Water Distribution System Capacity Study

FINAL

March 2014

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File No. 12-2214-002

Red River Exhibition Association
3977 Portage Avenue
Winnipeg, Manitoba
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ATTENTION: Mr. Garth Rogerson

RE: Water Distribution System Capacity Study
Final Report

Dear Mr. Rogerson:

Please find enclosed three (3) hard copies of the Final Report of the Water Distribution System Capacity Study.

KGS Group sincerely appreciates the opportunity to be of service on this project. If you have any questions, please do not hesitate to contact the undersigned.

Yours truly,

Roy J. Houston, P.Eng.
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RJH/jr
Enclosure

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FIGURE

Figure 2.1 – Existing Water Distribution System, and Proposed Expansion

1.0 INTRODUCTION

The Red River Exhibition (RREX) has been permanently located on the western outskirts of Winnipeg, adjacent to Assiniboia Downs since the 1980's. The site consists of approximately 460 acres of land, of which only about half is developed. RREX is now developing a Precinct Plan, to lay the foundation for the future development of the site.

KGS Group is providing engineering assistance to RREX for the development of the site. The purpose of this report is to analyze the existing water distribution system and develop upgrading and improvement options to the system to provide sufficient domestic and fire flows to both the existing and the proposed future developments on the site.

2.0 EXISTING SITE LAYOUT AND DESCRIPTION

Access to the RREX site is currently via Race Track Road. This road connects to Portage Avenue approximately 500 m west of the Perimeter Highway. Race Track Road then heads north, approximately parallel to the Perimeter, to the north end of the site. The Birchwood Auto Mall, the Iceplex and Assiniboia Downs are located on the east side of Race Track Road while RREX is located along the entire west side of the Road.

The current RREX complex consists of approximately 10 building, located 1.0 to 1.5 km north of Portage Avenue. An existing on-site water distribution system provides domestic water to the site. This system consists of a long, single-branch, system (no loops), connecting to the City's 300 mm AC watermain and running north to the site along Race Track Road. The main branch begins as a 300mm diameter pipe, downsizing to 250mm approximately 420 m north of Portage Avenue, and includes various150mm branches to service individual buildings. Hydrants are spaced at regular intervals along the service line.

Assiniboia Downs is also serviced by this same system, while City records indicate that the Iceplex and the Birchwood Auto Mall are not.

The existing on-site watermain system (and proposed expansion for future development discussed herein) are shown in Figure 2.1.

3.0 EXISTING SYSTEM FLOWS

3.1 FLOW CALCULATIONS

The RREX site consists of office buildings and sparsely used facilities for 355 days of the year. The remaining 10 days are the period of the Exhibition during which the site experiences a tremendous increase in population and water usage.

The flow calculations presented herein are non-standard, for the following reasons:

- A detailed water usage record does not exist as water flow records consist of data taken over 3 month intervals as opposed to 1 month
- water usage increases dramatically during the 10 day period of the Exhibition, overwhelming any demand calculations for the remainder of the year
- no separate metering is undertaken during the 10 day Exhibition so it is difficult to define water usage during this time
- the main purpose of this report is to determine available and future fire flows for the site and appropriate pipe sizes for new watermain construction. To that end, water usage during the 10 day Exhibition period governs and the domestic water usage through the rest of the RREX site is only of secondary consideration. Since the rest of the site essentially sits idle for some 12-15 hours a day, average and maximum day demand for this portion of the system is calculated for a “day” of less than 24 hours. This results in a greater domestic water demand for this portion of the system than would have otherwise been calculated by normal methods. This higher domestic demand is added to the derived demands during the exhibition which produces a degree of conservativeness in the fire flow analysis and pipe sizing design.

3.2 AVERAGE DAILY FLOW

There are eight buildings/facilities on the RREX where water service is provided. These are:

- Exhibition Building
- Exhibition Park Office
- RV Park
- Barn
- North Washroom
- South Washroom

- East Washroom
- West Washroom

To estimate the existing water demand, the following records were obtained and analyzed:

- water usage records, January 20, 2011 to January 12, 2012
- RREX visitor records from 2012

The water usage data obtained was only identified as records from water meters 1 through 8. These records are shown in Table 3.1. Since the data didn't include a user description, the users in the Table 1 are indicated by numbers, from 1 to 8.

TABLE 3.1
WATER USAGE RECORDS (JAN. 2011 – JAN. 2012)

User Number	Recorded Water Usage, m^3			
	2011			2011 / 2012
	Jan 20 - Mar 28	Mar 29 - Jul 5	Jul 6 - Sep 20	Sep 21 - Jan 12
1	57.7	48.6	5.8	57.9
2	33.0	188.9	40.2	24.0
3	1.8	496.5	23.5	0.4
4	45.4	307.4	12.5	1.6
5	15.2	62.2	46.3	31.9
6	174.4	257.8	29.6	118.7
7	85.3	312.2	52.2	109.0
8	15.7	1025.1	92.6	39.8
Total	428.5	2698.7	302.7	383.3
Number of Days	68	99	77	114
Daily Average, m^3/d	6.3	27.3	3.9	3.4

These results are fairly consistent with the exception of the March to July time period. This however is easily explained by the fact that the 10 day exhibition occurs during this time period with a correspondingly huge increase in the water demand at the Fairgrounds during that period.

Since separate metering is not undertaken during the 10 days of the exhibition, the average daily flow during this period can be analyzed as follows:

- Total Volume of flow between March and July =

  27.3 cu.m/day x 99 days = 2,702.7 cu.m.

- Assume the remainder of the RREX site continues to use water at the same rates as between July and January, i.e. 3.4 cu.m./day.

  Total Volume of flow exclusive of the exhibition at the Fairgrounds =

  3.4 cu.m/day x 99 days = 336.6 cu.m.

- The difference in these volumes will be the volume of water used at the Fairgrounds during the 10 day exhibition period.

  2,702.7 – 336.6 = 2,366.1 cu.m.

- Normalize this volume over the 10 day exhibition period.

  2,366.1 cu.m / 10 days = 236.6 cu.m/day

- Add to this amount the average daily flow from the rest of the RREX site.

  236.6 + 3.4 = 240 cu.m/day

RREX Daily Average Flow (during 2011 exhibition) = 240 cu.m./day

3.3 VISITOR RECORDS

In 2012 the overall number of visitors during the 10-day period of the exhibition was 215,000 people. The largest recorded one day attendance was 48,000 people, (a Saturday). This attendance was recorded the year after the records used to derive average flows above. As a check, daily flows for 2012 were estimated using a common average flow rate of 12 L/day per visitor with an average day population of 21,500 and a maximum day population of 48,000 people.

The estimated flow rates are as follows:

Average Daily Flow	= 21,500 x 12 L/day	= 258 cu.m./day
Maximum Daily Flow	= 48,000 x 12 L/day	= 576 cu.m./day

While the estimated Average Daily Flow rates for 2011 and 2012 do not agree precisely, they are reasonably close. Further, a yearly increase in attendance would normally be expected, as demonstrated by these figures.

The estimated Maximum Daily Flow is 2.23 times the estimated Average Daily Flow, which is greater than what would be expected in a distribution system containing a mix of residential, commercial, and other users. Typically in such systems the Maximum Daily Flow is 1.6 times, and the Peak Hourly Flow is 2.5 times, the Average Daily Flow. The Maximum Daily Flow, at 2.23 times, is closer to the expected Peak Hourly Flow. This is explained by the nature of the site and conditions during what is being referred to as the Maximum Day: an essentially single use site (commercial/entertainment) on a summer Saturday during the 10 days in which the exhibition is underway, an event anticipated and looked forward to by a large segment of the local population which overwhelms the small water usage throughout the remainder of the "non-exhibition" portions of the system. During a short 10 day window, local conditions (workday vs. weekend, sunny/hot vs. cold/wet weather) can have a much greater impact over the ratio of maximum to average day than over the entire year. It is understandable that Maximum Day conditions for a short, yearly, popular event would be higher than the averages for more typical municipal water systems.

3.4 ASSINIBOIA DOWNS

Assiniboia Downs draws its water supply from the RREX water line. This water must then also be accounted for. Similar water records were obtained from Assiniboia Downs, with average flows for winter and summer of 35 cu.m/day and 110 cu.m/day respectively. The Downs is open year-round, seven days a week, between the hours of 9:00 am and 2:00 am. As such, these flows were taken to be spread fairly evenly throughout the day. The estimated Average and Maximum Day Flows for Assiniboia Downs were thus determined to be 110 and 176 cu.m/day respectively.

3.5 TOTAL FLOWS

The overall flows drawn from the City watermain at Portage Avenue into the RREX system is thus the sum of the flows to the RREX site and to Assiniboia Downs. These flows are as follows:

Existing Average Daily Flow	258 + 110	= 368 cu.m/day
Existing Maximum Daily Flow	576 + 176	= 752 cu.m/day

For analysis purposes, it is necessary to convert per day flows to a per second flow. Since the RREX is shut down and has low water usage for a long portion of the day whereas the Downs is open almost continuously, the RREX daily flows are assumed to be spread over a 9 hour period, whereas the Assiniboia Downs flows are assumed to be spread over a period of 17 hours.

The flows for the existing site then become:

Existing Average Daily Flow	258 / (9x3600) + 110 / (17x3600)	= 9.8 L/sec
Existing Maximum Daily Flow	576 / (9x3600) + 176 / (17x3600)	= 20.7 L/sec

3.6 PEAK HOUR FLOWS

We have not placed much emphasis on the Peak Hour Flow in this report. In comparison, the flows on the site for the 355 non-exhibition days of the year are so low that the Peak Hour Flow during this time will have no impact on fire flow calculations based on the 10 day exhibition period.

Calculation of Peak Hour flows for the 10 day exhibition period is subject to the same non-standard analysis used previously. There is no separate metering of flows during this period. The only data is the three-month total usage record from late March to early July, and attendance records during the exhibition.

As discussed previously, typical flow ratios for municipal water distribution systems with a good mix of residential, commercial and other uses is:

Maximum Daily Flow = 1.6 Average Daily Flow
Peak Hour Flow = 2.5 Average Daily Flow

Peak Hour Flow could therefore be expressed as

Peak Hour Flow = 1.56 Maximum Daily Flow

The calculation of Maximum Day Flow was based on attendance records, and resulted in a flow 2.23 times the Average Day. Given this, it would seem that a better estimate of the Peak Hour would be to use apply the 1.56 increase to the Maximum Day Flow:

Peak Hour Flow = 1.56 x 20.7 L/sec = 32.3 L/sec

4.0 FUTURE SITE DEVELOPMENT

The Master plan for future development at the RREX site includes the following buildings which will require water servicing:

1. Hotel
2. RV Park
3. Dairy Farmers of Manitoba
4. Multipurpose Exposition Building
5. Event Centre
6. Agricultural Building
7. Agricultural Commodities Park Building
8. Expansion of Agricultural Commodities Park Building

The Plan also includes the Westport Festival, an approximate 40 acre commercial development fronting on Portage Avenue between Portage and the remainder of the RREX site.

5.0 FUTURE SYSTEM FLOWS

5.1 FLOW CALCULATIONS

As discussed in Section 3.1, Flow Calculations for Existing System Flows, the calculation of average and maximum daily flows for the RREX site are somewhat non-standard. The same rationale for the calculations used in Section 3 is also used for the future system.

5.2 RREX PARK FUTURE WATER DEMAND

The RREX Master Plan has identified projected future flows for the following facilities:

- Hotel
- New RV Park
- Dairy Farmers of Manitoba
- Multipurpose Exposition Building
- Event Centre
- Agricultural Building
- Agricultural Commodities Park Building
- Expansion of Agricultural Commodities Park Building

Future flows for these buildings/facilities were derived using standard design flow rates for developments. These rates are applied to a development on an area, or room, or population basis, depending on the type of development. The derivation for Average Day Flows for each component of the future development is shown in Table 5.1

TABLE 5.1
FUTURE FLOWS - RED RIVER EXHIBITION PARK

Facility	Master Plan N	Unit	Quantily	Unit Flow	Average Daily Flow, m^3/day
Hotel	**3**	bed space	100	225L/unit-day	22.5
RV Park[1]	**29**	space	100	800L/unit-day	80
Dairy Farmers of Manitoba[2]	**5**	m^2	10,000	6L/unit-day	60
Multipurpose Exposition Building	**14**	m^2	14,600	5L/unit-day	73
Event Centre	**21**	person	5,000	50L/unit-day	250
Agricultural Building[2]	**27**	m^2	3,200	6L/unit-day	19.2
Agricultural Commodities Park Building[2]	**6**	m^2	2,100	6L/unit-day	12.6
Expansion of Agr.Com. Park Building[2]	**7**	m^2	5,000	6L/unit-day	30
Total					**547.3**

Note:

1. New RV Park is assumed to have full water hook-up
2. Buildings # 5, 6, 7 and 27 were assumed to be office buildings
3. Areas of all buildings in Table 5.1 were estimated based on the RREX Master Plan

The Average Day Flow for the future development is 547.3 cu.m/day. As discussed in Section 3.3, outside of unusual situations such as the 10 day exhibition, Maximum Day Flow is typically 1.6 times the Average Day Flow. Using this multiplier, the Maximum Day Flow is 875.7 cu.m/day.

Converting these flow rates to per second rates, and assuming a 9 hour day for most of the activities on site, these rates become:

Average Day Flow = 16.9 L/sec
Maximum Day Flow = 27.0 L/sec

5.3 FUTURE FLOW REDUCTIONS AT EXISTING RREX COMPLEX

The RREX Master Plan is not simply a series of additions to the existing site. The new RV Park is a replacement of the old Park. When the new Park is constructed, the old Park will be eliminated. Similarly, the existing West Washroom appears to be eliminated in the future development shown in the Master Plan. When computing total future flows for the full development, the elimination of these flows must be taken into account.

While the individual meter readings in Figure 3.1 do not identify the actual building for which they are recording, it seems reasonable to assume the RV Park is recorded by meter number 8 and the West Washroom by meter number 4. The computed Average Daily Flow during the 10 day exhibition is 3.9 L/s. The Maximum Daily Flow is 8.7 L/s.

5.4 WESTPORT FESTIVAL FUTURE WATER DEMAND

The Westport Festival retail development plan includes 18 proposed building. While the total area of the building development is known, the function of individual buildings has not yet been determined. For the purpose of the preliminary flow estimation, the site was assumed to be a multi-building shopping centre area.

With a building area of 52,640 sq.m and using a usage rate of 5L/sq.m/day, the Average Day Flow for the Westport Festival is estimated to be 263.2 cu.m/day.

As with the rest of the RREX site (excluding the Fairgrounds during the 10 day exhibition) a 9 hour day is assumed with a 1.6 factor for Maximum Day. Flows at the Westport Festival are then estimated to be:

Average Day Flow = 8.1 L/sec
Maximum Day Flow = 13.0 L/sec

5.5 FUTURE SYSTEM FLOW SUMMARY

Total Average and Maximum Day Flows for the future system can now be easily determined by summing the flows estimated for the various locations within the overall RREX site. These flows are:

	Average Day	Maximum Day	Peak Hour
Existing RREX Complex and Assiniboia Downs	9.8 L/s	20.7 L/s	32.3 L/s
Future Development of Remainder of RREX Site	16.9 L/s	27.0 L/s	42.1 L/s
Future Reductions of Existing RREX Complex	-3.9 L/s	-8.7 L/s	-13.6 L/s
Fully Developed Future Westport Festival	8.1 L/s	13.0 L/s	20.3 L/s
Total Future Flows	30.9 L/s	52.0 L/s	81.1 L/s

6.0 WATER NETWORK ANALYSIS MODEL

6.1 MODEL DESCRIPTION

To determine the capacity of the existing water distribution system, and to evaluate future upgrades to meet future conditions, a computer model of the water distribution system was created using EPANET 2, a water distribution computer modeling software program from the U.S. Environmental Protection Agency. Using record drawings from the RREX, a scaled computer drawing of the water network was drawn as part of the input into the program. Nodes were placed at all existing pipe connections and end points, and at logical connections to the system representing future developments identified by the Master Plan. The water pipe network was represented by the interconnections between the nodes. Additional information, such as elevations, pipe diameters, water demands, etc. were then input into the network. as discussed below.

Nodes

- Nodes were located spatially in scale with the records drawings provided, so that distances between nodes as determined by the model represented the actual distance at the site between the points represented by the nodes.
- Elevation differences were not accounted for. The site is very flat, with little variation across the property. Even a couple of meters difference in elevation across the site would only result in a maximum variation of 3 psi in the results. This potential difference does not affect the conclusions of the analysis.
- Additional nodes were located within the model to allow for the inclusion of new piping for servicing of the future development of the site.

Pipes

- As indicated with the Nodes above, pipe lengths as determined from the network drawing represented the actual lengths at the site. These lengths were input into the model.
- Sizes for each pipe were taken from the drawings of the water distribution system supplied by RREX. Sizes ranged from 150 to 300 mm.
- Pipes were modeled as aged PVC pipe material throughout. with an initial pipe roughness coefficient (C value) of 120 for 150 mm mains and 130 for 250 and 300 mm mains.
- Pipes representing both the existing system and future extensions to the system to service the full future development were included in the model.

Demands

- Total demands (flows) input in the model are as derived earlier in this report. These flows are divided into their constituent parts as per Tables 3.1 and 5.1 and input into the model at the various nodes representing the various buildings/facilities.

Pump and Water Reservoir

- The City of Winnipeg was contacted for information about their water distribution system. A pressure/flow chart was obtained for the nearest hydrant on Portage Avenue to the connection point of the RREX water distribution system. This chart shows the flow available from the City's watermain for different system pressures. This chart then allows the entire City system to be modeled as a pump into the RREX system, with the chart representing the pump curve.
- Available flows from the City range from 0 L/s at 54 psi, to 153 L/s at 20 psi.
- As will be seen, the Portage Avenue watermain was not capable of providing the full fire fighting capacity required by the RREX site. One potential solution to this situation is to construct a second large diameter watermain feed into the RREX site from elsewhere in the City's watermain system, (too close and the two feeds will both be drawing from the same portion of the City's system, thereby reducing their capacity by robbing each other of some of their flow.) The nearest suitable point for considering a second large diameter servicing main to the RREX site is the intersection of Hamilton Avenue and Stewart Street in St. James. This intersection marks the end point of a 300 mm watermain that provides pressure and flow to the surrounding neighborhood. A second watermain connection from the RREX system to this intersection was also included in the model.

Fire Flow Analysis

- Fire flow analysis is conducted by simulating a fire flow demand at various nodes within the model and calculating pressures throughout the system. For proper fire fighting protection, a water distribution system must provide required fire flows at all points within the network with a minimum residual system pressure of 20 psi.
- According to the City of Winnipeg Watermain Design Guidelines, the minimum fire flow required for the types of developments at or proposed for the RREX site is 250 L/s. This flow was input into the model under a Maximum Day condition, and residual pressures calculated throughout the network.

Future Watermain Expansion

- The existing water distribution system is inadequate to service to full future expansion of the RREX site. For modeling the full development on the site, additional piping was introduced into the program to model the future watermain network required to provide servicing to the expanded site.
- Watermain loops were introduced into the future configuration of the water distribution system. These loops provide greater flexibility in systems operations, particularly during watermain repairs or other partial shut-downs of the system. Loops also provide multiple paths from the City main to the fire, thereby reducing velocities in the pipe during fire flow, which in turn reduces pressure losses within the system.

6.2 MODEL RESULTS

A number of scenarios were run with the model. These scenarios all involved locating fire flow demands at critical or worst case locations within the pipe network under a maximum day condition. Worst case locations are either end points of the system where pressure losses will be at a maximum, or at locations within the RREX site with high populations or critical buildings.

Future scenarios were run with two conditions:

- the existing connection to the City system as the only connection to the water network
- the existing connection to the City system supplemented with a second connection via a 300 mm watermain between RREX and St. James

The following results were obtained for the fire flow analysis of the RREX water distribution system:

Scenario	Maximum Day Flow	Fire Location	Available Flow at 20 psi
Existing Distribution System	20.7 L/s	Future Event Center	74.0 L/s
Existing Distribution System	20.7 L/s	New RV Park Area	68.0 L/s
Future Distribution System	52.0 L/s	Event Center	69.0 L/s
Future Distribution System	52.0 L/s	N. of New RV Park	62.0 L/s
Future Distribution System with second line from St. James	52.0 L/s	Event Center	160.0 L/s
Future Distribution System with second line from St. James	52.0 L/s	N. of New RV Park	119.0 L/s

As can be seen, in none of the scenarios is the minimum required fire flow of 250 L/s achieved. In the case of the existing system, and the case of the future system with only the Portage Avenue connection to the City's watermain, this is not surprising. The available flow from the City at 20 psi is only 153 L/s. Pressure losses within the RREX distribution system will only result is lower available fire flows the further away from Portage Avenue you go.

The case of the future system which includes the second connection to the City's system is also not surprising: the available flow from the second connection point is 206 L/s at 20 psi. The flow of 206 L/s, while an improvement, is still less than the required minimum of 250 L/s. Further, this flow must travel through the 1400 m long pipe extension from the Hamilton and Stewart intersection, with attendant pressure losses along the way. The second connection

does provide a small increase in available fire flows on the site, but is not sufficient to meet the City's minimum requirements.

6.3 SYSTEM IMPROVEMENTS TO MEET FIRE FLOW REQUIREMENTS

The RREX water distribution system can not meet the minimum fire flow requirement of 250 L/s at 20 psi as it is currently designed. Existing fire flows at the north end of the system are 68 L/s. Under the future development plan, with the added domestic water demand, future fire flows at the Event Center and at the north end of the system are only 62 L/s. Even with a second connection to the City watermain system, fire flows only improve to 160 L/s at the Event Center and 119 L/s at the north end of the system.

The City water distribution system at the Portage Avenue connection provides 153 L/s at 20 psi. Adding a pumping component alone to the RREX watermains will not increase fire flows as 153 L/s is the maximum flow that can be provided from Portage Avenue. Pumping would increase the pressure of the flow, but not increase its amount. To increase fire flows at the RREX, another source of water, i.e. a reservoir, must be developed.

There are two types of reservoirs that could be developed at the RREX site: a potable water reservoir integrated with, and pumped through, the existing water distribution system, or; a stormwater water pond/reservoir using stored rainwater and snow melt pumped through a separate fire protection water distribution system.

6.4 POTABLE WATER RESERVOIR WITH EXISTING WATER DISTRIBUTION SYSTEM

An 1,800 cu.m water reservoir would provide the volume of water necessary to meet the City's required flow. This is the volume necessary to supply 250 L/s over a two hour duration. The reservoir and associated pumps could be located anywhere within the RREX site. It would be drawn down during a fire flow event, and then would slowly refill after the fire has been put out.

A drawback to this option is that outside of the 10 day period of the public exhibition, when water demand is extremely high, the reservoir is otherwise somewhat oversized. Typically, a potable water reservoir is of a size to supply 1-2 days worth of water under average day conditions. In other words, water will only sit in the reservoir for 1-2 days before being drawn

out for domestic use. In this case, outside of major events such as the 10 day exhibition or large events at the Assiniboia Downs or the future Event Center, the turnover time of water through the reservoir will be several days more than ideal. This in turn results in stagnant water in the reservoir which will require chlorination equipment and chemical supply. Backflow protection will also be required to protect the City system from chlorine seeping back into their watermain.

It is likely possible to downsize the reservoir by allowing recharge from Portage Avenue during a fire event, effectively using water from Portage and from the reservoir at the same time to provide the required flow, but this might at best reduce the reservoir size by 30-40%. Even with this reduced size, the need for a chlorination unit and backflow protection should be expected.

6.5 STORMWATER POND WITH SEPARATE FIRE PROTECTION WATER DISTRIBUTION SYSTEM

This option would use the rainwater and snowmelt stored in on-site drainage ponds as a source of water for fire protection. Since this would not be treated water, a separate distribution system on site would be necessary to deliver this water for fire protection.

We understand that at least one drainage pond is included in the future development plans. A typical urban pond is between 3 and 5 acres in area. Allowing for 3m of depth, 1.5m of ice cover during a severe winter, and 7:1 side slopes on the pond, a 3 acre lake would contain approximately 20,000 cu.m of water below the ice, enough to fight several fires over the winter if necessary. If the pond or ponds on site are larger than 3 acres, then even more water will be available for fire protection use.

6.6 RESERVOIR COSTS

We have developed rough, order-of-magnitude costs for these two reservoir options. These costs are based on recent watermain projects and the design and construction of a new similarly sized concrete reservoir for the R.M. of Headingley.

Concrete Reservoir and Existing Distribution System

Concrete Reservoir	$2,000,000
Pumps (in reservoir building)	$500,000
Total	$2,500,000

An allowance of approximately $100,000 per year will also be necessary for a plant operator and chemical treatments.

Stormwater Pond and Separate Fire Protection Distribution System

Stormwater Pond (constructed for on-site drainage, not counted against fire protection)	$0
Intake Pipe	$250,000
Pumps and Separate Pump House	$1,000,000
Separate Fire Protection Distribution System	$1,000,000
Total	$2,250,000

A full time operator would not be required for maintenance of this system, however there will be periodic maintenance tasks required. These tasks would presumably fall to the RREX maintenance department and so an allowance of approximately $40,000 per year should be expected.

7.0 CONCLUSIONS

The existing on-site water distribution system for the RREX site consists of a long, single-branch system (no loops) connecting to the City's 300 mm AC watermain at Portage Avenue and running north to the site along Race Track Road. The main branch begins as a 300mm diameter pipe, downsizing to 250mm approximately 420 m north of Portage Avenue, and includes various 150mm branches to service individual buildings. From our analysis of the system we can summarize the following observations and conclusions:

- During most the year, the flows in the system are quite light. Water demand is equivalent to that of a small commercial/warehouse development with Average Daily Flows of 4 – 6 cu.m/day (less than 1 L/s over a nine hour work day).

- Water usage increases during events held at the RREX or at Assiniboia Downs. The greatest water usage occurs during the 10 day public exhibition in the summer. Using the derived flows during this 10-day period results in existing design flows for the site as follows:
  - o Average Daily Flow = 9.8 L/s
  - o Maximum Daily Flow = 20.7 L/s

- Water usage will increase after the future site development as envisioned in the RREX Master Plan. Again, the greatest overall usage on the site will be during the 10 day public exhibition. The future flows at the site during this period are:
  - o Average Daily Flow = 30.9 L/s
  - o Maximum Daily Flow = 52.0 L/s

- The system provides Peak Hour domestic flows with the following minimum pressures within the system:
  - o Current Existing System = 32.3 L/s at 51 psi
  - o Future Developed System = 81.1 L/s at 42 psi

  These pressures are adequate. Typical design standard require a minimum residual pressure of 30 psi throughout a water distribution system during the Peak Hour.

- The system does not provide the minimum fire flow of 250 L/s with a residual system pressure of 20 psi under the Maximum Day condition as recommended by the City of Winnipeg Watermain Design Guidelines. Various available fire flows for different scenarios are as follows:

Scenario	Fire Location	Available Flow at 20 psi
Existing Distribution System	Future Event Center	74.0 L/s
Existing Distribution System	New Exhibit Area 14	68.0 L/s
Future Distribution System	Event Center	69.0 L/s
Future Distribution System	N. of New RV Park	62.0 L/s

- Construction of a second feed from the City of Winnipeg water distribution system to the site does not appreciably improve the fire flow capacity of the RREX system. With a

second feed from St. James beginning at the 300 mm watermain at Hamilton and Stewart, flows do increase by 60 – 80 L/s, but are still well below the minimum fire flow of 250 L/s.

- To provide a fire flow of 250 L/s to the RREX site will require the development of a supplemental water source. This effectively means a water reservoir on the RREX site, complete with fire pumps and back-up generator. Two options for the reservoir are considered:
  - A concrete reservoir supplied by the City's watermain and pumping into the on-site water distribution system
  - A stormwater pond pumping into a separate fire protection distribution system, separate from the existing domestic water system.

- A concrete reservoir will have issues with stagnation of water in the reservoir. Chlorination and backflow prevention should be included in any reservoir design for the site.

- Rough order-of-magnitude costs were developed for the two reservoir options as follows:
  - Concrete reservoir and existing distribution system $2,500,000
  - Stormwater pond and separate fire protection distribution system
    $2,250,000

- Yearly operating costs will also be required for each reservoir option as follows:
  - Concrete reservoir utilizing existing distribution system
    $100,000 per year
  - Stormwater pond utilizing separate fire protection distribution system
    $40,000 per year

8.0 STATEMENT OF LIMITATIONS AND CONDITIONS

The last section of all reports should be a section including the Statement of Limitations and Conditions. This section shall include, at a minimum, the “Third Party Use of Report” disclaimer, plus any additional disclaimers, as determined by the Author/Issuer of the report.

8.1 THIRD PARTY USE OF REPORT

This report has been prepared for the Red River Exhibition Park to whom this report has been addressed and any use a third party makes of this report, or any reliance on or decisions made based on it, are the responsibility of such third parties. KGS Group accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions undertaken based on this report.

FIGURE

11x17

N

PORTAGE AVENUE

SASKATCHEWAN AVENUE

PERIMETER HIGHWAY
(PTH No 101)

AG COMMODITIES EXPANSION

HOTEL

DAIRY FARMERS
OF MB BLDG

AG COMMODITIES PARK

AG COMMODITIES PARK

EXIST. RETENTION POND

WESTPORT
FESTIVAL

EVENT CENTRE

MULTI-PURPOSE
EXPOSITION
BUILDING

EXIST. RETENTION POND

RV PARK

AGRICULTURAL
BUILDING

EXIST.
RETENTION
POND

WESTPORT
AUTO MALL

ICEPLEX

ASSINIBOINE DOWNS

RIVER LOT 89

RIVER LOT 90

RIVER LOT 91

RIVER LOT 92

250ø

300ø

150ø

200ø

300ø WM ALONG SASKATCHEWAN AVENUE TO BE INSTALLED BY THE CITY OF WINNIPEG IN 2014

LEGEND

- EXISTING RED RIVER EX. WATERMAIN
- EXISTING ASSINIBOINE DOWNS WATERMAIN
- PROPOSED WATERMAIN
- ST. JAMES SUPPLY LOOP OPTION
- PROPOSED BUILDING

0 50.0 100.0 150.0 200.0 250.0m

SCALE: 1:3000m (24"x36")
1:6000m (11"x17")

NO.	YY/MM/DD	DESCRIPTION	BY
0	14/03/26	ISSUED FOR FINAL REPORT	RJH

REVISIONS / ISSUE

KGS GROUP CONSULTING ENGINEERS

Red River EXHIBITION PARK

RED RIVER EXHIBITION PARK
WATERMAIN CAPACITY STUDY

EXISTING WATER DISTRIBUTION SYSTEM,
AND PROPOSED EXPANSION

MARCH 2014 | FIGURE 2.1 | REV: 0

FileName: P:\Projects\2012\12-2214-002\Doc.Control\ToBeIssued\DWG\12-2214-002_FIGURE 2.1-Rev 0.dwg - Tab: FIG 2.1 Plotted By: GLoewen 14/03/26 [Wed 11:40am]
11"x17" PLOT SCALE: 1:2