066	0.133	3.12	0.414	10	0.0025	50	
190	180		349	0.066																		0.066	0.133	3.12	0.414	10	0.0025	50	
200	190	164	513	0.097																		0.097	0.195	2.93	0.571	10	0.0025	69	
210																	1.1	1.1	0.001			0.001	0.001	3.65	0.005	8	0.0035	1	
220		50	50	0.010																		0.010	0.019	3.55	0.067	8	0.0035	12	
230	220	75	125	0.024																		0.024	0.048	3.43	0.163	8	0.0035	30	
240	210, 240		125	0.024													1.1	0.001				0.024	0.049	3.42	0.167	8	0.0035	31	
250	Urban Reserve	167	167	0.032	238	238	0.031															0.063	0.125	3.13	0.392	8	0.0035	72	
260	250	154	321	0.061		238	0.031															0.092	0.184	2.97	0.546	10	0.0025	66	
270	260		321	0.061		238	0.031					7.0	7.0	0.001								0.093	0.186	2.96	0.551	10	0.0025	67	
280	270	89	410	0.078		238	0.031					7.0	7.0	0.001								0.110	0.220	2.87	0.632	12	0.0020	63	
290	280		410	0.078	115	353	0.046					7.0	7.0	0.001								0.125	0.250	2.79	0.697	12	0.0025	70	
300	200, 240, 290		1048	0.199		353	0.046					7.0	7.0	0.001			1.1	0.001				0.247	0.494	2.46	1.215	15	0.0015	76	
310	130, 300		1607	0.305		816	0.106		80	27.4	0.063		7.0	0.001				2.1	0.001			0.477	0.954	2.35	2.242	18	0.0012	95	
320	310		1607	0.305		816	0.106		80	27.4	0.063		7.0	0.001				2.1	0.001			0.477	0.954	2.35	2.242	FM			
330	Brookfield	2176	2176	0.413	577	577	0.075	32	32	55.2	55.2	0.127	7.0	7.0	0.001			6.7	6.7	0.004		0.621	1.242	2.35	2.919	FM			
340	320, 330		3783	0.719		1393	0.181		112		82.6	0.190		14.0	0.002				8.8	0.006		1.098	2.196	2.35	5.161	FM			
350	340		3783	0.719		1393	0.181		112		82.6	0.190		14.0	0.002				8.8	0.006		1.098	2.196	2.35	5.161				
360	WRSP	405	405	0.077	252	252	0.033						8.2	8.2	0.001	74.6	74.6	0.063				0.175	0.349	2.60	0.907	15	0.0015	57	
370	350, 360		4188	0.796		1645	0.214		112		82.6	0.190		22.2	0.004		74.6	0.063		8.8	0.006		1.273	2.545	2.35	5.981			
380	370		4188	0.796		1645	0.214		112		82.6	0.190		22.2	0.004	9.6	84.2	0.072		8.8	0.006		1.281	2.561	2.35	6.019			
390	380		4188	0.796		1645	0.214		112		82.6	0.190		22.2	0.004		84.2	0.072		8.8	0.006		1.281	2.561	2.35	6.019			
TOTAL			4188	0.796		1645	0.214		112		82.6	0.190		22.2	0.004		84.2	0.072		8.8	0.006		1.281	2.561	2.35	6.019			

NOTES:

- 1 Peak Transmission Flow and Pipe Diameter based on hydraulic modeling prepared by RMC. (Please refer to Attachment 2.)
- 2 The 167 units of medium density residential and 238 units of high density residential future land uses on C-90 (Urban Reserve) are included in the hydraulic modeling.
- 3 Land use unit counts and acreages based on June 10, 2010 Creekview Specific Plan Land Use Plan.

Attachment B

Technical Memorandum

South Placer Regional Wastewater & Recycled Water Systems Evaluation Project

Subject: Unit Flow Factor Sets and Sewer Design Criteria –TM No. 3a (FINAL)

Prepared For: Art O’Brien – City of Roseville

Prepared By: Mai-Tram Le - RMC; revised by Gisa Ju - RMC

Reviewed By: Dave Richardson - RMC
Pete Bellows – BC

Date: May 25, 2005; Final revision October 3, 2006

Reference: 0091-4.02

This technical memorandum (TM) provides a definition of the unit flow factors that have been developed and used in analyses of treatment and trunk sewer facilities as part of the South Placer Regional Wastewater and Recycled Water Systems Evaluation Project (Project). The TM also proposes criteria to be used by developers for design of new sewer facilities.

The various analyses and their associated application are as follows:

1. **Treatment Plant Analyses** – A set of average dry weather unit flow factors has been developed for the entire South Placer Wastewater Authority (SPWA) service area. These factors include the average flow coming from various areas based on specific land use designations, along with a base dry weather groundwater infiltration (GWI) component across the service area. The average unit flow factors were developed using water use and flow monitoring data, as presented in TM 2a, “Dry Weather Flow Projection for 2005 Service Area.” For example, the unit flow factor for single-family residential dwelling units, regardless of density, is 190 gpd, of which 10 gpd represents the dry weather GWI component. The unit flow factors used for treatment plant analyses are presented in **Table 1**.
2. **Hydraulic Model Calibration and Trunk Sewer Analyses** – The dry weather flows used for model calibration and analyses of trunk sewers consists of base sanitary flows (BSF) which have been developed using the same unit flow factor concept as for the treatment plant analyses discussed above. However, the dry weather GWI component of the unit flow factors has been included on an areal basis based on actual measured flows, rather than having been considered as a uniform base dry weather GWI load across the service area.

Trunk Sewer analyses also include additional components of wet weather GWI and rainfall-dependent infiltration and inflow (RDI/I) that vary across the SPWA service area to reflect actual conditions as verified by the wet weather flow monitoring data. The wet weather GWI factors are specific to each wastewater treatment plant (WWTP) service area and were determined from analysis of WWTP flows to be 200 gpd/acre in the Dry Creek WWTP basin and 100 gpd/acre in the Pleasant Grove WWTP basin. The GWI rates and RDI/I parameters used in the trunk sewer model are documented in TM 2c, “Wet Weather Flow Projection for the Ultimate SPWA Service Area.”

**Table 1 – Average Dry Weather Unit Flow Factors
 Used for Treatment Plant Analyses**

Land Use Designation	Units	Flow Factor (gpd/unit)¹
Commercial	gpd per acre	850
Heavy Industrial	gpd per acre	850
Light Industrial	gpd per acre	850
Mixed Use	gpd per acre	2,300
Public/Quasi-Public	gpd per acre	660
Schools	gpd per acre	170
Residential 1 DU	gpd per DU	190
Residential 2 DU	gpd per DU	190
Residential 3 DU	gpd per DU	190
Residential Multiple DU ²	gpd per acre or gpd per DU	2,040 or 130
Open Space	gpd per acre	0
Parks > 10 Acres	gpd per acre	10
Vacant	gpd per acre	0

¹ Includes allowance for dry season GWI.

² Future development projects should use the factor that results in the highest flow .

3. **Design Flow Standards (Criteria) for Sizing Infrastructure** – For sizing future infrastructure facilities, the hydraulic model of the trunk sewer system should be used for pipes 18 inches in diameter and larger. For smaller facilities, the average dry weather unit flow factors for the treatment plant analyses can be used along with a safety factor of 2.0 and appropriate peaking factors. The safety factor of 2.0 will be used to factor the average dry weather unit flow factor in order to:

1. Account for changes that may occur over time in the behavior of residential and nonresidential contributors to the sewer systems, such as increased indoor water use;
2. Account for changes in environmental conditions (higher groundwater table and consequent higher GWI) and changes in infrastructure (aging pipes, etc.);
3. Provide for safety to adequately size the infrastructure to avoid any sanitary sewer overflows due to under-sizing;
4. Account for the increasing friction losses (increase in the roughness coefficient) due to pipe aging; and,
5. Account for nominal pipe diameter decreases due to accumulation of material adhering to the walls of the sewer piping and restricting capacity.

Peak wet weather flows will be accounted for using a system-wide peaking factor. A peaking factor curve was developed based on the following assumptions:

- Single family residential development at 4 DU/acre
- Design average dry weather flow (ADWF) based on a unit flow rate of 190 gpd/DU times a safety factor of 2.0

- Diurnal peaking factor ranging from 1.8 to 3.0 depending on area size (reflects the attenuation of peak flows through the sewer system as the tributary area increases – refer to Footnote 4 in Table 2))
- GWI at 150 gpd/acre
- RDI/I at 700 gpd/acre, estimated based on model parameters used for new development UGAs (Note: New development RDI/I parameters were assumed to be similar to those determined by flow monitoring and model calibration for relatively new areas of the system; see TM 2c for discussion.)
- Peak diurnal flow concurrent with peak RDI/I flow

The resultant peaking factor curve is presented in **Figure 1**. **Table 2** below shows the derivation of the peaking factor curve for areas ranging from 10 to 750 acres. (NOTE: the values in Table 2 are meant to support the derivation of the peaking factor curve, rather than to be published as design standards).

Table 2 - Derivation of Proposed Roseville/SPWA Design Peaking Factor Curve¹

Area (acres)	No. of DUs ¹	ADWF (mgd) ²	Factored Flow (mgd) ³	Diurnal PF ⁴	Wet GWI (mgd) ⁵	Peak RDI/I (mgd) ⁶	PWWF (mgd) ⁷	Peaking Factor	PF Curve
0			0						3.65
10	40	0.0076	0.0152	3.0	0.0015	0.0070	0.054	3.56	3.56
100	400	0.076	0.152	2.5	0.015	0.070	0.47	3.06	3.06
250	1,000	0.19	0.38	2.0	0.038	0.175	0.97	2.56	2.56
500	2,000	0.38	0.76	1.8	0.075	0.350	1.79	2.36	2.36
750	3,000	0.57	1.14	1.8	0.11	0.53	2.69	2.36	2.36

¹ Based on single-family residential development at 4 DUs/acre. 4 DUs/acre is considered to be a typical density for single family residences, and is not intended to be used as a design criterion.

² Based on 190 gpd/DU

³ Based on safety factor of 2.0

⁴ The diurnal PF values in this analysis are based on the peaking factor used for residential flows (PF = 1.8) in the hydraulic model, which was derived from dry weather flow monitoring data. Since that derivation was based on a large area, the PF value is increased progressively as the area decreases in order to account for decreased attenuation of peak flows. Selection of the upper limit of that range is based on engineering judgment and experience with similar analyses.

⁵ Based on 150 gpd/acre

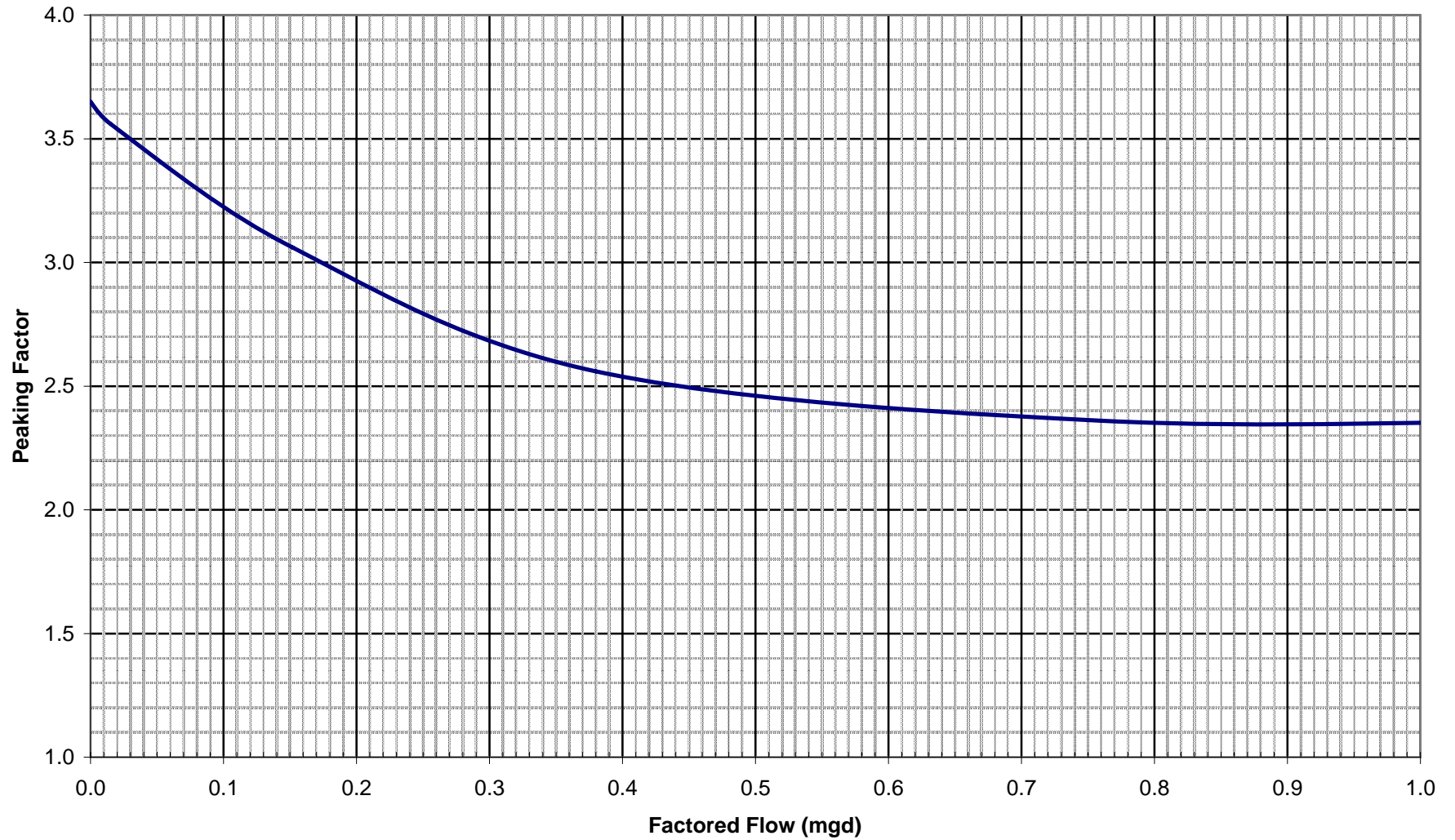
⁶ Based on 700 gpd/acre

⁷ Assumes peak RDI/I coincides with peak diurnal

Attachment A includes an example calculation illustrating the application of the peaking factor curve.

At the direction of SPWA member agencies, several planning-level criteria were developed to aid developers in the sizing and configuration of pump station and force main facilities. These criteria are presented in **Attachment B**.

Figure 1
SPWA Design Peaking Factor Curve



ATTACHMENT A: Example Design Flow Analysis for Sewers Smaller than 18-inches

Example calculation for application of peaking factor curve for 400-unit single family subdivision:

ADWF^a:

$$(400 \text{ DUs}) * (190 \text{ gpd/DU}) = \mathbf{76,000 \text{ gpd} = \text{ADWF}}$$

Factored Flow:

$$(\text{ADWF}) * (2.0) = (76,000 \text{ gpd}) * (2.0) = \mathbf{152,000 \text{ gpd} = \text{Factored Flow}}$$

PWWF:

$$(\text{Factored flow}) * (3.05^{\text{b}}) = (152,000) * (3.05) = \mathbf{464,000 \text{ gpd} = \text{PWWF}}$$

Per City of Roseville Improvement Standards, page SS-5, a 10-inch sewer at minimum slope is adequate for this PWWF.

^a Based on ADWF unit flow factors (as opposed to base sanitary flow unit flow factors, which do not allow for dry season GWI)

^b From Figure 1: SPWA Design Peaking Factor Curve

ATTACHMENT B: Recommended Planning Level Criteria for Pump Stations and Force Mains

Table B-1 presents planning-level criteria for the design of pump stations and force mains within the SPWA service area; these criteria should be confirmed during design.

Table B-1: Recommended Planning Level Criteria for Pump Stations and Force Mains

Pump Stations	
Capacity	PWWF (hydraulic modeling required for pipes 18 inches and larger)
Storage	24 hours, or 8 hours with an emergency generator
Operation	Lead/lag for duty pump(s), plus 1 standby pump
Maximum Pump Cycles	6 cycles/hour
Force Mains	
Headloss	Hazen-Williams roughness coefficient (C-factor) of 120
Maximum Velocity	7-10 feet per second
Minimum Velocity	3.0 feet per second

NOTE: Hydraulic transient, surge, and odor control analyses will need to be performed during final design.

ATTACHMENT #2

***Appendix D TM 2b – Dry Weather Flow Projections for
Ultimate Service Area (w/ UGAs)***

Technical Memorandum

South Placer Regional Wastewater and Recycled Water Systems Evaluation

Subject: Average Dry Weather Flow Projection for the Ultimate SPWA Service Area (Including Urban Growth Areas) -- (TM No. 2b)

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Date: November 4, 2005; updated October 31, 2006, January 24, 2008 & September 3, 2009

Reference: 0091-004 Task 2

0 Previous TM Publication and Updates

Since the initial publication of technical memorandum (TM) 2b on November 4, 2005, changes in information available for the South Placer Wastewater and Recycled Water Systems Evaluation (Systems Evaluation), as well as changes in the data, have resulted in the need to identify and update out-of-date information. As part of the June 2007 publication of the Systems Evaluation, an Update Sheet was prepared for this TM, and is included in **Attachment B**. Subsequent changes have resulted in the need for further updates of the TM. The newest version of the TM is consistent with the updates summarized in the 2009 Update Sheet which is included in **Attachment C**.

1 Introduction

This TM summarizes the average dry weather wastewater flow (ADWF) projections for buildout conditions within the Ultimate SPWA service area. This includes flows generated within the 2005 Regional Service Area boundary and flows generated within the Urban Growth Areas (UGAs) located outside the 2005 Regional Service Area boundary. ADWF projections are used to project flows for the analysis of the SPWA wastewater treatment plants.

This TM is a supplement to the *Dry Weather Flow Projection for the 2005 Regional Service Area TM* (TM No. 2a) which summarized flow projections within the 2005 Regional Service Area. Further discussion of wastewater flow components, flow monitoring, development of the base sanitary flow (BSF) unit factors, and groundwater infiltration (GWI) is presented in TM No. 2a.

2 Buildout Land Use

Development of the buildout land use map (including UGAs), land use code designations, and connected land use is documented in the *June 2004 and Buildout Land Use TM* (TM No. 1b). Buildout land use is based on buildout within the Ultimate Service Area as shown in **Figure 1**. For the buildout condition, all parcels are considered to be connected to the wastewater collection system even though some land uses in the “Open Space” category do not generate wastewater. Buildout land use acreages for connected parcels within the Ultimate Service Area are summarized in **Table 1** and **Table 2**. Detailed land use summaries for each UGA are provided in **Attachment A** and TM No. 1b.

The total buildout acreage within the SPWA Ultimate Service Area is 74,522 acres. This includes 30,637 acres in the Pleasant Grove watershed and 43,253 acres in the Dry Creek watershed.

Table 1: Buildout Land Use Summary within the 2005 Regional Service Area

Land Use Designation	Buildout Connected Area (Acres)		Total Buildout Connected Area (Acres ^{1,2})
	Pleasant Grove Watershed ¹	Dry Creek Watershed ²	
Commercial	2,151	2,915	5,066
Heavy Industrial	1,715	263	1,979
Light Industrial	1,599	637	2,236
Mixed Use	13	12	25
Open Space	7,318	3,502	10,820
Parks > 10 Acres	303	361	664
Public/Quasi-Public	327	878	1,206
Residential 1 DU	7,629	18,859	26,488
Residential 2 DU	0	839	839
Residential 3 DU	9	366	375
Residential Multiple DU	789	635	1,424
Schools	377	540	917
Total Acreage	22,231	29,808	52,039

¹ Includes portion of Placer Ranch UGA within the 2005 Regional Service Area.

² Includes portion of Placer Vineyards UGA within the 2005 Regional Service Area.

Table 2: Buildout Land Use Summary within Urban Growth Areas

Urban Growth Area (UGA)	Buildout Connected Area (Acres)		Total Buildout Connected Area (Acres)
	Pleasant Grove Watershed	Dry Creek Watershed	
Curry Creek UGA	3,212	--	3,212
Regional University UGA	1,140	--	1,140
Inviro Tech UGA	5	--	5
Placer UGA	--	630	630
Orchard Creek	25	--	25
Placer Ranch ¹	807	--	807
Placer Vineyards ¹	--	4,806	4,806
SMD-3	--	2,231	2,231
SPMUD UGA	--	6,410	6,410
Creekview UGA ²	749	--	749
Sierra Vista UGA	1,785	--	1,785
Brookfield UGA	683	--	683
Total Acreage	8,406	14,077	22,483

¹ Does not include portions of Placer Ranch or Placer Vineyards UGAs within the 2005 Regional Service Area.

² "Panhandle" refers to a 238-acre portion of the Reason Farms planning area that is adjacent to the western boundary of the 511-acre Creekview UGA. Though not considered a UGA, the panhandle area is assumed to contribute wastewater flow to the Creekview UGA.

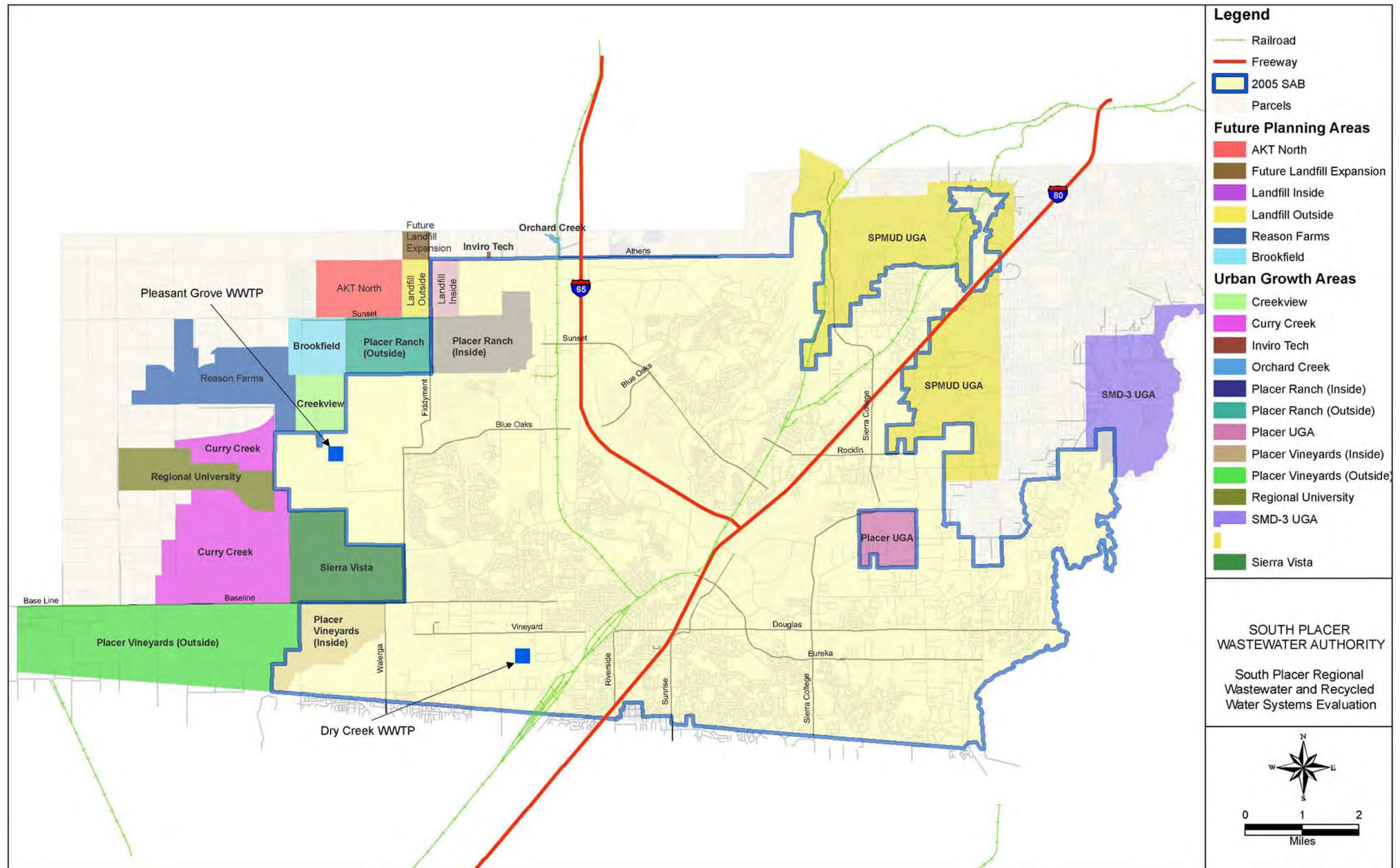


Figure 1 – Buildout Land Use Map Including UGAs

3 Point Sources

Seven existing point sources were identified within the 2005 Regional Service Area based on discussions with SPWA member agencies. Information about point sources is summarized in **Table 3**. There are also three point sources located within UGAs. These point source flows are included with the UGA flow projections presented later in this TM and the UGA flow projection worksheets provided in **Attachment A**. Existing point sources in the 2005 Regional Service Area were identified from flow monitoring and water billing information. The Placer County Landfill was also identified as a point source because it generates very little wastewater flow in comparison to its land area. Buildout flow projections from NEC and HP were provided by the City of Roseville and are based on buildout conditions for each development.

Table 3: June 2004 and Buildout ADWF from Point Sources in the June 2004 Service Area

Point Source	Location	Current Flow Data Source	Current ADWF (gpd)	Projected Buildout ADWF (gpd)
Union Pacific Railroad	Roseville	City of Roseville	85,000	85,000
Landfill	Placer County	City of Roseville	5,000	5,000
NEC	Roseville	Flow Monitor Data	700,000	2,000,000
HP	Roseville	City of Roseville	150,000	484,000
Kaiser Hospital	Roseville	Water Use Data	50,000	50,000
Formica	Placer County	Placer County	60,000	60,000
Rio Bravo Power Plant	Placer County	Placer County	15,000	15,000

Notes: Flow projections are based upon existing land use and existing land use designations current as of June 2004, and will provide the estimated flows for baseline modeling scenario for SPWA. Rezoning of HP and Kaiser Hospital properties are now better known than in June 2004, and are documented in TM No. 9b, and are included in a “Land Use intensification Scenario”.

4 Unit Flow Factors

Information about the development of unit flow factors used for the WWTP expansion analysis is discussed in the Dry Weather Flow Projection for the 2005 Regional Service Area TM (TM No. 2a). The 2005 unit flow factors for the buildout scenario are presented in **Table 4**. Unit flow factors for single family residential are applied on a per dwelling unit (du) basis while unit flow factors for other land uses are applied on an acreage basis.

Table 4: 2005 Average Dry Weather Flow (ADWF) Factors

Land Use Designation	Units	2005 Unit Flow Factors WWTP Analysis ¹	1996 Master Plan Unit Flow Factor
Commercial	gpd per acre	850	1,040
Heavy Industrial	gpd per acre	850	1,560
Light Industrial	gpd per acre	850	1,040
Mixed Use	gpd per acre	2,300	N/A
Public/Quasi-Public	gpd per acre	660	1,040
Schools	gpd per acre	170	N/A
Residential 1 DU	gpd per du	190	260
Residential 2 DU	gpd per du	190	260
Residential 3 DU	gpd per du	190	260
Residential Mult. DU	gpd per acre	2,040 ²	4,160
Open Space	gpd per acre	0	0
Parks > 10 Acres	gpd per acre	10	N/A
Vacant	gpd per acre	0	0

¹ Includes allowance for dry season GWI.

² The 2005 Residential Multiple DU unit flow factor can also be represented as 130 gpd per du

5 Buildout Flow Projections

Buildout ADWF projections within the Ultimate SPWA Service Area are based on the unit ADWF factors developed for the WWTP analysis above (includes dry season GWI). These flow projections include the results of proposed redevelopment/intensification within Roseville and Rocklin, which were analyzed as a separate scenario and are presented in detail in the *Intensification Land Use TM* (TM No. 9c). Buildout ADWF projections within the 2005 Regional Service Area are presented in **Table 5**. Buildout average dry weather flow projections within the Ultimate SPWA Service Area (including UGAs) are presented in **Table 6**. Detailed flow projections for each UGA are presented in **Attachment A** at the end of this TM.

South Placer Regional Wastewater and Recycled Water Systems Evaluation

Average Dry Weather Flow Projection

Table 5: Buildout ADWF Projections within 2005 Regional Service Area

Land Use	Unit Flow Factor	PG WWTP ³		DC WWTP ⁴		2005 Regional Service Area	
		Buildout Units (ac or du)	Buildout ADWF (mgd)	Buildout Units (ac or du)	Buildout ADWF (mgd)	Buildout Units (ac or du)	Buildout ADWF (mgd)
Commercial	850 gpd/ac	1,728	1.47	2,890	2.46	4,618	3.92
Heavy Industrial ¹	850 gpd/ac	1,680	1.43	263	0.22	1,943	1.65
Light Industrial ¹	850 gpd/ac	1,221	1.04	637	0.54	1,858	1.58
Mixed Use	2,300 gpd/ac	-	-	7	0.02	7	0.02
Public/Quasi-Public ¹	660 gpd/ac	282	0.19	851	0.56	1,133	0.75
Schools	170 gpd/ac	258	0.04	540	0.09	798	0.14
Residential 1 DU	190 gpd/du	26,893	5.11	42,866	8.14	69,759	13.25
Residential 2 DU	190 gpd/du	2	0.0004	2,122	0.40	2,124	0.40
Residential 3 DU	190 gpd/du	12	0.002	720	0.14	732	0.14
Residential Multiple DU	2,040 gpd/ac	594	1.21	606	1.24	1,200	2.45
Open Space	0 gpd/ac	6,034	-	3,171	-	9,205	-
Parks > 10 Acres	10 gpd/ac	270	0.003	361	0.004	631	0.01
Point Sources	Varies gpd/ac	1,043	2.56	91	0.14	1,134	2.70
Placer Ranch ²	Varies gpd/ac	1,027	0.90	-	-	1,027	0.90
West Roseville ²	Varies gpd/ac	3,162	2.07	-	-	3,162	1.70
Placer Vineyards ²	Varies gpd/ac	-	-	1,062	0.58	1,062	0.58
Rezones	Varies gpd/ac	-	0.50	-	0.17	-	0.67
Intensification	Varies gpd/ac	-	-	-	1.64	-	1.64
Total (mgd)			16.52		16.34		32.86

¹ Land use category does not include area of parcels associated with point sources identified in Table 3.

² Includes portion of development located within the 2005 Regional Service Area.

³ Pleasant Grove WWTP Service Area

⁴ Dry Creek WWTP Service Area

⁵ Includes all of WRSP, located entirely inside of the 2005 Regional Service Area boundary

Table 6: Buildout ADWF Projections within Ultimate SPWA Service Area

Description of Area	Buildout ADWF (mgd)		Total Buildout ADWF (mgd)
	PGWWTP ³	DCWWTP ⁴	
2005 Regional Service Area	16.52	16.34	32.86
Curry Creek UGA	2.72	-	2.72
Regional University UGA	1.17	-	1.17
Inviro Tech UGA	0.08	-	0.08
Placer UGA	-	0.01	0.01
Orchard Creek UGA	0.02	-	0.02
Placer Ranch UGA	1.27	-	1.27
Placer Vineyards UGA	-	2.23	2.23
SMD-3 UGA	-	0.29	0.29
SPMUD UGA	-	1.11	1.11
Creekview UGA and Panhandle ⁵	1.06	-	1.06
Sierra Vista UGA	2.10	-	2.10
Brookfield UGA	0.73	-	0.73
Total ADWF (mgd)	25.67	19.99	45.64

¹ Includes portion of Placer Ranch UGA within the 2005 Regional Service Area.

² Includes portion of Placer Vineyards UGA within the 2005 Regional Service Area.

³ Pleasant Grove WWTP Service Area

⁴ Dry Creek WWTP Service Area

⁵ "Panhandle" refers to a 238-acre portion of the Reason Farms planning area that is adjacent to the western boundary of the 511-acre Creekview UGA. The panhandle area is assumed to contribute wastewater flow to the Creekview UGA.

Attachment A

Urban Growth Area Flow Projections

**CURRY CREEK UGA
PLEASANT GROVE WATERSHED**

Connected Land Use Description	Units	DU or Area (acres)	Unit Flow Factor (gpd)	(gpd)
OPEN SPACE	Acres	931	-	-
COMMERCIAL	Acres	161	850	136,850
HEAVY INDUSTRIAL	Acres	64	850	54,400
LIGHT INDUSTRIAL	Acres	161	850	136,850
MIXED USE	Acres	64	2,300	147,200
PUBLIC/QUASI-PUBLIC	Acres	161	660	106,260
SCHOOLS	Acres	96	170	16,320
RESIDENTIAL 1 DU	DU	8,988	190	1,707,720
RESIDENTIAL 2 DU	DU	-	190	-
RESIDENTIAL 3 DU	DU	-	190	-
RESIDENTIAL MULTIPLE DU	DU	3,210	130	417,300
Total				2,722,900
Total (mgd)				2.72

**REGIONAL UNIVERSITY UGA
PLEASANT GROVE WATERSHED**

Connected Land Use Description	Units	DU or Area (acres)	Unit Flow Factor (gpd)	(gpd)
OPEN SPACE	Acres	149	-	-
COMMERCIAL	Acres	22	850	18,870
HEAVY INDUSTRIAL	Acres	-	850	-
LIGHT INDUSTRIAL	Acres	-	850	-
MIXED USE	Acres	-	2,300	-
PUBLIC/QUASI-PUBLIC	Acres	10	660	6,864
SCHOOLS	Acres	31	170	5,270
RESIDENTIAL 1 DU	DU	2,226	190	422,940
RESIDENTIAL 2 DU	DU	-	190	-
RESIDENTIAL 3 DU	DU	-	190	-
RESIDENTIAL MULTIPLE DU	DU	1,006	130	130,780
Point Sources				
UNIVERSITY				582,600
Total				1,167,324
Total (mgd)				1.17

**INVIRO TECH UGA
PLEASANT GROVE WATERSHED**

Connected Land Use Description	Units	DU or Area (acres)	Unit Flow Factor (gpd)	(gpd)
OPEN SPACE	Acres	0	0	0
COMMERCIAL	Acres	0	850	0
HEAVY INDUSTRIAL	Acres	0	850	0
LIGHT INDUSTRIAL	Acres	0	850	0
MIXED USE	Acres	0	2,300	0
PUBLIC/QUASI-PUBLIC	Acres	0	660	0
SCHOOLS	Acres	0	170	0
RESIDENTIAL 1 DU	DU	0	190	0
RESIDENTIAL 2 DU	DU	0	190	0
RESIDENTIAL 3 DU	DU	0	190	0
RESIDENTIAL MULTIPLE DU	DU	0	130	0
Point Sources				
INVIRO TECH				80,000
Total				80,000
Total (mgd)				0.08

**PLACER RANCH UGA (OUTSIDE 2005 REGIONAL SERVICE AREA)
PLEASANT GROVE WATERSHED**

Connected Land Use Description	Units	DU or Area (acres)	Unit Flow Factor (gpd)	(gpd)
OPEN SPACE	Acres	74	-	-
COMMERCIAL	Acres	67	850	56,610
HEAVY INDUSTRIAL	Acres	-	850	-
LIGHT INDUSTRIAL	Acres	29	850	24,650
MIXED USE	Acres	20	2,300	46,460
PUBLIC/QUASI-PUBLIC	Acres	21	660	14,058
SCHOOLS	Acres	30	170	5,100
RESIDENTIAL 1 DU	DU	2,046	190	388,683
RESIDENTIAL 2 DU	DU	-	190	-
RESIDENTIAL 3 DU	DU	-	190	-
RESIDENTIAL MULTIPLE DU	DU	2,281	130	296,582
Point Sources				
UNIVERSITY ^a				440,000
Total				1,272,143
Total ^b (mgd)				1.27

Footnotes:

(a) Does not include faculty housing, which is included in the Residential categories above.

(b) 1.27 mgd does not include flows from "offsite" areas.

**CREEKVIEW UGA & PANHANDLE^a
PLEASANT GROVE WATERSHED**

Connected Land Use Description	Units	DU or Area (acres)	Unit Flow Factor (gpd)	(gpd)
OPEN SPACE	Acres	248	-	-
COMMERCIAL	Acres	11	850	9,435
HEAVY INDUSTRIAL	Acres	-	850	-
LIGHT INDUSTRIAL	Acres	9	850	7,225
MIXED USE	Acres	12	2,300	27,600
PUBLIC/QUASI-PUBLIC	Acres	3	660	2,046
SCHOOLS	Acres	11	170	1,785
RESIDENTIAL 1 DU	DU	1,593	190	302,670
RESIDENTIAL 2 DU	DU		190	-
RESIDENTIAL 3 DU	DU		190	-
RESIDENTIAL MULTIPLE DU	DU	1,170	130	152,100
Total				502,861
Point Sources (From Panhandle Area)				
<i>From North Panhandle Area^{a,b}</i>				
MDH (Faculty Housing)	DU	96	190	18,240
Commercial (Hotel)	DU	150	190	28,500
Commercial (Athletic Club)	acres	1	850	850
<i>From South Panhandle Area^c</i>				
University ^d	acres	221	2,304	509,184
Total (mgd)				1.06

Footnotes:

(a) "North Panhandle" refers to the portion of the Reason Farms panhandle that is north of Pleasant Grove Creek; this area is adjacent to the western boundary of the Creekview UGA. This area is assumed to contribute wastewater flow to the Creekview UGA.

(b) As of July 2007, several development scenarios were under consideration for the North Panhandle area. The scenarios associated with the highest flow estimates are included here.

(c) The entire "Panhandle" area comprises approximately 238 acres. Subtracting 17 acres (Wood Rodgers) for the North Panhandle area yields 221 acres remaining for a proposed private university in the "South Panhandle" area.

(d) The unit flow factor for the university was derived by dividing the total flow projection for the university in the Placer Ranch UGA (0.68 mgd) by its corresponding acreage (295 acres), yielding 2,304 gpad.

**SIERRA VISTA UGA
PLEASANT GROVE WATERSHED**

Connected Land Use Description	Units	DU or Area (acres)	Unit Flow Factor (gpd)	(gpd)
OPEN SPACE ^a	Acres	412	-	-
COMMERCIAL	Acres	220	850	187,000
HEAVY INDUSTRIAL	Acres	-	850	-
LIGHT INDUSTRIAL	Acres	-	850	-
MIXED USE ^b	Acres	43	2,300	98,900
PUBLIC/QUASI-PUBLIC	Acres	10	660	6,600
SCHOOLS	Acres	68	170	11,492
RESIDENTIAL 1 DU	DU	7,799	190	1,481,810
RESIDENTIAL 2 DU	DU	-	190	-
RESIDENTIAL 3 DU	DU	-	190	-
RESIDENTIAL MULTIPLE DU	DU	2,399	130	311,870
Total				2,097,672
Total (mgd)				2.10

Footnotes:

(a) Estimated area. At zero gpd/acre, however, this estimate does not impact flow projections

(b) Differs from 78,900 gpd calculated in the Sierra Vista Sanitary Sewer Master Plan (MSCE, July 2007).

**BROOKFIELD UGA
PLEASANT GROVE WATERSHED**

Connected Land Use Description	Units	DU or Area (acres)	Unit Flow Factor (gpd)	(gpd)
OPEN SPACE	Acres	208	-	-
COMMERCIAL	Acres	14	850	11,560
HEAVY INDUSTRIAL	Acres	-	850	-
LIGHT INDUSTRIAL	Acres	-	850	-
MIXED USE	Acres	-	2,300	-
PUBLIC/QUASI-PUBLIC	Acres	2	660	1,320
SCHOOLS	Acres	22	170	3,740
RESIDENTIAL 1 DU	DU	835	190	158,650
RESIDENTIAL 2 DU	DU	2,087	190	396,530
RESIDENTIAL 3 DU	DU	-	190	-
RESIDENTIAL MULTIPLE DU	DU	1,252	130	162,760
Total				734,560
Total ¹ (mgd)				0.73

Footnotes:

¹ Brookfield developers supplied several sets of preliminary land use data during this project, resulting in a range of projected ADWF from 0.69 (the most recent) to 0.73 mgd. The largest of these projections, 0.73 mgd, was used for this analysis.

**PLACER UGA
DRY CREEK WATERSHED**

Connected Land Use Description	Units	DU or Area (acres)	Unit Flow Factor (gpd)	(gpd)
OPEN SPACE	Acres	-	-	-
COMMERCIAL	Acres	-	850	-
HEAVY INDUSTRIAL	Acres	-	850	-
LIGHT INDUSTRIAL	Acres	-	850	-
MIXED USE	Acres	-	2,300	-
PUBLIC/QUASI-PUBLIC	Acres	-	660	-
SCHOOLS	Acres	-	170	-
RESIDENTIAL 1 DU	DU	27	190	5,130
RESIDENTIAL 2 DU	DU	-	190	-
RESIDENTIAL 3 DU	DU	-	190	-
RESIDENTIAL MULTIPLE DU	DU	-	130	-
Total				5,130
Total (mgd)				0.01

**PLACER VINEYARDS UGA (OUTSIDE 2005 REGIONAL SERVICE AREA ^{a,b})
DRY CREEK WATERSHED**

Connected Land Use Description	Units	DU or Area (acres)	Unit Flow Factor (gpd)	(gpd)
OPEN SPACE ^c	Acres	729	-	-
COMMERCIAL	Acres	236	850	200,600
HEAVY INDUSTRIAL	Acres	-	850	-
LIGHT INDUSTRIAL	Acres	-	850	-
MIXED USE	Acres	63	2,300	143,750
PUBLIC/QUASI-PUBLIC	Acres	119	660	78,540
SCHOOLS	Acres	140	170	23,800
RESIDENTIAL 1 DU	DU	7,649	190	1,453,310
RESIDENTIAL 2 DU	DU	-	190	-
RESIDENTIAL 3 DU	DU	-	190	-
RESIDENTIAL MULTIPLE DU	DU	2,542	130	330,460
Total				2,230,460
Total (mgd)				2.23

Footnotes:

(a) There is an area of approximately 150 acres inside Placer Vineyards Shed A, but within the 2005 Regional Service Area Boundary. Mike Smith of MSCE provided land use information for this area in September 2007. Flow projections for this area were therefore subtracted from Shed A and added to the Shed B flows to represent the total flow from within the 2005 Regional Service Area Boundary.

(b) For convenience, the boundary for Shed A is henceforth assumed to be contiguous with the 2005 SAB and the area represented by the ADWF presented above.

(c) Estimated area. At zero gpd/acre, however, this estimate does not impact flow projections

**SMD-3 UGA
DRY CREEK WATERSHED**

Connected Land Use Description	Units	DU or Area (acres)	Unit Flow Factor (gpd)	(gpd)
OPEN SPACE	Acres	-	-	-
COMMERCIAL	Acres	3	850	2,550
HEAVY INDUSTRIAL	Acres	-	850	-
LIGHT INDUSTRIAL	Acres	-	850	-
MIXED USE	Acres	-	2,300	-
PUBLIC/QUASI-PUBLIC	Acres	11	660	7,260
SCHOOLS	Acres	-	170	-
RESIDENTIAL 1 DU	DU	1,268	190	240,920
RESIDENTIAL 2 DU	DU	14	190	2,660
RESIDENTIAL 3 DU	DU	-	190	-
RESIDENTIAL MULTIPLE DU	DU	250	130	32,500
Total				285,890
Total (mgd)				0.29

**SPMUD UGA
DRY CREEK WATERSHED**

Connected Land Use Description	Units	DU or Area (acres)	Unit Flow Factor (gpd)	(gpd)
OPEN SPACE	Acres	97	-	-
COMMERCIAL	Acres	99	850	84,150
HEAVY INDUSTRIAL	Acres	-	850	-
LIGHT INDUSTRIAL	Acres	-	850	-
MIXED USE	Acres	-	2,300	-
PUBLIC/QUASI-PUBLIC	Acres	-	660	-
SCHOOLS	Acres	-	170	-
RESIDENTIAL 1 DU - by 2050 ^a	DU	1,200	190	228,000
RESIDENTIAL 1 DU - after 2050 ^a	DU	4,180	190	794,200
RESIDENTIAL 2 DU	DU	-	190	-
RESIDENTIAL 3 DU	DU	-	190	-
RESIDENTIAL MULTIPLE DU	DU	-	130	-
Total				1,106,350
Total - by 2050 ^a (mgd)				0.23
Total - after 2050 ^a (mgd)				1.11

Footnotes:

a) Based on information provided by SPMUD, a total of 5,380 DUs are expected in the SPMUD UGA at ultimate buildout. However, SPMUD projects that only 1,200 of these DUs will be built within the planning horizon (2050) of this study, leaving 4,180 DUs for later buildout.

Attachment B

June 2007 TM Update Sheet

Update Sheet



South Placer Regional Wastewater and Recycled Water Systems Evaluation

Subject: Update for TM 2b
Prepared For: Art O'Brien, City of Roseville
Prepared by: Andy Smith, RMC
Reviewed by: Dave Richardson, RMC
Date: October 31, 2006
Reference: 0091-04

1 Summary of Update for TM 2b

Since the completion of TM 2b on November 4, 2005, changes in the scope of the South Placer Wastewater and Recycled Water Systems Evaluation, as well as changes in the data available, have resulted in the need to identify out-of-date information, to summarize the updated information, and provide justification as to the need for the update. **Table 1** presents a summary of the updates for TM 2b.

Table 1: Summary of Update for TM 2b

Page	Location	Summary of Outdated Information	Summary of Updated Information	Reason for Update
1	Paragraph 4	Total Ultimate Service Area acreage = 29,724 (PG); 36,070 (DC); 65,794 (Total)	Total Ultimate Service Area acreage = 30,407 (PG); 40,161 (DC); 70,568 (Total)	Expanded SPMUD boundary and Brookfield
2	Table 2	SPMUD UGA = 2,319 acres	SPMUD UGA = 6,410	SPMUD provided an expanded UGA boundary
2	Table 2	Brookfield not included	Brookfield: Pleasant Grove Watershed, 683 acres	Brookfield added as a UGA
2	Table 2	Total UGA acreage = 7,549 (PG); 6,242 (DC); 13,791 (Total)	Total UGA acreage = 8,232 (PG); 10,333 (DC); 18,565 (Total)	Expanded SPMUD boundary and Brookfield
3	Figure 1	SPMUD UGA included, but does not reflect expanded boundary	Expanded boundary shown in Figure 2-5 of Systems Evaluation report	SPMUD provided an expanded UGA boundary
3	Figure 1	Brookfield included, but not shown as a UGA	Brookfield is considered as a UGA	Brookfield added as a UGA
7	Table 6	Brookfield not included	Brookfield: 0.73 mgd (PG)	Brookfield added as a UGA
n/a	Attachment A	Brookfield not included	Refer to TM 11a for land use summary	Brookfield added as a UGA

Attachment C
2009 Update Sheet

Update Sheet



South Placer Regional Wastewater and Recycled Water Systems Evaluation

Subject: 2009 Update Sheet for TM 2b
Prepared For: Art O'Brien, City of Roseville
Prepared by: Chris van Lienden, RMC
Reviewed by: Dave Richardson, RMC
Date: September 3, 2009
Reference: 0091-04

The TM has been modified since it was originally developed in 2005 based on the following updates.

1 2006 Updates

The TM was updated in 2006 to reflect changes in the SPMUD UGA boundary and land use, and to add Brookfield as an additional UGA.

2 2008 Updates

The TM was further updated in 2008 to reflect changes in the land uses and flow projections of the UGAs.

3 2009 Updates

An additional update was prepared in 2009 to reflect the following changes.

3.1 Updates to the H2Omap Sewer Model

Since the 2008 update, the H2Omap Sewer software has been updated which resulted changes to the build-out flow estimates. The flow estimates in the TM has been updated to reflect the most recent model results.

3.2 Changes to the Development Timeline

Flow projections have been updated to reflect reduced rates of residential development due to the economic slowdown beginning in 2008.

3.3 West Roseville Specific Plan Rezone

Buildout flow estimates have been updated to reflect additional inflow from a proposed rezone in the West Roseville Specific Plan (May, 2009). The new land uses and associated average dry weather flow (ADWF) are summarized in Table 1.

Table 1 – West Roseville Specific Plan Rezone Comparison

Connected Land Use Description	Original Developer Agreements		2009 Proposed Update	
	DU or Area (DU or ac)	Flow (mgd)	DU or Area (DU or ac)	Flow (mgd)
1 Residential				
1.1 Low Density Residential	4842 DU	0.92	5963 DU	1.13
1.2 LDR (age restricted)	710 DU	0.13	0 DU	0.00
1.3 Medium Density Residential	1064 DU	0.20	1746 DU	0.33
1.4 High Density Residential	1774 DU	0.23	3229 DU	0.42
2 Open Space	670 ac		696 ac	0.00
2.1 Paseo	15 ac		0 ac	0.00
2.2 Park	251 ac		284 ac	0.00
2.3 Pocket Parks	19 ac		0 ac	0.00
3. Public/Quasi-Public				
3.1 Schools	108 ac	0.02	109 ac	0.02
3.2 Public/Quasi-Public	41 ac	0.02	15 ac	0.01
4 Community Commercial				
4.1 Commercial	34 ac	0.03	56 ac	0.05
4.2 Mixed Use	14 ac	0.03	0 ac	0.00
4.3 Church	0 ac	0.01	0 ac	0.00
5. Business Professional				
5.1 Commercial	20 ac	0.02	18 ac	0.02
6. Light Industrial	74 ac	0.06	75 ac	0.06
7. Industrial	34 ac	0.03	35 ac	0.03
Total		1.71		2.07

ATTACHMENT #3

TECHNICAL MEMORANDUM

TO: Steve Dalrymple, West Yost Associates

FROM: David W. Smith, PhD.

DATE: January 15, 2006

SUBJECT: Cumulative Analysis of UGA Impacts on Water Quality and Aquatic Resources in Pleasant Grove Creek, Roseville, California

INTRODUCTION

BACKGROUND AND NEED FOR ASSESSMENT

As part of the South Placer Wastewater Authority's (SPWA) Regional Wastewater and Recycled Water Systems Evaluation Project, the City of Roseville (City) has been reviewing information for planned developments seeking wastewater services for particular urban growth areas (UGAs) that are outside the geographical area currently covered by CEQA documents that were the basis of NDPEs permits to discharge from the City's two regional wastewater treatment plants, Pleasant Grove Wastewater Treatment Plant (PGWWTP) and Dry Creek Wastewater Treatment Plant (DCWWTP). The County of Placer (County), as the local land use authority, will serve as the Lead Agency for California Environmental Quality Act (CEQA) compliance for each UGA project located in the unincorporated area. SPWA will be a Responsible Agency under CEQA for purposes of financing regional wastewater/recycled water infrastructure. As a Responsible Agency, the SPWA will rely on the UGA CEQA documentation prepared by local lead agencies when taking discretionary actions related to funding or financing such infrastructure.

As agreed upon in Operations Agreement among the Regional Partners, the City owns and operates the regional wastewater treatment plants on behalf of the partners. In this capacity, the City approves plant expansion/upgrade designs, construction documents, and bid authorizations, awards construction contracts, and obtains the necessary National Pollutant Discharge Elimination System (NPDES) permits for the facilities. In this role, the City functions as a CEQA Lead Agency. When taking discretionary actions related to regional wastewater facilities to accommodate treatment and discharge of UGA flows, however, the City, serving as staff to SPWA which is a Responsible Agency, intends to rely on UGA project-specific CEQA documentation for all UGA-related environmental issues not addressed by the City's own existing CEQA documents. To be in a position to do so, the City needs to assure the adequacy of each UGA CEQA document. Of particular interest to the City in this regard is the adequacy of the discussion, in EIRs for

UGA projects, of future cumulative impacts associated with treatment and discharge of all of the foreseeable wastewater flows from pending UGA projects.

The scope and analytical requirements that the SPWA and the City require of future UGA CEQA documentation is outlined in the City's letter to Mr. Durfee dated April 26, 2005. The City expects that the County, as Lead Agency for the UGA CEQA documents, will rely on the City's 1996 Master Plan and Master Plan Environmental Impact Report (EIR) (Roseville, City of, 1996) and its West Roseville Specific Plan EIR (Roseville, City of, 2004) as baseline documents and examples of the appropriate level of analysis that is required for UGA CEQA documentation, particularly cumulative impact assessments. The 1996 Master Plan EIR addressed planned wastewater conveyance and treatment improvements to serve a regional service area through the year 2015. In looking at impacts that would result from actions to be taken over a 20 year planning horizon, its impacts assessments are "inherently cumulative" in nature. The service area for the regional system would cover approximately 95 square miles in southwestern Placer County, extending from the town of Newcastle westward to the City of Roseville, and from the City of Lincoln southward to the Placer County/Sacramento County line. The UGA CEQA documents will identify and adequately assess actions not addressed, or not sufficiently addressed, by the City's previously certified CEQA documents. The City's 1996 Master Plan EIR and its West Roseville Specific Plan EIR collectively evaluated, for CEQA purposes, impacts of future flows that will be generated from development within the "2005 service area." The 2005 service area includes the 1996 service area and any subsequent formal modifications thereto. Impacts from portions of UGAs located outside the 2005 service area, and appropriate mitigation, would need to be identified in the CEQA documents associated with each UGA. The 2005 service area and UGAs located outside this service area are shown in Figure 1.

PURPOSE AND USE OF THIS MEMORANDUM

The purpose of this technical memorandum (TM) is to evaluate future anticipated compliance with water quality regulations in Pleasant Grove Creek, and to assess future cumulative impacts to water quality and aquatic biological resources of Pleasant Grove Creek in light of the prospect of treating and discharging increasingly more wastewater from the PGWWTP, some of which is expected from particular UGAs planned for development located outside the geographical area currently covered by CEQA documents that were the basis of NDPEs permits to discharge from PGWWTP. More specifically, this TM acknowledges the future cumulative assessments included in the City's two certified EIR's (cited above) and the environmental documentation for the other areas included in the "2005 Service Area" (Reference the "Proposed 2005 Regional Service Area Boundary Tech Memo dated January 13, 2005"), which address wastewater flows from within the 2005 service area, and determines whether discharge of the

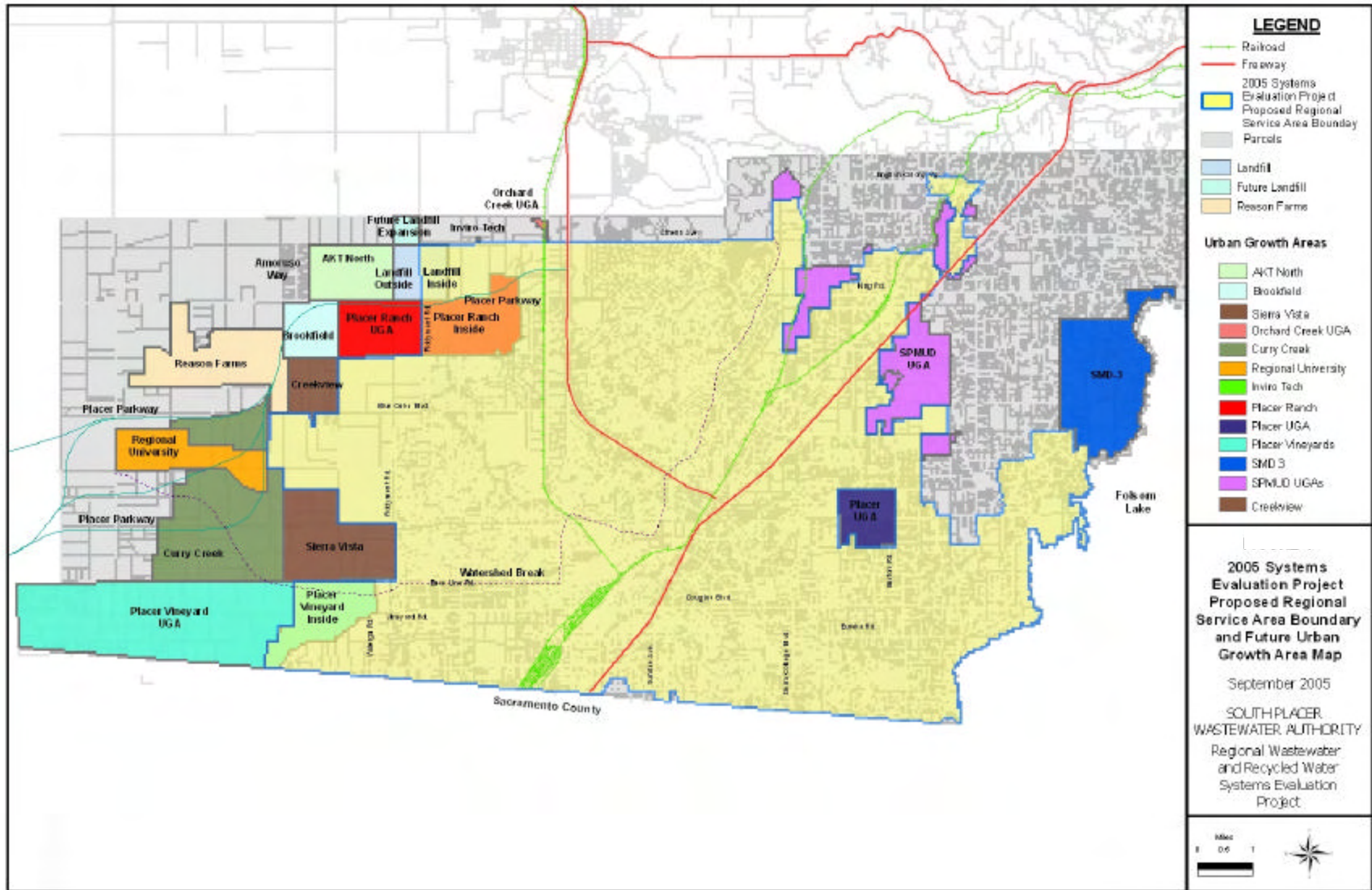


Figure 1. Location of UGAs (courtesy of RMC Water and Environment)

additional treated UGA flows (that are outside the 2005 service area) will result in any new significant cumulative impacts, not previously identified, or more severe cumulative impacts relative to those previously identified by the City's CEQA documents. Measures for mitigating future cumulative impacts are also discussed.

The assessment of water quality and aquatic biological resource impacts described in this TM is intended to contribute to a common basis for the cumulative impacts section of the project-specific CEQA documentation being prepared for each of the UGAs.

The future UGAs that are planned to be served by PGWWTP and considered in this assessment include:

- Curry Creek
- Regional University
- Orchard Creek
- Placer Ranch
- Invirotech
- Sierra Vista and Creekview Specific Plan Areas (formerly called West Roseville remainder area).

In addition, flows from the following future UGAs that are planned to be served by DCWWTP are provided in this assessment:

- Placer Vineyards
- Placer County Sewer Maintenance District No. 3
- Areas in the South Placer Municipal Utility District not currently within the 2005 SPWA boundary (i.e., flows for which discharge impacts have not already been addressed in a CEQA document).

Analysis of potential cumulative Pleasant Grove Creek impacts resulting from the future treatment and discharge of flow from all the UGAs tributary to the PGWWTP respectively, and identification of appropriate mitigation measures for any significant or potentially significant cumulative impacts, has been requested by the City to help assure adequate CEQA basis for approving annexation of the UGAs to the WWTP service areas, and eventual permitting of the future PGWWTP flows. This TM addresses impacts of flow incremental to that from the 2005 service area (i.e., flow from the UGAs) to Pleasant Grove Creek. Impacts to Dry Creek are not addressed in this TM. They have been addressed in a separate memorandum dated October 27, 2005.

For any future cumulative condition deemed (from this assessment) to have significant effects, a determination will be made as to whether the incremental increase in flow from

the UGAs would contribute considerably to that significant cumulative condition. For all assessments that find the future cumulative condition to be less-than-significant and, thus, not requiring mitigation, determination of whether the UGA's increment contributes considerably to the future cumulative condition becomes unnecessary under CEQA and, therefore, will not be addressed.

BASIS OF ANALYSIS

Table 1 shows the allocation of estimated flows from each of the UGAs to the DC and PGWWTPs and the allocation of flows from within and outside of the 2005 service area. Land uses for most of these UGAs are currently undergoing revisions and further analysis. Projected flow from any UGA may change slightly in the future, but minor changes in flow would not change the analysis herein.

ASSESSMENT APPROACH

This cumulative assessment builds upon the cumulative assessments included in the City's 1996 Master Plan EIR (which are inherently "cumulative" in nature) and West Roseville Specific Plan EIR (Roseville, City of, 1996; Roseville, City of, 2004). The following sections discuss whether new or more significant impacts to Pleasant Grove Creek water quality or aquatic biological resources would occur with the annexation of the UGAs into the SPWA service area and the resulting discharge of treated effluent from the PGWWTP into Pleasant Grove Creek.

REGULATORY ENVIRONMENT

Water Quality

Discharges from wastewater treatment plants are regulated by National Pollutant Discharge Elimination System (NPDES) permits. The Central Valley Regional Water Quality Control Board (RWQCB) issued a NPDES permit regulating discharges from the PGWWTP in 2000 (NPDES No. CA0084573, Order No. 5-00-075). The permitted capacity of the PGWWTP is 12.0 mgd (ADWF). NPDES permits expire and must be renewed every five years. Through its development and adoption of NPDES permits every five years, the RWQCB stipulates effluent and receiving water limitations that must be met, thereby assuring compliance with receiving water quality criteria/objectives and protection of beneficial uses.

Table 1 indicates the total estimated future flow from the PGWWTP, plus flow from UGAs located outside the 2005 service area, is 23.4 mgd. This is 13.4 mgd greater than the current permitted capacity of the DCWWTP, but 6.1 mgd *less than* the 29.5 mgd

Table 1. Estimated Future Wastewater Flows						
(All flows million gallons per day average dry weather flow. "Inside" refers to areas within the 2005 service area and "outside" refers to areas located outside the 2005 service area)						
	DCWWTP			PGWWTP		
	Inside	Outside	Total	Inside	Outside	Total
2005 Service Area	14.05		14.05	14.8		14.8
Placer Vineyards	0.85	3.04	3.89			
SMD-3		0.29	0.29			
SPMUD		1.09	1.09			
Placer		0.01	0.01			
Placer Ranch				0.90	1.29	2.19
Curry Creek					2.72	2.72
Regional University					1.16	1.16
Orchard Creek					0.02	0.02
Sierra Vista & Creekview					2.51	2.51
Total	14.9	4.4	19.3	15.7	7.6	23.4
Current Permitted Capacity			18.0			12.0
Data from Dry Weather Flow Projection for the Ultimate SPWA Service Area (including Urban Growth Areas) Tech Memo, RMC, November 4, 2005						

future flow projected for PGWWTP under one of the alternatives in the 1996 Master Plan EIR (see Master Plan EIR Table 2-4). Impacts for the 29.5 mgd alternative were evaluated in the 1996 Master Plan EIR at an equivalent level of detail to that of PGWWTP flow alternatives with lower flow (including the selected alternative with a flow of 20.7 mgd). In this regard, the approach used to evaluate impacts in this TM is conservative.

Aquatic Biological Resources

Because aquatic biological resources are an identified beneficial use of Pleasant Grove Creek, certain limitations included in the NPDES permit act to assure compliance with receiving water criteria/objectives adopted for the protection of aquatic life. By complying with aquatic life water quality criteria/objectives in the receiving waters downstream of the PGWWTP discharge, these resources are protected and maintained. As part of the permit renewal process, State (i.e., California Department of Fish and Game) and federal (i.e., NOAA Fisheries and the U.S. Fish and Wildlife Service) agencies charged with management of fisheries and aquatic resources receive a copy of the Tentative NPDES permit for review and comment. This further assures that the limitations included in the NPDES permit, when met, will protect fish and aquatic resources in the receiving water, downstream of the discharge.

EVALUATION OF IMPACTS

The 1996 Master Plan EIR (Roseville, City of 1996) identified the following significant/potentially significant impacts to water quality and aquatic biological resources associated with treatment and discharge of anticipated future PGWWTP discharges in Pleasant Grove Creek (i.e., operational impacts, not temporary construction-related impacts):

- Degradation of water quality in Pleasant Grove Creek (Impact 7-3);
- Erosion and sedimentation (Impact 5-2); and
- Loss of oak trees along Pleasant Grove Creek resulting from effluent discharge (Impact 4-2).

The 1996 EIR introduced mitigation that would reduce each of these impacts to a less-than-significant level. The first impact listed above attempted to address overall degradation of water quality due to increased effluent discharge. The latter two impacts identified in the 1996 EIR derive wholly, or in part, from the hydraulic effects of greater discharge rates. Consistent with the organization of the 1996 EIR, the two main impact categories discussed below are: 1) water quality degradation due to increased discharge of treated effluent, and 2) flow-related effects on riparian habitat and aquatic life. With regard to the water quality degradation category of assessment, this TM evaluates not only constituents specifically discussed in the City's 1996 EIR, but also evaluates additional constituents of potential concern under the future cumulative condition.

The West Roseville Specific Plan EIR (Roseville, City of 2004) found project-specific impacts to hydrology (with implementation of mitigation), water quality, groundwater, and biological resources to be less than significant. The West Roseville Specific Plan

EIR found cumulative impacts to hydrology, water quality, groundwater, and biological resources to be less than significant.

Several factors indicate the analysis of impacts in this TM is conservative:

- The total estimated future flow of 23.4 mgd from the PGWWTP is 6.1 mgd *less than* the 29.5 mgd future flow projected and evaluated in the 1996 Master Plan EIR.
- This analysis assumes all of the dry weather flow will be discharged. However, dry season discharge to Pleasant Grove Creek will be less than average dry weather flow generated because a portion of the flow will be returned to the UGAs as recycled water for irrigation instead of being discharged to Pleasant Grove Creek.
- The West Roseville Specific Plan EIR includes mitigation Measure 4.11-5, which conditions issuance of building permits on obtaining all the necessary permits to treat, discharge and reuse flows from the specific plan area. SPWA, as a Responsible CEQA agency, will require a similar mitigation measure for the UGAs that are the subject of this TM.

WATER QUALITY DEGRADATION DUE TO INCREASED DISCHARGE

The 1996 Master Plan EIR identified significant impacts to Pleasant Grove Creek water quality resulting from increase water temperature and elevated levels of trace metals and organic pollutants. The impact of the UGAs with respect to these constituents is discussed below. Other constituents of potential concern (i.e., toxicity, mercury, pH, biostimulatory substances, dissolved oxygen, and taste and odors) are also evaluated.

Temperature

The 1996 Master Plan EIR identified elevated temperature as an element of the significant impact to the water quality in Pleasant Grove Creek. The 1996 Master Plan EIR included the following to mitigate for this impact:

- Install cooling towers if necessary (Mitigation Measure 7-4)

Following mitigation, this element of the overall water quality impact would be reduced to a less-than-significant level.

Consistent with this mitigation measure, the City installed temperature cooling units at the DCWWTP, and began operating them in 2004. The City monitors receiving water temperature under the NPDES Permit Monitoring and Reporting Program. The City has not installed cooling units at PGWWTP because salmonid fish are not present there (due to lack of habitat), which is reflected in the less-stringent receiving water temperature limit in the PGWWTP NPDES permit relative to that in the DCWWTP NPDES permit.

During those periods when flow is present in Pleasant Grove Creek (Pleasant Grove Creek is naturally a seasonal stream), additional flows from the UGAs to the PGWWTP service area would cause additional temperature increases in Pleasant Grove Creek, downstream of the PGWWTP outfall. The amount of additional thermal load added to Pleasant Grove Creek would be directly related to the incremental increase in wastewater flow from the UGAs being treated and discharged at the PGWWTP. During those periods when flow (other than effluent from PGWWTP) is not present in Pleasant Grove Creek, incremental UGA flows will not affect water quality in Pleasant Grove Creek. Because the 2015 condition assessed in the City's 1996 Master Plan EIR was determined to be significant, the future cumulative condition with the UGA flows added also would be significant, and the UGA contribution to the future cumulative condition would be considerable.

As the capacity of the PGWWTP is expanded to accommodate flows from the UGAs, cooling units would be added, if necessary, to address the increased wastewater flow needing cooling, thereby assuring continued compliance with the temperature objectives in the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins (Basin Plan) and thermal protection of aquatic resources. The treatment and discharge of UGA flows from the PGWWTP into Pleasant Grove Creek would not result in any new thermal impacts not identified in the 1996 Master Plan EIR. Implementation of the already-identified mitigation will reduce the future cumulative Pleasant Grove Creek thermal impact to a less-than-significant level. No new mitigation measures are required in light of the additional UGA flows; rather, Mitigation Measure 7-4, already identified by the City, may simply need to be implemented sooner, or to a greater or expanded level as needed to address the UGA flows in addition to the flows evaluated in the 1996 Master Plan EIR. Implementation of Mitigation Measure 7-4, as in the case of flows considered in the 1996 Master Plan EIR, reduces this impact to a less-than-significant level.

Trace Metals and Organic Pollutants

The 1996 Master Plan EIR identified the introduction of elevated levels of trace metals and organic pollutants as an element of the significant impact to the water quality in Pleasant Grove Creek. The 1996 Master Plan EIR identified the following mitigation for this impact:

- install advanced treatment facilities (Mitigation Measure 7-2)
- institute metals source controls/pre-treatment (Mitigation Measure 7-3)

Following mitigation, this element of the overall water quality impact would be reduced to a less-than-significant level.

During those periods with flow is present in Pleasant Grove Creek, additional flows from the UGAs to the PGWWTP service area would cause the percentage of water in the Pleasant Grove Creek channel composed of treated effluent, downstream of the PGWWTP outfall, to be higher, all other factors (e.g., creek hydrology) remaining the same. Consequently, instream concentrations of trace metals and organic pollutants downstream of the outfall would increase in proportion to the incremental increase in wastewater flow from the UGAs being treated and discharged at the PGWWTP. During those periods when flow (other than effluent from PGWWTP) is not present in Pleasant Grove Creek, incremental UGA flows will not affect water quality in Pleasant Grove Creek. Because the 2015 condition assessed in the City's 1996 Master Plan EIR was determined to be significant, the future cumulative condition with the UGA flows added also would be significant, and the UGA contribution to the future cumulative condition would be considerable.

As the capacity of the PGWWTP is expanded to accommodate flows from the UGAs, any advanced treatment facilities that the City constructs and operates to comply with its NPDES permit would be expanded (or initially constructed for an expanded capacity) to address the increased wastewater flow from the UGAs, thereby assuring continued compliance with all Basin Plan pollutant objectives and California Toxic Rule criteria. The treatment and discharge of UGA flows from the PGWWTP into Pleasant Grove Creek would not result in any pollutant impacts that would not occur in the absence of the UGA flows. Implementation of the mitigation measures identified in the 1996 EIR, to the degree necessary, to comply with water quality standards under future cumulative flows will reduce the future cumulative Pleasant Grove Creek pollutant impact to a less-than-significant level. No new mitigation measures are required in light of the additional UGA flows; rather, Mitigation Measures 7-2 and 7-3, already identified by the City, may simply need to be implemented sooner, or to a greater or expanded level. Implementation of Mitigation Measures 7-2 and 7-3, as in the case of flows considered in the 1996 Master Plan EIR, reduces this impact to a less-than-significant level.

Aquatic Life Toxicity

The PGWWTP currently performs chronic three-species bioassay testing of its effluent quarterly. These bioassays determine a No Observable Effect Concentration (NOEC) and an Inhibition Concentration for a set percentage effect (IC₂₅). For example, the IC₂₅ is the concentration of toxicant that would cause a 25 percent reduction in mean young per female in the *Ceriodaphnia dubia* reproduction test or a 25 percent reduction in growth for the test population. The IC₂₅ is used because it is a very sensitive, non-lethal endpoint, which attempts to be indicative of the "first signs" of an effect on the test population. LC_{50s}, the lethal concentration to 50 percent of the test population, is a test endpoint showing a much greater level of toxic effect. The NOEC is the lowest dilution ratio (i.e., the largest proportion of effluent) at which no toxic effect is observed. The IC₂₅ is a point estimate that approximates the highest dilution ratio (i.e., the smallest

proportion of effluent) at which a specified level (25 percent) of effect is observed. These results are reported in toxicity units (TU), which are defined as:

$$TU_c = \frac{100}{NOEC}$$

For example, 8 TU_c represents a test result where the NOEC was observed at 12.5 percent effluent, or a dilution ratio of 1 part effluent to 7 parts dilution water. Similarly, 16 TU_c represents a test result where the NOEC was observed at 6.25 percent effluent, or a dilution ratio of 1 part effluent to 15 parts dilution water. As TU_c increases, more dilution water is required to have no effect on the test organisms. A TU_c of <1 indicates that no effect was observed in undiluted (100 percent) effluent, relative to control tests.

The three-species bioassay results for the PGWWTP for all four quarterly tests performed since discharge and bioassay testing began in 2004, have a result of <1 TU_c for all tests. These results show that the undiluted effluent is non-toxic to aquatic life.

PGWWTP effluent quality under the future cumulative condition would be maintained at essentially equivalent or possibly higher quality levels (if additional or more restrictive NPDES limits are permitted by the RWQCB), relative to current effluent quality. Therefore, no aquatic life toxicity would be expected in the future, once the PGWWTP is adequately expanded/upgraded, as necessary, and permitted to treat the incremental flows, including UGA flows. This would be a less-than-significant cumulative impact.

Mercury

The current NPDES permit contains a mercury (Hg) mass-loading limit of 1.71 pounds per year for the combined discharge of the DCWWTP and the PGWWTP. Based on Finding 25f in the DCWWTP NPDES permit, this limit is performance-based and is based on a flow-weighted average mercury concentration plus 20 percent using effluent quality data from January 1996 through September 1999. The average Hg concentration (based on detectable values during this period and upon which the mass loading limit was based) is 0.058 µg/L (see Table 2). Finding 25f indicates the Hg concentration data are questionable because “clean technique” was not used. This means that the actual concentration would likely be less than 0.058 µg/L. Indeed, the average concentration in DCWWTP effluent (based on detectable values) in 2004 through 2005 was 0.012 µg/L, a period during which clean techniques were used (see Table 2). Thus, actual flow could be as much as 0.058/0.012 or 4.9 times greater than the flow upon which the mass loading limit is based without causing the limit to be exceeded. The current NPDES permits have a combined permitted flow of 30 mgd, and the total incremental UGA flow (from areas outside the 1996 EIR area) is 12 mgd, for a total flow of 42 mgd or a 1.4-fold increase. This flow increase factor is less than 4.9, indicating that the combined incremental flow of all UGAs will not cause the Hg mass loading limit to be exceeded. Therefore, the

cumulative impact of the discharge from DCWWTP and PGWWTP on mercury loading is considered to be less than significant.

pH

The NPDES permit for the PGWWTP has an effluent limitation that requires discharges to have a pH between 6.5 and 8.5 units. Based on the current science regarding pH requirements of freshwater aquatic life, the beneficial use most sensitive to creek pH, the Central Valley RWQCB is processing a Basin Plan amendment that will remove the 0.5-unit change requirement of the current pH objective, leaving the component that requires controllable factors affecting water quality to maintain receiving water pH between 6.5 and 8.5 units (RWQCB 2002). Because the permit requires effluent discharged to Pleasant Grove Creek to have a pH between 6.5 and 8.5 and incremental UGA flows will not affect the pH of effluent, future discharges, regardless of volume, would not cause Pleasant Grove Creek pH to fall outside this range. Once the PGWWTP is expanded to accommodate future cumulative flows, the higher rate of discharge will not cause Pleasant Grove Creek pH to fall below a pH of 6.5 or be raised above 8.5. Based on these facts, the future cumulative condition for pH in Pleasant Grove Creek will have a less-than-significant impact on the creek's beneficial uses, including aquatic life uses, which are the uses most sensitive to creek pH.

Biostimulatory Substances (Nutrients)

The 1996 Master Plan EIR indicated that algal growth in Pleasant Grove Creek is limited by factors other than nutrient availability. This indicates that nutrients in effluent would not stimulate algal growth in the creek. In addition, PGWWTP bioassay data indicate that current undiluted PGWWTP effluent does not contain sufficient biostimulatory substances (i.e., nitrogen and phosphorus) to cause a significant increase in cell production in the *S. capricornutum* (algae) bioassay. Consequently, nuisance level plant or algae communities are not expected to develop in Pleasant Grove Creek, downstream of the PGWWTP outfall, under the future cumulative condition when higher rates of effluent discharge, including UGA flows, result in a greater proportion of creek water being constituted by treated effluent. Consequently, nutrient loading from the PGWWTP under the future cumulative condition constitutes a less-than-significant impact to nutrient water quality.

Dissolved Oxygen

The 1996 Master Plan EIR mitigation measures to address receiving water quality degradation impacts are as follows:

- Install advanced treatment facilities (Mitigation Measure 7-2, which is assumed to include mitigation for oxygen-related impacts since dissolved

oxygen impacts were not addressed in particular in the 1996 Master Plan EIR)

- Institute metals source controls/pre-treatment (Mitigation Measure 7-3)

Following mitigation, this element of the overall water quality impact would be reduced to a less-than-significant level.

Table 2. Total Recoverable Mercury Concentrations in the City of Roseville's Wastewater Treatment Plant Effluent		
Analysis Period	Sample Date	Concentration (mg/L)
Basis for NPDES Permit Mass Limit	2/6/96	0.04
	5/6/96	0.12
	8/13/96	0.007
	11/13/96	< 0.013
	3/10/97	< 0.02
	5/13/97	< 0.02
	9/10/97	< 0.02
	11/4/97	0.098
	2/27/98	< 0.02
	6/23/98	< 0.02
	9/21/98	0.041
	3/30/99	< 0.02
	5/26/99	< 0.02
	7/20/99	0.041
	12/5/99	< 0.02
	Period Average (Detected Concentrations Only)	0.058
Clean Sampling Techniques Implemented	1/26/04	< 0.00024
	5/18/04	0.0061
	8/3/04	0.0051
	11/9/04	0.0023
	2/6/05	0.0028
	4/19/05	0.043
		Period Average (Detected Concentrations Only)

The PGWWTP produces Title 22 quality, tertiary-treated effluent characterized by low BOD (typically less than 3 mg/L) and ammonia (typically less than 0.3 mg-N/L). As

such, its biochemical oxygen demand is relatively low. Re-aeration of downstream waters due to physical processes and photosynthesis tends to largely offset the oxygen demand of the effluent as it flows downstream, thereby resulting in small, if any, downstream dissolved oxygen (DO) sags (i.e., reductions in instream DO levels relative to background levels). This is shown by the DO data summarized in Table 3 that reflects the period since discharge from PGWWTP began in July 2004. In particular, the minimum monthly DO concentration is typically greater below the discharge than above it.

Table 3. Dissolved Oxygen in Pleasant Grove Creek										
	2004						2005			
	<i>Jul</i>	<i>Aug</i>	<i>Sep</i>	<i>Oct</i>	<i>Nov</i>	<i>Dec</i>	<i>Jan</i>	<i>Feb</i>	<i>Mar</i>	<i>Apr</i>
<i>Avg R1</i>	8.9	9.2	8.4	10.3	9.6	9.0	9.1	6.1	7.9	7.3
<i>Avg R2</i>	7.4	7.5	7.5	8.3	9.1	9.9	10.7	10.1	9.2	8.8
<i>Min R1</i>	3.1	0.0	4.8	7.4	0.0	0.0	3.7	2.6	3.6	0.0
<i>Min R2</i>	2.0	4.1	5.7	7.4	8.4	9.4	9.4	9.1	8.8	7.9
<i>Max R1</i>	20.6	25.0	11.5	14.1	12.7	13.9	14.6	10.7	14.9	17.3
<i>Max R2</i>	9.8	13.1	9.7	9.2	10.2	10.5	13.5	11.1	9.9	10.1

Notes:

R1 = 200 feet upstream of the PGWWTP discharge

R2 = 200 feet downstream of the PGWWTP discharge

As discharge rates increase in the future, the proportion of creek water constituted by effluent also will increase, as will the total oxygen demand of the discharged effluent. As such, a possibility exists that receiving water DO limitations (which derive directly from Basin Plan DO objectives) would not be met even if NPDES effluent BOD and ammonia limits are met. Available data are insufficient to conclusively establish whether the future cumulative discharge rates from the PGWWTP will result in DO sags downstream that will cause Pleasant Grove Creek DO levels to fall below applicable Basin Plan DO objectives. Because future discharges could potentially cause Pleasant Grove Creek DO concentrations to fall below the applicable DO objective, the future cumulative DO condition in Pleasant Grove Creek is considered to be potentially significant. The contribution of the UGA flows would be cumulatively considerable.

Although DO levels in Pleasant Grove creek were not specifically addressed in the 1996 EIR, this EIR's Mitigation Measure 7-2 (install advanced treatment facilities) is the same measure that would be implemented to address a DO issue. The type of advanced treatment facility would, of course, be tailored to the constituent of concern.

As the capacity of the PGWWTP is expanded to accommodate flows from the UGAs, any advanced treatment facilities that the City constructs and operates to comply with its NPDES DO limitations would be expanded (or initially constructed for an expanded

capacity) to address the increased wastewater flow from the UGAs, thereby assuring continued compliance with all Basin Plan DO objectives. Based on available information, the UGA flows are not expected to create a DO impact where, in the absence of the UGA flows, one would not exist. More likely, the UGA flows would simply further contribute to a cumulative DO impact, should one occur in the future. Consequently, no new mitigation measure(s) would be required in light of the additional UGA flows; rather, the advanced treatment facilities that the City would already have identified to address the potential DO impact may simply need to be implemented sooner, or to a greater or expanded level. Implementation of Mitigation Measure 7-2, as in the case of flows considered in the 1996 Master Plan EIR, reduces this impact to a less-than-significant level.

Tastes and Odors

The Basin Plan states that “*Waters shall not contain taste or odor producing substances in concentrations that impart undesirable tastes or odors to domestic or municipal water supplies or to fish flesh or other edible products of aquatic origin, or that cause nuisance, or otherwise adversely affect beneficial uses.*” No history of taste and odor problems exists in Pleasant Grove Creek at locations downstream of the PGWWTP discharge. Municipal water supply taste and odor problems are often associated with algae production in source waters. The biostimulatory substance assessment presented above concludes that problematic levels of bio-stimulation and associated increased algal production is not expected to occur in Pleasant Grove Creek under the future cumulative condition.

Effluent quality under the future cumulative condition will be maintained at essentially equivalent or possibly higher quality levels (if additional or more restrictive NPDES limits are permitted by the RWQCB), relative to current effluent quality. Therefore, no taste and odor problems would be expected in the future, once the PGWWTP is adequately expanded/upgraded, as necessary, and permitted to treat the incremental flows, including UGA flows. This would be a less-than-significant cumulative impact.

FLOW-RELATED EFFECTS

Flow can affect habitat and result in flooding. Each type of effect is addressed below.

Flooding Effects

Appendix A describes an analysis of the effects of discharge from PGWWTP on water surface elevation in Pleasant Grove Creek under 100-year flow conditions. The analysis indicates that water surface elevation would be increased 0.07 feet or less in the reach upstream of Reason Farm as a result of incremental UGA wastewater flows as a result of the incremental the PGWWTP discharge. Downstream of Reason Farms, the impact of

the incremental UGA discharge would be immeasurable, partially as a result of 207 acre-feet of storage that is being constructed at Reason Farms for the purpose of mitigating impacts of the PGWWTP discharge. The size of this storage was established to exceed that needed to mitigate the effect PGWWTP adwf of 24 mgd, and the analysis in Appendix A shows no more 165 acre-feet would be needed to mitigate for effects of PGWWTP adwf of 23.3 mgd (which includes the incremental UGA wastewater flows) downstream of Reason Farms. This impact is considered less than significant.

Effects on Aquatic Life

Increasing the flows in Pleasant Grove Creek through the discharge of additional treated effluent will result in channel conveyance of higher flow volumes with associated higher water velocities which could cause additional bed scour and bank erosion. Bed scour and bank erosion, if it occurs as a result of the incremental flows, would increase water column turbidity and alter substrate composition downstream of the PGWWTP outfall.

Sedimentation/Turbidity

Due to the constraints of the NPDES permit's effluent limits, the only mechanism for the discharge to cause sedimentation and higher turbidities within Pleasant Grove Creek under future cumulative conditions would be via the hydraulic effects of the higher flows re-suspending creek bed sediments and eroding creek banks near the outfall, and in downstream reaches. The effluent discharged from the PGWWTP under the future cumulative condition will have very low turbidity (i.e., average < 2 NTU) and suspended matter.

Appendix A describes the velocity (in the column entitled "vel chnl") of water in Pleasant Grove Creek under high and low streamflow conditions with and without the incremental UGA flows. The velocity of water indicates the amount of energy available to scour sediment from the bed and bank of the stream. Under high flow conditions, which is the channel forming condition, Appendix A indicates water velocity is not affected to a measurable extent by the incremental UGA flows. Under low flow conditions, the overall stream velocity regime is much lower than at high flow conditions, indicating much less bed and bank erosion would generally be expected under low flow conditions relative to the high flow condition evaluated in the study described in Appendix A. Therefore, the impact of the incremental UGA flows on sedimentation and turbidity is considered to be less than significant.

Water Quality Degradation (Temperature)

The temperature impact has been discussed previously (see Water Quality Degradation due to Increased Discharge section above).

Water Quality Degradation (Contaminant Levels)

The contaminant impact has been discussed previously (see Water Quality Degradation due to Increased Discharge section above).

Riparian Habitat Effects

The 1996 Master Plan EIR identified loss of oak trees along Pleasant Grove Creek resulting from effluent discharge as a significant impact. The 1996 Master Plan EIR included the following to mitigate for this impact:

- Conduct monitoring for oak mortality along Pleasant Grove Creek (Mitigation Measure 4-13)

Following mitigation, this impact is considered significant in the 1996 Master Plan EIR. This impact results from conversion of Pleasant Grove Creek from a seasonal stream to a perennial stream.

Appendix A describes the effect of the proposed incremental UGA flows on Pleasant Grove Creek water surface elevation under typical dry season conditions. The impact of the incremental UGA flows is estimated to be 0.44 feet or less depending on location. Pleasant Grove Creek riparian vegetation was not adapted to saturated soils during the dry season in or near the root zone prior to 2004 when discharge from PGWWTP commenced. The incremental UGA flows could further contribute to the significant impact identified in the 1996 Master Plan EIR. Assuming all feasible and effective mitigation was included in the 1996 Master Plan EIR, no new mitigation measure(s) would be required under CEQA to mitigate for the impact of additional UGA flows. Thus, the incremental impact of UGA flows on riparian vegetation would be considered significant.

REFERENCES

Roseville, City of. 1996. Roseville Regional Wastewater Treatment Service Area Master Plan Final Environmental Impact Report. Prepared for the City of Roseville by Montgomery Watson and ESA Associates. State Clearinghouse No. 93092079. October 25, 1996.

Roseville, City of. 2004. Final Environmental Impact Report for the West Roseville Specific Plan and Sphere of Influence Amendment, Volume I: Chapters 1, 2, 3, and 4 (sections 4.1 through 4.10). Prepared for the City of Roseville by EIP Associates, State Clearinghouse No. 2002082057, January 9, 2004.

Roseville, City of. 2004. Final Environmental Impact Report for the West Roseville Specific Plan and Sphere of Influence Amendment, Volume II: Chapter 4 (4.11

through 4.13 and Chapters 5-10. Prepared for the City of Roseville by EIP Associates, State Clearinghouse No. 2002082057, January 9, 2004.

RWQCB. 2002. Amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins for pH and Turbidity at Deer Creek, El Dorado & Sacramento Counties, Staff Report And Functional Equivalent Document. Central Valley Regional Water Quality Control Board. February.



CIVIL ENGINEERING

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MEMORANDUM

To: David Smith
Of: Merritt Smith Consulting
From: Thomas S. Plummer
Job Number: 2003.24
Re: Pleasant Grove Wastewater Treatment Plant (PGWWTP) impacts at Pleasant Grove Creek
Date: January 12, 2006

Dear David:

Per your request, we have reviewed your Draft summary table entitled "Table 1. Estimated Future Wastewater Flows". In quantifying the hydraulic impacts to Pleasant Grove Creek, the increased releases from the treatment plan would have the potential to increase peak discharges, above the existing estimated conditions, by an average flow rate of 7.6 MGD which is equivalent to 11.76 cubic feet per second (cfs). However, to determine the potential impact to peak flow rates you have advised that a peaking factor of 2.5 should be applied which results in a peak flow impact of 29.4 cfs. Secondly, Art O'Brien of the City of Roseville has advised that we also should review the impacts associated with the transfer of the storage from the PGWWTP site to the Reason Farms site.

Hydraulic Modeling Basis:

There are two historical hydraulic models of significance to this study. We have used a composite model of the two studies for this analysis.

In 1999 Carollo Engineers prepared a study "Hydrological Analysis of Pleasant Grove Creek – Pleasant Grove Wastewater Treatment Plan Project". The study indicates that cross sections were surveyed for the included hydraulic analysis. The study includes analysis of Pleasant Grove Creek from the Pleasant Grove Canal at the downstream end, to reaches of Pleasant Grove creek well upstream of the PGWWTP. Research for the Carollo study did not find the original hydraulic analysis files. Civil Solutions used the cross sections, the river stations and section map included in the study to create a replica version of the analysis.

In 2003, Wood Rodgers prepared a hydraulic analysis of Pleasant Grove Creek for the West Roseville Specific Plan area. The analysis includes all upper reaches of the Creek, and the downstream reach which flows past the treatment plant. The study terminates at the downstream end, upstream of Brewer Road at a location which is similar to River Mile (RM) Section 4.5 of the Carollo Study. Hydraulic analysis HEC-RAS files were obtained for the WRSP hydraulic analysis directly from Wood Rodgers.

In order to use the best information available for this analysis, we assembled a composite study, which includes all of the information from the WRSP hydraulic analysis, and added to it our replicated section information from the Carollo study for the sections downstream of RM 4.5. We joined Section 0.0189 of the WRSP to RM 4.5 of the Carollo study.

The WRSP hydrology study is the most recent study of Pleasant Grove Creek that we are aware of. We have used the flow rate estimates from the WRSP hydrology as a basis for the 2-year, 10-year, 25-year and 100-year peak storm events. For this study, we will compare the "Existing Conditions" flowrates from the WRSP analysis to the impacted flowrates determined in this study. Downstream starting water surface elevations were read from the Carollo report and specified in the composite model.

An exhibit is provided at the end of this letter which shows the river stationing for the combined study.

Peak Flow Impacts:

We have run the above described hydraulic model for the WRSP peak estimated "existing" flow rates, and for those same rates with 29.4 cfs added. 29.4 cfs being the 7.6 MGD average increase in discharge rates with a 2.5 peaking factor applied for the peak flow event. Flow discharges from the PGWWTP would enter the creek at WRSP station 3.451.

From WRSP station 3.648 (+/- 0.2 miles upstream of the PGWWTP discharge) to WRSP station 2.398 (+/- 1 mile downstream of the PGWWTP discharge) a 0.01 feet increase in 100-year water surface elevations is reported. From WRSP station 2.244 to WRSP station 1.879 (+/- 1.5 miles downstream of the PGWWTP discharge) a 0.02 feet increase in 100-year water surface elevations is reported. From WRSP station 1.825 to Carollo station 4.00 (roughly 1 mile upstream of the Sutter/Placer County line) a 0.01 feet increase in 100-year water surface elevations is reported. Downstream of this location to the Pleasant Grove Canal, no further increases in 100-year peak water surface elevations is reported. Overall, it is our opinion that the reported impacts would be less than measurable. We have attached the summary printout from the HEC-RAS model to this memo.

Low Flow Impacts:

Prior to the construction of the PGWWTP, Pleasant Grove Creek was documented in the PGWWTP EIR as an "intermittent stream". We interpret this to mean that at some times during the dry season, no base flow would be observed. Table 1 "Estimated Future Wastewater Flows" identifies the buildout wastewater flows from inside the 2005 planning area as 15.7 MGD (24.3 cfs), which is the baseline flow for this analysis. The best available information indicates Pleasant Grove Creek has

no other source of dry season flow. The dry weather average discharge rates with the buildout of the Urban Growth Areas are expected to increase 7.6 MGD to 23.4 MGD or 36.1 cfs.

We have performed a hydraulic evaluation using the composite model described above to determine the impacts to dry season water depths and velocities. We have included a comparison of the results of the current dry season flow rates (pre-project) to the proposed dry season flow rates (post-project) "Low Flow" analysis with this letter. The Maximum increase in water depths would be 0.55 feet between WRSP stations 1.116 (approximately 2.3 miles downstream of the discharge to Pleasant Grove Creek) and 0.829 (approximately 2.6 miles downstream of the discharge to the creek). Increases in water surface elevations were computed between WRSP station 3.878 (upstream of Haden Parkway, and .4 miles upstream of the discharge point to the creek), and Carollo Station 1.40 (downstream of the railroad crossing). The average increase in water depth over that reach was 0.34 feet.

Surveys for the detailed geometry of the low flow channel for Pleasant Grove Creek are not available. The analysis included should be adequate to represent the relative changes in water surface elevations due to the change in base flow rates. However, the results of this model should not be used to determine dry weather flood elevations at a point along the analysis reach.

Movement of Storage:

There are two potential issues which result from the movement of the peak flow storage component of the WWTP from the current WWTP site to the Reason Farms site.

First, *"What should the revised storage requirement be?"*:

Currently, the 1999 Carollo study predicted that when flow rates in Pleasant Grove Creek exceed 1000 cfs a flooding potential exists at Fifield Road, which could be worsened by adding additional flows. The hydrographs for the 24-hour precipitation event indicate that the potential for flow rates within the creek to exceed 1000 cfs in a 100-year event would extend for a period of up to 22 hours 10 minutes. The Carollo Study identified a storage requirement of 147 acre feet for the previous design flow rates of the treatment plant.

The WRSP Hydrologic analysis updated the Pleasant Grove Creek Hydrology for Storm centering issues and other factors identified in the Placer County Stormwater Management Manual. The results of that analysis, for the ultimate developed project, indicate the potential for flow rates in the 100-year event to exceed 1000 cfs would be for a period of 18 hours 5 minutes.

The proposed average discharge rate for the PGWWTP would be 23.3 MGD or 36.05 cfs. Applying a peaking factor of 2.5, the peak discharge rate for the plant to a storage facility would be 90.1 cfs. The required storage based on the Carollo and WRSP hydrology basis studies would be 165.1 acre feet and 134.6 acre feet respectively.

Second, *"What impact if any, would the release of the sustained peak discharge rates between the WWTP and the Reasons Farms site have on the 100-year peak flood elevations in the creek."*

For this analysis, 90.1 cfs was added to the existing peak flow rates, from WRSP station 3.451 (near the PGWWTP), to WRSP station 1.825 (near the intake for the Reasons Farms project). Then 29.4 cfs was added to the remainder of the downstream reaches.

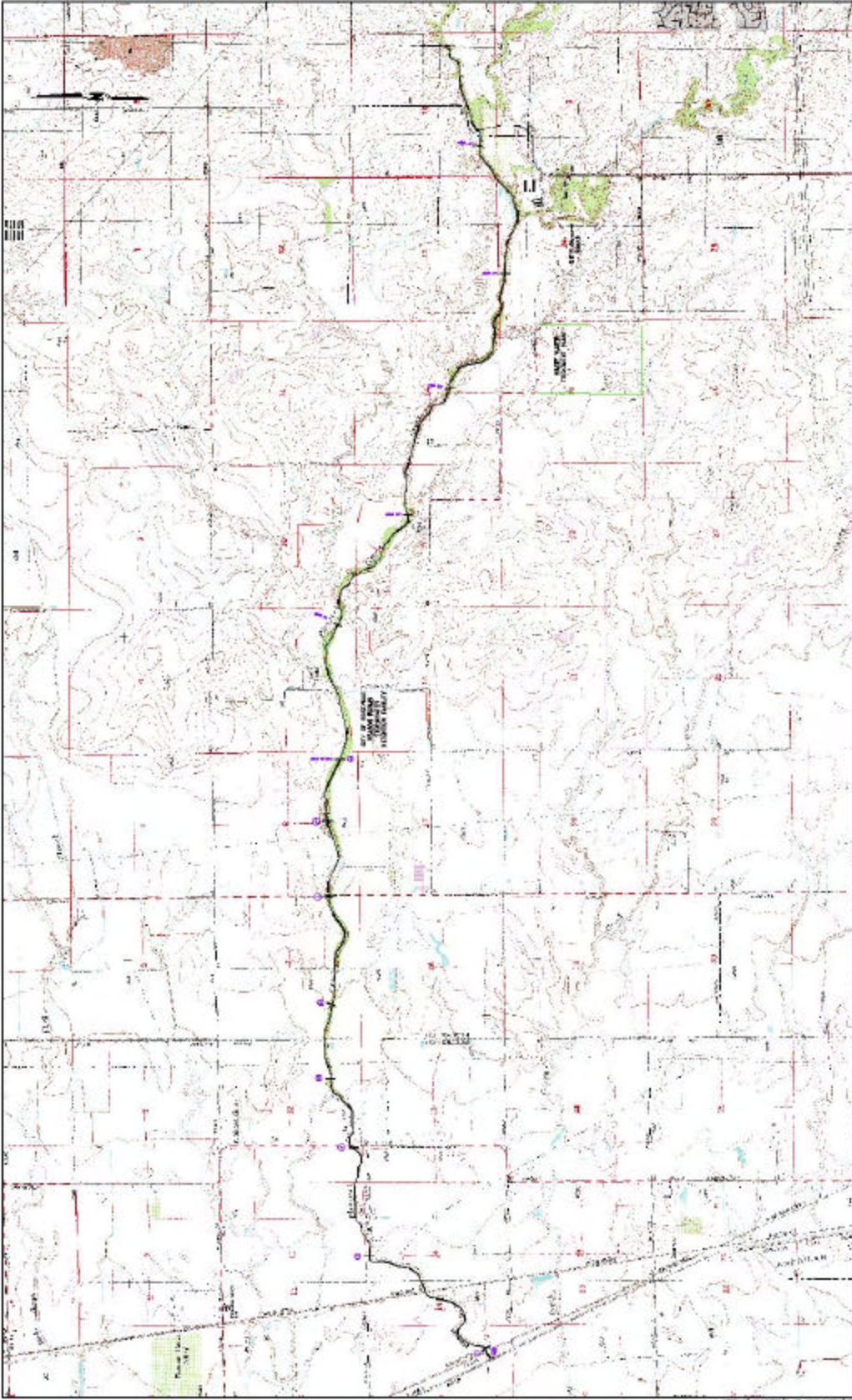
The results of the hydraulic analysis indicate that a 0.01 feet increase in 100-year water surface elevations would occur as far upstream as WRSP station 4.853 (upstream of Haden Parkway). The largest increase in water surface reported in the analysis was 0.07 feet at WRSP station 3.457, just upstream of the PGWWTP discharge location. 100-year water surface elevation increases average 0.04 feet from this location to the Reasons Farms site. Increases in 100-year water surface elevations gradually decrease from this point measuring 0.03 feet to no increase at Carollo Station 1.37 (downstream of the Railroad crossing, and upstream of the transition to the Pleasant Grove Canal). A copy of the HEC-RAS summary comparison is included at the end of this letter.

If you have any questions or comments please contact me at (916) 563-7300.



Sincerely,

Thomas S. Plummer P.E., CFM



DATE: 11/11/2020	SCALE: 1" = 100'	PROJECT: 2020-001	DATE: 11/11/2020
PROJECT: 2020-001	DATE: 11/11/2020	PROJECT: 2020-001	DATE: 11/11/2020
CIVIL ENGINEERING SOLUTIONS, INC. 1000 W. UNIVERSITY BLVD. SUITE 1000 DALLAS, TEXAS 75243-1000 TEL: 972.987.1000		PLEASANT GROVE CREEK CROSS SECTION LOCATIONS FIGURE 2	
SHEET NO. 1 TOTAL SHEETS 1	DRAWN BY: J.S. [Name] CHECKED BY: J.S. [Name]		

PEAK FLOW COMPARISON +29.4cfs (HEC-RAS OUTPUT):

HEC-RAS Plan: PGC Existing

Reach	River Sta	Profile	Q Total (cfs)	Min Ch E (ft)	W.S. Elev (ft)	Crit W/S (ft)	E.G. Elev (ft)	Vel Chnl (ft/s)
Main Channel 3	4.314	100-yr (Exist) M	8173.00	70.65	87.51		87.58	2.10
Main Channel 3	4.314	100-yr ex +29.4	8173.00	70.65	87.51		87.58	2.10
Main Channel 3	4.279	100-yr (Exist) M	8173.00	70.11	87.19		87.48	5.21
Main Channel 3	4.279	100-yr ex +29.4	8173.00	70.11	87.19		87.48	5.21
Main Channel 3	4.164	100-yr (Exist) M	8173.00	69.04	86.65	81.37	86.85	3.56
Main Channel 3	4.164	100-yr ex +29.4	8173.00	69.04	86.65	81.37	86.85	3.56
Main Channel 3	4.016	100-yr (Exist) M	8173.00	68.00	85.95	79.77	86.12	3.31
Main Channel 3	4.016	100-yr ex +29.4	8173.00	68.00	85.95	79.77	86.12	3.31
Main Channel 3	3.878	100-yr (Exist) M	8173.00	67.32	85.40	78.55	85.54	3.05
Main Channel 3	3.878	100-yr ex +29.4	8173.00	67.32	85.40	78.55	85.55	3.04
Main Channel 3	3.800	Bridge						
Main Channel 3	3.762	100-yr (Exist) M	8173.00	67.00	84.92		85.07	3.19
Main Channel 3	3.762	100-yr ex +29.4	8173.00	67.00	84.92		85.08	3.18
Main Channel 3	3.648	100-yr (Exist) M	8173.00	66.15	84.42	78.49	84.69	3.46
Main Channel 3	3.648	100-yr ex +29.4	8173.00	66.15	84.43	78.49	84.60	3.45
Main Channel 3	3.532	100-yr (Exist) M	8173.00	65.82	84.18	77.19	84.24	2.48
Main Channel 3	3.532	100-yr ex +29.4	8173.00	65.82	84.17	77.19	84.25	2.48
Main Channel 3	3.457	100-yr (Exist) M	8173.00	65.80	83.24	77.42	83.86	6.44
Main Channel 3	3.457	100-yr ex +29.4	8173.00	65.80	83.25	77.42	83.87	6.43
Main Channel 3	3.455	Bridge						
Main Channel 3	3.451	100-yr (Exist) M	8159.00	65.80	82.60	77.41	83.39	7.11
Main Channel 3	3.451	100-yr ex +29.4	8188.40	65.80	82.61	77.43	83.40	7.13
Main Branch 2	3.358	100-yr (Exist) M	8159.00	65.30	82.52	75.58	82.63	3.35
Main Branch 2	3.358	100-yr ex +29.4	8188.40	65.30	82.53	75.58	82.64	3.36
Main Branch 2	3.270	100-yr (Exist) M	8159.00	64.65	82.31	77.80	82.40	3.51
Main Branch 2	3.270	100-yr ex +29.4	8188.40	64.65	82.32	77.81	82.41	3.51
Main Branch 2	3.132	100-yr (Exist) M	8159.00	64.35	81.93		82.03	3.41
Main Branch 2	3.132	100-yr ex +29.4	8188.40	64.35	81.94		82.04	3.42
Main Branch 2	3.041	100-yr (Exist) M	8159.00	63.99	81.77		81.81	1.70
Main Branch 2	3.041	100-yr ex +29.4	8188.40	63.99	81.78		81.82	1.71
Main Branch 2	2.932	100-yr (Exist) M	8159.00	63.76	81.51		81.59	2.13
Main Branch 2	2.932	100-yr ex +29.4	8188.40	63.76	81.52		81.59	2.13
Main Branch 2	2.863	100-yr (Exist) M	8159.00	63.50	81.37		81.45	2.42
Main Branch 2	2.863	100-yr ex +29.4	8188.40	63.50	81.38		81.46	2.42
Main Branch 2	2.782	100-yr (Exist) M	8159.00	63.30	81.27		81.34	2.28
Main Branch 2	2.782	100-yr ex +29.4	8188.40	63.30	81.28		81.35	2.28
Main Branch 2	2.723	100-yr (Exist) M	8159.00	62.89	81.11		81.22	3.08

HEC-RAS Plan: PGC Existing (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	Vel Chnl (ft/s)
Main Branch 2	2.723	100-yr ex +29.4	8188.40	82.89	81.12		81.23	3.08
Main Branch 2	2.598	100-yr (Exist) M	8159.00	82.82	80.56		80.71	3.46
Main Branch 2	2.598	100-yr ex +29.4	8188.40	82.82	80.57		80.72	3.48
Main Branch 2	2.517	100-yr (Exist) M	8159.00	82.39	80.26		80.35	2.64
Main Branch 2	2.517	100-yr ex +29.4	8188.40	82.39	80.27		80.36	2.64
Main Branch 2	2.448	100-yr (Exist) M	8159.00	82.23	80.00		80.12	3.02
Main Branch 2	2.448	100-yr ex +29.4	8188.40	82.23	80.01		80.13	3.03
Main Branch 2	2.398	100-yr (Exist) M	8159.00	81.72	79.88		79.87	4.43
Main Branch 2	2.398	100-yr ex +29.4	8188.40	81.72	79.89		79.88	4.42
Main Branch 2	2.244	100-yr (Exist) M	8159.00	81.59	78.59	73.87	78.76	4.41
Main Branch 2	2.244	100-yr ex +29.4	8188.40	81.59	78.61	73.88	78.78	4.38
Main Branch 2	2.205	100-yr (Exist) M	8159.00	81.47	76.52	73.18	78.09	10.13
Main Branch 2	2.205	100-yr ex +29.4	8188.40	81.47	76.54	73.18	78.11	10.13
Main Branch 2	2.167	100-yr (Exist) M	8159.00	81.28	76.01	71.08	76.81	7.61
Main Branch 2	2.167	100-yr ex +29.4	8188.40	81.28	76.03	71.10	76.84	7.63
Main Branch 2	2.111	100-yr (Exist) M	8159.00	81.08	74.87		75.88	8.10
Main Branch 2	2.111	100-yr ex +29.4	8188.40	81.08	74.89		75.71	8.12
Main Branch 2	2.051	100-yr (Exist) M	8159.00	80.87	73.61		74.33	6.78
Main Branch 2	2.051	100-yr ex +29.4	8188.40	80.87	73.63		74.34	6.80
Main Branch 2	1.987	100-yr (Exist) M	8159.00	80.70	73.55	68.46	73.66	2.68
Main Branch 2	1.987	100-yr ex +29.4	8188.40	80.70	73.57	68.47	73.68	2.68
Main Branch 2	1.935	100-yr (Exist) M	8159.00	80.52	73.40	66.93	73.49	2.39
Main Branch 2	1.935	100-yr ex +29.4	8188.40	80.52	73.41	66.94	73.50	2.39
Main Branch 2	1.879	100-yr (Exist) M	8159.00	80.34	73.27	66.54	73.36	2.31
Main Branch 2	1.879	100-yr ex +29.4	8188.40	80.34	73.29	66.55	73.37	2.31
Main Branch 2	1.825	100-yr (Exist) M	8159.00	80.13	72.83	67.38	73.15	4.55
Main Branch 2	1.825	100-yr ex +29.4	8188.40	80.13	72.84	67.40	73.17	4.56
Main Branch 2	1.763	100-yr (Exist) M	8159.00	80.05	72.59		72.74	3.16
Main Branch 2	1.763	100-yr ex +29.4	8188.40	80.05	72.60		72.76	3.16
Main Branch 2	1.738	100-yr (Exist) M	8159.00	59.92	72.50		72.64	3.03
Main Branch 2	1.738	100-yr ex +29.4	8188.40	59.92	72.51		72.66	3.03
Main Branch 2	1.699	100-yr (Exist) M	8159.00	59.71	72.25		72.46	3.71
Main Branch 2	1.699	100-yr ex +29.4	8188.40	59.71	72.26		72.48	3.71
Main Branch 2	1.634	100-yr (Exist) M	8159.00	59.60	71.68	66.48	71.98	4.38
Main Branch 2	1.634	100-yr ex +29.4	8188.40	59.60	71.70	66.48	72.00	4.38
Main Branch 2	1.602	100-yr (Exist) M	8159.00	59.31	71.63	65.17	71.78	3.10
Main Branch 2	1.602	100-yr ex +29.4	8188.40	59.31	71.64	65.18	71.79	3.11

HEC-RAS Plan: PGC Existing (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	Vel Chnl (ft/s)
Main Branch 2	1.512	100-yr (Exist) M	8159.00	59.20	71.29	65.43	71.44	3.14
Main Branch 2	1.512	100-yr ex +29.4	8188.40	59.20	71.30	65.43	71.45	3.15
Main Branch 2	1.480	100-yr (Exist) M	8159.00	59.05	71.25	63.75	71.34	2.37
Main Branch 2	1.480	100-yr ex +29.4	8188.40	59.05	71.26	63.76	71.35	2.37
Main Branch 2	1.435	100-yr (Exist) M	8159.00	59.05	71.20	63.85	71.26	2.05
Main Branch 2	1.435	100-yr ex +29.4	8188.40	59.05	71.21	63.86	71.27	2.05
Main Branch 2	1.386	100-yr (Exist) M	8159.00	58.68	71.00		71.16	3.17
Main Branch 2	1.386	100-yr ex +29.4	8188.40	58.68	71.02		71.17	3.17
Main Branch 1	1.322	100-yr (Exist) M	8797.00	58.57	70.88	63.28	70.98	2.59
Main Branch 1	1.322	100-yr ex +29.4	8826.40	58.57	70.90	63.30	71.00	2.60
Main Branch 1	1.289	100-yr (Exist) M	8797.00	58.43	70.77		70.91	3.00
Main Branch 1	1.289	100-yr ex +29.4	8826.40	58.43	70.78		70.92	3.01
Main Branch 1	1.248	100-yr (Exist) M	8797.00	58.30	70.60		70.77	3.35
Main Branch 1	1.248	100-yr ex +29.4	8826.40	58.30	70.61		70.78	3.36
Main Branch 1	1.206	100-yr (Exist) M	8797.00	58.23	70.47		70.62	3.15
Main Branch 1	1.206	100-yr ex +29.4	8826.40	58.23	70.48		70.63	3.15
Main Branch 1	1.187	100-yr (Exist) M	8797.00	58.13	70.37		70.55	3.40
Main Branch 1	1.187	100-yr ex +29.4	8826.40	58.13	70.38		70.56	3.41
Main Branch 1	1.157	100-yr (Exist) M	8797.00	58.00	70.27		70.44	3.38
Main Branch 1	1.157	100-yr ex +29.4	8826.40	58.00	70.28		70.45	3.38
Main Branch 1	1.116	100-yr (Exist) M	8797.00	57.88	70.00		70.24	4.02
Main Branch 1	1.116	100-yr ex +29.4	8826.40	57.88	70.01		70.25	4.03
Main Branch 1	1.079	100-yr (Exist) M	8797.00	57.68	69.91		70.06	3.10
Main Branch 1	1.079	100-yr ex +29.4	8826.40	57.68	69.92		70.07	3.10
Main Branch 1	1.020	100-yr (Exist) M	8797.00	57.55	69.73		69.87	3.03
Main Branch 1	1.020	100-yr ex +29.4	8826.40	57.55	69.74		69.88	3.03
Main Branch 1	.982	100-yr (Exist) M	8797.00	57.47	69.63		69.76	2.96
Main Branch 1	.982	100-yr ex +29.4	8826.40	57.47	69.63		69.77	2.97
Main Branch 1	.957	100-yr (Exist) M	8797.00	57.31	69.53		69.68	3.30
Main Branch 1	.957	100-yr ex +29.4	8826.40	57.31	69.53		69.68	3.31
Main Branch 1	.906	100-yr (Exist) M	8797.00	57.05	69.18		69.42	3.97
Main Branch 1	.906	100-yr ex +29.4	8826.40	57.05	69.19		69.42	3.98
Main Branch 1	.829	100-yr (Exist) M	8797.00	56.96	68.99		69.09	2.75
Main Branch 1	.829	100-yr ex +29.4	8826.40	56.96	68.99		69.10	2.75
Main Branch 1	.802	100-yr (Exist) M	8797.00	56.84	68.84		68.98	6.26
Main Branch 1	.802	100-yr ex +29.4	8826.40	56.84	68.85		68.98	6.24
Main Branch 1	.765	100-yr (Exist) M	8797.00	56.70	68.69		68.83	4.08
Main Branch 1	.765	100-yr ex +29.4	8826.40	56.70	68.10		68.84	4.08

HEC-RAS Plan: PGC Existing (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	Vel Chnl (ft/s)
Main Branch 1	.722	100-yr (Exist) M	8797.00	56.62	67.83		88.02	3.71
Main Branch 1	.722	100-yr ex +29.4	8826.40	56.62	67.84		88.03	3.72
Main Branch 1	.688	100-yr (Exist) M	8797.00	56.57	67.72		67.84	3.01
Main Branch 1	.688	100-yr ex +29.4	8826.40	56.57	67.73		67.85	3.02
Main Branch 1	.685	100-yr (Exist) M	8797.00	56.23	67.67		67.75	2.67
Main Branch 1	.685	100-yr ex +29.4	8826.40	56.23	67.68		67.76	2.67
Main Branch 1	.600	100-yr (Exist) M	8797.00	56.18	67.42		67.48	2.27
Main Branch 1	.600	100-yr ex +29.4	8826.40	56.18	67.43		67.49	2.27
Main Branch 1	.566	100-yr (Exist) M	8797.00	56.00	67.01		67.32	5.02
Main Branch 1	.566	100-yr ex +29.4	8826.40	56.00	67.02		67.33	5.03
Main Branch 1	.515	100-yr (Exist) M	8797.00	55.85	66.79		66.95	3.85
Main Branch 1	.515	100-yr ex +29.4	8826.40	55.85	66.80		66.96	3.85
Main Branch 1	.467	100-yr (Exist) M	8797.00	55.85	66.16		66.55	5.69
Main Branch 1	.467	100-yr ex +29.4	8826.40	55.85	66.17		66.56	5.69
Main Branch 1	.3220	100-yr (Exist) M	8797.00	51.70	64.31		64.57	4.37
Main Branch 1	.3220	100-yr ex +29.4	8826.40	51.70	64.33		64.58	4.37
Main Branch 1	.1894	100-yr (Exist) M	8797.00	51.40	63.05		63.28	3.84
Main Branch 1	.1894	100-yr ex +29.4	8826.40	51.40	63.06		63.29	3.84
Main Branch 1	.0188	100-yr (Exist) M	8797.00	51.40	58.70		60.44	8.29
Main Branch 1	.0188	100-yr ex +29.4	8826.40	51.40	58.71		60.44	8.30
Main Branch 1	.0142	100-yr (Exist) M	8797.00	47.00	58.56		58.60	2.00
Main Branch 1	.0142	100-yr ex +29.4	8826.40	47.00	58.57		58.62	2.00
Main Branch 1	.014	100-yr (Exist) M	8797.00	45.80	55.58	51.98	56.39	7.19
Main Branch 1	.014	100-yr ex +29.4	8826.40	45.80	55.60	52.00	56.41	7.20
Main Branch 1	.0137	100-yr (Exist) M	8797.00	39.00	48.40		49.16	7.02
Main Branch 1	.0137	100-yr ex +29.4	8826.40	39.00	48.40		49.17	7.03
Main Branch 1	.0133	100-yr (Exist) M	8797.00	37.00	47.67		47.69	1.32
Main Branch 1	.0133	100-yr ex +29.4	8826.40	37.00	47.67		47.69	1.32
Main Branch 1	.013	100-yr (Exist) M	8797.00	29.40	47.59	41.19	47.60	0.96
Main Branch 1	.013	100-yr ex +29.4	8826.40	29.40	47.60	41.21	47.60	0.96
Main Branch 1	.012	100-yr (Exist) M	8797.00	29.70	47.59	36.73	47.59	0.13
Main Branch 1	.012	100-yr ex +29.4	8826.40	29.70	47.59	36.74	47.59	0.13
Main Branch 1	.011	100-yr (Exist) M	8797.00	24.40	47.40		47.55	3.47
Main Branch 1	.011	100-yr ex +29.4	8826.40	24.40	47.40		47.56	3.48
Main Branch 1	.0108	100-yr (Exist) M	8797.00	25.29	47.47	34.51	47.48	1.50
Main Branch 1	.0108	100-yr ex +29.4	8826.40	25.29	47.47	34.52	47.48	1.50

LOW FLOW COMPARISON 23.3 cfs to 36.1cfs (HEC-RAS OUTPUT):

HEC-RAS Plan POC Existing

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W/S (ft)	E.O. Elev (ft)	E.O. Slope (ft/s)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Friction f CH
Main Channel 3	4.314	24.3cfs	1.00	70.65	70.65	70.71	70.85	0.003948	0.27	3.66	22.38	0.12
Main Channel 3	4.314	36.1cfs	1.00	70.66	70.66	70.71	70.85	0.003944	0.27	3.66	22.40	0.12
Main Channel 3	4.278	24.3cfs	1.00	70.11	70.32	70.28	70.34	0.025253	1.12	0.89	8.40	0.81
Main Channel 3	4.278	36.1cfs	1.00	70.11	70.32	70.28	70.34	0.033900	1.20	0.83	8.11	0.88
Main Channel 3	4.164	24.3cfs	1.00	69.64	69.66	69.31	69.86	0.002237	0.24	4.09	10.01	0.07
Main Channel 3	4.164	36.1cfs	1.00	69.64	69.66	69.31	69.86	0.002228	0.24	4.15	10.08	0.07
Main Channel 3	4.016	24.3cfs	1.00	69.00	69.32	69.21	69.33	0.007714	0.77	1.30	8.07	0.34
Main Channel 3	4.016	36.1cfs	1.00	69.00	69.29	69.21	69.30	0.013186	0.94	1.06	7.28	0.44
Main Channel 3	3.878	24.3cfs	1.00	67.32	68.04	67.63	68.04	0.002768	0.40	2.48	6.91	0.12
Main Channel 3	3.878	36.1cfs	1.00	67.32	68.11	67.63	68.11	0.002626	0.33	3.04	8.60	0.10
Main Channel 3	3.800											
Main Channel 3	3.762	24.3cfs	1.00	67.00	67.59		67.59	0.002615	0.30	3.38	11.48	0.10
Main Channel 3	3.762	36.1cfs	1.00	67.00	67.66		67.66	0.002335	0.11	8.36	19.02	0.03
Main Channel 3	3.648	24.3cfs	1.00	66.15	67.20	66.40	67.20	0.002007	0.06	16.20	22.89	0.01
Main Channel 3	3.648	36.1cfs	1.00	66.15	67.27	66.40	67.27	0.002002	0.04	26.66	29.21	0.01
Main Channel 3	3.532	24.3cfs	1.00	65.82	67.58	66.07	67.58	0.002002	0.04	24.42	26.75	0.01
Main Channel 3	3.532	36.1cfs	1.00	65.82	67.57	66.07	67.57	0.002001	0.03	36.52	29.89	0.00
Main Channel 3	3.457	24.3cfs	1.00	65.80	67.57	65.97	67.57	0.002000	0.02	43.74	31.86	0.00
Main Channel 3	3.457	36.1cfs	1.00	65.80	67.57	65.97	67.57	0.002000	0.02	56.60	32.96	0.00
Main Channel 3	3.455											
Main Channel 3	3.451	24.3cfs	24.30	65.80	67.57	66.40	67.59	0.002040	0.56	43.74	31.86	0.08
Main Channel 3	3.451	36.1cfs	36.10	65.80	67.57	66.51	67.66	0.002235	0.64	56.60	32.55	0.09
Main Branch 2	3.395	24.3cfs	24.30	65.30	67.49	66.01	67.49	0.002140	0.44	54.92	36.08	0.06
Main Branch 2	3.395	36.1cfs	36.10	65.30	67.58	66.13	67.69	0.002147	0.51	70.98	40.99	0.07
Main Branch 2	3.270	24.3cfs	24.30	64.66	67.43	65.64	67.43	0.002103	0.42	57.57	34.03	0.06
Main Branch 2	3.270	36.1cfs	36.10	64.66	67.62	65.70	67.63	0.002121	0.51	71.24	36.73	0.06
Main Branch 2	3.132	24.3cfs	24.30	64.36	67.31		67.32	0.002263	0.56	43.42	30.81	0.08
Main Branch 2	3.132	36.1cfs	36.10	64.36	67.69		67.70	0.002258	0.65	56.33	32.27	0.09
Main Branch 2	3.041	24.3cfs	24.30	63.99	67.20		67.21	0.002184	0.55	44.38	23.04	0.07
Main Branch 2	3.041	36.1cfs	36.10	63.99	67.56		67.57	0.002044	0.68	62.75	24.06	0.08
Main Branch 2	2.932	24.3cfs	24.30	63.76	67.16		67.11	0.002174	0.56	44.26	21.66	0.07
Main Branch 2	2.932	36.1cfs	36.10	63.76	67.42		67.43	0.002248	0.71	51.16	22.01	0.08
Main Branch 2	2.883	24.3cfs	24.30	63.90	67.08		67.08	0.002017	0.18	133.01	73.41	0.02
Main Branch 2	2.883	36.1cfs	36.10	63.90	67.46		67.40	0.002024	0.23	196.91	79.49	0.03
Main Branch 2	2.782	24.3cfs	24.30	63.30	67.06		67.06	0.002002	0.07	350.37	146.71	0.01
Main Branch 2	2.782	36.1cfs	36.10	63.30	67.40		67.40	0.002003	0.09	396.94	149.85	0.01
Main Branch 2	2.723	24.3cfs	24.30	62.88	67.07	65.14	67.08	0.002051	1.08	22.47	27.06	0.21
Main Branch 2	2.723	36.1cfs	36.10	62.88	67.38	66.35	67.40	0.001903	1.14	31.73	32.92	0.20
Main Branch 2	2.698	24.3cfs	24.30	62.62	65.21		65.28	0.003865	2.01	12.09	9.32	0.31
Main Branch 2	2.698	36.1cfs	36.10	62.62	65.60		65.68	0.004064	2.28	15.96	10.71	0.33
Main Branch 2	2.617	24.3cfs	24.30	62.39	64.81		64.82	0.004488	0.72	38.65	27.83	0.12
Main Branch 2	2.617	36.1cfs	36.10	62.39	65.21		65.22	0.004668	0.79	46.71	32.44	0.12
Main Branch 2	2.499	24.3cfs	24.30	62.23	64.66		64.66	0.004612	0.68	36.87	29.67	0.11
Main Branch 2	2.499	36.1cfs	36.10	62.23	65.05		65.05	0.002087	0.74	48.92	34.65	0.11
Main Branch 2	2.396	24.3cfs	24.30	61.72	64.57		64.58	0.002234	0.57	42.76	30.00	0.09
Main Branch 2	2.396	36.1cfs	36.10	61.72	64.07		64.08	0.002258	0.65	56.70	34.24	0.09
Main Branch 2	2.244	24.3cfs	24.30	61.59	64.07	63.06	64.11	0.002888	1.73	14.06	11.38	0.27
Main Branch 2	2.244	36.1cfs	36.10	61.59	64.41	63.32	64.47	0.003156	1.98	18.27	12.95	0.29
Main Branch 2	2.205	24.3cfs	24.30	61.47	63.60	62.66	63.63	0.002204	1.26	17.90	16.62	0.23
Main Branch 2	2.205	36.1cfs	36.10	61.47	63.90	62.66	63.94	0.002168	1.55	23.31	19.19	0.25
Main Branch 2	2.167	24.3cfs	24.30	61.26	63.44	62.20	63.45	0.004657	0.69	36.41	32.78	0.12
Main Branch 2	2.167	36.1cfs	36.10	61.26	63.72	62.26	63.73	0.002658	0.90	46.27	37.07	0.13

HEC-RAS Plan P&C Existing (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch Bl (ft)	W.S. Elev (ft)	Ch W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Friction Ch (ft)
Main Branch 2	2.111	24.3cfs	24.30	61.08	63.29		63.30	0.000539	0.73	33.23	30.11	0.12
Main Branch 2	2.111	36.1cfs	35.10	61.08	63.54		63.55	0.000570	0.66	41.21	33.52	0.14
Main Branch 2	2.651	24.3cfs	24.30	60.67	63.16		63.16	0.000539	0.59	40.87	35.75	0.10
Main Branch 2	2.651	36.1cfs	35.10	60.67	63.37		63.38	0.000467	0.74	48.73	39.03	0.12
Main Branch 2	1.887	24.3cfs	24.30	60.70	63.10	61.47	63.10	0.000116	0.36	67.79	56.58	0.06
Main Branch 2	1.887	36.1cfs	35.10	60.70	63.28	61.60	63.28	0.000173	0.46	79.58	60.89	0.07
Main Branch 2	1.435	24.3cfs	24.30	60.82	63.08	61.17	63.08	0.000337	0.21	114.04	80.04	0.03
Main Branch 2	1.435	36.1cfs	35.10	60.82	63.26	61.29	63.26	0.000357	0.26	130.20	95.14	0.04
Main Branch 2	1.679	24.3cfs	24.30	60.34	62.96	62.96	63.03	0.023679	2.15	11.26	76.07	1.00
Main Branch 2	1.679	36.1cfs	35.10	60.34	63.19	63.01	63.20	0.006129	0.94	38.36	148.38	0.32
Main Branch 2	1.625	24.3cfs	24.30	60.13	62.70	60.85	62.70	0.000358	0.26	89.23	72.50	0.04
Main Branch 2	1.625	36.1cfs	35.10	60.13	63.14	60.96	63.14	0.000354	0.26	129.63	89.08	0.04
Main Branch 2	1.763	24.3cfs	24.30	60.05	62.07	62.07	62.28	0.050295	5.76	4.22	4.18	1.01
Main Branch 2	1.763	36.1cfs	35.10	60.05	62.41	62.41	63.02	0.058022	6.26	5.77	4.89	1.01
Main Branch 2	1.733	24.3cfs	24.30	59.92	61.56	60.60	61.57	0.000508	0.59	41.43	50.49	0.11
Main Branch 2	1.733	36.1cfs	35.10	59.92	61.81	60.72	61.82	0.000528	0.66	54.97	59.16	0.12
Main Branch 2	1.699	24.3cfs	24.30	59.71	61.39		61.40	0.001413	0.99	21.56	29.24	0.19
Main Branch 2	1.699	36.1cfs	35.10	59.71	61.63		61.65	0.001546	1.13	31.94	33.35	0.20
Main Branch 2	1.634	24.3cfs	24.30	59.60	60.92	60.28	60.93	0.001357	0.83	29.35	44.58	0.18
Main Branch 2	1.634	36.1cfs	35.10	59.60	61.19	60.37	61.20	0.001115	0.85	42.53	53.64	0.17
Main Branch 2	1.602	24.3cfs	24.30	59.31	60.83	60.86	60.83	0.000303	0.43	66.52	74.54	0.09
Main Branch 2	1.602	36.1cfs	35.10	59.31	61.11	60.98	61.11	0.000270	0.45	79.43	89.36	0.09
Main Branch 2	1.512	24.3cfs	24.30	59.20	60.42	60.01	60.46	0.000378	1.56	15.58	25.53	0.35
Main Branch 2	1.512	36.1cfs	35.10	59.20	60.78	60.14	60.81	0.002953	1.26	26.22	33.14	0.27
Main Branch 2	1.480	24.3cfs	24.30	59.05	60.33	59.51	60.33	0.000364	0.36	67.93	106.53	0.09
Main Branch 2	1.480	36.1cfs	35.10	59.05	60.74	59.59	60.74	0.000129	0.30	119.67	141.40	0.06
Main Branch 2	1.435	24.3cfs	24.30	59.05	60.24	59.53	60.24	0.000508	0.47	51.20	66.56	0.11
Main Branch 2	1.435	36.1cfs	35.10	59.05	60.70	59.52	60.71	0.000191	0.36	99.91	120.64	0.07
Main Branch 2	1.386	24.3cfs	24.30	58.88	60.19		60.19	0.000111	0.26	99.82	124.65	0.05
Main Branch 2	1.386	36.1cfs	35.10	58.88	60.68		60.68	0.000054	0.22	165.01	165.78	0.04
Main Branch 1	1.322	24.3cfs	24.30	59.57	60.16	59.01	60.16	0.000066	0.20	118.67	149.40	0.04
Main Branch 1	1.322	36.1cfs	35.10	59.57	60.57	59.08	60.57	0.000032	0.17	207.15	197.47	0.03
Main Branch 1	1.289	24.3cfs	24.30	58.45	60.14		60.15	0.000082	0.24	130.04	116.70	0.05
Main Branch 1	1.289	36.1cfs	35.10	58.45	60.66		60.66	0.000044	0.21	169.44	151.88	0.04
Main Branch 1	1.249	24.3cfs	24.30	59.30	60.11		60.12	0.000243	0.43	66.01	61.76	0.09
Main Branch 1	1.249	36.1cfs	35.10	59.30	60.64		60.65	0.000137	0.39	99.52	79.79	0.06
Main Branch 1	1.206	24.3cfs	24.30	58.28	60.10		60.10	0.000034	0.17	148.80	158.00	0.03
Main Branch 1	1.206	36.1cfs	35.10	58.28	60.64		60.64	0.000020	0.15	242.93	201.91	0.02
Main Branch 1	1.187	24.3cfs	24.30	59.13	60.10		60.10	0.000036	0.16	137.01	139.37	0.03
Main Branch 1	1.187	36.1cfs	35.10	59.13	60.63		60.63	0.000022	0.16	212.25	177.51	0.03
Main Branch 1	1.157	24.3cfs	24.30	59.00	60.09		60.09	0.000116	0.33	73.82	70.79	0.06
Main Branch 1	1.157	36.1cfs	35.10	59.00	60.63		60.63	0.000075	0.31	117.14	89.18	0.05
Main Branch 1	1.116	24.3cfs	24.30	57.88	60.07		60.07	0.000034	0.16	132.29	120.59	0.03
Main Branch 1	1.116	36.1cfs	35.10	57.88	60.62		60.62	0.000029	0.18	208.27	160.58	0.03
Main Branch 1	1.079	24.3cfs	24.30	57.66	60.07		60.07	0.000028	0.16	137.57	115.22	0.03
Main Branch 1	1.079	36.1cfs	35.10	57.66	60.62		60.62	0.000021	0.17	207.87	141.83	0.03
Main Branch 1	1.020	24.3cfs	24.30	57.55	60.06		60.06	0.000008	0.10	241.16	191.87	0.02
Main Branch 1	1.020	36.1cfs	35.10	57.55	60.61		60.61	0.000007	0.10	357.88	233.73	0.01
Main Branch 1	962	24.3cfs	24.30	57.47	60.06		60.06	0.000010	0.11	220.56	170.19	0.02
Main Branch 1	962	36.1cfs	35.10	57.47	60.61		60.61	0.000008	0.11	323.96	206.24	0.02
Main Branch 1	967	24.3cfs	24.30	57.31	60.06		60.06	0.000064	0.27	90.57	66.91	0.04
Main Branch 1	967	36.1cfs	35.10	57.31	60.61		60.61	0.000046	0.26	130.39	79.08	0.04
Main Branch 1	965	24.3cfs	24.30	57.05	60.05		60.05	0.000011	0.13	189.40	125.46	0.02

HEC-RAS Plan PGC Existing (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Ch W.S. (ft)	E.O. Elev (ft)	E.O. Slope (ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # CH
Main Branch 1	.906	38.1 cts	36.10	57.06	60.60		60.60	0.00010	0.14	263.72	149.43	0.02
Main Branch 1	.829	24.3 cts	24.30	56.96	60.05		60.05	0.00006	0.09	258.98	167.34	0.01
Main Branch 1	.829	38.1 cts	36.10	58.98	60.60		60.60	0.00005	0.10	358.88	197.14	0.01
Main Branch 1	.802	24.3 cts	24.30	56.84	59.35	59.35	59.68	0.08313	6.41	3.79	3.03	1.01
Main Branch 1	.802	38.1 cts	36.10	58.94	59.77	59.77	60.52	0.079220	6.95	5.19	3.54	1.01
Main Branch 1	.765	24.3 cts	24.30	56.70	58.59	57.63	58.61	0.00115	0.95	25.56	26.99	0.17
Main Branch 1	.765	38.1 cts	36.10	58.70	58.88	57.79	58.88	0.001216	1.08	33.30	30.81	0.18
Main Branch 1	.722	24.3 cts	24.30	56.62	58.38		58.30	0.00834	0.76	31.87	38.21	0.14
Main Branch 1	.722	38.1 cts	36.10	58.62	58.63		58.64	0.000907	0.97	41.54	41.34	0.15
Main Branch 1	.696	24.3 cts	24.30	56.57	58.01		58.11	0.011947	2.54	9.55	13.23	0.53
Main Branch 1	.696	38.1 cts	36.10	58.57	58.20		58.34	0.013757	2.96	12.19	14.94	0.68
Main Branch 1	.665	24.3 cts	24.30	56.23	57.84		57.85	0.001919	0.95	25.45	33.56	0.19
Main Branch 1	.665	38.1 cts	36.10	58.23	58.01		58.03	0.001769	1.16	31.16	34.73	0.22
Main Branch 1	.630	24.3 cts	24.30	56.18	56.95		56.98	0.002900	0.83	30.15	80.38	0.24
Main Branch 1	.630	38.1 cts	36.10	56.18	57.09		57.11	0.002962	0.86	43.15	95.20	0.22
Main Branch 1	.596	24.3 cts	24.30	56.00	56.77		56.78	0.00625	0.47	53.15	93.11	0.11
Main Branch 1	.596	38.1 cts	36.10	56.00	56.93		56.98	0.00654	0.56	67.64	95.27	0.11
Main Branch 1	.515	24.3 cts	24.30	55.85	56.69		56.69	0.000191	0.39	74.26	104.30	0.07
Main Branch 1	.515	38.1 cts	36.10	55.85	56.83		56.84	0.000233	0.41	89.09	105.21	0.08
Main Branch 1	.467	24.3 cts	24.30	55.85	56.57	56.22	56.50	0.001976	0.85	29.72	55.89	0.21
Main Branch 1	.467	38.1 cts	36.10	55.85	56.68	56.28	56.70	0.002272	1.03	36.20	56.67	0.23
Main Branch 1	.3220	24.3 cts	24.30	51.70	53.14		53.21	0.017385	2.02	12.01	29.61	0.65
Main Branch 1	.3220	38.1 cts	36.10	51.70	53.39		53.42	0.018809	1.62	22.32	56.67	0.46
Main Branch 1	.1894	24.3 cts	24.30	51.40	52.97		52.97	0.000068	0.25	96.67	111.69	0.05
Main Branch 1	.1894	38.1 cts	36.10	51.40	53.19		53.20	0.000091	0.30	121.64	112.96	0.05
Main Branch 1	.0188	24.3 cts	24.30	51.40	52.40	52.40	52.66	0.048313	4.07	5.97	11.95	1.01
Main Branch 1	.0188	38.1 cts	36.10	51.40	52.59	52.58	52.67	0.045009	4.37	8.26	14.05	1.01
Main Branch 1	.0142	24.3 cts	24.30	47.00	47.96	47.18	47.96	0.000151	0.32	76.57	94.20	0.06
Main Branch 1	.0142	38.1 cts	36.10	47.00	48.18	47.21	48.18	0.000162	0.37	97.50	100.72	0.07
Main Branch 1	.014	24.3 cts	24.30	45.80	46.21	46.21	46.32	0.064774	2.65	9.18	44.30	1.02
Main Branch 1	.014	38.1 cts	36.10	45.80	46.28	46.28	46.41	0.057165	2.92	12.34	46.73	1.00
Main Branch 1	.0137	24.3 cts	24.30	39.00	41.46	39.26	41.46	0.000011	0.14	168.84	93.29	0.02
Main Branch 1	.0137	38.1 cts	36.10	39.00	41.46	39.33	41.46	0.000029	0.21	168.47	93.40	0.03
Main Branch 1	.0133	24.3 cts	24.30	37.00	41.45		41.45	0.000001	0.05	477.90	134.77	0.00
Main Branch 1	.0133	38.1 cts	36.10	37.00	41.45		41.45	0.000001	0.06	477.95	134.78	0.01
Main Branch 1	.013	24.3 cts	24.30	29.40	41.45	30.62	41.45	0.000000	0.04	675.37	114.48	0.00
Main Branch 1	.013	38.1 cts	36.10	29.40	41.45	30.83	41.45	0.000000	0.05	675.37	114.48	0.00
Main Branch 1	.012	24.3 cts	24.30	29.70	41.45	30.37	41.45	0.000000	0.00	21186.63	10640.00	0.00
Main Branch 1	.012	38.1 cts	36.10	29.70	41.45	30.48	41.45	0.000000	0.00	21186.79	10640.00	0.00
Main Branch 1	.011	24.3 cts	24.30	24.40	41.45		41.45	0.000000	0.01	1905.18	184.00	0.00
Main Branch 1	.011	38.1 cts	36.10	24.40	41.45		41.45	0.000000	0.02	1905.18	184.00	0.00
Main Branch 1	.0109	24.3 cts	24.30	25.29	41.45	26.06	41.45	0.000000	0.01	3465.05	395.75	0.00
Main Branch 1	.0109	38.1 cts	36.10	25.29	41.45	26.22	41.45	0.000000	0.01	3465.05	395.75	0.00

PEAK FLOW COMPARISON from WWTP to Reasons Farms +90.1cfs (HEC-RAS OUTPUT):

HEC-RAS Plan PGC Existing

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	WS Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	Vel Chnl (ft/s)
Main Channel 4	5.039	100-yr (Exist) M	6798.00	72.55	91.85	91.58	91.98	4.03
Main Channel 4	5.039	100-yr ex +90	6798.00	72.55	91.85	91.58	91.98	4.03
Main Channel 4	5.033		Culvert					
Main Channel 4	5.020	100-yr (Exist) M	6798.00	72.48	91.32	91.10	91.42	3.59
Main Channel 4	5.020	100-yr ex +90	6798.00	72.48	91.32	91.10	91.42	3.59
Main Channel 4	4.974	100-yr (Exist) M	6798.00	72.35	91.21	94.49	91.31	2.58
Main Channel 4	4.974	100-yr ex +90	6798.00	72.35	91.21	94.49	91.32	2.58
Main Channel 4	4.853	100-yr (Exist) M	6798.00	72.00	90.60	89.31	90.74	2.98
Main Channel 4	4.853	100-yr ex +90	6798.00	72.00	90.61	89.31	90.75	2.98
Main Channel 4	4.742	100-yr (Exist) M	6798.00	71.68	89.90	94.00	90.02	2.65
Main Channel 4	4.742	100-yr ex +90	6798.00	71.68	89.90	94.00	90.03	2.64
Main Channel 4	4.642	100-yr (Exist) M	6798.00	71.33	89.50	90.64	89.62	2.64
Main Channel 4	4.642	100-yr ex +90	6798.00	71.33	89.50	90.64	89.63	2.64
Main Channel 4	4.6		Bridge					
Main Channel 4	4.528	100-yr (Exist) M	6798.00	72.00	88.37	82.41	88.85	4.23
Main Channel 4	4.528	100-yr ex +90	6798.00	72.00	88.38	82.41	88.86	4.23
Main Channel 4	4.409	100-yr (Exist) M	6798.00	71.95	87.63	81.03	87.78	3.05
Main Channel 4	4.409	100-yr ex +90	6798.00	71.95	87.64	81.03	87.79	3.05
Main Channel 3	4.314	100-yr (Exist) M	8173.00	70.65	87.51		87.58	2.10
Main Channel 3	4.314	100-yr ex +90	8173.00	70.65	87.52		87.59	2.10
Main Channel 3	4.279	100-yr (Exist) M	8173.00	70.11	87.19		87.48	5.21
Main Channel 3	4.279	100-yr ex +90	8173.00	70.11	87.20		87.49	5.20
Main Channel 3	4.164	100-yr (Exist) M	8173.00	69.04	86.65	81.37	86.85	3.56
Main Channel 3	4.164	100-yr ex +90	8173.00	69.04	86.67	81.37	86.86	3.55
Main Channel 3	4.019	100-yr (Exist) M	8173.00	69.00	85.95	79.77	86.12	3.31
Main Channel 3	4.019	100-yr ex +90	8173.00	69.00	85.97	79.77	86.14	3.30
Main Channel 3	3.878	100-yr (Exist) M	8173.00	67.32	85.40	78.55	85.54	3.05
Main Channel 3	3.878	100-yr ex +90	8173.00	67.32	85.43	78.55	85.57	3.03
Main Channel 3	3.800		Bridge					
Main Channel 3	3.762	100-yr (Exist) M	8173.00	67.00	84.92		85.07	3.19
Main Channel 3	3.762	100-yr ex +90	8173.00	67.00	84.96		85.11	3.17
Main Channel 3	3.648	100-yr (Exist) M	8173.00	66.15	84.42	78.49	84.59	3.46
Main Channel 3	3.648	100-yr ex +90	8173.00	66.15	84.47	78.49	84.64	3.43
Main Channel 3	3.532	100-yr (Exist) M	8173.00	65.82	84.16	77.19	84.24	2.49
Main Channel 3	3.532	100-yr ex +90	8173.00	65.82	84.22	77.19	84.30	2.47
Main Channel 3	3.457	100-yr (Exist) M	8173.00	65.80	83.24	77.42	83.96	6.44
Main Channel 3	3.457	100-yr ex +90	8173.00	65.80	83.33	77.42	83.93	6.33

HEC-RAS Plan POC Existing (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	Vel Cntl (ft/s)
Main Channel 3	3.455		Bridge					
Main Channel 3	3.451	100-yr (Exist) M	8159.00	85.80	82.80	77.41	83.99	7.11
Main Channel 3	3.451	100-yr ex +80	8249.10	85.80	82.64	77.47	83.43	7.16
Main Branch 2	3.356	100-yr (Exist) M	8159.00	85.30	82.52	75.56	82.63	3.35
Main Branch 2	3.356	100-yr ex +80	8249.10	85.30	82.55	75.63	82.67	3.37
Main Branch 2	3.270	100-yr (Exist) M	8159.00	84.65	82.31	77.80	82.40	3.51
Main Branch 2	3.270	100-yr ex +80	8249.10	84.65	82.34	77.81	82.43	3.52
Main Branch 2	3.132	100-yr (Exist) M	8159.00	84.35	81.83		82.03	3.41
Main Branch 2	3.132	100-yr ex +80	8249.10	84.35	81.87		82.07	3.43
Main Branch 2	3.041	100-yr (Exist) M	8159.00	83.99	81.77		81.81	1.70
Main Branch 2	3.041	100-yr ex +80	8249.10	83.99	81.80		81.85	1.71
Main Branch 2	2.932	100-yr (Exist) M	8159.00	83.76	81.51		81.58	2.13
Main Branch 2	2.932	100-yr ex +80	8249.10	83.76	81.54		81.61	2.14
Main Branch 2	2.863	100-yr (Exist) M	8159.00	83.50	81.37		81.45	2.42
Main Branch 2	2.863	100-yr ex +80	8249.10	83.50	81.40		81.48	2.43
Main Branch 2	2.782	100-yr (Exist) M	8159.00	83.30	81.27		81.34	2.28
Main Branch 2	2.782	100-yr ex +80	8249.10	83.30	81.30		81.37	2.29
Main Branch 2	2.723	100-yr (Exist) M	8159.00	82.89	81.11		81.22	3.08
Main Branch 2	2.723	100-yr ex +80	8249.10	82.89	81.14		81.25	3.08
Main Branch 2	2.598	100-yr (Exist) M	8159.00	82.62	80.56		80.71	3.48
Main Branch 2	2.598	100-yr ex +80	8249.10	82.62	80.59		80.74	3.48
Main Branch 2	2.517	100-yr (Exist) M	8159.00	82.39	80.26		80.36	2.64
Main Branch 2	2.517	100-yr ex +80	8249.10	82.39	80.29		80.38	2.65
Main Branch 2	2.448	100-yr (Exist) M	8159.00	82.23	80.00		80.12	3.02
Main Branch 2	2.448	100-yr ex +80	8249.10	82.23	80.03		80.15	3.03
Main Branch 2	2.398	100-yr (Exist) M	8159.00	81.72	79.68		79.87	4.43
Main Branch 2	2.398	100-yr ex +80	8249.10	81.72	79.71		79.90	4.41
Main Branch 2	2.244	100-yr (Exist) M	8159.00	81.59	78.59	73.87	78.76	4.41
Main Branch 2	2.244	100-yr ex +80	8249.10	81.59	78.65	73.92	78.81	4.35
Main Branch 2	2.205	100-yr (Exist) M	8159.00	81.47	76.52	73.18	78.09	10.13
Main Branch 2	2.205	100-yr ex +80	8249.10	81.47	76.59	73.22	78.15	10.13
Main Branch 2	2.167	100-yr (Exist) M	8159.00	81.28	76.01	71.08	76.91	7.61
Main Branch 2	2.167	100-yr ex +80	8249.10	81.28	76.07	71.14	76.98	7.65
Main Branch 2	2.111	100-yr (Exist) M	8159.00	81.08	74.87		75.69	8.10
Main Branch 2	2.111	100-yr ex +80	8249.10	81.08	74.72		75.75	8.15
Main Branch 2	2.051	100-yr (Exist) M	8159.00	80.87	73.61		74.33	6.78
Main Branch 2	2.051	100-yr ex +80	8249.10	80.87	73.65		74.37	6.83

HEC-RAS Plan PGC Existing (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Cnt W.S. (ft)	E.G. Elev (ft)	Vel Chnl (ft/s)
Main Branch 2	1.987	100-yr (Exist) M	8159.00	60.70	73.55	68.46	73.66	2.68
Main Branch 2	1.987	100-yr ex +90	8249.10	60.70	73.59	68.49	73.71	2.89
Main Branch 2	1.935	100-yr (Exist) M	8159.00	60.52	73.40	66.93	73.48	2.38
Main Branch 2	1.935	100-yr ex +90	8249.10	60.52	73.44	66.96	73.53	2.40
Main Branch 2	1.879	100-yr (Exist) M	8159.00	60.34	73.27	66.54	73.36	2.31
Main Branch 2	1.879	100-yr ex +90	8249.10	60.34	73.31	66.56	73.40	2.32
Main Branch 2	1.825	100-yr (Exist) M	8159.00	60.13	72.83	67.39	73.15	4.55
Main Branch 2	1.825	100-yr ex +90	8249.10	60.13	72.86	67.42	73.18	4.58
Main Branch 2	1.783	100-yr (Exist) M	8159.00	60.05	72.59		72.74	3.18
Main Branch 2	1.783	100-yr ex +90	8249.10	60.05	72.62		72.78	3.18
Main Branch 2	1.738	100-yr (Exist) M	8159.00	59.92	72.50		72.64	3.03
Main Branch 2	1.738	100-yr ex +90	8249.10	59.92	72.53		72.68	3.05
Main Branch 2	1.699	100-yr (Exist) M	8159.00	59.71	72.25		72.48	3.71
Main Branch 2	1.699	100-yr ex +90	8249.10	59.71	72.28		72.49	3.73
Main Branch 2	1.634	100-yr (Exist) M	8159.00	59.60	71.68	66.48	71.98	4.38
Main Branch 2	1.634	100-yr ex +90	8249.10	59.60	71.71	66.50	72.01	4.42
Main Branch 2	1.602	100-yr (Exist) M	8159.00	59.31	71.63	65.17	71.78	3.10
Main Branch 2	1.602	100-yr ex +90	8249.10	59.31	71.65	65.19	71.80	3.13
Main Branch 2	1.512	100-yr (Exist) M	8159.00	59.20	71.29	65.43	71.44	3.14
Main Branch 2	1.512	100-yr ex +90	8249.10	59.20	71.30	65.45	71.46	3.17
Main Branch 2	1.480	100-yr (Exist) M	8159.00	59.05	71.25	63.75	71.34	2.37
Main Branch 2	1.480	100-yr ex +90	8249.10	59.05	71.27	63.78	71.35	2.39
Main Branch 2	1.435	100-yr (Exist) M	8159.00	59.05	71.20	63.85	71.26	2.05
Main Branch 2	1.435	100-yr ex +90	8249.10	59.05	71.21	63.87	71.28	2.07
Main Branch 2	1.386	100-yr (Exist) M	8159.00	58.88	71.00		71.16	3.17
Main Branch 2	1.386	100-yr ex +90	8249.10	58.88	71.01		71.17	3.20
Main Branch 1	1.322	100-yr (Exist) M	8797.00	58.57	70.99	63.29	70.98	2.59
Main Branch 1	1.322	100-yr ex +90	8826.40	58.57	70.90	63.30	71.00	2.80
Main Branch 1	1.289	100-yr (Exist) M	8797.00	58.43	70.77		70.91	3.00
Main Branch 1	1.289	100-yr ex +90	8826.40	58.43	70.78		70.92	3.01
Main Branch 1	1.248	100-yr (Exist) M	8797.00	58.30	70.60		70.77	3.35
Main Branch 1	1.248	100-yr ex +90	8826.40	58.30	70.61		70.78	3.38
Main Branch 1	1.206	100-yr (Exist) M	8797.00	58.23	70.47		70.62	3.15
Main Branch 1	1.206	100-yr ex +90	8826.40	58.23	70.48		70.63	3.15
Main Branch 1	1.187	100-yr (Exist) M	8797.00	58.13	70.37		70.55	3.40
Main Branch 1	1.187	100-yr ex +90	8826.40	58.13	70.38		70.56	3.41
Main Branch 1	1.157	100-yr (Exist) M	8797.00	58.00	70.27		70.44	3.38

HEC-RAS Plan PGC Existing (Continued)

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	Vel Chnl (ft/s)
Main Branch 1	1.157	100-yr ex +90	8826.40	58.00	70.28		70.45	3.38
Main Branch 1	1.116	100-yr (Exist) M	8797.00	57.88	70.00		70.24	4.02
Main Branch 1	1.116	100-yr ex +90	8826.40	57.88	70.01		70.25	4.03
Main Branch 1	1.079	100-yr (Exist) M	8797.00	57.68	69.91		70.06	3.10
Main Branch 1	1.079	100-yr ex +90	8826.40	57.68	69.92		70.07	3.10
Main Branch 1	1.020	100-yr (Exist) M	8797.00	57.55	69.73		69.87	3.03
Main Branch 1	1.020	100-yr ex +90	8826.40	57.55	69.74		69.88	3.03
Main Branch 1	982	100-yr (Exist) M	8797.00	57.47	69.63		69.76	2.96
Main Branch 1	982	100-yr ex +90	8826.40	57.47	69.63		69.77	2.97
Main Branch 1	957	100-yr (Exist) M	8797.00	57.31	69.53		69.66	3.30
Main Branch 1	957	100-yr ex +90	8826.40	57.31	69.53		69.66	3.31
Main Branch 1	906	100-yr (Exist) M	8797.00	57.05	69.18		69.42	3.97
Main Branch 1	906	100-yr ex +90	8826.40	57.05	69.19		69.42	3.98
Main Branch 1	829	100-yr (Exist) M	8797.00	56.96	69.99		69.09	2.75
Main Branch 1	829	100-yr ex +90	8826.40	56.96	69.00		69.10	2.75
Main Branch 1	802	100-yr (Exist) M	8797.00	56.84	69.34		68.88	6.26
Main Branch 1	802	100-yr ex +90	8826.40	56.84	69.35		68.88	6.24
Main Branch 1	765	100-yr (Exist) M	8797.00	56.70	69.09		68.33	4.08
Main Branch 1	765	100-yr ex +90	8826.40	56.70	69.10		68.34	4.08
Main Branch 1	722	100-yr (Exist) M	8797.00	56.62	67.83		68.02	3.71
Main Branch 1	722	100-yr ex +90	8826.40	56.62	67.84		68.03	3.72
Main Branch 1	698	100-yr (Exist) M	8797.00	56.57	67.72		67.84	3.01
Main Branch 1	698	100-yr ex +90	8826.40	56.57	67.73		67.85	3.02
Main Branch 1	685	100-yr (Exist) M	8797.00	56.23	67.67		67.75	2.67
Main Branch 1	685	100-yr ex +90	8826.40	56.23	67.68		67.76	2.67
Main Branch 1	600	100-yr (Exist) M	8797.00	56.18	67.42		67.48	2.27
Main Branch 1	600	100-yr ex +90	8826.40	56.18	67.43		67.49	2.27
Main Branch 1	566	100-yr (Exist) M	8797.00	56.00	67.01		67.32	5.02
Main Branch 1	566	100-yr ex +90	8826.40	56.00	67.02		67.33	5.03
Main Branch 1	515	100-yr (Exist) M	8797.00	55.85	66.79		66.95	3.85
Main Branch 1	515	100-yr ex +90	8826.40	55.85	66.80		66.96	3.85
Main Branch 1	467	100-yr (Exist) M	8797.00	55.85	66.16		66.55	5.69
Main Branch 1	467	100-yr ex +90	8826.40	55.85	66.17		66.56	5.69
Main Branch 1	3220	100-yr (Exist) M	8797.00	51.70	64.31		64.57	4.37
Main Branch 1	3220	100-yr ex +90	8826.40	51.70	64.33		64.58	4.37
Main Branch 1	1894	100-yr (Exist) M	8797.00	51.40	63.05		63.28	3.84
Main Branch 1	1894	100-yr ex +90	8826.40	51.40	63.06		63.29	3.84

HEC-RAS Plan: PGC Existing (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	Vel Chnl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/s)
Main Branch 1	0188	100-yr (Exist) M	8787.00	51.40	58.70		60.44	8.28
Main Branch 1	0188	100-yr ex +90	8826.40	51.40	59.71		60.44	8.30
Main Branch 1	0142	100-yr (Exist) M	8797.00	47.00	58.56		58.60	2.00
Main Branch 1	0142	100-yr ex +90	8826.40	47.00	58.57		58.62	2.00
Main Branch 1	014	100-yr (Exist) M	8787.00	45.80	55.58	51.98	56.39	7.19
Main Branch 1	014	100-yr ex +90	8826.40	45.80	55.60	52.00	56.41	7.20
Main Branch 1	0137	100-yr (Exist) M	8787.00	39.00	48.40		49.16	7.02
Main Branch 1	0137	100-yr ex +90	8826.40	39.00	48.40		49.17	7.03
Main Branch 1	0133	100-yr (Exist) M	8787.00	37.00	47.67		47.68	1.32
Main Branch 1	0133	100-yr ex +90	8826.40	37.00	47.67		47.69	1.32
Main Branch 1	013	100-yr (Exist) M	8787.00	29.40	47.58	41.18	47.60	0.96
Main Branch 1	013	100-yr ex +90	8826.40	29.40	47.60	41.21	47.60	0.96
Main Branch 1	012	100-yr (Exist) M	8787.00	29.70	47.58	36.73	47.59	0.13
Main Branch 1	012	100-yr ex +90	8826.40	29.70	47.58	36.74	47.59	0.13
Main Branch 1	011	100-yr (Exist) M	8787.00	24.40	47.40		47.55	3.47
Main Branch 1	011	100-yr ex +90	8826.40	24.40	47.40		47.58	3.48
Main Branch 1	0109	100-yr (Exist) M	8787.00	25.28	47.47	34.51	47.49	1.50
Main Branch 1	0109	100-yr ex +90	8826.40	25.28	47.47	34.52	47.49	1.50