DUBLIN ROAD WATER PLANT
TREATMENT CAPACITY INCREASE STUDY AND EVALUATION
CONTRACT MODIFICATION NO. 1
SCOPE OF SERVICES

Metcalf & Eddy of Ohio, Inc. (M&E) recently completed the initial phase of the Dublin Road Water Plant (DRWP) Treatment Capacity Increase Study and Evaluation Project. During this initial phase, M&E prepared the following reports:

- *DRWP Condition Assessments*. This report documents the condition of the existing Dublin Road Water Plant in terms of performance, operational issues, structural condition, electrical systems, hydraulics, current unit process design standards and requirements, and raw water quality.
- *DRWP Alternatives Feasibility Study*. This report summarizes the most feasible alternatives for expanding and upgrading the Dublin Road Water Plant to achieve regulatory compliance and meet customer demand.
- *DRWP Pilot Study Plan.* This report describes the treatment processes to be tested, the modes of operation, and the water quality parameters to be sampled, and illustrates a preliminary flow diagram and layout of the pilot plant. The report was developed from the findings of the alternatives analysis and is based on discussions with the City of Columbus (City) and Ohio EPA regarding processes to be evaluated.

M&E completed the *Pilot Study Plan* under the original contract for the Treatment Capacity Increase Study and Evaluation Project. The *Pilot Study Plan* contains recommendations for pilot testing three process trains that were identified for further consideration in the *Alternatives Feasibility Study*. Contract Modification No. 1 provides for engineering services to carry the project forward through pilot system design, construction and operation. Additionally, Contract Modification No.1 provides funding for the additional work effort expended during the initial phase of the project. Attachment 1 to this Scope of Services consists of a letter that describes the additional work effort and associated costs.

The pilot plant will be constructed under two separate construction contracts. Under the first contract, a permanent pre-engineered metal building and associated site work will be constructed. Later, under the second contract, the general contractor will acquire and install the pilot system equipment in the metal building and will construct the required exterior process piping and pump stations. At the conclusion of the pilot study, the contractor will remove the pilot system equipment, leaving the building available for the City's use.

M&E will provide the engineering services associated with design and operation of the pilot facilities. These services will include preparation of detailed plans and specifications, bidding assistance, construction administration, pilot plant start-up and operation and decommissioning of the pilot plant for four seasons of pilot testing. The Scope of Services for the pilot study effort encompasses the following work tasks:

Task 1 Project Management

Task 2 Permanent Building Design

Task 3 Pilot System Design

Task 4 Pilot System Operation

The work proposed in this Scope of Services is consistent with the findings presented in the reports described above and is the next required step in moving towards the City's goal of expanding and upgrading the Dublin Road Water Plant.

A more detailed discussion of each of the four pilot study tasks is presented herein.

TASK 1 - PROJECT MANAGEMENT

Effective project management is critical in meeting established schedules and in responding to City needs and expectations. The Project Management task is presented for outlining those subtasks that will be performed by M&E to generally manage and administer the project which is assumed to have an approximate duration of 48 months. The Project Manager will administer the project, making sure that the project is properly executed and the City's needs are met. The following subtasks comprise the Project Management Task.

1.1 Project Work Plan

A Project Work Plan will be developed at the beginning of the project. This Plan will outline the goals and critical issues involving budget, schedule, modes of communication, quality, lines of communication and identification of contact information for each team member. Each Project Team member's role will be clearly defined along with expectations.

1.2 Project Schedule

The Project Schedule will be developed and submitted to the City in Gantt chart format. The Project Schedule will be submitted initially at the beginning of the project and then updated and resubmitted at critical points of the project. Progress will be discussed in the monthly project status reports. A preliminary schedule is included as an attachment to this scope of services.

1.3 Invoices

M&E will prepare and submit monthly invoices to the City. M&E will format the invoices to suit the specific needs of the City, including supplying the required backup information. Monthly progress status reports will be included with the invoices.

1.4 Quality Control and Quality Assurance Reviews

All deliverables (whether draft or final) will undergo a formal review process prior to submittal to the City. M&E's Technical Advisors will be involved in the project from conception through completion, particularly regarding project objectives, approach to completion of the scope of work, and client expectations.

1.5 Project Team Management

M&E will manage and coordinate the efforts of subcontractors and M&E team members including subcontract preparation, subcontract administration and invoicing, scheduling, and meetings. This task includes conducting routine communications between the City and M&E via telephone, email, fax, and meetings to ensure responsiveness.

TASK 2 - PERMANENT BUILDING DESIGN

M&E will prepare detailed plans and specifications for construction of a permanent pre-engineered metal building. The building will be sized to accommodate the pilot system equipment that will be installed under a separate construction contract. M&E will utilize performance specifications for design of the building to the extent possible.

The following basic assumptions have been used in developing this scope of services:

1. The permanent building will be a pre-engineered metal structure. The structure and the foundation system will be designed by the building vendor.
2. Based on discussions with the local building department, the building will initially have an industrial use classification. This classification could change depending on the City's ultimate use of the building. An occupancy permit will not be obtained until construction of the pilot system as described under Task 3 has been completed.
3. Construction drawings will be produced using AutoCAD Version 2005.
4. The building area will be approximately 10,000 square feet.
5. The building will be located at the existing DRWP site, along the north side of the property.
6. A site survey will be required to identify utilities, topographical features, and existing structures and facilities.
7. A geotechnical investigation will be required to evaluate soil conditions.
8. Plumbing and HVAC will be designed under Task 3 - Pilot System Design and constructed as part of the second pilot plant construction contract.
9. A building security system will not be provided. The security system design will be included in other contracts being administered by the City.
10. The building will be constructed initially with a gravel floor. A concrete floor will be installed as part of the second pilot plant construction contract.
11. Electricity will be used to heat the building.
12. The City Division of Electricity will provide incoming power to the building. The M&E design team will provide the power requirements to the City.

Task 2 will consist of the following subtasks:

- Detailed design services
- Bidding services
- Construction administration services

These subtasks are more fully described below.

2.1 Detailed Design Services

2.1.1 Site Survey

M&E will retain a professional land surveyor, registered in the State of Ohio, to perform a field survey and prepare existing-conditions survey base maps that will be used for the pre-engineered metal building and pilot system design effort. The surveyed area will include the building site and site piping alignments. M&E, through its designated subcontractor, Dynotec, will perform the survey and collect available utility information. Utilities, that are readily available and identifiable from existing record drawings or by

surface markings provided (if possible) by private utility companies, will be shown on the site plan. Private utility companies may or may not locate their services on private property. The utility information will be added to the survey base maps to provide the existing condition drawings.

M&E, through its subcontracted surveyor, shall:

- Perform research at the Franklin County Auditors Office to obtain record plans of the right-of-ways and easements, if necessary;
- Stake soil boring locations;
- Perform fieldwork to establish horizontal control based upon the Ohio State Plane Coordinate System;
- Locate visible surface utilities (underground utilities will be located by the respective utility companies and identified during the ground survey);
- Locate visible topographic features;
- Locate building fronts within 30 feet of the pipe centerline;
- Provide a topographic survey of the proposed pipeline routes and building location utilizing a 1-foot contour interval;
- Provide spot elevations along the centerline and edges of pavement every 50 feet along the route survey;
- Draft a pipeline route survey plan depicting the above information at a scale of 1" = 20'. Approximate right-of-way line locations, as determined from record plans, will be shown on the drawings; and
- Provide topographic drawings in AutoCAD format.

2.1.2 Geotechnical Investigation

M&E will acquire the services of Prime Engineering, the geotechnical subconsultant, to complete the soil boring investigation and prepare the geotechnical report. M&E will provide Prime Engineering with the locations where soil borings are needed. Prime Engineering will obtain the locations of known public and private utilities. We anticipate a site meeting will be needed to confirm utility locations. The geotechnical investigation for the permanent building will be conducted concurrently with the pilot system site piping described under Task 3. For estimating purposes, it is assumed that 2 borings will be needed for the building site and 8 borings will be required for the site piping.

Dynotec will stake the boring locations and Prime Engineering will perform the drilling operation. Prime Engineering will notify the City and M&E at least 48 hours prior to taking the borings.

Prime Engineering will perform the sample testing and provide M&E with the resulting subsurface information and geotechnical analysis including a discussion on bearing capacity, characterization of soil conditions including an identification of deficient soils or presence of rock, excavation and bedding requirements for the proposed pipelines, dewatering requirements, and other pertinent information. A professional engineer registered in the State of Ohio will prepare the geotechnical analysis. M&E will review the geotechnical report and provide Prime Engineering with comments. Prime Engineering will finalize the report and provide M&E a hard copy for final review. The geotechnical report will be included in the construction specifications for the bidders' information.

2.1.3 Preliminary Design

Metcalf & Eddy will finalize the space needs and building configuration identified during development of the *Pilot Study Plan* and will incorporate those needs into the layout of the new structure. Local building code requirements will be reviewed to identify various design parameters including, but not limited to, fire protection requirements, HVAC requirements, and restroom requirements. A preliminary site plan incorporating site grading, storm drainage, and paving requirements will be prepared. A building floor plan and elevations with suggested finishes will be presented to the City as a set of 30 percent drawings. The layout of the pre-engineered metal building will be established at the end of the preliminary design phase.

2.1.4 Final Design

M&E will prepare and submit 90 percent and 100 percent drawings for the pre-engineered metal building. The final design effort will include the following elements:

- Civil/site design drawings showing underground utilities, site grading, storm drainage and pavement.
- Performance specifications requiring the building vendor to complete the necessary design calculations and drawings for the building foundation and superstructure.
- Architectural drawings showing a basic floor plan and elevation views for the pre-engineered structure.
- Electrical supply requirements at the anticipated loads for the pilot study equipment, detailed electrical distribution design, panelboards, lighting, lightning protection, and site electrical coordination with the power company to provide three-phase power.
- Preparation of a set of specifications, with technical specifications developed by M&E, and front-end documents (Division 0) provided by the City and edited by M&E.
- Submittal of design drawings and specifications to the Columbus Building Department for review and issuance of a building permit.
- Preparation of a construction cost estimate at the 90 percent and 100 percent design stages.

A preliminary list of anticipated drawings for the permanent building design follows.

General	
1	Title Sheet and Drawing Index
2	Legends, Symbols, Vicinity and Location Map
Civil / Sitework	
3	Existing / Proposed Site Plan
4	Miscellaneous Details
5	General Notes
6	Erosion / Sediment Control Details
Architectural	
7	Legend, Abbreviations and General Notes
8	Floor Plan

9	Roof Plan
10	Building Elevations I
11	Building Elevations II
12	Wall Section
13	Door, Window, Louver Schedule and Notes
14	Door and Miscellaneous Details
Structural - Not Used	
Process Mechanical - Not Used	
HVAC – Not Used	
Plumbing – Not Used	
Electrical	
15	Electrical Site Plan (for contractor's information)
16	Electrical Details (for contractor's information)
Instrumentation and Control - Not Used	

2.1.5 Permits and Approvals

M&E will submit the detailed plans and specifications to the appropriate City departments for review and approval. These departments include the Building Department, Division of Water, Division of Sewerage and Drainage and the Division of Electricity. M&E has included an allowance of $2,500 to pay necessary plan review fees. Additional fees will be paid using contingency funds as necessary. It is assumed that the General Contractor will pay for building permit fees during construction.

2.1.6 Meetings / Site Visits

M&E will attend 1 meeting with the City to discuss design issues, design progress, or other matters pertinent to the design of the building. The M&E project manager will be available to attend this meeting on site and other team members will be available via conference call.

2.1.7 Opinion of Probable Construction Cost

M&E will prepare an opinion of probable construction cost at the 90 percent and 100 percent completion stages.

2.1.8 Quality Assurance / Quality Control

M&E will review the plans and specifications in accordance with the project-specific quality assurance plan prior to final submission to the City. Representatives from each of the design disciplines will conduct the review for completeness and accuracy.

2.2 Bidding Services

2.2.1 Plan Distribution

M&E will provide 40 sets of final plans and specifications to the City. The City will distribute the plans and specifications to interested bidders and other parties. The City will maintain a list of plan holders.

2.2.2 Prebid Meeting

M&E will conduct a prebid meeting. The M&E project manager will attend this meeting.

2.2.3 Bidders' Questions

M&E will receive and respond to bidders' questions. Written responses will be accomplished by addenda.

2.2.4 Contract Addenda

M&E will prepare up to 2 addenda to revise or clarify drawings and specifications in response to bidders' questions. M&E will forward the addenda materials to the registered plan holders via overnight delivery. If additional addenda are required they will be prepared using contingency funds, as necessary.

2.2.5 Bid Opening Meeting

The M&E project manager will attend the bid opening meeting.

2.2.6 Bid Tabulation

M&E will tabulate the bids for the permanent building and will include the bid tabulation with the recommendation for award.

2.2.7 Bid Recommendation

M&E will review the bids for responsiveness and will prepare and submit a recommendation for award.

2.3 Construction Administration Services

2.3.1 Preconstruction Meeting

M&E will conduct a preconstruction meeting. The M&E project manager and project engineer will attend this meeting. M&E will prepare the meeting minutes and distribute them to the appropriate parties.

2.3.2 Submittal Review

M&E will review shop drawing submittals and up to 1 resubmittal on each shop drawing. A submittal log will be maintained. If additional submittal reviews are required they will be conducted using contingency funds, as necessary.

2.3.3 Requests for Information

M&E will respond to the Contractors' requests for information (RFIs).

2.3.4 Change Order Review

M&E will review up to 2 change orders. If additional change order reviews are required they will be reviewed using contingency funds, as necessary.

2.3.5 Construction Progress Meetings

M&E will conduct 6 monthly progress meetings during construction of the permanent building. The M&E project manager and/or project engineer will attend these meetings along with M&E's construction observer.

2.3.6 Construction Observation

M&E's designated subcontractor, Dynotec, will provide part-time construction observation services for 16 person-days. These services are intended to check for general conformance with the plans and specifications.

2.3.7 General Construction Administration

The City will issue the notice to proceed. M&E will respond to Contractor requests for substitutions, review Contractor requests for payment, create a construction punch list, and monitor Contractor compliance with the construction documents and the punch list requirements.

2.3.8 Record Drawings

M&E will prepare construction record drawings, based on information furnished by the Contractor, and will submit one digital copy and one full-sized hard copy to the City for filing purposes.

TASK 3 - PILOT SYSTEM DESIGN

Following completion of the permanent building design effort, M&E will prepare a second set of detailed plans and specifications for installation of the pilot system equipment within that building. M&E will design the pilot system in accordance with the Ohio EPA-approved *DRWP Pilot Study Plan*. The pilot system will test 3 process trains, incorporating the following treatment processes:

- AquaDAF high-rate dissolved air flotation
- Actiflo® clarification
- Accelator® softening
- DensaDeg® sludge clarifier/thickener
- Ultrafiltration membrane treatment
- Reverse osmosis membrane treatment (both 4-inch and 18-inch membrane modules)
- Gravity filtration

The following basic assumptions have been used in developing this scope of services:

- The pilot system equipment will be housed in the pre-engineered metal building described under Task 2.
- The pilot system construction contract will be separate from the pre-engineered metal building construction contract. The pilot system construction contract will generally include the pilot system equipment, interior and exterior process piping and pumping facilities, a concrete floor for the pre-engineered metal building, interior chemical rooms and restroom facilities, and chemical feed equipment. The general contractor will be responsible for heavy equipment maintenance, equipment leasing, chemical supply for the duration of the study, and pilot system construction.
- The pilot system will be designed in conformance with the *DRWP Pilot Study Plan*, previously prepared by M&E and submitted to the City in December 2004. M&E anticipates only minor comments from Ohio EPA at this time.
- The pilot system equipment will be proprietary in nature and will be provided by the vendors as skid-mounted systems. M&E will specify the performance requirements for each unit process and will provide design details showing how each unit process is to be integrated into the overall pilot system. The vendors will design the skid-mounted systems.
- Treated water from the pilot plant will be discharged to the Scioto River. Sludge from the various unit processes will be directed to the existing DRWP sludge disposal system. RO concentrate will be discharged to the DRWP sanitary sewer. M&E will finalize the discharge approvals during the design phase and will hold bidding of the pilot equipment until the approvals are secured.
- Instrumentation and SCADA will be included with the pilot system. The skid-mounted systems such as the RO and others will be leased and will have their own onboard instrumentation and SCADA. This equipment will be returned to the vendors. Other instrumentation and SCADA will be required for the interconnecting systems and will be purchased and provided by the Contractor. This equipment will be owned by the City and will be available for salvage.

Task 3 will consist of the following subtasks:

- Pilot system preliminary design
- Pilot system final design
- Bidding services
- Construction administration services

3.1 Pilot System Preliminary Design

During the preliminary design phase, M&E will further develop the concepts that were created for the *Pilot Study Plan* including the process flow diagrams, system layouts and site piping routes. The following tasks comprise the preliminary design phase:

3.1.1 Kickoff Meeting

M&E will facilitate a meeting with City staff to review project objectives, design criteria, operational requirements, equipment preferences, control preferences, project constraints and schedule. The following M&E staff members will attend this meeting: project manager, technical director, and 2 project engineers. Prior to the meeting, M&E will prepare a draft agenda and list of desired data and documents. After the meeting, M&E will prepare and distribute meeting minutes.

3.1.2 Data Collection and Review

M&E will receive, log, review and file information furnished by the City, including: recent water quality data, as-constructed plans of the water treatment plant, plant schematics, and other pertinent, available information. It is assumed that record drawings of the water treatment plant and site are readily available and are of sufficient detail for design purposes. It is assumed that available and recent water quality data furnished by the City will be of similar form and availability to that provided during the Feasibility Study.

3.1.3 Technical Memoranda

M&E will prepare a technical memorandum to document project assumptions and memorialize decisions reached by M&E and the City.

3.1.4 Basic Design Data

The basic design data that was prepared as part of the *Pilot Study Plan* will be reviewed and finalized. The basic design data are used for equipment sizing and development of a process flow diagram.

3.1.5 Initial Equipment List

Concurrent with the development of the site layout and process flow diagram (PFD), an initial equipment list will be developed. Process equipment nomenclature will be established and identification numbers will be assigned. The initial equipment list may be expanded at a later date.

3.1.6 Process Flow Diagram (PFD)

The PFD is a diagrammatic layout of the treatment process components and the major interconnecting process piping. Mass balances for various design parameters will be

either reviewed or developed during preparation of the process flow diagram so that systems can be adequately sized.

3.1.7 Hydraulic Profiles

Hydraulic profiles will be developed in conjunction with preparation of the PFD. The hydraulic profiles will assist in determining the need for intermediate pumping systems.

3.1.8 Equipment Layout

A preliminary drawing will be prepared to locate treatment equipment, chemical feed systems, administrative areas, and routing of major piping systems.

3.1.9 Operation and Control Strategies

Preliminary operation and control strategies will be developed. The purpose of early development of these strategies is to: (1) define how the pilot system is to be operated, (2) determine instrumentation and control requirements, and (3) identify the need for and the extent of computer monitoring and control. The strategies will consider the following:

- Complexity of control--manual, automatic, or combination
- Functions to be monitored and/or controlled
- Central versus local control
- Recordkeeping or data logging requirements
- Special operation or maintenance considerations
- Possible ancillary equipment needs, i.e., surge protection
- Backup systems

It is assumed that that the system will be designed for primarily manual control and will utilize monitoring systems for detection of problems. M&E assumes that there will be automatic control of the raw water pumping. M&E assumes that there will be a minimal amount of control loops. M&E assumes that City staff will perform periodic checks of the system during unmanned times.

3.1.10 30 Percent Submittal

The overall submittal package will be identified as 30 percent complete. However, as is typical with any design project, certain disciplines will be more complete than others. Anticipated completion will be as follows for each design discipline:

1. Civil (site work, yard piping modifications): 30 percent.
2. Process / mechanical (pumps and piping): 30 percent.
3. Electrical single line diagrams: 10 percent.
4. Process and Instrumentation Diagrams (P & IDs): 10 percent.
5. HVAC: 10 percent.
6. Structural: 30 percent.
7. Architectural: 30 percent.
8. Specifications: Overall, the technical specifications at this stage will be 30 percent complete. Specifications will be prepared for the various sections using the CSI 16 division, 5-digit numbering system.

3.1.11 30 Percent Review Meeting

M&E will meet with City staff to verify that issues from the preliminary design phase have been addressed to the City's satisfaction. M&E will discuss general procedures for proceeding with the detailed design effort. The following M&E staff members will attend this meeting: project technical director, project manager and two project engineers. M&E will prepare and distribute meeting minutes.

3.2 Pilot System Final Design

The final design will be completed in accordance with the preliminary drawings, specifications, and finalized technical memorandum. The final design effort will produce three submittals: 60 percent, 90 percent, and 100 percent (bid ready).

Drawings will be prepared in AutoCAD, using City standards, as available. Specifications will be prepared in MS Word, using M&E standards and CSI numbering system. M&E will edit City-furnished General Provisions, as appropriate.

3.2.1 60 Percent Submittal

The overall submittal package will be identified as 60 percent complete. We anticipate completion will be as follows for each design discipline:

1. Civil (site work, yard piping modifications): 60 percent.
2. Process / mechanical (pumps and piping): 60 percent.
3. Electrical single line diagrams: 30 percent.
4. Electrical wiring and details: 30 percent.
5. P & IDs: 30 percent.
6. Structural: 60 percent.
7. Architectural: 60 percent.
8. Specifications: Overall, the technical specifications at this stage will be 60 percent complete.

3.2.2 60 Percent Opinion of Probable Construction Cost

M&E will prepare an updated opinion of probable construction cost at 60 percent completion.

3.2.3 60 Percent Review Meeting

M&E staff will attend one meeting with City staff to discuss and resolve City comments on the 60 percent submittal. The M&E project manager, technical director, and two project engineers will attend this meeting. We suggest that representatives of the City Operations and Maintenance (O & M) staff participate in this meeting so that the project design incorporates their input and preferences. M&E will prepare and distribute meeting minutes.

3.2.4 90 Percent Submittal

At this stage, drawings and specifications will be 90 percent complete. M&E will submit these documents to the City for final review and comment.

3.2.5 90 Percent Opinion of Probable Cost

M&E will prepare an updated opinion of probable construction cost at 90 percent completion.

3.2.6 90 Percent Review Meeting

M&E staff will attend one meeting with City staff to discuss and resolve City comments on the 90 percent submittal. The M&E project manager and two project engineers will attend this meeting. As with the 60 percent submittal, we suggest that representatives of the City O & M staff participate in this meeting so that the project design incorporates their input and preferences. M&E will prepare and distribute meeting minutes.

3.2.7 Permits and Approvals

M&E will request approval of the residuals disposal plan from the City of Columbus Division of Sewerage and Drainage, and the Ohio EPA Division of Surface Water. M&E will submit an application for a temporary NPDES permit for discharge of pilot plant treated water to the Scioto River. M&E has included an allowance of $4,000 to pay necessary permit fees for a temporary discharge of treated and overflow water to the river under a temporary NPDES permit issued by Ohio EPA. Additional fees will be paid using contingency funds as necessary. It is assumed that the General Contractor will pay the necessary building permit fees for construction of the pilot system, sewer capacity fees for discharge of membrane residuals to the sanitary sewer, and other permits as required. Additional fees will be paid using contingency funds as necessary. It is assumed that the General Contractor will pay for building permit fees during construction.

M&E will submit the detailed plans and specifications to the appropriate City departments for review and approval. These departments include the Building Department, Division of Water, Division of Sewerage and Drainage and the Division of Electricity.

3.2.8 100 Percent Submittal

The final plans and specifications will incorporate the City's comments on the 90 percent submittal.

3.2.9 100 Percent Opinion of Probable Cost

M&E will prepare an updated opinion of probable construction cost at 100 percent completion.

3.2.10 Quality Assurance / Quality Control

At the 30%, 60%, and 90% phases of the design, technical specialists within M&E will review the calculations, technical memoranda, drawings, and specifications and other pertinent documentation according to the project-specific quality assurance plan.

A preliminary list of anticipated drawings for the pilot system design follows.

Discipline	Title
General	
1	Title Sheet / Vicinity Map
2	List of Drawings / General Notes
3	Symbols and Abbreviations
Civil / Sitework	
4	Site Plan Index Sheet
5	Raw Water Line Plan and Profile
6	Product Water Line Plan and Profile
7	Product Water Line Plan and Profile
8	Concentrate Line Plan and Profile
9	Sludge Line Plan and Profile
10	Backwash Water Supply Line – Plan and Profile
11	Pump Stations - Details
12	Pump Stations - Details
13	Miscellaneous Details
14	Miscellaneous Details
15	Miscellaneous Details
16	General Notes
17	Erosion / Sediment Control Details
Architectural	
18	Legend, Abbreviations and General Notes
19	Floor Plan
20	Roof Plan
21	Building Elevations I
22	Building Elevations II
23	Door Schedule and Details
24	Miscellaneous Details
Structural	
25	Structural Notes
26	Floor Plan
27	Pump Stations
28	Sections and Details
29	Standard Details
30	Standard Details
Process Mechanical	
31	Floor Plan
32	Hydraulic Profiles
33	Sections
34	Sections
35	Sections

36	Piping Schematics
37	Piping Schematics
38	Piping Schematics
39	Piping Schematics
40	Piping Schematics
41	Break Tank Details
42	Break Tank Details
43	Chemical Feed Details
44	Chemical Feed Details
45	Chemical Feed Details
46	PFD Train 1
47	PFD Train 2
48	PFD Train 3
49	PFD AquaDAF
50	PFD Actiflo
51	PFD Accelator
52	PFD DensaDeg
53	PFD ZUF
54	PFD RO
55	PFD RO
56	PFD Gravity Filtration
57	PFD Residuals Disposal
HVAC	
58	Legend, Abbreviations & General Notes
59	Plans
60	Schedules and Details
Plumbing	
61	Legend, Notes, and Details
62	Plumbing Plan
63	Drainage Plan
64	Fire Protection
Electrical	
65	Electrical Symbols, Legend, General Notes
66	Electrical Site Plan and Connections to Existing Power
67	Raw Water Pump Station Electrical and Oneline Diagram
68	Pilot System Plan for Power and Instrument Circuits
69	Lighting and Systems Plan for Pilot Plant
70	Power and Control
71	One-Line Diagram From Permanaent Building
72	One-Line Diagram Pilot System
73	Panelboards and Lighting Fixture Schedule and MCC Elevation

74	Control and Fire Alarm Diagrams
75	Electrical Details
76	Pump Stations - Electrical
77	Conduit and Wire Schedule
Instrumentation and Control	
78	Legend
79	Architecture
80	SCADA Screen
81	Architecture
82	Central Panel Layout
83	P&ID Raw Water & Rapid Mix
84	P&ID Train 1 Part 1
85	P&ID Train 1 Part 2
86	P&ID Train 2
87	P&ID Train 3

3.3 Bidding Services

3.3.1 Plan Distribution

M&E will distribute the plans and specifications to interested bidders and other parties. M&E will maintain a list of plan holders. M&E will utilize the services of Key Companies to post the plans on www.plankey.com for viewing by interested bidders and other parties.

3.3.2 Prebid Meeting

M&E will conduct a prebid meeting. Due to the uniqueness of this project, the M&E project manager, project director, senior project engineer, and project engineerwill attend this meeting.

3.3.3 Bidders' Questions

M&E will receive and respond to bidders' questions. Written response(s) will be accomplished by addenda.

3.3.4 Contract Addenda

M&E will prepare up to 2 addenda to revise or clarify drawings and specifications in response to bidders' questions. M&E will forward the addenda materials to the registered plan holders via overnight delivery. If additional addenda are required they will be prepared using contingency funds, as necessary.

3.3.5 Bid Opening Meeting

The M&E project manager will attend the bid opening meeting.

3.3.6 Bid Tabulation

M&E will tabulate the bids for the pilot system construction contract and will include the bid tabulation with the recommendation for award.

3.3.7 Bid Recommendation

M&E will review the bids for responsiveness and will prepare and submit a recommendation for award.

3.4 Construction Administration Services

3.4.1 Preconstruction Meeting

M&E will conduct a preconstruction meeting. The M&E project manager, project director, senior project engineer and project engineer will attend this meeting. M&E will prepare the meeting minutes and distribute them to the appropriate parties.

3.4.2 Submittal Review

M&E will review shop drawing submittals and up to 1 resubmittals on each shop drawing. A submittal log will be maintained. If additional submittal reviews are required they will be conducted using contingency funds, as necessary.

3.4.3 Requests for Information

M&E will respond to the Contractors' requests for information (RFIs).

3.4.4 Change Order Review

M&E will review up to 2 change orders. If additional change order reviews are required they will be reviewed using contingency funds, as necessary.

3.4.5 Construction Progress Meetings

M&E will conduct 6 monthly progress meetings during construction of the pilot system. The M&E project manager and/or project engineer will attend these meetings along with M&E's construction observer. The M&E project director will attend 2 of these meetings at critical milestones during the construction of the system.

3.4.6 Construction Observation

M&E's designated subcontractor, Dynotec, will provide construction observation services for 520 hours. M&E has budgeted for one person to be on site for 520 hours. The total construction observation budget is 1040 hours. These services are intended to check for general conformance with the plans and specifications.

3.4.7 General Construction Administration

The City will issue the notice to proceed. M&E will respond to Contractor requests for substitutions, process Contractor requests for payment, create a construction punch list, and monitor Contractor compliance with the construction documents and the punch list requirements.

3.4.8 Record Drawings

M&E will prepare construction record drawings of permanent facilities, based on information furnished by the Contractor, and will submit one digital copy and one full-sized hard copy to the City for filing purposes.

TASK 4 - PILOT SYSTEM OPERATION

M&E previously developed a *Pilot Study Plan* (December 2004) for the City of Columbus Division of Water. The Plan was developed after completion of the *Condition Assessments* and the *Alternatives Evaluation*. M&E will operate the pilot system in accordance with the Ohio EPA-approved *Pilot Study Plan*. The treatment processes to be piloted include the following:

- AquaDAF high-rate dissolved air flotation
- Actiflo® clarification
- Accelator® softening
- DensaDeg® clarifier/thickener
- Ultrafiltration membrane treatment
- Reverse osmosis membrane treatment
- Gravity filtration

The principal operational objectives of the pilot study are:

- Determine finished water quality characteristics to ensure compliance with federal, state, and local regulations and customer acceptance, and develop a process for producing an acceptable finished water quality standard compatible with the existing finished water.
- Evaluate membrane pretreatment versus conventional pretreatment for RO desalination and subsequent impact on RO productivity.
- Evaluate the effect of operational parameters such as flux, recovery, and element hydrodynamics on RO permeate quality. Compare 4-inch RO systems to the Koch Megamagnum 18-inch system.
- Develop data on nitrate, atrazine, and DBP precursor removal through RO.
- Determine the cost benefit(s) of membrane pretreatment compared to conventional pretreatment by establishing capital, operational, and maintenance costs.
- Determine operational parameters for the full-scale plant upgrade.
- Evaluate and compare upgrade and expansion alternatives based on process performance

Pilot Test Alternatives

M&E will pilot test three treatment trains in parallel including the following treatment alternatives. The treatment trains are described and illustrated in greater detail in the *Pilot Study Plan*.

Pilot Testing Equipment Pilot Train 1 - Alternative 1

Pilot test high-rate AquaDAF dissolved air flotation, Accelator softening clarifiers, recarbonation, gravity filtration, reverse osmosis and remineralization. This equipment will operate continuously over a twelve-month period. Loading rates and operational parameters will be adjusted according to the *Pilot Study Plan*.

Pilot Train 2 - Alternative 2

Pilot Test Actiflo clarification, gravity filtration, reverse osmosis, and remineralization. This equipment will operate continuously over a twelve-month period. Loading rates and operational parameters will be adjusted according the *Pilot Study Plan*.

Pilot Train 3 - Alternative 3

Pilot test Zenon Zeeweed 500 followed by reverse osmosis and remineralization. Two reverse osmosis trains will be tested downstream of the Zenon process including a 4-inch-diameter system

and an 18-inch-diameter system (Koch Megamagnum). This equipment will operate continuously over a twelve-month period.

Residuals Disposal Systems

Operate systems to convey pilot products and residuals from the pilot system to the appropriate disposal locations.

M&E will provide the following services to operate the Dublin Road Pilot Plant.

4.1 Startup and Optimization

The general contractor will be responsible for acquiring, installing, field-testing, and initial startup of the pilot study equipment. Once the equipment is functional and operating, M&E will verify that the equipment is operating per specifications, instrumentation is online and calibrated, chemical feed systems are stocked and functioning, the field lab is operational, the SCADA system is functional, operators are trained, and that baseline performance is established. The equipment vendors will be responsible for assisting the contractor as required for system installation, startup, and optimization. M&E operating staff will be on site to monitor pilot system installation, startup, and optimization.

4.1.1 Set Up Field Laboratory

M&E will set up the field laboratory using equipment supplied by the Contractor. The purpose of the field laboratory is to conduct aqueous sampling to check system performance.

4.1.2 Conduct Jar Testing

M&E will conduct jar testing of raw water to determine initial operating conditions for the various unit processes.

4.1.3 Set Up Chemical Feeds

M&E will stock the chemical feed systems and will set up chemical feed rates for the various unit processes.

4.1.4 Calibrate Instrumentation

M&E will monitor the Contractor and vendors to ensure instrumentation is calibrated and ready for operation.

4.1.5 Hydraulic Testing and System Modifications

M&E will monitor the Contractor's efforts in performing system hydraulic testing and will monitor the Contractor's modifications should modifications be necessary.

4.1.6 SCADA Coordination

M&E will monitor the Contractor's efforts in starting, ensuring proper operation, and validation of the SCADA system.

4.1.7 Operator Training

M&E will participate in training sessions provided by the equipment vendors. City staff are encouraged to attend the vendor-sponsored training sessions.

4.1.8 Field Coordination

The M&E on-site senior project engineer will coordinate the efforts and progress between M&E field personnel and M&E office personnel to manage daily activities and ensure compliance with the project schedule, procure the necessary resources, and to facilitate startup of the pilot system.

4.2 Pilot System Operation - Field

M&E will operate the pilot system in accordance with the approved *Pilot Study Plan*. Operational duties generally include the following:

- Evaluate the impacts of disinfection on pretreated raw water quality and impacts on RO performance.
- Assess pretreatment system runtimes, cleaning frequencies, and cleaning methods.
- Conduct equipment maintenance, cleaning, chemical replenishment, equipment repair, membrane cleaning, data downloading, data analysis and interpretation, change system parameters depending on experiment and water quality characteristics.
- Establish optimum operational parameters for the various treatment processes.
- Determine the optimal design parameters that will generate stable system performance.
- Collect samples of waste streams and determine dewatering characteristics to develop data to be used in design of the full-scale facility.
- The analytical sampling and process monitoring will be conducted in accordance with the *Pilot Study Plan*. There will be three forms of analytical sampling and process monitoring including off-site analytical testing, on-site analytical testing, and continuous process monitoring via instrumentation. M&E will collect aqueous samples and deliver them to an Ohio EPA-certified laboratory for analysis.
- Conduct spiking studies of nitrate and atrazine per the *Pilot Study Plan*.

4.2.1 Weekday Operation

Because of the complexity of the study, the number of unit processes on site, and the desire to minimize downtime of the equipment, M&E will provide full-time, on-site operation. A maximum of 3 operators (an M&E senior process engineer and two engineers / operators) will each be on site 5 days per week, 9 hours per day.

4.2.2 Weekend and Holiday Operation

A maximum of two operators will each be on site 4 hours per day on weekends and holidays.

4.2.3 High Workload Operation

At certain critical phases of the study such as installation, initial optimization, cleaning, and sample collection, it will be necessary to provide additional operators on site. Operational assistance will be provided by subcontractors.

4.2.4 Miscellaneous Equipment and Supplies

M&E will provide miscellaneous equipment and supplies necessary for the onsite operating staff to operate the pilot plant, exclusive of consumables to be provided by the Contractor. Examples of equipment and supplies to be provided by M&E under the stipulated allowance include the following:

- Miscellaneous tools for equipment operation
- Analytical reagents and calibration kits for the onsite lab
- Protective clothing
- Health and safety equipment
- Office supplies

4.2.5 Decommissioning

M&E will provide personnel for pilot system decommissioning. General duties under this task include:

- Equipment dewatering and cleaning
- Chemical feed system cleaning
- Cleaning and packing of analytical equipment
- Salvage of valves, tanks, mixers, pumps, and other equipment for future use by the City. M&E assumes that the City will provide a list of those items the City wishes to retain, within four weeks prior to the cessation of pilot system operations.

The general contractor will be responsible for disconnecting, removing, and shipping of the various unit processes and other equipment not retained by the City.

4.3 Pilot System Operation – Office

In addition to the on-site personnel, a dedicated, full-time engineer will handle data downloading, data analysis and interpretation, report preparation, and other managerial duties.

4.3.1 Data Collection, Review, and Presentation

Data from on-site analyses will be recorded daily in a logbook, and then input into a spreadsheet file or database system for data analysis. The results from the certified laboratory will also be inserted into the spreadsheet as they become available.

It is assumed that a separate, independent SCADA system dedicated to the pilot system will be used to collect data from online instrumentation. Data from instrumentation will be digitally stored to the SCADA system, which will be transferred to spreadsheets or a database system on a routine basis for tracking and analysis.

Operating results and analytical data from each season of piloting will be summarized in a status report at the end of each season, for review by the state regulatory agency and the

City. Monthly technical memoranda that describe the monthly results and planned activities will also be prepared and presented to the City. Data analysis will include the following:

- Turbidity and particle removal through clarification and filtration,
- TOC removal through each unit process and pilot train,
- Algae removal through clarification,
- Hardness and TDS removal,
- Filter data (turbidity, particle counts, run times, UFRV, headloss profiles, spent washwater volumes),
- Assess removal of atrazine and nitrate,
- Membrane data (net driving pressure, flux and recovery data, cleaning frequency),
- Results of maximum and simulated distribution system DBP FPs,
- Tables summarizing other analytical results,
- Residuals data (TSS, pH, flow), and
- Brine data (TDS, conductivity, inorganic constituents, pH, flow).

The SCADA system will be configured for remote monitoring and alarm reporting, so that operators and office staff can remotely observe the operating data from the pilot plant.

4.3.2 Progress Meetings

M&E will conduct monthly progress meetings with the City during the pilot study and prepare and submit a monthly progress memorandum prior to each meeting. M&E will meet with the City and Ohio EPA after each piloting season to review the results.

4.3.3 Regulatory Approval

M&E will prepare and submit five copies of a draft pilot testing report which will detail the results of the pilot testing program. On the basis of the pilot tests, M&E (in conjunction with a project workshop conducted with the City) will recommend one or more process(es) for implementation. M&E will submit the draft report to the City for review. M&E will incorporate any City comments into the report and forward a copy to the Ohio EPA for review and approval.

M&E will meet with the City and Ohio EPA to review comments, to discuss the implementation plan and to obtain regulatory approval for the pilot test report. Final copies of the report will be forwarded to the City and Ohio EPA. Approval of pilot study results is required prior to construction of full-scale plant upgrades and/or expansions.

4.3.4 Report of Recommendations

M&E will prepare a final report summarizing a re-evaluation of the *Feasibility Analysis* according to results obtained through piloting. Specifically, the design criteria confirmed by piloting and O&M requirements will be used to re-evaluate present worth of the alternatives. This report will summarize the recommended process alternative, unit process loading rates, anticipated volume and quality of process residuals, anticipated finished water quality, anticipated operating and maintenance costs including power and

chemicals, and updated present worth costs. On the basis of that review a recommendation for the full-scale plant upgrade and expansion will be made.