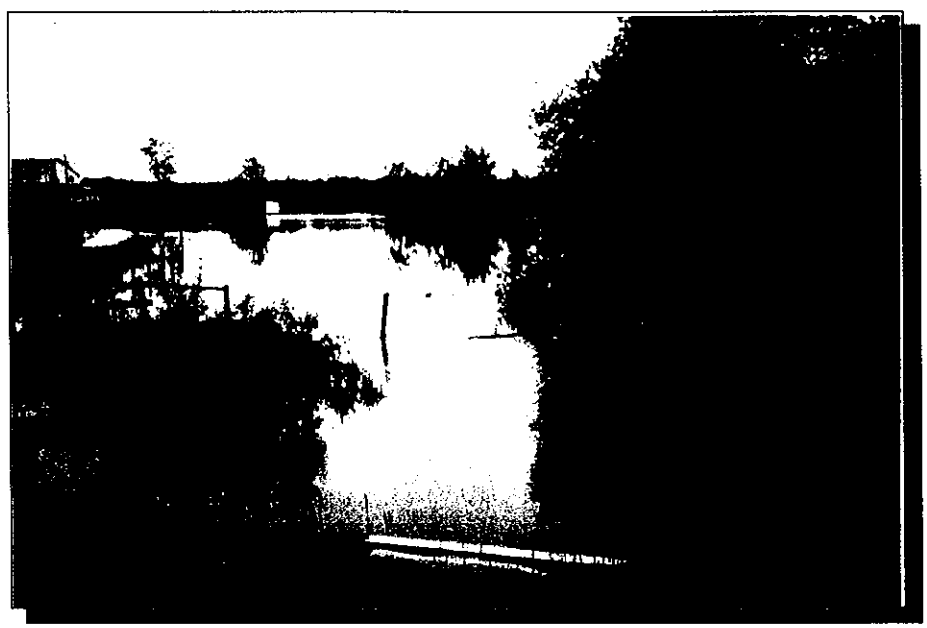
SUMMARY REPORT

BIG LAKE BASIN TASK FORCE

Big Lake Stormwater Management Plan



ASSOCIATED ENGINEERING

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INTRODUCTION

SECTION 1

1.1 BACKGROUND

The Big Lake Basin Task Force retained Associated Engineering, together with Sameng Inc., to investigate drainage problems in the Big Lake Basin and to recommend stormwater drainage guidelines for the Basin.

The Big Lake Basin encompasses an area of 3,500 km^2 to the west of the City of Fort Saskatchewan. It is composed of 8 municipalities located within a major metropolitan area approaching one million people. Land uses are a mix of agricultural, urban, country residential (acreage), and recreational development.

These kinds of development pressures inevitably put stress on the natural drainage systems. The basin is relatively flat and poorly drained and has limited outfall channel capacity. Drainage and flooding problems have been occurring in the basin including:

- flooding along Atim Creek,
- drainage problems in tributary streams,
- flooding around Big Lake,
- increasing runoff due to development,
- encroachment of landowners and developments into the floodplains of the drainage system,
- problems of water quality in St Albert.

Big Lake itself is a large and significant waterbody of regional significance and is subject to a host of environmental issues and public concerns including water quality, waterfowl, flooding, and encroachment of development.

The major issue in the basin is the lack of a clear understanding of the impact that agricultural drainage or urban development may have on flooding in the basin. There is a need for an adequate guideline that specifies how to deal with development applications and the runoff from these developments. Because a clear guideline does not exist, the developers and regulatory agencies have become frustrated.

1.2 PROJECT OBJECTIVES

The overall objective of the present study is to develop a stormwater management plan with long-term solutions for the Big Lake Drainage basin from Lac Ste. Anne to the North Saskatchewan River. Specific objectives of the study are to:

- review the hydrology and drainage reports completed to date,
- present a number of potential options and recommendations for long-term solutions that meet the needs of the member municipalities,
- provide direction to the member municipalities and Alberta Environment for setting stormwater management requirements in future developments.

Generally, the goals of the stormwater management plan are to:

- facilitate orderly development,
- prevent flooding problems downstream of development areas,
- protect the environment (water quality, drainage and flooding),
- plan for future generations.

The member municipalities have created a Task Force to direct the study, as well as a technical committee which will advise the Task Force. A major objective of the study is to work with the technical committee to try to reach a consensus that meets the needs of the member municipalities.

1.3 PROJECT SCOPE

Broadly speaking, the project involves the following tasks:

- preliminary discussions with member municipalities,
- review background data,

- interviews with the key stakeholders in the member municipalities to define and confirm project issues,
- preliminary evaluation of drainage issues at a screening level of detail to define which options are worthy of further consideration,
- review findings with the technical committee,
- technical analysis that includes modelling of alternatives to define their hydrological impacts,
- develop a draft stormwater management plan for the basin which includes a combination of structural measures and floodplain management/land use policies,
- provide interim results to the public through a series of public meetings and presentations to the municipal councils,
- document the analysis and make recommendations in a final report.

CONCLUSIONS AND RECOMMENDATIONS

SECTION 7

7.1 CONCLUSIONS

7.1.1 Flooding Issues

- The floodplain includes all areas along the water course that are flooded during a 1:100 year design event plus a 0.5 m safety factor: the channel, the floodway (the deeper, faster-flowing areas along the channel), and the flood fringe (the shallower and slower-flowing areas outside the main channel). The channel and floodplain must be considered as one.

- Floodplains provide several important functions which must be protected and preserved including:
  - conveyance of flood peaks,
  - storage of flood runoff to reduce the downstream peaks,
  - important wildlife habitat and wildlife corridors.

- Flooding of the floodplain is a natural occurrence; the channel banks are typically overtopped in the 1:2 year flood even with pre-development basin conditions. Problems arise when development occurs within the natural floodplain.

- Encroachment, infilling, and development within the floodplain has occurred and is occurring within the basin and includes:
  - agricultural (eg: haylands/grasslands/buildings),
  - recreational (eg: golf courses/parks),
  - roads (eg: culverts/fills),
  - rural (eg: acreages/industrial),
  - urban (eg: residential/commercial/industrial).

- Most debris and silt accumulation and beaver damming, which may increase the amount of flooding within the floodplain, are natural processes.

- Historically, extreme basin flood events tend to be caused by spring runoff rather than rainfall events. After development, urban areas generate most of their runoff during the summer months.

- Older urban areas which were developed without stormwater management can increase the summer flood peaks and base flows. Some of the resulting impacts are now being addressed through the development of stormwater management facilities as opportunities arise.

- All new urban and rural developments are proceeding with stormwater management. Development with stormwater management results in:
  - control of peak flows to the pre-development rate during the major, infrequent events,
  - increased duration and volume of flow.

7.1.2 Pre-development Discharge Rates

- Pre-development runoff rates vary with the basin size. For the Big Lake basin, the following peak discharge rates have been determined in Table 7.1:

Table 7.1
Regional Flood Discharge Rates for the 1:100 Year Flood

Effective Drainage Area (km^2)	1:100 Year Unit Flow (L/s/ha)
1	10.3
10	4.6
100	2.1
1000	0.9

- For areas the size of Stony Plain and Spruce Grove (approximately 25 km^2), the pre-development flows are approximately 2.5 L/s/ha.

7.1.3 Stormwater Management

- Some form of stormwater management is required for all forms of development including:
  - agricultural,
  - recreational,
  - roadways,
  - rural development,
  - urban development.

- Stormwater management can consist of:
  - urban stormwater management ponds,
  - ditch controls and flow restrictions,
  - routing to natural storage areas and sloughs,
  - local storm water management ponds,
  - regional storm water management ponds,
  - channels, streams, creeks, rivers and lakes.

- The rate of release should not exceed the sub-basin pre-development rate and the downstream floodplain capacity. A stormwater management pond release rate of 2.5 L/s/ha is a reasonable balance between pond sizing and operation and downstream impacts.

  Release rates lower than 2.5 L/s/ha would result in:

  - extended drawdown times exceeding 8 days for a major storm event and an increased risk of back-to-back storm events overloading the stormwater ponds,

  - increased operation and maintenance requirements and safety and aesthetic issues due to more frequent and extended ponding,

  - increased costs to homeowners due to increased pond sizes and increased cost of development servicing.

Release rates higher than 2.5 L/s/ha would result in:

- a small cost savings to developers, but
- higher downstream flows and increased risk of flooding.

7.1.4 Results of Development

The basin modelling indicates that:

- Some increase in flooding will occur along Atim Creek regardless of the discharge rate used to control runoff from urban development. Therefore, some erosion control and protection of existing homes may be required along Atim Creek, and the floodplain will need to be protected against further infringement.

- Big Lake provides significant natural attenuation to flows from the basin upstream of the lake. Peak flood levels on Big Lake are not materially affected by urban drainage that has occurred or is anticipated in the foreseeable future. However, flood levels could increase with:

  - sedimentation or encroachment within the outlet channel and floodplain,
  - encroachment into the floodplain of Big Lake or the floodplains upstream of Big Lake's outlet channel,
  - agricultural drainage improvements and acreage development if these were conducted without stormwater management (preliminary indications are that peak flood levels could rise by about 0.3 m and peak flows out of Big Lake could increase by as much as 30%).

  It follows that these developments should be monitored and regulated to ensure that their impacts are minimized.

- Urban development will increase the base flows in the basin which may be a benefit to the ecology of the river and lake system.

- Increasing the stormwater management release rate from the present standard of 1.2 L/s/ha to a value of 2.5 L/s/ha will reduce the cost of constructing stormwater management facilities in a typical urban area by about $200 per lot. Part or all of these savings could be collected as a development charge to pay for channel improvements and the purchase of floodplain lands.

7.1.5 Floodplain Protection

- Existing policies, regulations and standards for regulating land use and development provide some protection of the floodplain, but these regulations do not adequately reflect the ecological and hydrological value that the floodplain provides. There is opportunity for greater consistency in policy approaches.

- Based on observations made in the public open houses, there is awareness by the public of the value of the floodplains and the need to control development within them. This understanding may need to be expanded to include the wider public beyond those who attended the open houses.

  However, there is a general lack of awareness regarding provincial and federal legislation and regulations and the provisions within various Municipal Development Plans and Land Use Bylaws that need to be complied with when considering land use and development within floodplain areas.

- A land use bylaw is the most effective planning tool in regulating land use and development within floodplain areas. If all the member municipalities adopt common provisions and if the public is made aware of the restrictions within the bylaw, it will become a more effective tool.

- Acquiring or protecting lands through environmental and municipal reserve dedication, environmental reserve easements, conservation easements, purchase or ecological gift provides the highest level of protection and control of floodplain lands.

7.2 RECOMMENDATIONS

Associated Engineering recommends that the Big Lake Task Force and the member municipalities adopt the following:

7.2.1 Flooding Issues

- The floodplain shall include all areas along the water course that are flooded during a 1:100 year design event plus a 0.5 m safety factor and includes the channel, the floodway and the flood fringe.
- The floodplain areas must be protected and preserved.
- Development within the floodplain must be strictly controlled to ensure that it is safe from flooding and that it does not cause upstream or downstream impacts.
- Land use policies and planning tools must be implemented consistently throughout the basin to protect the flood plain.
- Selective work should be considered to protect historic development within the floodplain where it is cost-effective to do so. These works could include:
  - diking and debris removal,
  - channel excavation,
  - purchase of flood-affected properties,
  - flood-proofing of buildings.

7.2.2 Stormwater Management

- All developments should be required to provide stormwater management including:
  - agricultural,
  - recreational,
  - roadways,
  - rural development,
  - urban development.

- A release rate of 2.5 L/s/ha is recommended for stormwater management in the Big Lake basin on the basis that:
  - it is consistent with pre-development flows in the basin,
  - it represents the lower limit of pre-development flows for areas the size of Stony Plain and Spruce Grove,
  - it minimizes the operation and maintenance problems with stormwater management facilities while providing for improvements to water quality,
  - it is consistent with historic drainage facilities in the basin.

- Older areas which were developed without stormwater management should be provided with stormwater management facilities or their impacts should be mitigated.

- A mechanism should be developed whereby the various municipalities could cooperate in drainage improvements and purchase of floodplain lands for mutual benefit outside their municipal boundaries.

7.2.3 Floodplain Management

- A detailed floodplain map should be developed for Big Lake and other areas along the Sturgeon River, Atim Creek and tributary streams consistent with the following principles:

  - develop-single zone floodplain mapping (ie: with no distinction between the floodway and flood fringe areas),

  - provide adequate freeboard in regulating development to allow for the potential impacts of future land use changes, for morphological changes (channel erosion or siltation), and for limitations in predicting these changes and their impacts,

  - include an additional buffer to provide for ecological protection,

  - provide that site-specific flood studies may be required at the discretion of the municipality.

- The recommended design flood level in Big Lake should be no lower than 654.18 m, which includes an allowance of 0.5 m as a safety factor for historical flood events. The Municipal Government Act provides that land subject to flooding may be taken as environmental reserve by the municipality upon subdivision. All lands, regardless of zoning or land use, below the flood level should be treated as though they were zoned ER (i.e. no filling, development, or modification except as permitted in Environmental Reserves). These restrictions should be formalized in a Floodplain Overlay adopted by all the member municipalities within their land use bylaws. New buildings above this line should be required to provide additional freeboard, no less than 0.5 m to the floor elevation (i.e. minimum floor elevation of 654.68 m). No basements should be permitted below the elevation of 653.68 m and no openings should be permitted below an elevation of 654.18 m.

- The recommended design flood level along rivers, creeks and streams within the basin should be no lower than the 1:100 design event plus a 0.5 m factor of safety for historical flood events. All lands, regardless of zoning or land use, below the flood level should be treated as though they were zoned ER (i.e. no filling, development or modification except as permitted in Environmental Reserves).

- A consistent floodplain overlay should be adopted by all the member communities within their statutory plans and Land Use Bylaws as a tool to regulate land use and development within the floodplain. The floodplain overlay should contain:

  - a consistent set of goals and objectives that member municipalities can agree upon (the *Principles for Nature Conservation and Land Development Around Big Lake* prepared by the Big Lake Project Conservation Team is a good starting point),

  - a list of permitted, prohibited, and discretionary uses,

  - regulations to deal with historical land uses that do not conform to the proposed land uses.

- No development or filling should be permitted within the floodplains except for specifically defined land uses (passive parks, drainage facilities, and road crossings perpendicular to the floodplain).

- Floodplain lands are to be identified as environmentally sensitive lands to be dedicated as environmental reserve at the time of subdivision. Floodplain areas should be protected and left in the natural state and not used in a way that would jeopardize the environmental sensitivity and flood drainage capacity of the lands.

- In the absence of a recognized floodplain study to define the precise floodplain limits the floodplain overlay should apply to the entire parcel within which the floodplain lies.

- It would also be beneficial to develop a consistent protocol for taking environmental reserve in floodplains areas, including buffers within upland areas along the top of the bank, when the surrounding lands are developed.

- Purchase of land or conservation easements by the provincial government, individual municipalities, non-governmental organizations such as Ducks Unlimited, and other private land trusts should be encouraged to ensure that floodplain areas are protected and remain in a natural state.

- The Province of Alberta should be approached to fund the development of a Water Management Plan as defined by the Water Act for the Big Lake Basin and include the recommendations of this report.

- The Province of Alberta should be approached to fund the development of the detailed floodplain map and include the recommendations of this report.

- The Big Lake Task Force should consider a request to the Province to create a Provincial Park to protect and preserve the floodplain of Big Lake which includes the Atim Creek lowlands on the west side of Big Lake, extending as far west as Century Road.

- The Province of Alberta should be approached to fund the installation of stream flow gauges on the Sturgeon River, Atim Creek, Big Lake, and Carrot Creek to provide additional flow data and to monitor the future impacts of development.