

October 30, 2003

File No.: 424-001(101)

Bemoco Land Surveying Ltd.
21, 7895 49th Avenue
Red Deer, Alberta
T4P 2B4

Attention: Mr. Bob Smitten

**Re: Storm Water Modeling - Berg Subdivision, Lacombe County
Part of S.E. ¼ Sec. 15, Twp. 41, Rge.26, W. 4 Mer**

Overview

We have completed a storm water management study for the above proposed country residential subdivision. The results of our study are summarized herein.

The study area is located within the S.E. ¼ Sec. 15, Twp. 41, Rge. 26, W. 4 Mer. and is approximately two miles north and two miles east of Lacombe, Alberta. It is proposed to subdivide a single lot out of the study area. The proposed subdivision will create one (1) lot containing existing development (dwelling and outbuildings) with the remainder of the existing lot staying in an undeveloped condition. Lacombe County has requested that a development concept for the remaining lands complete with a storm water management plan be prepared.

The study area, as well as lands which drain into the study area from the south were analyzed. A total area of 32.30 ha. (79.81 ac.) was modeled. The total area within the parcel from which the single lot is to be subdivided is approximately 24.25 ha. (59.92 ac.). Currently, the proposed subdivision consists of one (1) lot containing an existing dwelling and out buildings. Prior to approving the subdivision of the single lot, Lacombe County requested a development concept for the remaining lands. The conceptual subdivision of future lands shows the potential for a total of seventeen (17) country residential lots, ranging in size from 1.22 ha.(3.0 ac.) to 1.85 ha.(4.57 ac.).

Approximately seventy three percent of the study area is treed. The existing topography is divided into three drainage basins. The relief in these drainage basins ranges from 6.0m to 24.0m. The lands are characteristically sloped from south to north.

Please refer to Figure PRE - Pre Development Condition illustrating drainage patterns for the pre-development condition of the property, and Figure POST - Post Development Condition illustrating drainage patterns for the post development condition of the property if further subdivision is completed to create a total of seventeen (17) residential lots. Drainage patterns that exist in the pre development condition are maintained in the post development condition.

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Modeling

The storm water management model was completed by Mr. George Fitzner, P.Eng. Using the Visual 2000 SE SWMM Ver. 7.12 computer model.

The drainage characteristics of the property and assumed improvements were evaluated for a 1:100 year - 24 hour design storm with “Chicago” distribution and an ‘r’ factor of 0.3. Rainfall Intensity-Duration-Frequency (IDF) data for Lacombe was provided by Atmospheric Environment Service (AES) of Environment Canada.

The study area was divided into 17 catchment areas. Figure POST - Post Development Condition delineates each of the catchment areas. The required inputs for each catchment area are the total area, percent of the area considered impervious, width, slope, Horton’s infiltration parameters, and depression storage coefficients. The following are a listing of the various parameters used by the model:

- o Depression Storage
 - o Impervious Area 1.0mm
 - o Pervious Area 3.0mm
- o Manning’s ‘n’
 - o Impervious Area 0.015
 - o Pervious Area 0.4
- o Horton Infiltration Parameters
 - o Maximum Infiltration Rate (F₀) 162.5 mm / hour
 - o Minimum (Asymptotic) Infiltration 9 mm / hour
 - o Decay rate of infiltration 0.00115 1/sec
- o Basin Widths (W)
- o Area (sq.m.) / Length of run (m)

When calculating the percentage of the lot area that is impervious we assumed that:

- o each lot would have one (1) home of roof area 232 m² (2,500 ft²);
- o a drive way of average 55 metres length and 5.5 metres width would be constructed on each lot;
- o each lot has a lawn area of 500 m² (5,382 ft²);
- o the remainder of each lot is assumed left in tree cover:

Discussion

Pre Development Condition

The pre development condition was modeled using a 1:100 year - 24 hour event. Please refer to Figure PRE - Pre Development Condition.

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Areas 100 and 101 drain onto an existing subdivision to the west. The cumulative peak pre-development run off rate offsite to the existing subdivision is 0.0445 cubic metres per second (cms). This equates to an average run off rate offsite of 3.36 litres per second per hectare (lps/ha). to the existing subdivision to the west.

Area 102 drains to an existing slough which is shared by the quarter section to the north. The peak pre-development run off rate to the slough is 0.0898 cms. This equates to an average run off rate of 4.71 lps/ha. to the slough. The total cumulative peak run off rate from the subject property is 0.1343 cms. This equates to an average run off rate of 4.16 lps/ha. from the entire property.

Post Development Condition

The post development condition was likewise modeled using a 1:100 year - 24 hour event. It was assumed that eventually there will be a total of seventeen (17) post development basins. Please refer to Figure POST - Post Development Condition. In the post development condition the drainage patterns apparent in the pre development condition are maintained.

Areas 200, 201 and RD 11 drain to the subdivision to the west. The total cumulative peak run off rate from areas 200, 201 and RD11 is 0.053 cms. This equates to an average run off rate of 4.06 lps/ha. which is higher than the average pre development run off rate to the existing subdivision of 3.36 lps/ha. If the areas designated 200, 201 and RD11 are developed in the future Lots 1 through 4 will need to incorporate some measures to reduce flows to a pre-development rate (i.e. storm water retention) or alternatively, agreement from adjacent land owners may be obtained to permit post development run off rates. Storage facilities may be required to attenuate the peak post development flow rate to 3.36 lps/ha.

The remainder of the modeled area drains to the centrally located wetland along the north boundary of the proposed subdivision. The peak run off rate to the wetland is 0.105 cms. This equates to an average post development run off rate to the wetland of 5.46 lps/ha. This is higher than the average pre development run off rate to the slough of 4.71 lps/ha. The natural wetland is thought to be capable of attenuating the post development flows from the property and it should not be necessary to construct additional facilities to further attenuate the flows. Upon subdivision it may be necessary to obtain permission from the adjacent land owner to allow post development discharge to the shared wetland at post development run off rates.

Conclusions

The overall drainage pattern apparent in the pre development condition is maintained in the post development condition.

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The majority of the property drains to a centrally located wetland straddling the north boundary of the study area. This slough is shared with the quarter section to the north. The average pre development flow rate to the slough is 4.71 lps/ha. The average post development flow rate to the slough is 5.46 lps/ha.

The remainder of the property drains west to an existing subdivision along the west boundary of the proposed subdivision. The average pre development flow rate to the existing subdivision is 3.36 lps/ha. The average post development flow rate to the existing subdivision is 4.06 lps/ha.

The proposal to subdivide the existing building site from the remainder of the parcel will not affect the drainage patterns, or rates, of the parcel. If future subdivision of the parcel is to take place, construction of storm water management facilities along the west boundary of the future subdivision will be required to ensure post development flow rates do not exceed pre-development rates in this area. The existing wetland along on the north boundary of the study area is adequate to attenuate the post development flows from any future country residential subdivision. Upon subdivision it will be necessary to obtain permission from the adjacent land owner to allow post development discharge to the shared slough at post development run off rates.

Should you have any questions or concerns, please contact the undersigned at your earliest convenience.

Yours truly,

WNM Engineering Ltd.

Bill Manning, P.Eng.

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CHICAGO STORM DISTRIBUTION

SWMM OUTPUT
100 YEAR - 24 HOUR STORM
PRE DEVELOPMENT CONDITION

SWMM OUTPUT
100 YEAR - 24 HOUR STORM
POST DEVELOPMENT CONDITION