Minimum Sewer Study Requirements

February 25, 2009

The following are the minimum requirements for acceptance of a sewer study by the Sacramento Area Sewer District (District). Each sewer study, once accepted, becomes a "stand-alone" document for purposes of future research, which becomes incorporated into the planning and modeling of the CSD-1 Master Plan, and must therefore be clear, precise, and easy to understand. There are three types of sewer studies:

An **Environmental/Financial Sewer Study (Level One)** is completed to ensure technical compliance with the CSD-1 Master Plan, and to demonstrate it is possible to provide sewer service to the project. The study focus is on Major Topography, Major Phasing & Timing, Interceptors (and their capacity), Major Trunks (and their capacity), and Sewer Sheds. Schematic lines will cover the remainder of the site and upstream areas. The study NEED NOT include minor trunks, collectors, manholes, reservations and easements, and subdivision layouts. The objective is District approval of the study for Environmental/Financial approval only. In most cases the District will issue a response similar to the following:

> This project, if constructed to District standards, will have a LESS THAN SIGNIFICANT IMPACT upon the District system. This study is not acceptable for design; further study(s) will be required to complete the design analysis and allow submission of improvement plans.

A **Specific/Community Master Plan (Level Two**) is completed to establish the backbone trunk system and sheds, locate and size pump/lift stations, and establish depth of pipes and verify cover. The study focus is on Topography, Phasing & Timing, Interceptors (and their capacity), Trunks (and their capacity), and to define Reservations and Shed Shifts needed for approval. Schematic lines will cover the remainder of the site and upstream areas. This level of study is generally not sufficient for trunk design. The study NEED NOT include collector pipes (other than schematic lines), residential street layouts, and collector manhole details. When this level of study is approved, the District will respond in a manner similar to the following:

> This study adequately outlines the trunk backbone system required for service to the project area. This study is not acceptable for design; further study(s) will be required to complete the design analysis and allow submission of improvement plans.

A **Subdivision Sewer Study (Level Three)** is the design analysis of the sewer system for a specific project site, and forms the basis for the improvement plans. The study focus is on everything required for a Level Two study, plus Collector Pipes, Residential Street Layout, Manhole Details, and any Exceptions to Policy. Any request for non-standard facilities must include supporting documentation. When this level of study is approved, the District will respond in a manner similar to the following:

This study may be considered approved. Any significant changes may require a revision to this study. Improvement plan associated with this project may be submitted for review and approval.

Each sewer study is different, and some parts of the minimum requirements may not apply to a specific project; in this case, a note is sufficient to meet the requirements (i.e. "There are no shed shifts" or "There are no interim facilities"). In addition, any details that are unusual or do not meet the minimum standards need to be called out within the Study (i.e. "Two manholes will not meet the minimum required depth of 6.33' and will therefore require flat-slab tops.")

A sewer study will not be accepted until it meets these minimum standards. County of Sacramento Improvement Standards, CSD-1 Master Plan, and Sacramento Area Sewer District Design Standards take precedence over this document, should any conflicts be found.

A. Title Page

Include the name of the project, submission date, and engineering firm.

B. Table of Contents

C. Executive Summary.

A brief summary of the report (1/2 to 2/3 of a page at most).

1. **Purpose Statement.** The author shall state why this study is required, and present the developer's strategy for serving the project. Examples include:
   a. Demonstrate the ability to gravity serve the on-site project.
   b. Demonstrate the ability and required facilities to serve the project and off-site areas (upstream and/or downstream).
   c. Process environmental documentation.
   d. Documentation to establish a Finance Plan.
2. **Project and Study Characteristics**
   a. Brief description of project and study area land uses. (*Ex: "…mostly single family development with some commercial and park lots"*)
   b. Brief, general location. (*Ex: "…the intersection of X Road & Y Street in the SW portion of the County"*)
   c. Project only total Acreage, ESDs (Equivalent Single Family Dwelling Units), & PWWF (peak wet weather flow in mgd).
   d. Upstream total Acreage, ESDs, & PWWF entering project, if applicable.
   e. Total Acreage, ESDs, & PWWF exiting project or at a particular important point, if applicable.
   f. Name of serving trunk or trunk shed.
   g. Name of the serving interceptor.
   h. Note if development phasing will occur.
   i. Note if a pump station and/or pump station upgrades will occur.
   j. State whether interim facilities will or will not be required.
   k. State whether trunk shed shifts have been approved.
3. **Findings**
   a. One to three sentences summarizing the issues and end results.

D. Introduction

1. **Level of Study**
   a. Discuss the level of study, and why it is the appropriate level.
2. **Location**
   a. On-site - Describe features (streets, creeks etc.) surrounding the on-site project area. Map shall clearly show boundary. In the report, please do not use names of other subdivisions unless they constitute the best description. Adjacent subdivision names are acceptable on the map. Staff does not always have historical knowledge of subdivision names.
   b. Off-site – Describe features surrounding the off-site study area. Map shall clearly show boundary.
3. **Topography**
   a. On-site
      1. General elevations and direction of drainage(s).
      2. Specific geographic features, if any.
   b. Off-site
      1. General elevations and direction of drainage(s).
      2. Specific geographic features, if any.
4. **Detail Description**
   a. On-site Project Description
      1. Project Characteristics and Attributes.
      2. Special features, project requirements or limitations, especially affecting sewer service.
   b. Off-site Study Area Description
      1. Study Area Characteristics and Attributes.
      2. Special features, study area requirements or limitations, especially affecting sewer service.
5. **Land Use and Zoning**
   a. On-site
      1. Previous, historical land use (*grazing, agricultural, mining*)
      2. Existing, current, actual land use.
      3. Land use zone as specified in the governing agency's General Plan.
      4. Proposed project land use. Use these proposed land uses for flow calculations.
   b. Off-site.
      1. Previous, historical land use.
      2. Existing, current, actual land use.
      3. Land use zone as specified in the governing agency's General Plan.
      4. Proposed study area land use. Use known proposed land uses, or the General Plan zone designations. Use these proposed land uses for flow calculations.

E. Vicinity Map

A full-page vicinity map of sufficient scale to quickly locate the project site will be bound into the text of the report.

F. Design

1. **Assumptions**

   Author shall clearly state the assumptions made and the basis for these assumptions for verification by the District. Recent assumptions invalidated by the District include:

   a. Future upstream development will not occur or will not be served through the project and/or study area.
   b. Downstream sewer facilities currently have capacity to carry study area flows.
   c. High ground water tables don't exist.
   d. A particular interceptor, trunk, and/or relief project will be in service prior to the project and/or study area requiring service.
   e. School is assumed to be elementary, (*middle or high school*).

2. **Approach**

   State the method used to determine flows. The following are possible steps in the method used.

   a. Major sheds were defined from topography.
   b. Schematic backbone of major trunks was established from topography.
   c. Land Uses were interposed over the major sheds to establish ESDs / acre.
   d. Sub-sheds were created by over laying known subdivisions and street alignments.
   e. Site observations and/or District facility maps were used to determine shed areas.
   f. Site observations and/or District facility maps were used to determine actual connections.
   g. Existing flows at a particular point were provided by the District. Attach documentation of information in an appendix.
   h. Flows were determined by the use of the Sacramento Area Sewer District Design Standards and the design criteria noted in this study.
   i. A spreadsheet was developed to calculate and determine flow and facility characteristics.
   j. Flows using minimum standards were compared to actual interim flows to determine design of proposed interim facilities.
   k. Cost analyses were prepared to compare alternatives.

3. **Design Criteria**

   State the basic criteria used. Use the following and / or other as applicable.

   a. The October 2006 Revised Edition of the CSD-1 Sewerage Facilities Expansion Master Plan. (or other year as applicable, the most current version).
   b. The Sacramento Area Sewer District Design Standards approved January 2008.
   c. School flow criteria. See Section 3.1.5 of the Design Standards. You are required to show both methods and compare the results to determine the greatest value.

G. Sewer flow Information

Any flow data obtained from another study shall reference the source of information. Changes in flow data for particular points shall be explained if they don't agree with the previous most current study.

1. **On-site Flows, (total Project Acreage, ESDs & PWWF).**

   a. Existing flow data.
   b. Full Development flow data as proposed.

c. Development Phasing flow data, if any. Note the changes in flows, acreage and ESDs at specific times and projected phases of development.
d. As needed, discuss sub-sheds and other features of concern.

2. Off-site Flows, (total Off-site Study Area Acreage, ESDs & PWWF).

a. Upstream Sewer
   1. Existing flow data.
   2. Full Development flow data as proposed.
   3. Development Phasing flow data, if any. Note the changes in flows, acreage and ESDs at specific times and projected phases of development.
   4. Note entry points of upstream flows to the Project area.
   5. If needed discuss sub-shed flows and other features of concern.

b. Downstream Sewer
   1. Point of connection to the downstream system.
   2. Available capacity in mgd.
   3. Existing flow data.
   4. Proposed flow data (by development phasing times).
   5. Impact to downstream system from Project and Study Area.

H. Sewer Alignments and Facilities

1. Interim Facilities.

a. Discuss alternatives. Include the following for each.
   1. Alignment.
   2. Gravity verses Force Mains and Pump or Lift Stations.
   3. Other features and requirements to provide capacity.
   4. Costs estimate.

b. Recommend an alternative as a solution & give reasoning for selection.

2. Ultimate Facilities.

a. Alignment.
b. Gravity verses Force Mains and Pump or Lift Stations.
c. Trigger event (or timeframe) to require switching from the Interim to the Ultimate Facilities.
d. Method of switching to the Ultimate Facilities, who will complete the task, and who will pay for the task.
e. Other features and requirements to provide capacity.

I. Conclusion

A paragraph about the level of study and the condition of service, including:

1. Purpose of the study and the relevance for design.
2. Interim **versus** ultimate solution.
3. Total acreage, ESD's, and flow (mgd). Please ensure consistency throughout the report.

J. Spreadsheet Information (recommended column titles).

Some sewer studies require more than one spreadsheet, depending on analysis. Please note that the spreadsheet(s) will be bound within the text portion of the report and not on the map.

1. Node number.
2. Land Use.

3. Gross Acreage per land use entering each node.
4. ESDs per land use entering each node (either the number of units per acre, or 6, whichever is greater).
5. Total Gross Acreage
6. ESDs.
7. Inflow and Infiltration (I/I).
8. Average Dry Weather Flow (ADWF).
9. Peaking Factor (PF).
10. Peak Dry Weather Flow (PDWF).
11. Peak Wet Weather Flow (PWWF).
12. Pipe size (outgoing).
13. Peak Flow Velocity.
14. Invert Depth
15. Subscripts
    a. Reference to other calculations in report, if applicable.
    b. Notation of abbreviations used in table as needed.
    c. Other notations if needed for pertinent or unusual items.

Note: Contributing flows vs. cumulative flows. Contributing flows (for both acreage and ESD) are those flows entering the sewer system at any given node. Cumulative flows (for both acreage and ESD) are all flows in the pipe at any given node, including both contributing flows and upstream flows. All results and pipe design will be based upon the cumulative flows, not the contributing flows.

K. Sewer Study Map (Minimum Scale 1" = 100")

Place a full size study map in a pocket holder bound into the report. Place a reduced size (11" x 17") study map bound into the report. The node and major street information shall be readable on the reduced sized map. This requirement may necessitate the increase in node size and/or the removal of some minor nodes on the reduced size map. The minimum scale on the full size map is needed in order that all information requested to be on the map is readable. Few exceptions are made to the minimum map scale; please contact the District if you feel you need an exception.

1. **Node Information.**
    a. Node Number
    b. Total Gross Acreage (A) entering each node, which is not accounted for in upstream node data. Note to the nearest tenth of an acre and be consistent. This also applies to the $\sum$A.
    c. ESDs entering each node, which is not accounted for in upstream node data. Note to the nearest tenth of an ESD and be consistent. This also applies to the $\sum$ESD.
    d. Gross Acreage ($\sum$A).
    e. ESDs ($\sum$ESD).
    f. PWWF (mgd).
2. **Manhole (MH) Information.**
    a. Pipe Invert Elevations.

1. Note the invert elevation for each pipe entering and exiting the manhole along with its pipe size, whether it is flowing in or out of the manhole, and the bearing direction. (*Ex: INV=171.40 8" OUT (S)*).

b. Depth of Invert
   1. Depth is measured from MH rim (top of proposed grade) to the invert of the exit pipe.
   2. Minimum manhole depth is 6.33 feet unless modified in accordance with Improvement Standards by 18" cones or slab top manholes.

3. Pipe Information.
   a. Diameter in inches (8-inch minimum for new construction).
   b. Length between manholes to the nearest foot.
   c. Slope
      1. Note the slope to the nearest ten thousandth.
      2. Use conventional rounding for all calculations.
      3. The minimum slopes are based on a minimum PWWF velocity of 2 fps. Since this velocity is not always possible in the upstream reaches due to low volumes of flow, the following standards apply:
         a. The last upstream 8-inch diameter pipe segment shall have a minimum slope of 0.0070 ft./ft.
         b. All upstream reaches of 8-inch pipes shall have a minimum slope of 0.0070 ft./ft. until at least 6 ESDs are being served.

4. **Grade Information.** The information must be readable and **<u>on</u>** the Sewer Study Map. Possible options are:
   a. Topography with contour lines and/or spot grades.
   b. Pad elevations with major contour lines and proposed street grades.
5. **Potential Utility Information.** Add when potential conflicts with sewer pipes exist.
   a. Location of concern, and nature of the conflict.
6. **Vicinity Map.**
7. **North Arrow and Map Scale.**
8. **Legend.**
9. **Notes.**
10. **Map Title.**
11. **Exhibit or Appendix Title.**
12. **Revision Date of Map.**
13. **Engineering Firm Name and Address.**

L. <u>Electronic Files</u>

In addition to the report, the Design Engineer shall submit electronic files (shape files) with each sewer study submittal. The electronic files shall be compatible with Arc View, typically in the format of a shape file (*.shp) using the coordinate system of NAD 83 State Plan California II, and contain the following attributes:

1. Manholes – unique manhole ID, rim/ground elevations (ft), sewer study name, date sewer study revised (Separate layers will need to be created for interim and permanent assets if applicable).

2. Pipelines – upstream MH, downstream MH, upstream invert (ft), downstream invert (ft), diameters (inch), lengths (ft), gravity/force main, sewer study name, date sewer study revised (Separate layers will need to be created for interim and permanent assets if applicable).
3. Pump Station – Maximum pump capacity (mgd), sewer study name, date sewer study revised (Separate layers will need to be created for interim and permanent assets if applicable).
4. Sewer Sheds – Unique shed ID defined by loading manhole
5. Land use Layer – Land use codes, land use description, proposed ESD densities (ESD/AC), sewer study name, and date sewer study revised.

The electronic files shall not be AutoCAD files.

M. Supporting Documentation. Add the following as needed and when referenced in the report.

1. **General, Specific, or Community Plan Exhibit(s).**
2. **Land Use, Aerial, or Parcel Maps.**
3. **Map of referenced areas showing boundaries or facilities mentioned.**
4. **Other Sewer Studies or parts thereof.**
5. **Cost Analyses** (required when alternative facilities are proposed).

Submittal Requirements

1. Submit two full studies on the first submittal. The District will request a third copy when we are ready to approve the study.
2. The study shall be bound in some method of plastic comb or spiral type binding.
3. All large maps (generally larger than 11" x 17") shall be folded and placed in pockets bound into the report.
4. Date the report on the title page.
5. CD/DVD with Electronic Files as described above.