City of Grand Forks

Utilities Capital Planning

Final Report – Rev. 1
May 2009

KERR WOOD LEIDAL
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CONSULTING ENGINEERS

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May 22, 2009

Ms Sasha Bird
City of Grand Forks
6350 2nd Street
Grand Forks, B.C.
V0H 1H0

Dear Ms Bird:

RE: UTILITIES CAPITAL PLANNING
Final Report – Rev. 1
Our File 147.126 - 300

We are pleased to submit the enclosed copy of our final report to City council for the above-captioned project and summarizes all of the work completed on the assignment to date.

Yours truly,

KERR WOOD LEIDAL ASSOCIATES LTD.

Irfan Gehlen, P.Eng.
Project Manager

IG/ww
Encl.

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City of Grand Forks

Utilities Capital Planning

Final Report – Rev. 1
May 2009

KWL File No. 147.126

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STATEMENT OF LIMITATIONS

This document has been prepared by Kerr Wood Leidal Associates Ltd. (KWL) for the exclusive use and benefit of the City of Grand Forks for Utilities Capital Planning. No other party is entitled to rely on any of the conclusions, data, opinions, or any other information contained in this document.

This document represents KWL's best professional judgement based on the information available at the time of its completion and as appropriate for the project scope of work. Services performed in developing the content of this document have been conducted in a manner consistent with that level and skill ordinarily exercised by members of the engineering profession currently practising under similar conditions. No warranty, express or implied, is made.

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Section 1

Introduction

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1. INTRODUCTION

1.1 BACKGROUND

The City of Grand Forks has a major investment in municipal infrastructure systems, which include water supply, wastewater management, storm drainage, road and sidewalk systems. In general, components of these systems are old and in need of refurbishment. The City has commissioned this planning initiative in order to establish a multi-year upgrading programme to upgrade these systems.

Over recent years the City has not experienced significant community growth and the population has remained relatively stable in the range of 4,200 people. Current economic conditions have created significant challenges for the major employment centres in the City and reduced or eliminated short to medium term community growth prospects.

While planning for future growth must not be ignored, it appears that the appropriate focus of any infrastructure capital investment program at this time should be on rehabilitation and upgrading of existing facilities and not expansion of these systems.

1.2 PROJECT SCOPE AND OBJECTIVES

The objective of this assignment was to assess the existing infrastructure, identify upgrading requirements, compile capital cost estimates and develop a prioritized upgrading program. This plan has been prepared on the basis of a 10-year horizon for capital planning. The scope of this plan includes work related to the sanitary system, potable water system, stormwater system, and road transportation network.

It is important to note that the upgrades discussed in this report are almost all at the conceptual level and will require detailed design work to be completed prior to proceeding to construction.

Copper Field is an area of approximately 200 hectares at the northern end of the city. It currently has rural status where the province is currently responsible for subdivision development approval. The Regional District of Kootenay Boundary is currently responsible for zoning and development permit approvals. In the context of the Grand Forks capital plan, there would likely be a need to extend municipal infrastructure to serve Copper Field if it becomes a part of the City where capital costs would be paid by the developer. This report only considers the infrastructure upgrade needs within existing municipal boundaries, and excludes any discussion on infrastructure needs due to potential boundary extensions.

This report is intended to provide the City with the framework for proceeding with necessary utility upgrade work. It is possible that unforeseen factors arising from the

implementation of the initial capital tasks may affect the timeline and capital budget developed herein.

1.3 ACKNOWLEDGEMENTS

KWL wishes to acknowledge the valuable input provided by the following City staff in preparing this capital plan:

Mr. Victor Kumar;
Ms. Cecile Arnott;
Mr. Wayne Kopan;
Ms. Sasha Bird;
Mr. Dean Chapman;
Mr. Ross Idler; and
Mr. Dave Reid.

1.4 METHODOLOGY

This report has been based on the following resources and initiatives:

- A two day Planning Workshop attended by City representatives and KWL staff held on February 11th and 12th 2009.
- A number of technical reports and other submissions prepared by KWL for the City since the mid 1990's, as detailed in Section 1.5 below. The majority of these documents relate to the water and sewer system only.
- City of Grand Forks Road Rehabilitation Study from October 2000, compiled by EMCON.

The proposed capital plan individually addresses the upgrading requirements of the water, sewer, storm drainage and roads systems within the community. It was also considered expedient to look for geographical synergies between these upgrading initiatives. This approach is necessary in order to ensure that any required underground piping work can be undertaken immediately prior to any necessary road repaving. This planning strategy has generated a fourth category of infrastructure upgrading, referred to as multi-utility upgrading, and this topic is addressed in Chapter 6 of this report.

Capital cost estimates have been based on projected costs for construction in 2010 and no allowance has been made for cost inflation beyond this date. The adopted capital plan will therefore need adjustment for inflation in future years. Except for a few instances where detailed design work has already been undertaken, these estimates should be considered as Class D preliminary estimates which will need refinement once more detailed engineering analysis and design have been completed.

1.5 KWL TECHNICAL REFERENCES

Table 1-1 summarizes relevant engineering work on the municipal infrastructure system previously complete by KWL. In general terms this Utilities Capital Plan report does not attempt to reproduce any of this technical material and interested parties can consult these documents for more detailed information on the various issues.

Table 1-1: Summary of Reports and Other Submissions by KWL 1991 to 2008

Project #	Report Title	Date
147.033	Design Memorandum for Replacement Feedermain from Mill Creek Reservoir	1991
147.033	Contract No. 147.039 for Construction of Replacement Feedermain from Mill Creek Res.	1992
147.038	Overview Report on Water Utility Financing	1992
147.039	Plans for Infrastructure Expansion and Schedule for Development Cost Changes to Meet the Needs of Future Development. Infrastructure Planning Studies	1992
147.040	Work Program for Development of Rate Models	1993
147.039F	A Look Beyond the Year 2000: Summary Report on Planning for Future Growth	1994
147.039J	A Look Beyond the Year 2000: Presentation to City Council on Planning for Future Growth	1994
147.039A	Design Populations for Long-Range System Planning	1994
147.039B	Report on Computer Modelling and Waterworks System Performance	1994
147.039C	Report on a Long-Term Wastewater Management Strategy	1994
147.039D/E	Impact of Subdivision Development on the Drainage System (D) and Roadway System (E)	1994
147.039	Status Rpt. No. 6 on Eng. Work for Infrastructure Expansion & Wastewater Treatment	1994
147.048	Contract No. 147.048 for 1995 Water and Sewer Construction Program	1995
147.049	Presentation to City Council on Infrastructure Expansion and Wastewater Treatment	1995
-	Investigation of Molybdenum Sources in the Wastewater System	1995
1027.004	Report on Lagoon System Performance and Sludge Removal	1995
1027.005	Pre-Design Report on a New Wastewater Treatment Facility	1995
147.039F	A Look Beyond the Year 2000: Summary Report on Planning for Future Growth	1995
1027.007	Contract 1027.007 for Construction of Grand Forks Wastewater Treatment Facility	1996
147.045	Engineering Work Program for Pump Station Audits and Reliability Assessments	1996
147.045	Study Report Pump Station Audit and Reliability Assessment	1996
147.056	Interim Report on Data Collection and SCADA Planning	1997
147.055	Pre-Design for New Westside Reservoir	1997
147.061	Ruckles Sewer Expansion	1997
147.056	Interim Report on Data Collection and SCADA Planning Part B	1998
147.068	Sewage Pump Station Upgrading Program	1998
147.060	Final Report: Valley Heights Preliminary Assessment of Access Alternatives	1998
147.076	Request for Quotation for Supply and Delivery of Sewage Pumps for Boundary Lift Station	1999
147.076	Upgrade of Boundary Lift Station	1999
147.074	Predesign Report for the Westside Reservoir	1999
147.078	Water and Sewer Servicing Study	1999
147.091	Granby River Water Main Crossing	2001
147.074	Predesign Report for the Westside Reservoir	2002
147.087	Wastewater Treatment Plant Lagoon Upgrading Study	2003
147.099	Infiltration and Inflow Study	2004
147.102	WWTP Plant Optimization	2004
147.107X	Proposal for Engineering Services: Amendment to the Development Cost Charges Bylaw	2005
147.105	WWTP Headworks Upgrading	2007
147.109	WWTP Lagoon Land Advice	2007
147.117	Grandby River Dyke Repair	2007
2344.001	City Park Lift Station	2008

Notes:
1. Documents dated 1990 and before are excluded.
2. It is understood that copies of all of the documentation were originally supplied to the City of Grand Forks by KWL.

Section 2

Sanitary System

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2. SANITARY SYSTEM

2.1 EXISTING SYSTEM

The Grand Forks wastewater collection system consists of three trunk sewers running from the north, east, and west sides of the City which discharge into an interceptor sewer. This sewer conveys sanitary flows via the Park and Industrial pump stations to the municipal wastewater treatment plant. Treated effluent from the wastewater treatment plant is discharged via outfall to the Kettle River.

Figure 2-1 shows the layout of the existing sanitary system at Grand Forks.

WASTEWATER COLLECTION

Past studies by KWL identified the need to upgrade several sections of the trunk sewer system to address hydraulic capacity deficiencies. The most recent study on this topic was the Sanitary Sewer Model Update completed in 2008 which reviewed the hydraulic capacity of the sanitary sewer system. Recommendations to upgrade sections of the South Kettle Trunk sewer were made based on computer model results generated as part of the scope of work for the sewer model update. It should be noted that the sewer modeling indicated that this South Kettle sewer will experience some surcharging at times of peak flow. This work should be included as part of the Park Lift Station upgrade. The estimated capital cost in 2007 for upgrade of the South Kettle sewer was approximately $500,000.

A Closed Circuit Television (CCTV) inspection of a major portion of the Grand Forks sanitary system has previously been conducted and the results were presented in KWL's *Inflow and Infiltration Study* in 2004.

Figure 2-2 shows the structural condition of the existing sanitary system classified according to the severity of the structural defects found in each pipe. The objectives of the CCTV inspection were to review the physical condition of the pipe, identifying the areas in which inflow and infiltration (I/I) volumes could be reduced by maintenance and upgrade work, and make recommendations for an I/I reduction and sewer maintenance program, and estimating the collection system rehabilitation and improvement costs.

As a result, KWL concluded that, based on the collected information, the City was generally in compliance with the Municipal Sewage Regulation (MSR) with regards to I/I. However, there were areas of concern with respect to the existing sewers that could lead to an increase in I/I over time if the sewers are not adequately maintained and/or refurbished.

The highest priority for upgrading the wastewater collection system should be to initiate repairs of all severe structural defects. However, since the 2004 CCTV inspection did not

cover the entire system, there may be additional severe defects that have not yet been identified. Therefore, the completion of CCTV inspection for the remaining sewers should also be considered as a priority item.

The City Park lift station requires upgrading due to its relative age and inadequate hydraulic capacity. KWL completed the detailed design for this upgrade and this project is currently on hold pending the availability of capital funding. The cost of this project and related infrastructure was estimated at approximately $3.7 million. Since the Park lift station is the key facility that conveys over 90% of the City's sewage to the wastewater treatment plant, this project should be considered as a high priority for upgrading of the wastewater conveyance system.

WASTEWATER TREATMENT AND EFFLUENT DISPOSAL

Prior to 1996, wastewater treatment consisted of a simple two-cell lagoon system for wastewater treatment but this system had become overloaded by the mid-1990s. A new mechanical-type secondary wastewater treatment facility was built to increase both treatment capacity and effluent quality, and the existing lagoons were upgraded to operate in parallel with the new facility. This new facility uses the extended aeration process, complete with clarifiers for solids separation, aerobic digestion tanks for biosolids management, and chlorine disinfection of the effluent. The design of the mechanical treatment plant provided for a future doubling of the plant capacity by adding a second circular process tankage unit and other smaller plant modifications. It is anticipated that the current wastewater treatment facilities will have adequate capacity to meet community needs for at least the next ten years unless there is growth and a boundary extension.

Although the topic has been previously addressed, only limited engineering work has been done to date on developing a long term plan for biosolids management. Biosolids continue to be piped to the secondary treatment lagoon where they continue to accumulate. At some stage this lagoon will need to be desludged, an expensive process, unless an alternative biosolids management is adopted. Due to natural processes, these biosolids are known to contain elevated levels of molybdenum which must not be allowed to enter the food chain. This factor creates a significant constraint in the future development of any new biosolids management strategy. It is recommended that the capital plan include an allowance to desludge these lagoons and/or install a new biosolids handling system.

The existing treatment plant continues to use a chlorine based system for effluent disinfection. Due to operator safety and environmental protection considerations, this technology has been overtaken in recent years by ultra-violet (UV) disinfection. At some stage the City will likely be required to either dechlorinate the effluent prior to discharge to the river or replace the existing disinfection equipment with UV technology. The latter strategy would appear to be a better capital investment. In the short term some minor changes to the chlorine contact chamber, in order to increase the height of the walls, is reportedly required.

2.2 CAPITAL PROJECTS

The recommended annual budget for sanitary system capital projects will be $1.0 million. The following list outlines the capital projects specific to the sanitary system using an implementation timeline based on a strategy of distributing these capital projects over time to work within this annual budget:

1. **Initiate CCTV Inspection in Year 1 on sewer sections not previously investigated.**

   CCTV inspection of sewers not covered in the 2004 study is recommended as a high priority item that should be initiated as soon as possible to allow the City to identify any structural defects in these remaining sections of the municipal sewer system. It is important to note that the results of this additional CCTV inspection may require the capital plan to be modified to address presently unidentified problems. The extent of any such changes will depend on the number and severity of structural defects detected.

2. **Initiate Repair of Structural Defects in Year 1 and adopt as an annual task.**

   The highest priority for the sanitary system is to repair the severe structural defects identified in the 2004 Inflow and Infiltration report. The locations of these defects have been identified in Figure 2-2. Repair of these identified defects will have a beneficial effect on reducing the volume of inflow and infiltration entering the sanitary system, and will also increase the hydraulic capacity of these pipes by reducing flow restrictions or blockages. Other high priority areas are also indicated on this figure. It is recommended that this work be initiated as soon as possible.

   Structural defects not considered as major have been classified as either moderate or minor structural defects. These medium and low priority upgrades can be initiated as part of an annual program to upgrade the sanitary system.

3. **Park Lift Station replacement in Year 1**

   The City Park lift station replacement should be considered as a high-priority item in the capital plan since it is the key facility that conveys over 90% of the City's sewage to the wastewater treatment plant. Priority should be given to this project as it is old and hydraulically undersized. Furthermore, it is a "shovel-ready" project where preliminary and detailed engineering design work has already been completed.

4. **South Kettle Sewer upgrade in Year 1**

   The upgrade of the South Kettle trunk sewer is a medium-priority item to eliminate the potential for sewer surcharge and to provide adequate hydraulic capacity for wastewater conveyance upon completion of the Park lift station construction

(Project #3). This project should be included as part of the Park Lift Station upgrade project.

5. Upgrade the Wastewater Disinfection System in Year 6.

As a medium-priority project, the existing chlorine based wastewater disinfection system should be upgraded with a new UV system to provide adequate disinfection of the wastewater effluent and to eliminate the use of chlorine.

6. Upgrade Sludge Management System in Year 9.

Upgrades to the sewage lagoon currently used as a storage area for residual sludge will ultimately be necessary as the available storage capacity of the lagoon diminishes. This is a lower-priority item that could be addressed in the future, but it is important to note that there may need for engineering work related to evaluating the economic feasibility of re-using the desludged lagoon for future sludge storage versus migrating to a more advanced sludge dewatering and disposal system.

7. Multi-utility Upgrading Initiatives.

To address sanitary system upgrades in locations throughout the City where there are other utilities that could also be beneficially be upgraded at the same time, a reserve amount should be set aside on an annual basis to allow multi-utility upgrade projects to be independently initiated. A more detailed discussion on multi-utility upgrade projects can be found in Section 6 of this report.

8. Miscellaneous Projects and Minor Upgrade Work.

A budget amount of $100,000 to $200,000 per year should be reserved for completing miscellaneous projects and minor upgrades to the sanitary system. These include projects such as smoke and dye testing of sewers, sewer main re-lining program, and miscellaneous upgrade of the WWTP headworks.

2.3 UNIT RATES

The unit rates used to develop the capital budgets for upgrade work on the gravity sewer collection system are as follows:

- $10,000 per severe structural defect;
- $5,000 per minor and moderate structural defect;
- $350 per lineal metre of sanitary sewer required for complete pipe replacement; and
- $12 per lineal metre of pipe requiring CCTV inspection.

These unit rates have been estimated based on KWL's recent experience on past projects and is intended for capital planning purposes only.

Val-Mar Pump Station

Boundary Pump Station

Granby Pump Station

Park Pump Station

WWTP

Industrial Pump Station

Marlex Pump Station

GRANBY RIVER

KETTLE RIVER

KETTLE RIVER

City of Grand Forks
Utilities Capital Plan

Legend

- Municipal Boundary
- Sanitary Main
- Sanitary Forcemain
- Manhole
- Pump Station

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Scale in Metres 1:15,000

Project No.	Date
147-126	May 2009

Existing Sanitary System

Figure 2-1

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Val-Mar Pump Station

Boundary Pump Station

Granby Pump Station

Park Pump Station

Industrial Pump Station

WWTP

Marlex Pump Station

GRANBY RIVER

KETTLE RIVER

KETTLE RIVER

City of Grand Forks
Utilities Capital Plan

Legend

- Municipal Boundary
- Manhole
- Pump Station
- Existing Sanitary Main
- High Priority for Upgrade

Notes:
Data compiled by KWL from CCTV based reports produced by Panaview Pipe Inspection Services between 1998-2000.
Problems rectified since CCTV inspection completed (ie. section of 77th Ave.) not shown.

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Scale in Metres 1:15,000

Project No.	Date
147-126	May 2009

Sanitary CCTV Inspection Results

Figure 2-2

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Section 3

Potable Water System

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3. POTABLE WATER SYSTEM

3.1 EXISTING SYSTEM

The Grand Forks potable water system consists of five groundwater wells located on the west side of the City. Water extracted from the wells is pumped to the East Zone reservoir for storage. This reservoir feeds virtually the entire City. A smaller high-zone reservoir is located nearby at a higher elevation to service the Valley Heights subdivision. Figure 3-1 shows the layout of the Grand Forks water system.

WATER SUPPLY SYSTEM

Grand Forks has historically relied on groundwater to meet the City's water demands. This has generally worked well for the community, although there are some concerns about the potential for future nitrate contamination of some of these wells. Recent engineering analysis has indicated that the City's current wells could be at risk if the identified nitrate plume should migrate southwards towards the river. A proposal to undertake further analysis of this nitrate concentration and assess associated risks to the existing well field is waiting for funding. The estimated cost of this work in 2007 was $29,200.

Recently, a drilling investigation to assess the potential for a new well located near the high school playing field was proposed. The objective of this initiative was to identify locations in which a new well could be constructed to provide additional water supplies for boundary extension or excessive use and also to enhance water quality security, using a new well location away from the known nitrate concentrations located further to the west. The estimated cost for this work was $35,100-$45,100 in 2007.

In addition to the above, the need to balance water storage and meet present and future water demands required the City to consider a new reservoir on the west side of the City. The primary benefit of the new reservoir would be to increase fireflow pressures on the west side of the community and improve overall water system security. The current situation, where only one major reservoir serves almost the entire community, makes effective reservoir maintenance challenging and leaves residents somewhat vulnerable to a major pipe system failure.

Figure 3-2 and Figure 3-3 illustrate the fireflow contours based on a single reservoir concept (existing scenario) and a two-reservoir concept. This analysis indicates that projected fire flows on the western side of the community are inadequate when fed only from the current reservoir located on the east side of the City. This effect is attributable to elevated friction losses in the long runs of pipe that traverse the City when a major fire occurs.

KWL proposed in the 2002 *Westside Reservoir Predesign Report* that a second reservoir be constructed on the west side of the City with a watermain connection to the existing distribution system near 76th Avenue and 23rd Street. If boundary extension occurs toward Copper Field, this location will not be suitable. This would allow the City's water system to become more balanced in terms of distribution pressure and fireflows, since the west side of the City is farther away from the existing Valley Heights reservoir. KWL completed the pre-design for this new reservoir in 2002. This second reservoir would also provide additional system security should any problem occur with the existing reservoir, as well as enhanced operational flexibility. Funding is required to finance the Westside reservoir either through development charges or from existing ratepayers. The capital cost estimate in 2002 for construction of the Westside reservoir was $2,532,000.

It is important to note, however, that water consumption in Grand Forks greatly exceeds typical levels found in similar communities. There is the potential to reduce water consumption via universal metering. This option has not been included as a component of this capital plan but could be considered by the City as an alternative to costly infrastructure upgrades.

DISTRIBUTION SYSTEM

In general, the backbone of the water distribution system is adequately sized to transmit fireflows under normal operating conditions. However, there are numerous local sections of pipe that are less than 150 mm diameter which could cause flow restrictions under certain conditions. Current industry practice is to install pipes with a minimum diameter of at least 150 mm. Consideration should also be given to looping watermains where possible to eliminate dead ends that can create water quality problems and to improve system security.

In terms of pipe materials, there are numerous sections of small diameter galvanized pipe which are generally in poor condition. These sections of pipe have caused problems and thus the priority should be placed on replacing galvanized pipe on a City-wide basis. Figure 3-4 illustrates the locations where the watermain pipe diameter is less than 150 mm or where the pipe material is galvanized.

Recent water distribution system upgrades include:

- design and construction of the Granby River watermain in order to twin the existing river crossing for enhanced system security (construction completed in 2004); and
- design and construction of the water chlorination systems to enhance water quality and thus protect consumer health (construction completed in 2007).

WATER CONSERVATION

Implementing water conservation through the adoption of universal metering is a promising option for delaying costly infrastructure capital projects. Other communities that have adopted universal metering programs have experienced reductions in water consumption ranging from 15-30 % of unmetered usage. Since the current water consumption in Grand Forks is relatively high compared to other local communities, it is possible that greater water savings could be achieved.

The Grand Forks gross water consumption is estimated to be 1,688 L/cap/day (Source: 2005 City of Grand Forks Drought Management and Conservation Plan), which is significantly higher than the national average of 638 L/cap/day. The capital cost for the implementation of a universal metering program is approximately $1,600,000 (excluding GST).

3.2 CAPITAL PROJECTS

The estimated annual budget for potable water system capital projects is $1.0 million. The following list outlines the capital projects specific to the water system with implementation timeline based on distributing capital projects over time to work within the estimated annual budget:

1. **Groundwater Contamination Investigation in Year 1.**
   As previously indicated, there is significant concern that a groundwater nitrate plume may be migrating towards the existing well field. Should elevated nitrates in the groundwater be detected in any of these wells it would significantly compromise water quality. Assessment of this risk and the identification of potential mitigation measures should be a top priority for the municipality. The projected cost of the initial investigation, based on the March 1st 2007 proposal is $29,200.

2. **Groundwater Source Well Investigation in Year 1, with construction of new well in Years 2-3.**
   It is recommended that the municipality proceed with the investigation of a new well site at the earliest opportunity. A new well would add additional water supply capacity and provide additional system security. The security factor is of particular importance in the light of the nitrate concerns identified above. The estimated cost for this test drilling work was $35,100-$45,100 in 2007. The proposed capital plan provides for test drilling to be undertaken in the first year of the plan with construction to follow in the second year.

3. **Replacement of Old Watermains, multi-year programme**
   It is proposed that the City institute a multi-year programme to replace watermains that are either old, undersized or made of corrosion prone galvanized iron pipe. Since galvanized pipes were typically used only in smaller diameters and have not been installed in recent years, many of these pipes will trigger replacement under all three

criteria. A phased replacement programme is proposed using the location of these pipes as the primary determinant of the replacement sequence as set out below.

A. Replace Old Watermains - pipe age greater than 40 years within downtown core area or adjacent to major institutional facilities.

The highest upgrade priority for the City's potable water distribution system is to replace all galvanized pipe and watermains less than 150 mm diameter. The locations of these pipes are illustrated in Figure 3-5. In discussions with the City it was noted that galvanized watermain pipes were generally in poor condition and in need of replacement. In terms of small diameter watermain less than 150 mm diameter, the pipes need to be upgraded to provide better fireflows in accordance with the guidelines produced by the Fire Underwriters Society (FUS).

It is recommended that the highest priority should be to replace all such mains that serve either commercial or institutional facilities.

B. Replace Old Watermains - pipe age greater than 40 years outside of downtown core area and not serving any major institutional facilities.

This is the next highest priority item for watermain replacement that would follow from Project #3A.

C. Replace Old Watermains - pipe age between 20 to 40 years within downtown core area or adjacent to major institutional facilities.

This is the next highest priority item for watermain replacement that would follow from Project #3B.

D. Replace Old Watermains - pipe age between 20 to 40 years outside of downtown core area and not serving any major institutional facilities.

This is the next highest priority item for watermain replacement that would follow from Project #3C.

4. Westside Reservoir Construction

It is proposed that this project should have a slightly lower priority than projects 1 and 2 above. Work should start with implementation of detailed design to be followed by the construction phase. The capital cost estimate in 2002 for construction of the Westside reservoir was $2,532,000.

5. Multi-utility upgrading initiatives.

To address water system upgrades in which there are other utilities that can be upgraded at the same time, a reserve amount should be set aside on an annual basis to allow multi-utility upgrade projects to be independently initiated. A more detailed discussion on multi-utility upgrade projects can be found in Section 6 of this report.

6. Miscellaneous projects and minor upgrade work.

A budget amount of $100,000 to $200,000 per year should be reserved for completing miscellaneous projects and minor upgrades to the water system. These include projects such as a unidirectional flushing program, well rehabilitation program, and for preparing water conservation and groundwater well/aquifer protection plans.

3.3 UNIT RATES

The unit rates used to develop the capital budgets for upgrade work are as follows:

- $300 per lineal metre to replace watermain pipe with 150 mm diameter PVC pipe;

These unit rates have been estimated based on KWL's recent experience on past projects and is intended for capital planning purposes only.

City of Grand Forks
Utilities Capital Plan

Legend

- Municipal Boundary
- Reservoir
- Well
- Watermain

Valley Heights Reservoir

East Side Reservoir

Well No. 2

Well No. 3

Well No. 3A

Well No. 4

Well No. 5

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Scale in Metres 1:15,000

Project No.	Date
147-126	May 2009

Existing Potable Water System

Figure 3-1

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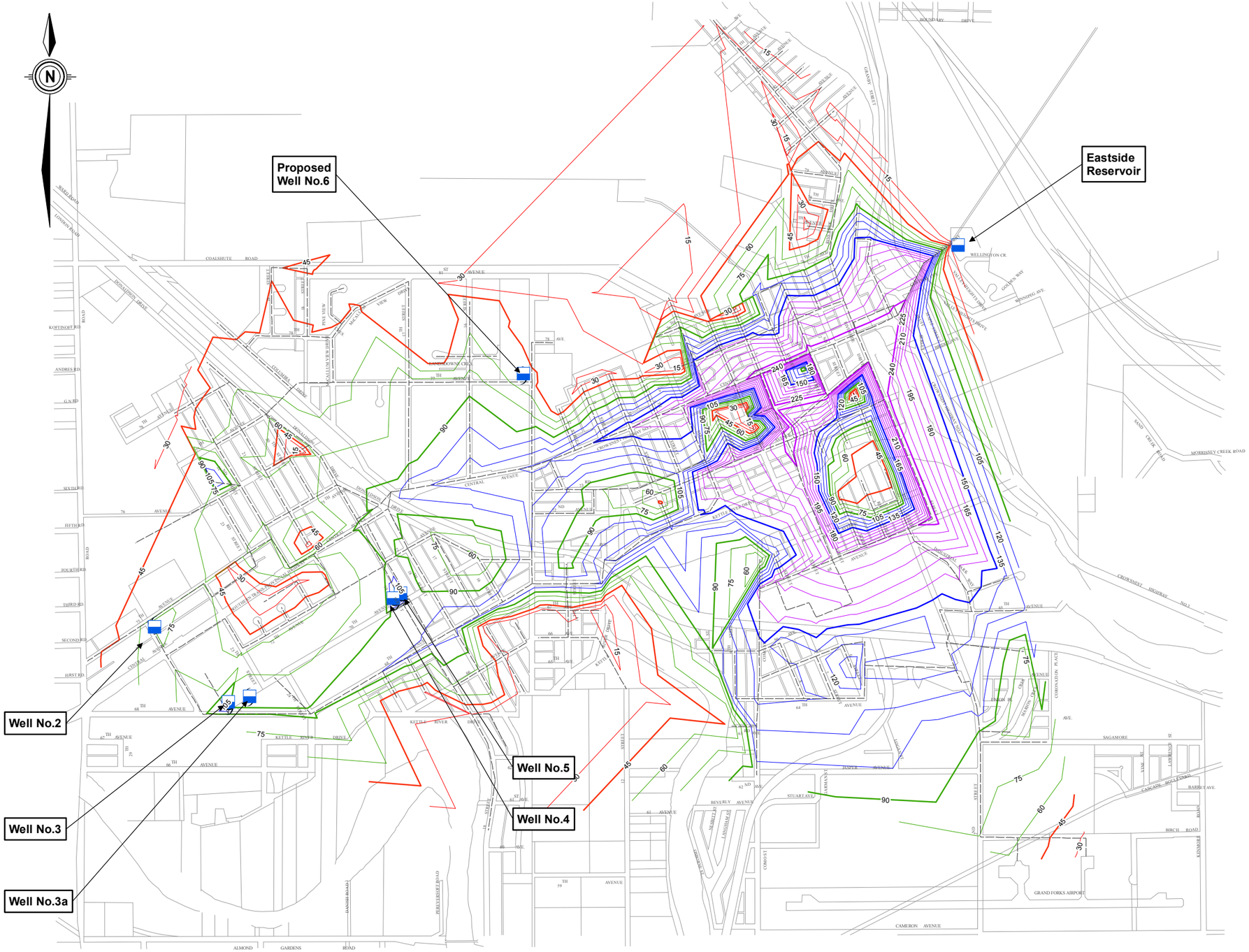

Note:
Contours show maximum fireflow contours at a minimum of 20 psi with no negative zone pressures.

City of Grand Forks
Utilities Capital Plan

Legend

- Supply Source
- Pump Station
- Water Main

Fireflow Contours (L/s)

- 0
- 15
- 30
- 45
- 60
- 75
- 90
- 105
- 120
- 135
- 150
- 165
- 180
- 195
- 210
- 225
- 240

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Project No.	Date
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Fireflow Contours
Existing System
One Reservoir
Figure 3-2

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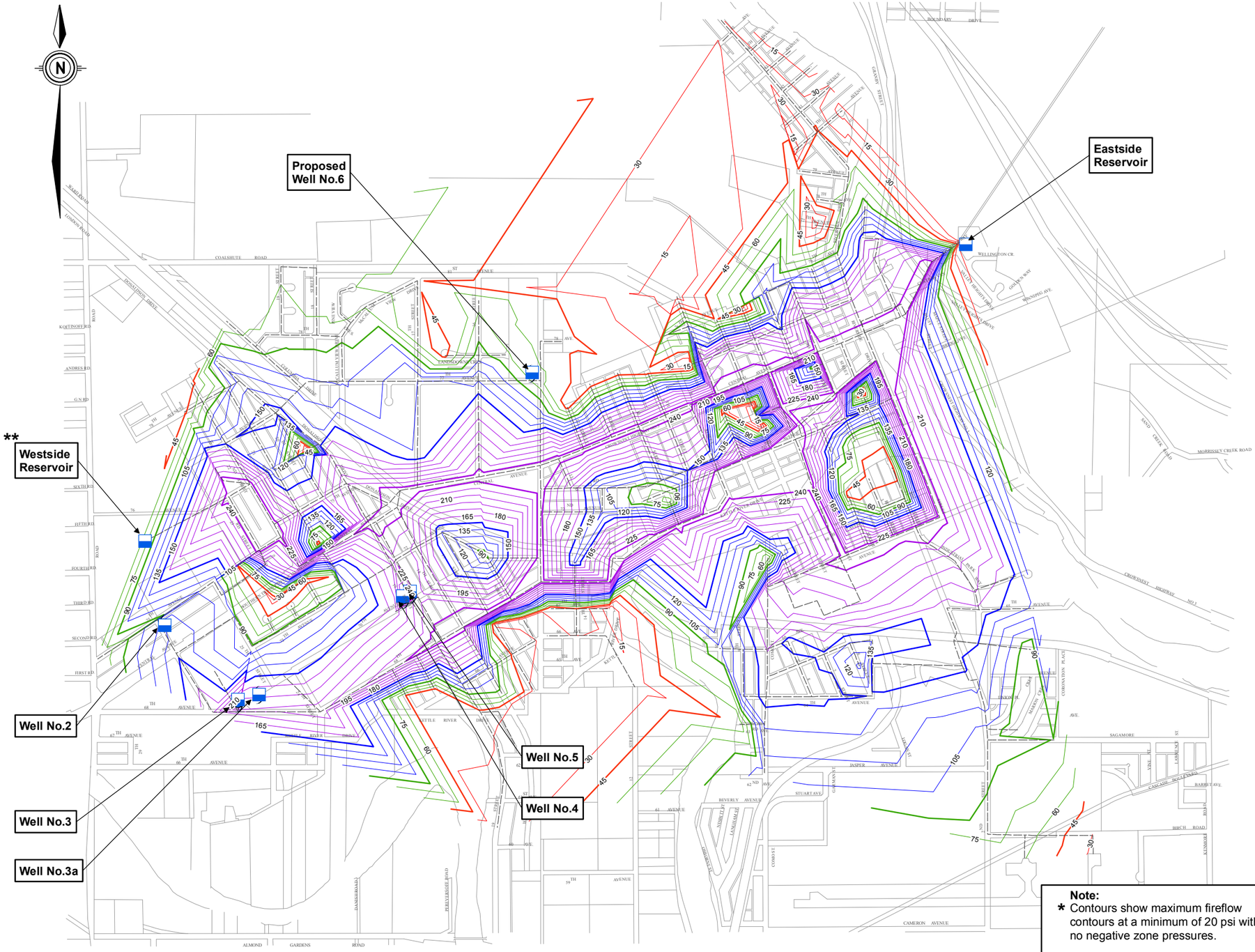

City of Grand Forks
Utilities Capital Plan

Legend

- Supply Source
- Pump Station
- Water Main

Fireflow Contours (L/s) *

- 0
- 15
- 30
- 45
- 60
- 75
- 90
- 105
- 120
- 135
- 150
- 165
- 180
- 195
- 210
- 225
- 240

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300 0 300
Scale in Metres 1:15,000

Project No.	Date
147-126	May 2009

Fireflow Contours Proposed Two Reservoir Concept

Figure 3-3

Note:
* Contours show maximum fireflow contours at a minimum of 20 psi with no negative zone pressures.

** Westside Reservoir location as shown in this figure only valid if the boundary extension to include Copper Ridge does not occur.

Map Document: (O:\0100-0199\147-126\430-GIS\MXD-Rp\147126Fig3-3.mxd)
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Valley Heights Reservoir

East Side Reservoir

Well No. 2

Well No. 3

Well No. 3A

Well No. 4

Well No. 5

GRANBY RIVER

KETTLE RIVER

KETTLE RIVER

City of Grand Forks
Utilities Capital Plan

Legend

- Municipal Boundary
- Reservoir
- Well

Pipe Age

- 0 - 20 Years
- 20 - 40 Years
- > 40 Years
- Unknown
- Galvanized Pipe

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Scale in Metres 1:15,000

Project No.	Date
147-126	May 2009

Existing Water System Pipe Age

Figure 3-4

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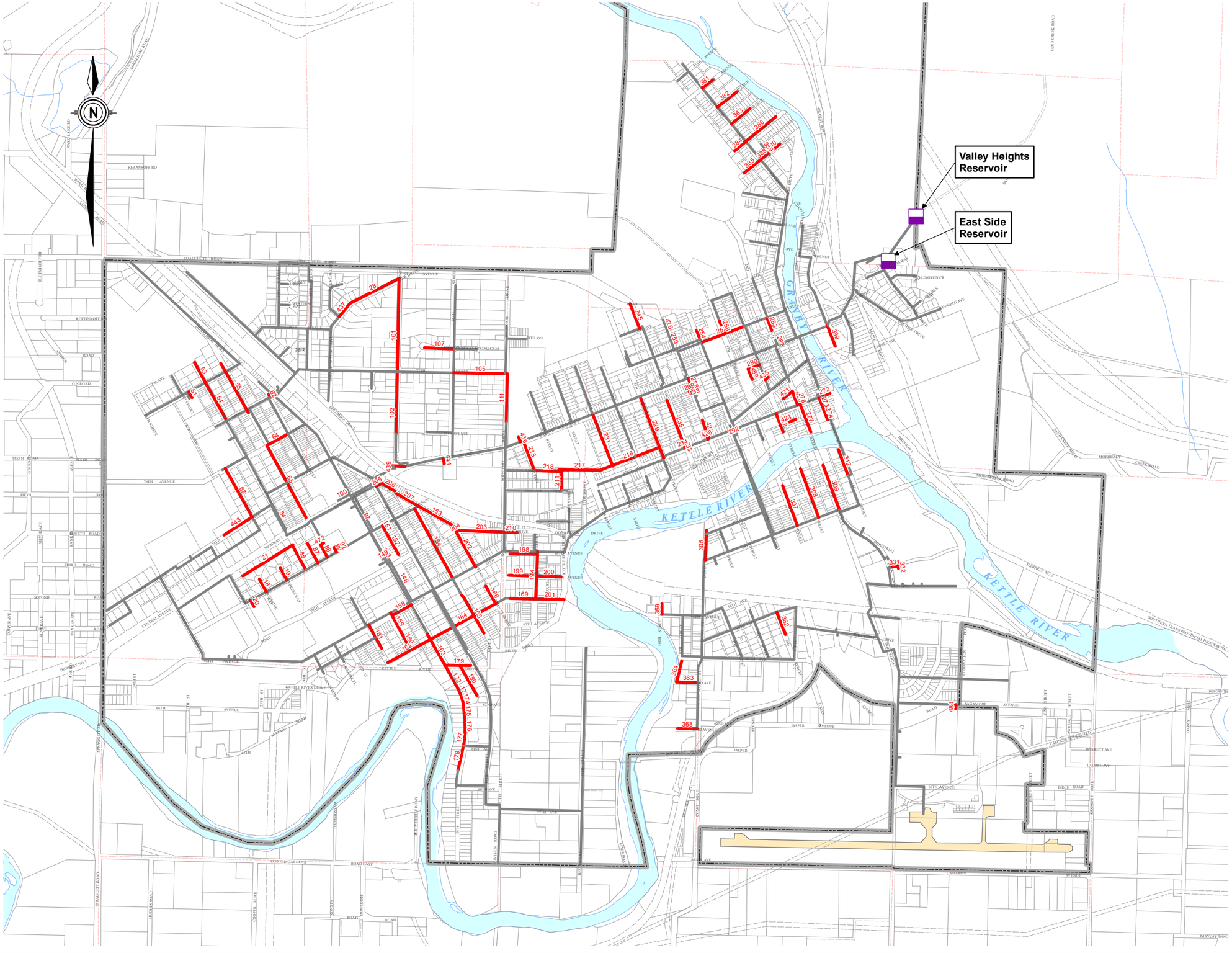

City of Grand Forks
Utilities Capital Plan

Legend

- Municipal Boundary
- Reservoir
- Existing Watermain
- Main ID — High Priority to Replace

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300 0 300
Scale in Metres 1:15,000

Project No.	Date
147-126	May 2009

Existing Water System Pipe Replacement Priorities

Figure 3-5

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Section 4

Stormwater System

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4. STORMWATER SYSTEM

4.1 EXISTING SYSTEM

Drainage problems in Grand Forks have historically been treated as a secondary infrastructure issue within Grand Forks. Accordingly there has been very little engineering work undertaken to date on this utility system. However, the report *A Look Beyond the Year 2000: Summary Report on Planning for Future Growth (KWL, 1994)* introduced the concept of intercepting and controlling the discharge of surface runoff (whether due to stormwater or snowmelt) to meet the demands of future land development.

4.2 EXISTING DRAINAGE SYSTEM

Grand Forks is located at the confluence of the Granby and Kettle rivers. The Kettle River is the dominating feature with respect to drainage for the following reasons:

- The valley is flat and low-lying, and the groundwater table is hydrogeologically controlled by river level.
- There are some problem areas where land is vulnerable to flooding under extreme high river water conditions.
- The river is the natural outlet for storm drainage facilities.

Figure 4-1 provides an overview of the existing stormwater management system at Grand Forks.

There are two small watercourses within the City which drain to the Kettle River; namely: Zak's Slough, and the Pahoda/Holiboff Slough. Additionally, there are four areas which are serviced with storm sewer systems to address site-specific problems. These areas are the West Side Area, Central Avenue, Downtown Core, and East Side Bench. This system has historically served the community adequately even though many of the storm drainage pipes are undersized when compared to normal design standards. This is due to the very high infiltration capacity of the underlying soils.

In the 1994 KWL report on the *A Look Beyond the Year 2000: Summary Report on Planning for Future Growth*, the following implementation strategy was recommended for consideration:

- Construct storm sewers along Granby Road and Boundary Drive during road reconstruction;
- Upgrade stormwater infrastructure downstream of Central Avenue;

- Construct a new drainage outlet that would serve the bench area west of the CPR, with proposed discharge to the Johnston Flats wetland area;
- Confirm the need to upsize the East Side drainage outlet; and
- Upsize the Zak Slough drainage outlet as a condition for future subdivision approval for development in the area behind the high school.

The above recommendations were made over 15 years ago within the context of an overview level assessment of the City's infrastructure and no follow up has since been undertaken. This is in sharp contrast to other municipal systems, which have received ongoing engineering analysis and variety of significant upgrades since that time. It is therefore proposed that a focussed Stormwater Management Plan be prepared in order to provide a solid foundation for future investment in this important utility.

4.3 CAPITAL PROJECTS

1. Prepare Stormwater Management Plan

It is not possible to prioritize the upgrade work required for the stormwater system without an appropriate Stormwater Management Plan (SWMP). It is recommended as the highest priority item for the stormwater utility that a SWMP be prepared covering the following items:

- Inventory and base mapping of the existing drainage system (catch basins, storm sewers, culverts, bridges, ditches, overland flow paths);
- Identification of flooding and erosion problems;
- Soils mapping, watercourse mapping and classification information;
- Analysis of conveyance capacities and identification of system inadequacies;
- Recommend and prioritize improvements and upgrades where required;
- Assess potential for stormwater runoff causing groundwater contamination and make mitigation recommendations; and
- Assess and make recommendations for stormwater quality control and environmental protection of watercourses by assessing frequently occurring events and riparian setbacks.

A budget allowance of $60,000 is proposed for this work.

2. Implement Capital Projects Outlined in Stormwater Management Plan

Once the stormwater management plan has been completed, implementation of the capital projects recommended in the plan should be included in the capital plan as an annual capital programme. A budget of $1.0M per year has been included for implementation of this strategy. It should be noted that it is possible that the results from the stormwater management plan will indicate that this level of annual investment may be excessive for this utility.

3. Miscellaneous projects and minor upgrade work.

A budget amount of $100,000 to $200,000 per year should be reserved for completing miscellaneous projects and minor upgrades to the stormwater system.

Based on currently available information, it does not appear to be appropriate to include a separate annual budget for this utility under the Multi-Utility Upgrading programme.

City of Grand Forks
Utilities Capital Plan

Legend

- Pit (Commercial)
- Pit (City)
- Pit (Private)
- Catchbasin (Commercial)
- Catchbasin (City)
- Catchbasin (Private)
- Catch Basin (Data from Pre-compiled Source)
- Existing Storm Main
- Proposed Storm Main
- Creek Flow Direction

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100 0 100
Scale in Metres

Project No.	Date
147-126	May 2009

Existing Stormwater Management System

Figure 4-1

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Section 5

Road Infrastructure

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5. ROAD INFRASTRUCTURE

5.1 EXISTING ROAD SYSTEM

In 2000, the City commissioned a road rehabilitation study undertaken by Emcon. The study included road surface assessment, road allowance condition assessment, road subsurface assessment, road maintenance planning map, and data base entry. Emcon rated the existing roads and divided them into high, medium and low rehabilitation priority. A graphical representation of the City's road network is shown in Figure 5-1.

5.2 SIDEWALKS

The existing sidewalk infrastructure and proposed upgrades are shown in Figure 5-2. Over the life of the capital plan, $500,000 has been set aside to incorporate new additions to the sidewalk infrastructure. Repair and reconstruction of sidewalks should be included as part of the associated road reconstruction work.

5.3 CAPITAL PROJECTS

The estimated annual budget for road infrastructure capital projects is $1.0 million. The following list outlines the capital projects specific to the road network with an implementation timeline based on distributing capital projects over time to work within the estimated annual budget:

1. Upgrade High Priority Roads.

The priority for road repaving in Grand Forks is illustrated in Figure 5-3. This figure was originally created using the information from the Emcon report and updated. In determining the priority of road upgrades, consideration was given to both the assessed current condition of the pavement and traffic volumes.

High Priority Roads:

- 22nd Street from Central Avenue to 78th Avenue
- Kettle River Drive from 68th Avenue to 72nd Avenue
- 68th Avenue from Boundary Drive to Kettle River Drive
- 68th Avenue from 19th Street to Boundary Drive
- Donaldson Drive from Boundary Drive to Central Avenue
- 3rd Street from Central Avenue to North of 75th Avenue

2. Upgrade Medium Priority Roads.

Medium Priority Roads:

- 2nd Street from Central Avenue to 2nd Street Bridge
- 73rd Avenue from Boundary Drive to 11th Street
- 73rd Avenue from 11th Street to 9th Street
- 2nd Street from 68th Avenue to Sagamore Road
- 14th Street from 68th Avenue to 66th Avenue
- 67th Avenue from Kettle River Drive to Boundary Drive
- 66th Avenue from Kettle River Drive to Boundary Drive
- 66th Avenue from Boundary Drive to 19th Street

3. Multi-utility Upgrading Initiatives.

To address road infrastructure upgrades in which there are other utilities that can be upgraded at the same time, a reserve amount should be set aside on an annual basis to allow multi-utility upgrade projects to be independently initiated. A more detailed discussion on multi-utility upgrade projects can be found in Section 6 of this report.

4. Miscellaneous Projects and Minor Upgrade Work.

A budget amount of $100,000 to $200,000 per year should be reserved for completing miscellaneous projects and minor upgrades to the road infrastructure system.

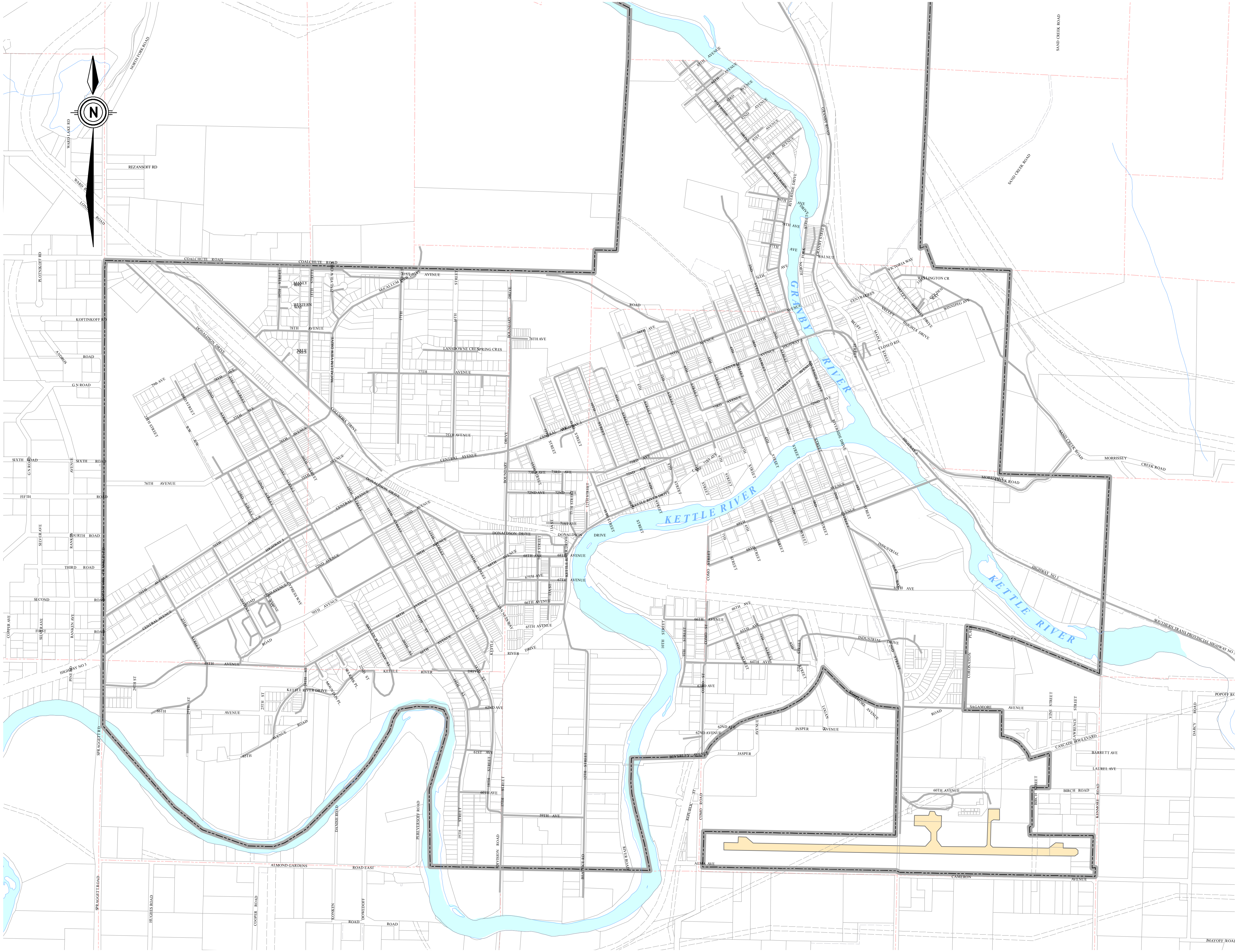
5.4 UNIT RATES

The unit rates used to develop the capital budgets for road upgrade work are as follows:

- $50 per square metre for asphalt road paving;
- $150 per lineal metre for curb restoration; and
- $60 per square metre for sidewalk construction.

These unit rates have been estimated based on KWL's recent experience on past projects and is intended for capital planning purposes only.

It is recommended that the City consider a contingency amount to account for upgrade work that may need to be done on an emergency basis.



City of Grand Forks
Utilities Capital Plan

Legend

Municipal Boundary

Existing Road

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300 0 300

Scale in Metres 1:15,000

Project No.	Date
147-126	May 2009

Existing Road Infrastructure Network

Figure 5-1

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City of Grand Forks
Utilities Capital Plan

Legend

- Municipal Boundary

Sidewalks

- Existing River Walkway
- Existing Asphalt Walkway
- Existing Concrete Walkway
- Proposed River Walkway
- Proposed Highway Asphalt Walkway
- Proposed Connector Concrete Walkway
- Proposed Downtown Connector Concrete Walkway

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300 0 300
Scale in Metres 1:15,000

Project No.	Date
147-126	May 2009

Sidewalk Plan

Figure 5-2

Map Document: (O:\0100-0199\147-126\430-GIS\MXD-Rp\147126Fig5-2.mxd)
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City of Grand Forks
Utilities Capital Plan

Legend

Municipal Boundary

Existing Road

Priority

- High
- Medium
- Low

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Scale in Metres 1:15,000

Project No.	Date
147-126	May 2009

Road Upgrade Priorities

Figure 5-3

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Section 6

Multi-Utility Upgrading Strategy

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6. MULTI-UTILITY UPGRADING STRATEGY

6.1 GUIDING PRINCIPLES

It is evident that synergies will exist in some parts of the City where significant work on upgrading underground utility pipes coincide with a need for pavement replacement. It is therefore proposed that a Multi-Utility Upgrading Strategy be adopted in certain locations to complement upgrading initiatives identified for individual utilities. Under this strategy the roads, water and sanitary utilities will each dedicate an annual budget to fund such projects.

The following principles have been considered for the purpose of developing an appropriate implementation strategy for multi-utility upgrades:

- No planned excavation of roads for upgrading of underground utilities within five years of repaving;
- Consider repaving the entire section of road if one or more utilities require upgrade as a high priority;
- Consider repaving the entire section of road if two or more utilities require upgrade as medium-priorities; and
- Consider repaving the entire road intersection where utilities cross at a road intersection.

6.2 UPGRADE PRIORITIES

In order to develop a comprehensive infrastructure upgrade plan, individual projects for upgrading each infrastructure system were initially assessed independently of adjacent infrastructure and categorized using a three-level priority approach as follows:

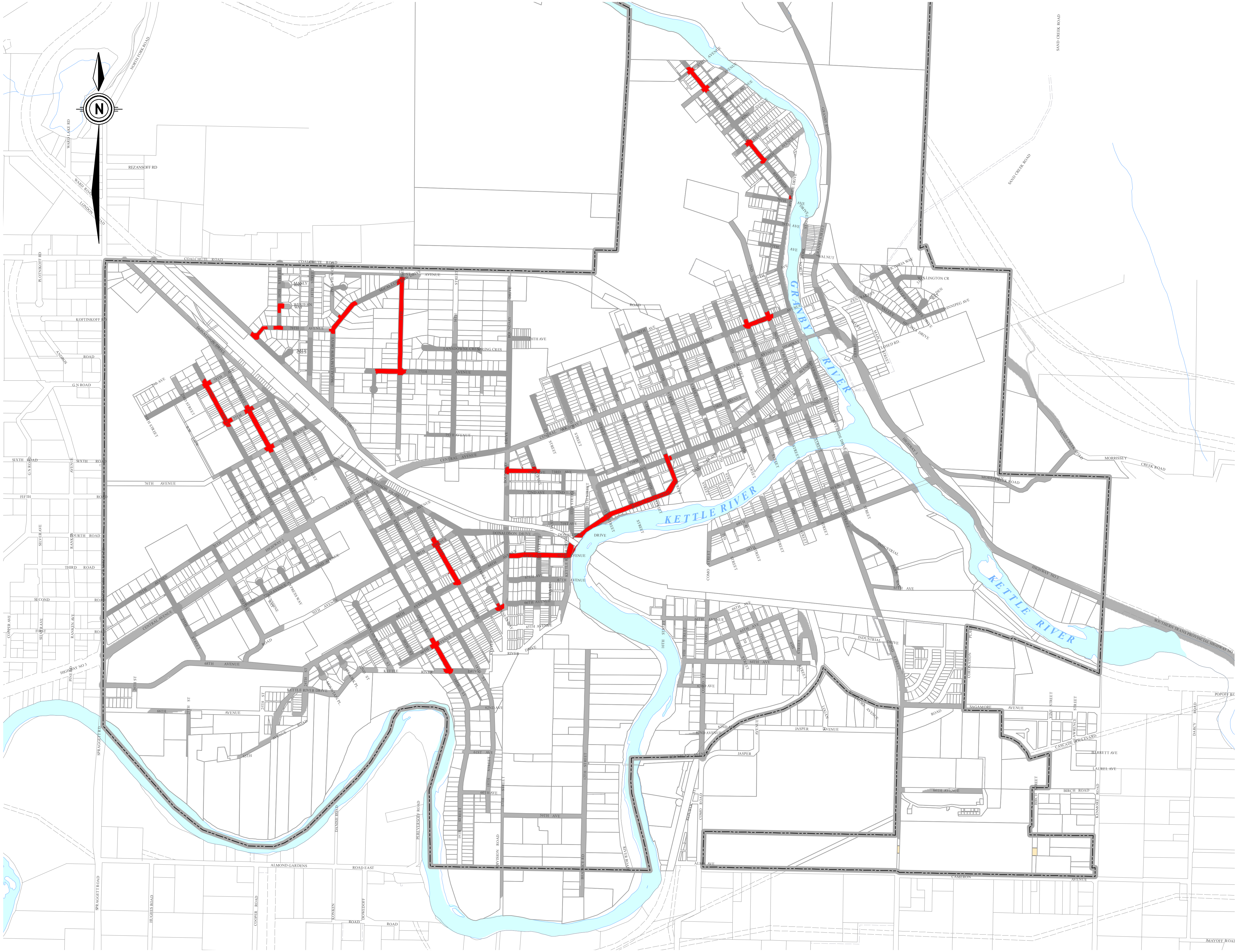
- High priority = 3
- Medium priority = 2
- Low priority = 1

To investigate the potential for increasing efficiency and reducing costs through an integrated construction approach, all high-priority and medium-priority projects were further analyzed to determine which projects were located in close proximity to each other. Project priority was assigned to each road section based on the combined priority score from each of the road, sanitary, and potable water utilities. The priority multi-utility projects identified with this approach were those that received the highest score using a decision matrix based on the principles summarized in Section 6.1 (i.e. high priority projects were identified as the sections with the highest cumulative score).

Figure 6-1: provides a graphical representation of the areas within the City that have been classified as high-priority under this approach.

6.3 CAPITAL PROJECTS

Based on this approach, the capital plan provides for an annual budget of $300,000 to fund multi-utility projects. The funding for this programme is based on an annual contribution of $100,000 each from the road, water and sewer utilities. This annual budget is only sufficient to complete portions of the identified multi-utility projects each year, and thus the multi-utility upgrade work is expected to be phased over several years. Proposed projects for this programme are identified on Figure 6-1.



City of Grand Forks
Utilities Capital Plan

Legend

Municipal Boundary

Upgrade/Repair Priorities

VALUE

Cumulative Priority Score = 1-8

Cumulative Priority Score = 9

Note:

Multi-utility upgrade priority determined based on computing the cumulative score for priorities for each of the sanitary, potable water, and roads.

For each utility, a three-level approach was adopted:

High priority = 3
Medium priority = 2
Low priority = 1

The highest priority thus has a cumulative score of 9.

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Scale in Metres 1:15,000

Project No.	Date
147-126	May 2009

Multi-Utility Upgrading Priorities

Figure 6-1

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Section 7

Capital Plan

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7. CAPITAL PLAN

Table 7-1 sets out the proposed capital plan for the individual utilities.

Table 7-1: Capital Plan

Projects	Year									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
SANITARY										
CCTV Inspection	100,000	100,000	50,000	-	-	-	-	-	-	-
Repair Structural Defects	300,000	500,000	600,000							
Park Lift Station Replacement and Related Infrastructure	3,000,000	-	-	-	-	-	-	-	-	-
South Kettle Sewer Upgrade	700,000	-	-		-	-	-	-	-	-
Upgrade Wastewater Disinfection System	-	-	-	-	-	420,000	-	-	-	-
Upgrade Sludge Management System	-	-	-	-	-	-	-	-	750,000	-
Multi-Utility Upgrading Initiatives	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Miscellaneous Projects and Minor Upgrade Work	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Subtotal	4,300,000	800,000	850,000	200,000	200,000	620,000	200,000	200,000	950,000	200,000
POTABLE WATER										
Groundwater Contamination Study	41,000	-	-	-	-	-	-	-	-	-
Groundwater Source Well Investigation and Construction	114,000	500,000	500,000	-	-	-	-	-	-	-
Upgrade Watermains										
Pipe Age Greater than 40 Years - Commercial/Institutional Areas	200,000	50,000	-	-	-	-	-	-	-	-
Pipe Age Greater than 40 Years - Residential Areas	250,000	250,000	300,000	600,000	800,000	800,000	600,000	600,000	400,000	400,000
Pipe Age Between 20 to 40 Years - Commercial/Institutional Areas	-	-	-	-	-	-	-	-	200,000	200,000
Pipe Age Between 20 to 40 Years - Residential Areas	-	-	-	200,000	-	-	200,000	200,000	200,000	400,000
Westside Reservoir	200,000	2,250,000	2,250,000	-	-	-	-	-	-	-
Multi-Utility Upgrading Initiatives	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Miscellaneous Projects and Minor Upgrade Work	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Subtotal	1,005,000	3,250,000	3,250,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,200,000
ROADS										
Upgrade High Priority Roads	600,000	600,000	600,000	600,000	600,000	600,000	600,000	600,000	600,000	600,000
Upgrade Medium Priority Roads	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000	200,000
New and Upgraded Sidewalks	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000	50,000
Multi-Utility Upgrading Initiatives	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000
Miscellaneous Projects and Minor Upgrade Work	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000	75,000
Subtotal	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
STORMWATER										
Prepare Stormwater Management Plan	60,000	-	-	-	-	-	-	-	-	-
Implementation of Projects Identified by Stormwater Management Plan		500,000	500,000	500,000	500,000	500,000				
Miscellaneous Projects and Minor Upgrade Work	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
Subtotal	160,000	600,000	600,000	600,000	600,000	600,000	100,000	100,000	100,000	100,000
TOTAL ANNUAL BUDGET	6,465,000	5,650,000	5,700,000	2,800,000	2,800,000	3,220,000	2,300,000	2,300,000	3,050,000	2,500,000
Note: 1. Construction engineering costs not included in the above projects.							**Grand total at the end of 10 years:**			**36,785,000**

Section 8

Conclusions and Recommendations

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8. CONCLUSIONS AND RECOMMENDATIONS

8.1 CONCLUSIONS

1. Based on currently available engineering analysis, a Utilities Capital Plan has been prepared that identifies a recommended upgrading strategy for municipal utilities.

2. While planning for future growth must not be ignored, it appears that the appropriate focus of any infrastructure capital investment program at this time should be on rehabilitation and upgrading of existing facilities and not expansion of these systems.

3. The plan includes a provision for a Multi-Utility Upgrading Programme where synergies between the upgrading needs of different utilities have been identified.

4. Each utility should receive an annual budget for addressing unidentified minor works.

5. The road, water and sewer systems all have adequate engineering analysis already completed in order to prepare this plan. However the stormwater utility has received minimal attention and it is appropriate to undertake a Stormwater Management Plan in order to provide the technical foundations required for future investment in this utility.

8.2 RECOMMENDATIONS

1. It is recommended that the City adopt this report as the technical foundation for a long term capital works programme to upgrade existing municipal utility systems. Should availability of funding not match the timeline set out in the plan, projects can be either accelerated or deferred in order to match financial resources.

2. A Stormwater Management Plan should be commissioned as a priority item in order to identify and assess related technical issues and develop the optimum strategies for resolving these challenges. The results will define future stormwater management capital projects for subsequent incorporation into this capital plan

Section 9

Report Submission

KERR WOOD LEIDAL
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CONSULTING ENGINEERS

9. REPORT SUBMISSION

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