ENGINEERING REPORT

HOLLAND MARSH DRAINAGE SYSTEM
CANAL IMPROVEMENT PROJECT

TOWN OF BRADFORD WEST-GWILLIMBURY

COUNTY OF SIMCOE

TOWNSHIP OF KING

REGION OF YORK

"TEXT"

VOLUME 1

Original: January 16, 2009
As Amended by Tribunal: March 12, 2010

File No. 03-023

K. SMART ASSOCIATES LIMITED
Kitchener Sudbury New Liskeard Rainy River

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HOLLAND MARSH DRAINAGE SYSTEM CANAL IMPROVEMENT PROJECT

TOWN OF BRADFORD-WEST GWILLIMBURY

ENGINEERING REPORT

SUMMARY

This is an Engineer's Report pursuant to Section 78 of the Drainage Act, RSO 1990. This report consists of four volumes (books), numbered I, II and III and IV. This report's purpose is to provide for an improvement to the canals and dykes that form part of the Holland Marsh Drainage System. The report provides that 16.95 km (16,950m) (11,300m North Canal and 5,650m South Canal) of the canals are to be improved by shifting the existing canals laterally and another 11.0 km (11,000m) (2,130m North Canal and 8,870m South Canal) are to be improved by a bottom cleanout with minor widening in some portions.

Ancillary work involved with the improvement to the canal system includes grading a berm beside the dyke roads on the canal backfill over 9.8 km, repair of scattered lengths of dyke, addressing the numerous irrigation inlets that have service from the existing canals, addressing the issue of drain outlets and well overflow outlets that discharge to the canal, addressing 13 bridges that cross the canal and to provide for minor works of buffer construction, lateral channels, and providing drainage along canal roads/where new berms are built.

A further purpose of this report is to better provide for future maintenance and to allow it to be more easily undertaken on the canals and dykes of the Holland Marsh Drainage System.

This report provides, sets out or contains the background of the Holland Marsh, the construction of the Holland Marsh Drainage System, the history of the system since constructed, the studies undertaken by the Engineer during the preparation of this report, matters given consideration in final design, the cost estimate, the methods of assessing such, the assessment schedules for distributing the costs, the specifications to direct the contractors in their performance of the work and the drawings, profiles and cross-sections.

Volume I (Book 1) of this report contains the background, the considerations and recommendations, the cost estimate, and general comments. **Volume II (Book 2)** contains the assessment schedules and the drawings to illustrate the location of assessed properties. **Volume III (Book 3)** contains the various construction drawings including the specific notes re work on each property. **Volume IV (Book 4)** contains the specifications.

Drawing 1 following this summary shows the watershed of the Holland Marsh Drainage System.
Drawing 2 following this summary shows the components of the Holland Marsh Drainage System.

The total project estimated cost, the portion to be assessed to lands and roads, the grants available and the resulting estimated net cost per acre to the lands is shown in Table 1 on the following page.

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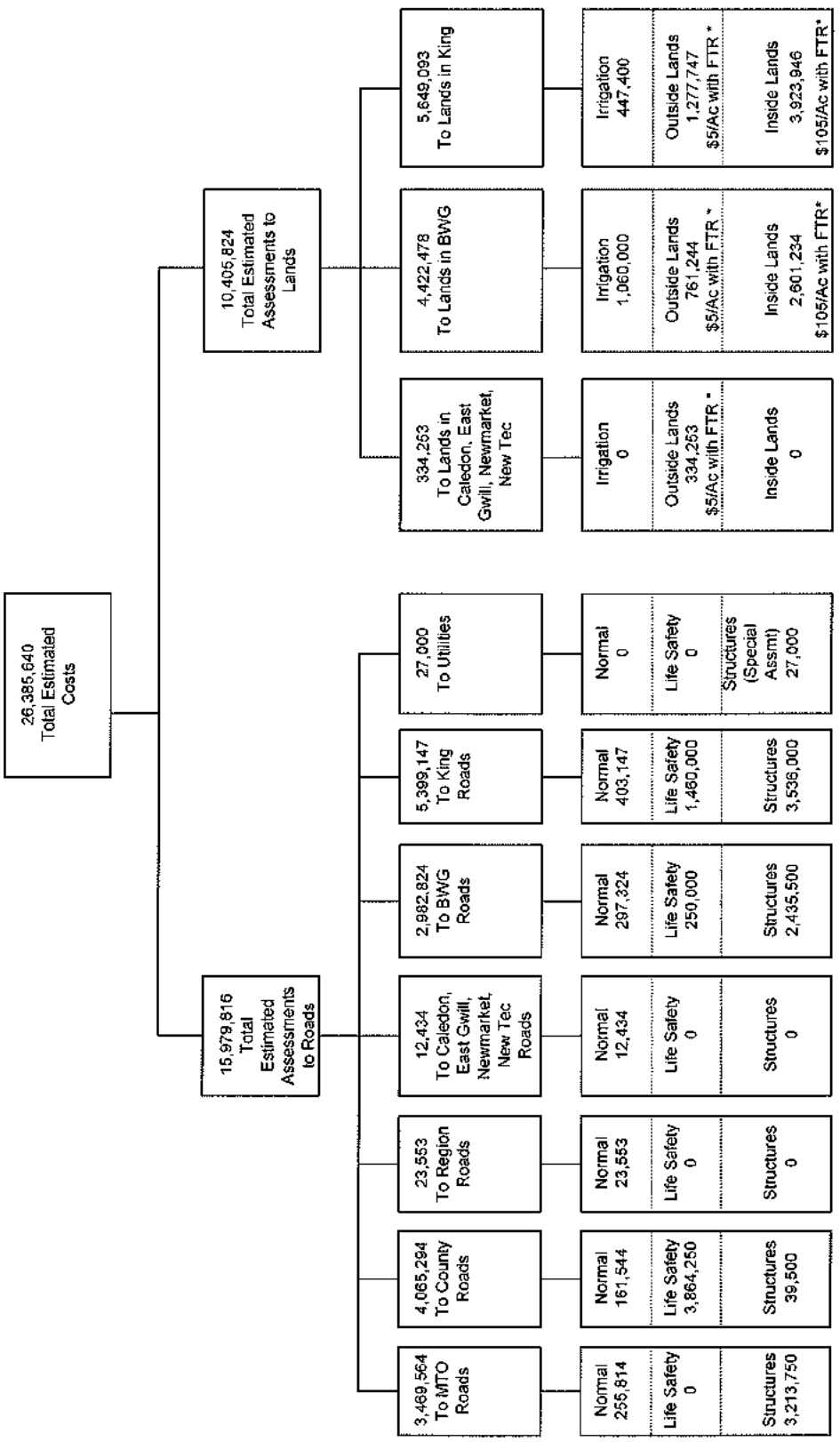
TABLE 1
ESTIMATED COSTS/ASSESSMENT SUMMARY



* This is the estimated out of pocket assessment per acre if the property is eligible for the Farm Tax Rate and receives the MIII grant and assuming the project is constructed exactly at the estimate. The estimated out of pocket assessment per acre if the property is not eligible for the Farm Tax Rate and again assuming the project is constructed exactly at the estimate, will increase to $15/ac for lands outside of the marsh and to $450/ac for lands within the marsh.

The project will involve a total of approximately 27,950m (13,430m North Canal and 14,520m South Canal) of canal improvement and substantial improvement work at eight bridge structures across the canal.

Drawing 3 following this summary shows the study interval and the recommended work per interval.

The watershed affected consists of 2,816.4 (6,959 acres) hectares of interior marsh lands and roads, and 26,047.2 hectares (64,361 acres) of exterior lands and roads that drain to the canals for a total of 28,853.8 hectares (71,297 acres) in the watershed. These are numbers based on assessed acreages.

The total overall cost estimate of this project is contained on Pages 75 to 99 of this Volume I.
The cost estimate broken down into subcontracts and/or billing periods is shown on Pages 103 to 106 of this book.
The assessment pages (Schedule A) are found in Volume II of this report.

To locate a landowner's or road property and the assessment to such, it is necessary to first consider the Municipality, and for those Town of Bradford-West Gwillimbury and Township of King owners it is necessary to consider whether the lands are inside or outside of the marsh area. Then the properties are listed in terms of ascending property roll numbers in the assessment schedules in Volume II.

To find a property on the drawings (figures) in Volume II, it is necessary to refer to the index map and then to refer to the index drawings (figures) following the schedules, and then to locate the specific assessment plan (figures) based on the plan (figure) referred to in the index.

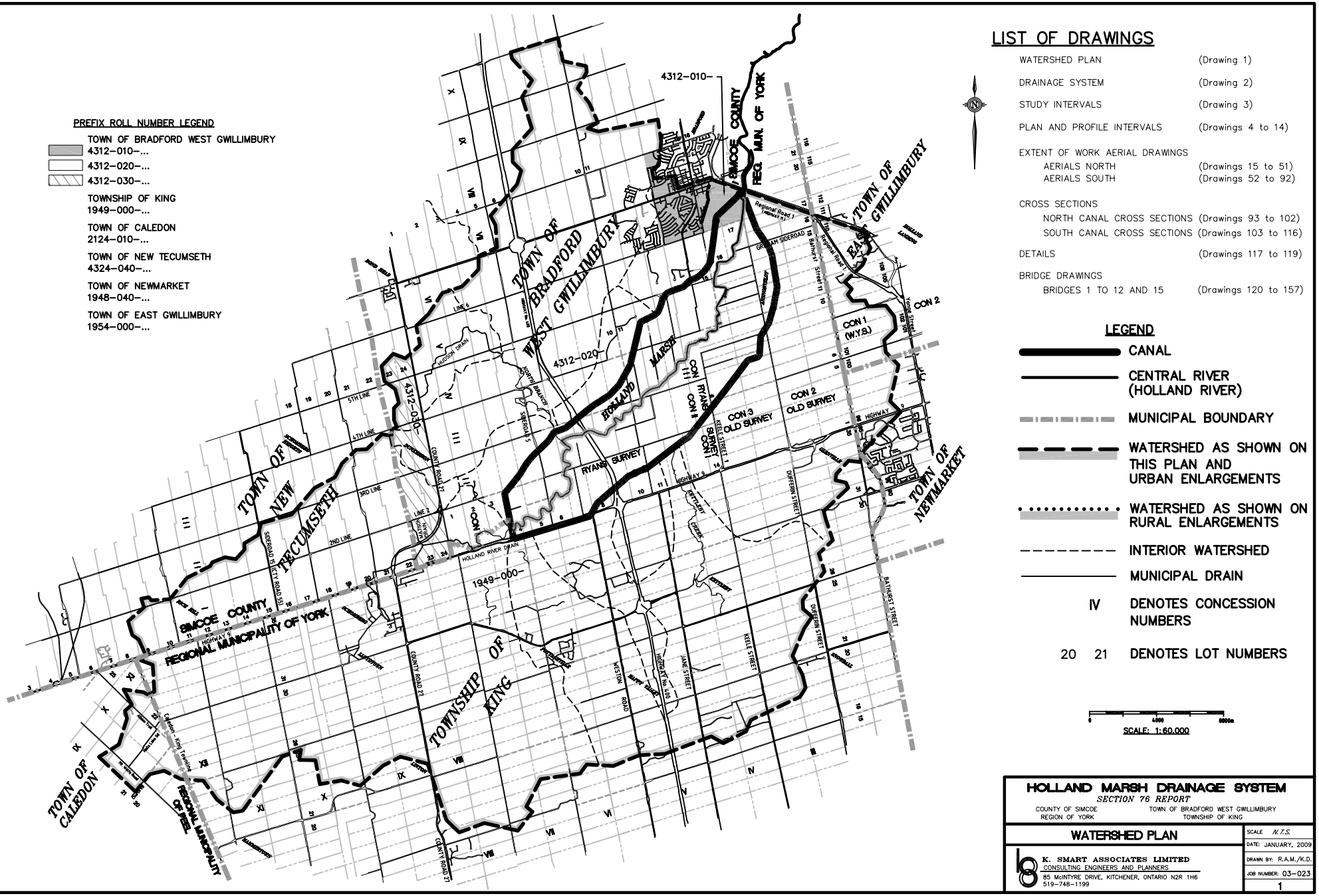
A separate book has been prepared, that is not part of this report, to show estimates of net assessments to owners. These net assessments are estimates of what the actual out of pocket costs could be to an owner if the project were constructed exactly at the estimate included and if the eligible grants are received and applied. These estimates of net costs were prepared by deducting from the estimates of the gross assessments firstly the one third available OMAFRA grant on the assessment if the property is eligible for the Farm Tax Rate, then secondly the owners' share of the MIII grant received, and then lastly the land allowances provided for use of land and damages to the lands during construction. This book is available at the Board office or on the Engineer's website if anyone wishes to review it. **This book illustrates that an average estimated net assessment per acre to a farm with the Farm Tax Rate and that receives the OMAFRA grant within the marsh is $105± per acre and $450 per acre for properties if the OMAFRA grant is not available. Outside the marsh the rates are $4 to $5 per acre for properties with the Farm Tax Rate and $15 to $20 per acre without.**

Due to the extent of this project, it is anticipated that construction will occur over a number of years. The report has been written so that tenders for subcomponents (contracts) of the project may be obtained.

It is proposed to have 6 contracts (Contracts 1A, 1B, 2A, 2B, 3A and 3B). Contract 1A is South Canal, Intervals 10 to 17 and North Canal, Intervals 1 & 2 for all work except for the berm works. Contract 1B is the same intervals as Contract 1A but is for the berm works only. Contract 2A is North Canal, Intervals 3 to 5 for all work except for the berm works. Contract 2B is the same intervals as Contract 2A but is for the berm work only. Contract 3A is North Canal, Intervals 6 to 9 and South Canal, Interval 18 for all work except for the berms works. Contract 3B is the same intervals as for Contract 3A but is for the berm works only.

For a property that fronts on the canals or dyke roads to find out what adjacent work is actually proposed and how it affects the property, the aerial drawings numbered 15 to 92 in Volume/Book 3 show the property and describe the work near or on the property. These aerial drawings are in

clockwise order starting at Highway 9 in the north canal. All drawings have a key plan to show what area the drawing applies to. The Table of Allowances on Pages 78 to 82 of this Volume 1 show the allowances to be paid to any parcel that will have work done on it. These allowances are subtracted from any assessment made to the property. The Construction Special Provisions on pages RS1 to RS87 in Volume/Book 4 describe in detail each item of work to be done. A Table of Contents indicates where any specification can be found.



LIST OF DRAWINGS

LEGEND

- CANAL
- CENTRAL RIVER (HOLLAND RIVER)
- MUNICIPAL BOUNDARY
- WATERSHED AS SHOWN ON THIS PLAN AND URBAN ENLARGEMENTS
- WATERSHED AS SHOWN ON RURAL ENLARGEMENTS
- INTERIOR WATERSHED
- MUNICIPAL DRAIN
- IV DENOTES CONCESSION NUMBERS
- 20 21 DENOTES LOT NUMBERS

SCALE: 1:60,000

HOLLAND MARSH DRAINAGE SYSTEM

SECTION 76 REPORT

COUNTY OF SIMCOE — REGION OF YORK — TOWN OF BRADFORD WEST GWILLIMBURY — TOWNSHIP OF KING

WATERSHED PLAN

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SCALE	N.T.S.
DATE:	JANUARY, 2009
DRAWN BY:	R.A.M./K.D.
JOB NUMBER:	03-023
	1

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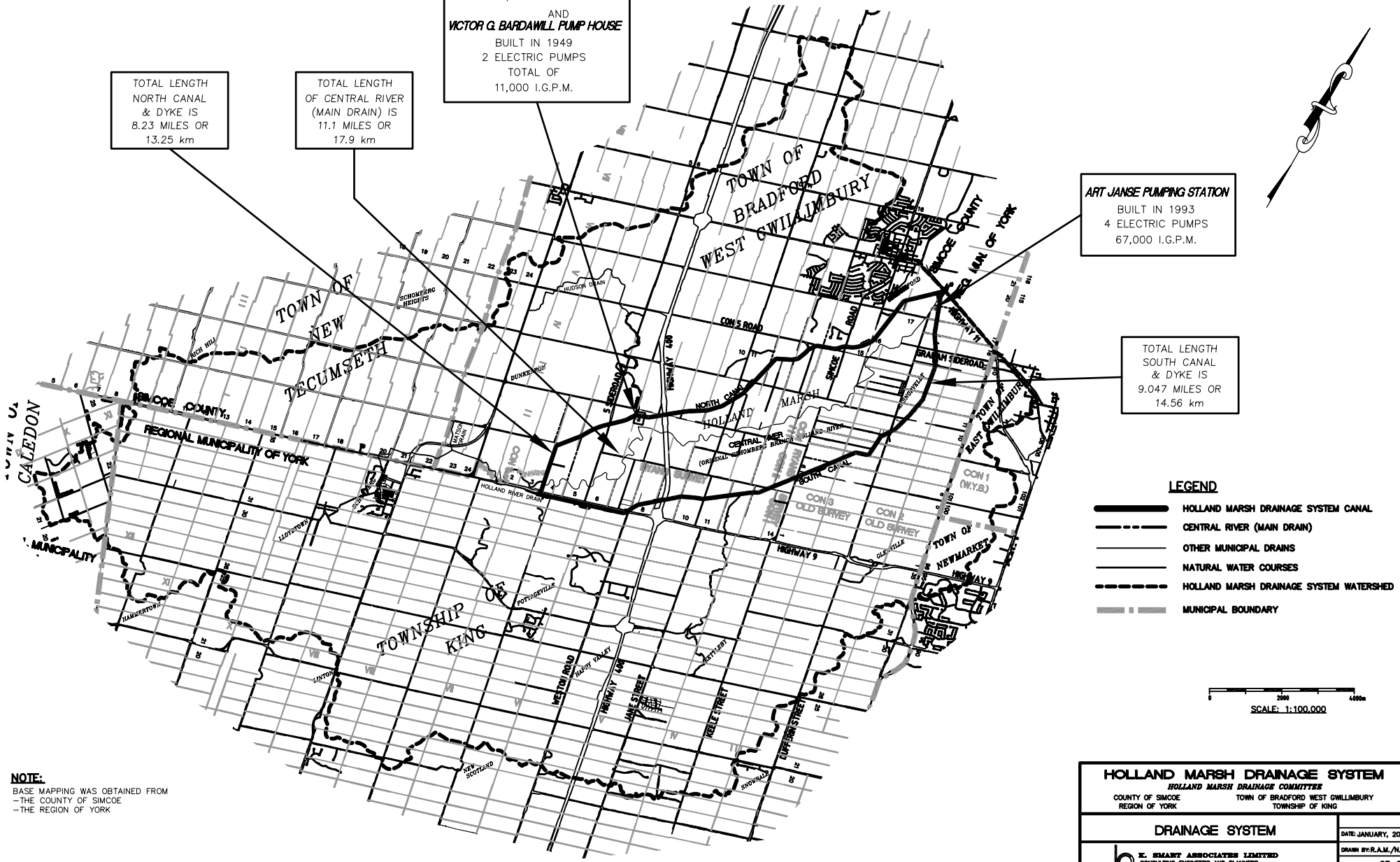
HOLLAND MARSH DRAINAGE SYSTEM



NOTE:
BASE MAPPING WAS OBTAINED FROM
–THE COUNTY OF SIMCOE
–THE REGION OF YORK

HOLLAND MARSH DRAINAGE SYSTEM
HOLLAND MARSH DRAINAGE COMMITTEE
COUNTY OF SIMCOE — TOWN OF BRADFORD WEST GWILLIMBURY
REGION OF YORK — TOWNSHIP OF KING

DRAINAGE SYSTEM

DATE: JANUARY, 2009
DRAWN BY: R.A.M./N.M.B.
JOB NUMBER: 03-023
2

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KITCHENER, ONTARIO N2R 1H6

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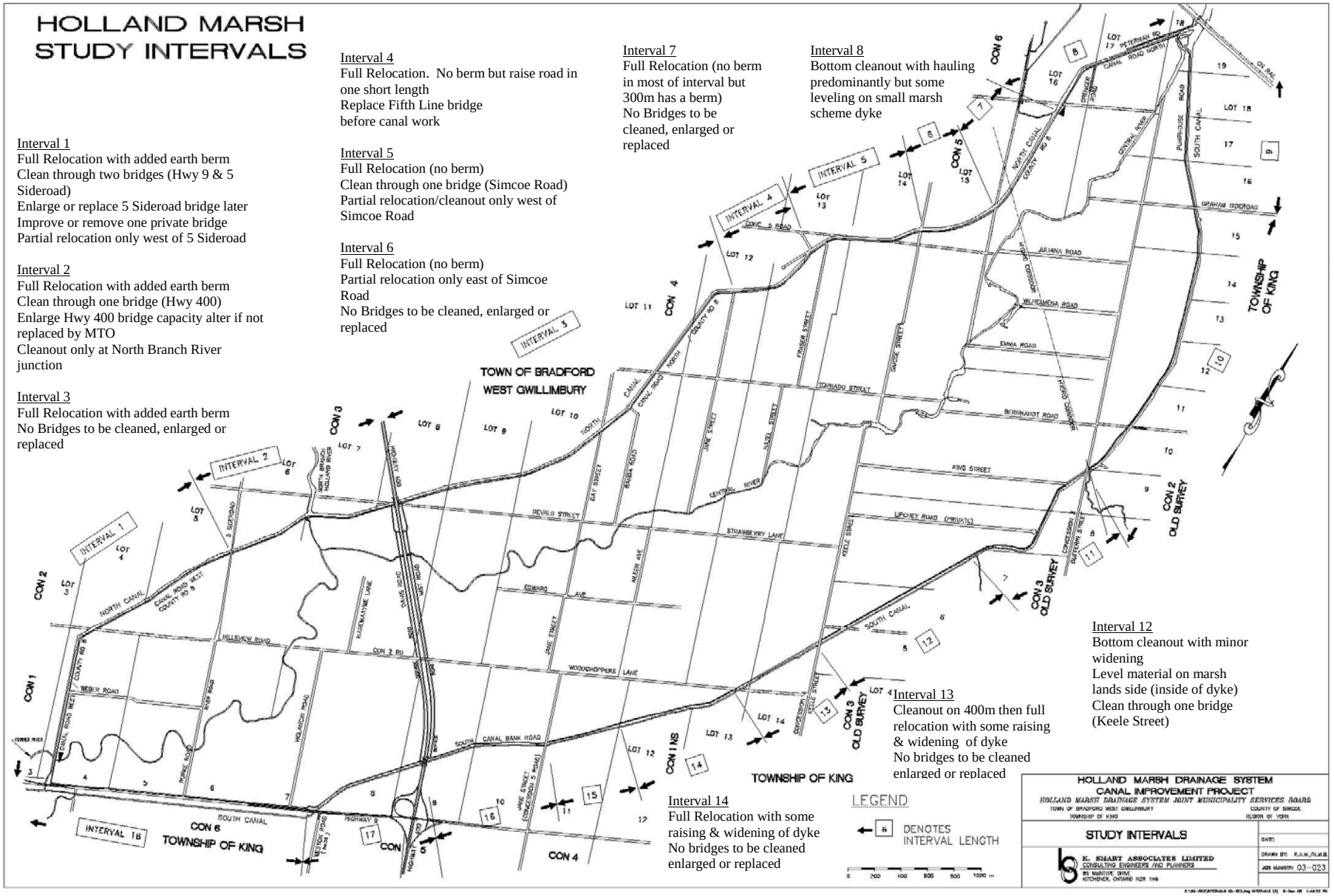
DRAWING 3
STUDY INTERVALS AND RECOMMENDED WORK



Interval 1
Full Relocation with added earth berm
Clean through two bridges (Hwy 9 & 5 Sideroad)
Enlarge or replace 5 Sideroad bridge later
Improve or remove one private bridge
Partial relocation only west of 5 Sideroad

Interval 2
Full Relocation with added earth berm
Clean through one bridge (Hwy 400)
Enlarge Hwy 400 bridge capacity alter if not replaced by MTO
Cleanout only at North Branch River junction

Interval 3
Full Relocation with added earth berm
No Bridges to be cleaned, enlarged or replaced

Interval 4
Full Relocation. No berm but raise road in one short length
Replace Fifth Line bridge before canal work

Interval 5
Full Relocation (no berm)
Clean through one bridge (Simcoe Road)
Partial relocation/cleanout only west of Simcoe Road

Interval 6
Full Relocation (no berm)
Partial relocation only east of Simcoe Road
No Bridges to be cleaned, enlarged or replaced

Interval 7
Full Relocation (no berm in most of interval but 300m has a berm)
No Bridges to be cleaned, enlarged or replaced

Interval 8
Bottom cleanout with hauling predominantly but some leveling on small marsh scheme dyke

Interval 9
Full Relocation (no berm)
Clean through one bridge (Graham Sideroad)
Enlarge or replace same bridge later

Interval 10
Bottom cleanout with minor widening
Level material on marsh lands side (inside) of dyke adjacent to lots in Ansnorveldt.
Haul excavation
Clean through one bridge
Enlarge or replace same bridge later (Dufferin St)
Replace private bridge with new laneway (done)

Interval 11
Bottom cleanout with hauling by King Road
Elsewhere, bottom cleanout with minor widening
Level material on marsh lands side (inside) dyke
No bridges to be cleaned

Interval 12
Bottom cleanout with minor widening
Level material on marsh lands side (inside of dyke)
Clean through one bridge (Keele Street)

Interval 13
Cleanout on 400m then full relocation with some raising & widening of dyke
No bridges to be cleaned enlarged or replaced

Interval 14
Full Relocation with some raising & widening of dyke
No bridges to be cleaned enlarged or replaced

Interval 15
Full Relocation with some raising & widening of dyke
Replace Jane Street bridge prior to canal work

Interval 16
Full Relocation with berm
Clean through Highway 400 overpass
Enlarge Highway 400 bridge capacity if not replaced by MTO

Interval 17
Full Relocation with berm
Clean through one bridge (Highway 9)

Interval 18
Bottom cleanout with some leveling on boulevard between Hwy 9and canal
Hauling away of balance
No bridges to be cleaned, enlarged or replaced

A DESCRIPTION OF THE HOLLAND MARSH

The Holland Marsh is a 2,833± hectare (7,000± acre) area of organic land that was reclaimed for agriculture by a substantial drainage (the Holland Marsh Drainage System) and land clearing scheme. It has been described by various documents with the general conclusion that it is one of the most fertile agricultural areas in the Province of Ontario and perhaps in the country.

The Holland Marsh and the Holland Marsh Drainage System are located in part in the County of Simcoe and in part in the Region of York. The County/Region boundary through the marsh follows the historic route of the Schomberg Branch of the Holland River which is now the Central River (Main Drain).

The local municipalities primarily involved are the Town of Bradford-West Gwillimbury in the County of Simcoe and the Township of King in the Region of York. The watershed draining to the canals consist of some 26,000± hectares (64,300± acres) from portions of the above municipalities plus from the Town of Caledon, Town of Newmarket, Town of East Gwillimbury and Town of New Tecumseth. **Drawing 1** shows the total watershed of lands draining to the canals

As is evident on the drawing, approximately one third of the Holland Marsh lands are located west of Highway 400 with the balance lying east of Highway 400. The marsh extends from just west of Highway 11 adjacent to the south limits of the Town of Bradford westerly to approximately 3.5 km west of Highway 400 as measured along Highway 9.

The primary crops grown in the marsh are vegetables with onions and carrots predominant. It has been estimated that 50% of the carrots and onions consumed in Canada originate from the marsh. There are also significant crops of lettuce, celery, cabbage and other greens. A review of the list of owners of the parcels within the marsh would indicate that there is a substantial diversity in ethnic backgrounds and it is known that a large variety of specialty vegetables are produced.

The marsh soils are valued as a medium for vegetable production because they are level and easy to work; the black soil warms up early in the spring; the soil moves with the plant and doesn't restrict its growth; the muck soil holds the rain, irrigation water and fertilizer and releases all to the plant when needed. Also the soil does not turn to mud which allows for easy mobility during planting, cultivating and harvesting times.

The marsh, as shown by 1920± plans, was originally divided up into approximately 77 properties. There are now approximately 800 different properties within the marsh. To indicate the complexity of the agricultural activities within the marsh, it was estimated in the year 2000, that there were 500 houses, 350 large storage barns, 125 garages, 250 greenhouses and 20 acres of year round greenhouses.

The estimated annual crop value of the marsh was estimated in 1998 at $48,000,000±. The total MPAC assessment in the marsh was $160,000,000± (1998 figures). The estimated present day value to the provincial economy would be $200,000,000±. A more detailed study of the current economic value of the Marsh is now being undertaken.

The commuting time to central Toronto from the marsh is approximately 30 minutes by means of canal roads and Highway 400. Access is also provided by Highway 400 to the Barrie area. The larger communities of Newmarket, Bradford, Aurora and Orangeville are within close proximity to the marsh.

DESCRIPTION OF HOLLAND MARSH DRAINAGE SYSTEM (HMDS)

The Holland Marsh Drainage System refers to a drainage project designed and constructed for the Holland Marsh lands pursuant to the Ontario Drainage Act. Alexander Baird, the engineer, prepared the engineering report in 1924 and the construction of the recommended work occurred in or around the mid 1920's.

The project involved the interception of the Schomberg Branch of the Holland River at the upstream limits of the area to be reclaimed and its diversion around the perimeter of the area using two drainage canals. The material from the canal excavation was used primarily to create dykes on the to-be reclaimed (marsh land) side of the canals. The remnants of the original river within the center of the reclaimed area (now known as the Central River or Main Drain) has been maintained to provide outlet for internal drainage waters from the marsh lands. A pumping scheme was provided as part of the original drainage works at the northeast end of the reclaimed area to pump the Central River waters through the dyke to the downstream continuation of the River.

The original drainage system and pumping scheme resulted in water levels in the canals being approximately 1.5m (5.0') higher than the maintained level of the Central River (Main Drain). With the evolvement of the pumping scheme and rising outlet water levels, this difference is now approximately 2.4m (8.0'). The dykes and canals on either side of the reclaimed land diverge in the area of Highway 9, approximately 2.5 km west of Weston Road, and then converge some 14 kilometres± downstream on the upstream side of the CN Railway, which parallels Highway 11 (Yonge Street).

Only minimal difference in bottom elevation (0.3m – 1') was to be provided by the 1924 report from the upstream to the downstream ends of the canals over the length of 14 kilometres±. Flow velocities in the canals are very low even in heavy flow periods and are estimated at 0.15 m/s or 0.5 fps.

The original pumping scheme constructed pursuant to the A. Baird report was capable of discharging 40,000 gallons per minute. This station was reconstructed in 1945 and then was replaced in 1993 by the present station which has a capacity of 67,000 gallons per minute.

In 1949, as a result of poor drainage in the Central River (Main Drain) and because of the planned construction of Highway 400 through the central portions of the marsh, a second pumping station was constructed pursuant to the recommendations of a further Drainage Engineer, W. G. McGeorge. This pumping station (two pumps) is located at the North Branch River junction and had a rated capacity of 18,000 gpm using two pumps. This pumping station was originally called the Springdale pumping station. The pumping capacity has been down rated, since construction, to 11,000 gpm and it is now known as the V. Bardawill Pumping Station. Following the Hurricane Hazel event, a second pumphouse (the Charles Davis Pumphouse) was constructed at this site. The original pumping capacity in it was to be 24,000 gpm but it is now rated at 13,500 gpm.

Drawing 2 shows the components of the Holland Marsh Drainage System as described above.

The original design of A. Baird was to provide the following dimensions of dykes and canals:

	North Canal from Highway 9 to North Branch River	North Branch River to 2000 feet east of Simcoe Road	East of Simcoe Road to converging point west of CN Railroad	South Canal Throughout
Canal:				
Top Width (ft)	38*	60	70	38*
Bottom Width (ft)	20*	40	40	20*
Depth (ft)	7	7	7	7
Dyke:				
Top Width (ft)	not less than 18 ft. top throughout			
Bottom Width (ft)	not less than 38 ft. bottom throughout			
Height (ft)	7	7	7	7
Separation width between toe of dyke and top of canal: (ft)	6*	6*	6*	6*

* Popular knowledge is that the work by the contractor in the late 1920's however provided the following:

a) a minimum top width of 40 feet
b) a much wider minimum bottom width so the dredge could travel in the canal as it was excavated
c) a separation that varied from 6 to 8 feet rather than 6 feet
d) top of dyke was constructed at 12' width

After the Hurricane Hazel event, the emergency reconstruction that occurred resulted in the following revisions to the canal dimensions (the newly excavated material was added to the dyke surface in part and otherwise widened the dyke embankment);

	North Canal from Highway 9 to North Branch River	North Branch River to 2000 feet east of Simcoe Road	East of Simcoe Road to converging point west of CN Railroad	South Canal Throughout
Canal:				
Top (ft)	58 avg.	65 avg.	76 avg.	54 avg.
Bottom (ft)	believed to be 40 to 60 ft. minimum when dug			
Depth (ft)	10	10	10	10
Separation between toe of dyke and top of canal: (ft)	0	0	0	0

The original report of A. Baird did not provide detailed specifications as to how the canals were to be maintained. It is customary for municipal drains, however, to maintain canals in the fashion that they were created.

This would mean that any materials excavated from the canal as part of maintenance (as per the original report intentions) would be placed on or beside the dyke that existed. It is presumed that the 1.8m (6') strip between the base of the dyke and the top of the canal was to be used in part by excavation equipment to maintain the canals. This separation disappeared during the reconstruction work following Hurricane Hazel.

HOLLAND MARSH DRAINAGE SYSTEM POLITICAL STATUS

a) Initiating Municipality

Pursuant to Section 1.14 of the Drainage Act, the Town of Bradford-West Gwillimbury is considered as the Initiating Municipality for purposes of this report. The Initiating Municipality is the body that authorizes a drainage report, that oversees the meetings and appeals re such and that oversees the financing, completion and billing out of the project. Where the Municipal Act provides, some of the responsibilities of the initiating municipality may be delegated to a Board (see below).

b) Drainage Superintendent

Pursuant to Section 93(1) of the Drainage Act, the municipalities of Bradford-West Gwillimbury and King have appointed one individual as their Drainage Superintendent. In addition to responsibilities for individual drains in the municipalities he also has drainage superintendent responsibilities in connection with the Holland Marsh Drainage System. He has the authority to assist in the supervision of construction of work recommended by this report and will be responsible for the future repair, maintenance and improvement of this project.

c) Holland Marsh Drainage System Joint Municipal Services Board (The Board)

The Board was created in 2007 pursuant to the Municipal Act and consists of municipal council representatives from both the Township of King and the Town of Bradford-West Gwillimbury, plus staff, and landowners from both municipalities. The purpose of the Board is to manage the Holland Marsh Drainage System on behalf of the Town of Bradford-West Gwillimbury and the Township of King. The Drainage Superintendent as described above is the Board's Project Manager for this project. It is believed the Board will prepare and award tenders for the project, and will prepare and convene the required meetings pursuant to the Act on behalf of the Initiating Municipality.

HISTORY OF EVENTS RE THE HOLLAND MARSH DRAINAGE SYSTEM (HMDS)

The following is a summary of main events or occurrences related to the Holland Marsh Drainage System since its original construction.

1930's to Present

- Since construction, there has been work from time to time to raise settled dykes, maintain the Central River (Main Drain), trap rodents, remove fallen trees or debris and to repair slumped and/or sloughed dyke banks.
- Cleanouts of the Central River (Main Drain) have occurred since the 1930's. Initially such were periodical and pursuant to separate bylaws. Since 1977± (when the Commission overseeing the drainage system acquired a river dredge with augers) the cleanouts have been annual and since 1982 have been pursuant to the provincial Drainage Superintendent's program.
- Along Pumphouse Road between the new and old pumphouses, material was cleaned out, until recently, every 10 years± since original construction of the dyke.
- Other than after Hurricane Hazel, and other than two cleanouts in three short locations each time (Jane Street, Kettleby Creek and near the former Rozenberg property all on the south canal), there has been no significant removal/maintenance of the accumulated sediments in the canals. Several bridges (including the Highway 400 overpasses) had a bottom cleanout in the 1980's.

1945

- The Holland Marsh Road Act came in existence in 1945 which gave legal status to the dykes being used as roads. A new pumping station was also built in 1945 to replace the original pumping station that was installed in the late 1920's.

1949

- A second pumping station was constructed at the intersection of the North Branch River and the north canal (the Springdale location).

1950's - Period of Highway 400 Construction

- To accommodate Highway 400, a substantial road embankment was constructed north/south through the marsh system, such that 39.63% of the marsh land area is to the west of Highway 400 and the balance of 60.37% is to the east.

- Concrete culverts were constructed to pass the Central River (Main Drain) below the embankment and two bridge structures were constructed to pass Highway 400 over the North and South canals.
- Also, to facilitate discharge of Central River (Main Drain) waters and to consider the Highway 400 proposal, the second pumping station was constructed by the MTO at the Springdale location.

1954 - Hurricane Hazel Period

- In 1954, Hurricane Hazel ravaged the area. The dykes were breached primarily where the North Branch River intersects but in other locations as well west of Highway 400. Water levels varying from 2' to 7' inundated the marsh lands. As a result of this disaster, it was determined that enlargements of the canals and dykes were necessary.
- Subsequently, a contract was let and funded, in part, through the Department of Public Works to enlarge the canals and the dykes throughout. Construction occurred over a period of 18 months. The work resulted in the canals being widened and deepened as previously described.
- The enlargement of the canals resulted in the disappearance of the 6' to 8' separation between the dyke and the canal. The excavated materials were primarily placed on the inside (marsh side) of the dyke. The canals were believed to be excavated up to a depth of 10'± as compared to the original depth of 7'±.
- Immediately after this rebuilding there were a substantial number of lives lost due to traffic accidents associated with the configuration of the road on top of the dyke and the loss of separation between the dyke and canal.
- Substantial sloughing of the new dyke slope occurred up to the road edge shortly after the 1950's improvements. (Such has also been intensifying in recent years due to increased traffic volumes and weights.)

1960

- In this year the dykes were threatened again due to high water associated with ice conditions and spring runoff. Overtopping would have occurred but sand banking was used.
- Popular knowledge is that this occurred at other times both prior to and after 1960, especially in early to mid 1980's. No sandbagging was done in the 1980's but water came to within 1" of overtopping the canal. This was also in an ice condition.

1970/1971

- When Highway 9 was constructed it was built along the original (1920's) canal path and the canal was diverted 60 metres to the south for a distance of 2.3 km.

1970's to 1980's - Maintenance of the Dyke by the Municipalities

- The Drainage Commission, as it was known then, in conjunction with the County and the municipalities attempted to restore settled areas along the dykes as subsidence occurred.
- The system's drainage superintendent has stated that substantial gravel was imported to raise various sections of the dyke. (Gravel was used as opposed to clay due to the dyke being a road and such could result in permeability and weakening of the dyke in flood conditions.)

1970's to 1990's - Lake Simcoe Region Conservation Authority (LSRCA) Active Era of Involvement

- The Lake Simcoe Region Conservation Authority undertook numerous studies of the system. (These studies have been listed in **Appendix 1** to this report.)
- Many of the studies indicated that added capacity in the canals and/or added flood protection along the dykes were necessary.
- A possible dam in the North Branch River was also studied.
- The principal physical work that resulted from these Conservation Authority studies was the construction of a sheet steel pile wall at the intersection of the North Branch River and the north canal. This wall was constructed over a length of approximately 130 metres. Construction was completed in 1979. This was done in conjunction with the raising of the dykes in part as referred to in the previous paragraph.

- Some of the Conservation Authority studies evaluated alternative methods of flood protection. However none were implemented due to cost and uncertainty of success because of the steepness of the slope and instability of the dykes.

1993 - Reconstruction of Main Pumping Scheme

- A major "improvement" to the main pumping scheme was completed in 1993 as per an engineer's report pursuant to Section 78 of the Drainage Act to provide for a new building complete with four new pumps, intake and discharge and the removal of the old station, in a report entitled Holland Marsh Drainage Scheme, Bradford Pumping Station No. 2 in accordance with a report by David A. Harsch, P.Eng. (Young-Smart Engineering, a former division of K. Smart Associates Ltd.) dated December 1990.

1997 - Initiation of Preliminary Engineering Studies

- The engineer was appointed pursuant to the Drainage Act to study needed repair and improvement to the canals and dykes of the Holland Marsh Drainage System and to prepare a preliminary report thereon.

1997- 1998 - Initial Engineering

- Surveys, cross sections, soundings
- Ownership drawings
- Perimeter watershed
- Initial discussions with Municipalities, MNR, LSRCA, DFO, MTO, Simcoe County
- Retention of Environmental Sub Consultant
- Review of past reports and soil surveys
- Many meetings with Drainage Superintendent
- Preparation of Preliminary Report costing and drawings

1998 – 2002 - Efforts to Verify Upstream Watershed including Riparian Owners Could be Assessed

- Retention of solicitor
- Many meetings/discussions with seven municipalities and their solicitors
- Appearances before Drainage Referee and Drainage Tribunal to approve a Section 76 report that would assess all upstream land including riparian landowners
- Public Meetings and Open Houses
- 7,831 notices sent out to upstream owners
- 26 appeals plus a municipal appeal was revised
- Approval was given to the Section 76 report

1999 – 2000 - Search for Additional Funding

- Drainage Superintendent, the Town of Bradford, West Gwillimbury and Township of King made many approaches to MP's and MPP's and to the Ministry of Finance with little or no success

2000

- It should be noted that the initiating Municipality (as per the Drainage Act terminology), the Town of Bradford-West Gwillimbury, received formal notice on June 1, 2000 pursuant to Section 79 of the Drainage Act to put the dykes and canals of the Holland Marsh Drainage System into a proper state of repair. Failure of the Municipality to do so could render it liable for any damages (crops, buildings) should flooding occur.

2000 to 2002 - Highway 9 Reconstruction

- In this period Highway 9 was again reconstructed. The roadway portion paralleling the south canal was widened so that the separation between the road embankment toe and canal was reduced from 32± m to 23± m. The minimum road elevation as constructed is 221.3 except for one 25± metre length which is elevation 221.15. The elevation of 221.3 is 0.3± m higher than the LSRCA's 1-D Report predicted 100 year flood levels and 0.3 m lower than that report's predicted Regional Flood levels. New culverts were installed below the road for drainage and all were equipped with back water valves. New piping for irrigation lines were also installed below the highway.

May 2003 - Appointment Re Final Engineering
- On May 13, 2003 the appointment was made by Bradford-West Gwillimbury pursuant to Section 78 of the Drainage Act to prepare a final engineering report on improvements to the Holland Marsh Drainage System canals and dykes.

July 2003 – Re-Involvement of DFO Commences

July 2004
- Work temporarily suspended on Final Engineering Report due to provincial reconsideration of grants

2004-2008
- CEAA Study undertaken

November 2007
COWSEP Study on Irrigation submitted

February 2008
- MIII grant for $10,200,000 for project received

March 2008
- Work recommences on Final Engineering Report

Spring 2008
- Due to the high Lake Simcoe levels and concerns re potential flooding re the spring thaw, aqua barriers were purchased by the Board in case such were necessary. Fortunately, a freeze-up with little rain made their use unnecessary at that time.

Note:
DFO – Department of Fisheries and Oceans
CEAA – Canadian Environmental Assessment Act
COWSEP – Canada Ontario Water Supply Expansion Program
MIII – Municipal Infrastructure Investment Initiative

OBSERVATIONS/PROBLEMS WITH HMDS

Five significant problems have been noted with respect to the Holland Marsh Drainage System:

a) Flood Protection

A previous section referred to the determinations by the LSRCA that the dykes should provide protection for the 100 year storm level. **Appendix 1** refers to the LSRCA's commissioned 1-D study that calculated levels of the 100 year event in existing condition.

A separate hydrologic and hydraulic analysis and modeling undertaken by K. Smart Associates (KSAL) in 1998 and updated in 2008 has provided a further prediction of the 100 year flood levels for existing and improved conditions. KSAL predicted 100 year flood levels would be slightly higher adjacent to the south canal than the Conservation Authority's studies levels, and slightly lower adjacent to the north canal. The KSAL studies also assessed the potential impacts of spring ice melt events.

This report being now submitted has adopted a 100 year flood line based on the higher of the two levels calculated by the two studies. Also, the existing condition level has been adopted to recognize that conditions do not remain continuously as constructed after a report's recommendations are implemented and especially in the HMDS considering the on-going sedimentation that is discharged into the canals and the substantial vegetative growth that occurs in the canals and also to recognize the impacts of ice conditions on flows.

The profile drawings included in this report in **Volume 3, Pages 4 to 14** indicate the 100 year flood level considered and also show the existing surface level of the dykes. These profile drawings show that significant lengths of dykes are lower than the 100 year flood level.

The previous studies have predicted a damage of $80+ million if the dykes are overtopped in a 100 year storm event.

b) Life Safety

Municipal staff have reported that within the 10 year period following the emergency works improvement of the canals and dykes necessitated by the Hurricane Hazel event, 11 fatalities associated with the existence of the canal, occurred. These fatalities were primarily a result of vehicles entering into the canal. There have been events leading to fatalities since this time with the latest occurring in the year 2005. Staff estimates the current fatality total to be 18 since the 1955 period. Over this period, other cars have entered the canal but the occupants were able to escape. In a previous year a truck carrying oil entered into the canal but fortunately a spill did not occur.

There is little room for error by anyone driving along the dyke/canal roads. The unevenness and the ponding of water along the dyke roads only add to the danger. A potential major tragedy could result if a school bus were to enter the canal. There are six school bus trips per day on many of the canal roads.

The initiating Municipality and the Holland Marsh Drainage Committee (now the Holland Marsh Drainage System Joint Municipal Services Board) requested, in 1997, that any engineering report on channel repair, maintenance or improvement should also provide for improved life safety. The Committee then indicated they wished to avoid a repeat of the past history of fatalities associated with just improving the canals as occurred after Hurricane Hazel.

c) Drainage

The original design of the system was to ensure that canals with 2.1m (7') of depth and 11.5m to 21.5m (38' to 70') of top width existed. After Hurricane Hazel, the channels were constructed with 16.5m to 21.5m (54' to 70') top width and up to 3.0m (10') of depth, it is understood. No plans or records exist re such but commission minutes exist re the work done. (The former Drainage Superintendent advised that the additional depth was provided not only for increased capacity but also to allow for sediment accumulation and to extend the life of the channel before maintenance and environmental disturbance occurred again.) The profile grades of the canals after Hurricane Hazel reconstruction were believed to be reasonably flat resulting in no drop in channel bottom elevation from the upstream to downstream ends except it is understood high bottoms remained at the bridges since they were not cleaned out.

The canals, for the past 50 years, have generally retained the top widths provided (some widths appear to have actually increased due to sloughing or erosion or wash due to loss of capacity from sedimentation) by the improvements subsequent to Hurricane Hazel, but the depths have been reduced substantially due to the accumulation of sediments. In an area east of, and at, Jane Street, the sediments have filled the canal to the water surface. At the mouths of Kettleby Creek and another creek in the south canal, sediments have filled approximately 100 metres of the canal (a minor cleanout of such was done together with the trial work in 2008). In portions below the south Highway 400 Bridge, the depth is reduced to almost water level and in other areas on the south canal and in the north canal west of Highway 400, the depth of water at the central portion of the canal would vary from 0.8m to 1.7m as compared to the described constructed depth of close to 3 metres in 1955. There is thus a substantial reduction in the drainage that can be provided by the canals. On the average the south canal would now have only 50%± of the drainage cross-sectional area

intended (The extent of filling extends from 25% to 95%). The north canal varies from 10% to 50% filled.

The slow movement of water in the canals has contributed to the build up of sediments and also has allowed the accumulation of clogging aquatic vegetation that is so evident in many intervals.

The extent of channel filling is evident from the profile drawings included in Volume II. These profiles indicate the bottom depth to be provided by this report (which is believed to be close to that provided by the post-Hurricane Hazel reconstruction work) and the bottom now existing.

d) Maintenance

The modification of the canals and dykes following the Hurricane Hazel event and also the agricultural land use and building development immediately adjacent to the dykes has rendered the intended maintenance impossible. The intended maintenance would be to work, in part, along the berm (now gone) between the dyke and the canal and to level materials on the inside of the dyke roads as based on the original engineering report. To alter this and to maintain the canals by cleaning the canal and disposing of the material elsewhere would involve equipment working along paved roads and hauling materials away to a disposal site which could be a substantial distance away. Costs would be excessive and the concern exists that the maintenance to be undertaken would be contrary to the maintenance provisions of the original engineer's report and could be legally challenged.

At the very least, the bylaw pertaining to the system requires substantial modification to more accurately describe the maintenance that can be or should be undertaken.

As well, the system itself requires modification to allow for improved ease of undertaking the routine future repair and maintenance that should be completed to avoid major works of improvement as are now necessary.

e) Structures

Since the construction of the original canal and dyke scheme, eight local or county jurisdiction structures have been constructed across the canals, four have been constructed by the province for Highways 9 and 400 (counting the Highway 400 overpass structures as two only) and three structures have been constructed privately. (One of the private structures existed up to 2001± but it collapsed and was removed and one other private structure was removed and replaced by a laneway on the outside of the canal in 2007.) A total of 13 structures across the canals therefore now exist. An analysis of these structures was undertaken by K. Smart Associates in 1997/1998 and it was subsequently determined that, as a minimum, improvements should occur to three of the municipal structures on the south canal and to two of the municipal structures on the north canal. As well, it was determined that increased capacity should be provided through the Highway 400 structures. In addition, the two (as existent then) private structures were found to be undersized. As has also been documented in studies prepared by others for LSRCA and by KSAL, a further concern at bridges is the obstruction and sizing of the opening areas to handle ice conditions.

It is necessary to both provide for improvements, replacements and/or removals of those existing undersized structures as well as to address any concerns re the other existing structures, and to develop a policy for the construction of any future structures across the canal.

There are many secondary or other problems with the existing system and five are listed here:

a) Use of Canals for Discharge of Drains and also for Inlets for Irrigation

There is no policy at the present time regulating or authorizing the construction of pipes through the dyke. A total of 240± pipes presently exist through the dykes, the majority of which are for irrigation

purposes. Most of these pipes have no protection, such as backwater valves, and should canal waters rise to the point of forcing flow through the pipes, flooding of marsh lands would be aggravated. These unauthorized crossings could also create locations of dyke weakening in periods of high flood levels. The immediate location of the canal beside the dyke has no doubt facilitated the past construction of these pipes.

There has to be flood protection provided to the existing dyke crossings and there has to be a policy addressing any future works of such construction.

b) Uncontrolled Field Cultivation/Excavation Adjacent to the Canal and on Top of the Dyke

In some locations there has been abuse of the top of the dyke and encroachment up to the canal by field cultivation. There have been past instances, in limited areas, of adjacent owners excavating into the dyke for a source of fill.

There is a need to both reconstruct these damaged portions of the dyke and to provide policies and/or requirements that all owners can be aware of with respect to working of fields, necessary dyke levels, farm practices and system stability on top of the dykes and adjacent to the canals including ensuring the dyke is always maintained clear of debris and equipment so it can be accessed for future maintenance.

c) Rodents

Due to the existence of the dyke immediately adjacent to the canal, there have been on-going problems with rodents burrowing into the dyke. This has caused minor slumping and settlements to date but has the potential of creating vulnerable areas for breaching should high waters again occur.

d) Tributary Streams

A number of tributary streams are depositing substantial sediments into the canals. To date, there has been very little control of upstream development along, and use of, these streams. The large extent of development in upstream areas has dramatically increased the flow in these streams during a runoff event. Reduced times of concentration (the time for runoff waters to accumulate) in these streams no doubt would contribute to the extent of flooding with a major event. Again there is a need to provide policies and guidelines, that all upstream owners and municipalities can be aware of, and to implement improved watershed management along the tributaries.

e) Potential Environmental Hazard

With the increased traffic along the roads and the increased hauling of oil and gasoline products, the potential exists for an environmental disaster should a spill occur.

CONSEQUENCES OF VARIOUS EVENTS

This section of the report attempts to evaluate the consequences of various scenarios in the existing conditions.

a) Consequences of Major Storm Event with Canal/Dykes as Existing

Engineering studies completed in the 1970's through to the 1990's for the LSRCA and the hydrology work undertaken by K. Smart Associates have indicated that many portions of Canal Road, which is the north canal dyke, are at or below the level of the 100 year storm event from Highway 9 northerly to 4 km northeast of Highway 400. The road/dyke varies up to 700mm (32") below the 100 year storm runoff level (CCL – 1D Study). There is also a short interval (0.2± km) of the north dyke between Simcoe Road and the Small Marsh Scheme that is also at or below the projected 100 year flood level. As well, many portions of South Canal Bank Road and its continuation east of Jane Street which is the dyke along the South Canal were identified by the KSAL studies as being below the 100 year flood level.

It had been determined by the Conservation Authority in the earlier studies that the 100 year level of protection should be provided for the marsh, and that the works to provide such protection were cost beneficial. This conclusion was verified by the undersigned in the report of 2000 (see listing of studies in **Appendices 1 & 2**).

This work completed in 2000 identified that if the dyke roads were inundated by a flood event, the losses to properties and crops within the marsh would be of the magnitude of $80 million. (See **Appendix 3**.)

In 1954 when Hurricane Hazel passed through the area, the dykes were inundated at that time and substantial losses to buildings, crops and farm activities were incurred. The estimated damage at that time was valued at $31.5 million.

b) Consequences on Accidents/Fatalities by Providing No Improvements to the Dyke

The extent of motor vehicle accidents along the dykes where used as roads has been described earlier herein. With increasing traffic along the dyke roads and the deteriorating conditions of the dyke roads, failure to do any work on the dyke roads has the potential of only aggravating the incidents of accidents. Road unevenness, ponding of waters which may subsequently freeze, deterioration of what protective tree cover exists and increasing volume in traffic will all contribute to further incidents.

To construct a guide rail along the dyke road would be extremely difficult in portions since there is insufficient shoulder in much of the affected lengths to allow such to be constructed on level terrain. In areas, the guide rail would actually have to be constructed along the slope of the dyke and its resistance to traffic impacts could be questioned. Trees along the dyke would have to be cleared to allow such construction, and the impacts on dyke stability could be an issue, especially if roots also had to be removed. Even the loss of the trees would be an issue since the trees create a partial barrier to entry into the canal.

A guide rail would impact on adjacent landowners ease to access the water for irrigation, and would make it difficult for future maintenance of the canal. It would require removal whenever the canals were repaired or improved, assuming the canals would have to be maintained from the dyke roads.

In many locations, the shoulder along the canal edge of the dyke road is less than the required 1 metre, such that very little room exists should one travel off of the asphalt surface.

A guide rail could create a hazard when farm equipment travels along the dyke roads since many pieces of equipment require almost a lane and a half (4 metres) for travel.

c) Consequences of Providing No Maintenance on the Canals

If there is a continued failure to clean the existing canals, the accumulation of sediments will only increase. As sediments increase in the canal, the area available for drainage decreases and the severity of a storm incident necessary to cause flooding is reduced. Already in the area of Jane Street and Kettleby Creek, the canal is almost completely filled with sediments and at other locations such as at the south Highway 400 crossing, substantial portions of the canal are filled.

Further, if no maintenance is provided, accumulation of debris and garbage within the canals will continue and perhaps accelerate.

d) Consequences of Significant Incident along Dyke Roads

Examples of the significant incidents that could occur would be a serious motor vehicle accident, spillage of fuel into the canals, or entry by a school bus into canal.

The possibility of any of the above events exists as long as the canal is located along the proximity of the dyke road and as long as the poor condition of the dyke road exists.

Fuel spills into the canal could be caused by overturning of vehicles hauling fuel along the dyke roads. Such incident would significantly damage fisheries, irrigation, and downstream water quality.

Entry of a school bus into the canal could have devastating impacts should there be any loss of life.

STUDY METHODOLOGY

To facilitate studies of the specific problems with and the improvements needed for the canals and dykes of the Holland Marsh Drainage System, the canal and dyke components of the system have been subdivided into 18 intervals. **Drawing No. 3** (Overall Plan of Work) to this report indicates the location of the specific intervals.

The interval limits chosen were based in part on land uses adjacent to the interval, in part on problems associated with the interval, in part on the anticipated solutions for the problems in the interval and in part on physical boundaries. On further reflection now, one or more intervals could have been combined and there may even have been one or two intervals that could have been further subdivided. However, at the time the initial division of intervals was made, the identification was felt to be proper and is still reasonably appropriate. There is some familiarity now by agencies and owners with the interval divisions created.

For each of these intervals, a document * has already been prepared to identify the location of each interval, its length, its problems and its characteristics related to bridges, accidents and adjacent lands and buildings. As will be discussed herein, the various alternatives of repairs/improvements that have been selected for analysis have been discussed on the same interval by interval basis.

As the enclosed **Drawing No. 3** indicates, eight of the 18 intervals (Intervals 1 to 8) are associated with the north canal and the balance of 10 intervals (Intervals 9 to 18) deal with the south canal. The numbering commences at the point of divergence of the canals at Highway 9 and proceeds clockwise around the north canal and then along the south canal back to the point of divergence.

A brief setting of the intervals is as follows:

i) North Canal

Interval 1 extends from Highway 9 to Five Sideroad of Bradford-West Gwillimbury (BWG).
Interval 2 is from Five Sideroad to Highway 400.
Interval 3 is from Highway 400 to a location opposite the Jane Street road allowance in BWG.
Interval 4 is from the Jane Street unopened road allowance to the 5th Concession Line (this interval was sub-identified since it was anticipated that different soil conditions would exist in this interval).
Interval 5 extends from 5th Line to Simcoe Road.
Interval 6 extends from Simcoe Road to the unopened road allowance between Lots 15 and 16.
Interval 7 extends from the said unopened road allowance to the start of the Small Marsh Scheme which is to the northwest of the main scheme.
Interval 8 extends along the perimeter of the Small Marsh Scheme.

ii) South Canal

Interval 9 then is in King Township and extends from a point 200 metres upstream of the convergence of the canals to the intersection of Pumphouse Road and Graham Sideroad.
Interval 10 extends from Graham Sideroad to Dufferin Street.
Interval 11 is from Dufferin Street to the mid lot line of Lot 7, Concession 2.
Interval 12 is from the Lot 7 mid lot line to Keele Street.
Interval 13 is the portion along Woodchopper's Lane.
Interval 14 extends from Woodchopper's Lane to the boundary between two golf course developments on the south side of the canal (line between Lots 11 and 12).
Interval 15 exists across the rear boundary of the westerly golf course development to Jane Street.

* *This document was a draft preliminary report undertaken by KSAL in 1998±. The document was updated and included in the May 26, 2000 report that was subject to a Peer Review by the LSRCA and MNR.*

Interval 16 extends from Jane Street to Highway 400.
Interval 17 is the portion from Highway 400 to Highway 9.
Interval 18 is the portion of the canal parallel to Highway 9 from South Canal Road to the West Canal Road.

A listing of the major work items that were undertaken prior to and during the early studies by the undersigned in 1997 to 1998 on characteristics, problems and solutions for each interval is as follows:

1. All existing reports prepared for the Holland Marsh Drainage Commission (later Committee) (HMDC) were obtained and reviewed. All reports available that had been prepared for the Lake Simcoe Region Conservation Authority (LSRCA) were also obtained and reviewed. Traffic accidents reports were obtained.
   All past soils (geotechnical) reports were obtained and reviewed. Various history documents of the marsh were obtained and reviewed. Aerial photography with various dates were obtained and reviewed. Municipal road needs studies, reports and structural appraisals were obtained and reviewed. Official Plans and Zoning Bylaw documents were obtained and reviewed. A survey of soundings completed by the HMDC was obtained and reviewed. The original engineering reports were obtained and reviewed. The Bardawill and Berry Water Management Study of 1970 was also reviewed.
2. Meetings/dialogue occurred with the Town of Bradford-West Gwillimbury and the Township of King and with the HMDC. Dialogue occurred with representative owners adjacent to the canal. Dialogue also occurred on multiple occasions with representatives of Fisheries and Oceans (DFO), Ministry of Natural Resources (MNR) and the Lake Simcoe Region Conservation Authority.
3. A detailed engineering survey was completed of each bridge and a report on bridges was prepared.
4. A hydrology study was completed to substantiate or update previous hydrology studies.
5. An engineering survey was conducted to profile the dyke throughout. Representative cross-sections were taken in each interval to determine widths of canal, depths, etc.
6. An environmental engineering sub-consultant was retained to advise on environmental issues, mitigation work and costings to be anticipated.
7. The canals were personally traveled by boat throughout (portaging was necessary in parts of the South Canal) and the dykes were traveled by truck throughout. The perimeter watershed was reviewed throughout by windshield survey and by aerial surveys.
8. Discussions occurred with the County of Simcoe Engineering department and with representatives of the Ministry of Transportation of Ontario and with the Engineering Departments of the two municipalities containing the dykes and canals.
9. Work occurred to prepare drawings to show the relationship of original canal bottoms, existing canal bottoms, present dyke levels, projected flood levels.
10. Possible construction techniques and equipment on similar projects were reviewed in the southern United States and in Europe.
11. Possible construction costs were reviewed with two construction firms.
12. Preliminary calculations of work required, land allowances, construction costs and engineering/administration costs were made.

Using the data secured, considering the requirements/input from interested owners and agencies and applying the knowledge of repair and maintenance of municipal drains, options for repair and improvement were prepared, costed and evaluated.

A draft Preliminary Report was prepared to summarize the work undertaken. This work occurred over the period of 1996 to 1998.

Subsequent to the preparation of the description of problems and potential improvements, studies were then commenced to determine:
a) if funding assistance to recognize the flood prevention component provided could be obtained from the Ministry of Natural Resources/Lake Simcoe Region Conservation Authority (a Peer Review was actually completed on this issue); and
b) to determine if all upstream 64,000± acres of lands could be legally assessed a portion of the costs.
The determination of answers to these questions involved a period of time extending from 2000 to 2002.

Following the Drainage Referee decision on the right to assess the 64,000± acres, a liaison committee consisting of Town of Bradford West Gwillimbury and Township of King representatives and the consultant was created to discuss future steps in the process. Upon completion of this liason, the initiating Municipality (Town of Bradford-West Gwillimbury) on May 13, 2003, authorized the completion of a **final** engineering report to provide for repair and improvements to the particular components of the Holland Marsh Drainage System.

Work commenced on the final engineering report but was suspended on two occasions: firstly at the time of the OMAFRA temporary decision in the second half of 2004 to eliminate the Drainage Grant program and then from 2004 to 2008 to complete a Federal Environmental Assessment. Only in early 2008 did work recommence on the final engineering report. A more detailed chronology listing of work by the undersigned (and KSAL) related to the HMDS is presented in **Appendix 2**.

EXISTING CONDITIONS

The biophysical environment, the problems with, and comments/characteristics of, each interval were identified in the previous referred to draft preliminary report and were also contained in the submission made to the MNR and LSRCA to Supplement the Funding Assistance Request of May 26, 2000). Some of the data included is summarized below. As well, the existing Social, Cultural and Environmental features are listed in this section.

i) Physical Descriptions

a) North Canal - Highway 9 to Highway 400 (Intervals 1 and 2)

- This is a length of 4600 metres±.
- The canal width varies from 18 to 21 metres (as measured at average water levels)
- The dyke is a paved road (County Road 8) with reasonably high traffic volumes.
- The road/dyke is directly beside the canal although a short portion north of Highway 9 had a successful “full” relocation, by MTO, a number of years ago.
- There is a sporadic to nearly continuous tree line along the edge of road.
- Lands noted as the Pottageville Swamp exist adjacent to the outside of the canal in the west half of this interval.
- The route of the original Schomberg Branch of the Holland River (now relocated) intersects the north canal just north of Highway 9.
- The North Branch of the Holland River intersects the north canal 0.5 km± west of Highway 400. Interlocking steel sheet piling exists along the dyke at its intersection.
- Most lands on the outside of the canal are wooded, low lying and not used for agriculture.
- The lands on the inside of the dyke have nearly continuous building development adjacent to the road with intensively farmed marsh farmlands to the rear.
- Many past accidents and fatalities have occurred in this interval.
- The dyke road is below the 100 year flood level in most of its length.
- Other problems exist with respect to undersized bridges (including the Highway 400 overpasses), bank sloughing, narrow/uneven/settling roads, steepness of dyke, rodents

burrowing, trees at the edge of the road, unprotected pipes through the dyke and build up of sediments in the bottom (1 metre±).
- The Municipality owns lands on the outside of the dyke over approximately one third of this interval.
- West of Five Sideroad on the north side of the canal a residential and a church lot exist close to the canal.

b) North Canal - Highway 400 to Small Marsh Scheme (Intervals 3 to 7)
- This is a length of 7,450 metres±.
- The canal width varies from 21 to 26 metres.
- The dyke is a paved road (County Road 8) with high traffic volume (1850 AADT in 1995).
- The road/dyke is directly beside the canal with a sporadic tree line adjacent to the dyke in most portions; it is nearly a continuous tree line in Interval 7.
- The lands on the outside of the canal are wooded and low lying in most portions and not used for agriculture.
- Some of the original excavated material was used to create a small berm on the outside of the canal.
- Closer to the community of Bradford, in Lots E½ 13, 14 & W½ 15, Con 5, lands beyond 125 metres± from the outside of the canal are being developed for urban uses.
- On either side of Simcoe Road, there are urban lots with buildings/parking lots close to the canal.
- Lands on the inside of the road/dyke have nearly continuous building development with intensively farmed marsh lands to the rear.
- Problems in this length include a past history of many accidents, some fatalities, uneven, narrow and settling dykes, steepness of dyke, burrowing rodents, sloughing dyke banks up to the edge of the pavement and numerous uncontrolled piping through the dyke.
- One bridge structure requires enlargement.
- There remains one vacant undersized lot adjacent to the outside of the canal (two adjacent and similar lots have now been acquired by the Municipality).
- The road/dyke is below the 100 year flood line in most of the west part of this length (Intervals 3 and part 4) and is above in the balance although a short length of Interval 7 is now at or below the 100 year flood level.
- The low portion of the dyke in interval 7 has had more continuous seepage through it with resultant increased settlement.
- Sediments/buildup in the bottom is not as significant as in other lengths (0.3 metres±).
- Municipality owns a width of land on the outside of the canal over approximately 45% of the length.

c) North Canal - Adjacent to Small Marsh Scheme (Interval 8)
- This is a length of 1300 metres±.
- The canal width varies from 23 to 27 metres.
- The dyke is a paved road maintained by the Town of Bradford-West Gwillimbury with a high traffic volume.
- The road/dyke is directly beside the canal with a nearly continuous tree line along the edge of the road.
- On the outside of the canal, the dyke of the “Small Marsh” drainage scheme exists.
- A road and some building lots exist on this dyke.
- Intensively farmed marsh lands exist adjacent to (northwest of) this second dyke.
- On the inside of the main dyke/Canal Road, many buildings exist along the road with intensively farmed marsh lands to the rear. These farm lands extend up to the dyke where no buildings exist.
- There have been numerous accidents and one fatality.
- The dyke is higher than the 100 year flood level.
- Sediment buildups vary from 0.3 to 0.5 metres.
- There are similar problems with narrowness and unevenness of road, steepness of dyke, uncontrolled pipes through the dyke and rodent damage.

d) South Canal - Adjacent to Pumphouse Road (Interval 9)

- This length is 1500 metres±.
- The canal width varies from 17 to 18 metres.
- The dyke is a paved King Township road with moderately high traffic volume.
- The dyke/road is directly beside the canal with a sporadic tree line along the edge of the dyke/road.
- On the outside of the canal, lands are farmed beyond a narrow tree line over 50% of the length.
- Elsewhere on the outside, the bush area is wider.
- Man-made drainage channels discharge to the canal from the outside.
- One small drainage scheme exists on the outside of the canal in portions of this interval. It was once a pumped scheme but not at this time.
- The discharge pipes from the main Holland Marsh Pumping Scheme discharge into the canal at the north/east limits of this interval.
- On the inside of the dyke, continuous building development exists with intensively farmed marsh lands to the rear.
- Other problems in the length relate to narrowness and steepness of dyke, uncontrolled pipes through the dyke, sediments entering from lateral channels, aquatic vegetation build up and rodent damage.
- The sediment build up is 0.3 to 0.5 metres.
- The dyke is above the 100 year flood level.
- The canal is narrow.
- The road structure in this interval is significantly undersized and low

e) South Canal - Graham Sideroad to Keele Street (Intervals 10 to 12)

- This is a length of 5,650 metres±.
- Other than a short length of 250 metres (which is King Street), the dyke is just an earth lane; in part used for farm access and in part overgrown.
- The dyke is directly beside the canal with a sporadic to nearly continuous tree line along the edge.
- The canal top width is narrow, varying from 16.5 to 20 metres.
- On the inside of the dyke, land uses vary. From Graham Sideroad to the built up area of Ansnorveldt, average quality marsh lands exist up to the dyke with scattered trees; for 250 metres east of Dufferin Street urban lots/backyards exist up to the dyke; from Dufferin Street for 250 metres to the west, King Street has been developed on the dyke (moderate traffic counts); from King Street for 1300 metres westerly a combination of farm buildings and bush areas exist adjacent to the dyke and in the balance of this length westerly to Keele Street the lands are fully wooded on the inside of the dyke.
- In general, the lands adjacent to and on the inside are much higher in elevation than any other lands in the marsh, are sandier with a lower organic content and are not used for the same intense marsh farming.
- The dyke is higher than even the Regional storm flood levels in most of this length.
- On the outside of the canal, the lands are used for agriculture more so than in other portions of the system. In areas, farming occurs directly up to the canal with no buffer. Numerous man-made channels outlet from these farmlands directly to the canal and are contributing sediments.
- In portions, where bush exists on the outside (west end), unleveled spoil exists as a berm adjacent to the canal.
- An overhead hydro line parallels the canal along the dyke in one portion.
- The canal bottom is substantially filled with sediments (0.5 to 1.2 metres).
- Aquatic vegetation also restricts the capacity.
- The municipal bridge in the interval requires additional capacity or replacement.
- Other problems relate to uncontrolled pipes through the dyke, steepness of dyke and rodent damage.

f) South Canal - Keele Street to Jane Street (Intervals 13 to 15)

- This is a length of 2,700 metres±.
- Over the east 1000 metres± of this length, the dyke is a paved King Township Road (Woodchoppers Lane) with a moderately low traffic volume. Over the balance, the dyke is

used and maintained as a cleared to partially cleared lane over most of its length providing access to the intensively farmed marsh lands that exist up to it. A significant powerline exists on the inside edge of the dyke land and scattered farm buildings exist adjacent to the dyke.

- Very few trees exist along the edge of the dyke in this portion but there is some smaller brush.
- On the outside of the canal, the east part of the length is wooded, except for a farm west of Keele Street and on the west part, golf course lands exist or are being developed to the south of the canal.
- The Municipality has an easement over the lands between the canal and the existing golf course lands.
- The canal width is narrow (17 to 18 metres) and has a substantial sediment buildup (1 to 2.8 metres).
- A berm has been developed adjacent to the canal in portions
- The canal is almost full of sediments downstream of the Kettleby Creek outlet.
- Aquatic vegetation also restricts the capacity.
- There have been accidents along the Woodchoppers Lane portion.
- Other problems exist related to normal narrowness and steepness along the road portion, piping through the dyke, rodent damage, one undersized municipal bridge, dyke being worked as a field in portions, and man-made and natural channel discharge into the canal.
- The dyke in portions is considered to be below the 100 year flood level by the KSAL studies.

g) South Canal - Jane Street to Highway 9 (Intervals 16 and 17)

- This is a length of 2,300 metres±.
- The dyke is a paved road (South Canal Bank Road) and is maintained by the Township. It has moderately low traffic volumes and few previous accidents.
- The dyke/road has considerable cracking, has steep embankments and very sporadic trees along its edge.
- The canal width is narrow at 15 to 17 metres and has 1 to 2 metres of sediments in it.
- At the Jane Street structure and at the Highway 400 structure, this canal is nearly full of sediments.
- The lands on the inside of the dyke/road have continuous buildings with intensively farmed marsh lands to the rear.
- The lands on the outside of the canal are primarily wooded with no nearby developed use.
- A new residential building exists adjacent and close to the canal just northeast of Highway 9.
- The Highway 400 structure requires additional capacity and significant sedimentation is in the canal at the bridge.
- Other problems relate to uncontrolled pipes through the dyke, steepness of slope, aquatic vegetation and rodent damage.
- The dyke in portions, is considered by the KSAL studies to be below the 100 year flood level.

h) South Canal - Parallel to Highway 9 (Interval 18)

- This is a length of 2,350 metres± (this is the section that was relocated in the 1970's)
- Here the original canal route is now the location of the Highway 9 roadway. The service road to the north of Highway 9 is the original dyke.
- The south edge of the road embankment is approximately 25 metres north of the canal edge and the lands between are primarily grassed with scattered trees and are vacant.
- To the north of Highway 9, nearly continuous building development exists with intensively farmed marsh lands to the rear.
- On the outside of the canal low lying wooded lands exist.
- A number of natural tributaries discharge into the canal from the south with significant sediment loading.
- The canal width is 19 to 20 metres and it has 1 to 1.5 metres of peat sediments. Significant aquatic vegetation exists in the canal in this portion.
- Numerous culvert pipes pass below Highway 9 with discharge into the canal. At the time of recent Highway 9 reconstruction all were equipped with backwater valves.
- Numerous irrigation lines with valves to prevent backflow also cross Highway 9.
- The most significant problem is the sediment and vegetation build up in the canal.

i) Impacts of Adjacent Land Use Development

- The existence of the small marsh scheme adjacent to Interval 8 precludes options other than cleaning of the canal. The existence of a residential lot and a church in Interval 1 west of Five Sideroad precludes the full relocation of the canal. The proximity of the Portuguese Cultural Club in Interval 6 also precludes full relocation of the canal. Building activity adjacent to the canal in Interval 11, part of Interval 13 and part of Interval 17 precludes full relocation of the canal.
- There is a former gravel pit operation on the southeast side of the south canal in Interval 14. This gravel pit operation is now on the site of a golf course development. This golf course extends across Interval 13 over to Keele St.
- There is a further former gravel pit operation to the southeast of the south canal in Interval 12. This gravel pit operation is also believed to be dormant, but is used for recreational purposes. There is a significant tributary that enters into the canal from the site of this gravel pit operation. This tributary has carried substantial sediments into the canal in the past.
- There are two existing golf course developments southeast of the south canal in Intervals 14 and 15. These golf course developments are associated with the Cardinal Golf Course facility. Both were developed with the Municipal requirement that the offset between the southeast bank of the south canal and the nearest fairway be 60 m (200 ft.). As well, the developer was required to provide a 24 m (80 ft.) easement to the Municipality adjacent to the southeast bank of the south canal to allow for future canal improvements.
- There is a further golf course development northwest of the north canal and to the southwest of Simcoe Road (in Interval 5). This golf course development does not actually abut the canal, but approaches it only in its southeast corner. Here, there is a pumping scheme that draws water from the north canal for purposes of the golf course development and this pumping station is approximately 50 m (150 ft.) from the canal.
- Between the golf course development referred to in the above paragraph and Simcoe Road, there is a residential development area northwest of the north canal. The closest that this development would approach the north canal is approximately 120 m+ (350 ft.+).

j) Existing Roads

- The principal roadway that is within the study area is Highway 400. This highway passes in a north-south direction through the watershed and would be near the line between the westerly third and the easterly two thirds of the marsh. This roadway through the marsh lands presently consists of two - triple lanes of roadway with service roads on either side of it.
- One of the other notable roadways within the watershed is Highway 9 which runs in an east-west direction through the central part of the watershed, and which actually now lies in part above the original south canal route along the north limits of Concession 6 of King Township.
- Former Highway 27, now known as a County Road, runs in a north-south direction through the watershed to the west of Highway 400. Highway 11 runs in a southeast-northwest direction just beyond the point of convergence of the canals.
- Sideroad 5 and Weston Road, which are the adjacent and paralleling roads west of Highway 400, serve as an emergency bypass route for traffic on Highway 400, and they also constitute a corridor used by cottage traffic heading north when Highway 400 volumes are high. Sideroad 5 is known as Rupke/ River Road in the actual interior of the marsh. These are local roads under the jurisdiction of Bradford-West Gwillimbury and King.
- Jane Street, Dufferin Street and Keele Street are King Township Roads that provide direct access to Highway 9 for marsh properties north of the South Canal.
- The original North Canal dyke from Highway 9 to the start of the Bradford Small Marsh drainage scheme in Lot 17, Concession 6 of Bradford-West Gwillimbury is called Canal Road and is Simcoe County Road 8. That portion of this North Canal Road that extends from Simcoe Road at the south edge of Bradford to Highway 400 is considered and is used as a substantial commuter road. Volumes of traffic of approximately 2500 vehicles per day (year 2000 data) are noted on this portion of road.
- This North Canal Road does have an interchange with Highway 400 and such has been the subject of substantial past debate as to whether its existence should continue.

- There are numerous other local roads within the marsh itself, but the only roads that cross the Central River are Highway 400 and its two service roads (Wist Road and Davis Road) and River Road.
- The dyke along the south canal has been developed as a road in part also. From Highway 9 to Jane Street it is known as South Canal Bank Road. In Interval 13 it is known as Woodchoppers Lane, in Interval 11 in part it is known as King Street and in Interval 9 it is known as Pumphouse Road.

k) Highway 400

- The most recent discussion (Aug. 2008) with MTO have indicated that the overpasses over the South Canal may be replaced within a 10 year period ±.
- At the same time the Ministry indicated there currently is no such active proposal for the North Canal overpasses.
- The MTO, in preliminary discussions, recognize that a cleanout of the canals through the existing bridges and enlargements to provide additional capacity may have to be done in advance of attendance to any detailed structural work by MTO.
- The proposal at this time with respect to attending to the enlargements of canal capacities through the Highway 400 bridge structures over the canals is to include paragraphs in this report describing the required additional capacity and methods of providing such.
- The possibility is that MTO will attend to construction to provide such, either by bridge reconstruction or replacement (at least at the south crossing) but if not done within a set period as set out in this Engineer's report, then the undersigned will be required to prepare, or have prepared, the necessary contract documents for enlargement of canals through the Highway 400 overpasses, all as part of special assessments of costs to the MTO.

l) Existing Bridges

- Since the construction of the canals, up to fifteen structures (bridge crossings) have existed across the watercourses. Three of these were private structures, of which only one fully remains; four of the others are below Highways (counting the Highway 400 structures as only two), while the others are municipal structures. There has never been a standard for structure construction.
- An analysis by KSA determined that improvements should occur to three of the municipal structures on the South canal and to two on the North canal.
- As well, increased capacity should be provided through the two Hwy 400 structures.
- The remaining private structure was found to be undersized and is to be improved privately or be removed.
- The primary concerns at bridges are existing and potential obstructions, the abilities to accommodate flows during ice conditions, the need to provide uniform capacities for the canals and the need to accommodate 100 year flows without excessive high water levels.
- The separate section of this report that follows deals with recommendations for bridges and also discusses existing conditions in more detail.

m) Adjacent Farming Uses

- The existence of farming activities up to the south bank of the south canal in portions of Intervals 9 to 12 require provision of narrow buffer strips.
- In Intervals 11, 14 and 15, there have been significant areas of farming or residential activity alongside the dyke and even onto the surface of the dyke.

n) Impact of Municipal Bridge Structures

- The blending of any canal improvements to existing structures, until replacements are scheduled, is necessary.

o) Impact of Farm Buildings in Intervals 10 to 12

- The existence of farm buildings and dwellings in scattered locations on the north side (inside) of the south canal dyke where leveling would occur requires special attention.

p) Private Bridge Structures

- The existence of the private structure in Interval 1 requires special attention.

ii) Social, Cultural and Environmental Features

a) Navigability – There has been some suggestion that the canal system could be considered as navigable. However in actual fact, it is not fully navigable as the undersigned determined (in 1998) when portaging was necessary in the area of Jane Street and it is expected would be now necessary in the area of the south Highway 400 canal and Kettleby Creek as well. As well, low headroom at some of the structures would also restrict navigability. A letter from the Canadian Coast Guard to the Ministry of Transportation of Ontario dated April 30, 1996 indicated that the Holland Marsh Drainage Canals was not navigable. It was also determined during the CEAA Study that the canals were not considered navigable.

b) Aboriginal Uses - There is no known impact on Aboriginal interests. Contact was made with First Nations during the CEAA Study and no concerns were identified to be examined. Mitigative measures were set out however should any artifacts, burial grounds or other areas of interest re First Nations be encountered during construction.

c) Provincially Significant Wetlands - Mapping has identified provincially significant wetlands along the north and south canals. These communities were identified by the MNR, both Aurora and Midhurst District offices. The Provincially Significant Wetlands include the Fraser Creek Wetland (North Holland River mouth west of Highway 400), the Pottageville Swamp, extending along the west end of the Marsh and the south side along Highway 9 and more recently expanded to include the wetland community between Highway 9 and Highway 400 along the South Canal, and, the Ansnorveldt Swamp community along the south side of the South Canal. These wetland communities are all designated Provincially Significant predominantly as a result of sheer size and their hydrologic function in flood control. The CEAA study considered these woodlands.

d) Oak Ridges Moraine - The Oak Ridges Moraine abuts the South Canal from west of Dufferin Street to west of Highway 400. The designation is defined in the Oak Ridges Moraine Conservation Plan and the ORM-related mapping was collected from the GIS-database under license by Watershed Management Ecology. The ORMCP and the supporting Oak Ridges Moraine Conservation Act were passed in 2002 to protect the natural heritage, surface water and ground water resources and functions of the ORM. Key Natural Heritage Features identified under the Plan are to be protected from development using prescribed setbacks, buffers and related measures.

The Oak Ridges Moraine Act encourages agricultural usages for countryside areas and natural linkage Areas and allows projects for flood and erosion control.

e) Greenbelt Designation - The Greenbelt Act was enacted in 2005 to protect agricultural land and rural country side from urban development. All of the Holland Marsh lies within the Greenbelt Plan. The Act restricts land uses to farm and/or rural related activities.

The lands outside of and adjacent to all canals and dykes of the Holland Marsh Drainage System and generally the lands to the south of the south canal have been included within the Greenbelt Mapping by the province. This designation restricts the development of the lands for non-agricultural uses. This has been considered in the allowances provided in this report.

Since the canal drainage scheme is necessary for farming in the Holland Marsh, the canal improvement project does not conflict with the Act.

f) Fishing Activity* – All fishing is recreational. No commercial activities are believed to exist. The main fishing activity occurs at the intersection of the North Branch of the Holland River at the sheet piling location, near the point of convergence of the canals between the Art Janse Pumping Station and the structure noted as Bridge 12, along Peterman Road and at scattered locations along Interval 18 adjacent to Highway 9.

g) Wildlife* – Notwithstanding the Provincially Significant Wetland communities identified adjacent to the canals, there are surprisingly few records of significant wildlife in the study area. Some records, as provided by MNR as to the specific location of observations and the species involved are considered to be confidential.

h) Natural Heritage Features – The illustration of the areas of Natural Heritage features by aerial photography is contained in Appendix 16 of Volume 3 of the CEAA Study Report (available at Engineer's or Board's office).

i) Tributary Channels* - The existence of significant stream discharge points into the canals require separate attention with respect to fish habitat impacts and sediment discharge. All of the permanent discharge streams tributary to the Holland Marsh Canals are either documented as supporting a complex fish community and providing fish habitat functions or are expected to provide habitat. Kettleby Creek supports a self-sustaining cold water community with brook trout as the key indicator species. The other tributaries also provide various cool and warm water habitat features and functions for the complex fish community associated with the Canals.

MAIN PURPOSES/GOALS IDENTIFIED

As a result of the evaluation of the existing conditions and problems, it has been determined that the works of improvement to the Holland Marsh Drainage System canals and dykes should create an improved drainage system that:

a) reduces the possibility and extent of flooding
b) is more easily and frequently maintained (both canals and dykes)
c) that reduces accidents and fatalities
d) can be constructed at reasonable cost
e) can be constructed so environmental impacts are minimized and mitigated.

a) To Reduce Potential and Costs of Future Flooding

The main aspect of the project is to reduce the possibilities and the significance of flooding. A goal of the project is therefore to provide continuous and ample capacity in the canal system throughout, to ensure bridge openings are consistent and then to provide berms beside the dykes where overtopping could occur and to a level to withstand the existing conditions 100 year storm event.

Overtopping could still occur in an event with a greater than a 100 year return basis, but it has been previously determined that it is not cost beneficial to provide a greater level of protection.

Earlier studies indicated that up to an additional one metre± of elevation above existing dyke levels on both the north and south dykes (over 50% of their lengths) may be required to provide for the Regional storm event.

* *Volume 3 of the CEAA Study Report as prepared by Michalski-Neilson Associates Limited, who were retained by the undersigned, contains further descriptions/discussions of water quality, sediment quality, fisheries, wildlife, vegetation and natural heritage features. This document is available for review at the Municipal offices.*

b) To Provide for Easier and More Frequent Maintenance

One of the significant problems with the existing system is that there is no physically practical method of undertaking the legal/required maintenance since the lands that were originally intended to be used for leveling or disposal of materials are now occupied by buildings and yards in much of the route.

To undertake maintenance of the existing canals, most excavated materials would have to be loaded into trucks and hauled away. To do such would be contrary to the existing by-law and the Municipalities could be found to be undertaking such maintenance illegally. Even if such were a permitted activity, the costs and damages to roads would be excessive each time work was done.

If the canal is relocated away from the road in most intervals, then an access corridor is provided along the backfilled dyke for future maintenance. Excavation could occur and materials could be stockpiled, dried and then more easily loaded into trucks and hauled away. Maintenance in sections where the dykes are not used as roads can continue to be by bottom cleanouts from the dykes.

In the existing drainage report, there are no appropriate specifications with respect to not only maintaining the canal and dykes but also with respect to status and maintenance of bridge structures and irrigation pipes and lines crossing the dykes, and use of dykes and outside lands for agricultural activities up to the edge of the canals. These are all matters that should be addressed in an engineering report to facilitate future maintenance.

Another deficiency with the existing (1924) report has been, until recently, the distribution of costs for undertaking maintenance. Prior to 2002, the existing report would assess all costs of any maintenance, small or major (and major is required now) only to the interior marsh lands. A Section 76 report completed by the Town of Bradford-West Gwillimbury has now been passed and would provide that the maintenance costs be distributed to the full watershed. This schedule has been updated and incorporated in this report providing improvement.

Planned frequency of cleanouts should also be established (even though such may not be fixed frequencies) in the Engineering Report to allow for budgeting and scheduling of activities by both landowners and the Municipalities.

c) To Reduce Motor Vehicle Accidents and Fatalities

In the first 10 years after the canal and dyke reconstruction following the Hurricane Hazel event approximately 11 fatalities occurred due to drivers leaving the dyke road and entering the canals. There have been fewer but just as significant occurrences since then.

The goal of any project for the Marsh Drainage System should be to guard against vehicles leaving the dyke road and entering into the canal. There are primarily two means of doing such. One is to move the canal away from the dyke and the other is to construct a guide rail along the interface between the dyke and the canal.

A consequence of moving the canal away from the dyke to facilitate maintenance will be the creation of a setback of the canal from the dyke to address life safety issues of vehicles leaving the dyke surface.

To construct a guide rail along the edge of the dyke can be done but is difficult due to the minimal area, in most portions, between the edge of pavement and the top of the dyke and due to the trees growing along the edge of the dyke slope as previously noted herein. A one metre minimum offset should exist from any guide rail to the edge of any pavement and to do such would mean that the posts for the guide rails would in part have to be in the dyke slope. The engineering to construct an acceptable guide rail could be complicated. In the Marsh a guide rail along the canal/dyke interface will impact farm and commercial type movement along the Canal

Roads. Only where a canal can not easily or economically be relocated away from a dyke that is used as a road is a guide rail considered.

d) To Undertake the Project at Reasonable Cost

As the report prepared in 2000 indicated, there were primarily two options to address the needs of the canal/dyke system where the dyke has been developed for road purposes. The one project would involve cleaning the canals out, hauling the material away, constructing guide rails for life safety and raising the dyke roads to provide the flood protection.

The other option, which was the recommended option, would be to move the canal away from the dyke, construct a berm along the backfilled dyke where required for flood protection, and to utilize the offset of the canal for life safety and maintenance.

The cleanout project as estimated in 2000 would have had a gross cost of $5 million more (a 40% cost increase using the 2000 estimates) than a project of moving the canal.*

e) To Undertake the Project to Minimize Existing & Future Environmental Effects

The environmental issues of interest revolve around the use of the canal as fish habitat, the use of the adjacent wetlands for wildlife and water fowl habitat and the very existence of wetlands adjacent to the canal.

Three provincially significant wetlands, significant woodlots, species at risk and many common species of wildlife and fish utilize the habitat surrounding the Holland Marsh Canals. The project construction activities required to relocate, widen or cleanout the canals will rely heavily on the extensive use of large equipment. Any of these works will disturb aquatic and terrestrial habitats to varying degrees. A project should be created now that facilitates more frequent but less disturbing maintenance in the future to avoid the costly and more intensive projects as is now necessary.

Some of the environmental problems that currently exist with the system due to its location and design are that garbage is dumped into the canal by people traveling along the dyke roads, trees fall into the canal and are difficult to remove, the canal is filled in portions with sediments from upstream runoff and these sediments are difficult to remove and, phosphorous levels are high in the canal due to the accumulation of sediments.

Two of the potential environmental incidents that could occur would be an accident from the immediately adjacent roads, resulting in a fuel spill into the canal, and erosion of sediments into the canal due to sloughing of the existing banks caused by heavy traffic on the adjacent roads.

PAST PUBLIC AND ON-SITE MEETINGS AND REVIEWS

The original contact between the local municipalities and affected agencies with respect to the need and potential costs of improving the Holland Marsh Drainage System dates back to the 1970's. This would have involved the members of the Holland Marsh Drainage Committee (HMDC), the directly affected municipalities and member municipalities of the LSRCA, the staff of the Conservation Authority and indirectly various provincial ministries.

Direct contact occurred between the HMDC and the Town of Bradford-West Gwillimbury and Township of King in the mid to late 1990's with respect to authorizing an engineering study of needed improvements to the Holland Marsh Drainage System. Since the appointment of the undersigned in 1997, there has been on-going or periodical dialogue regarding the early findings of problems and

* *In the 2000 report, cleanout work of the existing canal bottoms where the dykes have not been developed as roads and also in Intervals 8 and 18 (by the small scheme and by Highway 9) was common to both options.*

needs of the Drainage System with the two immediately affected municipalities, (Bradford-West Gwillimbury and King), and also with the County of Simcoe, the local police agencies, the Ministry of Transportation of Ontario (MTO), the Ministry of Natural Resources (MNR), Fisheries and Oceans Canada (DFO), the Ministry of Agriculture, Food and Rural Affairs (OMAFRA) and the County of Simcoe.

These contacts were the results of meetings by the undersigned and/or the former Holland Marsh Drainage Superintendent with representatives of the municipalities and agencies.

With respect to the LSRCA, MNR and DFO, multiple joint meetings occurred in the years 1996 to 1998. A letter was even received from MNR dated May 16, 1997 indicating that, after discussion with DFO, an environmental appraisal would not be necessary but that an evaluation or impact assessment as per the Fisheries Act would be required to determine mitigation and compensation.

With respect to the 64,350±* acres of land that surround and drain to the canals, and also with respect to the 6,950±* acres of marsh lands contained within the canals, all owners of these 71,300 ± acres were notified in April 2001 of the impending work as now to be provided by this report as a result of the studies and the Section 76 report necessary then to determine the right to assess the upstream 64,350 acres a portion of repair, maintenance or improvement. It was necessary to both notify all owners of the intention to assess the full watershed and also to provide all owners with background data. The document was created in April 2001 pursuant to Section 76 of the Drainage Act. It discussed the Holland Marsh Drainage System, the intention to involve all lands in assessment, what portion each ownership should bear of any assessment and also to notify the lands that once the assessment issue was resolved, a substantial and costly improvement of the canals was being planned. The right to assess all upstream lands was heard in the court of the Ontario Drainage Referee.

The owners to be notified by the April 2001 document and the extent of their assessment were determined by reviewing topography maps, reviewing full and up to date aerials of the whole watershed, by reviewing municipal assessment rolls and mapping, by driving all roadways within the perimeter watershed and by determining the land use, topography and soils of all the 64,350± external plus 6,950± acres of internal lands.

This 2001 document, which was sent to all owners, noted on its Pages 4 and 5 that a multi-million dollar project, including structure work was anticipated. Such was also noted in the covering letter that went with each report.

To assist in presenting this data to the public, three open house/public meetings were constituted in the year 2001 (Sept. 11, Sept. 25, and Oct. 11). One occurred in the Town of Bradford, the second occurred in the Town of Newmarket and a third meeting was held in the community of Pottageville. As well, a separate meeting occurred with Township of King Council. At these public meetings a number of displays were provided. Some displays were included to describe the particulars of the canal improvement project being planned. Many of the questions that were asked at the open house and public meetings pertained to the proposed improvement project.

The literature accompanying the submission of the Section 76 report and also the data presented at the public meetings advised all owners that any, who may be dissatisfied with the proposed assessment schedule and the impacts that such may have on them, had the right to appeal to the Drainage Referee.

* *These numbers are based on acreages identified in the assessment schedule.*

Out of 7,831 properties notified of the open house and sent a copy of the Section 76 report, approximately 80 attended the three open houses/public meetings and there were a total of only 26 appeals received. A general municipal appeal was also heard. The Referee heard and dealt with the appeals in March 2002 in part and on July 17, 2002 in part. The written decision of the Referee was dated October 11, 2002.

The decision of the Referee confirmed that upstream owners could be assessed for the Holland Marsh Drainage Scheme. Also a few owners and agencies who felt that their proportions of the assessment were unfair had such satisfactorily resolved at the Referee Hearing.

As a result of the submission of the Section 76 report, the public meetings associated therewith and the appearance before the Drainage Referee, a total of 71,300± acres of lands were made aware of the project. The various road agencies affected, the municipalities, the MTO and the County of Simcoe were all notified as well of the Section 76 report and of the public meetings.

A further round of agency involvement occurred as a result of a Peer Review that was undertaken. During the period of 2000/2001, the Holland Marsh Drainage Committee and the undersigned wished to determine if funding could be obtained from the MNR and the LSRCA due to the flood protection benefits that would be provided by the proposed project. To determine if such funding could be obtained, a joint committee was set up to study such. The following agencies/municipalities had representatives on the committee; Town of Bradford-West Gwillimbury; Township of King; LSRCA; OMAFRA and MNR.

To confirm that adequate flood protection would be provided and that no adverse impacts on the Regional Storm flood levels would result and to determine if indeed the project justified funding in part by the MNR and the LSRCA, the undersigned, the consultant for the Drainage Committee, was requested by the joint committee to prepare a report discussing the project, its costs, the cost benefits, how it would be paid for and how it would be maintained. The report prepared is the previously referred to May 26, 2000 Report. It accompanied the application for funding assistance.

The Peer Review was undertaken by the engineering firm URS Cole Sherman (B. Plezak, P. Eng.). The outcome of the review was to the effect that the project could be supported and it was recommended that the MNR and LSRCA participate in funding of the project (such did not occur however). It is to be noted that the work recommended in the May 2000 report that was accepted by the Peer Review formed the basis of the work described and recommended in this Engineering Report.

Subsequent to the submission, hearings and referee's decision, with respect to the Section 76 report, and subsequent to the Peer Review, the Municipalities of King and Bradford-West Gwillimbury in 2002 created a liaison committee to discuss the implications and methods of proceeding to implement a final engineering report to provide for improvements. The liaison committee concept was first discussed on May 28, 2002.

On January 27, 2003 and February 26, 2003, meetings occurred with the representatives of the two municipalities on the liaison committee. The Mayors and Clerks of each municipality were members, as well as the Road Superintendent from King and the Drainage Superintendent from Bradford. The seventh member was the undersigned. Subsequent to the liaison committee meetings, at which time lengthy discussions of the costs and components of the project occurred (substantial documentation was provided to the committee prior to the meetings), the engineer was appointed to prepare a final report under the Drainage Act for improvements to the marsh drainage system. It was agreed that the studies that had been undertaken to date which involved the work in 1997 and 1998 as part of the preliminary report studies and the work in the May 26, 2000 submission to the LSRCA, MNR, and the

work to notify all owners and the appearance before the Drainage Referee, sufficiently constituted the preliminary engineering phase. As a result, it was agreed that the engineer should prepare a final report based on the recommended option.

Subsequent to the appointment of the Engineer to prepare the final report on May 13, 2003, two on-site meetings were conducted, to which all owners directly abutting the proposed work were notified. These occurred on June 25 and 26, 2003. One was held for South Canal landowners and the other for North Canal landowners. All owners along both canals and dykes whose land could be physically affected by the work were notified. A total of 111 notices were sent. The recorded summary of these meetings is included in **Appendix 4**.

Also subsequent to the original appointment, in 1997 the Engineer attended on two occasions with representatives of the County of Simcoe, attended on two occasions in Downsview with the MTO, and attended on two occasions with representatives of the LSRCA, DFO and the MNR.

In March and April 2005, two further public meetings/open houses for lands adjacent to the dykes and canals occurred: the first for King Township owners and the second for Bradford West Gwillimbury land owners. The meetings were proposed to be the onsite meetings with adjacent owners as a result of the Study Report work necessary for the CEAA Study. All owners along the dykes and canals that would be affected by the work were notified. There was a mailed submission to each owner indicating in detail the work proposed using maps and text and also the implications as far as costs and allowances. A number of interior or Marsh Canal owners also attended these meetings. The recorded summary of these meetings is also included in **Appendix 4**.

More recently a further open house meeting/presentation occurred on June 17, 2008 with the owners adjacent to the canals and dykes and with the owners of the interior marsh lands being notified. A presentation using Powerpoint was given at this meeting to owners. The informal presentation reviewed the history of the project, the anticipated work and schedule of time and the possible financial impacts to owners in light of the recent MIII grant announcement. A summary of this meeting/open house is also included in **Appendix 4**.

As a follow up to this public meeting, landowners were sent a package of information referred to as **data sheets**, the aerials affecting their properties and other general notes to explain and show the work proposed, at the time, as affecting their property. (There have been few changes since submission of these data sheets except for changes as requested by some owners and except for changes in the assessment of irrigation costs as discussed elsewhere herein.)

OPTIONS STUDIED

Various options and alternatives* were studied by the undersigned in the period of 1997 to 2000. The conclusion of the various studies was that a project as outlined herein should be constructed. If reference is required to these past studies, such can be made available for review at the Holland Marsh Drainage System Joint Municipal Services Board's (the Board's) office on Dissette Street in Bradford. A summary only of the options/alternatives follows:

i) Option 1 - Do Nothing

If nothing were done, the canals would remain as they are. Maintenance would be questionable and subject to legal challenge. Life safety issues would remain as they are and could increase due to further deterioration of roadways. Scattered private construction works and even municipal works could occur

** "Options" are considered to be separate work items. When options are grouped to make a work program, the grouping is called an "Alternative".*

with no overall plan or report to control alterations, etc. on the canals and dykes. The flooding potential would worsen as canals became further filled and dykes further subsided. Residents would be unaware of potential problems and improvements that should be undertaken. The only immediate advantages would be that costs could be avoided and the environment would remain in its status quo, although it could be argued that the environmental condition of the canals would worsen with increased sedimentation.

ii) Option 2 - Clean Canal Bottoms Throughout

Three sub-options were identified in this general category.

a) Sub-Option A - Cleanout with Leveling Adjacent to the Canals on the Outside/Highlands Side

If the canals were cleaned and materials were leveled on the outside, there would be significant clearing required and also there would be reduction of flood plain availability. It is known that this would meet with objections from the Conservation Authority due to the greater intrusion into the wetlands and similar to any other work options that may be undertaken, could not be completed in all intervals due to development adjacent to the canal on the outside. Any option related to bottom cleanout would not attend to life safety considerations where necessary and could actually aggravate such. Flood protection, rodents, pipes through the dykes and road strengthening would not be provided.

b) Sub-Option B – Cleanout With Leveling on the Marsh/Inside

If the canals were cleaned and materials were to be leveled on the inside, there would only be scattered areas along the north canal where such could be undertaken due to the almost continuous building development that has occurred. Such also could not be successfully undertaken in those portions of the south canal where the dyke is used as roadways, being in intervals 9, part of 11, 13, part of 15, 16, 17 and 18. Such work could occur in Intervals 10, part of 11 and 12 and indeed such is recommended. The work could not easily be undertaken in Intervals 14 and 15 due to prime farmlands existing up to the foot of the dyke and due to the existence of a power line along the dyke throughout. As such this work is not a possibility in most intervals. Those items described to be not attended to in sub option A would be similarly not addressed by this option.

c) Sub-Option C - Bottom Cleanout with Hauling

The option of cleaning the canals where development exists with hauling of the materials to off-site locations has been considered as an option and has been investigated in more detail. In this option, leveling would occur in those intervals where it is felt that such would be possible on the inside. Those items described in sub option A & B would be similarly not addressed by this option.

iii) Option 3 - Partial Relocation of the Canals (Major Berm Work)

An early option that was prepared for improvement of the canals and to address life safety and flood protection issues and to also promote future maintenance was to consider a partial relocation where the canal would be shifted further away from the dyke to allow the creation of a berm adjacent to the dyke.

The excavated materials would be used to create the berm. The costing was based on use of geofabrics to attempt to reinforce the berm. Only one course of geofabrics was costed, although preliminary geotechnical input was that multiple layers of such would be necessary. Subsequent geotechnical work has indicated that an even more costly method of construction would be necessary (full coffer-damming and dewatering).

This option would be very costly and potentially unstable and thus is suspect with respect to its success and is no longer considered practical for wide scale usage. (It will be pursued in one short interval if soils permit.)

iv) Option 4 - Full Relocation of the Canals with Added Berm where Necessary

This is a further option that has been reported on and costed. Full relocation has been costed in Intervals 1 through to 7, in Interval 9 and in Intervals 13 to 17 inclusive. The concept of an added earth berm or dyke raising has been costed in Intervals 1 to 4 and in Intervals 13 to 17.

The inherent advantage of this option is that it is an option that can be more conventionally constructed and by common construction equipment. It has a greater probability of success and it does have the lower cost. It offers the greatest protection for life safety issues. It also addresses most of the other matters requiring attention.
In terms of the total length of the canal, the total canal system comprises 28 km and the relocation alternative would apply to 17± of these kilometers. Of the 17 km to be relocated, 10 km± would have the added berm constructed on it. (Slightly varying lengths of relocation and berm work were originally costed.)

v) Option 5 - Installation of Guide Rails for Life Safety

As an option to relocating the canal, or constructing any other works for life safety issues, an option was considered to construct guide rails throughout wherever the dyke roads were used as roadways to provide life safety issues. This option would be combined with other options to create a total package. Initial costing was for an approach that would be more costly than a conventional road guide rail system but substantially less costly than a fully pile supported and anchor tied system.

vi) Option 6 - Raise Road to Provide Necessary Flood Protection

Costs were determined to resurface the roads with additional gravel and asphalt wherever necessary to provide flood protection. The costing also would provide for the adjustments to the abutting front yards and driveways. This option would similarly be combined with other options to create a total package.

vii) Option 7 - Installation of Pre-Cast Products for Flood Protection

A study prepared by Cumming-Cockburn for the LSRCA in 1986 evaluated four options for providing flood protection other than raising the road. The four schemes had estimated construction costs per foot of $105 to $134 in 1986. These costs in 2000 were increased to present day values and were determined to range from $168 to $198 per foot. An option to provide this level of flood protection in Intervals 1 to 4 and 13 to 17 was developed and costed in 2000. This option could be done in combination with other work options. Due to the instability of the dyke, the potential of failure and the high cost of initial construction and of maintenance in the future, this option has never been pursued.

viii) Option 8 - Abandon South Canal and Work only on North Canal

This option was suggested by a Municipal representative at one point. It was not pursued for the following reasons.

- If undertaken, the north canal would require a substantial widening to provide an end area equal to both the south and the north canal.
- All six structures on the north canal would require immediate and full reconstruction.
- Substantial acquisition costs of development and lots along the north canal would be necessary, eg. at the Gleason, Springdale Church, Portuguese Club and the Ranjit properties. As well, full relocation of the small marsh scheme would be necessary.
- Some outlet for the natural watercourses draining into the south canal would still be necessary in any case and some mechanism to maintain drainage and the dykes would still be necessary along the south side.
- The possibility of having flows follow the alternate canal if there were a localized problem in one canal would not be available.
- The lack of the availability of the south canal for irrigation could be an issue with marsh farmers.

For these reasons, this option was not pursued further.

ix) Option 9 – Reduce Widths of Canals and Restore Separation Between Canal and Dyke as Per Original Construction

This option was also not pursued for the following reasons.

- Anticipated total rejection by both inside and outside landowners. It should be recalled that there was strong concern of undersized canals at the time of a Hurricane Hazel event. Even prior to Hurricane Hazel concerns were expressed regarding canal and dyke sizing.
- The original canal design was associated with different land uses than exist now. As is the case for most municipal drains, increased, rather than decreased, capacity is provided for changed and increased runoff due to development in the watershed.

- High costs and questionable success of creating a new bank slope in a wetted canal with wetted organic materials. (Same concerns as exists with the major berm option)

x) Summary of Options

A summary of these options as presented in 2000 and as summarized in an information session on June 17, 2008 follow. **It should be noted that the work and costing undertaken in the 1997 to 2000 period did not provide for, or anticipate, the extent of irrigation and structure work since determined to be necessary, did not anticipate the extent of environmental and excavation work now necessary as a result of the environmental studies and was based on material, bridge and fuel costs of the time that are now greatly increased.**

a) Options for Canal Improvement

- Option 1 – Clean Canal Bottoms Throughout (with Hauling) plus Selected Structures* (has no life safety provision) - Cost $10,589,960
- Option 2 – Major Berm** plus Selected Structures (Shift Canals 50% of their Width) - Cost $15,099,870
- Option 3 – Full Relocation of the Canals (Shift 100% of their Width) plus Selected Structures - Cost $10,398,900
- Option 4 - Bottom Cleanout – minimum cost – Level All Material On Outside of Canals plus Selected Structures (hypothetical). Not practical (due to flood plain). Will not meet environmental approvals for work to be done. - Cost $7,527,950

b) Options for Flood Protection

- Option 5 – Imported or Acceptable Native Soil Berm on Backfilled Canal Adjacent to Dyke - Cost $1,535,811
- Option 6 – Raising Roads/Dykes for Flood Protection - Cost $2,792,417
- Option 7 – Alternative Barrier Wall for Flood Protection - Cost $10,583,365

c) Options for Life Safety (where canal not relocated)

- Option 8 – Guide Rails Along All Roads - Cost $4,500,000

d) Future Maintenance

- If canal is relocated, maintenance is facilitated
- If it is not moved, costly traffic control and hauling would be involved

e) Grouping of Options to Make Alternative Work Program (Year 1997 to 2000 Estimates)

Alternative	Components	Description	Cost
Alt. #1	Options 1,8,6	Actual Bottom Cleaning, Guide Rails, Raise Road (Maintenance still expensive)	$17,882,377
Alt. #2	Option 2	Major Berm	$15,099,870
Alt. #3	Options 4,8,6	Hypothetical Bottom Cleaning, Guide Rails, Raise Road	$15,090,367
Alt. #4	Options 3, 6	Full Relocation, Raise Roads	$13,191,317
Alt. #5	Options 3, 5	Full Relocation, Adjacent Berms	$11,934,711

If all these were updated to 2008 figures, similar relative differences in costing would exist.

f) Alternative 1 Pros and Cons Bottom Cleaning, Guide Rails, Raise Road

Pros

- Minimal impact on environment
- Minimal impact on alignment with structures
- Reconstructs substantial length of the road

* *Selected structures means attending to capacity/obstruction problems at the more critical bridge crossings*

** *Major Berm work is now called Partial Relocation Work*

Cons

- Highest cost
- May render dykes and roads more unstable (as occurred after Hurricane Hazel)
- Substantial hauling (very expensive)
- Traffic Disruption now and in future
- Future maintenance not facilitated
- Guide rail would have high future maintenance costs
- Impacts adjacent Marsh properties
- Substantial costs to keep adding asphalt to roads to keep flood protection level
- Guide rails would not allow combined farm vehicle and domestic/commercial travel

g) Alternative 2 Pros and Cons Major Berm (Partial Relocation) (in some Intervals a Cleanout only)

Pros

- Moderate impact on environment
- Moderate impact on structures
- No hauling
- Better life safety features
- Berm more easily maintained than road

Cons

- May be difficult to initially stabilize berm and to maintain
- flood protection
- Partial dewatering and slope stability measures (costly) may be necessary
- A minimal reduction of flood plain
- Requires some new lands
- Second highest cost
- Does not facilitate future maintenance
- Direct hauling on roads still necessary

h) Alternative 3 Pros and Cons - Hypothetical Bottom Cleanout, Guide Rails, Raise Road

Pros

- Facilitates future maintenance
- Minimizes traffic disturbance to dyke/road during canal construction
- Reconstructs substantial length of roads
- No hauling
- Minimal impact on alignment with structures

Cons

- Higher impact on environment
- May still render dyke and road more unstable (similar to Hurricane Hazel situation)
- Significantly impacts flood plain and storage (would not be approved by MNR, by LSRCA and other environmental agencies)
- Requires new lands
- Roads and guide rails will have future maintenance demands
- Impacts adjacent Marsh properties during road work
- Conflicts between farm vehicles and domestic/commercial travel due to guide rails

i) Alternative 4 Pros and Cons - Full Relocation, Raise Roads (in some Intervals a Cleanout only)

Pros

- Second lowest cost
- Construction is more achievable
- Less impact on flood plain
- Increased flows are available
- Facilitates future maintenance
- Reconstructs substantial length of roads
- Has potential of low impact on environment during maintenance
- Initial construction would be more attractive to road agencies
- Costs of future canal maintenance will be substantially less
- Provides the option of either leveling or hauling away future cleanout materials

- Provides optimum area for drainage
- More easily to construct
- Provides greater life safety

Cons

- Higher initial impact on environment
- Will require more work to blend with existing structures
- Requires more new land
- Road will have high future maintenance demand and cost to maintain level for flood protection
- Impacts adjacent Marsh properties
- Leaves substantial depth from road level to old canal level

j) Alternative 5 Pros and Cons - Full Relocation, Adjacent Berms (in some Intervals a Cleanout only)

Pros

- Lowest Cost
- Berm more easily and cheaply repaired than raising a road if settlement occurs
- Facilitates future maintenance
- Has potential of low impact on environment during future maintenance
- Minimal disturbances on fronting properties
- Provides the option of either leveling or hauling away future cleanout materials
- Berm could be more stable (than major berm approach) due to staging of construction and selection of materials
- Provides flood protection with the lowest cost and lowest maintenance demand
- Provides greatest life safety
- Substantial reduction in future maintenance cost to road agencies and for drainage
- More easily to construct
- Provides substantial improved area for drainage

Cons

- Higher initial impact on environment
- Will require more work to blend with existing structures
- Requires more new land
- A minimal reduction in flood plain

xi) Selection of Alternative

Based on the lower costs and the increased advantages of doing such, alternative 5 was selected in 2000 as the work project to proceed with.

What follows in this January 2009 report is a description of the studies undertaken since the 1997-2000 work, the more detailed recommendations, the costs and the assessments to implement the previously elected Alternative 5.

APPLICABILITY OF SECTION 78 TO THIS PROJECT

Section78 of the Drainage Act is reprinted below:

78. (1) Where, for the better use, maintenance or repair of any drainage works constructed under a by-law passed under this Act or any predecessor of this Act, or of lands or roads, it is considered expedient to change the course of the drainage works, or to make a new outlet for the whole or any part of the drainage works, or to construct a tile drain under the bed of the whole or any part of the drainage works as ancillary thereto, or to construct, reconstruct or extend embankments, walls, dykes, dams, reservoirs, bridges, pumping stations and other protective works as ancillary to the drainage works, or to otherwise improve, extend to an outlet or alter the drainage works or to cover the whole or any part of it, or to consolidate two or more drainage works, the council of any municipality whose duty it is to maintain and repair the drainage works or any part thereof may, without the petition required in section 4 but on the report of an engineer appointed by it, undertake and complete the drainage works as set forth in such report. R.S.O. 1990, c. D.17, s. 78 (1).

Notice to conservation authority

(2) An engineer shall not be appointed under subsection (1) until thirty days after a notice advising of the proposed drainage works has been sent by prepaid mail to the secretary-treasurer of each conservation authority that has jurisdiction over any of the lands that would be affected. R.S.O. 1990, c. D.17, s. 78 (2).

Powers and duties of engineer
(3) The engineer has all the powers and shall perform all the duties of an engineer appointed with respect to the construction of a drainage works under this Act. R.S.O. 1990, c. D.17, s. 78 (3).
Proceedings
(4) All proceedings, including appeals, under this section shall be the same as on a report for the construction of a drainage works. R.S.O. 1990, c. D.17, s. 78 (4).

The new works herein will in part change the course of the drainage works, will in part construct, reconstruct or extend embankments, dykes, bridges and other protective work and will in part otherwise improve and alter the drainage works. Accordingly it is deemed that the new works are in accordance with Section 78 of the Drainage Act.

TRIAL WORK

Two areas of Trial Work were constructed in the months of October and November 2008. The first area undertaken was that part of Interval 15 (South Canal) lying from 450 to 650m east of Jane Street. In this Trial section, a 200m length of canal was cofferdammed by earth at one end and by rock at the other. Turbidity curtains were placed within the canal beyond the dams prior to the work. The cofferdammed section was then electro-shocked on two consecutive days to allow catching and movement of fish to adjacent areas of existing canal. Silt fences were then placed. Prior to the excavation work, the lands to be used for the relocation were cleared by a combination of mulching and felling of trees. Larger trunks which were not mulched were placed on the embankment separating the existing canal from the new canal. The new canal was then constructed. Notches were left on either side of the cofferdams to allow for continuous flow in the canal. Excavated materials were placed as backfill in the existing canal. The evident rate of excavation once procedures were established was approximately 1200 cubic metres per day.

A second Trial area was undertaken in Interval 1 (North Canal) over a length of 350m± north of Highway 9. The first activity was to clear along the route of the new canal. Upon completion of the Trial work in Interval 15 (South Canal) construction of cofferdams in Interval 1 commenced. Equipment was able to pass fully through the river meadow to undertake the clearing operation. The excavation and backfilling work occurred as in Interval 15 but in this trial 3 pieces of excavation equipment were used with one working from the dyke. The evident excavation rate once procedures were established was approximately 2000 cubic metres per day.

The Trial Works were undertaken to allow a better estimate to be prepared of the construction technique and cost as outlined in this report. It was felt that the work involved with this project is substantially unique in Ontario and prior examples of the type of work involved could not be researched. It was felt necessary to both undertake Trial Work for the clearing and for the excavation and canal backfilling. A particular concern was the existence of flooded lands in spring and early summer conditions and to determine the impact that such would have once the project was undertaken. It was also felt necessary to establish a time basis for undertaking the work to allow for better estimates of construction costs. Also to be examined were different means of cofferdamming the work sections and the fish shocking and fish movement work that would be necessary.

Since the activities undertaken in the Trial Work were considered to be necessary to allow engineering cost estimates and engineering estimates of time to be prepared, these components of work have formed a portion of the engineering costs of this project.

CANADIAN ENVIRONMENTAL ASSESSMENT ACT (CEAA) STUDY REPORT

A CEAA Study Report was completed by the undersigned since the Federal Department of Fisheries and Oceans determined in year 2003 that the works involved with the canal improvement project would have an impact on fisheries. As such, the proponent was required to participate in a Screening Report pursuant to the Canadian Environmental Assessment Act. The component undertaken by the proponent was to prepare the necessary Study Report.

Together with the Study Report, two separate and additional documents were prepared, one being a Scope of Project Report and the other being a Project Description Report.

The various documents that were prepared were undertaken over the period of March 2004 to January 2007. Upon completion of the Study Report, a Memorandum of Understanding was prepared and an Addendum to the Memorandum was also prepared in the months of February 2007 to December 2007 to augment the Study Report.

The proponent was notified on February 26, 2008 that as a result of the Study Report and Screening Report, the Federal Department of Fisheries and Oceans (DFO) had determined that if the monitoring and mitigation measures specified were implemented, the canal project is not likely to cause significant residual adverse environmental effects and that DFO would issue a Section 35(2) Fisheries Act Authorization. This therefore indicated that the canal project could proceed.

It was evident and understood however that annually a Letter of Intent (LOI) would have to be prepared and submitted to the DFO for the project work to be undertaken in that year.

Full documentation regarding the CEAA Study Report, the Memorandum of Understanding, the Addendum to such, Project Description Report, the Scope of Project Report and the LOI's already submitted is available at Board offices.

The commitment re sampling, monitoring, migrating birds, wildlife and plants necessary as a result of the CEAA Study are set out in **Appendix 5**.

COWSEP STUDY RE IRRIGATION

COWSEP stands for Canada-Ontario Water Supply Expansion Program. The Municipality of Bradford-West Gwillimbury was able to qualify for the program due to the need to study continuation of water supply through irrigation to the marsh landowners in consideration of the proposed canal improvement project.

The study was undertaken at the engineering level only and its main purposes were to establish the existence of, and the works necessary to ensure continuation of, irrigation with the canal improvement project.

The COWSEP report indicated that its goals and objectives were to:

1. Identify that the construction project to improve canals by relocation and cleanout will provide improved quantity and quality of water in the canals.
2. Identify the existing irrigation inlets and the work necessary to ensure their continued and improved use both during and after canal reconstruction.
3. Provide for new irrigation inlets where required.
4. Identify that the irrigation work is scientifically, technically and financially feasible.
5. Identify the process/mechanism for future construction and documentation of inlets.

6. Identify that the irrigation work will facilitate improved maintenance of the Holland Marsh Canals.
7. Assist in obtaining final environmental approvals prior to construction. With the improvement of water quality used for irrigation and installation of backwater valves/gates, irrigation lines will be environmentally acceptable.
8. Document that in the long-term, an improved irrigation line infrastructure will benefit many agricultural users and benefit those areas that these lines may impact.
9. Reiterate that the project as a whole (including the irrigation line system) will meet all applicable Acts, Standards and Guidelines. Irrigation lines will be installed, maintained and repaired in accordance with all Acts, Standards and Guidelines.
10. Refer to the engineering report pursuant to the Drainage Act that will list all the agricultural properties involved.

A full copy of the COWSEP Study Report can be made available by the Engineer to the Board's office and such is also available for review on the Engineer's website.

Separate funding was provided by COWSEP (Tier 3) for 100% of the engineering costs associated with preparing the irrigation report. A $90,000 grant was applied for and received.

GEOTECHNICAL/SOILS INVESTIGATIONS

There is a substantial history of geotechnical analyses in the marsh. The data that was obtained and reviewed dates back to 1978.

At that time, a significant study was undertaken by Peto MacCallum in the area of the dykes and canals west of Highway 400 along the north canal with scattered investigations at other locations throughout the marsh.

Also in the late 1970's/early 1980's, an investigation was undertaken by V. Bardawill, P.Eng. Soils along the north dyke soils from Highway 400 northeasterly for 5± km were analyzed.

At various times there have been soil investigations as part of highway and local roadway improvements or pumping station improvements.

In the year 2003 the undersigned commissioned a further soil investigation and report by Peto MacCallum. The Terms of Reference were to undertake sufficient additional boreholes to augment the data that exits and to prepare a report thereon. This report was submitted on March 17, 2004.

A full copy of the report is available at the Board office. The **strip plan drawings (Numbered 4 to 14)** in Volume 3 show the locations and summary of the boreholes that have been sampled.

A summary of the soil investigations undertaken would indicate that there is a mixture of soils to be encountered at the excavation depths for the new canals. In most locations, a typical borehole would indicate a depth of 0.6 to 0.9m of peat in the upper soil profile. Below that for a depth of 2 to 4m alluvial silts mixed with sands would be located. At depths of 4 to 5m the soils become firmer and become more glacial in nature.

However, at intersections of historic watercourses in the North Canal, such as the intersection of the Schomberg Branch of the Holland River west of Simcoe County Road 8 (Canal Road) north of Highway 9, at the intersection of the North Branch of the Holland River in Interval 2 west of Highway 400, and at the intersection of a further former tributary in Interval 7 east of Simcoe Road there are

significant depths of peat. In some locations these peat depths extend to or beyond the bottom of the proposed canal.

The two sections of Trial Work undertaken in October/November 2008 have confirmed the findings from the geotechnical reports. In Interval 15 (South Canal) a thin layer, 1 to 2 feet (0.3 to 0.6m) of peat was encountered at ground level and below this the soils would be considered as alluvial sandy silts. Gravel till soils were encountered at the bottom of the excavation.
In this Interval 15 the water table was encountered at a depth of 0.6m (2') but low capacity pumping was able to control ground water in the new trench.

In Interval 1 (North Canal), up to 2.1 to 2.7m (7' to 9') of peat was encountered and then soft soils below this. The water table was encountered at a depth of 2m but low capacity pumping was also able to control the ground water.

HYDROLOGY/HYDRAULICS STUDIES
The Holland Marsh Drainage System canals and flood plains have been studied on four occasions with respect to their abilities to accept high runoff flows. In the late 1970's/early 1980's, the Lake Simcoe Region Conservation Authority commissioned hydrology studies by consultants and the results of these studies were described by the reports listed in **Appendix 1**.

A more sophisticated analysis of the impacts of significant storms on the canal drainage system was undertaken by Cumming-Cockburn in 1991 as commissioned by the Conservation Authority. The study was entitled the Holland River One Dimensional Dynamic Model Analysis (One-D). The results of the study predicted 100 year water levels as shown on the profile drawings included with this report. The study also predicted the Regional Storm flood levels. These have not been shown but are in the magnitude of 0.5 to 1.0m higher than the predicted 100 year levels.

It is of interest to note that studies undertaken for the Conservation Authority in these years contained a cost benefit analysis that justified providing protection against the 100 year event but not for the Regional storm event.

In 1998, D. Harsch, P.Eng. of Young-Smart Engineering (a former division of K. Smart Associates Limited) undertook a further analysis of the impacts of a 100 year event on water levels within the Holland Marsh canal. This study also assessed possible effects of ice conditions within the canal. This study estimated 100 year levels for both existing conditions plus for a condition for a condition just after canals would be improved. This study was updated in 2007/2008 to incorporate further design data that was available. Revised cross-sections were entered and further data re structures was entered. The computed 100 year levels for both existing and conditions after completion of design improvements were provided. The 100 year levels for the existing conditions are shown on the drawings enclosed.

This report has taken the position that protection against 100 year levels should be based on existing conditions as opposed to design conditions in order to recognize that canals will become impacted by vegetation growth over time and that sedimentation into the canals will continue after construction. A further and significant reason for adopting the existing conditions is consideration of ice impacts. A previous study has indicated that at times of spring melts and runoffs when ice is in the canals, the dykes are prone to high water levels. At these times an improved canal section by itself may not be sufficient. Although it is recommended, and believed, that maintenance (will) be substantially more effective in maintaining canals at a condition improved from that existing prior to the undertaking of this report, it is this report's recommendation to provide flood protection to the levels calculated for existing conditions.

A summary of the predicted 100 year flows and the predicted 100 year flow levels is included in Table 2.

During the final design phase of this report, two separate and further hydraulics analyses were completed. Firstly analyses were made to determine what year of storm event could be handled by the south canal after the initial contract in it was completed and when the north canal was cofferdammed off to allow work in it to proceed. Similarly an analysis was made as to what year of storm the north canal could handle while the initial contract work in the south canal was attended to. In both analyses it was determined that a storm event of between a 2 and 5 year return frequency only could be reasonably accommodated.

Secondly, an analysis was made where the design width of the south canal was increased from 20 metres to 24 metres (as measured at design water levels) to determine if any difference would result in water levels when the south canal was improved and then used as the sole outlet while the north canal was cofferdammed off. It was found that there would be no noticeable difference in water levels for various flood events. This analysis overall indicated little would be gained by enlarging the south canal.

EFFECT OF LAKE SIMCOE ON CANAL WATER LEVELS

It has been noted over the course of the studies on this project that water levels in the canals fluctuate substantially in the spring to fall period. It has been noted that water levels in the spring period may approach a level of 219.2 whereas in late summer/early fall, water levels drop to a level of 218.7, a lowering of almost 500mm.

In the March through to July periods, canal water levels inundate adjacent lands, especially in the upper portions of the canals. As an example, the adjacent lands in Interval 1 (North Canal) are inundated until mid July/early August but by October water levels have receded sufficiently that the grounds become firmer and permit construction travel.

It is the recommendation of this report that every effort be made by the two Municipalities (Town of Bradford-West Gwillimbury and the Township of King) by the Lake Simcoe Region Conservation Authority (LSRCA), by the Ministry of Natural Resources (MNR) and by the Holland Marsh Drainage System Joint Municipal Services Board (HMDSJMSB) to request Parks Canada who operate the Trent Severn Waterway to control levels in the waterway as low as possible during the significant canal construction activities on this project which are expected to span from August to March each year. Such will greatly assist in construction ease and efficiency and will have a significant impact on construction costs, and also on the successful excavation and backfilling of canals.

EXISTING IRRIGATION, WELLS AND DRAIN OUTLETS

Existing irrigation as affecting the dykes and canals of the Holland Marsh Drainage System was studied in detail in 2007 through the COWSEP program as discussed earlier herein. A report entitled Irrigation and the Holland Marsh Drainage System Reconstruction Project as prepared by the undersigned described the history of irrigation in the marsh, the types of irrigation and other lines existing that cross the dykes, the problems of existing irrigation and provided recommendations to be considered to ensure irrigation was maintained both during and after the canal project. Possible methods of funding of irrigation improvements were also discussed. This report is available at the offices of the Board or on the web site of K. Smart Associates. A summary of the existing irrigation is reprinted here from this document.

The eight broad types of irrigation inlets that exist and that have to be considered are:

- Above grade installations that cross through the dyke in sleeves. The irrigation pipes in the sleeves normally vary from 4" to 6" diameter (Type A). The sleeves vary from 6" to 15" and are primarily corrugated steel pipe culverts.
- Small diameter irrigation pipes that cross through the dyke above grade without sleeves (Type B). These are primarily 2" diameter and are either iron pipe or plastic.
- Below grade small diameter pipes, again in the magnitude of 2" diameter (Type C). Most are plastic or iron pipes and are joined to jet pumps on the marsh side. These lines are designed below grade to prevent freezing.
- Below grade suction lines which are normally in the magnitude of 4" to 6" diameter (Type D) and are primarily iron pipe.
- Sub-irrigation/communal lines which are below grade and are gravity fed and vary from 4" to 6" (a few 8") for sub-irrigation (Type E) and 10" to 14" for communal lines (Type EC).
- Recently extended below grade suction lines through Highway 9 with 16" sleeves (Type F) (Extended when Highway was reconstructed in 2002±).
- Over the top systems in those sections where the dyke is not used as a road. In these intervals, the landowner brings a portable pump to the dyke, installs his inlet and then removes all at the end of the irrigation period (a variation of Type A).

There are a number of dyke crossings that are not used for irrigation. These include tile drainage discharge lines, small diameter lines that serve to carry water from canal side wells to marsh side buildings, small diameter lines that serve to carry artesian waters from marsh side wells to canal side for disposal and small diameter lines that are used for outlets from vegetable washing operations on the marsh side. In addition, there are discharge lines for the artesian waters from the canal side wells that go directly into the canals.

ACQUIRING TITLE TO CANAL ROAD WHERE REQUIRED BY COUNTY OF SIMCOE

The County of Simcoe has indicated that it may wish to pursue acquiring title to those sections of the North Canal Road where the road exists on a right-of-way only. The County has indicated that by doing such, it will assume any liability with respect to any incidents along the road and will allow new irrigation lines to be installed subject to a release form being signed, and that it will address the canal side well issue. As well septic beds within the right-of-way would be recognized. The County's intention is to acquire the roadway at a nominal fee but it will attend to all legal matters. A matter to be simultaneously pursued may be the closing and redeeding of the unopened Town road allowances at the rear of some of the affected properties.

The Aerial Drawings included in Volume 3 have attempted to indicate where the Engineer believes the road to be on a right-of-way as opposed to already being owned by the County.

At this time, there has been no indication from the Township of King or the Town of Bradford-West Gwillimbury of intentions to acquire title to sections of the canal bank roads within their jurisdiction, where not already owned, or to relocate any canal side wells in their jurisdiction.

OUTLET FOR HOLLAND MARSH DRAINAGE SYSTEM

At the point of convergence of the canals, approximately 0.5 km southwest of Highway 11, the "outlet" is the continuation of the original Holland River. This watercourse flows in a northerly direction for approximately 10 km prior to outletting into Cooks Bay (Lake Simcoe). The path through Lake Simcoe including Lake Couchiching is 70 km±. The lakes outlet to Georgian Bay (Lake Huron) 50 km± to the west via the Severn River. The Lakes and Severn River are part of the Trent Severn Waterway and are operated by Parks Canada. It is deemed that a sufficient outlet exists. It is

recommended however that the Board and the Municipalities request the Water Control Engineer of the waterway to lower levels in the outlet as much as possible during canal construction periods.

UTILITIES

It has been noted that there are both overhead and underground utilities along and across the canals to be worked on as part of this report. With respect to the overhead lines, most lines are on the inside of the dykes and are generally only found where the dyke is used as a road, but there are portions, in the south canal (Intervals 13 to 15 and part of 11) where there are lines on the inside of the dyke where the dyke is not a public road but is used as a laneway. The offset for the poles from the travelled roadway edges varies from 1 to 5m. There are numerous locations where there are anchor poles either on the interface between the dyke and the canal or on the opposite side of the canal and an attempt has been made to indicate these on the drawings. Many of these will require relocation and adjustment prior to construction and the contract documents will require the Contractor to govern his work accordingly.

In some cases, a continuous overhead utility line extends across the canals and these have also been noted. Dialogue will be undertaken with the utility companies in an attempt to pre-locate or adjust overhead lines that may affect construction prior to the commencement of construction. The costs of any adjustments to overhead utilities will in some locations be assessed to the project but in other locations the costs of the work will be a special assessment to the utility involved in accordance with Section 26 of the Act.

With respect to underground utilities, the **aerial drawings in Volume 3** have attempted to indicate the location of continuous underground Bell and Gas lines along the dyke roads. This is from data provided by Enbridge (Consumers Gas) and Bell. As well, those locations of crossings of the canal have also been indicated. This data too has originated from the utility company in part and from the former Drainage Superintendent in part.

The contract documents will require that wherever a crossing is proposed at the dyke, that the utility be located in advance to minimize damage or disturbance to the utility. Where it is necessary for the utility to be altered in location or grade, such will be the responsibility of the utility and/or the costs for such will be assessed in accordance with Section 26 of the Act if the utility serves the general public.

The same criteria applies to any underground crossings of the canal in that such will require prelocation and protection but any costs to alter or otherwise relocate the utility will be the responsibility of the utility company or will be a special assessment to the utility if undertaken through the report.

The approach taken in this report is that a utility that is along a road or laneway that is not used by the general public is considered to be a non-public utility and the costs are to the project. Where such utility exists along a public travelled road or is for general public use, any costs of alteration are to be dealt with in accordance with Section 26 of the Act. Where such utility exists along a private road, any costs of alterations are to be a general project cost.

EXISTING BRIDGES

The description of the existing bridges is included with the discussion of recommendations re bridges as contained in a following section of this report.

EMERGENCY WORK UNDERTAKEN IN FALL 2008

One further component of the project was attended to prior to completion and presentation of this engineering report. This involved the clearing of the land to be used for canal relocation in Intervals 13, 14, 15 and 16 (all part of South Canal) where not undertaken for the Trial work. Two purposes were to be fulfilled.

Firstly a condition of receiving the MIII grant on the project was that a component of the work was necessary to be started and substantially undertaken in the calendar year 2008.

The second purpose in undertaking the emergency work was to allow the first phase of construction work to commence in the year 2009 provided the Engineering report were successfully processed and adopted so as to allow work in 2009. This would allow one construction season of excavation not to be lost. It is considered that each year that passes with no construction will substantially increase the probability that severe flooding could damage the marsh lands.

The emergency designation was obtained from OMAFRA, in accordance with Section 124 of the Drainage Act, to allow this clearing work to be undertaken prior to the completion and adoption of the Engineering report. It was felt to be an emergency since if it were not undertaken, the $10 million grant would not be available and the possibility of flooding would be greater.

The costs for this emergency work are separately listed in the Cost Estimate.

RECOMMENDED CANAL WORK

As is evident from the preceding sections which describe the Holland Marsh and its drainage system, which set out the problems with the drainage system, which describe how the system was studied, and which describe existing conditions, it is evident that improvements are necessary.

The main items of work recommended herein on an interval by interval basis can be summarized as follows. The portion after this describes the different types of canal work listed here.

i) North Canal

Interval 1
- Full relocation of canal with added earth berm over most of route –partial relocation west of Five Sideroad
- Initially clean through one bridge (Highway 9)
- The private Gleason bridge is either to be removed or replaced prior to canal work
- Provide an allowance for new laneway to replace the private bridge but allow an enlargement if done privately to report criteria.
- The private Gleason bridge would only be cleaned if necessary while waiting for completion of any private improvement.

Interval 2
- Full relocation with added earth berm over most length; cleanout only at North River intersection
- Initially clean through the Highway 400 North Canal overpass structures and the Five Sideroad structure
- Provide additional canal capacity through the overpass structures prior to project completion
- Enlarge or replace Five Sideroad bridge prior to completion of project

Interval 3
- Full relocation with added earth berm
- No bridges to be cleaned, enlarged or replaced

Interval 4
- Full relocation with no berm. (Road to be raised and maintained and at a higher level over a 200 metre length.)
- Replace Fifth Line bridge prior to canal work
- If required temporarily, clean and provide costly connecting cofferdams at Fifth Line

Interval 5
- Full relocation no berm (partial relocation/cleanout only just west of Simcoe Road)
- Clean through one bridge (Simcoe Road)
- No bridges to be enlarged or replaced

Interval 6
- Partial relocation by Portuguese Cultural lands, if soils allow (cleanout to be done with new guide rail if soils do not allow partial relocation)
- Full relocation over balance with no berm
- No bridges to be cleaned, enlarged or replaced

Interval 7
- Full relocation (no berm in most of interval but 300 metre length requires a berm or the road to be raised and kept raised and with a 5 to 6m width of clay backfill adjacent to the road if raised only)
- No bridges to be cleaned, enlarged or replaced

Interval 8
- Bottom cleanout with some hauling from, and some leveling on, small marsh scheme dyke (outside of north canal)
- Clean through one bridge (Pumphouse Road)

ii) South Canal

Interval 9
- Full relocation
- Clean through one bridge (Graham Sideroad) if not replaced prior to canal construction
- Replace same bridge prior to completion of project

Interval 10
- Bottom cleanout with minor widening
- Level material on marsh lands (inside of dyke)
- Haul materials from portion behind Ansnorvelt lots
- Clean through one bridge (Dufferin Street)
- Enlarge or replace same prior to completion of project

Interval 11
- Bottom cleanout with minor widening
- Haul materials from portion by King Road and install new guide rail
- Level material on marsh lands (inside of dyke) in part and haul in part
- No bridges to be cleaned, enlarged or replaced

Interval 12
- Bottom cleanout with minor widening
- Level material on marsh lands (inside of dyke)
- Clean through one bridge (Keele Street)

Interval 13
- Cleanout and haul only for approximately 370m west of Keele Street along Woodchoppers Lane
- Install guide rail in the 370m length
- Full relocation with no berm over balance
- Raise and widen earth dyke level where necessary
- No bridges to be cleaned, enlarged or replaced

Interval 14
- Full relocation with no berm
- Raise and widen earth dyke level where necessary
- No bridges to be cleaned, enlarged or replaced

Interval 15
- Full relocation with no berm
- Raise earth or gravel dyke level where necessary
- Replace Jane Street Bridge prior to canal work

Interval 16
- Full relocation with added earth berm
- Clean through Highway 400 South Canal overpasses

- Provide additional canal capacity below the overpasses if suitable replacement not constructed by MTO prior to end of project

Interval 17
- Full relocation with added earth berm in most portions and cleanout with flood protection for 150 metres± north of Hwy 9
- Clean through one bridge (Highway 9)

Interval 18
- Bottom cleanout with some leveling on, and some hauling from, boulevard between Highway 9 and canal
- No bridges to be cleaned, enlarged or replaced (Hwy 9 bridges are listed in other intervals)

A more detailed description of canal relocation works, earth berm works, partial relocation of canals and canal cleanout work follows. The cross-sections, extent of work aerial drawings and specifications which form part of this report describe the proposed work in much more detail.

RECOMMENDATIONS BY CANAL WORK TYPE

a) On the South and North Canals where the work involves a canal relocation, the work anticipated is to involve the following:

Entry would be made in the autumn and winter months on the outside (non marsh side) and work would occur to clear a sufficient width from the existing canal outwards to allow for the new canal construction. This width varies as shown on the Extent of Work **Aerial Drawings (North 15 to 51 and South 52 to 92) in Volume (Book) III**. Most branches and small trees would be mulched/chipped and the chippings left as a mat for future excavation. Trunks of larger trees would be chainsawn and left to assist in retaining backfill on the existing canal. Some, where requested, will be cut into shorter lengths and left for owner's use.

A few of the trees and roots may be piled or windrowed in with existing adjacent trees so as to create scattered areas for wildlife. Some will be used as a working mat and will be disposed of in the old canal or will, when permits are obtained, be burned. Root masses when excavated will also be used for containment of backfill or for fisheries or wildlife enhancement.

A 3 metre wide maintenance strip may remain uncleared or may be cleared depending on the construction process adopted.

Then starting in July each year the new canal would be excavated in the cleared width and the removed material would be placed in the existing canal. The work may be done by excavators working along the new canal route, in the existing canal in part and/or also from the dyke roads depending on the process adopted.

The new canal will be approximately 3m deep measured from ground level, would have 3:1 side slopes and would have a 2.5m wide shelf for fish habitat. The back slope for the littoral shelf may have up to 1:1 slopes.

It is important for each owner to advise the Engineer if there are any irrigation lines, wells or tile drain outlets that are at the existing canal edge that could be impacted and that are not shown on the enclosed aerials.

b) Where an earth berm is to be constructed, the work would be undertaken approximately two years after the relocation works (which is the excavating of the new canal and the backfilling of the existing canal). This time period would provide for settlement/consolidation of the backfill. At the time of berm work the backfill materials including any material hauled in and placed above the

backfill would be graded to the shape of a berm with a 10m± base and a 2m± top adjacent to the existing Canal Road. Materials will be hauled in to rough out the berm as soon as conditions allow in order to surcharge the backfill and allow as early construction as possible of the final berm shape. The crest of the berm would be approximately 6m (20') away from the existing edge of asphalt. The road side of the berm would be seeded and the crest or upper part of the back slope would have plantings on it by the project or Board using separate funding, when available, to do such. As well, a small perforated drain would be run along the interface between the new berm and the existing road for drainage purposes. This drain would join to new catchbasins at frequent intervals and outlet pipes would be constructed from the catchbasins to the new canal.

c) Where a partial relocation is involved, the existing canal would be partially backfilled and partially widened. The excavation from the widening would be used to backfill the portion beside the Canal Roads. The backfill would be graded to the shape of a berm similar in shape to that described above. The work would be done in partially dewatered conditions using equipment working from the side of the widening plus from the surface of the Canal Road. A geofabric protection of the fill slope would be included. In some areas soil conditions may preclude construction of the partial relocation work unless a rock base is used. Where not constructed, cleanout with a new guide rail would be implemented.

d) Where the work is to be a bottom cleanout only in Intervals 10 to 12 (no proposed relocation of the canal), it is proposed to do the work by traveling along the dyke with a dragline (or similar excavator), removing the sediment and casting such on the dyke and on the inside lands (marsh lands). Trees would have to be cleared/mulched on the dyke and on the lands to be used for leveling. The cut wood material would be used to create a windrow at the edge of the cleared width and then earth material would be leveled from the windrow up to the dyke. The average width of work is expected to vary from 30 to 35 metres from the top of the dyke to the far edge of clearing. In areas where the bush is narrow, it would be cleared and removed, or ground up, then topsoils would be stripped in the adjacent open area, then the spoil would be leveled once dried, and then topsoils would be replaced. The canal itself will require some widening in much of its length and the width of such is expected to be 2 to 3 metres (5 to 10 feet) on the east or south side. Any trees removed on that side to allow the work will be mulched and windrowed in with other mulching or would be hauled away. It is not expected that any machinery other than chainsaws will work on the south or east side of the lands to be widened and none of the excavated earth is anticipated to be leveled on that side. For future removal of dead or dying trees on the south or east side, a 3m wide maintenance strip is to be made available but it would not be cleared at this time (unless necessary to do the work). Where the lands are open (field) on the south/east side of the South Canal, a new 3 metre wide grass buffer strip is required and it is to be seeded and kept as a buffer strip. The landowner will have the option of doing the work for this buffer strip, with compensation.

   On the north or west side in some areas of cleanout and leveling (Intervals 10 to 12), there are expected to be some modifications to the work plan depending on the particular property usage. For example, where there are buildings, etc. along the dyke and where the channel is not being relocated, the material will have to be leveled over a greater width to the east or west of the buildings but using greater depths of the property, etc. as room permits and as the landowner requests. Clearing and use of the dyke in front of the buildings would still be necessary.

   On the south side where materials are leveled on the marsh side of the dyke, a future maintenance corridor along the dyke and for 25 metres beyond it is to be available to allow leveling when the canal is cleaned again in the future (at a frequency of 15± to 20± years depending on location).

e) Where the work is to be a cleanout with partial leveling and partial hauling in Part of Interval 8 and in all of Interval 18, the work will be done from the small scheme dyke in Interval 8 and from the

boulevard between the Highway and the canal in Interval 18. The surface of the west part of the dyke in Interval 8 and the boulevard in Interval 18 will be stripped to create two berms and the excavated spoil will be leveled. Once it is dry, portions will be hauled away to temporary or permanent disposal sites or to the north canal, if scheduling allows and if the soil is suitable, for berm construction.

f) Where the work is a cleanout with same time hauling, the work will be done with excavators working along dyke roads or boulevards and with loading into trucks. The materials will then either be hauled to permanent or temporary disposal sites or will be hauled to the north canal, if scheduling allows, for berm construction.

DEPTHS OF CANAL

The bottom elevation proposed for the canal system in this report is elevation 216.1. This is a metric elevation that is to apply throughout the system. In Imperial designations, this elevation would be approximately 709.0. It was noted the original elevations for the canal system were to be imperial 710 at the easterly half and 711 in the westerly half. It is further understood that when the canals were widened and deepened following the Hurricane Hazel event, that the depths provided were in the magnitude of 709± imperial data. It is further evident from various bridge drawings that exist and that were prepared in the 1960's/1970's, that the bottom elevation provided, at least through municipal structures, were in the magnitude of 710 to 711 imperial. It is felt that by providing the elevation of 216.1 metric (709.0 imperial) in this report, that some provision for sedimentation will be available and the drain's life will be enhanced.

In addition, for fish enhancement, there will be scattered areas of deep pools where bottoms will be constructed one metre deeper which will result in sections of the canal being excavated to elevation 215.1 metric (705.7 imperial). These depths will also provide for additional sedimentation and it is proposed to construct these additional depths, where possible, in areas where greater sedimentation may occur. These greater depths are to be provided at 13 locations through the project if soils permit. These areas of greater depth are proposed to be over a 200m± length at each location.

CROSS-SECTIONS FOR THE PROPOSED WORK

The cross-sections proposed for any canals involving relocation will include a 2.5 metre (8.2') wide littoral shelf at a depth of approximately 1 metre (3.3') below the design water level and then 3:1 slopes below the littoral shelf and on the opposite bank. The design water level selected (for cross-section purposes) is elevation 218.75 (717.7 imp.) which based on recent recordings of water level, is a mean water level between higher spring/early summer levels and late fall levels.

It was noted in 2008 that the spring/early summer water levels were in the magnitude of 219.0 to 219.1 (718.5 to 718.8 imp) whereas in the fall, the levels dropped to 218.65 to 218.7 (717.4 to 717.5 imp.).

The cross-section slope for the far/outside bank above the littoral shelf has been set at the steeper slope of 1:1 to 1.5:1 to recognize that peat soils will be primarily encountered at this location and that such are stable at this slope. This steeper bank will provide additional channel capacity.

The proposed/design canal widths at the design water level vary throughout the project. The water widths used for design at the elevation of 218.75 (717.7 imp) are 21m (68.9') in the north canal west of the North River and 24m (75.5') east or north of the North River until near Simcoe Road where the water widths increase to 26m (85.3') from there to the outlet. In the south canal, the water level widths from the outlet to the upper end of Interval 17 are 20m (65.6') throughout and then in the very upper portion of Interval 17 near Highway 9 where land use restricts the width, the water width is to

be 17 to 18 metres (57'±). The water widths in Interval 18 which is along the south side of Highway 9will not vary from existing and they presently are in the magnitude of 20 metres (65.6').

It is not known for sure the canal cross-section provided following Hurricane Hazel but data provided by the former Drainage Superintendent indicated that the widths provided in the canal at that time were 54 feet (16.5m) in the south canal, 58 feet (17.7m) in the north canal upstream of the North Branch River, 65 feet (20m) from the North River to east of Simcoe Road, and then 76 feet (23m) from that point to the outlet.

The former Drainage Superintendent and the Commission minutes of 1954-1955 have indicated that the depths the Contractors attempted to provide during the Hurricane Hazel cleanup was 3m (10') throughout but it cannot be substantiated that such was provided in all locations. An attempt was made to compare the canal sizes existing to the heights and widths of the dykes and fill that exists adjacent to the canals since such should represent the total materials excavated from the canals. It was found in many areas that there is a close balance only if depths less than 3 metres were used for the depths of work after Hurricane Hazel. Some areas do balance.

POSSIBLE CHANGES TO CROSS-SECTIONS

It is to be noted that the canal sizes and shapes shown by the cross-sections in this report are the goals and desired end products of construction. However, soil conditions may prohibit such cross-sections from being constructed as shown and the final decision re the cross-section that can be constructed will be the responsibility and decision of the Engineer. The need to have a cross-section that provides equivalent area will be foremost acknowledged.

IRRIGATION RECOMMENDATIONS

a) During Construction (General Discussion)

This report recognizes that there are approximately 213 existing lines crossing the canal roads/dykes (excluding Highway 9) that serve for irrigation or similar purposes. A further 19 cross Highway 9. The majority of these are strictly for irrigation. Others are for lines to fill small diameter tanks for washing, for cooling and for lawn watering. Other pipes cross the dyke to serve as outlets for wells or drainage systems, but all have to be addressed in this report, especially where the canal is relocated and always to ensure backflow is prevented.

This report has been prepared to date on the basis that the irrigation will be addressed as part of the total project. However, due to the anticipated high costs of this project, it may be necessary to have irrigation dealt with as a separate task. As part of dealing with it as a separate item, separate approaches for funding may be pursued. Even if irrigation is pursued as a separate task, the work in this report would still be prepared to recognize that irrigation extensions will be required. The main components that would still require addressing by this report would be the possible construction of clay cofferdams at sub-irrigation, and other below grade, lines and at communal lines, ensuring that logs/roots placed in the backfill do not obstruct future irrigation, ensuring that grading of backfill is undertaken to allow above grade irrigation lines to be laid as soon as backfilling is completed, and also to recognize that temporary irrigation lines will have to be constructed where the canal work is occurring.

The approach that this report has adopted at this time, however, is that it will include irrigation components as discussed in the data sheets that were submitted to all owners during the months of July and August of 2008 with the exception that the costs will be separately assessed to the owners affected but in a fashion that the costs will be eligible for the grants except where new lines or oversizing are involved. The **aerial drawings in Volume III** show the irrigation recommendations on each property,

the majority of which conform with the data sheets that were submitted. Some changes have been made for some properties as a result of the properties feedback from the data sheets. Each owner should review the aerials and the extent of work notes on the aerials, being **Drawings 15 to 51 North and 52 to 92 South** to review the irrigation recommendations on their property. Also **Appendix 6** has a table that shows the irrigation proposed per property and the costs for such. Oversizing or new lines are not included. Also a discussion of each type of irrigation work proposed is presented and discussed in detail in **Appendix 6**.

It is to be noted that there is not a separate item in the canal improvement work costing to construct imported clay cofferdams at below grade irrigation locations but an allowance for these cofferdams is included in the estimated costs for the irrigation work. The tender once issued will separate out the cofferdams and will require separate quotes for these cofferdams.

As indicated above, the costs of the majority of the irrigation work will be a separate but special benefit assessment to the owner affected but these benefit assessments will be eligible for the OMAFRA grant, where the farm is eligible for the Farm Tax Rate, and will also receive a proportionate share of the MIII grant on these assessments. As a result the owners estimated out of pocket costs for the irrigation (based on the estimates herein), if the owner is eligible for the OMAFRA grant, will be 10 to 11% of the actual cost of the irrigation provided. Where the line is a communal line the 10 to 11% cost has been divided to the owners believed to be served as shown in the schedule of assessment.

These assessments have been made as special benefits so that the owners can take direct advantage of any funding programs that may be secured and so that the owners will be billed the actual costs of the irrigation which will allow the possibility of reduced costs if lower quotes of cost are obtained.

The only irrigation works not eligible for either of these grants will be where an owner has requested oversizing, a new line where one does not exist or where the canal is cleaned only or where an additional line is requested.

The reasons why the irrigation costs are now specially assessed is that since the time the data sheets were submitted there have been comments that the landowners with irrigation lines that are affected by the canal improvement work should alone and without any sharing of the MIII grant be responsible for their own costs for irrigation. It is not believed such should apply and such has not been done for the following reasons:

1. It has been indicated to owners all along that irrigation replacement would be part of the report. It was said such at the meetings and on the data sheets.
2. It would not be fair to the irrigating owners to not address such since these owners have paid their costs for irrigation just like interior owners have, and then if such is disrupted, these owners would have to pay fully again. Even as it is now, they do have to pay some of the cost.
3. On most drainage projects, when anything is affected by the drainage project it is addressed. For example, if a fence is removed by the drain, it is replaced by the drain.
4. The main purpose of the drainage project is to provide flood protection to the whole marsh. Also the goals are to ensure that the project is done at the lowest cost which would be by relocation, and also to ensure that it can be more easily maintained. These goals are to the whole marsh area and it would be unfair for some lands to pay substantially more than others to provide a project for the benefit of all.
5. It has to be considered that the interior marsh owners have received benefits in different fashions where the costs have been assessed over the whole watershed, example the provision of the river inlet that lets water in for irrigation, the improvements to the Bardawill pumphouse, and even the cleaning of the Central River.

However, it is this report's opinion now that some of the costs of irrigation should be assessed to the irrigating owners because:

1. The owners will give more consideration to which lines truly need to be replaced.
2. The owners may better participate in the decisions to be made re line replacement work.
3. If additional funds for irrigation are obtained, such can be more directly applied to the costs.
4. The owners affected may participate more in the actual reconstruction work of the irrigation line
5. Owners may be more prepared to replace below grade lines with above grade lines.
6. Such may discourage more costly lines for small parcels.

The reasons why all above grade crossings are being replaced in canal relocation areas is to ensure an extension to the canal can be made (the existing pipes may not allow such) and also to ensure backflow measures can be properly constructed.

It is to be noted that the well work and the drain outlet work has not been grouped with irrigation and such would remain a part of the full project. As well, any contingency costs for the irrigation work has neither been shown nor assessed since the assessments to be made will be for the actual costs.

Lastly the temporary irrigation work costs (for the work to ensure irrigation can continue when the canal by the irrigation is under construction) have been left as part of the overall project. **Appendices 6 and 7** contain details of the temporary irrigation work.

If any owner elects to delete or reduce the work shown for irrigation, the owner will receive full credit or reduction for the change.

As indicated, the detailed recommendations for each irrigation type (above grade, below grade, small diameter, normal diameter, communal, temporary irrigation) is included in **Appendix 6**. The detailed specifications to guide contractors in construction of irrigation work is included in Section D of **Volume IV (the Specifications**). The responsibilities of an irrigating owner during future maintenance is discussed in the "Maintenance" section of this report.

b) Summary of Work to be Done by the Project (as a Grantable Special Benefit) and by the Owner with Respect to Irrigation

a) Above Grade Larger Diameter Lines

To summarize, the work to be done by the project will involve a new steel pipe below the dykes and through the area of the berm where such is created. The pipe will be installed with end caps and at a grade that best suits the landowner but that recognizes utilities and canal backfill. The canal side cap will allow for quick coupling of the cap and aluminum tubing and for a cap that is not easily misplaced. The project will also grade a path from the pipe to the new canal and install pallets with flotation (or equivalent) to ensure that the line can be extended by the landowner when needed to the new canal. The project will also supply a power primer to each owner (one per pump that is actually used – maximum of one per property) when it is assured that irrigation will occur with the pipe installed.

The landowner would then be responsible to supply and add other flanges, clamps, etc. to connect his pump and his lines, to supply and lay the line on the pallets (or equivalent) if necessary to attend to the inlet in the canal, to attend to any connection involving the power primer and to attend to any grade corrections across the backfill. In special cases where a new line replaces more than one line or where a line replaces a below grade line, the project will allow the costs of, or provide, the aluminum tubing to extend to the canal and the costs to supply and place the couplings. If an owner wishes a larger size

of piping than 200mm, the increased costs will not be grantable except in the instances where used to eliminate multiple lines or below grade lines.

The project will either seal or remove the existing crossings when the new are installed.

b) Above Grade Small Diameter Lines

The project will extend small diameter lines to and into the new canal with 50mm black poly tubing. The project will couple such to the existing crossing and will lay such above grade on pallets with flotation or equal at an appropriate grade. The project will also seal any annular space within the sleeve that crosses the dyke/road. The owner would be responsible to attend to any screens, support or inlet work, the eventual burial/protection/removal of the lines and any future replacement of the actual dyke crossing.

c) Small Diameter Below Grade Lines

The project will supply and install the clay base for such and will then lay small diameter (50mm± black poly) piping in a steel pipe casing sleeve on the base and extend such into the new canal. The project will in most cases just place the pipe sleeve on the clay backfill without any further support. The poly supplied will be long enough to extend into the new canal. The poly will be joined to the existing crossing and then the excavation will be backfilled. The owner will be responsible for any further inlet work and for maintaining the pipe in the future, and including any future replacement of the dyke crossing.

d) Below Grade Sub-Irrigation or Suction Lines

The project will extend these existing lines to the new canal on a clay base (and supported by posts only if determined necessary at the time of construction). The pipe will extend sufficiently into the canal or the canal bank will be excavated so that the pipe has a 300mm freeboard underneath it. The pipe will be joined to the existing crossing (one size larger piping will be used for suction lines). Where a valve exists an attempt will be made to join to the existing valve. If the valve cannot be joined to, a new one may be installed but the costs of such will be billed without grant to the landowner. The pipe will be backfilled and the owner will be thereafter responsible for its maintenance and repair (subject to the normal one year warranty), any further inlet work and for any replacement of the dyke crossing in the future.

e) Communal Lines

For communal lines, the project will extend such to the new canal using flat grades and using pipe equivalent in size but using steel pipe construction. The pipe will be installed on a clay base and supported by posts. The pipe will sufficiently extend into the canal or the canal will be excavated so that its inlet is equal to or better than existing. Any existing inlet screen will be relocated to the new pipe, or if the owners wish to supply a new screen, it will be installed. The pipe will be joined to any existing valve and if the valve cannot be joined to, a new one will be installed as a grantable special benefit to the landowners. The future maintenance of the crossing (subject to a one-year warranty) will be fully by the owners served by the communal system and the owners will also be responsible for any replacement of the dyke crossing should such be necessary in the future.

f) Warranty

For all lines once the work as described is attended to, the project will provide a one year warranty on any work it attends to and thereafter the repair, maintenance, burial, protection, improvement, replacement or adjustment of such at maintenance occasions will be the full cost of the landowners and without any grants. All work undertaken initially by the landowner will be the landowner's full responsibility to maintain, operate, etc.

g) Special Benefit

All work to be done by the project would be a grantable special benefit except where noted for oversizing or for new lines, in which cases the work is shown as a non-grantable special benefit.

c) New Lines in the Future

With respect to policies for irrigation lines crossing the canal roads/dykes and/or backfilled canal if desired after this report is completed, any owner desiring to install such new line will have to approach the Board and obtain approval to do such. Criteria that the Board may consider prior to granting approval are:

a) The need for the line.
b) The specifications to apply to any construction
c) The responsibility of the owner to pay all costs
d) The requirement for any road crossings to be constructed only after the road authority is notified and approves the work
e) The need for the as-constructed work to be tied by a surveyor or engineer to the GPS system applicable.
f) The requirement that the work when completed leaves the dyke, berm and canal backfill in the condition equivalent to or better than existing.
g) The requirement that the specifications for such work are to be in line with the specifications included in this report for the type of line involved.
h) The requirement that the drawings for such work are to be prepared and submitted to the Board together with the request for approval.
i) The requirement that any application forms that the Board has for this type of work are to be filled out and submitted to the Board when approval is sought.

d) Other General

All owners that are affected by irrigation inlets into the canal are to be advised of the following:

a) The Municipality may award a separate tender for irrigation.
b) This report has created separate cost estimates and separate schedules of assessment for irrigation (grantable special benefits) so that the irrigation work may be separated out and actual costs be levied for such but with the full benefit of the OMAFRA grants where eligibility exists and with the full benefit of the MIII grant. During tendering, a table of contingency unit prices for irrigation components will be part of the tender in order to obtain prices for various options (see data in **Appendix 7**).
c) The proposal is to have meetings with each individual owner affected by irrigation prior to the commencement of work. The items to be discussed are the timing of the canal work, the period during which normal irrigation will be affected, the need for temporary irrigation, the type of irrigation work that should be installed and the extent of work to be done by the project and the amount of work to be done by the landowner, and the cost for different options to the landowner.
d) An owner may request enlargements or extensions to irrigation if such are within the limits of the project as far as construction, provided the owner is prepared to pay the increased costs. Any increased costs to an owner are to be paid directly at the time of construction or would be added to the owner's assessment as a special non-grantable benefit assessment.
e) Where the owner has already indicated he or she wishes an additional or a larger line, the assessment schedules show a non-grantable special benefit to the owner for this extra work. The amounts shown are based on the estimates only and the actual non-grantable special benefit will be calculated using tender costs received.
f) Owners are advised that the discharge of waste (e.g. vegetable wash waters) through irrigation or drain outlet lines or by any other means into the canal is prohibited. The Drainage Act in Section 83 provides fines for pollution of municipal drains.

g) All owners are advised that the Municipalities and Board are continuing to seek alternate sources of funding for irrigation components.
h) All owners are advised that the supplied caps are to be secured to the dyke or dyke and berm crossing whenever irrigation is not occurring. Irrigation piping that extends a dyke or berm crossing to the canal is to be disconnected when not in use and the cap that is supplied, is to be secured to the pipe to prevent backflow. Similarly, if an emergency exists during irrigation seasons, where flooding is imminent, there will be notices given to all owners and each owner will be responsible to ensure that the irrigation is disconnected and that the cap for the pipe is secure. All owners are also advised that the Board may authorize inspections from time to time to ensure that owners are complying with this requirement. Failure to comply could result in the sealing of the irrigation line.
i) All owners are advised that this report has created a right of way over the canal backfill and one of the uses of this right-of-way is for use by landowners for irrigation and drain/well outlet purposes.
j) All owners are advised that the Board will be required to attend to maintenance on the canal at infrequent intervals. Notices will be given when maintenance is proposed. At that time, the landowner is to ensure that the irrigation or other lines that he has crossing the backfilled canal and the inlet into the new canal will not affect or be affected by the maintenance. Each owner should ensure that discussions occur between himself and the Board with respect to lines that may be impacted by canal maintenance.
k) The only lines that are being replaced across the canal roads/dykes as part of this report work are the normal sized above grade lines. If at any time in the future a landowner wishes to replace a small diameter above grade or any sized below grade crossing, the work will have to be pre-approved by the Board as described for new line crossings and the cost will be to the landowner(s).

RECOMMENDATIONS RE THE DRAIN OUTLETS

It has been determined that there are a number of pipes across the existing dyke roads that are used as pumped outlets for gravity drainage schemes by the landowners on the inside of the dykes. These drain outlets will be intercepted on the canal side of the existing roads and will be extended to the new canal location by small diameter agricultural plastic tubing. The work will involve couplings with connectors and clamps to the existing outlets and the installation of the agricultural tubing either on or just below the surface of the canal backfill. As well, the outlet at the canals will be protected by means of a rodent gate. A check valve (back water valve) is to be installed on the tubing, on the owner's property adjacent to the well (crock) that houses the drain outlet pump in order to prevent or reduce backflow through the dyke during high water level periods.

Marker stakes will be placed on the dyke and at the new canal level of the extended outlets.

The burial, protection, repair and/or maintenance of the line placed on or in the canal backfill will be the responsibility of the served landowner from the time of the initial extension placement by the project. As well, the maintenance of the check valve will be by the landowner.

The canal road crossing itself will remain as is. If any future road crossing is required, the work and/or costs will have to be by the landowners and directional drilling methods may be necessary.

It is recommended by this report however that the Drainage Superintendent inspect check valves randomly from time to time to ensure their operation and that he causes to be sealed or removed any drain outlets that are not served with a check valve and at the landowner's cost in accordance with Sections 80 and/or 82 of the Drainage Act.

RECOMMENDATIONS RE THE WELLS

It has been determined that there are approximately 14 canal side wells on this project. These wells are primarily drilled wells and are along the interface of the canals and the dyke roads. Most wells have small diameter feeds across the dyke/roads to the properties on the inside. Many, especially those west of Highway 400 have overflow outlets indicating that the wells are artesian. This also was noted in the hydrogeological/geotechnical report that was prepared in 2003. This report does not anticipate any impact on wells unless they are shallow/dug wells. Any shallow wells if within 30m of the canals for sandy soils, 10m for silty soils or 5m for clayey soils, could be impacted by any dewatering that may occur of the canals. It is believed there are few shallow wells and that the majority, if not all, are drilled wells.

The recommendation of this report with respect to canal side wells is that 12 of the wells be ultimately relocated away from the edge of the dyke roads and be relocated to the building side of the dykes and two of the wells that are not being used, be sealed in accordance with MOE regulations. Notwithstanding this, the initial work at these wells, and the work that is costed to date, is to protect and work with the wells where they are.

Discussions/communication with the County of Simcoe which has jurisdiction over the majority of Canal Road, which is the road developed at the north canal dyke and along which approximately 12 of these 14 wells are located, has indicated that it is the County‘s desire to relocate any such wells away from the edge of the dyke and onto the building-side lands.

This report has taken the position that if the wells are not relocated prior to or during attendance to any works that may impact the elevations adjacent to the wells, the wells are to be protected and this will be done by constructing a casing to enclose the existing wells and to protect it to above the level of any new berm or swale construction or to extend the existing small diameter steel well casing itself to above new berm or swale level. Posts or bolsters would have to be constructed around the elevated well casing to protect it from traffic.

With respect to the overflow from any artesian wells that remain, small diameter piping will be installed as part of the project to extend the overflows to the new canal locations.

With respect to the two existing canal side wells that have already been abandoned, in terms of use by the adjacent landowners, this report recommends that if the wells are not otherwise addressed by the County of Simcoe or any road authority, that the provisions of the Ministry of Environment be implemented by a licensed well driller to seal these wells as part of the project prior to any berm construction. (Costs are included to do such.)

The County of Simcoe has indicated to date that it may attend to the work and absorb the costs to relocate canal side wells to the inside of Canal Road adjacent to the building areas provided the County is able to acquire title of lands along which the road exists where such is not already in County ownership and provided release forms re existence and use of irrigation lines below the road are executed with the affected owners.

The costing in this report has assumed that any relocation of the wells will not have occurred by the time of canal improvement work.

It may be found that even if the wells are not relocated by the County in advance, that it may be necessary to relocate such in any case prior to the canal work since the wells may interfere with usage of the berm and swale, may be in the path of travelling farm equipment and will interfere with future snow clearing operations once trees are removed.

It is the understanding of this report that if any canal side well is relocated to the building side of the canal road (dyke), the artesian overflow waters, if any, will have to be directed to the landowners building side drainage system.

It is also to be noted that any existing crossing of the canal road (dyke) will not be reconstructed by this project. Should such reconstruction be necessary in the future, it will be the responsibility and cost of the landowner. A crossing by directional drilling methods would most likely be necessary when and if done.

RECOMMENDED BRIDGE WORK (INCLUDING FURTHER DETAILS OF EXISTING) (in numerical order)

The following pages describe existing conditions and recommended work at each of the thirteen bridge structures that still exist across the canals. For purposes of this report, each structure has been given a number between 1 and 15. (Two structures no longer exist.) The drawings that accompany the text herein are included as **Drawings 120 to 157 in Volume/Book 3**. (These drawings also show the breakdown of any cost estimates listed herein.) All increased costs of work required at a structure serving a road are to be assessed as special assessments to the road authority as later described herein.

All drawings for enlargements and replacements are conceptual only. When a replacement or enlargement is required, final design and approvals would have to be completed before construction. The actual cost of design, approval and construction would then form the basis of the special assessment if the Engineer of this report undertook the design, etc. The cost estimates listed do include allowance for the design approvals and supervision. If the road authority undertakes final design and construction, the special assessment to the road authority in accordance with this report will only be for the engineering to date (as listed) and the cleanout, cofferdam and guide rail work necessary to accommodate the canal work if done before the structure is reconstructed. All costing shown also includes a contingency allowance in the construction costs. The numbering of all bridges is this report's nomenclature but municipal or provincial numbering is also referred to. At the end of this section, **Table 2** is included to show the existing and proposed criteria re structure and the adjacent canals.

i) Bridge 1

Bridge 1 is located on Provincial Highway 9 over the south canal and is a 3 span bridge (MTO Structure 37-32 1 & 2). The original structure was widened to accommodate additional lanes on Hwy. 9 in approximately 2000. The original structure consisted of a 3 span prestressed concrete slab bridge. The skew angle is 45° and the span lengths* are 11.9m, 13.4m and 11.9m for a total span of 37.2m (approximately). The opening widths perpendicular to the flow are 7.29m, 9.20m and 7.29m respectively. This part of the structure is supported on steel tube piles and has concrete abutments and wingwalls. The original plans (drawings) are dated November 1966 and construction was most likely soon after. The widening, constructed around 2000, is a 3 span structure consisting of a concrete deck supported by steel girders. The new portion of the structure is supported on steel tube piles and has concrete abutments and wingwalls. The skew angle is again 45° to match the existing and the three spans are 11.074m, 15.5m, and 11.074m for a total bridge span of 37.6m. The opening widths are 7.25m, 10.73m and 7.25m perpendicular to the flow respectively. The newer structure was most likely designed as a composite structure.

The soffit is sufficiently high and the openings are sufficiently large that no enlargement work is necessary. The canal bottom is however 2.0m± above the canal cleanout grade required and as a result a moderate cleanout is required. This is the only work costed for this structure.

* *All spans quoted are bearing to bearing unless reference is made to opening widths. For net spans or opening widths, thicknesses of piers and portions of abutments would have be subtracted.*
All spans and widths quoted are approximate.
Span length is defined as the distance from the centerline of the bearing to the centerline of the pier or bearing parallel to the road centerline.

The canal will be widened to give a minimum water surface width of 18m to the north (downstream) of the structure. If it is found necessary at the time of construction, a steel sheet piling wall may be constructed in the northeast corner of the structure to accommodate the widening on the east side. Alternatively it may be possible to widen on the west side of the canal for a short length downstream of the structure to provide the 18m width without adjusting the east bank and without the necessity of steel sheet piling.

ii) Bridge 2

Bridge 2 is located on Provincial Highway 9 over the north canal and is a 3 span prestressed concrete slab bridge (MTO Structure 37-31). The skew angle is 0°, the deck width is 12.8m and the spans are 8.4m, 9.5m and 8.4m for a total length of 26.29m (approximately). The opening widths are 8.04, 9.15 and 8.04 respectively. The structure is supported on piles and has concrete abutments and wingwalls. The original plans (drawings) are dated November 1966 and construction was most likely soon after. The most recent rehabilitation took place around 2000 when new parapet walls were constructed and deteriorated concrete was patched. There is no need to perform any work on this structure as part of this report on Canal Improvements since the canal will not be shifted at this location.

The soffit is sufficiently high and the openings are sufficiently large that no enlargement work is necessary. The canal bottom is however 1.0 to 1.2m above the canal grade required and as a result a moderate cleanout is required.

The only work therefore that is required is a bottom cleanout through the structure.

iii) Bridge 3

Bridge 3 is located on Graham Sideroad in the Township of King. It is also called Bridge 00013 in the Township of King Bridge Survey. It is a 2 span structure consisting of steel girders and a concrete deck, the deck is not composite with the girders. The skew angle is 13°, the deck width is 8.5m and each 90º opening width is 6.4m for a total opening width of 12.8m. The structure is supported on wood piles and has timber retaining walls. The original plans (drawings) are dated April 1956 and it was most likely constructed shortly thereafter.

One option for improvement could be to add at least 1 span to the structure to increase the opening width to 20m. This additional opening width would recognize a canal shift and widening and undersizing of the existing structure. Other work to consider for a rehabilitation/extension of this structure could include replacing the parapet walls with a new maintenance free design and constructing new approaches. However since the soffit is so low, the deck would also have to be raised. This would make the enlargement option not realistic as every part except for the piers would be rebuilt. It would not be justified to retain 50 year old piers to support a fully new superstructure and as such is not recommended.

The alternative to rehabilitation/extension would be to replace the structure with a two span structure with an opening width of 20m. In the case of a new structure, the bridge deck would be widened to 9.9m (8m effective). The soffit would be raised by 0.3m. A comparison of construction costs for rehabilitation including deck raising versus a complete replacement could be performed in detail but preliminary costs for replacement only are set out below.

The Township Bridge Appraisal of 2004 indicated $100,000 should be spent on the structure primarily in the 1 to 5 year period

Estimated costs (in 2008 dollars) to replace structure

Construction*	$ 970,000
Engineering	230,000
Budget	1,200,000

* *All costs of enlargement or replacement listed in this section of the report do not include the engineering costs to date, the cleanout costs, the cofferdam costs, and any guide rail costs. All of these items of work, if and as necessary, will also be special assessments to the Road Authority.*

Since the existing structure is undersized, and since its soffit is too low, a full replacement is recommended and such is a requirement of this report. The replacement would have to be completed prior to canal work in the interval. If necessary and approved due to approved timing delays in the new bridge work, the bottom through the structure would have to be cleaned when adjacent canal work occurs. The costs of any temporary cofferdam, if the structure were not rebuilt prior to construction, would also be a special assessment to the Municipality.

iv) Bridge 4

Bridge 4 is located on Dufferin Street in the Township of King. It is numbered as Bridge 00012 in the Township of King Bridge Survey. It is a 3 span structure consisting of steel girders and a concrete deck. The deck is not composite with the girders. The skew angle is 40°, the deck width is 8.5m and the opening widths are 6.1m± (on skew) for a total opening width of 18m± (The opening widths perpendicular to flow (90º spans) are 3 @ 4.3m). The structure is supported on wood piles and has timber retaining walls. The original plans (drawings) are dated April 1956 and construction most likely occurred soon after.

To enlarge the structure, it would be proposed to add one span to give a 7.2m minimum opening width at 90º to flow (9.5m skew opening) to increase the total 90º opening width to 20m±. Additional work that could be considered at this structure is the replacement of the existing parapet walls with a maintenance free design and a new deck overlay with associated bridge deck waterproofing and hot mix paving of approaches and structure deck. This increase in opening width is only required to improve the hydrology at the structure, there are no plans to shift the canal on either side of this structure but minor widening will occur. Prior to undertaking a rehabilitation, a detailed structural evaluation should be performed on this structure to determine its loading capacity. If the loading capacity is found to be insufficient, then strengthening or replacement of the entire structure will be necessary.

The other option costed is a full replacement. The new structure costed would be a two span structure with 90º total opening of 20m and a minimum deck width of 9.9m (8m effective). The soffit would be raised by 0.3m±.

The Township Bridge Appraisal of 2004 indicated $202,000 should be spent on the structure primarily in the 1 to 5 year period

Estimated costs (in 2008 dollars) to increase opening width by adding 1 span:

Construction	$ 412,700 ±
Engineering	200,000 ±
Budget	625,000

Estimated costs (in 2008 dollars) to replace structure:

Construction	$ 868,600 ±
Engineering	200,000 ±
Budget	1,100,000

The report requires either an enlargement or a replacement of this structure prior to year 2015. Unless one or the other occurs prior to canal construction, the bottom is to be cleaned at the time of adjacent canal work.

v) Bridge 5

Bridge 5 is located on Jane Street in the Township of King. It is called Bridge 00010 in the Township of King Bridge Survey. It is a 2 span structure consisting of steel girders and a concrete deck, the deck is not composite with the girders. The skew angle is 25°, the deck width is 8.5m and the opening widths are 6.9m on skew (5.9m at 90º to flow) for a total 90º opening width of 13.7m. The structure is supported on wood piles and has timber retaining walls. The original plans (drawings) are dated March 1957 and construction most likely occurred soon after.

If the structure were to be enlarged (and such is not recommended), it would be proposed to add 1 opening at 7.2m (90º) to increase the opening width of the structure to 20m (90º). This extension would allow for the undersizing of the original structure and would partially accommodate the canal shift. Additional work that could be undertaken for an enlargement would include replacing the parapet wall with a maintenance free style, new concrete deck overlay along with bridge deck waterproofing and hot mix paving of approaches and structure deck. Two costly cofferdams would also be necessary to divert the relocated canal to a cleaned out or enlarged structure. Before

proceeding with a rehabilitation of this structure, a detailed structural evaluation should be performed to determine a loading capacity. It the loading capacity of this structure is found to be insufficient, and then the structure will either require replacement or strengthening. The option of enlargement is not recommended due to the canal being relocated on either side and the high cost of cofferdam work to fit to an enlargement.

A new structure should be considered rather than an enlargement since the canal is to be fully relocated on either side of the structure. Such would require an opening width of 19m and a minimum deck width of 9.9m. Only the costs for replacement are shown.

The Township Bridge Approval of 2004 indicated $70,000 should be spent on the existing structure primarily in the 1 to 5 year period

Estimated costs (in 2008 dollars) to construct a replacement structure:

Construction	964,900
Engineering	200,000
Budget	1,200,000

The report recommends that only the replacement option be pursued and further recommends that such be done prior to or at the time of canal work due to the two costly cofferdams that would be required temporarily if the structure were not replaced until later. It is believed King Township supports the early replacement of this structure and final design work is to be commenced now to allow reconstruction in 2009/2010.

vi) Bridge 6

Bridge 6 is located on Keele Street in the Township of King. It is numbered as Bridge 000011 in the Township of King Bridge Survey. It is a 2 span structure consisting of precast concrete voided slabs with a concrete deck topping. The structure is supported on concrete abutments and a concrete centre pier cap with wood piles. The structure also has concrete wingwalls. The skew angle is 40°, the deck width is 9.8m (effective is 8.0m) and the opening widths are 12.2m (on skew), for a total opening width of 24.2m. The 90º opening is 18.7m±. The construction was most likely around 1971 as indicated by the OSIM reports. Because the opening width of this structure is approximately equal to the desired (19 to 20m) and since the soffit elevation is close to that required and since there is no relocation of the canal at this structure, there are no requirements to alter this structure from a hydrology or a location standpoint. It may be necessary at some point to perform a rehabilitation to this structure from a structural capacity point of view. This would only be the case if the results from a structural evaluation/structural inspection show that there deficiencies in loading or in the condition of the structure. The Bridge Appraisal sheets in 2004 noted that $145,000 of repairs were necessary.

This report therefore does not require any work to be done to the structure other than to clean the bottom.

vii) Bridge 7

Bridge 7 is located on Concession 5 in the Town of Bradford-West Gwillimbury. It is also known as Doane's Bridge and Structure 05002 in the Town of Bradford-West Gwillimbury inventory. It is a 3 span structure consisting of steel girders and a concrete deck, and the deck is not composite with the girders. The skew angle is 0°, the deck width is 8.7m and the opening widths are 6.1m, 6.1m and 6.1m for a total opening width of 18.3m. The structure is supported on wood piles and has timber retaining walls. The original plans (drawings) are dated March 1961 and construction was most likely soon after.

If the structure were enlarged only, and such is not recommended, it would be necessary to add 1 span with an opening width of 6m to increase the opening width to better fit a canal shift. Costly cofferdams would also be necessary if the structure was enlarged only and such would have to be done initially since the canal is being relocated on either side of this structure. These cofferdams would have to stay in place until replacement occurs. Other options to consider if a rehabilitation was undertaken include replacing the parapet wall with a maintenance free design, a bridge deck overlay including waterproofing and repaving of structure and approaches and replacing the timber wingwalls with gabion baskets or green terramesh units.

A detailed structural evaluation should be performed on this structure in order to determine a loading capacity prior to considering a rehabilitation. If this loading capacity is found to be insufficient, then the existing structure will need to be strengthened or replaced.

Due to the fact the canal is being relocated on either side of this structure and due to the need for costly cofferdams to accommodate the structure where it is, replacement of this structure prior to canal work is recommended. Since canal work could occur in the 2011 to 2012± period, design work should be commended soon for replacement. A new structure would require an opening width of 24m and a 9.9m deck width (8m effective).

Estimated costs (in 2008 dollars) to increase opening width by adding 1 span:

Construction	$ 397,000
Engineering	200,000
Budget	600,000

Estimated costs (in 2008 dollars) to replace structure:

Construction	$ 1,073,600
Engineering	200,000
Budget	1,300,000

viii) Bridge 8

Bridge 8 is located on Simcoe Road in the Town of Bradford-West Gwillimbury. This is County of Simcoe structure Number 041000. It is a 3 span structure consisting of steel girders and a concrete deck and the deck is not composite with the girders. The skew angle is 12.5°, the effective deck width is 8.5m and the opening widths are 7m for a total opening width of 21m. The structure is supported on wood piles and has timber retaining walls. The original plans (drawings) are dated September 1960 and construction was most likely soon after.

This structure comes close to providing the required capacity, soffit and location and no work other than a cleanout through it is required now. The calculations indicate that the existing structure if cleaned will have close to the required capacity for the 100 year event but will be deficient re end area equaling adjacent channel capacities. There is no substantial alteration in the canal widths or location proposed on either side of it.

A review of the bridge appraisal sheets dated 2006 indicates an average service life of 11 years. No repairs were costed.

Accordingly, this report is not requiring the structure to be replaced as part of the report but it is strongly recommended it be replaced or enlarged within 10 years by the County of Simcoe. The work required now is a bottom cleanout only.

Work that could be considered in the future for this structure include adding 1 span at 7m to the structure, replacing the parapet wall with a maintenance free design, a bridge deck overlay including new bridge deck waterproofing and asphalt paving of approaches and structure and replacing the timber wingwalls with gabion baskets or green terramesh. Prior to considering a rehabilitation, a detailed structural evaluation should be performed on this structure in order to determine a loading capacity. If the loading capacity is found to be insufficient, then the existing structure will need to be strengthened or replaced. If a new structure is considered it should have an opening of 24m (2 – 12m openings) and a deck width to give 8.5m effective.

Estimated costs (in 2008 dollars) to replace structure are shown for information only:

Construction	$ 1,005,900
Engineering	220,000
Budget	1,250,000

ix) Bridge 9

Bridge 9 is located on Five Sideroad opposite River Road in the Town of Bradford-West Gwillimbury. It is listed as Bridge 02001 in the Town of Bradford-West Gwillimbury Bridge Survey. It is a 3 span structure consisting of steel girders and a concrete deck. The deck is not composite with the girders. The skew angle is 30°, the effective deck width is 8.5m and each of three opening widths (90º) is 5.9m for a total 90º opening width of 17.7m. The structure is supported on wood piles and has timber retaining walls. Construction was in 1963.

It is recommended, as a minimum, to add 1 additional span to give an additional 7.0m opening width to better fit a canal shift and widening and to improve life safety on the road side. Other options to consider for the rehabilitation

include replacing the parapet walls with a newer, maintenance free design, bridge deck overlay and waterproofing as well as repaving of roadway approaches and structure deck.

Prior to proceeding with rehabilitation a detailed structural evaluation should be performed to determine the loading capacity of the existing structure. If the loading capacity of the existing structure is deemed to be below an acceptable level, then the structure will either need to be strengthened or replaced.

If replacement is pursued and such would be the preferred alternative of work, the new structure at this location would require a 21.6m (2 – 10.8m) opening width and a deck width of 9.9m± plus additional if a sidewalk is to be provided as for the existing. If a new structure is considered, the soffit should be raised approximately 0.2m. Since there is no road overflow available at this structure, the final design may increase this opening width suggested.

Estimated costs (in 2008 dollars) to increase opening width by adding 1 span:

Construction	$ 435,700	
Engineering	200,000	
Budget	650,000	

Estimated costs (in 2008 dollars) to replace structure (without sidewalk):

Construction	$ 858,500	
Engineering	200,000	
Budget	1,100,00	(Add $48,000 if a 1.5m sidewalk is provided as part of the deck)

As for all costings shown herein, the cost of the cleanout and cofferdam work necessary if the structure were not replaced prior to canal work, is not included in the costs shown.

x) Bridge 10

Bridge 10 (KSAL nomenclature) is the overpass of Hwy. 400 over the south canal in the Township of King (MTO Structure 37-34 1 & 2). There are two structures that constitute this overpass, one structure to carry northbound traffic and one structure to carry southbound traffic. Each bridge is a 6 span structure consisting of steel girders and a concrete deck and the deck is not composite with the girders. The skew angle is 29.3°. The structure is supported on piles and has concrete abutments and piers. The approximate spacing between centerline of piers measured on the skew is 11.5m. The original plans (drawings) are dated 1948 and construction most likely occurred soon after. In the 1970's the overpass was widened to accommodate additional traffic lanes. The current deck width is approximately 18m at each structure. The two channels for canal flow have an opening width at 90º to flow of 7.5m each.

The design of the current structure has significantly contributed to canal sediments. Discharge of drainage pipes has rendered the canal through the structure being 50% to 70% filled with sediments. Also the riprap at the central piers reduces the effective opening and will make cleaning of the canal more difficult.

The report is prepared upon the basis that desirably MTO will replace the Bridge 10 overpass prior to the completion of the full canal project. If MTO undertakes such replacement, the special assessment to MTO will only be for the engineering costs and the initial canal cleaning through the existing structure plus for the cost of the temporary cofferdams and guide rails to provide life safety and flood protection until the structure is replaced.

Any replacement bridge design should recognize that the canal work on either side of Highway 400 will be a full relocation from the existing situation whereby the new canal (water edge to water edge) will be shifted by its existing width+ (1761.8 metres) to the south and will be widened to 20m (water surface) and that the old backfilled canal is to remain as a maintenance corridor.

A new structure should be designed to accommodate the new channel width and depth without the placement of piers within the canal. Also pier placement should recognize the need to clean the canal from time to time from the surface of the backfilled existing canal. A flow area below normal water levels of 40m² should be provided and a flow area of 30 to 35m² above normal levels but below the design flood level of 220.6 plus a freeboard of 0.15m should also be provided. The new structure should also ensure that a berm or new dyke road elev. of 220.75 (minimum) is or can be provided through and beyond the structure.

If MTO did not replace the structure and provide the required canal capacity, it would be necessary to excavate and add sheet piling or other similar retaining wall system to provide an additional channel for flow (minimum 6.0m opening width at 90º). The addition is required to increase the channel flow area from approximately 25m² to approximately 37m² and to provide an additional 11m²± area for 100 year flood waters.

Estimated costs (in 2008 dollars) to add an additional flow channel:

Construction	$ 990,000
Engineering & Approvals	500,000
Budget	1,500,000

As for other costings, this cost does not include the cleanout or temporary cofferdam costs which would also be a cost of construction to the Ministry. Bridge enlargement or replacement is required by the time of completion of all works to be provided in the report (estimated to be 2014 to 2015). This report strongly recommends replacement rather than enlargement at this structure.

xi) Bridge 11

Bridge 11 (KSAL nomenclature) is the Hwy. 400 overpass over the north canal in the Town of Bradford-West Gwillimbury (MTO Structure 30-334 1 & 2). There are two structures that constitute this overpass, one structure to carry northbound traffic and one structure to carry southbound traffic. Each bridge is a 6 span structure consisting of steel girders and a concrete deck. The deck is not composite with the girders. The skew angle is 6.61° and the span lengths are 11.5m (bearing to bearing) for a total span of 69m±. The structure is supported on piles and has concrete piers and abutments. The original plans (drawings) are dated December 1948 and construction occurred most likely soon after. This original structure was widened in the 1970's to accommodate additional traffic lanes on Hwy. 400. The deck width of each structure is now 18m±). There are two channels for canal flow through the overpass. One has an 8.0m and the other has an 8.3m opening width at 90º to flow.

The existence of riprap at the piers between the two canal channels will render cleanout more difficult and such reduces canal capacity.

The desirable approach for this structure would be for the MTO to replace it and to provide a new structure with canal capacity of 50m² and overflow capacity also of 45 to 50m². However, it is understood any improvement or replacement, unlike the south canal overpass, is not in the planning and design stage by MTO at this time and any such work by MTO may not occur for some time in the future or not at all.

If MTO did propose a new structure here the design would have to recognize the canal shift proposed, the maintenance to be done from the backfilled canal and the minimum berm or canal road elevation of 221.40.

It could therefore be necessary to add sheet piling or other similar retaining wall system to add an additional channel for flow (8.5m minimum 90º opening width). The additional flow channel is required to increase the flow area from approximately 30m² to approximately 50m². There have been reports that the water level drops upwards of 150mm from upstream to downstream during heavy flow conditions. This indicates that the structure is confining the flow. The additional flow area should relieve this confining action thereby lowering the water levels upstream. The additional canal section would increase the overflow area from 40m² to 60m²±.

Estimated costs (in 2008 dollars) to add an additional flow channel:

Construction	$ 990,000
Engineering & Approvals	500,000
Budget	1,500,000

As for other structures, this cost does not include the cleanout or temporary cofferdam (necessary now) costs which would also be a cost of construction to the Ministry.
Bridge enlargement or replacement is required by the year 2015.

Desirably this structure should be replaced rather than enlarged but if MTO cannot provide for the replacement by the 2014 or 2015 time period, enlargement of canal capacity will be necessary.

xii) Bridge 12

Bridge 12 is located on Canal Road in the Town of Bradford-West Gwillimbury. It is a single span structure consisting of steel girders and a concrete deck. The deck is composite with the girders. The skew angle is 0°, the effective deck width is 8.5m and the opening width is 18m. The structure is supported on steel sheet piles which also serve as abutment walls and wingwalls. The original plans (drawings) are dated August 1987 and construction was most likely soon after.

There are no plans to replace or rehabilitate this structure since the canal will not be shifted and since no flow problems have been noted at this structure. Further, there are no indications of poor performance of the existing structure from a hydrology standpoint or from a maintenance aspect. Adding additional spans to this structure would be nearly impossible based upon the design used and as such modification to this structure would require a completely new structure.

Since it is a single span structure, it has not created any observed ice impacts. With the available end area and the calculated flow velocity, the structure is quite close in capacity required for the 100 year event.

The Simcoe County appraisal sheets show an average life expectancy of 15 years and it is suggested structure work should be undertaken by that time.

The only concern is the soffit elevation of the structure. When and if the structure is replaced, the soffit should be 0.3m higher and the opening width would then be recommended at 24m minimum for a 2 span structure.

For now, there are no plans for changes at this structure now, other than a bottom cleanout.

xiii) Bridge 13

Bridge 13 was a private bridge located east of Tornado Street over the north canal in the Town of Bradford-West Gwillimbury. It was a narrow multi-span wood structure that served as a footbridge to connect to 3 small lots. Removal of the structure has already occurred. There are no further plans for any structural works at this location.

xiv) Bridge 14

Bridge 14 was a private bridge located east of Dufferin Street over the south canal in the Township of King. The original structure was a multi-span wood structure. The structure was removed in 2007. The access provided by the former structure is now constituted by realigning the driveway to connect with Dufferin Street further south from the canal. This involved installing a new 900mm diameter roadside entrance culvert and a pair of 1900 x 2500mm arch culverts at the creek crossing. The new culverts were designed to adequately serve the hydrology requirements of the various agencies involved. Construction of the new laneway and associated culverts took place in Fall 2007. Demolition and removal of the existing structure other than some piers has already occurred. Since the need for this structure has been eliminated, there are no plans to replace this structure.

xv) Bridge 15

Bridge 15 is a private bridge located west of Five Sideroad over the north canal in the Town of Bradford-West Gwillimbury. The structure is a 17m seven span wood structure but the outer 2 spans are not effective. The original abutments exist in the outer two spans. Because of Bridge 15's undersizing, there would be a significant impact to the flow in the canal in peak flow periods. The multiple number of piers would also affect ice condition flow.

The preferred alternative would be to construct a new private access road from Five Sideroad to the west just north of the canal and to remove this crossing entirely but an acceptable alternative is to enlarge or replace the structure.

The recommended canal work is to shift the canal partially away from the road through this interval. This would require adding at least one opening width at 7.5m to account for the canal shift plus another opening width at 7.5m to account for the under sizing of the existing structure. This would result in an effective structure span of approximately 23m if the two opening widths of 4.4 and 3.4 were retained.

With respect to elevations, the structure should be raised so its deck elev. is 221.2 minimum (approx. 450mm higher) (desirable is 221.35) and so its soffit is 220.75 (approx. 300mm higher).

The report is prepared on the basis the owner will be allowed the equivalent cost to construct a private laneway access and he can then apply such allowances to the cost to enlarge and raise or to replace the existing structure but to the report's requirements for area and elevation as shown on the applicable drawing. If the structure is not enlarged or replaced to provide the required, capacity, it must be removed as part of the project. The removal costs would be deducted from the allowance to the owner.

Since the landowner would be responsible for the design and construction of any enlargement or replacement to this structure to provide the required end area and clearance, the landowner would be responsible for all maintenance and liability re the structural aspects of this bridge. This report has made no determination that any of the existing components of the structure are structurally capable of being retained or added to by any work proposed by the landowner.

TABLE 2 - HOLLAND MARSH DRAINAGE SYSTEM BRIDGE ANALYSIS

	NORTH CANAL							SOUTH CANAL					
Structure	2	15	9	11	7	8	12	1	10	5	6	4	3
Characteristics	Hwy 9 North	Verkaik	5 Sideroad	Hwy 400 North	5th Line	Simcoe	Pump-house	Hwy 9 South	Hwy 400 South	Jane	Keele	Dufferin	Graham
Exist. Bottom (low elev.) (approx)	217 to 217.5	217.3	217.0	216.7 to 217.6	217.0	216.7	217.0	218 to 218.2	217.5 to 218.2	218.6	217.6	217.2±	216.7
Exist. Soffit (approx)	220.89	220.46	220.55	N/A	220.43	220.38	220.05	220.91	N/A	220.4	220.6	220.22	220.1
Proposed Soffit													
Orig SWMM	221.0	220.85	220.85	N/A	220.35	220.2	219.8	221.0	N/A	220.8	220.8	220.5	220.1
Revised	N.C.	220.75	220.75		220.5	220.4	(220.4 if redone)	N.C.		220.7	N/A	220.5	220.4
* Exist. Opening Widths (at 90 deg. to channel)	8.4 9.5 8.4	3.4 4.4 3.2	3 @ 5.9	1 @ 8.0 & 1 @ 8.3 for canal channel	3 @ 6.1	3 @ 7.0	18	2 @ 7.3 to 8.0 1 @ 9.2 to 10.7	2 @ 7.5	2 @ 5.9	2 @ 9.35	3 @ 4.3	2 @ 6.4
* Proposed Additional Opening Width if Structure is Extended (at 90° to channel)	N/C	Exist. + 2 @ 5	Exist. + 1 @ 7	Exist. + 1 @ 8.5	Not Recom.	N/C	N/C	N/C	Exist. + 1 @ 6.0	Not Recomm.	N/C	Exist. + 1 @ 7.2 min	Not Recomm.
* Proposed Opening Width if New Structure (face to face of abutments but incl. piers at 90°)	N/C	23	2 @ 10.8	24 If done by MTO	2 @ 12	24 if & when redone	24 if & when redone	N/C	20 If done by MTO	2 @ 9.5	N/C	2 @ 10.0	2 @ 10.0
100 Yr WL Existing I-D	221.0	221.2	221.25	221.25	220.4	220.2		220.4	220.3	220.3	220.15	220.1	219.9
Condition - Revised KS	220.9	220.6	220.6	220.5	219.9	219.9	219.45	220.75	220.6	220.5	220.4	220.2	219.9
- Original KS	221.0	220.75	220.75	220.6	220.05	220.0	219.2	220.9	220.9	220.75	220.6	220.3	219.8
100 Yr WL with Improvement (Short Term)	220.4	220.3	220.3	220.2	219.8	219.8	219.45	220.4	220.35	220.35	220.15	219.9	219.7
100 Yr Flow (cms)	28	29	29	36	36	37	37	13	13	13	24	29	33
100 Yr Velocity (m/s)	0.4	0.4	0.4	0.45	0.5	0.5	0.7	0.3	0.2	0.2	0.4	0.45	0.6
Adj. Canal Proposed End Areas	30-35	30-35	30-35	40-45	40-45	40-45	45	30-35	30-35	30-35	30-35	30-35	30-35
Existing Normal Flow End Areas After Cleanouts	27	15	28	27	36	35	24	30	25	19	34	22	17
Existing Normal Flow End Area if Enlarged	N/A	35-40	46	47	49	N/A	N/A	N/A	37	38	N/A	35	39
Normal Flow End Area if New	N/A	(By Owner)	50	50	54	62	N/A	N/A	40	45	N/A	49	45
Overflow End Area Existing	44	20	30	38	32	34	27	45	30	19	32	28	13
Overflow End Area If Enlarged	N/A	40±	42	58	42	N/A	N/A	N/A	41	32	N/A	28	26
Overflow if New	N/A	(By Owner)	40	45 to 50	43	38	N/A	N/A	30 to 35	38	N/A	36	32
Comments	A bit small in flow area but OK for 100 yr flow Cleanout only	To be redone by owner or to be removed now and prior to canal work	Enlarge or replace** now. Clean and cofferdam if not done prior to canal work	Enlarge or replace ** now. Clean and cofferdam if not done prior to canal work	Replace now and prior to canal work.	OK for now but should be enlarged or replaced in future. Cleanout now	Bridge has not exhibited ice problems due to it being a single span. Soffit is low. OK for now but should be redone in future and with higher soffit Cleanout now	OK Cleanout only	Enlarge or replace** now. Clean and cofferdam if not done prior to canal work	Replace now and prior to canal work.	OK - No work other than cleanout	Enlarge or replace** now. Clean and cofferdam if not done prior to canal work	Replace now and prior to canal work

* All spans are at 90 deg. to channel and are approximate.
All dimensions are in metres.
Elevations are A.S.L. metric (geodetic)
N/A - not available N/C - no change

Note: Highest 100 Year flood levels for existing conditions plus 0.15m freeboard are used.

** Report will allow final enlargement or replacement to be delayed but to be done prior to time of completion of all report work. This decision, to allow delay, is in part based on the Board's intent to ensure openings of existing structures are maintained in a cleaned condition and to ensure that a best efforts approach is given to reduce potential ice impacts at these structures until enlargement or replacement occurs.

Note: It is a recommendation of this report that the abutments of all new bridges if not concrete full depth be sheet piled full depth, to avoid sloughing at times of cleanout.

TRAFFIC PROVISIONS

As the construction specifications indicate, the requirements of this report are that a minimum of one lane of traffic be maintained on all canal roads/dykes wherever possible. This may require where normally two lanes exist, the provision of flagmen and/or traffic lights or other methods to control the movement of traffic. Where two lanes can remain but construction is occurring adjacent to such, appropriate signing will be in place. Where one lane cannot be maintained, the road will be closed and a detour will be advertised and then signed. Wherever detours are provided, the Contractor will be required to maintain local access. There would only be for short periods when a specific laneway could not be used due to construction equipment working on the dyke immediately adjacent to the laneway. But access from one end or the other is to be maintained at all times for local and emergency traffic.

Where work occurs along provincial Highway 9, the requirements of the MTO will be observed with respect to construction signage and activities. Individuals experienced in design of Traffic Plans related to Highways will be retained and their recommendations, once approved, will be implemented.

ESTABLISHMENT OF CONTRACTS

The construction of the works in this report have been subdivided into three principal contracts. Each principal contract will have a subcontract portion involving the berm work. It is anticipated that the contracts will be attended to in the sequence listed. However prior to the tendering of any succeeding contract, the Municipality and the landowners are to agree as to the time of tendering the contract construction.

The report indicates that all design/report engineering costs may be billed initially. The construction costs and the supervision for each contract are to only be billed out when incurred. Similarly any allowances to be paid would only be paid out upon the completion of the work in the specific interval.

It is anticipated that billing of costs will be undertaken at intervals and may be undertaken at the completion of each contract or such may be undertaken after the completion of one or more contracts. This decision will be that of the initiating Municipality or the Board after review and discussion with the Engineer..

MISCELLANEOUS RECOMMENDATIONS

a) Legal Survey Bar Replacement/Identification

It is recommended an attempt be made by this project to field locate all survey bars that may be affected by construction. The Engineer will have attempted to make such determination but may not have all applicable plans. It will be the responsibility of each owner to notify the Municipality, the Board, the Drainage Superintendent and/or the Engineer of any bars that may be impacted by canal relocation or other improvements. The Engineer will then attempt to have each survey bar that may be damaged or destroyed identified using the co-ordinate system or other survey methods. An Ontario Land Surveyor will be retained to ensure that sufficient documentation of such bar removal is provided to allow for continued property definition and/or will replace bars removed with witness bars or equivalent if such is deemed necessary. Any documentation prepared by the land surveyor will be available for use when necessary. The procedures followed will be in accordance with Ontario Land Surveyor practice.

There is a separate item in the general administration portion of the cost estimate of this report for the costs of an Ontario Land Surveyor to attend to such bar identification

and/or replacement or witnessing as necessary. Actual costs incurred will be the costing for this component of work.

b) Right of Way over Canal Backfill

This report has been prepared on the basis that all sections of backfilled canal and all dykes or canal roads are to be available for future maintenance of the canals. Upon the adoption of this report by bylaw, the lands that formerly contained the canal and also the lands that contain the dyke as well as the lands that contain the new canal and the maintenance and buffer strips are to be considered as part of the drainage system and access and use of these lands for drainage and/or irrigation purposes may continue and are to be kept free and clear. Where deemed to be required, new allowances pursuant to Section 29 of the Act have been recommended. This right of way over dykes and canal backfill will allow adjacent landowners to maintain and operate the irrigation lines, etc. recognized by this report and/or later approved by the Board. It is the opinion of this report that all such lands either were formerly or are herein sufficiently allowed allowances for such right of way.

c) Creation of New Private Structures Across the Canal

Generally new private crossings are discouraged. However if any owner should wish to create a new bridge crossing of the canal, he is to approach the Board for approval to do such. The data that may be necessary to be submitted will include plans prepared by a Drainage and Structural Engineer to show the type of crossing proposed. Any crossing proposed must provide an end area and soffit elevation equal to or greater than any downstream structure that has been improved pursuant to this report and must be equal to or greater in end area than the adjacent canal cross section. The soffit must be equal to or greater than that evident from the table of bridges included on **Table 2 (on Page 6)** as related to the nearest upstream bridge and is to be a minimum of elevation 220.5. No more than one set of piers is to exist in the canal. The structure is to provide the bottom elevation of 216.1. The deck elevation at the structure is to be to the minimum elevation of the flood line plus 0.15 metres (6") as evident from the profile drawings. All costs of construction, maintenance, repair or improvement to a structure are to be paid by the owner. The owner will acknowledge that he will be responsible to attend to any works of repair, improvement or maintenance of the structure when directed by the Municipality or by the Board, or he will be assessed the costs of any such work if undertaken by the Board. The owners will have to acknowledge that any costs of canal maintenance or repair undertaken by the Drainage Superintendent within 30 metres of the structure will be separately assessed to the owner of the structure. The owner also is to be aware that he will be responsible for obtaining and implementing all environmental approvals to construct such crossing.

The Board will also have its Engineer review all drawings and such drawings must be stamped "Approved" by its Engineer prior to construction. The costs of the Board and its Engineer are to be paid in advance by the applicant.

d) Creation of New Municipal Structures across the Canal

Should any road authority wish to construct a new crossing of the canal, the road authority will be responsible for all costs and obtaining and implementing of approvals to do such. The criteria for opening areas is to be as set out in the table of structures on **Table 2** of this report and is to provide capacity equal to the nearest downstream structure that has been shown in the table. The soffit is to be equal to or greater than the nearest upstream structure shown in the table and is to be no lower than elev. 220.5. The road elevation is to be equal to or greater than the flood line shown on the drawings plus 0.15 metres. The bottom elevation of the structure is to be 216.1. The cross-section through the structure is to be equal to or greater than the cross-section of the downstream channel as designed herein. Cofferdams or pilings are to be provided as recommended by the Board. The design should provide for abutments

(either concrete or interlocking sheet steel piling) that prevents sloughing of backfill materials when the canals are cleaned through bridges during maintenance. All drawings are to be prepared by a structural engineer of the Road Authority and are to be reviewed by a drainage engineer selected by the Board and are to be stamped "Approved" by the Board's Engineer prior to construction occurring. All costs of the Board and its Engineer are to be paid by the applicant. If the criteria is already set out in **Table 2** of this Report for the structure, that data shall be applied.

e) Allowances for Fill Storage

It is recommended that an allowance be created in the cost estimate of this project to reimburse landowners whose property is approved and used for temporary or permanent storage of excavated or imported materials that may be used for cofferdam berm or canal backfill construction. The rate to be paid to any such owner is to be at the rate of $2,000 per hectare for bush lands and $4,000 per hectare for cleared or previously cleared lands that are not used for agriculture, and an amount between such where the land use is between. The Engineer will use these rates as criteria in establishing the amount to be paid to a landowner. Cultivated agricultural lands will not be used for fill storage. The specifications describe the work that would be necessary to prepare and restore any site that is used. A number of owners have indicated to date that their property could be considered for fill storage. However, approvals have not yet been obtained for any other than one east of Keele Street and as result the allowance is necessary so that owners of approved sites can be compensated.

f) Allowance for Future Access

Since it has not yet been determined where additional access routes may be required, and whether such will be approved, it is recommended that an amount be contained in the cost estimate to provide for payment to landowners for future access routes. Generally the amount to be paid to an owner for a typical access will be $2,000. This is on the basis that the Contractor maintains the access during construction and restores it upon completion. Where lengthy access routes are used, the rate for compensation shall be at the rate of $4.00 to $6.00 per metre depending on land use. The Engineer will use these as criteria in establishing the specific amount to be paid to an owner for access.

g) Environmental Mitigation, Sampling, Monitoring

It is recommended also that the cost estimate include a sum of money to allow for future sampling and monitoring as contained in the sediment sampling and monitoring plan which is attached hereto in **Appendix 9**. It is also recommended that the cost estimate and tender documents provide for the implementation of the commitments required as a result of the CEAA study as included in **Appendix 5** of this report.

h) Roads

It is recommended that where paved or granular roads are used by the general public and where such are used by canal construction activities, any reconstruction of such roads be by the Municipality. However it is recommended that the cost estimate include a sum to restore private roads by grading and the application of gravel where such are used by the construction activities. It is also recommended that on-going mud and dust control during construction on all roads be attended to by the Contractor, and that any snow or ice removal that is required by the Contractor in addition to that normally or routinely provided by the Municipality be attended to by the Contractor.

It is a further recommendation of this report that where any road authority desires to raise the elevation of the road where the road is on one of the dykes, and to widen such and create a platform for such in lieu of constructing a berm beside such for flood prevention and where

the road authority agrees that it will raise such road if and when directed by the Board due to later settlement, or acknowledges that it will be assessed the costs of any reconstruction attended to by the Board for flood protection where the road authority does not do such, the road authority may replace such berm with an elevated road to the elevation of the berm called for in this report. The Board will require to be satisfied that the blending of such raised road to adjacent properties is satisfactorily addressed, and that access to the canal edge for irrigation or other water supply or disposal purposes is attended to. Any costs in this report for berm work including the drainage for the berm may be transferred at the estimated amount, to the Road Authority to apply towards their costs to raise the road.

An addendum to this report to recognize that the raised road has replaced the berm and to recognize the maintenance of this road will be necessary. All construction costs beyond the costs of the berm replaced would be to the Road Authority.

i) Private Bridge No. 14

In Interval 10, the intention was to provide for the removal of the private Bridge 14 and to provide for construction of a gravel lane as an alternate improvement to this access in accordance with Section 18 of the Drainage Act. The intention was to provide for a payment for the right-of-way across J. Hovius for this lane and to pay for the construction of the laneway.

Due to the deteriorating condition of the bridge and the length of time to finish the report, the bridge and lane had to be removed/built respectively prior to the preparation of the report.

The undersigned engineer provided the design and obtaining of approval in order to construct the lane.

Accordingly it is now deemed appropriate to provide an allowance of $5,000 to J. Hovius pursuant to Section 29 for the right-of-way and $55,000 to S. Hovius for existing drain (Section 31).

However, since $21,700 of this cost has been now paid by Bradford-West Gwillimbury for the engineering, environmental and approvals work using the Marsh account as created by annual Marsh levies, the net payment pursuant to Section 31 to S. Hovius is to be $33,300, with the balance of $21,700 to the Town of Bradford-West Gwillimbury to reimburse the drain account.

These allowances recognize that this is an alternate form of access and is part of the drainage works for future use. Maintenance of the access is however to be by S. Hovius or at 100% of cost to S. Hovius.

j) Private Bridge No. 15

It is recommended that this bridge be removed and that a loss of access allowance of $60,000 be paid to the owners of private Bridge No. 15. Such sum of money would represent the costs of private laneway construction off of Five Sideroad and may be applied to the cost of bridge work if the owners wish to improve or replace the existing structure rather than to provide a private access. This is also consistent with the recommendations of the draft preliminary report and prior considerations that were made. As indicated elsewhere herein, any reconstruction of the private bridge has to implement the criteria established herein for it in **Table 2** and on **Bridge Drawing 156 in Volume 3** of this report. Any work done would have to be paid and maintained privately.

k) Hydro Line Relocation in Interval 11

It is recommended that the cost estimate include a sum of money to provide for the temporary removal and replacement of the private hydro line along the dyke road in Interval 11.

l) Docks

This project is prepared on the basis that each owner will be responsible for the removal of any dock that is in the existing canal prior to the excavation work. If the owner does not remove such prior to the attendance to the work, the project will remove the dock and will dispose of and/or will bury such in the canal backfill. If the owner wishes to construct a new dock in the new canal, such dock construction must be approved by the Board and by all applicable agencies having jurisdiction and must be a floating dock and be sufficiently secured that it is restrained during high water periods. It must be constructed also so that the owner can remove it during maintenance periods.

m) Stockpiling of Earth Fill

It is recommended that the Board designate properties that may be used for the temporary stockpiling of suitable and low cost earth fill that may be brought in from outside of the marsh area for canal cofferdam construction. Since the stockpiling of fill will save such a great cost, if the Board is unable to do such, the Drainage Superintendent and the Engineer should attempt to locate such sites using the allowances created for such in the cost estimate. It is recommended that the quantity of such materials in any location be confirmed with the Engineer and also that samples of all material be obtained and tested prior to the importing of such. The cost estimate in this report has been prepared on the basis that low cost imported materials suitable for cofferdam construction will be made available prior to or during the canal improvement project. It is also recommended that if the right to use suitable properties is obtained that work commence as soon as realistic to bring in suitable soil and stockpile such for upcoming canal work. A total of 50,000m³ may be required throughout the full project. The cost estimate includes an allowance to compensate owners for use of properties for this purpose.

n) Attendance to Work at Structures

Further to recommendations in the bridge section of this report, it is to be re-emphasized that all required works on the structure are to be attended to by the road authority or by the Drainage Engineer at the cost of the road authority as a special assessment prior to certification of completion of this project. Each road authority is to be aware that the passage of a bylaw to implement this report will make it mandatory that the recommended works in the report regarding bridges are attended to. Only if the recommendations are overturned by appeal could the proposed work not be implemented.

o) Board/Municipality Attendance to Work Items

If any of the items of work in the cost estimate are attended to by the Board and Staff and/or Municipality with the approval of the Engineer, the amount shown in the estimate is to be paid to the Board/Municipality for the work and would not be included in the Tender. Examples of such would be the supply and placement of seeding and planting along any berm area.

p) Long Term Property Purchase

It is recommended that the Board consider the acquisition or long term lease of a property by one of the Municipalities and within close proximity to the Holland Marsh Drainage System for disposal of materials that have to be hauled away during future canal cleanout projects. This property would also be of use, if acquired early, for the purposes of surplus excavation storage, for the storage of imported materials that may be used for embankment construction

and as a site to excavate for materials needed for cofferdam construction. It is felt that this acquisition cost of this property could be a part of this canal improvement project and/or could be a future maintenance item and be eligible as a future maintenance cost. The Board should be prepared to license such property under the Pits and Quarries Act.

q) Purchase of Miscellaneous Materials that May be Necessary for the Canal Improvement Project

Should miscellaneous materials in good condition become available, such as used or surplus interlocking sheet steel piling, or environmental material, the Board should consider whether the acquisition of such may reduce costs of the project and if so, should consider the acquisition of such as part of the project and out of the general contingency allowance.

r) Condition Surveys

It is recommended that a condition survey of all building structures within 10m of an existing dyke face or within 10 metres of the outside of any canal excavation be carried out prior to canal excavation. Special consideration is to be given to any structures located within 3 metres of the dyke face or canal to determine whether protective measures are warranted. The dyke face will be that location that would exist if the lands had not been graded to the dyke. The costs for such are to provided for in the general contingency or administration allowance.

s) Emergency Work, Etc.

It is recommended that this report carry a contingency sum that in part can be applied to the costs to open up any section of canal cofferdammed off, to allow it to serve during a flood event. This construction contingency sum will also provide for reconstructing the cofferdam to allow the excavation work to carry on once the flood event has passed.

t) Lateral Channels

It is recommended that the cost estimate and the specifications provide for protection at the mouths of intersected lateral channels. This will involve placement of root masses and/or riprap to reduce/minimize erosion and the possible construction of sediment ponds in the channel where environmental approval is obtained.

OVERALL SUMMARY OF MAIN RECOMMENDED WORK

Approximate Lengths of Each Type of Recommended Work

27.9 km of canal work

- 9.9 km± to have relocated canal with new and adjacent berm
- 5.6 km± to have relocated canal with no berm
- 1.9 km± to have partially relocated canal (if possible) (in areas of bridges and buildings close to canal)
- 5.1 km± to have bottom cleanout with leveling on adjacent lands
- 3.8 km± to have bottom cleanout with partial leveling hauling of balance
- 1.6 km± to have bottom cleanout with full hauling

Other Aspects of Recommended Work

- 2 Highway 400 crossings to have enlarged channel sections between piers or to be replaced such that required capacity is provided
- 5 Municipal structures to be enlarged or replaced
- 1 private structure to be removed or enlarged or replaced
- 214 irrigation inlets to be improved, replaced or constructed
- 14 wells to be addressed

- 4 drain outlets to be addressed
- Continuous fish and wildlife reconstruction/enhancement, littoral shelves, turbidity curtains, silt fences, and sediment ponds to be implemented
- Guide rails to be constructed in selected areas
- Temporary cleanout to be done at most structures
- Buffer strips to be graded and seeded adjacent to worked fields
- Raising and widening of earth dykes to be carried out where required

MISCELLANEOUS RECOMMENDATIONS/REQUIREMENTS FOR ALL LANDOWNERS

a) Preservation of Dykes

All landowners are advised that cropping on, storage on or use of any dyke other than for access purposes is not to be undertaken. The dykes are to be available at all times for future maintenance and emergency activities and are not to be damaged by construction, excavation, fill or by storage/deposit of any materials on them. If such should occur, the Municipality will consider it as damage to the drain in accordance with Sections 80 and 82 of the Drainage Act and the owner will be required to correct such or will be levied the costs of the Board to attend to such if the owner does not do such.

b) Waste Discharge

All owners are directed to Section 83 of the Drainage Act which prohibits the discharge of polluted waters into drains and which provides a penalty for such. Discharge of wash waters will be considered as polluted waters by the Board.

c) Maintenance of Areas of Canal Backfill

Similar to the provisions for not obstructing or damaging dykes or canal roads, the area of any canal backfill is also to be maintained free of any blockages and debris and is not to be used as a storage site or as a site for excavation or fill. The site is to be available for future maintenance and emergency activities by the Board and Drainage Superintendent. The canal backfill may be used for irrigation, water supply or drain and well outlet purposes.

d) Review with Tenants

It is recommended that each landowner review the Extent of Work notes and Aerial Drawings (see **Volume/Book 3**), specifically with respect to the irrigation and well recommendations with any tenant so that decisions formulated for irrigation will also consider the tenant's requirements.

In some instances, the Engineer may meet with various tenants since these tenants are involved with numerous irrigation inlets on their own properties. It would be appropriate for each owner to therefore discuss irrigation with their tenants.

e) Sites for Material Stockpiling

The previously submitted property data sheets indicated that the Engineer was interested in speaking to any owner that is prepared to accept surplus excavated materials, either on a temporary basis or permanently. Some owners responded favourably that they would be prepared to consider stockpile uses on their property. To date, the Engineer has not been able to fully follow up with all owners, but such will be done prior to contract tendering. If any other owner is so interested, he should contact the Board, Drainage Superintendent or Engineer. Allowances (compensation) will be made to the owner for such sites if used for stockpiling.

ASSESSMENT PLANS (FIGURES) AND CONSTRUCTION DRAWINGS

i) Assessment Plans (Figures) (In Volume/Book 2)

The location of the Holland Marsh Drainage System is shown on Figure 1, an overall plan (which also shows the full watershed). Figures 2 to 3 are index plans of the rural lands and the following 23 Figures are detailed enlargements of the Holland Marsh Drainage System rural watershed. Following the rural enlargements are index maps and enlargements for the urban Bradford areas. Following these are index plans for the urban areas in King and then the actual enlargements of urban King areas. These allow an owner to locate his property within the watershed area. Reference is required to first of all to the index plans and then to the individual map enlargements. These assessment plans are contained in Volume 2 of the report, just following the assessment schedules.

ii) Construction Drawings (In Volume/Book 3)

The location of the Holland Marsh Drainage System is shown on an overall plan Drawing 1, the watershed plan. Drawing 2 is an enlargement of the Marsh area and shows the components of the Holland Marsh Drainage System. Drawing 3 is an overall plan showing the canals and the 18 study intervals, the overall work required and contains a list of the other construction drawings. Drawing 1 is included at the start of this report and is repeated in Volume/Book 3. Drawings 4 to 14 show detailed plan enlargements along the canals and also contain the profiles for the proposed work (The profiles show existing dyke elevations, existing canal bottom and proposed canal bottoms. As well, canal water levels are indicated and the various design 100 year water levels are plotted. Bridge soffits and bottoms are also indicated. Soil boreholes are also included on these drawings.) Seventy eight aerial drawings then following Drawing No. 14. These drawings have their own numbering system (aerial drawings for North Canal 15 to 51 and for South Canal 52 to 92). These are further enlargements to a scale of 1:1000 based on aerial photography (2005 vintage) that show work notes (Extent of Work) on each sub-length of the system. (These drawings show landowner names, ownership lines, irrigation lines, width of clearing and leveling and canal work proposed). Drawings 93 to 116 are the cross-section drawings related to the proposed canal work. Drawings 117 to 119 show miscellaneous details. Drawings 120 to 157 are the bridge drawings related to the 13 bridge structures that cross the Holland Marsh Drainage System and show both existing conditions plus any required/ recommended improvements. All of these Construction Drawings are contained in Volume 3.

COST ESTIMATE (OVERALL)

The cost of the project has four components – a) the allowances, b) the construction costs, c) the engineering costs and d) the supervision and administration costs. These are set out in detail in the following sections.

a) Allowances

Allowances are monies that are paid as compensation to owners for use of lands for construction of drainage works and/or for damages to crops or land uses on the land during construction. They are sums of money that the Drainage Act requires to be provided. The Engineer sets out the amount of the allowance in his report and then at the completion of the project (at the time of the billing of costs), the allowances are subtracted from any assessment due and the surplus, if any, is paid to the owner. The allowances to be provided in the report are set out below. These allowances have been calculated using rates for lands and crops resulting from discussions with and input from the Holland Marsh Drainage System Joint Municipal Services Board and by local representatives of the area.

In the Drainage Act process, the project does not acquire title for any properties that are required to be used, but it does compensate the owner for the use of the land. These allowances (Section 29 allowances) have to be pre-determined by the Engineer, set out in his report, and they can only be changed on appeal to the report.

The actual wording of Section 29 of the Drainage Act is as follows:

The engineer in the report shall estimate and allow in money to the owner of any land that it is necessary to use,

(a) for the construction or improvement of a drainage works;
(b) for the disposal of material removed from drainage works;
(c) as a site for a pumping station to be used in connection with a drainage works; or
(d) as a means of access to any such pumping station, if, in the opinion of the engineer, such right of way is sufficient for the purposes of the drainage works, the value of any such land or the damages, if any, thereto, and shall include such sums in the estimates of the cost of the construction, improvement, repair or maintenance of the drainage works. R.S.O. 1990, c. D.17, s. 29.

Section 29 allowances of the Drainage Act provide for the payment of allowances to landowners who have, on their property, a portion of new drain, as a result of the improvement, that has not existed or been constructed pursuant to a previous report. This allowance compensates the owners for land used to accommodate the drain (right-of-way), access routes to the drain and for right-of-way alongside the drain for construction and maintenance purposes.

To ensure that the dyke that exists along the canal and that the existing canal itself can be used for construction and maintenance purposes, a small allowance is included in this report to any owner on whose property an earthen dyke or the canal exists but along which no recorded right of way has been established. The allowance is minimal since there is the argument that both the dyke and the canal have always been part of the drainage system and are thus available for use. No allowance is provided where the dyke is a roadway travelled by the public.

Section 29 allowances are based on the following rates:

Type of Land	Lands Inside of Marsh (Land Value)		Lands Outside of Marsh (Land Value)	
Bush	$3,700/ac±	$ 9,250/ha	$1,200/ac±	$ 3,000/ha
Rough Pasture (Scrub)	$7,400/ac±	$ 18,500/ha	$2,400/ac±	$ 6,000/ha
Standard Cultivated Farm Lands	$13,000/ac±	$ 32,500/ha	$10,000/ac±	$ 25,000/ha
Residential	$25,000/ac±	$ 62,500/ha	$25,000/ac±	$ 62,500/ha
Existing Canal	$ 500/ac±	$ 1,250/ha	$500/ac±	$ 1,250/ha
Maintenance Strip	$ 500/ac±	$1,250/ha	$500/ac±	$ 1,250/ha

Section 30 allowances of the Drainage Act provide for the payment of allowances to landowners along the drain for damages caused to lands and crops by the construction of the improvement to the drain.

These allowances also include amounts paid to the owner for damages along access routes to the drain. The only access routes for which compensation is included at this time are those shown on the drawings.

This allowance includes compensation for the leveling of the materials, clearing of bush and/or the operation of construction equipment.

The actual wording of Section 30 of the Drainage Act is as follows:

The engineer shall determine the amount to be paid to persons entitled thereto for damage, if any, to ornamental trees, lawns, fences, lands and crops occasioned by the disposal of material removed from a drainage works and shall include such sums in the estimates of the cost of the construction, improvement, repair or maintenance of the drainage works. R.S.O. 1990, c. D.17, s. 30.

Section 30 allowances are based on the following rates:

Type of Crop	Lands Inside of Marsh Area Crop Input Costs		Lands Outside of Marsh Area Crop Input Costs	
Bush Area	$1,000/ac±	$ 2,500/ha	$500/ac±	$ 1,250/ha
Pasture Area (Scrub)	$2,000/ac±	$ 4,950/ha	$750/ac±	$ 1,875/ha
Standard Cultivated	$3,500/ac±	$ 8,650/ha	$1,500/ac±	$ 3,700/ha
Residential	$7,000/ac±	$ 17,500/ha	$2,500/ac±	$ 6,250/ha

With respect to damage allowances for bush areas (part of Section 30 allowances), an allowance (primarily, but not always, at the uniform rate) has been established for each parcel. This report also is set up that an owner may receive the allowance plus if he or she requires any good trunks to be saved, and if he/she pre-identified the trees, there will then be an attempt to separately cut and leave the trunks along the edge of the right-of-way for the owner. Due to the need for a mat to work on, full salvage will not be possible. Some of the 3 metre wide maintenance strips may be cleared depending on the construction process implemented but in most cases it is anticipated to remain as it is. Woodlots were also reviewed by an individual experienced in bush lot values and his input was considered in the allowances provided.

Where excavated materials are to be leveled on inside (marsh) lands which is the general situation along the South Canal from Graham Sideroad to Keele Street, the allowances (part of Section 30 allowances) provide for stripping and replacing of topsoils in cultivated areas to an approximate average offset of 32.5 metres from the dyke and for the clearing of bush on wooded areas for the same average offset. Exceptions are noted on the individual data sheets.

Municipal roads are not eligible for allowances. Also allowances are not provided to municipal lands which were previously acquired or available for canal purposes. Allowances are paid to other municipal lands where used.

In accordance with Section 62(3) of the Drainage Act RSO 1990, the allowances shown may be deducted from the final assessment levied. Payment to the owner would only be made when the allowance is greater than the final assessment. The allowances are a fixed amount and are not adjusted at the conclusion of construction. Allowances can only be changed if the report is modified prior to adoption of the report by bylaw or in accordance with the paragraph in this report that deals with changing the scope of work after the bylaw is passed or an appeal prior to the adoption of the report.

The allowances payable to the owners entitled thereto on this project are therefore as follows:

Con	Lot	Roll No.	Owner	R-O-W (Sec 29)	Damages (Sec 30)	Sections 31 & 33		Total
North Canal - Interval 1 (Contract 1A)								
* 2	Pt 4	020-001-02600	P. Hunter (O)	1,450	2,075			3,525
* 2	Pt 4	020-001-02700	A. Bingham-Wallis (O)	3,025	4,200			7,225
* 2	Pt 4	020-001-02800	M. Bonigut (O)	4,925	1,950			6,875
* 2	Pt 4	020-001-02801	Springdale Christian Ref. Church (O)	1,525	375			1,900
* 2	Pt 4	020-001-02803	R. Gleason (O)	9,175	1,225	214,600	#	225,000
* 2	Pt 4	020-006-01700	P. Hui (M)	650	0			650
* 2	Pt 4	020-006-01800	P. Janse (M)	200	0			200
* 2	Pt 4	020-006-01900	K. Janse (M)	200	0			200
2	Pt 4	000-170-68000	J. Huang (O)	2,925	1,350			4,275
	Sub Total Interval 1:			24,075	11,175	214,600		249,850
North Canal - Interval 2 (Contract 1A)								
* 2	Pts 6&7	020-001-02900	M. Bonigut (O)	13,525	3,850			17,375
* 2	Pt 6	020-006-05600	Korag Farms Ltd. (M)	50	0			50
* 2	Pt 6	020-006-05601	V. Marquart (M)	25	0			25
* 2	Pt 8	020-006-06500	J. Kanyo (M)	400	0			400
* 2	Pt 8	020-006-06600	R. Singh (M)	50	0			50
	Sub Total Interval 2:			14,050	3,850			17,900
North Canal - Interval 3 (Contract 2A)								
* 3	Pt 8	020-005-00200	A. Cericola (O)	3,750	1,475			5,225
* 3	Pt 9	020-005-00300	L. Curtis (O)	5,350	2,125			7,475
* 3	Pt 10	020-005-00500	Barlow Square Inc. (O)	8,075	3,200			11,275
* 3	Pt 10	020-005-00600	F. Vaillancourt (O)	5,075	2,025			7,100
* 2&3	Pts 8&9	020-006-07300	J. Devald (M)	275	0			275
* 2&3	Pt 9	020-006-07301	Westfield Farms Ltd. (M)	75	0			75
* 3	Pt 9	020-006-07302	J. Kanyo (M)	150	0			150
* 3	Pt 9	020-006-07400	W. Kanyo (M)	150	0			150
* 3	Pt 9	020-006-07500	J. Buisman (M)	300	0			300
* 3	Pt 9	020-006-07600	J. Gorzo (M)	200	0			200
* 3	Pt 9	020-006-07700	R. Mahedeo (M)	100	0			100
* 3	Pt 9	020-006-07900	L. Szoldatits (M)	100	0			100
* 3	Pt 9	020-006-08000	A. Gaetano (M)	100	0			100
* 3	Pt 9	020-006-08100	A. Gaetano (M)	100	0			100
* 3	Pt 9	020-006-08200	L. Szoldatits (M)	100	0			100
* 3	Pt 9	020-006-08300	M. Weir (M)	100	0			100
* 3	Pt 9	020-006-08400	D. Grouchy (M)	100	0			100
* 3	Pt 9	020-006-08500	S. Gu & S. Hee Kang (M)	225	0			225
* 4	Pt 11	020-005-04501	H. Kedra (O)	230	95			325
	Sub Total Interval 3:			24,555	8,920			33,475

 # This is a Section 33 allowance for loss of right-of-way.

North Canal - Interval 4 (No Allowances in this Interval) (Contract 2A)								
North Canal - Interval 5 (Contract 2A)								
* 4	Pt 13	020-005-04903	D. Coccaro (O)	4,450	550			5,000
* 5	Pt 13	020-005-07300	ICG Golf Inc. (O)	1,175	450			1,625
* 5	Pt 14	020-005-10001	R. Ranjit (O)	2,825	275			3,100
	Sub Total Interval 5:			8,450	1,275			9,725
North Canal - Interval 6 (Contract 3A)								
* 5	Pt 15	020-005-11200	Bradford East Developments (O)	3,550	1,425			4,975
* 5	Pt 15	020-005-11203	Portuguese Cultural Centre (O)	12,175	3,000			15,175
	Sub Total Interval 6:			15,725	4,425			20,150
North Canal - Interval 7 (No Allowances in this Interval) (Contract 3A)								
North Canal - Interval 8 (Contract 3A)								
* 6	Pt 17	010-005-19200	D. Wickson (O)	4,425	450			4,875
* 6	Pt 16	010-005-19400	L. Gaudet (O)	1,525	2,300			3,825
* 5	Pt 16	020-005-12401	A. Van Dyke (O)	250	350			600
	Sub Total Interval 8:			6,200	3,100			9,300
South Canal - Interval 9 (Contract 3A)								
2 OS	Pt 16	000-150-85500	O. Huisman (O)	1,600	625			2,225
2 OS	Pt 16	000-151-01000	R. Buys (O)	1,400	550			1,950
2 OS	Pts17&18	000-151-25000	Adecar Properties Ltd. (O)	3,050	975			4,025
2 OS	Pts17-19	000-151-42000	363773 Ontario Ltd. (O)	8,650	1,900			10,550
2 OS	Pt 19	000-151-44500	G. Karakasidis (O)	25	0			25
	Sub Total Interval 9:			14,725	4,050			18,775
South Canal - Interval 10 (Contract 1A)								
2 OS	Pt 9	000-143-07500	J. Hovius (O)	5,175 **	25			5,200
2 OS	Pt 10	000-143-10000	S. Hovius (O)	7,725	450	33,300	@	38,175
-	-	000-163-99000	Town of Bradford West-Gwillimbury			21,700	@	25,000
2 OS	Pt 11	000-150-00500	A. Bray (O)	5,800	175			5,975
2 OS	Pt 12	000-150-01000	1289430 Ontario Inc. (O)	6,400	300			6,700
2 OS	Pt 13	000-150-38000	G. Huisman (O)	6,950	450			7,400
2 OS	Pts14&15	000-150-78500	K. Bray (O)	1,300	400			1,700
2 OS	Pt 15	000-162-30000	1646457 Ontario Inc. (M)	0	1,050			1,050
2 OS	Pt 10	000-162-50500	M. Freeman (M)	75	350			425
2 OS	Pt 10	000-162-51000	L. Ly (M)	25	200			225
2 OS	Pt 10	000-162-51200	R. & G. Horlings (M)	25	200			225
2 OS	Pt 10	000-162-51500	R. Horlings (M)	25	200			225
2 OS	Pt 10	000-162-52000	Holland Marsh C. R. Church (M)	50	400			450
2 OS	Pt 10	000-162-52500	Holland Marsh C. R. Church (M)	25	150			175
2 OS	Pt 10	000-162-53000	Holland Marsh C. R. Church (M)	50	325			375
2 OS	Pt 10	000-162-54500	Township of King (M)	75	250			325
2 OS	Pt 11	000-162-56000	R. Philipp (M)	50	1,600			1,650
2 OS	Pt 11	000-162-57000	Y. Nan Ang (M)	50	1,150			1,200
2 OS	Pt 11	000-162-58000	B. Butterfield (M)	25	525			550
2 OS	Pt 11	000-162-59000	N. Gasko (M)	25	1,025			1,050
2 OS	Pt 11	000-162-60500	R. Cornacchia (M)	75	3,025			3,100
2 OS	Pt 11	000-162-62500	S. Fiorini (M)	75	2,125			2,200

** This includes an allowance re the Section 31 Existing Drain work.

@ These are Section 31 allowances for Existing Drain (works to replace Bridge 14)

2 OS	Pt 12	000-162-66000	B. Iozzo (M)	50	1,725		1,775
2 OS	Pt 12	000-162-67000	Newland Resources Group Inc. (M)	50	1,700		1,750
2 OS	Pt 12	000-162-69000	C. Sumal (M)	50	1,550		1,600
2 OS	Pt 12	000-162-71000	A. Noordhuis (M)	50	1,900		1,950
2 OS	Pt 12	000-162-73500	1540078 Ontario Ltd. (M)	50	1,675		1,725
2 OS	Pt 13	000-162-76000	B. Randhawa (M)	0	3,700		3,700
2 OS	Pt 13	000-162-82000	N. Askaryar (M)	0	1,275		1,275
2 OS	Pt 13	000-162-84500	J. Whitely (M)	0	450		450
2 OS	Pt 13	000-162-85500	P. Ponnampalam (M)	0	875		875
2 OS	Pt 14	000-162-87500	G. Baldeo (M)	0	800		800
2 OS	Pt 14	000-162-90500	Man-O-Sa Landscaping (M)	0	700		700
2 OS	Pt 14	000-162-92000	D. Cator (M)	0	375		375
2 OS	Pt 14	000-162-93000	J. Visser (M)	0	350		350
2 OS	Pt 14	000-162-94000	O. Rodrigues (M)	0	150		150
2 OS	Pt 14	000-162-96000	J. Keller (M)	0	1,300		1,300
2 OS	Pt 14	000-162-98000	M. Youkhana (M)	0	600		600
2 OS	Pt 14	000-162-99000	S. Drakopoulos (M)	0	600		600
2 OS	Pt 15	000-163-00000	A. Noordhuis (M)	0	1,200		1,200
2 OS	Pt 15	000-163-02000	H. Degeus (M)	0	625		625
2 OS	Pt 15	000-163-03000	D. Vetro (M)	0	625		625
2 OS	Pt 15	000-163-04000	S. Blakelock (M)	0	600		600
2 OS	Pt 15	000-163-05000	M. Iwanyszyn (M)	0	450		450
2 OS	Pt 15	000-163-07000	M. Esmaeili (M)	0	2,100		2,100
	Sub Total Interval 10:			34,250	39,700	55,000	128,950
South Canal - Interval 11 (Contract 1A)							
3 OS	Pt 7	000-144-00000	M. Cogo (O)	525	175		700
3 OS	Pt 8	000-144-09000	J. Winter (O)	2,400	300		2,700
3 OS	Pt 8	000-144-11500	S. D'Souza (O)	900	50		950
3 OS	Pt 8	000-144-12500	V. Scaturchio Jr. (O)	700	50		750
3 OS	Pt 8	000-144-13000	J. Crawford (O)	250	25		275
3 OS	Pt 9	000-144-13500	K. Lee (O)	1,900	100		2,000
3 OS	Pt 9	000-144-14500	J. Jordan (O)	3,100	250		3,350
3 OS	Pt 8	000-160-10000	R. Gaglani (M)	0	2,050		2,050
3 OS	Pt 8	000-160-12500	C. Tomasso (M)	0	5,075		5,075
3 OS	Pt 8	000-160-14000	S. Bong & G. Ja Kang (M)	0	2,475		2,475
3 OS	Pt 9	000-160-48000	W. Servant (M)	0	1,600		1,600
3 OS	Pt 9	000-160-50000	J. Nanowski (M)	25	800		825
2 OS	Pt 7	000-165-05000	S. Seymour (M)	0	4,650		4,650
	Sub Total Interval 11:			9,800	17,600		27,400
South Canal - Interval 12 (Contract 1A)							
3 OS	Pt 5	000-143-58000	Pitway Holdings Ltd. (O)	2,125	725		2,850
3 OS	Pt 7	000-143-90000	D. Van Luyk (O)	475	150		625
3 OS	Pt 5	000-164-05500	M. Andruzko (M)	150	3,025		3,175
3 OS	Pt 6	000-164-06000	M. Charbonneau (M)	0	1,925		1,925
3 OS	Pt 6	000-164-08000	G. Aquino Jr. (M)	0	650		650
3 OS	Pt 6	000-164-09000	V. Fierro (M)	0	800		800
3 OS	Pt 6	000-164-10500	S. Bertucci (M)	0	1,200		1,200
3 OS	Pt 6	000-164-13000	Y. Sum Chan (M)	0	775		775
3 OS	Pt 7	000-164-15000	D. Hale (M)	0	275		275

3 OS	Pt 7	000-164-16000	G. Filoso (M)	0	350		350
3 OS	Pt 7	000-164-17000	N. D'Argenio (M)	0	1,225		1,225
3 OS	Pt 7	000-164-21000	D. D'Angelo (M)	0	550		550
3 OS	Pt 7	000-164-23000	A. George (M)	0	550		550
	Sub Total Interval 12:			2,750	12,200		14,950
South Canal - Interval 13 (Contract 1A)							
2 NS	Pt 14	000-144-80000	S. Tunno (O)	7,500	5,000	+	12,500
2 NS	Pt 14	000-170-77000	K. & T. Habenschuss (O) & (M)	1,000	100		1,100
2 NS	Pt 14	000-170-87000	A. Koch	650	250		900
2 NS	Pt 14	000-170-90000	J. Maidich	25	25		50
	Sub Total Interval 13:			9,175	5,375		14,550
South Canal - Interval 14 (Contract 1A)							
1 OS	Pt 12	000-140-74500	542215 Ontario Inc. (O)	1,075	450		1,525
1 NS	Pt 13	000-144-70000	1013351 Ontario Inc. (O)	4,300	1,750		6,050
1 NS	Pt 13	000-170-94000	D. Tran (M)	250	0		250
1 NS	Pt 12	000-170-95000	E. Young (M)	125	0		125
1 NS	Pt 12	000-172-13000	E. Young (M)	100	0		100
1 NS	Pt 12	000-172-14000	M. Gravelle & R. Brickell (M)	100	0		100
1 NS	Pt 12	000-172-15000	466203 Ontario Ltd. (M)	50	0		50
1 NS	Pt 12	000-172-15500	1522581 Ontario Ltd. (M)	75	0		75
	Sub Total Interval 14:			6,075	2,200		8,275
South Canal - Interval 15 (Contract 1A)							
1 OS	Pt 11	000-140-74500	542215 Ontario Inc. (O)	1,225	425		1,650
1 NS	Pt 11	000-170-97000	Y. Sue Tai (M)	100	0		100
1 NS	Pt 11	000-171-00000	M. Brouwer (M)	50	0		50
1 NS	Pt 11	000-171-03000	Borcsok Farms Inc. (M)	75	0		75
1 NS	Pt 11	000-171-06000	F. Srebot (M)	50	0		50
1 NS	Pt 11	000-171-09000	N. & M. Salama (M)	50	0		50
1 NS	Pt 11	000-172-16500	T. Phan (M)	75	0		75
1 NS	Pt 11	000-172-17500	J. & P. Srebot (M)	50	0		50
	Sub Total Interval 15:			1,675	425		2,100
South Canal - Interval 16 (Contract 1A)							
1 OS	Pt 10	000-140-88000	S. Marra (O)	5,850	1,700		7,550
1 OS	Pt 9	000-140-97500	V. Pulla & J. V. Horlings Ltd. (O)	2,975	5,175		8,150
1 NS	Pt 10	000-171-14000	E. Zarac (M)	50	0		50
1 NS	Pt 10	000-171-17000	L. King Chow (M)	50	0		50
1 NS	Pt 10	000-171-20000	J. & P. Srebot (M)	50	0		50
1 NS	Pt 10	000-171-23000	E. Kasiulis (M)	50	0		50
1 NS	Pt 10	000-171-26000	E. Skric et al (M)	50	0		50
1 NS	Pt 10	000-171-29000	Hollandale Farms Ltd. (M)	50	0		50
1 NS	Pt 10	000-171-32000	P. Greyn Jr. (M)	50	0		50
1 NS	Pt 10	000-171-38000	G. & K. Borcsok (M)	75	0		75
1 NS	Pt 10	000-171-40000	Borcsok Farms Inc. (M)	50	0		50
1 NS	Pt 9	000-171-43000	Hollandale Farms Ltd. (M)	50	0		50
1 NS	Pt 9	000-171-44000	D. Horlings (M)	50	0		50
1 NS	Pt 9	000-171-49000	D. Horlings (M)	100	0		100
1 NS	Pt 9	000-171-50000	Hollandale Farms Ltd. (M)	75	0		75
	Sub Total Interval 16:			9,575	6,875		16,450

\+ No further payment of this allowance is necessary.

South Canal - Interval 17 (Contract 1A)							
1 NS	Pt 8	000-118-80300	M.T.O. (O)	3,375	1,350		4,725
1 NS	Pt 8	000-118-84500	M. Van Gastel (O)	1,250	500		1,750
1 NS	Pt 8	000-118-85500	S. Morel (O)	2,025	800		2,825
1 NS	Pts 7&8	000-118-86500	G. Arconti (O)	2,725	275		3,000
	Sub Total Interval 17:			9,375	2,925		12,300
South Canal - Interval 18 (Contract 3A)							
--	--	Highway 9 S/S	M.T.O. (M)	1,600	6,350		7,950
	TOTAL ALLOWANCES:			192,055	130,445	269,600	592,100

Notes:

1. All lands in the Township of King are noted with an asterisk (*). The lands not noted with an asterisk are in the Township of West Gwillimbury, now in the Town of Bradford-West Gwillimbury.
2. (O) - denotes lands outside of the marsh and canals, (M) denotes marsh lands (lands inside of the canals and part of the marsh).
3. The allowances shown will be paid out when any sub-portion of the improvement work is finalized. For example, if Contract 1A is finalized in the year 2011, a separate tally of all costs not yet billed (and this statement is made since much of the costs re engineering and the work done to date may be billed out once the bylaw to adopt the report is passed) will be made and a billing will be made just for the work in Contract 1A. The allowance listed as being applicable to Contract 1A will be then paid out. Once Contracts 2A and 3A are done, similar payment work for all allowances for these contracts will be done.

b) Estimated Construction Cost Estimate (Overall)

The estimated cost for labour, equipment, and materials to construct the proposed canal improvement project is outlined in detail in the following section on an interval by interval basis. The final cost of the construction cannot be established until tenders are called and let and until all the construction is completed. Any Contractor selected is to supply all labour, equipment and materials except for any work in the estimate that may be attended to by the Board and/or its staff.

The breakdown of the overall project costs into six possible sub-contracts is included in a separate section which follows on Page 103.

As has been described before, once any of these sub-contracts are completed, a separate billing of costs for the sub-portion may be made.

Item	Work Description (Type)	Size	Ave. Length	Unit	Total Quantity	Unit Cost	Total Cost
Interval 1 (North Canal) (Contract 1A)							
A) ALL WORK EXCEPT IRRIGATION							
1	Type I canal (approx 2,000m³) (Tapers)			m	60	123	7,350
2	Type II canal (approx. 84,000m³) (Full relocation with future berm)			m	2,290	156	357,000
3	Type III-L canal (approx. 1000m³) (Cleanout with leveling)			m	85	20	1,700
6	Type IV canal (approx. 2,500m³) (Partial Relocation)			m	215	60	12,900
8	Type VI canal (Bridge cleanout)						
		a) Highway 9 (Bridge 2) (S)		m	15	400	6,000
		b) Private Bridge (Bridge 15) (S)		m	5	400	2,000
10	Environmental	a) Turbidity Curtain		each	5	1,000	5,000
		b) Silt Fence		m	2,965	5	15,000
		c) Sediment Pond		each	6	1,000	6,000
		d) Root Masses		each	15	300	4,500
		e) Gravel Substrate		each	3	500	1,500
		f) Macrophyte Transplants		each	7	1,200	8,400
		g) Fish Relocation		m	2,965	10	29,600
		h) Deep pools (200m long)		each	2	6,000	12,000
11	Hauling during excavation (Type IV canal works)			m³	3,500	7	24,500
13	Hauling from stockpile sites			m³	9,000	5	45,000
16	Clearing for relocation			ha	5.8	12,000	69,600
19	Clearing along road/canal edge/dyke			ha	0.5	16,000	8,000
22	Regrading of backfill/leveling			m^2	40,000	0.2	8,000
24	Longitudinal Cofferdams	a) Canal		m	60	250	15,000
25	Guide rail	a) Removal		m	70	50	3,500
		b) New		m	80	150	12,000
44	Raise well G-R			each	6	1,500	9,000
45	Well outlet extension G-E			each	5	1,000	5,000
46	Drain outlet G-D-O			each	1	1,000	1,000
	Other Work						
	a) Rock base for partial relocation			m³	3,000	35	105,000
	b) Filter fabric below and at top of rock			m²	4,500	4	18,000
	c) Move anchor poles			each	2	3,000	6,000
	d) River inlet 250mm pipe extension (clay base completed)			each	1	22,500	22,500
	e) Abandoned well work (Sta. 12+260 & 12+150)			each	2	500	1,000
	Sub Total All Work Except Irrigation:						822,050
B) IRRIGATION RELATED WORK							
30	Seal existing sleeve			each	3	500	1,500
32	Power Primer			each	16	2,000	32,000
33	Irrigation A2 (with berms)	a) 200mm dia.	28m±	each	10	7,650	76,500
		b) 250mm dia.	28m± (S)	each	1	8,200	8,200
35	Irrigation A4	a) 200mm dia.	40m±	each	2	9,150	18,300
		b) 250mm dia.	40m± (S)	each	2	10,000	20,000
36	Irrigation A5	a) 200mm dia.	28m± (S)	each	2	7,650	15,300
38	Irrigation B	a) 50mm dia.	28m	each	4	1,650	6,600
	Other Work						
	a) Shorten existing 300mm plastic pipe fire line			L.S.	1	500	500
	Sub Total Irrigation:						178,900
	Sub Total Interval 1 (Contract 1A):						1,000,950
Interval 1 (North Canal) (Contract 1B) (Berm Work)							
20	Swale and subdrain			m	2,900	25	72,500
21	Final berm grading, seeding and planting (incl. regrading backfill)			m	2,900	20	58,000
27	Catchbasins & outlets			each	8	4,000	32,000
	Sub Total Interval 1 (Contract 1B):						162,500
	TOTAL INTERVAL 1:						1,163,450

1. Costs for some items are rounded and are not strict products of the quantity and unit costs (typical all intervals).
2. All costs re cofferdams and excavation are based on the Board pre-stockpiling fill. If the fill is not pre-stockpiled, costs will substantially increase from what is shown.

Interval 2 (North Canal) (Contract 1A)							
A) ALL WORK EXCEPT IRRIGATION							
1	Type I canal (approx 13,000m³) (Tapers)			m	375	147	55,100
2	Type II canal (approx. 55,000m³) (Full relocation with future berm)			m	1,065	219	233,250
4	Type III-H canal (approx. 2,000m³)			m	115	122	14,050
8	Type VI canal (Bridge cleanout)						
		a) Sideroad 5 (Bridge 9)		m	15	400	6,000
		b) Hwy 400 (Bridge 11)		m	55	300	16,500
10	Environmental	a) Turbidity Curtain		each	3	1,000	3,000
		b) Silt Fence		m	1,625	5	8,000
		c) Sediment Pond		each	3	1,000	3,000
		d) Root Masses		each	8	300	2,400
		e) Gravel Substrate		each	2	500	1,000
		f) Macrophyte Transplants		each	4	1,200	4,800
		g) Fish Relocation		m	1,625	10	16,250
		h) Deep pools (200m long)		each	1	6,000	6,000
13	Hauling from stockpile sites			m³	4,400	5	22,000
16	Clearing for relocation			ha	3.6	12,000	43,200
19	Clearing along road/canal edge/dyke			ha	0.6	16,000	9,600
22	Regrading of backfill/leveling			m^2	30,000	0.20	6,000
24	Longitudinal Cofferdams	a) Canal		m	155	250	38,750
		b) Road	(S)	m	195	250	48,750
25	Guide rail	b) New		m	90	150	13,500
26	Lateral channel treatment			each	2	500	1,000
28	Riprap (at Bridge 9)			m³	100	30	3,000
29	New Bridge	a) Replace Br 9 (Sideroad 5) *(S)		L.S.	1	1,100,000	1,100,000
		b) Enlarge Br 11 (Hwy 400) (S)		L.S.	1	1,500,000	1,500,000
44	Raise well G-R			each	3	1,500	4,500
45	Well outlet extension G-E			each	4	1,000	4,000
	Other Work						
	a) Raise interlocking sheet steel pile wall (60m length) (25m²±)			L.S.	1	12,000	12,000
	Sub Total All Work Except Irrigation:						3,175,650
B) IRRIGATION RELATED WORK							
30	Seal existing sleeve			each	1	500	500
32	Power Primer			each	8	2,000	16,000
33	Irrigation A2	a) 200mm dia.	28m	each	5	7,650	38,250
		b) 250mm dia.	28m	each	1	8,200	8,200
35	Irrigation A4	b) 250mm dia.	40m	each	1	10,000	10,000
36	Irrigation A5	a) 200mm dia.	28m (S)	each	1	7,650	7,650
38	Irrigation B	a) 50mm dia.	28m	each	1	1,650	1,650
39	Irrigation C	a) 50mm dia.	28m	each	1	10,150	10,150
41	Irrigation D	d) 250mm dia.	28m	each	1	14,650	14,650
42	Irrigation EC	b) 300mm dia.	29m	each	1	30,600	30,600
	Sub Total Irrigation:						137,650
	Sub Total Interval 2 (Contract 1A):						3,313,300
Interval 2 (North Canal) (Contract 1B) (Berm Work)							
20	Swale and subdrain			m	1,400	25	35,000
21	Final berm grading, seeding and planting (incl. regrading backfill)			m	1,400	20	28,000
27	Catchbasins & outlets			each	3	4,000	12,000
	Sub Total Interval 2 (Contract 1B):						75,000
	TOTAL INTERVAL 2:						3,388,300

* If bridge enlargement rather than replacement occurs, cost estimate is $650,000 rather than $1,100,000.

Interval 3 (North Canal) (Contract 2A)							
A) ALL WORK EXCEPT IRRIGATION							
1	Type I canal (approx 3,500m³) (Tapers)			m	100	148	14,800
2	Type II canal (approx. 182,000m³) (Full relocation with future berm)			m	3,350	231	773,950
9	Type VII-A canal (approx. 1,800m³)(Full relocation, no berm)			m	278	270	75,000
10	Environmental	a) Turbidity Curtain		each	7	1,000	7,000
		b) Silt Fence		m	3,728	5	18,700
		c) Sediment Pond		each	7	1,000	7,000
		d) Root Masses		each	18	300	5,400
		e) Gravel Substrate		each	4	500	2,000
		f) Macrophyte Transplants		each	9	1,200	10,800
		g) Fish Relocation		m	3,728	10	37,300
		h) Deep pools (200m long)		each	2	6,000	12,000
13	Hauling from stockpile sites			m³	13,000	5	65,000
16	Clearing for relocation			ha	10.3	12,000	123,600
19	Clearing along road/canal edge/dyke			ha	0.7	16,000	11,200
22	Regrading of backfill/leveling			m^2	85,000	0.20	17,000
24	Longitudinal Cofferdams	b) Road	(S)	m	100	250	25,000
25	Guide rail	a) Removal		m	628	50	31,400
		b) New		m	80	150	12,000
26	Lateral channel treatment			each	1	500	500
44	Raise well G-R			each	6	1,500	9,000
45	Well outlet extension G-E			each	11	1,000	11,000
	Other Work						
	a) Relocate hydro pole			each	1	4,000	4,000
	b) Relocate anchor pole			each	5	3,000	15,000
	Sub Total All Work Except Irrigation:						1,288,650
B) IRRIGATION RELATED WORK							
30	Seal existing sleeve			each	6	500	3,000
32	Power Primer			each	33	2,000	66,000
33	Irrigation A2	a) 200mm dia.	29m	each	27	7,850	211,950
		b) 250mm dia.	29m (S)	each	1	8,400	8,400
35	Irrigation A4	a) 200mm dia.	44m	each	6	9,500	57,000
36	Irrigation A5	a) 200mm dia.	29m (S)	each	2	7,850	15,700
38	Irrigation B	a) 50mm dia.	30m	each	3	1,700	5,100
		b) 75mm dia.	30m	each	1	2,000	2,000
	Sub Total Irrigation:						369,150
	Sub Total Interval 3 (Contract 2A):						1,657,800
Interval 3 (North Canal) (Contract 2B (Berm Work)							
20	Swale and subdrain			m	3,422	25	85,500
21	Final berm grading, seeding and planting (approx 15,000m³ to be reshaped as part of regrading backfill)			m	3,422	30	103,000
27	Catchbasins & outlets			each	9	4,000	36,000
	Sub Total Interval 3 (Contract 2B):						224,500
	TOTAL INTERVAL 3:						1,882,300

Interval 4 (North Canal) (Contract 2A)							
A) ALL WORK EXCEPT IRRIGATION							
9	Type VII-A canal (approx. 50,000m³)(Full relocation, no berm)			m	844	251	211,850
10	Environmental	a) Turbidity Curtain		each	2	1,000	2,000
		b) Silt Fence		m	854	5	4,000
		c) Sediment Pond		each	2	1,000	2,000
		d) Root Masses		each	4	300	1,200
		e) Gravel Substrate		each	1	500	500
		f) Macrophyte Transplants		each	2	1,200	2,400
		g) Fish Relocation		m	854	10	8,500
13	Hauling from stockpile sites			m³	2,900	5	14,500
16	Clearing for relocation			ha	3	12,000	36,000
19	Clearing along road/canal edge/dyke			ha	0.3	16,000	4,800
22	Regrading of backfill/leveling			m^2	20,000	0.20	4,000
24	Longitudinal Cofferdams	a) Canal		m	105	250	26,250
25	Guide rail	a) Removal		m	609	50	30,450
28	Riprap			m³	50	35	1,750
29	New Bridge	Bridge 7 (5th Line)	(S)	L.S.	1	1,300,000	1,300,000
	Other Work						
	a) Fill in old abandoned channel (approx. 2,500m³)			L.S.	1	12,500	12,500
	Sub Total All Work Except Irrigation:						1,662,700
B) IRRIGATION RELATED WORK							
30	Seal existing sleeve			each	2	500	1,000
32	Power Primer			each	6	2,000	12,000
33	Irrigation A2	a) 200mm dia.	28m	each	4	7,650	30,600
35	Irrigation A4	a) 200mm dia.	44m	each	2	9,500	19,000
	Sub Total Irrigation:						62,600
	Sub Total Interval 4 (Contract 2A):						1,725,300
Interval 4 (North Canal) (Contract 2B)							
20	Swale and subdrain			m		0	0
21	Final berm grading, seeding and planting (incl. regrading backfill)			m		0	0
27	Catchbasins & outlets			each		0	0
	Sub Total Interval 4 (Contract 2B):						0
	TOTAL INTERVAL 4:						1,725,300
Interval 5 (North Canal) (Contract 2A)							
A) ALL WORK EXCEPT IRRIGATION							
1	Type I canal (approx 4,000m³) (Tapers)			m	112	151	16,900
8	Type VI canal (Bridge cleanout) (Simcoe Road - Bridge 8)			m	10	400	4,000
9	Type VII-A canal (approx. 53,500m³)(Full relocation, no berm)			m	908	250	227,000
10	Environmental	a) Turbidity Curtain		each	2	1,000	2,000
		b) Silt Fence		m	1,030	5	5,000
		c) Sediment Pond		each	2	1,000	2,000
		d) Root Masses		each	5	300	1,500
		e) Gravel Substrate		each	1	500	500
		f) Macrophyte Transplants		each	2	1,200	2,400
		g) Fish Relocation		m	1,030	10	10,000
13	Hauling from stockpile sites			m³	4,000	5	20,000
16	Clearing for relocation			ha	2.8	12,000	33,600
22	Regrading of backfill/leveling			m^2	26,000	0.20	5,200
24	Longitudinal Cofferdams	b) Road	(S)	m	112	250	28,000

25	Guide rail	a) Removal		m	308	50	15,400
26	Lateral channel treatment			each	1	500	500
28	Riprap			m^3	50	35	1,750
45	Well outlet extension G-E			each	1	1,000	1,000
	Other Work						
	a) Construct 50m of new fence to match existing (vinyl coated chain link, 1.5m high)			m	50	50	2,500
	Sub Total All Work Except Irrigation:						379,250
B) IRRIGATION RELATED WORK							
30	Seal existing sleeve			each	2	500	1,000
32	Power Primer			each	12	2,000	24,000
33	Irrigation A2	a) 200mm dia.	20m	each	15	5,650	84,750
38	Irrigation B	a) 50mm dia.	33m	each	3	2,000	6,000
42	Irrigation EC	b) 300mm dia.	34m	each	1	36,000	36,000
	Sub Total Irrigation:						151,750
	Sub Total Interval 5 (Contract 2A):						531,000
Interval 5 (North Canal) (Contract 2B)							
20	Swale and subdrain			m			0
21	Final berm grading, seeding and planting (incl. regrading backfill)			m			0
27	Catchbasins & outlets			each			0
	Sub Total Interval 5 (Contract 2B):						0
	TOTAL INTERVAL 5:						531,000
Interval 6 (North Canal) (Contract 3A) (Option 2 to east of Simcoe Road is costed)							
A) ALL WORK EXCEPT IRRIGATION							
1	Type I canal (approx 5,000m^3) (Tapers)			m	115	184	21,150
6	Type IV canal (approx. 8,000m^3) (Partial Relocation)			m	268	127	34,000
9	Type VII canal (approx. 20,500m^3) (Full relocation, no berm)			m	315	276	86,950
10	Environmental	a) Turbidity Curtain		each	2	1,000	2,000
		b) Silt Fence		m	698	5	3,500
		c) Sediment Pond		each	2	1,000	2,000
		d) Root Masses		each	3	300	900
		e) Gravel Substrate		each	2	500	1,000
		f) Macrophyte Transplants		each	2.0	1,200	2,400
		g) Fish Relocation		m	698	10	7,000
		h) Deep pools (200m long)		each	1	6,000	6,000
13	Hauling from stockpile sites			m^3	2,400	5	12,000
16	Clearing for relocation			ha	1.4	12,000	16,800
19	Clearing along road/canal edge/dyke			ha	0.1	16,000	1,600
22	Regrading of backfill/leveling			m^2	20,000	0.20	4,000
24	Longitudinal Cofferdams	a) Canal		m	115	250	28,750
	Other Work						
	a) Erosion control blanket			m^2	3,300	5	16,500
	Sub Total All Work Except Irrigation:						246,550
B) IRRIGATION RELATED WORK							
32	Power Primer			each	3	2,000	6,000
33	Irrigation A2	a) 200mm dia.	20m	each	3	5,650	16,950
	Sub Total Irrigation:						22,950
	Sub Total Interval 6 (Contract 3A):						269,500
Interval 6 (North Canal) (Contract 3B)							
20	Swale and subdrain			m			0
21	Final berm grading, seeding and planting (incl. regrading backfill)			m			0
27	Catchbasins & outlets			each			0
	Sub Total Interval 6 (Contract 3B):						0
	TOTAL INTERVAL 6:						269,500

Interval 7 (North Canal) (Contract 3A)							
A) ALL WORK EXCEPT IRRIGATION							
1	Type I canal (approx 4,000m³) (Tapers)			m	90	196	17,600
2	Type II canal (approx. 17,000m³) (Full relocation with future berm)			m	300	252	75,600
9	Type VII-B canal (approx. 37,000m³) (Full relocation, no berm)			m	640	245	156,800
10	Environmental	a) Turbidity Curtain		each	2	1,000	2,000
		b) Silt Fence		m	1,030	5	5,000
		c) Sediment Pond		each	2	1,000	2,000
		d) Root Masses		each	5	300	1,500
		e) Gravel Substrate		each	2	500	1,000
		f) Macrophyte Transplants		each	2	1,200	2,400
		g) Fish Relocation		m	1,030	10	10,000
13	Hauling from stockpile sites			m³	4,000	5	20,000
16	Clearing for relocation			ha	2.7	12,000	32,400
19	Clearing along road/canal edge/dyke			ha	0.1	16,000	1,600
22	Regrading of backfill/leveling			m^2	30,000	0.20	6,000
24	Longitudinal Cofferdams	a) Canal		m	90	250	22,500
26	Lateral channel treatment			each	1	500	500
	Sub Total All Work Except Irrigation:						356,900
B) IRRIGATION RELATED WORK							
30	Seal existing sleeve			each	1	500	500
32	Power Primer			each	12	2,000	24,000
33	Irrigation A2	a) 200mm dia.	20m	each	8	5,650	45,200
		b) 200mm dia.	28m	each	4	7,650	30,600
		e) Modified		L.S.	1	500	500
38	Irrigation B	a) 50mm dia.	35m	each	1	2,300	2,300
40	Irrigation D	a) 100mm dia.	35m	each	1	11,900	11,900
	Sub Total Irrigation:						115,000
	Sub Total Interval 7 (Contract 3A):						471,900
Interval 7 (North Canal) (Contract 3B)							
20	Swale and subdrain			m	300	25	7,500
21	Final berm grading, seeding and planting (incl. regrading backfill)			m	300	20	6,000
27	Catchbasins & outlets			each	1	4,000	4,000
	Sub Total Interval 7 (Contract 3B):						17,500
	TOTAL INTERVAL 7:						489,400
Interval 8 (North Canal) (Contract 3B)							
A) ALL WORK EXCEPT IRRIGATION							
3	Type III-L canal (approx. 1,000m³) (Cleanout with levelling)			m	150	30	4,500
4	Type III-H canal (approx. 11,000m³)			m	635	121	76,850
5	Type III-H & L canal (approx. 11,000m³) (including stripping for berms)			m	730	40	29,200
8	Type VI canal (Bridge cleanout) (Canal Rd - Br 12) (S)			m	10	400	4,000
10	Environmental	a) Turbidity Curtain		each	3	1,000	3,000
		b) Silt Fence		m	1,460	5	7,300
		h) Deep pools (200m long)		each	1	6,000	6,000
12	Hauling after excavation from old canals, dykes			m³	6,500	5	32,500
18	Clearing leveling including piling, spreading chips			ha	1.8	12,000	21,600
22	Regrading of backfill/leveling			m^2	10,000	0.20	2,000
28	Riprap			m³	100	35	3,500
	Other Work						
	a) Clearing, grubbing and adding granular to Peterman Lane			m	605	20	12,100
	Sub Total All Work Except Irrigation:						202,550

B) IRRIGATION RELATED WORK						
31	Add cap or capping plate or grout sleeve of existing irrigation line		each	15	500	7,500
34	Irrigation A3	a) 200mm dia. 15m (S)	each	2	4,750	9,500
		b) 250mm dia. 15m (S)	each	1	5,000	5,000
	Sub Total Irrigation:					22,000
	Sub Total Interval 8 (Contract 3A):					224,550
Interval 8 (North Canal) (Contract 3B)						
20	Swale and subdrain		m	0		0
21	Final berm grading, seeding and planting (incl. regrading backfill)		m	0		0
27	Catchbasins & outlets		each	0		0
	Sub Total Interval 8 (Contract 3B):					0
	TOTAL INTERVAL 8:					224,550
Interval 9 (South Canal) (Contract 3A)						
A) ALL WORK EXCEPT IRRIGATION						
1	Type I canal (approx. 5,000m³) (Tapers)		m	165	128	21,100
8	Type VI canal (Bridge cleanout) (Graham Sideroad - Br 3) (S)		m	10	400	4,000
	b) Type VII-A (approx. 47,000m³) (Full relocation, no berm)		m	1,200	166	199,200
10	Environmental	a) Turbidity Curtain	each	3	1,000	3,000
		b) Silt Fence	m	1,400	5	7,000
		c) Sediment Pond	each	3	1,000	3,000
		d) Root Masses	each	7	300	2,100
		e) Gravel Substrate	each	2	500	1,000
		f) Macrophyte Transplants	each	3	1,200	3,600
		g) Fish Relocation	m	1,365	10	13,650
		h) Deep pools (200m long)	each	1	6,000	6,000
11	Hauling during excavation (part of Type VII-A canal work)		m³	10,000	7	70,000
13	Hauling from stockpile sites		m³	5,000	5	25,000
14	Preparation of disposal sites (stockpile areas)		m³	10,000	1	10,000
16	Clearing for relocation		ha	3.5	12,000	42,000
22	Regrading of backfill/leveling		m^2	30,000	0.20	6,000
24	Longitudinal Cofferdams	a) Canal	m	80	250	20,000
		b) Road (S)	m	80	250	20,000
25	Guide rail	b) New	m	180	150	27,000
26	Lateral channel treatment		each	7	500	3,500
29	New Bridge	(Graham Sideroad - Br 3) (S)	L.S.	1	1,200,000	1,200,000
47	3m wide grass buffer strip		m	250	10	2,500
	Other Work					
	a) Relocate pumping station	(S)	L.S.	1	500	500
	b) Relocation 625m of ditch on 363773 Ont. Ltd. property Roll No. 151-42000 (1.25 ha clearing, 6,250m³ excavation)		L.S.	1	40,000	40,000
	c) 35m of inside bank work including leveling/disposal (200m³)		L.S.	1	1,000	1,000
	Sub Total All Work Except Irrigation:					1,731,150
B) IRRIGATION RELATED WORK						
32	Power Primer		each	6	2,000	12,000
33	Irrigation A2	a) 200mm dia. 18m	each	5	5,250	26,250
36	Irrigation A5	a) 200mm dia. 18m (S)	each	1	4,750	4,750
	Sub Total Irrigation:					43,000
	Sub Total Interval 9 (Contract 3A):					1,774,150
Interval 9 (South Canal) (Contract 3B)						
20	Swale and subdrain		m	0		0
21	Final berm grading, seeding and planting (incl. regrading backfill)		m	0		0
27	Catchbasins & outlets		each	0		0
	Sub Total Interval 9 (Contract 3B):					0
	TOTAL INTERVAL 9:					1,774,150

Interval 10 (South Canal) (Contract 1A)						
A) ALL WORK EXCEPT IRRIGATION						
3	Type III-L canal (approx. 30,000m³) (Cleanout with levelling)		m	2,120	30	63,600
4	Type III-H canal (approx. 10,000m³)		m	555	125	69,400
8	Type VI canal (Bridge cleanout) (Dufferin St - Br 4) (S)		m	10	400	4,000
10	Environmental	a) Turbidity Curtain	each	5	1,000	5,000
		h) Deep pools (200m long)	each	2	6,000	12,000
13	Hauling from stockpile sites		m³	10,000	5	50,000
14	Preparation of disposal sites (stockpile areas)		m³	10,000	1	10,000
15	Stripping topsoil to allow leveling and replacing		ha	3	4,000	12,000
17	Clearing widening		ha	0.25	16,000	4,000
18	Clearing leveling including piling, spreading chips		ha	6	12,000	72,000
22	Regrading of backfill/leveling		m^2	85,000	0.20	17,000
23	Widening/raising/regrading dyke	a) Earth dyke	m	100	10	1,000
26	Lateral channel treatment		each	11	500	5,500
29	New Bridge (Replace Dufferin St - Br 4) (Enlargement is an option to replacement. Costs to enlarge could be $625,000) (S)		L.S.	1	1,100,000	1,100,000
47	3m wide grass buffer strip		m	1,675	10	16,750
	Other Work					
	a) Remove old bridge remnants at Sta. 4+230 (S)		L.S.	1	1,000	1,000
	b) Pre-locate and avoid old header drain		L.S.	1	500	500
	c) Protect communal irrigation lines (two)		L.S.	1	500	500
	Sub Total All Work Except Irrigation:					1,444,250
B) IRRIGATION RELATED WORK						
31	Add cap or capping plate or grout sleeve of existing irrigation line		each	8	500	4,000
36	Irrigation A5	a) 200mm dia. 18m (S)	each	1	4,000	4,000
	Sub Total Irrigation:					8,000
	Sub Total Interval 10 (Contract 1A):					1,452,250
Interval 10 (South Canal) (Contract 1B)						
20	Swale and subdrain		m	0		0
21	Final berm grading, seeding and planting (incl. regrading backfill)		m	0		0
27	Catchbasins & outlets		each	0		0
	Sub Total Interval 10 (Contract 1B):					0
	TOTAL INTERVAL 10:					1,452,250
Interval 11 (South Canal)						
A) ALL WORK EXCEPT IRRIGATION						
3	Type III-L canal (approx. 30,000m³) (including approx. 8000m³ to be moved/hauled to adjacent level areas)		m	1,312	108	141,700
4	Type III-H canal (approx. 6,500m³)		m	300	151	45,300
10	Environmental	a) Turbidity Curtain	each	3	1,000	3,000
		h) Deep pools (200m long)	each	1	6,000	6,000
14	Preparation of disposal sites (stockpile areas)		m³	14,500	1	14,500
15	Stripping topsoil to allow leveling and replacing		ha	1	4,000	4,000
17	Clearing for widening		ha	0.45	16,000	7,200
18	Clearing leveling including piling, spreading chips		ha	3.6	12,000	43,200
22	Regrading of backfill/leveling		m^2	53,000	0.20	10,600
23	Widening/raising/regrading dyke	a) Earth dyke	m	360	10	3,600
25	Guide rail	a) Removal	m	220	50	11,000
		b) New	m	220	150	33,000

26	Lateral channel treatment		each	1	500	500
47	3m wide grass buffer strip		m	130	10	1,300
45	Well outlet extension G-E		each	1	1,000	1,000
	Other Work					
	a) Allowance for hydro line work (Line on 7± poles involved)		L.S.	1	25,000	25,000
	b) Adjust drain on outside		each	1	250	250
	Sub Total All Work Except Irrigation:					351,150
B) IRRIGATION RELATED WORK						
31	Add cap or capping plate or grout sleeve of existing irrigation line		each	2	500	1,000
	Sub Total Irrigation:					1,000
	Sub Total Interval 11 (Contract 1A):					352,150
Interval 11 (South Canal) (Contract 1B)						
20	Swale and subdrain		m	0		0
21	Final berm grading, seeding and planting (incl. regrading backfill)		m	0		0
27	Catchbasins & outlets		each	0		0
	Sub Total Interval 11 (Contract 1B):					0
	TOTAL INTERVAL 11:					352,150
Interval 12 (South Canal) (Contract 1A)						
A) ALL WORK EXCEPT IRRIGATION						
3	Type III-L canal (approx. 32,000m³) (Incl. approx. 1,500m³ that has to be loaded and moved laterally)		m	1,373	55	75,500
8	Type VI canal (Bridge cleanout) (Keele St - Br 6) (S)		m	10	400	4,000
10	Environmental	a) Turbidity Curtain	each	6	1,000	6,000
17	Clearing for widening		ha	0.55	16,000	8,800
18	Clearing leveling including piling, spreading chips		ha	5	12,000	60,000
22	Regrading of backfill/leveling		m^2	53,000	0.20	10,600
26	Lateral channel treatment		each	2	500	1,000
	Sub Total All Work Except Irrigation:					165,900
B) IRRIGATION RELATED WORK						
34	Irrigation A3	a) 200mm dia. 15m	each	1	4,500	4,500
	Other Work					
	a) Construct valve on existing irrigation pipe (S)		each	1	2,000	2,000
	Sub Total Irrigation:					6,500
	Sub Total Interval 12 (Contract 1A):					172,400
Interval 12 (South Canal) (Contract 1B)						
20	Swale and subdrain		m	0		0
21	Final berm grading, seeding and planting (incl. regrading backfill)		m	0		0
27	Catchbasins & outlets		each	0		0
	Sub Total Interval 12 (Contract 1B):					0
	TOTAL INTERVAL 12:					172,400
Interval 13 (South Canal) (Contract 1A)						
A) ALL WORK EXCEPT IRRIGATION						
1	Type I canal (approx. 2,500m³) (Tapers)		m	75	141	10,600
4	Type III-H canal (approx. 9,000m³)		m	380	165	62,700
9	Type VII-A canal (approx. 17,500m³)(Full relocation, no berm)		m	400	185	74,000
10	Environmental	a) Turbidity Curtain	each	2	1,000	2,000
		b) Silt Fence	m	475	5	2,500
		c) Sediment Pond	each	1	1,000	1,000
		d) Root Masses	each	2	300	600

		e) Gravel Substrate		each	1	500	500
		f) Macrophyte Transplants		m	1	1,200	1,200
		g) Fish Relocation		m	475	10	4,750
		h) Deep pools (200m long)		each	1	6,000	6,000
12	Hauling after excavation from old canals, dykes			m^3	4,000	5	20,000
13	Hauling from stockpile sites			m^3	2,500	3	7,500
14	Preparation of disposal sites (stockpile areas)			m^3	9,000	1	9,000
17	Clearing widening			ha	0.1	16,000	1,600
19	Clearing along road/canal edge/dyke			ha	0.43	12,000	5,200
22	Regrading of backfill/leveling			m^2	9,500	0.20	1,900
24	Longitudinal Cofferdams	a) Canal		m	75	250	18,750
25	Guide rails	b) New		m	455	150	68,250
26	Lateral channel treatment			each	1	500	500
	Sub Total All Work Except Irrigation:						298,550
B) IRRIGATION RELATED WORK							
31	Add cap or capping plate or grout sleeve of existing irrigation line			each	1	500	500
32	Power Primer			each	1	2,000	2,000
33	Irrigation A2	a) 200mm dia.	22m	each	1	6,400	6,400
34	Irrigation A3	a) 200mm dia.	15m	each	2	4,500	9,000
38	Irrigation B	a) 50mm dia.	28m	each	1	1,650	1,650
	Sub Total Irrigation:						19,550
	Sub Total Interval 13 (Contract 1A):						318,100
Interval 13 (South Canal) (Contract 1B)							
20	Swale and subdrain			m	0		0
21	Final berm grading, seeding and planting (incl. regrading backfill)			m	0		0
27	Catchbasins & outlets			each	0		0
	Sub Total Interval 13 (Contract 1B):						0
	TOTAL INTERVAL 13:						318,100
Interval 14 (South Canal) (Contract 1A)							
A) ALL WORK EXCEPT IRRIGATION							
9	Type VII-A canal (approx. 51,000m^3)	(Full relocation, no berm)		m	1,109	195	216,250
10	Environmental	a) Turbidity Curtain		each	2	1,000	2,000
		b) Silt Fence		m	1,100	5	5,500
		c) Sediment Pond		each	2	1,000	2,000
		d) Root Masses		each	4	300	1,200
		e) Gravel Substrate		each	1	500	500
		f) Macrophyte Transplants		each	2	1,200	2,400
		g) Fish Relocation		m	1,100	10	11,000
		h) Deep pools (200m long)		each	1	6,000	6,000
12	Hauling after excavation from old canals, dykes			m^3	9,000	5	45,000
13	Hauling from stockpile sites			m^3	4,000	5	20,000
19	Clearing along road/canal edge/dyke			ha	1.1	12,000	13,200
22	Regrading of backfill/leveling			m^2	24,000	0.20	4,800
23	Widening/raising/regrading dyke	a) Earth dyke		m	1,109	10	11,090
26	Lateral channel treatment			each	2	500	1,000
45	Well outlet extension G-E			each	1	1,000	1,000
	Other Work						
	a) Relocate (move) pumphouse and two new hydro poles and overhead hydro service at Sta. 8+853	(S)		L.S.	1	10,000	10,000
	Sub Total All Work Except Irrigation:						352,940

B) IRRIGATION RELATED WORK							
32	Power Primer		each	5		2,000	10,000
37	Irrigation A6	a) 200mm dia. 22m	each	5		2,200	11,000
	Sub Total Irrigation:						21,000
	Sub Total Interval 14 (Contract 1A):						373,940
Interval 14 (South Canal) (Contract 1B)							
20	Swale and subdrain		m	0			0
21	Final berm grading, seeding and planting (incl. regrading backfill)		m	0			0
27	Catchbasins & outlets		each	0			0
	Sub Total Interval 14 (Contract 1B):						0
	TOTAL INTERVAL 14:						373,940
Interval 15 (South Canal) (Contract 1A)							
A) ALL WORK EXCEPT IRRIGATION							
9	Type VII-A canal (approx. 21,500m³)* (Full relocation, no berm)		m	496	**	188	93,250
10	Environmental	a) Turbidity Curtain	each	1		1,000	1,000
		b) Silt Fence	m	500		5	2,500
		c) Sediment Pond	each	1		1,000	1,000
		d) Root Masses	each	1		300	300
		f) Macrophyte Transplants	each	1		1,200	1,200
		g) Fish Relocation	m	491		10	5,000
		h) Deep pools (200m long)	each	1		6,000	6,000
12	Hauling after excavation from old canals, dykes		m³	9,000		5	45,000
13	Hauling from stockpile sites		m³	1,600		5	8,000
19	Clearing along road/canal edge/dyke (33% already done)		ha	0.5		12,000	6,000
22	Regrading of backfill/leveling		m^2	16,000		0.20	3,200
23	Widening/raising/regrading dyke						
		a) Earth dyke	m	691		10	6,900
		b) Granular dyke	m	400		50	20,000
25	Guide rail	a) Removal	m	20		50	1,000
26	Lateral channel treatment		each	2		500	1,000
44	Raise well G-R		each	2		2,000	4,000
45	Well outlet extension G-E		each	4		1,400	5,600
46	Drain outlet G-D-O		each	1		1,000	1,000
	Other Work						
	a) 46m of new 50mm dia. waterline		m	46		50	2,300
	b) Hydro poles and lines to move at Sta. 9+525 & 9+840±		each	2		4,000	8,000
	Sub Total All Work Except Irrigation:						222,250
B) IRRIGATION RELATED WORK							
32	Power Primer		each	6		2,000	12,000
33	Irrigation A2	a) 200mm dia. 22m	each	4		6,400	25,600
37	Irrigation A6	a) 200mm dia. 22m	each	2		2,200	4,400

* This quantity recognizes that 200m± of trial work is done but that 1200m³ is to be excavated from the trial work yet.

** If the trial work length of 200m± were included (from where 1200mm³ is to be excavated), this length would be 691m.

38	Irrigation B	a) 50mm dia.	28m	each	2	1,650	3,300
39	Irrigation C	a) 50mm dia.	25m	each	1	9,400	9,400
42	Irrigation EC	c) 350mm dia.	26m	each	1	34,000	34,000
	Sub Total Irrigation:						88,700
	Sub Total Interval 15 (Contract 1A):						310,950
Interval 15 (South Canal) (Contract 1B)							
20	Swale and subdrain			m	0		0
21	Final berm grading, seeding and planting (incl. regrading backfill)			m	0		0
27	Catchbasins & outlets			each	0		0
	Sub Total Interval 15 (Contract 1B):						0
	TOTAL INTERVAL 15:						310,950
Interval 16 (South Canal) (Contract 1A)							
A) ALL WORK EXCEPT IRRIGATION							
1	Type I canal (approx. 2,700m³) (Tapers)			m	90	128	11,550
2	Type II canal (approx. 45,000m³) (Full relocation with future berm)			m	1,000	191	191,000
8	Type VI canal (Bridge cleanout) (Hwy 400 - Br 10) (S)			m	50	300	15,000
10	Environmental	a) Turbidity Curtain		each	2	1,000	2,000
		b) Silt Fence		m	1,090	5	5,500
		c) Sediment Pond		each	2	1,000	2,000
		d) Root Masses		each	5	300	1,500
		e) Gravel Substrate		each	1	500	500
		f) Macrophyte Transplants		each	2	1,200	2,400
		g) Fish Relocation		m	1,090	10	11,000
12	Hauling after excavation from old canals, dykes			m³	5,500	5	27,500
13	Hauling from stockpile sites			m³	4,000	5	20,000
19	Clearing along road/canal edge/dyke			ha	0.65	12,000	7,800
22	Regrading of backfill/leveling			m^2	22,000	0.20	4,400
24	Longitudinal Cofferdams	b) Road	(S)	m	90	250	22,500
25	Guide rail	a) Removal		m	25	50	1,250
		b) New	(S)	m	130	150	19,500
		c) Special	(S)	m	100	750	75,000
26	Lateral channel treatment			each	1	500	500
29	New Bridge	a) Replace Jane St (Br 5) (S)		L.S.	1	1,200,000	1,200,000
		b) Enlarge Hwy 400 (Br 10) (S)		L.S.	1	1,500,000	1,500,000
45	Well outlet extension G-E			each	2	1,000	2,000
	Sub Total All Work Except Irrigation:						3,122,900
B) IRRIGATION RELATED WORK							
30	Seal existing sleeve			each	2	500	1,000
32	Power Primer			each	7	2,000	14,000
33	Irrigation A2	a) 200mm dia.	25m	each	5	7,150	35,750
35	Irrigation A4	a) 200mm dia.	37m	each	2	8,150	16,300
41	Irrigation E	a) 150mm dia.	25m	each	2	10,450	20,900
42	Irrigation EC	c) 350mm dia.	26m	each	1	34,000	34,000
	Other Work						
	a) Extend existing irrigation pipe and ensure valve is functional			L.S.	1	1,000	1,000
	Sub Total Irrigation:						122,950
	Sub Total Interval 16 (Contract 1A):						3,245,850
CONTRACT 1B							
Interval 16 (South Canal)							
20	Swale and subdrain			m	1,090	25	27,250

21	Final berm grading (approx 5500m³ of shaping), seeding and planting (incl. regrading backfill)		m	1,090	20	21,800
27	Catchbasins & outlets		each	4	4,000	16,000
	Sub Total Interval 16 (Contract 1B):					65,050
	TOTAL INTERVAL 16:					3,310,900
Interval 17 (South Canal) (Contract 1A)						
A) ALL WORK EXCEPT IRRIGATION						
1	Type I canal (approx. 6,000m³) (Tapers)		m	200	128	25,600
2	Type II canal (approx. 35,500m³) (Full relocation with future berm)		m	745	202	150,500
4	Type III-H canal (approx. 3,200m³)		m	130	172	22,350
10	Environmental	a) Turbidity Curtain	each	2	1,000	2,000
		b) Silt Fence	m	1,070	5	5,500
		c) Sediment Pond	each	2	1,000	2,000
		d) Root Masses	each	5	300	1,500
		e) Gravel Substrate	each	2	500	1,000
		f) Macrophyte Transplants	each	3	1,200	3,600
		g) Fish Relocation	m	1,070	10	11,000
12	Hauling after excavation from old canals, dykes		m^3	6,500	5	32,500
13	Hauling from stockpile sites		m^3	3,600	5	18,000
16	Clearing for relocation		ha	2.3	12,000	27,600
17	Clearing widening		ha	0.05	16,000	800
19	Clearing along road/canal edge/dyke		ha	0.05	12,000	600
22	Regrading of backfill/leveling		m^2	19,000	0.20	3,800
24	Longitudinal Cofferdams	a) Canal	m	80	250	20,000
		b) Road (S)	m	100	250	25,000
25	Guide rail	b) New	m	55	150	8,300
		c) Special	m	60	750	45,000
45	Well outlet extension G-E		each	3	1,000	3,000
46	Drain outlet G-D-O		each	1	1,000	1,000
	Other Work					
	a) Extend surface culvert through new steel wall (if any) and place cap on it and extend well outlet through steel wall		each	2	500	1,000
	b) Drain outlet 75mm. Ensure it has inlet through new piling wall. Add flap gate or check valve. (Sta. 12+045)		each	1	500	500
	c) Adjust guy wires on pole on south side of canal if necessary (Sta. 13+137)		L.S.	1	1,000	1,000
	d) Reconstruct/raise South Canal Bank Road		m	130	450	58,500
	e) Construct new earth berm (2m top, 3:1 slopes) (Sta. 12+180 to 12+250) complete with seeding		m	70	100	7,000
	f) Extend culvert with 12m of 750mm dia. CSP (2.0mm wall & 1 coupler) & relocate flap gate		L.S.	1	6,000	6,000
	g) Redirect 50m of road drainage to new catchbasin (Sta. 12+200 to 12+250)		L.S.	1	1,500	1,500
	h) Construct new 900mm dia. plastic catchbasin (or 600 x 1200mm concrete catchbasin) on existing 750mm dia. CSP at Sta. 12+250 (or construct separate 15m of 600mm dia. CSP (2.0mm wall) with flap gate through new berm		L.S.	1	2,000	2,000
	Sub Total All Work Except Irrigation:					488,150

B) IRRIGATION RELATED WORK							
30	Seal existing sleeve			each	1	500	500
31	Add cap or capping plate or grout sleeve of existing irrigation line			each	1	500	500
32	Power Primer			each	5	2,000	10,000
33	Irrigation A2	a) 200mm dia.	25m	each	1	7,150	7,150
34	Irrigation A3	a) 200mm dia.		each	2	5,600	11,200
35	Irrigation A4	b) 250mm dia.	37m	each	4	8,150	32,600
38	Irrigation B	a) 50mm dia.	28m	each	1	1,650	1,650
41	Irrigation E	a) 150mm dia.	25m	each	1	10,450	10,450
		c) 200mm dia.	25m	each	3	11,550	34,650
	Sub Total Irrigation:						108,700
	Sub Total Interval 17 (Contract 1A):						596,850
Interval 17 (South Canal) (Contract 1B)							
20	Swale and subdrain			m	1,080	25	27,000
21	Final berm grading (approx. 2000m³ shaping), seeding and planting (incl. regrading backfill)			m	1,070	20	21,400
27	Catchbasins & outlets			each	3	4,000	12,000
	Sub Total Interval 17 (Contract 1B):						60,400
	TOTAL INTERVAL 17:						657,250
Interval 18 (South Canal) (Contract 3A)							
A) ALL WORK EXCEPT IRRIGATION							
5	Type III-H & L canal (approx. 45,000m³) (including berm work)			m	2,445	40	97,800
8	Type VI canal (Bridge cleanout) (Hwy 9 - Bridge 1) (S)			m	45	400	18,000
10	Environmental	a) Turbidity Curtain		each	5	1,000	5,000
		h) Deep pools (200m long)		each	1	6,000	6,000
12	Hauling after excavation from old canals, dykes			m^3	20,000	5	100,000
18	Clearing leveling including piling, spreading chips			ha	1.5	12,000	18,000
22	Regrading of backfill/leveling			m^2	49,000	0.20	9,800
26	Lateral channel treatment			each	2	500	1,000
	Other Work						
	a) Traffic protection and approvals Allowances (S)						
		i) Traffic Plan,Permit&Materials		L.S.	1	10,000	10,000
		ii) Implementation		L.S.	1	20,000	20,000
	Sub Total All Work Except Irrigation:						285,600
B) IRRIGATION RELATED WORK							
43	Irrigation F			each	19	500	9,500
	Sub Total Irrigation:						9,500
	Sub Total Interval 18 (Contract 3A):						295,100
Interval 18 (South Canal) (Contract 3B)							
20	Swale and subdrain			m			0
21	Final berm grading, seeding and planting (incl. regrading backfill)			m			0
27	Catchbasins & outlets			each			0
	Sub Total Interval 18 (Contract 3B):						0
	TOTAL INTERVAL 18:						295,100
	TOTAL CONSTRUCTION COST ESTIMATE:						18,690,990

(S) Denotes that this item is part of a special benefit or special assessment.

Contingency Allowance * – allow approximately 10% of costs other than structures (the cost estimate for structures includes allowances for contingency as well as engineering, supervision and interest)	$ 857,050
Allowance for costs of Clearing Contract Completed in 2008: (Emergency Work - Part of Contract 1A	110,000
TOTAL ESTIMATE OF CONSTRUCTION COSTS: Including Contingency Allowance and Emergency Work	***$ 19,658,040 *****

The estimate of construction costs per interval grouped into main categories and then broken down into the categories of irrigation, Contract A (1A, 2A and 3A) work excluding irrigation and Contract B work (1B, 2B and 3B) follows is included as **Tables 3-1 and 3-2** following the cost estimate.

c) Engineering Cost Estimate

Report Preparation

For all work (excluding Section 76 and COWSEP work but) including file set up, preliminary work, prepare for & attend open houses, on-site meetings, site examinations and surveys, prepare drawings, alternative designs, alternative cost estimates and assessments, review watersheds and all property information data, all trial work costs, full CEAA Study, write report, prepare schedules of assessment, complete drawings, prepare construction specifications, prepare preliminary work re structures, attend Board meetings, pursue sources of funding and attend consideration of report and court of revision (one meeting for each)

Total Engineering Cost Estimate (To Precede or to be Part of Contract 1A): $ 2,000,000

The cost for report preparation is usually not significantly altered unless the report is referred back for changes, more than two meetings are involved, separate follow-up with individual owners or agencies is necessary, or the report is appealed to the Drainage Tribunal or Drainage Referee. Such additional costs as incurred then become part of the project costs and are in addition to the estimate. Some miscellaneous contingencies or allowances are included elsewhere herein, to provide for some of these possible additional costs. Also all trial work costs have not fully been invoiced or made available at the time and also all engineering is not posted. Although the estimate has attempted to allow for such, the final cost for engineering re the report preparation may vary.

* *It is to be noted that the Contingency Allowance when included in the Form of Tender may be broken down into items including the following: mobilization and demobilization, general work, insurance and bonding costs, contingency items such as watering, hauling contaminated soils, locating and protecting utilities, traffic control, fueling provisions, spill prevention, co-ordination with others, attending to emergency work, dust control, supply of temporary drinking water, asphalt crack repairs, disposal of non-earth or non-wood materials, miscellaneous seeding, supernatant ponds, root work at dykes, access provisions, and all other items not listed, plus a lump sum construction contingency allowance of at least 5%.*

** *Of this total, $1,488,900 is related to individual and communal irrigation inlet work that is being specially assessed. A further $18,500 is related to pole lines and pumphouse relocations which are considered to be similar to irrigation reconstruction work and which are similarly assessed as grantable special benefits. This $18,500 is not listed in the cost estimate however under irrigation but rather with the general work.*

d) Construction Administration/Supervision and General Administration Cost Estimates

Construction Administration/Supervision

The estimate shown for construction supervision is based on past experience and assumes good construction conditions and contractors who complete the construction in an efficient manner. The final cost for construction supervision will vary as per the actual time spent and costs involved during each construction stage.

A listing of the duties or functions during the construction phases are:
Prepare tender documents and tender call, review tenders, attend pre-construction meetings, construction inspection and layout, as-built elevations, GPS work, payments, final inspection, post-construction follow-up, and prepare or assist in preparation of interim and final paperworks (billings of costs and grant applications, etc.) The estimates below assume that the on-going daily inspection is provided in part by the Drainage Superintendent and in part by individuals local to the area retained by the Engineer. It assumes the basic layout, as-built measurements, and payment certificates are attended to by the Engineer's staff and that periodic inspection and/or attendance when difficulties arise is provided directly by the Engineer

The estimate of construction administration/supervision/layout/as-built/paperwork are:

-	Contract 1A	$ 475,000
-	Contract 1B	175,000
-	Contract 2A	275,000
-	Contract 2B	100,000
-	Contract 3A	275,000
-	Contract 3B (includes job finalization)	100,000
Total Construction Supervision, etc. Estimate:		**$ 1,400,000**

Construction supervision costs are grouped with project administration costs although they could be included in the Engineering category since it is the anticipation of the Drainage Act that the Engineer who has prepared the report will oversee its construction, will be responsible for any appeals on quality of construction pursuant to Section 64 of the Act and will verify the project complete for purposes of grant applications. Certainly the Engineer who has prepared the various specifications is most suited to interpret and apply such during construction when unforeseen items or problems occur.

As has been previously noted the construction administration costs for the bridge replacements are included in the overall estimate for the bridges.

General Administration

The general administration cost estimate is included to cover items listed in Section 73 of the Drainage Act as eligible drain costs. One aspect of this cost estimate is to provide for financing until the project is completed. The interest estimate for this financing is based on a past record of interest charges and assumes that each contract (phase) of the project will be completed within approximately one year of tendering (two years for Contract 1A).

The general administration cost estimate does not cover legal expenses incurred by the Town of Bradford-West Gwillimbury (the initiating municipality) or Board or assessed to the Town or Board should the project be appealed, though such costs if incurred, will form part of the final drain cost.

Also included in the administration cost estimates is the cost of printing and mailing of the reports and various lump sum allowances.

It is suggested that the following total general administration costs and contingencies be carried:

-	Interest	$600,000	
-	Printing & mailing	200,000	
-	Temporary Irrigation	465,500	
-	Environmental Consultation	350,000	(200,000 already incurred)
-	Sampling Costs	90,000	
-	Access and Stockpile Sites Costs	130,000	
-	Ontario Land Surveyor for survey bars	140,000	
-	Provision for miscellaneous items including supply of imported fill, building condition surveys, root injections, well sealing by well driller	200,000	
-	Irrigation Specialist Consulting	60,000	
-	Lump Sum Contingency Allowance	500,000	
		$ 2,735,500	

It should be noted that there has been no credit shown in these cost estimates for the interest accumulating on the $10,200,000 grant received in March 2008 from the province. It is felt that this interest will help defray the unavoidable cost increases that will occur with tendering different contracts at much future times.

e) Summary Estimated Cost Estimate of this Project (Overall)

-	Allowances	$ 592,100
-	Construction including contingency & emergency work and excluding irrigation	18,169,140
-	Irrigation	1,488,900
-	Engineering	2,000,000
-	Construction Administration/Supervision	1,400,000
-	General Administration including contingencies	2,735,500
	TOTAL	$ 26,385,640

TABLE 3-1
BREAKDOWN OF CONSTRUCTION COSTS PER INTERVAL (INTERVALS 1 TO 8)

NORTH CANAL

Item	1 (2,965m)	2 (1,625m)	3 (3,728m)	4 (854m)	5 (2,000m)	6 (2,000m)	7 (8,000m)	8 (1,520m)	Sub Total (13,450m)
a) SUB-CATEGORIES									
Clearing (Items 16 to 19)	77,600	52,800	134,800	40,800	33,600	18,400	34,000	21,600	413,600
Excavation (Items 1 to 7 & 9)	378,950	302,400	863,750	211,850	243,900	142,100	250,000	110,550	2,503,500
Hauling (Items 11 to 13)	69,500	22,000	65,000	14,500	20,000	12,000	20,000	32,500	255,500
Cofferdams (Item 24)	15,000	87,500	25,000	26,250	28,000	28,750	22,500	—	233,000
Guide rails (Item 25)	15,500	13,500	43,400	30,450	15,400	—	—	—	118,250
Bridges cleanout (Item 8)	8,000	22,500	—	—	4,000	—	—	4,000	38,500
New Bridges (Item 29)	—	1,100,000 1,500,000	—	1,300,000	—	—	—	—	3,900,000
Lateral channel (Item 26)	—	1,000	500	—	500	—	500	—	2,500
Berm & swale & CB's (Items 20, 21 & 27) (Contract B work)	162,500	75,000	224,500	—	—	—	17,500	—	479,500
Irrigation work (Items 30 to 43)	178,900	137,650	369,150	62,600	151,750	22,950	115,000	22,000	1,060,000
Well & drain work (Items 44 to 46)	16,000	8,500	20,000	0	1,000	0	0	0	45,500
Environmental (Item 10)	82,000	44,450	100,200	20,600	23,400	24,800	23,900	16,300	335,650
Miscellaneous (Items 14,15,22,23,28&47)	8,000	9,000	17,000	5,750	6,950	4,000	6,000	5,500	62,200
Other work	151,500	12,000	19,000	12,500	2,500	16,500	—	12,100	226,100
Sub Total Construction	1,163,450	3,388,300	1,882,300	1,725,300	531,000	269,500	489,400	224,550	9,673,800
Contingencies	132,500	70,000	192,000	47,000	48,000	26,500	49,000	21,000	586,000
TOTAL CONSTRUCTION	1,295,950	3,458,300	2,074,300	1,772,300	579,000	296,000	538,400	245,550	10,259,800
b) GROUPED SUB-CATEGORIES									
Irrigation	178,900	137,650	369,150	62,600	151,750	22,950	115,000	22,000	1,060,000
Contract A excluding irrigation	806,050	3,167,150	1,268,650	1,662,700	378,250	246,550	356,900	202,550	8,088,800
Contract B	162,500	75,000	224,500	—	—	—	17,500	—	479,500
Contingencies	132,500	70,000	192,000	47,000	48,000	26,500	49,000	21,000	586,000
TOTAL CONSTRUCTION	1,295,950	3,458,300	2,074,300	1,772,300	579,000	296,000	538,400	245,550	10,259,800

TABLE 3-2
BREAKDOWN OF CONSTRUCTION COSTS PER INTERVAL (INTERVALS 9 TO 18)
SOUTH CANAL

Item	9 (1,605m)	10 (2,685m)	11 (1,622m)	12 (1,383m)	13 (855m)	14 (1,109m)	15 (691m)	16 (1,150m)	17 (1,070m)	18 (2,490m)	Sub Total (14,660m)	Gross Total (28,110m)
a) SUB-CATEGORIES												
Clearing (Items 16 to 19)	42,000	76,000	50,400	68,800	6,800	13,200	6,000	7,800	29,000	18,000	318,000	731,600
Excavation (Items 1 to 7 & 9)	220,300	133,000	187,000	75,500	147,300	216,250	93,250	202,550	198,450	97,800	1,571,400	4,074,900
Hauling (Items 11 to 13)	95,000	50,000	—	—	27,500	65,000	53,000	47,500	50,500	100,000	488,500	744,000
Cofferdams (Item 24)	40,000	—	—	—	18,750	—	—	22,500	45,000	—	126,250	359,250
Guide rails (Item 25)	27,000	—	44,000	—	68,250	—	1,000	95,750	53,300	—	289,300	407,550
Bridges cleanout (Item 8)	4,000	4,000	—	4,000	—	—	—	15,000	—	18,000	45,000	83,500
New Bridges (Item 29)	1,200,000	1,100,000	—	—	—	—	—	1,200,000 1,500,000	—	—	5,000,000	8,900,000
Lateral channel (Item 26)	3,500	5,500	500	1,000	500	1,000	1,000	500	—	1,000	14,500	17,000
Berm & swale & CB's (Items 20, 21 & 27) (Contract B work)	—	—	—	—	—	—	—	65,050	60,400	—	125,450	604,950
Irrigation work (Items 30 to 43)	43,000	8,000	2,000	6,500	19,550	22,000	99,300	124,950	114,200	9,500	449,000	1,554,500
Well & Drain work (Items 44 to 46)												
Environmental (Item 10)	39,350	17,000	9,000	6,000	18,550	30,600	17,000	24,900	26,600	11,000	200,000	535,650
Miscellaneous (Items14,15,22,23,28&47)	18,500	56,750	34,000	10,600	10,900	15,890	30,100	4,400	3,800	9,800	194,740	256,940
Other work	41,500	2,000	25,250	—	—	10,000	10,300	—	76,000	30,000	195,050	421,150
Sub Total Construction	1,774,150	1,452,250	352,150	172,400	318,100	373,940	310,950	3,310,900	657,250	295,100	9,017,190	18,690,990
Contingencies	53,000	41,000	36,000	17,000	37,000	41,000	34,000	55,000	74,000	26,000	414,000	1,000,000
TOTAL CONSTRUCTION	1,827,150	1,493,250	388,150	189,400	355,100	414,940	344,950	3,365,900	731,250	321,100	9,431,190	19,690,990*
b) GROUPED SUB-CATEGORIES												
Irrigation	43,000	8,000	1,000	6,500	19,550	21,000	88,700	122,950	108,700	9,500	428,900	1,488,900
Contract A excluding irrigation	1,731,150	1,444,250	350,150	165,900	298,550	351,940	211,650	3,120,900	482,650	285,600	8,442,740	16,531,540
Contract B	—	—	—	—	—	—	—	65,050	60,400	—	125,450	604,950
Contingencies	53,000	41,000	36,000	17,000	37,000	41,000	34,000	55,000	74,000	26,000	414,000	1,000,000
TOTAL CONSTRUCTION	1,827,150	1,493,250	388,150	189,400	355,100	414,940	344,950	3,365,900	731,250	321,100	9,431,190	19,690,990*

* Does not include $110,000 Emergency work.

COST BENEFIT ANALYSIS

The May 2000 report prepared to accompany an application for increased provincial funding assistance for the project contained a cost benefit analysis. At that time, the project estimated cost was $11,934,711* and it was determined that the project benefits were $82,284,000. It was felt much more that an acceptable cost benefit ratio existed. See **Appendix 3** for a summary of the year 2000 cost benefit analysis.

Since that time, it has been determined, as is evident from the cost estimate included herein, that the project cost is $26,375,640. It is expected that a similar cost increase in benefits has occurred. Even if no increase in benefits were determined, the project would still be substantially cost beneficial.

A further study is being undertaken by others at this time with respect to the value of the marsh on the provincial economy. The results of this data are expected January/February 2009.

TIMING OF THE COSTINGS/CONSTRUCTION SCHEDULING

Subject to resolution of any appeals and receipt of the annual DFO approval, it is anticipated that the Contract 1A work should commence in 2009. The estimated timing of all contracts is set out as follows:

Contract 1A	2009
Contract 1B	2011
Contract 2A	2011
Contract 2B	2013
Contract 3A	2012
Contract 3B	2014
Selected Bridges	2015 **

This allows 2 years for Contract 1A, one year for Contract 2A and one year for Contract 3A with Contracts 1B, 2B and 3B two years later than the corresponding Contracts 1A, 2A and 3A.

If there are appeals, the project could be delayed until the appeals are resolved. It would be ideal to have the 1A, 2A and 3A projects tendered early in each year to allow the maximum time. Early tendering (February/March periods) should also keep the tender prices low. It is anticipated that the up-coming years, if available for tendering, may allow competitive tendering due to the supply exceeding the demand.

It should be noted that if any tender is received that is greater than the estimate by 33% or more, the landowners will be re-contacted for input prior to any award of such greater tender. Consideration will have to be give to inflational increases for any tender let in future years as indicated earlier herein. There will be some accrued interest from the deposited MIII grant that will be applied against cost and assessment increases.

* *Pages 35 & 36 herein discuss the explanation re cost estimate increases.*

** *This project has been prepared on the basis that, other than the Jane Street and Fifth Line bridge replacements, which are to occur prior to canal work in their applicable section, other bridge replacements may be delayed until just after the completion of all other project work and prior to project completion (anticipated to be year 2015±).*

COST ESTIMATE BY CONTRACTS/BILLING PERIODS

The construction cost estimate for this project has also been subdivided into six components (possible contracts) (contracts 1A, 1B, 2A, 2B, 3A, 3B). A tender may be separately called for each component or for combinations of the components. Contracts/components 1A and 1B provide for the work in Intervals 1, 2 and 10 to 17. Contract 1A is for all work except for the final berm shaping, seeding and planting, the swale and subdrain work, the catchbasins and the outlets. All of this excepted work is listed in Contract 1B since it will be done two± years later. The relationship between Contracts 2A and 2B and 3A and 3B are similar. Contracts 2A and 2B provide for Intervals 3, 4 and 5, while Contracts 3A and 3B provide for Intervals 6 to 9 and 18. By establishing different contracts, the Board may elect when to tender and construct different portions considering costs at the time. In each of Contracts 1A, 2A and 3A, irrigation costs for final irrigation work are separately totaled to allow for possible separate tendering. Costs for temporary irrigation, the work necessary to ensure irrigation is available during construction, is shown in the miscellaneous cost estimate and is not included with the separated irrigation costs.

Further to the division of the construction costs into at least six contracts, the allowances, the construction administration/supervision costs, and the general administration costs can also be broken down and combined with the construction cost breakdowns. If the engineering costs, in whole or in part, are billed out as soon as the bylaw is passed and prior to the start of construction and if the bridges, other than Jane Street and Fifth Line are left to the end of the project and are separately billed, there could be a total of eight different billing periods.

The following tables and text describe how such billings could occur. To arrive at the sub-totals, the grouping of allowances per interval as shown on Pages 78 to 82, the summary of construction cost estimates per interval as shown in Tables 3-1 and 3-2, the separation of construction administration/ supervision as shown on Page 98 and the subdivision of general administration costs as shown on **Table 4** are used to prepare this possible estimate of costs in each of the six contract periods (see **Table 5**) or in each of eight billing periods (see **Table 6**).

It must be pointed out that this is a suggestion only of subdividing the project into construction contracts and billings. The final decisions re subdividing the project and timing of billings will be that of the initiating municipality and/or the Board.

TABLE 4

Total General Administration Estimate Split In Contracts/Billing Periods

The estimate of when these could be incurred or what contract they pertain is as follows:

	Preceding Contract 1A, (or could be part of 1A)	Contract 1A	Contract 1B	Contract 2A	Contract 2B	Contract 3A	Contract 3B	Total
Interest	125,000	275,000	20,000	100,000	15,000	50,000	15,000	600,000
Printing/Mailing	110,000	15,000	15,000	15,000	15,000	15,000	15,000	200,000
Temp. Irrigation	—	260,500	—	135,000	—	70,000	—	465,500
Environmental Sub-Consultant	—	260,000	—	45,000	—	45,000	—	350,000
Sampling	—	48,000	—	21,000	—	21,000	—	90,000
Access & Stockpile sites	—	65,000	—	40,000	—	25,000	—	130,000
Legal Surveying	—	75,000	—	28,000	—	37,000	—	140,000
Provision for miscellaneous items to supply fill, root killing, well sealing, condition surveys	—	100,000	—	65,000	—	35,000	—	200,000
Irrigation Specialist	—	30,000	—	20,000	—	10,000	—	60,000
Lump Sum administration contingency	—	250,000	—	150,000	—	100,000	—	500,000
TOTALS	235,000	1,378,500	35,000	619,000	30,000	408,000	30,000	2,735,500

TABLE 5

SEPARATION OF ESTIMATED COSTS INTO SIX COMPONENTS

By Contract (Keeping Engineering with Contract 1A and all Bridge Costs in a contract but with bridges separately noted)

	Contract 1A	Contract 1B	Contract 2A	Contract 2B	Contract 3A	Contract 3B	Total
Allowances	338,125	--	54,850	--	56,175	--	449,150
Contingency	493,000	43,000	241,000	27,000	194,000	2,000	1,000,000
Bridges	6,400,000 a)	--	1,300,000 b)	--	1,200,000 c)	--	8,900,000
Emergency Work	110,000 d)	--	--	--	--	--	110,000
Irrigation	692,950	--	583,500	--	212,450	--	1,488,900 h)
Other Construction	4,043,790	362,950	2,030,600	224,500	1,622,750	17,500	8,302,090
Engineering	2,000,000 e)	--	--	--	--	--	2,000,000
Supervision	475,000	175,000	275,000	100,000	275,000	100,000 g)	1,400,000
Admin. Incl. allowance	1,613,500 f)	35,000	619,000	30,000	408,000	30,000	2,735,000
TOTALS	16,166,365	615,950	5,103,950	381,500	3,968,375	149,500	26,385,640

a) This total is arrived at as follows:

- Five Sideroad	$ 1,100,000
- Highway 400 North Canal	1,500,000
- Dufferin Street	1,100,000
- Jane Street	1,200,000
- Highway 400 South Canal	1,500,000
	$ 6,400,000

The Jane Street structure is to be built at or before the time of canal work but the others may be constructed just after all other canal work is finished.

b) This represents the cost of the Fifth Line Bridge which is to be built at or before the time of canal work.

c) This represents the cost of the Graham Sideroad which may be constructed just after all other canal work is finished.

d) This emergency work cost may be billed prior to start of contract work.

e) This engineering cost may be billed prior to start of contract work.

f) Included in this total is $200,000 for Environmental sub-consultant, $110,000 for printing and mailing and $125,000 for interest which could be billed out prior to start of contract work.

g) Includes allowance to do final paperwork and job finalization.

h) If the $18,500 for pole line and pumphouse work were added to the total of $1,488,900 for irrigation, the new total would be $1,507,400.

TABLE 6

SEPARATION OF ESTIMATED COSTS INTO EIGHT BILLING PERIODS (BP)

	Billing Period 1 (BP1)	Contract 1A (BP2)	Contract 1B (BP3)	Contract 2A (BP4)	Contract 2B (BP5)	Contract 3A (BP6)	Contract 3B (BP7)	Billing Period 8 (BP8)	Total
Allowances		338,125	--	54,850	--	56,175	--		449,150
Contingency		493,000	43,000	241,000	27,000	194,000	2,000		1,000,000
Bridges		1,200,000	--	1,300,000	--	1,200,000	--	6,400,000	8,900,000
Emergency Work		110,000	--	--	--	--	--		110,000
Irrigation		692,950	--	583,500	--	212,450	--		1,488,900
Other Construction		4,043,790	362,950	2,030,600	224,500	1,622,750	17,500		8,302,090
Engineering	2,000,000	--	--	--	--	--	--		2,000,000
Supervision		475,000	175,000	275,000	100,000	275,000	100,000		1,400,000
Admin. Incl. allowance	235,000	1,378,500	35,000	619,000	30,000	408,000	30,000		2,735,500
TOTALS	2,235,000	8,731,365	615,950	5,103,950	381,500	2,768,375	149,500	6,400,000	26,385,640

ASSESSMENTS

In accordance with the requirements of the Drainage Act, all costs of this report cost estimate have to be assessed to the affected lands and roads and the assessments are to be by the Engineer preparing the report. Grants available are then deducted from the assessments shown.

All project costs have been assessed in one schedule since the service to be provided is uniform throughout the watershed assessed and since the selection of six different contracts should not result in separate schedules. Historically, any cost from any section of the canal system has been assessed through the full watershed since the canals are fully interconnected and interdependent. For these reasons, the Schedule A assessments will be used to levy the costs for any contract.

The Drainage Act requires that the total cost of a project be assessed against the lands and roads which contribute water to the drain and/or which derive a benefit from its construction. The cost of this project is assessed against the affected lands and roads as shown in Schedule A (Schedule of Assessments). The assessments shown are based on the estimated costs of the work and the final assessments shall be prorated on the basis of the final project cost (except for any special benefits and special assessments which are described to be based on actual costs). **Schedule A is contained in Volume II** of this report.

The Drainage Act further requires that the total estimated cost be assessed to the affected lands and roads under the categories of Benefit (Section 22), Outlet Liability (Section 23), Injuring Liability (Section 23), Special Benefits (Section 24), and Special Assessment (Section 26). On this project, there are assessments for benefit, outlet, special benefit and special assessment but none for injuring liability.

The assessments for benefit and outlet liability are in accordance with the Section 76 report that was prepared in April 2001 to create a new assessment schedule for maintenance for the Holland Marsh Drainage System. In accordance with the Section 76 report, 75% of the proratable costs are levied to the interior lands and roads of the Holland Marsh. The balance of 25% is levied to the exterior lands and roads that drain to the Holland Marsh canal system.

The assessments to the interior lands have been made under the category of benefit while the assessments to the exterior lands are under the category of outlet liability. The rates for benefit assessment to the interior lands are on an equal per hectare basis on this project since the canal improvement system conveys a benefit proportional to acreage due to relief from flood damages and a similar equal benefit in ensuring that a channel exists to convey outside drainage waters around the perimeter of the system. This is the approach that was established in the original assessment for the project and by the Section 76 report of 2001 and I have taken such into consideration.

The assessments for outlet liability to the exterior lands have also adopted and followed the approach of the Section 76 report. The particular sections of the Section 76 report which indicated the considerations given to making the outlet liability assessments are duplicated in italics below. These sections have been updated/modified to make such applicable to this new report.

> *New property plans were prepared at a scale of approximately 1:10,000. On these drawings, the relative topographical and soils classification data was added. Overlays with property plan boundaries were then prepared for each aerial photograph. The property plan with the soils and topographical data was then compared against the aerial and each property was then given a rating with respect to soils, topography and land use (the property factor). For certain types of land uses, the factor was only related to the land use and was not affected by the soil type or topography. Similar work was also done for the roadways.*

Next the area of the property affected was determined. For the majority of the properties, the full property would be involved and the area as per the last revised assessment roll was used. For those properties on the boundary, a field and/or mapping determination was made as to the percentage of the property that would be within the watershed of the Holland Marsh Drainage System Canal Improvement Project. These hectares affected are then shown in the Schedule of Assessment.

Each affected parcel of land and road in the exterior watershed then had its affected area in hectares multiplied by this property factor and the resultant "individual numbers" were totaled. This total number was then divided into 25% of the value to be prorated (edited here for this report). The resultant number was then multiplied by each property's "individual number" to arrive at the individual share for assessment in Schedule A and will also be used for future maintenance. Computer procedures were applied for all of this work.

Due to the unusual circumstances and flow characteristics in the Holland Marsh canals, where upstream flows can follow the route either of the north or the south canal, and where depending on runoff situations, flow in some portions of the canal may reverse during a runoff event, past experience has indicated that regardless of where the improvement or maintenance has been undertaken, the cost should be assessed against the full assessment schedule. This has been the method used since original construction and it is to be the approach with Schedule A as well.

This then indicates that the outlet liability assessments do consider land use, soil type and gradient to an extent.

The assessment schedules in the year 2001 Section 76 report have been updated to recognize further land divisions since the creation of the Section 76 report. Also the schedules reflect the amendments made pursuant to the appeals that followed the Section 76 report.

In addition to the benefits per hectare that have been levied to the interior lands and roads, separate benefit assessments have also been made to the roads that have been developed on the canal system dykes to recognize the improvements to life safety which will result from the construction of the works of this report. This approach was established by earlier studies in 2000 that indicated that a combined project that provided drainage, life safety, flood protection and improved ease of maintenance would reduce the separate costs to provide life safety by 40% and that the life safety aspect of the project should be approximately 30% of the total project costs excluding structure work This separate benefit assessment also recognizes that roads may be improved more easily and also that the road base will be better maintained as a result of the recommended improvements. These benefits are to be proratable assessments.

To recognize that the life safety varies due to relocation in some intervals and guide rails in others, I have applied the rates of $325/m for life safety and road base improvement where canals are relocated and $200/m for life safety where guide rails only are constructed. The total for life safety and road base improvements add to $5,574,250 which is 32% of the total project costs excluding structures. The following table lists the separate benefits for life safety/base improvements:

Contract & Intervals	Simcoe Cty Roads	Twp of King Roads	Town of Bradford-West Gwillimbury Roads	TOTALS
Contract 1A (Int. 1,2,10to17)	1,426,750	1,021,250	--	2,448,000
Contract 2A (Int. 3 to 5)	1,823,900	--	--	1,823,900
Contract 3A (Int. 6 to 9 & 18)	613,600	438,750	250,000	1,302,350
TOTALS:	3,864,250	1,460,000	250,000	5,574,250

Further I made separate grantable special benefit assessments to the owners adjacent to the canals and dykes who will have irrigation inlets altered as part of the project. These separate benefit assessments are based on the estimated costs of the irrigation work and the final value of these assessments will be calculated using actual tendered or incurred construction costs. The moving of two pumphouses and the moving of poles that serve pumping stations (a cost of $18,500 total) has been included as grantable special benefits related to irrigation, even though the cost estimate does not list this work in with the irrigation. Owners may delete or alter the work associated with these estimates, with pre-approval, and the final assessment will be deleted or altered accordingly. However any irrigation line work across a canal road or a new berm area has to be constructed by the project. These separate benefit assessments show in the schedules as special benefits eligible for grants. This means that if the property has the Farm Tax Rate, it will be eligible for the one-third provincial grant on the assessments and as well the MIII grant will be applied to a portion of the balance of the assessment. The estimates of these grantable special benefits are based on the cost estimates herein less any portion listed in the following section which is a non-grantable special benefit. **Appendix 6 Part II** contains a listing of each property that has a grantable special benefit to show the work involved and the gross and net assessments involved.

The special benefits (non-grantable) to be made to some landowners are for increased costs for upgrading (upsizing) of irrigation pipe work from the standard project sizes and/or for providing new irrigation lines where none now exist and/or for cleaning out private structures if such is deemed necessary, and/or removing private bridge remnants, all in accordance with Section 24 of the Drainage Act, RSO 1990. The Special Benefits as shown herein are based on estimated costs and are not eligible for any grants. The final non-grantable Special Benefits shall be based on final construction costs. Again if an owner deletes or alters (with pre-approval) or constructs himself (if approved) the work listed, the non-grantable special benefit will be deleted or altered. The estimated and final non-grantable Special Benefits are to be calculated in accordance with the following chart: (These non-grantable Special Benefits if related to irrigation are also listed in **Appendix 6, Part II**)

Int.	Cont #	Sta.	Roll No.	Owner	Work Description	Item No.	Total Special Benefit
1	1A	12+490	020-006-010	W. Zweep	New Type A5 200mm (28m)	36a)	2,000 (i)
1	1A	12+366 to 12+330	006-00700	N. De Mendonca	New Type A5 200mm (38m)	36a)	2,000 (i)
* 1	1A	12+120±	020-006-01000	L. & K. Radvanyi	Increase in Type A2 pipe from 200mm to 250mm (28m)	33c)	1,000 (ii)
* 1	1A	11+725	020-006-01500	J. & M. Devald	Increase in Type A4 pipe from 200mm to 250mm (40m)	35b)	1,000 (ii)
* 1	1A	10+646	020-006-02700	J. Devald	Increase in Type A4 pipe from 200mm to 250mm (40m)	35b)	1,000 (ii)
1	1A	10+480 to 10+475	001-02803	R. Gleason	Cleanout private bridge (5m) (Bridge 15)	8b)	2,500 (iii)
2	1A	9+493 to 9+449	006-06000	B. & M. Vandebelt	New Type A5 200mm (28m)	36a)	2,000 (i)

* 3	2A	8+290	020-006-07300	J. & M. Devald	Increase in Type A2 pipe from 200mm to 250mm (29m)	33b)	1,000 (ii)
* 8	3A	1+289	020-006-28700	R. & P. Kruger	New Type A3 pipe and at 250mm dia. (15m)	34b)	2,000 (iv)
8	3A	1+222	005-21100	G. Hoving	New Type A3 200mm (15m)	34a)	1,000 (ii)
8	3A	701	005-20300	D. Cilipka	New Type A3 200mm (15m)	34a)	1,000 (ii)
9	3A	1+500 to 1+595	000-162-41000	A. Arnold	New Type A5 200mm (18m)	36a)	3,500 (v)
10	1A	1+604 to 1+693	000-162-30000	1646457 Ont. Inc.	New 200mm Type A5 pipe (18m)	36a)	3,000 (v)
10	1A	4+230	000-143-10000	S. Hovius	Remove bridge remnants	Other work a)	1,000
12	1A	7+275	000-173-88000	A. Cilio	Add valve on existing pipe	Other work a)	2,000 (vi)
12	1A	5+927	000-160-2500	S. Seymour	New Type A3 200mm (15m)	34a)	1,000 (i)
13	1A	7+540	000-170-7700	K. Habenschuss	New Type A3 200mm (15m)	34a)	1,000 (i)
13	1A	7+675	000-170-87000	A. Koch	New Type A3 200mm (15m)	34a)	1,000 (i)
					TOTALS:		29,000

Notes:

* *The lands noted with an asterisk (*) are in the Township of West Gwillimbury now in the Town of Bradford-West Gwillimbury and the lands with no asterisk are in the Township of King. Special Benefits are non-grantable.*

(i) Final special benefit to be based on 25% of actual costs.

(ii) Final special benefit to be based on evident increased cost from tender.

(iii) Will be deleted if owner improves or removes bridge prior to construction so that cleanout is avoided but will be based on actual costs if undertaken.

(iv) Final special benefit to be based on 40% of actual costs.

v) Final special benefit to be based on 75% of actual costs.

vi) Final special benefit to be for the actual costs.

As well, special assessments are to be made for the actual increased cost of improving or replacing bridges, for cleaning bridges, for constructing cofferdams or guide rails at bridges and costs to alter a public utility in accordance with Section 26 of the Drainage Act, RSO 1990.

Section 26 of the Drainage Act states the following:

> 26. In addition to all other sums lawfully assessed against the property of a public utility or road authority under this Act, and despite the fact that the public utility or road authority is not otherwise assessable under this Act, the public utility or road authority shall be assessed for and shall pay all the increase of cost of such drainage works caused by the existence of the works of the public utility or road authority. R.S.O. 1990, c. D.17, s. 26.

Existing practice for the Holland Marsh Drainage System maintenance has been to assess all costs at bridges to the road authority.

The special assessments as shown herein are based on estimated costs. The final special assessments shall be based on final construction costs reduced by the fixed equivalent drain cost and increased by the actual increased engineering costs, all as shown herein. All costs to the project due to Bell, Gas or Hydro lines on publicly travelled roadways or across the canals are deemed to be increased costs and are to be Special Assessments unless the work is undertaken and paid by the utility. This report has assumed, for now, that any work necessary by a utility but not listed below will be undertaken by the Utility Company and accordingly no costs are shown other than those listed. Should it be necessary

for the project to attend to any other work at a structure or public utility further Special Assessments will be made and will be for the actual cost of the work plus the actual engineering incurred related to such. The estimated and final special assessments are to be calculated in accordance with the following chart:

Int.	Cont. #	Sta. to Sta.	Road	Authority	Const. Costs*	Less Equiv. Drain Costs **	Plus Increased Engin. Costs*	Special Assess.
1	1A	13+260 to 13+245	Hwy 9 (Bridge 2)	M.T.O.	6,000	500	1,500	7,000
1	1B	13+245 to 10+345	Cty Rd 8 (Canal Rd)	Ontario Hydro	6,000	--	1,000	7,000
1	1A	10+345 to 10+315	Sideroad 5	Town of B-W-G	33,500 a)	500	2,500	35,500
2	1A	10+345 to 10+315	Sideroad 5 (Bridge 9)	Town of B-W-G	900,000	--	200,000	1,100,000
2	1A	8+800 to 8+710	Cty Rd 8 (Canal Rd)	M.T.O.	76,250 b)	500	2,500	80,050
2	1A	8+800 to 8+710	Hwy 400 (Bridge 11)	M.T.O.	1,000,000	--	500,000	1,500,000
3	1B	8+710 to 4+135	Cty Rd 8 (Canal Rd)	Ontario Hydro	19,000	--	1,000	20,000
4	2A	4+135 to 4+120	5th Line (Bridge 7)	Town of B-W-G	1,100,000 c)	--	200,000	1,300,000
5	2A	3+108 to 3+098	Simcoe Road	Cty of Simcoe	32,000 d)	500	3,000	34,500
8	3A	005 to -005	Canal Road (Bridge 12)	Cty of Simcoe	4,000	500	1,500	5,000
9	1A	1+584 to 1+604	Graham Sideroad (Bridge 3)	Twp of King	1,000,000	--	200,000	1,200,000
9	1A	1+584 to 1+604	Graham Sideroad (Bridge 3)	Twp of King	24,000 e)	500	2,500	26,000
10	1A	4+250 to 4+270	Dufferin Street (Bridge 4)	Twp of King	900,000	--	200,000	1,100,000
10	1A	4+250 to 4+270	Dufferin Street (Bridge 4)	Twp of King	4,000	500	1,500	5,000
12	1A	7+267 to 7+292	Keele Street (Bridge 6)	Twp of King	4,000	500	1,500	5,000
16	1A	9+937 to 9+958	Jane Street (Bridge 5)	Twp of King	1,000,000	--	200,000	1,200,000
16	1A	11+027 to 11+108	Hwy 400 (Bridge 10)	M.T.O.	1,000,000	--	500,000	1,500,000
17	1A	11+027 to 11+108	Hwy 400 (Bridge 10)	M.T.O.	97,000 f)	2,000	5,000	100,000
18	3A	12+170 to 12+215	Hwy 9 (Bridge 1)	M.T.O.	18,000	2,000	2,500	18,500
18	3A	12+215 to 14+660±	Hwy 9	M.T.O.	--	--	10,000 g)	10,000
			TOTALS:		7,223,750	8,000	2,036,000	9,251,750

* This is estimated (as per cost estimate) for this report. Use final contract figures for final special assessment calculations.

** This is a fixed amount to be used in final calculations.

a) $6,000 cleanout plus $27,500 cofferdams (110m of cofferdam in Interval 2) = $33,500

b) $16,500 cleanout plus $46,250 cofferdams plus $13,500 guide rails = $76,250

c) This will be increased if bridge is not replaced before canal work
d) $4,000 cleanout plus $28,000 cofferdams = $32,000
e) $4,000 cleanout plus $20,000 cofferdams = $24,000
f) $15,000 cleanout plus $47,500 cofferdams plus $34,500 guide rails = $97,000
g) Traffic Plan, permit and materials for signing along Highway 9

The road authority or public utility has the option of constructing the work subject to the special assessment with their own forces. If any work item is so undertaken by the authority or utility the special assessment shall be calculated by substituting "zero dollars" in the column for construction costs.
Special assessments shall not apply for future maintenance purposes.

The final assessments to the landowners will be based on the final cost of the project. To prorate the final assessments, any nonproratable special benefits and special assessments will first of all be calculated and will be deducted from the total cost. This balance will then be compared to the estimated amount to be prorated in Schedule A which is the total of assessments less the total estimated nonproratable special benefits and special assessments. The ratio so determined will then be used to multiply all assessments.

A provincial grant of up to thirty three and one third percent (33 1/3%) is available from the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) for assessments to all privately owned agricultural lands. Those eligible for the Farm Property Class Tax Rate (F.T.R) are considered agricultural and are eligible for this grant. On this project, there are many properties, to date, that are noted to be eligible for the F.T.R. and they are shown with an asterisk (*) in Schedules A and B. This grant may also be available for maintenance assessments. **It is strongly recommended that any farm properties that are not yet eligible for the Farm Tax Rate contact their Municipal Clerk and make application for such, since there is such a great cost advantage on this project.**

As well and considering the $10.2 million MIII grant that was received from Infrastructure Ontario for this project, a further grant will also be applied to the assessments. The means of applying this grant are as follows:

- $4 million is related strictly to structure and life safety assessments to the municipal roads of the Township of King and the Town of Bradford-West Gwillimbury.
- A total of $6.2 million is to be applied to the assessments to all privately and municipally owned parcels of land and to all other local municipal road assessments within the watershed. This amount will be applied prorata to all applicable assessments for benefit, grantable special benefit and outlet but not to non-grantable special benefits.

After the eligible gross assessments are reduced by the provincial agricultural grant and then by the $10.2 million provincial MIII grant, any land allowances that are to be paid to the owner in accordance with the Table of Allowances in this report will then be deducted, and the net assessment will be billed to the owners. The estimates of these net assessments have been separately prepared and are available for review at the Board or Engineer’s office.

Where the allowances exceed the assessment (once the grants have been deducted), payment will be made to the owner for the difference and once the project has been completed.

Another consideration that will have to be given at the time of billing of assessments is that some of the costs incurred to date have been paid in part by using monies collected annually from marsh properties in King and Bradford-West Gwillimbury. These owners will have to be credited for any amounts that have been contributed and applied against costs shown in the project cost estimate.

Since the final project costs will be greater or lesser than the estimated project costs, the final proratable costs will be prorated against the proratable assessments in Schedule A. Non-prorateable assessments (the special benefits and the special assessments) will be separately calculated. As a result final assessments will vary from the assessments of the costs as estimated.

CONSTRUCTION PROVISIONS OF THE DRAINAGE ACT

The Drainage Act provides that once the Bylaw is passed to adopt the report and a tendering period to quash the report has been passed that tenders may be called for any or all of the construction work.

Various contracts can be called and the work can be done in sub-contracts.

The Contractors awarded the project can enter on whatever lands are designated by the report as working space to complete the work as per Section 63 of the Drainage Act.

Any landowner or other person who interferes with, or obstructs, the Contractor in his performance of the contract is guilty of an offence and is liable for a fine.

Any landowner dissatisfied with the quality of construction as per the Engineer's report may at any time during construction, or up to one year from completion of the particular construction, appeal to the Tribunal re the quality of construction.

SPECIFICATIONS INCLUDED WITH THIS REPORT

This report in **Volumes III and IV** contains numerous specifications to provide for the construction of the project.

The Construction Special Provisions which provide for most items of work constitute the main specifications and constitute the majority of **Volume IV**. The specific notes with respect to work required in various locations are entitled the "Extent of Work Notes" and they are included on the aerial drawings (**Drawings No. 15 to 92 in Volume III**). General Special Provisions are also included which deal with general items of construction.

The standard specifications that apply are the Ontario Provincial Standard Specifications which are not included but which are listed. As well, various Municipal Drain Standard Specifications of this engineer are also included.

The General Conditions which apply to general portions of the project are the Ontario Provincial Standard Specification General Conditions. Any modifications to these general conditions are included herein as Supplemental General Conditions.

Any owner wishing to know more re the work proposed on or adjacent to his property is encouraged to review these specifications. An index is included for easier use.

At this time, the specifications and cost estimate do not always agree re some matters such as which items will be separately tendered or left as parts of other items, re with which contracts hauling should be included, and re berm constructions. These items will be addressed at the time of tendering. The costs in all cases, however, are included.

WORKING CORRIDOR AND RIGHT OF WAY

The Contractor shall be allowed to operate his equipment within the working space as defined herein. In general the working space is to be all lands of the existing dykes including the canal roads, the existing canal, the lands designed for the new canal, the maintenance and buffer strips shown, the small marsh scheme dyke, all lands shown for leveling of materials, all access routes shown or later negotiated, all public roads and all other lands negotiated at the time of construction as working space. The working space is called the working area on the aerial drawings. Each landowner is required to provide the Contractor, the Drainage Superintendent and the Engineer with reasonable access to the drain on his or her property for both construction and maintenance. Owners are compensated for access across their lands from roadways on the outside of the canals.

MISCELLANEOUS ENVIRONMENTAL PLANS INCLUDED WITH THIS REPORT

Environmental plans have been created under the following topics:

- Sediment Sampling and Monitoring Plan
- Fueling Plan
- Spill Response and Prevention Plan
- Emergency Plan
- Weather Plan
- Accidents/Malfunctions Plan

These plans are contained in **Appendix 10** to this report. These plans will be incorporated as part of the contract documents for the project.

Miscellaneous mitigation measures to be considered based on the CEAA study report are contained in **Appendix 11** to this report.

AS-BUILT TIES TO GLOBAL POSITIONING SYSTEMS

The Engineer will attempt to ensure that all new canal edges, all irrigation and other line extensions, all cofferdam locations and all other items that may affect future maintenance of the project are tied to the co-ordinate system using global positioning methods. This data will be provided to the Board for their future records at the completion of the project.

BEST MANAGEMENT PRACTICES

This report contains a number of Best Management Practices. These are contained in **Appendix 12** to this report and an index for such is included. These Best Management Practices will be incorporated in the contract documents that are prepared for the work in this report.

ADDITIONAL WORK ITEMS THAT COULD BE REQUESTED BY OWNERS AT TIME OF CONSTRUCTION

Most items of additional work that could be required by owners at the time of construction (examples of this would be more expensive methods of disposal of excavated or brushed materials) or additional irrigation work would have to be paid directly by the owner to the contractor and such would not form part of the drain nor be eligible for the grant or such would have to be assessed to the Owner as a non-grantable Special Benefit. Only if the engineer determines that such additional items are necessary for the intended purpose of the drain could they be included as part of the drain and be eligible for grant. In addition all items of additional work that are desired, have to be pre-discussed

with the Engineer and/or Superintendent to ensure the work does not compromise the canal/dyke system.

MAINTENANCE

Each component of this drain is to be maintained by the Board on behalf of the Town of Bradford-West Gwillimbury and the Township of King at the expense of the lands and roads assessed for such, all in accordance with Schedule A with the exception that fixed benefits for life safety, the Special Benefits and the Special Assessments shall not be used for future maintenance calculations and with the exception that cleanout and other costs at road crossings are to be assessed fully to the Road Authority. Schedule A shall apply for future maintenance until such time that any changes are made pursuant to the Drainage Act, RSO 1990.

All parties affected by the Holland Marsh Drainage System Canal Improvement Project are encouraged to periodically inspect the drain that exists on or adjacent to their property and report any visible or suspected problems to the Board and/or Drainage Superintendent. Repeated inspection and maintenance of the drain should allow it to provide a service for many years and avoid major reconstruction. A right-of-way along the drain route equal to the working area described for this new improvement work is also to be available for future maintenance. Access for maintenance is to be along the dyke/canal roads, along and over any backfilled canal and over any private lands used for construction of partial relocations works. Access routes across other private lands during maintenance are to be negotiated at the time of maintenance.

Should any portions of the constructed work require corrective work up to the end of the maintenance period due to soil instability or erosion, the Engineer may authorize additional excavation and leveling, re-sloping of banks and/or erosion control blankets as necessary. The additional costs for such will be assessed against the overall assessment schedule. The Engineer and/or Board may also elect to do such repairs as Drainage Superintendent works if time and financing allow. Where the work is necessary due to faulty construction, the Contractor will be required to attend to such as part of his project holdback.

Wherever, and if, any road or private bridge requires repair, maintenance, improvement or replacement the cost is to be fully assessed to the applicable Road Authority or landowner. The repair or maintenance to be undertaken at any structure could include bottom cleanouts to maintain the grades and cross-sections included herein to remove debris and any blockages and to protect abutments, piers and wingwalls. All work at a bridge and within 30 metres of the bridge is to be an assessment to the Road Authority.

Other items re maintenance are as follows:

a) Frequency of Maintenance Re General Canal Cleanouts

It is anticipated that the frequency of attending to continuous bottom cleanout/ maintenance work in various portions of the canal will be close to what is shown by **Appendix 9**. This drawing was prepared for previous submissions and, as revised, is believed to still depict the approximate frequency of cleanouts. Due to the new canal construction being constructed in the dry, and due to the existence of a littoral shelf, and due to the creation of deep pools, it cannot be confirmed that this will be the actual frequency required. It does provide some estimate however for future planning purposes.

b) Reporting of Problems by Landowners

Wherever any owner is aware of a problem with the condition of the dykes or canals either due to slumping, fallen trees in the canal, creation of beaver dams or similar, he should notify the Board or the Drainage Superintendent.

c) Normal Repair & Maintenance Work to be Undertaken by Drainage Superintendent

The following is the normal maintenance work that may be undertaken by the Drainage Superintendent:

- Removal of dying or dead trees that are or may affect flows in the canal
- Removal of beaver dams and trapping of beaver
- Repair of slumped or eroded banks
- Cleanout through bridges to the cross-sections shown by this report and including the hauling or other disposal of the materials. The Drainage Superintendent may give each road authority the first opportunity to do bridge cleanouts.
- Notification to Road Authorities of the need for any structural repairs of a bridge that if not carried out could impede this drainage work
- Cleanout of sediments in bottom of canal
- Repair of slumped bermed areas
- Elevating of slumped berm areas to required elevations including restoration of plantings or seeding on such
- Repair and maintenance of any swale drains, catchbasins, outlets and backflow preventors
- Clearing/mulching of trees along any backfilled canal and along any dyke area to allow future maintenance
- Hauling away materials from future maintenance activities where such cannot be leveled on canal backfill areas, on adjacent dyke areas, on field area previously used for leveling, or where road usage dictates that hauling is necessary as indicated in the report, and/or where the nature of the materials requires their haulage.
- Repair or improvement of any cofferdam construction
- Installation of environmental measures required as a condition of approval for maintenance or repair
- Clearing to allow any areas to be used for excavation or leveling for repair or maintenance purposes
- Maintenance of continuous access along earth or granular dykes that are used for maintenance purposes
- Erection of limited fences and/or gates to protect any part of the Drainage System where the Drainage Superintendent deems such is necessary and where such is done with the consent of the affected landowners.
- Work associated with operation and restoration of sites where materials from cleanout are disposed of
- Use and restoration of any access routes that are necessary during maintenance
- Traffic provisions during maintenance

It is to be noted that all repair and maintenance work related to irrigation, water disposal or intake are to be fully the responsibility of the landowner(s) but the work has to be undertaken in a fashion that it does not impede the performance or maintenance of the canal drainage system as determined by the Drainage Superintendent.

d) Canal Bottom Cleanouts

It is recommended that canal bottom cleanouts on this project be undertaken whenever sediment buildups in the canal exceed 1 metre in thickness.

e) Future Control of Brush

It is recommended that the Drainage Superintendent consider a program of brush control after this project is completed. The Superintendent should consider periodic power brushing of the level portion of the backfill corridor along the relocated canals, along the dykes, over any private lands used for leveling, and along the Canal Road edges pursuant to the Drainage Superintendent program to avoid costly tree clearing at infrequent times.

f) Irrigation Lines at Maintenance Periods

With respect to ensuring that the irrigation lines as placed by the project or landowner across backfilled canals do not conflict with future maintenance activities of the canals, recognizing that the above grade lines will be laid initially on pallets, if required, or equivalent as part of the construction, it will be the landowner's responsibility to ensure that the line is removed prior to maintenance where it is aluminum tubing, or that it is buried and protected in the case of small diameter lines on the surface, or that it is removed and rolled up until the maintenance work is completed. Any relaying of the pipe after the repair work would then be the responsibility of the landowner. If such works are not done, the pipe may be removed by the Municipality during maintenance activities and the replacement of such would be fully by the landowner.

With respect to below grade lines that discharge into the canal, it will be the owner's responsibility to ensure that any inlet and outlet on such is noted and designated by a marker stake and protected during maintenance work. The Municipality will attempt to construct the maintenance with minimal damage to the inlet but it will be the landowner's responsibility to address any damage that cannot be avoided to the inlet during maintenance activities. The Municipality may require any inlet screens to be removed temporarily during maintenance activities.

Similar comments apply to any small diameter lines laid across the backfill to serve as drain outlets or as overflow from artesian wells. If an owner does bury a small line, he will be responsible for any damage that may occur to it during maintenance activities since excavation equipment will pass along the surface of the backfilled canal.

Such maintenance activities will not occur imminently and may be at frequencies of 15 to 20 years. However, scattered bottom cleanouts may be required earlier. In all cases, the Drainage Superintendent will attempt to minimize damage to existing lines and will notify owners of impending work to allow an owner to prepare for such, but it cannot be guaranteed that some damage will not occur to lines near the surface of the backfill if not protected during maintenance activities, even with care being given.

g) Cross-Sections to Maintain

With respect to cross-sections to maintain to:

- Canals, berms, backfilled canals and leveling areas are to be maintained to cross-sections in this report.
- Earthen dykes are to be maintained to a 5m top and to 1.5:1 slopes.
- Paved dykes are to be maintained to section of adjacent lengths.

MISCELLANEOUS ITEMS AND COMMENTS RE THIS REPORT

a) DFO Inspection

All landowners are to be advised that the Department of Fisheries and Oceans Canada (DFO) may attend on site during the construction to ensure that any or all of the mitigation measures

required by the CEAA study report and all sampling and monitoring required by this report are being attended to. Landowners are to make access available to DFO staff when necessary.

b) Existing Berms on the Outside of Canals

Where a berm exists on the outside of any canal, this report has taken the position that such berm will be reconstructed as part of the project upon completion of canal work.

c) Species at Risk, First Nations Artifacts and Burial Grounds

If any species at risk or First Nations artifacts or burial grounds are encountered or located during construction, the environmental sub-consultant is to be made aware of such and is to confer with the DFO and/or the Ministry of Natural Resources and/or First Nations to determine the measures necessary to attend to such. In some cases, construction will have to cease or be directed to other locations until the matter is satisfactorily mitigated or dealt with. In some instances modification to construction may be necessary. Any increased costs of doing such will be reviewed and agreed to prior to the work but will form part of the project cost.

d) Privacy of Lands

Even though a Municipal Drain exists and/or is being improved across the lands of the various owners, there still is no right of one owner to enter onto another owner's lands. Only the Drainage Superintendent as part of the maintenance of the drain or the Engineer as part of his work with respect to this report (and the Contractors awarded the construction work) have the right to enter onto privately owned lands of others. In addition and on this project, an allowance for right of way has been provided where necessary and as such any adjacent owner who requires access to the new canal for irrigation purposes or for well outlet, water inlet or drain outlet purposes across the backfilled canal even if it is owned by others, will have the right to use the lands to access the canal for irrigation or the other water related purposes described.

HOW THIS REPORT'S RECOMMENDATIONS WILL ADDRESS THE PRINCIPLE PROBLEMS

a) Flood Protection

The berms, steel pilings or railings and/or new road construction recommended in this report will recognize the higher of the projected 100 year flood levels considering both the One Dimensional study prepared for the Conservation Authority and the studies of K. Smart Associates. The elevations provided will be 150mm higher than the calculated higher flood level.

b) Life Safety

This report will have provided the required life safety by relocating the canal fully or partially away from the dyke wherever the original dyke is used as a road, in 15.4 km of the total of 18.4 km of public roads on the dykes (excluding Highway 9). In the 3± km length, existing guide rails will be retained or new guide rails will be installed.

c) Re Drainage

The new canals proposed in this report will provide capacities of canal that exceed the existing condition and will match (or exceed in some areas) the canal capacity as believed to have been provided following the Hurricane Hazel event. (Again it should be considered that the overall function of the canal system will be greater than that existing after the Hurricane Hazel reconstruction work, since there was no cleanout through the various bridges that existed at

the time.) The following table compares capacities as listed by the end area of the canal cross-sections in square metres:

	Canal Capacities Believed to Have Been Created Originally	Canal Capacity Existing	Canal Capacity Believed to be Constructed after Hurricane Hazel	Canal Capacity Recommended in this Report
South Canal	19m²±	6 to 12m²±	30 to 32m²±	30 to 32m²±
North Canal Upstream of North Branch River	19m²±	20 to 22m²±	30 to 32m²±	32 to 34m²±
North Canal North Branch River to Simcoe Road	32m²±	25 to 27m²±	40 to 42m²±	40 to 42m²±
North Canal Simcoe Road to Outlet	35m²±	26 to 28m²±	43 to 45m²±	43 to 45m²±

Notes:
1. As is evident, this report is providing that bridge capacities be improved to equal canal capacities.
2. As previously indicated, it was determined that no noticeable improvement would be gained by enlarging the south canal by up to 20%.

d) Improved Ease of Future Maintenance

A corridor will now exist along all sections of the system for future maintenance. Where the canals have been relocated the backfilled canal is to be used as the maintenance corridor throughout, and this will apply in Intervals 1 through 7, 9, 13 through 17 and in Interval 18. In Interval 8 the small scheme dyke is to continue to be used as the right of way for future maintenance. Where the canal is only partially relocated in Intervals 1, 5 and 6, the lands on the outside of the canals are to be used in part as a maintenance corridor over a width of 10 metres. In Intervals 10 through 12 where the canal is to be cleaned, maintenance will continue to be from the dyke with leveling on adjacent lands as provided in this report or with hauling as provided in this report. The original report did not anticipate that hauling of excavated materials would be undertaken as a maintenance item. This report acknowledges that hauling of some or all excavated materials in some or all intervals may be necessary at times of future maintenance.

e) Structures

By providing for improved capacities at designated structures and by providing recommendations for construction of any new structures, the impact of undersized structures on the drainage system will be attended to. This report also clarifies the repair and maintenance to be undertaken at structures.

DRAINAGE ACT REQUIREMENTS RE REPORT PROCESSING

The following sections of the Drainage Act provide for processing of the report:

Section 41 - Circulation of report once submitted including notices of meetings to consider such
Section 42 - The meeting to consider the report

Section 45 -	Adoption or non-adoption of report by Council
Section 46 -	Serving notice on owners re Court of Revision
Section 47 -	Appealing report on matters of law to Drainage Referee
Section 48 -	Appealing report to Tribunal re design, allowances, costs
Sections 49 & 50 -	Appealing report to Tribunal by Conservation Authority or a municipality
Section 52 -	Appealing report to Court of Revision re assessments
Section 54 -	Appealing report to Tribunal re assessments
Section 57 -	Referring report back to Engineer if necessary
Section 58 -	Adoption of report by bylaw once any or all appeals are resolved
Section 59 -	Meeting if necessary to consider high tender price
Sections 60 to 62 -	Collecting costs after construction is completed.

For details of these sections, reference should be made to the Drainage Act.
A flow sheet re the steps in processing the report is included in **Appendix 13.**

SECTION 41(3) OF THE ACT
In accordance with Section 41(3) of the Act, the Board and the affected municipalities are not required to submit a copy of the full engineering report to any owner assessed less than $100. All that needs to be submitted to the owner is a notice of the meeting date to consider the report and advice as to where a full copy of the report may be reviewed.

PROVISIONS OF SECTION 61(3) OF THE DRAINAGE ACT
Pursuant to Section 61(3), a Municipality may, but is not obligated to do so, pay out of General Funds any assessment equal to or less than $50. Any municipality electing to do such should send a copy of the notice regarding the meeting to consider the report to any owner affected by Section 61(3).

SUBMISSION OF DIGITAL RATHER THAN FULL HARD COPY OF THE REPORT
It has been determined that on this project, for purposes of Section 41(1) and 41(2) of the Drainage Act re the submission of this report, some landowners may be circulated a computer disk (CD) copy of the data of the report including the text, the drawings and all assessments sections rather than by hard copy, provided that a hard copy of the report is available for review at the municipal offices and at local public libraries and at other designated and convenient locations. All requirements re submission of the notice re the meetings would have to be circulated with the computer disk.

WEB SITE REVIEW
K. Smart Associates has already placed on their website (www.ksmart.on.ca) various documents completed with respect to the marsh canal improvement project. On the K. Smart website there is a link to the Holland Marsh Drainage System Canal Improvement Project. There is a brief introduction about the Holland Marsh as well as copies of the Irrigation Report and the Presentation to Landowners on June 17, 2008 that can be viewed or downloaded. The Town of Bradford-West Gwillimbury has the Project Description Report as prepared during the CEAA study in 2003-2004 on their website. K. Smart Associates may put this full January 2009 Report on their web site but such has not yet been done.

BYLAW
This report, including drawings and specifications, when adopted in bylaw form in accordance with the Drainage Act, RSO 1990, will provide the basis for construction and maintenance of this project.

PROVINCIAL OMAFRA GRANT

In accordance with the provisions of Section 85 of the Drainage Act, a grant not exceeding 1/3 may be available on the assessments against privately owned parcels of land which are used for agricultural purposes and are eligible for the Farm Property Class Tax Rate, the Managed Forest Tax Incentive Program and/or the Conservation Land Tax Incentive Program. On the Holland Marsh Drainage System Canal Improvement Project the lands eligible are noted with an asterisk (*) in Schedule A.

Section 88 of the Drainage Act directs that the application for this grant be made upon certification of completion of the drain (or subportion of the drain) provided for in this report. The Board will then deduct the grant from the assessment prior to collecting the final assessment. In accordance with Section 85 of the Drainage Act, a grant not exceeding 1/3 may also be available in the future on the assessment against privately owned parcels of land taxed as agriculture (again as per OMAFRA policies) for maintenance or repair of the Holland Marsh Drainage System Canal Improvement Project if done on the recommendation and supervision of the Drainage Superintendent.

CHANGES TO DRAIN AFTER BYLAW IS PASSED AND BEFORE COST IS LEVIED

Should significant changes, deletions or extensions to the drain proposed in this report be requested or required after the bylaw is passed and the contract is awarded, there may be some difficulty in attending to such. Since this drain is to be constructed in accordance with a Bylaw of the Town of Bradford-West Gwillimbury, changes to the drain cannot be undertaken without a change to the bylaw unless the change is necessary to allow the completion of the project as described.

The above statement does not apply to the items listed in the contingency allowance section of the cost estimate which may exceed the quantities listed and may cause the cost to increase. The cost of approved changes to the drain and increased cost from the contingency items may be prorated against some or all assessments as directed in this report.

If it is desired to make a substantial addition or deletion to the drain proposed in this report, it will be necessary that a revised report be prepared and processed through the Drainage Act, or an application to the Ontario Drainage Tribunal would be required under the Drainage Act to obtain approval for any modification.

If any individual or group of owners require additional work on the proposed drain and are prepared to pay for such, they may make their own arrangements with the Contractor to have such work constructed. The Engineer and Board will have to pre-approve such additions. Even so, the work added would not form part of the drain for the purpose of future maintenance.

SIGNIFICANT FUTURE CHANGES OF LAND USE WITHIN THE WATERSHED

This project has been designed to recognize existing development and existing flows. Should there be any significant change in land use on any upstream parcel or parcels in the watershed, it is recommended that the municipalities ensure that these properties institute storm water management techniques so that the resultant runoff is equivalent to existing runoff levels.

MODIFYING SCHEDULE A FOR FUTURE SUBDIVISIONS

It is recommended that in the case of the creation of new subdivisions, the requirements for the subdivider to have a report prepared to modify the assessment schedule, and at his cost, be a condition in the Subdivision Agreement applicable.

All of which is respectfully submitted.

K. A. Smart, P. Eng.

mw

APPENDICES

HOLLAND MARSH DRAINAGE SYSTEM
CANAL IMPROVEMENT PROJECT

TOWN OF BRADFORD WEST-GWILLIMBURY

APPENDIX 1

South Lake Simcoe Region Conservation Authority Studies

Kilborn, “Preliminary Report on Flood Control Dam North Branch, Schomberg River”, for South Lake Simcoe Region Conservation Authority, 1971.

Marshall Macklin Monaghan Ltd. “Holland Marsh Flood Protection Study”, for South Lake Region Conservation Authority, 1974.

Marshall Macklin Monaghan Ltd. “Flood Protection Study – Holland Marsh”, for South Lake Simcoe Region Conservation Authority, 1976.

Marshall Macklin Monaghan Ltd. “Holland Marsh Dyke Improvements Study”, for South Lake Simcoe Region Conservation Authority, 1979.

Cumming-Cockburn and Associates Ltd. “Flood and Fill Line Mapping Study of the Holland River and Tributaries”, for South Lake Simcoe Region Conservation Authority, 1984.

Cumming-Cockburn and Associates Ltd. “Structural Flood Protection Alternative Analysis”, for South Lake Simcoe Region Conservation Authority, 1986.

Cumming-Cockburn and Associates Ltd. “Holland River One Dimensional Dynamic Model Analysis”, for South Lake Simcoe Region Conservation Authority, 1990

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APPENDIX 2

MORE DETAILED HISTORY OF, AND DURING, K. SMART ASSOCIATES LIMITED INVOLVEMENT

August 26, 1993
Concerns re depth of south canal discussed with Holland Marsh Drainage Committee (HMDC)

February 1995
Meeting with Lake Simcoe Region Conservation Authority (LSRCA) and the HMDC regarding the general conditions of the canal

October 1995
K. Smart Associates (KSAL) authorized to do study of structures that span the canals

January 1996
Initial meeting with Ministry of Natural Resources (MNR) and Drainage Superintendent regarding possible improvements necessary to canals

June 1996
Initial meeting with Fisheries and Oceans (DFO), MNR, KSAL and the HMDC regarding possible improvements necessary to canals

August 15, 1996
KSAL present their report on findings of the structures in the canal to a joint meeting of the Drainage Committee, King Council and Bradford-West Gwillimbury Council.

February 6, 1997
KSAL submit a work plan to study the canals pursuant to August 1996 meeting discussions.

March 11, 1997
KSAL are appointed by Bradford-West Gwillimbury as the initiating municipality to bring in a preliminary report under Section 78 of the Drainage Act to look at the possible methods of repairing and improving the canals

April 15, 1997
KSAL recommends that P. Courey (lawyer) of Parorian and Raphael be retained to prepare application to the Drainage Referee to determine two issues of law re assessing upstream lands. Mr. Courey advises he will do study of law and will report back prior to any formal reference to the Referee.

May 16, 1997
MNR submits a letter stating they discussed project with DFO and concluded that an environmental appraisal, as referenced by the Drainage Act, will not be required. They did advise that a separate analysis to determine compensation and mitigation related to the Fisheries Act will be required as part of a Harmful Alteration, Disruption or Destruction (HADD) application.

April 1/98 to July 12/99
Much dialogue between Courey and other solicitors of all municipalities occurred re trying to have hearing to deal with upstream land assessment.

April 16, 1998
KSAL submits a 74 page draft report with preliminary options for improvement of canals and meets Holland Marsh Drainage Committee. Similar preliminary estimates of costs of doing the work are presented.

August 5, 1998
Further meeting with MNR and DFO to discuss possible alternatives in draft Section 78 preliminary report.

February 4, 1999
HMDC met with Joe Tascona, MPP regarding possible expanded provincial funding for canal improvement work

February 8, 1999
A submission for funding was presented to Joe Tascoma MPP signed by Mayor Black, Mayor Jonkman and the Drainage Superintendent.

February 25, 1999
Drainage Superintendent makes presentation for additional funding to Terrance Young, Parliamentary Assistant to the Minister of Finance

July 12, 1999
Hearing before Drainage Referee (to deal with application to assess upstream lands served by the Holland Marsh Drainage System) finally occurs but only on procedure

September 16, 1999
HMDC agrees with the idea of doing a Section 76 Report pursuant to the Drainage Act in lieu of trying to procure order directly from the Referee re assessing upstream lands

November 1999
Drainage Superintendent on behalf of HMDC submitts letter to LSRCA requesting formal application to Province of Ontario (MNR) for funding to cover flood protection component. LSRCA and MNR subsequently request a detailed report from KSAL and appoints Brian Plazek (URS Cole Sherman and Ass.) to do peer review of the study once completed

January 18, 2000
Town appoints KSAL to do a Section 76 Report

May 26, 2000
KSAL completes detailed report requested by LSRCA and MNR. Study updates options from the April 16, 1998 costing and prepare further drawings, preliminary cost estimate and sections re maintenance and cost benefit.

February 5, 2001
Tribunal approves preparation of Section 76 Report and notes hearing on the Report will be before the Referee.

April 27, 2001
Section 76 Report prepared and is subsequently served by Bradford-West Gwillimbury on heads of all councils affected by assessing upstream lands.

February 7, 2002
Results of Peer Review by Brian Plazek (URS Cole Sherman and Ass.) are presented to Peer Review Committee.

March 2002 and July 17, 2002
Drainage Referee heard and dealt with 26 appeals to the Section 76 Report prepared by KSA
(note: 7,831 owners within 72,000 acres of land circulated re the Section 76 report. The Section 76 report did discuss the substantial canal improvement project being studied.)

May 28, 2002
Liaison committee set up between Municipalities of King and BWG to discuss implications and methods to continue with the Engineering Report for the Holland Marsh Drainage System (HMDS)

July 26, 2002
LSRCA passed a resolution to approve Peer Review report by URS Cole Sherman and to indicate that LSRCA would fully support a request from the Town of BWG, the Township of King and the Drainage Commission to the Superbuild Corporation since the Peer Review supported the recommendations of KSAL as outlined in the May 26, 2000 report. Municipalities did not pursue such, since other applications to Superbuild were undertaken.

October 11, 2002
Written decision of Drainage Referee re the Section 76 report was issued, allowing all upstream owners to be assessed for the Holland Marsh Drainage System

October 2002 to May 2003
Liaison Committee with representatives of BWG and King discuss costs and procedures for continuing study

May 13, 2003
K. A. Smart appointed as engineer to prepare Final Report under the Drainage Act for improvements to the HMDS

June 25 and 26, 2003
Site meetings are conducted by KSAL with landowners who will be affected by improvements to HMDS

July 8, 2003
Peto MacCallum Ltd. contracted to prepare a further geotechnical and hydrogeological report for the Holland Marsh

July 17, 2003, September 3, 2003 and September 23, 2003 (three partial days)
Open dialogue and site examination with representatives of Fisheries and Oceans Canada (DFO), MNR, LSRCA, Holland Marsh Drainage Committee, K. A. Smart and environmental consultant

September 3, 2003
Meeting with Ministry of Transportation of Ontario (MTO) at Downsview to discuss impact of the HMDS on the two Highway 400
structures and on Highway 9

November 7, 2003
Letter from DFO requesting a Project Description Report be prepared outlining the proposed project and associated environmental issues.

November 2003
DFO place the HMDS on the Canadian Environmental Assessment Act Public Registry

March 2004
HMDS – Project Description Report – completed and submitted to DFO

March 17, 2004
Geotechnical and Hydrogeological Site Investigation and Analyses completed by Peto MacCallum

June 2004
DFO requests a Project Scoping table for the Holland Marsh to be prepared as part of the CEAA process

July 2004
OMAFRA announced that future provincial one-third grants for Municipal drain projects were to cease. Work suspended on Final Engineering Report but CEAA study was continued

August 2004
Project Scoping table completed and forwarded to DFO

August 13, 2004
DFO requests a Screening Environmental Assessment report for the Holland Marsh to be prepared as part of the CEAA process

October 2004
Review of Draft Greenbelt Plan and its impact on the Holland Marsh project

November 2004
Review and comment on DFO's Scope of the Environment Report

January 2005
Preparation of grant form to recover engineering costs due to July 2004 announcement. Ultimately OMAFRA reversed decision and grant remains on municipal drains. Note: OMAFRA has indicated they believe this HMDS project is necessary.

March to April 2005
Prepare for, submit notices and project summary to owners, and conduct two open houses and two public meetings with landowners adjacent to canal as required by CEAA study

May 2005
Discussions re possible submissions for funding to COMRIF

May 2005
Commence work on Study Report tables for CEAA document

June 2005
Preparation of and submission of final paperwork including assessment schedules to provide for billing of Section 76 Report costs

September 2005
Completion of report on first round of public consultation and submission to DFO

February 2006
Update of preliminary estimates of Annual Costs for Recommended Project and Preparation of Estimate of Annual Debt to be Financed to allow municipalities to budget for such

February 2006
Review of Toxic Screening Report and comments on letter to LSRCA

August 2006
CEAA Study Report completed (Volumes I, II and III) and submitted for review to DFO

November 2006
Applied to Agricultural Adaptation Council in Tier 3 Canada-Ontario Water Supply Expansion Program (COWSEP) grant to study Holland Marsh Canal Irrigation Improvements.

February 8, 2007
Meeting with Department of Fisheries and Oceans, Environment Canada (EC), Health Canada (HC), Michalski Nielson Associates Limited, K.Smart Associates Limited, Drainage Superintendent, Frank Jonkman Jr. and Bradford West Gwillimbury CAO Jay Currier, in Bradford to discuss Environment Canada, Department of Fisheries and Oceans and Health Canada comments

January 2007
Tier 3 Grant for COWSEP Study approved

February 20, 2007
Written comments received from EC and HC to DFO regarding inclusions to DFO's CEAA Screening Report

April 2007
KSAL and MNAL prepare drawings, report and schedule to LSRCA to allow Private Bridge 15 to be replaced by combination laneway and culvert project.
LSRCA issued permits to allow such

May 2007
Presentation by KSAL to joint meeting of BWG, King and Provincial Agencies re the Canal Improvement Project

February 2008
CEAA study report completed.
HADD application commences.

February 2008
Applied to MIII program for $10,200,000 towards cost of Canal Improvement Project.
Application was successful and grant was received.

March 2008
Work recommenced on Final Engineering Report

May 2008
HADD application for first construction year submitted to DFO.
Notification is received, CEAA Study Report concluded that if the monitoring and mitigation measures specified were implemented, the project is not likely to cause significant residual adverse environmental effects.

June 2008
Two further presentations to which all landowners abutting canals and dykes plus all landowners in the Interior Marsh lands are invited.

October/November 2008
Two areas of Trial Work plus the clearing work approved as Emergency Work are undertaken.

APPENDIX 3

Original: March 24, 2000 File No. 99198
Revised: August 1, 2000

REPORT ON
COST/BENEFITS OF RECOMMENDED PROJECT

HOLLAND MARSH DRAINAGE SYSTEM

SUMMARY
This report provides a simple analysis of the costs versus benefits of a project to improve the Holland Marsh Drainage System. The actual portion of the cost component that should be evaluated is the flood protection component capital cost and its maintenance over a 100 year period. These two values are $2,792,417 and 2,171,486 respectfully. The total cost component is the cost of the total recommended construction improvement scheme at $11,934,711 which has a total maintenance cost of $7,280,000 over 100 years. The benefit is the prevention of stated damages with a value of $82,284,000. This shows that the flood protection component is highly cost beneficial. Even the total project is cost beneficial from flood protection concerns only. An analysis using a statistical risk approach as presented by others confirms the benefits exceed the costs.

COSTS
The cost of the recommended improvement project as presented in the report ***Recommended Schemes and Cost Sharing*** is $11,934,711. This document shows that the low cost stand-alone flood protection component would cost $2,792,417. The annual costs of maintenance of a full relocation project with berm and with hauling of maintenance spoil is assumed as $72,800. The annual cost to maintain the stand-alone flood protection project would be $21,715. See report on ***Future Maintenance Provisions***.

MARSH ECONOMY
The benefit of a system improvement is the value of damages but would be prevented / avoided by the improvement project.

The Holland Marsh Drainage Committee through the Drainage Superintendent undertook a survey of all the Marsh Farmers to determine the value of equipment, crops, greenhouses and dwellings in the Marsh.

A Questionnaire as enclosed in Schedule A to this report was submitted to 24% of the properties within the Marsh.

Responses were received such that 18.6% of the properties were represented.

The data reviewed was tabulated by the Committee in Table 1 below.

Some additional information provided by the Committee is included in Table 2.

TABLE 1

Breakdown of Values
Based on Information Collected by Survey

INFORMATION GATHERED: REPRESENTING 16.8% OF TOTAL LAND OWNERS	**ESTIMATED VALUE (Based on Survey)**
Equipment Value:	
534 Tractors And Combine Equipment	$ 38,109,710
207,763 Storage Pallet Boxes (approx 350 lb per box)	$ 9,820,670
Refrigeration Equipment	$ 4,612,343
Crop Value:	
Greens such as Lettuce, celery, etc. (if all marsh were greens)	$ 39,500,000
Onions (if all of marsh was onions)	$ 40,625,000
Carrots (if all of marsh was carrots)	$ 32,287,840
Average of the above	**± $ 37,470,000**

Greenhouse Crop Values:	
18.3 Acres of Greenhouses Value of Crop contained in Greenhouses	$ 4,575,000
Potential Impact to Economy of the Province based on Retail Value by the Ministry of Agriculture & Food Figures Based on Crop Value being 24% Farm Gate Value	
Greens	$ 164,583,333
Onions	$ 169,270,833
Carrots	$ 134,532,666
Average of above	$ 156,125,000
Greenhouse Crop	$ 19,062,500
House and Contents Value:	
501 Houses within the Marsh @ $120,000 per house	$ 60,120,000
Contents, based on Insurance Companies estimate of cost of household contents being 80% of house value which is 0.8 x $120,000 = $96,000 per house	$ 48,096,000
Barns	
350 barns at an average cost of $120,000	$ 42,000,000
Greenhouses	
18.3 acres at a value of $250,000 per acre including electrical and heating Value of Greenhouses	$ 4,575,000

TABLE 2

GENERAL MARSH STATISTICS
The Marsh is presently a One Hundred Fifty Million ($150,000,000) Dollars Industry to the economy of this Province.

Total assessment is One Hundred Ten Million ($110,000.000) Dollars

Structures within the Marsh (see Schedule B):

- 501 Houses;
- 350 Barns;
- 125 Single and Double Garage;
- 256 Small Plastic Hoop Greenhouses;
- 2 Small Halls;
- 1 Church;
- 1 School;
- 1 Library;
- 3 Pumping Stations;
- 1 Experimental Station;
- 18.2 Acres of Greenhouses operated 12 months a year.

The above does not include infrastructure: interior drains, small tools, welders, motors, shop equipment; irrigation equipment such as pumps; chemicals, seeds, packing equipment, boxes, etc., roads, utilities.

VALUE OF MAJOR ITEMS ONLY:

- Farm Gate Value of Crop $37,500,000 Million Dollars;
- 537 Tractors, combines valued at $38,000,000 Million Dollars
- 207,000 Storage Boxes valued at $9,800,000 Million Dollars
- Refrigeration Equipment $4,600,000 Million Dollars
- Household Contents as per the inquiry to insurance company $48,000,000 Million Dollars.

WHAT ARE THE LIKELY BENEFITS/DAMAGES PREVENTED BASED ON THE DATA IN TABLES 1 AND 2

The following is the estimate of damages prevented if a 100 year flood were to occur.

(a)	Value of Tractors and Equipment	52,500,000	
	If 33% Damage to Equipment	17,500,000	17,500,000
(b)	Farm Crops		
	- local value	37,500,000	
	- if 50% crop loss	18,750,000	18,750,000
(c)	Impact on Province		
	- assuming Farm Gate Value is 24%		
	- Provincial Impact	78,125,000	
	- use 20% of this	15,625,000	15,625,000
(d)	Greenhouse Crops		
	- Value of Greenhouse Crop	4,575,000	
	- Assume 50% loss	2,287,500	2,287,500
(e)	House Damage		
	- 501 units with a possible damage of $69,200 each		
	- Assume 60% damaged or 0.6 x $69,200 x 501		20,911,500
(f)	Farm Buildings (Barn) Damages		
	- 350 buildings with a possible damage of $10,000 each		
	- Assume 60% damaged or 0.6 x $10,000 x 350		2,100,000
(g)	Greenhouse Structures		
	- 18.3 acres with a possible damage of $10,000/ac		
	- Assume 60% damaged or 0.6 x 18.2 x 10,000		109,800
(h)	Infrastructure – roads, drains, utilities, irrigation and field damages cleanup including pickup and disposal of crops and other damaged articles		
	- Assume maintenance/repair costs		5,000,000
	TOTAL POSSIBLE DAMAGES PREVENTED (BENEFITS)		**82,284,000**
	(This value per year if spread over 100 years		**825,000)**

Notes:

1. *The estimates of percentages of tractors, farm crops, houses, barns damaged are based on percent of damage by Hurricane Hazel event when dykes were flooded. See Schedule C.*
2. *The estimate of damages to a house, barn, greenhouse and to the infrastructure are included in Schedule B.*

ANALYSIS OF COST BENEFITS FOR FLOOD PROTECTION COMPONENTS ONLY

The Chapter 1 and 2 documents indicate that the lowest cost option just for flood protection is the option of raising roads at $2,792,417.

Chapter 3 indicates that the cost to maintain a "raised road" for flood protection would be $1,085,743 in a 50 year period. In a 100 year period the costs would be double or $2,171,486.

If these 2 costs are added, the total cost for a flood improvement project is as follows:

Improvement Project	2,792,417
Maintenance over 100 years	2,171,486
	$ 4,963,903

The ratio of benefit costs just for the flood protection component versus the damages prevented would thus be:

Ratio $\frac{82,284,000}{4,963,903} = 16.5$

This is a very favourable ratio.

WHAT ARE THE COSTS PER YEAR IN 100 YEAR LIFE FOR TOTAL RECOMMENDED PROJECT

Improvement Project	11,934,711
Maintenance over 100 Years	7,280,000
Total Costs	**19,214,711**
(This value per year over 100 years	**192,147)**

RATIO OF BENEFITS / COSTS FOR TOTAL PROJECT

Benefits	82,284,000
Cost	19,214,711

Ratio: $\frac{82,284,000}{19,214,711} = 4.28$

This is a favorable ratio.

APPROACH OF MARSHALL MACKLIN STUDY OF 1976

The particular Cost-Benefit Section from the 1976 Report is appended as Schedule E.

SCHEDULE A

From: Town of Bradford West Gwillimbury
Art Janse, Drainage Superintendent
61 Holland St. E, P.O. Box 160, Bradford, ON L3Z 2A8
(905) 775-5366

SURVEY

The following is information required for the benefit for the benefit of determining an estimated value of cost that could be incurred for damages should there be a flood in the Marsh.

Your participation with completing this survey would be greatly appreciated and beneficial.

Please note that the information you provide will be kept in strict confidentiality and no names will be released. This information will not be used for any other purpose, but solely to provide insight as to the potential cost of damages required by the Ministry for applying for grants.

Surveys must be completed prior to February 14, 2000. Thank you for your assistance and time.

Please <u>do not</u> put your name of this Survey

1. How many acres do you own or rent? _____

2. How many bags of onions per acre is a reasonable crop? _____

   What is a reasonable price? _____

3. How many bushels of carrots per acre is a reasonable crop? _____

   What is a reasonable price? _____

4. Do you grow any other crop, and if so, how many acres.? _____

5. Number of Pallet Boxes _____ Estimated Value $ _____

6. Number of Tractors _____ Estimated Value $ _____

7. Number of Combines _____ Estimated Value $ _____

8. Number of Other Equipment (irrigation pumps, seeders, etc.) Estimated Value $ _____

9. How many farm buildings do you have? _____

10. If the farm buildings are refrigerated, what would the estimated cost of the cooling units be if damaged by a flood? _____

11. If there is any other items that you can think of that would be damaged by a flood, please indicate? (i.e. equipment, supplies, etc.) _____

Please be advised that the above information is required in order to justify my report to the M.P.P. of a potential loss of $2000,000,000.00 Million if a flood occurred.

SCHEDULE B

1999 INVENTORY OF BUILDINGS AND ASSESSMENT

WITHIN THE DYKE AREA OF THE MARSH

TOTAL ASSESSMENT	110,000,000 (ONE HUNDRED AND TEN MILLION)	
HOUSES	501	
STORAGE BARNS	350	(1,500 TO 15,000 SQ. FT.)
GARAGES	125	(SINGLE AND DOUBLE)
SMALL GREENHOUSES	256	(PLASTIC HOOP, APPROX. 20’ X 100’ EACH)
HALLS	2	(SMALL)
CHURCH	1	
SCHOOL	1	
LIBRARY	1	
PUMP STATIONS	3	
EXPERIMENTAL STATION	1	

18.2 ACRES OF GREENHOUSES (UNDER GLASS AND PLASTIC, HEATED AND OPERATED ALL YEAR LONG)

SCHEDULE E

(REPRINT FROM 1976 MARSHALL MACKLIN STUDY ENTITLED *"FLOOD PROTECTION STUDY"*)

7.6 Cost-Benefit Comparison

In the foregoing sections the hydrology and hydraulics of flooding in the Holland Marsh area have been quantified, the alternative methods of providing protection against an event of Regional Storm Magnitude were analyzed, their costs estimated and a design concept outlined. The design concept chosen is felt to be the most economic and technically feasible combination of flood control works to provide the desired level of protection. The estimated cost of the works and improvements of the flood protection scheme is from $ 2,750,000.00 to $3,000,000.00 excluding land, engineering and contingency.

To establish possible flood damages a complex compilation of actual flood damages to other flood plains in Ontario and synthetic estimates of possible damages that could occur to the Holland Marsh at different flood elevations were undertaken to produce realistic estimates of flood damages. Two critical times of the year when a flood would most likely occur were considered: Spring and Fall.

Figures 5.1 and 5.2 were prepared to illustrate flood damages. They represent the losses caused by floods at various stages or elevations. All variations of elevation, whether caused by difference in topography or by construction techniques, were taken into account in the preparation of the stage-damage curves. Based upon the Regional Storm flood levels defined by hydrologic and hydraulic analyses the potential spring flood damages would be in the order of $30,500,000.00 and the potential fall flood damages would be $32,500,000.00.

Utilizing a statistical risk analysis and the existing watershed conditions the present Average Annual Flood Damage Cost would be $1,308,000.00. With the implementation of the proposed flood protection scheme, the future Average Annual Flood Damage Cost could be reduced to $63,000.00. This yields an Average Annual Benefit of $975,000.00.

The cost of works involved in the proposed flood protection scheme was estimated to be about $3,000,000.00, exclusive of land, engineering and contingency. Based upon a 100 year structure life and interest rates of 8% this translates into a capital recovery cost of $240,120.00 per year. Including an annual maintenance cost of $30,000.00 per year results in an Annual Flood Protection cost of $270,120.00 per year.

The ratio of benefit vs. cost of works is found to be 3.6 however, land, engineering and contingency allowances have not been included. By relating the capital recovery rate to the difference between annual costs and benefits, the value of land, engineering and contingent allowances that could be tolerated before the benefit-cost ratio dropped below 1.0 is $8,806,000.00.

The estimation of land costs could only be done after a pre-design study for each flood control project were undertaken in order to assess exact land requirements and to conduct more accurate research into land costs. A very cursory estimate has been made in order that the Authority might assess the desirability of proceeding with future engineering and land acquisitions.

Pottageville Swamp Reservoir	2000 acres @ $500/acre =	$ 1,000,000
North Branch Schomberg River Reservoir	900 acres @ $600/acre =	540,000
Kettleby Reservoir	180 acres @ $600/acre =	108,000
Glenville Reservoir	100 acres @ $600/acre =	60,000
Site No. 8 Reservoir	100 acres @ $600/acre =	60,000
		$ 1,768,000

ERRATA ADDENDUM – MARCH 29, 1977

HOLLAND MARSH FLOOD PROTECTION STUDY

Page 71 – Last paragraph should read -

"Utilizing a statistical risk analysis and the existing watershed conditions, the present Average Annual Flood Damage Cost would be $579,000. With the implementation of the proposed flood protection scheme, the future Average Annual Flood Damage Cost would be reduced to $63,000. This yields an Average Annual Benefit of $516,000."

Page 72 – Second paragraph should read –

"The ratio of benefit vs. cost of works is found to be 1.9 however, land, engineering and contingency allowances have not been included. By relating the capital recovery rate to the difference between annual costs and benefits, the value of land, engineering and contingency allowances that could be tolerated before the benefit-cost ratio dropped below 1.0 is $3,072,000."

SCHEDULE C

PERCENTAGE OF CROPS, TRACTORS AND HOUSES DAMAGED IN HURRICANE HAZEL EVENT

A) TRACTORS

- See November 26, 1954 minutes
- 180 full size tractors were repaired
- 210 small items (garden tractors) were repaired
- If there were 533 tractors, then as there are now, then the % damaged was 33%.

B) CROP LOSSES

a) In 1954 average price of onions was $1.11 per bag
With 6,500 acres @ 500 bags per acre, the value would be
325,000 bags x $1.11 = 3,607,500

b) In 1954 the average price of carrots was $0.92 per bushel
With 6,500 acres @ 650 bushes per acre, the value would be
4,225,000 x 0.92 = $3,887,000

c) According to December 21, 1954 minutes, the losses were $2,000,000.
This represents 50%± of the crop values at the time.

Using another analysis:
In 1954 the body paying the damage claims determined:

d) 9/10 of production cost of onions was $0.69 per bag
With 6,500 acres @ 500 bags per acre, the value would be
325,000 @ $0.69 = 2,242,500.

e) 9/10 of the production cost of carrots was $0.41 per bushel
With 6,500 acres @ 650 bushels per acre, the value would be
$4,225,000 @ $0.41 = $1,732,250

f) The damages paid were $1,000,000.
This represents 50% of the 9/10 of the production costs.

C) IMPACT ON PROVINCE

- 20% was used based on a judgement call
- The whole affected provincial infrastructure would not fall apart because of this one time loss but there would be an impact and 20% was used.

- There may be layoffs, etc. but not job losses.

D) GREENHOUSES
- Same percentage loss as for field crops

E) HOUSE DAMAGES
- November 26, 1954 minutes showed that 380 claims were adjusted for house contents damages
- In 1954 the number of houses was greater (the Superintendent recalls the number being closer to 630±).
- The 380 claims represent 380 / 630 = 60%
  Therefore 60%± of houses were damaged.

F) BARNS
- Assume the percentage of damaged barns is 60% like the houses

SCHEDULE D

ESTIMATING VALUES OF DAMAGE TO HOUSES, BARNS, GREENHOUSES, AND INFRASTRUCTURE IN A FLOOD EVENT

A)	HOUSES (based on 1500 sq.ft. and information collected from Builder's Survey within the Municipality)	
	- Paint	$ 1,700
	- Door and trim	5,500
	- Drywall and insulation	6,925
	- Flooring	7,000
	- Kitchen cupboards	3,300
	- Sub-floor	1,200
	Sub Total	$ 25,625
	- 50% removal, disposal and cleanup of the above listed items	12,812
	Sub Total	$ 38,437
	- Household contents 80%	30,720
	TOTAL	$ 69,157
B)	BARNS	
	Labour - 3 workmen for 6 days @ 8 hours/day and @ $25/ hour	$ 4,000
	Disposal of old materials - Lump sum	1,000
	New materials:	
	- Steel - 1200 sq.ft. @ $2.50	3,000
	- Insulation - 1200 sq.ft. @ $0.40	500
	Sub Total	$8,500
	Use:	$ 10,000

C) GREENHOUSES
- 1 acre is 43,650 sq.ft.
- If damages are $0.25/sq.ft. based on glass (barns were $2.50/sq.ft), then damage is $10,000/acre to structure
- If plastic, it has to be taken off and cleaned
- If its glass, broken glass has to be picked up, disposed of and replaced.
- The Superintendent recalls of 2 acres of greenhouses being damaged during a hail storm and the damages were $30,000.

D) INFRASTRUCTURE DAMAGE
- In Hurricane Hazel, land damages were $100,000 (see December 21, 1954 minutes) plus $100,000 paid to Ag College for assistance.
  Thus total is: $200,000

Picking Up Debris:
20 men x 3 months x 4 weeks x 50 hours x $20/hr = 360,000
10 trucks x 3 x 4 x 50 x $40/hr = 240,000 600,000

Disposal Site for damaged carrots, onions, etc.:

6,500,000 bags x ½ (50%) x 50 lbs/bag ÷ 2000 x $100 for tipping fee - $8,125,000 if all were taken to landfill site Assume 25% goes to landfill	2,000,000

Schedule D – Continued

Roads: 500 acres @ 50% in area = 250 acres 250 x 43,500 / 66 = 150,000 lineal feet Assume 30% were eroded 50,000' @ 20 x 1.5' x 1/27 x $20/cubic yard	1,200,000
Drains: Total length of drains / 750,000 feet± use 300,000' @ $1.50 per foot to clean out	500,000
Pumping River Level Down: Hydro to pump river level down ($3,000/foot of water @ 4 feet of water)	120,000
Utilities: Lump sum	100,000
River Clean up: $10,000 per mile x 10 miles	100,000
Irrigation repair: Lump sum	50,000
TOTAL	$ 4,870,000
Rounded to:	$ 5,000,000

APPENDIX 4
PUBLIC MEETING / SITE MEETING SUMMARIES

On June 17, 2008 an Open House and Presentation was given by the Engineer at the Bradford Community Centre. A notice was sent out inviting owners adjacent to the canals and dykes as well as the owners of the interior marsh lands. A total of 852 owners were invited. An Open House format occurred at 2pm with 32 people attending and a Presentation using power point was given at 7pm and 43 people attended.

The informal presentation topics included;

- What is the Holland Marsh?
- Original Engineers Report
- Events Between Original Construction and 1997
- Problems with HMDS Canal and Dykes
- Main Engineering Events Summarized
- Work Options and Alternatives Considered in 2000
- Current Recommended Work – Alternative 5
- Irrigation report – COWSEP
- CEAA Study Report – DFO Authorization
- Past Estimates of Project Costs and Portions to Owners
- Municipal Infrastructure Investment Initiative (MIII) $10.2 million
- Proposed Schedule for Completing Work
- Future Maintenance
- Cost Benefit

After the presentation there was a brief question and answer period. All questions were general in nature.

April 18, 2005 File No. 03-023

MINUTES OF PUBLIC MEETING FOR
HOLLAND MARSH DRAINAGE SYSTEM HELD APRIL 12, 2005
IN ANSNORVELDT, SENIOR CITIZENS CENTRE FROM 7-9:30 PM

Conducted by Kenn Smart, Art Janse, Kay Palmer, Al Shaw, Dave Cunningham, Jack Rupke and landowners

Mr. Smart introduces Art Janse (Drainage Superintendent), Kay Palmer (K. Smart Associates), Jack Rupke (councillor from King and landowner), Al Shaw and Dave Cunningham (Environmental Consultants, Michalski Nielsen Associates). Mr. Smart gives a brief outline as to why this meeting is being held. He talks of the Drainage Act process and also the Canadian Environmental Assessment Act process.

Al Shaw gives a brief description of what MNA will be doing this summer to meet the objectives of the Department of Fisheries and Oceans re report for the Federal Environmental Assessment.

General Summary of the Meeting

Due to the unexpected attendance, issues brought up, uncontrolled presentations and multiplicity of speakers at one time, not all speaker's names were recorded and recording of points raised was difficult. A general summary of the meeting would be that five or six vocal objectors voiced strong objections and spoke repeatedly. The main concern was with the cost of the project. After 90± minutes of uncontrolled presentations the vocal objectors gradually left the meeting and others followed. A few remaining land owners presented controlled and reasonable comments about the project.

Specific Points Recorded Were As Follows

- Fisherman will have an easier access to the canal with the new berm.

- Keep non-farmers (commuters) off the marsh roads (to deal with life-safety).

- Other options should be looked at such as;
  - Dredging (by pumps)*
  - slow and steady maintenance
  - place a guardrail around the whole marsh
  - do nothing, it's fine as it is

* Engineer stated dredging using pumps was considered and dismissed due to potential problems with tree trunks, branches etc. mixed in with sediments.

- People will dump more if there is a berm or swale along the canal.

- One vocal owner did not believe that the flow of the canal would be better once the canal was relocated/cleaned. He did not believe the results of the previous reports which investigated the flooding potential even though he was advised of the three completed studies that all concluded flooding would occur. (Marshall/Macklin, Cumming Cockburn and K. Smart Associates Ltd.)

- Why are we (marsh owners) being penalized by paying most of the costs? Marsh owners will pay 75% of costs vs. outside owners paying only 25% of the costs. Some believe outside owners are the cause of the sediment build up problems as well as the developers so they should pay for the project to be done.

- Make the federal government pay for it all since they are causing this study to be made.

- Leave the farmers alone.

- If a Hurricane Hazel flooding event happens again, the government will pay for the cleanup and damage costs (estimated at $80 million).

- There are concerns with loss/reduction of quality of irrigation lines. We have a very limited time frame to do our irrigation (some irrigation lines are very complex), if our irrigation is interrupted in any way we will sue you.

- We are a very unique farming community. We are exempt from the nutrient management program.

- Someone asks how can we stop the project?

- No one can drown in the marsh canals, there is too much sediment (This was in reference to life safety issues discussed at the start of the meeting)

- With respect to flooding, the dyke in the north canal holds back the water on the outside of the marsh from coming in. It is wet on the outside.

Possible Explanation of Unexpected Attendance and Discussions

Only owners alongside the dyke and canal were notified of the Open Houses/Public Meetings. However, some owners in the interior of the marsh dropped pamphlets in the mail boxes of all other owners in the interior to state an expensive project was being proposed and all should come to the meeting and object. That notice was circulated, not withstanding, that all owners were notified in 2002 of the proposed project and its projected costs.

One possible reason for the unexpected presentations could be a result of Mr. Janse's attendance and presentation to the Muck and Vegetable Growers Annual Conference (at the OMAF site in the marsh) on April 6 and 7, 2005 where he spoke on options, equipment and costs related to the proposed canal work. At that time he projected that the net cost of $350 per acre as presented in 2000 to 2002 could now increase to $500 per acre.*

* It was explained that the major reason for the increase results from the loss of the $2 million± grant from MNR/LSRCA that was originally expected.

April 18, 2005 File No. 03-023

MINUTES OF PUBLIC MEETING HELD APRIL 13, 2005
AT THE BRADFORD ARENA FROM 7 - 9:30 PM

Mr. Smart firstly introduced himself and his staff. He then introduced by first of all referring to the Section 76 report done in 2001 which was sent to all owners within the Holland Marsh Drainage System and gave an overview of the Section 78 process pursuant to which this study for improvements is being undertaken. He advised that the project was now the subject of a federal environmental assessment to determine if any significant environmental issues existed. He stated that the purpose of the Open House meeting (earlier) was to determine the physical, social and economic environmental issues/concerns of owners abutting the canal and dyke. Preliminary costs and assessments were presented but owners were advised that detailed data re financial matters would be presented in the future (note: since this is a Drainage Act project, affected owners are responsible for a portion of the cost of the project)

Mr. Smart introduced Art Janse (Drainage Superintendent for the Holland Marsh) and indicated that Mr. Janse and the Municipalities of Bradford West Gwillimbury (BWG)and King Township are the proponents of the project.

Mr. Smart then introduced Al Shaw, the environmental consultant from Michalski Nielsen Associates and advised that Mr. Shaw's firm will be participating in the detailed environmental assessment.

Further Comments of Mr. Smart Were as Follows

- These meetings/presentations are part of the environmental assessment process. In the Section 76 report, previously circulated to all, the $12 million project being studied now was discussed.

- In 2003 two site meetings were held with abutting owners, one in BWG and one in the Township of King. People who were affected directly were invited to these meetings.

- This April 2005 meeting is now an opportunity for owners affected by canal work to address environmental issues/concerns. Many owners have come to the two Open Houses in the afternoons before the evening Public Meetings.

- The engineering work done to date has examined different options (3 main options and 6 to 7 sub options).

- The "problems" issues (with the canal/dykes) considered are as follows:
  a) The canal can't be cleaned as originally done since there is no room to work. The materials would have to be hauled and hauling is expensive.
  b) Maintenance is needed but it cannot be legally and physically done as per the current drain by-law.
  c) Dykes are too low for flood protection and are unstable.
  d) Life safety is an issue. There have been 17 fatalities along the canals since the Hurricane Hazel emergency work.
  e) Municipalities could be legally liable if they do nothing to prevent flooding and damage.
  f) Installing guide rails, raising dykes and hauling material is very expensive compared to recommended work of relocating the canal where beside roads.
  g) By moving the canal in many areas:
     - Life safety is addressed
     - A berm can be built for flood protection (where required)
     - Future maintenance is facilitated
  h) An example of successfully moving the canal away from the dyke road is the work previously done just north of Highway 9.

- Details of the various interval work along the canals (Interval 1 to Interval 18) was presented.

- All owners will be invited to a follow-up meeting to illustrate all options looked at. It was suggested this meeting be considered for June and the need for such was evident after the previous night's Public meeting*

* Note to readers – After discussion amongst the proponents it was concluded the additional data could not be made ready for June and that more time to investigate COMRIF funding was required. Later dates in 2005 are being considered. Preliminary data re the environmental effects will be known then.

- In the 1970's and 1980's the Conservation Authority studied the canal and dyke systems but because of lack of funding could not proceed with identified work projects.

- The $12 million estimated cost of 2002 includes Engineering, Administration, Construction and Allowances. $8 million will be contributed by government (Municipalities, OMAF and MTO).

- $4 million± will be assessed to lands and roads.

- OMAF will contribute one third of assessments to agricultural properties.

- A Peer Review was undertaken in 2002 by the CA (Lake Simcoe Region Conservation Authority) to justify further provincial participation and it concluded the project was viable and should be supported. However, no direct commitment was given by MNR/CA only that they would lend support to other funding opportunities that may exist.

- Pursuant to the original engineering report (A. Baird 1924), inside marsh owners paid 100% of construction

- As a result of the 2001 Section 76 report, 64,000 acres of upstream/highland lands will now be assessed. Maintenance and new construction will now be assessed 75% to inside marsh owners and 25% to highland (outside marsh) owners.

- During the work on the Section 76 report only 30 appeals± (out of 8,000 properties) were made to the Drainage Referee from high land owners. There were no appeals made from inside marsh owners. Referee upheld the Section 76 report.

- In 2002 dollars, the net cost to each marsh owner for the $12,000,000 payment was estimated to be approximately $350/acre. The cost is now expected to be $500/acre for marsh owners and $18 to 20 per acre for outside marsh owners, without any further provincial/federal assistance and considering that MNR/CA will not contribute what was sought.

- There is a $16/acre± per year marsh drainage levy to marsh owners. This money will be applied to the project and will continue. The pumping station replacement (1.2 million±) was fully paid by these marsh levies.

- There will be more than one billing to owners if the project proceeds.

- 2007 is the first anticipated year of construction. The construction would involve 7 years to 2013. There will be an average of 4 km of work done per year. Work has to be timed to not overly impact fish spawning.

- The bridge structures to be done include two on Highway 400, 2 structures in BWG, 3 structures in King.

- Temporary irrigation is to be provided. After the new engineering report is adopted all existing pipes through the dyke will be recognized and subject to HMDC control and any new pipes can only be put through the dyke after approval is given.

- Some portions of the canal are to be relocated and some are to be cleaned with a breakdown as follows;
  -9.0 km Relocation with berm
  -8.9 km Relocation no berm
  -7.3 km Clean out with leveling
  -1.9 km Clean out with hauling
  -0.9 km Partial relocation

<u>Al Shaw (Michalski Nielsen Associates Ltd./MNAL) Comments</u>

- Al Shaw gives a brief description of environmental concerns and what his firm will do and what mitigation methods will be used.

- He advised he would be working with the DFO to get environmental approvals.

- The project will impact fish/fish habitat so the federal agency must give authorization which has triggered a CEAA.

- He will have to produce a good solid background of what exists.

- This summer MNA will determine species, population amounts and habitats.

- In the west end there is a Provincially Significant Wetland.

- MNA will determine if there are any rare plants and advise of work necessary. He stated that DFO wants to determine what exists and the goal is to impact the environment the least possible and compensate where there are impacts

<u>Questions Raised and Answers Provided Were as Follows;</u>

Q. Audience asks what is the possibility of DFO saying no to the project?

A. Proponent states that we do have positive feedback to date. DFO is however also concerned about impacts on adjacent owners. DFO wants to know the owners physical, social and economic environmental concerns.

Q. Audience says the dyke should be a private road.

A. Proponent replies that you can offer that request but it will be impossible. Paved roads are municipal roads and the north canal road is a county road. Only the earth dykes are not roads. They are private. I don't think we can turn the roads back to private status. Proponent makes reference to the Holland Marsh Road Act 1945. Dyke becomes a road and road authority is responsible. Act would have to be changed or rescinded.

Q. Audience says but we pay for that road.

A. Proponent says we are aware of the problems with the road. You would have to go to the Municipality to get it turned to a private road. We anticipate that if project is completed, the road will be repaired as its base would then be more stable.

Q. Audience asks if DFO has so much say, why are they not contributing money? Why aren't they here?

A. Proponent says we can only access federal money through COMRIF. Designated funding programs such as this program currently provide for joint Federal, provincial and municipal money for a project. King and Bradford have applied for 2 projects already through COMRIF but money for a further project may be still available

Q. Audience asks if there is a refusal for the project (and it stopped), who would be held liable?

A. If nothing were done and there was flooding, there would be liability and it would be an issue as to who is liable.

Q. Audience asks if DFO says no and we still want to do it, what happens?

A. Proponent says we will ensure DFO is aware of their possible liability and they know such already. Proponent says DFO personnel involved here are from Peterborough; they were no doubt reminded of flooding potential when the storm in Peterborough occurred last year.

Q. Audience asks can we provide new designated areas for people to fish? Otherwise there may be trespassing onto private lands.

A. Proponent said he hadn't considered such yet.

- Perhaps supplying designated fishing areas or planting that would discourage trespassers could be considered.
- Proponent says that the Conservation Authority and MNR police this. They have officers to use for this. Has anyone called them to address these problems with trespassing fishermen and dumping? OPP definitely do not look after this.
- We would welcome anyone's thoughts to implement fishing controls.

Q. Audience says that we have problems with fisherman going into our barns and stealing tools. They are trespassing and having picnics. Police do nothing. Has anyone called the CA re this?

A. Proponent suggests the Municipality could be asked to implement a bylaw to stop fishing.

- Audience (who is with the local police force) says York Regional Police can become involved if there are municipal by-laws to enforce. People can be charged with littering and trespassing.

Q. Audience asks how many people are there in the outside 65,000 acres and in inside 7,000 acres?

A. 8,000± owners.

Q. Audience says with 8,000 owners we should have federal and provincial governments ready to assist in the cost for this. There is a lot of land to drain to Lake Simcoe. We should rally to our government. This is a greenbelt (protected) area – put some money in it.

A. Proponent says the Municipalities have undertaken direct presentations to MPs and MPPs in an attempt to secure added funding. Use one of our existing programs was their response. If it is going to be done, we have to use an established program. Proponent agrees that there should be additional outside monies available for this project.

Q. Audience says he agrees to this project but not the costs. We should rally together to get money from the government.

A. Proponent says, in our presentation to MPs we told them that this project is affecting 8,000 people in their constituencies. The MP sent someone for 6 months to look into the project.

We spoke to him 3 times a week, he took his information to the management board and got no support. The second approach we did was to go to MNR and the CA. We did this and got nothing. We got bad support as someone said that the marsh is polluting (phosphorous from inside marsh lands*) Lake Simcoe and it undid what proponent was trying to say. We did a tour of the marsh and it still went nowhere.

* Note to readers – Design for a phosphorous treatment facility was shortly thereafter considered.

• Proponent said that people should rally together for this project to get funding.

Q. Audience points out that a sign reads "Heart of Agriculture" as you enter Brandford. He asks why we can't make the road a toll road? Farmers or those that abut the canal could be excluded from paying the toll. We would have the project paid for using the tolls.

A. Proponent says that he and proponent can't make the road a toll road but the marsh owners need to make people aware of that. If flooding occurs, an $80 million impact is an attention getter.

Q. Audience asks if trees will be replanted on the berm after the full relocation of the canal? He lives along the canal where a full relocation with a berm is proposed and has trees there. The trees offer some protection to his property.

A. There is not a plan to replant trees. However, natural regrowth of trees will not be hindered. It is proposed to put plants (shrubs)on the berm and let the backfilled canal grow wild. Owners can request planting be done.

• Audience says that skidoos were a very bad problem this winter. Relocation of the canal will bring noise closer, smell, etc.

Q. Audience had a number of questions and concerns;
- Control of the berm? As a landowner I would like control of the appearance and use of the berm as it is in front of my property. I have children with severe allergies.
- Who can access? What activities are done?
- Deed lines? Some owners own to middle of canal, some to the far side
- Liability for damage? Eg. heavy equipment, damage to irrigation. If they fail, who pays?
- Liability of wells with relocation – what if we have no pressure, contamination?

A. Control of berm:
The ownership lines will not change even if canal is shifted. As an owner the land is yours and you can do what you would like to it (except no obstructions can be placed in the canal). We will try to make it as aesthetic as possible. We will try to discourage access to berms with vehicles.

• Liability for damages:
Any damage to irrigation lines is the contractor's responsibility. A firm will be delegated to maintain irrigation during construction. If there are problems, someone will be there all the time to attend to ASAP. Proponent can't say there won't be some problems. Construction is like that. New irrigation inlets will be placed as part of construction. If there are construction problems (deficiencies) corrections will be made.

• Re wells:
In our opinion based on hydrogeological work most wells are artesian and in artesian wells there is a strata of water under pressure (head). It will remain the same. Existing water levels in the canals will be maintained. We do not see any impacts on the wells. If there are any problems they will be addressed/corrected as part of the project.
Our geotechnical and hydrogeological firm Peto MacCallum did a study and found no significant impacts on ground water are anticipated. (proponent to verify)

Q. Audience asks what if the costs are more than the $12 million estimated? If you run into a snag in construction and there are problems, that increases the cost.

A. Proponent states that he cannot anticipate a problem that will be that significant to cause a substantial increase in cost. The construction re canals cost is only one component of the $12 million. Considering the soil analysis done, there is no evidence of ground water problems, even with the quicksand area. As well, there is a substantial contingency built into the cost of construction.

Q. Audience says he can't see how the project can only cost $12 million. He thought it includes bridges.

A. Bridges are included in the $12 million cost and if final bridge costs exceed estimates the costs to the landowners are not increased. Section 26 of the Drainage Act assesses costs of structures to the road authorities only and not landowners. The road authorities are liable for the actual cost.

- Two excavation construction firms looked at the project estimates and thought they were fair. If the project proceeds, a tender above 33% of the estimated cost cannot be accepted without approval of the landowners.

Q. Audience asks if the cost of the project is a one time payment?

A. It is a one time payment subject to the fact the cost may be billed out in three or four annual levees. When the time comes for each payment, the Municipality could debenture. A fair bit of cost will be pre-collected, some post collected. Future marsh levy payments will continue to be paid to contribute to the future cost of maintenance.

Q. Audience feels we should have “no parking” designated and posted all along the marsh

A. Proponent advises that owners need to go to the Municipalities to discuss this.

Q. Audience asks if we can assess costs to future development as we are in a time of development and growth?

A. Costs for future development cannot be assessed. People will be opposed to a development charge on their taxes for a project such as this.

Q. Audience asks if we can put trails on the berm? In Windsor there are trails for cyclists. We have problem with cyclists on roads in both directions.

A. Although the berm could be developed in part as a bicycle path, such could then encourage vehicular parking along the canal road which would not be acceptable due to farm traffic interference, potential trespassing and unrestricted fishing (others also spoke against having bicycle trails).

Q. Audience asks if he will be able to put his irrigation pumping on the canal side? He will have 60' of line and will need suitable pumps.

A. Proponents have discussed this point prior to the meeting. It is acceptable to put small pumps by the relocated canal if you own the property, but if not, then you will need to get permission from the owner. There may be a designation of a maintenance corridor in the report with a provision to allow portable pumping systems.

Q. Audience asks about the next phase in the process. What will be next on the agenda?

A. Except for specific properties with specific problems to be resolved, you won't hear more until the environmental study is completed. However, in light of concerns from last evening, we may conduct another informal meeting such as this perhaps in June. Whenever a further meeting such as this is conducted we will try to go through the various previously considered options in detail and show why we are recommending the work as presented.

- The anticipated plan of work is to:
  - pursue DFO authorization
  - consider a further meeting just with marsh owners
  - pursue final engineering
  - complete costs and funding searches
  - have a meeting with all the people in the watershed
  - prepare a written report that would be sent to owners
  - conduct two meetings (because of size of project) to consider the report
  - conduct further meeting re assessments (the share of cost to owners)
  - deal with any appeals
  - once appeals are resolved, tender the project
  - the Drainage Act process will be followed

- There will be a lengthy process ahead.

Q. Audience states that after last night's meeting (very heated for him), 90% in room did not want the project to proceed.

A. The decision to proceed is that of the Municipalities'. There is a general agreement that the project needs to be done. The Municipalities could authorize all work, no work or do a partial component of the project and not all of it. The Municipalities can accept the report, stop the project or make changes to the report. Council(s) will need to make the decision.

- Under Section 79 of the Drainage Act the Municipality must bring the system into proper repair. If the petition is removed, the liability issue is still a concern. There has been new legislation enforcing liability of not dealing with flooding onto the staff of the Municipalities.

- The concerns last night were from a limited number of owners who disagree with the share of costs to land owners.

Q. Audience states that he feels Council should be here for any June meetings.

A. They would be notified.

Q. Audience asks who pays for a legal survey after construction?

A. A legal survey is paid by the owner as the property boundaries do not change.

- Audience states he does not believe that the survey doesn't change. He has been in real estate and feels this is not true.

- Proponent tells him that he would have to get a survey done only if he was to sell his property and he did not have a survey. If the construction disturbs any survey bars, such will be reset as part of the project.

Q. Audience asks about only doing maintenance on the canals as they exist now.

A. It would be difficult to impossible for two reasons. There are physical maintenance hindrances. As well there are legal problems as the By-law was not changed to reflect the physical changes made after the Hurricane Hazel destruction in 1954. Maintenance cannot be done following the original by-law and this is what is legally required. Maintenance cannot physically be done as anticipated due to lack of space to level as a result of all the houses, barns and sheds now existing.

Q. Audience states that our government should be invited (the MP’s of the area) to these meetings.

A. Proponent says we could invite all MP's from within the watershed.

Q. Audience says that he has concerns with the south canal. If the project is not happening soon he has some issues with sediment build up.

A. Proponent looked into dealing with the sediment build up but environmental issues are a hurdle so he thought he would wait for the full project environmental approval from DFO. Owners in the area may however make a further request for a cleanout in one specific area.

Q. Audience asks about the Petition pursuant to Section 79. Can owners remove their names?

A. They can remove their names but it only takes one person to keep the petition going. If one name remains then Council must act.

Q. Audience asks why doesn’t the GTA help us out?

A. There is a better chance of obtaining help from the Federal government than from the GTA.

ON-SITE MEETINGS JUNE 25 & 26, 2003

On **June 25, 2003**, the required on-site meeting was conducted with the owners along the south canal. All owners whose property would be affected by the proposed work were notified of the meeting. As well, road authorities and agencies were notified. The meeting occurred at the Ansnorveldt Library between the hours of 10:100 am and 12:00 noon.

At the start of the meeting, the Engineer gave an overview of the purpose of the meeting, of the work that has been done to date, of what was anticipated to be undertaken, what the steps in the Drainage Act process would be, and gave some indication as to what the expected costs would be, what the expected assessments may be and also what the timing of the project could be.

The Engineer explained that substantial work had been done on the project to date since it was necessary to determine prior to formal site meetings what the costs could be and what the level of funding could be from various agencies. In that regard, he explained that it was necessary to undertake a study to look at various options and to submit a report to the conservation authorities describing the proposed work, the cost benefits, the maintenance aspects and how the costs would be assessed. He explained that this was done with the expectation of funding being obtained from the Conservation Authority and Ministry of Natural Resources.

He also explained that substantial work had to be done to determine that the whole watershed draining to the canals could be legally assessed a portion of the costs to the project. He then described that the project would involve improvements to the Holland Marsh Drainage Canals. The majority of the work, especially in the west and southerly portions of the project would involve relocation of the canals by their existing width away from their present location. The excavated materials would be levelled in the existing canals and perhaps to a slightly higher elevation to allow for disposal of material.

He explained that there would be some intervals where a bottom cleanout only would be undertaken with levelling of the materials on the dykes on the adjacent farmlands. He indicated that this would primarily occur on the south canal between Graham Sideroad and Keele Street. He explained that there were some intervals where the bottom would be cleaned and materials would be hauled away and also guardrails would be constructed.

He explained that this was the evident desirable project after looking at projects that would involve only a cleanout and some projects that would involve just a partial relocation of the berm.

He explained that there were a number of structures that would require work in both Townships of King and Bradford-West Gwillimbury, plus work would be necessary at the two Highway 400 structures. He explained that the total estimated cost at this time was $12 million of which approximately $5.6 would be levied to the Municipalities and road authorities, $2.7 was expected to be received from the Province for grants and the balance of $4 million would be assessed to the various lands and roads. He explained that with the anticipated provincial grant, the expected net assessment to marsh farms could be in the magnitude of $300 and the expected net assessment to the farms outside could be in the magnitude of $10 per acre.

He explained that hopefully work would commence in the year 2004 but it more realistically would be 2005 and that the project would take a minimum of 7 years. It was indicated that if the one level of provincial funding was not obtained, some downstream portions of the work may be delayed even longer until costs could be properly met.

There was a discussion about the environmental work that had been undertaken to date, about the appeal procedures in the Drainage Act, and also with respect to the procedure of the Drainage Act, the number of meetings that would be involved before any work was undertaken. It was further explained that many one-on-one meetings would be conducted with various owners to talk about specific problems.

The Municipal representatives present were Mayor B. from the Township of King, Councillor V. K., CAO B. C., Clerk C. S., Acting Town Engineer B. B.. From the Town of Bradford-West Gwillimbury A. J. the Drainage Superintendent was present. A. J. is also the Superintendent for the full marsh scheme and represents the marsh drains as well. From the Holland Marsh Drainage Commission, those present were Commission Verkaik and one other.

The Engineer then indicated that he would like to have questions in general about the project and then he would like to discuss individual questions and concerns with each owner present. There were approximately 25 owners present. The sign-in sheet that was completed is attached to this document. It is not known for sure if all owners present did sign the sign-in sheet.

Those owners present whose questions were recorded are as follows:

R. D.
He represents the MTO Hydrology Division. He indicated that the Ministry may have concerns with respect to a design that provides for a relief for a 100 year storm event. He indicated that the properties are agricultural and this is an unusually high design event. He also indicated that the costs to address such design at the Highway 400 structures may have to be carefully reviewed. The Engineer indicated that the canals first of all were not being sized to provide a 100 year event. The canals would handle a lesser event but flood protection was being provided so that the marsh would not be inundated in a 100 year event. He indicated that the level of protection of the 100 year event has been the goal established by the Conservation Authority a number of years ago and has been recently confirmed. He indicated that his firm had completed a substantial document that was submitted to a Peer Review by the Authority to

determine if the scope of the project was consistent with authority policies. He indicated that such had been confirmed and the authority was prepared to assist any application and funding for flood protection. He indicated that his concern was to ensure that drainage in the various components of the canal was similar and that the Highway 400 structures were deficient. Proponent confirmed that even the Ministry had earlier acknowledged by letter that there were deficiencies in the 400 structures. It was agreed that R. D. would be given a tour of the whole system and the various aspects of existing drainage improvements required would be discussed. Then a follow-up meeting would be conducted with Ministry, Township staff and the consultant to discuss the specific impacts on the MTO.

Audience
It was indicated that he owns land on the highland side of the canals. His property is located in Lot, Concession (old survey). He wished to know how much widening would be necessary on the bank adjacent to his property and whether the bank slope would be stable. The Engineer indicated that he proposed to widen at various widths varying between 1m and 5m, depending on the location. He indicated that the intention was to retain geotechnical advice as to the safe slopes and there may also be slope protection required as part of the project.
It was at this time too that the Engineer indicated that all owners who would have work on their property would receive allowances for work done. It was indicated that where fields were affected, the allowances would be in the magnitude of $2,500 per acre. Where only low lying bush wet bush lands were involved, the rate would be $500. For other lands varying capabilities in between the rate would vary in between.

Audience
He wished to confirm the extent of work adjacent to his property.

Audience
He too wished to confirm the extent of work that was proposed and the impacts on his property.

Audience
He indicated that he had no great concerns with respect to the work at the rear of his property but he did wish to have some drainage improvements undertaken adjacent to Dufferin Street. The Engineer indicated that what he was requesting was on private property and he could not do such through the Drainage Act but what he would try to do is put the contractor that was attending to the work in touch with him so that they could discuss doing whatever he requires to be done. His telephone number was taken and was passed on to the Contractor.

Audience
He identified himself as an owner in the Ansnorveldt area and he is the owner of the structure that has been shown and described by the Engineer in the studies to date to be a private structure that requires replacement. He wished to confirm what the options were and what the timing could be. The Engineer explained that the preferred option would be to have the structure removed and have an alternate access constructed. The other option would be to improve the structure but any increased costs to improve the structure above the costs of providing the alternate access would be the responsibility of the owner. With respect to timing, the Engineer indicated that unless there were a specific request otherwise, the work would be attended to whenever the work in this particular interval was undertaken.
Audience enquired as to what the status would be if the work were undertaken and what compensation may be allowed. The Engineer indicated that if the alternate access were provided, the costing would provide for the provision of a right of way across the property involved which would be his brother. There would be some compensation provided to the brother and that the right of way may be part of the drain since it involves a culvert crossing. This would ensure that it has long-term recognition. The Engineer when asked also indicated that if this particular structure required work earlier than the time within which the interval was constructed, this is something that could be considered.

Some of the other owners were present. One owns the most northerly property on the south side of the canal. He has a ditch along the canal. Proponent explained to him that we had to relocate the ditch and any berm that was there plus the canal. Proponent explained to him that he would receive allowances somewhere between $500 and $2,500 per acre depending on the ground cover. Proponent said it is primarily brush. He did not seem to have a problem with the work. He did not think that his drainage actually went into his neighbour's to the west. He thought it had an alternate outlet. This is something that we will have to have the surveyors take a look at.

Audience
They are on the north side of Graham Sideroad and on the east side of the canal. Proponent explained the work required there - how we would be angling into the Graham Sideroad bridge and then angling out of it. He did not seem to have a problem with it. Apparently all of his is bush.

Audience
He has the property on the east side of Dufferin Street at the intersection of Juliana. His main concerns were regarding Drain 2. He indicated that the culvert across Dufferin Street has been partially filled in and should be cleaned out. He felt there was a settlement in the road in this area that should be looked at and he thought there is water sitting in the road ditches because of the condition of the road culvert.

His neighbour to the south, had some concerns. He felt that the old headwall wood should have been hauled away by the contractor and he asked us to take a look at that. He also was concerned about water sitting in the ditch.
After the meeting, proponent took a look at it. We did not see a great amount of water sitting in the ditch. There may have been some just in front of one's side but very little in front of the other. The road culvert may be a third filled in and it appears as though there is material downstream along Juliana Road that should be cleaned out as well.
Proponent thought that this could not be done this year, he thought it would have to be done next year but it is something that proponent has got to pass on to Drainage Superintendent.
Neither one of audience seemed to have any great concerns with respect to the work that is proposed.

Audience
He owns the property on the south side of Graham Sideroad on the east side of the canal. If he was present, he didn't have any strong concerns.

Proponent did indicate to the owners during my presentation that there would have to be a 5 to 10 foot buffer strip adjacent to the canals where fields were worked up to the canal edge.

Audience
They own the property on the east side of Dufferin Street just north of Bernhardt. It runs between Dufferin and the canal. He did not seem to have any problems with respect to the work proposed on the canal.

Proponent thinks to most of these owners he indicated that we would be levelling some spoil on the dyke and also to the north of it. Proponent thinks he told him we would need 75 to 80 ft.and the trees would be pushed back into a windrow and then the spoil would be levelled up against the trees. Nobody seemed to have a problem with that. There was one owner that said that he would want the trees hauled away and I may remember who it is as I go.

Audience thought, he wants to talk to Drainage Superintendent. He has a private ditch on his property that he would like a price from contractor to have cleaned out. Proponent said we would try to get a contractor or someone in touch with him.

Audience
This property should actually be ___. Apparently our address was correct but the name was wrong. Audience's son attended and asked that we correct it. He had no problems with respect to the work.

Audience
He does want to meet with us in the last week of July. We are also to meet with his brother and he will arrange with him to attend.
We may have to take a couple of cross-sections in his area when we are doing the work and we should, after we meet with him, put some flags and then profile the route that we want to follow.
He does have one building that he is a bit concerned about as well and we should see how close this building is to the bank and just how much work we have to do to the channel even though it is a bottom cleanout, because he is a bit concerned about the impact on his building.

An unknown owner, didn't record his name, expressed concern about drainage along what would be Bernhardt Street on the east side of Dufferin Street (the road that leads back to the library). He said it is a municipal road and he would like the ditch on the north side cleaned out. Proponents looked at it and it was very evident that there is carrot discharge from the property. It is almost like a sediment plume in the channel in one spot and proponent is sure that this is causing the problems. What it does is it holds water to the east of it and I think there was a concern expressed about mosquito breeding. Proponent said that what we should do is talk to the Township and see if they would agree to have it done at the same time as contractor is in there. We may have to get a separate price. Audience came around and looked at it when proponent was there and said that they did have it cleaned out he would look after it if the Township did the original cleanout. Proponent said that he may have to make it a municipal drain to ensure that it is followed up on.

Audience
This shows as the ____ property. It would be to the south of King Street on the east side of the canal. Proponent explained the work as far as the bottom cleanout and some widening. They did not have problem with it. Her neighbour may have been there as well and if they were, they did not have any concerns.

Audience & Audience
They are both on the inside on the marsh side and regardless of who it was, proponent explained the work that was required and neither had a great problem with it.

I think everyone brought to my attention in this area the buildings and that we would have to work around the buildings. I think they did agree with the extent of clearing that our plans show.

Audience
It is Interval 12 on the marsh side. Proponent described the work proposed. They agreed that it was bush. They did not seem to have any great concerns with respect to our work.

Audience
His three or four properties to the south of ___ on the east side of Keele Street. He had no substantial concerns with respect to the work.

The next owner is either audience or audience. They own property on the east side of the canal in Interval 16. Proponent described the work that was required and neither one had any concerns with respect to the work.

On **June 26, 2003** a second on-site meeting was conducted. This meeting was for the owners affected by the north canal. All owners whose properties would be affected by the work and the affected road authorities and agencies were notified. The sign-in sheet completed by those present is attached as Attachment B to this report. Those attending on behalf of the Municipality and the Engineer were Kenn Smart, Art Janse (Drainage Superintendent), Jim Verkaik and one other from the Holland Marsh Drainage Committee.

The Engineer gave a similar discussion of the background and the work done to date as presented at the south canal site meeting. The general questions that were asked were as follows:

1. Had consideration been given to the impact on small drainage ditches that come into the canal?
   If greater drainage occurs in the canals, will this impact the small channels that come in?
   The Engineer indicated that the overall capacity of the system will be increased from what it has been and would hopefully therefore provide improved drainage for any lateral channels. It was indicated that the main thrust of the study was to provide flood protection but also to ensure that each canal is operating to its full capacity. This will therefore mean that different components such as the south canal, which are almost blocked for normal drainage, will now have a greater conveyance capacity, and this will impact and assist the north canal's carrying ability.

2. Is it possible that the piping that is installed for temporary irrigation connections could be considered permanent and thereby eliminate the need to have so many individual pipes through the dyke into the canal?
   The Engineer indicated that it is something that could be looked at if there was a request. It may have high costs to do such but it is something that could be reviewed in final design. The Engineer indicated that he would be having a meeting with those owners on the inside of the canal to determine the extent of their connections.

3. What provisions would be in place for controlling the sediments coming down from the North Branch of the Schomberg River?
   The Engineer indicated that he did not anticipate any specific work in the river but the only item in the design that would address such is that it was being recommended that the canals be dug to 1' lower than the original design depth, as they were in Hurricane Hazel to provide for additional storage capacity of sediments.

4. Could the materials be bermed on the outside of the canal to provide flood protection?
   The Engineer indicated no, the Conservation Authority is quite concerned that the elevations of the ground on the outside of the canals not be raised to reduce flood storage.

5. Will the construction of the imported berm on the inside and the levelling of the spoil reduce flood storage capacity?
   The Engineer indicated that from the condition when the canals were constructed subsequent to Hurricane Hazel work, there probably would be a reduction. Compared to what exists now, there would be an increase in storage due to the greater conveyance and storage within the canals themselves. The canals will be marginally widened and additional capacity within the canal considering flow will be provided. He also indicated that there may be a necessity of reducing the height of berms in some locations marginally, a matter of inches, to try to ensure that any reduction in passive of storage is provided for by active storage.

Some of the individual parties who attended and whose questions/comments are recorded are as follows:

J. H. for the County of Simcoe
J. H. has reviewed previous documentation that was supplied by the Engineer to C. M. who is his associate. J.H. has indicated that he would wish to have a separate meeting with the Engineering firm to discuss the project further. He indicated that the second week of July would be an appropriate time to meet with the County if he could be advised of

such. He said at this time that he had no major concerns but he did not anticipate that the County would be doing substantial road work as part of the project.

Audience
He owns property on the northwest side of the canal between Sideroad 5 and Highway 9. He indicated that he is concerned somewhat with the allowances that were indicated. He feels that his land should be compensated at a greater sum than $500 per acre.

Audience
He owns property to the west of the Springdale Church. He has a private structure across the canal. He acknowledged that there would be further meetings between himself and the engineering firm to discuss what would be done with respect to widening and also with respect to the private structure that he retains. The Engineer had previously spoken to him and had indicated that the desirable approach would be to provide an alternate access but that an alternate would be to have the owner provide additional capacity through his structure, with any increased costs to be borne by the owner.

Audience
They indicated that they wished to have an individual meeting with the Engineer to review the impacts on the church property, given that it is located between the private bridge and the Sideroad 5 structure. They are interested in knowing the widening required and what may be done as far as an alternate access.
After the meeting, pronent indicated that there was a possibility that the church may wish to construct a retaining wall adjacent to their north property limits and that we should try to have a ballpark figure as to what the costs of the retaining wall may be.

Audience
They have acquired the former ___ estate property between Sideroad 5 and Highway 400. They too would like an individual meeting to review the allowances that may be provided and the relocation work involved. They indicated that they had paid close to $4,000 per acre for their property. The Engineer indicated though that that would be weighted much for the good land and lesser for the poor land, and the poor lands are generally adjacent to the canal. It was agreed that we would meet with the audience privately.

Audience
This is a developable parcel that is located opposite Day and Wanda Streets on the inside of the marsh. It is interval 3. A representative of the owner attended. The work involved was explained to the owner, involving the relocation plus the allowances. There were no concerns expressed at the time.

Audience
He indicated that he has bought the ___ lot that is at the end of Peterman Street. He acquired this lot last year. He indicated that he would be receptive to discussing the idea of selling the lot to allow the canal to be shifted over. He felt it would be appropriate to have a second meeting to discuss this and he also acknowledged that the work may not be required for a number of years into the future.

APPENDIX 5

COMMITMENTS REQUIRED AS A RESULT OF CEAA STUDY

The following pages document the principle requirements with respect to sampling and analyses to be undertaken prior to, during and after construction and also summarizes the provisions to be undertaken with respect to fisheries habitat replacement and enhancement construction and also addresses the items to be addressed with respect to other topics of concern.

1. **Sediment/Soil Sampling Strategy**

a) Sediment Sampling in Canal Bottoms Being Removed
- Collect samples at 500 to 1000m intervals.
- Collect one sample of sediment. If sediment depth is greater than 1.5m, collect two samples.
- Analyze for the OC pesticides DDT, DDE, DDD and Toxaphene plus for F3 and F4 PHC's.

b) Sampling Canal Bottom After Removal of Sediments
- Collect sample at 500 to 1000m intervals.
- Collect at 150mm to 300mm below bottom.
- Analyze for the OC pesticides DDT, DDE, DDD and Toxaphene plus for F3 and F4 PHC's.

c) Sampling Soils Where Excavated Sediments to be Levelled
- Collect sample at 500 to 1000m intervals.
- Collect at 150mm to 300mm below surface.
- Analyze for the OC pesticides DDT, DDE, DDD and Toxaphene plus for F3 and F4 PHC's.

d) Sampling Native Soils to be Used as Fill in Backfilled Canals
- Collect sample at 500 to 1000m intervals.
- Collect one sample from each 1m of depth.
- Analyze for the OC pesticides DDT, DDE, DDD and Toxaphene plus for F3 and F4 PHC's.
- Consider MOE Fill Quality Guidelines for Lake Fill.

e) Exceedences
- Where canal sediment pesticide levels exceed comparable levels of pesticides in fields to be used for levelling, canal sediments to be stockpiled and then hauled to and used as fill in sections of canal being backfilled.

f) Adaptive Management
- The extent of sampling may be altered after experience is gained with the first construction reach(es).

2. **Turbidity Sampling Strategy**

a) Background Sampling
- Obtain background turbidity samples within the year leading up to construction during spring runoff period, during midsummer, during fall period and after one significant runoff event.
- Collect three samples at each sample period and space the samples uniformly through the length to be excavated in the following year.
- Sample for other selected water quality parameters (suspended solids, phosphorous, nitrogen) twice before construction.

b) Sampling During Construction
- Initially collect turbidity samples daily during first week and then collect samples at 2 week frequencies and after any significant runoff event.
- Collect one sample upstream and one sample downstream of the work interval at each sampling time.
- Conduct visual observations for turbidity plumes daily.
- Sample for other selected water quality parameters (suspended solids, phosphorous, nitrogen) twice during construction.

c) Post Construction Sampling
- Sample turbidity over the two following years in any construction reach.
- Samples to be obtained in spring, summer and fall and after any significant runoff event.
- Sample for other selected water quality parameters (suspended solids, phosphorous, nitrogen) once per year.

d) Exceedences
- Exceedence is related to samples outside of the construction zone.
- Exceedence is defined as twice the standard error of the background.
- If exceedence occurs re sample, repair mitigation measures where required, create new measures as required and/or alter or suspend work where justified.
- Apply adaptive management techniques as required.
- CWQO will be utilized as part of the monitoring and reporting protocol as well as for establishing compliance thresholds for mitigative actions.
- Supernatant pond conditions and usage to be reviewed.

e) Adaptive Management
- The extent of sampling may be altered after experience is gained with the first construction reach(es).

3. **Commitments re Fish Habitat Reconstruction**
- Existing habitat found in the canal is quite uniform with essentially one habitat type dominating the canals. The new canals are proposed to have a diversity of habitats which are expected to offer variety in habitat depth and substrate type as well as function for spawning, nursery and feeding habitat for various species. The proposed features (in addition to the native substrates) are as follows:
  - littoral shelf;
  - log bundles;
  - macrophyte transplants;
  - gravel substrates; and
  - deep pool excavations.

- As an example, the density of the enhancements for the first construction reach (Intervals 13 through 16) will be;

  - Littoral shelf – 1 m in depth – 9,328 m^2 (3,731 m total length x 2.5 m width – specialized features described below, located in littoral shelf);

- Log bundles, large woody debris along littoral shelf – 157.5 m^2 (21 locations x 3 m in width x 2.5 m of littoral shelf – placed every 200 m);

- Macrophyte transplants, native aquatic vegetation in 1 m depth – 125 m^2 (5 locations x 10 m reach x 2.5 m width of littoral shelf);

- Gravel substrates along littoral shelf – 225 m^2 (3 locations x 30 m reach x 2.5 m width of littoral shelf);

- Deep pool habitat approximately 1 m below new typical canal depth – 2,400 m^2 (3 locations x 200 m in length x 4 m in width); and

- Native substrates following excavation, 3 m in depth – 69,235 m^2 (3,731 m length x 19.2 m width – 2,400 m^2 deep pool habitat).

• Through adaptive management these densities/frequencies may be modified to maximize the net benefit.

4. **Commitments re Migratory Birds**

Re Hooded Warbler (*Wilsonia citrina*) Listed on Schedule 1 of the SARA as "Threatened".
Re King Rail (*Rallus elegans*) Listed on Schedule 1 of the SARA as "Endangered".
Re Least Bittern (*Ixobrychus exilis*) Listed on Schedule 1 of the SARA as "Threatened".

Re Yellow Rail (*Coturnicops noveborancensis*) Listed on Schedule 1 of the SARA as "Special Concern"

• Any construction activities with the potential to destroy migratory birds, or their nests, such as vegetation clearing, should not take place in potential breeding habitat during the breeding season for bird species listed under the Migratory Birds Convention Act, 1994.
• The following mitigation measures, in order of preference, will be implemented to protect those species.
  - Restrict vegetation clearing during the winter months to those portions of the North and South Canal that are to be re-located.
  - No vegetation clearing during the breeding season for this region, with the breeding season generally defined as occurring between May 9th and July 31st.
  - If construction activity needs to be undertaken in breeding habitat during the breeding season, that a nest survey be conducted by a qualified avian biologist prior to commencement of construction works to identify and locate active nests of species covered by the Migratory Birds Convention Act, 1994.
  - Should a nest be located or evidence of breeding noted, then a mitigation plan (i.e., which may include establishing appropriate buffers around active nests) be developed to address any potential impacts on migratory birds or their active nests. It should be reviewed by Environment Canada prior to implementation.
  - If active nests are found on bridges where construction or maintenance work is to take place, Environment Canada should be contacted for further guidance.
  - The area to be cleared in any one year will be monitored during the prior year, primarily in the four areas noted to have potential breeding habitat (ie. cattail marsh at outlet of North Schomberg River/Fraser Creek and at the confluence of the north and south drain as well as deciduous stands associated with the Ansorveldt PSW and significant woodlands along the edge of the south canal), to determine if any use of the specific area is made by a Species at Risk.

5. **Commitments re Wildlife Habitat**
   - Careful delineation of clearing work prior to commencement.
   - No clearing of any more trees than necessary for the particular works.
   - Seeding of disturbed areas with native species mixture.
   - Use the top 50cm of organic material/topsoil in the new canal footprint or designated area to maximize restoration efforts.
   - Replanting of native shrubs along areas of imported berm.
   - Natural re-establishment of woody vegetation.
   - Re-vegetation (i.e., seeding) of riparian area of new Canal to be completed as soon as possible.

6. **Commitments re Plants**

   Re Butternut (*Juglans cinerea*)
   - Prior to construction works undertake a site walk by a qualified botanist to identify and locate any specimens within the proposed canal relocation corridor.
   - Should any specimens be found, their health and condition will be evaluated, particularly for any evidence of butternut canker. If evidence of canker infestation is found, then removal will be undertaken.
   - However, if found and if the specimen(s) appears disease free or there are healthy individuals within a group of diseased trees, then, a mitigation plan (i.e., which may include establishing appropriate buffers around the disease free or disease resistant specimens) will be developed to address any potential impacts, and Environment Canada will be consulted prior to implementation.

APPENDIX 6
(Part 1)

A **brief summary** of the recommendations of each irrigation type that are contained in this report are as follows:

1. Wherever a sleeve exists across a dyke road for irrigation purposes, the proposal is to either replace this sleeve or seal it, and install a new 200mm (8") steel pipe that would serve as the main irrigation line across the roads. This pipe would be supplied with end caps.* The project would also grade the backfill and place wood pallets if deemed necessary (and with flotation where necessary) to allow the owner access to the canal.

2. Where the sleeve that exists serves a residential property, the proposal is to install only a 100mm (4") pipe but the owner has the option of paying the increased costs for a larger pipe.

3. Where a berm is to be constructed as part of the project, the steel pipe that would be installed would be continued to the outside slope of the new berm.

4. Where an owner has already requested a pipe larger than a 200mm (8"), the report has provided for a 250mm and at the increased cost to the owner (as a special non-grantable benefit), except where noted otherwise.

5. If an owner at the time of construction requests a pipe larger than a 200mm (8") and is prepared to pay the increased costs based on the tendered price received, such is possible. The increased costs would similarly be a special non-grantable benefit to the owner.

6. In some instances, the report has determined that it is more appropriate for the project to not only construct the dyke and berm crossing, but also to supply and perhaps install a similar sized aluminum tubing to extend from the dyke or berm to the canal as part of the project rather than construct two new dyke crossings for one owner or rather than constructing a below grade crossing.

7. If an owner requires a new above grade line for irrigation where he does not presently have one, such would be undertaken if the owner requests such, or if it has already been requested it will be included, but its costs would be in part grantable and in part non-grantable. The grantable portion would be the portion of extra costs caused by the project and the balance would be non-grantable.

* *The pipe will be supplied with a flange and short extension on the canal side that would provide quick coupling of aluminum tubing by the landowner. The extension could also have a quick fitting cap. An inexpensive cap on the other side would be provided. All other work if not listed would be by the owner.*

8. As part of the works to be addressed with the above grade irrigation replacements, a new power primer will be supplied as part of the project where justified. The power primer would be a portable unit and self lubricating but it would be the owner's responsibility to connect such. The power primer would only be supplied where it is evident that the owner does use the new irrigation line and only one per property would be supplied. Where a landowner has multiple properties but fewer pumps than properties, only one power primer per pump used would be supplied.

9. Where small diameter lines cross the dyke above grade, the proposal is to extend these lines to the new canal using 50mm diameter black polypropylene tubing (referred to as black poly). The line would be placed on a graded section of the backfill, and as is indicated for other above grade lines, it may be necessary to install pallets (with flotation) to allow early passage. The actual canal road/dyke crossing would remain as is. If the project believes that there should be a steel beam or channel section supplied to reduce the impacts of future maintenance equipment passing over this tubing, such may also be supplied and installed as part of the project. This decision will not be made until the time of construction by the Engineer or his assistant or the Drainage Superintendent. If installed, the costs would be part of the grantable special benefit.

10. With respect to below grade small diameter lines, the proposal is to construct a clay cofferdam across the canal being backfilled prior to the actual backfilling of the canal, and to then be able to use this clay cofferdam as the base for the extension of a below grade line. When it is time to extend the below grade line it would be necessary to trench to the clay and into the clay and then to lay the small diameter line. The proposal at this time is to install a steel casing pipe as a sleeve to envelope the small tubing in order to protect it from maintenance or construction equipment passing above. If it is found necessary by the Engineer at the time of construction to install the casing pipe with pile or post supports underneath, such will be undertaken as part of the work but at greater cost. The black poly would extend into the canal sufficiently to draw water and the small diameter line would be coupled to the existing dyke crossing. However, any other work with respect to screens or inlets or supports would be the necessity of the owner. Again the actual canal road/dyke crossing itself would remain as is.

11. With respect to larger below grade suction lines and sub-irrigation lines that exist, the proposal is to encourage a landowner to replace such with an above grade 200 or 250mm diameter line but where the owner requires the below grade line to remain, the work will involve similar construction as described for small diameter below grade lines with the construction of the clay cofferdam, the trenching in it and the laying of steel pipe which would be the irrigation line. (The pipe would be structural steel piping.) Again, the decision would be made at the time of construction as to whether it is necessary to drive or auger steel piles or posts to support the piping. The costing enclosed does not include any post or pile work. Where auguring of posts is necessary such may be done at 2.4m (8') spacing, and the steel pipe would be supported by the posts. The project would couple the new pipe to the existing dyke crossing and desirably would couple to any valve that exists on the crossing. However, any costs of valve work other than just joining to it, on a sub-irrigation or suction line would be a non-grantable special benefit to the owner or the owner would have to attend to it. Also any screen work or inlet would be the responsibility of the owner. All junctions with existing steel pipe would be welded. If the canal road/dyke crossing (which itself is not to be replaced) consists of materials other than steel the decision would have to be made at the time of construction as to the coupling to be installed. The steel casing pipe supplied would be sufficient to extend sufficiently into the canal to be away from the banks. Any additional support for the pipe into the canal would be the responsibility of the landowner. It is anticipated that for the below grade line work, temporary cofferdamming and dewatering in the new canal would be necessary as a

part of the project work. This will allow the trench for the new crossing to be excavated with minimal water from the canal entering and will allow dewatering of the trench during the work.

12. With respect to communal lines, similar work as for sub-irrigation lines will be involved to extend the communal line to the new canal. With respect to the piping materials, all piping will be steel. With respect to couplings, appropriate couplers will be necessary to join to the materials that exist. (The canal road or dyke crossing itself will not be replaced.) It is known that some of the existing materials are asbestos cement. Where possible the couplings will be made at an existing valve. Where necessary, new valves will be supplied as part of the grantable special benefit. The decision will be made at the time of construction whether the valve should be at the canal edge or at its existing location and extended to the surface. For communal lines, steel posts would be augured as support for the lines and the costs for such are included. Any existing inlet screens will either be retained and the new pipe will be joined at these, or the screen will be relocated with augured supports in the new canal. If the owners of the communal line wish a new screen installed, it will be their responsibility to supply such and the project would then install it.

13. With respect to the grades for all below grade lines, it will be almost mandatory that the new extensions be laid at a flat grade so that the submergence in water is not reduced from that existing. Reverse grades will not be accepted.

14. With respect to the existing crossings of the canal roads (the dykes) that serve small diameter above and below grade lines and also that serve the larger suction, sub-irrigation and communal lines, the pipes below the roads will not be replaced as part of the project. If an owner or group of owners wishes the pipes across the dyke replaced for these crossings, such will be a non-grantable cost of the owner(s).

15. Where a sleeve across a dyke that envelopes a small diameter line is retained, the annular space between the small line and the sleeve will be grouted.

16.a) With respect to providing irrigation to the owners while the canal excavation and backfilling is occurring, the report is set up that a firm specializing in irrigation is to supply, and ensure that such is installed to their recommendations, two 500m long temporary irrigation lines using 200mm piping with a 3000 U.S. gallon per minute pump attached to each of the 200mm (8”) lines. During an irrigation period the pumps would maintain the required pressure in the 200mm (8”) lines to provide a rate of 1000 gpm to any connected owner provided the line usage is being shared. There would be couplings to each of these lines where an irrigation service is required and there would be an irrigation hose laid across the road with a valve to allow an owner to join up when required. In some instances it may be appropriate to join the hose to the existing crossing and in other instances it may be desirable to install the new crossing and join the hose to such. This will in part be done as requested by the owner and may be a decision of the project at the time of construction. A plan would have to be worked out with those owners served by the temporary irrigation to ensure that an agreed upon time of usage of the irrigation is agreed to since the pumps would not be able to supply high irrigation rates to all joined owners simultaneously. Prior to the removal of the temporary irrigation, provisions would have to be made to ensure that the new crossings are installed and are ready to be used. This will no doubt involve some leapfrogging of the 200mm lines as the work continues. The temporary irrigation lines will only be placed ready for use during irrigation seasons. Operation will occur when irrigation is occurring. **Appendix 7** shows details of the Temporary Irrigation proposed.

b) All owners are to be advised that the temporary irrigation to be provided during construction will not provide for any direct connections to below grade irrigation. All below grade irrigation lines will be temporarily sealed during adjacent canal construction and will not be returned to use until completion of the particular length of canal construction and as soon as the work can be completed after the canal construction is attended to. If any owner wishes to join a below grade line to the temporary irrigation that is provided, that will be the owner's opportunity but only an above grade connection will be made available. The Contractors will be directed to provide their transverse cofferdams to define work lengths adjacent to below grade irrigation installations wherever possible so that in some instances the below grade lines will only be out of service for a short period. This will not be possible however where sub-irrigation lines exist close to each other since the canal transverse cofferdams may be located 500 to 1000 metres apart.

17. In those locations where the canal is being cleaned only, above grade line sleeves will be retained but a new cap or capping plate will be installed to ensure that the sleeve is protected against back waters. If an owner requires a new line to be constructed to replace a sleeve in a cleanout area, there will be a non-grantable special benefit assessment to the owner for a portion of the cost as described in the Table of Non-Grantable Special Benefits. Where an owner requires a new sleeve where one does not exist, the cost would be to the landowner as shown in this table.

18. In cleanout areas, below grade lines would be located and protected and also small diameter above grade lines would be located and protected. Where these small above grade lines cross the dyke through a sleeve, the annular space in the sleeve would be grouted.

19. In those areas where the canal is being relocated away from the dyke and the dyke is not used as a road but rather as a private lane (Intervals 14 and 15), new piping will be supplied to the owner to be used from the edge of the dyke to the new canal and it will be the landowner's responsibility to irrigate from the edge of the dyke. A power primer would be supplied to these owners where it is evident that the owner actively uses the irrigation and to the same criteria for power primers in other intervals. The costs for this will be a grantable special benefit. As well, the backfill will be graded and pallets will be placed, if necessary, to facilitate the owners' access to the canal. If the owner requires the new piping to continue across the dyke, there will be a special non-grantable benefit to the owner for the costs involved as per the actual tender costs for such. All other costs such as placing the pipe, connecting, screen and inlet work would be the responsibility of the owner. Again, if an over-sized pipe is required the increased costs would a non-grantable cost be to the owner.

20. The goal of this report has been to minimize the number of irrigation crossings per property. Generally, only one above grade crossing would be provided unless the property has a greater frontage than 200 metres. Where possible, one larger crossing is recommended to replace two crossings for a farm and with all costs being grantable. Where a property does have a below grade line as indicated the desirable approach is to replace that even if it involves a larger diameter above grade line with the piping to the canal. However where it is necessary to ensure the below grade remains, such would be addressed. In no instance would more than one below grade line and one above grade line be provided per property as a grantable assessment. If the owner required a second line, it would be at their full cost.

21. With respect to those canal road (dyke) crossings that serve as drain outlets, the work recommended in the report is to extend these crossings to the new canal using agricultural tubing. The line would be laid on the surface of the backfill again on top of wooden pallets

(with possible floatation inserts). Any future burial of the lines would be the responsibility of the landowner. The project would supply and install a check valve at the owner's crock (pumping location) and would install a rodent gate on the outlet. Marker stakes would also be placed.

22. Where small diameter pipes discharge the overflow from existing wells on the edge of the canal, the project will extend these overflows to the new canal edge using small diameter agricultural tubing*. Again the line would be placed on the surface on wood pallets or similar and would be given a marker stake at the canal edge to ensure that it is evident. Any future burial of the line to protect it would be the responsibility of the landowner. The existing overflow piping would be extended where necessary to the agricultural tubing but so that an air gap remains.

23. All irrigation crossings will be marked and highlighted before work starts and then posts will be placed at the berm and/or dyke edge and at the new canal afterwards to identify that there is an irrigation crossing at this location. As well, all irrigation crossings will be surveyed by the Engineer and tied to a GPS co-ordinate system.

24. The particular specifications that will direct the Contractor in the installation of this irrigation work are included in the Construction Special Provisions of this report in the Irrigation subsection (Section D). Each landowner is to be contacted by the Board and or the Engineer or their representatives and by the Contractor at the time of construction to confirm the irrigation line extension work and to confirm any costs to the owner for such work. Where an owner is unavailable for contact, the work will be done in accordance with the notes on the drawings contained in this report.

25. All owners who have irrigation, drain or well lines across Canal Road (the North Canal Road) where such road is under the jurisdiction of the County of Simcoe are advised that the County has indicated they wish to pursue having each owner execute a release form whereby the County and landowner acknowledge that the line exists and that the owner is responsible for its repair, maintenance, etc.

26. All owners who have canal side wells are also to be advised that the County of Simcoe has indicated that their intention is to relocate, at their cost, these canal side wells to the marsh side of the County Road.

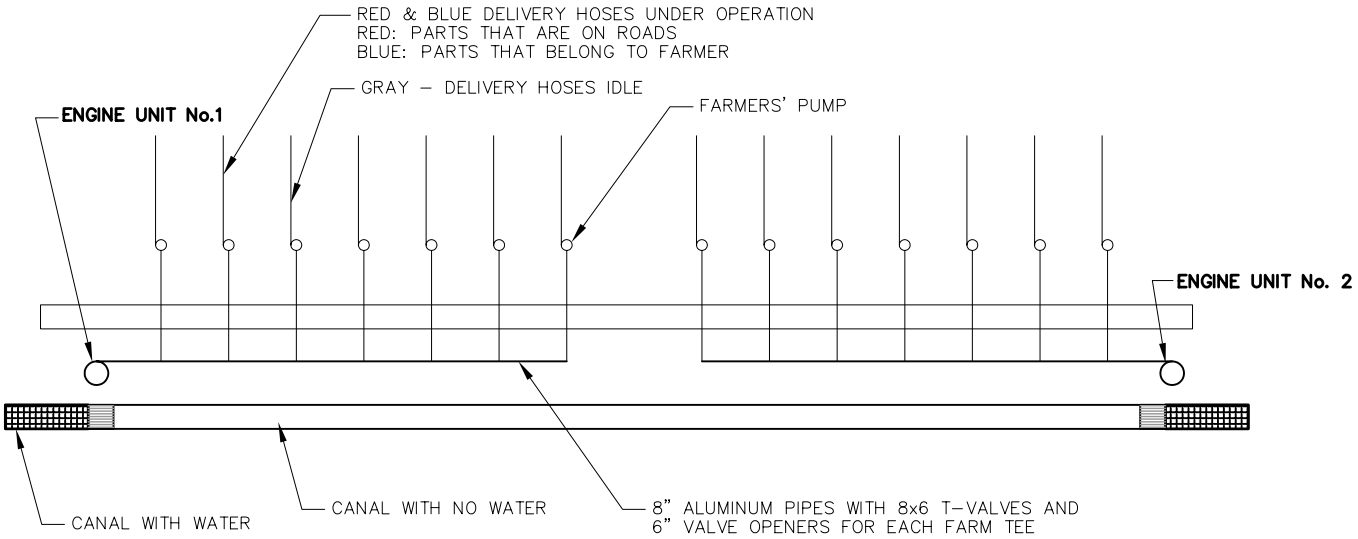
* *If any of these wells are relocated by others prior to the canal work these discharge lines will not be necessary since marsh side discharge will be required.*

Interval No.	Landowner	Roll Number	Abandon and Seal Irrigation Line	Other	Add cap or capping plate	Power Primer	Type A2	Type A3	Type A4	Type A5	Type A6	B	C	D	E	EC	F	Total Cost	Not Eligible for any Grant	Grantable Special Benefit	Has Farm Tax Rate	OMAFRA 1/3 Grant	MIII Grant	Net Assessment
1	W. Zweep	020-006-00100				2000				7650								9650	2000	7650	Y	2550	4208	2893
1	C. Vonk	020-006-00600				2000	7650					1650						11300		11300	Y	3767	6215	1318
1	N. De Mendonca	020-006-00700				2000				7650								9650	2000	7650	Y	2550	4208	2893
1	C. Kwan	020-006-00800				2000	7650											9650		9650	Y	3217	5308	1126
1	L. Radvanyi	020-006-01000				2000	8200											10200	1000	9200	Y	3067	5060	2073
1	C. Kwan	020-006-01100				2000	7650											9650		9650	Y	3217	5308	1126
1	J. Devald	020-006-01500				2000			19150			1650						22800	1000	21800	Y	7267	11990	3543
1	P. Hui	020-006-01700				2000	7650											9650		9650	Y	3217	5308	1126
1	P. Janse	020-006-01800				2000	7650											9650		9650	Y	3217	5308	1126
1	K. Janse	020-006-01900										1650						1650		1650	Y	550	908	193
1	NHK Poultry Farms	020-006-01950				2000	7650											9650		9650	Y	3217	5308	1126
1	F. Deutschbein	020-006-02001				2000	7650											9650		9650	N	0	5308	4343
1	J. Buss	020-006-02200				2000	7650											9650		9650	N	0	5308	4343
1	G. Verkaik	020-006-02400				2000			9150									11150		11150	Y	3717	6133	1301
1	H. Kenkel	020-006-02601										1650						1650		1650	N	0	908	743
1	J. Devald	020-006-02700	500			2000			10000									12500	1000	11500	Y	3833	6325	2342
1	R. Joos	020-006-02800	1000															1000		1000	N	0	550	450
1	J. Verkaik	020-006-02900				2000	7650											9650		9650	N	0	5308	4343
1	Carron Farms	020-006-03300				2000	7650											9650		9650	Y	3217	5308	1126
1	Springdale Christian	020-001-02801		500														500		500	N	0	275	225
2	Carron Farms	020-006-05300	500			2000			10000			1650	10150			9989		34289		34289	Y	11430	18859	4000
2	Hillside Gardens Ltd.	020-006-04400														10316		10316		10316	Y	3439	5674	1203
2	J. Verkaik	020-006-04900														10295		10295		10295	Y	3432	5662	1201
2	A. Kooring	020-006-05400				2000	7650											9650		9650	N	0	5308	4343
2	R. Scholten	020-006-05500				2000	7650							14650				24300		24300	Y	8100	13365	2835
2	B. Vandebelt	020-006-06000				2000				7650								9650	2000	7650	N	0	4208	5443
2	Korag Farms Ltd.	020-006-05600				2000	7650											9650		9650	N	0	5308	4343
2	K. Chan	020-006-06301				2000	8200											10200		10200	Y	3400	5610	1190
2	J. Kanyo	020-006-06500				2000	7650											9650		9650	Y	3217	5308	1126
2	R. Singh	020-006-06600				2000	7650											9650		9650	Y	3217	5308	1126
3	J. Kanyo	020-006-06900				2000	7850											9850		9850	Y	3283	5418	1150
3	R. Singh	020-006-07000	500			2000	7850											10350		10350	Y	3450	5693	1208
3	R. Singh	020-006-07100				2000	7850											9850		9850	Y	3283	5418	1150
3	J. Devald	020-006-07300				2000	8400											10400	1000	9400	Y	3133	5170	2097
3	J. Kanyo	020-006-07302				2000	7850											9850		9850	N	0	5418	4433
3	Westfield Farms	020-006-07301				2000			9500									11500		11500	Y	3833	6325	1342
3	J. Buisman	020-006-07500				2000	7850											9850		9850	Y	3283	5418	1150
3	J. Gorzo	020-006-07600				2000	7850											9850		9850	Y	3283	5418	1150
3	R. Mahadeo	020-006-07700				2000	7850											9850		9850	Y	3283	5418	1150
3	L. Szoldatits	020-006-07900				2000	7850					1700						11550		11550	Y	3850	6353	1348
3	A. Gaetano	020-006-08100				2000	7850											9850		9850	Y	3283	5418	1150
3	L. Szoldatits	020-006-08200				2000	7850											9850		9850	Y	3283	5418	1150
3	S. Kang	020-006-08500				2000	7850											9850		9850	N	0	5418	4433
3	D. Vander Kooi	020-006-08600				2000	7850											9850		9850	Y	3283	5418	1150
3	A. Jagodics	020-006-08700				2000	7850											9850		9850	N	0	5418	4433
3	W. Prokopchuk	020-006-08800				2000	7850					2000						11850		11850	N	0	6518	5333
3	J. Jagodics	020-006-08900				2000	7850											9850		9850	N	0	5418	4433
3	R. Scotch	020-006-09000				2000	15700											17700		17700	Y	5900	9735	2065
3	R. Scotch	020-006-09100				2000	7850											9850		9850	Y	3283	5418	1150
3	J. Gorzo	020-006-09200				2000	7850											9850		9850	Y	3283	5418	1150
3	J. Gorzo	020-006-09300				2000	7850											9850		9850	Y	3283	5418	1150
3	O. Jagodics	020-006-09400				2000	7850											9850		9850	N	0	5418	4433
3	S. Gaetano	020-006-09600	500			2000	7850											10350		10350	N	0	5693	4658
3	D. Sopuch	020-006-11610				2000				7850								9850		9850	Y	3283	5418	1150
3	Marshland Gardens	020-006-11600	1000			2000	7850			7850								18700		18700	Y	6233	10285	2182
3	P. Sopuch	020-006-12800				2000			9500			1700						13200		13200	Y	4400	7260	1540
3	L. Ferragina	020-006-12806				2000	7850		9500									19350		19350	Y	6450	10643	2258

Interval No.	Landowner	Roll Number	Abandon and Seal Irrigation Line	Other	Add cap or capping plate	Power Primer	Type A2	Type A3	Type A4	Type A5	Type A6	B	C	D	E	EC	F	Total Cost	Not Eligible for any Grant	Grantable Special Benefit	Has Farm Tax Rate	OMAFRA 1/3 Grant	MIII Grant	Net Assessment
3	J. Gorzo	020-006-13000	500			2000			9500			1700						13700		13700	Y	4567	7535	1598
3	H. Kedra	020-006-17700				2000			9500									11500		11500	Y	3833	6325	1342
3	Toth Farms Ltd.	020-006-17100				2000	7850											9850		9850	Y	3283	5418	1150
3	A. Moro	020-006-17000				2000	7850											9850		9850	Y	3283	5418	1150
3	F. Moro	020-006-17800				2000	7850											9850		9850	Y	3283	5418	1150
4	I. Moro	020-006-17801	1000			2000			9500									12500		12500	N	0	6875	5625
4	I. Moro	020-006-17900				2000	7650											9650		9650	Y	3217	5308	1126
4	1758885 Ontario Ltd.	020-006-18000	500			2000			9500									12000		12000	N	0	6600	5400
4	M. Moro	020-006-18100				2000			9500									11500		11500	Y	3833	6325	1342
4	M. Moro	020-006-18102				2000	7650											9650		9650	Y	3217	5308	1126
4	F. Iannozzi	020-006-18101				2000	7650											9650		9650	Y	3217	5308	1126
4	A. Silva	020-006-18200				2000	7650											9650		9650	Y	3217	5308	1126
5	E. Czachor	020-006-18300	500			2000	5650											8150		8150	Y	2717	4483	951
5	A. Czemmel	020-006-20301														6189		6189		6189	Y	2063	3404	722
5	Naso & Son Farms Inc.	020-006-20200														1548		1548		1548	Y	516	851	181
5	A. Czemmel	020-006-19500														3092		3092		3092	Y	1031	1701	360
5	A. Naso	020-006-20100														1624		1624		1624	Y	541	893	190
5	C. Naso	020-006-19700														2437		2437		2437	Y	812	1340	285
5	D. Czemmel	020-006-20402														4061		4061		4061	Y	1354	2234	473
5	J. Haas	020-006-20404														2707		2707		2707	Y	902	1489	316
5	C. Naso	020-006-14500														2707		2707		2707	Y	902	1489	316
5	F. Lombardo	020-006-14700														2160		2160		2160	N	0	1188	972
5	Naso & Son Farms Inc.	020-006-20303														2707		2707		2707	Y	902	1489	316
5	Naso & Son Farms Inc.	020-006-20304														1354		1354		1354	Y	451	745	158
5	Naso & Son Farms Inc.	020-006-20400														2707		2707		2707	Y	902	1489	316
5	D. Czemmel	020-006-20403														2707		2707		2707	Y	902	1489	316
5	J. Erochko	020-006-20501				2000	11300											13300		13300	Y	4433	7315	1552
5	A. Gammicchia	020-006-20502				2000	5650											7650		7650	Y	2550	4208	893
5	A. Naso	020-006-20600				2000	5650											7650		7650	Y	2550	4208	893
5	J. Ngo	020-006-20700				2000	5650											7650		7650	N	0	4208	3443
5	J. Ngo	020-006-20800					5650											5650		5650	N	0	3108	2543
5	J. Ngo	020-006-20900				2000	5650											7650		7650	N	0	4208	3443
5	W. Andruszko	020-006-21000										2000						2000		2000	N	0	1100	900
5	F. Novogradacz	020-006-21100				2000	11300					4000						17300		17300	Y	5767	9515	2018
5	Z. Gorecki	020-006-21300				2000	5650											7650		7650	Y	2550	4208	893
5	A. Boonstra	020-006-21400				2000	5650											7650		7650	Y	2550	4208	893
5	A. Boonstra	020-006-21500				2000	5650											7650		7650	N	0	4208	3443
5	M. Schulyer	020-006-21700				2000	5650											7650		7650	N	0	4208	3443
5	J. Merschilz	020-006-21800				2000	5650											7650		7650	Y	2550	4208	893
5	F. Jonkman Sr.	020-006-21900	500															500		500	N	0	275	225
6	Estate of Lopushinsky	020-006-26401				2000	5650											7650		7650	N	0	4208	3443
6	D. Tezuka	020-006-26404				2000	5650											7650		7650	N	0	4208	3443
6	C. Van Wissen	020-006-26600				2000	5650											7650		7650	Y	2550	4208	893
7	Brinkos Farms Ltd.	020-006-26800												11900				11900		11900	Y	3967	6545	1388
7	R. Justin	020-006-26900				2000	5650											7650		7650	Y	2550	4208	893
7	H. Grencer	020-006-27000				2000	5650											7650		7650	Y	2550	4208	893
7	K. Novagradecz	020-006-27200	500			2000	7650											10150		10150	Y	3383	5583	1185
7	A. Gammichia	020-006-27300				2000	5650											7650		7650	Y	2550	4208	893
7	R. Kruger	020-006-27400				2000	5650											7650		7650	Y	2550	4208	893
7	H. Grencer	020-006-27600				2000	5650											7650		7650	Y	2550	4208	893
7	E. Toth	020-006-27700				2000	15300					2300						19600		19600	Y	6533	10780	2287
7	R. Kruger Farms	020-006-28000				2000	500											2500		2500	Y	833	1375	292
7	N. Chreptiuk	020-006-28100				2000	5650											7650		7650	Y	2550	4208	893
7	H. Grencer	020-006-28200				2000	7650											9650		9650	Y	3217	5308	1126
7	Hoving Farms Ltd.	020-006-28300				2000	5650											7650		7650	Y	2550	4208	893
7	G. Hoving	020-006-28400				2000	5650											7650		7650	Y	2550	4208	893
8	R. Kruger	020-006-28700						5000										5000	2000	3000	Y	1000	1650	2350
8	G. Hoving	010-005-21100			500			4750										5250	1000	4250	Y	1417	2338	1496
8	M. Matos	010-005-20500			2000													2000		2000	Y	667	1100	233

Interval No.	Landowner	Roll Number	Abandon and Seal Irrigation Line	Other	Add cap or capping plate	Power Primer	Type A2	Type A3	Type A4	Type A5	Type A6	B	C	D	E	EC	F	Total Cost	Not Eligible for any Grant	Grantable Special Benefit	Has Farm Tax Rate	OMAFRA 1/3 Grant	MIII Grant	Net Assessment
8	R. Appleton	010-005-20400			500													500		500	Y	167	275	58
8	D. Cilipka	010-005-20300						4750										4750	1000	3750	Y	1250	2063	1438
8	J. Talcik	010-005-20200			500													500		500	Y	167	275	58
8	J. Arruda	010-005-20100			1000													1000		1000	N	0	550	450
8	S. Brinkos	010-005-19900			500													500		500	Y	167	275	58
8	S. Cipponeri	010-005-19800			1000													1000		1000	Y	333	550	117
8	A. Pirritano	010-005-19700			500													500		500	Y	167	275	58
8	A. Pirritano	010-005-19600			1000													1000		1000	Y	333	550	117
9	363773 Ontario Ltd.	000-151-42000		500														500		500	N	0	275	225
9	A. Abasnejad	000-163-90000				2000	5250											7250		7250	N	0	3988	3263
9	S.Khawaja	000-163-87200				2000	5250											7250		7250	N	0	3988	3263
9	A. Brkovic	000-163-83500				2000	5250											7250		7250	N	0	3988	3263
9	T. Tran	000-163-15000				2000	5250											7250		7250	N	0	3988	3263
9	A. Buziashvili	000-163-82500				2000	5250											7250		7250	N	0	3988	3263
9	A. Arnold	000-162-41000				2000				4750								6750	3500	3250	N	0	1788	4963
10	164657 Ont. Inc.	000-162-30000								4000								4000	3000	1000	Y	333	550	3117
10	M. Esmaeili	000-163-07000			500													500		500	N	0	275	225
10	1540078 Ont. Ltd.	000-162-73500			500													500		500	Y	167	275	58
10	C. Sumal	000-162-69000			500													500		500	N	0	275	225
10	B. Iozzo	000-162-66000			500													500		500	N	0	275	225
10	Newland Resources	000-162-67000			500													500		500	N	0	275	225
10	S. Fiorini	000-162-62500			500													500		500	N	0	275	225
10	R. Philipp	000-162-56000			500													500		500	Y	167	275	58
10	Township of King	000-162-54500			500													500		500	N	0	275	225
11	J. Nanowski	000-160-50000			500													500		500	N	0	275	225
11	S. Kang	000-160-14000			500													500		500	Y	167	275	58
12	S. Seymour	000-160-05000						4500										4500	1000	3500	Y	1167	1925	1408
12	A. Cilio	000-173-88000		2000														2000	2000	0	Y	0	0	2000
13	K. Habenschuss	000-170-77000			500			4500										5000	1000	4000	Y	1333	2200	1467
13	A. Koch	000-170-87000						4500										4500	1000	3500	Y	1167	1925	1408
13	J. Maidich	000-170-90000				2000	6400					1650						10050		10050	Y	3350	5528	1173
14	542215 Ontario Ltd.	000-140-74500		10000														10000		10000	N	0	5500	4500
14	D. Tran	000-170-94000				2000					2200							4200		4200	N	0	2310	1890
14	E. Young	000-170-95000				2000					2200							4200		4200	Y	1400	2310	490
14	M. Gravelle	000-172-14000				2000					2200							4200		4200	Y	1400	2310	490
14	466203 Ont. Ltd.	000-172-15000				2000					2200							4200		4200	Y	1400	2310	490
14	1522581 Ont. Ltd.	000-172-15500				2000					2200							4200		4200	Y	1400	2310	490
15	542215 Ontario Ltd.	000-140-74500		8000														8000		8000	N	0	4400	3600
15	T. Phan	000-172-16500				2000					2200							4200		4200	Y	1400	2310	490
15	P. Srebot	000-172-17500				2000					2200							4200		4200	Y	1400	2310	490
15	S. Tai	000-170-97000				2000	6400						9400					17800		17800	Y	5933	9790	2077
15	D. Brouwer	000-171-00000										1650				2834		4484		4484	Y	1495	2466	523
15	P. Dyriw	000-172-92000														2834		2834		2834	Y	945	1559	330
15	F. Weaning	000-172-93000														2834		2834		2834	Y	945	1559	330
15	E. Ziemba	000-172-94000														2834		2834		2834	Y	945	1559	330
15	J. Srebot	000-172-95000														2834		2834		2834	Y	945	1559	330
15	W. Hoving	000-172-96000														2834		2834		2834	Y	945	1559	330
15	F. Kuppek Ltd.	000-172-97000														5664		5664		5664	Y	1888	3115	661
15	A. Kubik	000-173-00000														5664		5664		5664	Y	1888	3115	661
15	S. Visser	000-173-01000														2834		2834		2834	Y	945	1559	330
15	R. Visser	000-173-02000														2834		2834		2834	Y	945	1559	330
15	Borscok Farm Inc.	000-171-03000				2000	6400											8400		8400	Y	2800	4620	980
15	F. Srebot	000-171-06000				2000	6400											8400		8400	Y	2800	4620	980
15	N. Salama	000-171-09000				2000	6400					1650						10050		10050	N	0	5528	4523
16	E. Zarac	000-171-14000				2000	7150											9150		9150	Y	3050	5033	1068
16	L. Chow	000-171-17000				2000	7150											9150		9150	Y	3050	5033	1068
16	P. Srebot	000-171-20000	500															500		500	Y	167	275	58
16	E. Kasiulus	000-171-23000				2000	7150											9150		9150	Y	3050	5033	1068
16	Hollandale Farms	000-171-29000				2000	7150									2338		11488		11488	Y	3829	6318	1341

Interval No.	Landowner	Roll Number	Abandon and Seal Irrigation Line	Other	Add cap or capping plate	Power Primer	Type A2	Type A3	Type A4	Type A5	Type A6	B	C	D	E	EC	F	Total Cost	Not Eligible for any Grant	Grantable Special Benefit	Has Farm Tax Rate	OMAFRA 1/3 Grant	MIII Grant	Net Assessment
16	H. Horlings	000-173-06000														3003		3003		3003	Y	1001	1652	350
16	F. Weeing	000-173-07000														3921		3921		3921	Y	1307	2157	457
16	E. Ziemba	000-173-09500														6537		6537		6537	Y	2179	3595	763
16	T. Visser	000-173-12000														2577		2577		2577	Y	859	1417	301
16	P. Shri	000-173-13000														3921		3921		3921	Y	1307	2157	457
16	L. Vanhart	000-172-47000														3862		3862		3862	Y	1287	2124	451
16	Hillside Gardens Ltd.	000-172-48500														2616		2616		2616	Y	872	1439	305
16	Hollandale Farms	000-172-49500														5225		5225		5225	Y	1742	2874	609
16	G. Borscok	000-171-38000													10450			10450		10450	Y	3483	5748	1220
16	Borscok Farm Inc.	000-171-40000													10450			10450		10450	Y	3483	5748	1220
16	Hollandale Farms	000-171-43000				2000	7150											9150		9150	Y	3050	5033	1068
16	D. Horlings	000-171-49000	500			2000			8150									10650		10650	Y	3550	5858	1243
16	Hollandale Farms	000-171-50000				2000			8150									10150		10150	Y	3383	5583	1185
16	Muck Research Centre	000-174-77000		1000														1000		1000	Y	333	550	117
17	J. Maan	000-171-62000				2000			8150									10150		10150	Y	3383	5583	1185
17	Kailyn Investment	000-171-62500	500			2000			8150									10650		10650	N	0	5858	4793
17	Hillside Gardens	000-171-66000													11550			11550		11550	Y	3850	6353	1348
17	J. Maan	000-171-67000				2000	7150								10450			19600		19600	Y	6533	10780	2287
17	R. Scholten	000-171-68000				2000			8150						11550			21700		21700	Y	7233	11935	2532
17	K. Borscok	000-171-97200				2000			8150						11550			21700		21700	Y	7233	11935	2532
17	H. Schakel	000-171-97400						5600				1650						7250		7250	Y	2417	3988	846
17	Foothill Greenhouses	000-170-02000			500			5600										6100		6100	N	0	3355	2745
18	M. Voorberg	000-170-02700															500	500		500	Y	167	275	58
18	A. Maan	000-175-30000															500	500		500	Y	167	275	58
18	J. Frans	000-170-09500															500	500		500	N	0	275	225
18	T. Makarenko	000-170-11000															500	500		500	Y	167	275	58
18	A. Moor	000-170-17000															500	500		500	Y	167	275	58
18	J. Maan	000-170-21000															500	500		500	Y	167	275	58
18	J. Rupke	000-170-22500															500	500		500	Y	167	275	58
18	M. Rupke	000-170-22000															500	500		500	N	0	275	225
18	J. Maan	000-170-29500															500	500		500	Y	167	275	58
18	G. Rupke	000-170-32000															500	500		500	Y	167	275	58
18	J. Verkaik	000-170-36000															500	500		500	Y	167	275	58
18	M. Rupke	000-170-46000															500	500		500	Y	167	275	58
18	Westfield Farms	000-170-48000															500	500		500	Y	167	275	58
18	T. Munshaw	000-170-53000															1000	1000		1000	Y	333	550	117
18	D. Chin	000-170-60000															500	500		500	N	0	275	225
18	M. Banjac	000-170-63000															500	500		500	Y	167	275	58
18	Westfield Farms	000-170-65000															500	500		500	Y	167	275	58
18	J. Huang	000-170-68000															500	500		500	N	0	275	225
		TOTALS	9000	22000	13500	240000	661250	39200	173200	47400	15400	30250	19550	26550	66000	134600	9500	1507400	25500	1481900		391734	815045	300621



APPENDIX 7

N.T.S.

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HOLLAND MARSH DRAINAGE SYSTEM CANAL IMPROVEMENT PROJECT

HOLLAND MARSH DRAINAGE SYSTEM JOINT MUNICIPAL SERVICES BOARD

TOWN OF BRADFORD WEST GWILLIMBURY
COUNTY OF SIMCOE
REGION OF YORK

JOB NUMBER
03–023

DATE
JANUARY, 2009

DRAWING NUMBER
117

TEMPORARY IRRIGATION

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APPENDIX 7

Temporary Water Supply System for Holland Marsh Canal

1.0 *Project highlights*

- Distance of water delivery: 1 km (3,300 feet)
- Volume of supplied water:
    - As per design: 4,000 US gallons per minute
    - Maximum consumption in peak periods – up to 6,000 US gallons per minute with condition of precise water taking planning
- Discharge pressure will vary between 15 PSI and 60 PSI. Discharge pressure can be restricted by upward-opening valves
- Type of pipelines: 8” Aluminum pipes with Wade Rain RL couplers.
- Take-off adapters: sixteen 8” x 6” Upward-valves with RL valve openers
- Delivery hoses: fifteen 30’ and 40’ collapsible high pressure hoses. Adapters for discharge side will be manufactured individually for each farm to fit existing suction adapter of farmers’ pump.
- Pump station: Two identical engine units that include:
    - 155 HP 6-cyl John Deere 6068 engines
    - Cornell 6RB with Ready-Prime and Run-Dry options
    - 100 Gallon Fuel Tank (aerated, permits transportation with the fuel in)
    - Power primer
    - Automated throttle control that automatically controls RPM depending on water consumptions and automatically turns engine off if all valves are closed.
    - 10” Suction Lines
    - Two-wheeled frame with removable hitch and hood

Project Estimation

Ln#	Product	Product Desc	Q-ty	Units	Price	Amt
1	EIJ6068T155	ENGINE JOHN DEERE 155HP 6068T POWERTECH	2	EA	$16,080.00	$32,160.00
2	6RB-RP	CORNELL PUMP 6RB READY PRIME	2	each	$17,690.00	$35,380.00
3	EIT-FRAME	FRAME ONLY DIESEL UNIT	2	EA	$1,080.00	$2,160.00
4	EIE-ACCE	ACCESS. FOR JOHN DEERE ENGINE UNIT	2	EA	$931.63	$1,863.26
5	EIP100KIT	FUEL TANK ROUND 120 U.S. GAL INSTALATION	2	EA	$1,135.00	$2,270.00
6	DS-AUTOSET	AUTOMATED RPM CONTROL	2	each	$3,700.00	$7,400.00
7	GABSA6X8	6"X 8" BAUER SUCTION ASSY-ALUM	2	EA	$564.24	$1,128.48
8	BE11-2MXF6X8RL	ADAPTER PUMP RING LOCK 6" X 8"	2	EA	$112.02	$224.04
9	AUSFS10	SCREEN SUCTION 10"	2	EA	$305.96	$611.92
10	EGSDBC10	CLAMP SPIRAL TIGERFLEX 10"	2	EA	$60.15	$120.30

Ln#	Product	Product Description	Q-ty	Units	Price	Amt
11	EGW1000	HOSE SUCTION TIGERFLEX 10" 25 PSI	60	FT	$85.76	$5,145.60
12	DA10-06430	PIPE ALUMINUM 10"X 30' 064 WALL	20	FT	$14.35	$287.00
13	GA08-30WR-RL	8" x 30' ALUM PIPE W/WADE RL COUPLERS *	110	EA	$432.00	$47,520.00
14	2-8-4MXFEU	T-VALVE 8" X 6" RL UPWARD	15	each	$540.00	$8,100.00
15	BCSUVEO606	VALVE OPENER STEEL UNIVERSAL 6" X 6"	15	EA	$234.97	$3,524.55
16	GAAIT66	6" ALUM INSERT X 6" TUBE 1/8" WALL LESS B&L	15	EA	$116.42	$1,746.30
17	AZM6KOPER	HOSE FLEXTEX KOPER 6" FOR CUT LENGTHS	600	FT	$16.20	$9,720.00
18	GAAIF66	6" ALUM INSERT X 6" WADE FEMALE COUPLER	15	EA	$146.31	$2,194.65
19	00MISC	MISC FITTINGS (ESTIMATION)	1	EA	$20,000.00	$20,000.00
TOTAL						$181,556.10

Comments: Changes have been made since previous 3-yer old estimation:

1. System capacity increased up to 6,000 GPM max. System elements have been changed accordingly:
    a. 155HP John Deere engine units instead 100 HP IVECO
    b. 10" suction instead 8"
    c. Fully automated Ready-prime system with self-re-priming instead 12 power primers
2. Double 6" pipe line replaced by single 8" (each 8" aluminum pipe can be returned to Vanden Bussche after 7-year use. Price will be determined at the moment of returning. Today's estimation is $166.
3. Berkeley 6JQBH pump head replaced by industrial duty Cornell 6RB with Run-Dry feature

APPENDIX 8
CONTINGENCY UNIT PRICES FOR IRRIGATION

Item	Work Description (Type) Size Ave. Length	Unit	Total Quantity	Unit Cost	Total Cost
CONTINGENCY ITEMS FOR IRRIGATION				(Estimated Now To be Used for Tendering Later	
34	a) Irrigation A-2 Construct new pipe across asphalt dyke. Minimum length 18m (non road portion could be earth, lawn or gravel). Includes bed work across backfill, seal or remove old pipe and supply of cap				
	a) 100mm	each		3,750	
	b) 150mm	each		4,250	
	c) 200mm	each		5,250	
	d) 250mm	each		5,600	
	b) Irrigation A-2 Construct new pipes across earth dykes (even if some granular exists). Minimum length 18m Non-road portion could be earth, lawn or gravel. Includes bed work across backfill, seal or remove old pipe and supply of cap				
	a) 100mm	each		3,000	
	b) 150mm	each		3,500	
	c) 200mm	each		4,500	
	d) 250mm	each		5,000	
	c) Irrigation A-2 Construct new pipes across asphalt dyke and extend across berm area. Minimum length 25m (also applies at partial relocations) Non-road portion could be earth, lawn or gravel. Includes bed work across backfill, seal or remove old pipe and supply of cap				
	a) 100mm	each		5,000	
	b) 150mm	each		5,650	
	c) 200mm	each		7,150	
	d) 250mm	each		7,650	
	d) Irrigation A-2 Construct new pipe across earth dyke and extend across berm area (even if some granular exists). Minimum length 22m Non-road portion could be earth, lawn or gravel. Includes bed work across backfill, seal or remove old pipe and supply of cap				
	a) 100mm	each		4,250	
	b) 150mm	each		4,900	
	c) 200mm	each		6,400	
	d) 250mm	each		6,900	
	e) Additional lengths if necessary to extend ends of A-2 (in all condtions - lawn, gravel or earth)				
	a) 100mm	m		90	
	b) 150mm	m		115	
	c) 200mm	m		175	
	d) 250mm	m		195	

APPENDIX 8
CONTINGENCY UNIT PRICES FOR IRRIGATION

Item	Work Description (Type) Size Ave. Length	Unit	Total Quantity	Unit Cost	Total Cost
35	a) Irrigation A-3				
	Place new pipes across paved dyke in cleanout				
	section. Minimum length is 18m. Non-road portion				
	could be anything. Includes removal or seal of old				
	pipe and cap				
	a) 100mm	each		3,750	
	b) 150mm	each		4,200	
	c) 200mm	each		5,250	
	d) 250mm	each		5,600	
	b) Irrigation A-3				
	Place new pipes across granular or earth dyke in				
	cleanout sections. Minimum length is 18m.				
	Non-road portion could be anything. Includes				
	removal or seal of old pipe and cap				
	a) 100mm	each		3,000	
	b) 150mm	each		3,500	
	c) 200mm	each		4,500	
	d) 250mm	each		5,000	
	c) Additional lengths to extend ends of A-3 (in all				
	conditions) lawn or gravel condition				
	a) 100mm	m		90	
	b) 150mm	m		115	
	c) 200mm	m		175	
	d) 250mm	m		195	
36	a) Additional work to alter A-2 irrigation to Type				
	A-4 in berm areas including supply of minimum				
	length of 12m of aluminum irrigation piping and				
	includes supply and placement of connector and				
	laying of aluminum piping if needed immediately				
	a) 100mm	each		1,150	
	b) 150mm	each		1,300	
	c) 200mm	each		1,500	
	d) 250mm	each		1,800	
	b) Additional work to alter A-2 irrigation to Type				
	A-4 in non-berm areas including supply of minimum				
	length of 25m of aluminum irrigation piping and				
	includes supply of and placement connector and laying				
	of aluminum piping if needed immediately				
	a) 100mm	each		1,550	
	b) 150mm	each		1,850	
	c) 200mm	each		2,250	
	d) 250mm	each		2,800	
	c) Additional costs if required for additional				
	aluminum irrigation piping (supply and place)				
	a) 100mm	m		52	
	b) 150mm	m		65	
	c) 200mm	m		83	
	d) 250mm	m		105	
	d) Additional costs to supply and place a sleeve				
	for aluminum piping if deemed necessary across cana	m		200	
	backfill after bed preparation (375 x 125mm structural				
	steel channel section)				

APPENDIX 8
CONTINGENCY UNIT PRICES FOR IRRIGATION

Item	Work Description (Type) Size Ave. Length	Unit	Total Quantity	Unit Cost	Total Cost
37	a) Irrigation A-5				
	New line across asphalt dyke in cleanout or				
	relocation section complete with cap and for all types				
	of ground at ends and including bed preparation work				
	on canal where needed. Minimum length 18m				
	a) 100mm	each		3,250	
	b) 150mm	each		3,750	
	c) 200mm	each		4,750	
	d) 250mm	each		5,100	
	b) Irrigation A-5				
	New line across earth dyke in cleanout or relocation				
	sections complete with cap and for all types of				
	ground at ends and including bed preparation work.				
	on canal where needed. Minimum length 18m				
	a) 100mm	each		2,500	
	b) 150mm	each		3,000	
	c) 200mm	each		4,000	
	d) 250mm	each		4,500	
	c) Irrigation A-5				
	New line across paved dyke in relocation sections				
	with berms complete with cap and grading				
	backfill and for all types of ground at ends.				
	Minimum length 25m.				
	a) 100mm	each		4,500	
	b) 150mm	each		5,150	
	c) 200mm	each		6,650	
	d) 250mm	each		7,150	
	d) Irrigation A-5				
	New line across earth dyke in relocation sections				
	with berms complete with cap and grading				
	backfill and for all types of ground at ends.				
	Minimum length 22m.				
	a) 100mm	each		3,750	
	b) 150mm	each		4,400	
	c) 200mm	each		4,900	
	d) 250mm	each		6,400	
	e) Additional lengths if necessary to extend				
	ends of A-5 (all conditions)				
	a) 100mm	m		90	
	b) 150mm	m		115	
	c) 200mm	m		175	
	d) 250mm	m		195	
38	a) Irrigation A-6				
	Prepare base for new pipe on canal backfill from top				
	of berm to new canal and supply minimum 15m				
	new aluminum piping (Intervals 13 to 15)				
	a) 100mm	each		1,200	
	b) 150mm	each		1,300	
	c) 200mm	each		1,650	
	d) 250mm	each		2,000	

APPENDIX 8
CONTINGENCY UNIT PRICES FOR IRRIGATION

Item	Work Description (Type) Size Ave. Length	Unit	Total Quantity	Unit Cost	Total Cost
	b) Irrigation A-6				
	Where owner wishes new steel pipe supplied and				
	installed across earth dyke and berm (minimum of				
	23m) and the supply of aluminum piping (minimum				
	12m) from steel pipe to canal including cap and				
	prepare base and for all ground types at ends				
	a) 100mm	each		5,200	
	b) 150mm	each		5,950	
	c) 200mm	each		7,720	
	d) 250mm	each		8,500	
	c) For extensions to steel piping (for all ground				
	types at ends) (supply and install)				
	a) 100mm	m		90	
	b) 150mm	m		115	
	c) 200mm	m		175	
	d) 250mm	m		195	
	d) For extensions to aluminum piping (supply only)				
	a) 100mm	m		22	
	b) 150mm	m		35	
	c) 200mm	m		93	
	d) 250mm	m		75	
39	a) Irrigation B (Above Grade)				
	Couple to and extend existing small diameter				
	line to new canal including preparing bed (base)				
	across backfill in full relocation section.				
	Supply and place. Minimum length 28m				
	a) 50mm	each		1,300	
	b) 75mm	each		1,500	
	b) Irrigation B (Above Grade)				
	Couple to and extend existing small diameter				
	line to new canal including preparing bed (base)				
	across backfill in partial relocation.				
	Supply and place. Minimum length 12m				
	a) 50mm	each		1,300	
	b) 75mm	each		1,600	
	c) Supply and install channel or I beam or pipe	m		80	
	sleeves where required on surface of canal backfill				
	(150 x 75mm structural steel channel or 150mm				
	piping (__ mm wall)).				
	d) Supply and install 150mm dia. steel pipe	each		3,900	
	sleeves (__ mm wall) across earth dyke				
	where required (min. length 15m). All ground				
	types at ends including supplying and installing				
	small tubing				
	e) Supply and install 150mm dia. steel pipe	each		4,650	
	sleeve across paved dyke (__mm wall)				
	where required (Min. length of 15m).				
	All ground types at ends including supply and				
	installing small tubing				
	f) Additional lengths of 150mm steel piping				
	across dyke (all ground conditions). Supply	m		225	
	and install including small pipe.				

APPENDIX 8
CONTINGENCY UNIT PRICES FOR IRRIGATION

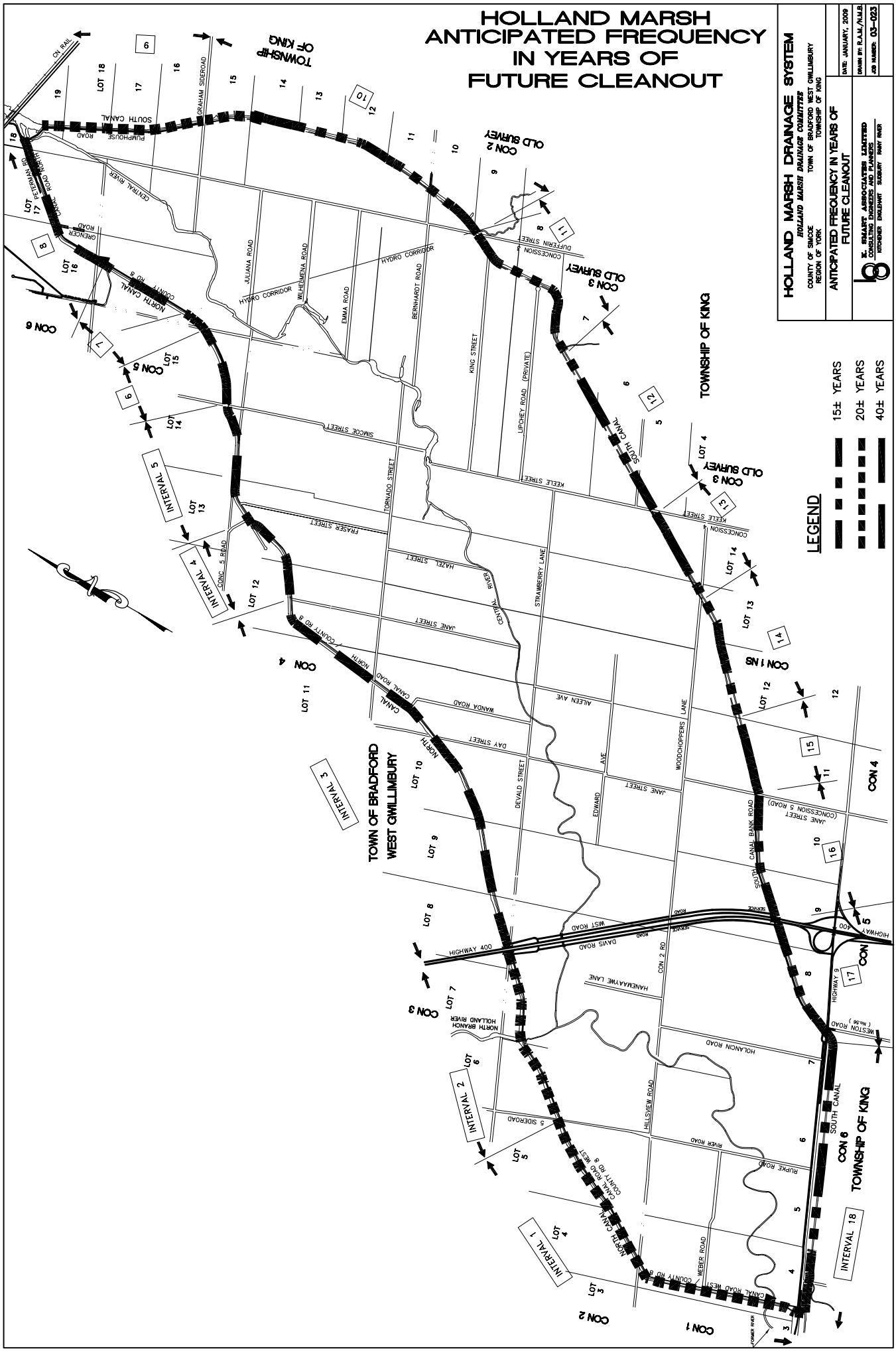
Item	Work Description (Type) Size Ave. Length	Unit	Total Quantity	Unit Cost	Total Cost
	g) Additional lengths of 50 & 75mm tubing - supply and install and in all ground conditions				
	a) 50mm	m		25	
	b) 75mm	m		35	
40	a) Irrigation C (Below Grade) Couple to and extend existing small diameter line to new canal across backfill in full relocation section including clay cofferdam, excavating, placing 150mm structural steel pipe, sleeve, no posts. Supply and place. Minimum length 28m.				
	a) 50mm	each		9,500 *	
	b) 75mm	each		10,000 *	
	b) Irrigation C (Below Grade) Couple to and extend existing small diameter line to new canal including clay cofferdam, excavating, placing 150mm structural steel pipe sleeve (__mm wall), no posts, across backfill in partial relocation sections. Supply and place. Minimum length 12m				
	a) 50mm	each		5,500	
	b) 75mm	each		6,000	
	c) Supply and install 150mm dia. steel pipe sleeves (__mm wall) across earth dyke where required (min. length 15m). All ground types at ends including supply and installing small tubing	each		5,400	
	d) Supply and install 150mm dia. steel pipe sleeve across paved dyke (__mm wall) where required (Min. length of 15m). All ground types at ends including supply and installing small tubing	each		4,650	
	e) Additional lengths of 150mm steel piping across dyke (all ground conditions). Supply and install.	m		225	
	f) Additional lengths of piping for extention in backfilled canal including clay, excavating and install and in all ground conditions (no posts)				
	a) 50mm	m		250	
	b) 75mm	m		300	
41 & 42	a) Irrigation D (Suction Lines, Below Grade) and Sub-Irrigation Couple to and extend existing suction line to new canal across backfill in full relocation sections including clay cofferdam, excavating, placing pipe* and excluding any valve work including reusing screens. No valve work except joining to existing where required. Supply and place. Minimum length 28m				
	a) 100mm	each		10,850	
	b) 150mm	each		11,700	
	c) 200mm	each		12,100	
	d) 250mm	each		14,650	

* If steel posts were augered to support pipe, add $10,000 per crossing

APPENDIX 8
CONTINGENCY UNIT PRICES FOR IRRIGATION

Item	Work Description (Type) Size Ave. Length	Unit	Total Quantity	Unit Cost	Total Cost
	b) Irrigation D (Suction Lines, Below Grade)				
	Couple to and extend existing suction line to new canal across backfill in partial relocation sections including clay cofferdam, excavating, placing pipe ** and excluding any new valve work including reusing screens. No valve work excepting tying to existing where required. Supply and place. Minimum length 12m.				
	a) 100mm	each		6,000	
	b) 150mm	each		6,000	
	c) 200mm	each		7,000	
	d) 250mm	each		8,000	
	c) Additional lengths of steel piping including clay cofferdam, excavating, screens				
	a) 100mm	m		150	
	b) 150mm	m		200	
	c) 200mm	m		250	
	d) 250mm	m		300	
43	a) Irrigation EC (Below Grade)				
	Couple to and extend existing communal line to new canal across backfill in full relocation sections including clay cofferdam, excavating, placing augered support posts and brackets and excluding any valve work including reusing screens. No valve work except tying to existing where required. Supply and place. Minimum length 28m				
	a) 250mm	each		27,500	
	b) 300mm	each		29,500	
	c) 400mm	each		37,000	
	b) Additional lengths of steel piping for communal including clay cofferdam, excavating, augering posts (2.4m spacing)				
	a) 250mm	m		1,000	
	b) 300mm	m		1,100	
	c) 350mm	m		1,400	

** Augered steel posts would add $5,000 to this cost



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APPENDIX 10

ENVIRONMENTAL PLANS

HOLLAND MARSH DRAINAGE SYSTEM

A. *SPILL PREVENTION AND RESPONSE PLAN*

Purpose
The purpose of this plan is to provide a procedure to prevent but to immediately respond to a spill and to minimize impact to the land and/or water environment in the immediate and surrounding area when necessary. The procedure for clean-up, containment, disposal, authority to contract emergency spill contractors, on-site equipment and migration will be covered in the following plan.

Criteria
A Spill is defined as a pollutant discharged, from a structure, vehicle or other container that is abnormal in quality or quantity into the natural environment.

Potential Contamination

- Soil stabilizers/binders
- Dust palliatives
- Herbicides
- Growth inhibitors
- Fertilizers
- Deicing/anti-icing chemicals
- Fuels
- Lubricants
- Other petroleum distillates

General Response
Initial response to any spill on the project site is:

1. Ensure safety in the spill area
2. Stop the flow of hazardous material safely
3. Secure and isolate the affected spill area

The first responders shall safely take actions to prevent additional spillage, utilize on-site resources and notify the person in authority and appropriate regulatory authorities. If the spill is large in nature and can't be controlled with on-site resources call the project engineer (both Kitchener and Site) immediately and the Spill Response Team will be notified. Any spills reaching a watercourse must be reported to the Ministry of Environment immediately by the contractor. The contractor shall also notify the municipality and owner if on private land.

Spills on Land
The first action for clean-up of land based spills is to prevent the spread to watercourses and/ or canals by containing or damming the spill. Second limit the saturation of the material deep into the soils by removal of liquid by absorbents or pumping. When the free liquid is contained, steps can then be taken to collect all contaminated soil for later disposal.

Spills into Water-courses or Water-bodies
The first action for clean-up should be to immediately stop the spread of the spilled material downstream. This can be accomplished with the use of absorbent booms and absorbent material designed to pick up oil. Spills into watercourses have the potential to cause environmental damage and must be reported to the Ministry of Environment immediately.

General Cleanup and Storage Procedures

a) Minor Spills

Minor spills typically involve small quantities of oil, gasoline, paint, etc., which can be controlled by the first responder at the discovery of the spill.

- Use absorbent materials on small spills rather than hosing down or burying the spill.
- Remove the absorbent materials promptly and dispose of properly.
- The practice commonly followed for a minor spill is:
- Contain the spread of the spill.
- Recover spilled materials.
- Clean the contaminated area and/or properly dispose of contaminated materials.

b) Semi-Significant Spills

Semi-significant spills still can be controlled by the first responder along with the aid of other personnel such as laborers and the foreman, etc. This response may require the cessation of all other activities.

- Notify the Ministry immediately.
- Contain the spills immediately:
- Notify the project inspector immediately. The inspector shall notify the Project Engineer.
- Contain spread of the spill.
- If the spill occurs on paved or impermeable surfaces, clean up using "dry" methods (absorbent materials, cat litter and/or rags). Contain the spill by encircling with absorbent materials and do not let the spill spread widely.
- If the spill occurs in dirt areas, immediately contain the spill by constructing an earthen dike. Dig up and properly dispose of contaminated soil.
- If the spill occurs during rain, cover spill with tarps or other material to prevent contaminating runoff.

c) Significant/Hazardous Spills

For significant or hazardous spills that cannot be controlled by personnel in the immediate vicinity, the following steps shall be taken:

- Notify the Ministry immediately.
- Notify the project engineer immediately.
- Stop all construction activities within the interval where the spill occurred.
- Contain the spill immediately.
- Call emergency spill contractor if not able to reach the project engineer.
- Call all organizations in emergency contract list.
- Minimize containment area affected with on-site equipment.

Implementation

To the extent that it doesn't compromise clean-up activities, spills shall be covered and protected from storm water run-on during rainfall.

- Spills shall not be buried or washed with water.
- Used clean up materials, contaminated materials, and recovered spill material that is no longer suitable for the intended purpose shall be stored and disposed of in conformance with the special provisions.
- Water used for cleaning and decontamination shall not be allowed to enter storm drains or watercourses and shall be collected and disposed of in accordance with MOE protocol.
- Water overflow or minor water spillage shall be contained and shall not be allowed to discharge into drainage facilities or watercourses.
- Proper storage, clean-up and spill reporting instruction for hazardous materials stored or used on the project site shall be posted at all times in an open, conspicuous and accessible location.
- Waste storage areas shall be kept clean, well organized and equipped with ample clean-up supplies as appropriate for the materials being stored. Perimeter controls, containment structures, covers and liners shall be repaired or replaced as needed to maintain proper function.

On-site Resources (Preliminary Kit Materials)

Total quantity	Item	size	Purchase units	Current amount
1	Steel drum	45 gallon	Drum	
450’	Heavy Absorbent rolls	30” x 150’	Bale, 150’ roll	
1	Spill Placard		item	
1	Car shovel		item	
20	Large garage bags	3mm, 147L	Box, 10 bags	
100	Absorbent Pads	15” x 18”	Box, 100 pads	
100’	Absorbent socks	3” dia x 10’	Bale, 10 socks	
160’	Absorbent booms	5” dia x 10’	Bale, 4 socks	
10	Absorbent pillows	18” x 18”	Box, 10 pillows	
1	Utility knife		item	
100	Plastic Tie-wraps	6”	Box, 100 ties	
1	Personal protective equipment	Goggles, gloves, full body suit	Item	
3000 sq. ft.	Polyethylene "Ultra" vapour barrier	8.5’ x 175’x6mm	Roll, 1500 sq. ft.	
150’	Containment boom	18” x 50’	Sections, 50’	
1	Containment berm, track mat and ground pad,	15’ x 54’	Item	
1	Emergency guidebook		Book	
1	List of items and where to buy more supplies		Book	

Plan Communication

This plan will be made available to all employees and sub-contractors on site. It will also be discussed at the initial site meeting and safety training sessions.

Monitoring of Clean-Up and Restoration

The clean up and restoration of every spill will be monitored by the project engineer site and office. The project inspector will be in contact with the project engineer and appropriate government agencies, as required. The spill response contractor will be responsible for restoring the contaminated site to its previous state.

Debriefing

After the clean up of a significant spill is complete, the contractor is to hold a debriefing with all involved personnel. This debriefing will include the following:

- What caused the spill? Review all stages of the incident from first identification to final clean up.
- What can be done to prevent a similar incident from happening again?
- Review with response personnel why the incident went right/wrong.
- What equipment was useful or not useful?
- Was there sufficient equipment?
- Nature of response; could the incident have been avoided?
- How could the response have been improved?

This debriefing will be included in a report to the Provincial and Federal and regulatory authorities, as required.

Report Filing

At the end of the clean up, a detailed environmental report will be filed with the province and government regulatory agencies, if required.

Emergency Telephone Numbers

Organization	Telephone
Project Engineer Kitchener	519-748-1199 Cell 519-658-7610
Project Engineer Site	905-853-2006
Township of King	905-833-5321
Town of Bradford West-Gwillimbury	905-775-0163
MOE Spills Action Centre	1-800-268-6060
Fisheries and Oceans Canada, Fisheries Officer	1-705-750-4013
Lake Simcoe Conservation Authority Officer	1-800-465-0437
Spill Response Firm (Team-1)	(905) 383-5550
Holland Marsh DSJMSB	Sarah Murray- 1-905-788-4321
Drainage Superintendent	Frank Jonkman 1-905-967-5306
Ministry of Natural Resources Officer, GTA	1-905-713-7400
Ministry of Natural Resources Officer, Simcoe	1-705-725-7500
York Health Department	1-800-361-5653
Simcoe & Muskoka Health Department	1-877-721-7520
Fire Emergency	911
Police Emergency	911
Ambulance	911

Prevention Measures

All vehicles must be filled at least 15m from any watercourse or environmental sensitive areas. All vehicles must use an environmental friendly hydraulic fluid. All vehicle maintenance must be done, on a impervious surface at least 15m from any watercourse or environmental sensitive areas. A spill kit must be in all construction vehicles, and be properly stocked. Verify weekly that spill control clean up materials is located near material storage, unloading and use areas.

Spill Response Training

Spill response training will be undertaken as part of the health and safety program for site personnel. This training program will familiarize the workers with the location and use of spill equipment and the need to report all spills to the project inspector. The review will focus on:

- Due diligence to prevent spills;
- Safety procedures;
- Roles and responsibilities;
- Spill assessment;
- Site security and safety;
- Characteristics of petroleum products;
- Spill containment and recovery;
- Site restoration; and
- Spill documentation.

Field demonstrations of correct procedures for spill response and mitigation will be scheduled periodically. Update spill prevention and control plans and stock appropriate clean-up materials whenever changes occur in the types of chemicals used or stored onsite. Educate employees and subcontractors on what a "significant spill" is for each material they use, and what is the appropriate response for "significant" and "insignificant" spills. Educate employees and subcontractors on potential dangers to humans and the environment from spills and leaks. Hold regular meetings to discuss and reinforce appropriate disposal procedures (incorporate into regular safety meetings). Establish a continuing education program to indoctrinate new employees. **The project engineer will arrange a spill control training session at the commencement of the project and all contractor staff attendance is mandatory.**

B. ***FUELING PLAN***

Due to the shallow groundwater and proximity to watercourses, fueling and maintenance of heavy equipment used in the excavation and filling operations will, wherever possible and where access permits, be conducted away from the canals to minimize potential for accidental discharge or spillage of petroleum, oil, lubricants (PO) to the aquatic environment. This can be done by fueling on roadways away from the water body. A POL station will be established for each reach where accidental spillage, if any, can be effectively trapped and cleaned up without direct loss to the canals or tributaries. This can be done by construction an impermeable layer on the ground to refuel the vehicles. There are a number of different techniques that could be used to build an impermeable layer.

1) A onetime use Polyethylene plastic sheets with a absorbent sock surrounding the vehicle as a berm. Since the tracks of the vehicles can easily puncture the plastic this would be a onetime use alternative.
    a. This alternative cost about $\$0.6/m^2$ per refuel plus time.
2) A layer of heavy absorbent matting. One must ensure that the matting does not rip; therefore a heavy absorbent mat should be used. This alternative can be use a number of times until the mat is heavily ripped.
    a. This alternative cost about $\$3/m^2$ and must be replaced after ripped or when fabric is used.
3) A usable containment berm could be used. This is a reusable prefabricated folder open container that vehicles can drive onto. The container is made of plastic with a hard plastic track bottom to protect the container from the tracks of the vehicles.
    a. This alternative cost about $\$60/m^2$
4) A bermed area with a 200mm thick clay base.

Pollution Prevention

- Use properly maintained off-site fueling stations whenever possible. These businesses are better equipped to handle fuel and spills properly.
- Educate employees about pollution prevention measures and goals.
- Focus pollution prevention activities on containment of spills and leaks, most of which may occur during liquid transfers.
- "Spot clean" leaks and drips routinely. Leaks are not cleaned up until the absorbent is picked up and disposed of properly.
- Manage materials and waste to reduce adverse impacts on stormwater quality.
- Post signs to remind employees and customers not to top off the fuel tank when filling and signs that ban customers and employees from changing engine oil or other fluids at that location.
- Report leaking vehicles to fleet maintenance.
- Ensure the following safeguards are in place:
    - Overflow protection devices on tank systems to warn the operator to automatically shutdown transfer pumps when the tank reaches full capacity.
    - Protective guards around tanks and piping to prevent vehicle or forklift damage.
    - Clear tagging or labeling of all valves to reduce human error.

Fuel Dispensing Areas

- Maintain clean fuel-dispensing areas using dry cleanup methods such as sweeping for removal of litter and debris, or use of rags and absorbents for leaks and spills.
- If you periodically clean by washing, place a temporary plug in the downstream drain and pump out the accumulated water. Properly dispose the water. Note: permission from the local sewering agency must be obtained before discharging wash water to the sanitary sewer.
- Fit fuel dispensing nozzles with "hold-open latches" (automatic shutoffs) except where prohibited by local fire departments.
- Post signs at the fuel dispenser or fuel island warning vehicle owners/operators against "topping off" of vehicle fuel tanks.
- Design fueling area to prevent stormwater runoff and spills.
- Cover fueling area with an overhanging roof structure or canopy so that precipitation cannot come in contact with the fueling area and use a perimeter drain or slope pavement inward with drainage to sump; pave area with concrete rather than asphalt.
- Install vapor recovery nozzles to help control drips as well as air pollution.
- Use secondary containment when transferring fuel from the tank truck to the fuel tank.
- Post “no littering” signs.

Procedure for refueling vehicles and general maintenance

1) All vehicles must drive to designated areas, if not at a road or close to a watercourse, a constructed impermeable layer must be constructed before the vehicles is refilled or maintained. The refueling or maintenance areas should be placed on cleared, level ground (less than 2% slope), with no overhanging vegetation and with no visible direct course to a waterway. Refueling in rain or snow should be minimized.
2) After the imperious layer is constructed, the vehicle can be driven on the imperious surface and then maintenance or refueling can occur. During refueling a person must be at the vehicle at all times. The vehicle tank and gas cap must be in good working order and shape. A large spill kit must be on hand during all maintenance and refueling operations. All vehicles should not be topped off during refueling to minimize over filling the vehicles.
3) After the refueling or maintenance is finished, the vehicle is driven off the impermeable surface must be disposed of or cleaned off dry.

Remote Site Fueling

1) Where remote fueling is necessary, the Contractor shall propose his method to supply fuel to the equipment.
2) Remove fueling situations would exist where excavation equipment is working on the outside of an existing canal and cannot be moved to a designated fueling location.
3) Where such remote fueling is necessary, containment channels or pipings for lines that extend across any open water body are necessary.
4) Fuel containment and spillage kits are to be located at the fuelling truck and are also to be on at the equipment being fueled.
5) If transportation of fuel occurs across any open waterbody by barge or boat, a containment system is necessary on the barge or boat to confine any spillage that should occur.
6) It will be necessary for the Contractor to have pre-approved his method of fueling remote equipment.

Emergency Maintenance or Refueling

1) All leaks or spills must be immediately contained.
2) A berm should be constructed around the vehicle. Absorbent pads should be placed under the vehicle.
3) If fuel is need the fuel should be brought in an airtight plastic container.
4) The vehicle should be inspected to ensure no is no other damage or the vehicle is in working order.
5) Once the vehicle is fixed or refueled it can be driven off the containment area. The absorbent pads should be disposed.

Hydraulic Fluids

1) The use of biodegradable hydraulic fluids is required on this project for any equipment working in water.
2) The Contractor shall be required to provide verification at the time of project start up that all equipment working in water to clean or excavate canals or to otherwise work, across or through any canal or water body is operated with biodegradable hydraulic fluids.

- Where designated fuelling stations cannot be provided for due to equipment working in a non-accessible area, the following provisions for remote fuelling shall apply.
  a) The Contractor shall submit and have pre-approved his plan for remote fuelling.
  b) If fuel lines have to be extended across the canal being backfilled, lines shall be laid in channel iron sections, carried across the watercourse by means of a bridge or pontoons that confines any leakage to the channel or pipe section. As well, absorbent materials shall be available to be placed in the channel section to provide for collection of any spills. Fuel lines shall be specially constructed to provide for lengthy reaches.
  c) At the equipment location being fuelled, pans shall be placed below the fuelling nozzle and self absorbent materials shall be in close proximity to provide for any spillage.
  d) Provisions shall also be in place at the fuelling truck to ensure that pans are available to be used below any lines leaving the vehicle. Also absorbent material shall be in close proximity and shall be used where necessary.
  e) Consideration will be given to having mobile fuelling tanks in the vicinity in the remote location that are fuelled from fuel trucks and where such fuelling tanks are mobile such that they can be brought to the equipment to be fuelled.
  f) Fuel containment and spillage kits shall be pre-approved and shall exist on both sides of any waterbody.
- Where fuelling is necessary from, or for equipment working on, barges, the following general notes shall apply:

a) The plan for such refueling must be submitted and pre-approved in advance
b) Any barges that are to be used for transporting and support of excavation equipment shall have waterproof rails on the perimeter of the barge capable of containing any fuel spillages.
c) The barge shall be equipped with absorbent type materials to be used should a spillage occur.
d) Equipment shall be filled from the barge while the barge is stationary and secured and at as close of a location as possible to shoreline.

e) Where fuel lines must extend across open bodies of water to access the barge and/or equipment on the barge, sections of channel material that is waterproof shall be used as a sleeve on which the fuel line is to be placed. The sleeve material shall be of sufficient strength that it does not sag due to the weight of the fuel line. The sleeve should also be equipped or shall have on it at sufficient locations absorbent material capable of absorbing any spillage that occurs. The sleeve shall be sufficiently supported that it does not rotate or flex during operation.

- There will be no separate measurement or payment for fuelling provisions.

General

- Use properly maintained off-site fueling stations whenever possible. These businesses are better equipped to handle fuel and spills properly.
- Educate employees about pollution prevention measures and goals.
- Focus pollution prevention activities on containment of spills and leaks, most of which may occur during liquid transfers.
- "Spot clean" leaks and drips routinely. Leaks are not cleaned up until the absorbent is picked up and disposed of properly.
- Manage materials and waste to reduce adverse impacts on stormwater quality.
- Post signs to remind employees and customers not to top off the fuel tank when filling and signs that ban customers and employees from changing engine oil or other fluids at that location.
- Report leaking vehicles to fleet maintenance.
- Ensure the following safeguards are in place:
    - Overflow protection devices on tank systems to warn the operator to automatically shutdown transfer pumps when the tank reaches full capacity.
    - Protective guards around tanks and piping to prevent vehicle or forklift damage.
    - Clear tagging or labeling of all valves to reduce human error.

Emergency maintenance or refueling

- Ensure the following safeguards are in place:
- All leaks or spills must be immediately contained.
- A berm should be constructed around the vehicle. Absorbent pads should be placed under the vehicle.
- If fuel is needed, the fuel should be brought in an airtight plastic container.
- The vehicle should be inspected to ensure there is no other damage and that the vehicle is in working order.
- Once the vehicle is repaired or refueled it can be driven off the containment area. The absorbent pads should be disposed.

C. ***SEDIMENT AND EROSION CONTROL PLAN***

Purpose

To minimize sediment discharge and erosion is critical to minimize the environmental impact of the works off site. To achieve this objective a number of mitigation measures must be in place on land and in the canal. Silt fencing, turbidity curtains, berm/cofferdams, sediment basins, dewatering, re-vegetation and erosion control mats will be the main devices used to control erosion and sediments.

Devices

The silt fencing will be installed along the edge of the cleared land around the outside of the new canal. The silt fence must go to the existing canal edge. The silt fence must also be installed around all stockpiles. The silt fence must be installed as per OPSD 219.130 and OPSS 577.07.04.01. The silt fence must be installed immediately after the land is cleared.

The silt fence must not be installed in areas of concentrated channel flow volumes. The silt fence should be checked and maintained twice a week and before anticipated and after major rain storms (1:2 year storm and/or 40mm> in a 24 hour period) or melts. Remove fence after vegetation is established and soil stabilized. Deactivate fabric by cutting off the top portion of fabric above ground; the bottom trenched-in portion can be left in-ground to minimize ground disturbance.

The turbidity curtains are used 15 to 20m away from either side of the work and installed after the site is cleared of vegetation. Turbidity curtains that allow for maintenance of low flows are to be used. The turbidity curtain are designed to filter out large suspend particles in the canal around the work site. Double turbidity curtains should be used in case of curtain failure. The curtains should be installed as per OPSD 219.261 and 219.260.

The turbidity curtains should be inspected after storms and twice a week to ensure the curtain is working properly with no gaps. Once the work within the site is complete, the turbidity curtains can be removed the day after completion.

The berms and cofferdams are then used to contain the soil and material removed from the new canal works. The berms will be constructed out of a soil, with a lower hydraulic conductivity less than 2mm/hr. The soil should be free of deleterious material and be low in moisture content (less than 6% moisture content). The cofferdams shall be installed across the canal and must be able to withstand the weight of the material excavated from the new canal. The soil can be placed upwards of 1.5m above the waterlevel.

After the new canal is constructed the cofferdams and/or berms should be left in place. The berm banks should be reinforced against erosive forces.

The straw bale check dams, are installed at the inlets and outlet of the sediment basins installed to filter the surface water of large particles and debris. The straw bale check dams should be installed as per OPSD 219.180. The straw bale check dam should be removed after construction is complete or the new canal has replaced the sediment basin. In winder conditions stone check dams with a filter fabric (suitably designed) exist.

The sediment basins are installed at the downstream end of the new canal section. The sediment basin is used to reduce large particle material from the displaced water in the old canal as the water is discharged during the filling of the work section. The sediment basin should be constructed 16m long and 8m wide. The sediment basin is to be connected to the old canal sections by a ditch (within which straw bale dams are to be placed (see above)). The installed the sediment basins as per OPSD 219.220.

The sediment basin must be inspected and maintained twice a week or after any major storm. The sediment basin should be cleaned out if it is filled with sediment. The sediment basin should be removed during the last stages of the new channel excavation and integrated into the new channel. Straw bale check dams are to be installed the ditch.

The erosion control blankets are installed to reduce sheet erosion from stockpiles, berms, and fill areas and stabilize the canal bank. The erosion control blankets are installed by laying them on the ground and stapled into the ground as per the manufacturer's instructions. The blankets should be laid perpendicular to the flow of the canal if installed across the water air interface.

The erosion control blankets should be made of biodegradable materials and left in place until the ground surface is vegetated. The erosion control blankets should be supplied to last one year, to allow the vegetation to establish itself.

Re-vegetation should be used to stabilize new berms. The seed and plants on the berm should be by a landscaping contractor.

Emergency Sediment Control

During large storms or natural disasters or human disasters the sediment control devices may deteriorate rapidly. A set of redundancies, should be employed. See berm/cofferdams removal plan for details. After any disaster the sediment control devices must be repaired and inspected before regular work can continue.

General

All erosion control devices should be installed or constructed when applicable. All erosion control measures should be routinely inspected and repaired. If new areas of concern are found the appropriate erosion control device should be implemented. Turbidity curtains, berms/cofferdams, erosion control blankets, re-vegetation, straw bale barrier, sediment basins, and silt fences should all be considered. All erosion control devices should follow the specification as per OPSS 577.

D. *SITE SPECIFIC SAMPLING PLAN*

Purpose

Ongoing monitoring is done, to ensure the work is not negatively affecting the areas outside the work area. To ensure high results are not just seasonal fluctuations samples will be taken a year before excavation work. Turbidity samples are taken after storms to ensure the sediment control devices are working properly. The soil samples are taken to ensure the soils placed are not contaminated above the soil that it is being placed around. So the soil where material will be placed should be tested, as well as the sediment that will be placed. After the work is completed, a number of samples should be taken. These samples are taken to monitor the ongoing change in the canals caused by the project and if the canals return to pre-construction conditions.

COMMITMENTS REQUIRED AS A RESULT OF CEAA STUDY

The following pages document the principle requirements with respect to sampling and analyses to be undertaken prior to, during and after construction and also summarizes the provisions to be undertaken with respect to fisheries habitat replacement and enhancement construction and also addresses the items to be addressed with respect to other topics of concern.

1. **Sediment/Soil Sampling Strategy**

a) Sediment Sampling in Canal Bottoms Being Removed
- Collect samples at 500 to 1000m intervals.
- Collect one sample of sediment. If sediment depth is greater than 1.5m, collect two samples.
- Analyze for the OC pesticides DDT, DDE, DDD and Toxaphene plus for F3 and F4 PHC's.

b) Sampling Canal Bottom After Removal of Sediments
- Collect sample at 500 to 1000m intervals.
- Collect at 150mm to 300mm below bottom.
- Analyze for the OC pesticides DDT, DDE, DDD and Toxaphene plus for F3 and F4 PHC's.

c) Sampling Soils Where Excavated Sediments to be Levelled
- Collect sample at 500 to 1000m intervals.
- Collect at 150mm to 300mm below surface.
- Analyze for the OC pesticides DDT, DDE, DDD and Toxaphene plus for F3 and F4 PHC's.

d) Sampling Native Soils to be Used as Fill in Backfilled Canals
- Collect sample at 500 to 1000m intervals.
- Collect one sample from each 1m of depth.
- Analyze for the OC pesticides DDT, DDE, DDD and Toxaphene plus for F3 and F4 PHC's.
- Consider MOE Fill Quality Guidelines for Lake Fill.

e) Exceedences
- Where canal sediment pesticide levels exceed comparable levels of pesticides in fields to be used for levelling, canal sediments to be stockpiled and then hauled to and used as fill in sections of canal being backfilled.

f) Adaptive Management
- The extent of sampling may be altered after experience is gained with the first construction reach(es).

2. **Turbidity Sampling Strategy**

a) Background Sampling
- Obtain background turbidity samples within the year leading up to construction during spring runoff period, during midsummer, during fall period and after one significant runoff event.
- Collect three samples at each sample period and space the samples uniformly through the length to be excavated in the following year.

- Sample for other selected water quality parameters (suspended solids, phosphorous, nitrogen) twice before construction.

b) Sampling During Construction
- Initially collect turbidity samples daily during first week and then collect samples at 2 week frequencies and after any significant runoff event.
- Collect one sample upstream and one sample downstream of the work interval at each sampling time.
- Conduct visual observations for turbidity plumes daily.
- Sample for other selected water quality parameters (suspended solids, phosphorous, nitrogen) twice during construction.

c) Post Construction Sampling
- Sample turbidity over the two following years in any construction reach.
- Samples to be obtained in spring, summer and fall and after any significant runoff event.
- Sample for other selected water quality parameters (suspended solids, phosphorous, nitrogen) once per year.

d) Exceedences
- Exceedence is related to samples outside of the construction zone.
- Exceedence is defined as twice the standard error of the background.
- If exceedence occurs re sample, repair mitigation measures where required, create new measures as required and/or alter or suspend work where justified.
- Apply adaptive management techniques as required.
- CWQO will be utilized as part of the monitoring and reporting protocol as well as for establishing compliance thresholds for mitigative actions.
- Supernatant pond conditions and usage to be reviewed.

e) Adaptive Management
- The extent of sampling may be altered after experience is gained with the first construction reach(es).

3. Sampling Procedure
- The soil sample will consist of a 5 kg soil sample with no deleterious material and with few cobbles. The surface samples should be taken between 300mm and 450mm below the surface. The samples should be contained in a non-absorbent, water proof, single uses containers. The soil should be obtained with a clean shovel and handled with clean gloves. The sediment samples should be obtained using a hand held core samplers by personnel in a small watercraft. Samples will be taken as deep as possible. Where excavation depths are great, additional samples will be taken after removal of upper levels of sediments. Cores collected will be frozen and then send off to labs for analysis.
- The water samples should be a clean sample with little or no debris. The samples bottles with a preservative should be filled with another bottle to ensure the preservative is not lost during sampling. The samples bottle without a preservative can be sampled directly from the canal. All water samples should be cooled to $4^{O}C$.
- The samples should be contained in a non-absorbent, water proof, single uses containers.
- For turbidity sampling, a representative water sample from the canal is to be acquired in a clean container. The sample should contain no large pieces of debris. The turbidity gauge is then dipped into the sample water and the turbidity measure is recorded. The measure should be taken after the gauge is in the water for 30 seconds, so the gauge has time to stabilize and smaller particles have not settled in the sample container.
- The turbidity gauge should be calibrated once each sample day as per the manufacturer instructions. The gauge must be cleaned with de-ionized water before and after each test.

4. **Commitments re Fish Habitat Reconstruction**
- Existing habitat found in the canal is quite uniform with essentially one habitat type dominating the canals. The new canals are proposed to have a diversity of habitats which are expected to offer variety in habitat depth and substrate type as well as function for spawning, nursery and feeding habitat for various species. The proposed features (in addition to the native substrates) are as follows:
  - littoral shelf;

- log bundles;
- macrophyte transplants;
- gravel substrates; and
- deep pool excavations.

- As an example, the density of the enhancements for the first construction reach (Intervals 13 through 16) will be:
  - Littoral shelf – 1 m in depth – 9,328 m^2 (3,731 m total length x 2.5 m width – specialized features described below, located in littoral shelf);
  - Log bundles, large woody debris along littoral shelf – 157.5 m^2 (21 locations x 3 m in width x 2.5 m of littoral shelf – placed every 200 m);
  - Macrophyte transplants, native aquatic vegetation in 1 m depth – 125 m^2 (5 locations x 10 m reach x 2.5 m width of littoral shelf);
  - Gravel substrates along littoral shelf – 225 m^2 (3 locations x 30 m reach x 2.5 m width of littoral shelf);
  - Deep pool habitat approximately 1 m below new typical canal depth – 2,400 m^2 (3 locations x 200 m in length x 4 m in width); and
  - Native substrates following excavation, 3 m in depth – 69,235 m^2 (3,731 m length x 19.2 m width – 2,400 m^2 deep pool habitat).
- Through adaptive management these densities/frequencies may be modified to maximize the net benefit.

5. **Commitments re Migratory Birds**

Re Hooded Warbler (*Wilsonia citrina*) Listed on Schedule 1 of the SARA as "Threatened".
Re King Rail (*Rallus elegans*) Listed on Schedule 1 of the SARA as "Endangered".
Re Least Bittern (*Ixobrychus exilis*) Listed on Schedule 1 of the SARA as "Threatened".

Re Yellow Rail (*Coturnicops noveborancensis*) Listed on Schedule 1 of the SARA as "Special Concern"

- Any construction activities with the potential to destroy migratory birds, or their nests, such as vegetation clearing, should not take place in potential breeding habitat during the breeding season for bird species listed under the Migratory Birds Convention Act, 1994.
- The following mitigation measures, in order of preference, will be implemented to protect those species.
  - Restrict vegetation clearing during the winter months to those portions of the North and South Canal that are to be re-located.
  - No vegetation clearing during the breeding season for this region, with the breeding season generally defined as occurring between May 9th and July 31st.
  - If construction activity needs to be undertaken in breeding habitat during the breeding season, that a nest survey be conducted by a qualified avian biologist prior to commencement of construction works to identify and locate active nests of species covered by the Migratory Birds Convention Act, 1994.
  - Should a nest be located or evidence of breeding noted, then a mitigation plan (i.e., which may include establishing appropriate buffers around active nests) be developed to address any potential impacts on migratory birds or their active nests. It should be reviewed by Environment Canada prior to implementation.
  - If active nests are found on bridges where construction or maintenance work is to take place, Environment Canada should be contacted for further guidance.
  - The area to be cleared in any one year will be monitored during the prior year, primarily in the four areas noted to have potential breeding habitat (ie. cattail marsh at outlet of North Schomberg River/Fraser Creek and at the confluence of the north and south drain as well as deciduous stands associated with the Ansorveldt PSW and significant woodlands along the edge of the south canal), to determine if any use of the specific area is made by a Species at Risk.

6. **Commitments re Wildlife Habitat**
   - Careful delineation of clearing work prior to commencement.
   - No clearing of any more trees than necessary for the particular works.
   - Seeding of disturbed areas with native species mixture.
   - Use the top 50cm of organic material/topsoil in the new canal footprint or designated area to maximize restoration efforts.
   - Replanting of native shrubs along areas of imported berm.
   - Natural re-establishment of woody vegetation.
   - Re-vegetation (i.e., seeding) of riparian area of new Canal to be completed as soon as possible.

7. **Commitments re Plants**
   Re Butternut (*Juglans cinerea*)
   - Prior to construction works undertake a site walk by a qualified botanist to identify and locate any specimens within the proposed canal relocation corridor.
   - Should any specimens be found, their health and condition will be evaluated, particularly for any evidence of butternut canker. If evidence of canker infestation is found, then removal will be undertaken.
   - However, if found and if the specimen(s) appears disease free or there are healthy individuals within a group of diseased trees, then, a mitigation plan (i.e., which may include establishing appropriate buffers around the disease free or disease resistant specimens) will be developed to address any potential impacts, and Environment Canada will be consulted prior to implementation.

E. *EMERGENCY PLAN*

The Contractors are to be aware that the potential exists at any time that a section of canal that has been cofferdammed off for relocation may have to be restored to service if high flow/flood conditions are anticipated and/or occur.

It is anticipated that the work involved with canal reconstruction will involve attending to sections of relocation up to 1000m in length by creating cofferdams in the section of canal to be backfilled and replaced. It is anticipated that the new work will involve excavation equipment sitting on the lands of the new canal and/or on the dyke beside the existing canal. It is anticipated that each new section of canal excavation will be like a self contained pond with end cofferdams created by either natural and unexcavated material (until necessary) or by man-installed cofferdams. In an emergency these end cofferdams would require temporary alteration as discussed in the next paragraph.

The emergency plan that is to exist and be implemented should it be necessary to return a cofferdammed section of canal back to use for flow purposes as following:

a) Careful watering up of the new excavated length is to be undertaken to prevent sedimentation. High capacity pumps will be necessary to fill the excavated section as quickly as possible.
b) A notch is to be excavated between the newly excavated section and the adjacent existing canal and the notch size is to be equivalent to the existing canal's area.
c) The end cofferdam of the new section adjacent to the previous new excavation is to be removed to give the newly excavated canal access to the previously constructed length.
d) The far end cofferdam of the existing canal is to be removed to thereby allow continuous canal flow from the previously excavated section through the new section being excavated into the unexcavated section through the temporary notch.
e) The turbidity curtains downstream and upstream of the existing cofferdammed section are to be removed.
f) To ensure that such work is possible, cofferdam construction using clay materials are desirable since this would both allow easy removal of such plus the reconstruction of such when excavation reoccurs.
g) Further to ensure that such work is possible, at that end where excavation of the new section of canal has commenced, the previous earth cofferdam in the old canal is to allow access for excavation equipment to the short extent of natural ground separating the previously excavated section of the canal and the section being currently excavated. This access would be necessary in any case to allow removal of this section of unexcavated material once the balance of the section being currently excavated is complete.

Drawings 118 to 119 contain details to show the schematics of the emergency plan.

Upon passage of emergency flows and when and as designated by the engineer, the Contractor may resume the canal excavation work. The turbidity curtains and the cofferdams would have to be reconstructed and the notch section would have to be filled using clay materials or equivalent. It may be appropriate to cross over a backfilled canal if such construction is possible, and create the cofferdam closer to where the work ceased. The Contractor would have to supply and use pumps to dewater the section of canal that was under construction at the time to allow the excavation to continue.

The payment for emergency work would be on a time and material basis using realistic unit prices for the equipment in use and at a payment of realistic invoices for materials at a markup of 10%.

Similarly, realistic hourly labour costs would be paid. The costs would be paid both for the removal of cofferdams and for the reconstruction of such. There would be no payment made for standby time while the flood event occurs.

With respect to the emergency plan for events involving a cleanout section, the work necessary will only be to remove turbidity curtains and to cease excavation until the emergency passes.

There is a separate allowance in the Cost Estimate for such emergency work.

F. *ALL WEATHER PLAN*

a) Provisions for Winter Work

- The Contractor is to have a site prepared free of snow and ice for stockpiling of earth brought in for cofferdam construction and is to ensure the materials brought in are dry and are protected from moisture during storage. If the site exists, the soil is to be kept available and dry.
- The Contractor is to ensure that ice is removed and that fish shocking and removal can occur in freezing conditions or alternatively is to ensure that fish shocking occurs prior to freeze up and that nets or screens are placed to prevent most fish from re-entering the area.
- The Contractor is to ensure that ice breakup is undertaken to allow for excavation.
- The Contractor is to provide for releveling of all leveled materials in the following construction season.
- All disposal sites are to be cleared and/or stripped in the summer/fall conditions in preparation for winter activity.
- Avoid working in those sections of the canal where limited space for disposal of excavated materials exist.
- Avoid work from canal roads in winter conditions if hauling is the sole means of disposal.
- Prepare to break ice for turbidity curtains.
- Construct longitudinal earth cofferdams before freeze up.
- Schedule work so that sediment ponds and silt fences are constructed prior to winter conditions.
- Schedule activities so that below grade irrigation work is not impacted by winter conditions.
- Schedule activities so minimal impacts on road work re freeze up is attended to.
- Provide ice and salt control.
- Keep leveling areas free of snow build ups.
- Avoid or minimize work in Intervals 10 (in part) 11 (part), 13, and part of 8, transition sections, partial relocation sections and other sections of cleanouts from roads.
- Have contingencies for increased road maintenance activities.
- Provide separate stockpile areas for frozen excavated soils that are to be hauled.
- Ensure ice control is provided to reduce safety impacts on construction equipment.
- Provide for snow removal activities to allow construction.
- Ensure fuel and fluid lines on all equipment are inspected and kept free from damage by ice and snow.
- Monitor weather forecasts and schedule work to prepare for such.
- Build in allowances for lost time.

b) Extreme Rainfall Periods

- Observe the Emergency Plan for opening up cofferdammed section.
- Monitor weather forecasts and schedule work to prepare for such.
- Stockpile additional materials for cofferdam construction and protect such from moisture.
- Keep existing stockpile areas dry.
- Ensure construction yards are constructed at high elevations.
- Build in allowances for lost time.

c) Extreme Droughts

- Build in time allowances and allow for such in construction scheduling.
- Have contingency equipment and materials and staff to provide for continued and additional irrigation where affected by work areas.
- Reduce lengths of work zones.
- Ensure paths are unobstructed to canals in non-work areas for landowners.
- Ensure replacement irrigation is constructed immediately

d) Extreme Heat Conditions

- Build in allowances to recognize loss of time.
- Reduce work zones.
- Monitor weather reports.
- Provide unobstructed access to canals in non-work areas.
- Provide backups for temporary irrigation.
- Ensure replacement irrigation is constructed immediately
- Provide education to Contractor staff.

e) Extreme Snowfall

- Build in time allowances to allow for such.
- Prepare for increased road maintenance.
- Provide for additional barricades to safeguard construction staff and the travelling public.
- Be prepared to have work suspended by the Engineer where he deems conditions are not suitable for continued construction.
- Have sites available for disposal of snow removal.
- Monitor weather forecasts
- Ensure access to private properties is no less restricted

f) Extreme Winds

- Suspend operations in high wind periods.
- Monitor weather forecasts
- Have provisions to remove fallen trees
- Provide barricades around areas that could be impacted

G. PLAN FOR ACCIDENTS AND MALFUNCTIONS

The Contractor is to provide for the following with respect to accidents and malfunctions:

- Monitor as-constructed sections for possible signs of erosion and sloughing.
- Continuously inspect equipment for damaged fuel lines and possible spill occurrences.
- Continuously monitor temporary irrigation piping. Have additional temporary irrigation materials on site if needed
- Monitor newly constructed irrigation piping to ensure such continues to be operable
- Inspect all sites after any cleanout work
- Inspect all road embankments continuously for signs of failure
- Have ample supply of pylons and signs to cordon off any accident site
- Have on site traffic control signs for traffic movement in accident areas
- Implement all requirements of the Spill Response Plan re equipment ensures duplicates in the Spill Plan are on site
- Have surplus turbidity curtains and silt fences on site at all times.
- Have surplus erosion control blankets and filter fabric on site
- Have surplus stockpile of earth on site at all times
- Have emergency contact numbers available at all work locations
- Have access to water/aquadams and/or geofabric tubes and baskets and be familiar with their operation.

APPENDIX 11

MISCELLANEOUS MITIGATION MEASURES TO CONSIDER AS RECOMMENDED BY CEAA STUDY REPORT

Municipalities/Board

- Have backup plan if any inlet damaged during maintenance
- Education of landowners in Drain Report
- Periodic inspection of drain by Drainage Superintendent
- Provide early notice to all landowners as to when land will be impacted
- Conduct pre-construction meetings between landowners and contractors
- Provide signage where no fencing is erected
- Provide gates at end of dykes where used as lanes
- Enact Municipal By-Law to provide for no trespassing
- When maintenance occurs, allow some of the revegetated area to remain and do not disturb plantings on berm slope
- Provide education to owners that canal is not for common use
- Educate owners re the use of the buffer strips
- Restrict recreational use during construction
- Consider long term prohibition of boaters
- Minimize hidden or unexpected hazards
- Provide marker stakes at irrigation inlets or submerged habitat locations
- Sign and post the dyke roads with respect to no dumping
- Provide education in advance about dumping
- Post markings re submerged obstacles and hazards
- Consider passing by-laws to prohibit boating long term in the canal
- Consider long-term prohibition of biking on dyke road
- Provide advance publication/notification of activities
- Do maintenance at low hunting activity periods
- Consider long-term prohibition of cross-country skiing and snowmobiling along the canals
- In post-construction periods, ensure equipment access is available to each length during emergencies
- Have detour contingency plans in place for road closures
- Have Municipal commitment to restore roadway portions
- Use provisions of Section 66 to address any developments that may change the rate of runoff into a Municipal Drain
- Have all plans reviewed by Committee to ensure provisions for drainage and storm water management are implemented
- Any attendants at the construction site be wearing safety clothing and apparel

Contractors

- Remove silt curtains to allow fish movement as soon as possible
- Have contingency equipment should temporary irrigation be inadequate during construction
- Have contingency measures in place to supply emergency water
- Have measures to replace shallow dug wells

- Specify mufflers on construction equipment
- Discourage idling or extensive warm-ups
- Encourage use of current technological advances where possible
- Ensure material used for fill is kept moist (optimum moisture only)
- Use tarps on trucks
- Provide for controlled speeds of equipment
- Facilitate aeration of sediments when stockpiled
- Level excavated materials and cover with topsoil as soon as possible
- Complete construction as soon as possible once started
- Attempt to do work involving road closures when farm traffic is low
- Plant shrubs on top of berm in areas of full relocation where a berm is required
- Facilitate natural growth on berm and backfilled areas
- Use varieties of species and patterns of shrubs on the earth berms
- Allow scattered trees to remain in the leveled portions of the backfilled areas
- Provide floating barricades during construction for boater protection
- Have dam and pump materials onsite to account for additional drainage from tributaries

Environmental Sub-Consultant

- Monitor success of created habitat
- Continuous monitoring of cleared edges for erosion potential

Items to be Addressed by Report

- Prior notification of all construction
- Provide for training of contractor staff
- Protecting the work through signage, pylons, detours, road closures
- Provide for speed limits and postings and policing
- Provide for illumination
- Provide for designated working hours
- Provide for defined hauled routes
- Provide for requirement of safety clothing
- Provide emergency contacts in engineering report and specifications
- Educate contractors and provide project specifications about dumping
- Provide for on-going inspection during construction and have specifications to provide for settlements
- Provide for possible First Nations concerns
- Provide knowledge of utilities to contractor in the contract document
- Advise re need for development projects upstream to implement storm water manage practices

APPENDIX 12

BEST MANAGEMENT PRACTICES*
(BMP's)

1. Fuelling

Description and Purpose

Vehicle and equipment fueling procedures and practices are designed to minimize or eliminate the discharge of fuel spills and leaks into storm drain systems or to watercourses.

These procedures are applied on all construction sites where vehicle and equipment fueling takes place.

Limitations

Onsite vehicle and equipment fueling shall only be used where it's impractical to send vehicles and equipment off-site for fueling.

Implementation

When fueling must occur onsite, the contractor shall select and designate an area to be used, subject to approval of the Resident Engineer (RE).

Absorbent spill clean-up materials and spill kits shall be available in fueling areas and on fueling trucks and shall be disposed of properly after use.

Drip pans or absorbent pads shall be used during vehicle and equipment fueling, unless the fueling is performed over an impermeable surface in a dedicated fueling area.

Dedicated fueling areas shall be protected from storm water run-on and runoff, and shall be located at least 15 m (50 ft) from downstream drainage facilities and watercourses. Fueling must be performed on level-grade areas.

Nozzles used in vehicle and equipment fueling shall be equipped with an automatic shut-off to control drips. Fueling operations shall not be left unattended.

Protect fueling areas with berms and/or dikes to prevent run-on, runoff, and to contain spills. Use vapor recovery nozzles to help control drips as well as air pollution where required. Ensure the nozzle is secured upright when not in use.

Fuel tanks shall not be "topped-off."

Vehicles and equipment shall be inspected on each day of use for leaks. Leaks shall be repaired immediately or problem vehicles or equipment shall be removed from the project site.

Absorbent spill clean-up materials shall be available in fueling and maintenance areas and used on small spills instead of hosing down or burying techniques. The spent absorbent material shall be removed promptly and disposed of properly.

Federal, provincial, and local requirements shall be observed for any stationary above ground storage tanks.

Mobile fueling of construction equipment throughout the site shall be minimized. Whenever practical, equipment shall be transported to the designated fueling area.

Inspection and Maintenance

Fueling areas and storage tanks shall be inspected regularly.

Keep an ample supply of spill cleanup material on the site.

Immediately cleanup spills and properly dispose of contaminated soil and cleanup materials.

2. Worker Education

Description and Purpose

Employee training and supervision in and around the construction site is important for worker safety and public safety.

Implementation

Require an independent contractor to do inspections

* Not all of these BMP's are applicable to the project and a "best efforts" approach will be followed to apply the applicable BMP's to this project.

Adequately train employees

Maintain an adequate number of employees on the job

Properly supervise employees

Have emergency number and contact information available to employees

Protect the work area with proper signage, pylons, detours, closures

Have designated working hours

3. Wood Mulching

Description and Purpose

Wood mulching consists of applying a mixture of shredded wood mulch, bark or compost to disturbed soils. The primary function of wood mulching is to reduce erosion by protecting bare soil from rainfall impact, increasing infiltration, and reducing runoff.

Limitations

Not suitable for use on slopes steeper than 3:1. Best suited to flat grades or gentle slopes.

Not suitable for areas exposed to concentrated flows

May need to be removed prior to further earthwork

Implementation

There are many types of mulches. Selection of the appropriate type of mulch should be based on the type of application, site conditions, and compatibility with planned future uses.

Prior to application, after existing vegetation has been removed, roughen embankment and fill areas by rolling with a device such as a punching type roller or by track walking.

Avoid mulch placement onto roads, sidewalks, drainage channels, existing vegetation etc.

Green Material mulch:

Produced by the recycling of vegetation trimmings such as grass, shredded shrubs and trees.

Methods of application are generally done by hand although pneumatic methods are available

Green material can be used a as temporary ground cover with or without seeding

The green material should be evenly distributed on site to a depth of not more than 2 inches

Shredded Wood mulch:

Suitable for ground cover in ornamental or revegetated planting
Shredded wood/bark is conditionally suitable
Distribute by hand or use pneumatic methods
Evenly distribute the mulch across the soil surface to a depth of 2 to 3 inches

Inspection ad Maintenance

Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.

Areas where erosion is evident shall be repaired and BMPs reapplied as soon as possible.

Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require reapplication of BMPs.

Regardless of the mulching technique selected, the key consideration in inspection and maintenance is that the mulch needs to last long enough to achieve erosion control objectives. If the mulch is applied as a stand alone erosion control method over disturbed areas (without seed), it should last the length of time the site will remain barren or until final re-grading and re-vegetation.

Where vegetation is not the ultimate cover, such as ornamental and landscape applications of bark or wood chips, inspection and maintenance should focus on longevity and integrity of the mulch.

Reapply mulch when bare earth becomes visible.

4. Wind Erosion Control

Description and Purpose

Wind erosion or dust control consists of applying water or other dust palliatives as necessary to prevent or alleviate dust nuisance generated by construction activities. Covering small stockpiles or areas is an alternative to applying water or other dust palliatives.

Limitations

Watering prevents dust only for a short period and should be applied daily (or more often) to be effective

Over watering may cause erosion

Oil or oil-treated sub grade should not be used for dust control because the oil may migrate into drainageways and/or seep into the soil

Effectiveness depends on soil, temperature, humidity and wind velocity

Chemically treated sub grades may make the soil water repellant, interfering with long-term infiltration and the vegetation/re-vegetation of the site. Some chemical dust suppressants may be subject to freezing and may contain solvents and should be handled properly

Asphalt, as a mulch tack or chemical, requires a 24 hour curing time to avoid adherence to equipment, worker shoes etc. Applications should be limited because asphalt surfacing may eventually migrate into the drainage system

In compact areas, watering and other liquid dust control measures may wash sediment or other constituents into the drainage system

Implementation

For heavily traveled and disturbed areas, wet suppression (watering), chemical dust suppression, gravel asphalt surfacing, temporary gravel construction entrances, equipment wash-out areas, and haul truck covers can be employed as dust control applications

Permanent or temporary vegetation and mulching can be employed for areas of occasional or no construction traffic

Preventive measures would include minimizing surface areas to be disturbed, limiting onsite vehicle traffic 15 mph, and controlling the number and activity of vehicles on a site at any given time

Schedule construction activities to minimize exposed areas

Quickly stabilize exposed soils using vegetation, mulching, spray-on adhesives, calcium chloride, sprinkling and stone/gravel layering

Identify and stabilize key access points prior to commencement of construction

Minimize the impact of dust by anticipating the direction of prevailing winds

Direct most construction traffic to stabilize roadways within the project site

Water should be applied by means of pressure-type distributors or pipelines equipped with a spray system or hoses and nozzles that will ensure distribution

All distribution equipment should be equipped with a positive means of shutoff

Unless water is applied by means of pipelines, at least one mobile unit should be available at all times to apply water or dust palliative to the project

Pave or chemically stabilize access points where unpaved traffic surfaces adjoin paved roads

Provide covers for haul trucks transporting materials that contribute to dust

Provide wet suppression or chemical stabilization of exposed soils

Provide for rapid clean up of sediments deposited on paved roads. Furnish stabilized construction road entrances and vehicle wash down areas.

Stabilize inactive construction sites using vegetation or chemical stabilization methods

Limit the amount of areas disturbed by clearing and earth moving operations by scheduling these activities in phases

Inspection and Maintenance
Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.

Check areas protected to ensure coverage.

5. Streambank Stabilization

Description and Purpose
Stream channels, streambanks, and associated riparian areas are dynamic and sensitive ecosystems that respond to changes in land use activity. Streambank and channel disturbance resulting from construction activities can increase the stream's sediment load, which can cause channel erosion or sedimentation and have adverse affects on the biotic system. BMPs can reduce the discharge of sediment and other pollutants to minimize the impact of construction activities on watercourses.

Implementation
Planning
Proper planning, design, and construction techniques can minimize impacts normally associated with in stream construction activities. Poor planning can adversely affect soil, fish, wildlife resources, land uses, or land users. Planning should take into account: scheduling; avoidance of in-stream construction; minimizing disturbance area and construction time period; using pre-disturbed areas; selecting crossing location; and selecting equipment.

Scheduling
Construction activities should be scheduled according to the relative sensitivity of the environmental concerns and in accordance with Scheduling BMP.

Minimize Disturbance
Minimize disturbance through: selection of the narrowest crossing location; limiting the number of equipment trips across a stream during construction; and, minimizing the number and size of work areas (equipment staging areas and spoil storage areas). Place work areas at least 50 ft from stream channel. Field reconnaissance should be conducted during the planning stage to identify work areas.

Use of Pre-Disturbed Areas
Locate project sites and work areas in areas disturbed by prior construction or other activity when possible.

Selection of Project Site
Avoid steep and unstable banks, highly erodible or saturated soils, or highly fractured rock.

Select project site that minimizes disturbance to aquatic species or habitat.

Equipment Selection
Select equipment that reduces the amount of pressure exerted on the ground surface, and therefore, reduces erosion potential and/or use overhead or aerial access for transporting equipment across drainage channels. Use equipment that exerts ground pressures of less than 5 or 6 lb/in2, where possible. Low ground pressure equipment includes: wide or high flotation tires (34 to 72 in. wide); dual tires; bogie axle systems; tracked machines; lightweight equipment; and, central tire inflation systems.

Types of Streambank StabilizationTechniques
-Preservation of Existing Vegetation
-Hydraulic Mulch
-Hydroseeding
-Soil Binders
-Straw Mulch
-Geotextiles and Mats
-Earth Dikes, Drainage Swales, and Lined Ditches
-Velocity Dissipation Devices
-Slope Drains
-Silt Fences
-Fiber Rolls

-Gravel Bag Berm
-Straw Bale Barrier
-Rock Filter
-K-rail
-Sediment/Turbidity Curtains

6. Straw Mulch

Description and Purpose

Straw mulch consists of placing a uniform layer of straw and incorporating it into the soil with a studded roller or anchoring it with a tackifier stabilizing emulsion. Straw mulch protects the soil surface from the impact of rain drops, preventing soil particles from becoming dislodged.

Application

Apply straw at a minimum rate of 4000 lb/acre, either by machine or by hand distribution

Roughen embankments and fill rills before placing the straw mulch by rolling with a crimping or punching type roller or by track walking

Evenly distribute straw mulch on the soil surface

Anchor for holding the straw mulch in place depend upon the slope steepness, accessibility, soil conditions and longevity on small areas, a spade or shovel can be used to punch in straw mulch on slopes with soils that are stable enough and of sufficient gradient to safely support construction equipment without contributing to compaction and instability problems, straw can be punched into the ground using a knife blade roller or a straight bladed coulter, known commercially as a crimper on small areas and/or steep slopes, straw can also be held in place using plastic netting or jute. The netting shall be held in place using 11 gauge wire staples, geotextiles pins or wooden stakes a tackifier acts to glue the straw fibers together and to soil surface. The tackifier shall be selected based on longevity and ability to hold in fibers in place. A tackifier is typically applied at a rate of 125 lb/acre. In windy conditions the rate are typically 180 lb/acre

Inspection and Maintenance

Inspect BMPs prior to forecast of rain, daily during extended rain events, after rain events, weekly during the rainy season and at two week intervals during on rainy season

Areas where erosion is evident should be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs.

The key consideration in inspection and maintenance is that the straw needs to last long enough to achieve erosion control objectives

Maintain an unbroken, temporary mulched ground cover while disturbed soil areas are inactive. Repair any damaged ground cover and re-mulch exposed areas

Reapplication of straw mulch and tackifier may be required to maintain effective soil stabilization over disturbed areas and slopes.

7. Straw Bale Barriers

Description and Purpose

A straw bale barrier is a series of straw bales placed on a level contour to intercept sheet flows. Straw bale barriers pond sheet- flow runoff, allowing sediment to settle out.

Limitations

Straw bale barriers:
-Are not to be used for extended periods of time because they tend to rot and fall apart
-Are suitable only for sheet flow on slopes of 10 % or flatter
-Are not appropriate for large drainage areas, limit to one acre or less
-May require constant maintenance due to rotting
-Are not recommended for concentrated flow, inlet protection, channel flow, and live streams
-Cannot be made of bale bindings of jute or cotton
-Require labor-intensive installation and maintenance

-Cannot be used on paved surfaces
-Should not to be used for drain inlet protection
-Should not be used on lined ditches
-May introduce undesirable non-native plants to the area

Implementation

General

A straw bale barrier consists of a row of straw bales placed on a level contour. When appropriately placed, a straw bale barrier intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding provides quiescent conditions allowing sediment to settle. Straw bale barriers also interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets, which erode rills, and ultimately gullies, into disturbed, sloped soils.

Straw bale barriers have not been as effective as expected due to improper use. These barriers have been placed in streams and drainage ways where runoff volumes and velocities have caused the barriers to wash out. In addition, failure to stake and entrench the straw bale has allowed undercutting and end flow. Use of straw bale barriers in accordance with this BMP should produce acceptable results.

Design and Layout

Locate straw bale barriers on a level contour.

- Slopes up to 10:1 (H:V): Straw bales should be placed at a maximum interval of 50 ft (a closer spacing is more effective), with the first row near the toe of slope.

- Slopes greater than 10:1 (H:V): Not recommended.

Turn the ends of the straw bale barrier up slope to prevent runoff from going around the barrier.

Allow sufficient space up slope from the barrier to allow ponding, and to provide room for sediment storage.

For installation near the toe of the slope, consider moving the barrier away from the slope toe to facilitate cleaning. To prevent flow behind the barrier, sand bags can be placed perpendicular to the barrier to serve as cross barriers.

Drainage area should not exceed 1 acre, or 0.25 acre per 100 ft of barrier.

Maximum flow path to the barrier should be limited to 100 ft.

Straw bale barriers should consist of two parallel rows.
- Butt ends of bales tightly
- Stagger butt joints between front and back row
- Each row of bales must be trenched in and firmly staked

Straw bale barriers are limited in height to one bale laid on its side.

Anchor bales with either two wood stakes or four bars driven through the bale and into the soil. Drive the first stake towards the butt joint with the adjacent bale to force the bales together.

Materials

Straw Bale Size: Each straw bale should be a minimum of 14 in. wide, 18 in. in height, 36 in. in length and should have a minimum mass of 50 lbs. The straw bale should be composed entirely of vegetative matter, except for the binding material.

Bale Bindings: Bales should be bound by steel wire, nylon or polypropylene string placed horizontally. Jute and cotton binding should not be used. Baling wire should be a minimum diameter of 14 gauge. Nylon or polypropylene string should be approximately 12 gauge in diameter with a breaking strength of 80 lbs force.

Stakes: Wood stakes should be commercial quality lumber of the size and shape shown on the plans. Each stake should be free from decay, splits or cracks longer than the thickness of the stake, or other defects that would weaken the stakes and cause the stakes to be structurally unsuitable. Steel bar reinforcement should be equal to a #4 designation or greater. End protection should be provided for any exposed bar reinforcement.

Inspection and Maintenance

Maintenance

Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.

Straw bales degrade, especially when exposed to moisture. Rotting bales will need to be replaced on a regular basis.

Replace or repair damaged bales as needed.

Repair washouts or other damages as needed.

Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.

Remove straw bales when no longer needed. Remove sediment accumulation, and clean, regrade, and stabilize the area. Removed sediment should be incorporated in the project or disposed of.

8. Establish Buffer Strips

Vegetated areas between watercourses or other water bodies and alternate land uses have a number of benefits including filtration of runoff, reduced erosion, delayed snowmelt rates, and provision of terrestrial and aquatic habitat. Existing naturally vegetated buffer zones are protected from urban development through legislation. Areas where the vegetation has been removed should be reestablished using a mix of natural species blending grasses, shrubs and trees.

9. Dust Suppressant Options

Description and Purpose

Water and various chemical dust suppressants can be applied to reduce emissions at construction sites. For instance, water/dust suppressants can be applied to mitigate fugitive dust from site preparation, storage piles, materials handling and transfer, unpaved roads, etc.

The application of water is typically the most common dust control method that is employed. Practically all construction companies that are implementing options to reduce dust are applying water to mitigate dust generation from at least one emission source on their construction site. Water can be applied by a variety of methods, for instance trucks, water pulls, water canons, hoses, fire hydrants, sprinklers, etc.

A variety of chemical dust suppressants are available to suppress fugitive dust emissions from construction sites. While being more expensive that water, they are also more effective in suppressing dust and have to be applied much less frequently. Examples of dust suppressants include the following: (i) liquid polymer emulsions (ii) agglomerating chemicals (e.g., lignosulfonates, polyacrylamides); (iii) cementitious products (e.g., lime-based products, calcium sulphate); (iv) petroleum based products (e.g., petroleum emulsions); and (v) chloride salts (e.g., calcium chloride and magnesium chloride).

Limitations

While the application of water and chemical dust suppressants are proven and effective options for mitigating dust, they have to be applied judiciously. Their usage, while mitigating dust, can trigger other (just as serious) environmental consequences. It is important to keep these environmental consequences in mind when deciding on the extent to which water and chemical dust suppressants are to be utilized.

The following potential environmental impacts of applying chemical dust suppressants must be taken into consideration before application:

· the hazardous, biodegradable and watersoluble properties of the substance;
· the effect their application could have on the surrounding environment, including water-bodies (e.g., surface water pollution from runoff, contaminated ground water, pH) and wildlife (e.g., fisheries); and
· whether the use of chemicals has been limited due to nearby watershed considerations for protection of fish and fish habitat from surface runoff.

There are potential environmental consequences resulting from the over-application of water that must be considered. These include: runoff problems; soil instability; spreading of contaminants in the environment (e.g., oil or coolant from engines), and erosion. In addition, consideration should be given to water conservation or water allocation limitations in areas where construction occurs. The over-application of water can also lead to equipment mobility problems and reduce

the ability of earth-moving equipment to efficiently move saturated soils. If the moisture contents of soils used in construction are sufficient, water may not always need to be added prior to handling, crushing, etc.

Implementation

Applying Water at Construction Sites

Site Preparation

Water may be applied prior to earthmoving activities to increase the moisture content of the soils thereby increasing their stability. The pre-application of water may be to the depth of the proposed cuts or equipment penetration. The area should continue to be pre-wetted if it is not moist to the depth of the cut.

After grading the construction site, water should be applied within active earth-moving areas at sufficient frequency and quantity to prevent visible emissions from extending more than 30 meters from the point of origin. Schedule thorough and consistent watering that does not run off the site throughout the duration of the construction project. At the end of each workday, water trucks may treat all exposed areas to create a stabilizing crust on the soil. Water may also be applied at the end of the day to soak the next day's work area. Water may be applied into the backfill material until the optimum moisture level is reached.

Water may be applied continuously in front of earthmoving equipment by means of water truck/water pull. If the soil is dry, the earthmoving equipment should cease further disturbance when the water truck/water pull runs out of water and should not resume until the water truck/water pull is operational again. Optimally, one water truck may work for every 1-3 pieces of heavy earthmoving equipment that are in operation, depending on soil and weather conditions (if practical).

Water may be applied on a daily basis to all inactive disturbed surface areas, where there has been no activity for seven days or more days. Water may be applied with sufficient frequency to prevent visible emissions (at least every 2 hours). Automatic sprinkler or spray bar systems are optimal in these areas.

Construction sites should employ a sufficient number of water trucks and have back-up water trucks available if the site experiences dust control problems.

Perimeter watering system or fence line misting consisting of portable irrigation equipment may be applied to mitigate dust impacting surrounding residences and businesses.

Storage Piles

For some materials, hard crusts can be built-up on storage piles by application of water. Crusts reduce the dust blown off the storage piles. Care is required to avoid application of water to a degree that may erode or settle the fines to the bottom of the pile.

Water may be applied to at least 80% of the surface area of all open storage piles on a daily basis when there is evidence of wind driven fugitive dust.

Storage piles that are greater than 2.5 metres (8 feet) in height and not covered may have a road bladed to the top to allow water truck access or should have an operational water irrigation system that is capable of complete stockpile coverage (water truck access on large volume aggregate storage piles is unrealistic).

Material Handling and Transfer Systems

Material to be transported may be mixed with water prior to loading and/or the entire surface area of material may be watered after loading. Water should be available while loading and unloading in order to prevent visible dust plumes.

Material may be tested to determine moisture content and silt loading. Only materials that have optimum moisture content should be crushed or screened.

Materials may be sprayed with water 15 minutes prior to handling and/or at points of transfer.

Water may be applied at the feed and/or intermediate points in the conveyor system as needed.

Washing separated or screened materials are effective in controlling fugitive dust emissions from chutes and conveyors.

Hollow cone nozzles are believed to produce the greatest control while minimizing clogging when using wet suppression systems. Optimal droplet size for surface impaction and fine particle agglomeration is about 500 mm - finer droplets are affected by drift and surface tension and appear to be less effective.

Application of water sprays to the underside of a conveyor belt improves the performance of wet suppression systems at belt-to-belt transfer points.

Road Surfaces
Water may be applied to all unpaved roads used for vehicular traffic at least once per every two hours of active operations (i.e., 3 times per normal 8 hour working day). If the area is inaccessible to water trucks due to slope conditions or other safety factors, watering may be conducted with hoses or sprinkler systems. Runoff should be controlled so it does not saturate the surface of the unpaved haul road, therefore increasing the potential of trackout.

Control efficiency of water depends on: (i) amount (per unit road surface area) of water added during each application; (ii) period of time between applications; (iii) weight, speed and number of vehicles traveling over the watered road during the period between applications; and (iv) metrological conditions that affect evaporation.

Demolition and Deconstruction
Water may be applied at the following times/locations in order to minimize dust generation: (i) the exterior of building surfaces prior to initiating demolition activities as well as continuously during the knock down phase. It has been suggested that all exterior surfaces of the building, up to six stories in height (where feasible), may be wetted before and during the use of the wrecking ball; (ii) debris pile immediately following blasting and as needed afterwards; (iii) debris during handling and haulage operations; (iv) the surrounding surface area following demolition; (v) unpaved road surfaces within 30 meters of the demolition site, 1 hour prior to the actual demolition; and (vi) unpaved surface areas where equipment will operate.

Applying Dust Suppressant/Chemical Stabilizers
Site Preparation
Chemical stabilizers may be applied to graded areas within 5 working days of grading completion. In addition, if an area having 0.2 hectares or more of disturbed surface area remains unused for 7 or more days, the surface area should be stabilized. Chemical stabilizers are generally only effective in areas that are not subject to daily disturbances. Vehicle traffic and disturbance of stabilized soils should be limited through the use of fencing, ditches, barriers, barricades and/or wind barriers.

Chemical stabilizers should be applied according to the manufacturers specifications.

The effectiveness and longevity of chemical stabilizers can be affected by the rate of application, soil pH, moisture levels in the air or soil, amount of sunlight, plant growth and traffic.

Construction operators may consider the addition of water-soluble surfactants to water. These surfactants increase the wetting power of water by breaking down the initial resistance of dry soils to water. Surfactants are relatively inexpensive and greatly decrease the amount of water necessary during dust control operations.

Storage Piles
Disturbed areas of a construction site, including storage piles of fill dirt and other bulk materials that are not being actively utilized for construction purposes for a period of 7 calendar days or more, should be stabilized with a chemical dust stabilizer or suppressant.

A much more effective technique (than applying water to the storage pile) is to apply chemical agents (such as surfactants) directly to the storage pile, which permit more extensive wetting. Surfactants allow particles to more easily penetrate the water droplet and increase the total number of droplets, thus increasing total surface area and contact potential.

Foam can be used instead of chemical surfactants to reduce fugitive dust emissions from storage piles (as well as material handling operations). Foam is generated by adding a chemical (i.e., detergent-like substance) to a relatively small quantity of water that is then vigorously mixed to produce small bubbles, high-energy foam.

Material Handling & Transfer
Dust suppressants should be applied and maintained prior to and after to stabilize screened materials and surrounding area after screening.

Material being transported in a vehicle should be sprayed with a dust suppressant.

Road Surfaces
The control effectiveness of chemical dust suppressants depends on: (i) the dilution rate used in the mixture; (ii) the application rate (volume of solution per unit road surfaced area); (iii) the time between applications; (iv) the size, speed and amount of traffic during the period between applications; and (v) meteorological conditions (rainfall, freeze/thaw cycles, etc.) during the period.

Chemical dust suppressants have much less frequent reapplication requirements as compared to water.

Dust suppressants are generally applied to the road surface as a water solution and should be uniformly applied to all areas disturbed by vehicles. When used to stabilize heavily trafficked areas, dust suppressants typically require ground preparation prior to application and reapplication 1-4 times a year to remain effective.

Because most chemical products need to soak into the soil, they generally require above-freezing temperatures to work (exceptions include magnesium chloride and calcium chloride). Calcium chloride and magnesium chloride are the most commonly used dust suppressants for unpaved roads. Proper road surface preparation, grading and scarification is required before applying calcium chloride or magnesium chloride. It should be noted that calcium chloride and magnesium chloride use may be restricted in certain areas by municipal or provincial authorities. Environment Canada's Best Practices For The Use And Storage Of Chloride-Based Dust Suppressants, (March 2004) provides guidance on the application of chloride-based dust suppressants.

For greatest effectiveness and lowest cost it is important to follow the manufacturer's instructions for mixing and applying these chemicals.

PVA polymers, acrylic copolymers, and water-emulsified petroleum resins, etc. can also be used to mitigate dust generation on unpaved roads.

Surfactants can be added to the watering operation to increase fugitive dust control. Surfactants are agents that break the surface tension of the water that allows for better penetration and saturation of the soil particles.

Demolition and Deconstruction
Dust suppressants/chemical stabilizers may be applied during the following situations: (i) unpaved surface areas within 30 meters (100 feet) where materials from demolition will fall; (ii) debris piles immediately following blasting and periodically afterwards; (iii) the surrounding area following demolition; and (iv) unpaved surface areas where equipment will operate.

10. Slope Drains

Description and Purpose
Heavy duty, flexible pipe that carries water from top to bottom of fill or cut slope to prevent concentrated water flowing downslope and eroding face of slope

Applications
Temporary or permanent measure

Used on cut or fill slopes where there is a high potential for upslope runoff waters to flow over the face of the slope causing erosion, especially at areas where runoff converges resulting in concentrated runoff flows

Used in conjunction with some form of water containment or diversion structures, such as diversion channels, berms, or barriers, to convey upslope runoff water and direct water towards slope drain

Limitations
Pipes must be sized correctly to accommodate anticipated flow volumes
Water can erode around inlet if inlet protection is not properly constructed

Erosion can occur at base if outlet protection or energy dissipator is not constructed

Slope drain must be anchored securely to face of slope

Construction
(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)

Construct diversion or intercept channel, ditch block, barrier, or other inflow apron structure at crest of slope to channel flow toward the slope drain inlet

Install slope drain through inlet berm or barrier with a minimum of 0.45 m of soil cover above top of drain pipe to secure the inlet

Install scour inlet protection (such as rip rap, sand bags)

Install energy dissipator (such as rip rap, gravel, concrete) at downslope outlet end of slope drain; the outlet must not discharge directly onto unprotected soil

Secure the pipe from movement by tying to steel anchor stakes, hold-down grommets, or other approved anchor method

Space anchors on each side of drain pipe at maximum 3 m intervals along entire length of drain pipe

Construction Considerations (For guidance only)
Use coiled drain pipe for low flows only

If constructing inflow apron at crest of slope out of sandbags, only fill each sandbag ¾ full, this will allow sandbag to be flexible enough to mould around drain pipe and remain in continuous contact with the ground

Several slope drains may be required if upslope drainage areas are too large for one drain pipe

Inspection and Maintenance
Inspect slope drains at least once per week, or after significant storm events (1:2 year storm and/or 40 mm precipitation in 24 hours)

Repair any damaged section of pipe immediately

If evidence exists of pipe movement, install additional anchor stakes to secure and anchor at zones of movement
Remove sediment from upslope inflow apron area after each storm event otherwise either downslope sediment transport will occur or cause the drainpipe to be plugged which could result in overtopping of inflow apron structure and sheet flow over slope face

Similar Measures
Rock lined channel
Storm sewer
MTO Developed/Adopted References for Contract
O.P.S.S.: 577
O.P.S.D.: 219.230

11. Stabilize Construction Roadways

Description and Purpose
Access roads, subdivision roads, parking areas, and other onsite vehicle transportation routes should be stabilized immediately after grading, and frequently maintained to prevent erosion and control dust.

This BMP should be applied for the following conditions:
Temporary Construction Traffic:
- Phased construction projects and offsite road access
- Construction during wet weather

Construction roadways and detour roads:
- Where mud tracking is a problem during wet weather
- Where dust is a problem during dry weather
- Adjacent to water bodies
- Where poor soils are encountered

Limitations
The roadway must be removed or paved when construction is complete.

Certain chemical stabilization methods may cause stormwater or soil pollution and should not be used. See Wind Erosion Control BMP.

Management of construction traffic is subject to air quality control measures. Contact the local air quality management agency.

Materials will likely need to be removed prior to final project grading and stabilization.

Use of this BMP may not be applicable to very short duration projects.

Implementation

General

Areas that are graded for construction vehicle transport and parking purposes are especially susceptible to erosion and dust. The exposed soil surface is continually disturbed, leaving no opportunity for vegetative stabilization. Such areas also tend to collect and transport runoff waters along their surfaces. During wet weather, they often become muddy quagmires that generate significant quantities of sediment that may pollute nearby streams or be transported offsite on the wheels of construction vehicles. Dirt roads can become so unstable during wet weather that they are virtually unusable.

Efficient construction road stabilization not only reduces onsite erosion but also can significantly speed onsite work, avoid instances of immobilized machinery and delivery vehicles, and generally improve site efficiency and working conditions during adverse weather

Installation/Application Criteria

Permanent roads and parking areas should be paved as soon as possible after grading. As an alternative where construction will be phased, the early application of gravel or chemical stabilization may solve potential erosion and stability problems. Temporary gravel roadway should be considered during the rainy season and on slopes greater than 5%.

Temporary roads should follow the contour of the natural terrain to the maximum extent possible. Slope should not exceed 15%. Roadways should be carefully graded to drain transversely. Provide drainage swales on each side of the roadway in the case of a crowned section or one side in the case of a super elevated section. Simple gravel berms without a trench can also be used.

Installed inlets should be protected to prevent sediment laden water from entering the storm sewer system. In addition, the following criteria should be considered.

Road should follow topographic contours to reduce erosion of the roadway.

The roadway slope should not exceed 15%.

Chemical stabilizers or water are usually required on gravel or dirt roads to prevent dust (see Wind Erosion Control BMP).

Properly grade roadway to prevent runoff from leaving the construction site.

Design stabilized access to support heaviest vehicles and equipment that will use it.

Stabilize roadway using aggregate, asphalt concrete, or concrete based on longevity, required performance, and site conditions. The use of cold mix asphalt or asphalt concrete (AC) grindings for stabilized construction roadway is not allowed.

Coordinate materials with those used for stabilized construction entrance/exit points.

If aggregate is selected, place crushed aggregate over geotextile fabric to at least 12 in. depth. A crushed aggregate greater than 3 in. but smaller than 6 in. should be used.

Inspection and Maintenance

Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.

Keep all temporary roadway ditches clear.

When no longer required, remove stabilized construction roadway and re-grade and repair slopes.

Periodically apply additional aggregate on gravel roads.

Active dirt construction roads are commonly watered three or more times per day during the dry season.

12. Stabilization of Construction Entrances/Exits

Description and Purpose

A stabilized construction access is defined by a point of entrance/exit to a construction site that is stabilized to reduce the tracking of mud and dirt onto public roads by construction vehicles.

Use at construction sites:
Where dirt or mud can be tracked onto public roads.

Adjacent to water bodies.

Where poor soils are encountered.

Where dust is a problem during dry weather conditions.

Limitations
Entrances and exits require periodic top dressing with additional stones.

This BMP should be used in conjunction with street sweeping on adjacent public right of way.

Entrances and exits should be constructed on level ground only.

Stabilized construction entrances are rather expensive to construct and when a wash rack is included, a sediment trap of some kind must also be provided to collect wash water runoff.

Implementation
General
A stabilized construction entrance is a pad of aggregate underlain with filter cloth located at any point where traffic will be entering or leaving a construction site to or from a public right of way, street, alley, sidewalk, or parking area. The purpose of a stabilized construction entrance is to reduce or eliminate the tracking of sediment onto public rights of way or streets. Reducing tracking of sediments and other pollutants onto paved roads helps prevent deposition of sediments into local storm drains and production of airborne dust.

Where traffic will be entering or leaving the construction site, a stabilized construction entrance should be used. Appropriate measures should be implemented to prevent tracking of sediments onto paved roadways, where a significant source of sediments is derived from mud and dirt carried out from unpaved roads and construction sites.

Stabilized construction entrances are moderately effective in removing sediment from equipment leaving a construction site. The entrance should be built on level ground. Advantages of the Stabilized Construction Entrance/Exit is that it does remove some sediment from equipment and serves to channel construction traffic in and out of the site at specified locations. Efficiency is greatly increased when a washing rack is included as part of a stabilized construction entrance/exit.

Design and Layout
Construct on level ground where possible.

Select 3 to 6 in. diameter stones.

Use minimum depth of stones of 12 in. or as recommended by soils engineer.

Construct length of 50 ft minimum, and 30 ft minimum width.

Rumble racks constructed of steel panels with ridges and installed in the stabilized entrance/exit will help remove additional sediment and to keep adjacent streets clean.

Provide ample turning radii as part of the entrance.

Limit the points of entrance/exit to the construction site.

Limit speed of vehicles to control dust.

Properly grade each construction entrance/exit to prevent runoff from leaving the construction site.

Route runoff from stabilized entrances/exits through a sediment trapping device before discharge.

Design stabilized entrance/exit to support heaviest vehicles and equipment that will use it.

Select construction access stabilization (aggregate, asphaltic concrete, concrete) based on longevity, required performance, and site conditions. Do not use asphalt concrete (AC) grindings for stabilized construction access/roadway.

If aggregate is selected, place crushed aggregate over geotextile fabric to at least 12 in. depth,
or place aggregate to a depth recommended by a geotechnical engineer. A crushed aggregate greater than 3 in. but smaller than 6 in. should be used.

Designate combination or single purpose entrances and exits to the construction site.

Require that all employees, subcontractors, and suppliers utilize the stabilized construction access.

Implement street sweeping and vacuuming, as needed.

All exit locations intended to be used for more than a two-week period should have stabilized construction entrance/exit BMPs.

Inspection and Maintenance
Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMPs are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.

Inspect local roads adjacent to the site daily. Sweep or vacuum to remove visible accumulated sediment.

Remove aggregate, separate and dispose of sediment if construction entrance/exit is clogged with sediment.

Keep all temporary roadway ditches clear.

Check for damage and repair as needed.

Replace gravel material when surface voids are visible.

Remove all sediment deposited on paved roadways within 24 hours.

Remove gravel and filter fabric at completion of construction

13. Soil Binders

Description and Purpose
Soil binders consist of applying and maintaining a soil stabilizer to exposed soil surface to temporarily prevent water induced erosion of exposed soils on construction sites. Soil binders also prevent wind erosion.

Soil binders are applied to disturbed areas requiring short term temporary protection. They are good alternatives to mulches in areas where grading activities will soon resume. Soil binders are also suitable for use on stockpiles.

Limitations
Soil binders are temporary in nature and may need reapplication

Soil binders require a minimum curing time until fully effective, as prescribed by the manufacturer. Curing time may be 24 hours or longer. Soil binde4rs may need reapplication after a storm event.

Soil binders will experience spot failures during heavy rainfall events.

Soil binders do not hold up well to pedestrian or vehicular traffic across treated areas.

Soil binders may not penetrate soil surfaces made up primarily of silt and clay, particularly when compacted

Some soil binders may not perform well with low relative humidity. Under rainy conditions, some agents may become slippery or leach out of the soil

Soil binders may not cure if low temperatures occur within 24 hours of application

The water quality impacts of soil binders are relatively unknown and some may have water quality impacts due to their chemical makeup

Implementation
Regional soil types will dictate the appropriate soil binders to be used

A soil binder must be environmentally benign, easy to apply, easy to maintain, economical and should not stain paved or painted surface. Soil binders should not pollute storm water.

Some soil binders may not be compatible with existing vegetation

Avoid over spray onto roads, sidewalks, drainage channels, existing vegetation etc.

Soil binders should not be applied to frozen soil, areas with standing water, under freezing or rainy conditions, or when the temperature is below 47 F during the curing period.

Inspection and Maintenance
Inspect BMP prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and two week intervals during the non rainy season
Areas where erosion is evident shall be repaired and BMPs re-applied as soon as possible. Care should be exercised to minimize the damage to protected areas while making repairs, as any area damaged will require re-application of BMPs
Reapply the selected soil binder as needed to maintain effectiveness

14. Silt Fences

Description and Purpose
Permeable fabric barriers installed vertically on support posts along contours to collect and/or filter sediment laden sheet flow runoff

Causes water to pond and sediment to settle out as fabric impounds water

Decreases flow velocity in channels with low to moderate flows (<0.03 m3/s)

Entraps and minimizes coarse sediment from sheet flow or overland flow from entering waterbodies

Perimeter control for sediment transport and deposition

Applications
Temporary measure
Used at bottom of cut or fill slopes to collect sediment laden runoff
Used along streams or watercourse banks
Used around stockpiles
Midslope grade-break (using "J-hook" or "smile" pattern to cause ponding and sedimentation)

Advantages
Low permeability silt fences have high ponding and settling capabilities for fine sand to coarse silt

Limitations
Successful performance is highly dependent on proper installation; silt fence is commonly installed incorrectly and failures can cause erosion

Applicable for sheet flow, normally cannot handle concentrated channel flow volumes

May fail under high runoff events or due to damage caused during sediment removal

Limited to locations suitable for temporary ponding of sediment laden runoff

Low permeability silt fences may not be strong enough to support weight of water retained behind it and may require reinforcement (i.e. wire mesh and stronger support posts)

Sediment build up needs to be removed at 1/2 height and on a regular basis

Has a useable life of approximately one year, depending on maintenance and sediment requirement

Construction
(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)
Two methods of installation are commonly used:
– Trench method
– Mechanical (slicing) installation method (e.g. Tommy Silt Fence Machine or equivalent)
The mechanical installation method is recommended because it results in less disturbance to native ground and in general provides a stronger end product

Trench Method
– Select the location of the silt fence (usually along contours)
– Excavate a trench 0.30 m deep by 0.15 m wide for the entire length of fence
– Drive the support posts a minimum of 0.6 m into the ground along the downstream side of the trench, spaced a maximum of 2 m apart; use a spacing of 1 m for critical water-retaining areas
– Attach the wire mesh or snow fencing, if used as reinforcement to fence fabric, to the upstream side of each post with staples

– Extend the filter fabric to the base of the trench and attach it over the wire mesh or snow fence, if used, on the upstream side of posts
– Backfill and compact the soil in the trench, being careful not to damage the fence

Mechanical Installation Method
– Select the location of the silt fence (usually along contours)
– Use a mechanical installation machine to embed the fabric a minimum of 0.2 m to 0.3 m into the ground. One mechanical installation method involves slicing (with special equipment) the geotextile fabric to embed it into the ground without excavation or backfill. This results in only minor disturbance of the ground and only minor tamping of the ground is required for compaction.
– Drive the support posts a minimum of 0.6 m into the ground, spaced a maximum of 2 m apart; use a spacing of 1 m for critical water-retaining areas
– Attach the wire mesh or snow fencing, if used as reinforcement, to the silt fence fabric and to the upstream side of posts with staples
• Note on Type 2 Silt Fence
– Heavy grade silt fence may be required by regulatory agencies for installation near watercourses
– Type 2 silt fence uses steel posts, with filter fabric supported by wire fencing material and a compacted gravel toe anchorage

Construction Considerations
Site Selection
– Size of drainage area to a silt fence should be no greater than 0.4 ha
– Maximum flow path length above silt fence should be no greater than 30 m
– Maximum slope gradient above the silt fence should be no greater than 2H:1V

Fence should be placed on the contour to produce proper ponding

Fence should be placed far enough away from the toe of slope to provide an adequate ponding area (minimum of 1.8 m away from toe of slope is recommended)

Ends of the fence should be angled upslope to collect runoff

Fence should not extend more than 0.6 m above grade

Posts can be wood or metal, depending on design and ground conditions

Posts should be placed on the downstream side of the fence

Posts should be driven at least 0.6 m into the ground

Posts should not be spaced greater than 2 m apart

Wire mesh or snow fencing may be placed between the posts and the filter fabric to provide additional strength and support reinforcement

Filter fabric should be cut from a continuous roll to avoid joints. If joints are necessary, filter fabric should be wrapped around the fence post with a minimum overlap of 0.2 m, and staples should be used to attach the fabric to the post

Fence (and wire mesh or snow fence, if used) should be attached to the posts with heavy duty staples, tie wires, or hog rings

Fence (and wire mesh or snow fence, if used) should be dug into a trench at least 0.30 m deep to prevent undercutting of fence by runoff

Trench backfill should be compacted

Long runs of silt fence are more prone to failure than short runs
– The maximum length of each section of silt fence should be 40 m
– Silt fence should be installed in 'J' hook or 'smile' configuration, with maximum length of 40 m, along contours allowing an escape path for ponded water (minimizes overtopping of silt fence structure)

Inspection and Maintenance
Inspections should occur twice per week and after significant storm events (1:2 year storm event and/or >40 mm rainfall over 24 hours duration)

Repair undercut fences and repair or replace split, torn, slumping or weathered fabric immediately

Sediment build up should be removed once it accumulates to a depth of 0.2 m or at 1/2 height of fence

Remove fence after vegetation is established

Deactivate fabric by cutting off the top portion of fabric above ground; the bottom trenched-in portion can be left in-ground to minimize ground disturbance

Similar Measures
Check Dams
Permeable synthetic barriers

15. Sediment Basins and Sediment Traps

Description and Purpose

Low height dam enclosure for impoundment of sediment laden storm water, sedimentation and release of treated runoff

Used to trap sediment laden run off and promote settlement of sediment prior release

Constructed by excavating a pond or building embankments above the original ground surface

Sediment traps and basins can be divided by size of pond impoundment enclosure
– Basin (Type I) for pond area ≥500 m²
– Trap (Type II) for pond area ≤500 m²

Applications

Temporary (for construction period) or permanent measure

Used at terminal or selected intermediate points of concentrated runoff for impoundment of runoff and sedimentation of silt prior to release of treated runoff

Used as a sediment control measure at outlets from construction sites where runoff may enter watercourses, storm drains, or other sensitive areas

Used where there is a need to impound a significant amount of sediment from significant areas of land disturbance

Removal of small diameter particles may require use of flocculants. This should be done with caution to prevent adverse effects on aquatic life

Sediment basins (Type I) used for disturbed drainage areas greater than 2.0 ha

Sediment traps (Type II) used for disturbed drainage areas of 2.0 ha or less

Where practical, contributing drainage areas should be subdivided into smaller areas and multiple sedimentation impoundment installed

Advantages

High capacity of runoff impoundment and more efficient means of sedimentation necessary along perimeters of construction sites with high risk sensitive environmental areas and watercourses

Sediment can be cleaned out easily

Robust

Can be deactivated easily by breaching the enclosure dyke

Limitations

Requires specialized design by qualified personnel

Sediment traps and basins do not remove 100% of the sediment; net efficiency for sedimentation of silt may be around 50% dependent on design

Anticipated service life of 3 years or longer due to possible clogging of outlets in the long-term

Sedimentation traps and basins with a riser outlet should have an auxiliary spillway with adequate erosion protection to permit overflow in the event that the riser pipe outlet clogs during a storm event

For drainage areas greater than 40 ha, multiple basins may be required

Efficiency of sedimentation is very dependent on surface area; sediment basins require large surface areas to permit settling of sediment

Fences and signage may be required to reduce danger to the public

May provide breeding habitat for mosquitoes and other pests
Sediment traps only remove medium and large diameter silt particles and upstream erosion or sediment control measures are required to reduce the amount of sediment laden to the runoff at downstream sensitive areas

Periodic removal of accumulated sediment is required

Construction
(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)
The consequences of failure for any water retaining structure will determine the level of effort in the design and construction phases. The construction guidelines presented herein are minimum requirements. A geotechnical engineer should design water retaining structures if warranted by the consequences of failure

All footprint areas for embankment dykes should be stripped of vegetation, topsoil, and roots to expose a mineral soil subgrade

Embankment fill material should be clean mineral soil with sufficient moisture to allow proper compaction

Fill should be placed in lifts not exceeding 150 mm in compacted thickness and should be compacted to a minimum of 95% Standard Proctor maximum dry density (SPD)

The main outlet structure should be installed at farthest possible point from inlet
– The outlet should be placed on firm, smooth ground and should be backfilled to 95% SPD
– Proper inlet and outlet protection should be installed to protect from scour
– The outlet pipe should consist of corrugated steel pipe to protect against pinching and blockage

The embankment should be topsoiled, seeded or protected with gravel or riprap immediately after construction

Construct an emergency spillway to convey flows not carried by the principal outlet
– The emergency spillway should consist of an open channel (earth or vegetated) over native undisturbed soil (not fill)
– If the spillway is elevated, it should be constructed of rip rap
– The spillway crest should be depressed at least 0.15 m below embankment

Construction Considerations
It is preferable to strip to mineral soil only along the footprint area required for dyke construction; the pond floor centre area can be left cleared but unstripped

The pond can be constructed by excavating, constructing embankments, or a combination of the two methods
Baffles should be provided to prevent short-circuiting of flow from inlet to outlet. The optimum ratio of flow length to flow width is 5:1

Construct sediment ponds and basins at the construction site perimeter prior to wet season and construction activities

Sediment pond/basin bottom should be flat or gently sloping towards outlet

Dyke slopes should not be steeper than 2H:1V and should be well-compacted

Basins should be located where:
– Low embankment can be constructed across a swale or low natural terrain
– It is accessible for maintenance work, including sediment removal

Inspection and Maintenance
Regular inspection is required to identify seepage, structural soundness, outlet damage or obstruction and amount of sediment accumulation

Inspections should be performed weekly and after significant storm events (1:2 yr storm and/or 40 mm rainfall in 24 hours)

Sediment should be removed upon reaching 1/2 height of the containment berm or within 0.4 m of crest of embankment

Sediment traps may be deactivated or removed after vegetation of previously disturbed upstream areas has been established

Design Considerations
The design can use a riser outlet option or a permeable rock berm outlet option. The permeable rock berm outlet option is recommended for most applications

Minimum particle size for rock rip rap shall be 200 mm

If the design of a riser outlet is utilized
– Main outlet pipe shall be fabricated from corrugated steel pipe conforming to
CSA standard CAN 5-G401-M81 or the latest revision thereof
– Outlet pipe shall consist of a horizontal pipe welded to a similar vertical riser at a 45° mitre joint

Close to the base of the riser pipe, a 100 mm diameter hole shall be fabricated and a mesh with 12 mm square openings tack welded over the hole as a screen
– A similar hole shall be provided along the riser pipe immediately above the elevation of the maximum sediment buildup (usually 0.4 m below crest of embankment)

16. Sediment/Filter Bags

Description and Purpose
Filter bags can be used as an effective filter medium to contain sand, silt and sediment when dewatering a proposed work area. In situations where there is not sufficient available space to construct a sediment retention basin, filter bags can be used effectively. They may also be used in conjunction with a sediment retention basin when discharge is particularly turbid.

Implementation
Filter bags shall meet the following specifications and adhere to the following guidelines:

They are constructed of a non-woven geotextile fabric.

Only one six-inch discharge hose will be allowed per filter bag.

Bag capacity will be exceeded beyond 2,000 gallons per minute.

Typical, recommended bag dimensions are 15 feet by 13.25 feet.

To help prevent punctures, geotextile fabric shall be placed beneath the filter bag when used in wooded locations.

Hose clamps shall be used to secure the discharge hose to the filter bag.

Inspection and Maintenance
When maintaining filter bags to ensure proper function, the following conditions shall apply:

Prior to removing the bag from the hose, the bag will be tied off below the end of the hose, allowing the bag to drain.

To avoid rupture, the bags will be attended and pumping rates monitored.

Once the bag is inflated to a height of four (4) feet, pumping shall stop to avoid rupture.

Filter bags used during construction shall be bundled and removed for proper disposal.

17. Scheduling

Description and Purpose
Proper sequence of construction activities to reduce erosion potential should be incorporated into the schedule of every construction project especially during rainy season.

Limitations
Environmental constraints such as nesting season, fish habitat timing etc.

Implementation
Avoid rainy seasons. Schedule major grading operations during dry months when practical. Allow enough time before rainfall begins to stabilize the soil with vegetation or physical means or to install sediment trapping devices.

Plan the project and develop a schedule showing each phase of construction. Clearly show how the rainy season relates to soil disturbing and re-stabilization activities. Incorporate the construction schedule into the SWPP.

Include on the schedule, details on the rainy season implementations and deployment of:
Erosion Control BMP
Sediment Control BMP
Tracking Control BMP
Wind Erosion Control BMP

Include dates or activities such as dewatering, sawcutting, grinding, drilling, boring, crushing, blasting, painting, mortor mixing, pavement cleaning etc.

Work out the sequencing and timetable for the start and completion of each item such as site clearing and grubbing, grading, excavation, paving, foundation pouring, utilities installation etc to minimize the active construction area during the rainy season
Sequence trenching activities so that most open portions are closed before new trenching begins
Incorporate staged seeding and re-vegetation of graded slopes as work progresses
Schedule establishment or permanent vegetation during appropriate planting time for specified vegetations

Non-active areas should be stabilized as soon as practical after the cessation of soil disturbing activities or one day prior to the onset of precipitation

Monitor the weather forecast for rainfall

When rainfall is predicted, adjust the construction schedule to allow the implementation of soil stabilization and sediment treatment controls on all disturbed areas prior to the onset of rain

Be prepared year round to deploy erosion control and sediment control BMPs. Erosion may be caused during dry season by un-seasonal rainfall, wind and vehicle tracing. Keep the site stabilized year round, and retain and maintain rainy season sediment trapping devices in operational condition

Apply permanent erosion control to areas deemed substantially complete during the projects defined seeding window

Inspection and Maintenance
Verify that work is progressing in accordance with the schedule. If progress deviates, take corrective actions.

Amend the schedule when changes are warranted.

Amend the schedule prior to the rainy season to show updated information on the deployment and implementation of construction site BMPs.

18. Sand Bag Barriers

Description and Purpose
A sandbag barrier is a series of sand-filled bags placed on a level contour to intercept sheet flows. Sandbag barriers pond sheet flow runoff, allowing sediment to settle out.

Limitations
It is necessary to limit the drainage area upstream of the barrier to 5 acres

Degraded sandbags may rupture when removed, spilling sand

Installation can be labour intensive

Barriers may have limited durability for long-term projects

When used to detain concentrated flows, maintenance requirements increase

Burlap should not be used for sandbags

Implementation
Sandbags may be suitable as a linear sediment control measure;
Below the toe of a slope, as sediment traps at culvert/pipe outlets, below other small cleared areas, along the perimeter of a site, down slope of exposed soil areas, around temporary stockpiles and spoil areas, parallel to a roadway to keep sediment off paved areas, along streams and channels

As linear erosion control measure;
Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow, at the top of slopes to divert runoff away from disturbed slopes, as check dams across mildly sloped construction roads

A sandbag generally consists of a row of sand-filled bags placed on a level contour. When appropriately placed, a sandbag barrier intercepts and slows sheet flow runoff, causing temporary ponding. The temporary ponding provides conditions for sediment to settle. While the sand-filled bags are porous, the fine sand tends to quickly plug with sediment, limiting the rate of flow through the barrier. Sandbag barriers interrupt the slope length and thereby reduce erosion by reducing the tendency of sheet flows to concentrate into rivulets which erode rills, and ultimately gullies, into disturbed slopes soils. Sandbag barriers are similar to ground bag berms but are less porous.

Locate sandbag barriers on a level contour

Turn ends of the sand bag barrier up slope to prevent runoff from going around the barrier

Allow sufficient space up slope from the barrier to allow ponding, and to provide room for sediment storage

For installation near the toe of the slope, consider moving the barrier away from the slope toe to facilitate cleaning. To prevent flow behind the barrier, sandbags can be placed perpendicular to the barrier to serve as cross barriers

Drainage should not exceed 5 acres

Stack sandbags at least three bags high

Butt ends of bags tightly

Overlap butt joints of row beneath with each successive row

Use a pyramid approach when stacking bags

Non-traffic areas
Height 18 in., top width 24 in. for three or more layer construction, side slopes 2:1 or flatter

Construction traffic areas
Height 12 in maximum, top width 24 in. for three or more layer construction, side slopes 2:1 or flatter

Materials
Sandbag Material
Sandbag Size
Fill Material

Inspection and Maintenance
Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.

Sandbags exposed to sunlight will need to be replaced every two to three months due to degradation of the bags.

Reshape or replace sandbags as needed.
Repair washouts or other damage as needed.

Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.

Remove sandbags when no longer needed. Remove sediment accumulation, and clean, regrade, and stabilize the area.

19. Rock Filter

Description and Purpose

Rock filters are temporary erosion control barriers composed of rock that is anchored in place. Rock filters detain the sediment laden runoff, retain the sediment, and release the water as sheet flow at a reduced velocity. Typical rock filter installations are illustrated at the end of this BMP.

Applications

Near the toe of slopes that may be subject to flow and rill erosion.

Limitations

Inappropriate for contributing drainage areas greater than 5 acres.

Requires sufficient space for ponded water.

Ineffective for diverting runoff because filters allow water to slowly seep through.

Rock filter berms are difficult to remove when construction is complete.

Unsuitable in developed areas or locations where aesthetics is a concern.

Specifications

Rock: open graded rock, 0.75 to 5 in. for concentrated flow applications.

Woven wire sheathing: 1 in. diameter, hexagonal mesh, galvanized 20gauge (used with rock filters in areas of concentrated flow).

In construction traffic areas, maximum rock berm heights should be 12 in. Berms should be constructed every 300 ft on slopes less than 5%, every 200 ft on slopes between 5% and 10%, and every 100 ft on slopes greater than 10%.

Inspection and Maintenance

Inspect and verify that activity-based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and at two-week intervals in the non-rainy season to verify continued BMP implementation.

Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.

Reshape berms as needed and replace lost or dislodged rock, and filter fabric.

Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.

20. Reforestation and Woodlot Management Protection

Description and Purpose

This specification describes the measures required to protect trees not designated for removal. It has been developed for use in provincial- and municipal-oriented Contracts. .

Implementation

For the purpose of this specification, the following definitions apply:

Barrier means a fence placed around a single tree or group of trees to protect them from removal and injury.

Dripline means the location on the ground surface directly beneath the theoretical vertical line from the tips of the outermost branches of the trees.

Operational Constraints

Trees not designated for removal shall not be damaged and shall be protected from flooding and sediment deposits from construction operations.

Equipment and vehicles shall not be operated within the dripline of trees not designated for removal unless specified in the Contract Documents. In such cases, operation of equipment shall be kept to the minimum necessary to perform the work required.

Equipment or vehicles shall not be parked, repaired, or fuelled within the dripline of any tree not designated for removal.

Construction materials and earth shall not be stockpiled within the dripline of any tree not designated for removal.

Barrier for Tree Protection
Barriers for tree protection shall be a minimum height of 1.2 m consisting of material approved by the Contract Administrator, supported by steel posts. The number of steel posts shall be enough to keep the material from sagging and the fence erect.

The barriers shall be erected at the dripline of trees or woodlot edges within the Working Area, prior to commencement of construction operations at locations specified in the Contract Documents. Where a clearance zone of 1.5 m cannot be established between the barrier at the dripline and the limit of grading, the barrier may be placed within the dripline, subject to the approval of the Contract Administrator. When the barrier is placed within the dripline,
a) a minimum distance of 0.75 m shall be maintained between the trunk of the tree and the barrier, and
b) a distance of 1.5 m shall be maintained between the barrier and the limit of grading.

When the trunks of trees are less than 4.5 m apart, the trees shall be considered a woodlot and the barrier shall be placed so it forms a continuous barricade around the woodlot as specified in the Contract Documents.

A barrier is not required where an existing fence serves the same purpose. At such locations, the barrier shall terminate at the existing fence so that a continuous barricade is provided between the trees and the area of work.

The barriers shall be maintained erect and in good repair throughout the duration of construction operations without breaks and unsupported sections and shall be removed upon completion of the work.

Tree Repair
Trees not designated for removal that are damaged by construction operations shall be repaired as follows, within 5 Days of the damage:
a) Branches 25 mm or greater in diameter that are broken shall be cut back cleanly on the tree side of the break or to within 10 mm of their base, if a substantial portion of the branch is damaged.
b) Roots 25 mm or larger in diameter that are exposed shall be cut back cleanly to the soil surface.
c) Bark that is damaged shall be neatly trimmed back to uninjured bark without causing further injury to the tree.

21. Preservation of Existing Vegetation

Description and Purpose
Carefully planned preservation of existing vegetation minimizes the potential of removing or injuring existing trees, vines, shrubs, and grasses that protect soil from erosion.

Limitations
Requires forward planning

Limited opportunities for use when project plans do not incorporate existing vegetation into the site design

For sites with diverse topography, it is often difficult and expensive to save existing trees while grading the site satisfactory for the planned development

Implementation
Provide for preservation of existing vegetation prior to the commencement of clearing and grubbing operations or other disturbing activities in areas where no construction activity is planned or will occur at a later date

Mark areas to be preserved with temporary fencing. Include sufficient setback to protect roots

Locate temporary roadways, stockpiles, and layout areas to avoid stands of trees, shrubs, and grass

Consider the impact of grade changes to existing vegetation and the root zone

Maintain existing irrigation systems where feasible. Temporary irrigation will be required

Instruct employees and subcontractors to honour protective devices. Prohibit heavy equipment, vehicular traffic, or storage construction materials within the protected areas

Inspection and Maintenance
Verify that protective measures remain in place. Restore damaged protection measures immediately.

Serious tree injuries shall be attended to by an arborist

Damage to the crown, trunk or root system of a retained tree shall be repaired immediately

Trench as far from tree trunks as possible, usually outside the tree drip line or canopy. Curve trenches around trees to avoid large roots or root concentration. If any roots are encountered, consider tunneling under them. When trenching or tunneling near or under trees to be retained, place tunnels at least 18in below the ground surface and not below the tree centre to minimize impact on the roots.

Do not leave tree roots exposed to air. Cover exposed roots with soil as soon as possible. If soil covering is not practical, protect exposed roots with wet burlap or peat moss until the tunnel or trench is ready for backfill

Cleanly remove the ends of damaged roots with a smooth cut

Fill trenches and tunnels as soon as possible. Careful filling and tamping will eliminate air spaces in the soil, which can damage roots

If bark damage occurs, cut back all loosened bark into the undamaged area, with the cut tapered at the top and bottom and drainage provided at the base of the wood. Limit cutting the undamaged areas as much as possible

Aerate soil that has been compacted over a trees root zone by punching holes 12 in deep with an iron bar, and moving the bar back and forth until the soil is loosened. Place holes 18 in apart throughout the area of compacted soil under the tree crown

Fertilization

22. Limiting of Construction within Floodplains

Description and Purpose

Construction within the floodplain area should be discouraged because of the risk of damage/destruction from flooding. The local conservation authority requires a permit for any development in these areas. Through the permit process, development in these areas can be prevented or restricted to areas of minimal impact.

23. Hydraulic Mulch

Description and Purpose

The spraying-on of a slurry to a slope or channel surface to provide a layer of seed and growth bedding medium

The slurry consists of seed, fertilizer, mulch, tackifiers, and water which are mixed together in a tank

Enables quick re-vegetation of very steep or rocky/gravelly slopes where revegetation by any other method would be very difficult or unsafe; frequent reseeding and special mix design may be required

When sprayed on the soil, the slurry forms a continuous blanket with seeds and protects the soil from wind and water erosion and raindrop impact by aggregating (or adhering) them in place

The slurry conserves moisture, reduces soil moisture evaporation, and decreases soil surface crusting due to evaporation/drying of soil

Applications

Can be used to provide temporary and permanent erosion control prior to establishment of vegetation

Slurry is held in suspension through consistent agitation and is sprayed onto disturbed areas using high pressure pumps

Can be used for spray-on seeding covering large areas efficiently after placement of topsoil

May be used to provide soil stabilization for seeding disturbed soil areas

Can also be used with higher efficiency and large area coverage with advantages over conventional methods (broadcast seeders, drill seeders)

Can be used in areas where little topsoil is available

Advantages

Relatively cheap and efficient spraying method of seeding and promoting plant growth as well as erosion protection

Allows spray-on re-vegetation of steep slopes where conventional re-vegetation methods are very difficult

Minimizes effort required to re-vegetate disturbed areas as hydroseeding hydromulching usually only requires one spray-on operation in comparison with planting and farrow method

Relatively efficient operation with high coverage rates

Provides dust control and protection from wind erosion

Limitations
Site must be accessible to hydroseeding-hydromulching equipment
– Usually mounted on trucks
– Maximum hose range of approximately 150 m

May require subsequent spraying to reseed bare spots or areas with low growth

Construction
(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)
Prepare soil surface by removing large rocks or other deleterious materials

Apply topsoil if available

Spray on hydroseed-hydromulch as per supplier's recommendations

Construction Considerations
Seed
– Selected seed mixes must be appropriate for site specific conditions
– Some jurisdictions have developed recommended seed mixes for specific regions based on historic performance results
– Qualified agronomists or agrologists should be consulted if a suitable seed mix is not identified

Hydraulic Mulches
– Cellulose
– Comprised of recycled paper from newspapers, magazines, or other paper sources
– Rapid method for applying seed, fertilizer, mulch, and water in almost any disturbed areas
– Usually installed without tackifier in slurry
– Short fibre lengths and lack of tackifier limits erosion control effectiveness and does little to moderate moisture content and temperature within the soil
– Residual inks within the recycled paper may leach into soil, which may present a problem in environmentally sensitive areas
– Longevity significantly shorter than for wood fibre mulches or bonded fibre matrices (BFM)
– Cheaper than wood fibre mulches and BFM
– Wood Fibre
– Comprised of whole wood chips
– Industry standard, provides quick and uniform method and medium for revegetating large areas quickly and economically
– Longer fibre lengths than for cellulose mulches
– Longer lasting and has better wet-dry characteristics than cellulose mulches
– Provides limited erosion control even when sprayed on with tackifiers
– Provides limited moderation of soil moisture content and temperature when applied at higher rates
– Cheaper, but less effective than, BFM
– More expensive, and more effective than, cellulose mulches
– Bonded Fibre Matrices (BFM)
– Slurry comprised of either cellulose mulch, wood fibre mulch, or a combination of the two
– Mulches are bound together using chemical bond, mechanical bond, or a combination of the two
– All fibres and binding agents are premixed by the manufacturer, ensuring uniformity and consistency throughout the application
– Well suited for sites with existing desirable vegetation and where worker safety and minimal ground disturbance are desired
– Degree of protection is similar to that obtained from rolled erosion control products (RECP)
– Quicker installation than for RECP
– Chemically bonded BFM may require a 'set-up' or curing/drying period
– Application must be limited to periods where there is no threat of rain during curing period
– Mechanically bonded BFM have no curing time and are effective immediately after application
– Application on dry soils is not recommended

– More expensive, and more effective, than cellulose and wood fibre mulches

Tackifiers
– May include vinyl compounds, asphalt, rubber, or other water-mixed substances

Inspection and Maintenance
Inspect hydroseeded-hydromulched areas at least once per year after initial application or after significant storm events (1:2 year storm and/or 40 mm rainfall in 24 hours)

Areas damaged by runoff may need to be repaired and protected

Small bare spots may need to be reseeded

Similar Measures
Seeding
Mulching
Rolled erosion control products (RECP)

24. Heavy Equipment Maintenance

Definition and Purpose
Procedures and practices to minimize or eliminate the discharge of pollutants to the storm drain systems or to watercourses from vehicle and equipment maintenance procedures.

These procedures are applied on all construction projects where an onsite yard area is necessary for storage and maintenance of heavy equipment and vehicles.

Limitations
None identified

Implementation
Drip pans or absorbent pads shall be used during vehicle and equipment maintenance work that involves fluids, unless the maintenance work is performed over an impermeable surface in a dedicated maintenance area.

All maintenance areas are required to have spill kits and/or use other spill protection devices.

Dedicated maintenance areas shall be protected from storm water run-on and runoff, and shall be located at least 15 m (50 ft) from downstream drainage facilities and watercourses.

Drip Pans or plastic sheeting shall be placed under all vehicles and equipment placed on docks, barges, or other structures over water bodies when the vehicle or equipment is planned to be idle for more than one hour.

Absorbent spill clean-up materials shall be available in maintenance areas and shall be disposed of properly after use. Substances used to coat asphalt transport trucks and asphalt-spreading equipment shall be non-toxic.

Use off-site maintenance facilities whenever practical. For long-term projects, consider constructing roofs or using portable tents over maintenance areas.

Properly dispose of used oils, fluids, lubricants, and spill cleanup materials.

Do not dump fuels and lubricants onto the ground.

Do not place used oil in a dumpster or pour into a storm drain or watercourse.

Properly dispose or recycle used batteries.

Do not bury used tires.

Repair of fluid and oil leaks immediately.

Provide spill containment dikes or secondary containment around stored oil and chemical drums.

Maintenance and Inspection
Maintain waste fluid containers in leak proof condition.

Vehicle and equipment maintenance areas shall be inspected regularly.

Vehicles and equipment shall be inspected on each day of use. Leaks shall be repaired immediately or the problem vehicle(s) or equipment shall be removed from the project site.

Inspect equipment for damaged hoses and leaky gaskets routinely. Repair or replace as needed.

25. Gravel Bag Berm

Description and Purpose

A gravel bag berm is a series of gravel-filled bags placed on a level contour to intercept sheet flows. Gravel bags pond sheet flow runoff, allowing sediment to settle out, and release runoff slowly as sheet flows, preventing erosion.

Limitations

Gravel bags may be difficult to remove

Removal problems limit their usefulness in landscaped areas

Gravel bag berm may not be appropriate for drainage areas greater than 5 acres

Runoff will pond upstream of the filter, possibly causing flooding if sufficient space does not exist

Degraded gravel bags may rupture when removed, spilling contents

Installation can be labour intensive

Berms may have limited durability for long-term projects

When used to detain concentrated flows, maintenance requirements increase

Implementation

Gravel bag berms may be used as a linear sediment control measure;
Below the toe of a slope, as sediment traps at culvert/pipe outlets, below other small cleared areas, along the perimeter of a site, down slope of exposed soil areas, around temporary stockpiles and spoil areas, parallel to a roadway to keep sediment off paved areas, along streams and channels

As linear erosion control measure;
Along the face and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow, at the top of slopes to divert runoff away from disturbed slopes, as check dams across mildly sloped construction roads

For installation near the toe of the slope, consider moving the gravel bag barriers away from the slope toe to facilitate cleaning. To prevent flows behind the barrier, bags can be placed perpendicular to a berm to serve as cross barriers

Drainage area should not exceed 5 acres

Non-traffic areas
Height 18 in., top width 24 in. for three or more layer construction, top width 12 in. maximum for one or two layer construction, side slopes 2:1 or flatter

Construction traffic areas
Height 12 in maximum, top width 24 in. for three or more layer construction, top width 12 in. maximum for one or two layer construction, side slopes 2:1 or flatter

Butt ends of bags tightly

On multiple row, or multiple layer construction, overlap butt joints adjacent row and row beneath

Use a pyramid approach when stacking bags

Materials
Bag Material
Bag Size
Fill Material

Inspection and Maintenance

Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.

Gravel bags exposed to sunlight will need to be replaced every two to three months due to degrading of the bags.

Reshape or replace gravel bags as needed.

Repair washouts or other damage as needed.
Sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.

Remove gravel bag berms when no longer needed. Remove sediment accumulation and clean, re-grade, and stabilize the area. Removed sediment should be incorporated in the project or disposed of.

26. Fuel Oil and Chemical Storage

Description and Procedures

Procedures and practices for the proper handling and storage of materials in a manner that minimizes or eliminates the discharge of these materials to the storm drain system or to watercourses.

These procedures are implemented at all construction sites with delivery and storage of the following:

Hazardous chemicals such as:
Acids,
lime,
glues,
adhesives,
paints,
solvents, and
curing compounds.
Soil stabilizers and binders.
Fertilizers.
Detergents.
Plaster.
Petroleum products such as fuel, oil, and grease.
Asphalt and concrete components.
Pesticides and herbicides.
Other materials that may be detrimental if released to the environment.

Limitations

Space limitation may preclude indoor storage.

Storage sheds must meet building & fire code requirements.

Implementation

General

Train employees and subcontractors on the proper material delivery and storage practices.

Temporary storage area shall be located away from vehicular traffic.

Material Safety Data Sheets (MSDS) shall be supplied to the Resident Engineer (RE) for all materials stored. Material Storage Areas and Practices

Liquids, petroleum products, and substances shall be stored in approved containers and drums and shall be placed in temporary containment facilities for storage.

Throughout the rainy season, each temporary containment facility shall have a permanent cover and side wind protection or be covered during nonworking days and prior to and during rain events.

A temporary containment facility shall provide for a spill containment volume able to contain 100mm precipitation from a 24-hour, 25-year storm event, plus the greater of 58% of the aggregate volume of all containers or 75% of the capacity of the largest container within its boundary, whichever is greater.

A temporary containment facility shall be impervious to the materials stored therein for a minimum contact time of 72 hours.

A temporary containment facility shall be maintained free of accumulated rainwater and spills. In the event of spills or leaks, accumulated rainwater and spills shall be collected and placed into drums. These liquids shall be handled as a

hazardous waste unless testing determines them to be non-hazardous. All collected liquids or non-hazardous liquids shall be sent to an approved disposal site.

Sufficient separation shall be provided between stored containers to allow for spill cleanup and emergency response access.

Incompatible materials, such as chlorine and ammonia, shall not be stored in the same temporary containment facility.

Materials shall be stored in their original containers and the original product labels shall be maintained in place in a legible condition. Damaged or otherwise illegible labels shall be replaced immediately.

Bagged and boxed materials shall be stored on pallets and shall not be allowed to accumulate on the ground. To provide protection from wind and rain, throughout the rainy season, bagged and boxed materials shall be covered during non-working days and prior to rain events.

Stockpiles shall be protected in accordance with Stockpile Management BMP.

Minimize the material inventory stored on-site (e.g., only a few days supply).

Have proper storage instructions posted at all times in an open and conspicuous location.

Do not store hazardous chemicals, drums, or bagged materials directly on the ground. Place these items on a pallet and when possible, under cover in secondary containment.

Keep hazardous chemicals well labeled and in their original containers.

Keep ample supply of appropriate spill clean up material near storage areas.

Also see Hazardous Waste Management BMP for storing of hazardous materials.

Material Delivery Practices
Keep an accurate, up-to-date inventory of material delivered and stored onsite.

Employees trained in emergency spill clean-up procedures shall be present when dangerous materials or liquid chemicals are unloaded.

Spill Clean-up
Contain and clean up any spill immediately.

If significant residual materials remain on the ground after construction is complete, properly remove and dispose any hazardous materials or contaminated soil.

See Spill Prevention and Control BMP, for spills of chemicals and/or hazardous materials.

Inspection and Maintenance
Storage areas shall be kept clean, well organized, and equipped with ample clean-up supplies as appropriate for the materials being stored.

Perimeter controls, containment structures, covers, and liners shall be repaired or replaced as needed to maintain proper function.

Inspect storage areas before and after rainfall events, and at least weekly during other times. Collect and place into drums any spills or accumulated rainwater.

27. Fiber Rolls

Description and Purpose
Straw rolls consist of bundled straw or natural fibre, wrapped in photo-degradable open-weave plastic netting, and staked into the soil along slope contours as a grade break to reduce erosion potential

Fibre rolls are installed across slope contours as a grade break to reduce erosion potential by reducing overland flow velocities and encouraging ponding and sediment deposition

Live stakes can be installed to anchor the fibre rolls and wattles to provide deep root vegetation with potential favourable moisture retention provided by the fibre roll

Fibre rolls and wattles capture sediment, organic matter and seeds carried by runoff

Applications
Temporary measure

May be used on slopes stable enough to support vegetation (steep, confined, slopes and channel banks with gradients greater than 1H:1V may have low success)

May be used on slopes and channel banks with adequate sunlight, moisture, and wind protection to support vegetation

May be used along long slopes as a grade break to shorten slope length between lines of fibre rolls at different contour elevations

May be used as grade breaks, where slopes transition from flatter to steep gradients

May be used on lake shores as wave breaks to assist in revegetation and stabilization of banks

Can be used in conjunction with live staking as bioengineering measure

Advantages
Function as a grade break measure to lower sheet and rill erosion potential
Can be used on slopes too steep for silt fences
In time, plastic netting will degrade due to the sunlight and straw will degrade and be incorporated into the soil
Primary purpose is erosion control, but fibre rolls also provide some sediment control

Limitations
Designed for low sheet flow velocities
Designed for short slopes with a maximum gradient of 1H:1V

May be labour intensive to install

Straw rolls have short life span due to natural degradation; usually only functional for two seasons

Susceptible to undermining and failure if not properly keyed into the soil

Labour intensive maintenance may be required to ensure rolls are in continuous contact with the soil, especially when used on steep slopes or sandy soils

Construction
(Note: The following method is provided for guidance only. A site-specific design by a qualified designer is required.)
Prepare slope face and remove large rocks or other deleterious materials

Excavate small trenches approximately one-half roll diameter deep and wide across the width of the slope, perpendicular to slope direction, starting at the toe of the slope and working upwards towards crest of slope

Space trenches a maximum of 3 to 8 m apart along the slope incline, with steeper slopes having trenches spaced closer together

Place fibre rolls into trench, ensuring continuous contact with soil surface

Butt-joint adjacent fibre roll segments tightly against one another

Use a metal bar to make pilot hole through middle of the fibre roll a minimum depth of 0.3 m into underlying soil

Pilot holes should be spaced a maximum of 1.2 m apart

Secure fibre roll to soil using wooden stake or other appropriate anchor; live stake may be used as alternate anchor

Place soil excavated from trench on upslope side of fibre roll and compact to minimize undermining of fibre roll by runoff

Seed the soil along the upslope and downslope sides of the fibre roll

Construction Considerations
Use live stakes instead of wooden stakes

If the slope soil is loose and uncompacted, excavate trench to a minimum depth of 2/3 of the diameter of the fibre roll
On steep slopes, anchors may be required on the downslope side of the fibre roll

Inspection and Maintenance
Inspect structures at biweekly intervals or after significant storm events (1:2 year storm and/or 40 mm rainfall in 24 hours)

Areas damaged by washout or rutting should be repaired immediately

Additional erosion control measures should be considered for rilling areas damaged by runoff

Similar Measures
Synthetic permeable barriers

28. Entrance/Outlet Tire Washes

Description and Purpose
A tire wash is an area located at stabilized construction access points to remove sediment from tires and under carriages and to prevent sediment from being transported onto public roadways.

Tire washes may be used on construction sites where dirt and mud tracking onto public roads by construction vehicles may occur.

Limitations
The tire wash requires a supply of wash water.

A turnout or doublewide exit is required to avoid having entering vehicles drive through the wash area.

Do not use where wet tire trucks leaving the site leave the road dangerously slick.

Implementation
Incorporate with a stabilized construction entrance/exit. See Stabilized Construction Entrance/Exit BMP.

Construct on level ground when possible, on a pad of coarse aggregate greater than 3 in. but smaller than 6 in. A geotextile fabric should be placed below the aggregate.

Wash rack should be designed and constructed/manufactured for anticipated traffic loads.

Provide a drainage ditch that will convey the runoff from the wash area to a sediment trapping device. The drainage ditch should be of sufficient grade, width, and depth to carry the wash runoff.

Use hoses with automatic shutoff nozzles to prevent hoses from being left on.

Require that all employees, subcontractors, and others that leave the site with mud caked tires and undercarriages to use the wash facility.

Implement street sweeping and vacuuming, as needed.

Inspection and Maintenance
Inspect and verify that activity–based BMPs are in place prior to the commencement of associated activities. While activities associated with the BMP are under way, inspect weekly during the rainy season and of two-week intervals in the non-rainy season to verify continued BMP implementation.

Inspect BMPs subject to non-stormwater discharge daily while non-stormwater discharges occur.

Remove accumulated sediment in wash rack and/or sediment trap to maintain system performance.

Inspect routinely for damage and repair as needed.

29. Earth Dykes and Drainage Swales

Description and Purpose
An earth dyke is a temporary berm or ridge of compacted soil used to divert runoff or channel water to a desired location. A drainage swale is a shaped and sloped depression in the soil surface used to convey runoff to a desired location. Earth dykes and drainage swales are used to divert offsite runoff around the construction site, divert runoff from stabilized areas and disturbed areas, and direct runoff into sediment basins or traps.

Limitations
Dykes should not be used for drainage areas greater than 10 acres or along slopes greater than 10 percent. For larger areas more permanent drainage structures should be built.

Earth dykes may create more disturbed area on site and become barriers to construction equipment

Earth dykes must be stabilized immediately, which adds cost and maintenance concerns

Diverted stormwater may cause downstream flood damage

Dykes should not be constructed of soils that may be easily eroded

Regrading the site to remove the dyke may add additional cost

Temporary drains and swales or any other diversion of runoff should not adversely impact upstream or downstream properties

Temporary drains and swales must conform to local floodplain management requirements

Earth dykes/drainage swales are not suitable as sediment trapping devices

It may be necessary to use other soil stabilization and sediment controls such as check dams, plastics, and blankets, to prevent scour and erosion in newly graded dykes, swales and ditches

Implementation

The temporary earth dyke is a berm or ridge of compacted soil, located in such a manner as to divert stormwater to a sediment trapping device or a stabilized outlet, thereby reducing the potential for erosion and offsite sedimentation. Earth dykes can also be used to divert runoff from offsite and from undisturbed areas away from disturbed areas to divert sheet flows away from unprotected slopes.

An earth dyke does not itself control erosion or remove sediment from runoff. A dyke prevents erosion by directing runoff to an erosion control device such as a sediment trap or directing runoff away from an erodible area. Temporary diversion dykes should not adversely impact adjacent properties and must conform to local floodplain management regulations, and should not be used in areas with slopes steeper than 10%.

Slopes that are formed during cut and fill operations should be protected from erosion by runoff. A combination of a temporary drainage swale and an earth dyke at the top of a slope can divert runoff to a location where it can be brought to the bottom of the slope. A combination dyke and swale is easily constructed by a single pass of a bulldozer or grader and compacted by a second pass of the tracks or wheels over the ridge. Diversion structures should be installed when the site is initially graded and remain in place until post construction BMPs are installed and the slopes are stabilized.

Diversion practices concentrate surface runoff, increasing its velocity and erosive force. Thus, the flow out of the drain or swale must be directed onto a stabilized area or into a grade stabilization structure. If significant erosion will occur, a swale should be stabilized using vegetation, chemical treatment, rock rip-rap, matting, or other physical means of stabilization. Any drain or swale that conveys sediment laden runff must be diverted into a sediment basin or trap before it is discharged from the site.

Earth Dykes

Temporary earth dykes are a practical, inexpensive BMP used to divert stormwater runoff. Temporary diversion dykes should be installed in the following manner:

All dykes should be compacted by earth moving equipment.

All dykes should have positive drainage to an outlet.

All dykes should have 2:1 or flatter side slopes, 18 in. minimum height, and a minimum top width of 24 in. Wide top widths and flat slopes are usually needed at crossings for construction traffic.

The outlet from the earth dyke must function with a minimum of erosion. Runoff should be conveyed to a sediment trapping device such as a Sediment Trap or Sediment Basin when either the dyke channel or the drainage area above the dyke are not adequately stabilized.

Temporary stabilization may be achieved using seed and mulching for slopes less than 5% and either rip-rap or sod for slopes in excess of 5%. In either case, stabilization of the earth dyke should be completed immediately after construction or prior to the first rain.

If riprap is used to stabilize the channel formed along the toe of the dyke, the following typical specifications apply:

Channel Grade Riprap Stabilization
0.5-1.0% 4 in. Rock
1.1-2.0% 6 in. Rock
2.1-4.0% 8 in. Rock
4.1-5.0% 8 in. -12 in. Riprap

The stone riprap, recycled concrete, etc. used for stabilization should be pressed into the soil with construction equipment.

Filter cloth may be used to cover dykes in use for long periods.

Construction activity on the earth dyke should be kept to a minimum.

Drainage Swales
Drainage swales are only effective if they are properly installed. Swales are more effective than dykes because they tend to be more stable. The combination of a swale with a dyke on the downhill side is the most cost effective diversion.

Standard engineering design criteria for small open channel and closed conveyance systems should be used (see the local drainage design manual). Unless local drainage design criteria state otherwise, drainage swales should be designed as follows:

No more than 5 acres may drain to a temporary drainage swale.

Place drainage swales above or below, not on, a cut or fill slope.

Swale bottom width should be at least 2 ft

Depth of the swale should be at least 18 in.

Side slopes should be 2:1 or flatter.

Drainage or swales should be laid at a grade of at least 1 percent, but not more than 15 percent.

The swale must not be overtopped by the peak discharge from a 10-year storm, irrespective of the design criteria stated above.

Remove all trees, stumps, obstructions, and other objectionable material from the swale when it is built.

Compact any fill material along the path of the swale.

Stabilize all swales immediately. Seed and mulch swales at a slope of less than 5 percent, and use rip-rap or sod for swales with a slope between 5 and 15 percent. For temporary swales, geotextiles and mats may provide immediate stabilization.

Irrigation may be required to establish sufficient vegetation to prevent erosion.

Do not operate construction vehicles across a swale unless a stabilized crossing is provided.

Permanent drainage facilities must be designed by a professional engineer (see the local drainage design criteria for proper design).

At a minimum, the drainage swale should conform to predevelopment drainage patterns and capacities.

Construct the drainage swale with a positive grade to a stabilized outlet.

Provide erosion protection or energy dissipation measures if the flow out of the drainage swale can reach an erosive velocity.

Inspection and Maintenance
Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.

Inspect BMPs subject to non-stormwater discharges daily while non-stormwater discharges occur.

Inspect ditches and berms for washouts. Replace lost riprap, damaged linings or soil stabilizers as needed.

Inspect channel linings, embankments, and beds of ditches and berms for erosion and accumulation of debris and sediment. Remove debris and sediment and repair linings and embankments as needed.

Temporary conveyances should be completely removed as soon as the surrounding drainage area has been stabilized or at the completion of construction.

30. Tracking

Description and Purpose
A stabilized construction access is defined by a point of entrance/exit to a construction site that is stabilized to reduce the tracking of mud and dirt onto public roads by construction vehicles.

Implementation
Use at construction sites;
-Where dirt or mud can be tracked onto public roads
-Adjacent to water bodies
-Where poor soils are encountered
-Where dust is a problem during dry weather conditions

Limit points of entrance/exit to the construction site.

Limit speed of vehicles to control dust.

Properly grade each construction entrance/exit to prevent runoff from leaving the construction site.

Route runoff from stabilized entrances/exits through a sediment-trapping device before discharge.

Design stabilized entrances/exit to support the heaviest vehicles and equipment that will use it.

Select construction access stabilization based on longevity, required performance and site conditions.

Designate combination or single purpose entrances and exits to the construction site.

Incorporate with Entrance/Outlet Tire Wash BMP.

Inspection and Maintenance
Inspect routinely for damage and assess effectiveness of the BMP.

Keep all temporary roadway ditches clear.

Inspect damage and repair as needed.

31. Definitions of Recreational Routes

Description and Purpose
During construction recreational areas and routes will have to be designated. Fishing activities, hiking and biking will be impacted.

Implementation
Provide publication in advance notice to reduce impacts on construction.

Provide barricades around working areas.

Limit areas affected by constructing at any one time.

Fishing Activities
Post “no fishing” signs and police such (temporary in some areas, permanent in others with the appropriate by-laws in place).

Designate and improve acceptable fishing areas.

Explore possible locations for new and acceptable fishing areas.

Implement coffer dams and silt curtains to reduce downstream sedimentation in areas that are not being constructed so as not to impact fishing.

32. Agricultural Cropland Erosion

Description and Purpose

Agricultural cropland erosion can decrease crop returns for farmers and impact the environment particularly water quality. Soil conservation practices need to be practiced on the farm to reduce these effects. There are a number of practices that can reduce soil loss including mulch tillage, no-till/ridge tillage, soil management, residue management, crop rotation, cover crops, nutrient management and pest management.

See OMAFRA website to order Best Management Practices: Field Crop Production information

33. Cropland Field Management

A wide variety of techniques are available to reduce runoff, wind and water erosion, and nutrient loss from cultivated lands. In addition to reducing contamination of water systems, the adoption of many of these techniques will result in cost savings or improved efficiencies for the operator:

Grassed waterways involve shaping and seeding an overland drainage route to convey runoff away from a field without causing gully erosion.

Filter strips are vegetated buffers located between cultivated areas and agricultural drains, ditches, and watercourses.

Contour farming reduces runoff and soil loss by simply plowing and seeding cross the slope following the topography.

Low till / no till farming improves long-term soil viability and reduces soil loss by leaving at least 30% of previous year's crop residue on the field.

Strip cropping increases infiltration and reduces runoff by alternating a ground cover crop and a row crop changing effectively the amount of surface cover.

Crop rotation involves alternating crops year to year thereby improving soil structure, infiltration and reducing erosion while improving crop yield.

Windbreaks or fence rows reduce soil erosion by reducing wind velocity and the loss of soil moisture which binds soil particles together.

34. Check Dams

Description and Purpose

A check dam is a small barrier constructed of rock, gravel bags, sandbags, fiber rolls, or reusable products, placed across a constructed swale or drainage ditch. Check dams reduce the effective slope of the channel, thereby reducing the velocity of flowing water, allowing sediment to settle and reducing erosion.

Limitations

Not to be used in live streams or in channels with extended base flows.

Not appropriate in channels that drain areas greater than 10 acres.

Not appropriate in channels that are already grass-lined unless erosion is expected, as installation may damage vegetation.

Require extensive maintenance following high velocity flows.

Promotes sediment trapping which can be re-suspended during subsequent storms or removal of the check dam.

Implementation

General

Check dams reduce the effective slope and create small pools in swales and ditches that drain 10 acres or less. Reduced slopes reduce the velocity of stormwater flows, thus reducing erosion of the swale or ditch and promoting sedimentation. Use of check dams for sedimentation will likely result in little net removal of sediment because of the small detention time and probable scour during longer storms. Using a series of check dams will generally increase their effectiveness. A

sediment trap (Sediment Trap BMP) may be placed immediately upstream of the check dam to increase sediment removal efficiency.

Design and Layout
Check dams work by decreasing the effective slope in ditches and swales. An important consequence of the reduced slope is a reduction in capacity of the ditch or swale. This reduction in capacity must be considered when using this BMP, as reduced capacity can result in overtopping of the ditch or swale and resultant consequences. In some cases, such as a "permanent" ditch or swale being constructed early and used as a "temporary" conveyance for construction flows, the ditch or swale may have sufficient capacity such that the temporary reduction in capacity due to check dams is acceptable. When check dams reduce capacities beyond acceptable limits, there are several options:

Don't use check dams. Consider alternative BMPs.

Increase the size of the ditch or swale to restore capacity.

Maximum slope and velocity reduction is achieved when the toe of the upstream dam is at the same elevation as the top of the downstream dam. The center section of the dam should be lower than the edge sections so that the check dam will direct flows to the center of the ditch or swale.

Check dams are usually constructed of rock, gravel bags, sandbags, and fiber rolls. A number of products manufactured specifically for use as check dams are also being used, and some of these products can be removed and reused. Check dams can also be constructed of logs or lumber, and have the advantage of a longer lifespan when compared to gravel bags, sandbags, and fiber rolls. Straw bales can also be used for check dams and can work if correctly installed; but in practice, straw bale check dams have a high failure rate. Check dams should not be constructed from straw bales or silt fences, since concentrated flows quickly wash out these materials.

Rock check dams are usually constructed of 8 to 12 in. rock. The rock is placed either by hand or mechanically, but never just dumped into the channel. The dam must completely span the ditch or swale to prevent washout. The rock used must be large enough to stay in place given the expected design flow through the channel.

Log check dams are usually constructed of 4 to 6 in. diameter logs. The logs should be embedded into the soil at least 18 in. Logs can be bolted or wired to vertical support logs that have been driven or buried into the soil.

Gravel bag and sandbag check dams are constructed by stacking bags across the ditch or swale, shaped as shown in the drawings at the end of this fact sheet.

Manufactured products should be installed in accordance with the manufacturer's instructions.

If grass is planted to stabilize the ditch or swale, the check dam should be removed when the grass has matured (unless the slope of the swales is greater than 4%).

The following guidance should be followed for the design and layout of check dams:
Install the first check dam approximately 16 ft from the outfall device and at regular intervals based on slope gradient and soil type.

Check dams should be placed at a distance and height to allow small pools to form between each check dam.

Backwater from a downstream check dam should reach the toes of the upstream check dam.

A sediment trap provided immediately upstream of the check dam will help capture sediment. Due to the potential for this sediment to be resuspended in subsequent storms, the sediment trap must be cleaned following each storm event.

High flows (typically a 2-year storm or larger) should safely flow over the check dam without an increase in upstream flooding or damage to the check dam.

Where grass is used to line ditches, check dams should be removed when grass has matured sufficiently to protect the ditch or swale.

Gravel bags may be used as check dams with the following specifications:

Materials
Gravel bags used for check dams should conform to the requirements of Gravel Bag Berms BMP. Sandbags used for check dams should conform to Sandbag Barrier BMP. Fiber rolls used for check dams should conform to Fiber Rolls BMP. Straw bales used for check dams should conform to Straw Bale Barrier BMP.

Installation
Rock should be placed individually by hand or by mechanical methods (no dumping of rock) to achieve complete ditch or swale coverage.

Tightly abut bags and stack according to detail shown in the figure at the end of this section. Gravel bags and sandbags should not be stacked any higher than 3 ft.

Fiber rolls and straw bales must be trenched in and firmly staked in place.

Inspection and Maintenance
Inspect BMPs prior to forecast rain, daily during extended rain events, after rain events, weekly during the rainy season, and at two-week intervals during the non-rainy season.

Replace missing rock, bags, bales, etc. Replace bags or bales that have degraded or have become damaged.

If the check dam is used as a sediment capture device, sediment that accumulates in the BMP must be periodically removed in order to maintain BMP effectiveness. Sediment should be removed when the sediment accumulation reaches one-third of the barrier height. Sediment removed during maintenance may be incorporated into earthwork on the site or disposed at an appropriate location.

If the check dam is used as a grade control structure, sediment removal is not required as long as the system continues to control the grade.

Remove accumulated sediment prior to permanent seeding or soil stabilization.

Remove check dam and accumulated sediment when check dams are no longer needed.

35. Fish Shocking

Description and Purpose
Given the size of the canals and complexity of habitat, the most effective means of collecting fish for relocation is by boat electroshocking. Essentially an electric current is passed through the water from a generator on the boat, to stun fish for capture. The electric current used is capable of harming both fish and people if proper care and procedures are not followed.

Implementation
Human Safety
At least three personnel will be on the boat when electrofishing, one supervisor and two netters.

At a minimum, the supervisor will have taken an electrofishing certification course and have a Pleasure Craft Operators Card.

All staff will be trained in CPR.

All crew members will wear chest or hip waders to insulate the wearer from electrical shock.

All crew members will wear an approved personal floatation device while on the boat.

Net handles will be constructed of a nonconductive material and will be of sufficient length to avoid hand contact with the water.

All team members will wear rubber gloves of sufficient length to isolate hands from external surfaces.

Gloves will be visually inspected for punctures before each use and will be replaced if tears or punctures are evident.

General boat housekeeping must provide adequate working space to conduct safe operations.

The boat and equipment will be visually inspected for safety by the supervisor or operator in charge, prior to each use.

The boat operator must have ready access to a on/off, emergency stop, or deadman switch to cut the power in case of an accident.

The phone number and direction to the closest hospital will be identified and clearly displayed.

Fish Health
Polarized sunglasses will be worn to increase visibility.

Two netters will be on the boat when in operation.

Bubblers or an appropriate alternative will be used to ensure better than ambient dissolved oxygen in the onboard storage tanks.

The length of time fish are contained will be monitored as not to induce unnecessary stress.

Current strength will be continually monitored to ensure operation within safe levels.

Fish handling will be kept to a minimum to reduce fish stress.

Fish condition will be continually monitored, in terms of spinal injuries and rate of recovery.

A permit to collect fish will be obtained from the Ministry of Natural Resources for each construction interval.

36. Winter Work

Description and Purpose

Use of vehicles and working in the cold call for special attention in winter.
Operation of vehicles must be performed according to all vehicle codes, traffic laws, company procedures and manufacturer's recommended operating guidelines. When using vehicles drive defensively, back in when practical, ensure vehicle has an emergency road kit, ensure to clear snow from all windows, lights and mirrors, accelerate and brake gently to reduce skids or spinouts and monitor weather reports. Beware of ground conditions when parking equipment overnight. Wherever possible avoid mud where equipment may be frozen in lace and difficult to dislodge in the morning. Check propane cab heaters for leaks and proper venting. When setting up signs and barricade control, allow extra distance so that motorists can spot warning signs and slow down or stop in time.
Dress properly for cold weather. Protective clothing is needed for work at or below 4ºC. Multiple layering of clothing provides better protection and in wet conditions the outer layer of clothing should be waterproof. Ensure winter clothing does not restrict movement, vision or hearing. Proper footwear, gloves and headwear are required and in extremely cold conditions face and eye protection from sunlight, glare, blowing snow/ice crystals and high winds at cold temperatures will be needed.

37. Ice control on Roads

Description and Purpose

In sufficient concentrations, road salts pose a risk to plants, animals and the aquatic environment. It is therefore important to both control ice on roads and reduce salt impacts to the environment. Salt should be managed to ensure safe, efficient and cost-effective use on roadway systems. As part of a salt management plan, best management practices should be implemented for winter maintenance of vehicles, use of road salt, sand and salt storage and disposal of snow.

APPENDIX 13

TIME-LINE CHART

FOR A ENGINEERING PROJECT COMPLETELY CONTAINED WITHIN ONE MUNICIPALITY FROM FILING OF REPORT TO CONSTRUCTION

(added notes are for projects contained within more than one municipality)

- Report filed by engineer
- Report and Notice of Meeting sent (there is no maximum number of days specified, just the "no fewer than")
- Meeting to consider report (COR requires a member from each municipality, 2 from Town of BWG)
- Provisional by-law and Notice of COR sent out
- All appeals finalized
- By-law given third reading (including all the municipalities)
- Construction may begin

Within 30 days, a copy of the report and notice of a meeting to consider the report must be sent out [S. 41(2)]	Meeting must not be less than 10 days after the last mailing [S. 41(4)]	After provisional adoption of the bylaw, a copy of the bylaw and a notice of the Court of Revision (COR) must be sent out within 30 days [S. 46(2)]	COURT OF REVISION Any owner of land who has assessment complaints can appeal to the COR; appeals must be filed at least 10 days before the COR [S. 52]	The COR must be held between 20 and 30 days after the notice is sent [S. 46(3)]	After the COR decision is given, appellants can appeal this decision to the Tribunal within 21 days [S.54(1)]	If an appeal is filed, the Tribunal will hear the appeal and decide.	After all appeals have been heard and dealt with, Council can give third reading to the by-law. [S. 58(1)]	Construction may begin 10 days after third reading, subject to Section 58(1) and 58(2).

DRAINAGE REFEREE: Any owner of land or public utility can file an appeal to the Drainage Referee on the grounds that the report does not comply with the Act, within 40 days of the mailing. [S. 47(1)] — If an appeal is filed, a Referee hearing is held and a decision is made.

DRAINAGE TRIBUNAL: Any owner of land, public utility or Conservation Authority may file an appeal to the Drainage Tribunal on technical grounds, within 40 days of the mailing. [S. 48(1) and S. 49] — If an appeal is filed, a Tribunal hearing is held and a decision is made

REPORT CONSIDERATION STAGE

clerks of other municipalities have 30 days to send report and notice (potential 60 days here until next step)

APPEALS STAGE

if/when report is provisionally adopted by two readings, Town of BWG notifies other municipalities within 5 days of the COR. COR is to be between 20 and 30 days from mailing date of notice

REPORT ADOPTION STAGE