



## **EXECUTIVE SUMMARY**

In 1990, the City of Columbus initiated the Water Beyond 2000 Feasibility Study in order to develop a plan to ensure an adequate, dependable water supply for the central Ohio communities served by the Columbus Division of Water. This study concluded that the current water use exceeded the safe yield of the existing supply system (130 mgd). The Feasibility Study recommended the development of five well sites near the South Wellfield to provide an additional 15 mgd safe yield during drought conditions as well as the development of the Upground Reservoir Project in northwest Delaware County.

The South Wellfield Project is currently in the final design phase for the first of the five new wells located near the Parsons Avenue Plant with construction to begin in 2006. Final design activities for the development of the remaining well sites are ongoing.

In September of 2004, the City contracted with a consultant team led by **ms consultants, inc.** to conduct the preliminary and final design activities for the Scioto River Upground Reservoir Project. The enclosed preliminary design report provides the basis for the preliminary reservoir site design, the evaluation of the alternative pump station locations and pipeline alignments for the Upground Reservoir Project. The detailed evaluation of population and water demand projections, alternative sources of supply and alternative reservoir locations were presented in the Water Beyond 2000 Feasibility Studies and Updated Reports.

### **Project Justification and Recommended Supply Augmentation Measures**

The existing supply sources do not have the capacity to meet the current demand during drought conditions. Furthermore, the City does not have an adequate supply to meet the current demand, even with emergency conservation measures. The actual usage rates recorded in recent years have been 144.6 mgd in Calendar Year 2000 and 141 mgd in 2004. The City is operating at a deficit as compared to the current safe yield of their supply sources, 130 mgd.

It was concluded that all of the water supply augmentation projects, listed in the 1998 Water Beyond 2000 Report, are still required to meet the City's water demand. Those improvements were projected to increase the overall system safe yield to 190 mgd. This additional supply will provide the water needed to meet the projected water demand of 185.2 mgd for year 2025.

### **Existing Sources of Supply**

The 1998 Water Beyond 2000 Report indicated a total system yield of 130 mgd with 111 mgd from all of the combined surface water reservoirs in the Columbus supply system and 19 mgd from the existing South Well Field. The planned expansion of the South Well Field will provide an additional 15 mgd safe yield resulting in a total system safe yield of 145 mgd.

The combined safe yield of the two existing Scioto River reservoirs (Griggs and O'Shaughnessy Reservoirs) was re-evaluated as part of the preliminary design due to the variability in previous



reservoir yield calculations and also due to the lack of previous accounting for seepage and evaporation losses. A consistent methodology was developed for use in the evaluation of the safe yield from the existing and from the proposed upground reservoirs, evaluating the Scioto River as the single supply source serving all five reservoirs. In the revised yield analyses, the yield from the two existing reservoirs was evaluated considering the two reservoir storage volumes individually, the system as a sequence of reservoirs managed in accordance with the City of Columbus operational guidelines. All previous yield studies of these two reservoirs have considered Griggs and O'Shaughnessy Reservoirs as a single combined storage pool.

The safe yield available from the two existing combined reservoirs during the one in fifty year drought conditions was calculated to be 49.7 mgd. This revised safe yield calculation would bring the total system safe yield to 142.7 mgd, 157.7 mgd following completion of the South Wellfield project. With the adjusted safe yields calculated for the Grigg's and O'Shaughnessy Reservoirs, the South Wellfield and Upground Reservoir Projects would increase the overall system safe yield to 202.7 mgd by year 2020. These revised calculations indicate that it may be possible to delay the construction of the third of the Upground Reservoirs to a later date.

### **Scioto River Supply Source Evaluation**

The supply source evaluations included the analysis of the historical stream flow at each alternative pump station (diversion) location through flow duration curve and daily mean stream flow plots. The impact of the proposed pumping rates on the flows within the river at each location was assessed and a preliminary diversion schedule recommended.

Pumping period model simulations were prepared to provide better understanding of the most likely river flow levels during pumping periods and of the volume of pumping that would be required to maintain the upground reservoir supply during both average and drought year conditions. As reflected in this analysis, the pumping required to maintain this proposed water supply in the Upground Reservoirs could be timed to occur during the extreme high flows in the river. This proposed pumping would not result in significant reductions of the river flow during pumping time periods.

In November, 2005, a proposed preliminary diversion plan specifying a required minimum release level at the diversion site was submitted to the ODNR for approval along with summary environmental documents on the project. Following detailed review of the environmental documents and the proposed diversion plan, ODNR submitted a written response recommending that the seasonal 80 percent duration flow be maintained in the stream as the minimum flow (24.1 cfs (15.6 mgd) during July through March; 100.5 cfs (64.9 mgd) during April through June).

### **Reservoir Siting & Design**

The three reservoirs are being designed on property, which the City purchased in northwestern Delaware County, with a small portion extending into Union County. The upground reservoirs are being sized and designed based upon updated safe yield and storage volume requirements,

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embankment stability analyses and construction methods determined from the subsurface investigations.

The one in fifty year safe yield of the entire combined Scioto River Reservoir System, during single year drought conditions, will be 110 mgd with the ODNR recommended minimum release levels from the diversion point. The combined Scioto River Reservoir System includes all three proposed upground reservoirs plus the two existing on-stream reservoirs, Griggs and O'Shaughnessy Reservoirs. This safe yield figure accounts for the 8 mgd that is to be provided to the Del-Co Water Company. The Upground Reservoir supply system will provide an additional 54 mgd of safe yield for the City bringing the total system safe yield to 218 mgd, including all existing and proposed sources.

The total system safe yield would be increased as follows through the stepwise construction of each of the Upground Reservoirs:

- 186 mgd with the construction of Reservoir 2
- 203 mgd with the construction of Reservoirs 2 and 3
- 218 mgd with the construction of Reservoirs 2, 3 and 1

The raw water pumping station required to supply water to the upground reservoirs will have a total pumping capacity of 160 mgd. The pump station will be designed with three 40 mgd pumps operating in parallel mode with the capacity for the fourth 40 mgd standby pump to operate, as needed to refill the upground reservoirs following extended drought periods.

**Reservoir Surface Areas and Storage Volumes.** Initial reservoir configurations and surface areas were established by locating the outboard toe of slope of each impoundment approximately 500 feet from any adjacent roadway or property line for each of the three sites. Reducing the embankment offset from 500 feet to 150 feet subsequently optimized the reservoir footprint for Reservoir Site 2. The design surface area of Reservoir 2 was thereby increased by nearly 20 percent, from 715 acres to approximately 857 acres with a storage volume of 9.6 billion gallons. The initial surface areas and storage volumes of 349 acres, 4.3 billion gallons and 398 acres, 4.4 billion gallons for Reservoir Sites 1 and 3 respectively, were determined without site optimization.

**Reservoir Geotechnical Conditions.** The subsurface conditions present at the three reservoir sites are acceptable for the construction of the upground reservoirs. However, due to the presence of shallow bedrock, shallow granular deposits and shallow groundwater, a synthetic liner will be required at each reservoir site. This liner is required to minimize seepage losses; soil piping; and the potential for the advancement of solution cavities in the underlying limestone bedrock. The exact type of liner will be evaluated during the final design of the reservoir.

The embankment will be constructed of properly compacted soil (structural fill), that can be excavated from the interior portions of the site. The embankment will have a minimum width of at least 15 feet to accommodate the crest perimeter service road, 20 feet in areas where significant traffic is considered on the embankment. Rock channel protection will be placed starting at the inboard crest elevation and extended down to 20 feet below the normal pool elevation.



**Reservoir Site Preparation.** Prior to construction, all remaining structures within each reservoir site will be demolished and removed from the site. The basement floors, garage floors and foundation systems will be excavated and removed from the site. Basements extending below the proposed reservoir bottom, will be backfilled and compacted with cohesive structural fill.

**Reservoir Site Drainage.** Surface water creeks, streams, swales and agricultural ditches will be diverted around the proposed footprint of each upground reservoir to permit the passage of the design storm without impacting adjacent property owners. New perimeter ditches will be provided on each reservoir site to intercept subsurface tile drainage and surface drainage that currently flows through and over each reservoir surface area. The perimeter ditch drainage design for each reservoir site will incorporate the use of two-stage ditch sections as much as practicable. It is anticipated that there will be areas where insufficient City owned land beyond the toe of slope exists to provide for the two-stage ditch design. In these areas, a linear trapezoidal channel will be required.

**Reservoir Inlet/Outlet Structures.** A 72-inch diameter transmission pipeline will be provided linking the three reservoir sites. Individual inlet and outlet pipes will be extended from this transmission pipeline to each reservoir, with 72-inch isolation valves provided to direct flow into or out of any of the reservoirs. The valves will allow the reservoirs to be filled and topped off individually due to the staged construction and variation in pool elevations.

The outlet structure of each reservoir will be a rectangular cast in place concrete structure with multiple openings equipped with sluice gates at varying depths. The actual rate of release from each reservoir will be controlled via a valve at the river outlet structure.

**Reservoir Operation, Maintenance and Inspection Facilities.** A 16-foot wide aggregate access road will be provided from the public road right-of-way to the outboard toe of each reservoir. At a minimum, a single lane boat launch ramp will be provided for maintenance purposes at each reservoir. A twelve-foot wide aggregate roadway will be extended around the perimeter of the reservoir crest for the purposes of maintenance and site inspection.

**Reservoir Site Security.** The general recommendations of Columbus' Vulnerability Assessment will require that the majority of each reservoir site have restricted access, with perimeter fencing with gated access for authorized personnel only. In addition, video cameras will be installed to provide 24-hour remote surveillance of the site.

**Recreational Facilities.** Numerous recreational opportunities have been evaluated at the reservoir sites. Public consensus should be obtained relative to construction of recreational facilities recommended to be located in the northeast portion of Reservoir Site 2, outside the security perimeter fence. It is proposed that this land will then be leased to Preservation Parks of Delaware County. Specific elements of the recreational area are currently envisioned to include:

- Access drive & parking area;
- Shelter-house with adjacent restroom facility;
- Well and mound treatment system;
- Playground area;



- 10 foot wide asphalt multi-use trail, encircling park facilities and approximately 2 miles in length;
- Two separate ponds on either side of Ottawa Creek to be created from reservoir embankment borrow areas. At least one pond will include bird nesting islands. Observation and fishing platforms/piers to be provided, with signage prohibiting bank fishing;
- A nature trail will traverse Ottawa Creek and the two ponds.
- At least two warm season prairie grass restoration and wildlife areas will be provided on the park site (estimated 10 acres);
- Observation Tower or elevated platform will be provided to view both park and reservoir water body;
- Educational boards along trails.

Additional recreational opportunities could also be considered for Reservoir Site 1, which could support a much larger prairie restoration project, and a multi-use trail linking Reservoir Sites 1 and 2 to a proposed canoe livery at the confluence of Scioto River and Ottawa Creek. A pedestrian bridge or at-grade crossing of Mooney Road would be recommended to link the two reservoir sites.

It is also recommended that a new public canoe access point to the Scioto River be provided downstream of the preferred raw water intake and pump station to provide unobstructed travel to the next public access point at the Mill Creek confluence at Bellpoint. A possible location for this access point, which must have an area for off-street parking, is land currently owned by the City of Columbus near the confluence of Scioto River and Ottawa Creek, east of SR 257. If recreational facilities are incorporated into the Reservoir 1 sitework at the time it is constructed, a pedestrian crossing of SR 257 would be needed to link it to this canoe access site.

Any recreational facilities located at the reservoir will have hours of public access limited to daylight hours only. Park District Rangers and/or local law enforcement agencies will routinely patrol any developed park sites.

### **Raw Water Pump Station Alternative Locations**

Three alternative raw water pump station sites were identified by the City to receive detailed consideration. The major evaluation criteria included the availability of surplus water at each location during the high flow periods, adequacy of stream pool depths for pumping operations, environmental constraints, availability of adequate electrical power, and the probable construction and operation costs. The alternative evaluations of each site included evaluation of the costs/benefits associated with the use of soft start synchronous motors as compared to VFD pumps with induction motors.

Regardless of the pump station location, the conceptual design for the pump station building will include a recessed wet well design employing vertical turbine style pumps in multiple bays, protected by traveling water screens. Two wet wells will be provided, each containing two pumps. A sluice gate will be included between the wet wells to provide flexibility in operation of the screens and pumps. Four vertical turbine raw water pumps, each rated at 40 mgd @ 100'

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TDH will be required. Two 10-foot wide by 39-foot tall traveling water screens are proposed to capture debris and for fish recovery. The screens will be equipped with special fish capture baskets and have 3/8-inch openings of stainless steel wire mesh.

The pump station building will be masonry construction (block and brick) with a barn-like exterior treatments designed to fit into the rural setting. The shell will be sized as 71' x 130' with a high ceiling center area for a bridge crane to function for pump removal. A roof system utilizing galvanized metal trusses with galvanized interior liner panels is proposed, with gabled peaks covered with a preformed metal roofing system. Vandal resistant doors and windows and skylights for screen removal are proposed and have been included in the pump station cost estimates. The SCADA system will be used to transmit data from the pump station through radio communications compatible with the City's current hardware and software platform. In addition to controlling (level, pressure, flow sensors), monitoring and reporting on the equipment at the pumping station and intake, several process instruments to record basic water quality data are proposed for the raw water pump station and have been included in preliminary cost estimates.

**Hoskins Road Raw Water Pump Station, Site 1.** The general location for this intake and pumping station alternative would be between SR 257 and the Scioto River, north of Hoskins Road, south of Curren Road. An inflatable weir has been proposed to create the diversion pool for this pump station location. The inflatable weir will be completely deflated whenever pumping is not required for the water supply diversion.

The preliminary design recommended an inflatable weir having a length of 150 feet and rise of 5 feet-9 inches creating a 5,500-foot backwater, with an approximate supply pool of 109 acre-feet of water. Due to an auto-deflate feature, water levels will not exceed 8 feet, which is commensurate with a 2-year storm event or less.

The conceptual design for the intake structure would be a shore intake beginning with an open concrete channel section, transitioning to a buried pipeline approximately 300 feet from shore. A small jetty on the upstream face of the shore intake will protect the cross-section from major debris. A coarse bar rack with 3-inch openings located approximately 300 feet from the intake would be proposed along with a traveling monorail type mechanical trash raking mechanism.

Based on the operating conditions currently developed for this location, each pump would require a 1,000 HP motor, with the voltage to be rated at 4160 volts 3 phase. The feasibility of reducing the motor voltage rating to 480 volts will be evaluated as part of the overall system design progresses. Electrical service will be provided to Site 1 by Consolidated Electric Power Company. Both arrangements of soft starters with synchronous motors and Variable Frequency Drives (VFDs) with induction motors have been evaluated. The preliminary design report proposed that two 5,000 KVA transformers will be placed on the site. Each transformer will be sized to provide 100% of the connected motor load. This redundant arrangement is recommended to provide a higher degree of reliability in case one transformer fails or needs to be serviced when pumping operations are required.

The majority of construction at Pump Station Site 1 will be above the 100-year flood elevation of 906 feet MSL. Access to the site would be directly from SR 257 for construction as well as for permanent use. A 24-foot wide asphalt roadway would be proposed to provide the access to

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the pumping station. Security gating and fencing would be included around the main building area only. For added facilities security, remote monitoring of the pumping station site from the Dublin Road WTP with closed-circuit video cameras is anticipated.

The general public can access the Scioto River with personal watercraft from the eastern bank of the Scioto River off Gast Road and just downstream of the Prospect Dam. This access point is approximately one mile upstream of the proposed inflatable weir location. As part of the final design for this alternative, consideration must be made for placing signage upstream of the inflatable weir to advise canoeists that the weir is ahead. When the weir is inflated and the pump station operational, boaters must portage their canoe using a trail to be placed on City owned property.

Electrical heating, an individual, residential-type water well, and an on-lot septic tank/leach field type system are recommended as the on-site utilities. Site drainage would consist of swales/ditches and buried storm sewers with drainage directed to the river.

**Mill Creek Raw Water Pump Station Location, Site 2.** The general location for this intake and pumping station alternative would be immediately north of the confluence of Mill Creek with the Scioto River. The proposed raw water intake would be situated at the riverbank approximately 50 feet from the pumping station. Withdrawal at Pump Station Site 2 would be from the backwater of the O'Shaughnessy Reservoir, which should provide better water quality and a more predictable water level compared to Site 1. The wet well would be designed to provide the additional recession depth needed to create the same backwater depths created by the inflatable weir.

The conceptual design for the intake at this alternative site is a shore intake, beginning with an open concrete channel section. A small jetty on the upstream face of the shore intake will protect the cross-section from major debris. A coarse bar rack with 3-inch openings located at the expanded area of the intake adjacent to the pumping station would also be proposed at this location, along with a traveling monorail type mechanical trash raking mechanism.

With the pump station sited at this location, each pump will require a 2,500 HP motor, with the voltage to be rated at 4160 volts 3 phase. The motors are estimated to draw 2250 KVA each or a combined 6750 KVA running load. Primary Service provided by First Energy would be dropped through redundant 12,000 KVA pad mounted transformers, sized to provide 100% of the connected motor load and located on the pump station site. The incoming primary power would be rated at 12,470 or 23,000 volts.

All construction at Pump Station Site 2 would be in the 100-year flood plain, below elevation 861 feet MSL. Construction at this site would therefore require placement of fill within the floodplain to raise the access roadway and building structure above the base flood level. Access to the site would be provided from Bellpoint Road for construction as well as permanent use. A 24-foot wide asphalt roadway is proposed to provide access to the pumping station with a gravel road providing access to the shore intake. Security gating and fencing would be included around the main building area only.



Electrical heating, on-lot septic tank/mound system and Del-Co Water service would provide the on-site utilities. Site drainage will consist of swales/ditches and buried storm sewers with appurtenance inlets.

**Owls Point Pump Station Location, Site 3.** This alternative pump station location was sited on City owned land known as Owls Point, located on the east bank of the O’Shaughnessy Reservoir, approximately 6,000 feet south of US 42. Key features of this site included perceived advantages of increased supply pool depth, increased river flows due to the downstream location, primary electrical power transmission lines traversing the site.

This site was screened from detailed consideration based upon initial findings relative to the lack of available and accessible energy supply, the presence of wetlands and 100-year floodplain, in addition to the need to cross the river with the large diameter pressure main to fill the reservoirs.

#### **Pipeline Alignment Alternatives**

A network of pipelines and flow control structures or valves will be required for the raw water pump station to fill any of the three proposed reservoirs and to link the reservoirs to the existing Del-Co Water properties and the City of Columbus supply system. Alternative alignments for the network of pipeline and flow control structures were evaluated. The ultimate goal is to have the release pipeline routed to a location in the river where the City owns the riparian corridor, near the O’Shaughnessy Reservoir.

For each of the two pump station locations, pipeline routings were identified and evaluated based upon the following factors: topography, subsurface conditions, right-of-way availability, roadway reconstruction requirements/constraints and inconvenience to the general public and local residents. Pump Station Site 2, near O’Shaughnessy Reservoir, would specifically require that the pipeline function both as a “fill” and “release” pipeline for nearly the entire length.

For the alignment evaluation process, the overall pipeline network was divided into three geographic segments. The **northern segment** included any interconnecting piping north of the Del-Co connection point, all reservoir inlet, outlet and interconnection piping. Two sub-alternative alignments were identified within this northern segment, an eastern and western alignment. The **central segment** included the portion of pipeline routed between the Del-Co connection point and SR 36. The **southern segment** included the pipeline segment south of SR 36 to alternative release points or to raw water Pump Station Site 2.

**Pipeline Alternatives with Raw Water Pump Station Site 1, Hoskins Road.** The northern segment would function to fill the reservoirs, as well as provide emergency drawdown and release water to meet water supply needs of the City and Del-Co. The central and southern segments would function solely as a release pipeline.

An eastern alignment along SR 257, Option 1B, would provide the most direct alignment between the reservoirs and the discharge location. A large portion of the pipeline in the vicinity of the reservoirs could be constructed within City-owned land. However, south of Smokey Road, the pipeline would have to be installed in ODOT right-of-way or within a permanent easement.

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The central segment would continue south along SR 257 requiring bored and jacked/tunneled crossings of SR 37 and SR 36. The southern segment would then continue south, approximately 10,500 LF from SR 36 to the City's riparian rights corridor near the Fry Road intersection. This section will require 4,000 feet of pipeline in deep tunnel and another bored/tunneled crossing of SR 257 near Fry Road. Property acquisition would be required for the release and outlet structure at this location.

A 72-inch diameter pipeline is recommended for the northern segment for both the pump station and pipeline segments. A 66-inch pipeline was found to be sufficient for the central and southern pipeline segments south of the Del-Co property. The total length of this alignment was approximated at 54,200 LF. Pre-stressed concrete cylinder pipe is recommended for this pump station and pipeline alignment option.

If routed entirely within easements, parallel to SR 257, this alignment would require 43 easements in the northern segment, 42 easements for the central segment and 12 for the southern segment. There are several structures located very close to or within the right-of-way of SR 257 in the central section, which may require property acquisition.

As an alternative, installing the pipeline entirely within public right-of-ways and within a 4-foot clear distance from the edge of existing pavement was also evaluated. The existing right-of-way width for SR 257 is in most cases 60 feet. A horizontal alignment entirely within this and outside the influence zone of the pavement was considered to be unlikely for the entire project length. Consequently, the pipeline routing evaluation assessed the feasibility of constructing the pipeline near or within the edge of pavement, and formulated costs to replace either one lane of travel, or the entire pavement section, "in-kind".

One alternative looked at the feasibility of constructing the pipeline using a 4-foot clear distance between the edge of existing pavement and the outside of pipe. It was found by doing this, only one structure would be impacted. In this case, it would be necessary to dismantle the front deck during the construction in that area. The construction contract could specify that the contractor build a new deck for the homeowner to replace the existing structure once the pipeline was installed beyond this location.

A western alignment, Option 1F, was evaluated to provide an alternative route outside the SR 257 right-of-way for a significant portion of the northern pipeline segment. Following this alignment, approximately 22,500 LF of pipeline length would be removed from the ODOT right-of-way along SR 257. The length of the western alignment within the northern segment would be 2,265 LF longer than the eastern alignment, bringing the total budgetary length to 56,500 LF. Western alignment alternatives for the central and southern segments of the pipeline were reviewed and determined to not be feasible. The western alignment of the northern segment would require 17 easements, 42 easements for the central segment and 12 easements for the southern segment.

**Pipeline Alternatives with Raw Water Pump Station Site 2, Mill Creek Area.** With this alternative pump station, the pipeline must have the capacity to "fill" the proposed reservoirs at the desired pumping rate as well as to "release" the water to meet the supply requirement for the City. The pipeline routing for this alternative was consistent with that proposed for the Hoskins



Road Pump Station with variations to the southern segment to provide access to the pump station location. Two alternative alignments were evaluated to provide access to the Mill Creek Pump Station at O'Shaughnessy Reservoir.

The first alignment parallels Bellpoint Road from the pump station to SR 257, follows SR 257 to Fry Road. Options 2A and 2C reflect this alignment in combination with the eastern and western alignment options within the northern pipeline segment. Due to the proximity of structures along this segment of SR 257, a second alignment was evaluated. This alternative alignment would locate the pipeline within City owned property, approximately 30 LF off the west of the property line. Options 2B and 2D reflect this alignment again in combination with the eastern and western alignment options within the northern pipe segment. These second alignments eliminate the need for easement requirements and/or major pavement replacement but may have additional environmental considerations.

It was determined that as a minimum a 72-inch pipeline would be required for the entire length with this pump station location. Due to high pressures within the line, the use of pre-stressed concrete cylinder pipe is recommended. In addition, several air and vacuum release valves would be recommended at locations, which will be determined through surge analysis to determine water hammer effects. It was recommended that with this alternative pump station location, the pipeline remain full to minimize operational problems with long start up procedures associated with filling a dry pipeline of this size and length.

### **Environmental Evaluations**

Numerous environmental evaluations have been conducted and are on-going as part of the evaluation and design of this project. The following environmental studies have been conducted to document existing conditions at the reservoir sites, the pump station sites and along the alternative pipeline alignments.

### **Reservoir Sites**

**Cultural Resources.** As the project requires a 404 Permit from the U.S. Army Corps of Engineers, Section 106 of the National Historic Preservation Act (NHPA) of 1966 will apply. Literature reviews and field surveys were conducted at all three reservoir sites. Reservoir Sites 1 and 2 both have previously recorded Ohio Historic Inventory (OHI) and Ohio Archaeological Inventory (OAI) sites. No OHI or OAI sites were previously recorded at Reservoir Site 3.

In August of 2005, the Phase 1 Cultural Report for Reservoir Site 3 was completed and submitted to the OHPO. The conclusions were that three of the newly identified archeological sites are recommended for further work if they are to be affected by the proposed construction.

The Phase I Cultural Resources Report for Reservoir Site 2 was completed in April of 2006. The report concluded that a cluster of five sites, 33DL2055 and 33UN402-405, along with 33DL2116 were potentially eligible for the NRHP and that additional study is recommended. The results of the field survey on Reservoir 1 will be submitted at a



later date in an addendum. However, the draft findings identified four potentially eligible sites on Reservoir Site 1.

The recommended Phase II studies will be performed only for Reservoir Site 2 during the summer of 2006, with others at a later date.

**Aquatic Resources.** All three reservoir sites are being evaluated for potential short-term construction impacts and long-term operational impacts to the streams. Field investigations determined that Ottawa Creek and three other jurisdictional streams are located on the reservoir sites. The impacted streams would include:

- Reservoir 1 – Impacts up to 3,000 LF of Stream 7 and 4,000 LF of Stream 8
- Reservoir 3 – Impacts up to 3,400 LF of Stream 3

Ottawa Creek could also be impacted by the construction and operation of the reservoirs. The stream and wetland impacts for the construction of the reservoirs will exceed the criteria of the “Nationwide Permit” program. Therefore, the project will proceed under the “Individual Permit” program, and will require both a Section 404 permit from the USACE and a Section 401 Water Quality Certification from the Ohio EPA.

Since the construction of the reservoirs will result in impacts to “Water of the United States” remediation and mitigation will be required as part of the 404/401 permit process. To date, there has been no detailed analysis of stream mitigation opportunities.

**Wetlands.** Field surveys to delineate wetlands were completed in November of 2004 for all three of the reservoirs sites. Based on preliminary results, development of the reservoir sites could have the following impacts:

- Development of Reservoir Site 1 would impact about 0.9 acres of Category 1 (low quality) wetlands.
- Development of Reservoir Site 2 would impact up to 7.3 acres of Category 1 and 0.1 acres of Category 2 (moderate quality) wetlands.
- Development of Reservoir Site 3 would impact up to 7.1 acres of Category 1 and 1.2 acres of Category 2 wetlands.

The USACE and the Ohio EPA will require mitigation for the anticipated losses. Mitigation will vary based on the category of wetland, and whether mitigation is done on-site or off-site using mitigation banking. The exact mitigation will be identified during the 404/401 permitting process and could include the creation/restoration of wetlands, wetland banking, and/or conservation easements to protect high quality wetlands.

**Terrestrial Resources.** According to the U.S. Fish and Wildlife Service, Delaware County and Union County are within the range of two federally-listed terrestrial species. The species are the Indiana Bat (*Myotis soadalis*) and the Bald Eagle (*Haliaeetus lauccephalus*). In the winter of 2005-2006 a pair of Bald Eagles began nesting in an old Herron rookery along the Scioto River within the project area. Since this a protected



species the FWS has been contacted and coordination will be ongoing during the design phase.

Each of the three reservoir sites has been surveyed for Indiana Bat habitat and each reservoir has trees that could be potential habitat for this endangered species. Coordination with the U.S. Fish and Wildlife Service (USFWS) will be conducted as part of the 404/401 permit process. In most cases, the USFWS will allow you to remove trees between September 15<sup>th</sup> and April 15<sup>th</sup>. However, should they determine that significant habitat exists, additional surveys may be necessary to determine if the Indiana Bat is present and actively utilizing the habitat. Should the Indiana Bat be present in large numbers, further coordination with the USFWS would be required.

**Hazardous Materials.** No parcels were identified with hazardous materials within the three reservoir sites. However, a limited building survey is recommended of buildings to be demolished within each reservoir prior to construction.

#### **Raw Water Pump Station Locations**

**Cultural Resources.** Detailed fieldwork in the Phase I Cultural Resources Study of Pump Station Site 1 found one archaeological site that may be potentially eligible for the NRHP. The OHPO has reviewed the Phase I Study and concurred that a Phase II Study should be implemented at this location. The Phase II Study was completed in April of 2006 and concluded that the site is not eligible for the NRHP and that no additional work would be recommended. OHPO has concurred with the findings.

Two sites were found at Pump Station Site 2 but neither of the sites was considered eligible for the NRHP. Therefore no further study is currently recommended at the site.

**Aquatic Resources.** No streams are present at either pump station site. However, the pump stations will be withdrawing waters from the Scioto and in the case of Pump Station Site 1, an inflatable weir will be constructed in the Scioto River to create the diversion pool.

Field studies completed in five sampling sites in the Scioto River indicated that the Scioto River achieved the warmwater criteria in all locations except the proposed location for the inflatable weir. The sampling at the location for the inflatable weir indicated that the criterion for habitat diversity was not attained and that this site did not meet the warmwater habitat designation. Field studies also indicated that no mussels or aquatic species of concern were identified in these locations.

Impacts will occur during the construction and operation of the inflatable weir and pump station. With careful mitigation the construction impacts should be temporary and the aquatic communities should be able to recover quickly. The operation of the inflatable weir will result in impacts to the communities of the Scioto River. However, these impacts will be considerably less than the installation of a permanent impoundment on the river. The inflatable weir will lie flat on the riverbed and will not impede normal water flow when deflated. The weir will only be inflated during high flow conditions and will bypass the ODNR recommended minimum release flow around the structure



when pumping occurs. The proposed inflatable weir will require permit approval and will be addressed in detail during the 404/401 permit process.

To date no field studies have been completed at Pump Station Site 2, as the feasibility of this location is dependent on the resolutions of the constraints related to the pipeline routing.

**Wetlands.** No wetlands were recorded on the pump station sites.

**Terrestrial Resources.** As stated previously a Bald Eagle nesting site is located in this portion of Delaware County and coordination is ongoing with the FWS.

The field studies on Pump Station Site 1 did identify trees that could provide habitat for the Indiana Bat. The trees are located along the riparian corridor of the Scioto, in the woods on the northern portion of the City property, and isolated trees are found along the fence rows. Limited tree removal and removal during winter months would help avoid impacts to the Indiana Bat. Further coordination with the USFWS will occur during the 404/401 permit process.

As mentioned previously, field studies are on hold for Pump Station Site 2.

**Hazardous Materials.** Based on the review of historic information, visual observation and aerial photography, it was concluded that no parcels of interest are located on either Pump Station Site 1 or Site 2.

### **Alternative Pipeline Alignments**

**Cultural Resources.** There are seven OHI sites along SR 257 between Reservoir Site 3 and Bellpoint. Of these, two are National Register properties. Care will be taken during design and construction to avoid any impacts that would “change the character” of the sites.

It is currently anticipated that the pipeline corridor would include the road right-of-way and 50 feet out on each side. Since the additional 100 feet would be on private property and right of entry letters would be required, this additional field work is being delayed until the alignments are further refined.

**Aquatic Resources.** Field studies were conducted in August of 2005 along the pipeline alignments to determine the quality of any streams that the alignments might cross during construction. The impacts from any stream crossings will be included in the overall mitigation plan prepared as part of the 404/401 permit process.

The construction and use of the outlet structure that returns stored water from the reservoirs to the Scioto River can directly and indirectly impact the Scioto River. Some of these impacts will be permanent while others will be temporary. The footprint of the outlet structure may produce direct/permanent impacts due to the inevitable placement of impervious structures into the Scioto River. In addition, the construction of these



structures can produce direct/temporary impacts in the form of increased silt/sediment transport downstream.

Other potential stream impacts that can result from the use of the outfall structure include changes in water temperature and in dissolved oxygen levels. Several measures are proposed to reduce the project's impacts on these stream characteristics and fish resources. The stored water, as it moves from the upground reservoir via the long buried pipelines to the outlet structure, will have temperatures commensurate with that of groundwater prior to discharge. In addition, the outlet structure will utilize step cascade aeration to re-oxygenate flows to adequate levels prior to entering the Scioto River. Finally, it is proposed that a gradual increase in the rate of flow returned to the Scioto River over a number of days to reach the desired rate versus an instantaneous higher rate release. This operational strategy will allow time for the aquatic habitat to become acclimated to the flow regime and minimize the potential for dramatic changes in temperature and dissolved oxygen levels.

**Wetlands.** Areas of concern would include the crossing near Fulton Creek, the segment of alignment from Donovan Road to the back of the Del-Co property and the Del-Co parcel itself. Once the alignment is further refined, the impacts can be detailed as part of the 404/401 permit process.

**Terrestrial Resources.** A Bald Eagle nesting site is located in this portion of Delaware County and coordination is ongoing with the FWS.

Field biologists have evaluated the area and concluded that no large pockets of Indiana Bat habitat exist along the alignments. Pipeline design should be able to avoid the limited number of isolated trees that were found.

**Hazardous Materials.** Based upon the review of regulatory documentation, historical information, visual observation, and aerial photography eight parcels were identified in the ESA screening as warranting Phase I ESA investigations. Of these, three were junkyards in the area where the pipeline would be tunneled. These parcels would therefore not be recommended for Phase I ESA investigation.

### **Permit Requirements**

This project as a whole will require the following permits/approvals as part of the final design process:

#### Federal Agencies

US Army Corps of Engineers

- Clean Water Act Section 404 Permit(s)

#### State Agencies

Ohio EPA- Division of Drinking and Groundwater

- Reservoir Construction Permits for each reservoir site;

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- Pump Station Construction Permit;
- Construction Permits for each Pipeline Phase;

Ohio EPA- Division of Surface Water

- Clean Water Act Section 401 Water Quality Certification;
- Stormwater permits for each project element;
- Permit to Install for Sewage Disposal System at Pump Station

ODNR

- Dam permit from the Division of Water for each reservoir site;
- Registration to withdraw in excess of 100,000 gpd per ORC 1521.16;
- Permit for major increase in withdrawal of waters of the state per ORC 1501.33 and 1501.34;
- Division of Watercraft coordination on Canoe Access/Portage areas along Scioto River in vicinity of inflatable weir.
- Floodplain permits;

ODOT

- SR 257 Access Drive Permits for Reservoir Site 3, Pump Station Site 1 and the Canoe Access along Scioto River
- SR 257 Perpendicular/Longitudinal occupancy permits for each Pipeline Phase

Local Agencies

Delaware County

- Building permits from Delaware County;
- Agreements/permits/bonds/inspection fees for construction haul routes using County Roads
- Agreements/permits/bonds/inspection fees for perpendicular/longitudinal occupancies of County Roads for pipeline construction
- Drainage, Erosion and Sediment Control, (DESC) permit and fees, administered by the Delaware County Engineer.
- Agreements/plan review and comment/inspection fees for surface and subsurface drainage improvements by the Delaware County Soil and Water Conservation District;

Union County

- Agreements/permits/bonds/inspection fees for construction haul routes using County Roads
- Agreements/plan review and comment/inspection fees for surface and subsurface drainage improvements by the Union County Soil and Water Conservation District;

Thompson & Radnor Townships

- Agreements/permits/bonds/inspection fees for construction haul routes using Township Roads
- Agreements/permits/bonds/inspection fees for perpendicular/longitudinal occupancies of Township Roads for pipeline construction



## **Costs Estimates**

The estimates of the projected construction costs presented in the Preliminary Design Report have been presented for the purposes of project budgeting and alternative comparison and selection. The cost estimates will be refined periodically based upon subsequent refinements to the design. Consequently, a contingency factor of 10% has been included in each of the estimates to account for future circumstances that may alter the actual construction cost.

**Reservoirs.** The total estimated cost for reservoir construction was \$57.2 million, \$93.5 million, and \$51.3 million for Reservoirs 1, 2, and 3, respectively. These figures have been projected to year 2008 dollars and included the costs for the earthen embankment construction, installation of the synthetic liner, rock channel protection for the inboard slope, seeding of the outboard embankments, surface and subsurface drainage, inlet and outlet piping, operation, maintenance and inspection facilities. There are no easements or additional property acquisition costs associated with the reservoir site construction.

**Raw Water Intake and Pump Station.** The total estimated cost for the raw water pump station alternative and intake facility was \$16.6 million and \$17.3 million for Pump Station Site 1 with soft start synchronous motors and with VFD pumps with induction motors, respectively. At Pump Station Site 2, the total estimated cost for the raw water pump station and intake facility was \$12.8 million and \$13.7 million with soft start synchronous motors and with VFD pumps with induction motors, respectively. These figures represent budgetary estimates including costs for site work, intake structures and piping, the pump station structure, screening and pumping equipment, plumbing, HVAC, primary electrical transmission facilities, as well as on-site transformers, switchgear and power distribution equipment. The anticipated property acquisition costs have been included in the estimates.

**Interconnecting Pipelines.** Numerous pipeline routing alternatives were identified and evaluated for the interconnection between the two alternative pump station sites and the reservoir sites. Costs are presented in the preliminary design report both as total estimated cost for each segment and as the dollar per linear foot basis. The least cost option for Pump Station Site 1 was the eastern alignment, Option 1B (construction in easements), with a total estimated cost of \$47.1 million. The least cost option for Pump Station Site 2 was the eastern alignment, Option 2B (construction within easements), with a total estimated cost of \$51.5 million.

**Operation and Maintenance Costs.** Annual costs for operation and maintenance of the facilities will include costs such as labor, chemicals, and electricity. The electrical costs associated with operating the raw water pumps will be different at the two proposed locations. These costs also represent the most significant operation and maintenance cost for this project. In order to make an economic comparison between the pumping arrangements, a present worth (PW) analysis was conducted for both 20-year and 50-year evaluation periods. The annual operation and maintenance costs, as well as equipment and infrastructure replacement and salvage value costs were used for the present worth analysis. The least cost alternative in both the 20 and 50-year planning horizon was Pump Station Site 1 with soft starter synchronous motors.



## **Conclusions and Recommendations for Final Design**

### **Reservoir Site Design**

- The installation of a synthetic liner is recommended at each reservoir site due to the consistently shallow granular soils, high groundwater levels and karst geologic conditions.
- Reservoir Site 2 is recommended as initial project for construction.
- Reservoir Site 3 is recommended as the second project for construction, provided the additional preliminary geotechnical and environmental evaluations have been completed without significant issues being identified.
- Reservoir Site 1 is proposed as the final reservoir for construction.
- It is recommended that surface and subsurface drainage design for each reservoir site incorporate the use of two-stage ditch sections as much as practicable.
- Public consensus should be obtained for recreational facilities proposed for construction in the northeast portion of Reservoir Site 2, outside the security perimeter fence. Additional recreational facilities may also be considered at the time Reservoir Site 1 is to be constructed.

### **Raw Water Intake & Pump Station**

- The construction of Pump Station at Site 1- Hoskins Road Area is the preferred alternative.
- Pump Station Site 1 and Pipeline Option 1B (pipeline constructed entirely in easement) represents least cost location on capital cost basis, with combined cost of \$63.7 million.
- The present worth analyses indicates that the Pump Station Site 1 and Pipeline Option 1B have significantly lower total cost on both the 20-year and 50-year basis as compared to Pump Station Site 2.
- It is recommended that the diversion pool be created at this site through the construction of an inflatable weir in the Scioto River. The City will need to purchase additional land on the eastern side of the Scioto River to construct the inflatable weir.
- It is recommended that the City of Columbus register with the ODNR for withdrawal of up to 160 mgd from the Scioto River.
- It is proposed that ODNR's recommended minimum stream flow equal to the seasonal eighty percent flow of 24.1 cfs from July through March and 100.5 cfs from April through June be maintained within the river, downstream of the weir to maintain water quality and aquatic habitat during pumping periods.

### **Construction Phasing of Interconnection Pipelines**

- The pipeline alignment Option 1B is recommended. Option 1B refers to the pipeline alignment from Pump Station 1 to the reservoirs entirely in easements and west of SR 257 to the Del-Co Site and then south to Fry Road. This alignment represents the least cost alternative for the pipeline construction.
- A phased plan for the construction of this alignment option is recommended due to the need for permanent and temporary construction easements, as well as occupancy permits from the Ohio Department of Transportation prior to construction.



### **Phase 1**

- **Phase 1** will include constructing all necessary piping north of Smokey Road that would link Pump Station Site 1 and Reservoir Site 2. The estimated construction cost for this phase of the pipeline construction is \$9.4 million.
- The City of Columbus will have to secure seven additional easements prior to the bidding and construction of Phase 1 at an estimated cost of \$254,750.
- The pipeline could serve the required function of filling any of the three reservoirs. In addition, the piping, valves and river outfall at Pump Station Site 1 that is necessary to drawdown the reservoirs in an emergency could also be used to release the stored supply back to the Scioto River as needed to meet City of Columbus demand.

### **Phase 2**

- **Phase 2** will involve the additional pipeline construction needed to supply the 8-mgd demand to the Del-Co Site. This improvement could be designed and constructed concurrent with Phase 1. The eastern alignment is recommended for this portion of the pipeline corridor. The estimated construction cost for the Phase 2 Pipeline construction is \$11.6 million.
- The cost associated with the acquisition of these easements required for this option is estimated at \$731,800.
- This phase also includes the design of an outlet structure sited on land on the west bank of the Scioto River and owned by the Del-Co Water Company. The outlet structure will provide for a controlled rate of release and utilize step cascade aeration to re-oxygenate flows to adequate levels prior to entering the Scioto River.
- This phase also includes connection piping to the Del-Co site and provisions for the Phase 3 extension.

### **Phase 3**

- **Phase 3** will involve design, right-of-way acquisition and securing of ODOT occupancy permits for central and southern segments of the pipeline. This phase addresses the ultimate goal of the pipeline system, which is to release the water at a location in the river where the City owns the riparian corridor, near Fry Road and the O'Shaughnessy Reservoir.
- Project limits and construction costs associated with the Phase 3 Pipeline project are as follows:
  - The estimated construction cost for the central segment of the pipeline between the Del-Co site and SR 36 is \$13.1 million, with an estimated cost for acquisition of easements to be \$1.03 million.
  - The construction cost for the southern segment between SR 36 and Fry Road is currently estimated at \$13.6 million, with easement acquisition estimated at \$405,800.