



Submitted by
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46 Pages

STAFF REPORT ACTION REQUIRED

c31
Item 44

Stormwater Pond Safety

Date:	February 20, 2013
To:	Public Works and Infrastructure Committee
From:	General Manager, Toronto Water
Wards:	All
Reference Number:	P:\2013\Cluster B\TW\pw13001

c31 Communication CW: <u>Sept 21/14</u> Item: <u>44</u>
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SUMMARY

The purpose of this report is to describe the public safety issues associated with publicly owned stormwater management ponds including current practices for providing fencing and footpaths.

RECOMMENDATIONS

The General Manager, Toronto Water recommends that:

1. Public Works and Infrastructure Committee receive this report for information.

Financial Impact

There is no financial impact associated with this report.

DECISION HISTORY

City Council on June 6, 7 and 8, 2012, referred the following motion to the Public Works and Infrastructure Committee:

<http://app.toronto.ca/tmmis/viewAgendaItemHistory.do?item=2012.MM24.2>

The motion recommends that:

1. City Council request the General Manager, Toronto Water to study the safety of Toronto's retention and detention ponds and report to the Public Works and Infrastructure Committee with recommendations aimed at improving safety.
2. City Council request the General Manager, Toronto Water to amend the City's Stormwater management policy so that it includes:
 - a. Where and when fencing should be installed around retention and detention ponds; and

- b. A requirement to include footpaths when retention and detention ponds are designed and built.
3. City Council request the General Manager, Toronto Water to review the need for footpaths at existing retention and detention ponds.

ISSUE BACKGROUND

The City of Toronto currently maintains 89 retention and detention ponds for the purposes of stormwater management. Retention ponds, also commonly called "wet ponds", refer to facilities that maintain a permanent pool and are generally designed for water quality improvement, while detention ponds, often called "dry ponds" contain water only in the aftermath of significant rainfall events and are typically used for flow control or flooding protection. A detention pond will hold the water for a short time and then slowly release it, normally within 24 to 48 hours. The design of stormwater management ponds is subject to the approval of the Ministry of the Environment (MOE) and must meet the requirements of MOE's "Stormwater Management Planning and Design Manual" (March 2003).

Stormwater management ponds are usually constructed when a new subdivision is created. The City and the Toronto and Region Conservation Authority (TRCA) have requirements for new developments to control / reduce the peak rate of stormwater runoff from the subdivision so as not to cause flooding downstream and also improve the quality of the stormwater runoff by removing sediment and suspended solids. Stormwater ponds are a cost effective way of meeting these requirements. In new subdivisions, these ponds are built by the developers, and later assumed by the City. In recent years, the City has also built a number of wet ponds through the implementation of the City's Wet Weather Flow Master Plan, and dry ponds in existing neighbourhoods to help provide flooding relief through the City's Basement Flooding Protection Program.

Although constructed stormwater management ponds/wetlands are engineered facilities, they can be landscaped to look natural and are often used as habitat by migrant birds and animals. When they are located close to parks or vegetated areas, they are usually designed to integrate as naturally as possible.

COMMENTS

Whenever people are next to open water there is a public safety concern. In the case of stormwater management ponds, which are built, owned, operated and maintained by the City, there is an onus on the City to mitigate these risks. Stormwater management ponds are primarily for flood control and water quality improvement. In comparison to natural ponds, these facilities are typically deeper with steep side slopes; fast flowing water at inlets and outlets, which may be submerged; and widely fluctuating water levels. In some municipalities these ponds are simply treated as wastewater treatment facilities and are completely fenced in, and accessible only by City staff. However, most municipalities, including Toronto, use a more flexible approach. In most cases, the ponds are designed to look as natural as possible, aesthetically pleasing and integrated within the generally natural surroundings. To protect public safety, a variety of design features and safety measures are incorporated including:

- Signs to warn people to keep away from the water;
- Dense and woody vegetation around the perimeter of the pond to limit immediate access;
- A bench of shallow water around the perimeter of the permanent pool to reduce the hazards of falling or sliding into deep water;
- A rock structure at each water inlet if necessary to dissipate fast-flowing waters;
- Inlet and outlet structures designed to prevent children from being trapped by flowing water;
- Unfenced areas should have a very gradual slope of not steeper than one foot vertical for each four feet horizontal;
- Fences and guard rails are provided at the top of steeper slopes and walls
- Fences (where necessary) are built at least 1 metre back from the high water level of the pond; and
- Some dry ponds have alarm systems and staff are required to monitor the area when the pond is flooding (inspection staff carry lifesaving equipment).

Staff from Toronto Water are preparing a landscaping design guideline for stormwater ponds based on suggested good practice from the 2003 MOE Stormwater Management Planning and Design Manual, with the support from staff in Parks, Forestry and Recreation. The design guideline will be used in the review and approval of ponds proposed by developers to meet the stormwater management requirements for their plans of subdivision. It will identify acceptable side slopes, maintenance access, plant types, paths and fencing. Consultations with other City Divisions, including Engineering and Construction Services, City Planning and Public Realm, as well as the TRCA will take place following the development of the draft design guideline. The design guideline is expected to be finalized by the summer of 2013.

Currently Parks, Forestry and Recreation staff assist with the review of landscaping plans at proposed stormwater ponds that abut parks or natural areas. The provision of footpaths around or near a pond is determined on a case by case basis with Parks, Forestry and Recreation staff. The overall objective is to achieve an adequate level of public safety around stormwater management ponds through proper design without the need for unsightly perimeter fencing.

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Stormwater Management

Retention and detention ponds

Stormwater management retention/detention ponds

In urban areas the carrying capacities of the storm and combined sewer systems vary widely, depending on when they were built. One common factor is that the systems have difficulty handling the runoff from very infrequent and intense storms. As result one may have observed one or more of the following hazards:

- sewer backup into basements (basement flooding)
- flooded properties and roads
- manhole cover blown off and water gushing from manholes, sometimes several metres high, and
- swollen and rapidly flowing stream

The City of Toronto has constructed and is continuing to construct ponds in known problem areas. This reduces flooding by directing as much excess storm runoff as possible away from roads and sewers to properly-designed storage facilities rather than randomly-occurring flood locations. The water is contained in these areas until the sewers are able to handle it.

A retention pond, such as Milliken Park near Steeles Avenue and Markham Road in the Scarborough community, always contains water. It also has the capacity to handle excess rainwater when necessary. In addition, these "wet ponds" are often built to allow for settlement of suspended solids through extended detention time.

A detention pond, such as Scarden Park at Warden Avenue and Cass Avenue, also in the Scarborough community, is a dry area such as a park or an open space with the necessary mechanics to close off access to sewers and direct water into the detention area. These areas are well-signed so that residents are aware that they should leave the area during a storm. Each area is also equipped with an alarm system that activates should water start to flow in. At that point, staff are notified to check the area.

Since conditions vary from site to site, here are a number of safety precautions used:

- alarm systems alert staff to check the area when it is activated (inspection staff carry lifesaving equipment)
- enough signs are erected and maintained to warn residents of possible danger
- each area is made as vandal-proof as practical and avoids, as much as possible, any structure that might trap a child against a grating
- each entrance point for water into a detention area has a rock structure that dissipates fast-flowing waters
- all unfenced areas have a very gradual slope of four feet horizontal for each foot vertical
- fences are built at least one metre back from the high-water level of the pond

All safety practices are reviewed regularly and modified as necessary based on experience.

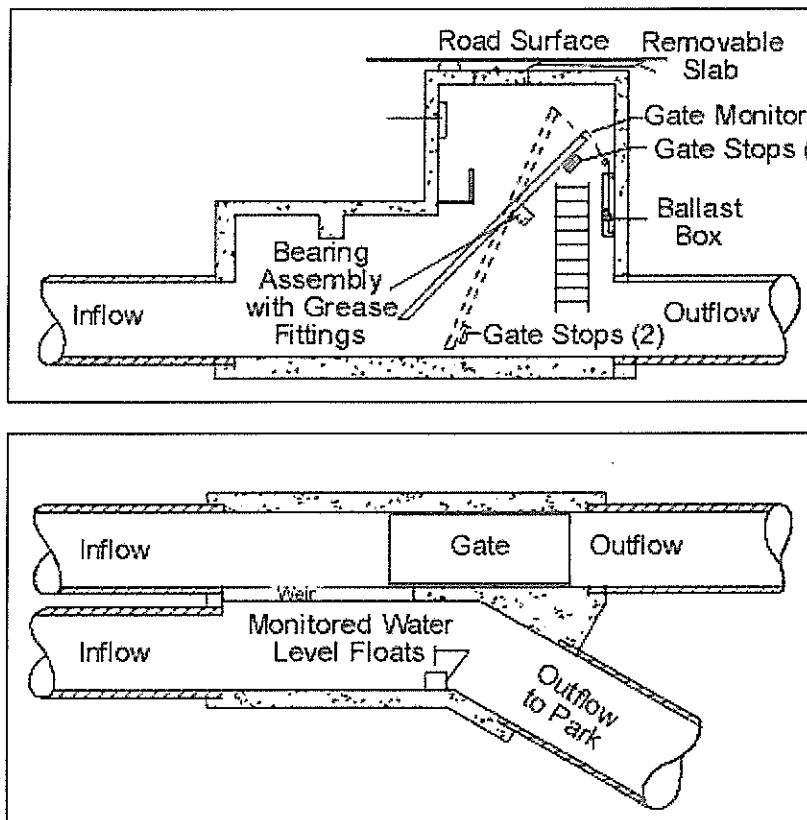
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Stormwater Management

Scarden Park Stormwater Management Pond

Scarden Park Stormwater Management Pond



Note: In the drawing above, the first is a side view and the second is a view from the top.

How it works

1. Under normal conditions, stormwater passes under the gate.
2. When the volume of stormwater increases to a predetermined level because of a rainstorm, it pushes the bottom of the gate into a shut position blocking the sewer outflow pipe. (See the first view showing the open and closed positions of the gate.) The stormwater then flows into the detention area through the outflow to the park. (See the second view which shows the gate closed.)
3. When the gate closes, it sets off an alarm in our Radio Room. Staff are then notified that the site is active. They visit the site to make sure no one is in the area now receiving water and that all conditions are safe.

4. When the rainstorm has stopped and the volume of rainwater in the pipes has decreased to the predetermined level, the gate opens and stormwater is again directed into the storm sewer.

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Run Free and Safe in Gallanough Park

Help stop the proposed dry pond and demand better long term solutions!

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August 14, 2014

The Preferred Option: Underground Reservoir

Save Gallanough Park, Come to City Hall

September 2, 2014

Committee of the Whole

11:00am

Council Chambers

2nd Floor

2141 Major Mackenzie Drive

Vaughan, Ontario

What do we, the residents of Thornhill, Vaughan, who live around and use Gallanough park want?

WE WANT THE CITY TO GO WITH THE PREFERRED SOLUTION OF AN UNDERGROUND RESERVOIR.

This is what was deemed the preferred option, back in 2007. 2008 and that is what residents of Vaughan were expecting.

A stormwater management dry pond is unacceptable.



Parent and child play on the swings at Gallanough Park

It will destroy our park. It will be a drowning risk to young children playing in the field.

We will lose our open space and no longer run free and safe in Gallanough park.

The beautiful serene open space will turn into a gully 12 feet deep.

The beginners little kids soccer field will be moved to this very low point to become the dry pond holding area probably for 24 to 48 hrs.

This will happen when the Brooke Street stormwater system becomes overloaded, and overflow water is surcharged during very severe rainstorms, into the dry pond.

Project Background:

On August 19th 2005 , approximately 85 % of The City of Vaughan, experienced a rainstorm event which was equivalent to the 1 in 100 year storm condition or worse. This storm caused considerable flood damage.

As well, short duration and intense rainstorms are becoming increasingly common throughout The Greater Toronto Area, and are considered one of the effects of climate change.

So what does this have to do with a little kids soccer field? Or all of the flat open space in Gallanough park?

The old sewer system in Old Thornhill has to be upgraded. In fact some houses still have old septic tanks in their backyards.

The City wants to stop flooding that occurred to about 20 houses on Arnold Ave and Thornridge Ave. close to Brooke St and Yonge St.

What did the City of Vaughan Engineering Studies offer back in 2007, when they held the first meetings at The Garnet Williams Community Centre to “describe the drainage issues, and solicit input from the public in selecting the preferred solutions?”:

(1). The most costly solution, but appropriate way of minimizing the chance of flooding in the future, is to upgrade the old existing sewer system.

(2). The second less costly solution, which was the community’s PREFERRED SOLUTION, was to build an underground reservoir. This cistern would hold the overflow storm water, in very short intense rain storms, and then disperse it back to the Brooke Street trunk over time.

This would keep the park safe for our community, kids, and pets. There would be NO DROWNING RISK to curious children, or animals.

Did you know that the City of Vaughan recommended in 2008, to put Lifesaving Stations at all Stormwater Management ponds?

So why would the City of Vaughan retrofit a stormwater management dry pond, into a small, mature, loved, safe community park, all within walking paths to the Thornhill Public School, a Pre- nursery School at Gallanough Resource Centre, and a Summer Camp at the Arnold House?

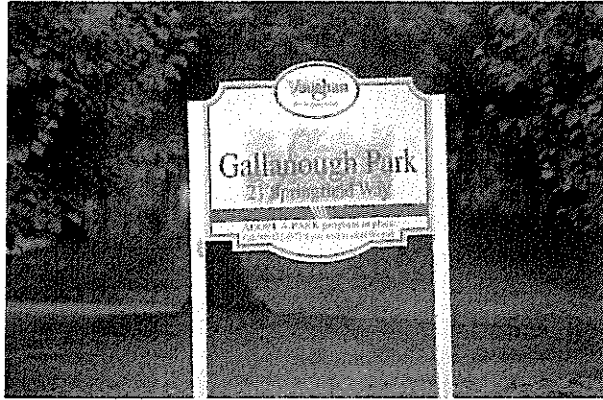
(3). The CHEAPEST SOLUTION: The Dry Pond.

The City of Vaughan knows that the Dry Pond is the worst solution, but has chosen to go ahead with it for COST SAVING reasons.

They cannot justify putting the extra money for a long term solution, into our community park.

They reason that the dry pond will be constructed during the 2015 winter months, and be ready for their revenue creating Arnold House summer camp.

With the intensification of the Yonge Street corridor, and concrete condominiums taking over, green open active space is a premium and parks highly valued.



The Gallanough Park is now loved by second generation families who have grown up in our community, and will continue to be used for generations to come.



This deserves better than a Quick Cheap solution.

The soccer field turf, where little kids play, will probably have deposits of biological contaminants, heavy metals (lead), oils, molds.

Where do these come from?

The City of Vaughan also plans for overflow stormwater from Springfield way to drain into the park, very close to the playgrounds, and summer camp.

Did you know City workers maintaining stormwater facilities need to protect themselves from disease, getting inoculated with Hepatitis A and B vaccines?

STORM WATER BELONGS UNDERGROUND.

Instead we are threatened with an unsafe park, where mosquitoes with West Nile Virus, and the new Chikungunya Virus can breed.

An unplayable soccer field for the whole spring summer season, which is what happened to two soccer fields at Dufferin Clarke District Park.



One soccer field which is at the bottom of a gentle slope, serves as an overland draining management for service water.

Eventually the City of Vaughan after we get over the SHOCK OF LOSING our OPEN SPACE will probably put a fence all around the kids' soccer field, to protect their liability. This is what the City of Toronto proposes for all their dry ponds.



MP Peter Kent Community BBQ

For now, Alan Shefman and parks development, want us to choose the trees, and thick bushes, which will act as a barrier to protect children from the rocks which filter sediments, and pipes which will bring flood water with very strong currents near the playground.

Also, the walking paths on the landscape design, supposedly connecting the playground and other park amenities to the soccer field, are actually a safety feature, in the Ministry of Environment, dry pond design manual.

Dry Ponds are deeper then Wet Ponds.

For Public Safety, they need gentle slopes for maintenance, and emergency access to get to a drowning person caught at the bottom of this 12 foot deep stormwater pond.

Some ponds in other cities have ALARM SYSTEMS requiring staff to monitor the area when the pond is flooding.

Isn't the City of Vaughan responsible for our sewer system?

Doesn't stormwater belong underground?

Why are we being warned of probably higher taxes, if the City of Vaughan saves Gallanough Park, with our PREFERRED SECOND LESS COSTLY SOLUTION?

The safe underground reservoir.

The park will look the same as it is today, and not be a threat to our community.

It will not cause parents to be anxious, that their curious children will be drawn to this deep body of water that suddenly appears one day after an intense rainstorm, and will remain probably for 24 to 48 hours.

Back in 2007:

Our community clearly stated our preferred solution, at the public meetings.

We were warned of probably higher taxes:

But our position was that the City of Vaughan in the past 25 years has been getting substantially higher tax revenue from very large homes being built, on the lots, that old houses which payed far less taxes are being torn down.

All houses on the north side of Spring Gate Blvd. from Yonge Street to Bathurst Street have been built on the severed lots of Arnold Avenue. This means the City of Vaughan is getting 3 property taxes from 1 old lot.

A lot of these houses have been flooded during the 2005 storm.

Our services have been cut back.

WHERE IS ALL THIS EXTRA REVENUE GOING?

The Liberal article stated that the PETITION would be left at the Gallanough Library which has a Pre-nursery in the basement for our community to sign, but Marilyn Braude and Linda Orriell, managers of the Gallanough Resource Centre, who are both on the board of the library, requested the editor to print the following correction:

"We are a not for profit charitable organization and not comfortable with petitions being signed at the Gallanough." in an e-mail sent to The Liberal.

PETITION

We, the undersigned, RESIDENTS living in the neighbourhood of Gallanough Park, object to the City of Vaughan's intention to create a dry pond in Gallanough Park for stormwater management purposes.

The appropriate way of minimizing the chance of flooding in the future is upgrading the existing sewer system.

The second preferred solution is to create an UNDERGROUND POND. A "dry pond" (above ground) is unacceptable.

The wording "dry pond" is misleading and Residents thought that it referred to an UNDERGROUND POND.

Sign our PETITION on Sunday August 24 at the gazebo of the Gallanough Park 11am to 12pm and 6pm to 7pm.

Fight to SAVE GALLANOUGH PARK

"Run free and safe in Gallanough Park, to save Designated OPEN ACTIVE space."

Keep our children and pets safe.

Come to City Hall September 2nd at 11 o'clock onwards, where councillor Alan Shefman will present our position and make your voice HEARD.

Essential Safety Considerations for Urban Stormwater Retention and Detention Ponds

By: Jonathan E. Jones, P.E.¹, James Guo, Ph.D., P.E.², Ben Urbonas, P.E.³, and Rachel Pittinger⁴

INTRODUCTION

Urban stormwater retention and detention ponds are widely used in the United States. Retention ponds, also commonly called “wet ponds” refer to facilities that maintain a permanent pool, while detention ponds, often called “dry ponds” contain water only in the aftermath of runoff events.

Although retention and detention ponds can be effective for stormwater management and flood control, they can also pose risks to public health, safety, and welfare. Urban storm drainage system planners, designers, facility owners, maintenance staff, and municipalities, including their elected officials and governing bodies, must be aware of such risks and insist on the use of recommended techniques to minimize them. Licensed professional engineers should be especially concerned about the risks that their designs may pose and be knowledgeable of design approaches that reduce such risks, given that their paramount responsibility as licensed professionals is to protect public health, safety, and welfare.

The purposes of this paper are to:

- Review safety hazards that can be associated with retention/detention ponds.
- Discuss techniques that can be used to reduce the risk of such hazards.
- Review representative pond safety recommendations and guidance from municipalities, state and federal governments, professional societies, and the general stormwater literature.

Although the focus of this paper is on wet and dry ponds, many of the issues and recommendations presented herein apply to other stormwater facilities, such as best management practices (BMPs), long underground pipes, and culverts (see discussion of this topic near end of paper).

Conceptual designs of a typical wet pond and dry pond are provided in Figures 1 and 2, respectively. Photographs 1 and 2 show examples of typical facilities.

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TYPICAL SAFETY CONCERNS

Overview

Unsafe conditions can occur under both dry and wet weather conditions. These range from readily apparent problems such as outlet pipes that are open (unprotected with trash/safety racks) to less obvious concerns such as outflow pipes that are subject to overwhelming hydrostatic forces due to high headwater depths. A complicating factor is that children are often attracted to stormwater facilities, and this poses special design challenges and risks. For instance, the authors are aware of a case where a dry pond in an office park had a rapid rise, and a child playing in the pond was apparently knocked down by jet flows from an inlet pipe, tumbled by vortex flows, and ultimately, dragged into an unprotected outlet pipe by suction forces. These forces were not visible (apparent) when the water depth in the pond covered the pipe entrances and outlet. Although it is not feasible to anticipate every public safety risk, many scenarios are foreseeable and can be accounted for during design.

Pond safety issues that do not involve drowning must also be considered. For example, embankment slopes that are too steep can be hazardous to the public and maintenance staff (such as those operating lawn mowers). Another example is high wingwalls or other vertical structures. In the past few years, a serious public health concern that has emerged is related to ponds that create mosquito-breeding habitat due to shallow and stagnant standing water, thus increasing the risk of West Nile virus to the adjacent community.

Specific Safety Deficiencies

The authors have observed the following safety deficiencies in storage facilities.

- Outlets are open and unprotected, they lack trash/safety racks, the racks have openings large enough to pose a danger to the public, and/or the racks are too close to the outlet to provide sufficiently slow flow velocities that will not impinge a person against them.
- Adjacent land uses are incompatible with storage facilities and few, if any, steps have been taken to minimize obvious risks. For example, a nursery school playground without a fence was observed immediately next to a retention pond that had a high concrete wall along one side without a suitable railing.
- The public is effectively “invited” to spend time near storage facilities because they are located in parks, along bike trails, next to playgrounds, etc., yet the designers fail to recognize that frequent use will occur, and public safety has clearly not been a specific design objective.
- Education of community residents, office and industrial park employees, users of multi-purpose recreational facilities, etc. regarding pond hazards is not provided. Signs warning the public of rapidly rising floodwaters and associated danger are not posted.
- Side slopes of the facility are excessively steep or vertical without suitable safety rails. As a result, it would be very difficult for someone to get out of the pond when water levels are rising.
- Side slopes within the pond’s permanent pool are too steep, and/or ponds lack “safety benches” around their perimeter.

- Pond inflow and outflow pipes are directly across from and in close proximity to one another. In this case, a person can be knocked over by the impulse forces (momentum) of inflows and then sucked into and/or pinned against the outlet structure.
- Pond depths increase very rapidly, and inflow/outflow pipes are quickly inundated and not visible.
- Hydraulic structures are designed and constructed in a manner that makes them hazardous. For example, steel bars on grates are not beveled, rounded, or covered, but have sharp ends. Bolts have jagged, exposed ends. Gaps between steel bars and concrete walls are too wide. Railings are either not used where they should be or are improperly designed.
- Ponds with a “hard edge” appearance, such as a block or cobblestone vertical wall, immediately adjacent to the water surface drop into a pond that has steep side slopes, so a person who falls in cannot get out without having to swim.
- A variety of problems with spillways have been observed. For example, spillways are undersized. Dams and embankments are not designed to withstand overtopping forces during floods larger than they were designed to detain, despite the presence of homes and businesses in the “dam break” floodplain downstream. This is often the result of designers assessing embankment behavior for the design event, such as the 50-year storm or the 100-year storm, but failing to recognize that larger events can and do occur, and that the consequences of such events have to be considered.
- Inadequate maintenance and monitoring occur, thus leaving the facilities unable to function as designed or intended. For example, when pond outlet structures are fully or partially blocked with debris, the risk of embankment overtopping and failure increases. Orifices in riser pipes that are used to gradually “bleed down” a water quality design storm typically have small diameters, which leaves them vulnerable to plugging by trash, debris, sediment, algae, etc. unless frequently inspected and maintained. This can lead to prolonged pooling of shallow, stagnant water, which sets the stage for mosquitoes and, potentially, West Nile virus.
- Other drainage facilities adjacent to the pond (designed when the pond was) are unsafe, such as channels, drop structures, energy dissipaters, and culverts.

The key to reducing the observations described above is careful consideration of risks in the design phase, coupled with regular inspection and maintenance of the pond to insure that the facility is functioning as intended and that unforeseen hazards have not been created.

DESIGN AND OPERATIONAL TECHNIQUES TO REDUCE SAFETY RISKS

The following risk reduction techniques are recommended (see Photographs 3 – 10 for examples):

- 1) Inform members of the pond design team that promoting public safety is an essential design objective. Raise the subject regularly while the design is progressing. Educate designers to understand that safety can be addressed without significantly increasing costs, or disrupting hydraulic function.

- 2) After a conceptual or preliminary design for the facility has been prepared, review it with the facility owner, municipality, state staff concerned with dam safety (if relevant), and parties charged with its long-term operation/maintenance for potential safety issues. Modify, as necessary, to reduce risks to the public. Pay particular attention to risks to unattended children. Engineers are advised to design storage facilities in concert with a landscape architect, who will often have excellent suggestions for promoting safety (along with techniques to enhance appearance and maintenance).
- 3) Outlets pose particular risks and merit special attention. Do not utilize open, unprotected pipes as outlets. Instead, integrate the outlet pipe into an outlet structure that has smaller openings, and/or utilize a sloping trash/safety rack at the pipe entrance. The rack should have a surface area that is many times larger than the surface area of the outlet pipe to reduce entrance velocities (which is necessary to minimize the risk of a person being pinned against the rack) and to assure that if debris is a factor, at least some of the surface area of the rack will be open during flooding to enable the pond to drain.

The Urban Drainage and Flood Control District (UDFCD) in Denver, Colorado has prepared detailed minimum design guidance for pond outlet racks; Figure 3 is an excerpt of this guidance. The rack should be sloped at 3H:1V or milder. A clear opening at the bottom of 9 to 12 inches will permit small debris at lower flows to go through. The bars on the face of the rack should be spaced to provide 4 to 5 inch clear openings between them. Transverse support bars should be minimized, but they are essential for structural support under heavy hydraulic loads and will enable a person to climb up the rack.

- 4) When feasible, place the outlet away from areas of heavy public use such as playgrounds, parks, schoolyards, etc. Screen the outlet so that the public will not be “drawn” to it. Thick shrubs, grading techniques and aesthetic fencing/railing can be useful in this regard. Assure that embankment sideslopes adjacent to the outlet structure are not too steep to enable people to scramble away from the structure as pond waters are rising.
- 5) Grade the overall site with safety in mind. For example, provide mild side slopes leading to and within the pond and minimize the use of vertical walls. Use safety railings when vertical walls or overly steep slopes are used.
- 6) Integrate a “safety ledge” (also referred to as a “safety bench”) around the perimeter of the permanent pool of a pond. Fortunately, this recommendation is consistent with another technique related to stormwater quality enhancement: integrating a littoral zone of emergent vegetation around the pond perimeter. Integrating a safety bench with emergent vegetation will discourage people from wading into the pond. This approach can also create wildlife habitat and provide an attractive natural shoreline.
- 7) Owners are advised to periodically observe the facility to ascertain how the public interacts with it. Owners should also consider the comments received from adjoining property owners. For example, if children are skateboarding on concrete pans in the bottom of a dry basin, they should be told to not do this and warned of the hazard. Signs that say “No Skateboarding” may be helpful, although it may also be necessary to create a rough surface to make skating difficult. For facilities that are on private property, it is often feasible to have them included on security watches. Security staff should be instructed to pay particular attention to them during runoff events.

- 8) Community education can be a valuable tool. Use signs that warn of rapidly rising floodwater and educational, interpretative signs that explain how the stormwater storage facilities work. Urge local radio and television stations to include short public service announcements that emphasize the hazards posed by storm drainage facilities. Educate school children to these risks. Distribute flyers. Inform homeowner associations and property owner associations (for commercial areas) of these risks.

Ponds are often located near public facilities such as recreation centers, libraries, fire stations, etc. Staff can be asked to observe the storage facility during dry and wet weather conditions and to identify potential hazards. Similarly, facilities in office parks and industrial complexes are often visible to workers, and they can be asked to identify potential hazards.

- 9) Attempt to separate certain land uses, such as preschools, from ponds or incorporate obstacles that will assuredly prevent access.
- 10) Separate inflow and outflow pipes by long distances and assure that the pipes are not directly across from each other. This will avoid the creation of a continuous flow stream (current), which poses special dangers for the public. If this is not feasible, utilize an energy dissipater at the outlet where it discharges into the detention facility.
- 11) Regularly inspect/maintain the detention facility. Anticipate potential problems. Look at the impoundment from the perspective of someone who knows nothing about the risks that such facilities pose. Look for potential hazards and address them.
- 12) Recognize that detention facility dams can be hazardous and use care in their design. Assure that all aspects of dam safety, ranging from upstream and downstream sideslopes to spillway adequacy to behavior of pond during overtopping, are addressed. In particular, acknowledge that floods larger than the 100-year event can and will occur, and determine how the dam will behave under such conditions. If the dam is anticipated to fail during extreme floods, analyze the downstream impact of such failure.
- 13) Take steps to eliminate shallow, shallow-stagnant water in the bottom of "dry" basins that can be conducive to mosquito breeding. For example, determine maximum groundwater table elevations prior to design. Do not utilize outlet structure designs that are subject to plugging. Consider the use of gravity underdrains.

Because mosquitoes generally require a stable, shallow, and stagnant water surface for at least three days to reproduce, design ponds to drain the water quality design storm in less than 72 hours and utilize fountains/aerators in wet ponds to induce waves. Over the past few years, there have been many articles in the stormwater literature about mosquito control, and readers are urged to become familiar with this subject and to address it during design and operations/maintenance.

- 14) The question of whether or not to construct fences around detention facilities is complicated, with arguments both for and against the practice. Ultimately, the decision should be site specific and there should be a good rationale for whatever decision is made.

Fences certainly discourage some people from accessing ponds. Fences lend themselves to the installation of warning signs. Provided that fencing materials are carefully selected and well maintained, fences can be aesthetic.

On the other hand, many children or youths will view crossing a fence as a worthy and exciting challenge. The authors have observed many unattractive, poorly maintained fences that are eyesores. It often seems to be the case that ponds surrounded by fences are not as well maintained as those that are in the open, and more visible. Ironically, if a situation does occur involving public safety, reaching the person who requires assistance will be impeded by a fence. If the safety issues are addressed using many of the other techniques described in this paper, it should not be necessary to fence the facility.

Isolated lengths of fence can be desirable, provided that they are attractive and properly integrated into the overall site plan (again, this emphasizes the value in engineers working closely with landscape architects during design). For example, it can be valuable to include a fence at the top of a steep slope to discourage access.

- 15) Concrete pans in pond bottoms should be designed to make them less attractive for skateboarding, such as finishing the concrete with a rough texture and/or narrow “V”-shaped surface.
- 16) Reduce the number of small, “onsite” ponds that are used in new residential and commercial developments by appropriate drainage master planning, minimizing directly connected impervious area, utilizing Low Impact Development (LID) measures, and emphasizing larger, regional storage facilities. It should not be necessary for every new convenience store, gas station, and fast food outlet to have its own dry detention pond, as this needlessly compounds public risks and creates other problems.

REVIEW OF RECOMMENDATIONS REGARDING POND SAFETY

Many municipal, county and state governments around the United States already have significant pond safety requirements in place, as outlined in their stormwater management manuals and guidance documents. Excerpts from some of these manuals appear in Table 1. Table 1 indicates to the authors that accounting for public safety when designing stormwater storage facilities is clearly “state of the practice”. Engineers who fail to account for public safety when designing retention/detention facilities do so at considerable risk to themselves, their clients, and/or employers.

Table 1
Safety Excerpts from Representative Storm Drainage Criteria Manuals

Title of Local Storm Drainage Regulation/ Ordinance Criteria	Pond Safety Measure Description/Quotation
Georgia Stormwater Management Manual, 2001	<i>In most instances, trash racks will be needed. Trash racks and safety grates are a critical element of outlet structure design and serve several important functions.</i>
Construction and Materials Specifications, Kansas City Metropolitan Chapter American Water Works Association, 2003	<i>All openings shall be protected by trash racks, grates, stone filters, or other approved devices to insure that the outlet works will remain functional. No orifice shall be less than 3-inches in diameter. (Smaller orifices are more susceptible to clogging.)</i>
Stormwater Manual: Lexington-Fayette Urban County Government, Lexington, Kentucky, 2001	<u>§10.9 Wet Ponds</u> — <i>Provide safety benches at least 10 feet wide around the perimeter above the permanent pool. Design these benches to have a slope not greater than 10:1 (h:v)</i>

Title of Local Storm Drainage Regulation/ Ordinance Criteria	Pond Safety Measure Description/Quotation
Louisville Metropolitan Sewer District Design Manual, 2002	<u>Safety, Signage, and Fencing</u> —Ponds, which are readily accessible to populated areas, should incorporate all possible safety precautions. The inside pond slope shall be no steeper than 3H:1V.
Stormwater Management Standards Manual, Toledo Metropolitan Area Council of Governments, 2002	§5.2.1 Public safety shall be a paramount consideration in storm water system and pond design. Providing safe retention is the applicant's responsibility. Pond designs will incorporate graduated side slopes, vegetative and barrier plantings, and safety shelves.
Delaware Erosion and Sediment Control Handbook for Development, 1997	<u>Standard and Specifications for Sediment Basin</u> —Sediment basins are attractive to children and can be very dangerous. Local ordinances and regulations must be adhered to regarding health and safety...If fencing of sediment basins is required, the location of and type of fence shall be shown on the plan.
Stormwater Management Manual for Western Washington, 2001	A fence is needed to discourage access to portions of a pond where steep side slopes (steeper than 3:1) increase the potential for slipping into the pond. Detention Ponds, infiltration ponds, wet ponds, and combined ponds should have a sign placed for maximum visibility from adjacent streets, sidewalks, and paths.
Maryland Stormwater Design Manual Volume II, 2000	<u>Trash Racks</u> —All pipe inlet structures shall have a trash rack. Openings for trash racks shall be no larger than ½ of the barrel conduit diameter, but in no case less than 6 inches.
Catalog of Stormwater Best Management Practices For Idaho Cities and Counties, 2000 - 2005	<u>Safety, Signage and Fencing</u> —Ponds which are readily accessible to populated areas should incorporate all possible safety precautions. Steep side slopes (steeper than 3H:1V) at the perimeter should be avoided and dangerous outlet facilities should be protected by enclosure. Warning signs should be used wherever appropriate.
Public Facilities Manual Fairfax County, Virginia, 2001	§6-1606.1A Trash racks and other debris control structures shall be sized to prevent entry by children. Bar spacing on any debris control structure shall be no greater than 12" (300mm) in any direction, with the preferred spacing being 6" (150mm). §6-1606.1B Fencing or other barriers shall be required around spillway structures having open or accessible drops in excess of 3' (900mm). §6-1606.1C Embankment and pond slopes generally should be no steeper than 3H:1V. For dam embankments exceeding 15' (4.5m) in height, a 6' to 10' (1.8m to 3m) wide bench should be provided at intervals of 10' to 15' (3m to 4.5m) in height, particularly if slopes are steeper than 3H:1V. Slopes steeper than 2.5H:1V shall not be permitted without approval by the Director.
Asheville, North Carolina Standard Specifications and Details Manual, 2000	§8.03.16 Access to the basin shall be prevented by a six foot high chain link fence with a locked entrance gate...The key to not fencing retention facilities is the design of specific safety measures to make basins reasonably safe under the full range of storm water conditions it is likely to encounter. §8.03.19 A trash catching device is to be installed on all outlets and such is to be easily accessible for removal of collected debris.

Title of Local Storm Drainage Regulation/ Ordinance Criteria	Pond Safety Measure Description/Quotation
Stormwater Management Manual City of Tulsa, Oklahoma Department of Public Works, 1994	<i>§1303.3.2 Outlet safety considerations include both the safety of the structure and safety to the public at the facility. The outlet works create a potential hazard when in operation due to the possibility of a person being carried into the opening. Grating or trash racks are often used; however a person can be forced against the grate or trash rack with substantial pressure, preventing escape. Low entrance velocities at the trash rack are recommended. Fencing or other effective measures should be provided to exclude people from potentially hazardous areas. Alternative measures include education, site grading, signing, planting of thorny shrubs, and grading for "safety ledges" along the pond perimeter.</i>
Metropolitan Nashville and Davidson County Stormwater Management Manual Volume 4 Stormwater Best Management Practice (BMP) Manual, 2002	<i>§PTP-02 The public's safety must be a foremost consideration. For the design of wet detention ponds, this usually takes place in the grading, fencing, landscaping, pipe cover, grating and signage.</i>
Construction and Materials Specifications Kansas City Metropolitan Chapter, American Water Works Association, 2003	<i>All openings shall be protected by trash racks, grates, stone filters, or other approved devices to insure that the outlet works will remain functional. No orifice shall be less than 3-inches in diameter. (Smaller orifices are more susceptible to clogging.)</i>
City of Snellville, Gwinnett County Development Regulations, Georgia, 2004	<i>9.8.3(c) A trash rack protecting an orifice shall have surface area of at least 10 square feet...No opening in the trash rack shall have an area more than one-half the size of the area of the orifice being protected. Two stage trash racks, or screens having progressively smaller openings placed in series, are suggested.</i> <i>8.7.1(e) The side slope in graded areas is recommended to be 3H:1V or flatter. When the depth of the permanent pool is greater than four feet and the slope is steeper than 4H:1V, a bench shall be provided. The bench shall have a slope of 10H:1V. The bench shall be located so that the permanent pool elevation is between the top and bottom edge of the bench.</i> <i>8.7.1(f) The minimum length: width ratio of the permanent pool shall be 2:1. The length shall be measured at the shortest flow path from the inlet to the outlet...the location of the outlet structure within the basin shall maximize travel time from the inlet to the outlet.</i>
Controlling Urban Runoff: A Practical Manual for Planning and Designing Urban BMPs, Thomas R. Schueler, Metropolitan Washington Council of Governments, July, 1987	<i>Wet ponds can be designed to minimize the risk of accidental drowning by keeping them relatively shallow, installing an underwater safety bench, avoiding any sharp drop-offs from shores, keeping side slopes gentle, and fencing off large diameter outfalls.</i>
Storm Drainage Design and Technical Manual, City and County of Denver, October 1999	<i>In the event that someone is trapped in a channel during flood flows, a trash rack will enable the individual to climb to safety and not be swept into the culvert.</i>
City of Aurora, Storm Drainage Design and Technical Criteria, January 2002	<i>Open Space Detention and Regional Detention Ponds Requirements:</i> <i>Side slopes shall be 4:1 or flatter.</i> <i>Trash racks for flood detention pond outlets must have a net opening area of at least four times the area of the outlet orifice, but in no event less than three square feet. Trash rack bar spacing shall not exceed six inches and shall be no larger than half the diameter or the smallest dimension of the outlet orifice.</i>
Delaware Erosion and Sediment Control Handbook for Development, Department of Natural Resources and Environmental Control, 1997	<i><u>Anti-Vortex Device and Trash Rack</u>—An anti-vortex device and trash rack shall [be] securely installed on top of the riser and shall be the concentric type as shown [in handbook].</i>

Title of Local Storm Drainage Regulation/ Ordinance Criteria	Pond Safety Measure Description/Quotation
Stormwater Management Basins and Their Maintenance, The Monmouth County Mosquito Extermination Commission, New Jersey, 1999	<u>Education</u> - <i>What Homeowners Can Do:</i> ...You can help by removing trash and debris from basin during dry periods. Do not enter basin during rain events.
California Stormwater BMP Handbook, Municipal, California Stormwater Quality Association, January 2003	<u>Inspection/Maintenance Considerations</u> —In order to maintain the pond's design capacity, sediment must be removed occasionally and adequate resources must be committed to properly maintain peripheral aquatic vegetation...and maintain effective pool volume.
Construction and Material Specifications, Kansas City Metropolitan Chapter, American Public Works Association, November 2003	<u>Section 5608.4E5</u> —Ponds shall be designed with a non-clogging outlet such as a reverse-slope pipe, or a weir outlet with a trash rack. <u>Section 5608.4E6</u> —All openings shall be protected by trash racks, grates, stone filters, or other approved devices to insure that the outlet works will remain functional. No orifice shall be less than 3-inches in diameter.

Many references commonly used by engineers also provide guidance specifically addressing safety issues associated with ponds. Excerpts from such manuals are presented in Table 2.

Table 2
Safety Excerpts from Representative Stormwater Guidance Manuals and Books

Title of Storm Drainage Manual	Pond Safety Measure Description
Evaluation and Management of Highway Runoff Water Quality (Publication No. FHWA-PD-96-032) U.S. Department of Transportation Federal Highway Administration, 1996	<i>The water depth at the perimeter of a storage pool should be limited to that which is safe for children. This is especially necessary if bank slopes are steep or if ponds are full and recirculating in a dry period. Restriction of access (fence, walls, etc.) may be a consideration if land availability dictates.</i>
Residential Storm Water Management: Objectives, Principles & Design Considerations Published by the Urban Land Institute, American Society of Civil Engineers and the National Association of Home Builders, 1977	<i>In creating urban ponds or lakes, certain special considerations are worthy of mention:</i> • Access to and along shorelines may be effectively limited to desired locations by planting thorny decorative shrubs. • Lake bottoms within ten feet of the shore should be so graded that water depth normally will not exceed eighteen inches to simplify immediate rescue of small children.
Design and Construction of Urban Stormwater Management Systems Water Environment Federation American Society of Civil Engineers, 1992	<i>Outlets for detention basins must be protected by trash racks.</i> <i>Outlet safety considerations include both the safety of the structure and safety to the public at the facility. The outlet works create a potential hazard when in operation due to the possibility of a person being carried into the opening. Grating or trash racks are often used; however, a person can be forced against the grate or trash rack with substantial pressure, preventing escape. Low entrance velocities at the trash rack are recommended. Fencing or other effective measures should be provided to exclude people from potentially hazardous areas. Alternative measures include education, site grading, signing, planting of thorny shrubs, and grading for "safety ledges" along the pond perimeter. (Note: this excerpt is also included in Tulsa Manual, referenced in Table 1).</i>

Title of Storm Drainage Manual	Pond Safety Measure Description
Urban Runoff Quality Management Water Environment Federation Manual of Practice No. 23 American Society of Civil Engineers Manual and Report on Engineering Practice No. 87, 1998	<i>When the facility is in operation, safety concerns need to focus on flow velocities, water depths, and keeping the public from being exposed to high-hazard areas. During dry weather periods, safety is enhanced by reducing the use of high vertical walls and steep side slopes. Outlets and inflow structures and adjacent areas require special attention, and ASCE suggests the use of thorny shrubs and trash/safety racks at all outlet orifices, pipes, and weirs.</i> <i>In configuring an extended detention basin, try to make these facilities an integral part of the community. Consider multiple uses, aesthetics, safety, and the way the facility will fit into the urban landscape. Also, maintainability is an important consideration. Although these basins provide passive treatment with no operational attention, continued successful performance will depend on good maintenance.</i>
Municipal Stormwater Management, Second Edition, Thomas N. Debo and Andrew J. Reese, 2003	<i>Full consideration must therefore be given to maintenance during the design process...Good stormwater management facility design practices recognize that all structures require periodic maintenance inspections and repairs.</i>
Urban Hydrology, Hydraulics, and Stormwater Quality, Engineering Applications and Computer Modeling, A. Osman Akan and Robert J. Houghtalen, 2003	<i>Detention basin length to width ratio should be no less than 3.0. The inlet, outlet, and side slopes must be stabilized to prevent erosion. Pond side slopes are usually limited to 3H: 1V or flatter. Outlets often require trash racks to prevent clogging...An emergency spillway provides controlled overflow relief for large storms.</i>
Water Resources Engineering, 1st Edition, Larry W. Mays, Arizona State University, 2001	<i>The outlet works are staged so that the water-quality design volume is released very slowly. The other stages provide storage and outlet peak discharges for erosion and flood control.</i>

SAFETY RACKS AT STORMWATER QUALITY BMPS, LONG UNDERGROUND PIPES, AND CULVERTS

Safety (trash) racks should often be integrated into the outlet structures for BMPs such as wetlands and swales. Although the primary focus of such facilities is water quality enhancement, designers must concurrently protect public safety.

The use of trash/safety racks at inlets to culverts and long underground pipes should be considered on a case-by-case basis. While there is a sound argument for the use of racks for safety reasons, field experience has shown that when the culvert is needed the most, that is, during the heavy runoff, trash racks often become clogged and the culvert is rendered ineffective. A general rule of thumb is that a trash/safety rack will not be needed if one can clearly "see daylight" from one side of the culvert to the other, if the culvert is of sufficient size to pass a 48" diameter object and if the outlet is not likely to trap or injure a person. By contrast, at entrances to longer culverts and long underground pipes and for culverts not meeting the above-stated tests, a trash/safety rack is necessary (UDFCD 2001).

CONCLUSION

Public safety must be carefully accounted for when planning, designing, and maintaining urban stormwater detention and retention facilities, BMPs, culverts, and other facilities. Failure to properly address these risks could leave all parties involved with their ownership, design, and

maintenance subject to legal liability in the event of injury or death. The potential risks are numerous and significant, but they can be managed. Indeed, the great paradox of designing safe stormwater detention and retention facilities is that if they are attractive, interesting, well maintained, and “inviting,” they will be regularly used by people of all ages, and this will promote public safety.

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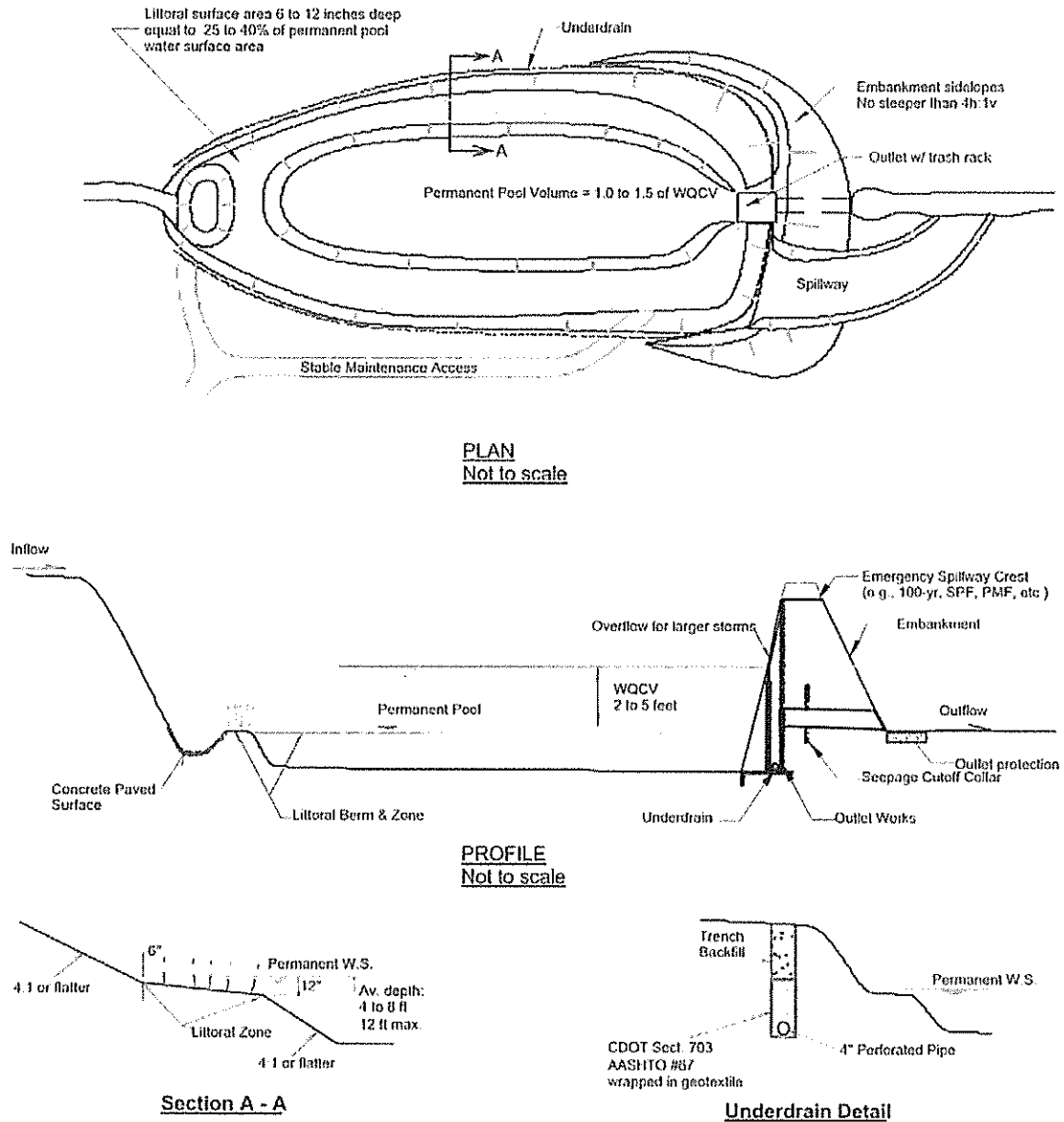


Figure 1. Retention Pond (Wet); Plan, Profile and Details

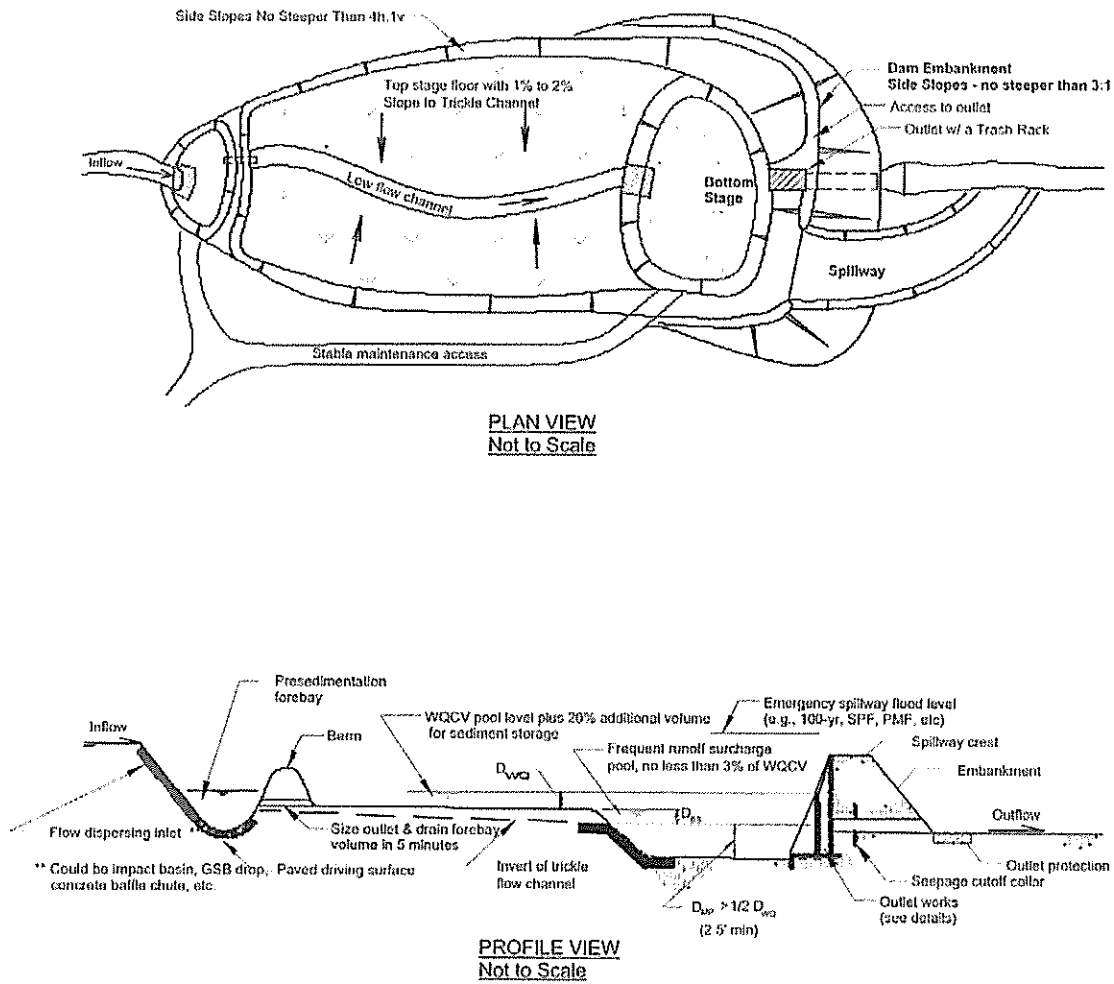


Figure 2. Plan and Profile of an Extended Detention Basin

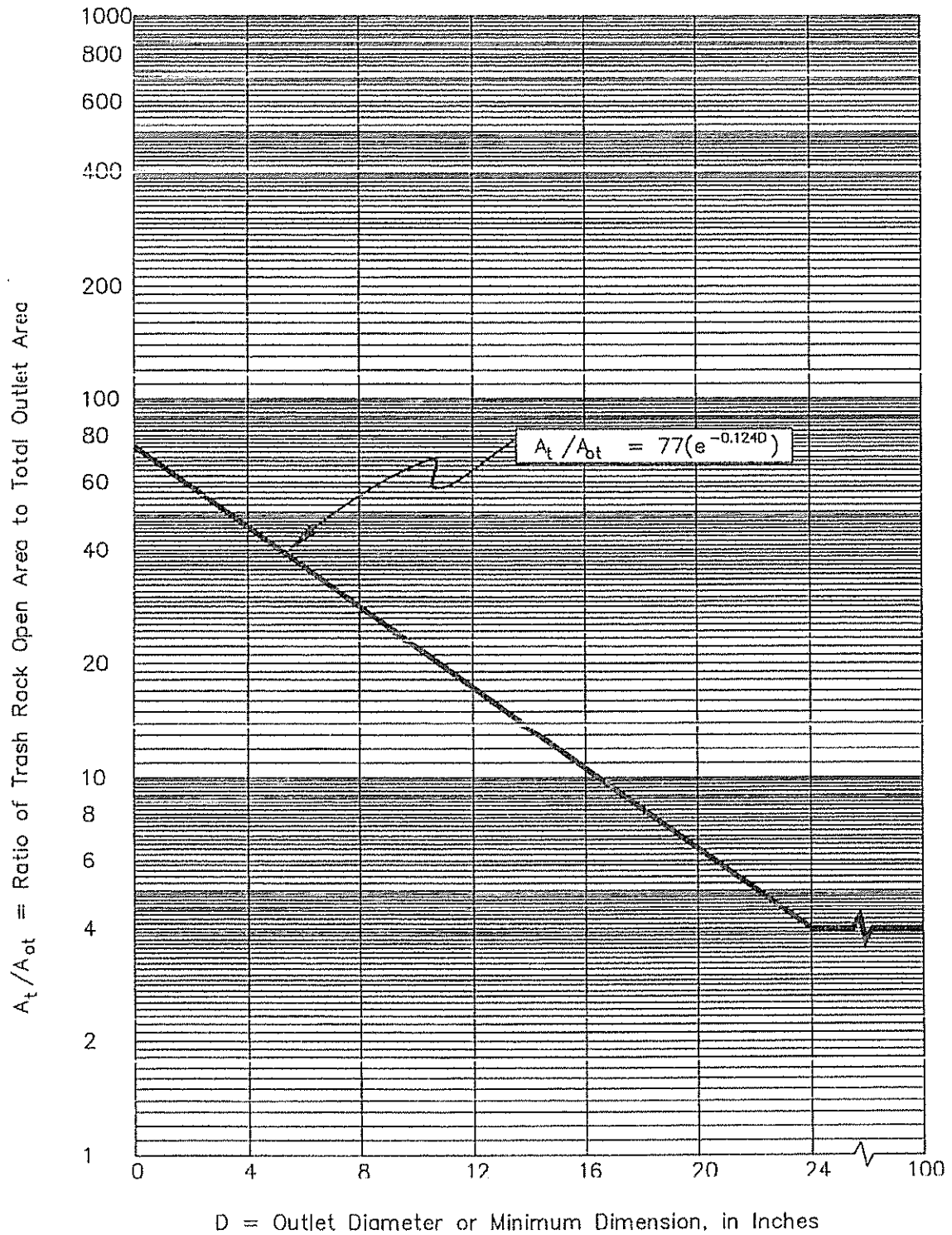


Figure 3. Minimum Trash Rack Open Area – Extended Range



Photo 1. Typical retention pond.



Photo 2. Typical detention pond.

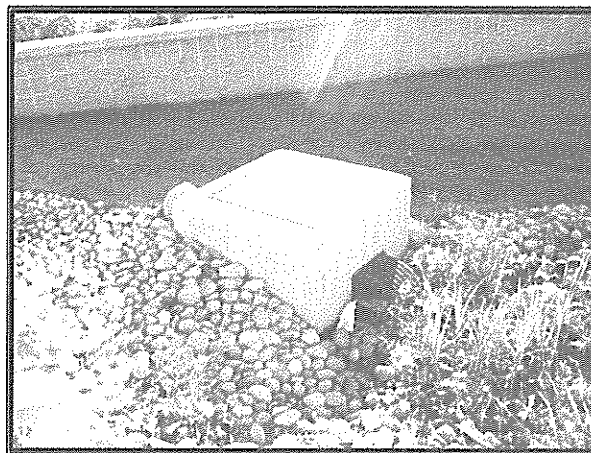


Photo 3. Detention pond outlet with trash/safety racks

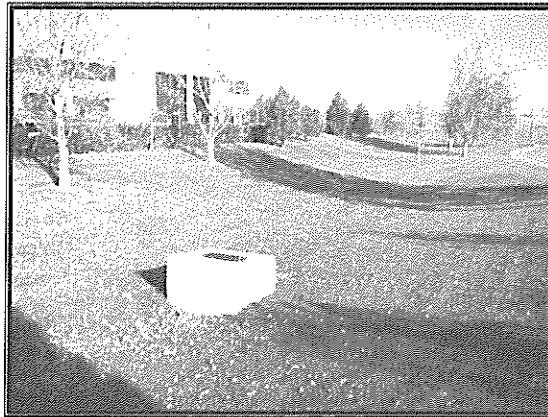


Photo 4. Detention pond with safe outlet, placed in middle of pond, with mild side slopes and good visibility from office building.

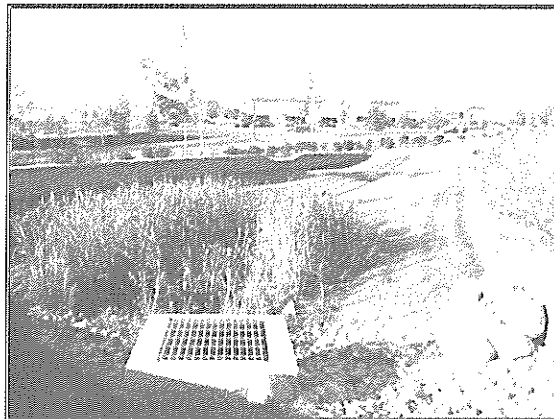


Photo 5. Wetland vegetation in pond bottom promotes water quality enhancement and tends to discourage public access, thus promoting safety.

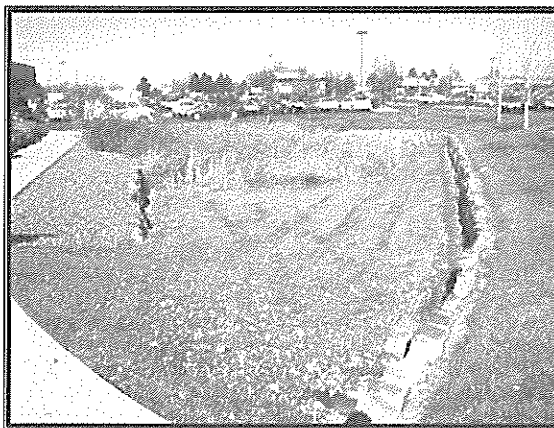


Photo 6. Limit the use of vertical walls in ponds, where feasible. Have mild sideslopes above and below walls, and use railings where appropriate.



Photo 7. Retention pond with various safety provisions, including mild side slopes and shallow water around full pond perimeter.



Photo 8. Fences have pros and cons as a safety measure; in general, do not rely exclusively on fencing for safety.



Photo 9. There is widespread recognition of public hazards associated with impoundments in urban areas and attempts to limit liability.



Photo 10. Trash/safety rack on drop inlet pipe at wet pond.



Stormwater plan has residents concerned

Newmarket Era

A pond can provide a scenic setting for a community, but residents of a Thornhill neighbourhood are concerned about a plan being considered to create a body of water in a nearby park.

Vaughan is evaluating a consultant's proposal to construct a stormwater retention pond in Gallanough Park, in the Yonge Street and Clark Avenue area.

The recommendation is one of several from the Thornhill storm drainage improvements study initiated after the August 2005 storm that created havoc across the region, particularly in Thornhill.

The current drainage system was deemed insufficient, with two large flows of water converging in the valley on Yonge Street, north of Centre Street.

Three suggestions made in the report include improving culverts, rehabilitating the road network and, possibly, creating the stormwater pond.

A city report last week recommended setting aside \$255,000 for work on the detail and design of the first phase of work. If approved, residents affected would then be sent notices.

Councillor Alan Shefman said he has already been fielding calls from residents worried about the changes, including that the pond could serve as a haven for mosquitoes carrying the West Nile Virus.

"(The plan) doesn't mean there will be standing water in the park," he said.

Mr. Shefman cautioned that all the city has in hand now is the consultant's reports and they are evaluating it and coming up with options.

Those could include building underground cisterns instead of a surface body of water, he said.

The cost of the facility, be it a pond or something else, is estimated at between \$1 and \$3 million, according to a letter from engineering and public works commissioner Bill Robinson.

The city requires all new subdivisions to include stormwater retention ponds and, over the years, they have evolved from utilitarian reservoirs to attractive features.

A pond in Thornhill Woods has a fountain to ensure the water is not a haven for insects, for example.

Residents of an older neighbourhood, such as this one, may not be used to the concept, Mr. Shefman said.

"People are getting hysterical over a recommendation. This is not even at our own engineering department," he said.

"We're nowhere near deciding what to do."

"I have many concerns and unanswered questions about this proposal," said one local resident who did not want to be named.

She said she read the final report, which came out in February, on two occasions.

She has since e-mailed her concerns to city officials.

The most recent public meeting about the flooding issues was held in December, but Gallanough Park was not mentioned in the notice sent to homeowners directly affected by flooding, she said.

The report is publicly available at the Bathurst Clark Library and contains a map showing the proposed pond taking up most of the large, grass field south of the centre and east of the main playground.

Though the Gallanough Resource Centre and Thornhill Public School are nearby, the report only looked at engineering concerns.

Vaughan's staff and councillors will look at social and other possible effects of whatever measures are introduced, Mr. Shefman said.

"We will look at several option and assess all these issues," he said.

In the meantime, it is hoped work on the roads and culverts can begin by late summer or early fall, Mr. Shefman said.

HAVE YOUR SAY

Is the stormwater plan a good idea for Thornhill? E-mail kchampion@yrmg.com

COMMITTEE OF THE WHOLE – MARCH 3, 2008

LIFE SAVING STATIONS IN STORM WATER MANAGEMENT FACILITIES

Recommendation

Councillor DiVona, Chair Safe City Committee, in consultation with John Caruso, Chief Fire Prevention Officer, Andrew Pearce, Director of Development/Transportation Engineering, and Joseph Chiarelli, Manager of Licensing/Risk Management, recommend:

1. That the City of Vaughan Council approve of the recommendations contained herein as to the introduction of "life saving stations" in storm water management facilities throughout the City of Vaughan;
2. That Staff be directed to finalize an implementation, operational, and financial plan to equip each storm water management facility in the City with lifesaving stations, and report back to a future Committee of the Whole meeting in the next 30 days; and
3. That the City of Vaughan Council approve of the proposal to amend the "adopt a park" program to provide for "adopt a pond" for all existing ponds.

Economic Impact

There are no immediate budgetary impacts resulting from the adoption of this report and the new safety standard.

However, should Vaughan Council approve of the life saving stations as a new standard for safety, it will result in the revision to the design criteria as contained within the subdivision agreements and life savings station costs will be absorbed by the developer. Currently, the design criteria provides for signage. This is the funding practice used by the City of in Brampton for all "new" and "unassumed" swm facilities and being recommended for the City of Vaughan.

It is further recommended that Vaughan Council should advance the life saving stations to cover all swm facilities. Should Vaughan Council approve of the life saving stations as a new standard for safety, abutting property owners and the public will be offered an opportunity to "adopt a pond" and pay the estimated \$350 cost for the installation of the life saving station for those swm ponds that have already been assumed by the municipality using the guidelines and principles of the "adopt-a-park" program.

Existing maintenance levels are to be maintained. However, during the normal or regular maintenance periods it is requested that the safety audit form be completed which requires a visual 3 point inspection. Should any damage or stolen safety device exist, it is expected that we keep a supply of the life savings station device(s) .

Annual safety audit of all storm water management ponds by Engineering and Parks Maintenance Departments. As swm facilities have been constructed over the past few decades at varying standards, it is necessary, with or without this recommendation, to ensure the necessary signage exists, and consider life saving stations with those facilities in older established areas. A further report will come forth in one year to address the results of the inspections of the older swm facilities and any implication.

Communications Plan

There will be no communications plan required resulting from the adoption of this report.

Purpose

The purpose of this report is to provide Council with information on a new initiative for the City of Vaughan similar to that of a neighbouring municipality (Brampton) to equip storm water management facilities with lifesaving devices and to receive direction with respect to staff reviewing and implementing this practice in Vaughan.

Background - Analysis and Options

Storm water management techniques are necessary to mitigate the effects of urbanization on the hydrologic cycle, and have been incorporated as part of the municipal services in new development in the City since the early 1980's. Currently, the City owns approximately 120 storm water management facilities. It is anticipated that through further development within the City, an additional 80 SWMF will be constructed over the next 20 years.

Properly designed storm water management plans maintain the existing hydrologic cycle while protecting water quality and preventing increased erosion and flooding. Typically, storm water management plans employ a treatment train approach, which uses a combination of lot level, conveyance and end-of-pipe (storm water management facility) measures. The form, function and design of SWM facilities have evolved over time. Initially, SWM facilities were regular shaped and designed to detain storm water as a means of preventing down stream flooding. Today, SWM facilities are integrated as focal features in new communities and are designed to meet a multitude of objectives including water quantity, quality and erosion control. Over the years, safety has been an important consideration in the design of each SWM facility.

In 1994, the MOE published a document entitled "Storm Water Management Practices Planning and Design Manual" which provided technical and procedural guidance for the planning, design and review of SWM facilities. This document was subsequently updated in 2003 and is currently considered the primary resource/design manual for storm water management facilities by engineers and review agencies. In accordance with the Provincial, City, Conservation Authority, and industry standards, the design of new storm water management ponds must incorporate numerous public safety features including:

- Grading near the edge of the permanent pool is to be terraced with gentle slopes to minimize the potential for any person to fall into the water;
- The maximum depth of the permanent pool is generally between 1.0 and 1.5 metres deep;
- Perimeter fencing is provided along the property lines of residential, commercial and industrial or institutional lands where they abut a storm water management pond block;
- Warning signs are placed near pedestrian traffic routes or walkways located near the perimeter of a storm water management pond;
- Dense landscaping is strategically placed near structures and areas of steeper topography to restrict access and to act as a fall arrest;
- Many SWM facilities have extensive public frontage to ensure that the interior of the facility can be seen by motorists and pedestrians;
- All structures are equipped with the necessary grates and handrails;
- Side slopes between 3:1 and 7:1 which are easily accessible by foot; and
- Pedestrian and vehicular accessibility.

Notwithstanding the above inherent safety design features, there is still a potential risk that a member of the general public, in particular a child or youth, could stray into the permanent pool area of a SWM facility and may need assisted extraction. In consideration of this potential situation, the Safe City Committee has recommended that the City explore the feasibility of equipping each SWM facility with lifesaving stations. In addition, the Safe City Committee has suggested that the following procedure could be adopted:

- The initial audit of all ponds and storm water maintenance ponds was completed by their Engineering Department. This included identifying locations and size of the ponds and number of safety stations required.
- The installation of the safety stations was completed by outside contractors or internal staff.
- Inspections are carried out on a by-weekly basis by their Parks Service Personnel who then complete inspection forms and maintain the records. (VFRS anticipated Enforcement Services would look after this).
- Inspectors will keep an inventory of parts and equipment on hand for replacement purposes.
- Inspectors will complete a work order for damaged stands, signs etc and submit to their Supervisor for processing within 24 hrs.

Insurance and Risk Management Considerations

The City of Vaughan insurance carrier has been contacted by the Manager of Licensing, Mr. Joe Chiarelli and has submitted a few comments.

The City of Vaughan is required to ensure signage is properly and sufficiently displayed. Currently, new subdivisions include signage requirements at storm water management facilities. Sample signage is attached #4 for Engineering Department to review and consider for inclusion within the design guidelines within subdivision agreements.

The City of Vaughan would be required to ensure that a plan is established to regularly maintain storm water management facilities. Currently, swm facilities are maintained on a regular cycle. The City of Vaughan would be required to include within any regular inspection the inspection and maintenance of the life savings station, i.e. replace the life pole, ring or rope. A sample of the Brampton Parks Department, "safety station inspection" report is attached showing the three point visual inspection requirement. See attachment 5.

No further concern has been raised by the insurance company or Licensing Department.

Relationship to Vaughan Vision 2020

In consideration of the strategic priorities related to Vaughan Vision 2020, the recommendations of this report will assist in:

- The pursue of excellence in service delivery;
- Enhancing and ensuring community safety, health and wellness; and
- Demonstrating leadership and promoting effective governance.

This report is therefore consistent with the priorities previously set by Council.

Regional Implications

There will be no Regional implications resulting from the adoption of this report.

Conclusion

The permanent pool in most storm water management facilities in the City presents a potential risk (water hazard) to the general public. To mitigate this risk, it is recommended that staff investigate the feasibility of equipping each storm water management facility in the City with

lifesaving stations and report back to a future Committee of the Whole meeting. The feasibility study shall include consideration for the operational, financial and liability implications of implementing such a program.

Attachment

1. Storm water Management Pond Summary
2. Life Saving Stations Components and Criteria- John Caruso, Chief Fire Prevention Officer
3. City of Vaughan Storm Drainage and Stormwater Management Master Plan
4. Proposed signage for Life Savings Stations and signage requirements.
5. Safety Station Inspection form.

Report prepared by:

Bernie DiVona, Councillor Ward 3
John Caruso, Chief Fire Prevention Officer
Andrew Pearce, Director of Development/Transportation Engineering
Joseph Chiarelli, Manager of Licensing/Risk Management
Michael Frieri, Supervisor of Engineering Planning and Studies

Respectfully submitted,

Bernie DiVona
Councillor – Ward 3
'Working for You'

ATTACHMENT No. 1

STORMWATER MANAGEMENT POND SUMMARY

Assumed Dry Ponds	20
Assumed Wet Ponds	52
Proposed or Constructed (Unassumed) Wet Ponds	50
Potential New Retrofit Wet Ponds	20
Regional OPA 19 - West Vaughan Enterprise Zone Estimated Future Wet Ponds	12
Urban Expansion Area (City Limits) Estimated Future Wet Ponds	48
Total Estimated City-Wide Ponds	202

Attachment (2)

**City of Vaughan Storm Drainage and Storm
Water Management**

Components:

- 1 stand 10' in concrete footing
- Ring bouy with 50'ft of rope
- Sign with international symbols

Criteria:

Storm drainage and storm water management should be place approx 150 ft Apart?, and above the possible maximum water level with a minimum of 2 stations per site.

Inspections:

Bi- weekly all year round.
Repairs or replacements should be accomplished within 24hrs.
Documentations should be noted to i.e. Parks.

Budget:

Labour cost to put concrete footing
Equipment
Capital Start up for existing Ponds

The supplier is Aquam Specialiste Aquatique inc.
5500 Fullum suite 100
Montreal, Que
H2G 2H3
Tel # 514-948-4878

John Caruso

Chief Fire Prevention Officer

CITY OF VAUGHAN STORM DRAINAGE AND STORMWATER MANAGEMENT MASTER PLAN



Attachment #3

DRAFT

- LEGEND**
- CITY BLOCK MAPS
 - EXISTING PROPERTY SEGMENT
 - PROPOSED DEVELOPMENT
 - PROPOSED EXISTING
 - PROPOSED NEW PAVES
 - ADJACENT CITY PARKS
 - PROPOSED PARKS
 - EXISTING POTENTIAL FOR IMPROVING

City of Vaughan
Storm Drainage and Stormwater Management Master Plan
Attachment #3

VAUGHAN
City of Vaughan
Storm Drainage and Stormwater Management Master Plan
Attachment #3



WARNING



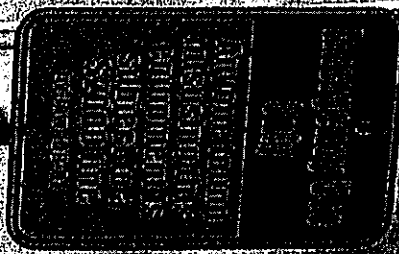
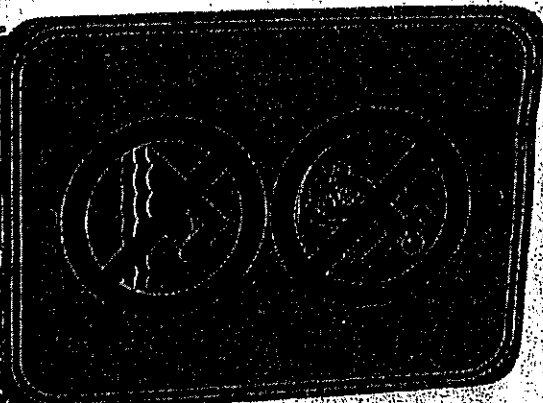
**CONDITIONS IN THE
STORM WATER POND
CAN CHANGE RAPIDLY
INCLUDING FLUCTUATING
WATER LEVELS AND THIN ICE
SKATING & SWIMMING
ARE PROHIBITED**

By-Law 89-161

UNAUTHORIZED
MOTOR
VEHICLES

BY LAW 161-83







Attachment 5

SAFETY STATION INSPECTION

PERFORMED BY: _____

DATE: _____

LOCATION	# OF STNS	LIFE POLE		LIFE RING		ROPE		REPLACE/COMP DATE	SIGNATURE
		MISSING	PRESENT	MISSING	PRESENT	MISSING	PRESENT		
NORTH	Hilldale S.	1							
	Hilldale N.	1							
	Maitland N.	2							
	Maitland S.	2							
	Manitou	1							
	Prof's Lake	8							
	Castlemore S.	1							
	Ezard	1							
	Major Oaks	1							
	Ken Park	1							
	Chesham	1							
	Donnelly East	1							
	Lonfer's Lake	2							
SOUTH	Birchbank	1							
	Victoria	1							
	Aloma	1							
	Balmoral	1							
	Clarke	2							
	Crawley	1							
	Norton	4							
	Parr. L. N.	4							
	Parr. L. S.	3							
	Centennial	2							
	Eldorado	2							

URGENT - Please Read

Keep Gallanough Park Safe for Families

We want an underground stormwater reservoir

What is happening to Gallanough Park?

This winter, the City of Vaughan plans to convert Gallanough Park into a stormwater detention pond. If there is a heavy rainfall it will fill with up to 12 feet of water until it can be drained by the storm sewers.

Why is this dangerous?

- ▶ Creates a drowning risk for nearby children at the playground, preschool and elementary school
- ▶ Deposits industrial and biological contaminants in a popular park used by kids, residents and pets
- ▶ Creates a breeding ground for mosquitoes and West Nile Virus

There is a better solution

The city can fix the problem properly. The most effective way is to bury the stormwater reservoir. This will protect children and residents. Despite universal resident support for this option, the city proceeded with the current plans to save money.

Get involved

1. Follow our blog and get info on our petition at www.savegallanoughpark.wordpress.com
2. Call our councillor, Alan Shefman, and let him know your view at 905-709-1163
3. Make your views known at City Council Sept. 2 starting at 11 am, 2141 Major Mackenzie W



**Example of drowning risk from
detention ponds**

Swatara Township officials clash over mosquitoes infected with West Nile Virus

By Monica Von Dobreneck | Special to PennLive
on August 13, 2014 at 10:28 PM, updated August 14, 2014 at 8:55 AM

... positive results from mosquitoes in a detention pond in the Oakleigh area of the township ...

**West Nile was found in a detention
pond in another community**



**Current state of sports fields at
Dufferin Clark Community Centre**