

ROSEMONT AREA DRAINAGE STUDY

OCTOBER, 2004

PREPARED FOR:

**TOWN OF GOFFSTOWN
DEPARTMENT OF PUBLIC WORKS
404 ELM STREET
GOFFSTOWN, NH 03045**

PREPARED BY:



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MJ Project #16476.00**

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STORMCAD REPORT AND HYDRAULIC GRADE PROFILES



I. INTRODUCTION

The following drainage study for the area around Rosemont Street in Goffstown, New Hampshire has been prepared for the Town of Goffstown to provide:

- An existing conditions analysis of the closed drainage systems in the area, and
- Proposed solutions for the recurring drainage problems.

The site currently experiences flooding of low-lying areas around some residential and commercial buildings and flooding of local parking areas and roadways. In support of this drainage assessment, McFarland-Johnson, Inc. (MJ) has:

- Completed a field survey of the existing closed drainage systems,
- Analyzed existing site conditions for current land uses and drainage components,
- Completed a drainage analysis using hydrologic and hydraulic computer modeling,
- Developed recommended improvements to correct these drainage issues, and
- Developed conceptual opinions of probable cost for each recommendation.

II. BACKGROUND DISCUSSION

The Rosemont Drainage Study Area is located in the southeast corner of Goffstown, in an area of the town commonly known as Pinardville. A "Site Location Map" is provided in the Appendix. The study area is bounded by Mast Road and Rockland Avenue to the east, Desaulnier Street to the north, Goffstown's College Road to the west, and St. Anslem's Drive to the south. Included within this area are other side roads such as Rosemont Street, Elmwood Avenue, West Side Avenue, Glen Ridge Avenue, and Maplewood Avenue. There is a wetland area located between Rosemont Street and Glen Ridge Avenue that is a source of flooding for the neighboring properties. Furthermore, the intersection of Mast Road and Rosemont Street also floods periodically, as well as the businesses located adjacent to the intersection. The primary purpose of this study was to determine the cause of the flooding in the Rosemont Drainage Study Area and determine plausible solutions to the identified problems.

The Rational Method of hydrologic analysis was used to calculate peak storm water runoff rates for the closed drainage systems. The drainage area for each pipe inlet and catch basin was computed based on topography determined by aerial mapping provided by the Town of Goffstown. Aerial mapping was also used to determine land use within the area. The aerial mapping was field verified by MJ for topographic information and land uses. A "Drainage Area Map" with designated subdrainage areas is included in the Appendix for review.

In addition to the aerial mapping, the existing closed drainage systems within the Study Area were field surveyed to determine invert elevations, pipe size and type, and the exact location of these drainage features. This field survey information has been integrated into the aerial mapping to create a base map. StormCAD computer software was used to model

the hydraulics of the closed drainage systems. The existing closed drainage systems were analyzed using multiple storm recurrence intervals (i.e. 2-year, 10-year and 25-year). All proposed solutions were sized to accommodate the 25-year storm event, per the current Town of Goffstown design standards.

III. EXISTING CONDITIONS

This project area has several drainage issues that contribute to the flooding problems. The following locations are the main areas of concern with a description of how these areas contribute to the stormwater flooding.

- ***Mast Road Closed Drainage System***

The closed drainage system located along Mast Road begins approximately 300 feet southeast of the intersection of Mast Road and Desaulnier Street. This system travels down the Mast Road corridor to the southeast and discharges into another closed drainage system located in Manchester near the intersection of Mast Road and Manchester's College Avenue. The discharge point is a very deep (i.e. 30 feet \pm) manhole with other closed systems entering and exiting this structure at lower elevations. Since the other closed systems are much lower in this manhole, it was assumed that this elevated discharge point is not affected by the other closed systems passing through this manhole. Ultimately, the intercepted closed system discharges to the Piscataquog River. The closed drainage system along Mast Road consists of a 12" corrugated metal pipe (CMP) from the upstream end to near the intersection of Mast Road and Rockland Avenue. From this location to the discharge point in the deep manhole, the system is constructed of 24" reinforced concrete pipe (RCP). Approximately 900 feet of the 24" RCP is located within the City of Manchester. The entire closed system is relatively flat and does not have sufficient capacity to handle the existing stormwater flow to this area. In fact, the system fails during the 2-year storm event based on the computer modeling. Failure of the system is defined to be when stormwater surcharges the drainage structures and flows across the top of the ground. The stormwater bypassing the surcharged upstream structures flow towards the intersection of Mast Road and Rosemont Street, which is a low point where water ponds frequently. Also, the existing CMP has been in place for a significant period of time (i.e. 30+ years) and has deteriorated due to rusting of the pipe materials. In some case, the invert troughs of the pipes have completely rusted away.



*Mast Road – Rockland Avenue –
Rosemont Street Intersection*

- ***Rosemont Street/Rockland Avenue/Mast Road Intersection***

The eastern end of Rosemont Street is a low point on the Rosemont Street roadway profile with the road draining from the west. Portions of Mast Road and Rockland Avenue also slope towards this intersection creating a “bowl effect” at this location. Adjacent to this intersection is a parking lot for a hardware store and an automotive repair shop. There is very little change in elevation between the low point on Rosemont Street and the adjacent commercial parking lot. Also, the sill elevation for the hardware store and the automotive repair shop are approximately at the same elevation of the parking lot. The Rosemont Street area is drained by a closed system



*Rosemont Street Looking East Towards
Mast Road*

connecting to the Mast Road closed drainage system easterly of the intersection of Rosemont Street/Rockland Avenue/Mast Road. This Rosemont Street drainage system is undersized for the amount of flow that this area receives. This system also fails during the 2-year storm event based on the computer modeling. As noted above, the failure of the Mast Road closed drainage system also drains to the low spot at this intersection. Therefore, during heavy storm events, the drainage system is overwhelmed and

stormwater ponds in the Rosemont Street/Rockland Avenue/Mast Road intersection. Since there is not much difference in elevation in this intersection area, the adjacent parking lot and commercial buildings occasionally flood as well.

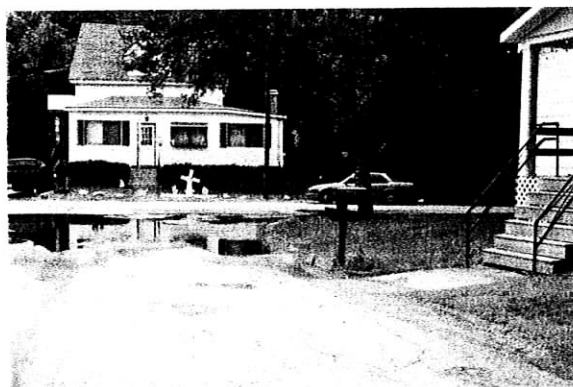
- ***Wetland Located Between Rosemont Street and Glen Ridge Avenue***

This wetland is a major source of flooding for the abutting residential yards. This wetland is the receiving point of multiple closed systems, as well as a collection area for a large contributing area located to the west. The closed systems discharging to this wetland are located in Roy Park and along Glen Ridge Avenue (see descriptions below in the text). Historically, there was a 24” CMP drainage outlet for this wetland. This outlet drainage pipe connected to a closed drainage system conveying the stormwater under Rockland Avenue to the Mast Road closed system. Through the course of this study, it was verified that this 24” CMP outlet is no longer in place because it has been truncated. Therefore, the wetland did not have an established outlet until recently. Because of frequent flooding of the adjacent yards, a property owner has recently installed a 12” drainage pipe near the rear of his property and connected this pipe to the closed drainage system on Rosemont Street. The installation of this drainage pipe was an attempt to alleviate flooding associated with the wetland. However, this new outlet pipe is located at the far edge of the wetland

and is not low enough to effectively drain the wetland until significant ponding of the wetland has already begun. While this outlet pipe does provide some minimal relief, the pipe does not have adequate capacity to handle the flow from this wetland and, therefore, has not adequately corrected the drainage issues associated with this wetland.

- ***Glen Ridge Avenue***

There are two existing closed drainage systems located on Glen Ridge Avenue. The two systems drain the area bound by St. Anslem's Drive and Glen Ridge Avenue. Both closed drainage systems are comprised of primarily 12" CMP, which are in poor condition due to deterioration from rusting and age. Both of these systems discharge to the wetland located between Rosemont Street and Glen Ridge Avenue as noted above. The two drainage areas generally slope towards the northeast and do not have any low pockets for storm water to pond, with the exception of a small localized area around the Glen Ridge Avenue and West Side Drive intersection. Both of the closed drainage systems fail during the 2-year storm event based on the computer modeling. Even though the systems do surcharge, any overflow of stormwater flows continues to flow along the street toward the discharge points in the wetland area. Since there are not any critical ponding issues in this area, correcting this drainage problem is not as high a priority as other problems within the study area. However, it is noted that the discharges from these systems do contribute to the existing drainage problems associated with the wetland.



Ponding at Intersection of Glen Ridge Avenue and West Side Avenue

- ***Roy Park***

There are two closed drainage systems for the recreational Roy Park, which is located at the westerly end of Rosemont Street. These systems drain the parking lots, as well as some of the wooded hillside to the west of the recreational park. The existing playing field on the northerly side of the park discharges to the Lumber Yard drainage area noted below. These closed systems outlet to the wetland area located between Glen Ridge Avenue and Rosemont Street from the southeasterly corner of the recreational park. Both of the closed drainage systems consist of CMPs, which appear to be in good condition from brief visual observations. Both of these systems have sufficient capacity to pass the 25-year storm event, as per the current Town of Goffstown design standards. Therefore, this area is not considered to be a priority area

for drainage problems, other than the fact that it contributes to the wetland drainage area.

- ***Mast Road Lumber Yard/Roy Park Baseball Field***

There is a closed drainage system predominantly collecting stormwater from the baseball field area of Roy Park and the existing Mast Road Lumber Yard. In addition, there is a portion of the wooded hillside and residential areas between the Desaulnier Street and Roy Park watershed noted above that also contributes to the stormwater runoff. This closed drainage system consists of CMP materials. It is noted that the inlet to this system at the baseball field has a larger diameter than the lower section of the system. The closed drainage system fails during the 2-year storm event based on the computer modeling. Since this system surcharges, the stormwater ponds in a low spot near the southeast corner of the lumber yard and could potentially contribute to the flooding of the hardware store due to the relatively flat grades in this general location. In addition, some of this stormwater also potentially flows towards Mast Road due to the relatively flat grades of this entire area. The existing CMP has been in place for a significant period of time and have deteriorated due to rusting of the pipe materials. In some cases, the invert troughs of the pipes in the lower section have completely rusted away.

In summary, the existing closed drainage systems in the Rosemont area, with the exception of the two small closed systems from Roy Park, are undersized and in poor condition. The main wetland in the central area of the overall watershed receives a considerable amount of flow but does not have an adequate outlet to drain it properly before flooding occurs on abutting properties. An "Existing Conditions Plan" is included in the Appendix which shows the locations of the closed drainage systems and the wetland area between Rosemont Street and Glen Ridge Avenue described above.

IV. PROPOSED SOLUTIONS

The following proposed solutions have been separated into different phases that could be constructed sequentially. Each phase improves a separate drainage issue. Some phases are dependent on other phases being constructed, while others can be installed independently. A "Proposed Solution Plan" is included in the Appendix showing the limits of each phase.

- ***Phase 1 – Wetland Drainage and Lower Mast Road Improvement***

This phase would consist of the up-sizing of the lower section of the main trunk line of the closed system on Mast Road located to the south of the intersection with Rockland Avenue. The new pipe would be sized to have sufficient capacity to pass the 25-year storm event for the entire contributing area. Also as part of this phase, a drain line would be constructed to provide an adequate outlet for the wetland area and connect this location to the up-sized system along Mast Road. This drain line has been sized assuming the wetland does not attenuate or detain any flow. This assumption provides a conservative approach, but is reasonable given the potential for property owners

continuing to fill in parts of the wetland, thereby further reducing its ability to store stormwater and limit peak flows. Also, this wetland area is relatively flat and excavating the area to create a pond would be the primary detention option requiring a significant environmental permitting effort. This drain line could be constructed within an existing easement shown as a "paper street" on the Town's assessing map. If this "paper street" and easement do not actually exist, some form of a right-of-way would need to be acquired to construct the new pipe into the wetland area. It is likely that the main line on Mast Road would require some utility restoration (i.e. services line interference) as part of the improvement. These issues would need to be investigated further during the formal design process.

These improvements would alleviate some of the surcharging of the closed system further north along Mast Road, but would not eliminate it. This phase alone would not correct the drainage issues at the intersection of Rosemont Street and Mast Road or the issues along Mast Road northerly of the Rosemont Street intersection. However, it would provide an outlet for the wetland between Rosemont Street and Glen Ridge Avenue and eliminate the flooding of stormwater on residential properties.

Even though providing some form of attenuation for the wetland area appears to be difficult as noted above, creating a detention pond within the wetland area to minimize the size of drainage pipes was investigated. It was discovered from the computer modeling that the peak stormwater flow from the wetland area already occurs after the peak of the closed system along Mast Road even without providing any attenuation. Therefore, even eliminating or reducing the flow from the wetland area, attenuation would not preclude the need to provide greater capacity for the existing drainage pipes in Mast Road downstream of the wetland area. Since the benefits of detention were not substantial and more issues would arise with trying to construct a detention basin in a wetland area, detention was not included as a recommended solution. This result further justified the initial assumption of no attenuation of flow from the wetland area.

- ***Phase 2 – Mast Road Trunk Line***

This phase would consist of up-sizing the main drainage trunk line on Mast Road north of Phase 1 from the Rockland Avenue intersection. No cross pipes on Mast Road would be replaced in order to minimize the amount of traffic control and utility relocation required. As noted above, utility interference issues would need to be investigated further during the formal design process. It is recommended the entire length of the trunk line be replaced due to the lack of capacity and deterioration of the existing metal piping. Replacing this trunk line would eliminate the surcharging of the structures in the area and minimize the amount of stormwater bypass flowing to the intersection of Rosemont Street and Mast Road. In addition, the existing drain line from the southeast corner of the parking lot for Mast Road Lumber would also be replaced and up-sized to create greater capacity. Replacement of this drain line would eliminate the potential for stormwater to pond in the lumber yard parking lot and any

overflow into the hardware store parking lot. The construction of this phase requires that Phase 1 already be installed.

- ***Phase 3 – Mast Road/Rosemont Street Intersection***

This phase would consist of the upgrading of the drainage system around the intersection of Rosemont Street and Mast Road. Some of the existing pipes in the existing intersection are adequately sized and in good condition. Therefore, these components will not need to be replaced. However, a new drain line is necessary to sufficiently drain catch basins along the easterly end of Rosemont Street. In addition, the existing drain line discharging from the Rosemont Street intersection would be up-sized to convey the stormwater to the improved closed drainage system in Rockland Avenue constructed during Phase 1. As noted above, utility interference issues would need to be investigated further during the formal design process. Therefore as with Phase 2, the construction of this phase requires that Phase 1 already be installed.

- ***Phase 4 – Mast Road/Henriette Street Intersection***

This phase would consist of reconstructing the drainage lines near the intersection of Mast Road and Henriette Street. The existing drainage lines in this area are not sized to adequately pass the 25-year storm event and are in poor condition. Increasing the size of this pipe would eliminate ponding at this intersection due to the lack of capacity of the existing closed drainage system. The installation of this phase requires that both Phase 1 and Phase 2 already be constructed. The construction of this improvement would not affect ponding problems associated with Mast Road at the Rosemont Street intersection, but is a localized drainage issue within the scope of our drainage study. While this drainage improvement primarily corrects the drainage issue near the intersection of Mast Road and Henriette Street, it is also necessary to replace the cross pipe connecting to Mast Road trunk line on the westerly side of the street. As noted above, utility interference issues would need to be investigated further during the formal design process. Therefore, additional traffic control for crossing Mast Road and potential utility relocations may be required.

- ***Phase 5 – Glen Ridge Avenue***

This phase would consist of reconstructing the drainage along Glen Ridge Avenue. The existing drainage in this area is undersized and in poor condition. Reconstruction of this system is not as critical as other areas within the study area, as there are no major ponding issues in this sub drainage area. However, it is recommended that a drain inlet be installed at the intersection of West Side Drive to alleviate a small localized ponding situation. Although the system does not have adequate capacity to pass the 25-year storm event as noted above, any stormwater bypassing the existing closed drainage system simply flows down the street gutters and discharges into the wetland at the same location as the closed drainage system. Increasing the size of these pipes would only reduce the amount of surface stormwater flowing down the street. The construction of this phase does not require any other phase to be installed, although this system does contribute to the flooding situation of the wetland area.

Therefore, it would be advantageous to have Phase 1 already constructed, but not required.

V. RECOMMENDATIONS

It is MJ's recommendation that, ultimately, all five phases as outlined above be constructed, but the individual phases could be constructed at different times due to budgetary constraints. As noted above in the individual area summaries, each solution solves a specific drainage issue within the specified area of concern. With all five phases constructed, we do not anticipate ponding of stormwater within the Rosemont Drainage Study Area.

At a minimum, we highly recommend Phase 1 and Phase 3 be constructed as the priority portions of the study area. These two phases alleviate the majority of the primary stormwater ponding near the Rosemont Street/Mast Road intersection and the properties adjacent to the wetland. As noted herein, Phase 1 would greatly reduce the stormwater ponding in the wetland area, while Phase 3 would allow the intersection of Rosemont Street and Mast Road to adequately drain. However, it is further noted that without constructing Phase 2, there is a potential for minor ponding at the Rosemont Street intersection due to the stormwater bypassing structures on the upper section of Mast Road. However, the ponding associated with the bypassing of the structures should not be as extensive as the current condition having inadequate drainage downstream of this intersection. It is our recommendation that Phase 2 be constructed after Phase 1 and Phase 3 are completed and as soon as budgetary constraints allow. With the combination of Phase 1, Phase 2, and Phase 3, we do not anticipate that stormwater will pond in the Rosemont Street/Mast Road intersection or in the wetland area.

As noted in the solution summary above, Phase 4 will eliminate the localized issues in the Henriette Street area, but this phase could be delayed further into the future than any of the first 3 phases. Similarly, Phase 5 of these drainage improvements could also be delayed until a complete rehabilitation of the Glen Ridge Avenue roadway and utilities could be performed. It would be ideal to install the drainage improvements outlined in Phases 4 and 5 to eliminate the identified drainage issues within the study area. However, we recognize budgetary constraints exist within municipalities due to limited funds and these phases could be delayed into the future with minor overall impact to the drainage issues within the study area.

VI. OPINION OF PROBABLE COST

As part of this study, we have provided the following summary of our conceptual opinion of probable cost for the recommended phases. A detailed cost breakdown for various components of each phase is included in the Appendix.

Engineer's Opinion of Probable Cost

Phase 1	\$307,000.00
Phase 2	\$162,000.00
Phase 3	<u>\$75,000.00</u>
Sub-Total	\$544,000.00
Phase 4 (Future)	<u>\$53,000.00</u>
Sub-Total	\$597,000.00
Phase 5 (Future)	<u>\$203,000.00</u>
Grand Total	\$800,000.00

It should be noted that these costs are preliminary in nature and do not include any right-of-way that may be required. More detailed information and design is required to obtain a firm estimate of the costs involved.



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MJ Project: 16476.00
DATE: 9/20/2004
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**TOWN OF GOFFSTOWN
ROSEMONT DRAINAGE IMPROVEMENTS
PHASE 1
ENGINEER'S CONCEPTUAL OPINION OF PROBABLE COST**

ITEM	DESCRIPTION	QUANTITY	UNIT	PRICE	AMOUNT
	Pipe Removal	1145	LF	\$15.00	\$17,175.00
	18" RCP, 2000D		LF	\$70.00	\$0.00
	24" RCP, 2000D		LF	\$75.00	\$0.00
	30" RCP, 2000D	560	LF	\$80.00	\$44,800.00
	36" RCP, 2000D	1010	LF	\$100.00	\$101,000.00
	Drainage Structures	11	EA	\$2,000.00	\$22,000.00
	Incidental Items	30%	U	\$56,000.00	\$56,000.00
	SUBTOTAL				\$240,975.00
	Survey				\$5,000.00
	Engineering, Permitting, & Limited Construction Phase Support	15.00%			\$36,146.25
	Project Contingency	10.00%			\$24,097.50
	CONSTRUCTION TOTAL				\$306,218.75
	USE				\$307,000.00

Note: Pipe costs include trench patching



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**TOWN OF GOFFSTOWN
ROSEMONT DRAINAGE IMPROVEMENTS
PHASE 2
ENGINEER'S CONCEPTUAL OPINION OF PROBABLE COST**

ITEM	DESCRIPTION	QUANTITY	UNIT	PRICE	AMOUNT
	Pipe Removal	970	LF	\$15.00	\$14,550.00
	18" RCP, 2000D	550	LF	\$70.00	\$38,500.00
	24" RCP, 2000D	420	LF	\$75.00	\$31,500.00
	30" RCP, 2000D		LF	\$80.00	\$0.00
	36" RCP, 2000D		LF	\$100.00	\$0.00
	Drainage Structures	7	EA	\$2,000.00	\$14,000.00
	Incidental Items	30%	U	\$30,000.00	\$30,000.00
	SUBTOTAL				\$128,550.00
	Survey				\$1,250.00
	Engineering, Permitting, & Limited Construction Phase Support	15.00%			\$19,282.50
	Project Contingency	10.00%			\$12,855.00
	CONSTRUCTION TOTAL				\$161,937.50
	USE				\$162,000.00

Note: Pipe costs include trench patching



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**TOWN OF GOFFSTOWN
ROSEMONT DRAINAGE IMPROVEMENTS
PHASE 3
ENGINEER'S CONCEPTUAL OPINION OF PROBABLE COST**

ITEM	DESCRIPTION	QUANTITY	UNIT	PRICE	AMOUNT
	Pipe Removal	200	LF	\$15.00	\$3,000.00
	18" RCP, 2000D	285	LF	\$70.00	\$19,950.00
	24" RCP, 2000D	160	LF	\$75.00	\$12,000.00
	30" RCP, 2000D		LF	\$80.00	\$0.00
	36" RCP, 2000D		LF	\$100.00	\$0.00
	Drainage Structures	5	EA	\$2,000.00	\$10,000.00
	Incidental Items	30%	U	\$14,000.00	\$14,000.00
	SUBTOTAL				\$58,950.00
	Survey				\$1,250.00
	Engineering, Permitting, & Limited Construction Phase Support	15.00%			\$8,842.50
	Project Contingency	10.00%			\$5,895.00
	CONSTRUCTION TOTAL				\$74,937.50
	USE				\$75,000.00

Note: Pipe costs include trench patching



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**TOWN OF GOFFSTOWN
ROSEMONT DRAINAGE IMPROVEMENTS
PHASE 4
ENGINEER'S CONCEPTUAL OPINION OF PROBABLE COST**

ITEM	DESCRIPTION	QUANTITY	UNIT	PRICE	AMOUNT
	Pipe Removal	275	LF	\$15.00	\$4,125.00
	18" RCP, 2000D	275	LF	\$70.00	\$19,250.00
	24" RCP, 2000D		LF	\$75.00	\$0.00
	30" RCP, 2000D		LF	\$80.00	\$0.00
	36" RCP, 2000D		LF	\$100.00	\$0.00
	Drainage Structures	4	EA	\$2,000.00	\$8,000.00
	Incidental Items	30%	U	\$10,000.00	\$10,000.00
	SUBTOTAL				\$41,375.00
	Survey				\$1,250.00
	Engineering, Permitting, & Limited Construction Phase Support	15.00%			\$6,206.25
	Project Contingency	10.00%			\$4,137.50
	CONSTRUCTION TOTAL				\$52,968.75
	USE				\$53,000.00

Note: Pipe costs include trench patching



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**TOWN OF GOFFSTOWN
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PHASE 5
ENGINEER'S CONCEPTUAL OPINION OF PROBABLE COST**

ITEM	DESCRIPTION	QUANTITY	UNIT	PRICE	AMOUNT
	Pipe Removal	1130	LF	\$15.00	\$16,950.00
	18" RCP, 2000D	1115	LF	\$70.00	\$78,050.00
	24" RCP, 2000D	50	LF	\$75.00	\$3,750.00
	30" RCP, 2000D		LF	\$80.00	\$0.00
	36" RCP, 2000D		LF	\$100.00	\$0.00
	Drainage Structures	12	EA	\$2,000.00	\$24,000.00
	Incidental Items	30%	U	\$37,000.00	\$37,000.00
	SUBTOTAL				\$159,750.00
	Survey				\$2,500.00
	Engineering, Permitting, & Limited Construction Phase Support	15.00%			\$23,962.50
	Project Contingency	10.00%			\$15,975.00
	CONSTRUCTION TOTAL				\$202,187.50
	USE				\$203,000.00

Note: Pipe costs include trench patching