

3.0 Wastewater Treatment Plant Construction/Expansion/Modification

The purpose of this section is to provide guidance for preparing an engineering report/environmental information document (ER/EID) for projects which propose to construct, expand and/or modify a wastewater treatment plant (WWTP). Examples are:

- Build a new WWTP to accommodate growth in a sewershed that may be sending flow to another WWTP at the present time.
- Expand an existing WWTP to accommodate an area where residences have failing septic systems.
- Replace large portions of an existing WWTP to address issues related to age, nutrient removal, or treatment inefficiencies.

This section applies to projects similar to the above-listed examples. For projects which propose the rehabilitation, repair or replacement of individual or relatively small pieces of equipment, see Section 5.0. The outline of the ER/EID must follow the order presented in this section, and the following subsections describe and discuss what the ER must include.

Some projects may qualify for Minor ERs/EIDs. (See Section 1.4.1 for the details of when these are allowed.) For Minor ERs/EIDs, complete the tables provided in Appendix F for the requirements in each section. For calculations discussed throughout this section, worksheets provided in the workbook titled Wastewater Treatment must be utilized and the information reported in the appropriate tables. This workbook is available in the Toolbox.

For Major ERs/EIDs, the guidance may allow alternative data, methodologies, and the way material is presented; *however, the format must always be followed*. Each subsection will advise if these are allowable.

- Alternative data sets other than those specified in this section *may be* proposed in certain subsections. *In all cases, alternative data sets must be identified, discussed, justified and compared with the corresponding data set specified in the guidance*. An acceptable rationale for the preferred alternative data set to the one specified in the guidance *must be provided* if it is to be approved.
- Alternative methodologies must be specified and discussed, and the findings compared with the findings based on the corresponding methodologies in the guidance. All alternative methodologies must include supporting data, calculations, assumptions and documentation so that results can be replicated.
- If material is presented in alternative manner, the required discussion must be in the body of the ER/EID. Supporting information (e.g., maps, calculations, supporting data, etc.) may be included in an appendix rather than the body of the ER/EID. A tabular display of the data is encouraged where practicable. Use of the worksheets found in the Wastewater Treatment workbook is encouraged.

It is strongly recommended that as the ER/EID is prepared, the Consultant and Owner meet with IFS to discuss population and/or flow projections well before proceeding to the next steps, which should help the process move more smoothly and help determine the alternatives to be analyzed.

As stated in Section 2, the report must follow the prescribed format in the guidance. ERs/EIDs for projects under this section must follow the format below:

- Upfront Information
- 1.0. Executive Summary
- 2.0. Current Situation
 - 2.1. Wastewater Collection System and WWTP Condition
 - 2.2. Current Population
 - 2.3. Current Wastewater Flow
- 3.0. Future Situation
 - 3.1. Population Projections
 - 3.2. Flow Projections
- 4.0. Purpose and Need
- 5.0. Alternatives Analysis
 - 5.1. Alternatives Description
 - 5.2. Present Worth Analysis
 - 5.3. Alternatives Analysis Summary
 - 5.4. Project Description
- 6.0. Environmental Information Document
- 7.0. Financial Analysis
- 8.0. Public Participation

3.1 Upfront Information

Prepare the upfront information (e.g., Title Page, Table of Contents) as specified in Section 2.2.1.

3.2 Executive Summary

Prepare the Executive Summary in accordance with Section 2.2.2. Include, the existing WWTP capacity and a reference to the existing NPDES Permit location in the ER/EID.

3.3 Current Situation

Before drafting the Need and Purpose statement as defined in Section 2.2.3, the reasons for the project must be determined. To do so, first characterize the current situation. The following sections discuss what should be included in the current situation.

3.3.1 Collection System Condition

This section will determine the potential issues related to the actual condition of the system. The information presented in this section will provide part of the basis for the need and purpose of the project. Review the following sections and complete the requirements as discussed.

3.3.1.1 *Overview of System*

Requirements

Part of determining the condition of the WWTP is to gain an understanding of the size of the collection system that flows to the WWTP. Provide two figures. The first should be more of a vicinity figure that shows the LGU. In this figure, provide

- Basemapping as described in Section 2.1.5.
- The municipal limits of the LGU and/or county lines.
- Major roadways and waterbodies.
- Major interceptors and pump stations.
- All WWTP(s) which collect(s) wastewater from the entire system.
- The WWTP service area for each WWTP of the LGU.
- The WWTP where the project is located.

In addition to including this figure, if there are multiple WWTPs in the LGU, then provide an additional figure that shows the following:

- Basemapping as described in Section 2.1.5.
- The municipal limits of the LGU and/or county lines.
- Major roadways and waterbodies.
- Major collection system lines and pump stations in the WWTP's service area.
- The direction of wastewater flow.
- The WWTP where the project will occur.

Minor ERs/EIDs

Please include these figures as part of Section 2.1 of the ER/EID.

Major ERs/EIDs

Please include these figures as part of Section 2.1 of the ER/EID. Additionally, text may be provided to provide more explanation regarding the collection system.

3.3.1.2 *General Overflow History*

Sanitary Sewer Overflows (SSOs) are often indicators of the condition of the collection system served by the WWTP and may offer some information as to why a WWTP may be experiencing large flows. Complete the following regarding SSOs within the collection system served by the WWTP.

Requirements

For SSOs, describe if any SSOs have happened over the past five years within the collection system served by the WWTP. Include in an appendix to the ER/EID any information such as reported SSOs that show where these SSOs occurred.

Discuss whether the local government unit (LGU) is under a Special Order by Consent (SOC) or is currently negotiating one with the North Carolina Department of Environment and Natural Resources (DENR) Division of Water Quality (DWQ). Additionally, discuss any other special orders under which the LGU may be, such as an order for the U.S. Environmental Protection Agency (EPA). For any of these orders, provide such pertinent information as to why the special order was issued, deadlines by which the LGU must comply and/or any intermediate deadlines. Provide full copies of these orders in an appendix of the ER/EID.

Show all SSOs on a map. This map should also contain the same basemapping as the project location figure (see Section 2.1.5), the sewershed boundaries, the collection system lines and pump stations within the sewershed, the direction of wastewater flow, the WWTP, and the location of all SSOs that are keyed to Table 2.1.1 in Appendix F.

Minor ERs/EIDs

- Complete Table 2.1.1 in Appendix F and place it in the body of the ER/EID.
- Include the required map in the ER/EID with the appropriate map reference in Table 2.1.1.
- Provide all SSO reports for SSOs shown in the table in an appendix of the ER/EID. List the appendix reference in the table.
- Provide full copies of any special orders in an appendix of the ER/EID. List the appendix reference in the table.

Table E.5.1 in Appendix E shows an example of how this table would be completed.

Major ERs/EIDs

Describe any SSOs and special orders as discussed in this section. Show all SSOs on a map and provide SSO reports in an appendix of the ER/EID. Provide full copies of any special orders in an appendix of the ER/EID.

3.3.1.3 Unsewered Areas

In addition to SSOs, it is important to know about any unsewered areas that may be located in the service area of the WWTP, as these areas could eventually be connected to the collection

system served by the WWTP where the project is occurring. Complete this section as described below.

Requirements

Identify any locations within the WWTP's service area that contain unsewered areas. Show this area on a map. The map should include the basemapping utilized for the Project Location map, the service area boundary, major sewers within the service area, and the boundaries of the unsewered area(s).

If the project received priority based on serving failing septic tanks, then the purpose and need of the project must *primarily* be that scope. Additional facilities beyond that scope may not be eligible expenses.

Minor ERs/EIDs

- Complete Table 2.1.2 in Appendix F and place in the body of the ER/EID.
- Provide a map that meets the requirements above and place in the ER/EID. Provide the appropriate reference in Table 2.1.2.

Table E.5.2 in Appendix E shows how this table would be completed.

Major ERs/EIDs

Include information related to unsewered areas as discussed above. A map showing the unsewered areas must be provided.

3.3.2 WWTP Condition

As part of determining the need for the project, it is important to gain an understanding of the WWTP condition. An overall assessment of the condition of the WWTP provides an overview of the basics of the WWTP and the groundwork for a more detailed assessment of the specific components of the WWTP. Complete the following sections related to the WWTP.

3.3.2.1 General WWTP Condition

Requirements

Describe the general condition of the WWTP. This description should be a general description of (1) the basic process; (2) whether the WWTP is in good working order, and (3) the trend in flows.

Provide the average daily flow in million gallons per day (MGD) for the past four years and its current flow. DMRs must be provided in an appendix of the ER/EID.

Include in this discussion any Notices of Violation (NOV) that the WWTP might have incurred over the past five years. If there are any special orders such as a SOC, discuss the pertinent

information as to why the special order was put into place, the final completion deadline, and any intermediate deadlines.

Additionally, include diagrams or schematics of both liquid and sludge treatment trains, noting the overall direction of flow as well as recycle loops. Also, provide a plan (or plans) which show(s) and label(s) the physical location of each unit operation and process or (system of operations and processes) in sufficient detail to show (and label) major yard piping as well as recirculation piping and pumping.

Minor ERs/EIDs

- For the current condition of the WWTP, complete Table 2.1.3 in Appendix F and include in the body of the ER/EID.
- If NOVs or special orders are listed, provide full copies of these NOVs or special orders in an appendix of the ER/EID. Reference the appendix in the table.
- Provide both a conceptual schematic and a plan diagram in the ER/EID. Supply the appropriate reference for these figures in the table.
- Include DMR records for the past four years in an appendix of the ER/EID. Reference the appendix in the table.

Table E.5.3 in Appendix E shows how this table would be completed.

Major ERs/EIDs

Describe the WWTP condition as discussed in this section. Include DMRs in an appendix of the ER/EID as well as any NOVs or special orders that the WWTP might have incurred.

3.3.2.2 *Historical Wastewater Flows*

Requirements

Historical flow data is a key component in assessing the need to expand or construct a WWTP. Provide flow data for the last four years. Specifically, provide the average annual daily flow (Q_{AA}) and the maximum monthly average flow (Q_{Mo-max}), and the minimum monthly average flow (Q_{Mo-min}) for each year.

Annual Average Daily Flow – The daily flows averaged over a year (i.e., any consecutive 12 month period).

Monthly Average Flow – The daily flows averaged over a month. May be calendar month or 30 day period.

Provide a discussion of the variations in wastewater flow that specifically addresses inflow/infiltration, industrial flow, and any unique user variations (e.g., summer peak flows at a beach community). In addition, provide a discussion of the LGU's asset management planning with respect to the collection system as it relates to addressing inflow/infiltration issues.

Minor ERs/EIDs

- Complete Table 2.1.4 in Appendix F for average flow for the four year period ($Q_{4\text{-yr}}$) as well as average annual flow (Q_{AA}), the maximum monthly average flow, ($Q_{Mo. \text{max}}$), and the minimum monthly average flow ($Q_{Mo. \text{min}}$) for each year. This table must be in the body of the ER/EID.
- In an appendix of the ER/EID, provide backup information such as daily flow records from the last four years from DMRs or NDMRs. The Q_{AADF} and Q_{AMF-MM} must be bolded.

Table E.5.4 in Appendix E shows an example of how this table would be completed.

Major ERs/EIDs

Additional parameters / rationale may also be used.

3.3.2.3 *Condition of WWTP Equipment (Existing WWTPs)*

To further understand the condition of the WWTP, each piece of equipment should be assessed. For WWTPs that will be modified, it will also provide the basis for the need to upgrade/modify/replace equipment.

Requirements

Provide information regarding the size, age, condition, and other pertinent information that would provide a solid assessment of each portion of the wastewater treatment processes. If possible, provide photos of each piece of equipment. The equipment should include but is not limited to the following:

- Influent pump station
- Bar screen and grit removal
- Aeration equipment
- Clarifiers
- Disinfection
- Post-aeration
- Sludge treatment
- Sludge disposal

Condition should be assessed as follows:

- **Good.** The equipment shows little signs of wear and functions in an efficient manner with only routine maintenance. It shows minimal signs of corrosion and deterioration.
- **Fair.** The equipment shows some signs of wear and fails periodically. Some repair outside of routine maintenance is required to keep the equipment functioning. Minor upgrades provide reliability.

- **Poor.** The equipment shows signs of wear and fails on a regular basis. Repairs outside of routine maintenance occur frequently. The equipment shows excessive signs of corrosion that limits functionality. Upgrades are needed to provide reliability.

Use a sub-section (Major ER/EID) or table (Minor ER/EID) per each piece of equipment to discuss the information above and any additional information that provides an accurate description of the equipment. On a diagram, show where this piece of equipment is located within the WWTP site. Also, where possible, include photographs and reference these photographs in the description. Provide any supporting information in an appendix to the ER/EID and supply the appropriate reference in the body of the ER/EID. Additional information should be provided in an appendix of the ER.

Minor ERs/EIDs

- Using Table 2.1.5 as the standard, complete a table for each piece of equipment (e.g., 2.1.5a, 2.1.5b). Print these tables and include them in the body of the ER/EID.
- Provide any photos taken of equipment in an appendix to the ER/EID. List the appropriate reference in the table.
- Provide any supporting information in an appendix to the ER/EID. List the appropriate reference in the table.

3.3.2.4 *Proposed WWTP(New WWTPs only)*

Requirements

For construction of a new WWTP, state that a WWTP does not exist. Then describe how wastewater generated in the area to be served by the proposed WWTP is currently treated. For example, the LGU might be sending part of the area's wastewater to other treatment providers while utilizing septic systems to treat the remaining portion of wastewater generated. Provide preliminary design information for the proposed project, such as the wastewater quantity (e.g., peak hour flow, peak day flow, average daily flow, minimum/startup flow, maximum month flow, etc.) and conventional wastewater quality characteristics, in mg/l (e.g., biochemical/biological oxygen demand [BOD₅], total suspended solids [TSS], ammonia nitrogen [NH₃, NH₄⁺], total kjeldahl nitrogen [TKN], total nitrogen [TN], and total phosphorus [TP]).

Minor ERs/EIDs

- Complete Table 2.1.5 in Appendix F by discussing in the Additional Information cell the fact that the WWTP is new construction.
- Provide a map that shows the location of the new WWTP. List the reference for this map in the table.

3.3.2.5 *Permit Information*

Requirements

Provide a short discussion of limits referring to effluent limit page(s), speculative limit letters, rules, etc. For existing WWTPs to be expanded or modified, provide a copy of the limits pages of the NPDES permit in an appendix in the ER. If speculative limits are available for the expansion or modification, provide those as well. For new WWTPs, place a copy of the speculative limits letter in the ER.

Speculative effluent limits must have been issued no earlier than four years prior to the submittal of the ER.

Minor ERs/EIDs

- Utilize Table 2.1.6 in Appendix F and complete it by providing the information requested above and place it in the body of the ER/EID. Print this table and place in the body of the ER/EID.
- Provide a copy of the permit in an appendix of the ER/EID. List the appropriate reference in the table.

3.3.3 *Current Population*

Current population provides the basis for future population and may supply part or all of the need for the project. Follow the steps in this section to determine current population for the LGU and the WWTP service area.

Requirements

1. Provide the total population for the LGU.

Provide the total population for the LGU for 2010 using [U.S. Census data](#). 2010 estimates only should be used.

2. Provide the population density per square mile.

Provide the number of persons per square mile based on [U.S. Census](#) data. Select the LGU in the search box and locate the “Geography Quick Facts” at the bottom to find the number of persons per square mile.

From the inputs determined per the above instructions, the persons per dwelling unit in the LGU, current population in the service area and current population in the service area will be calculated in Table 1.

3. Provide the size of the LGU.

Using the U.S. Census website, find the size of the LGU, which is located under “Geography Quick Facts” at the bottom of the webpage.

4. Provide the size of the WWTP service area.

Using GIS or other appropriate mapping method, estimate the square mileage of the WWTP service area. Note that service area size may differ from the size of the LGU.

WWTP Service Area – The area of the LGU served by the WWTP.

Sewershed Service Area – The area of the WWTP service area that contains the project. Note that for major sewer interceptors, this may be the entire WWTP service area.

Minor ERs/EIDs

- Complete Table 2.2.1 in the Wastewater Treatment workbook found in the Toolbox. Print this table and place it in the body of the ER/EID.
- Provide supporting information from the U.S. Census website in an appendix of the ER/EID. Reference the appropriate appendix in the table.

Table E.5.5 in Appendix E shows how this table would be completed.

Major ERs/EIDs

Alternative methodologies may be used. If an alternative methodology is used, then it must be explained in the body of ER/EID, and the results must be presented. All backup data, methodologies used, assumptions made, and calculations must be provided in an appendix of the ER/EID.

3.3.4 *Current Wastewater Flow*

Part of describing the current condition of the WWTP to be expanded, constructed, or modified is characterizing the flow coming into the WWTP from the service area. Flow coming into the WWTP must be determined by estimation. This section of the guidance describes the methodologies used.

Requirements

1. Calculate residential and commercial flow in the sewershed.

Determine residential flow in the service area by determining water usage based on water billing records from residential connections *within the service area* and calculating a 10 percent consumptive loss. Then, determine water usage based on water billing records from commercial connections *within the service area* and calculate a 10 percent consumptive loss. If water billing records are ambiguous in showing the amount of water used in the calculations for current flow estimations, then provide the calculations in an appendix of the ER/EID.

Include copies of water billing records in an appendix of the ER/EID. Highlight the data used for current flow estimation. If the documentation is too large for hard copies, a CD containing the data may be submitted instead.

1. Calculate industrial flow.

Determine industrial flow *from within the service area* based on dual metering. Dual metering for industries is required because sometimes, industries may obtain their water supply from other sources than an LGU.

Dual Metering – Metering at an industry that monitors both water coming in and wastewater going out.

Include hard copies of industrial flow metering in an appendix of the ER/EID.

3. Include flow commitments.

Part of the current wastewater flow for a service area includes residential, commercial, and industrial flows that have been officially committed. For example, within a sewershed, a developer may be planning a 1,200-unit residential development that also has 12 commercial parcels.

Because flow commitments are counted as current flow, they may not be included in future flow projections.

This flow would be considered to be committed if the developer has sent documentation to the LGU that has been approved by the LGU confirming the number of residential and commercial units and when the development will be constructed.

Include these flows as part of the current flow calculation *only if these committed flows are within the service area of the WWTP*. Include correspondence that shows the commitments for each individual development in an appendix of the ER/EID.

4. Calculate Inflow/Infiltration

In many instances, a collection system may be experiencing inflow/infiltration (I/I) issues that must be accounted for in current flow estimations at the WWTP. Inflow/infiltration may be estimated using either WWTP flow information only or both WWTP and water usage records. Equation 3.1 shows the I/I estimation using WWTP information only, and Equation 3.2 shows I/I estimation using both WWTP and water usage records. If the sewershed where the project will occur is a percentage of the WWTP's overall sewershed, then multiply the percentage of land area covered by the sewershed by the overall I/I estimate.

$$I/I = Q_{WWTP-ADF} - Q_{WWTP-MinADF}$$

I/I= Infiltration/Inflow

$Q_{WWTP-ADF}$ = Average of the average monthly flow over the most recent four-year period of record at the WWTP

$Q_{WWTP-MinADF}$ = Average of the minimum monthly flows over the most recent four years of record at the WWTP

Equation 3.1. Inflow/Infiltration Estimation Using WWTP Information Only

$$I/I = Q_{WWTP-ADF} - (WU_{Total} - CL)$$

- I/I= Inflow/Infiltration
 $Q_{WWTP-ADF}$ = Average of the average monthly flows over the most recent four-year period of record at the WWTP
 WU_{Total} = Average water use for residential, commercial, and industrial users over the same recent four-year period used for the WWTP.
 CL= Consumptive loss of 10 percent

Equation 3.2. Inflow/Infiltration Estimation Using WWTP and Water Usage Records

3. Calculate current flow.

Add the calculations from Steps 1 through together to determine total current flow to the WWTP to be constructed, expanded, and/or modified as shown in Equation 3.3.

$$ADF_{Current} = [(ADF(Water)_{Residential} - (ADF(Water)_{Residential} \times 10\%)] + [ADF(Water)_{Commercial} - (ADF(Water)_{Commercial} \times 10\%)] + ADF_{Industrial} + FC + I/I]$$

- $ADF_{Current}$ = Current average daily wastewater flow at WWTP
 $ADF(Water)_{Residential}$ = Current average daily water flow for residential customers.
 $ADF(Water)_{Commercial}$ = Current average daily water flow for commercial customers
 $ADF_{Industrial}$ = Average daily industrial flow with dual metering
 FC= Flow commitments
 I/I= Inflow/Infiltration

Equation 3.3. Current Flow Estimate Calculation

Minor ERs/EIDs

- Use Table 2.3.1 in the Wastewater Treatment workbook found in the Toolbox. Print this table and place it in the body of the ER/EID.
- Provide supporting information in an appendix of the ER/EID and supply the appropriate reference in the table.
- Provide any letters related to flow commitments in an appendix of the ER/EID.

Table E.5.6 in Appendix E shows an example of how this table would be completed.

Major ERs/EIDs

Alternative methodologies may be used. If an alternative methodology is used, then it must be explained in the body of ER/EID, and the results must be presented. All backup data, methodologies used, assumptions made, and calculations must be provided in an appendix of the ER/EID.

3.4 Future Situation

The life of many pieces of WWTP equipment is expected to be 20 years which is also the terms of loans made by IFS. This is important because the future situation will help establish the need for the project and will help size the WWTP accurately. This section discusses what the Infrastructure Finance Section (IFS) needs to review in terms of population projections and flow projections.

3.4.1 Population Projections

Follow the steps below to determine population projections. If the service area spans multiple counties, a table for each county and then prepare a table that summarize the projections from all counties.

Requirements

1. Provide the Current LGU population and service area population.

Use the current LGU population and service area population. If using the Future Population table provided in the Wastewater Treatment workbook found in the Toolbox, then the data will appear in the cell.

2. Determine the 2010 county population.

For Year 1 (year 2010), use [U.S. Census QuickFacts](#) page and select the county for the total county population. Use only 2010 estimates.

3. Calculate percentage of population.

The population projections will be based on two parameters, the percentage of the county population that is located in the LGU and the percentage of the LGU that is located in the service area. To provide the basis for this calculation, divide the 2010 LGU population by the 2010 county population. Then divide the service area estimated population by the 2010 LGU population.

4. Determine population estimates using State Data Center (SDC) data.

Determine the year in which construction of the project will begin. This is the implementation year. Then, using information from the [State Data Center](#), determine the population projections for the next 20 years. Select “Annual County Populations”. If using the Wastewater Treatment workbook found in the Toolbox, enter this information into the Future Population worksheet.

There may be cases where the SDC data might not extend the full 20 years. If this is the case, then determine the difference between the last two years of the estimate. Then add that difference for each needed year.

5. Calculate the future LGU and service area populations.

Use the percentage of LGU in the county and the percentage of the LGU in the service area to determine future service area population. If using the Wastewater Treatment workbook found in the Toolbox, this information will be automatically calculated.

If the service area spans multiple counties, then complete separate tables for each county. Complete a summary table showing the projected population for each county and sum the total future population for the counties and LGU(s) involved. Most importantly, show the total future service area population.

6. Provide alternative population projections from other sources (if proposed).

Requirements

Other sources of data such as municipal population estimates, comprehensive plans, or projections based on connections may be used to determine future population so long as the same window used for the SDC populations above is used. To calculate the service area number, multiply the LGU future population by the percentage of the service area in the LGU. If multiple data sources are used, show the results of each source in the table as discussed below and provide supporting information in the appendices of the ER/EID. Additionally, justify the use of this data as an additional data set to be used along with the SDC data. If no alternate population data set is proposed in lieu of the SDC, then skip this step and move to Section 3.4.2.

It is strongly recommended that as the ER/EID is prepared, the Consultant and Owner meet with IFS to discuss population projections before proceeding to the next steps, which will help determine the alternatives to be analyzed.

Minor ERs/EIDs

- Use Table 3.4.1 in the Wastewater workbook found in the Toolbox. Select the appropriate current population methodology from the pulldown menu and enter the required information. Print this page and place it in the body of the ER/EID.
- Provide supporting information verifying the population projections for other population methodologies used.

Table E.5.7 in Appendix E shows how this table would be completed.

Major ERs/EIDs

It is recommended to utilize the spreadsheets found in the Wastewater Treatment workbook; however, it is understood that alternative methodologies may be used to calculate population projections. If this is the case, then the methodology used must be described and the results shown in the body of the ER/EID. Include all assumptions and calculations in an appendix of the ER/EID.

3.4.2 Flow Projections

Determining future flow is critical to ensuring that the proposed project is properly sized to accommodate future flows. Since population projections determine flows, ensure that the population projection was completed as discussed in Section 3.4.1. The following sections describe how to determine average daily flows.

Requirements

Current flows are based on the methodology used to estimate flows across large service areas. Utilize Equation 3.3 to calculate future flows. If an alternative population and flow projection was utilized as the population and flows used in the alternatives analysis, provide a justification as to why this was used over the flow projection developed based on the methodologies described in this guidance.

$$Q_{Design} = (Q_{Current} + Q_{Res}(Pop_{Year} - Pop_{Cur}) + Q_{Com}(Pop_{Year} - Pop_{Cur}) + Q_{IR}[Q_{Current} + (Q_{Res}[Pop_{Year} - Pop_{Cur}] + (Q_{Com}[Pop_{Year} - Pop_{Cur}]])])$$

- Q_{Design}= Design Flow for Implementation Year plus 20 years
- Q_{Current}= Current average daily flow for WWTP (Section 3.3.3)
- Q_{Res}= Design Residential flow (70 gpd/capita)
- Q_{Com}= Design Commercial Flow (15 gpd/capita)
- Q_{IR}= Industrial Reserve (10%)
- Pop_{Year}= Population for year of projected flow
- Pop_{Cur}= Population for current year

Equation 3.3. Flow Projection Calculation

Minor ERs/EIDs

- Complete Table 3.4.2 in the Wastewater Treatment workbook found in the Toolbox. The spreadsheet will complete the calculation. Print this table and include it in the body of the ER/EID.
- Provide any supporting information related to alternative flow projections in an appendix and list the appropriate reference in the table.

Table E.5.8 shows how this table would be completed for this methodology.

Major ERs/EIDs

Alternative methodologies may be used. If an alternative methodology is used, then it must be explained in the body of ER/EID, and the results must be presented. All backup data, methodologies used, assumptions made, and calculations must be provided in an appendix of the ER/EID.

3.5 Purpose and Need

Complete the Purpose and Need statement in accordance with Section 2.2.3.

3.6 Alternatives Analysis

3.6.1 Alternatives Description

The first part of the alternatives analysis consists of describing the alternatives considered for projects which propose to construct, expand and/or modify a WWTP. Describing the alternative provides the opportunity to consider the impacts and benefits related to each alternative under consideration and provides the groundwork related to the present worth analysis (see Section 2.2.4). For projects which propose to construct, expand and/or modify a WWTP, the following alternatives must be considered:

- No-Action Alternative
- Optimum Operation of Existing Facilities
- Land Application (see description for limitations)
- Decentralized Systems
- Regionalization
- Consideration of Construction/Expansion/Modification Using at Least Two Treatment Technologies
- Biosolids Alternatives
- Preferred Alternative

Requirements

The details of what is needed for the description of the alternatives will be discussed in Sections 3.6.1.1 through 3.6.1.8 below.

Minor ERs

Each of the alternatives discussed in the sections below must be included by using Tables 5.1.1 through 5.1.7 in Appendix F, as needed, for each alternative. Each alternative description must include the following:

- A description of each alternative as described in the sections below. Where appropriate, include figures, schematics, and maps.
- For the alternative wastewater and biosolids treatment technologies considered, include preliminary design information for the proposed project, including preliminary design criteria for all proposed unit processes and operations, a flow schematic for major treatment processes and/or operations, detention times, loading rates, aeration requirements, tank and pump sizes, sludge handling and biosolids treatment and disposal alternatives, etc. sufficient to evaluate the proposed project.
- For feasible alternatives, the capital cost and present worth as derived from the present worth analysis.
- For all alternatives, a *brief qualitative* discussion of environmental impacts and a comparison to the Preferred Alternative.
- For all alternatives, a discussion regarding why the alternative was accepted or rejected, including capital cost, present worth, and

Major ERs/EIDs

For Major ERs/EIDs, include the information as discussed above in the requirements for Minor ERs/EIDs. However, the information may be presented in narrative form, or in some combination of narrative with tables. Supporting documentation must be included in an appendix to the ER/EID.

3.6.1.1 No-Action Alternative

For this alternative, discuss what would happen if the project were not built. In answering this question, describe the social, economic, and environmental impacts that would occur from not building the project. In the rationale, describe why this alternative was not chosen, including whether it was feasible to continue as discussed in the no-action scenario.

3.6.1.2 *Optimum Operation of Existing Facilities*

In the description of this alternative, discuss how the facilities at the WWTP could be optimized to improve performance without making any upgrades beyond those that would be a part of normal maintenance procedures. In the rationale, describe why this alternative was accepted or rejected as a stand-alone alternative, including its feasibility.

3.6.1.3 *Land Application*

Describe the land application alternative if the following criteria are met:

- Located in the Piedmont Physiographic Province with a projected increase in wastewater flow less than 130,000 gallons per day.
- Located in the Coastal Plains Physiographic Province with a projected increase in wastewater flow less than 330,000 gallons per day.¹

If describing the land application alternative, discuss what type of application is under consideration (e.g., reclaimed water, conventional spray irrigation). Loading rates may be based on a general knowledge of soils and estimated loading rates based on other facilities' permitted loading rates for similar soils or published hydraulic conductivity values.

Provide the rationale as to why this alternative was accepted or rejected as a stand-alone alternative, including its feasibility.

3.6.1.4 *Decentralized systems*

Discuss whether decentralized systems would be a viable alternative. The discussion of the proposed treatment system should identify whether onsite systems (such as septic tanks with drainfields, at-grade systems, mound systems, media filters, small aerobic units, pressure distribution systems, etc.) could be utilized. Identify cluster systems (which would serve two or more dwellings but less than an entire community). For cluster systems, describe the various treatment components, and discuss the overall treatment strategy.

Specify provisions for wastewater minimization and for diverting extraneous waters from the wastewater system (e.g., cooling system condensate discharges).

Discuss any proposed phasing schedule for facilities and system components.

Currently, no land application facilities exist in the Mountains Physiographic Province. If the proposed project is to install a land application system in this area, please contact CG&L.

Stand-Alone Alternative – An alternative that is the only alternative considered rather than part of a combination of alternatives (e.g., optimizing existing facilities only rather than optimizing facilities and considering land application as well.)

¹ If a new WWTP is being built, then these limits apply to the new facility (e.g., in the Coastal Plain, a new facility with a 330,000 gpd flow).

Provide the rationale as to why this alternative was accepted or rejected as a stand-alone alternative, including its feasibility.

3.6.1.5 Regionalization

Regionalization has been a goal that has been supported by the DENR, and it must be examined for WWTP construction, expansion, or modification. Note that regionalization may include not only constructing, expanding, or modifying a WWTP to serve more than one LGU but may also consist of bringing wastewater service for more than one LGU under one management umbrella such as a sanitary district.

Describe what type of regionalization will occur (e.g., management, physical interconnection, etc.). If more than one combination of regionalization was considered, then each combination should be its own alternative. For any regionalization alternatives that move forward in the analysis, provide the interlocal agreements (ILAs). On a figure, show what entities will be impacted by the regionalization. If infrastructure is involved, show this infrastructure on the figure.

Provide the rationale as to why this alternative was accepted or rejected as a stand-alone alternative, including its feasibility. If the LGU is already a regional provider (definition?) then this alternative does not need to be investigated. In this case, provide information related to regionalization activities in the past.

3.6.1.6 Consideration of Construction/Expansion/Modification Using at Least Two Treatment Technologies

At least two types of treatment technologies appropriate for the proposed effluent limits must be considered, and each must be a separate alternative in the ER. For instance, if the (speculative) effluent limits do not involve nutrient removal, two of the many variations of the activated sludge process may be considered. However, if nutrient removal is a requirement, then both alternatives must be biological nutrient removal (BNR) processes (e.g., Bardenpho, modified Ludzack-Ettinger, etc.). For each treatment technology, discuss the processes involved and provide diagrams that show each.

Provide the rationale as to why this alternative was accepted or rejected as a stand-alone alternative, including its feasibility.

3.6.1.7 Biosolids Alternatives Description

At least two types of biosolids disposal alternatives must be considered (e.g., land application, biosolids drying, etc.), and each must be a separate alternative in the ER. For each biosolids disposal alternative, discuss the processes involved and provide diagrams that show each. Each alternative must include sludge reduction calculations and how the alternative will adhere to the sludge and vector reduction requirements as discussed in [40 CFR Part 503](#). Additionally, show that the required volume for sludge digestion as well as the residual storage [30 days minimum per [15A NCAC 02T .0505\(o\)](#)] is provided.

Provide the rationale as to why this alternative was accepted or rejected as a stand-alone alternative, including its feasibility.

3.6.1.8 Preferred Alternative

The project selected as the preferred alternative may be different from the above alternatives. If it is not, simply state that one of the above alternatives is the preferred. If it is, then describe the preferred alternative in the same manner as discussed above. Provide the rationale as to why this alternative is the preferred alternative.

For example, a project may be a combination of regionalization of infrastructure that accepts flow from three LGUs using Treatment Process X and Biosolids Alternative B. Considered as stand-alone alternatives, Regionalization and expanding the WWTP using Treatment Process X and Biosolids Alternative B would be rejected, but when considered as a combination, they would be accepted.

3.6.2 Present Worth Analysis

Complete the present worth analysis in accordance with Section 2.2.4.

3.6.3 Alternatives Analysis Summary

Complete the alternatives analysis in accordance with Section 2.2.5.

3.6.4 Proposed Project Description

Prepare the project description in accordance with Section 2.2.6. Include in the project description, a bulleted list of all project components.

3.7 Environmental Information Document

Complete the environmental Information Document for the Preferred Alternative in accordance with Section 12.²

3.8 Financial Analysis

Complete the financial analysis in accordance with Section 2.2.7.

3.9 Public Participation

Complete the public participation section in accordance with Section 2.2.9.

² IFS has the right to request additional environmental impact analysis if it is deemed necessary during ER/EID review.