SECTION “E”

WATER DISTRIBUTION SYSTEM

E1 GENERAL

The specific requirements of the water distribution system will depend on whether the **development** is defined as a rural or urban **development**. Regardless, the intent of the water distribution system design is to properly distribute potable water throughout the **development**, including appropriate supply and treatment systems as necessary. The supply, treatment, and distribution systems are to be approved by the **County** and must meet current design standards. A tracer wire must also be placed with all water lines.

Water Supply and Distribution is regulated provincially under both the Environmental Protection Act and the Water Act. The **Developer** is responsible to ensure that all water treatment, distribution facilities, and infrastructure is designed and constructed in accordance with the manufacturer's design guidelines, Alberta Environment approvals, and good construction practices.

Plans, Engineered Drawings, specifications, and a report prepared by a qualified Professional Engineer must be submitted to the **County** and Alberta Environment for review and approval prior to construction of any water treatment or distribution system.

If the proposed water supply is to be via a common water supply and distribution system, then the water supplier is required to provide proof of supply and Alberta Environmental approvals, licenses, and **permit**s to the satisfaction of the **County**.

The **Developer** is responsible to ensure that the requirements of all Provincial legislation, regulations, guidelines and standards for water supply, treatment and distribution are complied with including but not limited to:

- Water Act.
- Environmental Protection and Enhancement Act.
- Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage Systems.
- Subdivision and **Development** Regulations.
- Copy of Kneehill **County** Water and Wastewater Bylaws.

All materials used in the **development** shall be new and in compliance with the most recent standards of American Water Works Association (**AWWA**), American Society or Testing and Materials (**ASTM**), or Canadian Standards Association (**CSA**).

The **Developer** is responsible to confirm adequate capacity in any existing system to be extended into the **development area**, if such information is not readily available from the system owner.

Generally, rural systems of five (5) residential lots or more that involve individual wells on each lot, or a communal well and treatment system, with appropriate distribution must meet Alberta Environment requirements. Suitability of the existing aquifer to sustain the **development** demand with no adverse impact on existing wells is to be documented in the **Geotechnical/Hydrogeological Report** for the site.

Where the **Developer**'s proposal includes a high-pressure pipeline or other such crossings, the **Developer** will be fully responsible for the preparation and submission of drawings to the owner(s) and/or proper authorities, and for obtaining the necessary permission to enter upon, cross over, or construct under any gas or oil transmission lines or other structures. The **Developer** will bear the full responsibility for any works, extra costs, damage claims, or insurance costs related to any of the above mentioned crossings. Submission of documentary evidence that such **permit**s have been obtained at the time of the **Developer**'s initial submission of drawings to the **County** will also be required.

The **Developer** will ensure that application is made to the Department of Environment for a **permit** to construct the work as required by the Clean Water Act (latest revision) of the Province of Alberta.

E2 GUIDELINES FOR URBAN WATER DISTRIBUTION SYSTEM DESIGN

E2.1 Pipe:

- Unless specified otherwise in the **Development** Agreement, the minimum design standards and guidelines will be in accordance with the Alberta Environment Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage.

E2.2 Water mains:

- Unless specified otherwise in the **Development** Agreement, the minimum design standards and guidelines will be in accordance with the Alberta Environment Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage.

E2.3 Consumption:

Unless specified otherwise in the **Development** Agreement, the minimum design standards and guidelines will be in accordance with the Alberta Environment Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage.

E2.4 Valves:

- Location - Valves will be located such that during a shutdown:

  i) no more than three valves are required to effect a shutdown;
  ii) no more than one hydrant is taken out of service; and
  iii) no more than twenty residential units are taken out of service.

- Position - All valves will be set in a vertical position and valve boxes must be adjustable. The top of valve boxes are to be set to grade in unpaved areas and 5 mm to 10 mm below grade within paved areas.

E2.5 Hydrants:

- Hydrants will be AVK Series or Canada Valve, of the same style and make as presently exist in the **County**, and will be complete with:

  i) Two (2) 65 mm hose nozzles at 180º;
  ii) One (1) 115 mm pumper connection; and
  iii) Threads on hose and pumper connections conforming to the Alberta Mutual Aid Standards.

- Fire Hydrants must be located as follows:

  Hydrants will be installed on the distribution mains at the projection of **property** lines wherever possible. Unless specified otherwise in the **Development** Agreement the minimum design standards and guidelines will be in accordance with the **County** Design Standards and Alberta Environment Standards and Guidelines:

- Valves – Valves will be of the same styles and make as presently existing in the **County**. There will be a gate valve in the lead to each hydrant. This valve will conform to the grade of the surrounding area.

- If a mechanically bolted fire hydrant, valve and tee assembly is specified, it will include stainless steel hardware wrapped with denso tape.

E2.6 Thrust Blocks: (Refer to Drawing E-01 in Appendix C)

- Thrust blocks will be installed at all fittings between solid ground and the fitting to be anchored so that the pipe and fitting joints are accessible for repair. Metal harnesses of corrosive resistant tie rods and pipe clamps will be used to prevent movement when requested by the **County**.

E3 MATERIALS

All materials used for the water distribution system will meet the latest applicable **CSA**, **AWWA**, or **ASTM** Standards, or as approved by the **County**, and will be supplied by the **Developer**. If other than approved materials are incorporated in the works, such materials will be removed and replaced with approved materials, all at the **Developer**'s expense and to the satisfaction of the **County**. The **Developer** may be required to produce certification by an independent testing authority to confirm that the material conform to the specified standards at any time.

E3.1 Pipe & Joints:

All pipe and jointing material will comply with the appropriate **AWWA** Specification, or as otherwise approved to by the **County** in writing:

- Poly Vinyl Chloride (PVC) Pressure Pipe - PVC Pipe will conform to CAN 3- B.137.3 and the Standard Specification for Class 150 **AWWA** Specification C- 900 or C-905 as applicable, SDR 18 colored blue. Joints will be flexible Elastomeric Seals designed for use in pressurized pipes, or as otherwise approved in writing by the **County**.

- Reinforced concrete cylindrical pipes (Hyprescon) - Reinforced concrete cylindrical pipe will comply with **AWWA** Specifications C301 and C303, latest revision thereof.

E3.2 Valves:

- Gate Valves - Gate valves will conform to **AWWA** Specification C500-571, latest revision thereof, and will meet the following supplementary requirements:

  i) operating pressure will be 1034 kPa;

  ii) bronze mounted, resistant to de-zincification under high pH water;

  iii) resilient seat assembly;

  iv) "o" - ring type stem seal;

  v) non-rising stem type;

  vi) 50 mm square operating nut turning counter clock-wise to open;

  vii) type 304 stainless steel stem; and

  viii) valve Boxes - Valve boxes will be a two section cast iron, asphalt coated, of the sliding type (Type “A”) and of sufficient length to provide for adjustments of 300 mm. The internal extension spindle will be at least 6 feet long and will include a rock disk and operating nut. The valve box will have a minimum of 300 mm overlap in the installed position. The operating nut will be no closer than 300 mm from the finished ground surface nor more than 600 mm below the finished ground surface.

E3.3 Hydrants:

Fire hydrants will be the compression-type, closing with pressure and conforming to **AWWA** Specification C502, latest revision thereof, and meet the following requirements:

- designed for a working pressure of 1033 kPa;
- number 6 three-sided operating nut, opening left (counter-clockwise);
- bottom connection with drip valve;
- come with a minimum 300 mm extension;
- minimum flange to bonnet distance of 600 mm; and
- hydrants will be set plumb with the larger pumper nozzle at right angles (90°) to the road alignment. The bottom of ground flanges will be set to an elevation 50 mm above finished grade. Hydrants will be located to provide complete accessibility and to minimize possibility of damage from vehicles or injury to pedestrians. Unless otherwise approved, the location of the hydrant will conform to the approved plans.

E3.4 Fittings:

All fittings will be coated cast iron conforming to **AWWA** C110 or PVC Injected Moulded to **CSA** 137B for 150 mm and 200 mm sizes With compatible rubber joints and belled ends for the pipe, or as otherwise approved by the **County** in writing.

E3.5 Aggregates:

Bedding Sand - All bedding sand must be clean and meet the requirements noted in Section H3.1 – Stormwater Drainage Systems.

E3.6 Flush Valves: (Refer to Drawing E-02 in Appendix C)

Flush valves will be installed at all high points and dead ends of the main, except where the hydrants are located within 15 m of a dead end, unless approved otherwise by the **County**.

E3.7 Cathodic Protection: (Refer to Drawing E-03 in Appendix C)

All buried metallic fittings and valves will be cathodically protected with 2.3 kg zinc anodes and all hydrants will be cathodically protected with a 5.5 kg zinc anode. Zinc anodes will conform to B418-73 Type II.

All old steel, cast iron, or ductile iron being connected to must have at least two 7.7 kg (17 lb) magnesium anodes at point of connection as specified by the Engineer.

E4 CONSTRUCTION

E4.1 Excavation/Pipelaying:

See Excavation and pipelaying requirements as provided in Section H3.3 to H3.5 – Storm Water Drainage Systems.

E4.2 Fittings:

Bends, tees, crosses, valves, and reducers will be lowered into the trench, inspected, and cleaned as specified. Thrust blocks will be placed at all fittings. Where a metal harness of tie rods and pipe clamps are used they will be corrosive protected. All underground nuts and bolts on valves, hydrants, and water main appurtenances will be stainless steel.

E4.3 Hydrants: (Refer to Drawing E-04 in Appendix C)

Hydrants will be thoroughly cleaned of dirt or other foreign matter before setting.

All hydrants will stand plumb +/- 10 mm from Centre at top of hydrant. The larger pumper nozzle will be at right angles to and facing the roadway. Bottom of ground flanges will be set to an elevation of 50 mm above finished grade.

Hydrants are to be placed on a seat of completely treated rough fir on undisturbed ground. An area 1 sq. metre and 300 mm (minimum) above the drainage outlet will be filled with 25 mm washed rock and covered with a single 150 micro-metre layer of polyethylene film.

Where the water table is above the hydrant drain, the hydrant may require plugging. The **County** is to be consulted to determine drain plugging requirements.

E4.4 Valves & Valve Casings:

All valves will be set in a vertical position and a sliding Type A valve casing will be installed vertically over each valve. The valve casing bonnets will be set on 2 or more layers of 50 x 200 x 600 mm treated timber blocks and centered over the operating nut.

The top of the operating stem of the valve will be 300 mm - 600 mm from final grade. The top part of the assembly will be in such a position that the plug over it is flush with the **adjacent** surface.

E4.5 Dead Ends:

Standard plugs will be inserted into the bells of all dead end fittings and plain ends of pipe. A concrete thrust block will then be placed behind this plug backing onto undisturbed material. A valve will be placed within a distance of two (2) full pipe lengths (12 m typical) from the end of the pipe or between the plug and fitting, as required.

E4.6 Backfilling & Compaction:

- Work will conform to the requirements provided in Section H3.6 – Storm Water Drainage System.
- Water Flushing - Water flushing will be permitted under special circumstances, as approved in writing by the **County**.
- Testing - For all density tests indicating insufficient compaction, two more density tests, proportionately representative of the ditch length tested, will be taken at that depth. If the average of the three tests is below the required density, the area of deficient density will be re-excavated and re-compacted to meet the specified density. Densities greater

than 100% will be deemed to be at 100% for calculating the average of the three tests.

- Augering - All service connections into multi-family sites will be installed by augering under existing streets and sidewalks except where augering is not feasible due to adverse soil conditions. Open trenching may be permitted subject to the **County**'s acceptance of the need and acceptance of the backfill material.
- Backfill of auger pit excavation over 300 mm above the pipe will be compacted in lifts not to exceed 150 mm in depth, to a minimum of 98% Standard Proctor Density within the road right-of-way and 95% outside the road right-of-way.

E5 GUIDELINES FOR RURAL WATER DISTRIBUTION SYSTEM DESIGN

The guidelines developed by the **County** are intended to be consistent with the Water Act, its regulations and any related guidelines developed by Alberta Environment. Where any discrepancy exists, Alberta Environment requirements will apply.

This section provides information on the use of groundwater for proposed subdivisions. It may not be feasible to connect a proposed residential subdivision to a waterworks system that supplies Municipal standard water.

E5.1 Groundwater:

- Groundwater Supply:

There are two basic groundwater supply alternatives in rural areas of Alberta, these include:

i) A private groundwater supply system (based upon a central well with a piped water distribution systems), or

ii) The use of privately owned household water supply systems where each lot has its own system.

For alternative i) the **applicant** must submit an application under the Water Act to the appropriate regional office of the Water Administration Branch of Alberta Environment. The direction and evaluation of aquifer testing for wells requiring a license under this Act will require the assistance of a **person** competent in groundwater evaluations and who is a member of the Association of Professional Engineers Geologists and Geophysicists of Alberta.

Alberta Environment, Standards and Guidelines Branch recommends that the groundwater potential be evaluated when:

i) the number of unserviced residential parcels per quarter section, or per river lot, both existing and proposed, using the underlying groundwater resource is six or more; or

ii) whenever there is a possibility that each proposed parcel will not have access to an adequate long term supply of potable groundwater using a privately owned household well (potable means suitable for drinking).

- Well Drilling:

Wells used for water supply must be drilled by Alberta licensed water well drillers.

- Groundwater Specialist:

If the subdivision authority decides that these guidelines apply, a Groundwater Supply Evaluation Report must be prepared by a groundwater geologist (hydrogeologist) or professional engineer whose area of competence encompasses groundwater evaluations, and who is a member in good standing with APEGGA. The household groundwater supply potential must be evaluated by using the following five criteria:

i) The potential of one or more aquifers, if present, to provide a sufficient supply of groundwater to meet the needs of any existing **development** and proposed unserviced residential subdivision within a quarter section during peak demand periods and over the long term (an aquifer is a water bearing formation which is capable of transmitting and yielding water in usable quantities).

ii) The extent to which each aquifer is continuous beneath the proposed **development area** (if discontinuous, each proposed parcel may not be able to have a privately owned household well).

iii) The potability of each aquifer's water in its current state considering its natural quality and possible existing anthropogenic contamination (anthropogenic refers to the impact of man on nature; existing contamination may be from agricultural, industrial activities, etc.; refer to the Local Health Unit's criteria for potable water).

iv) Feasibility of treating groundwater if needed.

v) The susceptibility of each aquifer to potential contamination taking into account aquifer depth, overlaying low permeability

layers such as clay and shale, and the presence of fractures, fissures or cracks in these fine textured layers. Each parcel within an unserviced residential subdivision is serviced by on site **private sewage disposal system**, therefore, the potential for contamination by sewage effluent is of primary concern.

- Quantity of Water:

  A central well must be capable of meeting the household requirements of all the existing and proposed lots within a quarter section, calculated based on an average meter consumption of 1250 m^3/year/household (0.523 igpm/household). These requirements do not provide for fire protection, irrigation, livestock, or any other use.

- Groundwater Supply Evaluation Report must include, but not be limited to, the following:

i) **Collection and Summary of Existing Local Groundwater Data** - the Groundwater Supply Evaluation Report must be prepared by a groundwater geologist (hydrogeologist) or professional engineer whose area of competence lies within the groundwater field, and who is a member in good standing with APEGGA. The consultant must collect and summarize in the report existing local groundwater data for an area termed the Evaluation Area which includes the proposed subdivision and surrounding land within a minimum of 3.2 km (2 miles) from the subdivision boundary.

ii) **Assessment of Existing Information** - Using the information collected, the **developer** must assess with respect to each of the groundwater supply evaluation criteria, whether there is sufficient existing hydrogeological information to confidently estimate the groundwater supply potential in the vicinity of the proposed subdivision. This assessment must be presented in the report.

iii) **Aquifer Testing if Existing Information Insufficient** - Any testing of aquifer capacity will be carried out in strict accordance with AEP guidelines, with the **Developer** responsible for all necessary licensing.

iv) **Determination of the Adequacy of the Groundwater Supply** Using the above information in the groundwater water supply evaluation criteria, the **developer** must determine whether the groundwater supply is adequate to meet the needs of both the existing **development** and the proposed subdivision.

Discussion and findings must be presented in the report.

v) **Conclusion** - In the conclusion of the report, the **developer** must clearly state that there is an adequate groundwater supply potential to meet the needs of any existing **development** and the domestic requirements of the proposed residential subdivision.

In addition, the consultant must state in the conclusion whether the evaluation was performed in conformance with these guidelines. If the report does not contain a recommendation on the groundwater supply potential and/or statement of conformance to these guidelines, the subdivision approval authority must identify this as a major deficiency and not proceed with the application until this has been remedied; and

vi) **Recommendations** -The **developer** must recommend appropriate ongoing monitoring and well **maintenance** schedules, any water servicing devices or any other means to protect the ground water source. Copies of the report must be submitted to the subdivision approving authority for circulation to the municipality (if applicable) and the Local Health Unit, and sent to the Groundwater Information Centre.

- Sources of Existing Groundwater Data:

The collection and summary of the existing groundwater data must be performed by a groundwater geologist (hydrogeologist) or professional engineer whose area of competence lies within the groundwater field, and who is a member in good standing with APEGGA.

Sources of Data - the Groundwater Information Center (GIC) maintains a provincial groundwater data archive of Water Well Driller's Reports, aquifer tests, chemical analysis, provincial observation, well hydrograph data, electric logs, records on flowing shot holes from seismic exploration, groundwater consultant's reports, and most of the hydrogeological reports from the Alberta Geological Survey Information Sales (formerly Alberta Research Council).

E6 INSPECTION

Before acceptance of the work, the entire water system will be subjected to a hydrostatic pressure test under the direction of the **Developer's Engineer** and in the presence of the **County** representative. The **Developer** will provide all necessary labor, materials, and equipment for the test including a suitable pump, measuring tank, pressure hoses, connections, plugs, caps, gauges, and all other apparatus necessary for filling the main, pumping to the required test pressure, and recording the pressure and leakage losses.

- The **Developer** will provide evidence that the gauges used are accurate.
- The water distribution systems may only be charged through one valve. Only one valve may be operated during pressure and leakage testing as well.
- Prior to the start of pressure and leakage, chlorination, and bacteria testing, the **Developer**'s consultant will be required to provide a plan outlining how the testing is to be accomplished. The plan must include the sequence of valve turning, sections of water main to undergo pressure and leakage testing, how chlorination is to be accomplished, and locations when chlorine residual and bacteria tests are to be taken. Testing will not be allowed to proceed until the above is approved by the **County** representative.
- The **Developer** will be required to give a minimum of 48 hours' notice to the **County** representative.
- The system will be filled with water slowly and air bled off at each hydrant within the area being tested. If there are sections that cannot be bled from hydrants due to the profile of the main, the **Developer** may be required to tap the main at high points and install temporary bleeder valves at the ends of each tested area. At the completion of testing, these taps will be satisfactorily plugged at the **Developer**'s expense.
- When the line has been filled and most of the air expelled, time must be allowed for the remaining air and water to reach a constant temperature.
- The test section may be pressured through a hydrant or a tap may be installed in the line. After testing, the pipe will be plugged at the **Developer**'s expense.
- The mains or section of mains will be subject to a pressure of not less than 1035 kPa. Test sections will not exceed 450 m of main.

Leakage tests will be made only after completion of services, partial or complete backfill, and a minimum of 24 hours after the pipe has been filled with water. No test will be applied until at least 36 hours after the last concrete reaction or thrust block has been cast with high early strength cement, or at least 7 days after the last concrete reaction or thrust block has been cast with standard cement. The duration of each test will be two (2) hours.

The allowable leakage will be determined by the following table:

PVC LEAKAGE ALLOWANCE TABLE
(NEW CONSTRUCTION)

LEAKAGE ALLOWANCE IN LITERS PER 100 JOINTS PER HOUR

	TEST PRESSURE (kPa)						
Pipe Ø (mm)	**345**	**515**	**690**	**860**	**1035**	**1380**	**1550**
150	2.17	2.65	3.07	3.42	3.76	4.34	4.60
200	2.89	3.54	4.09	4.57	5.02	5.79	6.14
250	3.62	4.42	5.19	5.71	6.27	7.24	7.67
300	4.34	5.31	6.14	6.86	7.52	8.69	9.21
450	6.51	7.96	9.21	10.29	11.28	13.03	13.81
600	8.69	10.61	12.28	13.71	15.05	17.37	18.41
750	10.86	13.27	15.35	17.14	18.81	21.72	23.01
900	13.03	15.92	18.42	20.57	22.57	26.06	27.62

Above leakage allowances calculated from the following formula from **AWWA** Manual # M23 (PVC Pipe - Design and Installation):

$$* \; L = NDP^{1/2} / 1283$$

Where: * L = allowable leakage (L/h)
N = total number of joints/100
D = pipe diameter (mm)
P = test pressure (kPa)

Leakage allowance for new construction for materials of other than PVC or ductile iron will be in accordance with the applicable **AWWA** standard.

No mains will be charged and no pressure and leakage tests will be permitted between October 15th to April 15th inclusive, unless approved by the **County**.

Each section between valves will be brought to test pressures with the valves closed to test the valves under pressure. Test pressure will be held without loss for two (2) minutes before opening the valve and releasing the pressure into the next section.

Prior to the initial acceptance of the water system, water mains are to be disinfected in accordance with **AWWA** C651 continuous feed method. Procedural method of disinfection including chlorine concentration calculations and contact times are to be submitted to the **County** representative for acceptance. Upon completion of the disinfection and of the waterlines flushed, one bacteria sample will be submitted for each 300 linear metres of water main installed. The water main is to remain valved off until such time as the bacteria sample results are approved.

Under Alberta Environmental Protection standards and regulations, super chlorinated water used for disinfection of the system cannot be directed into a storm sewer or open water body. Dechlorination will be required prior to being discharged into the environment.

Prior to initial acceptance of the water system and the system put into service, bacteriological testing will be carried out on all water mains and acceptable test results achieved.

Prior to issuance of the **Construction Completion Certificate**, hydrants flow testing will be conducted by the **Developer**'s **consulting engineer** to verify that the flows and pressures identified in the design calculations are being provided in the field. The **Developer**'s **consulting engineer** will coordinate the testing with the **County** representative to ensure he is present for all testing. Results of the testing will be compiled by the **Developer**'s **consulting engineer** and submitted to the **County** representative with a comparison of the actual flows and design flows for the same hydrant. Where the actual flows do not meet the minimum fire and service requirements all hydrants in the project must be tested and the **Developer** must advise the corrective action he will be taking to provide the necessary service level. The location and extent of initial testing will be as required by the **County** representative.

E7 RECORD DRAWINGS

Record drawings will be made according to the requirements outlined in Section C – Engineering Plans & Drawings.