



Mountain Street and Leslie Street Stormwater Improvements Report



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Infrastructure Services Department
Roads and Transportation Division

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Executive Summary

On July 14, 2010, City Council with the passage of resolution #2010-290 directed staff to develop a plan to deal with the historical flooding issues that have plagued the area and a plan to divert stormwater from the Sunrise Ridge Development pond away from the low area of Mountain Street and Leslie Street, which had experienced flooding as a result of the July 26, 2009 storm.

The report therefore outlines options for:

- a) Alleviating flooding in the low area of Mountain Street and Leslie Street, and
- b) Diverting stormwater from the Sunrise Ridge Subdivision stormwater pond away from the Mountain Street and Leslie Street area.

Various factors combined and contributed to create the level of flooding and damage residents experienced on July 26, 2009. These include lack of an overland flow route for major storms, uncontrolled lot infilling and grading within the older area, minimal size storm sewers built over fifty years ago, area roads with steep 10 percent grades, and most significant, the intensity of the July 26, 2009 rainstorm.

The intensity of the July 26, 2009 rainstorm (90mm per hour) was such that the rainstorm was deemed to be at least a one in one hundred year storm, and a rare event. It is probable that such an intense rainstorm would have severely strained or possibly exceeded any drainage outlet system constructed to the most recent enhanced design standards.

Given the storm's intensity, the substantial flooding in the Mountain/ Leslie Street area would have occurred with the upper mountainous area in its natural state.

The Sunrise Ridge subdivision has urbanized a portion of the upper mountainous area of this watershed. The developer was required to hire professional consulting engineers to design and supervise the construction of a storm water management pond to ensure that the post

development stormwater flows do not exceed pre development levels. The pipe outlet for the Sunrise Ridge subdivision stormwater management pond functioned as designed.

While the pond outlet functions as designed, Mountain Street residents have since July 26, 2009 regularly expressed concern with the volume and noise of stormwater spilling over the mountain face during rainstorms from the Sunrise Ridge pond outlet. They are further concerned with the build-up of ice on the spillway during winter months and the potential for flooding due to major rainstorms, and or the spring thaw period.

In consideration of the noted drainage problems and concerns, various drainage improvement options have been examined and are set out in the report.

The resolution of potential flooding in the low area of Mountain Street and Leslie Street is considered the highest drainage priority to be resolved. Option G, the creation of a regional storm outlet channel through the Mountain Street and Leslie Street area to Junction Creek is the preferred solution at a conceptual cost estimate of \$1.8 million in conjunction with Option A, the creation of the north east drainage channel to Junction Creek at a conceptual estimated cost of \$0.7 million.

The resolution of the Mountain Street residents' concern of the existing Sunrise Ridge pond outlet can be achieved through the implementation of Option A the creation of the northeast drainage channel, Option B the creation of the Sunrise Ridge pond site flood barrier wall, and Option D the creation of the pipe and channel east diversion of the Sunrise Ridge pond outlet. The conceptual estimated cost of these three options is \$1.9 million.

Option A is fundamental to both the low area flooding and the issue raised by the residents with regard to the Sunrise Ridge Subdivision Pond Outlet. The cost of Option A has been included separately in both solutions referred to above.

The resolution of both the low area flooding and the diversion of the Sunrise Pond outlet can be achieved by implementing Options A, B, D, and G as set out in the report at a total conceptual estimated cost of \$3.7 million.

In anticipation of Council's desire to consider implementing drainage improvements for the Mountain Street/ Leslie Street area, the 2011 Five year Drainage Capital Budget Envelope will include an allocation of \$350,000 in the 2012 budget for engineering, public meetings, environmental approvals and associated work. The 2012 identified funding could be advanced into 2011 to allow engineering, environmental approvals, public meetings and associated work to be commenced in 2011 if Council wishes. Given the Drainage Capital Funding envelope, and the Drainage priority projects currently set out in the 2011 Five year capital budget, the funding of construction of Mountain Street/ Leslie Street drainage improvements would be considered to be in the five to ten year timeframe unless additional funds are added to the existing envelope.

In conclusion, the implementation of the drainage improvement works outlined in the report for the Mountain Street and Leslie Street area should provide the measures necessary to alleviate surface water flooding caused by similar future severe rainstorm events.

Mountain Street and Leslie Street Stormwater Improvements

I. Background

On the evening of July 26, 2009, an intense summer thunderstorm cell struck a portion of the upper Junction Creek watershed. Rainfall intensities of up to 90mm per hour were experienced for a one to two hour period. The areas most seriously affected were some of the older developed sub-watersheds in the City. Before development, these areas were naturally drained by small tributary creeks leading to the main branch of upper Junction Creek. As the City was built, many of the small creeks were filled in and small diameter piped storm sewer systems installed to drain roads and lots. These storm sewer systems were designed to accept rainfall from frequent annual rainstorms and to engineering standards at the time of construction. The consideration of over land flow routes for major or rare storms was not a standard engineering practice at that time. As a result of Hurricane Hazel in 1954 and the Timmins storm of 1961, engineering practice has been amended over time to consider major over land flow routes.

The lower portion of the Mountain/Leslie Street area was one of the areas of the City hardest hit by the storm. The mountainous terrain and roads with steep grades were subjected to the full intensity of the storm and the rapid rate of runoff that resulted. Existing storm sewers were quickly filled and surcharged. Stormwater flowed down Mont Adam and Mountain Street to the lowest areas in the proximity of # 327 and # 331 Mountain Street. As the storm progressed, there was substantial ponding of stormwater in this low area of the street until it overflowed westerly into the yard of # 338 Leslie Street and onto the low area of Leslie Street from # 345 to # 329.

In addition to stormwater proceeding down existing streets, stormwater from the new Sunrise Ridge development flowed over the mountain side behind # 314 and # 318 Mountain Street. The interceptor ditch at the base of the mountain was unable to handle the volume of stormwater and an overflow occurred between the above houses to Mountain Street.

Numerous homes in the area were damaged by either surface flood water or by surcharged sanitary sewers backing up into basements due to flooded conditions. Approximately 50 damage claims were made to the City with an approximate accumulated value of \$ one million. Pictures set out in **Appendix "A"** to the report are indicative of the flooding problems that occurred.

II. Historical Development of Mountain Street and Leslie Street

The earliest City records indicate that the lands of the “Mountain/Leslie Street” area were first surveyed in 1894. The plans creating the Mountain Street (formerly Peter Street) Subdivision M-55 were surveyed and registered in 1906. The Leslie Street Subdivision plan M-125 was surveyed and registered in 1908. A further extension of this subdivision to and including Harvey Street was surveyed in 1909 and registered in 1910.

By 1929, these subdivisions were serviced with roads with open side ditches, sanitary sewers and watermain. It is evident from plans of the era that a number of houses had been constructed.

Pre 1953, City of Sudbury plans illustrate that an open ditch drainage system existed along streets in these subdivisions. The roadside ditches outletted to two (2) east-west outlet ditch systems crossing through lots of the subdivision.

The above system is illustrated by City of Sudbury Public Works drawing B-459 attached to this report as **Appendix “B”**. The southerly ditch outlet system intercepted a natural creek (on lots 40 and 41 Peter Street) and directed roadside drainage through an open ditch crossing the school property, lots 10 through 12 and lots 33 to 35 of the Leslie Street Subdivision prior to outlet across the CNR right-of-way to Junction Creek.

The northerly ditch outlet system commenced at the rear of lot 22 (north end of Peter Street) with an incoming ditch draining approximately 25 acres from the northeast. Open roadside ditches on Peter Street conveyed drainage to the open ditch outlet system which proceeded diagonally southwest across lots 17, 18 and 19 Peter Street (now house numbers # 325, # 327 and # 331 Mountain Street) and hence westerly across lot 23 Leslie Street (now house # 338 Leslie Street). After a culvert crossing on Leslie Street, the drainage ditch continued through Lot 2, Leslie Street before outletting across the CNR right-of-way to Junction Creek.

A 1953 City drawing indicates that the east-west open ditch drainage systems crossing between Peter Street and Leslie Street had been enclosed with a piped system following the ditch alignment. The same drawing also proposed a storm sewer system for Peter and Leslie Streets. The proposed outlets for this system were a 24 inch diameter concrete pipe from Peter

Street to Leslie Street through the side yard of # 313 Peter Street and # 328 Leslie Street with a further 36 inch diameter concrete pipe along the side yard of 339 Leslie Street to the CNR right-of-way. This system is shown by City of Sudbury drawing C-641 attached to this report as **Appendix “C”**. More detailed 1975 City of Sudbury plan and profile drawings confirm the construction of the 1953 system and that the older storm sewer enclosure of the original cross ditches through lots was still operational.

It is important to note that Peter Street was renamed Mountain Street.

III. Review of the Current Storm Drainage System

The open road ditch and outlet drainage systems of the Peter and Leslie Street Subdivisions were enclosed and or storm sewered by the 1950's. The system was designed to minimal standards to provide street drainage for frequent annual type rainstorms and snowmelt events. There was no planned routing of stormwater flow from major or rare storm events. The current storm drainage system is shown on the plan attached to this report as **Appendix “D”**.

It may be that the 1953 system depended to some extent on the additional flow capacity and continued operation of the older ditch enclosure system that went between lots. However, it is clear that with the passage of time, this cross lot system was negatively impacted by the construction of new buildings and the unregulated regrading of rear yards. Today the system has been for the most part removed, blocked or filled in. The City did not have easement control on this system. In recent times, the City has been called upon to repair collapsed portions of pipe or access holes along this alignment.

A recent investigation of the storm drainage pipe outlets west of Leslie Street to Junction Creek determined that both the southerly Leslie Street 24 inch diameter outlet and the more northern 36 inch diameter outlet are connected to individual corrugated steel pipes. These pipes cross the CNR right-of-way and join together in the Groom Callaghan storage yard. These pipes join to a 1350 mm diameter corrugated steel pipe that outlets into a ditch to Junction Creek. There are no easements or drawings to confirm the original design and construction of these pipes across the CNR right-of-way or Groom Callaghan property. This pipe network was found to have numerous underground bends and minimal maintenance access manholes. It is noted that the only access point to this system is a chamber located under a Groom Callaghan storage shed.

The present 600 mm / 900 mm diameter pipe outlet from Mountain Street to the CNR right-of-way is located substantially up grade from the lowest portion of Mountain Street and Leslie Street where flooding has occurred.

In summary, the 1953 era storm sewer system is minimally adequate for minor storms (ie. frequent one year storms) and there is nowhere for the major stormwater (ie. from larger rare storm events) flows to go except to pond in the street low area and or overflow through existing lots. The storm drainage situation of the Leslie Street / Mountain Street area is consistent with many of the older developed areas of the City of Greater Sudbury.

IV. Storm System Drainage Areas

The Mountain Street/Leslie Street storm drainage system receives stormwater runoff from the mountainous area to the east of Mountain Street and from the lots and asphalt surfaces of Mountain and Leslie Streets. These drainage areas are set out in the plan attached to this report as **Appendix “E”**. Prior to 2005, the mountainous area was an irregular rock out crop with sparse vegetation and some small ponding areas. Runoff coming over the hill was distributed over the perimeter of the hill crest and was directed to small pipe outlet systems through the lots or was picked up by an interceptor swale at the rear of the Mountain Street lots which conveyed drainage to a northern inlet behind # 336 Mountain Street.

The Saldan Developments Sunrise Ridge Subdivision lies within a significant portion of the easterly mountainous drainage area as shown on **Appendix “E”**. Approximately eight percent of the original drainage area flowing south to the Kingsway was included or diverted to the Mountain Street drainage area. Such small diversions are common in all new developments to accommodate the drainage of roads and lots. As a result of the development, the virgin landscape of approximately 15 hectares was planned to be regraded to suit new roads and building lots. Approximately, 60 percent of the regrading was complete in 2009. As part of the subdivision approval, the City required the developer to hire professional engineering consultants to design engineering plans and limit post development stormwater flows coming off the mountain to pre-development levels. The resultant engineering study and detailed engineering plans required the construction of a large stormwater control pond on the hill top plateau overlooking Mountain Street and some associated smaller ponds on the southern side of the project.

The larger pond servicing a 5.9 hectare portion of the site has an outlet control chamber which controls the rate of stormwater flow outletting from the pond depending on the level of stormwater in the pond. The maximum pond outflow is the capacity of a 525 mm diameter outlet pipe. This pipe ends at a concrete spillway which directs stormwater over the hillcrest. As a result of Council Resolution 2010-290, the developer in August 2010 constructed a small concrete wall with a 200 mm diameter outlet pipe a short distance from the spillway to further spread out the water flow over the mountain side. The stormwater coming over the hillcrest is picked up in an improved interceptor ditch at the base of the mountain and directed northerly to an existing 24 inch diameter pipe inlet.

It is probable that under major rainstorm conditions a significant portion of the stormwater draining from the south easterly 9 hectare portion of the Sunrise Ridge development bypasses the street catchbasins and flows down Sunrise Ridge and Mont Adam Street to Mountain Street.

There is reference in both 1953 and 1968 era City plans to a 25 acre drainage area incoming to the Mountain Street storm drainage system from the northeast. This area includes part of the northern plateau and mountain side of the area east of Mountain Street. Assessment using current topographical plans indicates that the drainage area is (34 acres) or 13.84 hectares. There is opportunity for reducing this drainage impact on Mountain Street by diverting part of the drainage area from the upper area north easterly.

V. Drainage Issues and Design Constraints

Stormwater control design is now based on the minor-major concept. Storm sewers are designed to handle 2 to 5 year rainstorms and are the minor control system. Larger rainstorms from the 5 year storm to the Regional (Hurricane Hazel type) storm require large drainage channels or pipes to provide a major control system.

Any proposed drainage improvements to the Mountain Street/Leslie Street drainage system must consider the following drainage issues and design constraints:

1. The lack of an acceptable major storm outlet overflow route subjects area residents to potential reoccurring flood damage.

2. The existing street storm sewer pipe network was designed and/or installed in the early 1950's. It does not meet current two (2) year storm design minimum standards. It does provide minimum service for frequent annual smaller intensity rainstorms.
3. The existing pipe network is approximately 55 to 60 years old and well along a reasonable design life.
4. Existing storm sewers are often surcharged.
5. Previous pre 1950 cross subdivision open ditches between Mountain Street and Leslie Street have been filled in.
6. Easements for existing outlet storm sewers between Mountain Street and Leslie Street are too narrow for servicing or expanding the existing pipes. Some pipes are under structures.
7. Street grades of Sunrise Ridge, Mont Adam Street and Mountain Street are ten (10) percent or more which cause stormwater runoff to accelerate to the lowest area of Mountain Street and Leslie Street with minimum inflow into curbside catch basins.
8. Subdivision lots have been built on over 100 years. Lot grading has been unregulated and problem land grading results in pockets of low lying lands within yards and around houses.
9. The number and style of existing catchbasin inlets are not conducive to inletting large quantities of fast flowing stormwater.
10. Mountain Street residents are very concerned with the concentration and noise of stormwater flow over the mountain side from the upper Sunrise Ridge stormwater pond. They are also concerned with ice build up on the spillway downstream of the pond. They are further concerned with erosion and sediment washoff from the area surrounding the pond.
11. No drainage easements exist for storm sewers that cross the CNR right-of-way or the Groom Callaghan property. Existing 900 mm diameter culvert pipe outlets that cross the CNR right-of-way and Groom Callaghan lands are undersized for the primary system outlet.

VI. Proposed Design Criteria

It is recommended that the improved Mountain Street and Leslie Street storm drainage system be designed to the following criteria:

1. The new drainage system shall be designed on the dual drainage system concept with provision for both flows from frequent (minor) storms and from less frequent (major) storms.
2. Existing storm sewers on the steep section of Mont Adam Street, Mountain Street and Leslie Street will be accepted as is for the conveyance of the frequent annual type rainstorm and snow melt conditions. Upgrading of these pipe systems will be deferred until reconstruction of existing sanitary sewers, watermain and roads.
3. Any storm sewers in the low area of either Mountain or Leslie streets that must be replaced shall be designed on the minimum basis of the two (2) year design storm.
4. Any catchbasin that must be replaced or installed shall have a 150 mm vertical inflow gutter as well as upgraded inlet grates.
5. A major storm overland flow channel or pipe outlet from Mountain Street to Junction Creek shall be designed to convey the Regional Storm in as much as economically possible.
6. The Sunrise Ridge upper stormwater pond outlet above house # 314 and # 318 Mountain Street shall be diverted away from Mountain Street or piped through the mountain slope underground to an improved storm sewer network.
7. Provision by barrier wall shall be made at the Sunrise Ridge stormwater pond site to prevent any spill over of major stormwater runoff over the crest of the hill by way of storm waters bypassing or over flowing the pond.
8. Stormwater from the northeast drainage sub-watershed shall be limited to 3.98 hectares.
9. Energy dissipation shall be considered and enacted if possible on the main system outlet to reduce erosion impact on the connection to Junction Creek.

10. The Regional Storm flow conditions shall be based on the Timmins storm of 1961, 7.62 inches over 12 hours. It is noted that the 2004 Peterborough storm produced over 9 inches over 24 hours. It is recommended that the system be designed to protect and convey an 8 inch runoff over 24 hours in as much as economically possible.

VII. Factors Considered For Drainage Improvement Options

The following factors have been considered in the preparation of options for resolving drainage problems in the Mountain / Leslie Street areas:

1. Rainstorms

As a result of the initial design of the Mountain / Leslie Street subdivisions and the lay of the land, stormwater outlet for most of the incoming drainage areas must be directed south westerly to the main branch of upper Junction Creek as shown in **Appendix "D"**. It is clear that under rainstorm conditions (other than annual frequent 10 to 40mm rainfall events) that the low zone of Mountain and Leslie Streets can be affected by street ponding and flooding. The July 2007 rainstorm had moderate intensity and produced approximately 50 mm rainfall over a few hours. The result was ponding as shown by the pictures set out in **Appendix "F"** to this report.

It is important to note in the consideration of options that the Mountain Street / Leslie Street low area is at increased risks of flooding as the intensity and duration of a storm increases.

The City of Greater Sudbury has been subjected to many significant rainstorm events in its past. Rainfall records indicate that there have been many events producing 60 to 70 mm of rainfall over a few hours. Storms providing 90 mm to 125 mm of rainfall have occurred over eight (8) times in the past 55 years. The July 26, 2009 high intensity storm produced over 90 to 100 mm of rainfall in a one to two hour period and is considered to be at least a one in a 100 year rainstorm event. The Mountain Street/Leslie Street area flooded by this storm is set out in the plan shown in **Appendix "G"** to this report.

Larger rainstorms, considered Regional Storm events which produce 200 mm to 250 mm do happen and can happen to Sudbury. Regional storms produce total rainfall volume 2 to 2 ½ times that of a 100 year storm. The 1961 Timmins storm that created 193 mm (7.62 inches) of rainfall in a 12 hour period was just 125 miles away from Sudbury. The 2004 Peterborough

rainstorm, 197 miles from Sudbury produced 190 to 240 mm of rainfall over 24 hours. It is therefore prudent to consider the impact of a Regional storm condition on the Mountain Street / Leslie Street area.

2. Preliminary Concepts

In order to deal with flooding and drainage issues, the following basic concepts have been considered:

- a) Create additional pipe capacity to the southwest outlet to Junction Creek.
- b) Create a drainage channel through the lowest portion of the subdivision to the southwest outlet to Junction Creek.
- c) Create a combination of pipe and drainage channel outlets to the southwest outlet to Junction Creek.
- d) Reduce the size of pipes and / or drainage channels to the southwest outlet by diverting portions of the northeast drainage area to a north east drainage channel outlet to Junction Creek.
- e) Reduce the size of pipes and/or drainage channels to the southwest outlet by diverting the outlet of the upper plateau Sunrise Ridge pond to the northeast channel outlet to Junction Creek.
- f) Increased stormwater storage.

3. Special Development Considerations

Concerns have been raised that the new Sunrise Ridge housing development drainage outlet system over taxes the Mountain / Leslie Street drainage system and that outlet drainage should be redirected from going over the mountain side.

As previously indicated, the upper plateau Sunrise Ridge Stormwater pond has been designed on a pre to post concept. This means that the pond is designed to accept the difference of stormwater flow resulting from the change from natural land to developed land.

Previous to the pond, runoff from the hill was dispersed around the perimeter of the hill crest or directed to small ravines. The underground pipe network and lot grading of the developed portion of the upper plateau drainage area now directs a significant percentage of the drainage area to the pond site. Site stormwater storage is limited to the volume capacity of the pond.

Under pre-development site conditions, a rare 100 year or Regional storm would have created large stormwater flows over the hill crest. The larger flows would have proceeded over or around Mountain Street lots at the base of the mountain to the low area of Mountain Street. Those flows are now concentrated in the direction of the pond. The current pond is not designed to hold back those predevelopment flows. The pond is designed to hold back and control the difference of stormwater flow between the predevelopment and post development conditions. At the time of the 2009 storm and currently, there has been only partial development of the Sunrise Ridge site. However, the development will eventually be built out and the full post development stormwater condition will then be in place.

VIII. Drainage Improvement Options

Eight drainage improvement options have been evaluated to alleviate Mountain Street and Leslie Street flooding problems. Options A to D deal with drainage diversion solutions. Options E to H deal with drainage outlet improvements for Mountain Street and Leslie Street.

I. Option A - Diversion of the Northeast Drainage Area

The (34 acre) 13.84 hectare northeast drainage area drains to the low area of Mountain Street. It is proposed to lessen the drainage impact on the Mountain Street / Leslie Street area by the diversion of 9.86 hectares of this drainage area in a 1060 metre long drainage channel directed east to Junction Creek as shown on the plan set out as **Appendix “H”** to this report. This option has a conceptual cost estimate of \$700,000. The detail of the cost estimate is set out in **Appendix “P”** to this report.

2. Option B - Sunrise Ridge Development Floodwall

Given the experience of the July 2009 storm and concerns of the Mountain Street residents, we believe that the construction of a major storm flood barrier wall would be an added improvement along the hillside perimeter of the Sunrise Ridge Development upper pond site. This proposed

wall, as shown on plans set out in **Appendix “I”** to this report will reduce any potential for stormwater bypass around the pond apron and will provide additional flood storage at the pond site for major storms. The proposed flood barrier wall has a conceptual estimate cost of \$200,000. The detail of the cost estimate is set out in **Appendix “P”** to this report.

3. Option C - Pond Outlet Pipe Through Mountain Slope

Mountain Street residents have concerns with regard to the existing Sunrise Ridge pond pipe outlet and spillway over the hillside. The residents feel that the current outlet is unacceptable due to the creation of a waterfall after rainstorms. They are further concerned with the noise of rushing water, ice build up in winter months and the potential for flood waters overflowing the mountain base interceptor ditch into their properties.

With Option C, it is proposed to close down the existing pipe outlet and spillway and to drill a hole through the mountain slope from the pond to the base of the mountain. A pipe would be put through the hole and be connected from a revised pond outlet structure to a new stormsewer on Mountain Street as shown on the plan set out in **Appendix “J”** to this report. This option has a conceptual estimated cost of \$700,000. The detail of the cost estimate is set out in **Appendix “P”** to this report.

4. Option D - Pond Outlet Northeast Diversion

With Option D, it is proposed to close down the existing pipe outlet and spillway and divert the pond water northeasterly 270 metres to an existing depression in the mountain slope as shown on the plan set out in **Appendix “K”** to this report. This would involve the construction of a new 525 mm diameter pipe pond outlet and an overflow channel northeasterly along the mountain ridge to the depression. Associated improvements to the depression down the mountain slope would also be required. This option has a conceptual estimated cost of \$1,000,000. The detail of the cost estimate is set out in **Appendix “P”** to this report. If constructed, the proposal would be connected to the drainage channel set out in Option A.

5. Option E - 100 Year Storm Design Pipe Outlet For Mountain and Leslie Streets

This option proposes the construction of a 100 year storm design pipeline from Mountain Street to Junction Creek as shown on the plan set out as **Appendix “L”** to this report to replace the existing outlet system. Concrete pipe sizes for this option vary from 1950 mm diameter (77 inch) to 2100 (83 inch) diameter. The outlet alignment is upstream of the low area flooded in

2009 and would require new enhanced catch basin structures to inlet stormwater to the new large pipe. This option would require the acquisition of property from landowners to obtain the necessary land space for the pipeline. This option would provide flood protection to the 100 year storm level. A Regional storm would result in some flooding in the low area. This option includes the cost of a pipe through the mountain slope from the Sunrise Ridge pond outlet to a storm sewer outlet at the base of the mountain, the cost of a flood barrier wall at the pond site and the northeast drainage channel to Junction Creek. The conceptual estimated cost of Option E is \$6,400,000. The detail of the cost estimate is set in **Appendix “P”** to this report.

6. Option F - 2 Year Storm Design Pipe Outlet With Overflow Channel

This option proposes the construction of a 2 year storm pipe in combination with an overflow channel to provide Regional storm level flood protection for the Mountain Street and Leslie Street area as shown on the plan set out as **Appendix “M”** to this report. This option is located in the low area flooded in 2009 and would require the acquisition of property from landowners to obtain the necessary space for the pipeline and channel.

This option includes the cost of a pipe through the mountain slope from the Sunrise Ridge pond outlet to a stormsewer outlet at the base of the mountain, the cost of a flood barrier wall at the pond site and the northeast drainage channel to Junction Creek. The conceptual estimated cost of Option F is \$5,200,000. The detail of the cost estimate is set out in **Appendix “P”** to this report.

7. Option G - Regional Storm Drainage Channel

This option proposes the construction of a Regional storm drainage channel from Mountain Street to Junction Creek as shown on the plan set out as **Appendix “N”** to this report. It would be located within the low area of Mountain and Leslie Streets and would require the acquisition of property to obtain the necessary space for the channel. The conceptual estimated cost of Option G is \$1,800,000. The detail of the cost estimate is set out in **Appendix “P”** to this report.

8. Option H - Regional Storm Drainage Channel With Mountain Street Storm Pipe Improvements

This option proposes the construction of an upgraded stormsewer outlet on Mountain Street and a major storm drainage channel from Mountain Street to Junction Creek as shown on the plan set out as **Appendix “O”** to this report. It would be located within the low area flooded in 2009

and would require the acquisition of property from landowners to obtain the necessary space for the channel. This option includes the cost of a pipe through the mountain slope from the Sunrise Ridge pond outlet to a storm sewer outlet at the base of the mountain, the cost of a flood barrier wall at the pond site and the northeast drainage channel to Junction Creek. The conceptual estimated cost of Option H is \$3,900,000. The detail of the cost estimate is set in **Appendix “P”** to this project.

IX. Summary of Drainage Improvement Options

Option	Option Description	Cost (\$)
Option A	northeast drainage channel	700,000
Option B	Sunrise Ridge pond flood barrier	200,000
Option C	pond outlet pipe through mountain slope	700,000
Option D	pond outlet northeast diversion	1,000,000
Option E	100 year storm pipe outlet with pond pipe outlet through mountain slope. Pond site flood barrier and north east drainage channel	6,400,000
Option F	2 year storm pipe with overflow channel and pond pipe outlet through mountain slope, pond site flood barrier and northeast drainage channel	5,200,000
Option G	regional storm drainage channel from Mountain Street to Junction Creek	1,800,000
Option H	regional storm channel with Mountain Street storm pipe improvement, pond pipe outlet through mountain slope, pond site flood barrier and northeast drainage channel	3,900,000
Composite Option A and G	composite of northeast drainage channel and regional storm channel from Mountain Street to Junction Creek	2,500,000
Composite Option A, B, D	composite of northeast drainage channel, Sunrise Ridge pond flood barrier and pond outlet northeast diversion	1,900,000
Recommended Composite Option A, B, D, G	composite of northeast drainage channel, Sunrise Ridge pond flood barrier, pond outlet northeast diversion and the regional storm outlet channel from Mountain Street to Junction Creek	3,700,000

X. Factors Affecting Project Cost

Within the current cost estimates for the options presented, there are several factors which have been allowed for but require further work to increase cost accuracy.

All options require the creation of the northeasterly diversion drainage channel to Junction Creek. A substantial volume of rock removal (1350 cubic metres) has been allowed for. Soils testing is required to substantiate if this amount is accurate. If no or little rock is found, this option becomes significantly less expensive.

The quantity of rock removal for the Mountain Street to Junction Creek outlet options needs to be verified and could affect the price of the options up or down. Allowances have been made for the purchase of property and easements. Those allowances can be subject to adjustment based on property appraisals.

Soils testing along the alignment of the chosen option alignment may uncover problem soil or ground water conditions which could increase the cost of the project. The early completion of soils testing will confirm if any difficult conditions exist.

Polymer coated corrugated steel pipe has been used for the cost estimates of Option F and Option H to reduce overall project costs. This pipe is anticipated to have a minimum 75 year life span. Both options would have a cost increase if concrete pipe was used.

A 30 percent general contingency allowance has been added to each option for unanticipated costs or changes to engineering design. The cost estimates provided are conceptual and will need to be adjusted as more detailed information and design work is completed.

The costs presented in this report refer only to storm drainage improvements. There is no allowance for any upgrade to existing sanitary sewers and associated connections.

XI. Consideration of Options

It is considered that the flooding of the low area of Mountain Street and Leslie Street is the highest priority drainage problem to deal with. This problem can be addressed as a first phase by implementing Composite Option A, and Option G at a total conceptual cost of \$2.5 million.

Council resolution #2010-290 passed on July 14, 2010 was specific in its direction to staff to develop a plan to divert stormwater from the Sunrise Ridge Development Detention pond away from the Mountain and Leslie Street area. It is considered that this work be the second priority drainage problem to be addressed by the implementation of Composite Options A, B, and D at a conceptual estimated cost of \$1,900,000.

To achieve a comprehensive solution to the stormwater flooding issues of the Mountain Street / Leslie Street area and the Mountain Street residents concerns with the Sunrise Ridge pond outlet, it is recommended that Composite Options A, B, D and G be implemented at a conceptual estimated cost of \$3,700,000.

XII. Recommendations

As a result of the engineering investigation that supports this report and the report findings, the following recommendations are made to City Council:

1. That Composite Options A, B, D and G to create a new northeast drainage channel to Junction Creek, to create a flood barrier wall at the Sunrise Ridge pond site, to divert the Sunrise Ridge pond outlet to the northeast and to create a major storm drainage channel from Mountain Street to Junction Creek be approved for implementation at a conceptual estimated cost of \$3,700,000.
2. That staff be directed to proceed as soon as practical to obtain the services of civil engineering consultants to have engineering, environmental approvals, public meetings, detailed cost estimates and associated work completed for Composite Options A, B, D and G.
3. That the 2011 Five year Capital Budget contain a funding allocation of \$350,000 in the 2012 projections for the engineering, environmental approval, public meetings and associated work requirements of the approved project.
4. That Council may wish to consider advancing the use of the \$350,000 budgeted in 2012 for use in 2011. This option will be presented during the 2011 Capital Budget deliberations.

5. That phased implementation of construction work be scheduled in accordance with the five to ten year capital plan which will be presented during the 2011 Capital Budget deliberations.

XIII. Conclusion

In conclusion, the implementation of the drainage improvement works outlined in the report for the Mountain Street and Leslie Street area should provide the measures necessary to alleviate surface water flooding caused by severe rainstorm events.

Prepared by,

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February 2, 2011

Date