

City of Lawrence – Wastewater Facilities Master Plan and Wakarusa Water Reclamation Facility Scope and Timing Review

## **Project Philosophy**

✓ Burns & McDonnell and BG Consultants philosophy is to accomplish the City's primary goals

# **Project Philosophy**

Burns & McDonnell / BG Consultants Team offers a project philosophy that accomplishes the following:

- Delivers a dynamic hydraulic model that meets Lawrence's needs for accurate planning built on, and in the future readily updatable using, the most current information regarding constructed facilities, population and development plans, and monitored sewer flows.
- Answers questions regarding the timing and staging of the planned Wakarusa Water Reclamation Facility to serve the drainage basins that flow to the Wakarusa River watershed.
- Addresses economic trade-offs and the permitting interrelationships between the Kaw River and Wakarusa WRF facilities.
- Provides an updated capital improvements program that optimally meets the City's planned growth and development with proper consideration of the financial impacts, costs escalation, and sewer rates.
- Provide a rehabilitation and replacement plan using existing information, staff knowledge, and CMOM needs.

### **Project Objectives**

The City of Lawrence has identified the following objectives for this project:

- Review City Planning Department growth rates and land use patterns to confirm the timing for the Construction and capacity of the Wakarusa WRF
- Create a dynamic model of the sanitary sewer system, from GIS and flow & rainfall data
- Conduct modeling software selection workshop to assist the City in selecting the model
- Deliver a completed full functional calibrated sanitary sewer model for City use
- Provide hydraulic model training
- Recommend improvements to build out and intermediate scenarios based on growth rates & population projections
- Update the wastewater system Capital Improvements Plan in a format compatible with the City's GIS
- Provide a rehabilitation and replacement to the system improvements plan for all facilities from staff knowledge
- Evaluate the cost of system improvements on user charges, by using the City's existing rate model.

## Value Added Concepts

Our master planning experience, systems design, field experience, computer modeling, and GIS/Database experience uniquely positions the Burns & McDonnell/BG Consultants team to develop the City of Lawrence's Wastewater Facilities Master Plan to provide a detailed roadmap for capital improvements projects, as well as a very powerful tool for management of the utility's infrastructure. To remain a useful tool, this Wastewater Facilities master plan and associated hydraulic models will need to be "living" tools within a framework that can be easily maintained and that is amenable to changes,

### **Project Objectives**

 ✓ Our project objectives match the City's objectives as listed in the RFP and preproposal meeting

## Value Added Concepts

- ✓ The master plan and model will be "living" tools, easily maintained and updated
- ✓ Our "Always Planning" concept builds on partnership, timeliness, effective use of data, and GIS Technologies

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additions and growth of the service area.

Our proposed implementation of your project will emphasize four basic themes: 1) partnership; 2) timeliness; 3) effective use of data, and 4) GIS technology. These concepts are discussed behind the Value Added tab.

#### **Project Knowledge**

Burns & McDonnell and BG Consultants have been very fortunate over the years to work on many mid-west master planning and treatment projects similar to yours. We know what it takes to complete a large Wastewater Facilities Master Planning effort, and how to avoid problems that can occur with this type of project. Most importantly, we know how to address key issues when they do arise. Our approach is designed to address the key issues as we understand them from your RFP, the prior master plan and other reports.

The prior Wastewater Facilities Master Plan for Lawrence was prepared in 2003. Since 2003, the northwest area study and Wakarusa WRF siting and design reports were prepared. Also since 2003, growth trends in the 2003 plan have changed in both growth rate and growth pattern substantially.

As development in Lawrence has moved north and west, the cost, timing, staging, and need for the Wakarusa WRF have become major issues. The plant would serve all areas tributary to the Wakarusa River; in the 2003 plan, these areas included the developing basins in western Lawrence and the currently undeveloped basins southwest and southeast of the City. Growth in these areas will drive the hydraulic need for either constructing the Wakarusa WRF or constructing facilities to pump and convey the increased flows to the Kaw River WRF.

Wastewater treatment considerations may accelerate the need for the Wakarusa plant. KDHE already approved for the Wakarusa WRF planning a permit for nutrient permit limits of 8 mg/L phosphorus and 1.5 mg/L total nitrogen. Similar limits were not placed on the Kaw River plant considering the total system loading to the Kaw River. Postponing the Wakarusa plant could lead to a regulatory decision to require nutrient removal facilities at the Kaw River plant. As a result the regulatory relationships and economic impact of these relationships must be carefully considered.

To provide for planned systematic growth, the City proposes to update its Wastewater Facilities Master Plan, including a dynamic hydraulic model. The City's current Wastewater Master Plan was adopted in 2003. These plans projected the community's utility requirements for 20 years, but are outdated, for the forecast growth locations and rates have not been realized.

In addition, the City is proposing the development of dynamic model. The prior master plan model utilized consultant written software, the City is now looking for a main stream Hydraulic Modeling application to implement at their location. A Wastewater System Modeling Program will provide the City with commercially available modeling tools that will allow for a cohesive and dynamic approach to wastewater planning and design that can in the future be

## **Project Knowledge**

- ✓ Numerous Master Plan project experiences
- ✓ National expertise
- ✓ Local Knowledge and familiarity of Lawrence issues
- Plan must consider regulatory interrelationships between Wakarusa and Kaw facilities
- ✓ Plan must account for Wakarusa and Kaw interrelationships in the evaluation of alternative scenarios and the financial forecast





kept in sync with the latest facility data in the City's GIS and with changes in growth forecasts and development plans that may occur. Properly designed and updated models are a valuable tool for evaluation of current and future scenarios for the Sanitary Sewer System capacity capabilities. *The model needs to be available for City staff use after this project, accurately simulate Lawrence wastewater flows and capacities, and be readily updateable as new sewers are built and new development plans are considered. Burns & McDonnell has expertise with most of the available software packages and has recent experiences helping several other communities in making the best modeling software choice.* 

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### **Proposed Scope of Services**

This is a significant Wastewater Facilities Master Planning effort to enable the City of Lawrence to better manage its wastewater infrastructure. The City has requested a scope of services that includes two main phases. The first phase will answer looming timing questions for the proposed Wakarusa Water Reclamation Facility. The second phase will analyze the entire existing system and future scenarios for the entire system. These scenarios will develop the recommended improvements to the system based on build out scenario, and will also update the capital Improvements plan. In addition to the dynamic model, hydraulic model software implementation and training will be conducted. Another component of Phase II is a rehabilitation and replacement component to the wastewater system plan for all facilities.

Phase I is crucial to meeting the expectations and needs of the City, and to provide critical budget information! Substantial cost savings may be achieved if the Wakarusa plant can be delayed while satisfying regulatory requirements, particularly for nutrient loads discharged to the Wakarusa and Kaw Rivers. Our approach to problem solving and effective communication, described above, is an organized project approach resulting in a successful outcome.

Phase I is also designed to allow integration of interim master planning outputs with the PS-9 project. PS-9 will provide an additional equalization facility at this key location. The PS-9 consultant will be required to confirm the basin sizing and operation; these tasks will benefit from the flow and rainfall monitoring data analysis and the initial hydraulic modeling results. PS-9 currently discharges to trunk sewers on 31<sup>st</sup> Street, that are known to experience sanitary sewer overflows (SSOs). Modeling can help address the relationship between PS-9 flow equalization, pump operation, SSOs, and projected growth.

The anticipated scope of services includes the following items:

#### Phase I – Initial Services and Wakarusa Answers

- Initial Services
  - o Project initiation, goal setting, and data availability
  - Software Selection Workshop
  - o Characterization of study area
    - Existing land uses
    - Proposed land uses
    - Population projections
    - Topography
    - Geology

# Proposed Scope of Services & Approach Methodology

- ✓ Phase I:
  - Collect data
  - o Select software
  - Determine Wakarusa WRF timing and triggers
- ✓ Phase 2:
  - o Hydraulic Model
  - o CIP
  - Maintenance /& Replacement Program
  - Financial Impacts
    Report
    - Report
- ✓ Deliverables include Technical Memoranda at key steps, workshops, meetings and presentations
- ✓ Select best model for Lawrence
- ✓ Identify triggers for Wakarusa WRF needs
- ✓ Integrate planning with PS-9 project
- ✓ Complete comprehensive master plan
- ✓ Evaluate rate impacts of CIP



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- Wastewater Data gathering and collation
  - General data collection
  - City GIS data
  - Field investigations
  - Wastewater flow and rainfall data
  - Condition data (GIS system data,
  - MasterSeries records, staff knowledge, etc.)
- Review of existing utility policy and ordinances
- Wakarusa Water Reclamation Facility Scope, Timing and Triggers (Western drainage basins)
  - Develop model for tributary area
  - Analyze flow and rainfall monitoring data
  - Analyze Planning Department population growth and development projections
  - Review, evaluate and recommendations concerning the timing of full use of available sewer capacity
  - Review, evaluate and recommendations concerning the timing of combined Kaw River WRF and Wakarusa WRF nutrient loading limits
  - Consider costs and timeline of expanding Kaw River WRF, building Wakarusa WRF with nutrient removal, or modifying Kaw River for nutrient removal

# Phase II – Wastewater Facilities Master Plan

- Wastewater Facilities Master Plan
  - o Development of a GIS based data source and system
  - o Wastewater flow and load determinations
  - o Regulatory aspects
  - Water Reclamation plant and wastewater collection system reviews
  - Development of hydraulic model/future development tools
  - o Model calibration
  - o Existing wastewater system evaluation
  - Future wastewater system evaluation
  - o Development of a Capital Improvement Plan
  - Development of a maintenance program
  - CMOM program assessment
- Financial strategies
  - o Gather Data and Update City's rate model
  - o Develop Financial Forecast
  - o Revenue Forecast
  - o Project Operating and Capital Costs
  - o Prepare Cash Flow Analysis
  - o Assess rate impacts of CIP scenarios
- Other Tasks
  - o QA/QC
  - o Draft and Final Report development
  - Project meetings
  - o Project management/coordination
  - o Modeling Delivery and Training Workshop



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#### **Project Approach**

- ✓ Numerous Master Plan project experiences
- ✓ Team lead effort for both City of Lawrence and Burns & McDonnell / BG team.

### **Project Approach**

Our goal has always been to closely coordinate with the our clients on all of their projects that we work on in order to provide technical expertise and quality engineering in the most responsive manner possible. As stated previously, Burns & McDonnell and BG will continually involve the City of Lawrence in the decision-making process on this project as it progresses. While we must retain ultimate responsibility for the content and quality of the Wastewater Facilities System Master Plan, we emphasize a total team approach to ensure a high quality, comprehensive plan that developed within budget and which will meet all of the City's goals and expectations for the project. *Our approach will ensure that the Burns & McDonnell/BG team and City of Lawrence work together towards a successful project that meets all objectives*.

#### Project Management/Project Control Plan

- Effective project management to meet City quality, schedule and budget goals
- Project Control Plan is the tool for managing the project
- ✓ Quality control integral part of project
- ✓ Open lines of communications with you

### **Project Management/Project Control Plan**

Burns & McDonnell/BG will provide administrative services including supervision of the project team, review of project costs and billings, preparation of invoices, preparation of monthly status reports, and general correspondence. Project management will also include:

- Preparing a Project Control Plan (PCP). The PCP will contain the final scope of services, project schedule, budget, communications protocols, team organizational structure, the Owner and consultant lines of authority, team members' directory, and quality assurance and quality control (QA/QC) plan.
- Providing a quality control review to each deliverable for the project in accordance with the PCP. Quality control reviews will be provided by senior technical staff.
- Providing technical supervision, direction, and guidance to the project team throughout the project.
- Maintaining open lines of communication to the Owner including monthly progress reports; project meetings; discussion of Technical Memoranda; and telephone and email communications.

## **Data Collection**

- ✓ City GIS data is mostly complete
- City permanent flow and rainfall metering data
- Planning information on location and pace of growth
- Key facility information for modeling
- ✓ Use City Staff for data collection to fill in gaps

# **Phase I Activities Discussion**

#### **Review Existing System Data & Data Gathering/Collation**

Members of the project team will work with Mike Lawless, the City's Project Engineer, as well as engineers and maintenance staff to develop the data review and collection program. It is essential that this program identifies and obtains ALL sources of existing data prior to collecting further data. This





data includes the previous master planning reports, interim planning and design documents, and other reports and studies done by and for the City and private developers, as well as collection of the wastewater collection system manhole and pipeline information and condition data presently used by maintenance staff. We reviewed the structure of the City's sewer GIS database already provided, and are ready to begin the data collection for modeling. The City's data appears topographically complete. We will initially review the data fields not provided with the RFP to identify any gaps or inconsistencies that may need correction. This is a key issue in the development stage as the wastewater collection system model will be constructed within this GIS framework.

Information provided by the City (including but not limited to the following) will be collected and reviewed:

- All available GIS themes including sewer system facilities, aerial photography, contours, parcels, land use, zoning, street maps, and other available themes
- Historical by-customer metered sales data and locations, if available, for base load allocations
- Historical customer data
- Operating and SCADA information
- Location on development and associated year of development initiation and completion
- Pipe age and type of construction
- Other pertinent paper data
- Wastewater collection system maps
- Previous Master Plans
- Financial water rates model
- Current CIP
- Current maintenance and replacement program
- Lift station operating parameters
- Large water user data and location
- Information to define any out-side City contributors to the sewer system and any areas served by onsite systems
- Recent sewer construction project bid data
- Other data determined to be pertinent

Once all data is compiled and reviewed, 'gaps' in the data will be determined and provided to the City for review. Any data that is required and not available will need to be addressed. This may include field surveys or investigations by City personnel. The Burns & McDonnell/BG team can also provide field surveys or research if desired.

#### Software selection / workshop

The Burns & McDonnell / BG Consultants team members are experienced in GIS/database systems like the City's and in the main wastewater modeling software packages available today. Recent project experience includes XP-Software's XP-SWMM, Bentley/Haestad Methods' SewerCAD, Wallingford

#### **Software Selection**

 ✓ We have helped several utilities select modeling software in recent years



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- ✓ We have expertise in the software packages to be considered
- ✓ A workshop approach with vendor's participation will effectively help the City reach a selection

software's Hydroworks, and MWH-Soft's H20MAP Sewer and InfoSewer. Several recent master plans have included a software review and selection workshop. The most recent workshop, in Rapid City, SD, included vendor presentations from MWH-Soft, DHI software and Bentley Software. We will update our prior review materials and selection matrix for recent upgrades and new support modules in the major software systems. We are prepared to present advantages and disadvantages of each package, and help city staff reach a decision on the most appropriate software package for this project and future updates.

There are several factors that should guide the selection of your model including:

- Commercial Availability: The model package should not be proprietary in nature and licensable to both the City and its consultants. BMcD offers the flexibility to choose a number of commercially available, non-proprietary platforms.
- Interface Capabilities with GIS Attribute Data Base: The model must have the capability to utilize the city's GIS database with minimal or no data manipulation.
- Ability to simulate surcharged sewer conditions and flow equalization basins: Many models simulate open channel flow conditions quite well. However, only a few have the capability to accurately shift from open channel to surcharge conditions and analyze hydraulic grade lines accurately. This will become especially important as the SSO/CMOM federal regulations take shape.
- Ability to route flows dynamically: Many models do not account for the time variation and storage capacity within a collection system. This functionality is critical to avoid over design and construction-related expense associated with "static" type models.
- Additional features in some models such as methods of developing flows, flow monitor data analysis modules, costing module, CIP development, rehabilitation/replacement plan development, or pipe design.

## Flow and Rainfall Data Analysis

- ✓ City's data will provide excellent coverage
- ✓ Data is analyzed for base flow, infiltration and inflow
- Consider selecting a modeling software package that has a flow/rainfall analysis feature
- ✓ Use City Staff to collect additional data as needed



Flow and Rainfall Data Analysis

The City has accumulated a year and a half worth of data from its permanent system of flow and rainfall monitors installed at key locations in the sanitary sewer system This data will be analyzed for dry and wet weather conditions to determine appropriate loading factors for the hydraulic model. We will also evaluate the flow data from the wastewater plant and available lift stations operating data. The analysis

# excellent coverage

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will specifically look at historical peak rainfall events and the corresponding inflow response. All of this data will be critical for calibration of the wastewater collection model.

Flow data analysis will determine, for each site, the Base, Infiltration and Inflow Factors. WTF historical flow records will indicate total system annual average flow, average dry weather flow, peak dry weather flow and historical wet weather flows. Burns & McDonnell will process the flow and rainfall data to determine average dry weather flow, peak daily dry weather flow, peak wet weather flow for each rain event and relationship between rainfall and infiltration/inflow flows.

These calculations have historically been completed using either software provided by the monitor vendors, or spreadsheets. Current modeling software packages offer modules that can assist with or completely perform the analysis. Selecting a package that includes a flow data module will assist with this project and with future updates.

### Population, Customer, and Land Use Projections

We understand the City Planning Department will provide the historical data and projections of population, employment, land use, and development staging for this project. Obtaining accurate population projections allows for accurate projections of future needs, and will be conducted early on in this portion of work. Our team will review population and growth information to be provided by the City's Planning Department, as well as customer counts and land use data for the study areas. Electronic maps and databases will be reviewed for areas

under current and planned build-out development. The distribution of existing and planned population, customers, and land use to sub-areas will be reviewed using the compiled information. Sewer planning will require current and planned build-out development data along with intermediate scenarios.

The current hydraulic modeling software packages include modules to develop sanitary flow inputs from GIS-based population and land use data. Depending on the software selected, our approach is to utilize the appropriate module for



effective model creation and easier future updates by the City staff.

Updating the planning data in GIS format will help identify when growth triggers expansion and improvement needs. The Centralized Data Management<sup>TM</sup> approach will benefit both the Planning Department and Utilities Department. For discussion of the Centralized Data Management<sup>TM</sup> approach please see the value Added Concepts section

# Phase I and Phase II

For Phase I, the hydraulic model development is limited to the basins tributary to Wakarusa WRF, and model analysis is limited to the runs

#### **Projections**

- ✓ Integrated growth projections with GIS and the model to automate model loading
- ✓ Flexible for future updates with new growth projections
- ✓ Linking projections with model helps define trigger points for new facilities





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needed to determine Wakarusa WRF sizing and timing. Phase II activities complete the master plan analyses and recommended improvements.

# Make the Most of the Hydraulic Model!

What provides for a "living" strategic plan?

- ✓ One element is the ability to modify the land use, population, and zoning data to quickly see the impact of these changes on the existing or proposed changes in the collection system. This is done by coupling the relational GIS database to the hydraulic modeling engine for analysis.
- ✓ The City is often approached by a residential, commercial or industrial developers with proposals to develop land, change land use or zoning.
- Wouldn't it be nice to more accurately predict the impacts of the development on existing or proposed infrastructure?
- This would be a very valuable tool in justification for recouping infrastructure costs to support development.

## Hydraulic Model Development and GIS Integration

One of the cornerstones of our project approach is to develop a "living" strategic plan that will grow and change as the community grows and changes. GIS tools allow this flexibility by providing a comprehensive relational database with very simple user interface tools. Data within the database is then analyzed from a viewpoint of geographic area or any other type of boundary condition that the user may specify. Defining the extent of this database will need to be accomplished in Phase I of the project.

Burns & McDonnell/BG Consultants have extensive experience in GIS database development and the local knowledge required to maximize the benefits to the City. Our master planning project teams include GIS professionals experienced in comprehensive mapping capabilities of GIS. We used GIS as an analytical tool for evaluating the impact of future development, for predicting sewer flows, and for building models synchronized with City GIS maps and databases. Our standard practice is to submit as much information in a GIS format as possible

Utilizing GIS to build the models for master planning projects results in the development of integral parts of a City's GIS foundation. In Oak Grove, Missouri, Burns & McDonnell built the wastewater collection system in the ArcView GIS software package. In support of the project the roads, parcels and landuse were developed as well. The result was a comprehensive wastewater master plan for the city that was built on a GIS foundation. The GIS foundation was then given to the city and they can use it for a number of different municipal projects such as street improvements, planning activities and fire routing. Burns & McDonnell saved the city GIS development costs by integrating GIS into their current projects. The same procedure was used in the Harrisonville, Missouri Water Distribution System Master Plan. In this case, Harrisonville had the early stages of a GIS setup and the master plan will augment their system by integrating with the current information they have. In Lawrence the GIS is essentially complete; the modeling will provide a quality control check on GIS data as needed for a correctly operating model. Also, improvements to the system will be compatible with the City's GIS, to allow them to use this data upon completion of the project.

Burns & McDonnell is saving their clients development costs and providing more effective master plans by effectively utilizing GIS.



the selected software's GIS connectivety features. The model will include all sewers in the GIS (in comparison to the 2003 Master Plan model that included mostly 10-inch and larger lines). Errors in the GIS such as missing data, connectivety, incorrect

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incorrect flow directions, etc., will be screened for and reported to the City. Errors and data gaps may be surveyed by City staff or (if jointly agreed) handled by reasonable assumptions or interpolations. Other data presumably not in the GIS will be input, such as lift station data, siphon details, and flow diversions. The hydraulic models to be as directly linked to the GIS database as the selected software allows. The complete system model will provide an opportunity for City staff to directly and easily answer questions necessary to continue economic development and manage future systematic growth.

The hydraulic modeling portion of this project will determine the cost-effective plan to safely transport wastewater flows through the collection system to the system outlets under a variety of flow, growth, and design conditions. The development of a calibrated hydraulic model of the collection system will be the centerpiece and principal diagnostic tool to evaluate



these conditions and will be used to forecast the need to increase the City's treatment and pumping capabilities.

One challenge the City will face, even with GIS-based models, is keeping the model up to date as design projects are completed. Historically, Cities have faced the task of incorporating design or as-built data to the City mapping system and then the modelers have dealt with hard copies of plans and specifications and CAD files to update models. Generally, changes to the configuration must be made by reconfiguring the model. What we propose is that the City implements standards requiring all new projects to use geo-reference CAD files with a database, specified to easily update the City's GIS. Then, the model will be periodically synchronized with the current GIS. Current models have GIS exchange modules to facilitate this task. With this approach, the database information and CAD files can simply be uploaded, and the model is easily reconfigured. As a result City is more likely to have a complete up-to-date model for many years to come.



al analysis of data, it is always al data obtained in the field. 1 monitoring program data.

#### Calibration

- Critical to having a reliable model for decision-making
- ✓ Calibration against actual monitored data for dry weather and wet weather events
- ✓ Process will consider future recalibration of basins with



future flow and rainfall data



The data collected during this flow monitoring period will be used to address any

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uncertainties in the model, and improve accuracy. The most critical portion of the wastewater model calibration involves a very intensive analysis of the rainfall response of the inflow in the system. Typically, inflow peaks due to rainfall can be 2 to 4 or more times the peak dry weather approach. Our team has evaluated and calibrated many models utilizing this method. Using this method the inflow peak of a return flow period rainfall event (10 year frequency storms for Lawrence planning) can be calibrated so that the City can evaluate the desired level of design provided by the existing wastewater system. Once calibrated, the model can predict peak flows including, base flow, infiltration and inflow based on a rainfall design frequency. Dry Weather Calibration: Flow data during dry periods establishes unit flow contributions and diurnal flow patterns. It is critical to have accurate base line data to assign per capita flows and to identify

- industrial and commercial flow contributions. Wet Weather Calibration: It is also important to understand how the collection system responds to wet weather events. Typically, several rain gauges are installed within the study area. For a particular rainfall event an intensity/duration curve is developed. The hydraulic model is then calibrated to correlate the system response to that particular rainfall event.
- Model Verification: Once the model is calibrated to wet weather conditions, it is important to verify the model's performance. Specifying a measured rainfall event and evaluating the model performance against measured flow in the collection system does this.

# **System Evaluation**

Once the GIS database and hydraulic models are developed, our engineering team can run multiple scenarios using the population projections, land uses, and all other data assumed during the data collation phase. These evaluations form the basis for the Wastewater Facilities Master Plan.



## **Model Training**

Model training is an oftenoverlooked facet from the

perspective of the Consultant. Burns & McDonnell and BG Engineering believe that this phase of the project is crucial to project success. Without

providing sufficient training, the "living" document often is not maintained properly, or is not maintained for the long term. Our approach is twofold: 1) have the software vendor train staff on the basic features; and 2) follow this up with Burns & McDonnell working with the staff on specific, representative projects that your staff would like to do with the model. A focused project is essential to a successful training session. We have recently trained the City of Gillette, Rapid City, Wichita, and other clients on their collection system models. The key to success for this task is to realize that your staff may go for long periods where they will not use the software, making it difficult to remember. Burns & McDonnell handles this situation by: 1) providing a training

#### **Analysis**

- ✓ The model will be used to test a wide variety of scenarios
- Relief sewers, expansion sewers, lift stations and force mains, and flows to treatment will be evaluated

# Model Training

- $\checkmark$ We have turned over the model and conducted training seminars on several recent projects
- Software vendors offer effective training on software use
- Training specific to your model by the engineers who prepared it
- Training material will document engineering aspects



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of the Lawrence model ✓ You team also remains available for help after the Master Plan is delivered

## **Master Plan**

- Capital Improvements Program will identify current and future problem areas and solutions
- ✓ System expansion
- ✓ Treatment facilities
- ✓ Trigger points for facility needs
- ✓ Other components including rehabilitation/replacement, regulatory requirements

## **Rehabilitation/Replacement**

- ✓ Built on existing information and City staff knowledge
- ✓ Flow data identifies "leakiness" of sub-basin for prioritizing repair programs
- ✓ MasterSeries data provides City's work history

manual that documents the steps taken for the representative project; and 2) lets staff know they can call Burns & McDonnell or BG Consultants when they have a question.

### Wastewater Facilities Master Plan

This task presents the culmination of all previous tasks. Using the calibrated wastewater collection model and all of the information and data gathered, Burns & McDonnell will prepare a comprehensive Wastewater Facilities Master Plan report that identifies Capital Improvements to the City's wastewater system. The Wastewater Facilities Master Plan will address current and future problem areas in the water system including capacity issues, expansion requirements, potential source water concerns, potential water quality issues, and areas where the existing facilities may require replacement. Similarly, it will summarize wastewater issues including current and future problem areas of excessive inflow and infiltration, pipelines and manholes that are surcharged under during peak flow and storm events, and areas where the existing facilities (pipeline, manholes, structures, pump stations, etc.) have reached or exceeded their design life and which require rehabilitation or replacement. Specific capital projects will be identified and the need or cost effectiveness of I/I removal projects will be determined.

The Capital Improvement Program will be prepared for 5-, 10-, 15-, and 20-year intervals. Different intervals for maintenance/replacement programs

Identifying the cost effectiveness of I/I removal will insure the lowest financial impacts.

will be developed if it is determined necessary. This decision will need to be made once a more comprehensive analysis has been made of the collection system. The Burns & McDonnell/BG Engineering Team has extensive experience in developing CIP plans that follow and meet the latest regulatory requirements of CMOM.

#### **Rehabilitation/Replacement Component**

A rehabilitation / Replacement component to the Master Plan will be completed utilizing existing data, including City staff knowledge of the system, flow and rainfall data analysis, prior studies and reports, and facility records contained in the City's GBA MasterSeries maintenance management program. The flow data

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Equipment # 0-181 Transformer Type # USUD RALED Consection: * CBL TH*Y11 VAR: * 460 SR * 4 Marc * 3 KR * 300 OC: * MK3 Temp Size * 0 Pr 2 201 [mar consent) [Path]	Hectricol Transfe	oraner
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Vote:      + (0)      H2:      + (1)        Place:      - 3      K/H2:      > 30        OCD:      + M3: Temp Rise:      + 00        Price:      200	Connection: - DEL	TA-WYE
Phase + 3 K/R + 30.0 OCD + MCB Temp Rice + 00 Prt 2: 201_ [Inter Comments] Fittilb	Voltz - 600	NR - 4
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will be used to rank and prioritize monitored sub-basins according to their level of infiltration and inflow (I/I). Additional field surveys are not envisioned in the RFP. Complete utilization of GIS can allow the implementation of a detailed maintenance program for the wastewater system. The City uses MasterSeries to track history on sewer system components, track work orders and maintenance activities, and other daily operations. The program may include field programs to locate and remove sources of I/I, inspection and/or repair of known defects, or recommendations of the amount of rehabilitation/replacement appropriate to the Lawrence

system. The Burns & McDonnell/BG Consultants is well versed in developing an effective maintenance program, and is prepared to address this in Phase II of the project.



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#### **Financial Aspects**

- ✓ We are completely familiar with rate models similar to the City's current model
- ✓ The results of the financial studies is the rate impact that would occur under each modeled scenario

#### Evaluate Cost Impacts Using City Rate Model

Burns & McDonnell will evaluate the impacts of capital projects through the preparation of a financial forecast of net revenues to determine the adequacy of revenues provided by existing rates. This forecast will include projections of annual revenues under existing rates and the annual revenue requirement, including all operation and maintenance expenses, capital requirements, debt service requirements, and margins, by year for a



future period. The financial forecast will identify the overall change in revenue required to provide for adequate funding to meet all recurring annual operating and capital expenditures, to cover all debt service requirements, and to maintain sufficient cash balances and capital reserves.

Burns & McDonnell will complete the evaluation utilizing the City's existing rate model and will incorporate the capital requirements identified in the master plan study. We will make necessary adjustments to the model to allow the City to fully evaluate the impact proposed capital projects will have on future rates levels. Burns & McDonnell is experienced in spreadsheet-based rate models similar to the City's. The rate model will be reviewed, updated as needed, and utilized to assess the cost impact of each growth scenario developed in prior tasks. This work will include the following scope of services:

- <u>Gather Data.</u> Burns & McDonnell's project team will prepare and submit to the City a data request for information and data sources required to perform the analysis. This will include the rate model and documentation, various historical and budgeted financial information, as well as certain electronic data and specific documents. The request for data will be as comprehensive as possible. However, as the evaluation proceeds, additional information may be requested, as necessary.
- Develop Financial Forecast. Burns & McDonnell will develop a fiveyear financial forecast of the City's sanitary sewer system operating results. The forecast will include the current year and the years ending December 31, 2009, 2010, 2011, 2012, and 2013. This will result in a determination of whether The City's current sewer rates will provide adequate revenues to meet system operating and capital costs for five years into the future. The forecast will also include a projection for 10 years and 15 years in the future. The results of this financial forecast will be utilized to define the target annual revenue requirements for the sewer services. The financial forecast will be developed within existing guidelines such as those of "Financing and Charges for Wastewater Systems," published by APWA, ASCE and WPCF and Manual M-1 "Principals of Water Rates, Fees, and Charges," published by the American Water Works Association (AWWA).
- <u>Revenue Forecast</u>. Projected annual system service revenues under the existing rates for the sanitary sewer system will be developed. The analysis will use the forecasts of number of customers and usage for each year of the five-year forecast period. The existing schedules of sewer rates will be applied to the projected annual billed usage and the estimated annual numbers of customers to develop forecasted annual billed sewer revenues under the existing service rates for the five-year



City of Lawrence – Wastewater Facilities Master Plan and Wakarusa Water Reclamation Facility Scope and Timing Review

forecast period. Burns & McDonnell will also develop projections of sewer revenues from other sources, including interest income, penalties, and other miscellaneous income sources.

- <u>Project Operating & Capital Costs</u>. Burns & McDonnell will include projected annual operating expenses, as well as annual capital expenditures for additions and replacements of the sewer system, in the financial forecast. Projections of annual system operation and maintenance expenses will be developed based on projected volumes of usage, historical levels of these expenses, existing budgets for future periods, and the input of the City staff as to impacts of any planned changes to the operation and maintenance of the utility system. Existing annual debt service requirements on any outstanding debt will also be included in the financial forecast. The analysis will also consider the potential impacts to sewer rates and fees. Projections of any other sewer system expenditures not included in any of the above categories will also be considered in the financial forecast.
- <u>Prepare Cash Flow Analysis.</u> Burns & McDonnell will summarize the annual forecasts of the sanitary sewer system revenues, as well as the projected annual operating expenses and capital improvement expenditures in the form of five-year pro forma cash flow analysis. This analysis will calculate annual net operating margins and total net margins, including projections of any net non-operating margins. The total projected annual net margins will provide an indication of whether the existing sewer rates will generate sufficient revenues to cover the system's costs for each year of the forecast period and whether an overall revenue adjustment is necessary.
- <u>Evaluate Percentage Impact on Sewer Rates.</u> Following the determination of the annual revenue requirements for the sanitary sewer system, Burns & McDonnell will identify needed percentage future rate adjustments including timing and expected levels of increases.
- <u>Prepare Chapter</u>. Upon completion of the financial analysis, revenue requirement determination and rate impacts, Burns & McDonnell will summarize the study results for the sanitary sewer system in a letter report. The letter report will describe the analysis completed and will identify the inputs, assumptions, methodology, and results of the study.

## **Regulatory Aspects**

- ✓ Nutrient regulations on the Wakarusa and Kaw River are a key aspect of the need for the Wakarusa plant
- ✓ CMOM regulations are coming for Kansas utilities
- ✓ The model and City GIS can be very helpful in meeting GASB-34 reporting regulations

## **Regulatory Review**

Regulations affecting the Wastewater Facilities Master Plan discussed below include the nutrient limits in discharges to the Wakarusa and Kaw Rivers, and Capacity, Management, Operation and Maintenance (CMOM). Also, the GASB-34 regulation response links to the City's data systems including GIS, maintenance management, modeling and CMOM program. Therefore, a discussion of GASB-34 is provided.

#### **Nutrient Regulations**

Based on the prior planning for Wakarusa WRF and discussions with KDHE, Biological Nutrient Removal (BNR) will be required for a future Wakarusa WRF. However, in prior plans BNR was not expected to be required at the Kaw River WRF based on total system loads to the Kaw River from both plants and the criteria then in place. The basis for the prior agreement with KDHE may change depending on timing and capacity of the Wakarusa WRF. We will take this into consideration during Phase I as Wakarusa alternatives are developed.



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Discussions with KDHE an City staff will determine KDHE's current position and currently anticipated nutrient criteria for Lawrence's effluent. It may be determined that it is advisable to build Wakarusa WRF sooner than it is hydraulically needed so as to avoid BNR facilities at Kaw River WRF.

### Capacity, Management, Operation and Maintenance (CMOM)

Midwest communities status regarding the components of Capacity, Management, Operation, and Maintenance (CMOM) Programs are being included in new Region 7 NPDES permits, and being questioned in EPA's periodic inspections. CMOM is intended to ensure proper management, operation, and maintenance of collection systems; provide adequate capacity for base and peak flows, prevent and mitigate sanitary sewer overflows (SSOs); and appropriately address overflow events should they occur. The basis for a CMOM Program is the Clean Water Act (CWA) and the National Pollutant Discharge Elimination System (NPDES). SSOs are viewed as a violation of the CWA and under NPDES, agencies must provide "proper operation and maintenance" of collection systems and have a "duty to mitigate" SSOs. Thus, utilities are encouraged to institute a CMOM Program as part of the NPDES permit renewal process. When implemented, CMOM will help the City of Lawrence evaluate existing conditions, identify potential problem areas, prioritize the corrective measures, and address capacity limitations proactively. In addition to improving the efficacy of the collection system, a fully developed and functional CMOM Program will demonstrate commitment to meeting regulatory requirements and will streamline approval by regulatory agencies for future system expansions necessary to accommodate future growth. We propose to assist the City in completing the initial CMOM Program assessment worksheet as part of the master plan development. The Burns & McDonnell/BG Consultants team can also assist the City in developing a CMOM program or implementing program components as may be needed.

#### GASB-34

The Government Accounting Standards Board has issued standard 34 that requires municipalities and their utilities to account for assets in a manner similar to that used by business for years. It offers two different methods for depreciating assets and leaves it up to the municipality to decide which one it will use. It is our understanding that a municipality cannot use one method for some of its departments and the second method for others. For wastewater systems, the objective of GASB-34 is to determine the value of the assets, what it will cost to properly maintain and replace them over time, and establish capital, operating, and maintenance budgets accordingly. Municipalities and utilities that adopt the proper procedures and adequately fund their systems to maintain them in a satisfactory manner will see their financial ratings (and corresponding interest rates on bond issues, etc.) remain fairly reasonable. Those who don't could see a significant downgrade in their ratings, with a corresponding increase in the cost of borrowing.

Concurrently addressing GASB-34 and the CMOM program is a logical

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way to link the financial accounting component (GASB-34) with the planning and management components of proper asset management. Using the accounting requirements of GASB-34 in conjunction with a CMOM program provides the means to evaluate what is required for the wastewater system to become financially self sufficient, rather than

subsidized by tax revenues. Modeling and master planning are keys to evaluating (and documenting) where the utility currently stands and where it needs to be at a defined time in the future. Modeling identifies current system capacity, existing problem areas (and quantifies their magnitude), and where future problems may occur. It provides a tool for characterizing problem areas (severity, possible causes, alternative solutions, etc.) and prioritizing corrective measures to address them. By having a well



BG CONSULTANTS,

prepared master plan backed by an accurate system model the City of Lawrence will demonstrate a commitment to correcting existing problems such as Sanitary Sewer Overflows (SSOs) and capacity problems, as well as preventing anticipated problems. This will allow for a more streamlined approval by regulatory agencies for system expansion necessary to accommodate future growth.

## **Public Relations**

The Burns & McDonnell/BG team has extensive knowledge regarding public involvement. Although the RFP does not specifically include public meetings or similar services, we are able to offer such services at the City's request. Public Relations may include public meetings, notices, publications, web sites or other services.

## **Deliverables = A Successful Project**

- ✓ Key deliverables planned for the proposed scope of work include the following:
- ✓ Project Control Plan
- ✓ Software Selection Workshop and Software Selection Matrix
- ✓ Technical Memorandum (TM) # 1 Service Area and Planning Scenarios
- ✓ TM # 2 Flow and Rainfall Data Analysis
- ✓ TM # 3 Existing Data Summary
- ✓ TM # 4 Phase I Hydraulic Model
- ✓ TM # 5 Wakarusa WRF Evaluation
- $\checkmark$  TM # 6 Calibrated Model
- ✓ TM # 7 Design Storm Model Scenarios
- ✓ TM # 8 CIP
- $\checkmark$  TM # 9 Rate Impacts
- ✓ TM # 10 Maintenance and Rehabilitation Program
- ✓ Draft and Final Master Plan Reports
- ✓ GIS based hydraulic model with calibration and future scenarios.

# **Public Relations**

✓ As desired, we offer a full range of PR services

#### **Key Deliverables**

- ✓ Deliverables include workshops, meetings, major task Technical Memoranda, and the Master Plan report
- ✓ Production, review, and approval of interim work products leads to a successful project

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- Geodatabase of existing system of existing system data gaps and questions for City resolution
- ✓ Geodatabases of land use and population inputs for modeling
- ✓ Final Geodatabase of the existing and future model with CIP improvements linked to model
- ✓ Software selection matrix
- ✓ Training material documents for Model training
- ✓ Hydraulic Model Software Licenses/Implementation (Assume two licenses)

#### QA/QC

✓ Burns & McDonnell's QA/QC program will ensure the project is well planned, executed, and reviewed

#### **Quality Control Program**

In order to maintain a high standard of work quality, the Team will follow Burns & McDonnell's formal quality assurance process. This inter-disciplinary design review has been used on all Burns & McDonnell projects since 1981. The procedures, incorporated into a published quality review manual, were developed from guidelines published by the Professional Engineers in Private Practice section of the National Society of Professional Engineers. Reports, specifications or drawings cannot be reproduced until the proper reviews have been conducted and the quality of the report, drawing or specification meets acceptable standards. Quality control tasks are separately identified and monitored within the accounting system. For an engineering study and report project, three distinct quality control review subtasks are identified. These steps, called Q1R through Q3R reviews, are explained below:

#### Q-IR

The largest impact on the quality of study efforts can come at the outset of the project. The Project Manager will review the agreement with the Quality Review Manager. The scope of the service assignment, the proposed project approach and work tasks, the schedule and budget will be reviewed. The Q-1R review process will be performed after the project agreement has been executed and the initial kickoff meetings have been held between the project staff and the client.

#### **Q-2***R*

The Q-2R review is performed after the initial conclusions of the study have been formulated based on the analyses to date. Multiple Q-2R's will be performed for the different deliverables in this project. These are usually accomplished at about the 50 percent point completion level for the tasks reviewed. The Q-2R discusses the initial conclusions of the study prior to the development of the first draft of the report.

#### Q-3R

The Q-3 review is the final review necessary before the draft report can be printed for submission. This review provides three functions. The first function is to make sure that all of the components of the report are included. The second function is to make sure that the document has been checked for grammar and spelling. The final function of this form is to make sure that the contents of the report are an accurate reflection of the study and the conclusions and recommendations that Burns & McDonnell has developed.





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Before the report document is sent to the Reprographics Department, the Project Manager must resolve all of the comments among the reviewers and obtain the signature of the Quality Review Manager on a required review form. This Q-3R form contains a signature block to release the report to for printing.

#### **Quality Program for Subconsultant Services**

The same quality assurance reviews that apply to in-house work product are conducted on engineering study and design work that is subcontracted. As with the work done by Burns & McDonnell personnel, reports, specifications or drawings done by subcontracted consultants cannot be reproduced until the quality assurance procedures are followed.

All of the QA/QC processes have allowed Burns & McDonnell to provide top quality end products to our clients, whether reports or detailed design documents. The true test is what our clients say about us and we trust that you will ask them.

### Meeting the City's Expectations

Our Team is used to meeting the needs of municipal clients. We have the experience and tools needed to provide a final project that meets the schedule, budget, and operational expectations of the City and the Utilities Department.

# Conclusion

✓ The Burns & McDonnell and BG Consultants team is Committed to Meeting and Exceeding Your Expectations

# Wastewater Facilities Master Plan and Reclamation Facility Scope and Timing Review Tabulated Estimate of Labor Hours City of Lawrence, Kansas

City of Lawrence, Railsas		
	Totals BG	Totals Burns & McDonnell
Phase I - Initial Services and Wakarusa Answers		
1.0 Initial Services		
1.1 Project initiation, goal setting, and data availability	4	18
1.2 Prepare Project Control Plan	0	10
1.3 Software Selection Workshop	0	0
1.3.1 Review Existing Model Functionality	0	24
1.3.2 Conduct Modeling Software Demonstration and Work Shop	0	34
1.3.3 Confer with City and Select Software	0	12
1.4 Characterization of study area	0	0
1.4.1 Existing land uses	8	26
1.4.2 Proposed land uses	8	28
1.4.3 Population projections	8	14
1.4.4 Topography	8	9
1.4.5 Geology	8	9
1.4.6 TM # 1 - Service Area and Planning Scenarios	20	16
1.5 Wastewater Data gathering and collation	0	0
1.5.1 General data collection	80	2
1.5.2 City GIS data	0	32
1.5.3 Field investigations	0	0
1.5.4 Wastewater flow and rainfall data	8	16

1.5.5 Condition data (GIS system data, MasterSeries records, staff

2.0 Wakarusa Water Reclamation Facility Scope and Timing Review

2.3 Analyze Planning Department population growth and development

2.4 Review, evaluate and recommendations concerning the timing

2.5 Review, evaluate and recommendations concerning the timing of combined Kaw River WRF and Wakarusa WRF nutrient loading limits

2.6 Consider costs and timeline of expanding Kaw River WRF, building Wakarusa WRF with nutrient removal, or modifying Kaw River for nutrient

Lawrence\_WWMP\_Fee\_Estimate.xls

knowledge, etc.)

(Western drainage basins)

Subtotal Hours

projections

removal

1.5.6 TM # 3 - Existing Data Summary

2.1 Develop model for tributary area

of full use of available sewer capacity

2.7 TM # 5 - Wakarusa WRF Evaluation

2.4.1 TM # 4 - Phase I Hydraulic Model

2.2 Analyze flow and rainfall monitoring data

2.2.1 TM # 2 - Flow and Rainfall Data Analysis

0

40

0

0

0

12

0

0

0

0

0

192

32

58

340

132

72

32

38

44

61

72

156

82

532

**Fotal Project** 

# Wastewater Facilities Master Plan and Reclamation Facility Scope and Timing Review Tabulated Estimate of Labor Hours City of Lawrence, Kansas

Subtotal Hours	12	689	701
Phase II - Wastewater Facilities Master Plan			
3.0 Wastewater Facilities Master Plan			
3.0.1 Development of a GIS based data source and system	0	63	
3.0.2 Wastewater flow and load determinations	0	80	
3.0.3 Regulatory aspects	0	38	
3.0.4 Review and evaluate sewer system facilities	16	26	
3.0.5 Water Reclamation plant and wastewater collection system reviews	0	168	
3.0.6 Development of hydraulic model/future development tools	0	52	
3.1 Model calibration	0	0	
3.1.1 TM # 6 - Calibrated Model	0	61	
3.2 Existing wastewater system evaluation	0	44	
3.3 Future wastewater system evaluation	0	200	
3.3.1 TM # 7 - Design Storm Model Scenarios	0	48	
3.4 Development of a Capital Improvement Plan	0	104	
3.5 Development of a maintenance program	32	28	
3.5.1 TM # 10 - Maintenance and Rehabilitation Program	10	34	
3.6 CMOM program assessment	0	10	
Subtotal Hours	58	956	1014
4 Financial strategies			
4.1 Gather Data and Update City's rate model	0	20	
4.2 Develop Financial Forecast	0	28	
4.3 Revenue Forecast	0	26	
4.4 Project Operating and Capital Costs	0	26	
4.5 Prepare Cash Flow Analysis	0	20	
4.6 Assess rate impacts of CIP scenarios	0	34	
4.7 TM # 9 - Rate Impacts	0	15	
Subtotal Hours	0	169	169
5 Other Tasks			
5.1 QA/QC	15	75	
5.2 Draft and Final Report, Meetings, PM, Training	0	4	
5.2.1 Prepare Draft of Final Report Summarizing the Finings of TM1 thru			
TM 10	28	212	
5.2.2 Present Draft Report	6	6	
5.2.3 Revise Draft Report	7	93	
5.2.4 Prepare Final Report	0	52	
5.3 Present Final Report To Governing Body	2	10	
5.4 Project meetings	16	90	
5.5 Project management/coordination	8	84	
5.6 Modeling Delivery and Training Workshop	0	52	
Subtotal Hours	82	678	760
BASE FEE ESTIMATE (TASKS 1-5)			
Project Total Hours	344	2832	3176

# Schedule of Hourly Professional Service Billing Rates

Position Classification	Classification Level	Hourly Billing Rate
General Office*	5	\$53.00
Technician*	6	\$58.00
Assistant*	7 8 9	\$67.00 \$94.00 \$104.00
Staff*	10 11	\$113.00 \$127.00
Senior	12 13	\$134.00 \$147.00
Associate	14 15 16 17	\$160.00 \$171.00 \$176.00 \$182.00

#### NOTES:

- 1. Position classifications listed above refer to the firm's internal classification system for employee compensation. For example, "Associate", "Senior", etc., refer to such positions as "Associate Engineer", "Senior Architect", etc.
- 2. The hourly rates shown above are effective for services through December 31, 2008, and are subject to revision thereafter.
- 3. For any nonexempt personnel in positions marked with an asterisk (\*), overtime will be billed at 1.5 times the hourly labor billing rates shown.
- 4. Project time spent by corporate officers will be billed at the Level 17 rate plus 25 percent.
- For outside expenses incurred by Burns & McDonnell, such as authorized travel and subsistence, and for services rendered by others such as subcontractors, the client shall pay the cost to Burns & McDonnell plus 10%.
- 6. A technology charge of \$9.50 per labor hour will be billed for normal computer usage, computer aided drafting (CAD) long distance telephone, fax, photocopy and mail services. Specialty items (such as web and video conferencing) are not included in the technology charge.
- 7. Monthly invoices will be submitted for payment covering services and expenses during the preceding month. Invoices are due upon receipt. A late payment charge of 1.5% per month will be added to all amounts not paid within 30 days of the invoice date.

# BG CONSULTANTS STANDARD HOURLY RATES FOR 2008

POSITION	PER HOUR
PRINCIPAL	\$165.00
ASSOCIATE	\$150.00
PROJECT ENGINEER III	\$132.00
PROJECT ENGINEER II	\$120.00
PROJECT ENGINEER I	\$100.00
SENIOR DESIGN ENGINEER	\$120.00
DESIGN ENGINEER	\$95.00
ASSISTANT DESIGN ENGINEER	\$75.00
ARCHITECT	\$160.00
PROJECT ARCHITECT	\$120.00
ASSISTANT ARCHITECT	\$74.00
TECHNICIAN	\$82.00
TECHNICIAN I	\$72.00
SENIOR CONSTRUCTION INSPECTOR	\$84.00
CERTIFIED CONSTRUCTION INSPECTOR	\$70.00
CONSTRUCTION INSPECTOR	\$64.00
SENIOR PROJECT SURVEYOR	\$150.00
PROJECT SURVEYOR	\$110.00
GPS SURVEYOR	\$90.00
3-MAN SURVEY CREW	\$155.00
2-MAN SURVEY CREW	\$120.00
CAD SYSTEM AND OPERATOR	\$90.00
CLERICAL	\$50.00