Scope of Services

A collaborative approach based on an integrated project team that includes process experts from the Black & Veatch Technical Solutions Group, project management and support services from Black & Veatch local and regional offices, and key City of Ann Arbor Water Treatment Plant staff will be used to perform the analyses and deliver the services described in this scope document.

This project covers a range of planning and engineering related activities divided into two distinct phases: Phase I will evaluate source of supply and system reliability alternatives, Phase II will provide more detailed analysis of the preferred alternative selected in Phase I. Three baseline source of supply and system reliability alternatives will be evaluated in Phase I including connection to the Detroit Water and sewerage Department (DWSD), additional treatment capacity in the vicinity of the City's wellfield supply, and improvements at the City's existing water treatment facility. Phase I will provide evaluations of these source of supply and system reliability alternatives based on economic and non-economic considerations, with a focus on ensuring continued reliable service of the Ann Arbor drinking water system over a 20-year planning horizon.

Phase I is further sub-divided into Phase IA and Phase IB. Phase IA will provide feasibility-level evaluations of the three baseline source of supply and system reliability alternatives considered here, and will be based largely on the results of previous studies and modeling performed by the City and its consultants, as well as interviews and discussions with City staff. Phase IB is an optional component of this project that will be triggered if phase IA evaluations indicate that additional distribution system hydraulic modeling is warranted to better understand cost and non-economic considerations associated with how treated water will be delivered to the City's customers under each of the baseline source of supply and system reliability alternatives.

Phase II of this project will perform a more in-depth evaluation of the preferred source of supply and reliability alternative selected in Phase I. In keeping with the proposal Black & Veatch prepared and submitted in response to the City's RFP, this scope document presents an outline of tasks related to Phase II evaluation of improvements to the City's existing treatment facilities. A revised scope for Phase II of the project will be developed at a later date if one of the other source of supply and system reliability alternatives considered in Phase I is selected for further evaluation. It is assumed that any revised scope of work for Phase II would follow an organizational structure similar to that provided here, with evaluations and analyses performed at a similar level of detail.

On-site workshops with participation by the integrated City of Ann Arbor/Black & Veatch project team form the cornerstones of our collaborative approach. These workshops will provide the opportunity for exchange of information and ideas related to the project scope and review and ranking of alternatives developed. The multi-day workshops are supplemented by key one-day meetings as noted herein.

Our Scope of Work is divided into seven major elements to address the issues outlined in the RFP, plus supporting and optional tasks. We refer to each of these major elements as Task Series, as described in the following sections.

Task Series 000 – Project Management & Administration

Task 010 – Project Management and Administration

Consultant will provide monitoring and control of project scope and budget with monthly reporting to the City in conjunction with monthly invoicing for services. Consultant's Project Manager will review progress with the City's project manager on a monthly basis upon issuance of the progress reports. Consultant will provide for web-based document management and access for project deliverables and related documents, with access provided to project team members (Consultant and City).

Task 020 – Project Factsheet

A one-page project factsheet will be developed for the City's use, providing a basic description of the intent, scope, and schedule for the project.

Deliverable(s): One page Project Factsheet

Task 030 – Summary Final Report

At the conclusion of the project technical activities, a summary final report will be prepared that contains an executive summary which highlights results and findings of the project, and supporting technical memoranda and meeting minutes as appendices. The draft report will be provided for City review, and a conference call/web meeting review meeting facilitated to receive and address comments. A final report will then be prepared and delivered to the City (three printed copies and electronic files in source (Word and Excel) format).

Deliverable(s): Draft and Final Summary Reports

Task 040 – Council/Planning Commission Presentation and Meetings

A presentation (MS PowerPoint format) for use at City Council and Planning Commission meetings will be prepared for presentation by City staff.

Deliverable(s): MS PowerPoint presentation

Project Phase I – Preferred Source of Supply and System Reliability Alternative Selection

Phase I of the project will select a preferred source of supply and system reliability alternative from among several candidates. Phase IA and Phase IB (optional) tasks are listed and described separately in the following sections. The source of supply and reliability alternative selected in Phase I of the project will be carried forward to Phase II for further evaluation.

Phase IA – Reconnaissance Level Evaluations

Task Series 100A – Source of Supply and System Reliability Alternatives Evaluation

The evaluations performed under this task series will provide feasibility-level development and screening of selected concepts related to source of supply and overall system reliability. Three source of supply and system reliability alternatives will be evaluated including connection to the Detroit Water and sewerage Department (DWSD), additional treatment capacity in the vicinity of the City's wellfield supply, and improvements at the City's existing water treatment facility. These evaluations will leverage the findings and results of previous system planning efforts performed by the City and its consultants. Each source of supply and reliability alternative considered here will be evaluated at the current buildout capacity of 50 mgd. Because of the conceptual nature of source of supply and reliability alternatives evaluated here, opinions of probable cost associated with these alternative evaluations will be at AACE level 5. Life-cycle costs associated with these reliability alternatives will use information provided by the City on its current treatment and distribution costs as the basis for comparison.

Task 101A – Operational and Facilities Data Gathering

This task involves collecting operational and water treatment plant facilities data from the City of Ann Arbor that will be used to support the evaluations and analyses performed throughout this study. Types of historical operational data that will be required for this study include source water and treated water quality, treatment chemical usage, residuals production, residuals disposal contract costs and practices, and maintenance and upkeep schedules. Operational data for the most recent 5-year period is desired. Drawings that depict the current status of facilities, including locations of yard piping, will also be required.

Data identification will begin as soon as notice-to-proceed (NTP) is received. Black & Veatch will provide a consolidated data request to the City that details water quality parameters of interest and their desired periodicity. It is anticipated the operational data provided by the City will be in electronic form, and be compatible with Microsoft Excel® for post-processing. Operational and facilities data that will be used for evaluations and analyses performed as part of this project will be reviewed and finalized during the Project Initiation Meeting.

Deliverable(s): TM-101 – Operational and Facilities Data List

Task 105A – Project Initiation Meeting

Key members of the project team will meet at the Ann Arbor WTP for a one-day project initiation meeting. This meeting will consist of discussions, interviews, and facility tours to familiarize Black & Veatch project team members with City facilities, operational and management practices, maintenance and training practices, and equipment and facility preferences. B&V professionals will review historical water quality data for the City's existing Huron River and groundwater supplies, and will discuss known and likely threats to the quality and treatability of these supplies.

The City's finished water quality goals that augment Michigan Department of Environmental Quality (MDEQ) enforceable Primary Drinking Water Standards will be reviewed and documented. Goals related to aesthetic water quality parameters including hardness, color, and objectionable tastes and odors impact evaluations of process performance of existing treatment facilities and other potential alternative treatment technologies. Any goals that relate desirable finished water hardness to source water quality are of particular interest to this project.

Black & Veatch will review the City's existing distribution system map with staff and discuss current operation of the system. The intent of this effort is to understand where existing infrastructure may present bottlenecks or limitations to conveying treated water under each of the three baseline source of supply and system reliability alternatives. Significant distribution system improvements required by each of baseline alternatives will be identified so that opinions of probable cost may be prepared and non-economic factors considered.

Chris Tadanier will present a brief introduction to the K-T Structured Decision Analysis framework as it will be applied in this project, including demonstrations of computational engines that may be used to perform matrix-based alternative ranking calculations. Critical success factors for the project will be identified during discussions with City staff and documented.

Deliverable(s): Meeting minutes

Task 110A – Connection to Detroit Water and Sewerage Department

This task will evaluate the feasibility of receiving treated drinking water from Detroit Water and Sewerage Department (DWSD).

Black & Veatch will review the map of the City's distribution system with special emphasis on location and capacity of large diameter transmission mains, pump stations, and storage reservoirs to investigate the feasibility of receiving treated drinking water from DWSD. We will also review hydraulic modeling of distribution system performance previously performed by the City and discuss current operations with operations staff. The most feasible locations for interconnections with DWSD will be identified, with consideration of required infrastructure improvements or changes to current distribution system operations.

Potential differences in water quality between supplies delivered from DWSD and treated by the City will be identified, and potential impacts on distribution system infrastructure and operations evaluated. Significant improvements to the City's distribution infrastructure needed to receive treated water from DWSD will be identified and AACE level 5 opinions of probable construction cost will be developed. Additional incremental O&M costs associated with distributing treated water from DWSD throughout the Ann Arbor distribution system will be evaluated.

Potential impacts on City staffing levels associated with connection to DWSD will be reviewed and documented. Issues related to specific contractual terms between the City of Ann Arbor and DWSD will

not be addressed. A life-cycle opinion of probable cost will be developed based on the City's appraisal of what it would be willing to pay for service from DWSD compared to its current operating costs.

Deliverable(s): TM-110 Connection to Detroit Water and Sewerage Department

Task 120A – Treatment Capacity in the Vicinity of the City's Wellfield Supply

This task will evaluate the feasibility of locating additional treatment capacity in the vicinity of the City's existing groundwater wellfield.

Black & Veatch will review the map of the City's distribution system with special emphasis on location and capacity of large diameter transmission mains, pump stations, and storage reservoirs to investigate the feasibility of conveying treated drinking water from the vicinity of the City's wellfield supply throughout the distribution system. We will also review hydraulic modeling of distribution system performance previously performed by the City, and discuss current operations with operations staff.

For the purposes of this evaluation, it is assumed that precipitative softening technology and either granular media or low-pressure membrane filtration technologies would be implemented at this site. It is further assumed that groundwater treatment capacity would be limited to the current 10 mgd capacity of the wellfield. Blending with up to 5 mgd of treated water from the City's Huron River surface water supply will also be considered. Significant improvements to the City's distribution infrastructure needed to distribute treated water from the wellfield site will be identified and AACE level 5 opinions of probable construction cost will be developed. Additional incremental O&M costs associated with distributing treated water from the wellfield site throughout the Ann Arbor distribution system will be evaluated.

Deliverable(s): TM-120 – Treatment Capacity in the Vicinity of the City's Wellfield Supply

Task 130A – Existing Treatment Facility Improvements

This task will evaluate the capabilities of treatment processes and solid residuals handling and disposal practices currently implemented at the City's existing treatment facility. Potential for treatment of currently unregulated contaminants of emerging concern (CECs) will be evaluated, and other processes that could provide additional barriers for these contaminants will screened for potential implementation at the Ann Arbor water treatment plant. Potential improvements that would increase the reliability and redundancy of solid residual handling and disposal practices will also be screened for possible implementation at existing City facilities. The treatment process portion of this task will be lead by Chris Tadanier and the residual handling and disposal portion will be lead by Trish Scanlan.

Treatment barriers currently in place in existing facilities for contaminant categories including turbidity, microbial pathogens, DBP precursors and DBPs, inorganic macro-contaminants, inorganic micro-contaminants, organic micro-contaminants, and taste and odor compounds will be identified and their relative performance qualitatively characterized. Other treatment processes that could provide additional barriers for specific contaminants on the current regulatory horizon, as well as for contaminant classes such as pharmaceuticals and personal care products, will be identified. The

qualitative effectiveness of additional processes for treatment of contaminants in the seven categories listed above will be documented in matrix form. Because of the known threat of contamination of the City's Huron River supply by 1,4-Dioxane, this contaminant will be specifically addressed.

Solid residual handling and disposal practices in place at the existing facilities will be reviewed and their relative performance qualitatively characterized. Other solids handling and disposal practices that could increase the reliability and redundancy of solids management will be identified, and their relative benefits and drawbacks will be documented in tabular from.

One set of treatment process improvements and one set of solid residuals handling and disposal improvements will be selected for consideration in Phase I of this project based on the collective experience and judgment of the project team. Conceptual level opinions of capital cost, annual O&M cost, and life-cycle net present value will be prepared for the selected improvement packages. A feasibility-level site plan for the selected improvement packages will also be prepared.

Deliverable(s): TM-130 – Existing Treatment Facility Improvements

Task 140A – Structured Decision Model Development

This task will develop a structured decision model that will be used to select a source of supply and reliability alternative that will be carried forward for further evaluation in Phase II of the project. This task will be lead by Chris Tadanier. A preliminary set of criteria that will be used to rank source of supply and system reliability alternatives will be proposed by Black & Veatch and reviewed at the Project Initiation Meeting. Criteria will include water quality, operations, constructability/footprint, social welfare/sustainability, and economic considerations, as well as others suggested by City staff. The set of criteria to be used and their relative importance in the decision process will be finalized in a project update conference call.

Deliverables: TM-140 – Source of Supply and System Reliability Structured Decision Model

Task 150A – Workshop #1 (Day 1)

The results of Task Series 100 evaluations will be reviewed in Workshop #1, and the structured decision analysis model developed in Task 140A used to select the source of supply and reliability alternative to be carried forward for Phase II evaluation.

Deliverable(s): Meeting minutes

Phase IB – Planning Level Evaluations (optional; if required based on Phase IA results) - Optional

Additional targeted hydraulic, treatment, and facility improvement evaluations may be performed in Phase IB as informed by review of Phase IA evaluation efforts and input from City staff. It is anticipated these evaluations would be required if findings from Phase IA indicate a lack of differentiation among evaluated alternatives, or if further evaluation is required to any specific part of the identifications. If

required, the actual required scope of the Phase IB evaluations are intended to be defined following the results of Phase IA.

Task 110B – Connection to Detroit Water and Sewerage Department

If Phase IA indicates that further analysis of how treated water will be conveyed is required to appropriately evaluate the cost and non-economic implications of this source of supply and system reliability alternative, Black & Veatch will perform additional targeted hydraulic modeling using the City's existing hydraulic model. The feasibility of distributing the current system design capacity of 50 mgd to meet customer demands will be documented.

Deliverable(s): Addendum to TM-110

Task 120B – Treatment Capacity in the Vicinity of the City's Wellfield Supply

If Phase IA indicates that further analysis of how treated water will be conveyed and/or if additional analysis of supply or treatment options is required to appropriately evaluate the cost and non-economic implications of this source of supply and system reliability alternative, Black & Veatch will perform additional targeted hydraulic modeling using the City's existing hydraulic model., and additional supply or treatment process evaluations as necessary. The feasibility of distributing the current system design capacity of 50 mgd to meet customer demands will be documented.

Deliverable(s): Addendum to TM-120

Task 130B – Existing Treatment Facility Improvements

If Phase IA indicates that further analysis is required of the assumptions and criteria utilized as the evaluation baseline for existing facility improvements, the evaluation will be further developed and revised accordingly.

Deliverable(s): Addendum to TM-130

Task 140B – Structured Decision Model Update

This task will update the structured decision model for the further evaluations of Phase IB.

Deliverables: TM-140 – Source of Supply and System Reliability Structured Decision Model

Task 150 – Review Meeting

The results of Phase IB evaluations will be reviewed in an on-site one day meeting, and the structured decision analysis model updated in Task 140B used to select the source of supply and reliability alternative to be carried forward for Phase II evaluation.

Deliverable(s): Meeting minutes

Task 160A – Hybrid Source of Supply and Reliability Alternatives (Optional)

Up to two additional source of supply and reliability alternatives that combine various aspects of the DWSD and additional greenfield treatment capacity alternatives with limited improvement to the City's existing treatment facilities may be evaluated. If this optional task is selected by the City, these additional alternatives would be evaluated concurrently with the three baseline alternatives.

Deliverable(s): TM-160 – Hybrid Source of Supply and Reliability Alternatives

Project Phase II – Preferred Source of Supply and System Reliability Alternative Detailed Evaluation

The source of supply and reliability alternative selected in Phase I of the project will be evaluated in more detail in Phase II of the project.

Task Series 200 – Alternatives Screening and Preliminary Investigations

This task series will identify and screen alternatives to be evaluated in Phase II. Workshop #1 days 2 and 3 represent the core activity of this task series, and will provide information for several follow on preliminary investigations.

Task 210 – Workshop #1 (Day 2 and Day 3)

This workshop will include discussions and interviews with City staff, inspection and assessment activities, and observation of plant operations and targeted bench-scale testing conducted during the time on site for the workshop. Important topics for discussion will include City staff views on rehabilitation/replacement of Plant 1 pre-treatment basins, overall treatment philosophy and treatment technology preferences, and reliability/redundancy of facilities. It is intended that this portion of the Workshop follow immediately upon the meetings of either of Task 150A or 150B as applicable.

Prior to this workshop activity, Black & Veatch will prepare a list of preliminary alternatives for each WTP improvement category including Plant 1 Pre-Treatment Alternatives, Solids Management Alternatives, and Future Treatment Alternatives. These preliminary lists will be refined during discussions with City staff during the Workshop and then screened for constructability, footprint required, compatibility with existing plant operations, reliability, operational flexibility, and regulatory acceptance by the integrated City/Black & Veatch project team. Alternatives that have a fatal flaw will be removed from further consideration. Up to five screened alternatives in each category will be carried forward for more detailed evaluation in Task Series 300 scope elements.

Key outcomes from Workshop #1 include:

- Source water qualities (groundwater and surface water) to be used in softening analyses
- Criteria that will be used to rank alternatives and their relative importance in the decision process (both economic and non-economic)

- A list of alternatives for future use of the existing pre-treatment facilities and space that comprise Plant 1 that will be carried forward for further evaluation
- A list of residuals management alternatives that will be carried forward for further evaluation
- A list of future treatment alternatives that will be carried forward for further evaluation
- Economic parameters to be used for life-cycle cost analysis of Plant 1 pre-treatment alternatives

Black & Veatch will provide an agenda with scheduling information prior to the workshop to facilitate City input on scheduling and to allow for resource planning.

Deliverable(s): Meeting minutes

Task 220 – Structured Decision Model Development

This task will develop a structured decision model that will be used to select a preferred alternative from each category of potential improvements, and will be lead by Chris Tadanier. Criteria that will be used to rank alternatives in each category will be developed, and their relative importance in the decision process established. Criteria will include water quality, operations, constructability/footprint, social welfare/sustainability, and economic considerations, as well as others identified during Workshop #1 (Day 2) discussions.

The computational engine that will be used to perform matrix-based alternative ranking calculations will also be established and documented in this task. The computational engine may be either an MS Excel-based tool such as the City's existing Multi-Attribute Utility Prioritization Analysis & Capital Planning Model, or the commercially available software package Criterium DecisionPlus® which has sensitivity analysis capabilities.

Deliverable(s): TM-220 – Plant 1 Pre-Treatment Facility Structured Decision Model

Task 230 – Applied Turbidity Evaluation

This task will evaluate the magnitude, nature, and seasonal variation of turbidity in settled water applied to the filters. Historical water quality and operational data will be reviewed and WTP staff will be interviewed to identify and document correlations between applied water turbidity and source water quality or treatment practices. The physical characteristics of existing pre-treatment facilities (basin loading, weir loading, and configurations) will be compared with industry-standard design criteria and current best design practices. Historical performance of existing pre-treatment facilities will be compared with that of other precipitive softening facilities that treat similar source waters. As historical operating data availability allows, settled water turbidity will be correlated with filtered water turbidity and filter productivity.

Alternatives to lower applied turbidity, which may include physical modifications or alternative treatment practices, will be identified and screened for applicability at Plant 1. Physical modifications that will be considered include addition of more weirs or plates/tubes to primary and secondary settling basins, among others. Alternative treatment practices will be evaluated with reconnaissance-level investigations though in-depth discussions with plant staff and with consideration for potential bench-

scale testing. Any recommended bench scale testing will be either conducted during the time on site for the workshop, or by plant staff with direction provided by the B&V team. AACE level 4 opinions of probable capital and annual O&M costs will be developed for modifications that were considered potentially viable during initial screening. Potential impacts on continuing treatment operations will be documented.

As part of Workshop #1, Black & Veatch process specialists will meet with City operations staff to review previous pre-treatment optimization efforts that have been performed. We will make recommendations on additional optimization activities that City staff could undertake to fill any gaps in previous efforts (including bech scale tests as previously described).

Project Deliverable(s): TM-230 – Applied Turbidity Evaluation

Task Series 300 – Facility Plan Alternatives Development

This task series will further develop alternatives carried forward from Workshop #1 in three WTP facility plan categories that include Plant 1 pre-treatment (Task 230), solids management (Task 240), and future treatment options (Task 250). Several supporting analyses will also be performed in this task series.

Task 310 – Precipitative Softening Analysis

The evaluations performed for this task will consider issues related to softening operations and will be lead by Doug Elder. This task will evaluate the best use of current sources of supply and determine if there is a better treatment scheme than what the City is currently using. Fall back positions for the optimum treatment scheme that would provide the City with added operational flexibility will be identified.

A desk-top analysis will be performed to evaluate the impacts of blending groundwater and surface water in varying proportions on softening performance. Blend ratios of 0 percent, 25 percent, 50 percent, 75 percent, and 100 percent groundwater will be evaluated. Softening analyses will be performed using one historical average groundwater quality and up to three unique surface water qualities, as established in Workshop #1. Surface water qualities may be based on historical data provided by the City or synthesized to represent extended drought or contamination events.

A suite of commercially available chemical equilibrium modeling software packages, as well as proprietary softening analysis software previously developed by Black & Veatch will be used to perform these analyses. The Water!Pro™ Corrosion Control and Treatment Process Analysis Program (Schott Software, 2002) will be used to determine basic water quality parameters of blended waters including pH, alkalinity, hardness, total dissolved solids, chloride and sulfate of blended waters, as well as to calculate corrosion related indices of blended waters before and after chemical stabilization. The United States Environmental Protection Agency Water Treatment Plant Model (USEPA, 2001) will be used to evaluate the impacts of source water blending ratio on TOC removal and regulated DBP

formation. Proprietary modeling tools previously developed by our project team will be used to model recarbonation and solid residuals production.

The predictive performance of these models will be validated using full-scale operational data provided by the City. Our previous experience using the proposed models has shown that their predictive capabilities are generally well suited for the types of evaluations to be performed here, and extensive calibration activities are not required.

Deliverable(s): TM-310 – Precipitative Softening Analysis

Task 320 – Plant 1 Service Life Extension Alternatives

The Plant 1 pre-treatment facilities evaluation performed here will serve as an update to the condition assessment performed under the 2006 Water Treatment Facilities and Water Resources Master Plan, which recommended replacement of aging pre-treatment and solids management facilities by 2016 (emphasis on Plant 1). The key goal of this evaluation is to identify future restoration alternatives that may provide meaningful service life extension of Plant 1 pre-treatment facilities and the feasibility and planning-level costs associated with these alternatives. Mr. Whitehead will attend Workshop #1 and will focus on evaluating Plant 1 pre-treatment facilities.

Service life extension options will be developed based on the following background investigation:

- Condition assessment: Plant 1 pre-treatment basins and related process equipment will be visually inspected, not to interfere with ongoing plant operations. An itemized list of material deficiencies will be prepared to document the condition of each basin and its related equipment. Where possible, photos will be taken to supplement written documentation.
- Data collection: Plant record documentation will be reviewed as needed to estimate the intended design service life, design capacity, and design performance. Records to be referenced may include the 2006 Water Resources Master Plan, equipment operation and maintenance manuals, and as-constructed background drawings. Previous condition assessment and rehabilitation cost information developed by City staff will be reviewed and incorporated in this evaluation.
- Conduct staff interviews: Interviews will be conducted with appropriate WTP staff to supplement data collected from review of existing documentation. The experience of City operation and maintenance staff will be leveraged to document Plant 1 pre-treatment performance, maintenance requirements, and operational concerns.

A technical memorandum will be prepared to summarize the condition and reliability of existing pre-treatment basins and equipment. The memorandum will include a table of known material deficiencies, summary descriptive text, and a supporting photo journal. The memorandum will also identify up to three options for service life extension of existing Plant 1 pre-treatment facilities, one of which will be based on minimal improvements (do-nothing option). AACE level 4 opinions of probable capital cost and associated service life extension for each alternative will be provided.

Deliverable(s): TM-320 – Plant 1 Service Life Extension Options

Task 330 – Plant 1 Pre-Treatment Alternatives

Alternatives for future use of the existing pre-treatment facilities and space that comprise Plant 1 carried forward from Workshop #1 will be evaluated in further detail. AACE level 4 opinions of probable capital and annual O&M costs will be developed for each alternative evaluated in this task. A life-cycle cost analysis will also be performed for each alternative evaluated using economic parameters established during Workshop #1. A conceptual layout of facilities from each alternative on the WTP site will be developed. Non-economic criteria developed in Workshop #1 will also be applied to the evaluation.

Up to five screened alternatives carried forward from Workshop #1 will be evaluated in more detail in this task. It is anticipated that at least one service-life-extension alternative will be evaluated, as well as at least one conventional precipitative softening alternative and at least one high-rate precipitative softening alternative that are based on replacement of existing Plant 1 pre-treatment facilities.

Deliverable(s): TM 330 – Plant 1 Pre-Treatment Alternatives

Task 340 – Solids Management Alternatives

This evaluation will consider issues related to solids handling and management and will be lead by Trish Scanlan. Specific issues addressed in this task will include:

- Capacity of existing lagoon and mechanical dewatering
- Condition/age of mechanical dewatering system
- Efficiency
- Reliability and redundancy
- Solids handling alternatives for long term solution

This task will investigate potential dewatering options to support the City's long term residuals treatment goals. Potential disposal options, including landfill, monofill, or beneficial reuse, and potential treatment options to support the disposal options, including mechanical dewatering (plate-and-frame filter press and other technologies), lagoon dewatering, and siting constraints, will be considered.

Up to five screened alternatives carried forward from Workshop #1 will be evaluated in more detail in this task. AACE level 4 opinions of probable capital and annual O&M costs will be developed for each alternative evaluated in this task. A life-cycle cost analysis will also be performed for each alternative evaluated using economic parameters established during Workshop #1. A conceptual layout of facilities from each alternative on the WTP site will be developed.

Deliverable(s): TM-340 – Solids Management Alternatives

Task 350 – Future Treatment Options and Regulatory Compliance

This task will address issues related to compliance with currently unregulated contaminants of emerging concern (CECs) and will be lead by Chris Tadanier. This task builds on the existing treatment evaluation from Task 130, and will evaluate other treatment processes that could provide additional barriers for potential CECs in categories including turbidity, microbial pathogens, DBP precursors and DBPs, inorganic macro-contaminants, inorganic micro-contaminants, organic micro-contaminants, and taste and odor compounds. Because of the known threat of contamination of the City's Huron River supply by 1,4-Dioxane, this contaminant will be specifically addressed. AACE level 4 opinions of probable capital and annual O&M costs will be developed for each conceptual treatment scheme, as well as required footprint for facilities. Specific treatment equipment vendors will not be selected, and detailed layout of equipment will not be developed.

Up to five screened alternatives carried forward from Workshop #1 will be evaluated in more detail in this task.

Deliverable(s): TM-350 – Future Treatment Options and Regulatory Compliance

Task 360 – Facility Visits and Vendor Presentations for Selected Technologies

Black & Veatch will arrange meetings with equipment vendors and plant tours for technologies included in the final portfolio of WTP improvements as directed by the City. The basis of scope and fee for this alternative task is based on two visits to operating facilities, including travel costs for up to four City staff, and including two Consultant team members accompanying on the visits. Also included is the facilitation of up to four vendor presentations on specific technologies, assumed to be held at the Ann Arbor WTP, scheduled between Workshop #1 and Workshop #2. Consultant staff will participate in these presentations via teleconference and/or web meeting.

Task Series 400 – Facility Plan Alternatives Evaluation

This task series will rank alternatives developed in three WTP facility plan categories that include Plant 1 pre-treatment, solids management, and future treatment options. The alternatives in each category will be ranked against one another to establish a preferred alternative in each category. The principles of KT® structured decision analysis will be used to rank alternatives in each category. The computational engine that will be used to perform matrix-based alternative ranking calculations may be either an MS Excel-based tool such as the City's existing Multi-Attribute Utility Prioritization Analysis & Capital Planning Model, or the commercially available software package Criterium DecisionPlus® which has sensitivity analysis capabilities. The computational engine to be used will be selected during Workshop #1.

Task 410 – Plant 1 Pre-Treatment Alternatives Ranking

This Scope of Work element will compare and rank up to five Plant 1 Pre-Treatment Alternatives developed in Task 330. This will be an interactive activity conducted by the City/B&V Project Team as

part of Workshop #2, which bridges between the evaluations of this task series and the consensus building of the following task series.

Deliverable(s): TM-410 – Plant 1 Pre-Treatment Alternatives Ranking

Task 420 – Solids Management Alternatives Ranking

This Scope of Work element will compare and rank up to five Solids Management Alternatives developed in Task 340. This will be an interactive activity conducted by the City/B&V Project Team as part of Workshop #2, which bridges between the evaluations of this task series and the consensus building of the following task series.

Deliverable(s): TM-420 – Solids Management Alternatives Ranking

Task 430 – Future Treatment Alternatives Ranking

This Scope of Work element will compare and rank up to five Future Treatment Alternatives developed in Task 350. This will be an interactive activity conducted by the City/B&V Project Team as part of Workshop #2, which bridges between the evaluations of this task series and the consensus building of the following task series.

Deliverable(s): TM-430 – Future Treatment Alternatives Ranking

Task 440 – Workshop #2 (Day 1)

Workshop #2 will be scheduled midway through the project. Day 1 will be primarily devoted to reviewing details of alternatives developed and ranking them against one another. Key outcomes from Workshop #2 Day 1 include:

- A ranked list of Plant 1 Pre-Treatment Alternatives and their relative evaluation scores
- A ranked list of Residuals Management Alternatives and their relative evaluation scores
- A ranked list of Future Treatment Alternatives and their relative evaluation scores

Black & Veatch will provide an agenda with scheduling information prior to the workshop to facilitate City input on scheduling and to allow for resource planning.

Deliverable(s): Meeting minutes

Task Series 500 – Facility Plan Alternatives Integration and Consensus Building

Task 510 – Workshop #2 (Day 2)

This Scope of Work element will use a holistic approach to combine alternatives that address each of the three principal WTP facility plan categories including Plant 1 Pre-Treatment, Solids Management, and Future Treatment and Compliance Issues into an integrated portfolio of WTP improvements. This portfolio will be developed by the project team during Workshop #2 Day 2, using a consensus-building approach facilitated by Dr. Tadanier. The starting point for developing an integrated WTP

improvements portfolio will be consideration of the interrelationships and linkages between the three preferred alternatives identified in Task 410, Task 420, and Task 430, respectively. If irreconcilable or unacceptable conflicts exist between the three facility plan preferred alternatives, one or more of the preferred alternatives will be replaced with the next highest ranked alternative(s). This process will continue until a satisfactory combination of facility plan alternatives is established. The final portfolio will be screened against the City's regulatory compliance, sustainability, and customer satisfaction goals.

Deliverable(s): Meeting minutes

Task Series 600 – Document Facility Plan Solutions

This task series documents the final improvements portfolio selected in Task Series 500, and provides information related to facility site layout, costs, implementation schedule and construction phasing, and financing options.

Task 610 – Facility Site Layout and Opinions of Probable Cost

This Scope of Work element will provide a potential facility site layout and AACE level 4 total capital and annual O&M opinions of probable cost for the final WTP improvements portfolio developed in Task Series 500.

Task 620 – Implementation Schedule and Phasing

A projected implementation schedule for alternatives in the selected portfolio will be developed that considers possible phasing options for construction of alternatives.

Deliverable(s): Site Layouts, Cost opinions, Implementation Schedule, and Phasing Plan

Task Series 700 – Optional Tasks

The following optional tasks may be performed at the City's discretion based on the results of analyses and evaluations performed during this study.

Task 710 – Pilot Testing Plan

If pilot testing of technologies identified by alternatives developed is deemed desirable, a testing plan will be developed. Black & Veatch process experts would develop the testing plan including:

- Proposed tests
- Sampling protocol and testing methods
- Implementation cost

Task 720 – Plant 1 Basin Hydraulic Modeling

If viable alternatives for basin rehabilitation and modification are identified, computational fluid dynamic modeling of basin hydraulics may be conducted to evaluate the potential benefits to basin performance including:

- Existing flow distribution
- Flow distribution(s) with modification(s)

The basis of scope and fee for this alternative task is based on the modeling of existing conditions with development of an optimized configuration to improve identified deficiencies.