9.0 ALTERNATIVE #5 – INTERCONNECTION WITH WINDHAM WATER WORKS

9.1 ASSESSMENT OF FEASIBILITY

This alternative involves an interconnection with Windham Water Works (WWW). WWW operates a large public water utility in Windham and southern Mansfield that has a single surface water supply source (the Willimantic Reservoir). Withdrawals from the reservoir are authorized by a diversion permit. WWW currently possesses the available water to meet its projected demands in the short term but would require additional supply sources to meet its peak day demand (PDD) before 2028, a year corresponding to the utility's 20-year planning horizon.

In order to reliably provide the University and the Town of Mansfield with additional water supply while maintaining an adequate margin of safety (MOS), WWW would require a new or modified diversion permit and a treatment plant expansion. Additional withdrawals may be *facilitated* if the United States Army Corps of Engineers (USACE) were able to formally commit to operating Mansfield Hollow Lake[1] for maintenance of instream flows in the Natchaug River, although this is not requisite for a new or modified diversion permit. Such an act could require congressional authorization as well as funding to cover the costs for personnel and monitoring.

In the event that a new diversion permit could be obtained and the existing treatment plant expanded, the upper limit of withdrawal would be 7.9 million gallons per day (mgd), equivalent to the existing safe yield, under average day demand (ADD), maximum month average day demand (MMADD), and PDD conditions. While some water utilities have the ability to withdraw water in excess of safe yield for short periods of time, WWW does not have this capability because the reservoir is a run-of-the-river impoundment with little available storage. Table 9.1-1 presents projected system MOS utilizing a potential future available water supply of 7.9 mgd.

TABLE 9.1-1
Potential Future Water Demands and MOS in the WWW System

Year	ADD (MG)	ADD MOS	MMADD (MG)	MMADD MOS	PDD (MG)	PDD MOS
2013	2.31	3.42	2.75	2.87	3.37	2.34
2028	2.93	2.70	3.49	2.26	4.28	1.85
2058	3.20	2.47	3.81	2.07	4.67	1.69

Under this potential condition, WWW would have additional water to provide to the University and Mansfield under the ADD, MMADD, and PDD conditions. Table 9.1-2 presents the amount of water that would be available for sale while maintaining a MOS of 1.15. Projections for 2013 are not presented, as this condition would not be possible in such a time frame. As shown in Table 9.1-2, WWW would have the capability to reliably provide the University and Mansfield with 2.0 mgd under all conditions.

[1] The outflow from the lake is managed for flood control and mitigation.

TABLE 9.1-2
Potential Future Water Available (MG) for Bulk Sales from the WWW System While Maintaining a MOS of 1.15

Year	ADD	MMADD	PDD
2028	3.94	3.38	2.59
2058	3.67	3.06	2.20

The projected demands and MOS for the WWW System with the addition of a regional pipeline to the University and Mansfield are presented in Table 9.1-3 below utilizing the potential future system safe yield and treatment capacity of 7.9 mgd and a constant draw at 2.0 mgd.

TABLE 9.1-3
Projected Water Demands in the WWW System with Regional Pipeline to Mansfield

Year	ADD (MG)	ADD MOS	MMADD (MG)	MMADD MOS	PDD (MG)	PDD MOS
2028	4.93	1.60	5.49	1.44	6.28	1.26
2058	5.20	1.52	5.81	1.36	6.67	1.18

The figures in Table 9.1-3 indicate that WWW would have sufficient capacity to supply a regional pipeline to the University and Mansfield at 2.0 mgd while maintaining a MOS of 1.15 under ADD, MMADD, and PDD conditions. While this is a conservative view (since the projected ADD of the University and Mansfield is only 1.23 mgd and projected PDD is 1.93 mgd), it is important to note that up to 7% of average daily withdrawals are lost to filter backwashing and therefore withdrawals will not equal available water.

WWW appears to have sufficient capacity to supply up to 3.0 mgd under all but PDD conditions while maintaining an adequate MOS, thus demonstrating the ability to expand to accommodate additional future potential on-campus growth if necessary.

One potential consideration beyond the scope of this EIE is that WWW could re-calculate its safe yield subsequent to reaching some future agreement with USACE to release water from Mansfield Hollow Reservoir during low flow periods. The basis of this new calculation would be that WWW's safe yield is directly dependent on operational protocols of Mansfield Hollow Lake. However, without making specific informed assumptions about the structure or terms of such an agreement, any estimation of a new safe yield would be speculation. Thus, the current safe yield of the reservoir is utilized for analysis of this alternative.

In summary, WWW may take several steps to provide 1.93 mgd or more of treated water to the University and the Town of Mansfield, with the ability to expand to accommodate future additional potential on-campus growth. Given that this alternative is feasible and can meet the stated project purpose and need, an evaluation of potential impact follows.

9.2 LAND USE AND ZONING

An interconnection between WWW and the University and Town of Mansfield has the potential to affect land use in the Town of Mansfield. The Town of Mansfield is undergoing a comprehensive and detailed revision of its regulations and has proposed an overlay zone to restrict development in areas of public water supply such that local development is consistent with the State Plan. Refer to Section 4.1.3 for details. The proposed overlay zone will restrict development within potential pipeline areas for the purpose of controlling unwanted or unanticipated secondary growth.

9.3 SOCIOECONOMICS

Under this alternative, the University would be in a better position to service its committed demands, and the Town of Mansfield would have sufficient water to serve Mansfield Four Corners and other areas. This would affect socioeconomics as discussed below.

9.3.1 DEMOGRAPHICS

A proposed overlay zone in combination with the RAR-90 zoning present for undeveloped parcels along the potential pipeline routes in Mansfield will restrict the development density associated with this alternative[2]. However, effects to demographics are expected in Mansfield due to the presence of additional water supply.

Table 9.3-1 presents the potential developable areas along the various pipeline routing scenarios. Parcels without extensive undeveloped areas are not included in this calculation. Furthermore, portions of parcels within the 1% annual chance floodplain, commercially-zoned areas, and existing land owned by the University, the State of Connecticut, or the Town of Mansfield (including conservation easements) are not included as developable areas for this calculation. Storrs Center and development in other areas of Mansfield where demands and potential population growth are known and desired are also not included. These areas represent entire parcel sizes and not the final developable area of a parcel (subject to restrictions from wetlands, steep slopes, open space requirements, etc.). Thus, the analysis presented herein is will overestimate the potential effect to demographics.

As noted in Table 9.3-1, some pipeline segments pass residentially-developable parcels that, if developed, could influence demographics. Table 9.3-2 compares the developable areas to the potential pipeline scenarios. This level of residential density could be achieved under existing zoning without the regional pipeline. The presence of the public water supply pipeline may or may not make these areas more attractive to development.

[2] While some undeveloped parcels are located under other zoning types along pipeline routes near the University, these areas are either (1) owned by the University and will not be developed (i.e., the Fenton River Wellfield) or (2) are already in areas of public water service such that the presence of a new water main will not spur additional development.

TABLE 9.3-1
Developable Residential Parcels in Mansfield by Pipeline Segment along Potential WWW Interconnection Scenarios

Pipeline Segment	Developable Frontage along Water Main (ft)	Number of Parcels	Total Acres
20	0	0	0
21	0	0	0
22	700	3	26.1
28	70	1	19.3
34	0	0	0
35	660	1	10.7
36	3,090	7	179.0
37	0	0	0
38	0	0	0
39	2,920	6	226.9
40	360	3	66.8
45	0	0	0
46	0	0	0
47	0	0	0
48	0	0	0
49	0	0	0
50	0	0	0

TABLE 9.3-2
Potential Developable Areas along WWW Pipeline Scenarios

Routing Scenario	Developable Frontage along Water Main (ft)	Number of Parcels	Total Acres	Potential Population*
#5A-1	4,520	12	235.1	573
#5A-2	4,520	12	235.1	573
#5B-1	3,690	10	272.3	663
#5B-2	3,690	10	272.3	663
#5C-1	1,130	7	112.2	273
#5C-2	1,130	7	112.2	273

*Assuming subdivision into one-acre lots with an average household size of 2.44.

Based on the figures in Table 9.3-2, the total population of Mansfield (as a direct result of development along the water main routing) could increase between 270 and 660 under any of the WWW Interconnection scenarios. The population figures presented above represent a maximum scenario under existing zoning that does not account for unbuildable lot areas. The existing zoning in these areas also allows multi-family homes that require larger lot sizes, as well as group homes. These types of development would reduce the potential population along the pipeline routes. This development would likely not significantly change existing household sizes.

9.3.2 ECONOMY AND EMPLOYMENT

As this alternative can provide the amount of water necessary for the University to meet its committed water demands, the local and regional labor force will benefit from the construction of Storrs Center, expansion of North Campus, and the eventual redevelopment of the Depot Campus. This benefit would include both construction jobs as well as jobs created at these facilities.

Mansfield Four Corners would be redeveloped and provide additional jobs in this area. The small Neighborhood Business zones in Mansfield Center and Spring Hill and the small areas of Professional Office zones along the Route 195 corridor would minimally benefit, since these areas are small parcels that are already developed. The remaining zoning is residential, such that only short-term construction jobs would be indirectly generated in this area from potential future housing.

A benefit would be realized by the Town of Mansfield in terms of increased tax income over existing levels, since several existing and proposed projects would continue development.

In total, this alternative has the potential to provide a benefit to employment and the local economy through the development of construction jobs and long-term bioscience and service jobs. Indirect effects, such as the need for additional housing to support workers, may also occur. In order to ensure that development density is controlled along the enacted water main route, land use mitigation measures are proposed to restrict development along certain segments of the pipeline.

9.3.3 EXISTING WATER RATES

Property owners immediately adjacent to the proposed WWW water main (predominantly residential customers) in Mansfield would have the option to connect to public water service.

WWW water rates for individual customers (based on 72,000 gallons of annual use at existing water rates) would be $371 per residential connection or commercial connection. This is slightly less than the cost of a similar amount of water from the University system ($393 per year). Cost of fire service is presented in Table 9.3-3.

TABLE 9.3-3
Cost of Fire Service from WWW

Routing Scenario	Distance*	Number of Hydrants	Total Cost to Mansfield per Year
#5A-1	50,580	65	$27,040
#5A-2	50,580	65	$27,040
#5B-1	39,840	62	$25,790
#5B-2	46,580	62	$25,790
#5C-1	34,100	57	$23,710
#5C-2	40,840	57	$23,710

* Does not include North Hillside Road extension which would have hydrants installed as part of the utility work with that project, nor areas of existing water service that already have hydrants.

The University's 2011 *Water Supply Plan* notes that annual revenue from the sale of water and provision of sewer service to non-University customers in 2009 was $861,902. The *Water Supply Plan* further notes that the amount of revenue generated from the sale of water was estimated to be 50% of this value, or approximately $431,000. Thus, much of the income from sales would be significantly reduced if WWW or the Town of Mansfield directly served these customers.

9.3.4 PROPERTY OWNERSHIP AND EMINENT DOMAIN

As WWW is not proposing the use of any new water sources, and the majority of construction work would take place within the roadway easements, the pipelines for this alternative will not require significant changes in property ownership. Acquisitions through eminent domain are not expected.

Additional land would be needed for backwash lagoons at the WWW treatment plant site, a new storage tank in the area between Spring Hill and Mansfield Center, and the potential need for a new storage tank in Mansfield Four Corners. Negotiations for purchase of a parcel would be sought in all cases. Additional detail follows.

- Two older residuals settling basins are located north of the WWW clearwell alongside the Willimantic Reservoir, and two newer and larger residuals basins were constructed in 2004 and 2006 to the west of the older basins. WWW uses all four basins to optimize settling of residuals. The two newer basins handle most of the settling and are cleaned out annually. The four basins are able to keep up with water treatment wastewaters. An expansion of the treatment plant would likely require additional basin areas for settling of residuals. WWW does not possess the land needed for expansion of the basins. The land immediately to the north is owned by the Town of Mansfield and has been identified by WWW as the next logical site for a new basin or basins.

- In order to appropriately deliver water to northern Mansfield and the University from the high lift pumps, a new water tank would be needed in southern Mansfield. This tank would need to be situated at the same grade line as the Hosmer Mountain Reservoir (overflow at 464 feet) in order to provide hydraulic balance to the WWW system. The tank would then provide direct draw to the University system. Ideally, the ground elevation at this tank would be at least 440 feet. A transfer of property from the University, the State of Connecticut, or the Town of Mansfield to WWW would be required, or a privately-owned parcel would need to be purchased. Potential tank site areas are listed below:

    - A privately-owned parcel located on the west side of Storrs Road may be a good tank site for any WWW interconnection. This parcel on pipeline segment 28 is used for timber or forest land. Much of the upper portion of the property is located at 470 feet, and this area is located 1,400 feet from Route 195.

    - A privately-owned parcel located on the west side of Storrs Road may also be a good tank side for any WWW interconnection. This parcel on pipeline segment 22 is used for timber or forest land. The southwestern portion of the property is at approximately 440 feet near Beech Mountain Road. As an electrical utility easement dominates most of the parcel, a new pipeline from the tank could be directed along the easement approximately 1,300 feet to Route 195.

  - Land owned by the Town of Mansfield that is part of Schoolhouse Brook Park could be a potential tank location for the Maple Road interconnection scenario. Several areas in the park near Clover Mill Road are located at elevation 440 or higher. A utility transmission tower already exists near the entrance of Bicentennial Park, so an additional utility use in this area may be permissible. A small parcel could be ceded to WWW for storage purposes.

  - Land owned by the State of Connecticut on the west side of Route 195 may be a good tank location for the Route 195 interconnection scenario. This land is referred to as the "Orchard" property by University faculty. Much of the area is used for agriculture, but areas of forest exist between an elevation of 440 and 500 feet in elevation. A small parcel could be ceded to WWW for storage purposes.

- A storage tank may be needed in the Mansfield Four Corners area to maintain proper system pressure. A transfer of property from the University or the purchase of property from a private entity would be required. The best areas for a tank would be as noted in Section 7.3.

A new pumping beyond the new tank in southern Mansfield would ideally be located on a small parcel of land owned by the State (possibly in the roadway right-of-way), the University, or the Town of Mansfield.

In summary, significant impacts to property ownership are not expected.

9.4 COMMUNITY FACILITIES AND SERVICES

The community facilities and services along the 17 potential pipeline segments associated with the various WWW interconnection scenarios are summarized in Table 9.4-1 below and presented in more detail in the following sections.

9.4.1 EDUCATION

Regardless of the WWW interconnection scenario selected, the proposed research spaces on the North Campus and the Depot Campus would be fully realized under this alternative. Such development will provide additional educational and research opportunities to University students and faculty.

Only pipeline segments 39, 46, and 47 pass non-University educational facilities. These include Mansfield Middle School on Spring Hill Road and E.O. Smith High School on Route 195. The high school is already served by the University System, while the Middle School is served by a well. Scenarios #5B-1 and #5B-2 would install a water main past the Middle School, providing an opportunity for fire protection and public water supply to this facility. However, access to any of the schools would be temporarily impacted during the construction period in areas where the pipelines pass. Performing construction in these areas during the summer would be the best method of avoiding this impact.

Indirect impacts to education are possible. As additional population growth could be expected to some degree from this alternative, additional students could be recognized in Mansfield. The influx of students may require the hiring of additional faculty or staff as well as potentially requiring expansion of facilities. These educational expenses could potentially be offset by the additional taxes collected on the developed and redeveloped properties in these communities.

TABLE 9.4-1
Summary of Community Facilities and Services
by Pipeline Segment along WWW Interconnection Scenarios

Pipeline Segment	School?	Potential Benefit from Fire Protection?	Recreation Area?
20	No	Residential & Commercial	No
21	Yes	Will be served by UConn	Proposed
22	No	Residential & Commercial	No
28	No	Residential & Commercial	No
34	No	Residential	No
35	No	Residential & Commercial	Yes*
36	No	Residential	Yes*
37	Yes	Already served	Yes*
38	No	Residential	No
39	Yes	Residential & Commercial	Yes
40	No	Residential & Commercial	Yes*
45	Yes	Already served	Yes*
46	Yes	Already served	Yes
47	Yes	Already served	Yes
48	Yes	Already served	No
49	Yes	Already served	No
50	Yes	Already served	No

*Hiking trails only.

9.4.2 PUBLIC SAFETY AND EMERGENCY SERVICES

The primary benefit to fire protection associated with this alternative is that a pipeline could provide a large quantity (more than 1,000 gpm for two hours) of water for fire flows at locations along each pipeline route. This would provide a benefit to Mansfield. The longer pipeline routes would provide a greater benefit in terms of the availability of fire protection water, and commercial nodes located in Mansfield such as in Mansfield Center would particularly benefit from the availability of fire protection water.

A fire flow of 1,000 gpm for two hours is equivalent to 0.12 million gallons (MG). Given that projected future demands in the Mansfield Four Corners area are 0.17 MG, a tank would be prudent for construction in the vicinity of Mansfield Four Corners. A 2.0 MG tank is also contemplated under this alternative for the Mansfield Center area; a tank this size would provide storage for fire flows south of the University.

The construction period associated with this alternative would require the use of state and local police services to provide maintenance and protection of traffic.

Extension of public water service could have an indirect effect on public safety and emergency services similar to that of education. The additional population could require additional expenditures for police, fire, and emergency services due to the increased population and coverage area. Additional taxes collected on newly developed and redeveloped properties may partially or fully offset these additional expenditures.

9.4.3 PARKS AND RECREATION

Several parks and recreational facilities are located in Mansfield along the potential pipeline routes. Mansfield Middle School and the Spring Hill fields (pipeline segment 39) include a multi-use ball field, outdoor basketball hoops, tennis courts, and an indoor gym and auditorium. This area is located next to Schoolhouse Brook Park, which includes picnic areas, fishing, swimming, canoeing, cross-country skiing, and mountain biking. These are the only recreational areas that do not consist entirely of hiking trails or are not already served with public water by the University. These areas are currently serviced by wells. A connection to a public water system could be beneficial to provide a backup supply for irrigation, sanitation, or drinking water.

A minor and temporary impact to parks and recreation would be expected during the construction period if Scenario #5B (Maple Road) was utilized since there would be construction in the vicinity of Mansfield Middle School and Schoolhouse Brook Park.

9.4.4 PUBLIC TRANSPORTATION

A slight benefit to public transportation may be realized under this alternative. The creation of educational and research facilities on North Campus and the Depot Campus would likely spur an expansion of shuttle service to and from the University. The proximity of Mansfield Four Corners to the Technology Park suggests that a University stop could be added to Mansfield Four Corners as well, particularly if properties are redeveloped into shops, restaurants, and mixed-use housing. In addition, redevelopment of Mansfield Four Corners could create the demand necessary to add additional Windham Regional Transit District (WRTD) stops in the area.

A temporary impact to public transportation would be realized during construction due to traffic delays dependent on the amount of pipeline being installed along existing major bus routes (Route 195). Overall, a minimal impact to these transportation services is expected. The two scenarios that do not route directly to the campus along Route 195 are expected to have less of an impact on public transportation during construction.

9.5 AESTHETIC AND CULTURAL RESOURCES

The entire Town of Mansfield is designated as a scenic resource in the 2006 *Plan of Conservation and Development.* Much of the proposed WWW pipeline routes through Mansfield pass areas that are predominantly residential in nature, with generally sparse development along much of the roads. Trees grow right to the edge of the roadway, inhibiting long scenic views in most areas, instead providing a shady, tree-lined drive. Many areas are undeveloped, particularly along Mansfield Hollow State Park off Chaffeeville Road and Schoolhouse Brook Park on Clover Mill Road. The view over Spring Hill from just south of the University on southbound Route 195 (pipeline segment 40) is a particularly notable vista for University students, staff, and visitors as well as residents of Mansfield.

As new water mains would be installed within existing roadways, long-term impacts to aesthetic and visual resources is expected to be minimal. The selection of the site for a new water tank in Mansfield Four Corners and in the Spring Hill or Mansfield Center area will need to consider aesthetics.

Development density increases closer to the University, with limited commercial areas located along Route 195 that include restaurants, banks, and other shops. Additional apartment buildings and condominium complexes are also located close to campus. Mansfield Four Corners is considered a historic village and is located at the terminus of the potential water main scenarios. While the center of this village is located at the intersection Moulton Road and Daleville Road with Route 44, many of the commercial buildings in this village are located near the intersection of Route 44 and Route 195. These commercial buildings are dilapidated and/or vacant and in need of redevelopment. An interconnection with WWW would provide sufficient water supply to promote redevelopment in this area. Coordination with the Planning and Zoning Commission will be necessary to ensure that new development and redevelopment in Mansfield Four Corners is consistent with the historic aspects of this village.

The potential pipeline routes pass by several historical properties and sites as noted in Mansfield's 2006 *Plan of Conservation and Development*. These properties are located on Route 195, Maple Road, Spring Hill Road, Clover Mill Road, Chaffeeville Road, and Gurleyville Road. The majority of these properties are located within the historic villages of Mansfield Center, Spring Hill, Chaffeeville, and Gurleyville. The extension of public water service past these properties is not expected to impact the historic nature of these properties.

Mansfield's 2006 *Plan of Conservation and Development* further identifies areas of archaeological sensitivity, historic site areas, and prehistoric site area in Mansfield. Areas of sensitivity are located along potential pipeline segments 35 and 36. Prehistoric site areas are identified between Route 195 and Chaffeeville Road along pipeline segment 35 and 38 as well as near the Towers storage tanks. Historic site areas are located throughout Mansfield Center with more limited areas near Spring Hill, Chaffeeville, Gurleyville, and the Storrs Campus. The Barrows Cemetery (pipeline segment 34), Old Mansfield Center Cemetery (pipeline segment 28), Old Storrs Cemetery (pipeline segment 49), and Riverside Burying Ground (pipeline segment 36) are also located along potential pipeline routes. The State Archaeologist and the State Historic Preservation Officer will be consulted prior to beginning work in these areas, as well as the Mansfield Historic District Commission and the Cemetery Committee.

Route 195 (pipeline segment 34) crosses a stone flume and culvert over Chapin Brook that may be a historic feature. This bridge could potentially be avoided through the use of directional drilling. Another alternative would be to utilize Dodd Road and avoid this area. This would subtract approximately 100 feet of pipeline length from scenario #5A but add 800 feet to scenarios #5B and #5C.

Minor construction related impacts to aesthetic and cultural resources in Mansfield are expected but will be temporary. The nature of roadway construction requires a high amount of visibility for safety purposes.

9.6 PUBLIC WATER SUPPLY

This alternative would increase available water supply available, principally within the Town of Mansfield and at the University. Potential demands in Mansfield south of the University along a potential interconnection pipeline route have not been previously defined. The potential population increase estimated in Section 9.4 has been utilized to determine potential additional demands through the long-term planning period. As these demands are primarily residential, the Connecticut DPH per-capita standard of 75 gallons of water per person per day has been utilized to estimate demands. The use of the most conservative figures with the DPH per-capita standard above yields an additional water demand of 0.05 mgd from developments that could potentially be spurred by the availability of public water.

Additional demands could also be realized related to small Community and Non-Community Water systems that may wish to connect to the system, and other areas of Mansfield that may benefit from the availability of public water service. These potential demands are discussed in the following section.

Other Public Water Systems

Additional areas of potential water need in the Town of Mansfield were identified in the 2002 Mansfield *Water Supply Plan*, and several small Community water systems are located along potential WWW pipeline routes. These are identified as follows:

- Rosal Apartments is located near Mansfield Four Corners and has a water demand of approximately 1,800 gpd. This area is already included in the projected water demands for Mansfield Four Corners.
- Mansfield Village is a 20-unit trailer park served by one well that requires pH adjustment. Sodium levels are reportedly elevated. Demands for this development were not reported in the 2002 Mansfield *Water Supply Plan*. The potential demand at this location has been estimated at 3,660 gpd (assuming 2.44 persons per unit and 75 gpcd). This complex could potentially wish to connect to the water main, but could only be connected if routing scenario #5A was chosen.
- Maplewood Apartments (including Millbrook Apartments) have two wells and adequate storage, but the water is moderately hard. The system has a water demand of approximately 11,500 gpd. This system could only be connected for system redundancy if routing scenario #5B was chosen, but would not likely be replaced with WWW water.
- Knollwood Acres Apartments are served by four wells. Iron is elevated. According to the 2002 Mansfield *Water Supply Plan*, this system has an ADD of 20,500 gpd. This system has been located adjacent to the University system for many years such that it is unlikely to connect to a new water main, although the availability of more water could trigger its connection to the University water system.
- Birchwood Heights has three bedrock wells and a demand of approximately 3,750 gpd. This system is owned and operated by CWC. While this system would likely connect for system redundancy if a water main was extended along routing scenario #5C, it is not likely to be replaced by WWW water.

Based on the information above, the only small Community water system considered likely to connect to and be served by a WWW water main would be Mansfield Village along routing scenario #5A. This water demand is relatively minimal.

Finally, several small non-transient non-community (NTNC) and transient non-community (TNC) systems are located in the Town of Mansfield. Several of these systems lie along potential pipeline segments associated with a WWW interconnection as follows:

- Mansfield Center General Store, Mansfield Restaurant and Pizza, and the First Church of Christ are located along all potential routing scenarios. These facilities would represent a relatively minimal water demand if they connected to the water main. A figure of 1,500 gpd has been estimated for these facilities.
- The Holiday Mall is located just north of Mansfield Four Corners and may wish to connect;
- The Public America in Mansfield Four Corners is already included in demands presented above.
- The demands at 503 Middle Turnpike are included in the Mansfield Four Corners demands presented above.
- Mansfield Middle School is located on Spring Hill Road (routing scenario #5B). It has a potential water demand of 10,500 gpd. According to the 2002 Mansfield *Water Supply Plan*, this system has one well with low levels of trichloroethylene. The 2002 Mansfield *Water Supply Plan* recommended consolidating this system with the Maplewood Apartments system. This facility would likely connect to a WWW water main.
- Bicentennial Park is located adjacent to Mansfield Middle School as park of Schoolhouse Brook Park. The system is seasonally used with what is expected to be a relatively minimal ADD. A figure of 2,000 gpd has been estimated for peak use. The Town may wish to connect this facility to the water main.
- Several homes in the vicinity of Spring Hill reportedly had poor well water quality in the past due to the presence of elevated nitrate. If public water service were extended past this area (routing scenario #5C), the potential demands in this area would be approximately 2,300 gpd.
- The Altnaveigh Inn & Restaurant and the First Baptist Church are located along routing scenario #5C. These would each present a relatively minimal water demand if connected to the WWW water main. A PDD of 1,500 gpd has been estimated for these two facilities.

Based on the information above, the following potential water demands can be attributed to future connections along the WWW routing scenarios:

- <u>Routing scenario #5A</u>: Approximately 6,000 gpd including commercial demands in Mansfield Center and Mansfield Village;

- <u>Routing Scenario #5B</u>: Approximately 15,000 gpd including commercial demands in Mansfield Center and connections to the Middle School and Bicentennial Park; and

- <u>Routing Scenario #5C</u>: Approximately 6,000 gpd including commercial demands in Mansfield Center and connections in Spring Hill.

Thus, if Routing Scenario #5B were selected, it would add less than 0.02 mgd to demand. This is relatively minimal and does not change the original conclusion of feasibility of this alternative.

9.7 OTHER PUBLIC UTILITIES AND SERVICES

9.7.1 SANITARY SEWER

The proposed overlay zones in Mansfield would restrict development density to that which can be served by individual wells and septic systems. As such, expansion of sanitary sewer service in Mansfield would be limited to new development on the University campus and the proposed extension of the sewer main to Mansfield Four Corners.

The 2007 *Water and Wastewater Master Plan* concluded that the capacity of the University's WPCF is sufficient for future wastewater treatment. Average daily flows at the WPCF typically average 27% to 44% (0.81 mgd to 1.32 mgd) of its average day capacity, while peak flows can utilize up to 90% of the plant's peak hourly capacity as a result of inflow and infiltration to the system, independent of the number of users discharging to the system. The University continues to take measures to alleviate this condition. Based on the likely additional flows to the University's WPCF (assuming the majority of new water customers would discharge to the sanitary sewer), the facility is believed to have sufficient capacity.

9.7.2 STORMWATER SYSTEMS, BRIDGES, AND CULVERTS

A variety of bridges, cross culverts, and stormwater systems can be found along the potential pipeline segments associated with the interconnection scenarios with WWW. Table 9.7-1 summarizes these watercourse crossings. Photographs of several of these crossings are presented in Appendix C.

The only major crossing affecting all WWW interconnection scenarios is the potentially historical stone archway over Chapin Brook. This structure could be avoided by redirecting the water main along Dodd Road, although this road also has a bridge crossing for Chapin Brook.

Connection to the Fenton River Wellfield (routing scenario #5A) would require two crossings of the Fenton River. The first crossing (pipeline segment 35) would be over the existing large box culvert. There may be enough clearance over the top of this culvert to install a water main in the roadway. The second crossing is located on Gurleyville Road (pipeline segment 26) where a pipe would need to be hung on the side of the bridge, or a different method (such as directional drilling beneath the river) would need to be employed. This is a design detail that can affect the project cost but should not impact the viability of the bridge infrastructure.

Many minor crossings will also affect construction. Roberts Brook (pipeline segments 36 and 48) and Schoolhouse Brook (three crossings on pipeline segment 39), could create construction-related challenges, as could smaller shallow culverts beneath roadways. The installation of potential water mains and pump stations will be designed to avoid interference with existing stormwater systems. If modifications to stormwater systems are necessary, they will need to be evaluated within the design phase of the eventual project.

New stormwater systems would be developed in concert with any new University development, such as North Campus and would need to meet the University's design standards. Such stormwater systems would be evaluated through state permitting requirements. Drainage systems associated with new development in the Town of Mansfield (such as Mansfield Four Corners) would be evaluated through local and potentially State permitting processes.

TABLE 9.7-1
Summary of Stormwater Systems by Pipeline Segment along Potential WWW Interconnection Scenarios

Pipeline Segment	Bridge	Storm Drainage Systems	Cross Culverts	Comment
20	None	Yes	Yes	Nearby pedestrian bridge.
21	None	Future	Future	Future North Hillside Road extension.
22	None	Yes	Yes	
28	None	Swales	None observed	
34	Chapin Brook	Swales	Yes	Stone arch over Chapin brook may be historical structure.
35	Fenton River	Swales	Yes	Large box culvert conveys Fenton River
36	Fenton River	Swales	Yes	May need to hang pipe on side of bridge.
37	No	Yes	No	Drainage on Horse Barn Hill Road
38	None	No	None observed	
39	None	Yes	Yes	Storm drainage near Silo Road. Top of Schoolhouse Brook culverts are near the level of the roadway – may need to hang water main.
40	None	Yes	Yes	
45	None	Yes	None observed	
46	None	Yes	None observed	
47	None	Yes	No	
48	None	Yes	Yes	Roberts Brook
49	None	Yes	No	
50	None	No	No	

9.7.3 ENERGY, ELECTRICITY, AND NATURAL GAS

The proposed interconnection with WWW would result in the following additional energy demands over current levels:

- Additional energy demands at the WWW WTP for treatment;
- Additional energy demands of a pumping station in the Mansfield Center or Spring Hill area;
- Additional energy demands in new buildings on the North Campus and the Depot Campus that would be serviced by the proposed water supply;
- Additional energy demands in the form of vehicle fuel and additional office work (computers, etc.) due to an increased service area for WWW operations and maintenance personnel; and
- Additional energy demands (electricity, fuel) from new development and redevelopment spurred by the presence of the water main.

Electrical Service

As noted above, incremental electrical demands will be realized by WWW to support this project. These include electricity for producing for treating additional water at the WWW WTP, additional pumping station demands to direct water into Mansfield, and potentially increased electrical demands from additional personnel and equipment.

Electrical service would also be extended into any new developments including those spurred by the presence of a public water supply. New University buildings would partially or fully be serviced with electricity from the central utility plant (CUP). As exact building uses are not known at this time, estimates of electrical service cannot be provided. However, it is assumed that Connecticut Light & Power has sufficient supply to provide electrical service to any related incremental increases and new development.

Natural Gas Service

Expansion of natural gas is expected to occur to new buildings in North Campus and the Depot Campus. New buildings in the vicinity of Mansfield Four Corners may also be serviced with natural gas. While an estimated amount of new usage of natural gas in these areas cannot be quantified at this time as buildings have not been designed, it is assumed for the purposes of this EIE that sufficient supply exists to serve these developments. In addition, natural gas usage to create electricity at the CUP may increase to support proposed University development.

Coordination with these utilities will be necessary to determine the depth of the gas pipelines during the design phase in order to avoid interference. Additional protective controls such as extra casing may be necessary in the vicinity of the gas pipelines. No direct impact to natural gas service or existing pipelines (other than additional usage and service area) is expected.

Other Energy Sources

Construction of an interconnection under this alternative is expected to have an incremental impact on the amount of fuel utilized for backup generation at pump stations. Construction-related traffic delays will also cause an incremental increase in fuel consumption during the construction period. In addition, the construction period will involve a direct consumption of fuel by equipment that cannot immediate be quantified. Indirect impact to these fuel sources would likely occur through increased demand in the project area following development and redevelopment activities.

9.7.4 TELECOMMUNICATIONS SERVICE

Expansion of telecommunications service is expected to occur to any new buildings developed as a result of the availability of water supply. It is assumed for the purposes of this EIE that sufficient capability exists to serve these developments. University Information Technology Services (UITS) has indicated that it will be able to service any new buildings on the North Campus and the Depot Campus without issue. Coordination with existing utilities will be necessary to determine the depth of any underground wires during the design phase in order to avoid interference. No direct impact to telecommunications providers (other than additional usage and service area) is expected.

9.8 TRAFFIC, PARKING, AND OTHER TRANSPORTATION

The potential interconnection with WWW may have several impacts related to parking, traffic, and other transportation. Table 9.8-1 presents the characteristics of roadways along potential pipeline segments associated with WWW interconnection scenarios. The majority of these routes are well traveled roadways.

TABLE 9.8-1
Traffic Characteristics along Potential WWW Pipeline Segments

Pipeline Segment	Distance (ft)	Road Type	Traffic Count	Speed Limit (mph)	Source
20	1,540	Arterial	9,000	40	2010 CT DOT
21	3,400	Future Collector	-	N/A	-
22	7,330	Arterial	12,600	40	2010 CT DOT
28	2,390	Arterial	11,700	40	2010 CT DOT
34	2,230	Arterial	9,600	40	2010 CT DOT
35	9,920	Local	607	30	2009 Town of Mansfield
36	13,070	Local	964 / 1786[1]	30	2004 / 2001 Town of Mansfield
37	6,400	Local	1,800	30	2006 Town of Mansfield
38	570	Arterial	9,600	45	2010 CT DOT
39	17,230	Local	2,400	25	2005 Town of Mansfield
40	14,900	Arterial	9,600 / 11,300[2]	40 / 45	2010 CT DOT
45	3,410	Arterial	6,500	30	2010 CT DOT
46	1,360	Arterial	12,400	30	2010 CT DOT
47	380	Local	-	25	-
48	2,820	Arterial	12,400	30	2010 CT DOT
49	4,040	Arterial	16,800	25	2010 CT DOT
50	260	Utility	-	-	-

Notes: [1] Chaffeeville Road south of Gurleyville / Gurleyville Road west of Gurleyville
[2] Route 195 South / North of Spring Hill Road

The interconnection with WWW would cause temporary traffic impacts along the Route 195 corridor during the construction period. While Routing Scenario #5A presents the longest construction distance, nearly 9,000 feet of this work is performed in off-road areas. In addition, nearly 20,000 feet is performed along local roads such that this routing scenario would have the least traffic impact. Routing Scenario #5B also utilizes local roads such that the overall traffic impact would be less than Routing Scenario #5C. Additional traffic impacts would result if water mains were extended to the W-Lot storage tank under the latter two scenarios. As such, Routing Scenario #5A would result in the least traffic impact during the construction period.

Construction in most areas would be constrained to one lane, resulting in alternating one-way traffic along most of the potential pipeline connection routes. These delays would also impact bus service in the area. State Police traffic protection would be required. Construction activities may also temporarily restrict access to businesses and homes. Bikeways and sidewalks in the vicinity of the University (such as along Route 275) may need to have portions temporarily closed during the construction period. Efforts will be made during the construction period to not restrict access to homes and businesses any more than necessary. In addition, performing construction work during the summer period would minimize the volume of traffic passing the construction area near the University. None of the proposed routing scenarios pass railroads such that impacts to railroad traffic are not expected.

9.9 WETLAND RESOURCES

An interconnection with WWW has the potential for wetland impacts due to construction of new infrastructure. Direct impacts could also occur in the Willimantic Reservoir associated with dredging that may be required. Long-term impacts related to drawdown in the Willimantic Reservoir are expected to be minimal, since the reservoir operates as a run-of-the-river impoundment with a constant base level exerted by the Natchaug River dam. These are described further in the following sections.

9.9.1 EXISTING WETLAND AREAS ALONG POTENTIAL WWW PIPELINE SEGMENTS

The potential pipeline segments associated with an interconnection with WWW pass a variety of wetlands and watercourses. Refer to Figure 9.9-1 for a depiction of inland wetland soils and watercourses adjacent to potential pipeline segments. Direct wetland impacts are not expected to occur along most of these pipeline segments through the use of construction techniques that avoid construction in the wetlands (such as hanging pipes on bridges or directional drilling beneath wetlands and watercourses), an analysis of these areas is appropriate for the EIE.

Table 9.9-1 summarizes the wetlands found along each pipeline segment for the potential WWW interconnection. These are described in more detail in the ensuing narrative.

- Pipeline Segments 20 and 21: Refer to Section 7.9.
- Pipeline Segment 22: An intermittent watercourse passes to the southeast beneath Route 195. This watercourse is fairly narrow and constrained mostly to a wet trough on the western side of the road that drains from a small pond approximately 250 feet to the north.
- Pipeline Segment 28: A series of seeps appear to drain into a trough on the west side of Route 195 just northwest of Old Mansfield Cemetery.
- Pipeline Segment 34: A stone arch bridge conveys Chapin Brook southeast across Route 195. This watercourse is the outlet of Barrows Cemetery Pond, and appears to have narrow adjacent wetland areas on both sides of Route 195. A second intermittent watercourse crosses Route 195 to the southeast not far to the north of the stone arch bridge.

TABLE 9.9-1
Wetlands along Potential WWW Pipeline Segments

Pipeline Segment	Number of Adjacent Wetland Areas	Total Adjacent Wetland Distance (ft)	Comment
20	1	50	Forested wetland
21	2	420	Intermittent watercourse / wetland, vernal pool
22	1	300	Wet trough / forested watercourse
28	1	300	Seeps collecting on west side of road
34	2	225	Barrows Cemetery Pond and intermittent watercourse (Chapin Brook)
35	5	1,510	Large swamp, Fenton River floodplain and forested wetland
36	6	675	Several watercourses, the Fenton River, and a forested swamp
37	4	300	Potential vernal pools, forested wetlands, intermittent watercourses, wetland soils located in agricultural field
38	0	0	-
39	14	4,210	Forested wetlands and intermittent watercourses associated with Schoolhouse Brook, Mansfield Middle School, Sawmill Brook, Dunham Pond Brook
40	6	4,200	Large emergent wetland, forested wetland associated with Hank's Brook, intermittent watercourses
45	1	180	Forested wetland draining to Tift Pond
46	0	0	-
47	0	0	-
48	1	50	Roberts Brook
49	0	0	-
50	0	0	-

- Pipeline Segment 35: A large emergent marsh / open water / scrub-shrub swamp is located near the intersection of Dodd Road and Chaffeeville Road is parallel to the road approximately 50 feet away. The Fenton River has an associated forested floodplain with seeps at the toe of the road embankment. The floodplain has backwater pools and braided channels. Three intermittent watercourses that are tributaries to the Fenton River also cross Chaffeeville Road.

- Pipeline Segment 36: Three intermittent and one perennial watercourse cross Chaffeeville Road flowing west to the Fenton River. The perennial watercourse has associated forested wetlands. The Fenton River runs close to the road in some areas with a forested floodplain and backwater pools. A scrub swamp wetland that drains to the Fenton River is located near Fenton Well D. The unpaved utility access road from Well D to the pumping station crosses Roberts Brook.

- Pipeline Segment 37: Refer to Section 6.9 for a description of wetlands near the Fenton River Wellfield.

- Pipeline Segment 39: This pipeline route crosses Schoolhouse Brook and its associated forested wetlands in seven locations along Clover Mill Road. It also passes two palustrine forested wetlands near Mansfield Middle School; both may potentially have vernal pools. These wetlands also drain southeast to Schoolhouse Brook. A large marsh is located near the intersection of Clover Mill Road and Route 195 that includes cattails and invasive giant reed (Phragmites) growing in open water. Further northwest, a palustrine forested / shrubby wetland is conveyed to the south across Maple Road just northwest of Spring Hill Road; this intermittent watercourse eventually discharges to Sawmill Brook. A potential vernal pool exists on the east side of the road. An intermittent watercourse with an associated palustrine forested wetland flows southwest across Maple Road northwest of the gas pipelines. Finally, a series of small farm or fire ponds and seeps lie adjacent to the road just south of the western end of Davis Road.

- Pipeline Segment 40: A large emergent wetland and watercourse system exists along most of this route south of Spring Hill Road. This system drains into Schoolhouse Brook. It lies close to the road in many places but is generally 10 feet below the level of the road. Route 195 impounds a stream locally known as Hanks Brook near the northern terminus of Flaherty Road. This perennial stream has a large palustrine forested wetland west of Route 195. Small intermittent watercourses also cross the road in several places; these drain from seeps or in some cases appear to be drainage swales.

- Pipeline Segment 45: A forested wetland is located south of Route 275 in the vicinity of Knollwood Apartments. This wetland drains to Tift Pond and eventually to Hanks Hill Brook. The Town of Mansfield notes that a vernal pool featuring frogs and salamanders is located within this wetland area.

Pipeline segments associated with the potential interconnection with WWW lie entirely beneath paved roadways with few exceptions. Construction activities occurring off-road in the vicinity of the Fenton River Wellfield have the highest potential of resulting in a wetland impact since activities will not be constrained within a roadway. Evaluation of nearby wetlands and vernal pools and best management practices for construction should be utilized in this area. The use of best construction management practices for sedimentation, erosion, and debris controls should result in minimal impact to adjacent wetlands along the remainder of potential pipeline routes.

The above wetland areas were identified during reconnaissance by a certified soil scientist and professional wetland scientist based on the presence of perennial streams, intermittent streams, and State wetland soils. Wetlands and vernal pools will be delineated along the selected pipeline scenario by a professional wetland scientist during the design phase.

9.9.2 POTENTIAL DRAWDOWN IMPACTS

The pipeline and interconnection with WWW would utilize water from Willimantic Reservoir to supply potable water to the University and Mansfield. WWW has indicated that dredging of the reservoir would be required by its Water Commission if this alternative were pursued. Although the quantity of sediment to be removed has not been determined, it would likely be greater than 200,000 cubic yards in order to achieve depths that could facilitate the improvement in water quality that is desired by WWW. Potentially affected wetlands could include emergent and scrub-shrub vegetation located in the part of the reservoir closest to the intake. Removal of wetland vegetation would likely result in a net loss.

WWW operates its source of supply as a run-of-the-river withdrawal rather than relying on reservoir storage. The wetlands around the reservoir are likely dependent on relatively constant water levels, as they have enjoyed the stable base level provided by the dam. In addition, the managed releases from Mansfield Hollow Reservoir have provided a steady influx of flow to the reservoir. Thus, it is expected that water levels in wetlands surrounding the reservoir would remain relatively stable under this alternative, except during periods of drawdown for dredging.

9.10 BIOLOGICAL ENVIRONMENT

Some clearing is believed to be required under this alternative, limited to road edges where pipelines, pressure reducing valves, or meter pits would need to be installed and that required for the proposed storage tanks. Clearing will be minimized in order to preserve as much of the existing environment as possible.

The Natural Diversity Data Base (NDDB), Technology Park Final Environmental Impact Statement (FEIS), and 2002 Mansfield *Water Supply Plan* reference several State-Listed species that have been identified along potential pipeline routes associated with the WWW alternative. These include grasshopper sparrows, showy lady's slipper, vesper sparrows, American kestrels, frosted elfin moths, bobolinks, eastern meadowlarks, savannah sparrows, and wood turtles. Descriptions of these species were presented in Section 4.9. Qualified personnel will perform a biological survey along the proposed construction route to determine if these species are present and to set a construction timetable to avoid these species.

Areas of listed species outside of those identified in the FEIS for the proposed extension of North Hillside Road are listed below. Routing Scenario #5C will have the least potential impact on the habitats of Endangered, Threatened, or Special Concern species.

- Routing Scenario #5A: The frosted elfin moth and the wood turtle have been found along this route.
- Routing Scenario #5B: Wood turtles have been found along this route.
- Routing Scenario #5C: The NDDB indicates that construction along this route will not impact any populations of Federal or State Endangered, Threatened, or Special Concern Species.

9.11 INLAND FISHERIES

The Willimantic Reservoir has limited storage available for water supply. Instead, Mansfield Hollow Lake informally acts as a water supply storage reservoir, providing relatively constant releases into the Willimantic Reservoir for distribution by WWW. As such, the safe yield of the reservoir is predicated based upon releases from Mansfield Hollow Reservoir.

The 1995 *Instream Flow Study* and its 2002 addendum were reviewed to determine if the information within could be applied to the subject assessment. The 1995 *Instream Flow Study* noted that while the USACE regulation of the river causes low flows to be relatively infrequent, low streamflows can be detrimental to fisheries habitat downstream of the dam. This is because flow could cease to spill over the Willimantic Reservoir dam during sustained low flow periods. No low-flow outlet is available for releases from the Willimantic River Reservoir.

Appendix C of the 2002 addendum to the 1995 *Instream Flow Study* includes estimates of habitat usability by fish species known as Weighted Useable Area (WUA). Curves were presented for adult brown trout; fry, juvenile, and adult smallmouth bass; fry, juvenile, and adult white sucker; and young-of-year, juvenile, and adult longnose dace as simulated for riffle, run, and pool habitat for specific study flows. Appendix D of the 2002 addendum to the 1995 *Instream Flow Study* interpolated between these flows to provide a more completed WUA picture that can be used to estimate potential impacts.

The 2002 addendum provided direct percentages to represent the decline in WUA for particular river discharges with and without the then proposed diversion of 4.1 mgd (6.35 cfs). In some cases, WUA decreases with increasing discharge or vice-versa, the reverse of what is normally expected. This can occur because changes in velocity of depth change the suitability of habitat. The tables presented in Appendix D of the 2002 addendum to the 1995 *Instream Flow Study* have been modified to include the effects of an additional withdrawal of 2.0 mgd to support the future water demands of the University and Town of Mansfield discussed in this document.

<u>Brown Trout</u>

The instream flow study found that adult brown trout had a moderate to significant amount of useable pool habitat, but slightly less run habitat and a slightly limited amount of riffle habitat in the Natchaug River. Table 9.11-1 presents the WUA reductions for a 6.1 mgd (9.44 cfs) withdrawal from the Natchaug River based on figures from Appendix D of the 2002 addendum to the 1995 *Instream Flow Study*.

Consistent with the 2002 addendum, the incremental change in WUA is greatest for the lowest flows (in this case, the 7Q10 flow). An incremental decrease in WUA of 12 to 20 percent over each habitat for brown trout at the 7Q10 discharge is expected. This represents a greater than minimal impact to fisheries habitat. The incremental decrease for the other low-flow indices is relatively minimal (less than six percent). Overall, it is likely that the increased withdrawal would have a greater than minimal impact on brown trout habitat in the Natchaug River without modified (higher) flow releases from Mansfield Hollow Reservoir.

TABLE 9.11-1
Potential Change in WUA for Adult Brown Trout

Low-Flow Index	Unaltered WUA (ft^2/1,000 ft of River)	Existing WUA Change (Current authorized withdrawal of 4.1 mgd)	Potential WUA Change (Potential withdrawal of 6.1 mgd)	Incremental Change
Pool				
7Q10 – 13.6 cfs	18,811	-21.7%	-34.3%	-12.7%
7Q2 – 26.9 cfs	23,711	-8.0%	-13.0%	-4.9%
30Q2 – 38.8 cfs	25,793	-3.9%	-6.1%	-2.2%
Run				
7Q10 – 13.6 cfs	13,897	-32.3%	-50.5%	-18.2%
7Q2 – 26.9 cfs	18,650	-10.6%	-16.6%	-5.9%
30Q2 – 38.8 cfs	20,919	-5.1%	-7.9%	-2.8%
Riffle				
7Q10 – 13.6 cfs	7,808	-17.1%	-38.0%	-20.9%
7Q2 – 26.9 cfs	8,481	-2.9%	-4.0%	-1.1%
30Q2 – 38.8 cfs	8,346	+1.0%	1.1%	0.1%

7Q10 = Average of consecutive flows over seven days whose level is reached once every 10 years; it is typically equivalent to the flow equaled or exceeded 99.2% of the time.
7Q2 = Average of consecutive flows over seven days whose level is reached once every two years; it is typically equivalent to the flow equaled or exceeded 94% of the time.
30Q2 = Average of consecutive flows over 30 days whose level is reached once every two years; it is typically equivalent to the flow equaled or exceeded 90% of the time.

Smallmouth Bass

The instream flow study found that smallmouth bass had a moderate amount of useable pool habitat at all life stages. Only a minimal amount of run habitat was available for the fry and adult stages, with a moderate amount available for the juvenile stage. Similarly, riffle habitat was very limited for fry and adult smallmouth bass, but was only limited for juveniles. Table 9.11-2 presents the WUA reductions for a 6.1 mgd withdrawal from the Natchaug River based on figures from Appendix D of the 2002 addendum to the 1995 *Instream Flow Study*.

Consistent with the 2002 addendum, the percent change in WUA is greatest for the lowest flows (in this case, the 7Q10 flow) and for those habitats and life stages with the most limited WUA (fry life stage in riffle habitat). For the fry life stage, minimal incremental impacts are expected for pool habitat with more significant impacts occurring in run and riffle habitats. The juvenile and adult life stages would experience significant impacts for the 7Q10 flow in all habitats, although there is a noticeable decrease in the amount of incremental impact for the higher flow indices. An incremental decrease in WUA of 20 to 30 percent is expected over each habitat for smallmouth bass at the 7Q10 discharge at each life stage except for fry in pool habitats. This represents a greater than minimal impact to fisheries habitat. The incremental decrease for the other low-flow indices is generally minor to minimal (less than 10 percent). Overall, it is likely that the increased withdrawal would have a greater than minimal impact on smallmouth bass habitat in the Natchaug River without modified (higher) flow releases from Mansfield Hollow Reservoir.

TABLE 9.11-2
Potential Change in WUA for Smallmouth Bass

Low-Flow Index	Unaltered WUA (ft^2/1,000 ft of River)	Existing WUA Change (Current authorized withdrawal of 4.1 mgd)	Potential WUA Change (Potential withdrawal of 6.1 mgd)	Incremental Change
Fry – Pool				
7Q10 – 13.6 cfs	14,866	-4.0%	-7.6%	-3.6%
7Q2 – 26.9 cfs	15,321	-1.7%	-2.9%	-1.1%
30Q2 – 38.8 cfs	15,786	-1.4%	-2.1%	-0.7%
Fry – Run				
7Q10 – 13.6 cfs	512	-55.4%	-76.0%	-20.6%
7Q2 – 26.9 cfs	758	-11.5%	-19.5%	-8.0%
30Q2 – 38.8 cfs	898	-8.5%	-11.7%	-3.2%
Fry – Riffle				
7Q10 – 13.6 cfs	18	-21.0%	-51.7%	-30.6%
7Q2 – 26.9 cfs	11	+36.9%	+62.3%	+25.4%
30Q2 – 38.8 cfs	3	+123.0%	+203.4%	+80.4%
Juvenile – Pool				
7Q10 – 13.6 cfs	9,730	-42.7%	-65.5%	-22.8%
7Q2 – 26.9 cfs	15,902	-16.0%	-25.4%	-9.4%
30Q2 – 38.8 cfs	18,943	-7.9%	-12.2%	-4.3%
Juvenile – Run				
7Q10 – 13.6 cfs	11,663	-41.2%	-62.5%	-21.3%
7Q2 – 26.9 cfs	17,230	-13.2%	-20.7%	-7.5%
30Q2 – 38.8 cfs	20,566	-8.1%	-12.3%	-4.3%
Juvenile – Riffle				
7Q10 – 13.6 cfs	5,278	-25.5%	-46.9%	-21.4%
7Q2 – 26.9 cfs	6,526	-6.0%	-10.3%	-4.2%
30Q2 – 38.8 cfs	6,514	+0.6%	+0.3%	-0.2%
Adult – Pool				
7Q10 – 13.6 cfs	11,114	-30.5%	-46.9%	-16.3%
7Q2 – 26.9 cfs	16,182	-13.1%	-20.7%	-7.6%
30Q2 – 38.8 cfs	18,785	-6.8%	-10.5%	-3.7%
Adult – Run				
7Q10 – 13.6 cfs	2,047	-44.4%	-65.3%	-20.9%
7Q2 – 26.9 cfs	3,122	-15.0%	-23.1%	-8.1%
30Q2 – 38.8 cfs	3,731	-8.1%	-12.15	-4.1%
Adult – Riffle				
7Q10 – 13.6 cfs	694	-16.7%	-38.9%	-22.1%
7Q2 – 26.9 cfs	737	-1.4%	-2.0%	-0.6%
30Q2 – 38.8 cfs	706	+2.3%	+3.1%	+0.8%

White Sucker

The instream flow study found that white sucker had a significant amount of useable pool habitat for the fry life stage, with slightly less run habitat available and a limited amount of riffle habitat. Juvenile and adult life stages were relatively limited in the amount of pool and run habitat, and were very limited in the amount of riffle habitat available under low flows. Table 9.11-3 presents the WUA reductions for a 6.1 mgd withdrawal from the Natchaug River based on figures from Appendix D of the 2002 addendum to the 1995 *Instream Flow Study*.

TABLE 9.11-3
Potential Change in WUA for White Sucker

Low-Flow Index	Unaltered WUA (ft^2/1,000 ft of River)	Existing WUA Change (Current authorized withdrawal of 4.1 mgd)	Potential WUA Change (Potential withdrawal of 6.1 mgd)	Incremental Change
Fry – Pool				
7Q10 – 13.6 cfs	33,530	-1.7%	-3.1%	-1.4%
7Q2 – 26.9 cfs	34,373	-1.1%	-1.7%	-0.7%
30Q2 – 38.8 cfs	34,512	-0.1%	-0.2%	-0.2%
Fry – Run				
7Q10 – 13.6 cfs	27,927	-22.5%	-38.1%	-15.6%
7Q2 – 26.9 cfs	27,481	+2.6%	+3.0%	+0.4%
30Q2 – 38.8 cfs	25,490	+4.3%	+6.6%	+2.3%
Fry – Riffle				
7Q10 – 13.6 cfs	7,298	+23.8%	+16.2%	-7.5%
7Q2 – 26.9 cfs	5,141	+15.4%	+28.4%	+13.1%
30Q2 – 38.8 cfs	4,290	+8.3%	+13.3%	+5.0%
Juvenile & Adult – Pool				
7Q10 – 13.6 cfs	7,494	-44.9%	-67.8%	-22.9%
7Q2 – 26.9 cfs	13,117	-18.7%	-29.0%	-10.3%
30Q2 – 38.8 cfs	16,418	-9.9%	-15.4%	-5.5%
Juvenile & Adult – Run				
7Q10 – 13.6 cfs	6,263	-53.5%	-77.2%	-23.7%
7Q2 – 26.9 cfs	9,137	-11.9%	-19.2%	-7.3%
30Q2 – 38.8 cfs	9,770	-2.3%	-3.8%	-1.5%
Juvenile & Adult – Riffle				
7Q10 – 13.6 cfs	491	-15.3%	-49.3%	-34.0%
7Q2 – 26.9 cfs	445	-2.4%	+6.4%	+8.8%
30Q2 – 38.8 cfs	338	+15.8%	+23.8%	+8.0%

Consistent with the 2002 addendum, the percent change in WUA is greatest for the lowest flows (in this case, the 7Q10 flow at the juvenile and adult life stages). For the fry life stage, relatively minimal incremental impacts are expected for pool and riffle habitats with more significant impacts occurring in run habitat for the 7Q10 flow. The juvenile and adult life stages would experience impacts for lower flows in all habitats, although there is a noticeable increase in the amount of riffle habitat for the 7Q2 and 30Q2 flows. Overall, it is likely that the increased withdrawal would have a greater than minimal impact on white sucker habitat in the Natchaug River without modified (higher) flow releases from Mansfield Hollow Reservoir.

Longnose Dace

The instream flow study found that longnose dace had a limited amount of useable habitat at the fry life stage, a negligible amount of habitat available at the juvenile life stage, and fairly limited to limited amount of habitat available for the adult life stage. No pool and very limited run habitat was available for juveniles in pools and riffles, respectively. Table 9.11-4 presents the WUA reductions for a 6.1 mgd withdrawal from the Natchaug River based on figures from Appendix D of the 2002 addendum to the 1995 *Instream Flow Study*.

TABLE 9.11-4
Potential Change in WUA for Longnose Dace

Low-Flow Index	Unaltered WUA (ft^2/1,000 ft of River)	Existing WUA Change (Current authorized withdrawal of 4.1 mgd)	Potential WUA Change (Potential withdrawal of 6.1 mgd)	Incremental Change
Young of Year – Pool				
7Q10 – 13.6 cfs	2,844	-5.6%	-7.7%	-2.1%
7Q2 – 26.9 cfs	3,008	+0.5%	-3.7%	-4.3%
30Q2 – 38.8 cfs	3,235	-2.9%	-4.9%	-2.0%
Young of Year – Run				
7Q10 – 13.6 cfs	8,678	-32.7%	-37.3%	-4.6%
7Q2 – 26.9 cfs	9,643	+3.1%	+1.9%	-1.1%
30Q2 – 38.8 cfs	8,416	+7.3%	+11.3%	+4.0%
Young of Year – Riffle				
7Q10 – 13.6 cfs	5,651	-1.9%	-17.4%	-15.5%
7Q2 – 26.9 cfs	5,926	+1.2%	+0.4%	-0.8%
30Q2 – 38.8 cfs	5,455	+4.5%	+6.7%	+2.2%
Juvenile – Pool				
7Q10 – 13.6 cfs	0	N/A	N/A	N/A
7Q2 – 26.9 cfs	0	N/A	N/A	N/A
30Q2 – 38.8 cfs	0	N/A	N/A	N/A
Juvenile – Run				
7Q10 – 13.6 cfs	0	N/A	N/A	N/A
7Q2 – 26.9 cfs	66	-63.0%	-91.1%	-28.1%
30Q2 – 38.8 cfs	153	-32.6%	-46.5%	-13.9%
Juvenile – Riffle				
7Q10 – 13.6 cfs	121	-84.3%	-97.7%	-13.4%
7Q2 – 26.9 cfs	715	-53.0%	-69.8%	-16.8%
30Q2 – 38.8 cfs	2,039	-38.7%	-54.1%	-15.4%

TABLE 9.11-4 (Continued)
Potential Change in WUA for Longnose Dace

Adult – Pool				
7Q10 – 13.6 cfs	1,180	-7.9%	-13.8%	-5.8%
7Q2 – 26.9 cfs	1,328	-4.5%	-8.6%	-4.1%
30Q2 – 38.8 cfs	1,387	-2.1%	-3.4%	-1.3%
Adult – Run				
7Q10 – 13.6 cfs	4,480	-30.1%	-39.8%	-9.6%
7Q2 – 26.9 cfs	5,310	-2.8%	-7.1%	-4.3%
30Q2 – 38.8 cfs	5,346	-0.3%	-0.6%	-0.3%
Adult – Riffle				
7Q10 – 13.6 cfs	4,430	-26.1%	-43.1%	-17.0%
7Q2 – 26.9 cfs	6,502	-14.7%	-22.4%	-7.7%
30Q2 – 38.8 cfs	8,101	-10.2%	-15.3%	-5.2%

Consistent with the 2002 addendum, the percent change in WUA is greatest for the lowest flows (in this case, the 7Q10 flow) and for those habitats and life stages with the most limited WUA (juvenile life stage in run and riffle habitats). For the young-of-year life stage, minimal incremental impacts are expected for each habitat type except for riffle habitats at the lowest flows. The adult life stage would also experience greater than minimal incremental impacts. The juvenile life stage would also experience significant impacts, but this is because very little habitat is available under the natural condition. Overall, it is likely that the increased withdrawal would have a greater than minimal impact on longnose dace habitat in the Natchaug River without modified (higher) flow releases from Mansfield Hollow Reservoir.

<u>Summary</u>

The 2002 addendum to the 1995 *Instream Flow Study* utilized flow data and statistics from the Natchaug River USGS gage located downstream of the Willimantic Reservoir with corrections for the withdrawal rate at WWW. This discussion presented a 7Q10 discharge of approximately 14 cfs. It is notable that over the last ten years, mean daily flows at this USGS gage have only fallen below 20 cfs a total of five times and below 25 cfs a total of 46 times. The 99.2% duration flow (considered to be approximately equivalent to the 7Q10 flow) over the last ten years is 23 cfs despite the droughts that occurred in 2001, 2005, 2007, and 2010. Thus, it appears that the USACE has been providing a steady level of releases above 20 cfs from Mansfield Hollow Dam and should this trend continue, the results presented in the 2002 addendum to the 1995 *Instream Flow Study* and the additional analysis presented above should be considered conservative. In other words, while this cannot be guaranteed, the decreases in WUA in the last decade may have not been as significant as listed in the above tables under “Withdrawal of 4.1 mgd.”

The usage of WWW’s water by the University would result in an inter-basin transfer of water since water would be primarily returned to the Willimantic River basin via the University WPCF. This is consistent with the University’s current inter-basin transfer from the Fenton River Wellfield to the Willimantic River as the Fenton River is a tributary of the Natchaug River. It is notable that the Natchaug River and the Willimantic River combine to form the Shetucket River approximately 3.3 miles downstream of the Willimantic Reservoir. Thus, impacts related to the inter-basin transfer would manifest within this reach.

The Connecticut Department of Energy & Environmental Protection (CT DEEP) fisheries personnel have stated that additional withdrawals on the order of 0.5 to 1.0 mgd (0.77 to 1.55 cfs) could have significant impacts to fisheries resources along the lower Natchaug River; thus additional withdrawals on the order of 2.0 mgd could have impacts as well. In particular, there may be adversely affected riffle and run habitats downstream of the Willimantic Reservoir Dam. CT DEEP personnel have noted that increased releases from Mansfield Hollow Lake could mitigate downstream impacts during low-flow periods, although there is no mechanism in place to accomplish this at the present time.

Should this alternative be selected, it may be desirable to revisit the *Instream Flow Study* using the more recent (higher) river discharge data to re-determine the baseline fisheries habitat impacts. This would present a more current baseline to evaluate the most appropriate minimum flow release from Mansfield Hollow Reservoir. A watershed mass-balance model may need to be utilized to determine how the operational protocols at Mansfield Hollow will need to change to ensure that the Willimantic Reservoir receives the minimal amount of water it requires each year to meet its demands while minimizing adverse impacts to downstream fisheries habitat.

The implementation of this alternative may require the installation of a new intake structure into the Willimantic Reservoir as well as dredging of the reservoir. Construction period impacts to fisheries in the Natchaug River are expected to be minimal since best management practices will be utilized during this type of work. Fisheries habitat impacts along the proposed pipeline routes are expected to be minimal because in-water work would not be conducted.

9.12 WATER QUALITY AND STORMWATER MANAGEMENT

9.12.1 TREATED WATER QUALITY

WWW would require an expansion of its treatment plant to provide quantities of water greater than 4.1 mgd to its system. Beyond the expansion of the water treatment plant, production of additional water for the University and Mansfield would require other improvements. The use of chemicals in the summer months is very temperature-dependent. Above a water temperature of 72 degrees, chemical usage increases substantially as WWW must control and remove organic and inorganic compounds from the raw water. For example, manganese becomes problematic and the use of sodium hypochlorite increases significantly to help precipitate the metal in the sedimentation basins. Cooler water temperatures would alleviate these issues. However, the reservoir is reportedly only two feet deep throughout most of its area in the summer, which facilitates rapid warming of any water flowing from the upstream Mansfield Hollow Reservoir.

WWW has long believed that a deeper reservoir would cause cooler water temperatures. Dredging to accomplish increased depths would also help remove much of the organic matter than is costly and difficult to immobilize and remove in the water treatment plant. It is important to note that a deeper reservoir would not affect safe yield because: (1) the safe yield of WWW is based on statistical low flows of the Natchaug River; and (2) the raw water intake is fixed at the water surface and cannot access deeper areas. Dredging of the Willimantic Reservoir is believed to be a multi-year effort whether hydraulic dredging or conventional excavation are utilized, as water control will be challenging and the reservoir must continue to serve as the sole source of supply to WWW.

The presence of disinfection byproducts (DBPs) is an important consideration in the analysis of this alternative. The two regulated disinfection byproducts are total trihalomethanes (TTHM) and haloacetic acids (HAA5). Because any water transmitted to the University would originate at the water treatment plant rather than an existing section of the distribution system, the most appropriate point of analysis of DBPs for WWW is the entry point sample site. The lowest TTHM and HAA5 levels in a system are typically found at the entry point. Although this is not always the case for HAA5 in some public water systems, it is believed true for the WWW system.

According to the Windham Water Works Consumer Confidence Report (CCR) published for the year 2011, the range of TTHM detected throughout the system was 10 ppb to 91 ppb. The low end of the range is assumed to correspond to the entry point. The range of HAA5 detected throughout the system was 8 ppb to 25 ppb. Likewise, the low end of the range is assumed to correspond to the entry point sample.

A review of prior CCRs (available for 2003-2007 and 2011) indicates that the low end of the TTHM range was generally below 20 ppb for the years 2003, 2004, and 2007. However, the lowest TTHM level detected in the Windham system in 2005 and 2006 was 45 ppb. There could be many reasons for these elevated levels, including varying source water quality or the need to modify treatment processes. The return to a low detection of 18 ppb in 2007 and 10 ppb in 2011 indicates that treated water quality has improved relative to disinfection byproducts.

The low end of the HAA5 range was generally below 15 ppb for all years that CCRs were available, and the 8 ppb detection in 2007 is the same as the lowest level detected in 2011. Treated water quality appears to be very stable relative to HAA5, and the highest levels detected in the system have not exceeded the EPA’s maximum contaminant level (MCL) of 60 ppb since 2003.

After water leaves the WWW treatment plant and is routed north on Route 195, it would either be stored in the new tank or will flow directly to the University distribution system. TTHM and HAA5 concentrations will increase with age during this time just as they increase throughout the WWW distribution system.

Water that enters a new tank will experience some degree of stagnation and will be older than water that flows directly to the University. Because the tank will be new and should therefore benefit from the best available technologies to reduce water age, this analysis assumes that water age will be minimized at the tank. Given the likely volume of the tank (2.0 MG), it can be expected to add two to three days of age to treated water in the warmer months when disinfection byproducts are typically higher.

Table 9.12-1 presents a narrative series of questions and conclusion relative to potential DBP levels resulting from use of a WWW interconnection.

TABLE 9.12-1
Treated Water Quality Summary Table for WWW

Assessment	TTHM	HAA5
What is the typical concentration near the starting point at the present time?	10 ppb	8 ppb
Will provision of water to the University and Mansfield cause a decrease in water age in the host system?	No	No
If so, will the decrease in water age cause an improvement in DBP levels at the starting point?	NA	NA
Could biodegradation of the haloacetic acids be occurring in the system?	Unknown	Unknown
Will treated water enter the pipeline with DBP levels less than half the MCLs?	Yes	Yes
Will the pipeline volume increase the age >1 day at 2.0 mgd?	No	No
Will new storage add significant age at 2.0 mgd?	Possible	Possible
Do DBPs exceed their MCLs in the extremities of the host system?	Yes	No
What is the likelihood that DBPs will be lower than MCLs upon entry to the University system at 2.0 mgd? [high, moderate, low]	Moderate to High	High
Will blending with the University's water mitigate DBPs at 2.0 mgd?	Yes	Yes
What is the likelihood that DBPs will be lower than MCLs in the University system at 2.0 mgd?	High	High

The use of WWW water at the University will result in the presence of DBPs at higher concentrations in the University distribution system as compared to current levels. The University would need to manage its water supply to ensure DBP compliance with the Stage 1 and Stage 2 of the DBPR. However, there is a high likelihood that DBPs will be lower than the MCLs under this alternative. The small variety in the pipeline lengths is not expected to make a significant difference in the generation of DBPs under the various interconnection scenarios.

9.12.2 Surface Water Resources

This alternative would withdraw water from the Willimantic Reservoir in the Natchaug River basin (#3200) to provide water supply to Mansfield. The surface water in the Willimantic Reservoir is classified as B/AA, indicating that is suitable for fish and wildlife habitat, recreation, navigation, and industrial and agricultural water supply. The State's long-term goal is to restore the water quality of the reservoir to Class AA. As shown in Table 4.11-2, the Natchaug River (upstream of the Shetucket River) is listed as not meeting the standard of designated use for recreation due to an unknown source of *E. Coli* bacteria and also has a fish consumption advisory.

The Connecticut DPH completed a Source Water Assessment (SWAP) report for the Willimantic Reservoir in May 2003. This report noted that the water source has an overall susceptibility rating of "high" to potential sources of contamination. The watershed draining to Willimantic Reservoir includes a significant amount of land in Ashford, Chaplin, Eastford, Hampton, Mansfield, Pomfret, Scotland, Union, Willington, Windham, and Woodstock, Connecticut as well as Monson and Wales, Massachusetts. Approximately 27% of the land in the watershed is preserved as open space.

9.12.3 Groundwater Resources

Groundwater beneath potential pipeline areas is primarily mapped as GAA with areas of GA mapped along Maple Road. The GAA designation is applied for the entire Willimantic Reservoir watershed, although two areas of GAA-Impaired exist in Mansfield Center and south or Spring Hill along Route 195. The installation of new pipelines is not expected to have an impact on ground water quality. In fact, the extension of pipelines to Mansfield Four Corners (an area with reduced water quality) is an important mitigation measure for public health concerns.

9.12.4 Stormwater Management

Significant impacts to stormwater quality are not expected. Best management practices will be utilized during the construction period such that construction debris and sediment are not directly released to stormwater systems. New stormwater systems would be developed in concert with any new University development, such as North Campus. New stormwater systems would need to meet the University's design standards. In addition, new stormwater systems would be created during new development projects. The impacts of these systems will be evaluated during local permitting processes.

9.13 Flood Hazard Potential

The only potential pipelines that are located within the 1% annual chance floodplain include the Fenton River crossings on pipeline segments 35 and 36 (routing scenario #5A). The installation of pipelines in roadways, through directional drilling, or on the sides of bridges is not expected to result in an increase in flood hazard potential in these areas.

Upgrades at the WWW water treatment plant would need to be performed under this alternative, but these will be located above the 1% annual chance floodplain of the Natchaug River. Stream channel encroachment lines (SCELs) are not located along the Fenton River or the Natchaug River.

9.14 Physical Environment

9.14.1 Topography

The topography of the study area is typical of the Eastern highlands in Connecticut with many hills and ridgelines sloping down into stream and river valleys. The ground elevation of the WWW WTP at Willimantic Reservoir is approximately 190 feet. Water at the WTP would be pumped up to a tank in the Mansfield Center/Spring Hill area that would have an elevation of at least 460 feet. From this area, the three routing scenarios traverse a variety of hills to connect with University infrastructure.

- Routing Scenario #5A: The ground elevation is approximately 300 feet at the Fenton River Wellfield such that the University's pumping station would direct water up to the W-Lot and Towers storage tanks (elevation 700 feet). Water directed on this routing would require the least energy expenditure from WWW for pumping since the University would power the Fenton pumping station.

- Routing Scenarios #5B and #5C: These scenarios both terminate either at the 12-inch diameter express main at Bolton Road (elevation 630 feet) or at the W-Lot storage and the Towers storage tanks (elevation 700 feet). Water directed on these routes would require pumping. The increase in elevation may also require the use of individual pressure reducing valves to service areas in Mansfield Center.

9.14.3 SURFICIAL GEOLOGY

A variety of surficial geology is mapped along potential pipeline routes. The type of soil in a particular area is important for the delineation of wetlands and for construction challenges. The types of surficial geology and soils present along potential pipeline routes are not expected to present insurmountable challenges to the completion of this alternative.

9.14.4 BEDROCK GEOLOGY

This interconnection alternative will not rely on bedrock well or stratified drift well sources. As such, impacts to bedrock water quality or quality are not expected. Fault lines are mapped along potential pipeline segments associated with the WWW alternative. However, these fault lines are generally considered to be inactive. The presence of shallow bedrock or ledge will be a design consideration.

9.15 AIR QUALITY AND NOISE

The implementation of pumping improvements, treatment plant improvements, new water mains and utility work, and other associated construction will not result in a degradation of air quality. New buildings associated with this alternative would have interior equipment and would not be significant generators of air pollution.

Temporary construction impacts to air quality in the vicinity of the WTP are expected and unavoidable. Additional construction traffic will be realized near the WTP during the expansion resulting in an increase in vehicular emissions near the site. Overall, these emissions are expected to have a minor and temporary impact on air quality.

Other construction activities are expected to generate fugitive dust and mobile source emissions. Such sources of dust are attributed to construction vehicle disturbance during hauling, loading, dumping, and bulldozing on any areas of proposed development or construction. Meteorological conditions, the intensity of the activities, and the soil moisture content govern the extent to which particles will become airborne.

The use of air pollution devices on construction equipment and other forms of controls that reduce the impact from fugitive dust emissions will be utilized during this project to minimize impacts to air quality. The proper phasing of construction will further minimize the length of time that soil remains exposed to wind and water. Activities will be conducted in accordance with proper protocols and regulations, and no washings will be directed to storm drainage.

The implementation of the WWW alternative and associated new water mains and utility work will not result in long-term noise impacts. New treatment facilities would be located in the vicinity of the existing WTP with interior equipment that will is not expected to create significant noise at the street. New tanks and underground pumping stations also are not significant noise generators. While temporary impacts associated with the construction of new water mains would be realized along many state and town roads, the noise generated by these construction activities would primarily occur during daylight hours.

9.16 SOLID WASTE, HAZARDOUS MATERIALS, & POTENTIAL POLLUTION SOURCES

The presence of solid waste, hazardous materials, and potential pollution sources is particularly important for surface water supplies. Ongoing water quality monitoring is performed at the Willimantic Reservoir to identify the presence of contaminants. This supply source has been consistently monitored and utilized with acceptable water quality.

The potential pipeline routes pass several areas with potential pollution sources. However, the installation of pipeline routes will not result in an impact to potential pollution sources. In addition, water mains will be pressurized such that contaminants in the surrounding soil would not be able to enter into the pipe and contaminate the water.

Construction and demolition-related waste will be generated by the project. Disposal of these wastes will be handled in accordance with applicable solid waste statues and regulations.

9.17 OTHER PROJECT IMPACTS

9.17.1 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

Certain adverse impacts associated with construction of an interconnection with WWW are unavoidable. These are predominantly in the category of short-term construction related impacts. The project will undergo a construction phase wherein additional equipment will be utilized. Mitigation measures have been identified with respect to associated short-term air and noise quality. However, a certain degree of additional truck and equipment use and access will be necessary during this time period, which is unavoidable. Potential soil erosion and sedimentation impacts will be largely mitigated through proper construction management techniques. No other unavoidable adverse environmental impacts have been identified.

9.17.2 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The construction of the interconnection will utilize nonrenewable resources during the construction and implementation (i.e., construction supplies, fuel, personnel time, etc.). Since these resources cannot be reused, they are considered to be irreversibly and irretrievably committed. Specifically, these include the following actions:

- Clearing;
- Access road construction;
- Dredging work within Willimantic Reservoir;

- Installation of water mains to connect to the University and Mansfield; and
- Installation of associated infrastructure, treatment plant expansion, etc.

9.17.3 CUMULATIVE IMPACTS

Cumulative impacts are those that result from the incremental impact of the proposed action when added to other past, present, or reasonably foreseeable future actions. Cumulative impacts associated with the alternative include the following:

- Additional withdrawals from Willimantic Reservoir, and hence, the Natchaug River;
- Potential impacts to fisheries resources in the Natchaug River;
- Interbasin transfer of water from the Natchaug River basin to the Willimantic River basin;
- Formation of additional disinfection byproducts in treated water due to higher water ages along the pipeline;
- Additional water mains within roadways;
- Incremental energy demands; and
- Additional development due to the presence of the water main.

9.17.4 MITIGATION OPPORTUNITIES TO OFFSET ADVERSE ENVIRONMENTAL IMPACTS

Several mitigation opportunities have been identified for this alternative to minimize or offset adverse environmental impacts. These include the following:

- Future coordination with the U.S. Army Corps of Engineers to release additional water from Mansfield Hollow Lake during periods of low flow in the Natchaug River;
- Implementation of overlay zones in the Town of Mansfield to reduce future development density and creation of impervious surfaces along potential pipeline routes;
- Coordination with various local departments, commissions, and committees regarding the proposed pipeline;
- Designs that hang pipe on bridges or include directional drilling to prevent direct wetland impacts;
- Routing the Mansfield Center portion of the pipeline along Dodd Road to avoid a potentially historic bridge;
- Targeting construction in the summer whenever possible to minimize traffic impacts near the University;
- Fit the new 2.0 MG tank in Mansfield with internal baffles or mixing systems to minimize water age;
- Perform a biological survey for endangered, threatened, or special concern species during the design phase to establish buffers and construction timetables to minimize the impact to these species;
- Adherence to best management practices to mitigate impacts to stormwater runoff; and
- Performance of construction activities during daylight hours to minimize noise impacts.

9.18 EVALUATION OF PROJECT COSTS

9.18.1 LAND ACQUISITION AND EASEMENT COSTS

The implementation of this alternative will require the purchase or easement of land for pressure reducing values, a new storage tank in Mansfield Four Corners, a new storage tank in the vicinity of Mansfield Center, and new backwash lagoons adjacent to the WTP. The cost for these items could range from minimal (transfer of land from the University for the tank and from the Town of Mansfield for the new backwash lagoons, for example) to approximately $110,000.

9.18.2 COSTS TO IMPROVE EXISTING INFRASTRUCTURE

WTP Upgrade or Replacement

The WWW treatment plant consists of two separate buildings. One building (constructed in 1885) houses all pumping equipment, and the other contains the treatment facilities. The treatment building was constructed in 1936 and has had numerous renovations and upgrades over the years. A $4.7 million upgrade was completed in 1997. Additional upgrades and/or replacement would be necessary for providing water to the University and Mansfield. Table 9.18-1 provides a summary of estimated costs to nominally expand the WTP to add 2.0 mgd capacity.

TABLE 9.18-1
Construction Cost Estimate for Nominal WTP Expansion

Component	Cost at 2.0 mgd
Raw Water Pumps	
Third pump	$63,000
Associated piping & valves	$66,000
Facility structural modifications	$20,000
Rapid and Static Mixing Basins	
Convert rapid mix to static mix basin	$17,500
Install new rapid mix basin	$32,000
Grading & landscaping	$2,000
Associated piping & valves	$12,500
chemical piping & valves	$3,200
mixer power & control	$4,500
Flocculation and Settling	
Install more flocculation chambers (8)	$152,000
Install more settling basins (4)	$208,000
Install sludge collectors (4)	$108,000
Conduit, wire and controls for collectors	$15,000
Associated piping & valves	$70,000
Grading & landscaping	$16,000

TABLE 9.18-1 (Continued)
Construction Cost Estimate for Nominal WTP Expansion

Component	Cost at 2.0 mgd
Filters	
Install new filters (4)	$252,000
Associated piping & valves for all filters	$100,000
Expand building to north	$200,000
Relocate piping in yard	$60,000
Grading & landscaping	$16,000
Contact/Clearwell	
Replace 24" pipe with 30" pipe	$110,000
Expand clearwell	$330,000
Expand contact chamber	$270,000
Relocate drainage swale	$8,000
Grading & landscaping	$6,000
Treated Water Pumps	
Third treated water pump	$85,000
Associated piping & valves	$62,000
Backwashing/Residuals	
Third backwash pump	$15,000
Associated piping & valves	$30,000
Install new residuals lagoon	$318,000
Cost of land (assumed donated)	$0
Controls	
Modification of panels & controls	$25,000
new Raw Water Pump VFD	$20,000
new distribution water pump	$30,000
Control software reconfiguration	$25,000
Network Hardware	$10,000
Electrical	
New Process conduit & wiring	$75,000
lighting & miscellaneous	$17,500
Control wiring	$30,000
New Service	$170,000
Temporary process and control power	$25,000
New generator, fuel system	$100,000
Totals	**$3,179,200**

Full replacement of the WTP may be prudent rather than expanding it to add 2.0 mgd capacity. For a plant replacement, it would make sense for capacity to be expanded to that of the safe yield (7.9 mgd) or thereabouts. Many variables could affect the cost of this type of action. The estimate below is based on water treatment plant construction projects completed in the last two years.

TABLE 9.18-2
Construction Cost Estimate for New WTP with 7.9 mgd Capacity

Component	Cost (million)
New reservoir intake structure	$2.0
WTP with process and utility infrastructure, administrative facilities, laboratory, and 0.5 MG finished water storage	$15.6
Process equipment	$3.5
Decommission existing WTP	$0.5
Total	**$21.6**

This estimate is comparable to those provided in Section 7.18 for the various upgrades of the Rockville WTP, and is reasonable for the purpose of comparing the alternatives that are evaluated in this EIE.

Sediment Removal

Beyond the expansion of the water treatment plant, production of additional water would require other improvements. WWW believes that a deeper reservoir would cause cooler water temperatures, leading to improved water quality. Sediment removal or dredging to accomplish increased depths would also help remove much of the organic matter than is costly and difficult to immobilize and remove in the water treatment plant. The reservoir is reportedly only two feet deep throughout most of its area in the summer, which facilitates rapid warming of water in the river. Although the quantity of sediment to be removed has not been determined, it would likely be greater than 200,000 cubic yards in order to achieve depths that could facilitate the improvement in water quality that is desired by WWW.

Four sets of cost estimates were prepared for removing sediment from the reservoir: conventional and hydraulic methods to a depth of eight feet (total of 200,000 cubic yards), and conventional and hydraulic methods to a depth of 17 feet (1 million cubic yards). Table 9.18-3 summarizes the costs. Intermediate quantities of sediment removal would have intermediate costs. The four costs assume that sediment is not contaminated, and that a local disposal site or use can be identified.

TABLE 9.18-3
Cost Estimates for Willimantic Reservoir Sediment Removal

Method	Quantity (cubic yards)	Cost (million)	Duration
Conventional excavation	200,000	$4.439	Two seasons
Hydraulic	200,000	$4.497	Two seasons
Conventional excavation	1,000,000	$19.320	Ten seasons
Hydraulic	1,000,000	$21.060	Ten seasons

Removal of sediments from Willimantic Reservoir is believed to be a multi-year effort whether hydraulic dredging or conventional excavation are utilized, as water control will be extremely challenging and the reservoir must continue to serve as the sole source of supply to WWW. As noted in the table, sediment removal could require two to ten seasons for excavation or hydraulic dredging.

For the purpose of this EIE, the lowest-cost sediment removal using hydraulic methods is carried forward. This is because hydraulic dredging will likely have fewer temporary environmental impacts than conventional excavation for this particular reservoir, as conventional excavation requires dewatering of sections of the reservoir.

9.18.3 CONSTRUCTION COSTS

Pipeline and Associated Water Mains

Three sets of cost estimates have been prepared. These correspond to the 12-inch water main options along the three potential routes described in this document. The following assumptions have been incorporated:

- Bends – one located per 1,000 feet of pipeline
- Isolation valves – one located per mile of pipeline
- Flush hydrants – one located per mile of pipeline
- Air release – one located per mile of pipeline
- Fire hydrants – one located per 500 feet of pipeline

TABLE 9.18-4
Construction Cost Estimates for Potential Pipeline Scenarios

Alternative Pipeline Route	Description	Assumed Capacity	Cost (million)
5A-1	12-inch to Fenton River Clearwell	2.0 mgd	$9.50
5B-1	12-inch along Maple Avenue	2.0 mgd	$8.62
5C-1	12-inch along Route 195	2.0 mgd	$7.70

The lowest-cost option appears to be installation of the 12-inch diameter pipeline along Route 195.

Pumping Station

A cost of $500,000 is estimated for a pumping station along Route 195 between the new 2.0 MG tank and the University. This pumping station would include up to three 350-gpm pumps (two active and one for redundancy) as well as two high-flow fire pumps. The estimate includes the building, site work, electrical, etc. A cost of $400,000 for the interconnection meter and vault has been estimated.

New Tank in Southern Mansfield

The main pressure zone is supplied directly from the treatment plant, and is served from the Hosmer Mountain Reservoir. The level of the Hosmer Mountain Reservoir typically controls treatment plant operations. The Hosmer Mountain Reservoir is believed to have 4,500,000 gallons of usable storage. This reservoir directly serves most of the system. In order to appropriately deliver water to northern Mansfield and the University from the high lift pumps, a new water tank would be needed in southern Mansfield. Costs are summarized below. These are believed appropriate for at least two of the sites, with the assumption that land would be donated. Two of the sites are privately-owned and therefore land donation would not be applicable.

TABLE 9.18-5
Construction Cost Estimate for New 2.0 MG Tank

Component	Cost
Tank	$1,500,000
Site Work	$150,000
Piping, Valves, etc.	$100,000
Telemetry and electrical	$35,000
Land	$0 (donated)*
Total	$1,785,000

* Two of the potential sites are privately-owned and therefore land donation would not be applicable

9.18.4 Analysis of Probable Capital Costs

The costs described above are summarized in Table 9.18-6. For the WTP expansion, the higher cost associated with WTP replacement has been carried forward.

TABLE 9.18-6
Summary of Estimated Costs for Alternative #5

Component	Cost
WTP Expansion - plant	$21,600,000
WTP Expansion - land - *assume donated by Town of Mansfield*	$0
Dredging of Willimantic Reservoir	$4,496,500
Tank	$1,785,000
Land - *assume donated by University or Town of Mansfield*	$0
New pumping station	$500,000
Pipelines	$7,700,000
Interconnection/meter	$400,000
Design/contingency (20% of above)	*$7,296,300*
Permits and Approvals	$400,000
Legal agreements and services	$200,000
Totals	**$44,377,800**
Normalized Cost per MGD	***$22,188,900***

Most of the mitigation opportunities listed in Section 9.17.4 will have costs that are inherently incorporated into components of the alternative. For example, coordination with local departments and commissions regarding the pipeline are typically incorporated into design and regulatory costs, as are designs that hang pipe on bridges or include directional drilling to prevent direct wetland impacts, and construction in the summer whenever possible to minimize traffic impacts near the University. Thus, much of the mitigation does not have a separable cost. On the other hand, implementation of overlay zones by the local land use commission in Mansfield will have a moderate cost on the order of $10,000.

A new diversion permit for withdrawals from the Willimantic Reservoir could be facilitated by developing an agreement with the U.S. Army Corps of Engineers to release more water from Mansfield Hollow Reservoir during low flow periods. Because this possibility is speculative, a cost has not been estimated for future coordination with the U.S. Army Corps of Engineers.

9.19 FINDING

Interconnection with WWW is a feasible alternative that may result in impacts to downstream aquatic habitat under low stream flow conditions. Mitigation could take the form of increased releases from Mansfield Hollow Lake by the U.S. Army Corps of Engineers, although this is beyond the control of the University, Town of Mansfield, or WWW. This alternative meets the project purpose and need to provide a safe, reliable water supply source that that maximizes benefits while minimizing land use and other adverse impacts. An interconnection with WWW has the ability to provide water supply to the University that will maintain a long-term system MOS greater than 1.15 while meeting committed demands. Further, it has the ability to provide additional water supply to support future growth at the University and in the town of Mansfield.