MUNICIPAL ENGINEERING AND CONSTRUCTION STANDARDS

TOWN OF HIGH LEVEL

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WSP Canada Inc.
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Town of High Level
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The Municipal Engineering and Construction Standards (MECS) work in collaboration with the Land Use Bylaw and Municipal Development Plans to ensure infrastructure meets and/or exceeds the servicing requirements for commercial, industrial and residential development within the Municipality.

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Town of High Level
January 2015

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LAND DEVELOPMENT, WATER, SEWER AND ROAD SYSTEMS

1.1 GENERAL

1.1.1 INTENT

The Municipal Engineering and Construction Standards (MECS) are intended to provide specific guidelines to assist the Municipality and the Developer in the engineering design, preparation and submission of plans and specifications, and construction of municipal projects.

The MECS have been developed to:

1. Ensure that the Municipality is provided with a quality product that will meet an acceptable long-term life expectancy while maintaining cost efficiency and practicality so as not to prohibit land development;
2. Minimize the operational and maintenance requirements associated with land development and municipal infrastructure.

The MECS presented in this document shall only be considered as minimum requirements. The Developer remains fully responsible for the design and construction of municipal improvements according to accepted engineering practice and standards that address and meet the specific needs and site conditions of the development. Certain site-specific conditions may warrant the use of standards that are more stringent.

The MECS, as well as the latest editions of any referenced legislation or documents, from part of the requirements for the design and construction of any project within the Municipality.

1.1.2 DEFINITIONS

Adjacent shall refer to those lands next to the proposed development area and includes those lands severed by a roadway, utility right-of-way, railroad, river, stream, reserve lands or other means of natural barrier.

Consulting Engineers shall mean the consulting professional engineer(s) retained by the Developer and/or the Municipality.

Construction Completion Certificate shall mean a certificate issued pursuant to the Development Agreement or Contract document and shall be issued upon completion of construction work.

Municipality shall mean the Town of High Level.

Municipality Property shall mean:

1. Any property owned or leased by the Municipality developed for use as public park, sports field, playground or other recreational area;

2. Undeveloped reserve land as either: reserve, municipal reserve, school reserve, environment reserve or combination of reserves;
3. Municipal right-of-way including all forms of public roadways (roads, lanes, streets, highways) sidewalks, boulevards, road allowances, utilities right-of-ways, public utility lots, public spaces, undeveloped right-of-ways, and storm water management facilities, bridges, culverts and water bodies;
4. Any property developed as a pathway or park trail system;
5. Any property owned or titled to the Municipality including buildings, structures and parking facilities.

Municipality Manager shall mean the Chief Administrative Officer, or designate, of the Municipality.

Council shall mean persons duly elected to the Council of the Municipality.

Developer shall mean the proponent of a land development proposal, or the Owner as defined in the Development Agreement.

Developer's Engineer shall mean the professional engineer(s) and/or firm retained by the Developer for the preparation of design, reports, studies, engineering drawings, specifications and all other documents associated with the design and construction of the municipal improvements.

Development shall mean the carrying out of any construction or excavation or other operations, in, on, over or under land, or the making of any change in the use or the intensity of use of any land, buildings or premises.

Development Agreement shall mean documents specifying the terms and conditions for the construction of municipal improvements necessary to service the approved development.

Development Area shall mean the lands as described and as shown in the Development Agreement.

Development Approving Authority(s) shall mean that person(s) designated and known to be the Development Authority to exercise the duties and powers and perform the functions prescribed in the Land Use Bylaw pursuant to the Municipality's Development Authority Bylaw.

Engineer shall mean the professional engineer(s) and/or firm retained by the Municipality to review, inspect and recommend approval or rejection of the work proposed or performed by the Developer under the terms of the Development Agreement.

External Road shall mean any public road which is not an internal road or provincial highway.

Final Acceptance Certificate shall mean a certificate issued pursuant to the Development Agreement for final acceptance of all works.

General Design Standards shall mean the General Municipal Servicing Standards as amended by the Municipality and approved by the Engineer for construction and installation of the local improvements.

Geotechnical Report shall mean a document prepared by an Engineer, Geological or Geophysical Professional licensed to practice in the Province of Alberta and that bears the seals or stamps signed and dated by the professional in accordance with the enactments that govern their profession.

Grading shall mean an operation or process intended to level or to grade the development area to a desired horizontal gradient.

Internal Road shall mean a public roadway, the primary function of which is to provide access to individual sites within a multi-lot subdivision, with the exception of mobile home communities or bare land condominium developments in which case the internal roads are privately owned.

Local Improvements, External shall mean all of the local improvements or the portions thereof to be constructed by the Developer outside of the proposed development as described in the Development Agreement and/or Contract document.

Local Improvements, Internal shall mean all of the local improvements or the portions thereof to be constructed by the Developer within the proposed development as described in the Development Agreement and/or Contract document.

Municipal or Local Improvements shall mean the installation of municipal services including, but not limited to , roadways, water and sewer systems, storm sewer and storm water management systems, landscaping, street lighting, power, gas and telecommunication as required and specified in the Development Agreement.

Off Site Levies shall mean the monies collected by the municipality from the Developer or industry to assist with the payment of the portion of the off-site services that the development will utilize.

Order shall mean an order issued under the Land Use Bylaw in accordance with the municipal Government Act, or an order issued under provisions of other municipal bylaws and the governing Provincial Act.

Permit, Building shall mean a certificate or other document permitting the construction or alteration of a building or structure, which constitutes part or all of the specified development. The permit issuance shall be in accordance with the minimum requirements of the Alberta Building Code.

Permit, Development shall mean a certificate or other document permitting a specified development and includes, where applicable a plan or drawing, or a set of plans or drawings, specification or other documents as authorized by the Development Approving Authority to proceed with the specific development.

Person shall mean one or more individuals, partnerships, corporate bodies, unincorporated organizations, government body, trustees, executors, administrators or legal representative other than the Municipality or its legal counsel.

Plans and Specifications shall mean plans, specifications, material lists and performance criteria for the development approved by the Engineer covering design, construction and installation of the municipal improvements.

Private Sewage Disposal System shall mean a separate system for treatment and disposal of sewage, including a septic tank and absorption field, which is not connected to a municipal sewage disposal system.

Private Property shall mean land owned by a person, group, corporation or entity that is not a government body.

Property shall mean any land, building, structures or premises including any personal property located on, over or in the property that is located within the municipal boundaries of the Municipality.

Suitable Development Area shall mean that each lot created by either a single lot or multi-lot subdivision development that is suitable for the construction and use of a residence, ancillary building, and access road, a privately owned domestic water well and a private sewage treatment system.

Unauthorized Use shall mean the use of the Municipality property either by constructing, storing, landscaping, erecting, placement or removal of any structure, item or thing on, over or in the Municipality property without written authorization from the Municipality, which include but are not limited to:

1. The placement of surface structures such as a driveway, parking area, walkway, patio, deck, stairs or retaining wall;
2. Permanent buildings, relocateable structures or accessory structures such as a detached garage, barn, shed, greenhouse, lean-to composter;
3. Landscaping including fencing, fire pits or fire wood storage, the addition or removal of vegetation or a use that interferes with the growth of existing vegetation;
4. Installation of utilities, antenna, satellite receiving dish or other telecommunication facilities and devices;

5. Storage of vehicles or trailers or off-road equipment, building materials, rubble, stockpiles, debris or chattel;
6. Site drainage including the use of pipes, culverts, catch basins, ditches, swales, sump drainage, dry wells, sewage disposal systems, detention ponds or related ancillary structures;
7. Excavating, cutting, filling or undermining.

Units of Measurement shall mean that the standard units of measurement approved by the Municipality are System International) metric) only, and any reference to imperial measurement units may be allowed for convenience purposes only.

Utilities shall mean those utilities together with all necessary appurtenances, which are described in the Development Agreement and/or Contract document.

Utilities, Franchise shall mean those utilities provided by a service company such as electrical service, natural gas, telephone or cable television.

Warranty Period shall mean the minimum period of time commencing on the date of issuance of the Construction Completion Certificate and ending on the date of issuance of the Final Acceptance Certificate.

1.1.3 REFERENCE STANDARDS

LATEST EDITIONS

All references to Specifications, standards, or methods of technical associations refer to the latest adopted revision, including all amendments.

ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
AADT	Average Annual Daily Traffic
ABC	Alberta Building Code
ABSA	Alberta Boiler Safety Association
ACI	American Concrete Institute
AFBMA	Antifriction Bearing Manufacturers Association
AGA	American Gas Association
AGMA	American Gear Manufacturers Association
AISC	American Institute of Steel Construction
AMCA	Air Moving and Conditioning Association
ANSI	American National Standards Institute
AISI	American Iron and Steel Institute
API	American Petroleum Institute
ARI	Air Conditioning and Refrigeration Institute

ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating, and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AT	Alberta Transportation
AWMAC	Architectural Woodworkers Manufacturers Association of Canada
AWPA	American Wood Preservers Association
AWS	American Welding Society
AWWA	American Water Works Association
CBM	Certified Ballast Manufacturers
CBTIC	Clay Brick and Tile Institute of Canada
CCA	Canadian Construction Association
CCDC	Canadian Construction Documentation Committee
CEC	Canadian Electrical Code
CEMA	Canadian Electrical Manufacturers Association
CGA	Canadian Gas Association
CGRA	Canadian Good Roads Association
CGSB	Canadian General Standards Board
CISC	Canadian Institute of Steel Construction
CITC	Canadian Institute of Timber Construction
CLA	Canadian Lumbermen Association
CMAA	Crane Manufacturers Association of America
CMHC	Canadian Mortgage and Housing Corporation
CPCA	Canadian Painting Contractors Association
CPCI	Canadian Pre-stressed Concrete Institute
CSA	Canadian Standards Association
NEC	National Electric Code

NEMA	National Electrical Manufacturers
NESC	National Electric Safety Code
NFPA	National Fire Protection Association
NLGA	National Lumber Grade Authority
OECI	Overhead Electrical Crane Institute
PCA	Portland Cement Association
PCI	Pre-stressed Concrete Institute
PMBC	Plywood Manufacturers Association of British Columbia
RLM	RLM Standards Institute
RTAC	Toad Transportation Association of Canada
SAE	Society of Automotive Engineers
SBI	Steel Boilers Institute
SJI	Steel Joint Institute
SSPC	Steel Structures Painting Council
TTMAC	Terrazzo, Tile and Marble Association of Canada
ULC	Underwriters' Laboratories of Canada
USFG	United States Federal Government
WCB	Workers' Compensation Board
WCLIB	West Coast Lumber Inspection Bureau

CONFORMANCE

Conform to these Standards, in whole or in part as specifically requested in the Specifications. They are part of the Specifications as specified and modified. In case of a conflict between the requirements of the Specifications and those of the listed referenced Standards, the requirements of the Specification will prevail.

Demonstrate conformance to the satisfaction of the Engineer if there is a question as to whether any product or system is in conformance with applicable Standards. Pay the costs associated with any testing or certification to demonstrate conformance.

1.1.4 DEVELOPER'S RESPONSIBILITY

The Developer shall, at his own cost and expense, provide the following:

1. Design and construction of the proposed municipal improvements including necessary off-site upgrades and utility up-sizing associated with the Development.

2. Quality control and materials testing by a third party independent qualified engineering firm.
3. The certification by an independent third party that the construction has been completed in accordance with the approved drawings and specifications shall be required.
4. Acquisition of additional land for roadways widening and municipal utilities and services as required.
5. Registration with Alberta Land Titles all easements including plans and documents for the construction of municipal improvements outside of the municipal right-of-way.
6. Register a Plan of the Development (Subdivision), made in accordance with the Plan approved by the Municipality's Subdivision Approving Authority, at the Land Titles Office.
7. Supply to the Municipality both digital and hard copy, of the Plan of the Development (Subdivision) drawings and as-built (as-constructed) drawings, as per Municipality drawing standards.

It is the Developer's responsibility to satisfy all statutory requirements governing the proposed works and obtaining approvals for compliance with those requirements from the applicable jurisdiction authorities. Should conflicts or inconsistencies with the MECS and referenced documents arise due to compliance with or amendment of statutory requirements, the Developer shall be responsible for satisfying the more stringent requirements.

It is the Developer's responsibility to satisfy the requirements established in the MECS unless stated otherwise. All design criteria, methodologies, materials, installation and testing shall be in accordance with the most recent editions of the referenced documents which include but are not limited to:

- Public Lands Act
- Municipal Government Act
- Water Act
- Environmental Protection & Enhancement Act
- Canadian Environmental Assessment Act
- Fisheries Act
- Species at Risk Act
- Navigable Water Protection Act
- Safety Codes Act
- Rural Utilities Act
- Provincial Offences Procedures Act
- Plumbing Code
- Alberta Private Sewage Standards of Practice
- Alberta Building Code
- Provincial Wetlands Policy
- Alberta Environment, Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems
- Alberta Highway Design Guide
- Transportation Association of Canada Geometric Design Guidelines
- Transportation Association of Canada Uniform Traffic Control Devices for Canadian Roads
- Transportation Association of Canada Highway Lighting Design Guide
- Municipal Bylaws
- Other Provincial/Federal Government Authorities

It is the Developer's or the Developer's Engineer responsibility to obtain, at their own cost, copies of the referenced documents from the applicable authority.

The above compiled list of referenced documents shall not be considered as all inclusive, as other applicable standards and documents may be listed in specific sections of the MECS for reference. The Developer and the Developer's Engineer shall remain responsible for the design and construction of their development according to accepted best engineering and work practices.

1.1.5 DEVELOPMENT AGREEMENT

The Developer shall enter into a Development Agreement (attached) with the Municipality prior to the construction and installation of proposed development. There will be no Building Permit issued for construction within the proposed development until all required municipal improvement plans are in place and accepted by the Municipality. Endorsement of the development agreement plans plus registration at Alberta Land Titles must be completed.

1.1.6 CHANGES IN DESIGN STANDARDS

It is the Developer's responsibility to ensure that the design and construction is in compliance with the latest edition of the Municipal Engineering and Construction Standards (MECS) including any revision thereto up to the date of acceptance of the detailed design.

1.1.7 INSPECTIONS AND FINAL ACCEPTANCE

Upon Completion of all municipal improvements associated with the proposed development, the Developer shall give notice to the Municipality and arrange for inspections. Upon the receipt of a Construction Completion Certificate (CCC) from the Developer, the Engineer, on behalf of the Municipality, shall inspect the municipal improvements, prepare a deficiency list and forward it to the Developer through the Municipality.

All deficiencies shall be rectified to the satisfaction of the Engineer prior to the acceptance and approval of the Construction Completion Certificate by the Municipality. Record drawings and manuals must be submitted and approved by the Municipality prior to issuing CCC.

The warranty period shall commence upon acceptance and approval of the Construction Completion Certificate. During this period, the Developer shall repair any defects in materials or workmanship.

Prior to the expiry of the warranty period, the developer shall notify the Municipality and arrange for an inspection. Upon the correction of all deficiencies satisfactory to the Engineer, the Developer's Engineer shall issue a request for the Final Acceptance Certificate (FAC).

1.1.8 WARRANTY PERIOD

The warranty period for the municipal improvements shall commence upon acceptance of the Construction Completion Certificate by the Municipality and shall be governed by the terms outlined in the Development Agreement. Warranty periods generally extend for:

1. Two (2) years for site clearing, topsoil stripping, stockpiling, grading, erosion and sediment control and storm water ponds;
2. Two (2) years for surface work related to roadway construction including road structure, curb, gutter, sidewalks, walkways, trails, ditches, swales, other storm water facilities and drainage structures with the exception of the surface layer of asphalt concrete pavement and pavement markings.
3. Two (2) years for the surface layer of asphalt concrete pavement and pavement markings.
4. Two (2) years for underground utilities and related above ground components such as valves, hydrants and manhole and catch basin covers.
5. Two (2) years for power and street lighting components.
6. Two (2) years for landscaping features.
7. Two (2) years for topsoil placement and seeding.

Where there is a delay in the application of the surface layer of asphalt concrete pavement on internal roads and approaches, the warranty period for the surface layer of asphalt concrete pavement shall

be extended for a period of twelve (12) months form the date of acceptance of the Construction Completion Certificate by the Municipality.

The Developer shall comply with all terms and conditions of the Crossing Agreement and make application to transfer the Agreement to the Municipality's name prior to the application for the Construction Completion Certificate.

1.1.9 FRANCHISE UTILITIES

It is the Developer's responsibility to coordinate the design and installation of works with franchise utilities. The Developer shall be responsible for any deficiencies noted as a result of installation such as fill settlements and damages occurred to curb and gutter, roadway pavement structure, boulevards or landscaping features.

1.1.10 EASEMENT AND RIGHT OF WAY

It is the Developer's responsibility to obtain all easements and right-of-ways for the installation of municipal improvements located outside of the normal right-of-way or utility lot. Prior to application for the Construction Completion Certificate all the permanent easements, including applicable plans and documents, shall be registered at the Land Titles Office naming the Municipality as the Grantor.

1.1.11 PERMITS AND LICENCES

It is the Developer's responsibility to obtain all permits and licenses in compliance with the Provincial and Federal statutory requirements.

2

EXISTING INFORMATION

2.1 SUBMISSION REQUIREMENTS FOR DEVELOPMENT AND LOT/SITE GRADING PERMIT

2.1.1 GRADING PERMIT

Pursuant to Municipality's Land Use Bylaw, the following technical information shall be submitted with a Development Permit Application to begin site stripping, stockpiling of topsoil and cut and fill operations only:

1. For multi-lot subdivision development the Subdivision Application shall be approved by the Municipality's Subdivision Authority prior to the submission for engineering drawings for review and approval.
2. For large scale industrial or commercial development, where site grading may be desirable in advance of all other approvals, the Municipality's Development Authority at its own discretion may issue a separate Development Permit for site grading.
3. For excavations other than for construction or building purposes, including, but no limited to, sand and gravel, topsoil stripping, peat moss, and construction of artificial bodies of water.
4. Pursuant to the Soil Conservation Act, appropriate measure shall be implemented to prevent soil loss or deterioration from taking place or to stop soil loss and deterioration from continuing.

Development permit submission requirements are:

1. Provide a General Site Plan illustrating existing contours at 0.5m intervals preferred and not to exceed 1.0m maximum. Elevations shall be relative to geodetic datum. Reference benchmarks shall be detailed on the General Site Plan.
2. Provide a Conceptual Site Plan illustrating proposed site stripping, cut and fill requirements and proposed contour elevations. The Developer is responsible for the completion of rough grading for the entire development or subdivision area including roadways rights-of-way, laneways, drainage and utility easements, municipal reserve and for all lots. The benchmarks to be used in the control of construction of the project shall be indicated on the plan. Other information to be shown includes proposed locations for stock piling and windrows.
3. A Geotechnical and Hydrogeological Investigation of the proposed site shall be completed by a qualified geotechnical engineering firm to a level that will allow the Engineer to assess the site geotechnical and hydrogeological conditions and their effect on the development or subdivision. The report shall outline any findings of contamination that may exist and any general recommendations.
4. For the development or subdivision sites that require 1m or more of fill, a geotechnical evaluation and engineering requirements for each site or lot shall be submitted to support the development of each lot or site. Each lot shall be identified on the Conceptual Site Plan. The Developer is responsible for the supply, placement and compaction of necessary fill for rough grading. The rough grades shall ensure that the overall drainage plan requirements are met. No standing water or areas where water may pool or pond shall be allowed.

5. A Phase 1 Environmental Site Assessment (ESA) of the proposed development area shall be completed in accordance with Canada Standards Association requirements. A Phase II ESA shall be required if recommended in the Phase I ESA report.
6. If a creek, river or other major watercourse crosses the proposed site, the Developer shall submit a Plan of the Floodplain and a letter outlining the recommended measures to ensure that the proposed development and adjacent areas and developments would not be exposed to flooding.
7. Overall conceptual plans, technical studies and reports and description for the proposed development or subdivision shall be required for review and approval, as well as roadways layout, water and sanitary sewer servicing and storm water management plan. The storm water management plan shall address the capacity of existing systems, and the proposed additional measures to accommodate the new flows shall be required for review along with supporting calculations.
8. Any development or subdivision involving pipeline, power transmission line and/or public utility right-of-way shall be sited to comply with all relevant Federal and Provincial legislation. Setbacks from pipelines and other utility corridors shall be in accordance with appropriate Provincial Regulations of Acts and any regulation or directive established by the Energy and Utilities Board. Letter of crossing agreements shall be provided with the application.

The standard drawing size of 841mm by 594mm, E size sheet (or other standard sheet size), shall be used for all plan submissions with a scale of 1:1000, with a scale of 1:5000 acceptable as an option for larger areas. The index plan may be a reduction of the standard scale to allow the plan to fit the standard size sheet.

The Municipality reserves the right to request submission of relevant non-technical information as part of the application, such as a Historical Resource Report to identify any significant historical, archaeological and paleontological resources within the boundaries of the proposed development.

2.2 PREREQUISITES TO REVIEW OF ENGINEERING DRAWINGS

The Development or Subdivision Plan shall be approved by the Municipality prior to the submission of engineering drawings for review and approval.

The engineering drawings shall be prepared and signed by a qualified Professional Engineer registered in the Province of Alberta and shall indicate the permit number.

The submission of drawings shall be accompanied by all supporting documents, reports, studies, calculations or any other information as required by the Municipality.

2.3 ENGINEERING DRAWING SUBMISSION AND APPROVAL PROCEDURE

The Developer shall submit complete engineering drawings at least eight weeks prior to start up of construction. The Municipality or its designated Engineer is not responsible for any delay of approval if submissions are incomplete or found to contain excessive errors or omissions.

Initially, the Developer shall submit six (6) complete sets of drawings and three (3) copies of specifications to the Municipality along with all supporting documents and reports.

The Developer is responsible to contact the Government of Alberta for submittal and permitting requirements.

The Municipality shall respond to the Developer's initial submissions within four weeks and return one set of drawings and specifications to the Developer with comments for revision.

The Developer shall promptly revise the engineering drawings to the satisfaction of the Engineer and resubmit six (6) complete sets of revised drawings and specifications and one (1) digital copy to the Municipality for approval, as per Section B.4 "General Requirements and Standards for Engineering Drawings" along with any additional information as required by the Engineer.

Upon receipt of revised drawings, satisfactory to the Engineer, the Municipality shall return one (1) complete set of drawings to the Developer with a stamp of "Approved for Construction".

The Developer shall not proceed with construction until the engineering drawings have been approved for construction.

The Municipality's Approval for Construction shall not relieve the Developer's or its Engineer's from the responsibility for the adequacy of the designs or the liability arising thereof.

2.4 GENERAL REQUIREMENTS AND STANDARDS FOR ENGINEERING DRAWINGS

Each drawing shall include the following:

1. A suitable title block, identifying:
   - Name of the Project;
   - The Municipality File No.;
   - Draft or Revision No.;
   - Revision Date;
   - Date of Drawings Issued;
2. The scale of the drawing;
3. A north direction indicator;
4. An appropriate space for the Professional Engineer Permit to Practice seal.

All dimensions and measurements shown in the engineering drawings shall be in metric units. All elevations shown in the engineering drawings shall be referenced to geodetic datum and shall be noted as such.

Geodetic Datum, surveys and plans shall be prepared utilizing North American Datum NAD83 (Adopted).

The standard drawing size of 841mm by 594mm shall be used.

All lettering shall be a minimum of 2.5mm high.

All abbreviations and drawing symbols used in the engineering drawings shall be consistent with drawings standards provided by the Municipality.

The engineering drawings shall provide a complete description of all existing and proposed municipal improvements, including any provisions for future extensions of utilities and systems.

The engineering drawings shall include:

Cover sheet of standard size, indicating the names of the development or subdivision, the Developer and the Consultant, and the legal location or address of the development or subdivision;

Index plan of standard size, scale 1:1000 or a reduction thereof, duplicating the legal plan, indicating drawing sheet number and related title;

Topography and Land Use Plan, scale 1:1000, indicating the existing contours at 0.5m intervals and the proposed land uses;

Lot Grading Plan, scale 1:1000, indicating:

- Proposed lot corner elevations,
- The proposed finished grades at the buildings,
- Directions of surface drainage on the lots, roadways and swales,
- Proposed building elevations and sewer services invert elevations,
- All lots on fill, disturbed or unsuitable soil must be identified,
- Minimum rough site grading requirements to be completed by the Developer (Rough grades shall ensure that the overall drainage concept is satisfied. No standing water or areas where water may pool or pond shall be allowed at the rough site grading stage.);

Roadway Overall Plan, scale 1:1000, indicating all walks, lanes, roadway widths and alignments;

Drainage Basin Plan, showing 1.0m contours, indicating areas adjacent to all roadways, existing overland drainage routes and flood plains or water ponding areas;

Pavement Marking and Signage Plan, scale 1:1000, indicating pavement marking and proposed signage locations and specifications;

Sanitary, Storm and Water Main Overall Plan, scale 1:1000, indicating the alignments and sizes of sanitary sewers, storm sewers and water mains and services, locations of manholes, catch basins, drainage, valves, hydrants and other proposed underground utilities;

Erosion and Sediment Control (ESC) Plan (ESCP), scale 1:1000, indicating the following elements and incorporating best management practices (BMP):

- Minimize needless clearing and grading,
- Protect waterways and stabilize drainage ways,
- Phase construction to limit soil exposure,
- Stabilize exposed soil immediately,
- Protect steep slopes and cuts,
- Install perimeter controls and filter sediment,
- Employ advanced sediment settling controls,
- Training on ESCP implementation, inspection, maintenance and repairs,
- Adjust ESCP at construction site
- Assess ESC practices after rainstorms or snow melt events;

Gas, Power and Telecommunication Overall Plan, sale 1:1000, indicating: gas, power, telephone, television and other underground utilities locations and easements;

Landscaping Plan, scale 1:1000, identifying street names and landscape amenities, including fencing, signage, screening berms, Canada Post mail boxes and pads, entrance features, entrance signs location and specifications and name and location of all trees and shrubs (Street naming approval will be completed by the Municipality. The Municipality reserves the right to select or reject proposed names.);

Roadways Plans and Profiles, scale 1:500 horizontal and 1:50 vertical, showing:

- Roadway right-of-way width, roadway width offset from property line and horizontal curve data,
- Original ground profiles and chainages,
- Proposed centerline profiles and changes,
- Proposed top of curb elevations,
- Proposed catch basin locations and inlet elevations,
- Vertical curve data,
- Elevations of shallow utilities at road crossings,
- Proposed pavement structure;

Water, Sanitary and Storm Sewers Plans and Profiles, scale 1:500 horizontal and 1:50 vertical, showing:

- Horizontal alignment and separation distances between each utility,
- Water main plan showing pipe sizes, location of hydrants, valves and fittings,
- Water main profile showing grades, cover, pipe sizes, pipe materials and class of pipe bedding,
- Storm and sanitary sewer plan showing pipe sizes and manhole locations,

- Storm and sanitary sewer profile showing pipe sizes and materials, manhole invert elevations, length of pipe, grades between manholes and class of pipe bedding,
- Location of services and invert elevations at property line,
- Elevations of oil and gas pipe line crossings.

2.5 REPORTS AND STUDIES

The Developer shall provide all relevant reports and studies in the submission of engineering drawings including:

1. Geotechnical and hydrogeological report to identify:
   - Existing soil and sub-soil conditions, groundwater tables, limits of identified site contamination, top of bank setbacks for adjacent creeks or ravines with stability problems,
   - Proposed pavement structure based on in-situ conditions and projected traffic volume (A 20 year structure recommended by the Geotechnical Engineer shall be requires; however, minimum pavement structure thickness as illustrated on the cross-sectional standard drawings shall be maintained),
   - Construction methods and procedures for trenching and backfilling operations for proposed underground infrastructure, storm drainage facilities and service requirements for proposed private servicing and building foundations;
2. Engineering design brief including design calculations and analysis of proposed municipal improvements;
3. Environmental impact assessment may be required for the proposed development depending on the circumstances;
4. Erosion and Sediment Control (ESC) Report (ESCR). It is a description of the overall strategy for ESC. It should summarize the aspects of the project that are important for erosion and sediment control and should include:
   - Location and site characteristics,
   - Proposed development characteristics,
   - Erosion and sediment controls,
   - Sediment control calculations,
   - Inspection and maintenance,
   - Modifications to an ESCP,
   - ESCP checklist;
5. Servicing Study to identify:
   - Water distribution system,
   - Sanitary sewer system,
   - Storm water management.

2.6 AS-CONSTRUCTED RECORD DRAWINGS

Prior to the issuance of the Construction Completion Certificate (CCC), all deficiencies noted on the CCC inspection must be completed, also the Developer shall submit to the Municipality a set of as-constructed record drawings and construction manuals in a digital format, as determined by the Municipality, along with three (3) sets of printed copies and one (1) digital copy.

All drawings shall indicate “As-Constructed” and shall be stamped, signed, sealed and dated by a Professional Engineer.

3

LAND USE DISTRICTS AND LEVEL OF SERVICE

3.1 INTENT

This section is intended to assist the Municipality and the Developer with a general guideline outlining the level of service for a particular development based on the land use district. The Developer shall use this section to determine the most appropriate servicing standards presented in the following sections.

The level of service applicable to any particular development is subject to review by the Municipality. The Municipality reserves the right to require a higher level of service for any particular development.

The guidelines and standards presented in this document shall only be considered as minimum requirements. The Developer shall remain fully responsible for the design and construction of municipal improvements according to accepted engineering practice and standards that address and meet the specific needs and site conditions of the development. Certain site-specific conditions may warrant that standards that are more stringent be met.

It is the Developer's responsibility to satisfy, in addition to these requirements, all regulations and conditions required by referenced legislation or document, Municipality Bylaws, as well as Provincial and Federal Government Authorities.

Should the need arise where any of the following standards cannot be met, a written request describing the variance complete with supporting documentation shall be forwarded to the Engineer for review. The request shall be reviewed and a written reply returned with the final decision.

3.2 LAND USE DISTRICTS

All lands within the Municipality are divided into Zones. The proposed development shall have proper reference to a zone classification according to the Municipality Bylaw.

3.3 LEVEL OF SERVICE

3.3.1 ROADWAYS

The Developer's Engineer shall be responsible for determining an estimated Annual Average Daily Traffic (AADT) generated by the proposed development in order to determine the required roadways cross sectional elements and pavement structure. Section 10 provides a geometric design table and cross sections for the various roadway classifications.

3.3.2 WATER SYSTEMS

Developments may require one of the following types of water distribution systems:

Private Water Systems

The Municipality requires (mandates) that all new developments be connected to the water supply system. Exceptions will only be allowed by signed resolution of council. Private water systems shall consist of individual wells or water cisterns. Systems must be designed and installed according to the Canadian Plumbing Code and applicable Alberta Regulations. Water analysis is to be potable water standards.

The Municipality will not permit the construction of communal water systems, which are designed to incorporate a water supply from an on-site well.

Piped Water Distribution Systems

Piped water distribution systems shall consist of a piped network at normal operating pressure or a trickle system that delivers water at lower than normal operating pressure. The specific type of system will depend on the layout, size and type of development as well as the existing infrastructure in the area.

All piped systems shall be designed and installed according to standards outlined in this document. Other applicable standards include:

- American Water Works Association Standards
- Alberta Environment Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems
- Fire Underwriters Survey
- Water Supply for Public Fire Protection

3.3.3 SANITARY SEWER SYSTEMS

Developments may require one of the following types of sanitary sewer systems:

Private Sanitary Sewer System (Residential)

The Municipality requires (mandates) that all new developments be connected to the public sanitary sewer system. Exceptions will only be allowed by signed resolution of council. Private sanitary sewer systems consist of sewage collection and treatment system located entirely within private property. Private sanitary sewer systems shall be designed and installed in accordance with the Alberta Private Sewage Treatment and Disposal Regulations and Canadian Plumbing Code. Also, all designs must be completed by a qualified professional Engineer.

Private Sanitary Sewer Systems (Non-Residential)

A private sanitary sewer disposal system that is expected to receive more than 5.68m³ of sewage per day shall be designed by a qualified Professional Engineer.

Piped Sanitary Sewer System

Piped sanitary sewer systems consist of either gravity lines or low-pressure lines. The need for specific type of system shall be determined based on the layout, size and type of development, as well as the existing based on the layout, size and type of development, as well as the existing infrastructure in the area. All communal sanitary sewer systems, including municipal and co-op systems, shall be designed and installed according to the minimum standards outlined in this document. Other applicable standards include the Alberta Environment Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems and Rural Utilities Act.

3.3.4 STORM WATER MANAGEMENT SYSTEMS

The type of storm water management system will largely be dictated by the roadway standards. All urban cross sections with curb and gutter may require a piped storm water sewer system. Under most circumstances, overland drainage will not be accepted for an urban type development. Rural

cross sections shall employ an overland drainage system consisting of ditches and swales. However, if the new development is in a location where there is an existing overland drainage system, modifications for the new construction may be allowed.

All storm water management systems shall comply with the standards outlined in this document. Other applicable standards include the Alberta Environment Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems.

It is the Developer's responsibility to supply, place and compact necessary fill for rough grading for the entire subdivision area including road right-of-ways, laneways, drainage and utility easements, municipal reserve and all lots. The rough grades shall ensure that all storm water is properly directed and managed regardless of the stage of lot development on either public or private property. No low area that could promote standing water shall be permitted at the rough grading stage.

3.4 UNAUTHORIZED USE

Unauthorized use is when a private person or a corporation accesses public property with encroachment, construction, storage, landscaping or removal of anything on, over or in public property without written approval of the Municipality. Unauthorized use can result in public safety issues, limit public access or use of public property, prevent maintenance or operation from occurring and damage to natural environment.

The Municipality as the stewards of all public property shall ensure that the use and enjoyment of public property is a benefit to all residents and is not interfered with by those who deliberately or inadvertently enter onto public lands. The Municipality shall regulate the use of all public property to ensure the public safety and to protect natural areas and ecosystems.

The Municipality shall notify and work with unauthorized users of public property on a case by case basis providing an explanation of unauthorized use and detail what corrective measures must be completed.

Non-compliance with the Municipality directions may result in legal enforcement.

4

WATER DISTRIBUTION SYSTEM

4.1 GENERAL

The design of the water system shall conform to the Standards and Guidelines for Municipal Waterworks, Wastewater, and Storm Drainage Systems in Alberta, as published by Alberta Environment and as amended by these Design Guidelines and Construction Standards.

4.2 MUNICIPAL WATER SYSTEM

The Contractor will be required to tie into a municipal water system or to shut off system valves to undertake the proposed Work. When this is required, the Contractor shall:

1. Give the Municipality sufficient notice of the proposed Work and schedule so proper planning and approvals can take place.
2. Supply all water necessary for the Work and obtain written permission from the Municipality prior to using any hydrants.
3. Obtain written permission prior to operating any of the Municipality's valves and/or hydrants. The Contractor shall be held responsible for any damage done to the hydrants or surrounding area. The Municipality may require their own personnel to operate their valves and/or hydrants.
4. Make an agreement with the Municipality for payment of water used.
5. Provide 24 hours' notice to any property owner affected by water service disruption.
6. Supply an alternative water service if the water disruption is longer than 4 hours.
7. For establishments relying on an uninterrupted water source for their operations, an alternative water source shall be provided.
8. The above noted requirements shall be done at the Contractor's cost.

4.3 DESIGN REQUIREMENTS

The minimum size of distribution main shall be 150mm diameter for residential development unless one or more hydrants are located on the line in which case the minimum diameter shall be 200mm. For commercial/industrial development minimum water main size shall be 250mm.

The Developer shall perform a hydraulic network analysis for the proposed development unless the Town indicates otherwise.

PVC pipe shall be used and the value of "C" in the Hazen-Williams formula shall be 120 for all types of pipes.

Per capita design consumption shall be:

- Average Daily Demand- 340 lpd
- Maximum Daily Demand- 1.8 x Average Demands
- Peak Hourly Demand- 4.0 x Average Demands

The design population shall be the ultimate population for the area under consideration.

For non-residential developments, the minimum water consumption rate shall be equal to 0.20 litres per second per hectare. The applied peaking factor shall be $P_f = 10Q^{-0.45}$ to a maximum of 25 and a minimum of 2.5, where Q is in litres per second. Where possible, water demand shall be based upon site specific requirements for identified uses. Fire flow requirements are to be included in all calculations.

An analysis will be made for Peak Hour Demand, and mains shall be sized such that there will be a minimum residual pressure of 280kPa (40 psi) at ground level at any location in the system.

Separate analysis shall be made for Maximum Demand plus Fire Flow. The residual pressure at any location at the ground level shall not be less than 140kPa (20 psi).

Fire flow requirements shall be in accordance with the Fire Underwriters Survey publication entitled "Water Supply for Public Fire Protection – a Guide to Recommended Practice", latest revision thereof. Generally these are:

- For single family residential 75 l/second, for multi-family residential 90 l/sec, for Institutional 90 l/sec, commercial 190 l/sec, and light industrial 230 l/sec.

Where the size of the area to be developed warrants, or if required by the Municipality, a network analysis will be carried out and all relevant information will be submitted with the design documents.

Water main looping will be required where the number of lots exceed 10 lots except the distribution lines serving single residence cul-de-sacs less than 120m.

4.4 WATER MAIN – LOCATION AND INSTALLATION

Mains shall be installed to provide a minimum depth of cover of 3.0 metres below the final finished surface grade. Tracer wire is to be included on all mains, extend to surface with one meter of additional length and be tested at each valve and manhole.

In all cases a distance of 3.0m from the centreline of a road shall be maintained.

A minimum of a 3.0m horizontal separation shall be maintained between a water main and any sewer main.

The minimum requirement for pipe bedding shall be Class "B" bedding

Water main installation shall be in accordance with manufacturer's requirements and these Standards.

4.5 HYDRANT – LOCATION AND INSTALLATION

The maximum allowable spacing between fire hydrants shall be 150m in single-family residential areas and 90m in multiple-family residential, school, or industrial/commercial areas.

Hydrant locations shall be such that the distance to any building shall be no greater than 75m. For the case of multi-family and/or commercial buildings with standpipes, the distance shall be 45m unobstructed driving distances, between hydrant and standpipe.

Hydrants on the distribution main will be installed at the projection of property lines, except:

1. Where the hydrants are installed at the intersections, they shall be installed adjacent to the cut-off corners of the lot.
2. Where the hydrants are installed in a cul-de-sac, they will not be installed within the turning circle but shall be located at the tangent points.
3. Where a hydrant and sanitary manhole fall on the same property line projection, the manhole will be moved a minimum of 5 metres away from a hydrant.

Hydrants shall be located to conform to curb and sidewalk design and shall be installed as follows:

1. The center of the barrel is to be 2m back of face-of-curb or 0.5m back of walk.
2. The maximum distance from the face of the curb to the hydrant shall be 3.5 metres.

3. Shall be installed in accordance with the Standard Drawing Details and the Engineering Standards outlined in these documents.
4. Hydrants shall be plugged and include prefabricated insulation kit;
5. A gate valve will be provided on each hydrant lead;
6. Cathodic protection to be installed as per Standard Drawing Details.
7. All bolts to be stainless steel.
8. All barrels to be epoxy coated.

Additional hydrants shall be installed at high value properties if deemed necessary by the Municipality.

4.6 VALVE – LOCATION AND INSTALLATION

All valve boxes located in streets shall be left flush with the base course asphalt. Immediately prior to the final lift of asphalt being placed, these valve boxes shall be raised to final grade. Refer to Standard Drawing Details.

Valves on the distribution mains will be installed:

1. At the projection of a property line at intersections or in mid-block, for urban sections, or as designated by Engineer.
2. With two valves at a tee and three valves at a cross.

4.7 VALVE BOX

Valve box shall be Norwood Foundry Type A, PVC or Cast. Valve box shall consist of a cast iron bonnet of sufficient size to fit over the valve, and an adjustable cast iron top box with lid. Refer to Standard Drawing Details.

Valve boxes shall be of suitable length for depth of bury specified for mains, with possible adjustment of 300mm up or down from this length.

Valve box extensions shall be cast iron suitable for use with the valve box to be installed.

All cast iron surfaces to have a bituminous coating for corrosion resistance.

Distribution main valves shall be located such that during a shutdown:

1. No more than one hydrant is taken out of service;
2. No more than four valves are required to affect a shutdown;
3. Maximum length of a dead end line is 120m. No more than 20 residential units are taken out of service by a shutdown, including cul-de-sacs;
4. Commercial sites loop the main feeder with at least one valve on the loop and
5. Valves shall be installed in accordance with the Contract Specifications for the project and as per the Standard Drawing Details.
6. Valves shall be of the same size as the main.

4.8 THRUST BLOCK

At all hydrants, plugs, tees, crosses, bends, and all other points of concentrated thrust, provide reaction blocking (thrust blocks), as detailed, to prevent movement. Place reaction blocking against solid undisturbed ground. Details provided herein are intended to be general, and are based upon soil load values of 7,300kg/m² or more. Where soil will not provide this load value, provide additional bands and clamps, or provide more substantial reaction blocking, as required to take the anticipated reaction. Place blocking to provide access to pipe and fittings for repairs or future extensions of the line.

Thrust blocks will be provided as per the Standard Drawing Details. Thrust blocking shall be Type 50 sulphate resistant concrete having a minimum compressive strength of 20 MPa at 28 days.

Pipe restraint devices shall be used separately or in conjunction with thrust blocks, where identified as being required, and shall be in accordance with the manufacturer's recommendation. All restraint devices shall be stainless steel or suitable, resistant to corrosion, to the satisfaction of the Municipality.

4.9 HYDROSTATIC PRESSURE TESTING

Tests shall 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 thrust block has been cast with high early strength cement, or at least seven days after the last concrete thrust block has been cast with sulfate resistant cement. The duration of each test shall be two (2) hours. Test pressure will be 2.0 times the normal system operating pressures or 1,035kPa (150 psi), whichever is greater. Test pipeline in sections not exceeding 365 meters in length.

4.10 DISINFECTION

All water mains will be disinfected in accordance with AWWA specification C651, latest revision.

Before being placed in service, and before certification of completion by the Engineer, all installed mains will be disinfected according to the AWWA Standard C651-99 "Disinfecting Water Mains" and tested for bacterial content and chlorine residual.

On completing the chlorination of the mains, the Contractor shall set the system in operation as directed by the Engineer.

Dechlorination of the chlorinated water may be required in some circumstances before discharging the water to the environment, in order to meet the regulatory requirements of the Municipality or Alberta Environmental Protection. Dechlorination, if required, is to be performed by adding neutralizing chemicals (AWWA C651-86, Appendix B) to the chlorinated water as it is flushed from the system and before it enters the receiving environment.

4.11 CATHODIC PROTECTION

All buried fittings and valves shall be cathodically protected with a 2.3kg Zinc Anode, and all hydrants shall be cathodically protected with a 5.5kg Zinc Anode.

Zinc Anodes shall conform to ASTM B418-73, Type II.

Lead Wires No. 10A WG/7, two metres long.

Wire shall be connected to fittings with a cadweld.

A minimum of three litres of water shall be poured on each Anode to initiate the Anode's operation.

Refer to Standard Drawing Details.

4.12 FLUSHING OF EXISTING AND NEW WATER MAINS

Prior to flushing of any water mains, the Municipality of High Level will receive a minimum of two working days' notice. Only Municipality personal will operate existing valves.

4.13 USAGE OF MUNICIPALITY WATER

The Developer's Engineer shall be responsible for calculating the water used for flushing of mains. This calculation shall be submitted to the Municipality at the time of the Construction Completion Certificate (CCC). The Developer shall be responsible for the cost of the water used to flush the mains and shall be invoiced accordingly. The cost of this water shall be calculated using the current charges, as may be amended from time to time, as outlined in the Municipality Bylaw(s).

4.14 GROUNDWATER SUPPLY FOR UNSERVICED RESIDENTIAL SUBDIVISIONS

The use of groundwater for un-serviced residential subdivisions shall follow the regulations set in the current edition of Environmental Guidelines for the Review of Subdivision in Alberta.

5

WATER MAIN CONSTRUCTION

5.1 WORK INCLUDED

Provide all labour, products and equipment required for the work, including but not limited to:

- Bedding under and over pipe
- Water mains and appurtenances
- Testing water mains
- Flushing and disinfecting water mains
- Connection to existing systems
- Thrust blocks

5.2 QUALITY STANDARDS AND ASSURANCES

Products, workmanship and testing shall conform to standards specified in this section.

All products and workmanship may be subject to inspection by the Municipality.

Perform all tests required by the specification and by authorities having jurisdiction.

Notify the Municipality and authorities in ample time before testing to permit inspection and allow tests to be witnessed.

Do not cover any work before inspection and testing unless authorized by the Municipality in writing.

Remove or repair defective products or work which fails to meet specified requirements as directed by the Municipality, at no additional cost to Owner.

5.3 PRODUCTS

5.3.1 POLYVINYL CHLORIDE (PVC) WATER PIPE

Polyvinyl chloride water pipe shall be equivalent to cast iron pipe outside diameter meeting CAN3-B.137.3 M86 (AWWA C900).

Pipe shall be Class 150 (dimension ratio 18) and pipe must be blue in colour.

Pipe joints shall be integral gasketed bell ends. Couplings shall be permitted only for closures or special connections.

Gaskets shall conform to AWWA C111.

An affidavit of compliance shall be provided if requested.

5.3.2 PIPE FITTING

Cast iron or ductile iron fittings shall meet the requirements of AWWA Specification C110-77. Pressure rating shall be 1.1 MPa (60 psi).

Joints on fittings shall be the same as specified for pipe.

Fittings shall be externally and internally coated with bituminous material approved for waterworks service.

PVC fittings shall be to CAN3-B.137.3, pressure Class 150, which are designed to accommodate the pipe for which they are used.

PVC fittings shall be gasketed bell end type similar to pipe except where adaptors are required in which case flanged or threaded joints may be permitted subject to approval by the Municipality. Gaskets to conform to AWWA C111.

Cast ductile iron couplings to be robar couplings or approved equal complete with ANSI 303 stainless steel nuts and bolts compatible with outside diameters of pipes to be joined in locations approved or specified by the Municipality.

5.3.3 GATE VALVES (NRS)

Valves shall be iron body, bronze mounted, double disc or solid-wedge, with full 360 degree rubber to cast iron resilient seat gate valves approved for potable water use, meeting AWWA Specification C509-80 and the following:

1. Valves to be bronze mounted with a grade of bronze completely resistant to de-zincification by water having a ph of 9.0.
2. Valve ends shall be consistent with the type of joint used for pipe and fittings except where otherwise detailed.
3. Valves to be supplied with either bronze or type 304 stainless steel stems.
4. Working pressure 1,035kPa (150 psi).
5. Valve interior to be epoxy coated for corrosion protection.
6. Valves shall close by turning clockwise and be a non-rising stem type and be equipped with a 50mm square operating nut. Valve stem shall be equipped with "O-Ring" type seals.
7. Exterior to be factory coated.
8. All exterior bolts and nuts must be T304 or type 314 stainless steel.
9. Main Valve Casing Detail is located in Standard Drawing Details.

5.3.4 VALVE BOXES

Valve boxes shall be Norwood Foundry Type A, or equal. Valve box shall consist of a cast iron bonnet of sufficient size to fit over the valve, and an adjustable cast iron top box with lid.

Valve boxes shall be of suitable length for depth of bury specified for mains with possible adjustment of 300mm up or down from this length.

Valve box extensions shall be cast iron suitable for use with the valve box to be installed.

All cast iron surfaces to have a bituminous coating for corrosion resistance.

Valve Box Construction Detail is located in Standard Drawing Details.

5.3.5 HYDRANTS

Hydrants are to be of the post type, dry barrel hydrant with compression shut-off conforming to AWWA Specification C502-80, having the following features:

1. Working pressure of 1,035 kPa.
2. Two hose connections at 180 Deg., 63mm ID with threads to Alberta Mutual Standard.
3. One pumper connection, 100mm OD, outlet nozzles to be fastened by a thread connection.
4. 150mm riser barrel, 125mm bottom valve.
5. Minimum distance from flange to bonnet will be 600mm.
6. Main connection to be 150mm ductile iron size rubber gasketed bell end joint.
7. Plugged and include prefabricated insulation kit.

8. Number 6 operating nut with five sides.
9. Hydrant to open counter clockwise.
10. All hydrants will be painted Fire Engine Red.
11. Ground line breakaway system: 2.75m from invert to flange, including a 450mm top extension spool section with hydrant rod coupled at extension.
12. Minimum 710mm from top of operating nut to bottom of base flange.
13. All exposed nuts and bolts to be T304 or type 314 stainless steel.
14. Interface between removable parts of main valve and hydrant body shall be bronze to bronze.
15. Hydrants shall be of the same type and make as presently used in the Municipality (Canada Valve, McAvity, [redacted]).

Typical Hydrant and Valve Detail is located in Standard Drawing Details.

5.3.6 WATER MAIN PLUGS

Water main plugs shall be of standard manufacture to suit type of pipe and pipe joint specified.

5.3.7 AIR RELIEF VALVE AND FLUSHING CHAMBER

Air Relief Valve and Flushing Chamber located in Standard Drawing Details.

5.3.8 BEDDING PIPES

Excavate trenches to widths not less than 300mm greater than pipe diameter. Maximum width at top of pipe zone shall not exceed outside pipe diameter plus 600mm, plus allowance for timbering, if required. Refer to Standard Drawing Details.

Excavate below bottom of trench at joints as required to provide working space. Body of pipe to rest on minimum 100mm firmly compacted sand bedding throughout its length.

Place sand bedding for PVC pipe as per trench bedding and installation and backfill with Class B granular surround as detailed in the Standard Drawing Details. If site material meets bedding sand specification requirements, it may be used to replace the top 300mm of bedding sand.

For trench in rock, bed pipe on minimum of 150mm of compacted sand.

5.3.9 LAYING AND JOINTING PIPE

Carefully lower pipe and specials into trench using proper appliances. While suspended, inspect for defects. Remove foreign materials from inside of pipe. Unless otherwise directed, lay pipe from lower end of line upward.

Lay pipe true to line and establish grade using laser level or measurement rod and sight rails. Install “watermain” marker tape 305mm (one foot) above pipe. Install tracer wire on outside of pipe.

Cut pipe accurately to bring valves, fittings and hydrants to correct position.

At all hydrants, plugs, tees, crosses, bends of 22 degrees or more and all other points of concentrated thrust, provide reaction blocking as detailed in the Standard Drawing Details to prevent movement. Place reaction blocking against solid undisturbed ground. Details are based on soil load values of 7,323kg per square meter, or more. Where soil will not provide this load value, provide bands and clamps to take reaction. Refer also to special thrust block details. Place blocking to provide access to pipe and fittings for repairs or extensions of line.

Install turned wood or plastic plugs, properly sized, in pipe and fittings to prevent ingress of water, mud, dirt and debris at all times. Do not use rags, clothing or other means.

Install slip type rubber gasket joints to manufacturer's directions. If requested, provide copies of manufacturer's directions on site for reference and obtain technical assistance from manufacturer or representative.

Ensure that valve box can be adjusted up or down at least 300mm. It is intended that valve boxes installed at this time to finished crushed gravel elevation, will be raised at the time of paving without having to supply a new upper extension.

5.3.10 SETTING AND JOINTING VALVES

Check and ensure stuffing glands on valves are properly packed before installation.

Set valves accurately in position, set valve box carefully over hood with shaft vertical and cap at proper level plus or minus 50mm from elevations provided by the Municipality.

Anchor valves to prevent movement under unbalanced pressure conditions when recommended by pipe manufacturer.

Check operation of valves in presence of the Municipality before and after testing.

5.3.11 SETTING AND JOINTING HYDRANTS

Set hydrants and hydrant valves on pressure treated timber blocking as per details.

Ensure hydrant stock and valve box are truly vertical.

Locate hydrants and valves as per drawings within the following tolerances: 50mm horizontal, 15mm vertical.

Face pumper nozzles to roadway with hose nozzles parallel to roadway. No portion of the hydrant or nozzle cap shall be within 150mm of the sidewalk.

Concrete thrust blocks will be required at hydrants and hydrant valves as detailed.

Ensure that regular maintenance of hydrants is carried out for the duration of the maintenance period. Pay all costs for maintenance such as repainting, draining prior to freeze-up, etc.

5.3.12 THRUST BLOCKS

Do concrete work in accordance with Section 9 – Curb, Gutter and Sidewalks.

Cement to be sulfate resistant Portland cement.

Place concrete thrust blocks between undisturbed ground, tees, plugs, caps, bends, reducers, hydrants, and fittings.

Keep joints and couplings free of concrete.

Do not backfill over concrete within 24 hours after placing.

Thrust Block Details are located in the Standard Drawing Details.

5.4 TESTING WATER MAINS

Water main testing may be carried out when all the following conditions have been met:

- A section of water main not exceeding 365 meters in length has been completed.
- The section has been carefully filled with water and allowed to sit for at least 24 hours.
- Reaction or thrust blocking within the section has reached 15.0 MPa of compressive strength.

If all the conditions have been met, apply a constant pressure of 1,035 KPa (150 psi) for a minimum of two hours to mains, hydrants, valves and services. Make good all defects at no additional cost to Owner. Ensure all water service connections are turned off at curb stops to avoid damage to private plumbing.

Conduct leakage tests after completion of pressure testing. Conduct leakage tests at 1,035 KPa (150 psi) in accordance with AWWA C600-82 procedures. Allowable leakage will be calculated using the following formula:

1. Allowable leakage = N x D x P 0.5 □128320 = Litres per hour
2. Where N = Number of joints; D = nominal diameter of pipes (mm); and P = average test pressure (kPa).

If test leakage in any section is greater than permitted by AWWA Standards, locate and repair defective pipe joints until leakage is within permitted allowance. Test pipelines in sections not exceeding 365m in length.

Tracer wire testing will be completed at every valve and manhole.

Provide all equipment, labour, and material for tests.

5.5 FLUSHING AND DISINFECTING WATER MAINS

After completing satisfactory hydrostatic tests and before placing into service, flush all mains to remove as much foreign matter as possible from system. Flush at minimum velocity of 0.8 meters per second as required by AWWA C651-99 procedures (250mm line requires 2 - 50mm openings to provide the required flushing velocity).

After flushing, disinfect mains by pumping chlorine solution into mains through a special main cock at beginning of line near source of water. Do not use hydrants at point of application for disinfectant.

Introduce disinfectant according to AWWA C651-99 and to approval of the Municipality and Provincial Ministry of Health.

Conform to AWWA C651-99 for quantity of disinfectant, method of distribution throughout system and final flushing.

After final flushing and before placing water main in service, the Municipality will collect samples in sterile bottles from an approved sampling point. The sampling is to be witnessed by local authorities as necessary. Samples will be submitted to Provincial Ministry of Health for testing and test results forwarded to Local Authorities. Heterotrophic plate counts will be provided.

If initial disinfection fails to produce satisfactory results, repeat disinfection until satisfactory samples are obtained.

Dechlorination of the chlorinated water may be required in some circumstances before discharging the water to the environment in order to meet the regulatory requirements of the Municipality of High Level or Alberta Environment. Dechlorination, if required, is to be performed by adding neutralizing chemicals (AWWA C651-86, Appendix B) to the chlorinated water as it is flushed from the system and before it enters the receiving environment.

5.6 MARKERS

A 50mm by 100mm stake, from 1000mm below ground to 600mm above ground level shall be placed at each water valve, the top 600mm to be painted blue. Marking tape is to be installed 305mm above pipe and be labelled “watermain”.

5.7 TRENCHING AND BACKFILLING FOR UTILITIES

5.7.1 GENERAL

Trenching and backfilling is to be carried out in accordance with Alberta Occupational Health and Safety Regulations, Part 10. Standards for pipe bedding and typical trench details are located in the Standard Drawing Details.

5.7.2 WORK INCLUDED

Provide all labour, products and equipment for trenching and backfilling for utilities, including but not limited to:

- Water mains
- Sanitary sewers
- Storm sewers
- Manholes, valve boxes
- Lot service connections
- Shoring, sheet piling
- Dewatering

5.7.3 EXCAVATION

Excavate to lines and to design depth shown or as required by the Municipality to provide satisfactory bearing. Excavate unsuitable soil from trench bottoms as required by the Municipality. Backfill with screened rock material specified to the required level and compact to provide uniform bearing.

No additional compensation will be paid for any changes due to deterioration of excavations caused by activities or neglect of the contractor.

Level and clean excavation bottoms free from loose material and debris.

Where excavation is made below depth shown through error, fill to required depth with 20 MPa compressive strength concrete or screened rock at no additional cost to Owner.

Provide firm undisturbed earth or rock bearings for granular bedding below pipelines and structures.

Excavate for structures to widths sufficient for formwork construction. Place no concrete or masonry until the Municipality has inspected excavation.

Where concrete is to be placed, thaw excavation bottom if frozen, and protect from further freezing.

Maximum lengths for open trenches are 30 meters ahead of pipe laying crew and 200 meters behind, unless otherwise permitted by the Municipality.

Where pipelines are constructed through fills and embankments, surface elevations will generally at least be 250mm above top of pipeline prior to excavation.

Where trenches are excavated in existing pavements, saw cut the pavement to neat lines.

5.7.4 ROCKS AND BOULDERS

Remove boulders to provide 150mm minimum clearance under pipes. Backfill with granular and compact at required level to provide suitable bearing, if boulders are less than 0.4 cubic meters.

Boulders larger than 0.4 cubic meters and material which cannot be removed with pick and bar will be classified as rock by the Municipality. Notify the Municipality when rock is encountered for classification and measurement.

Excavate rock to provide 150mm minimum clearance on each side and under pipes. Backfill with granular and compact at required level to provide suitable bearing.

Prior to commencing blasting operations, obtain written approval from authorities having jurisdiction and from the Municipality. Employ qualified and licensed workers only.

5.7.5 SHORING, BRACING AND SHEET PILING

Provide all shoring, bracing and sheet piling required for support and protection of earth banks at excavations.

Erect all shoring, bracing and sheet piling independent of utilities and structures.

Shore and brace sides of trenches and excavations in accordance with Workers' Compensation Board Regulations.

Maintain during backfilling and remove in stages as backfilling progresses or as approved by the Municipality.

Remove all shoring, bracing and sheet piling unless otherwise permitted by the Municipality. If shoring is allowed to remain, cut off to a level at least 600mm below finish grade.

Pre-fabricated cages or shields may be used, at the discretion of the Municipality, to supplement or replace conventional shoring provided they conform to all applicable safety regulations, and permit the proper placing and tamping of bedding material under and around utility pipes.

5.7.6 BACKFILLING - GENERAL REQUIREMENTS

Bedding of pipes and utilities and backfill to 300mm above top of pipes and utilities is included in other sections.

Backfill trenches and excavations with excavated earth material. Remove all rocks larger than 200mm in diameter from earth backfill.

Place and compact all backfill in maximum 300mm deep loose layers, prior to compaction.

Compact site material used as trench backfill in all areas from 300mm above top of pipe to 300mm below bottom of granular base for roads to a density not less than 95% of Standard Proctor Density, as defined herein, and carried out at moisture content within 3% of optimum moisture content. Remove any free water in the trench prior to placing additional lifts. Note that if moisture content is too high and densities not initially attainable the contractor will make every reasonable attempt to dry the material by whatever means available (i.e. discing, spreading, etc.) should the Municipality deem the material to be "unworkable" the use of imported granular backfill may be required. Compact the final 300mm below road or lane granular base to not less than 100% of Standard Proctor Density.

Compaction results will be based on a minimum of one density test per 150 lineal metres of trench for each 1.5 metres of depth. If a density test indicates insufficient compaction at any depth, then two more densities, which are proportionally representative of trench length will be taken at that depth. Then, if the average of the three tests is below the required density, the contractor will re-excavate and re-compact to meet the specified density.

Place and compact evenly around structures to prevent damage or displacement. Grade surface to direct water away.

Stockpile, spread or remove excess excavated earth material where directed by the Municipality.

Remove and dispose of boulders off site at no additional cost.

Where additional pipes are to be, or have been laid, crossing the trench being backfilled and at a higher elevation, take special care to ensure the backfill is compacted to a minimum of 95% or 100% of Standard Proctor Density if 300mm below road or granular base from the lower pipeline up to the obvert elevation of the higher pipeline.

Where imported material is called for by written direction of the Municipality, place the specified depth of granular material to the elevations provided and compact to specified Standard Proctor Densities.

Where filter fabric is called for by written direction of the Municipality, place fabric to the overall dimensions specified.

5.7.7 SETTLEMENT

The Contractor shall be responsible for all settlement of backfill that may take place during a period of two (2) years after date of completion certificate.

When notified of any such settlement, promptly repair same, or make arrangement for others to do so at the contractor's expense. Failure to do so will result in the Owner making appropriate arrangements at the Contractor's expense and at no cost to the Owner.

Pay the cost of all damages that may be caused by such settlements, including but not limited to repair and/or replacement of concrete sidewalks, curb and gutter and asphaltic concrete pavement.

The Contractor is to pay all costs associated with the investigation into the reason(s) for the settlement and recommendation for repair or retrofit will be completed by a qualified Geotechnical Engineer.

5.8 ADJUSTMENT OF APPURTENANCES

5.8.1 WORK INCLUDED

The work described in this section pertains to the adjustments of all appurtenances.

5.9 EXECUTION

5.9.1 VALVE AND CURB BOXES ADJUSTMENTS

Valve box tops and curb box tops shall be adjusted so that the top of the box is set exactly to the required elevation. The Contractor shall shorten or lengthen the boxes and stems as required and block the boxes to prevent any settlement. The adjustments shall be made so that the boxes are plumb and the valves operate effectively. The rock guard and operating nut are to be located no closer than 300mm below the proposed finished grade.

5.9.2 MANHOLE AND CATCH BASIN ADJUSTMENTS

Manhole and catch basin frames shall be adjusted so that the top of the cover is set exactly to the required elevation. Where it is necessary to raise manhole frames it shall be done with approved precast rings or blocks meeting the requirements of the current issue of ASTM C478. Joints between slab top blocks, and frame shall be mortared, and the joints finished flush and smooth. Joints between slab top, precast rings, and frame shall be made watertight utilizing preformed bituminous gaskets or other approved sealant. Under no circumstances shall the depth from the rim of the manhole to the first ladder rung be more than 800mm.

5.9.3 DAMAGED APPURTENANCES

The Contractor shall replace any appurtenances damaged by his work or forces. Any existing damaged appurtenances found within the proposed work zone shall be replaced by the Contractor as approved by the Municipality.

5.9.4 FINAL ADJUSTMENT ELEVATIONS

The tops of valve boxes, manholes, and catch basins shall be set to the design elevations, or as approved by the Municipality. Generally, the following shall apply for setting the final elevations of the tops of the appurtenances.

1. In **asphaltic pavement**, 5mm below the finished surface elevation for manhole frames.
2. In **concrete curb gutter**, 10mm below gutter elevation for catch basin frames.
3. In **gravel roadways/lanes**, 50mm below the surface.
4. In **landscape areas**, 50mm above the final surface, providing a smooth transition to match the surrounding areas.

6

SANITARY SEWAGE SYSTEM

6.1 DESIGN FACTORS

The sanitary sewerage system shall be of sufficient capacity to carry peak flows plus an inflow and infiltration allowance. Foundation weeping tile and roof leaders shall not be connected for discharge into the sanitary sewer system. The following factors shall be used in the design of sanitary sewerage systems:

6.1.1 RESIDENTIAL

Population estimates for the purpose of system design shall be based upon the actual lot proposed for the development and a persons/dwelling estimate of not less than 4.0.

The Municipality reserves the right to require additional system capacity to accommodate potential future subdividing of larger lots.

- Average Sewage Flow 340 liters/day/capita
- Peaking Factor $1 + 14/ (4 + p^{0.5})$ (Harmon's Formula)

Where p equals the equivalent population in 1,000's

- Infiltration 0.20 L/s/ha
- Inflow at Sag Manholes 0.4 l/s/manhole

6.1.2 COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL

Average Sewage Flow

- Commercial: 40,000 l/ha/d
- Industrial 20,000 l/ha/d
- Peak Flow 3.0 x Average Flow
- Infiltration 0.28 l/s/ha
- Inflow at Sag Manholes 0.4 l/s/manhole

The total design peak flow rates for the sanitary sewer shall be the sum of the peak flow rates plus all extraneous flow allowances.

Pipe sizing shall be determined by using the Manning's Formula with an "N" value of 0.013.

Minimum flow velocity shall be 0.6 m/s during average flow, maximum flow velocity shall be 3.0m/s.

The minimum size for sanitary sewer mains shall be 200mm diameter for residential and 250mm for industrial/commercial areas.

Minimum pipe slopes shall be as recommended by Alberta Environment.

Sanitary sewers may have to be oversized to conform to the Municipality's Sanitary Sewer planning.

6.1.3 SEWER MAIN INSTALLATION AND LOCATION

Mains shall be installed to provide a minimum depth of 3.0m from top of pipe to final finished grade at the surface. Install marker tape 305mm (one foot) above pipe and label “sewer main”.

Mains shall be installed to provide adequate sewer service connection depth at the property line

Mains shall be located within the road right-of-way in accordance with the Roadway Cross-Section Standard Drawing Details.

Pipe bedding shall be provided for all mains in accordance with the Standard Drawing Details.

6.1.4 MANHOLE INSTALLATION AND LOCATION

Manholes shall be located at the end of each line, at all changes in pipe size, grade or alignment, at all junctions, and at intervals no greater than 120m along the length of the sewer.

Inverts in manholes at changes in direction shall have at least 50mm fall across manhole. To maintain a continuous energy gradient through manholes, the obvert (crown) elevation of the lowest upstream pipe shall be equal to, or higher than, the obvert of the downstream pipe.

Manholes shall be installed as shown on Standard Drawing Details. Manhole bases shall be pre-cast slabs, concrete poured bases, vaults or pre-cast tees. Pre-benched manholes shall be used when possible. All manholes shall be 1200mm inside diameter for all pipe 900mm diameter and less. For pipe exceeding 900mm diameter, manhole diameter shall be pipe diameter plus 600mm, or a Tee-Riser shall be used.

Manhole frames and covers to be Type F-39 in landscaped areas, Type NF-80 in paved areas and Type NF-90 gasketed in sags. All manhole covers are to be clearly stamped “Sanitary Sewer”.

An exterior drop manhole shall be used where invert levels of inlet and outlet pipes differ by more than 750mm. See standard detail.

All joints shall be sealed with rubber gaskets and grouted inside and outside to make it watertight.

Safety platforms at intermediate levels are required for manholes greater than 5.0m in depth when measured from the top of the frame to the lowest invert. Refer to Standard Drawing Details.

6.1.5 CURVED SEWERS

Curved sewers will be permitted, with the following restrictions:

1. The PVC sewer shall be laid as a simple curve, with a radius equal to or greater than 90m or the manufacturer’s minimum recommended radius, whichever is larger.
2. Manholes shall be located at the beginning and end of the curve.
3. Manholes shall be located at intervals not greater than 90m along the curve.
4. The main shall run parallel to the curb or street centreline.
5. The minimum grade for sewers on curve shall be 50% greater than the minimum grade required for straight runs of sewers.

6.1.6 INSPECTION AND TESTING

Prior to issuance of the Construction Completion Certificate of the project, all sewer mains shall be tested as follows:

CLOSED CIRCUIT TELEVISION INSPECTION

All sections of sanitary sewers shall be inspected with closed circuit video equipment prior Construction Completion Certificate (CCC) and Final Acceptance Certificate (FAC). A written report and a colour digital recording shall be submitted to the Municipality for their approval and records.

LEAKAGE TEST

Sewer main and service connections to be tested for water tightness by an exfiltration test and/or infiltration test. In areas where the water table rises up to the sewer pipe invert or higher, each section of the sewer main and service connections shall be tested for water tightness by an infiltration test. In all other situations, an exfiltration test shall be conducted. The test results shall be recorded for each section of the main tested and the results forwarded to the Municipality and/or the Engineer.

6.2 LOW PRESSURE SEWAGE SYSTEMS

6.2.1 DESIGN FACTORS

System design shall comply with all environmental legislations, including but not limited to safety, odour control, accidental line break, spillage control, health issues, zoning development standards and its impact on existing and proposed downstream treatment facilities.

System and pump configuration will need to be designed for increased future sewage flows, based on greater “per capita” sewage generation and/or staged low-pressure system expansions to existing networks, as presented in area structure and long range development plans. Accessibility and maintenance provision shall be considered when locating the units.

All materials incorporated in the system shall meet Municipality approval and be installed as per manufacturer’s instructions. Unapproved materials shall be replaced at the contractor’s or developer's expense.

All systems shall be designed for a minimum 20 year operating life span.

Pipe sizing shall meet all the requirements of the design flow rate(s). The total dynamic head (TDH) at each pump location during peak flow conditions shall not exceed the recommended pump operating parameters on any flow path. Minimum inside diameter shall be 50mm.

Low pressure sewage systems shall be laid out in a branched or tree configuration. The end of a branch is determined by the joining of two or more main sections and/or when the outfall is reached. There shall be no looping of collection mains.

A minimum of 1.0 metres/sec scouring velocity shall be achieved in each sub-system at least once per day, based on design flows.

Where systems require the retrofitting of existing sewage holding tanks, inspection and re-certification of the structure is required.

The low pressure system can utilize either centrifugal or semi-positive displacement pumps; whichever is deemed more applicable for the particular application. In no case shall both pump styles be utilized within the same system.

Design flows for low-pressure residential collection main systems shall be designed as follows:

6.3 CENTRIFUGAL PUMP SYSTEM

Q=1.2611 + (0.0316 x R) where

R=The accumulative number of residences contributing sewage flows to each system segment.

Q=Equivalent design flows for each segment in litres/second (l/s).

6.4 SEMI-POSITIVE DISPLACEMENT

Q=N x PR where

N=The maximum number of households contributing sewage flows to each system segment at any one time. Where pumping rates range between 0.38 l/s and 0.95 l/s, the maximum number of households shall be based on statistical evidence listed below.

PR=Pump Pumping Rate.

Table 1. Pumps

Number of Contributing Pumps	Maximum Daily Simultaneous Pump Operations
1	1
2-3	2
4-9	3
10-18	4
19-30	5
31-50	6
51-80	7
81-113	8
114-146	9
147-179	10
180-212	11
213-245	12
246-278	13
279-311	14
312-344	15

Note: Where pumping rates are outside the 0.38 l/s to 0.95 l/s range, verify the number of simultaneous pump operations with the pump supplier and adjust accordingly.

All minor losses at bends and valves according to the supplier specifications must be taken into consideration in the system design.

Elevation changes shall be taken into consideration in the system design.

The system shall contain provisions against any possibility of flow reversal due to back siphoning.

System operating pressures shall normally be in the range of 200 kPa to 415 kPa (30 psi to 60 psi). The network shall be designed to prevent any long-term high-pressure situations.

Piping material shall be either, PVC DR26 (series 160) gasketed joints or HDPE DR11 (series 160) butt fused, electro-fused; or better. Pipe network shall be designed to operate at a sustained system pressure of 885 kPa (128 psi).

Final plastic sewer pipe selection shall be the consulting engineer's responsibility, and shall take availability, cost, local code, soil conditions and system design requirements into consideration. Material selection must be shown to adequately meet structural and chemical conditions.

Piping from sewage generating facilities to grinder pump units shall meet all applicable code requirements.

An analysis is required to determine if a grinder pump (GP) or septic tank effluent pump out (STEP) low-pressure system is best suited for the particular application.

6.5 GRINDER PUMP STATION

6.5.1 GENERAL

The following grinder pump station and service installation requirements are provided as a guideline for property owners who choose to complete the on-property installation and service tie-in components of new sewer systems independently. Any work completed on private property by the owners is the sole responsibility of the property owners.

Grinder pump station equipment installation and service tie-ins required on private property to connect to the low pressure sewer main are as follows:

- Installation of the pump station.
- Connection to the buildings existing gravity service and extension to the pump station. Refer to Standard Drawing Details.
- Installation and connection to the pump discharge line to the low pressure sewer system service at the property line. Refer to Standard Drawing Details.
- Installation of the control cable and panel.
- Power supply connection to the pump station control panel.

The following materials and methodology are required to meet the project minimum installation requirements.

6.5.2 MATERIALS

Pressure service line from the pump station to the municipal service, at the property line, shall be 38m DR 11 polyethylene pipe manufactured in accordance with AWWA 906 and CAN/CSA B1237.1 based on IPS outside diameter sizing. Pipe joints shall be completed by thermal butt-fusion or suitable compression fittings complete with stainless steel inserts.

Gravity service line from the building service pipe to the pump station inlet shall be 100mm SDR 28 PVC pipe to CSA B182.1, or equivalent.

Valves installed on the residences gravity service pipe to isolate the existing septic tanks and new pump stations shall be PVC compact ball valves (Cepex or equivalent). These valves are only required if the pump station and tie-in is complete prior to system commissioning.

System will typically include:

- Pump access way and pump chamber;
- Grinder pump (single phase 230V);
- Control cable and panel (10m length of cable); and
- Remote sentry panel.

6.5.3 EXECUTION

The pressure service line from the pump station to the service connection shall be buried a minimum depth of 2.5m.

Lay pipes on a prepared bed and hand place sand bedding material around and up to 300mm above the pipe. Do not place frozen or other unsuitable material above the pipe. Do not place backfill directly on the pipe. Ensure the pipe does not “kink” during installation. Install marker tape 305mm (one foot) above pipe labelled “pressure sewer line”.

Support valves by means of either concrete or wood blocks, located between valve and solid ground, bedding same as adjacent pipe. Valves shall not be supported by pipe. Valves operating handles should be accessible.

Pump station should be installed in accordance with the Manufacturers Typical Installation Instructions.

All electrical work shall be completed, or supervised and approved, by licensed master electrician as per the conditions of the Provincial Act respecting manpower vocational training and qualification.

6.6 SYSTEM REQUIREMENTS

Control system (SCADA – Supervisory Control and Data acquisition) by FLYGT, XYLEM.

Where possible all sewer piping shall be installed at sufficient depths to prevent freezing. Where pipe sections and appurtenances have less than 3.0 metre cover, necessary rigid insulation shall be used to prevent freezing.

Air release/vacuum break valves will be installed at all locations where trapped air affects system functionality.

Standard water/sewer clearances shall be maintained at 3.0 metres horizontal and 0.5 metres vertical.

Clean outs shall be installed at the upstream of each line segment and major directional changes. Maximum spacing for cleanouts and isolation valves shall be 150 metres. Units shall include a quick coupler system for system flushing compatible with Municipality maintenance requirements.

All forcemain lines will be installed with metallic tape or insulated 14 gauge copper wire for locating purposes c/w the required surface detection unit connection points. All cleanouts shall include an isolating valve. An additional check valve shall be located between the isolating valve and the cleanout assembly.

Fitting connections shall be butt fused, socket weld, mechanical flange or electro – fused. All joints shall be equal to or greater than the pipe pressure ratings, be approved for use in the particular application, and be full bore with smooth interior surfaces.

Service line sizes shall be as per the grinder pump manufacturer’s instructions and will have the same or better pressure rating as the collection mains.

Low-Pressure collection lines can be installed using trenching, ploughing, or directional drilling. Prior to installation, all utilities need to be located and identified.

Use of repair clamps will not be permitted.

6.7 PROPERTY SHUT-OFF AND MAIN LINE ISOLATION VALVES

Isolation valves shall be located at key points, and major directional changes for maintenance and repair requirements, to a maximum of 150 metres between each other.

Valves on lines less than 75mm diameter shall be fully ported ball valves, true union type or flanged connection to allow for removal without cutting the line.

Isolation valves on lines 75mm diameter or greater shall be eccentric plug type, suited for operation in sewage systems.

Isolation valves shall remain accessible via a service box or access chamber assembly. Where a chamber unit is utilized it will be insulated to prevent freezing.

All service lines to individual lots shall incorporate a shut-off valve. Lot shut off valves shall be located at least 300mm outside the property limits. Accessibility shall be the same as for isolation valve units. The maximum number of shut-off valves clustered together shall be dependent on Municipality policy and the access chamber size.

Cast valve boxes shall be epoxy coated. Other materials shall be suited for direct bury applications and approved for use by the Municipality. Valve open/closing rotation shall be as per water valve requirements.

6.8 PUMP REQUIREMENTS

Pump operating parameters shall be based on the present and future system requirements as determined by the Engineer. The required individual grinder pumping rates shall be determined according to daily inflow rates.

Pump units shall be submersible types, either semi-positive displacement or centrifugal, with integrally built grinder assembly and isolation valves. Pump units shall pump directly into low-pressure mains. Pumping equipment shall meet all applicable safety, fire and health requirements for the intended application and location.

Grinder assemblies shall be capable of macerating all material in domestic sewage, including reasonable amounts of glass, wood, plastic, rubber, light metal objects, disposable diapers, sanitary napkins, and be specifically designed for the purpose intended. Processed material must have a consistency that will not clog any part of the discharging system.

While outside below ground installations are preferred, inside installations meeting all code and collection system requirements may be allowed subject to Municipality approval. Pump operating parameters shall be based on the present and future system requirements as determined by the Engineer. The required individual grinder pumping rates shall be determined according to daily inflow rates.

Grinder pump assembly to consist of 440-C stainless steel hardened to C-58-60 Rockwell. Remaining parts exposed to sewage shall be manufactured to prevent corrosion.

The unit shall operate at 120 or 240 volts, single phase, and be able to provide the required flows at the design total dynamic head. All complete grinder pump installation manuals including but not limited to electrical wiring, piping installations and detailed installations, shall be provided to the installer and Municipality personnel prior to construction.

The pump unit shall be constructed such that open shafts are not exposed inside the raw sewage passageways where they can become clogged.

The sewage tank shall be of sufficient built-in storage to accommodate peak flow and power outage situations. Provision for mobile power generating units should be considered, where applicable.

Semi-positive grinder pump unit will have a built-in automatic shut off mechanism when system back pressures cause thermal overload. Units shall be able to automatically restart after cooling.

Grinder pump rated maximum pumping pressures shall not exceed 85% of low-pressure collection pump systems, designed maximum working pressures.

Pumps shall be of the flooded suction type to ensure positive priming.

Where high ground water levels exist, grinder pump and tank assemblies shall need to be securely anchored to avoid floating.

Pump holding tanks shall be vented such that the airspace above the wastewater level is always at atmospheric pressure.

Tank interior geometry and generated pump suction currents during operation must be adequate to provide scouring velocities to prevent build-up of solids.

Grinder pump assembly shall include all level controls to turn unit on/off at set levels. In addition high level/pump operation alarms shall be provided.

Maintenance replacement and power consumption evaluations shall be performed as part of the final system design. Where required, provide a minimum of two manuals to Municipality maintenance personnel. Literature shall include but not be limited to:

- Parts listing
- Parts supplier
- Maintenance schedule

6.9 SYSTEM TESTING

The low-pressure collection system shall be pressure tested prior to commissioning, after backfilling operations are complete and at least 36 hours after the casting of concrete thrust blocks.

Zero infiltration/exfiltration is permitted.

Components to be tested shall include the entire collection system, up to the grinder pump assembly. Test duration shall be a minimum of 2 hours, or if the pipe network is buried, 8 hours.

The test pressure shall be 1.5 times the maximum operating pressure, but not less than 350 kPa.

6.10 PRIVATE SEWER SYSTEMS

The Municipality mandates that all new developments be connected to the public sanitary sewer system. Exceptions will only be allowed by signed resolution of Council.

The Municipality requires the design, installation, and use of all private sewage systems must comply in full to the standards outlined in the current edition of the Alberta Private Sewage Systems Standard of Practice. All designs must be completed by a qualified professional Engineer.

7

SEWER MAIN CONSTRUCTION

7.1.1 WORK INCLUDED

The system will typically include:

- Bedding under and over piping
- Sanitary sewers and appurtenances
- Manholes and appurtenances
- Cleaning sewers
- Testing sewers
- Connection to existing systems

7.1.2 QUALITY STANDARDS AND ASSURANCES

Products, workmanship and testing shall conform to standards specified in this section.

All products and workmanship are subject to inspection by the Municipality.

Perform all tests required by the specifications and by authorities having jurisdiction.

Notify the Municipality and authorities in ample time before testing to permit inspection and to allow tests to be witnessed.

Do not cover any work before inspection and testing unless authorized by the Municipality in writing.

Remove or repair defective products or work which fails to meet specified requirements as directed by the Municipality.

Alterations to the existing system must be approved by the Municipality prior to design and construction.

7.2 PRODUCTS

7.2.1 SEWER PIPE

To be type called for in the schedule of quantities or shown on drawings and meet the requirements noted in subsequent clauses of this section.

Non-reinforced pipe and fittings to meet requirements of CAN/CSA-A259.1 Class 3, designated for flexible rubber gasket joints to CAN/CSA-A257.3.

Reinforced concrete pipe to meet requirements of ASTM Specification C76- CSA-A257.2-M92.

PVC pipe and fittings - DR 35 meeting ASTM Specification D3034 and CSA-B182.2 and CSA-B182.1 may be utilized for mains up to and including 375mm diameter with prior approval of the Municipality.

Cement - sulphate resisting Portland for all concrete pipe, meeting Type 50 CSA-A5.

7.2.2 PIPE JOINTS

For all sewers - as recommended by pipe manufacturer, to produce watertight joints with infiltration within specified limits.

Concrete pipe - rubber gasket to meet requirements of ASTM C443, and CAN/CSA A257.3-M92

PVC - rubber gasket to meet requirements of ASTM 03212 or ASTM F477.

7.2.3 PRE-CAST CONCRETE MANHOLE UNITS

To meet requirements of ASTM C478 and CSA A257.4 to dimensions shown on drawings.

Cement - sulphate resisting Portland, CSA A5, Type 50.

Manhole steps shall be 19mm diameter, galvanized iron safety rungs spaced at a maximum distance of 400mm centre to centre for full height.

Pre-cast bases to be minimum 20.7 MPa concrete.

7.2.4 CONCRETE BLOCKS AND BRICKS

Solid concrete, conforming to CSA A165.1 and 165.2 and ASTM C139, not less than 128mm thick for block, standard dimensions for brick, true to shape, free from cracks and surface defects, compressive strength not less than 17.2 MPa, absorbing not more than 8% water by weight during 24 hours immersion test performed after drying.

Cement - sulphate resisting Portland CSA A5, Type 50.

7.2.5 MORTAR

For pipe joints and all other parts of the work, one part sulphate resisting Portland cement to two parts clean sand, by volume.

7.2.6 CAST IRON FRAME, COVERS AND GRATES

For manholes and catch basins, close-grained grey cast iron, meeting ASTM A48, Class 20, true in form and dimension, free from faults, sponginess, cracks, blowholes and other defects. Cast steel to conform to ASTM A27, grade 70-36. Substitution of ductile iron meeting ASTM A445 for cast iron or cast steel shall be subject to approval of the Municipality.

Machine or grind frames, covers and grates to even non-rocking bearing surfaces.

Hot dip in asphaltic varnish.

Manhole covers and frames:

Sanitary - Norwood Foundry Model F-39, or approved equal

7.2.7 MANHOLE STEPS

Safety type, 19mm diameter solid steel bar, hot dip galvanized after fabrication.

7.2.8 SAFETY PLATFORMS

Safety platforms shall be aluminium grates to MSU Mississauga or approved equal.

To be installed according to manufacturer's recommendations.

To be installed on manholes greater than 5.0 meters in depth when measured from the top of the frame to the lowest invert.

Refer to Standard Drawing Details.

7.2.9 CONCRETE

Ready-mixed concrete, sulphate resisting, Portland cement CSA A5, Type 50, 25 MPa compressive strength at 28 days, to CSA A23.1

7.2.10 REINFORCING STEEL

CSA G30.12 or G30.13, 34.5 MPa minimum yield, Grade 50 all deformed except where noted otherwise. Use Grade 40 for ties.

7.2.11 SEWER PIPE TESTS AND REJECTION

Include all costs for testing, supply and delivery of specimens to testing laboratory and replacing defective material.

The Municipality reserves the right to select, either on site or at the manufacturer's stockpile, 0.5% of total length of each category of pipe for testing, minimum number of lengths as follows:

1. For each category of over 100 lineal meters - 4 lengths
2. For each category of over 50 lineal meters and less than 100 lineal meters - 2 lengths
3. For each category of less than 50 lineal meters - 1 length.

Where the Municipality has selected full sized pipe specimens for load tests, deliver these specimens to an approved testing laboratory. Results of the tests shall be mailed directly to the Municipality in triplicate. Pipe will be accepted, based on certified factory tests, provided they are done under supervision of an independent testing agency. All pipe tests shall be performed in accordance with ASTM Specifications.

Should any specimens fail to meet test requirements, test two additional selected specimens for each failure. Pipe will be acceptable only if all re-test specimens meet requirements. Should test results be unsatisfactory, all or part of pipe supplied may be rejected and acceptance withheld until satisfactory tests of pipe in place are conducted.

Inspect pipe on delivery and reject any that fails to meet specified requirements. Replace rejected pipe with satisfactory pipe without delay. Mark all rejected pipe plainly as "Rejected" and immediately remove from site.

The Municipality may require submission of a manufacturer's report verifying satisfactory random testing of the pipe designated for this project.

7.3 EXECUTION

7.3.1 BEDDING SEWERS

Excavate trenches to widths not less than 300mm greater than pipe diameter. Maximum width at top shall not exceed outside pipe diameter plus 600mm.

Bed pipe per trench bedding and initial backfill Class "B" granular surround conditions for plastic pipe and Granular Foundation for concrete pipe, as detailed in the Standard Drawing Details.

Obtain Municipality approval for all materials to be used in the pipe bedding zone.

7.3.2 LAYING AND JOINTING PIPE

Commence laying at lower end of line, lay pipes and specials true to line and grade, socket ends up grade, joints close and evenly butted all around pipe. Take special care to prevent sagging of spigot end in hub and provide true, even invert surface throughout entire length of sewer. Excavate at end of each pipe to provide rest for socket, sufficient to permit proper jointing. Clean pipe interior, remove all dirt, mud and other extraneous materials.

7.3.3 INFILTRATION/EXFILTRATION TESTING

Total infiltration of groundwater into whole of system or exfiltration, shall not exceed 5.0 litres per mm of internal pipe diameter per kilometre per day including manholes, for PVC pipe, and 20 litres per mm of internal pipe diameter per km per day including manholes for concrete and clay tile pipe. Where such leakage is exceeded, repair sewer mains so total infiltration is within specified limits. During construction and immediately on completion of a manhole, measure infiltration at new manhole. If amount exceeds specified limit, make necessary repairs immediately to reduce infiltration to allowable limit. Failure to comply with this requirement will be sufficient cause for the Municipality to stop sewer laying work until repairs have been made.

7.3.4 CLEANING SEWER MAINS

On completion of construction of mains and services, flush and string, (in readiness for video inspection) all mains until all deposits of earth or other material are removed. If new system connects to an existing system, plug outgoing line at manhole at junction and remove dirt and debris at that manhole. Do not permit debris from new construction to enter existing system. Pay all costs for repairs where damages occur due to negligence. Pay all costs of water from the municipal authority.

During flushing operations, check all manholes. If depth of flow in any manhole is greater than should be anticipated, bucket main and remove obstructions in pipe line. Pay all costs for required repairs.

Whenever practicable, flush out in runs not over 250 meters. Remove all foreign material from each run before proceeding with next.

7.3.5 TESTING

If required by the Municipality, perform Pig test after cleaning sewer mains. Through each section of main, pull wood or metal ball with diameter 50mm less than inside pipe diameter. If the Pig does not readily pull through, uncover pipe and repair defective section.

Pig test is not required on lines 216mm diameter and larger if they are visually inspected in a satisfactory manner.

Video Testing - the Contractor, at their cost will carry out a video inspection of all sanitary and storm water mains. All defects identified by the video inspection shall be corrected by the contractor at the contractor's expense. The contractor shall be responsible for the cost of flushing and stringing the mains prior to video inspection. If additional video inspection is required to verify correction of defective work, it will be at the Contractor's cost. The Contractor shall provide a copy of the video recordings and a written report to the Municipality for record purposes.

7.3.6 MANHOLES

Construct manholes as shown on drawings, unless otherwise permitted in writing by the Municipality. Submit full details of any proposed alternative construction with bid.

For cast-in-place concrete for manholes, conform to CSA A23.1.

Place manholes accurately, plumb, in alignment and at exact plan location.

Construct manholes watertight and complete, including finishing flow bottoms, as work proceeds. Do not lay pipe in advance more than two manholes ahead of last completed manholes.

Shape bottoms accurately for necessary flows as shown on drawings or as directed by the Municipality. In manholes with sewers 610mm in diameter and smaller, form invert through manhole with half-round pipe. In manholes containing lot services, shape bottoms to provide slopes required to ensure no build up of sewage occurs in manholes.

Place stubs for future lines accurately and plug watertight. Shape flow bottoms to suit future lines.

At all bends through manholes, provide 50mm drop in invert from inlet to outlet.

Support pipes at manholes to prevent shearing or settlement. Where not detailed use concrete fills, concrete or timber beam, or suitably compacted gravel.

During construction, plug pipes at manholes to prevent entry of concrete and mortar. Remove plugs immediately after construction is completed.

Set covers accurately within 15mm of correct grade. On sloping streets, set covers to match slopes.

Set all precast concrete sections, bricks, blocks and frames in mortar. Tool joints smooth and point all voids after setting.

All sanitary manhole barrels are to be sealed with rubber neck to prevent infiltration.

8

STORM WATER MANAGEMENT DRAINAGE SYSTEMS

8.1 STORM WATER DESIGN STANDARDS

8.1.1 GENERAL

The design of the storm sewer system should conform to *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems* in Alberta, as published by Alberta Environment and Sustainable Resource Development and as amended by these Guidelines. Detailed storm water management standards and guidelines are described in the Alberta Environmental Protection publication entitled *Storm Water Management Guidelines for the Province of Alberta*.

The Developer and the Developer's Engineer are responsible to ensure that the storm sewer system is designed and constructed according to accepted engineering practice. These guidelines are intended as a guide only and shall not be considered as a substitute for a detailed material and construction specification to be prepared by the Developer's Engineer.

The storm water management system should be designed with major and minor drainage systems. In general, a minor system consists of piping, manholes, catch basins and outfall structures that have been designed in order to avoid property damage and flooding due to runoff generated by a 1 in 5 year rainfall event. A major system consists of the roads, gutters, lot drainage and detention facilities designed to avoid significant property damage and control flooding caused by a 1 in 100 year rainfall event. When the capacity of the minor system is exceeded, the major system must provide a continuous overland flow route allowing the excess runoff to reach the designated ponding areas or water body.

Storm sewer pipe shall have been manufactured in conformity with the latest standard by the American Society for Testing Materials (ASTM) and the Canadian Standard Association (CSA).

The current standard and specification issued by the following organizations shall be implemented during design and construction of the sanitary sewer systems:

- ASTM – American Society for Testing and Materials,
- CSA – Canadian Standards Association,
- Alberta Environment and Sustainable Resource Development *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems.*

8.1.2 STORM WATER MANAGEMENT

Storm water management is the process of controlling run-off, usually by diverting the water to a detention facility, in order to control the quantity and quality of the water released into an existing storm sewer system, receiving water body, or stream.

These Guidelines are the basis for storm water management in all developable land, including land upstream of existing pipe systems.

The main objectives of storm water management are as follows:

1. Ensure that the hydraulic capacities of existing pipe systems and/or watercourses are not exceeded.
2. Reduce to acceptable levels (1:100 year probability of occurrence, where reasonably attainable), the potential risk of property damage from flooding within the development and in the existing developments downstream of the proposed development.
3. Reduce to acceptable levels (1:5 year probability of occurrence, where reasonably attainable), the inconvenience caused by surface ponding within development areas.

Based on the preceding criteria, storm water management is to be implemented for all developable land unless approved otherwise by the Engineer.

8.1.3 MAJOR/MINOR SYSTEM

The storm drainage system shall be designed using a dual drainage concept consisting of a minor system and a major system.

The minor system comprised of pipes, manholes, catch basins, storm water storage facilities, and outfall structures, shall be designed to accommodate the runoff generated from a 1:5 year or more frequent rainfall event without surcharge of sewer pipes or ponding at catch basins. An allowance should be made for sump pump discharge or individual service lines from weeping tiles where required. The system shall convey run-off from snowmelt and rainfall events to an adequate receiving stream, lake or pond without sustaining any surface ponding or excessive surface flows for events up to a 1 in 5 year return period.

The major system comprises the street system, storm water storage facilities, parkland, and any other routes required to convey run-off during rainfall events up to a 1 in 100 year return period, to the receiving water body. The major system shall be evaluated in a manner sufficient to determine that no flooding that may cause significant property damage (i.e. flooding of buildings) occurs during the 100-year storm event.

In general, post-development release rates must be controlled so they do not exceed pre-development release rates based on a 1:100 year storm. This is achieved by providing storage for the difference between a 1:100 year storm based on the post-development runoff conditions and a 1:100 year storm based on the pre- development runoff conditions over a 24 hour time period. Any stored water is permitted to be released at the pre-development release rate based on a 1:100 year storm.

8.1.4 RAINFALL INTENSITY DURATION FREQUENCY

The following formulas define the Intensity-Duration-Frequency Curves (IDF Curves) developed by Atmospheric Environment Services of Environment Canada for the Town of High Level Airport.

Table 2. Extrapolated IDF Formulas

EXTRAPOLATED IDF FORMULAS (1971-2007 DATA)

Frequency	Average Intensity (mm/hr)
2 year	$156.3 / (t + 0.897)^{0.648}$
5 year	$233.3 / (t + 1.171)^{0.653}$
10 year	$272.6 / (t + 1.053)^{0.646}$
25 year	$340.3 / (t + 1.241)^{0.651}$
50 year	$387.2 / (t + 1.301)^{0.652}$
100 year	$422.7 / (t + 1.185)^{0.647}$

t = storm duration in minutes.

These IDF formulas shall be used for all new storm basins.

8.1.5 RATIONAL METHOD DESIGN

The Rational Method of analysis shall be used to determine design flows for piped storm sewer systems of predominantly residential, commercial, and/or industrial land up to 65 ha (160 ac) in area. Alternatively, computer modelling may be used (see Clause 1.6 of this Section). The Rational Method formula is:

Q = (CiA)/360

Where:

"Q" is the design peak flow rate (m3/s) "C" is the run-off coefficient

"i" is the rainfall intensity (mm/hr) corresponding to the time of concentration

"A" is the drainage area contributing runoff (ha)

RUN-OFF COEFFICIENTS (C)

Minimum recommended run-off coefficient (C) values to be used in the Rational Method are as follows:

Table 3. Run-off Coefficients

LAND USE OR SURFACE CHARACTERISTICS	STORM FREQUENCY	
	5 Year	100 Year
Residential	0.35	0.60
Apartments	0.70	0.80
Downtown Commercial	0.85	0.90
Neighbourhood Commercial	0.65	0.80
Lawns, Parks, Playgrounds	0.20	0.30
Undeveloped Land (Farmland)	0.10	0.20
Paved Streets	0.90	0.95
Gravel Streets	0.25	0.65

In development areas where a mixture of land uses or surface characteristics are proposed, the weighted average of pervious and impervious area run-off coefficients shall be used.

STORM DURATION

The storm duration used to determine the rainfall intensity for the Rational Method is equal to the time of concentration for the catchment (which equals the inlet time plus the time of travel in the sewer). The inlet time is the time taken for run-off from the furthest reach of the catchment to flow overland to the first inlet; and normally should not exceed 10 minutes. The time of travel is the time taken for flow from the furthest inlet to reach the point of design; based on full flow pipe velocities.

8.1.6 COMPUTER MODELLING

Computer models shall be used to determine design flow conditions in sewer systems with drainage areas larger than 65 ha (160 ac). They may be used for smaller systems as an alternative to the Rational Method.

Computer models shall be used to determine design flows and the sizing of systems that contain non-pipe storm water management facilities (i.e. detention ponds) or systems that include a significant amount of undeveloped land.

When large parcels (quarter section or larger) are being developed and will connect to the existing storm water facilities, the Consulting Engineer shall prepare a storm water model that simulates both major and minor systems. As a general rule, this model will have sub-basins no larger than 5 ha. The modeling, input and output, shall be generated utilizing software acceptable to the Town.

The selection of an appropriate computer model shall be based on an understanding of their principles, assumptions, and limitations in relation to the system being designed. Acceptable computer models are US EPA SWMM, PCSWMM, OTTSWM, XP-SWMM, EXTRAN, OTTHYMO, and SWMHYMO.

Wherever possible, the computer model shall be calibrated. In all analyses, the parameters used, the drainage boundaries, the pipe network and its connectivity shall be clearly identified on an overall drawing, and submitted to the Town along with computer model input and output and a design summary report.

The design storm hyetograph shall be developed using the Chicago Method, unless otherwise approved by the Engineer.

The storm duration used for modelling simulations will depend on the type of system being analysed. Depending on basin characteristics and outlet rates, short duration storms (1 - 4 hours) will generally govern the design of the storm sewer systems and the longer duration storms (6 - 24 hours) will generally govern the design of detention ponds and major system components. Therefore, several design storms should be evaluated to determine the worst run-off result for the system being designed.

Historical, continuous rainfall data in one-hour increments, over the past 25 or more years, may be routed through the storm run-off model to provide statistical frequency analysis of various flow and storage characteristics of the catchment in question.

8.1.7 SERVICE CONNECTIONS

Effluent from sanitary sewers or surface drainage from industrial, agricultural, or commercial operations that may be contaminated shall not be discharged to the storm sewer.

Connections from roof leaders shall not be made to the storm sewer system. Roof drainage from residential housing units, apartments, commercial, and industrial buildings shall discharge to grassed or pervious areas.

8.1.8 LENGTH OF RUN

Surface water should not be permitted to run a distance greater than 150m in streets or 200m in lanes and swales without interception by a catch basin.

8.1.9 BACK OF LOT DRAINAGE

The following will apply to back of lot drainage in laneless subdivisions:

- For back-to-back lots, a concrete swale is to be constructed along the rear property lines within a Town easement to direct the drainage to a street. Concrete swales are to be constructed with continuous grade lines with a minimum 0.8% slope to convey rear lot drainage to a catch basin located in a street or utility right of way.
- For lots backing onto a park or reserve area, a grass swale is to be provided within the park or reserve area adjacent to the rear lot line. Grass swales are to be constructed with continuous grade lines with a minimum 0.8% slope to convey rear lot drainage to a catch basin located in a street or utility right of way.

The flow from rear lot swales should not be allowed to cross a sidewalk in order to prevent ice build-up and dirt accumulation on the sidewalk. A catch basin may be required at back of walk to intercept these flows.

8.2 STORM SEWER MAINS (MINOR SYSTEM)

8.2.1 GENERAL

Storm sewer mains shall be designed for gravity flow unless approved otherwise by the Engineer.

8.2.2 FLOW CAPACITY

Sewer hydraulics shall be calculated using Manning's equation. Manning's n value shall be 0.013 for concrete and PVC. For other pipes and open channels, the values suggested in "Modern Sewer Design" (AISI, 1980 or latest) shall be used, but shall not be less than 0.013.

8.2.3 PIPE STRENGTH

The strength of the pipe shall be sufficient to carry the loads due to trench backfill and live loads. The strength of pipe shall be calculated on the basis of the external loads, trench conditions, and bedding class provided. Class B sand bedding is the minimum bedding requirement.

8.2.4 DEPTH OF COVER

All sewers shall be designed so that the top of the main shall be located at the minimum depth required to meet the following conditions:

Sanitary and storm service inverts at property/easement line shall be set at an elevation at least 2.7m below finished grade and deep enough to be extended below the anticipated building footing elevation. Sanitary and storm inverts at property/easement line should be set at the same elevation and no deeper than 3.5m if possible.

Where existing conditions dictate that the depth of bury be less than 2.7m, the main/service is to be insulated. In no case shall the depth of cover be shallower than 1.5m, unless otherwise approved by the Engineer.

8.2.5 MINIMUM SIZES

The minimum size of a storm sewer main shall be 300mm in diameter.

8.2.6 MINIMUM SLOPES

Sewer velocities shall not be less than 0.60m/s when flowing full. Flow velocities of less than 0.9m/s are not recommended. When the flow velocity exceeds 3.0m/s, special consideration shall be given to the design of junctions and bends in the system. The Minimum Design Slopes for storm sewers shall in accordance to *Minimum Design Slopes for Storm Sewer* (Table 5.1) in Alberta Environment and Sustainable Resource Development's publication entitled *Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems* in Alberta. Specific reference should be made to *Part 5 Storm water Management Guidelines of a Total of 5 Parts*. March 2013, or latest.

8.2.7 CURVED SEWERS

Although it is recommended that storm sewers be laid with straight alignments between manholes, curved sewers will be permitted with the following restrictions:

1. The sewer shall be laid as a simple curve with a radius equal to or greater than that recommended by the pipe manufacturer. Minimum radius shall not be less than 60m.
2. Manholes shall be located at the beginning and end of curves, and at intervals not greater than 90m along the curve unless approved otherwise by the Engineer.
3. The curve shall run parallel to the street centre line.
4. The minimum grade for sewers on curves shall be 50% greater than the minimum grade required for straight runs of sewer.

8.2.8 ALIGNMENT

Storm sewers shall be located on the standard alignment shown in Standard Drawing Details. Consistent alignments shall be used along the entire length of a street.

8.2.9 MANHOLES

Manholes shall be installed at the end of each line, at all changes in size, grade, or alignment, at all junctions, and at a spacing of no greater than 150m along the length of the sewer.

To maintain a continuous energy gradient through manholes, the obvert (crown) elevation of the lowest upstream pipe shall be equal to or higher than the obvert of the downstream pipe. Where a bend in pipe alignment occurs in a manhole, the invert elevation of the downstream pipe shall be at least 50mm below that of the lowest upstream pipe.

Storm sewers for weeping tile connections are to be extended 1.5m past the last house service lead, with the exception of storm mains in cul-de-sacs where service leads may be connected directly to the end of the line manhole provided that the lead enters the manhole less than 0.60m above the invert of the main.

The flow channel through manholes shall be made to conform in shape and slope to that of the sewer. The depth of the flow channel should be at least one-half the diameter of the downstream sewer.

Standard 1200mm diameter precast manhole shall be used on mains 600mm in diameter or less. Precast manhole vaults or an oversized manhole barrel shall be used on mains of 675mm in diameter or greater. A "T-Riser" manhole may be used on mains 1200mm in diameter and larger, providing there is no deflection in alignment or grade.

8.2.10 CATCH BASINS AND CATCH BASIN MANHOLES

GENERAL

Catch basins at street intersections shall normally be located at beginning or end of the curb return. Catch basins are not to be located within the limits of a paraplegic ramp. Invert crossings of streets (swales) are not permitted.

CATCH BASIN LEADS

Catch basin leads shall connect directly to a manhole. A minimum lead size of 300mm shall be used for all leads including the following:

- Twin catch basin required to drain an area shall consist of a catch basin and a catch basin manhole interconnected by means of 300mm pipe;
- The lead from the catch basin manhole to a main line manhole shall be a 300mm pipe;
- Single catch basins require 300mm leads as well. All leads shall have a minimum grade of 2.0%.

The length of catch basin leads shall not exceed 30m. If it is required to extend a lead more than 30m, a catch basin manhole shall be used.

DESIGN CAPACITY

For design purposes, catch basin capacities in litres/second (L/s) are approximately as follows:

Table 4. Catch Basin Capacities

NORWOOD MODEL	SUMP CONDITION*	CONTINUOUS SLOPE**	
		Capture	Overflow
F-51 (with side inlet)	190	20	95
F-51 (grate only)	155	35	85
F-33	75	10	30
F-39	80	15	40
F-49	105	20	50

* based on 100mm depth of ponding

** based on 50mm depth on 1% slope

TYPES OF CATCH BASINS AND CATCH BASIN MANHOLES

Catch basins shall be built with a 900mm barrel. Catch basin manholes shall be built with a 1200mm barrel. Catch basins and catch basin manholes shall be built with sumps.

The type of inlet assembly to be used for catch basins and catch basin manholes shall be as follows:

1. **Type K-1** (i.e. Norwood F-51) catch basin assembly is to be used in conjunction with standard curb and gutter, and standard monolithic sidewalk construction.
2. **Type K-3** (i.e. Norwood F-51) catch basin assembly is to be used in conjunction with lane construction.
3. **Type K-4** (i.e. Norwood F-33) catch basin is to be used in conjunction with rolled monolithic sidewalk construction.
4. **Type K-6** (i.e. Norwood F-39) catch basin assemblies may be used to drain landscape areas and swales.

8.2.11 REQUIRED DEPTH FOR STORM SEWERS AND CATCH BASIN LEADS

Storm sewers shall be installed at a sufficient depth to meet the following requirements:

- The main shall have a minimum depth of cover of 1.5m measured from finished grade to the crown.
- The storm sewer shall have sufficient depth of cover to provide complete frost protection.
- The main shall have sufficient depth to allow all required building foundations to drain by gravity to the sewer. Special consideration should be taken when building floor elevations are lower than the roadway. Service lines shall have a minimum cover of 2.0m from the finished lot surface to the top of pipe at the property line.
- The catch basin leads shall have a minimum of 1.5m of cover measured to the top of pipe.
- Under normal conditions, storm sewer mains shall cross below water mains with sufficient clearance to allow for proper bedding and structural support of the pipes. Pipe clearance when passing under any water main shall be a minimum of 300mm separation between the top of the sewer pipe and the bottom of the water main.
- Pipe clearance when passing over any water main shall be a minimum of 500mm separation between the bottom of the sewer pipe and the top of the water main. Efforts shall be made to pass under the water main when possible.

8.2.12 CULVERTS

Culvert design should consider flow capacity and back water effects over a range of flows. The design capacity of the culvert requires assessment of both its nominal design and its performance during the 100-year storm event. For maintenance purposes, the minimum nominal diameter for any culvert is 400mm and the maximum buried length without manway access is 18.3 meters (60 feet).

8.2.13 MATERIAL REQUIREMENTS

Unless specified with better material accepted by the Engineer, all underground and water retaining structure shall be designed against frost and sulphate attack (with sulphate resistant cement to ASTM type V) and conform to CSA A23.1 and ACI 350R-89 ”Environmental Engineering of Concrete Structure”.

Concrete Grade 25 shall be used and tested in accordance with CSA 23.2.

The design of foundation, footing, excavation, soil, rock and liquid retaining structure shall comply with the current National Building Code (NBC) and Alberta Building Code (ABC). A surface investigation, including ground water condition, shall be carried out by or under the direction of a professional engineer having the knowledge and experience in planning and executing such investigations to a degree appropriate for the structure or substructure of it use, the ground and the surrounding condition.

Concrete manholes, catchbasins shall be manufactured with pre-cast reinforced concrete components conform to ASTM C478. No Corrugated Steel Pipe (CSP) shall be used.

Component joint shall be supplied with a pre-formed and sealed O-ring type rubber gasket, comply to ASTM C443 or current requirement.

Minimum of 100mm thick bedding of granular gravels or sand (no particles larger than 32mm) shall be allowed for levelling bed for the aforesaid structures.

8.2.14 MANHOLE DESIGN AND LOCATION

Manholes shall be located at the end of each line, at all changes in pipe size, grade and alignment.

1. The maximum distance between manholes shall not exceed:
   - 120m for sewers less than 1200mm in diameter;
   - 180m for sewers 1200mm to 1650mm in diameter;
   - 240m for sewers larger than 1650mm in diameter.

2. All manholes shall be 1200mm minimum inside diameter.
3. Manholes shall be located at the extension of property lines whenever possible in order to avoid conflicts with driveways.
4. The drop across manholes should be of sufficient magnitude to account for any energy losses in the manhole.
5. Pipe deflections of less than 45° require a drop of at least 30mm.
6. Pipe deflections of 45° to 90° require a drop of at least 50mm.
7. Invert drops for pipes larger then 600mm or for high flow situations shall be assessed on an individual basis.
8. The obvert elevation of a sewer entering a manhole shall not be lower than the obvert elevation of the outlet pipe.
9. Pipe deflections in manholes shall not be greater than 90°.

8.2.15 STORM SERVICES AND FOUNDATION DRAINS

1. Foundation drain service connections will be required for weeping tile flow in areas where the water table is higher than the basement foundations. Sizing of foundation drain service lines shall be based on expected flows as determined by the geotechnical investigation.
2. Sump pump discharge collection systems with surface discharge shall not be permitted in areas with urban road cross sections.
3. Storm sewer connections for the connection of roof drains will only be required where geotechnical conditions dictate such as areas where slope stability is an issue.
4. When required, separate storm sewer or foundation drain service connections shall be provided for each separately titled lot.
5. The minimum size of a residential storm sewer or foundation drain service shall be 100mm. Non-residential service connections shall be sized according to anticipated flow.
6. Connections for all proposed residential lots requiring storm sewer or foundation drain services shall be installed at the time of initial subdivision development.
7. The minimum grade for a storm sewer or foundation drain service line shall be 2.0%.
8. Services shall be located such that they do not conflict with driveway locations.
9. The storm sewer or foundation drain services shall be installed to the property line. In areas where natural gas distribution facilities require an easement along the front of the property, the service connections shall be extended to the edge of the easement furthest from the roadway.

8.2.16 CATCH BASINS AND LEADS

1. The maximum surface/gutter flow distance shall be 120m.
2. The catch basin grates, leads and spacing shall be designed such that there will be no ponding during a 1:5 year rainfall event.
3. At sag locations, the determination of the required capacity must account for flow that may bypass inlets at upstream gutter locations.
4. The minimum inside diameter for a pre-cast catch basin shall be 610mm.
5. The minimum sump depth in catch basins shall be 500mm.
6. Gutter flow shall be intercepted by a catch basin prior to crossing a walkway wherever possible.
7. The depth of flow in gutters should not exceed the top of curb at any point.
8. Catch basins shall be located at the BC or EC of any curb return.
9. The maximum length of a catch basin lead shall be 30m. If the length must exceed 30m, a catch basin manhole must be installed on the upstream end.
10. All leads shall be connected to a manhole or catch basin manhole at the downstream end.
11. Catch basins and leads shall not be placed beyond the public right-of- way. Lots must be filled and graded to ensure that all runoff drains to a public right-of-way.

8.2.17 STORM SEWER MATERIALS

1. The Developer shall supply only new materials. All materials found to be defective or damaged shall be replaced at the cost of the Developer.

2. Where specific products are specified, it is intended that approved equals are also acceptable. Approval must be obtained by the Engineer prior to installation.
3. PVC pipe and fittings shall conform to the following:
   - CSA B182.2, ASTM D3034, ASTM F679, NQ 3624-130 and NQ 3624-135 standards with minimum stiffness of 320kPa. Service lines shall a minimum stiffness of 625kPa.
   - Ultra-rib PVC or approved equal is acceptable from 250mm to 600mm. Pipe shall conform to CSA B182.2 and ASTM F794 with a minimum stiffness of 320kPa.
   - Standard Dimension Ratio (SDR) 35 unless otherwise indicated on the drawing.
   - Sealing gaskets shall meet requirements of CSA B182.2 and ASTM F477.
   - Injection moulded gasketed fittings for service connections shall conform to CSA B182.1 or CSA B182.2 and fabricated fittings shall conform to CSA B182.2 and ASTM F679.
   - Pipe shall be tested by the manufacturer and marked in accordance with CSA B182.2. Test results shall be recorded on a certification form signed by a qualified representative of the manufacturer.
   - Pipe and fittings shall be installed within two years from the production date indicated on the certification.
4. Concrete pipe and fittings shall conform to the following:
   - All concrete pipes shall be manufactured using Type 50 sulphate resistant cement CSA A3000;
   - Non reinforced concrete pipe shall conform to CSA A257.1, minimum Class 3 and ASTM C14;
   - Reinforced concrete pipe shall conform to CSA A257.2 and ASTM C76;
   - Flexible rubber gasket joints shall conform to CSA 257.3 and ASTM C443;
   - The manufacturer of the concrete pipe shall perform quality testing and control in accordance with CSA 257.0, 257.1, 257.2 and 257.3;
   - Each concrete pipe shall be marked with the manufacturer's name, date of casting and quality testing passing stamp.

8.2.18 MANHOLE MATERIALS

1. Manholes shall be manufactured using sulphate resistant Type 50 cement or the approved type Chemical Resistance Fibre Glass or HDPE material with proven record of 50 years life time. Material Data sheet and past record (at least 5 references in Canada) shall be submitted to the Engineer for approval.
2. Manhole sections shall be pre-cast reinforced concrete conforming to ASTM C478 and CSA A257.4.
3. All manholes shall have an inside diameter of 1200mm for pipe 900mm and less. For pipe exceeding 900mm or manhole having multiple inlets, manhole sizing shall be subject to review by the Engineer.
4. Manhole steps shall be standard safety type, hot dipped galvanized iron conforming to ASTM A615 and ASTM A123 or aluminum forged from 6061-T6, 6351-T6.
5. All joints shall be sealed with rubber gaskets conforming to ASTM C443 and grouted with non-shrink grout.
6. Manhole frames and covers shall be cast iron conforming to Class 20 ASTM A48 and ASTM A536. Type NF80 covers shall be used for all streets and driveways, type NF90 covers with rubber gasket shall be used for manholes located in sags and low areas and type F39 covers shall be used for all other areas. Castings shall be marked with series designation, foundry identification and date of casting. Manhole covers with the Municipality identification will be encouraged. Manhole covers with names of other municipality names are not permitted.
7. Pre-benched manhole bases shall be use wherever possible with pre-cored connection holes and watertight Duraseal or G-Loc joints or approved equal.
8. Tee Riser manholes shall conform to CSA 257.2, ASTM C76 and CSA A257.4, ASTM C76.

9. Safety platforms are required for all manholes greater than 7.0m in depth.
10. All pre-cast units shall be market with manufacturer's identification, date of casting, type of cement and CSA standard.

8.2.19 CATCH BASIN MATERIALS

1. Catch basin barrels shall be manufactured using sulphate resistant Type 50 cement.
2. Catch basin frames and grates shall be cast iron conforming to Class 20 ASTM A48 and ASTM A536. Type F38 or F39 grates shall be used for all round top inlet catch basins, type F51 or F36A grates shall be used for straight face curbs and type F33, K7 or DK7 shall be used for rolled face curb. Any other types must obtain approval by the Engineer. Castings shall be marked with series designation, foundry identification and date of casting.
3. If required, catch basin steps shall be standard safety type, hot dipped galvanized iron conforming to ASTM A615 and ASTM A123 or aluminum forged from 6061-T6, 6351-T6.
4. All pre-cast units shall be market with manufacturer's identification, date of casting, type of cement and CSA standard.

8.2.20 TRENCHING, BEDDING AND BACKFILLING

1. All trenching and backfilling shall be completed in strict accordance with Occupational Health and Safety Guidelines.
2. If unsuitable soil conditions are encountered, proper measures for dealing with the conditions shall be identified either on the design drawings or as a brief report to the Engineer prior to construction.
3. Class "B" pipe bedding shall be utilized in suitable soil conditions. Washed rock shall be used if water table is above the pipe zone. Bedding sand shall have minimum depth of 100mm below the pipe, shall extend up both sides to the trench wall and provide a minimum cover of 300mm above the pipe. The Developer's Engineer shall identify special pipe foundation measures for areas where unsuitable pipe foundation conditions exist.
4. The minimum trench width measured at the pipe spring line shall be the pipe outside diameter plus 450mm. The maximum trench measured at the pipe spring line shall be the pipe outside diameter plus 600mm. The Engineer must be notified if the trench must be excavated deeper or wider than specified.
5. Excavated material shall be stockpiled at a safe distance from the edge of the trench.
6. The Developer's Engineer shall identify areas where the trench excavation requires sheathing, shoring or bracing in order to protect workers, property or adjacent structures.
7. Trench excavations shall be kept free of water.
8. It shall be the Developer's responsibility to ensure that the utility trenches are adequately compacted.

→ Native backfill under existing or proposed roads or laneways shall be compacted throughout the entire right-of-way width to:

- 98% of Standard Proctor Density from subgrade to 1.5m below subgrade or original ground, whichever is lower;
- 95% of Standard Proctor Density greater than 1.5m from the subgrade or original ground, whichever is lower.

→ Granular backfill under existing or proposed roads or laneways shall be compacted to 95% of Standard Proctor Density throughout the entire trench depth below subgrade and the entire right-of-way width.

→ Backfill in all other areas shall be compacted to 95% of Standard Proctor Density.

→ If the above standards cannot be achieved due to a large variation in soil types throughout the development, the Engineer, at his or her sole discretion, may establish a more appropriate standard on an individual case basis. One-mould proctor density testing may be permitted if the Developer submits an acceptable proposal prepared by the Developer's Engineer, justifying the required changes to the compaction standards.

9. If the minimum compaction standards cannot be met due to abnormal weather or wet ground conditions, the Engineer may establish a more suitable standard on a site specific basis provided adequate justification is presented by the Developer. One-mould proctor density testing will not be permitted as an alternate testing procedure due to wet soil conditions. The Developer's Engineer will be required to suggest appropriate measures such as drying in-situ material or importing suitable material in order to meet the required Standard Proctor Densities.
10. All landscaping, pavement structures, sidewalks, curb and gutter damaged or removed during trenching shall be restored or replaced unless otherwise directed by the Engineer.
11. All debris, surplus fill and unused materials must be removed from the site.

8.2.21 STORM SEWER INSTALLATION

1. The pipe and gasket installation shall be conducted in compliance with the pipe manufacturer's specifications. Installation of PVC pipe and fittings shall conform to CSA-B182.11.
2. Pipe installation shall start at the outlet and work upstream.
3. Align pipes carefully when jointing. Keep joints free of mud, gravel and foreign material and apply sufficient pressure to ensure that the joint is complete as outlined in the manufacturer's specifications. Complete each joint before laying the next length of pipe. Deflections shall not exceed those permitted by the manufacturer.
4. The pipe must be thoroughly flushed of all dirt, stones and pipe lubricant when complete.
5. The alignment of pipes less than 900mm in diameter shall not be more than 150mm off the designated alignment. The alignment for pipes larger than 900mm shall not deviate by more than 50mm per 300mm of diameter.
6. The invert of the pipe shall not deviate from the design grade by more than 6mm plus 20mm per metre of diameter of sewer pipe.

8.2.22 MANHOLE INSTALLATION

1. Manholes shall be installed as depicted on the detail drawings and in accordance with manufacturer's recommendations.
2. Backfill around manholes shall be compacted to a minimum of 95% and 100% of Standard Proctor Density for 1.5m below subgrade or original grade.
3. Tee Riser manholes shall require Class A bedding to the elevation of the spring line.
4. Pre-cast manhole bases shall be installed on a base of 100mm to 300mm of washed gravel.
5. Cast in place manhole bases approved by the Engineer shall be places directly on undisturbed ground.
6. Safety steps shall be aligned on centerline perpendicular to the main flow channel. Wherever possible the steps shall be aligned so that a person exiting the manhole would face oncoming traffic if not conflicting with the previous requirement. The distance from the top of the rim to the first step shall not be greater than 300mm. Steps shall be evenly spaced at a maximum of 410mm to within 600mm of the base of the manhole. Refer to Standard Drawing Details for details.
7. The frame and cover shall be installed following manufacturer's recommendations.

8.2.23 INSPECTION AND TESTING

1. All sewer installations shall be subject to inspections by the Engineer prior to issuance of the Construction Completion Certificate (CCC) and Final Acceptance Certificate (FAC).
2. Video inspections by qualified personnel are required prior to CCC for all sewers less than 1800mm in diameter. A walk through inspection is permitted for any sewer 1800mm and larger. A written report including still photographs and/or a video tape recording of the entire inspection shall be submitted to the Engineer for review. The report shall indicate the location and severity of all leaks, cracks, breaks, collapses, deflections, sags, obstructions and any other defects affecting the performance of the line. Sections requiring repair will be subject to re-inspection when complete.

3. Re-inspection by camera may be required on suspect areas prior to FAC at the discretion of the Engineer. All video inspection costs shall be borne by the Developer.
4. All material testing (backfill densities) shall be performed by an accredited agency. All test results shall be submitted to the Engineer with a report indicating any deficiencies and remediation.
5. An infiltration and/or exfiltration test may be required at the Engineer's sole discretion for any section showing deficiencies during the camera test.

→ The test section shall be filled with water allowing displacement of air in the line and will be allowed to stand for 24 hours to ensure absorption in the pipe wall. Prior to the test, add enough water to ensure a head of 1m to 3m over the pipe crown in the upstream manhole. The test duration shall be 2 hours. The water level should be measured at the beginning and end of the test in order to calculate the infiltration/exfiltration.

→ The allowable leakages are as follows:

- **Infiltration Test:** Performed when the groundwater is above the pipe crown for the entire test length. Allowable infiltration is 5.0 L/day/mm dia/km for PVC pipe and 20.0 L/day/mm dia/km for concrete pipe.
- **Exfiltration Test:** Performed when the groundwater is below the pipe invert for the entire test length. Allowable exfiltration is 5.0 L/day/mm dia/km and 20.0 L/day/mm dia/km for concrete pipe.

8.3 MAJOR DRAINAGE SYSTEM

8.3.1 GENERAL

The major conveyance system accommodates flows not intercepted by or beyond the capacity of the minor drainage system through planned surface flow routes and storage facilities. The intent of the major system is to provide surface flow management in order to minimize flooding and property damage from a 1:100 year rainfall event. The design of the major drainage system must not be limited to the immediate development area but must consider overland flows that may enter the area from adjacent land as well as downstream effects on adjacent development and receiving water bodies.

8.3.2 LOT GRADING

Proper lot grading is the first step towards a well planned major drainage system. The goal of the lot grading shall be to ensure that water flows away from the building, water supply well, and septic bed, and in no case shall ponding levels come within 300mm from the finished ground elevation at the building during a 1:100 year rainfall event. Flow from lots shall always have an escape route to a public right-of-way. The lot- grading plan shall develop a proper balance between the road and gutter elevations, proposed building elevations, surrounding development and existing topography.

Generally, the lots shall be designed to drain from back to front. Drainage towards the back of lot will be permitted where laneways or public right-of-ways are in place to accommodate drainage directly from the lot without crossing adjacent lots. An overall drainage plan will be required for all subdivisions.

An initial grade of 10% sloping away from the building for a distance of 2m shall be required on all sides. The slope shall continue at a minimum grade of 2.0% to the property boundary. Larger slopes are desirable if topography allows to a maximum of 10%.

8.3.3 SWALES

1. Drainage swales on municipal or private property shall be constructed prior to any development of subdivision lots. Complete swale construction shall be a prerequisite to the issuance of the Construction Completion Certificate.

2. Drainage swales located on private property shall be covered by an easement in favour of the Municipality. A minimum clearance of 200mm should be provided between the edge of the swale and the property line. Major rainfall event flows shall be contained within the easement.
3. Drainage swales crossing several properties for the collection of runoff shall not be permitted unless special circumstances warrant.
4. Concrete swales shall be required when accommodating flow from more than three adjacent lots.
5. Earthen swales shall be protected from erosion by grass cover, appropriate ground cover or geotextile fabric.
6. The minimum design slope for concrete swales on private property is 0.75%.
7. The minimum design slope for concrete swales on public property is 0.5% or as required to provide adequate hydraulic capacity.
8. The minimum design slope for swales without a concrete gutter is 1.5%.

8.3.4 ROADWAYS

Grading of streets comprising the major drainage system shall follow the guidelines listed below:

- Continuity of overland flow routes between adjacent developments shall be maintained.
- Collectors shall have at least one lane that is not inundated.
- Local roads should not have a depth of water more than 50mm above the crown of the road.
- The depth of water at the curb shall be less than 500mm for all roadways.

8.3.5 DRAINAGE

The grading of streets and the layout of the major drainage system shall be assessed, relative to the following guidelines, during the 100-year storm event:

- No building shall be inundated at its ground line.
- Continuity of the overland flow routes between adjacent developments shall be maintained.
- The depth of water at curbside should be less than 500mm for all roadways. Depths greater than 300mm are not recommended.
- The velocities and depths of flow in the major drainage system shall not exceed the following values:

Table 5. Major Drainage Velocities and Depths of Flow

DEPTH VELOCITY CRITERIA FOR OVERLAND FLOWS

depth of flow (m)	Maximum Water Velocity (m/s)
0.80	0.5
0.32	1.0
0.21	2.0
0.09	3.0

Source: Alberta Environmental Protection
Storm water Management Guidelines for the Province of Alberta, January 1999

- Trapped low storage should be implemented to offset peak flows where necessary to keep water velocities and depths below those noted above. The Developer shall recommend a building elevation to the lot purchaser that is above trapped low ponding elevations and designed to drain surface run-off to the street or lane/utility right of way.

8.4 STORM WATER MANAGEMENT (SWM) FACILITIES

8.4.1 DESIGN REQUIREMENTS FOR STORM WATER MANAGEMENT STORAGE FACILITIES

GENERAL

This section identifies the general design parameters for the planning and design of storm water storage facilities.

A Storm Water Master Plan (SWMP) must be prepared by the Developer providing a detailed description of the development area including overland flow, catchment areas, natural storage and planned storage.

Several different storage methods may be employed for a storm water storage facility such as:

1. **Retention Storage (wet ponds)** – collects and stores runoff for a period of time and releases it after the inflow has ceased. The essential feature of a wet pond is the provision of a Permanent Pool (the portion of the pond from the pond's base to the Normal Water Level) which provides water quality enhancement. The storage available for storm water management purposes resides between the Normal Water Level (NWL) and the High Water Level (HWL), referred to as the *Active Storage* of the pond. Retention storage also includes constructed wetlands.
2. **Detention Storage (dry ponds)** – provides a control outlet to the area restricting flow. When the inflow exceeds the allowed outflow, water is detained in the designated storage area until flows diminish, after which time the impounded storm water is release at the established pre-development rate. Low flows are not usually detained.
3. **Channel Storage** – channels constructed with wide bottoms and small grades will provide a type of storage as the channel fills with water.

The design of the storage facility shall be based on a 1:100 year rainfall event. The Developer's Engineer shall include detailed calculations for a range of storm durations to determine the critical volume as well as an analysis of the capacity and characteristics of the downstream receiving drainage course. Measures shall be taken in order to avoid flooding, erosion or sedimentation in the downstream receiving drainage course.

These minimum standards are not intended to restrict Developers from formulating innovative storm water management processes intended to protect the environment and improve the storm water quality prior to release. All storm water management plans must be submitted to the Municipality for review and approval.

The use of storm water storage facilities may be required to reduce peak flow rates to downstream sewer systems and/or watercourses, or to provide a temporary receiving area for peak major drainage flows. Storm water management facilities that are to be maintained by the Town should be Dry Pond or Wet Pond type.

Their approximate location and size must be identified at the time of the Subdivision Outline Plan approval to avoid conflicts with adjacent land uses. The effects of the maximum pond water levels shall be considered in the design of the minor system and lot grading. If possible, the crown elevations of the pipes in the first manhole upstream of a pond shall be at or above the maximum pond level during the five-year storm event.

Detention ponds in residential setting should have gentle side slopes and be aesthetically contoured and landscaped to provide an attractive feature for the subdivision.

GEOTECHNICAL CONSIDERATIONS

Soils investigations specific to the detention facility shall be undertaken to determine the soil's permeability and salinity (or other potential contaminants), and the height of the groundwater table. Where the facility is sited above a shallow aquifer the potential for groundwater contamination must

be minimized. Where the pond bottom is below the water table, weeping tile systems may be required to keep the pond bottom dry enough to support grass growth and maintenance equipment traffic.

Minimum Storm Water Quality Standards

The following is an excerpt from the Wastewater and Storm Drainage Regulations published by Alberta Environment:

Storm outfalls without due consideration for water quality will not be allowed. Storm water management techniques to improve water quality shall be included to effect a minimum of 85% removal of sediments of particle size 75 microns or greater. Additional quality measures shall be required, based on site-specific conditions.

Based on the preceding statement, the Developer shall incorporate storm water treatment measures (i.e. Installation of storm water treatment units) in the design of any storm water storage facility.

SIGNAGE FOR SAFETY

The design of storm water management facilities shall include adequate provisions for the installation of signage to warn of anticipated water level fluctuations, with demarcation of maximum water levels to be expected for design conditions. Warning signs will be designed by the Developer and approved by the Engineer.

8.4.2 DRY DETENTION PONDS

SAFETY PROVISIONS AT INLETS AND OUTLETS

All inlet and outlet structures associated with dry ponds shall have grates provided over their openings to restrict access and prevent entry into the sewers by unauthorized persons. A maximum clear bar space of 100mm shall be used for gratings.

Grated outlet structures are to be designed with a hydraulic capacity of at least twice the required capacity to allow for possible plugging. Further, the velocity of the flow passing through the grating should not exceed 1.0m/sec. Appropriate fencing and guardrails are to be provided to restrict access and reduce the hazard presented by the structure head and wingwalls.

DESIGN PARAMETERS

The following general design parameters should be considered for a dry pond:

- Lands covered by the facility including areas covered by water at the 1:5 year level, inlets, outlets, control structures and access routes shall be designated as Public Utility Lot (PUL).
- Storage capacity for up to the 100-year storm event.
- Detention time to be determined based on downstream capacity, recommended maximum detention time is 24 hours.
- Maximum active retention storage depth of 1.5m. The maximum water level should be below adjacent house basement footings (a greater freeboard may be required if an emergency overflow route cannot be provided).
- Minimum freeboard of 0.6m above 1:100 year high water levels.
- Provision of an emergency overland flow route. If an emergency overland route cannot be provided, the minimum freeboard shall be raised to the higher water level generated by the 1:100 year storm under a plugged outlet scenario.
- Private property subject to potential flooding shall be covered by an easement in the favor of the Municipality.
- A restrictive covenant shall be placed on the lots abutting the facility as required to control development that will restrict the capacity.

- Pumping station(s) are required to drain pond area(s). This may require deeper depths and/or channels. For pumping systems consult Section 6.6, 6.7 and 6.8.
- All dry ponds shall be designated as off-line storage areas designed to temporarily detain excess flow and control downstream flow to acceptable limits. Low flow conditions shall not be diverted to the dry pond.
- The pond shall be designed to drain completely after excess flow has dissipated. The pond bottom shall have a minimum slope of 1.0% towards the outlet (2.0% is preferred).
- French drains adjacent to inlet/outlet structures, where slopes are less than 1.0% are to be provided.
- Low flow bypass for flows from minor events to be provided.
- Side slopes shall have a maximum slope of 7H:1V within private property and 5H:1V within public property.
- Grass cover shall be established after completion of construction.
- Length, width and depth dimensions must be acceptable to The Town of High Level Parks Department, particularly when the bottom of the pond is to be used for recreation facilities.
- Address all safety issues (particularly during operation).

8.4.3 WET RETENTION PONDS

- Lands covered by the facility including areas covered by water at the normal water level (NWL), inlets, outlets, control structures and access routes shall be designated as Public Utility Lot (PUL).
- Private property subject to potential flooding shall be covered by an easement in the favour of the Municipality.
- A restrictive covenant shall be placed on the lots abutting the facility as required to control development that will restrict the capacity.
- The design shall incorporate a semi-annual turnover at average annual precipitation.
- The high water level shall be at least 300mm below the lowest building opening on adjacent lots.
- The minimum surface area at Normal Water Level (NWL) shall be 1.0 ha. Due to higher maintenance costs, the proliferation of a large number of small wet ponds is discouraged.
- The lake shall have maximum side slopes of 3H:1V from the lake bottom to 1m below the NWL. Slopes above this level shall have a maximum slope of 5H:1V to 7H:1V. These slopes may be revised in confined spaces or areas with extreme topography at the discretion of the Engineer.
- The minimum depth from the NWL to the lake bottom (Permanent Pool depth) shall be 2.0m in order to discourage growth of vegetation.
- Maximum permanent pool depth of 3.0m.
- Maximum active detention storage depth of 1.5m.
- Detention time of 24 hours.
- Minimum freeboard of 0.6m above 1:100 year high water levels.
- Provision of an emergency overland flow route. If an emergency overland route cannot be provided, the minimum freeboard shall be raised to the higher water level generated by the 1:100 year storm under a plugged outlet scenario.
- Length to width ratio shall be from 4:1 to 5:1.
- Where the ground water level is below the NWL, the lake bottom shall be of impervious material. Where the ground water level is near or above the NWL, the lake bottom may be made of a pervious material based on geotechnical investigation.
- Inlets and outlets are to be placed in order to maximize detention time and water circulation thereby avoiding dead storage areas and hydraulic “short circuiting”.

- Inlet and outlet pipes are to be fully submerged a minimum of 1.0m below the NWL and at least 100mm above the Lake Bottom measured at the pipe's invert.
- The inlet manhole invert shall be at or above the NWL in order to avoid sedimentation.
- Provision shall be made in order to drain the lake completely by gravity or portable pump system.
- An overflow channel and overland drainage route must be provided.
- Edge treatment is required for erosion protection due to wave action from 0.3m below the NWL to 0.3m above the NWL.
- Maintenance vehicle access must be provided to all control works.
- Approved fencing and signage shall be installed where necessary for safety purposes.

8.5 MISCELLANEOUS DESIGN ITEMS

- Obverts of outfall pipes shall be above the 1:5 year flood level of the receiving drainage course.
- Inverts shall be above the winter ice or completely submerged with obverts 2.0m below NWL.
- Drop structures, energy dissipaters, riprap and filter fabric shall be used where necessary to prevent erosion.
- Removable grates shall be installed on openings to discourage unauthorized access.
- All piped inlets and outlets for storm water storage facilities shall be capped with compacted clay or other impervious material at the pond inverts in order to prevent water from washing out the granular bedding material.

8.5.1 OUTFALLS

Inlet/outlet structures in detention ponds are to be aesthetically blended into the landscape design, include adequate erosion protection, require low maintenance, and have trash bars to preclude access by children. Outlet velocities should be kept below 1.0 m/s.

8.5.2 RECEIVING WATERS

Measures such as detention ponds should be incorporated in new developments to prevent any increase in the amount of erosion and downstream flooding to existing receiving streams. Where erosion control or bank stability work must be done, preservation of watercourse aesthetics and wildlife habitat must be considered.

8.5.3 CULVERTS AND BRIDGES

Culverts and Bridge design should consider backwater effects over a range of flows. The design of a hydraulic structure requires assessment of both its nominal design "capacity" and its performance during the 100-year storm event as well as the 100-year ice level and break up.

8.6 EXECUTION

8.6.1 BEDDING SEWERS

Excavate trenches to widths not less than 300mm greater than pipe diameter. Maximum width at top shall not exceed outside pipe diameter plus 600mm.

Bed pipe per trench bedding and initial backfill Class "B" granular surround conditions for plastic pipe and granular foundation for concrete pipe, as shown in Standard Drawing Detail.

Obtain the Municipality's approval for all materials used in the pipe bedding zone.

8.6.2 LAYING AND JOINTING PIPE

Commence laying at lower end of line, lay pipes and specials true to line and grade, socket ends up grade, joints close and evenly butted all around pipe. Take special care to prevent sagging of spigot

end in hub and provide true, even invert surface throughout entire length of sewer. Excavate at end of each pipe to provide rest for socket, sufficient to permit proper jointing. Clean pipe interior, remove all dirt, mud and other extraneous materials.

8.6.3 INFILTRATION/EXFILTRATION TESTING

Total infiltration of groundwater into whole of system or exfiltration, shall not exceed 5.0 litres per mm of internal pipe diameter per kilometre per day including manholes, for PVC pipe, and 20 litres per mm of internal pipe diameter per km per day including manholes for concrete and clay tile pipe. Where such leakage is exceeded, repair sewer mains so total infiltration is within specified limits.

During construction and immediately on completion of a manhole, measure infiltration at new manhole. If amount exceeds specified limit, make necessary repairs immediately to reduce infiltration to allowable limit. Failure to comply with this requirement will be sufficient cause for the Municipality to stop sewer laying work until repairs have been made.

8.6.4 CLEANING SEWER MAINS

On completion of construction of mains and services, flush and string, in readiness for video inspection, all mains until all deposits of earth or other material are removed. If new system connects to an existing system, plug outgoing line at manhole junction and remove dirt and debris at that manhole. Do not permit debris from new construction to enter existing system. Pay all costs for repairs where damages occur due to negligence. Pay all costs of water from the Municipality Authorities.

During flushing operations, check all manholes. If depth of flow in any manhole is greater than should be anticipated, bucket main and remove obstructions in pipe line. Pay all costs for required repairs.

Whenever practicable, flush out in runs not over 250 meters. Remove all foreign material from each run before proceeding with next.

8.6.5 TESTING

If required by the Municipality, perform Pig test after cleaning sewer mains. Through each section of main, pull wood or metal ball with diameter 50mm less than inside pipe diameter. If Pig does not readily pull through, uncover pipe and make good, defects at no cost to Owner.

Pig test is not required on lines 216mm diameter and larger if they are visually inspected in a satisfactory manner.

Video Inspection - the Contractor, at his cost will carry out a video inspection of all sanitary and storm water mains. All defects identified by the video inspection shall be corrected by the Contractor at the Contractor's expense. The Contractor shall be responsible for the cost of flushing and stringing the mains prior to video inspection. If additional video inspection is required to verify correction of defective work, it will be at the Contractor's cost. The Contractor shall provide a copy of the electronic recordings and a written report to the Municipality for record purposes.

8.6.6 MANHOLES

Construct manholes as shown on drawings, unless otherwise permitted in writing by the Municipality. Submit full details of any proposed alternative construction with bid.

For cast-in-place concrete for manholes, conform to CSA A23.1.

Place manholes accurately, plumb, in alignment and at exact plan location.

Construct manholes watertight and complete, including finishing flow bottoms, as work proceeds. Do not lay pipe in advance more than two manholes ahead of last completed manholes.

Shape bottoms accurately for necessary flows as shown on drawings or as directed by the Municipality. On manholes with sewers 610mm diameter and smaller, form invert through manhole

with half-round pipe. At manholes containing lot services shape bottoms to provide slopes required to ensure no build up of sewage occurs in manholes.

Place stubs for future lines accurately and plug watertight. Shape flow bottoms to suit future lines.

At all bends through manholes, provide 50mm drop in invert from inlet to outlet.

Support pipes at manholes to prevent shearing or settlement. Where not detailed use concrete fills, concrete or timber beam, or suitably compacted gravel.

During construction, plug pipes at manholes to prevent entry of concrete and mortar. Remove plugs immediately after construction is completed.

Set covers accurately within 15mm of correct grade. On sloping streets, set covers to match slopes.

Set all precast concrete sections, bricks, blocks and frames in mortar. Tool joints smooth and point all voids after setting.

All sanitary manhole barrels are to be sealed with a rubber neck to prevent infiltration. Gaskets for storm manholes only may be omitted at the discretion of the Municipality.

8.7 CULVERTS

8.7.1 DEFINITION

Culverts shall mean galvanized corrugated steel or PVC Ultra-rib pipes acting as drainage conduits to conduct the flow of surface drainage water.

8.7.2 TERMINOLOGY

CSP shall mean Corrugated Steel Pipe.

CSP Arch means Corrugated Steel Pipe Arch.

PVC shall mean Poly Vinyl Chloride.

SPCSP means Structural Plate Corrugated Steel Pipe

8.7.3 REFERENCES

The latest version of the publications listed below form part of this Specification to the extent specified in this Section:

- CSA Standard G401
- CSA B182.4, ASTM F794
- Corrugated Steel Pipe Institute (CSPI)
- 501-78 Metric Specification for Corrugated Steel Pipe Products.

8.7.4 QUALITY ASSURANCE

Supply, fabricate and install CSP culverts strictly in accordance with manufacturer's instructions and recommendations and as specified.

8.7.5 PRODUCT DELIVERY AND HANDLING

Deliver to site, handle and store pipes, sections, fittings and hardware in a manner to prevent distortion or bending and damage to metal or galvanized coating.

8.7.6 JOB CONDITIONS

Protect CSP/PVC pipes before, during and after installation and protect installed work and materials.

In the event of damage, make repairs or replacements necessary to the Municipality's approval.

8.8 PRODUCTS

8.8.1 MATERIALS

Culvert pipe shall be galvanized corrugated steel pipe or PVC Ultra-rib complying with CSA Standard G401 or CSA B182.4.

Culvert pipes up to 600mm diameter shall have a wall thickness of 1.6mm and larger pipe up to and including 900mm diameter, shall have minimum 2.0mm wall thickness.

Specified wall thicknesses shall not include the thickness of galvanized coating.

The zinc coating mass shall be not less than 1,100 g/m² when tested by the single spot test.

Corrugation profile for the pipes shall be 68mm x 13mm.

End sections (square or bevelled as indicated), couplers, fittings and hardware shall match the culvert pipe.

8.8.2 EXECUTION

Trench shall be properly drained and free of unsuitable material prior to placing and compaction of bedding material.

8.8.3 TRENCHING AND EXCAVATION

The excavation for the culvert base shall be carried to a depth of not less than 150mm below the invert grade, as established by the Municipality and shall be of sufficient width to permit pipe assembly and to accommodate operation of compaction equipment on either side of the culvert. Refer to Standard Drawing Details.

8.8.4 CULVERT BEDDING

Place minimum 150mm thick layer of compacted granular material on bottom of excavation. Place material in uniform layers not exceeding 150mm thickness, and compact each layer to at least 95% Standard Proctor Density before placing succeeding layer. Any soft and yielding or other unsuitable material below this level shall be removed to the depth required by the Municipality and backfilled with approved granular material compacted to a uniform density of 95% of Standard Proctor Density throughout the entire length of the culvert.

The base for culverts installed along main water courses or through yielding areas shall consist of gravel bedding compacted to the excavated depth and extending over a width of three (3) times the diameter of the pipe. The depth of this base shall be not less than 300mm. An impervious compacted bedding material shall be provided for a minimum length of 3m or three (3) times the diameter of the pipe, whichever is greater, at the inlet end of the culvert to achieve a seal against seepage.

Trench line and grade requires the Municipality's approval prior to placing bedding material or pipe.

Do not backfill until pipe grade and alignment are checked and accepted by the Municipality.

8.8.5 LAYING PIPE CULVERTS

Commence pipe placing at downstream end on the prepared granular bedding with separated sections securely joined together by means of a coupling band.

The couplers are to match thickness and corrugations of the pipe.

Corrugations of pipes and couplers must mate before tightening and joints shall be tapped with a mallet during tightening to ensure proper seating of couplers.

Do not allow water to flow through pipes during construction except as permitted by the Municipality.

All culverts shall be laid so that the horizontal seams fall at the sides of the culverts.

The pipe shall be laid true to line and grade as established by the drawings and the pipe shall be carefully handled to prevent damage to the galvanized coating. Damaged pipe sections shall be immediately reported to the Municipality and repaired and replaced according to their direction. Damaged protective coating shall receive two coats of zinc rich paint.

Centreline of culvert shall not vary from the designated horizontal alignment by more than 75mm. Invert grade shall not vary from the designated invert grade elevation by more than 12mm provided positive flow is maintained.

The maximum buried length without manway access is 18.3 meters (60 feet).

8.8.6 CULVERT BACKFILL

After assembly of the culvert on the bedding, the culvert shall be backfilled with approved granular and random backfill. Backfill shall be brought up on both sides of the culvert simultaneously in 150mm lifts and shall be compacted with a method approved by the Municipality to a minimum density of 95% Standard Proctor.

The backfill shall be spread and compacted in 150mm layers and special care shall be taken to ensure proper filling and compacting under the haunches and within the culvert corrugations. Heavy equipment shall not be allowed over the culvert until a minimum of 0.5m of fill is obtained above the crown of the pipe.

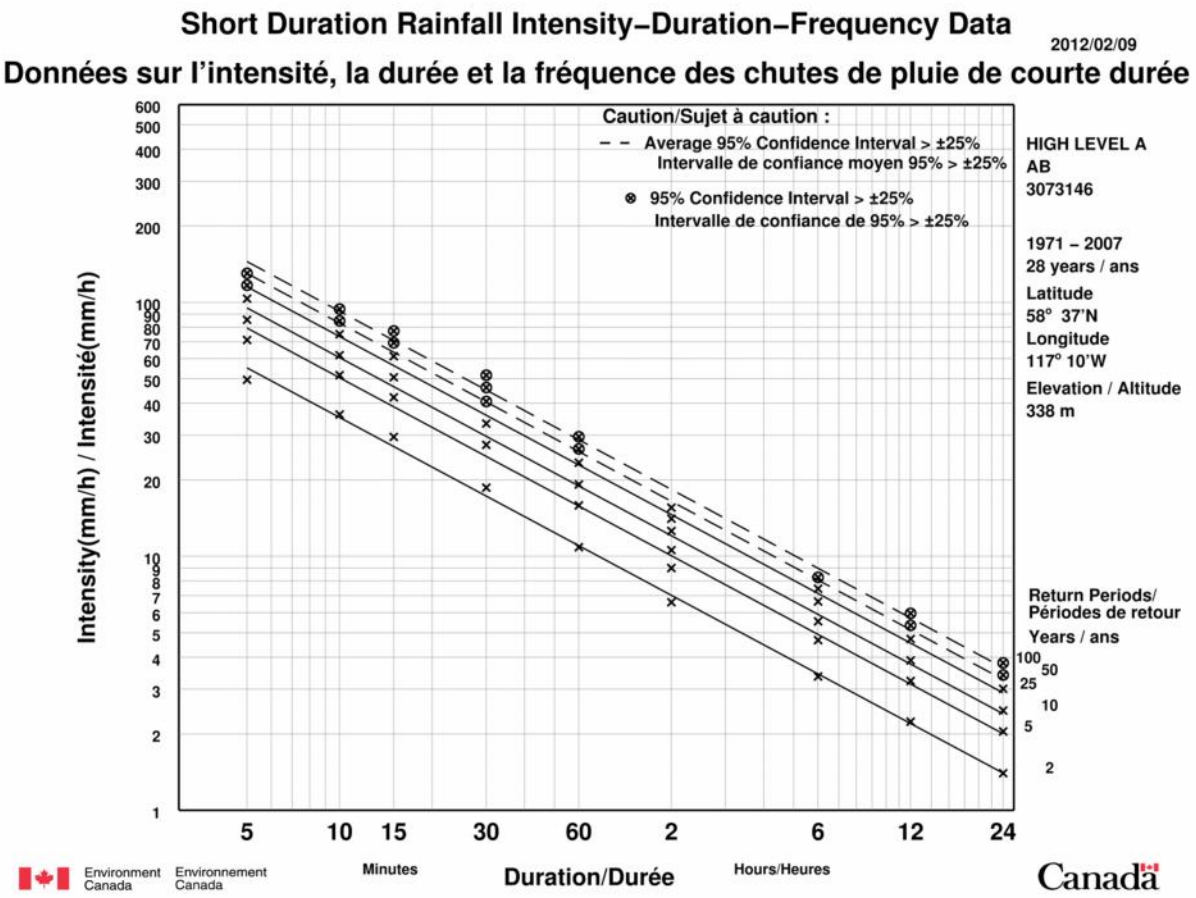
8.8.7 RIP – RAP

The ends of the culvert shall be finished with the placement of rock rip–rap or alternative material (as approved by the Municipality) as shown in the Standard Drawing Details.

8.8.8 ADJUSTMENT AND CLEANING

Inlet and outlet ends and waterway through the pipe shall be kept free from debris or foreign matter, to prevent restriction to flow of water through the culvert.

8.9 SHORT DURATION RAINFALL INTENSITY DATA



8.10 RAINFALL INTENSITY DATA

idf_v2-2_2012_02_09_307_AB_3073146_HIGH_LEVEL_A.txt
Environment Canada/Environnement Canada

Short Duration Rainfall Intensity-Duration-Frequency Data
Données sur l'intensité, la durée et la fréquence des chutes de pluie de courte durée

Gumbel - Method of moments/Méthode des moments

2012/02/09

HIGH LEVEL A AB 3073146

Latitude: 58 37'N Longitude: 117 10'W Elevation/Altitude: 338 m

Years/Années : 1971 - 2007 # Years/Années : 28

Table 1 : Annual Maximum (mm)/Maximum annuel (mm)

Year / Année	5 min	10 min	15 min	30 min	1 h	2 h	6 h	12 h	24 h
1971	4.1	5.6	6.4	10.9	13.2	16.0	24.1	45.5	55.2
1972	5.1	6.6	6.9	7.1	7.1	8.6	13.5	15.2	17.8
1973	4.8	7.9	9.9	10.7	14.2	21.8	43.9	55.6	68.3
1974	6.4	10.2	13.0	17.3	22.6	22.6	22.6	22.6	27.5
1975	6.6	7.1	8.9	11.4	14.5	14.5	-99.9	-99.9	47.0
1976	5.6	10.9	15.2	17.0	17.5	20.3	23.6	26.8	29.5
1977	3.2	5.8	7.6	11.4	18.1	18.9	19.0	24.6	31.5
1978	3.4	3.7	3.9	6.3	8.4	13.0	18.3	20.0	23.9
1982	3.0	3.3	4.2	4.8	6.1	9.6	14.9	19.2	30.5
1983	-99.9	-99.9	-99.9	-99.9	9.3	12.0	17.2	24.0	32.6
1984	5.2	7.8	9.5	15.3	16.7	16.9	25.8	44.3	63.2
1985	3.1	4.3	6.0	6.9	7.7	12.0	20.5	31.1	31.8
1986	6.9	9.2	12.3	13.4	14.3	16.2	25.0	29.9	37.4
1987	4.7	8.9	11.7	20.7	25.5	27.4	28.4	28.4	43.0
1988	2.6	4.2	6.3	10.3	14.4	18.2	36.8	38.6	47.6
1989	3.1	4.5	5.6	6.4	7.8	9.0	11.5	12.9	18.6
1990	5.7	11.3	14.2	23.7	24.8	24.8	30.2	45.0	45.0
1992	9.9	10.1	10.4	10.4	10.4	10.4	14.5	18.4	19.8
1993	3.7	5.6	6.3	7.3	8.9	10.8	23.2	43.8	64.6
1994	5.6	5.9	5.9	5.9	7.3	12.7	31.2	47.1	52.5
1995	2.1	2.3	2.7	3.5	4.3	7.0	10.2	18.6	20.2
1996	7.3	10.1	11.0	11.3	11.3	11.3	16.3	19.6	19.6
1997	3.0	6.0	7.9	9.1	11.3	17.1	41.5	61.0	81.0
2000	1.7	2.1	2.5	4.4	5.4	8.2	17.6	20.6	26.5
2002	2.9	4.5	4.7	4.7	5.3	7.3	12.8	16.8	19.5
2003	1.7	2.6	3.9	5.4	6.2	6.9	10.7	11.6	11.6
2004	2.0	2.5	3.3	6.3	8.0	10.0	13.0	13.4	20.9
2005	6.1	10.4	12.8	13.0	13.0	13.0	18.1	32.5	49.2
2006	7.3	10.4	10.8	11.2	11.2	11.9	21.6	25.2	29.6
2007	2.6	4.9	7.3	7.8	8.9	13.8	-99.9	-99.9	28.2
# Yrs. / Années	29	29	29	29	30	30	28	28	30
Mean / Moyenne	4.5	6.5	8.0	10.1	11.8	14.1	21.6	29.0	36.5

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Std. Dev. Écart-type	2.0	2.9	3.6	5.0	5.7	5.4	8.9	13.5	17.5
Skew. Dissymétrie	0.67	0.17	0.32	1.02	0.99	0.77	0.99	0.80	0.85
Kurtosis	3.32	2.00	2.35	4.02	3.66	3.19	3.81	2.97	3.24

*-99.9 Indicates Missing Data/Données manquantes

****

Table 2a : Return Period Rainfall Amounts (mm)
Quantité de pluie (mm) par période de retour

****

Duration/Durée	2 yr/ans	5 yr/ans	10 yr/ans	25 yr/ans	50 yr/ans	100 yr/ans	#Years Années
5 min	4.1	5.9	7.1	8.6	9.7	10.8	29
10 min	6.0	8.6	10.3	12.5	14.1	15.7	29
15 min	7.4	10.6	12.7	15.3	17.3	19.3	29
30 min	9.3	13.7	16.7	20.3	23.1	25.8	29
1 h	10.9	15.9	19.2	23.4	26.5	29.5	30
2 h	13.2	18.0	21.2	25.2	28.1	31.1	30
6 h	20.2	28.0	33.2	39.8	44.7	49.6	28
12 h	26.8	38.8	46.7	56.7	64.1	71.5	28
24 h	33.6	49.0	59.3	72.2	81.8	91.3	30

****

Table 2b :

Return Period Rainfall Rates (mm/h) - 95% Confidence limits
Intensité de la pluie (mm/h) par période de retour - Limites de confiance de 95%

****

Duration/Durée	2 yr/ans	5 yr/ans	10 yr/ans	25 yr/ans	50 yr/ans	100 yr/ans	#Years Années
5 min	49.5	71.1	85.3	103.4	116.7	130.0	29
	+/- 8.1	+/- 13.7	+/- 18.5	+/- 25.0	+/- 29.9	+/- 34.8	29
10 min	36.2	51.7	61.9	74.9	84.5	94.0	29
	+/- 5.9	+/- 9.9	+/- 13.3	+/- 18.0	+/- 21.5	+/- 25.0	29
15 min	29.5	42.2	50.7	61.3	69.2	77.1	29
	+/- 4.8	+/- 8.1	+/- 11.0	+/- 14.8	+/- 17.7	+/- 20.6	29
30 min	18.6	27.5	33.3	40.7	46.2	51.6	29
	+/- 3.3	+/- 5.6	+/- 7.6	+/- 10.2	+/- 12.3	+/- 14.3	29
1 h	10.9	15.9	19.2	23.4	26.5	29.5	30
	+/- 1.9	+/- 3.1	+/- 4.2	+/- 5.7	+/- 6.8	+/- 7.9	30
2 h	6.6	9.0	10.6	12.6	14.1	15.5	30
	+/- 0.9	+/- 1.5	+/- 2.0	+/- 2.7	+/- 3.3	+/- 3.8	30
6 h	3.4	4.7	5.5	6.6	7.5	8.3	28
	+/- 0.5	+/- 0.8	+/- 1.1	+/- 1.5	+/- 1.9	+/- 2.2	28
12 h	2.2	3.2	3.9	4.7	5.3	6.0	28
	+/- 0.4	+/- 0.6	+/- 0.9	+/- 1.2	+/- 1.4	+/- 1.6	28
24 h	1.4	2.0	2.5	3.0	3.4	3.8	30
	+/- 0.2	+/- 0.4	+/- 0.5	+/- 0.7	+/- 0.9	+/- 1.0	30

****

Table 3 : Interpolation Equation / Équation d'interpolation: R = A*T^B

R = Interpolated Rainfall rate (mm/h)/Intensité interpolée de la pluie (mm/h)

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RR = Rainfall rate (mm/h) / Intensité de la pluie (mm/h)
T = Rainfall duration (h) / Durée de la pluie (h)

****

Statistics/Statistiques	2 yr/ans	5 yr/ans	10 yr/ans	25 yr/ans	50 yr/ans	100 yr/ans
Mean of RR/Moyenne de RR	17.6	25.2	30.3	36.7	41.5	46.2
Std. Dev. /Écart-type (RR)	17.2	24.7	29.7	36.0	40.6	45.2
Std. Error/Erreur-type	2.4	3.5	4.3	5.2	5.9	6.6
Coefficient (A)	11.0	15.8	18.9	22.9	25.8	28.7
Exponent/Exposant (B)	-0.649	-0.649	-0.650	-0.650	-0.650	-0.650
Mean % Error/% erreur moyenne	4.6	6.1	6.7	7.4	7.7	7.9

9

SEWER AND WATER SERVICE CONNECTIONS

9.1 SERVICE CONNECTIONS – MINIMUM REQUIREMENTS

The minimum size of service connections to a single-family dwelling shall be as follows:

- Sanitary Sewer 150mm diameter
- Water Service 25mm diameter
- Storm Sewer 100mm diameter

The minimum grade on a 100mm sewer service shall be 2.0% and on a 150mm service shall be 1.0%.

Connection to a main sewer line shall be by means of a tapped service saddle (full wrap) at the top quadrant of the main on existing mains. In-line tees may be used with prior approval of the Municipality.

Where bends are utilized, the long radius type or a combination of 22½ degree bends and straight pipe shall be used.

For water services sized 50m and smaller, the tapping shall be at the 2 to 3 o'clock position on the distribution main.

- Water mains shall be tapped under full operating pressure.
- All water services to be direct tapped or utilize service clamps.
- Each residential dwelling unit must have a separate service.
- All proposed school sites shall be provided with a water service. The size, type and location will be determined by the Municipality.
- Each residential dwelling unit with garage floor drain(s) must have its own sump. Connection to sanitary sewer is NOT permitted. Please consult Building By-law No. 686-98.
- Commercial establishments may require water a water meter (flow recording). Each meter shall have an associated shut off valve(s) and be accessible by the Municipality.
- Commercial establishments such as restaurants, car washes and other businesses must design internal plumbing systems for sumps, sand pits, grease, interceptors, etc. Discharge into the Municipal sanitary system must be in total conformance with Building By-lay No. 686-98.

9.1.1 SERVICE PIPE

Sanitary Sewer Service pipe shall be PVC SDR 35 (minimum) building service pipe to CSA B182.1

Water Service Pipe shall be PVC (PEX) water service tubing or type "K' soft copper to ASTM B88M.

Service fittings shall be either in-line tees or saddle tees, complete with gasket and stainless steel straps and nuts.

9.1.2 SERVICE CONNECTIONS – INSTALLATION REQUIREMENTS

Where the water service is 50mm or smaller in size, the water and sanitary services shall be installed in a common trench to the middle of each lot.

The services shall be installed so that, when facing the lot being served, the water service is on the right of the sanitary service.

Where two services are installed in a common trench, they shall be installed per the Standard Drawing Details.

The minimum depth of cover over the water and sanitary services at the property line shall be 3.0m and the maximum shall be 3.5m, per the Standard Drawing Details.

Where the sewer services are required to connect to mains in excess of 4.50m deep, risers shall be installed to within 3.60m of finished surface.

Corporation main stops and curb stops shall be installed in accordance with the Standard Drawing Details. Material to be Meuller or approved equal.

Where a copper service is installed, there shall be a vertical loop near the corporation main stop. Water service is to be goose necked. Service shall be snaked in the trench to allow for thermal contraction.

Service box for residential service to have adjustable sliding top section, standard black iron pipe with threaded top. Top section to be 600mm in length, with a minimum ID of 35mm and a 10mm set screw. The service box shall be adjustable from 2.5m to 3.5m bury. The threaded steel cap shall have a slotted top with a 19mm pentagon brass plug.

The casing shall be standard black iron pipe with an OD of 33.5mm. The rod should be T-304 stainless steel, 12.5mm diameter by 2.2m long, complete with standard pig tail for 25mm ID pipe and welded bottom bracket with an 8mm cored hole. Rod to be complete with a 6mm diameter cotter pin of sufficient length.

Box bottom boot to be cast or ductile iron, factory coated, with a clear opening to allow curb stop access. The boot is to attach to the casing by means of a threaded joint.

Curb stops shall be installed at property or easement lines as shown on the Standard Drawing Details and shall be stop and drain unless approved otherwise based on site conditions.

Sewer services shall be installed at property or easement lines as shown on the Standard Drawing Details, and shall be properly capped or plugged to prevent the entry of earth, water or deleterious material into the pipe.

All services shall be laid on 75mm of granular bedding, and the bedding material shall be placed up to a level of 300mm above the crown of the highest service in the trench.

Painted stakes of 50mm x 100mm size shall be extended from the end of the service connections to a minimum of 0.70m above the ground level, per the Standard Drawing Details.

9.1.3 SERVICE CONNECTION REPORT

The Developer's Engineer shall provide detailed record drawings for all installed service connections, with such drawings providing information related to pipe dimensions, invert elevations, depth of service lines, location of services relative to property line(s), manholes and/or water main valves.

9.1.4 LOT SERVICE CONNECTIONS

WORK INCLUDED

1. water service piping
2. sewer service piping
3. corporation cocks, connection to main
4. curb stops, service boxes, service markers

QUALITY STANDARDS AND ASSURANCES

Products and workmanship shall conform to applicable municipal and provincial standards and to specifications.

All products and workmanship will be subject to inspection by the Municipality.

Perform all tests required by authorities having jurisdiction. Test water and disinfect services with mains.

Notify the Municipality and authorities in ample time before testing to permit inspection and to allow tests to be witnessed.

Do not cover work before inspection and testing unless authorized by the Municipality in writing.

Remove or repair defective products or work which fails to meet specified requirements as directed by the Municipality.

9.2 PRODUCTS

9.2.1 SERVICE PIPE, FITTINGS

Underground service pipe - Type K copper or approved PVC materials (IPEX Municipal Service Tubing).

Main or corporation cocks – Compression type AWWA thread.

Curb stops – Copper to copper ball valve with a drain. Curb stops 38mm or larger shall be ball bearing type.

Couplings – Standard Brass Compression type.

Service Boxes – Epoxy coated extension type for a maximum extension of 3.5m, complete with stainless steel operating rod, brass clevis and key. Service box to be supported on a cast iron piece nailed to a pressure treated preserved wood plank.

Service Clamps – Bronze double strap conforming to Smith-Blair 323 or approved stainless steel AWWA Boss.

2.3 kg Zinc Anode Protection to be installed as indicated on Standard Drawing Details.

Service boxes to be adjustable from 2.4m to 3.0m bury, unless otherwise noted on drawings.

9.2.2 SEWER SERVICE PIPE

PVC, SDR 35 minimum.

9.2.3 SEWER SADDLES

Manufactured tee saddles, gasketed joints secured with double steel clamps.

9.2.4 SAND BAGS

Bags to be new material and in a condition acceptable to the Municipality. Sand to be clean and free from debris, conforming to imported sand requirements.

9.2.5 RIGID FOAM URETHANE INSULATION

Density (ASTM D1622) not less than 28.8 kg/cubic meter. (Nominal 32.0 kg).

Closed cell content (ASTM D2856) not less than 90%.

Water absorption (ASTM D2842) not greater than 0.34 kg/square meter.

Initial thermal conductivity (ASTM D2326) (K Factor) not greater than watts/meter degree Celsius.

Dimensional stability (ASTM D2126)

Compressive strength (ASTM D1621) not less than 206.8 kPa at 10% deflection.

9.2.6 WATER SERVICES

Use tapping machine to drill, tap and thread corporation main stop into main. Use special care to prevent cuttings falling into main. Wherever possible, tap main under pressure and obtain written approval from the Municipality to do otherwise.

Lay service pipe to designated location and connect to existing service lines. Service connections shall be tapped into the upper portion of the water main at an angle of at least 45 degrees from the horizontal. Tapings shall have a minimum spacing of at least 600mm. Attach curb stop and set service box to grade where required.

Brace boxes securely to keep plumb during backfilling. Test for operation both before and after pressure test.

Where curb stop is located under sidewalk, concrete slab or other structure, set top of extension service box flush with surface and fill hole around pipe neatly with concrete.

Use service clamps on all services tapped into 150mm mains and on 25mm and larger services tapped into 200mm to 300mm lines. In all other cases, use service clamps where size of main stop is larger than recommended for size of main.

Place water service lines at least 3.0m below final finished grade elevations, unless otherwise directed.

Lay water service lines in same trench with sewer service line. Install sanitary services on left side of water service as viewed from main towards property line. Install storm sewer service on right side of water service as viewed from main towards property line. Paint last 1m of sanitary service pipe red. Paint last 1m of storm service pipe green. Make all connections to existing services using appropriate couplings.

Lot service connections to residential lots (R.1 and R.2) shall be installed inside property line to easement line for lane servicing; and to property line, or easement line if an easement exists, for street servicing. Water services connections to residential lots (R.1 and R.2) shall be 0.15m short of the easement line for lane servicing and 0.15m outside property line or easement line if an easement exists, for street servicing.

The Municipality may require the delivery of curb stop risers to the public works yard. The Contractor shall confirm this requirement with the Municipality and shall provide evidence of a receipt signed by the Public Works employee accordingly.

9.2.7 SEWER SERVICES

Connect services to mains with manufactured Tee or Wye fittings placed in mains, or by cutting into mains and installing manufactured Tee saddles or Wye saddles and 45 degree bends. A 150mm x

100mm reducer shall be installed at property line to transition from the 150mm connection at the main to the 100mm Lot Service Pipe. Take care to avoid cracking pipe and remove all cuttings from pipe. Secure joint between saddle and main with mortar or other means acceptable to the Municipality.

Do not allow spigots or other obstructions to project into main. Lay service pipe to an even gradient as directed. For discharge guidelines please consult Building By-law No. 686-98.

Install service lines as detailed, at locations and to grade designated by grade sheet provided in field. Install services at right angle to main, unless otherwise specified.

Bends permitted only at three locations – 45 degree bend with Wye or 22.5 degree bend with tee connection at main, 45 degree bend at top of riser and 22.5 degree bend maximum at property line for house service connection between these points.

Support service lines adequately to prevent dislocation, buckling or settlement. When water lines must be laid below sewer lines, ensure that backfill over water lines is adequately compacted to prevent settlement or dislocation of sewers.

When a connection cannot be made directly to a house service line, plug end of sewer service to prevent entry of water and dirt.

Install service risers only where noted on the lot grading plan. Ensure adequate support for the riser section utilizing sandbags or screened rock.

9.2.8 MARKERS

A 50mm by 100mm marker stake, from invert elevation to 600mm above ground level shall be placed at the end of each water service line, the top 600mm to be painted blue. Place a 100mm diameter white PVC pipe over the water service box from 600mm below ground to 600mm above ground.

All service line(s) shall have marker tape placed 305mm above line and all PVC lines shall have tracer wire included with installment.

10

CURB, GUTTER AND SIDEWALKS

10.1 GENERAL

Products, Concrete Materials, Execution and Methods of Concrete Construction shall be in accordance with CSA CAN3-A23.1 or as described in this section.

10.1.1 WORK INCLUDED

The work described in this section pertains to the construction of concrete curbs, gutters, sidewalks, crossings and paving stones. Refer to Standard Drawing Details.

10.2 PRODUCTS

10.2.1 PORTLAND CEMENT

Portland cement shall meet the requirements of CSA Standard Portland A5 M cement and shall be Type 10 normal, or type 50 sulphate resistant, as required by the Municipality.

10.2.2 AGGREGATES

The fine and coarse aggregate used in the concrete mix shall conform to the following specifications:

- Fine Aggregate - CSA CAN3 A23.1, Clause 5.3.
- Coarse Aggregate - CSA CAN3 A23.1, Clause 5.4. Table 2 Group 1 (28-5)

Table 6. Aggregates

SIEVE SIZE (MM)	% PASSING BY MASS
40.000	100
28.000	95 – 100
14.000	30 – 65
5.000	1 – 10
2.500	0 – 5

10.2.3 ADMIXTURES

All admixtures used to enhance the concrete shall conform to the following specifications:

- Air Entrainment: ASTM C260
- Chemical: ASTM C494

→ Calcium Chloride: ASTM C494

The use of calcium chloride shall only be used when approved by the Municipality, but in no case will the amount added be greater than 2% of the cement weight. It shall not be used when the air temperature is above 4ºC.

Fly ash shall not exceed 10% by weight of cement, and it shall conform to the requirements of CAN/CSA-A23.5. Only approved compatible super plasticizing admixtures and air entertaining agents shall be used with the fly ash. The Municipality may require characteristic data for fly ash to prove conformance to the standards. After September 1st no portion of the specified cement content may be replaced with fly ash unless approved in writing.

10.2.4 REINFORCING STEEL

Reinforcing bars shall be deformed bars in accordance with CSA Standard Specification G30.12 M1977.

Cold drawn wire or welded wire fabric for concrete reinforcement shall be 150 x 150 and conform to the requirements of CSA Standard Specification G30.3 1972.

10.2.5 EXPANSION JOINT FILLER

Joint filler shall conform to CGSB Standard Specification for polyurethane sealing compound #19 GP 15 or ASTM Standard Specification for SIKA FLEX 1A.

10.2.6 MEMBRANE CURING COMPOUND

Resin base impervious curing compound shall conform to ASTM Standard Specification C309 Type 1D Type B. The curing compound shall contain white fugitive dye.

10.2.7 PREFORMED EXPANSION JOINT FILLER

Preformed expansion joint filler shall conform to ASTM Standard Specification D 1752.

10.2.8 CONCRETE

Concrete mixes shall be designed by a qualified professional engineer engaged by the Contractor. The mix design shall be submitted to the Municipality for approval a minimum of 10 days prior to delivery of any concrete to the site. The specified compressive strength at 28 days shall be 30 MPa. The strength level of 30 MPa shall be considered to be achieved if averages of all sets of 3 consecutive strength tests equal or exceed the specified strength, and no individual strength test is less than 20 MPa.

The concrete shall contain not less than 315 kg of Portland cement per cubic metre of concrete produced.

The air content of the concrete shall be maintained between the limits of 6 8%.

The minimum slump permissible will be that which will allow the concrete to be placed efficiently and provide a homogeneous mass. The maximum allowable slump shall be 70mm +/ 10mm for all hand poured concrete and 40mm +/ 10mm for all machine extruded concrete.

10.2.9 RETEMPERING WITH AIR

If, due to a low air entrainment percentage, as specified, the Municipality feels it is necessary to add an approved air entraining agent on site, placement of concrete shall stop to allow the concrete truck's drum to turn at mixing speed for a minimum of 3 minutes. Should the air content of the concrete not conform to specifications after retempering with air, then the concrete shall be rejected.

The Municipality has the right to withdraw permission to add an air entraining agent to the mix and reject the concrete if this practice is being abused.

10.2.10 RETEMPERING WITH WATER

If, due to a low slump as specified, the Municipality feels it is necessary to add water to the mix, it shall be injected into the drum under such pressure and direction of flow that it conforms to the specifications in ASTM C 94, Appendix XI. Placement of concrete shall stop at that point to allow the concrete truck's drum to turn at mixing speed for a minimum of 3 minutes. Should the slump of the concrete not conform to specifications, after retempering with water, then the concrete shall be rejected.

The Municipality has the right to withdraw permission to add water to the mix and reject the concrete if this practice is being abused.

10.3 EXECUTION

10.3.1 PLACING CONCRETE

Concrete shall not be placed until the subgrade, sub-base and base course materials have been completed, and approved by the Municipality. The base shall be sufficiently moist to prevent absorption of water from the concrete, and free from mud or water ponding.

The concrete shall be placed within 90 minutes of initial mixing at the plant, or before the drum on the concrete truck has turned 300 revolutions. Complete discharge of concrete shall not exceed 2 hours. The concrete shall be transported by methods which will prevent segregation and deposited on the subgrade so that as little handling as possible is required.

Concrete shall be placed continuously until a complete section between expansion joints has been poured.

The concrete shall be thoroughly consolidated against and along the faces of the forms. Hand spreading shall be done with shovels, not with rakes, in order that the concrete will not be segregated. Precautions should be taken to prevent overworking of the concrete.

Concrete shall be handled from the mixer to the place of final deposit as rapidly as practicable by methods which shall prevent the separation or loss of the ingredients. It shall be deposited in the forms as near as practicable to its final position to avoid rehandling.

The sequence of concrete placement shall be arranged so that concrete which has partially hardened shall not be subjected to injurious vibration.

The vertical free fall height of concrete shall not exceed 1.0m. For falls greater than 1.0m chutes or tremies shall be used.

During placement, concrete shall be sufficiently tamped or vibrated with suitable equipment to secure a close bond with the reinforcement, eliminate entrapped air voids and ensure a homogeneous structure with adequate consolidation.

The rate of delivery of mixed concrete shall be such that the interval between the placing of successive truck loads shall not exceed 30 minutes. If the time exceeds 30 minutes, then a construction joint shall be formed.

After the initial set of the concrete, neither the forms nor the concrete structure shall be jarred and no strain shall be placed on the ends of projecting reinforcement.

Construct all pararamps and crossings monolithically to the dimensions and at locations specified.

10.3.2 JOINTS

Curb, gutter and sidewalk contraction joints shall be constructed at 3.0m intervals and as detailed on the Standard Drawing Details and shall not be less than 50mm deep. Contraction joint widths shall not be greater than 5mm.

Midway between each contraction joint on the sidewalk, a surface joint, 13mm deep, shall be constructed. These joints shall not extend into curb and gutter.

A surface joint shall be constructed longitudinally at the location shown on the Standard Drawing Details and shall continue through all driveways and lane crossings.

A construction joint shall be formed at the end of every pour. This joint shall be constructed in a “V” shape, as directed by the Municipality, and using 10 M rebar 600mm long, spaced every 500mm.

10 M bars at 500mm on centre shall be dowelled and epoxied into the back of the existing curb prior to placing concrete.

10.3.3 FINISHING

Sidewalk surfaces, either separate or monolithic with curb and gutter, shall be struck off and screeded to the slope, cross section and elevation shown on the drawings or as directed by the Municipality. The surface shall be consolidated and smoothed using a wood float. Light steel trowelling shall be used followed by a uniform brush finish. Sidewalk shall be edged at all joints to prevent chipping of the concrete.

The exposed surfaces of concrete curbs and gutters, either separate or monolithic with sidewalks, shall be finished by means of a wood float then light steel trowelling followed by uniform brushing, and all edges shall be rounded to the required radius. No patching will be allowed.

Pararamps, and crossings to lanes and private property shall be struck off and screeded to the required slope and cross section. The finished surface shall be brushed as specified above.

All edges, including contraction or surface joints, shall be tooled for a width of 50mm and rounded to a radius of mm. The brush grooves shall be transverse on the sidewalk and longitudinal on the curb and gutter. The finished surface shall have no exposed aggregate or honeycomb.

If there is evidence of excess water on the concrete surface, finishing shall be delayed until the excess water has evaporated.

Surface grooves made by the broom shall not be more than 3mm deep. Before brushing, all surplus water shall be removed from the brush.

10.3.4 CURING

Immediately after finishing, the concrete surface shall be protected by applying a membrane curing compound. After finishing and removal of forms if necessary, all exposed surfaces shall be wetted with water and then thoroughly sprayed with membrane curing compound. The membrane curing compound shall be applied in accordance with the manufacturer’s instructions with an approved pressurized spray.

The curing compound shall be applied in such a manner as to cover the entire surface thoroughly and completely with a uniform film at a rate which shall depend on the roughness of the surface of the concrete, but in no case at less than 0.25 litres per square metre of concrete surface.

10.3.5 BACKFILLING

Unless otherwise directed by the Municipality, the Contractor shall backfill along the back of the curb edges, to the top of the concrete, within 3 to 7 days of the placing of the concrete. The backfill shall be mechanically tamped in maximum lifts of 150mm, to a minimum of 95% Standard Proctor Density and to a distance of 300mm from the back of the walk or curb.

Where landscaping is to be carried out immediately after completion of the walks or curbs and gutters, the backfilling shall be left 100mm low to allow for the topsoil.

10.3.6 FORMING

Forms shall be steel or wood of sufficient strength to resist the pressure of wet concrete, and the supply shall be sufficient to permit their remaining in place until hydration has occurred, or longer if the Municipality considers it necessary. The Contractor shall remove all face forms to allow for a smooth brush finish. The use of bent, twisted, battered or worn out forms will not be permitted. Forms will be checked for alignment and elevation by the Municipality before concrete is poured, and shall be cleaned and oiled before each use.

Where required, reinforcement shall be secured in the location shown on the Standard Drawing Details and shall be free from mill scale, grease and rust prior to placing concrete. Forms shall be held securely by approved methods to prevent movement and bulging when the concrete is placed. Forms must be approved by the Municipality before concrete is poured.

Curbs having a radius of less than 40m shall be constructed with flexible forms. A sufficient length of form (not less than 50 metres) shall be placed and checked before concrete is poured to ensure true line and grade. The forms shall be well staked, braced or otherwise held rigidly true to the established line and grade. The Municipality may, at any time, reject the use of any forms considered unsatisfactory.

10.4 MECHANICAL EXTRUDING MACHINES

Slip form paving machines or concrete extruding machines may be used for placing concrete provided they have received the approval of the Municipality prior to commencement of the work and meet the following requirements:

- The vibrators on the equipment shall be capable of producing a dense mass with a smooth surface, free of honeycombing.
- The equipment shall include automatic grade and line controls which shall be used at all times.

Commence placement of concrete only after the subgrade has been prepared and approved by the Municipality.

Any special grading or preparation of the base required by the Contractor to accommodate equipment shall be the responsibility of the Contractor, and shall restore the roadway and boulevards to their original condition within 3 to 7 days of the initial disturbance.

The extruded concrete shall be checked for alignment and elevation by the Municipality while the concrete is being placed. All incorrectly placed or misaligned work shall be immediately removed while the concrete is still wet, and the work redone to the proper specifications using whatever means are required.

Whenever possible, the forming and placing of concrete by conventional hand pouring methods (as may be required at corners, crossings and catch basins) shall be carried out in conjunction with the extruding machine operation. Where this procedure is not practical, the “tie ins” shall be completed within 3 days of construction of the adjacent extruded section, using 10 M rebar at all joints. All “tie ins” shall be completed in one continuous pour.

10.4.1 CONSOLIDATION

The concrete shall be consolidated by means of an approved vibrating screed or, in the case of curb and gutter only, by means of a poker or pencil vibrator not exceeding 50mm in diameter.

Particular care shall be given to placing and tamping along the faces of the forms to ensure a dense, smooth surface.

Vibrations shall be of sufficient duration to thoroughly compact the concrete but not long enough to cause segregation. Vibrators shall not be used for moving concrete.

10.5 INSPECTION

All exposed concrete surfaces shall be checked by the Contractor with a 3m straight edge, and any water pockets or deviations in line or grade exceeding a total of 6mm shall be corrected immediately.

Differences in elevation at any given point from that given by the design shall not exceed 13mm, and the maximum variation shall not be greater than 13mm.

Deviations in horizontal alignment at any given point from that given by the design shall not exceed 25mm, and the fluctuations in the horizontal alignment shall not be greater than 25mm.

Concrete not meeting the above criteria shall be replaced.

10.6 FIELD TESTS

Testing shall be performed by a qualified CSA testing laboratory in accordance with the following:

- 1) Samples of concrete shall be obtained in accordance with CSA Test Method A23.2 1C for sampling plastic concrete.
- 2) Test cylinders shall be made and stored in accordance with CSA Test Method A23.2 3C. No less than 1 strength test shall be made from samples from each 150 cubic metres of concrete placed, and in no case shall there be less than 1 test from each day's pour. Each strength test shall consist of 3 test cylinders, 1 tested at 7 days and 2 at 28 days.
- 3) Air content determinations shall be made in accordance with CSA Test Method A23.2 7C, air content of plastic concrete by the volumetric method.

During construction start up, every load or batch of concrete shall be tested until such time as satisfactory control of the air content has been established. Air content tests taken with the test cylinders will be sufficient once satisfactory control has been established. Whenever a test falls outside the specified limits, the testing frequency shall revert to one test per load or batch until satisfactory control is re established. Any concrete that falls outside specified air control levels shall be rejected from use.

Slump tests made in accordance with CSA Test Method A23.2 5C, Slump of Concrete, shall be made in conjunction with each strength test.

10.7 CLEAN-UP

As the work progresses, the Contractor shall clean up the site and all areas in which work has been done shall be left in a neat and presentable condition. All gutters and street drainage ditches that have been blocked as a result of the Contractor's operation shall be restored or repaired.

The Contractor shall dispose of all surplus excavated material, organic soil, rock, boulders and pieces of concrete and masonry at an approved location.

10.8 PROTECTION

The Contractor shall be responsible for keeping all animals and pedestrians off the newly constructed sidewalks or curb until completely set. The Contractor shall also be responsible for keeping all vehicles off the work for a period of 3 days after the concrete has been finished.

10.9 DEFICIENCY PENALTY

Where there are variations from specified design strength, the following Deficiency penalty shall be assessed based on the 28 day, laboratory cured cylinders.

1. When the concrete strength of any set exceeds 95% of design strength, no deficiency penalty will be administered.
2. When the concrete strength of any set is greater than 80% but less than 95% of design strength, the deficiency penalty will be administered as follows:

$$\frac{Q\,[P \times 2\,(A - B)]}{A}$$

Where: P = unit price

A = specified strength

B = average 28 day cylinder strength

Q = quantity of deficient concrete

3. If the concrete strength of any set is less than 80% of design strength, the work represented by that set of cylinders will be rejected and replaced by the Contractor.

11

ROADWAYS

11.1 GEOMETRIC DESIGN STANDARDS

Street classification and designation shall be in accordance with the classification system outlined in the Transportation Association of Canada (TAC) Manual - Geometric Design Standards for Canadian Roads and Streets latest edition.

The following are general minimum requirements and shall be used in the design of streets.

Street cross-sections shall be as defined by tables and the Standard Drawing Details. Curb and gutter will be required in some areas, at the discretion of the Municipality.

Straight face curb and gutter shall be constructed on all streets, in accordance with the design Drawings. With written approval by the Municipality, rolled curb and gutter may be constructed in accordance with the drawings.

Separate Sidewalks shall be preferred, although conditions requiring monolithic sidewalks may occur. Separate sidewalks shall be 1.5m wide and shall be constructed in accordance with the Standard Drawing Details, with written approval by the Municipality. Monolithic curb, gutter and sidewalks may be constructed in accordance with the Standard Drawing Details. Sidewalks shall be clear of all obstructions including surface utilities. Sidewalk locations shall be in accordance with the Standard Roadway Drawings. Wider sidewalks may be required in areas of high pedestrian activity, as determined by the Municipality.

Rear lanes (alleys) shall have a surfaced width of 5.5m within a 6.0m right-of-way. Where rear lane traffic activity is expected to be high, such as for certain commercial developments, a wider surfaced width and right-of-way may be required.

All driveways shall be constructed to give a minimum of 1.5m clearance from any structure, (e.g. hydrants, light standards, service pedestals), and shall be constructed in accordance with the Standard Drawing Details.

Curb ramps shall be constructed in accordance with Standard Drawing Details.

11.1.1 VERTICAL ALIGNMENT

Minimum gutter grades around all curves and along all tangents shall not be less than 0.5%. Minimum gutter grades on curb returns shall be 0.7%.

Maximum gutter grades shall not exceed those defined by tables and Standard Drawing Details.

All roadways shall be crowned or shall have a cross fall as shown on the applicable Standard Drawing Details. The standard cross fall rate is 2.0%.

The grades at intersections for all roadway classifications shall not exceed 2% for a minimum distance of thirty (30) metres, measured from the shoulder edge of the receiving road.

All vertical curves shall be designed to meet or exceed the following minimum requirements:

Table 7. Vertical Curve Requirements

VERTICAL CURVE REQUIREMENTS K VALUE

DESIGN SPEED	CREST	SAG*	MINIMUM LENGTH
(km/h)			(m)
50	7	6	50
60	15	10	60
70	22	15	70

K = L/A

L = Length of vertical curve in metres

A = Algebraic difference in grades percent

* = Based on comfort control and assumes street lighting

The minimum length of a vertical curve shall be 30m.

Vertical curves are not required where the algebraic difference of the grades is less than 1.5.

The maximum super elevation is shown in Tables and Standard Drawing Details.

Rear lanes (alleys) shall have a minimum longitudinal grade of 0.6%. If gravel-surfaced, the lane shall be cross sloped to one side at 3.0%. If paved, the lane shall be cross sloped to one side at 2.0%. Paved lanes that have a centre swale must be approved in writing by the Municipality and shall have cross slopes of 2.0%.

11.1.2 HORIZONTAL ALIGNMENT

The minimum radius is relative to the Road Classification, the design speed and the maximum super elevation.

All horizontal curves shall be designed to meet the minimum design requirements shown in Table

Minimum edge of pavement radius for cul-de-sacs is fifteen meters (15m).

Maximum cul-de-sac length shall be one hundred twenty meters (120m).

Flares at intersecting roadways shall have the following minimum radius from shoulder to shoulder:

- Residential access and local 10.0 metres
- Residential collector 15.0 metres
- Industrial local and collector 15.0 metres

11.1.3 STOP SIGHT DISTANCE

The minimum Stop Sight Distance criterion is shown in the table below:

Table 8. Stop Sight Distance

STOP SIGHT DISTANCE	
Design Speed km/h	**Minimum Stopping Sight Distance Meters**
50	65
60	85
80	140

11.1.4 CURB RETURNS

Curb returns at residential local street intersections shall be constructed to a radius of 10.0m at face of curb.

Curb returns at residential collector street intersections shall be constructed to a radius of 12.5m at face of curb.

In industrial/commercial areas the face of curb radius should be 15.0m to accommodate truck turning movements.

For arterial street intersections the curb returns shall be designed in consideration of the type and volume of the turning traffic. Two and three centred curves, with or without islands, may be required.

Curb ramps are required at all intersections which have sidewalks.

11.1.5 CULVERTS AND DRAINAGE

The minimum allowable ditch grade shall be 0.5%. Ditch grades in excess of 2.0% shall be protected against erosion through rock ditch checks, silt fences, Enviroberm fences and/or erosion control blankets. Typical installation is illustrated in Standard Drawing Details.

Ditch side slopes and back slopes shall not be steeper than 3:1.

The minimum ditch bottom width shall be 3.0 metres along arterial roads and 1.0m along the collector and local roadways, sloping away from the roadway at a minimum of 5.0%.

Culvert size requirements shall be determined through the storm water drainage analysis; however, the minimum size culverts shall be as follows:

- Roadway cross culvert 600mm (24 inch)
- Residential approach culvert 400mm (16 inch)
- Industrial approach culvert 500mm (20 inch)

Culverts should be new galvanized C.S.P. with a minimum wall thickness of 1.6mm, or as required by the loading criteria. C.S.P. may be substituted with PVC Ultra-rib.

All culverts shall be installed in accordance with the manufacturer's recommendations and Section 8.

In high density residential developments, all culverts shall be installed with beveled end sections on both the inlet and outlet sides, with the invert extended to the toe of the side slope.

All culverts, except those in industrial developments, shall be installed to provide a minimum depth of cover of 300mm or one-half the culverts diameter, whichever is greater. This should be measured from the finished shoulder grade of the roadway to the top of the culvert. Culverts in industrial developments shall be installed to provide a minimum depth of cover of 500mm or one-half the culverts diameter, whichever is greater, as measured from the finished shoulder grade of the roadway to the top of the culvert.

Riprap shall be placed around the inlet and outlet of each culvert, with the riprap extending a minimum of 1.0 metre beyond the ends of the culvert. Rip-rap material shall consist of rock ranging in size from 150mm to 350mm with 50% of the rock material being larger than 200mm.

11.1.6 SURVEY CONTROL MARKERS AND LEGAL PINS

The Developer or their Consultant shall make every effort to protect existing markers.

Markers which are destroyed or disturbed shall be replaced b the Developer at his sole expense.

Additional markers, as required by Alberta Forestry, Lands and Wildlife, Alberta Bureau of Surveys and Mapping Branch, shall be added to the existing network by the Developer to maintain the necessary density for survey control.

Front lot legal posts shall be clearly marked with a flexible marker post extending a minimum of 1.0m above grade at initial posting of the subdivision.

The Developer shall instruct the legal surveying consultant to replace any missing or disturbed posts as required by the Municipality. All costs are to be borne by the Developer.

11.2 ROAD APPROACHES

This sub-section outlines the requirements respecting the design and construction of approaches within subdivision developments.

Residential approaches shall typically be located as follows:

- For low density residential, the approach shall typically be located to provide the best and most direct access to the building site on the lot.
- For internal high-density residential lots, the approach shall typically be centered on the lot frontage.

A residential approach shall not exceed eight (8.0) metres in width; and industrial lot approach shall not exceed fifteen (15.0) metres in width. Any deviation from these maximum widths requires the approval of the Municipality.

All approaches shall be constructed to the same structure as the adjoining roadways, with asphalt surfacing extending to the property line:

All residential subdivision development shall require the Developer to construct one approach to each lot, consistent with the standard outlined herein.

Approaches to industrial/commercial lots are required to be constructed by the Developer where the access locations are known. Where access locations cannot reasonably be determined, the Municipality may choose to have the Developer provide materials and/or securities to permit future construction of the approaches.

11.3 ROAD SURFACE FINISHES

The Municipality presently approves three types of roadway surface finishes:

1. Gravelled surface,
2. Asphalt stabilized base course surface (A.S.B.C.),
3. Asphaltic concrete (hot mix asphalt) pavement surface (A.C.P.)

Roadways in all subdivision developments shall be surfaced with asphaltic concrete pavement (hot mix asphalt). The exception, with the approval of the Municipality, is in low-density residential subdivisions where Asphalt Stabilized Base Course may be permitted, provided the subdivision is approved without water truck haul traffic. The Municipality will require the developer to supply a deposit to complete the A.S.B.C. surfacing as part of the development agreement. The Municipality will consider the surfacing when the subdivision is two-thirds occupied.

Irrespective of the roadway surface finish approved by the Municipality for a specific development, good roadway industry construction practices and techniques shall be employed at all times. Furthermore, roadway subgrade and base construction shall be undertaken with the view that an asphaltic concrete pavement will ultimately be placed as the surface finish for the roadway.

Should a graveled surface be approved, even for an interim period, the surface gravel shall be a minimum compacted layer of 50mm depth of 20mm crushed gravel. All approaches shall be similarly treated.

11.4 PAVEMENT STRUCTURE

All roadways other than rear lanes (alleys) shall be paved with hot mix asphalt. A geotechnical report with recommended pavement designs shall be conducted by a Professional Engineer and submitted to the Municipality for review.

Paved roadways shall be designed in accordance with the Asphalt Institute Method of pavement design, using minimum design loadings of 8,165 kg (18,000 pound) axle loads. The design parameters, such as traffic count, percentage of trucks, California Bearing Ratio (CBR), are to be utilized in the calculations. The Municipality reserves the right to request the Developer to engage an engineering firm to carry out tests, prior to paving, to confirm adequacy of design.

The following are the minimum pavement structure requirements. An independent pavement design is required for all developments. Additional pavement structure strengths and/or materials may be required in areas with poor subgrade materials, pending the results of the geotechnical investigation.

Table 9. Pavement Structure

STREET	RESIDENTIAL LAND USE	INDUSTRIAL/COMMERCIAL LAND USE
Local	▪ 150mm Subgrade Prep. to 100% SPD ▪ 250mm Pitrun Gravel ▪ 100mm 19mm Road Crush ▪ 90mm Asphaltic Concrete Surface (Light Duty) – 2 lifts 50mm/40mm final	▪ 300mm Subgrade Prep. to 100% SPD ▪ 250mm Pitrun Gravel ▪ 100mm 19mm Road Crush ▪ 90mm Asphaltic Concrete Surface (Heavy Duty)
Collector	▪ 150mm Subgrade Prep. to 100% SPD ▪ 300mm Pitrun Gravel ▪ 150mm 19mm Road Crush ▪ 100mm Asphaltic Concrete Surface (Heavy Duty)	▪ 300mm Subgrade Prep. to 100% SPD ▪ 300mm Pitrun Gravel ▪ 150mm 19mm Road Crush ▪ 100mm Asphaltic Concrete Surface (Heavy Duty)
Arterial	▪ 300mm Subgrade Prep. to 100% SPD ▪ 350mm Pitrun Gravel ▪ 200mm 19mm Road Crush ▪ 125mm Asphaltic Concrete Surface (Heavy Duty)	▪ 300mm Subgrade Prep. to 100% SPD ▪ 350mm Pitrun Gravel ▪ 200mm 19mm Road Crush ▪ 125mm Asphaltic Concrete Surface (Heavy Duty)

Note: *The final 40mm lift of asphaltic concrete shall be placed in the second year of the maintenance period, 60 days prior to Final Acceptance Certificate. Delay of paving may be subject to individual Development Agreement(s).

Alternative pavement designs, such as soil cement base, may be considered. Approval of alternate pavement designs must be obtained in writing from the Municipality prior to submission of design drawings.

Gravel surfacing is permitted on rear lanes (alleys). Aggregate base material shall be used to a minimum depth of 250mm, with 150mm placed during initial construction and 100mm placed during the final year of the maintenance period.

11.5 RIGHT-OF-WAY PREPARATORY REQUIREMENTS

The entire road right-of-way (R.O.W.) shall be cleared of all vegetation (trees, shrubs, brush, etc.) including removal of all tree roots and stumps. All such material shall be removed from the site for disposal at approved locations. No burying of this material, or any portion thereof, shall be permitted within the R.O.W.

Organic soil and material are not acceptable as subgrade materials and shall be stripped within the roadway, ditch and back slope portion of the new construction. Organic soils (horizon A) shall be stockpiled in approved locations for the re-spreading on the ditches and back slopes after completion of the roadway construction.

Table 10. Summary of Recommended Design Standards for Streets

SUMMARY OF RECOMMENDED DESIGN STANDARDS FOR STREETS (TAC 1999)

Classification	Traffic Volumes (vpd)	Design Speed[a] (km/h)	Right of Way Width (m)	Pavement Widths (m)	Travel Lanes[c]	Parking Lanes	Maximum Gradients (%)	Maximum Super Elevation (m/m)	Minimum Radius of Curvature (m)	Minimum Intersection Spacing (m)	Minimum Corner Cuts at Intersection	Sidewalks	Lighting Poles and other Obstructions	Parking	Access
Undivided Arterials	5,000 – 12,000	60 – 70	30.0	14.8	4 – 3.7m	outside lanes	5	.04 - .06	170	150	30m radius	Separate, 1 or 2 sides	2.5m min. from face of curb or behind sidewalk	Restricted	Restricted
Major Residential Collector UAU 60	2,500 – 5,000	60	24.0	14.0	2 – 3.7m	2 – 2.5m	6	.025 - .04	150	60	10m	Separate, both sides	2.0m min. from face of curb 1.5m min. from face of curb	Permitted	Permitted
Minor Residential Collector UCU 60	1,000 – 2,500	60	20	12.0	2 – 3.5m	2 – 2.5m	6	.025 - .04	90	60	6m	Both sides	1.8m min. from face of curb	Permitted	Permitted
Local Residential ULU 50	Up to 1, 000	60	18	10.0	2 – 3m	2 – 2m	6	.025	90	6	6m	Optional	1.65m min. from face of curb	Optional	Permitted
Industrial Collector	N/A	60 – 70	22.0	14.0	N/A	Optional	6	.025	150	60	10m	Optional	2.25m min. from face of curb	Optional	Some restrictions
Cul-de-Sac	Up to 1,000	60	18	10.0	N/A	N/A	6	.025	60	60	6m	Separate or mono, 2 sides	1.65m from face of curb	Permitted	Permitted

Notes:
a. Posted speed to be 10 km/h less than design speed. Rear lane (alley) access preferred.
b. Land for noise attenuation will be in addition to the road right-of-way requirement.
c. Additional travel lane width may be required to accommodate cyclists, e.g. on arterials the outside lanes are 4.2m wide.
d. Additional right-of-way required where rural roadway cross-section is used for initial stage. Prohibited for residential land uses.

Table 11. Test Frequency

TEST FREQUENCY			
SPECIFICATION	**TYPE OF TEST**	**RECOMMENDED TEST FREQUENCY**	**REMARK**
Trenching, backfillng and compaction for sewers, catch basins leads, water mains and hydrants sewer and water service connections, shallow utilities and for electrical installation	Density Test		Testing will vary with location of project and consequences of trench settlement
	Trench longer than 15m	2 tests per 600mm depth for every 100m of trench length	
	Trench shorter than 15m	3 tests per trench	
Roadway excavation, backfill and compaction	Grading/Fill Compaction	1 density test per 2,000m² of compacted lift	
	Subgrade Preparation	1 density test per 1,000m² of compacted subgrade lift	
	Proof Rolling	Entire project	
Aggregate : General Granular Subbase Granular Base	Source Sampling	1 sieve analysis per 500 tonnes of asphalt aggregate for crushing control	Required 2 weeks prior to commencing work
	Compaction	1 sieve analysis per 2,500 tonnes of base and subbase aggregate 1 density test per 1,500m² of compacted granular lift of road	
	Proof Rolling	Entire project	
Stabilization: Lime	Source Sampling	400m² to establish and demonstrate work methods and timing	Required 2 weeks prior to commencing work
	Test Area		
	Proof Rolling	At completion of curing period	

TEST FREQUENCY

SPECIFICATION	TYPE OF TEST	RECOMMENDED TEST FREQUENCY	REMARK
Soil Cement	Source Sampling (aggregate)	1 sieve analysis per 2,500 tonnes	Required 2 weeks prior to commencing work
	Mix Design		
	Thickness Test	1 core sample per 1,000m² of soil cement in place	Areas suspected to have inadequate thickness
	Compaction Test		
	Strength Test	1 seven day compressive strength test per 1,000 tonne of soil cement	
Topsoil	Topsoil Analysis		Required 4 weeks prior to commencing work
	On-site sources	1 analysis report for each topsoil source	
	Contractor supplied	Contractor to supply 1 litre sample of each topsoil type for testing	
Asphaltic Concrete Paving	Mix Design	3 cores per 300 tonnes of asphalt pavement	Required 2 weeks prior to commencing work
	Density/Thickness Test	1 Marshall per 600 tonnes of mix with a minimum of 1 test from each full day's production	
	Mix Proportions	For each project per application	
Water Main	Hydrostatic/Leakage Test*	Test section not to exceed 365m in length	Provide Municipality at least 24 hours notice
	Bacteria/Chlorine Test*		

TEST FREQUENCY

SPECIFICATION	TYPE OF TEST	RECOMMENDED TEST FREQUENCY	REMARK
Storm Water Sanitary Sewer	Television and Photographic Inspection	Upon completion of sewer installation, after backfilling	Performed by Contractor
Force Mains	Hydrostatic/Leakage Tests*	Test section not to exceed 365m in length	Provide Municipality at least 24 hours notice
Concrete Curbs and Gutters, Walks, Medians, Driveways and Swales, General Concrete, Slip Formed Concrete	Mix Design	Project basis for each compression of strength	Required 2 weeks prior to commencing work
	Slump Test	1 per 20m³ for each class of concrete poured, min. I per day	Every truck until consistency is established
	Air Content Test		
	Strength Test		

*Tests to be witnessed by Municipality

11.6 ROAD STANDARDS (RURAL)

In this section we examine the existing road standards to ensure the Municipality's needs reflect current design practices in the transportation and road building industry. Before setting road standards it is helpful to classify the roads according to the type and volume of anticipated traffic.

There are two means of classifying roads. One is by design standard, which includes a definition for road width, surface type, number of lanes, and design speed. The other is by function.

Functional classifications indicate the anticipated role that the road plays in the network and the broad set includes freeways, expressways, industrial/arterials, collectors, local roads, including roads within Hamlets, machinery and resource roads. Within the Municipality's local road network, there are no freeways or expressways.

Table 12. Design Parameters for Road Standards

DESIGN PARAMETERS FOR ROAD STANDARDS					
	Industrial Road	**Major Collector Road**	**Collector Road**	**Minor Collector Road**	**Farm Access Road**
Typical Daily Traffic Volume	<500	500	250	<100	<100
Roadway Width (meters)	9	8	8	7.6	6.5
Recommended R.O.W. (meters)	40	30	30	20	20
Desirable Side Slope	4:1	3:1	3:1	3:1	3:1
Desirable Back Slope	5:1	4:1	4:1	4:1	As required
Minimum Back Slope	2:1	2:1	2:1	2:1	
Minimum Radius (meters) (with Spirals)	600	600	600	600	300
Minimum Sight Distance (meters)	140	140	140	140	85
Maximum Gradient %	7%	7%	8%	8%	9%
Surfacing	Paved/Gravel	Paved	Paved	Paved	Paved

The standards for Key Local roads and for non-key local roads are set out in the following sections.

11.7 CLASS 1: INDUSTRIAL ROAD

11.7.1 FUNCTION

These roads serve the resource sector such as forestry or oil and gas. They usually accommodate higher than average volumes of heavy truck traffic and can link with any arterial or collector road and sometimes with provincial highways. An industrial road meets one or more of the following criteria:

1. Roads constructed to provide all weather access to heavy resource and industrial traffic.
2. Accommodates heavy resource and industrial traffic.
3. Traffic volumes in excess of 500 AADT.
4. Nine metre road top.

11.7.2 RIGHT OF WAY REQUIREMENTS

- 40-metre right of way, with backsloping easement for construction.
- Full width of right of way to be cleared.

11.7.3 CROSS-SECTION ELEMENTS

- Finished road top – 9.0 metres, 10.0 metres for roads with greater than 500 AADT.
- Side slope
  - Minimum 1.0 metre vertical @ 4:1 slope
  - 4:1 slope up to 2 metres of fill.
  - 3:1 slope in 2 – 4 metres of fill.
  - 2:1 slope over 4 metres of fill.
- Minimum 1.5 metres of fill above high water level or ground water table.
- Ditch – flat bottom @ 3.5 metres width.
- Back slope – Desirable @ 5:1 with a maximum of 2:1.
- Minimum stopping sight distance – 140 metres @ 80 km/h.
- Horizontal curve – Minimum radius 600 metres.
  - Spiral curve required for less than 600-metre radius.
  - Minimum 300-metre radius for spiral curves.
- Maximum super elevation – 6 %.
- Maximum gradient 7 % - preferred maximum gradient 6 %.
- Intersection sight distance – Minimum 85 metres from the point of intersection or as per AIT guidelines.
- Average shoulder elevation of road surface to be approximately 0.5m above adjacent ground surface except in cuts.

11.7.4 STRUCTURAL REQUIREMENTS

- Surface aggregate – Des 4 Class 20 material
  - 9.0 metre road top – 330 cubic metres / km.
  - 10.0 metre road top – 400 cubic metres / km.
- Grade - Minimum 1.0 metre non-organic material.
- Compaction - Top 0.3 metres - 100 % of standard proctor density.
  - Below 0.3 metres - 95 % of Standard Proctor Density

Moisture Content - Optimum moisture content.

Refer to Standard Drawing Details, Industrial Road Standard Cross-Section.

11.8 CLASS 2: MAJOR COLLECTOR ROAD

11.8.1 FUNCTION

Major collector roads are the main thoroughfares and generally have the highest traffic volumes within the Municipality's subsystem of roads (excluding industrial roads). They are designed to handle traffic that is going from a provincial highway to another provincial highway or going from a community, through other communities on the way to a provincial highway. They also handle traffic heading to and from numerous resources in the area. The major collector roads provide an integrated network of connections to the provincial highway system. They serve both local and through traffic. The major collector road meets one or more of the following criteria:

1. Major collector roads constructed to provide market access for agriculture, industry as well as access to recreational facilities and country residential subdivisions.
2. Market access for agriculture and industry.
3. Grid road collector.
4. Provides access to recreational facilities.
5. Traffic volumes of 250 – 500 AADT.
6. Eight metre road top.

11.8.2 RIGHT OF WAY REQUIREMENTS

- 30-metre right of way with backsloping easement for construction.
- Full width of right of way to be cleared.

11.8.3 CROSS-SECTION ELEMENTS

1. Finished road top width – 8.0 metres for gravel surface roads, 8.6 metres for oil surface roads or asphalt concrete paved roads and 10 metres for roads with greater than 250 AADT.
2. Road top widened an additional 0.6 metres in embankment areas over 3.0 metres and all curves.
3. Side slope – minimum 1.0 metre vertical @ 3:1 slope.

- 3:1 slope up to 3 metres of fill.
- 2:1 slope over 3 metres of fill.

4. Minimum 1.5 metres of fill above high water level or ground water table.
5. Ditch – flat bottom @ 3.5 metres width.
6. Back slope – Desirable @ 4:1 with a maximum of 2:1.
7. Minimum stopping sight distance – 140 metres @ 80 km/h.
8. Horizontal curve – Minimum radius 600 metres.

- Spiral curve required for less than 600 metre radius.
- Minimum 300-metre radius for spiral curves.

9. Maximum super elevation – 6 %.
10. Maximum gradient 7 % - preferred maximum gradient 6 %.
11. Intersection sight distance – Minimum 85 metres from the point of intersection or as per AIT guidelines.
12. Average shoulder elevation of road surface to be approximately 0.5m above adjacent ground surface except in cut areas.

11.8.4 STRUCTURAL REQUIREMENTS

- **Surface aggregate** – Des 4 Class 20 material @ 280 cubic metres / km.
- **Grade** – Minimum 1.0 metres of non-organic material.

- **Compaction** – Top 0.3 metres – 100 % of standard proctor density.
- **Below 0.3 metres** – 95 % of Standard Proctor Density
- **Moisture Content** – Optimum moisture content.

11.9 CLASS 3: COLLECTOR ROAD

11.9.1 FUNCTION

A collector road serves the purpose of linking Minor Collector roads to Major Collector roads. They also serve the purpose of gathering traffic from internal country residential roads or multi parcel subdivisions to the Major Collector roads.

- Provide access from minor collector roads and internal country residential subdivision roads to the major collector system.
- Access to country residential subdivisions.
- Access to recreational facilities.
- Accommodate traffic volumes of 100 – 250 AADT.
- Eight metre road top.

11.9.2 RIGHT OF WAY REQUIREMENTS

- 30-metre right of way.
- Full width of right of way to be cleared.

11.9.3 CROSS-SECTION ELEMENTS

1. **Finished road top width** – 8.0 metres.
2. Road top widened to 8.6 metres in embankment areas over 2.0 metres and all curves.
3. **Side slope** – minimum 0.6 metres vertical @ 3:1 slope.
   - 3:1 slope up to 3 metres of fill.
   - 2:1 slope over 3 metres of fill.
4. Minimum 1.5 metres of fill above high water level or ground water table.
5. **Ditch** – flat bottom @ 3.5 metres width.
6. **Back slope** – Desirable @ 4:1 with a maximum of 2:1.
7. **Minimum stopping sight distance** – 110 metres @ 70 km/h.
8. **Horizontal curve** – Minimum radius 600 metres.
   - Spiral curve required for less than 600 metre radius.
   - Minimum 300-metre radius for spiral curves.
9. **Maximum super elevation** – 6 %.
10. **Maximum gradient 8 %** - preferred maximum gradient 7 %.
11. **Intersection sight distance** – Minimum 85 metres from the point of intersection or as per AIT guidelines.

11.9.4 STRUCTURAL REQUIREMENTS

- Surface aggregate – Des 4 Class 20 material @ 230 cubic metres / km.
- Grade – Minimum 0.6 metres of non-organic material.
- Compaction – Top 0.3 metres – 100 % of standard proctor density.
  - Below 0.3 metres – 95 % of Standard Proctor Density
- Moisture Content – Optimum moisture content.

11.10 CLASS 4: MINOR COLLECTOR ROAD (NON KEY LOCAL ROAD)

11.10.1 FUNCTION

Minor collector roads are the first level of roads within the network, which provide a means to funnel traffic to a higher classification of road. These roads would serve as collector roads where a minimal number of residences are involved in a rural setting or to gather traffic onto the internal road of a rural residential area.

- Roads constructed to provide access to Collector roads.
- Provides access to Collector roads.
- Accommodate traffic volumes of less than 100 AADT.
- 7.6 metre road top.

11.10.2 RIGHT OF WAY REQUIREMENTS

- 20.12 metre right of way with backsloping easement for construction.
- Full width of right of way to be cleared.

11.10.3 CROSS-SECTION ELEMENTS

1. **Finished road top width** – 7.6 metres.
2. Road top widened to 8.1 metres in embankment areas of 2 -3 metres and all curves.
3. Road top widened to 8.6 metres in embankments over 3 metres.
4. **Side slope** – minimum 1.0 metres vertical @ 3:1 slope.

- 3:1 slope up to 3 metres of fill.
- 2:1 slope over 3 metres of fill.

5. Minimum 1.5 metres of fill above high water level or ground water table.
6. **Ditch** – flat bottom @ 3.5 metres width.
7. **Back slope** – Desirable @ 4:1 with a maximum of 2:1.
8. **Minimum stopping sight distance** – 140 metres @ 80 km/h.
9. **Horizontal curve** – Minimum radius 600 metres.

- Spiral curve required for less than 600 metre radius.
- Minimum 300-metre radius for spiral curves.

10. **Maximum super elevation** – 6 %.
11. **Maximum gradient 8 %** - preferred maximum gradient 7 %.
12. **Intersection sight distance** – Minimum 85 metres from the point of intersection or as per AIT guidelines.

11.10.4 STRUCTURAL REQUIREMENTS

- Surface aggregate – Des 4 Class 20 material @ 230 cubic metres / km.
- Grade – Minimum 1.0 metres of non-organic material.
- Compaction – Top 0.3 metres – 100 % of standard proctor density.
  - Below 0.3 metres – 95 % of Standard Proctor Density
- Moisture Content – Optimum moisture content.

11.11 CLASS 5: MINOR ACCESS ROAD (NON KEY LOCAL ROAD)

11.11.1 FUNCTION

Rural roads that are not included in the above classification system or the provincial highway system are considered to be non-key local roads. Non-Key Local roads meet one or both of the following criteria:

- → Roads constructed to minimal standards to provide farm machinery access to agricultural land.
- → Generally 0.8 – 3.2 km long.
- → 6.5 metre road top.

11.11.2 RIGHT OF WAY REQUIREMENTS

- 20.12 metre right of way with back sloping easement for construction.
- Full width of right of way to be cleared.

11.11.3 CROSS-SECTION ELEMENTS

1. Finished road top width – 6.5 metres.
2. Road top widened to 7.1 metres in embankment areas over 2 metres, and all curves.
3. Side slope – minimum 0.6 metres vertical @ 3:1 slope.

- → 3:1 slope up to 2 metres of fill.
- → 2:1 slope over 2 metres of fill.

4. Ditch – V-ditch.
5. Back slope – as required.
6. Minimum stopping sight distance – 85 metres @ 60 km/h.
7. Horizontal curve – Minimum radius 300 metres.
8. Maximum super elevation – 6 %.
9. Maximum gradient 9 % - preferred maximum gradient 7 %.
10. Intersection sight distance – Minimum 85 metres from the point of intersection.

11.11.4 STRUCTURAL REQUIREMENTS

Surface Aggregate – Des 4 Class 20 material as required.

Grade – Minimum 0.6 metres of non-organic material.

Compaction – 95 % of Standard Proctor Density

Moisture Content – Optimum moisture content.

11.12 AGGREGATES

11.12.1 GENERAL

This section specifies general requirements for supplying and processing of aggregates to be stockpiled or incorporated into work. Specific requirements for physical properties of aggregates not provided in this section are given in related work section.

11.12.2 SOURCE APPROVAL

Source of materials to be incorporated into work or stockpiled requires approval.

Inform the Municipality of proposed source of aggregates and provide access for sampling at least two weeks prior to commencing production.

If, in the opinion of the Municipality, materials from proposed source do not meet, or cannot reasonably be processed to meet specified requirements, produce an alternative source or demonstrate that material from source in question can be processed to meet specified requirements.

Should a change of material source be proposed during work, advise the Municipality two weeks in advance of proposed change to allow sampling and testing.

Acceptance of a material at source does not preclude future rejection if it is subsequently found to lack uniformity, or if it fails to conform to requirements specified, or if its field performance is found to be unsatisfactory.

11.12.3 PRODUCTION SAMPLING

Aggregate will be subject to continual sampling during production.

Provide the Municipality with ready access to source and processed material for purpose of sampling and testing.

The developer will bear the cost of sampling and testing of aggregates in order to meet design gradations and specifications.

11.13 PRODUCTS

11.13.1 GENERAL

All imported backfill, granular material, gravel and screened rock shall be suitable for the uses intended.

Aggregate shall be sound, hard, durable material free from soft, thin, elongated, or laminated particles, organic material, or other deleterious substances.

Flat elongated particles are those whose greatest dimension exceeds five times their least dimension.

Fine aggregates satisfying requirements of applicable section shall be one, or a blend of following:

- Natural sand
- Manufactured sand and/or fines
- Screenings produced in crushing of quarried rock, boulders, gravel or slag.

Course aggregates satisfying requirements of applicable section shall be one of following:

- Crushed rock or slag.
- Gravel composed of naturally formed particles of stone.

11.13.2 MATERIALS

GRADATION To be within the limit and for the types of materials specified below, when tested to ASTM C117 and ASTM C136, and having a smooth curve without sharp breaks when plotted on a semi-log grading chart to ASTM E11.

PRODUCTION OF MANUFACTURED FINES Manufactured fines are defined as that portion of the material passing the 5.0 sieve size which is produced by the crushing process.

In the event the manufactured fines in the total combined aggregate do not meet the requirement for the specified Asphaltic Concrete Mix, extra manufactured fines shall be produced by screening the Pitrun material so that the screened material contains no more than 5% material passing a 5.0 sieve. This screened material shall then be crushed so that 100% passes the 10.0 sieve and a minimum of 95% passes the 5.0 sieve. All material produced by this crushing process shall be placed in a separate stockpile and designated as manufactured fines.

MOISTURE CONTENT As specified in specific sections.

BEDDING SAND Bedding sand shall be free from organic material and meet the following gradation:

Table 13. Bedding and Imported Sand

BEDDING AND IMPORTED SAND	
Sieve Size (mm)	**% Passing by Mass**
12.500	100
5.000	90 – 100
1.250	55 - 85
0.315	10 – 35
0.080	0 – 5

The liquid limit shall not exceed 25 and the Plasticity Index shall not exceed 6.

GRANULAR MATERIAL (IMPORTED SAND) Imported sand shall be free from rubbish, rubble, organic material, vegetation, clay lumps and meet the gradation of bedding sand.

GRANULAR MATERIAL (IMPORTED GRAVEL) Imported gravel shall be a well graded mixture of sand and gravel meeting the following gradation:

Table 14. Imported Gravel

IMPORTED GRAVEL	
Sieve Size (mm)	**% Passing by Mass**
80.0	100
50.0	90 – 100
25.0	55 - 75
5.0	20 – 55
0.080	2 – 10

SCREENED ROCK Screened rock shall be composed of sound, hard uncoated particles free from clay lumps, flaky particles, soft shale, friable materials, roots, vegetable matter and frozen lumps meeting the following gradation:

Table 15. Screened Rock

SCREENED ROCK	
Sieve Size (mm)	**% Passing by Mass**
50.0	100
40.0	95 – 100
20.0	5 – 10
10.0	0 – 5
5.0	0 – 5

GRANULAR ADMIXTURES (CEMENT) Sub bases may be strengthened, reinforced and/or stabilized by adding cement to the granular material(s). Design and construction must be approved by the Municipality and certified by a qualified Geotechnical Engineer.

11.14 EXECUTION

11.14.1 PROCESSING

Process aggregate uniformly using methods that prevent contamination, segregation, and degradation.

Split and combine aggregates if required to obtain gradation requirements specified. Use approved methods and equipment. Do not blend in stockpiles.

Blending to increase percentage of crushed particles or decrease percentage of flat and elongated particles is permitted.

Wash aggregates, if required to meet specifications. Use only equipment approved by the Municipality.

11.14.2 HANDLING

Handle and transport aggregates to avoid segregation, contamination and degradation.

11.14.3 STOCKPILING

Stockpile aggregates on site in location indicated or designated. Do not stockpile on completed pavement surfaces where damage to pavement may result.

Stockpile aggregates in sufficient quantities to meet project quantities schedules.

Stockpiling sites shall be level, well drained, and of adequate bearing capacity and stability to support stockpiled materials.

Except where stockpiled on acceptably stabilized areas, provide a compacted sand base not less than 300mm in depth to prevent contamination of the aggregate or, if permitted, stockpile aggregates on ground but do not incorporate bottom 300mm of pile into work.

Separate aggregates by substantial dividers or stockpile far enough apart to prevent intermixing.

Reject intermixed or contaminated materials. Remove and dispose of rejected materials as directed within 48 hours of rejection.

Stockpile materials in uniform layers of thickness as follows:

- Max 1m for course aggregate and base course materials
- Max 2m for fine aggregate and sub base materials.
- Max 1.5m for other materials

Complete each layer over entire stockpile area before beginning next layer.

Uniformly spot-dump aggregates delivered to stockpile in trucks and build up stockpile as specified.

Coning of piles or spilling of material over edges of pile will not be permitted. Stacking conveyors will not be permitted for stockpiling road base and graded seal coat aggregates.

During winter operations, prevent ice and snow from becoming mixed into stockpile or in material being removed from stockpile.

11.14.4 STOCKPILE CLEANUP

Leave stockpile site in a tidy, well drained condition, free of standing surface water.

Remove any unused aggregates as directed.

11.15 SUBGRADE PREPARATION

11.15.1 WORK INCLUDED

The work described in this section pertains to the preparation and construction of the subgrade.

11.15.2 SUBGRADE

Subgrade is that material immediately beneath the compacted granular course as detailed on the drawings.

11.15.3 COMMON EXCAVATION

Common excavation shall consist of all materials such as earth, topsoil, organic material, muskeg, clay, hardpan, shale, silt, sand, gravel, fractured bedrock, cobbles and frozen material, removed from the roadway and placed in fill or embankment areas, or otherwise disposed as approved by the Municipality. Excavation shall be to the lines and grades indicated on the plans, or as directed by the Municipality. Schedule work to utilize all excavation materials completely. Borrow material will be authorized only after excavated materials have been utilized.

11.15.4 SCARIFY AND COMPACT

In excavation areas, the top 150mm of the subgrade shall be scarified and compacted to 100% Standard Proctor Density at optimum moisture content. In lieu of sub-grade preparation a geotextile filter fabric will be accepted.

No stones or boulders larger than 100mm in diameter shall be left within the top 200mm of the subgrade unless otherwise directed by the Municipality.

11.15.5 OVER EXCAVATION

Notify the Municipality whenever unsuitable materials are encountered.

Materials which cannot be compacted to the specified density due to high or low moisture content shall be dried or watered by the Contractor to their optimum moisture content in order to achieve the specified compaction.

All common excavation materials below subgrade elevation which, in the opinion of the Municipality, are considered unsuitable shall be removed and disposed in a site located by the Contractor, and approved by the Municipality.

11.15.6 STOCKPILING OF MATERIAL

To facilitate the Work, the Contractor may stockpile embankment material. Such material shall be piled at a location determined by the Contractor, approved by the Municipality, and in such a manner that it will not endanger persons, the Work, or adjacent properties, and ensure proper drainage is maintained. If the construction site does not facilitate stockpiling, the Contractor shall haul material to an approved location.

11.15.7 EXCAVATION WASTE

All common and rock excavation deemed unsuitable for use in embankments, or in excess of that required for embankment, shall be disposed of at locations determined by the Contractor and approved by the Municipality.

All disposal areas shall be left in a neat and tidy condition satisfactory to the Municipality. Excavation materials shall be graded smooth to promote surface drainage and not to impede existing surface drainage by the Contractor to the approval of the Municipality.

11.15.8 COMMON EMBANKMENT (FOR SITE GRADING)

Embankment placed on lots and within the road right of way, but not under the road structure, shall be uniformly constructed to the typical cross-section and grades shown on the plans or as set out by the Municipality, and shall include the formation, compaction and shaping of the embankment.

The full depth of fills shall be constructed of suitable material in layers not exceeding 200mm compactive depth. Each layer shall be compacted to 95% Standard Proctor Density (SPD) at optimum moisture content. All fills greater than 1.0m are to be compacted to 95% SPD.

Do not place material in free standing water. Drain all areas before placing materials.

Materials which cannot be compacted to the specified density due to high or low moisture content shall be dried or watered by the Contractor to their optimum moisture content as necessary to achieve the specified compaction.

11.15.9 SHAPING AND FINISHING

The finished compacted subgrade shall be constructed to within 30mm of the design section. Localized soft spots that develop in the finished subgrade due to poor work shall be corrected by excavating the material to a depth approved by the Municipality, and replacing it with suitable subgrade material compacted in place.

Subgrade shall be true to the design cross-section.

Maintain and keep ditches open and free from debris to permit ready flow of surface water, and until final acceptance of the Work.

11.15.10 TESTS

Field density and moisture content tests shall be carried out by a representative approved by the Municipality in accordance with the following ASTM standards:

- Standard Proctor Compaction Test - ASTM D698, Methods (A) and (B)
- ASTM D1556 or In-Place Density Test - ASTM D2167 or ASTM D2922 and D3017.

The frequency of field density and moisture content tests shall be at minimum 1 test per 100 metres of constructed roadway and at various locations left and right of centre line, or as directed by the Municipality.

Before approval by the Municipality, the subgrade shall conform to the compaction requirements specified and shall show no visible subsidence or deflection under the wheels of a loaded gravel

truck. Such trucks shall be provided by the Contractor, as the Municipality requires, for proof rolling of the subgrade.

11.16 GRANULAR SUB-BASE

11.16.1 WORK INCLUDED

The work described in this section pertains to granular sub-base material as detailed on the drawings.

11.17 PRODUCTS

11.17.1 GRANULAR SUB-BASE

Granular sub-base is the material lying above the subgrade and below the base course. The gradation to be utilized shall be as designated by the Municipality.

11.17.2 GRADATION

The granular sub-base material shall consist of rock, gravel, and sand consisting of hard, clean, durable material, free from coatings of silt, clay or other deleterious materials and contain no organic matter.

The following gradation shall apply to pit run granular sub-base courses:

Table 16. Pit Run and Granular Subbase Course

PIT RUN AND GRANULAR SUBBASE COURSE	
Sieve Size (mm)	**% Passing by Mass**
150.0	100
80.0	80 – 100
25.0	50 – 80
5.0	25 –
0.080	2 – 10

11.17.3 APPROVAL

Preliminary approval of the material as represented in the test results shall not constitute general acceptance of all material in the deposit or source of supply, and acceptance shall be subject to confirming field tests taken at the discretion of the Municipality. Materials may be considered unsuitable, even though particle sizes are within the limits of the gradation sizes required, if any characteristic precludes satisfactory compaction or if the material fails to provide a roadway suitable for traffic. The acceptability of the final material shall be determined by the Municipality.

11.17.4 QUALITY

The material shall consist of durable rock or gravel. The granular subbase shall not contain any organic or other deleterious materials. The material shall have a minimum California Bearing Ratio of 55% at the specified compaction as determined by the current issue of ASTM D1883.

11.18 EXECUTION

11.18.1 PLACEMENT

The granular subbase material shall not be placed until the underlying subgrade has been inspected and approved by the Municipality.

Unless otherwise specified, the granular material shall be placed in uniform layers not exceeding 200mm in thickness before compaction. The material shall be placed by mechanical spreaders or deposited in windrows and levelled with a suitable motor grader.

11.18.2 COMPACTION

The material shall be compacted by rolling with a pneumatic-tired or vibrating roller of a type approved by the Municipality. The material shall be compacted at or near optimum moisture content to 100% Standard Proctor Density.

If the moisture content exceeds the optimum during compaction, the material shall be aerated by mechanical means until the material has been dried sufficiently to obtain the specified density.

If the moisture content is below optimum, water shall be added by an acceptable applicator and in such quantities to achieve specified compaction.

11.18.3 SHAPING AND FINISHING

A motor grader shall be used in conjunction with the compaction equipment to keep the finished surface of each layer even and uniform. The finished surface of the granular subbase shall conform to the required cross-section and grades as shown on the drawings or as directed by the Municipality, within a tolerance of 30mm. The subbase material shall be uniform and show no signs of segregation.

11.18.4 TESTS

Field density, moisture content and sieve analysis tests will be carried out by the representative of the Municipality to ensure that the material is satisfactory.

The frequency of field density and moisture content tests shall be 1 test per approximately 100 metres of constructed roadway and at various locations offset left and right of centre line, or as directed by the Municipality.

All sieve tests should comply with the gradation limits as stated in above.

The Contractor will, as the Municipality requires, provide a loaded gravel truck with operator for visual checks of soft spots.

11.19 GRANULAR BASE COURSE

11.19.1 WORK INCLUDED

The work described in this section pertains to base course gravel as detailed in the Drawings.

11.20 PRODUCTS

11.20.1 GRADATION

Granular base course material shall consist of crushed rock and/or crushed gravel and sand consisting of hard, clean, durable material, free from coatings of silt, clay or other deleterious materials, and containing no organic matter. The base course aggregate shall meet the following gradation requirements when tested to ASTM C136 and C117, (AASHTO T11 and T27):

Table 17. Granular Base Course Gradation Requirements

GRADATION REQUIREMENTS	
Sieve Size (mm)	**% Passing by Mass**
20.000	100
16.000	84 – 94
10.000	63 – 86
5.000	40 – 67
1.250	20 – 43
0.630	14 – 34
0.315	9 – 26
0.160	5 – 18
0.080	2 – 10

A minimum of 60% by weight of the material retained on the 5.0 sieve shall have at least 2 fractured faces. Other properties shall be as follows:

LIQUID LIMIT maximum 25, ASTM D423-66

PLASTICITY INDEX maximum 6, ASTM D424-59

LOS ANGELES ABRASION Gradation "B":35% maximum loss by mass, ASTM C131-76

SAND EQUIVALENT minimum of 35%, ASTM D2419-74

11.20.2 APPROVAL

Preliminary approval of the material as represented in the test results shall not constitute general acceptance of all material in the deposit or source of supply, and acceptance shall be subject to confirming field tests taken at the discretion of the Municipality.

Materials may be considered unsuitable even though particle sizes are within the limits of the gradation sizes required, if particle shapes are thin or elongated, if any other characteristic precludes satisfactory compaction or if the material fails to provide a roadway suitable for traffic.

The acceptability of the final material will be determined by the Municipality.

11.20.3 QUALITY

The material shall consist of durable rock or gravel. The base course shall not contain any organic or other deleterious materials. The material shall have a minimum California Bearing Ratio of 55%, as determined by the current issue of ASTM D1883 at the specified compaction.

11.21 EXECUTION

11.21.1 PLACEMENT

The granular base course material shall not be placed until the underlying subgrade or granular sub-base course has been inspected and approved by the Municipality. The subgrade or sub-base shall be shaped to cross section shown on the drawings, or as directed by the Municipality, and shall be maintained free of ruts, waves, and undulations by whatever means are necessary.

Unless otherwise specified, the granular material shall be placed in uniform layers not exceeding a 200mm compactive depth. The material shall be placed by mechanical spreaders or deposited in windrows and levelled with a suitable motor grader.

When called for in the contract, temporary material shall be placed from the granular base course level to the lip of gutter, with a 1% crown. The following year this material shall be excavated, reshaped and recompacted prior to paving. Any additional material shall be used as sub-base material in lanes or as directed by the Municipality.

11.21.2 COMPACTION

The material shall be compacted by rolling with a pneumatic-tired or vibrating roller of a type approved by the Municipality. The material shall be compacted at or near the optimum moisture content to 100% Standard Proctor Density.

For temporary material, compaction shall be 95% Standard Proctor Density.

If the moisture content exceeds the optimum during compaction, the material shall be aerated by mechanical means until it has dried sufficiently to obtain the specified compaction.

If the moisture content is below the optimum, water shall be added by an acceptable applicator and in such quantities to achieve the specified moisture content.

11.21.3 SHAPING AND FINISHING

A motor grader shall be used in conjunction with compaction equipment to keep the finished surface of each layer even and uniform.

The finished surface of the granular base course shall conform to the required cross-section and grade as shown on the drawings or as directed by the Municipality, within a tolerance of plus or minus 20mm.

The granular base course shall be uniform and show no signs of segregation of the material placed.

11.21.4 TESTS

Field density, moisture content and sieve analysis tests will be carried out by the representative of the Municipality to ensure that the material is satisfactory.

The frequency of field density and moisture content tests shall be 1 test per approximately 100 metres of constructed roadway and at various locations offset left and right of centre line, or as directed by the Municipality.

The Contractor will, as the Municipality requires, provide a loaded gravel truck with operator for visual proof rolling of soft spots. The granular surface course shall show no visible subsidence of deflection under the wheels of the truck.

11.22 PRIME, TACK AND FOG COATS

11.22.1 PRIME COAT

Prime coat shall be the application of bituminous material to previously prepared granular base course, prior to placing bituminous surfacing materials.

11.22.2 TACK COAT

Tack coat shall be the application of bituminous material to a previously constructed paving surface of any type in preparation of placing bituminous surfacing materials, and against curb and gutter faces, manholes, valves and other appurtenances in the street to be paved.

11.22.3 FOG COAT

Fog coat shall be the application of bituminous material to seal small cracks and surface voids on surface materials.

Fog coat shall only be required if, in the opinion of the Municipality, the asphalt is open in texture.

11.23 PRODUCTS

11.23.1 PRIME COAT

The bituminous material for priming the base course shall be liquid asphalt. The asphalt types may vary from medium curing (MC) type MC-30 to MC-250; from slow setting (SS) type SS-1 to SS-1H or a special emulsified asphalt primer S.E.P. to suit the condition of the base.

11.23.2 TACK COAT

The bituminous material for tacking the existing asphalt surface shall be liquid asphalt. The asphalt types may vary from rapid curing (RC) type RC-30 to RC-250; from slow setting (SS) type SS-1 to SS-1H depending on conditions to suit the base. The SS emulsion shall be diluted by adding an equal amount of water prior to application.

11.23.3 FOG COAT

The bituminous material for sealing the surface course if specified shall be liquid asphalt. The asphalt types may be slow setting (SS) type SS-1 or medium curing (MC) type MC-30 depending on the surface material to be sealed.

11.23.4 SAND BLOTTER

The materials for sand cover shall consist of clean granular mineral material approved by the Municipality, all of which shall pass a 5,000 sieve.

11.24 EXECUTION

11.24.1 EQUIPMENT

Cleaning equipment shall consist of power brooms, flushers, and whatever hand scrapers may be necessary to remove all foreign material.

The pressure distributor used for applying asphaltic material shall distribute the asphaltic material at an even temperature, uniformly on variable widths of surface up to 5 metres. Uniform spray without atomization shall be determined and controlled from 0.2 to 5.4 litres per minute (L/m) with uniform pressure, and with an allowable variation from any specified rate not exceeding 0.1 L/m.

Suitable means for accurately indicating the temperature of the asphaltic material shall be provided at all times. The thermometer well shall be so placed as not to be in contact with a heating tube.

If provided with heating attachments the distributor shall be so equipped and operated that the asphaltic material shall be circulated or agitated throughout the entire heating process.

11.24.2 PREPARATION

Immediately prior to applying the asphalt primer, tack or fog coat, the surface shall be brought to uniform cross-section by patching all depressions and defective areas using an approved patching material and by removing all bumps and irregularities.

All loose and foreign material shall be removed by light sweeping.

11.24.3 APPLICATION

Obtain Municipality's approval of existing surface before applying asphalt prime, tack or fog coats. Clean surface as required.

Upon the prepared surface the asphalt shall be applied uniformly at a rate of from 0.50 to 1.50 litres/square metre (L/m^2) for asphalt primer, and at a rate of from 0.25 to 0.90 L/m^2 for tack coat. The asphalt primer, tack or fog coat shall be applied only when the surface is dry or slightly damp, unless otherwise allowed by the Municipality in writing, or only when the air temperature in the shade is above 10°C.

The application temperature of the asphalt primer, tack or fog coat shall be as follows:

Table 18. Application Temperature

Rapid Curing Asphalt		Medium Curing Asphalt		Emulsified Asphalt		Special Emulsified Primer Asphalt	
RC-30	50 - 68ºC	MC-30	51 - 68ºC	SS-1	20 - 50ºC	S.E.P.	50ºC
RC-70	70 - 88ºC	MC-70	74 - 88ºC	SS-1H	20 - 50ºC		
RC-250	100 - 110ºC	MC-250	100 - 110ºC				

Coat contact surfaces of curbs, gutters, headers, manholes and like structures with a thin uniform coat of asphalt material. Do not prime or tack surfaces that will be visible when paving is complete. Work adjacent to the roadway shall be completely protected from the application operation by a suitable covering. Any unnecessary splashing of the concrete shall be cleaned.

Do not apply asphalt coat when air temperature is less than 5°C or when rain is forecast within 2 hours.

The Contractor shall maintain the primed surface until the surface course has been placed. Maintenance shall include spreading any additional sand and patching any breaks in the primed surface with additional asphaltic material.

The asphalt primer should preferably be entirely absorbed by the base course and therefore require no sand cover. If, however, the asphalt has not been completely absorbed 24 hours after application, just sufficient sand shall be spread over the surface to blot up excess asphalt and prevent it from being picked up by any traffic.

Traffic shall not be permitted to travel on tack or fog coat until cured. The Contractor shall use flagmen, if required, and signage to control traffic until the tack or fog coat has cured.

Traffic shall not be permitted to travel on prime coat until 6 hours after application or until it has cured. After this period of time, excess asphalt material remaining on the surface shall be blotted by sand before traffic is permitted to travel on the surface.

11.25 HOT MIX ASPHALTIC CONCRETE

11.25.1 GENERAL

The work of this section pertains to urban roadways. The Municipality, in their sole discretion, may apply Alberta Infrastructure and Transportation guidelines for asphalt or road construction for any roadway in their jurisdiction.

11.25.2 WORK INCLUDED

The work described in this section is that required for construction of a hot-mix asphaltic concrete surface course.

11.26 PRODUCTS

11.26.1 AGGREGATES

The Contractor shall submit to the Municipality at least ten (10) work days before start of paving, a mix design using the Marshall Method and performed by an independent testing laboratory acceptable to the Municipality. The Contractor shall submit a separate mix design for each change in the supplier or source of materials. No mixing of asphaltic concrete shall proceed until the job mix formula or any subsequent change is approved by the Municipality.

Preliminary approval of the aggregate as represented by the samples shall not constitute general acceptance of all material in the deposits or source of supply; acceptance shall be subject to field tests taken at the discretion of the Municipality.

Materials may be considered unsuitable even though particle sizes are within the limits of the gradation sizes required if particle shapes are thin or elongated or any other characteristic precludes satisfactory compaction, or if the material fails to provide a pavement suitable for traffic. The acceptability of the final material shall be determined by the Municipality.

11.26.2 GRADATION

Aggregate shall consist of hard, durable, uniformly graded, crushed gravel, free of coatings of silt or clay, and shall not contain organic or soft materials that break up when alternately frozen and thawed, or wetted and dried, nor other deleterious materials.

Coarse aggregate is aggregate retained on the 5000 μm sieve. Fine aggregate is aggregate passing the 5000 μm sieve.

The combined aggregates shall meet the following gradation requirements when tested to ASTM C136 and C117.

Table 19. Hot Mix Asphaltic Concrete Gradation Requirements

GRADATION REQUIREMENTS	
Sieve Size (mm)	**% Passing by Mass**
12.500	100
10.000	83 – 92
5.000	55 – 70
1.250	26 – 45
0.630	18 – 38
0.315	12 – 30
0.160	8 – 20
0.080	4 – 10

Additional properties that shall be met are as follows:

Plasticity Index - Non Plastic, ASTM D424-59

Los Angeles Abrasion Gradation "B" - 35% maximum loss by mass, ASTM C131-76

11.26.3 ASPHALT CEMENT

The asphalt cement shall be uniform in character, free of water and shall not foam when heated to 175 degrees Celsius and it shall have a penetration value of 150-200mm at 25°C and shall meet all specifications as to viscosity, flash point, thin film oven test and solubility established by Alberta Infrastructure and Transportation for the Premium Grade 150 – 200 (A) Asphalt Cement.

11.26.4 DESIGN MIX

A qualified testing laboratory engaged by the Contractor shall be employed to prepare a mix design and job mix formula for the aggregate on which the tender is based. The mix design and job mix formula shall be submitted to the Municipality for approval a minimum of 10 days prior to paving. No paving shall commence before the Municipality's approval is given for the mix design or job mix formula.

The laboratory mix design shall be based on the Marshall Method. Absorption of asphalt into the aggregate shall be taken into account using the ASTM bulk specific gravity of the aggregate in calculating optimum asphalt content.

The mix design shall meet the following specifications:

Table 20. Mix Design

MIX DESIGN		
		Local Residential Only
Number of compaction blows each face of specimen	75	50
Min. stability (kN) at 60ºC	10	5.3
Flow (mm)	2 – 3.5	2 – 4
% air voids total mix	3.5 – 4	3.5 – 4
% voids in mineral aggregate		
At 3.5% air voids	13.5	13.5
At 4% air voids	14	14
% aggregate voids filled with asphalt	65 – 75	65 – 78
Retained stability (%) (min)	70	70
Minimum Theoretical Film Thickness (µm)		
Design air voids (%)		
4.0 and 3.9	6.0	6.5
3.7 and 3.8	6.1	6.6
3.5 and 3.6	6.2	6.7
Crushed fragments minimum material retained on the 5,000 µm with two crushed faces	70	60
Manufactured fines content as a percentage of fine aggregate mass (minimum)	70	50

The mix produced shall conform to the job mix formula approved by the Municipality and to the following tolerances:

- The percent of asphalt in the mix shall not vary by more than 0.3% from the percentage indicated in the approved mix design.
- The mixing temperature for asphaltic materials shall not vary from those specified in the job mix formula by more than 9 degree Celsius. In no case shall the mixing temperature exceed the maximum mix temperature indicated from the asphalt temperature-viscosity curve data.

11.26.5 DATA

The Contractor shall make available to the Municipality any of the following upon request:

- Temperature-viscosity data or curves, as obtained from the refineries, for the various grades and types of asphaltic material.
- All test data performed by the testing company licensed to practice in the Province of Alberta.

11.26.6 CHANGES

The Contractor shall notify the Municipality of all proposed changes in the mix proportions. No changes shall be made until a representative of the Municipality is there to witness the change.

11.27 EXECUTION

11.27.1 TRANSPORTATION

The mixture shall be transported from the mixing plant to the work in vehicles with tight metal bottoms previously cleaned of all foreign materials. The vehicle shall be suitably insulated, and each load shall be covered with canvas or other suitable material of sufficient size to protect it from weather conditions.

The inside surface of the box may be lubricated with a light coating of soap or detergent solution; petroleum derivatives shall not be permitted. Any accumulation of asphaltic material which has collected in the box shall be thoroughly cleaned before loading with hot mix. Trucks shall be clean of mud or any substance which could contaminate the working area.

11.28 PREPARATION OF EXISTING SURFACE

11.28.1 GENERAL

Before the asphalt mix is placed, dirt and other objectionable material shall be removed from the surface to be paved, by brooming or other methods and a tack coat shall be applied.

Contact edges of existing mats and contact faces of curb, gutters, manholes, sidewalks and other structures shall be coated with a film of liquid asphalt material before placing the asphalt mix.

11.28.2 PRELIMINARY LEVELLING

Areas that require preliminary levelling will be identified. Generally areas that show depressions, rutting or other deformations to a depth of 15mm or greater will be designated for preliminary levelling and all the following shall apply for acceptance.

1. Asphalt mix for preliminary leveling shall be spread by means of a motor grader or other approved method.
2. Only pneumatic tired rollers will be allowed for compaction, and a minimum density of 91.0% of the Marshall density, is required.
3. Preliminary leveling is intended to be a separate operation and shall not be done as part of the construction of the subsequent lift of asphaltic concrete pavement.

11.28.3 PLACING

Unless otherwise permitted by the Municipality, the mixture shall be spread by a mechanical self-powered paver, with an automatic levelling device and automatic grade control capable of spreading the mix without segregation or tearing, in thicknesses varying from 12mm to 150mm and in widths greater than 3.0m and to true line, grade and cross-section as shown on the plans.

The mixture shall be laid at a temperature not lower than 120 degrees Celsius or higher than 140 degrees Celsius. The air temperature shall not be less than 2 degrees Celsius and rising, no frost shall be present and the roads dry.

Where the asphaltic surface course is to be placed in 2 lifts, the first lift shall be placed, finished and compacted for the full width as shown on the drawings, prior to commencing on the second lift. The maximum lift thickness is 75mm.

In placing the second lift, the individual mixture spreads shall be aligned in a manner such that the longitudinal joints in each layer will not coincide.

In narrow areas, deep or irregular sections, intersections, turnouts or driveways, where it is impractical to spread with a paver, the Contractor may use hand methods as directed by the Municipality.

11.28.4 WEATHER LIMITATIONS

The mixture shall not be placed:

- during periods of rain or when there is an imminent danger of rain;
- during excessive winds; or
- when air temperature is 2 degrees Celsius or cooler or frost is present on the surface.

11.28.5 JOINTS

The mixture shall be laid so that all longitudinal joints are made while the first mat of the 2 being laid is still hot. A narrow strip along the edge of a mat which is joined with another asphalt mat shall be left without rolling until the adjoining mat has been placed against it. The joint which is formed shall be rolled immediately after the adjacent mat has been placed to ensure a bonding of the material while the asphalt is still hot.

Transverse joints shall be carefully constructed and thoroughly compacted to provide a smooth-riding surface. Joints shall be straight-edged to assure smoothness and true alignment and shall be offset at least 1 metre from joints of adjacent mats.

All concrete or metal structures such as gutters, manholes, etc. shall be painted with an approved bituminous material prior to placing the asphalt.

11.28.6 TOLERANCE AND PENALTIES

The pavement shall have the thickness specified on the Municipality's drawings. Areas suspected to be deficient shall be cored, as directed by the Municipality, on the basis of 1 core for every 1000 square metres of pavement. At least I core shall be taken at the designated Marshall location.

Should the asphalt be found to be deficient in thickness, the Contractor will be permitted to take 2 additional cores in an effort to isolate and confirm the deficient areas. The location of the two additional cores shall be located no further than half way between the deficient core, and the next adjacent core, or contract boundary.

The exact location of the core locations are to be determined by the Contractor, and approved by the Municipality. The Contractor shall be responsible for all costs associated with the recoring of the asphalt.

A deficiency penalty shall be assessed according to the following:

Table 21. Tolerance and Payments

TOLERANCE AND PAYMENTS	
Thickness Deficiency (mm)	**Payment Reduction Factor %**
0 – 5	0
6 – 9	10
10 – 12	25
13 – 15	50
Over 15	Remove and replace

No additional payment will be made to the Contractor for greater thicknesses.

The Contractor shall fill all core holes within a maximum period of 24 hours.

11.28.7 DENSITIES

Densities shall be based on core samples, each of which shall represent approximately 1000 square metres per constructed lift. Asphalt densities are specified as 97% of the standard laboratory Marshall. A minimum of 1 Marshall per day shall be performed with 1 core sample taken at a designated Marshall location.

If any core fails to meet the density specified, no more than 2 additional cores may be taken by the Contractor within 1 metre of the first core sample, and the average density of the three cores shall represent the area. No additional rolling to achieve a more favourable density shall be allowed without the written consent of the Municipality. The Contractor shall be responsible for all costs associated with the recoring of the asphalt.

If the densities are less than specified, a deficiency penalty shall be assessed according to the following:

Table 22. Densities and Assessed Deficiency Penalties

DENSITIES AND ASSESSED DEFICIENCY PENALTIES	
Field Density	**Payment Reduction Factor %**
97.0 – 96.6	0
96.59 – 96.1	3
96.09 – 95.6	12
95.59 – 95.0	25
<95.0	Remove and replace

All asphalt below 95% standard Marshall Density shall be removed and replaced at the Contractor's expense.

No adjustment to the unit price is to be made for areas with a density higher than that specified.

11.28.8 SMOOTHNESS

The surface of the compacted pavement shall be true to the required grade and cross-section with a smooth riding quality acceptable to the Municipality.

In addition to the above, when checked with a 3.0 metre straight-edge, held in successive positions parallel or perpendicular to the centre line and in contact with the surface, the pavement surface shall not deviate from the straight-edge by more than 3mm.

If, in the opinion of the Municipality, an objectionable riding surface exists, the Contractor shall either grind and resurface with an asphalt overlay or remove and replace the asphalt surface.

11.28.9 TEXTURE

The completed pavement shall have a tightly knit texture and shall be free from segregation and surface cracking. Mixes that are excessively tender or difficult to roll shall be redesigned in order to remedy the situation. The new design shall meet all of the requirements of this section, and shall be submitted to the Municipality for approval at least three (3) working days prior to its use.

11.28.10 TRAFFIC

No traffic shall be allowed on the finished surface until it has cooled to atmospheric temperature.

11.29 ASPHALTIC CONCRETE PAVEMENT MILLING

11.29.1 GENERAL

This section specifies requirements for milling or grinding existing asphalt pavement to lines, grades, and typical cross sections indicated on plans or as established by the Municipality.

11.29.2 PROTECTION

Protect existing pavement, utility appurtenances, traffic detector loops, home runs, light units, and structures from damages. In event of damage immediately replace or make repairs to approval of the Municipality and at no additional cost to the Owner.

11.30 EXECUTION

11.30.1 PREPARATION

Inspect site and verify with the Municipality areas designated for milling.

Arrange for temporary traffic control in areas where signal light traffic detector loops and home runs are to be removed.

11.30.2 EQUIPMENT

Use cold milling or grinding equipment capable of removing part of asphalt pavement surface to depths or grades indicated with a tolerance of +/- 10mm within areas designated.

Sweeping and collecting equipment capable of removing all residues from planning operation.

Apply water as necessary during milling operation to suppress dust.

11.30.3 ASPHALT REMOVAL

Mill asphalt pavement to grade and cross section dimensions indicated or as directed by the Municipality.

Exercise care to avoid disturbance to pavement or other work designated to remain.

Keep drainage system clear of loose and waste materials.

Asphalt is to be removed to a uniform level including areas surrounding valves, manholes or other appurtenances.

Remove all residue materials resulting from milling operation.

Milling may be restricted on designated roads and streets with particular time frames throughout the week. The Contractor shall abide by these restrictions.

Surface to be left in a condition that can be reopened to traffic following removal of grindings.

11.30.4 DISPOSAL OF MATERIALS

Removed pavement material is the property of the Owner and is to be stockpiled at a location designated by the Municipality.

11.30.5 FINISH TOLERANCES

Milled surfaces to be within +/- 10mm of specified grade but not uniformly high or low.

11.31 ASPHALT PAVEMENT CRACK ROUTING AND SEALING

11.31.1 GENERAL

The Work Consists of routing, cleaning and drying cracks in pavement surfaces, supplying crack sealant material and sealing the routed cracks with the sealant.

11.31.2 MATERIAL

Hot poured rubberised asphalt products generally accepted for this work are Husky 1G11, CRAFCO 522, KOCH 9030 or Beram 195LM.

The use of other materials will be subject to the approval of the Municipality. In situations where the Contractor obtains approval to use a material not included in the above list, he shall provide the Municipality with the following information 5 days prior to commencing the Work:

1. Name and mailing address of the crack sealant supplier and manufacturer
2. Name of crack sealant product to be supplied
3. Written confirmation from the manufacturer that the crack sealant to be supplied meets all specified requirements along with test results that demonstrate that the product meet all specified requirements.

The Contractor shall verify that the crack sealant delivered and used in the Work is the type and grade ordered.

11.31.3 PROCEDURE

No Work shall be performed during rain or snow or when the pavement surface is wet.

The crack sealant shall not be applied when the pavement temperature is below 10 degrees Celsius.

Unless otherwise directed by the Municipality, all cracks between 2mm and 12mm in width shall be routed and sealed. All cracks shall be routed to a minimum width of 20mm and a depth of 10mm.

Prior to the application of crack sealant, the entire road surface shall be cleaned ensuring all loose material and moisture is removed from the routed cracks and surrounding areas.

Crack sealant shall be heated and applied in accordance with the manufacturer's recommendations. Routed cracks shall be filled with crack sealant such that upon cooling the sealant shall not be more than 3mm below the pavement surface.

Excessive crack sealant shall be removed from the pavement surface immediately following application. Traffic shall be kept off sealed cracks until the crack sealant has cured. At locations such as intersections where this is not practical, the Contractor shall prevent tracking by applying a blotting agent to the crack sealant. When a blotting agent is used, it shall not be applied until the sealant has cooled sufficiently to prevent inclusion of the blotting agent into the sealant.

When necessary, the Contractor shall supply one of the following blotting agents:

- Screened sand with a maximum topsize of 2mm
- Cement
- Fly ash

The use of other blotting agents shall be subject to the approval of the Municipality.

Fuel, asphalt and any other spills shall be cleaned up to the satisfaction of the Municipality at the Contractor's expense.

11.31.4 SAMPLING AND TESTING

The Contractor shall supply material samples to the Municipality for Quality Assurance (Audit) testing purposes when requested.

11.31.5 ACCEPTANCE CRITERIA

Evaluation of the Work will be based on a visual inspection by the Municipality. To be acceptable, the Work must conform to the following:

1. All routed cracks conform with the specified rout profile
2. The rout conforms to the path of the crack with no part of the crack outside or touching the edge of the rout cross section
3. All routed cracks have been sealed
4. At least 95% of the cracks treated have been filled with an adequate amount of crack sealant material.

Failure to comply with the acceptable criteria will result in the Contractor re-treating all failed cracks at their own expense.

11.32 ASPHALTIC PAVEMENT CRACK SEALING

11.32.1 GENERAL

The work consists of supplying crack sealant and sealing cracks in asphalt concrete pavement.

11.32.2 MATERIALS

The type and grade of asphalt/emulsified asphalt material generally accepted for this work are Alberta Infrastructure and Transportation designated EC101 or HC200.

The use of other materials will be subject to the approval of the Municipality. In situations where the Contractor obtains approval to use a material not included in the "Recognized Products List", he shall provide the Municipality with the following information 5 days prior to commencing the Work.

1. Name and mailing address of crack sealant supplier and manufacturer
2. Name of crack sealant product to be supplied

3. Written confirmation from the manufacturer that the crack sealant to be supplied meets all specified requirements along with test results that demonstrate that the product meets all specified requirements.

The Contractor shall verify that all crack sealant delivered and used in the Work is the type and grade ordered.

11.32.3 PROCEDURE

No Work shall be performed during rain or snow or when the pavement surface or cracks are wet.

Crack sealant shall not be applied when the atmospheric temperature at the work site is below 10 degrees Celsius.

All cracks within the entire width of the pavement surface, which are between 5mm and 25mm in width, shall be sealed.

Prior to the application of crack sealant, the Contractor shall ensure that the road surface adjacent to the cracks is clean.

Hot Pour crack sealant shall be heated to the temperature specified by the manufacturer. Overheating will not be permitted.

Crack sealant shall be applied within the manufacturer's specified temperature range. Crack sealant shall be applied so that the crack is flush filled immediately following application and a thin overband of sealant extends approximately 25mm beyond the edges of the crack. Excess crack sealant shall be removed from the pavement surface immediately following application. Removal shall involve the use of a squeegee, starting from the centreline and proceeding to the shoulder.

Traffic shall be kept off sealed cracks until the crack sealant will not track under action of traffic. At locations such as intersections where this is not practical, the Contractor shall prevent tracking by applying a blotting agent to the crack sealant.

When necessary, the Contractor shall supply one of the following blotting agents:

- Screened sand with a maximum topsize of 2mm
- Cement
- Fly ash

The use of other products shall be subject to the approval of the Municipality.

Fuel, asphalt and other spills shall be cleaned up to the satisfactory of the Municipality at the Contractor's expense.

11.32.4 SAMPLING AND TESTING

The Contractor shall supply material samples to the Municipality for Quality Assurance (Audit) testing purposes when requested.

11.32.5 ACCEPTANCE CRITERIA

Evaluation of the Work will be based on a visual inspection by the Municipality. To be acceptable, all applicable cracks must be treated as specified herein and at least 95% of the treated cracks must contain an adequate quantity of crack sealant material.

Failure to comply with the acceptable criteria will result in the Contractor re-treating all failed cracks at his own expense.

Cold pour rubber filled bituminous emulsified pavement crack sealant shall conform to the requirements specified in the following table, for the grade designated by the Municipality:

Table 23. Specification for Cold Pour Rubber Filled Bituminous Emulsified Pavement Crack Sealant

ASPHALT GRADE	EC-101		TEST METHOD	
Requirements	**Minimum**	**Maximum**	**Alberta Transportation**	**A.S.T.M.**
Uniformity	Pass		9.1	
Viscosity @ 25ºC, Krebs units	70	90	9.2	D562
Solids Content by Evaporation, % by mass	59		9.3	D244
Ash Content, % by mass		2.0	9.4	
Rate of Curing, %			9.5	
24 hour	50			
6 days	80			
Low Temperature Flexibility	Pass		9.6	
Elastic Recovery, %	40		9.7	

Table 24. Specifications for Hot our Bituminous Crack Sealant

Hot pour bituminous crack sealant shall conform to the requirements specified in the following table, for the grade designated by the Municipality:

ASPHALT GRADE	HC200		A.S.T.M. TEST METHOD
Requirements	Minimum	Maximum	
Softening Point, ºC	80	95	D36
Flash Point, C.O.C., ºC	230		D92
Penetration			D5
@ 0ºC, 200g, 60 sec.	30		
@ 25ºC, 100g, 5 sec.	55	60	
@ 46 ºC, 50g, 5 sec.		150	
Ductility @ 25ºC	45		D113
Solubility in Trichloroethylene, % by mass	98		D2042
Viscosity @ 177ºC, mm²/s		1,200	D2170

11.33 TRAFFIC CONTROL DEVICES

Plans shall be provided to the Municipality that depicts the locations and details of all traffic control devices (traffic signs and traffic signals), street name signs and pavement markings.

All traffic control devices and pavement markings shall be designed and installed in accordance with the manual “Uniform Traffic Control Devices for Canada” as issued and revised from time to time by the Transportation Association of Canada (formerly RTAC).

Guide and information signing shall be designed and installed in accordance with the “Urban Guide and Information Sign Manual” as issued by the Alberta Government.

Street signing shall be standard aluminium, white on green, with a minimum vertical dimension of 150mm.

11.34 MATERIALS

All signs shall utilize High Intensity reflectorized material to ASTM-D4956, Type III.

All sign posts shall be U Channel, galvanized Schedule 40 steel unless otherwise approved in writing by the Municipality.

Along arterial streets and at arterial street intersections, pavement markings shall be of a “permanent” type, thermoplastic. Painted markings are acceptable elsewhere.

11.35 INSTALLATION

All traffic control signs shall be mounted to provide 2.0m vertical clearance to the lowest portion of the sign, unless otherwise approved by the Municipality.

All signs shall be mounted to provide a minimum of 0.3m of horizontal clearance from back of curb or back of walk. Where there is no curb or walk within the right-of-way, the sign location is to be approved by the Municipality.

11.36 PAVEMENT MARKINGS

11.36.1 SAMPLES

If requested by the Municipality, submit the following material sample quantities at least 4 weeks prior to commencing work.

1. Two 1 L samples of each type of paint.
2. One 1 kg sample of glass beads.
3. Sampling to CGSB 1-GP-71.

Mark samples with name of project and its location, paint manufacturer's name and address, name of paint, CGSB specification number and formulation number and batch number.

11.37 PRODUCTS

11.37.1 PAINTED MARKINGS

To CGSB 1_GP_74M, alkyd traffic paint.

Colour: to CGSB 1_GP_12C, yellow 505_308, white 513_301.

Thinner: to CAN/CGSB_1.5.

11.37.2 PERMANENT MARKINGS

The use of other permanent marking materials that do not meet the following requirements will be subject to approval by the Municipality. Acceptance during the warranty period will be based on the following:

- not lift from the pavement,
- exhibit no material loss within 4 weeks of installation,
- not deteriorated by contact with sodium, calcium chloride or traffic residue,
- show no appreciable deformation or discoloration under exposure to traffic and road temperatures between –40ºC and 40ºC and,
- maintain their original dimension and placement without chipping or cracking.

Cold Plastic Marking: two-component, cold-extruded and cold-curing, having a specific gravity of 1.9 minimum at 25°C.

Hot Thermoplastic Marking: hot-extruded, having a specific gravity of 2.0 minimum at 25°C, having a softening point of 90°C minimum according to ASTM E28.

Both cold and hot plastic markings shall conform to the following:

- Water Absorption: 0.5% maximum by mass retained water after 24 hour immersion, according to ASTM D570 Procedure A.
- Impact Resistance: minimum 1.13 J at 25°C when material is cast into bar of 25mm^2 cross-section by 75mm long, with 25mm extending above vice jaws in a cantilever beam (Izod type) tester using the 2.82 J scale, according to ASTM D256 Method C.

- Abrasion Resistance: maximum weight loss of 0.50 g when subjected to 200 revolutions on Taber abrader at 25°C using H-22 Calibrade wheels weighted to 500 g with sample kept continuously wet with distilled water. Prepare test sample with representative material placed on 100mm square plate, 3 ±0.1mm thick.
- Chemical Resistance: Test samples of 50mm square, no degradation after exposure to:
  - 24 hours immersion in 5% NaCl.
  - 24 hours immersion in 5% CaCl.
  - 1 hour spot test with mineral oil.
- No deterioration when in direct contact with asphalt cement in asphalt materials, or with sodium chloride, calcium chloride or other de-icing chemicals.
- Non-toxic and not harmful to persons or property when in hardened state.
- No discoloration from sunlight ultraviolet exposure and no bond failure for warranted life of material.

Glass Beads: minimum 80% true spherical shape; clear of cloudiness, dark inclusions, trapped air, or other defects; and conforming to the following:

1. Index of Refraction: 1.5 minimum when tested in liquid immersion at 25°C according to CGSB 1-GP-71 Method 49.1.
2. Gradation of glass beads for mixing with and for surface application on thermoplastic material, tested according to ASTM D1214:

Table 25. Gradation of Glass Beads

GRADATION OF GLASS BEADS	
Sieve Size (mm)	**% Passing by Mass**
850	90 – 100
300	15 – 50
180	0 – 10

Premarking Paint: as reviewed by the Municipality.

Groove Filler: LRS 424 or approved equal.

11.37.3 MIX FORMULATION

Glass Sphere Content: minimum 20%, maximum 30% by mass of thermoplastic material.

White Colour: brilliant white, 70% minimum when measured with the Gardner Multi-Purpose Reflectometer 0, 45° daylight luminous directional reflectance, with a green filter.

Yellow Colour: conforming to CGSB Colour #505-308 or U.S. Federal Standard 595a, Colour Chip 33538, 45% minimum when measured with the Gardner Multi-Purpose Reflectometer 0, 45° daylight luminous directional reflectance, with a green filter. Colour tolerance to be within limits of U.S. Department of Transport Yellow Tolerance Chart PR#1 December 1972.

No formulation change unless approved by the Municipality. Any significant change will be subject to field trials.

11.38 EXECUTION

11.38.1 EQUIPMENT REQUIREMENTS

Paint applicator to be an approved pressure type distributor capable of applying paint in single, double and dashed lines. Applicator to be capable of applying marking components uniformly, at rates specified, and to dimensions as indicated, and to have positive shut-off.

Grooving machine subject to the Municipality's approval.

11.38.2 CONDITION OF SURFACES

Pavement surface to be dry, free from ponding water, frost, ice, dust, oil, grease and other foreign materials.

Remove conflicting markings.

11.38.3 TRAFFIC CONTROL

Conduct all traffic control to the requirements as specified.

11.38.4 PAINT APPLICATION

Lay out pavement markings and review with the Municipality.

Apply paint only when air temperature is above 10°C, wind speed is less than 60 km/h and no rain is forecast within next 4 hours.

Apply traffic paint evenly at rate of 3.0 m²/L.

Paint lines to be of uniform colour and density with sharp edges.

Thoroughly clean distributor tank before refilling with paint of different colour.

11.38.5 COLD PLASTIC APPLICATION

Mix components and apply cold plastic marking according to manufacturer's surface application procedure, to a thickness of 2mm minimum and 3mm maximum.

Apply when ambient temperature is between –10°C and 30°C.

Apply glass beads to surface of extruded material before it has set, at a rate of 140 to 250 g/m^2.

Let marking cure into a hardened state.

11.38.6 HOT THERMOPLASTIC APPLICATION

Cut groove into pavement surface to designated width and depth. Remove grindings and haul to designated location. Sweep or air blast groove clean and dry.

Heat material and apply according to manufacturer's hot extrusion process.

Fill groove with hot molten material. Do not overfill more than 3.0mm above pavement surface.

Apply glass beads to surface of extruded material while it is still molten at a rate of 140 to 250 g/m^2.

Trim surplus material to give clean straight edges.

Let marking cool to a hardened state.

11.38.7 PROTECTION AND CLEANUP

Do not permit traffic over applied markings until they have adequately hardened.

Protect surrounding areas and structures from disfiguration and damage. Repair any damage as directed by the Municipality.

On completion of work, clean up and leave site free of debris and waste matter.

11.38.8 TOLERANCE

Paint markings to be within plus or minus 12mm of dimensions indicated.

Remove incorrect markings.

Cold Plastic Marking:

Measurement: The quality assurance laboratory will measure suspect markings with a surface micrometer. The average of 5 measurements will represent 300m of marking, or one job site, whichever is less.

Thickness Deficiencies: Where a significant number of deficiencies occur in the work, involving average thicknesses greater than 3.0mm or less than 1.8mm, the Municipality may order removal and replacement, or application of additional material.

If surface dishing deeper than 0.5mm occurs, the Municipality may order removal and replacement.

The quality assurance laboratory will determine the width of suspect markings by the average of 5 measurements representing 300m of marking, or one job site, whichever is less.

11.38.9 HOT THERMOPLASTIC MARKING

Measurement: The quality assurance laboratory will core suspect markings. The average thickness of 3 cores will represent 300m of marking, or one job site, whichever is less.

Overfill Thickness: That portion of marking above pavement surface will receive no additional payment. If overfill exceeds 3.0 mm, the Municipality may order removal and replacement of marking.

Groove Thickness Deficiencies: Where a significant number of deficiencies occur, involving average thicknesses less than 70% of that specified, the Municipality may order removal and replacement.

If surface dishing deeper than 0.5mm occurs, the Municipality may order removal and replacement. Variations in asphalt surface profile may be taken into consideration.

The quality assurance laboratory will determine the groove width of suspect markings by average measurement of 3 cores representing 300m of marking, or one job site, whichever is less.

11.38.10 WIDTH DEFICIENCIES

Where a significant number of deficiencies occur greater than 10mm in average widths of cold plastic, or in average groove widths of hot thermoplastic, the Municipality may order removal and replacement.

11.38.11 PROTECTION OF COMPLETED WORK

Protect pavement markings until dry.

11.39 REGULATORY ROADWAY SIGNS

11.39.1 DESIGN REQUIREMENTS

Sign supports and appurtenances to be capable of withstanding summation of following loads:

- Wind and ice loading specified to be consistent with anticipated loads in locality of installation. Refer to current edition of the National Building Code of Canada and/or applicable provincial building code.

- Dead load of signboards, sign supports and appurtenances.
- Ice load on one face of signboards and around surface of all structural members and appurtenances.

Structural deflections and vibration in accordance with American Association of State Highway and Transportation Officials (AASHTO), “Specifications for the Design and Construction of Structural Supports for Highway Signs”.

11.39.2 SHOP DRAWINGS

Submit shop drawings for signage structures indicating product data and design.

11.40 PRODUCTS

11.40.1 SIGN SUPPORTS

Steel posts: to CAN_G40.21, 3.1m long, flanged “U” shaped in cross section, measuring 65mm wide by 30mm deep. Metal thickness: 4.5mm. Hot dipped galvanized: to CAN/CSA_G164

Base plates for mounted signs: to ASTM B209M.

Fasteners: bolts, nuts, washers and other hardware for roadside signs to be cast aluminium alloy, or galvanized steel.

11.40.2 SIGNBOARDS

Aluminium sheet shall be tension levelled, sign grade aluminium and conform to ASTM B209M, Alloys 6061-T6 or 5052-H38 pre-cut to required dimensions. Minimum thickness to be 1.6mm for signboards up to 750mm wide. Minimum thickness to be 2.0mm for signboards 750 to 1200mm wide.

Connecting straps and brackets to ASTM B209M.

Reflective sheeting shall meet or exceed the minimum requirements specified in ASTM-D4956 Performance Requirements Type III, High Intensity Retro Reflective Sheeting.

11.40.3 FABRICATION

SIGNBOARDS

Aluminium blanks: Degrease, etch and bond with chemical conversion coating. Clean surfaces with xylene thinner. Dry. Aluminium signboards are to be painted before installation. Spray and bake face of signboards with two coats of enamel in accordance with CAN/CGSB_1.104.

SIGN IDENTIFICATION

Apply sign number and date of installation with 25mm high stencil painted black letters on lower left back face of each signboard.

11.41 EXECUTION

11.41.1 INSTALLATION

SIGN SUPPORT

- Erect supports where indicated. Where separate concrete footings have been placed, erect posts with base plates resting on aluminum nuts and restrained with nuts and washers.
- Coat underside of base plate with corrosion protective paint before installation.
- Close open aluminum tubes and posts with aluminum cap.
- Erect posts plumb and square to details as indicated.

- Single channel steel posts are to be driven to required depth without damage to posts. If rock or concrete is encountered, auger hole to required depth and set post in sand.
- In finished concrete or asphalt surfaces, backfill with concrete or grout. Protect from adverse conditions until cured.
- Wooden post installations are to be excavated with an auger. Compact bottom of hole to provide firm foundation. Set post and backfill in 150mm layers with excavated material. Compact each layer before placing each subsequent layer.
- Permissible tolerance is ±12mm departure from vertical.

SIGNBOARD:

- Fasten signboards to supporting posts and brackets as indicated.
- Use strapping with crimped or bolted connections where signs fastened to utility poles.

11.41.2 PROTECTION

Place temporary covering on signboards where required. Covering to be capable of withstanding rain, snow and wind and be non-injurious to signboard. Replace deteriorated covering and remove covers as reviewed by the Municipality.

11.41.3 CORRECTING DEFECTS

Correct defects, identified by the Municipality, in consistency of reflectivity, colour or illumination.

12

STREET LIGHTING

12.1 GENERAL

The following standards are applicable to all types of development in the Municipality, except for industrial developments. Standards for industrial developments shall be determined by the Municipality during the initial planning stages of the proposed development.

The street lighting design shall be in accordance with *the Guide for the Design of Roadway Lighting* published by the Transportation Association of Canada (TAC), as well as applicable standards published by the Illuminating Engineering Society of North America (IES).

All roadway lighting systems shall be installed in strict compliance with the Canadian Electrical Codes.

All street lighting cables in new subdivisions shall be installed underground.

12.1.1 DESIGN

Street lighting posts with fixtures shall be low maintenance, galvanized steel posts, comparable to the existing posts within the Municipality and specifications currently used by power utilities within the Municipality.

The location and density of street lights shall provide the following minimum lighting levels:

- Street lighting fixtures shall be high pressure sodium type.
- Street lighting design shall be approved by the utility provider.

12.1.2 LOCATION

The Developer shall coordinate the location of street lights to ensure that they do not interfere with other utilities and driveways.

Street lights shall be provided for each internal park area that does not abut onto a lighted street. A street light shall be located at the point where each walkway opens out onto the park area.

The Municipality and the local power utilities shall approve the street lighting layout prior to installation.

12.1.3 COSTS

It is the Developer's responsibility to arrange with the local power utilities operators for necessary approvals and power connection.

The Municipality will pay rental charges to the utility company for the operation of street lights after the development construction has been accepted by the Municipality.

13

LOT GRADING

13.1 DESIGN

The grading design shall compliment the overall design of both the minor and major storm drainage system. In general, the lots shall be graded and sloped in such a manner that a minimum of surface run-off water will be conducted to other properties. Where surface drainage swales direct run-off from one lot to the next, the necessary drainage easements shall be registered concurrently with the plan of subdivision.

Reserves and public lands shall be graded to drain towards developed streets and/or storm water catch basins or drainage channels.

Boulevard areas shall be graded to provide a minimum slope of 2% from property line to top of curb.

Commercial and industrial lots shall be graded to drain to on-site storm water catch basins.

In cases where the backyard slopes towards the building, provisions are required to keep the runoff at least 3.0m away from the building, with the possibility of draining the surface water along the lot lines onto the streets.

Where drainage swales are provided on rear property lines in laneless subdivisions, the developer shall provide an approved concrete drainage swale. The drainage swale shall be provided on one side of the property line and be placed in a drainage easement.

The maximum slope draining towards property lines shall not exceed 10% within 1.5 metres of the property line. The slope away from buildings shall meet the minimum requirements of the Alberta Building Code. Downspouts from eavestroughs and discharges hoses from sump pumps shall not discharge within 0.6 metres from the property line.

Refer to Standard Drawing Details.

13.1.1 RETAINING WALLS

Where extremes in elevation of adjoining lots require the construction of a retaining wall, such shall be indicated on the proposed grading plan and no work or construction will be permitted on the building lots that are the subject of, or adjacent to, the said retaining wall without a signed commitment by either owner of the two lots involved to construct such retaining wall at the time of construction of the proposed building.

14

LANDSCAPING

14.1 GENERAL

The Developer is responsible for the design and development of the Neighbourhood Park Site(s), School Sites, and Detention Ponds, all remaining public open space (i.e. parkettes, linear parks, natural parks, boulevards, medians, utility lots, buffer areas, roadway berms), including all amenities falling within these open spaces (i.e. plantings, walkways, furniture, playgrounds, buildings, structures) as specified in the Development Agreement.

14.2 STORM WATER MANAGEMENT FACILITIES

Dry pond and areas surrounding new storm water management lake facilities must be graded, top soiled, seeded or sodded, and landscaped by the Developer to the satisfaction of the Director of Field Services.

Plant materials will be selected to respect hydrological and soil saturation characteristics of the facility.

Public lands within the facility must be planted with a minimum of 30 trees per landscaped acre above normal water line, and designed and massed into major groupings. Minimum deciduous tree caliper 60mm. Minimum coniferous tree height 2.5m. Tree mix 60% coniferous and 40% deciduous suggested.

Shrubs may be substituted for trees at a rate of five shrubs for one tree, to a minimum of 15 trees per landscaped area, with approval from the Municipality.

Shrubs to be massed within large planting beds above the 1:5 year flood line to create major focal areas on the slopes of the dry pond. Minimum shrub size to be five gallon pot planted 1m o.c. or appropriate to species. Minimum shrub height and spread 600mm, subject to availability. Suggest trees be positioned within planting beds.

Planting bed layouts will provide a minimum width of turf areas between planting beds of 2.0m. Landscape edging may be required in formal shrub beds.

Planting beds shall be designed complete with weed liners. Use of weed liners for planting beds located in flood prone areas is strongly recommended.

Major storm water outlets/inlets should be landscaped with plant materials and large rockery to provide visual screening and security buffering for pedestrians and dry pond users.

Where possible, relatively flat open areas should be designed to encourage active recreational uses.

Approved furniture may be provided by the Developer and placed at strategic locations within the dry pond.

Lighting, if provided, to be to the satisfaction of the Municipality.

Special or unique features, such as recreational facilities, bridges and architectural and structural features will be designed and sealed by recognized accredited professionals.

14.3 NATURAL AREAS

Existing natural and naturalized areas impacted by the proposed improvements that cannot be protected during construction must be re-naturalized with native plant materials having regard for the surrounding environment, new drainage patterns, soil conditions, and ecological rehabilitation.

The Developer will determine the level of restoration to be completed in consultation with the Municipality.

The Developer will design an appropriate mix of native trees, shrubs, ground covers and wild seed mixes to rehabilitate impacted naturalized areas.

The Developer will design any required subsurface drainage, surface drainage and erosion control measures in the rehabilitation area.

The Developer shall, if required, coordinate this rehabilitation with other consultants to implement geotechnical, structural and bioengineering principles and recommendations.

The landscape drawings will identify all plant communities to be established and all other information necessary to implement the proposed improvements.

The Developer will specify all tree, shrub and ground cover sizes. No minimum or maximum sizes are specified. Tree mix to match natural setting.

Park development shall be seeded at a rate of one kilogram per 50 square metres with Canada Number One seed mixed to the following proportion by weight:

70% Creeping Red Fescue and 30% Kentucky Blue Grass or other approved mixture.

Forestry stock, seedlings, deciduous tree whips, and propagated and rooted cuttings are acceptable for use.

All plant materials to be nursery stock or obtained from Provincial Government sources.

Park development may be planted with trees, species specified by the Municipality, at a maximum spacing of 9.0 metres, if requested by the Municipality in writing at the time of the signing the development agreement.

Soil preparation, fertilizer and other treatment shall be in accordance with Alberta Agriculturist Recommendations for High Level Area. The Landscape Architect will identify appropriate planting installation specifications and detailing on landscape drawings.

“Round-Up” or other approved herbicides may be used to eradicate natural slopes prior to planting of trees and shrubs. Herbicide shall be applied by a licensed applicator.

14.4 MAINTENANCE PERIOD

All park development shall coincide with development of the subdivision and shall be completed within (12) twelve months of the commencement of development, unless otherwise stipulated in the Development Agreement.

The maintenance period for all planted material shall be two (2) years from the date of issuance of a Completion Certificate.

Any plant that is dead, not true to name or size as specified, or not in satisfactory growth, as determined by the Municipality, shall be removed from the site. In case of any question regarding the condition and satisfactory establishment of a rejected plant, the Contractor may elect to allow such a plant to remain through another complete growing season, at which time the rejected plant, if found to be dead or in an unhealthy or badly impaired condition, shall be replaced by the Contractor.

The applicant shall be responsible for, and at his own expense to remedy, any defect, fault or deficiency in the completed works during the maintenance period.

15

UTILITY COMPANIES

15.1 GENERAL

The following guidelines apply to all developers for the construction of municipal improvements, as well as Utility companies wishing to repair, replace or otherwise modify their existing services, within the Municipality

15.2 POWER, TELEPHONE, GAS AND CABLE TV SERVICES

15.2.1 GENERAL

Private utility companies provide electrical power service, gas service, telephone service, and cable TV service.

15.2.2 RIGHT-OF-WAY

Where required, the Developer shall provide right-of-way and easements of sufficient size and location to satisfy the above mentioned Utility Companies.

Utilities shall be located according to the Standard Drawing Details, or as directed in writing by the Municipality.

All easements on Municipality property shall be registered in the name of Town of High Level.

15.2.3 INSTALLATION

Each utility company shall submit plans of the proposed works, and an approval must be obtained from the Municipality prior to any excavation on Municipality property.

All distribution cables shall be installed in one common trench, a minimum of 300mm wide, at the required alignment. All power and communication cable trenches on the road allowance shall be at a minimum of 1.5m below finished grade level. The trench bottom shall be free of stones, loose earth and sharp objects.

All gas trenches on the road allowance shall be at a minimum of 1.0m below finished grade level. Trenches shall be a minimum of 300mm wide. The trench bottom shall be free of stones, loose earth and sharp objects.

Gas lines shall be installed in a separate trench from cable installations, and shall maintain a minimum distance of 3.0m from any valve, hydrant, catch basin, manhole, vault, water, sanitary and storm water lines.

Power, telephone, and/or other communication cables shall maintain a minimum distance of 3m from any valve, hydrant, catch basin, manhole, vault, water mains, sanitary mains, and storm water line. A minimum clearance in all directions is to be maintained when crossing gas service lines, please consult the Crossing Agreement.

Extreme care must be taken when backfilling so as not to disturb any Legal survey pins. Any survey pins disturbed during installation shall be replaced at the Utility Company's expense.

Trenches shall not be left open, with cables or gas line exposed, longer than forty-eight (48) hours without permission of the Municipality. In such cases, the open trenches shall be properly marked and barricades with flashers provided by the developer. In locations where flooding of the trenches may occur, or the open trench creates a public hazard, the Municipality may, at his discretion, require the excavation to be appropriately covered.

The use of trench digging machinery will be permitted, except where its operations will cause damage to trees, buildings, fences, or other existing structures or municipal infrastructure above or below the ground. At such locations, hand digging shall be employed to avoid damage.

To protect persons from injury and to avoid property damage, adequate barricades, construction signs, warning lights and guards, as required, shall be placed. Whenever required, watchmen shall be provided to prevent accidents.

Backfill material shall be native soil material excavated from the ditch/trench or Fillcrete, at the discretion of the Municipality. Sand must be substituted for poor existing soils. Poor existing soils are defined as organic soils, peat, black loam, sod, clay that has hardened and stones. Backfill material shall be compacted to 95% density of the maximum density of a standard proctor compaction test within boulevards and 100% within streets under concrete, asphalt structures or lanes. All backfill material may be subject to the approval of the Municipality.

Augering, in some instances, may be required. In cases where augering is necessary, the diameter of the augered hole shall not be over 50mm greater than the diameter of the duct to be installed.

15.2.4 COSTS

Any capital contribution that the utility company may charge for installation of the above services shall be paid by the Developer.

16

PIPELINE CROSSING AGREEMENTS

16.1 GENERAL

The contractor shall be responsible in obtaining and providing to the Municipality, all pipeline crossing agreements from the respective pipeline companies and all work orders from Alberta1Call.

17

FORMS AND CERTIFICATES

17.1 WATER AND SEWER CONNECTION PERMIT APPLICATION

Refer to the Water and Sewer Connection Permit Application form.

17.2 CONSTRUCTION COMPLETION CERTIFICATE

Refer to the Construction Completion Certificate.

TOWN OF HIGH LEVEL
CONSTRUCTION COMPLETION CERTIFICATE (CCC)
DEVELOPMENT PROJECTS

Development Area: _____

Developer: _____

Servicing Agreement Date: _____ Servicing Agreement No. _____

Contractor: _____

Municipal Improvement
(as specified in the agreement) _____

Boundaries of Development Area: _____

Date of Application: _____

Pursuant to the Town of High Level Servicing Agreement No. _____ Dated: _____

I, _____ of _____

Hereby certify that as of the above date, the said municipal improvement noted herein meets all the requirements for a final Construction Completion Certificate as specified by the said Development Agreement mentioned above, and constructed, as far as can be practically ascertained, according to the specified standards as per the requirements of the said Development Agreement, I hereby recommend this municipal improvement for the approval of the Construction Completion Certificate.

_____

Project Engineer (Consulting engineer or Municipality Representative) Date

_____

Signing Officer (Consulting Engineer or Municipality Representative) Date

_____

Developer Date

_____

Authorized Town Representative Date

Approved on _____ _____
Authorized Town Representative

Approved on _____ _____
Authorized Town Representative

Causes for Rejection: (See Attached Report)

I hereby certify that the items listed as reasons for rejection have been corrected.

Approved: _____
Date

_____

Development Officer Date

Date Maintenance period to start: _____

Date Maintenance period to end: _____

17.3 FINAL ACCEPTANCE CERTIFICATE

Refer to the Final Acceptance Certificate.

TOWN OF HIGH LEVEL
FINAL ACCEPTANCE CERTIFICATE (FAC)
DEVELOPMENT PROJECTS

Development Area: _____

Developer: _____

Servicing Agreement Date: _____ Servicing Agreement No. _____

Contractor: _____

Municipal Improvement
(as specified in the agreement) _____

Boundaries of Development Area: _____

Date of Application: _____

Pursuant to the Town of High Level Servicing Agreement No. _____ Dated: _____

I, _____ of _____

Hereby certify that as of the above date, the said municipal improvement meets all the requirements for final acceptance as specified by the said residential servicing agreement, and I hereby recommend this municipal improvement for final acceptance by the Town of High Level.

_____

Project Engineer (Consulting Engineer or Municipality Representative) Date

_____

Signing Officer (Consulting Engineer or Municipality Representative) Date

_____

Developer Date

_____

Authorized Municipal District No. Inspector Date

Approved on _____ _____

Authorized Town Representative

Approved on _____ _____

Authorized Town Representative

Causes for Rejection: (See Attached Report)

I hereby certify that the items listed as reasons for rejection have been corrected.

_____

Project Engineer (Consulting Engineering Firm or Municipality Representative) Date

Approved: _____

Date

_____

Development Officer Date

Date Maintenance period to start: _____

Date Maintenance period to end: _____

17.4 TYPICAL DEVELOPMENT AGREEMENT

Refer to the Typical Development Agreement

MEMORANDUM OF AGREEMENT made this ____ day of _____, A.D. 20__

The Town of High Level
a municipal corporation, (hereinafter referred to as “the Municipality”)

OF THE FIRST PART

-and-

_____ Ltd.
a body corporate duly authorized to carry on business in the Province of Alberta,
(hereinafter referred to as "the Developer")

OF THE SECOND PART

WHEREAS the Developer is or is entitled to become the registered owner of those lands situate in the Municipality as described in Schedule "A" attached to this Agreement; and

AND WHEREAS the Developer proposes to develop a portion of the said lands (hereinafter referred to as "the Development Area") as shown on the Plan attached as Schedule "B" to this Agreement;

AND WHEREAS the Municipality and the Developer are agreeable to the development of the Development Area by the Developer in accordance with the provisions of this Agreement;

AND WHEREAS the Municipality and the Developer have agreed to enter into an Agreement to provide services required within and adjacent to the Development Area;

AND WHEREAS the Municipality and the Developer agree that the Developer shall construct and install the Municipal Improvements required throughout and adjacent to the Development Area at the Developer's sole cost and expense;

AND WHEREAS upon satisfactory completion of the construction and installation of the Municipal Improvements and the Final Acceptance of them by the Municipality, the said Municipal Improvements which are on or under Public Property shall become the property of the Municipality;

AND WHEREAS the Municipality and the Developer have agreed that the said construction and installation of the Municipal Improvements and all matters and things incidental thereto and all other matters or things relating to the development of the Development Area, shall be subject to the terms, conditions and covenants hereinafter set forth:

NOW THEREFORE, in consideration of the premises and of the mutual terms, conditions and covenants to be observed and performed by each of the parties hereto, the Municipality agrees with the Developer and the Developer agrees with the Municipality as follows:

1. INTERPRETATION

1.1 "Construction Completion Certificate" shall mean the Certificate issued by the Municipality, as contemplated in Section 10, certifying the completion of the Municipal Improvements, or a portion thereof, once the Municipal Improvements have been constructed and installed by the Developer to the satisfaction of the Municipality in accordance with this Agreement.

1.2 "Commencement of Construction" or "Commence Construction" shall mean the date upon which the Developer commences the actual grading for purposes of servicing the Development Area, or such other date as may be agreed upon in writing by the Municipality and the Developer; provided, that commencement of grading shall not include the placement of machinery or equipment within the Development Area nor any work preparatory to grading such as the removal of any buildings, materials or things whatsoever within or under the Development Area.

1.3 "Developer's Consultant" shall mean the consulting professionals retained by the Developer and shall include, but not be limited to professional engineers and land surveyors.

1.4 "Development Area" shall mean that portion of the lands legally described in Schedule "A" and which are delineated and in redon the map attached hereto as Schedule "B" to this Agreement.

1.5 "Design Standards" shall mean the procedures, standards and specifications for Municipal Improvements which are specified and set forth in the Town of High Level Municipal Engineering Servicing Standards adopted by the Municipality's Council from time to time, provided that the Municipality and the Developer may, by written agreement only, vary or change any of the procedures, standards or specifications set forth in the Design Standards.

1.6 "Essential Services" shall mean:

(a) those Municipal Improvements described in clauses (a), (b), (c), (d), (e), and (g) of Schedule "C" of this Agreement.

1.7 "Final Acceptance Certificate" shall mean a written acceptance, as contemplated in Section 10, issued by the Municipality for the Municipal Improvements, or a portion thereof, upon the completion of any repairs for defects or deficiencies and the expiration of the Guarantee Period.

1.8 "Guarantee Period" with respect to the Municipal Improvements, subject to Sections 10, 19 and 20 of this Agreement, shall mean:

(a) a period of TWO (2) years for all Municipal Improvements, including landscaping;

1.9 "Landscaping" includes the modification or enhancement of a site referred to as "Landscaping" under Schedule "D".

1.10 "Lands" means those lands legally described in Schedule "A" to this Agreement;

1.11 "Municipal Improvements" shall mean and include, within and without the Development Area, those services and facilities identified in Schedule "C" to this Agreement.

1.12 "Plans" shall mean plans and specifications prepared by the Developer's Consultant covering the design, construction and installation of all Municipal Improvements.

1.13 "Prime Rate" shall mean the prime lending rate established from time to time at the High Level branch of the Canadian Imperial Bank of Commerce. For the purpose of calculating interest payable under this Agreement, the Prime Rate established on the first business day of a particular month shall be utilized and shall be deemed to be the Prime Rate for that entire month.

1.14 "Public Property" or "Public Properties" shall include all properties within and adjacent to the Development Area to be owned or administered by the Municipality, including utility rights-of-way or easements, following the registration of the Plan or Plans of Subdivision for the Development Area.

1.15 "Municipality" shall mean the municipal corporation of the Town of High Level and the Municipality shall be represented by the Municipality's Development Authority, unless otherwise designated in writing by the Municipality.

2. PLANS

2.1 Prior to commencing construction and installation of the Municipal Improvements within or adjacent to the Development Area, the Developer shall submit Plans to the Municipality for approval and the Plans shall give all necessary details of the Municipal Improvements to be constructed by the Developer, including any necessary specifications to be attached thereto.

2.2 The Plans for the construction and installation of the Municipal Improvements for the development of the Development Area shall conform strictly to the Design Standards.

2.3 If the Municipality does not approve whatever Plans may be required to be submitted to the Municipality by the Developer, the Developer shall be entitled to refer any matter in dispute to the Municipality's Council and the decision of the Municipality's Council shall be final and binding and any such dispute or difference shall not be subject to arbitration.

2.4 The Developer covenants and agrees that the Plans for Public Properties shall comply with the Design Standards and shall include all landscaping required by the Municipality.

2.5 Subject to the terms of this Agreement, it is understood and agreed between the Municipality and the Developer that the Developer shall be entitled to construct the Municipal Improvements in accordance with the Plans once such Plans have been approved by the Municipality.

2.6 It is understood and agreed that the Municipality's approval of the Plans for the Municipal Improvements shall be in principle only and, in the case of unforeseen conditions which may adversely affect development, or in the case where a Municipal Improvement to be built in accordance with the Plans would not be suitable for the purposes intended, the detailed design specifications for any of the Municipal Improvements shall be subject to review and revision, from time to time, by the Municipality in accordance with the Design Standards and in accordance with accepted engineering and construction practices.

3. DRAINAGE STANDARDS

3.1 The Developer shall include with the Plans, a site drainage plan for the Development Area and if appropriate, any adjacent lands.

3.2 The Developer covenants that the preparation of the drainage Plans, the construction and installation of all storm water management systems both within private lands and public property shall be in accordance with accepted engineering and construction practices and in accordance with the Design Standards.

4. CONSTRUCTION AND INSTALLATION OF MUNICIPAL IMPROVEMENTS

4.1 The Developer warrants to the Municipality that all of the Municipal Improvements shall be constructed and installed in a good and workmanlike manner, in strict conformance with the Plans and proper and accepted engineering and construction practices, in accordance with the terms of this Agreement, in accordance with the Design Standards, and in accordance with the requirements of law applicable to the work.

4.2 In the event that it is necessary or reasonable, in the opinion of the Municipality, to construct or install any temporary or emergency access during the construction and installation of the Municipal Improvements, the Developer

shall construct and install any such temporary or emergency accesses in accordance to specifications, and in such locations, as determined by the Municipality acting reasonably and the Developer shall grant to the Municipality an easement, in a form acceptable to the Municipality, across the required land for the period for which the access is required.

4.3 At all times during the construction and installation of the Municipal Improvements and during all work by the Developer or its agents related thereto:

(a) The Municipality shall have free and immediate access to all records of or available to the Developer and the Developer's Consultant relating to the performance of the work, including, but without limiting the generality of the foregoing, all design, inspection, material testing and "as constructed" records.

(b) The Municipality may:

(i) exercise such inspection of the performance of the work as the Municipality may deem necessary and advisable to ensure to the Municipality the full and proper compliance by the Developer with the Developer's undertakings to the Municipality, and to ensure the proper performance of the work;

(ii) reject any design, material or work which is not in accordance with the Design Standards or accepted engineering and construction practices;

(iii) order that any unsatisfactory work be re-executed at the Developer's cost;

(iv) order the re-execution of any unsatisfactory design and the replacement of any unsatisfactory material, at the Developer's cost;

(v) order the Developer within a reasonable time to bring on the job and use additional labour, machinery and equipment, at the Developer's cost, as the Municipality deems reasonably necessary to the proper performance of the work;

(vi) order that the performance of the work or part thereof be stopped until the said orders can be obeyed;

(vii) order the testing of any road materials to be incorporated in the work and the testing of any Municipal Improvements;

and the Developer at its own cost and expense shall comply with the said orders and requirements of the Municipality unless the Developer takes issue with any such order or requirement, in which case the Developer shall request, in writing, that such issue be arbitrated in accordance with the provisions of Section 18 hereof; PROVIDED, that in no event shall the Developer be entitled to dispute nor arbitrate any decision made by the Municipality pursuant to clauses 4.3(b)(v), 4.3(b)(vi) or 4.3(b)(vii); AND PROVIDED FURTHER, that the affected work, except as otherwise agreed by the Municipality in writing, shall stop until such arbitration has taken place.

4.4 Notwithstanding anything expressed or implied in the preceding paragraph, it is agreed between the Municipality and the Developer:

(a) that the Municipality shall have no obligation or duty to exercise any of the Municipality's powers of inspection nor any obligation or duty to discover or advise the Developer of any deficiencies in construction or workmanship during the course of the construction and installation of the Municipal Improvements;

(b) that the Developer shall during the course of the construction and installation of the Municipal Improvements provide and maintain adequate inspection services, supervised by a professional engineer; and

(c) that nothing set forth in the preceding paragraph shall in any way be construed so as to relieve the Developer of any responsibilities as set forth in this Agreement, and without restricting the generality of the foregoing, the Developer shall fulfill all responsibilities in respect to the design, construction, installation and maintenance of the Municipal Improvements as required by the terms of this Agreement.

4.5 The Developer covenants and agrees that during the construction and installation of the Municipal Improvements, and during the Guarantee Period for the Municipal Improvements, that the Developer shall pay all contractors and other parties hired by the Developer to fulfill the Developer's obligations under this Agreement and that the failure of the Developer to pay any such contractors or other parties shall constitute a breach of this Agreement by the Developer unless there is a bona fide dispute between the Developer and the contractor or other party.

4.6 The Developer shall take effective measures to reasonably control dust and dirt in the Development Area, including, and without limiting the generality of the foregoing, on any loam stockpile site so that dust and dirt originating therein shall not be conveyed therefrom by any means whatsoever or cause annoyance or become a nuisance to property owners and others within or adjacent to the Development Area. The Developer is solely responsible for ensuring dust and dirt control within the Development Area. In the event, however, that the Municipality deems that there is dust or dirt problems the Municipality shall attempt to notify the Developer of the problem by telephoning the Developer, or the Developer's Consultant. If the Municipality is not able to contact the Developer, or the Developer's Consultant, or if the Developer, or the Developer's Consultant, shall fail to take effective measures to control the dust or dirt problem after being notified, then the Municipality may take such steps as are necessary to eliminate the dust or dirt problem at the expense of the Developer and shall within SEVENTY-TWO (72) hours notify the Developer in writing of the action taken by the Municipality.

4.7 Upon the completion of the work by the Developer, and prior to the issuance of Construction Completion Certificates for the Municipal Improvements, the Developer's Consultant shall submit to the Municipality a statement under his professional seal certifying that the Developer's Consultant has provided adequate periodic inspection services during the course of the work and that the Developer's Consultant is satisfied that the work has been completed in a good and workmanlike manner in accordance with the Plans; in accordance with accepted engineering and construction practices; and in accordance with the Design Standards.

4.8 It is understood and agreed between the Municipality and the Developer that during the course of constructing the Municipal Improvements, the re-execution or replacement of unsatisfactory work which is of a minor nature (as determined by the Municipality in its discretion) and which does not pose a health or safety danger, may be re-executed or replaced by the Developer, in its discretion, at any time prior to the request by the Developer for a Construction Completion Certificate for the Municipal Improvements in question.

4.9 Notwithstanding anything hereinbefore contained to the contrary, the Developer covenants and agrees (such covenant being of the essence of this Agreement) that it shall plan and stage the development of the Development Area so as to guarantee and ensure to the Municipality that all Essential Services shall have been installed and rendered operative in any part of the Development Area and Construction Completion Certificates are issued for the same before any buildings or facilities are occupied in any such part of the Development Area, except as otherwise permitted in writing by the Municipality.

5. USE OF PUBLIC PROPERTIES
IN THE PERFORMANCE OF THE WORK

5.1 The Municipality hereby grants to the Developer the right, permission and power to use, break-up, dig, trench, or excavate in the public highways, streets, roads, lanes, boulevards, parks and similar Public Places under the control of the Municipality, within or adjacent to the Development Area, and otherwise to do such work therein and thereon as may be necessary from time to time to construct, develop, erect, lay, operate, maintain, repair, extend, relay and remove any Municipal Improvements forming part of the work of the Developer, as may be necessary for the purpose of this Agreement, PROVIDED:

(a) That not less than fourteen (14) days prior to the date that the Developer intends to enter upon any Public Property (except in the case of emergency repair work) the Developer shall provide to the Municipality detailed written proposals, for approval by the Municipality, for the work to be done within any such property, including:

(i) a specific work schedule and procedures proposed to be followed;

(ii) provisions to be implemented for temporary access and services;

(iii) installation of temporary traffic control devices and personnel deployment to minimize traffic disruption;

(iv) form and schedule of notification and public relation strategy to be utilized.

(b) No such work shall be commenced prior to the Developer obtaining the written consent of the Municipality to enter upon such Public Properties; and the Municipality shall not unreasonably delay or withhold such written consent;

(c) That the work within Public Properties by the Developer and its agents, contractors and subcontractors shall be subject to the inspection rights of the Municipality as set forth in this Agreement and all directions and requirements of the Municipality shall be obeyed;

(d) That the Developer shall do as little damage as possible in the performance of such work, and will cause as little obstruction to such Public Properties as possible;

(e) That upon completion of such work the Developer shall restore all such Public Properties to a condition and state of repair equivalent to that which prevailed prior to the performance of such work, including, where necessary, the re-planting or replacement of trees and shrubs, and shall maintain such restored portions of such Public Properties, including such replaced or re-planted trees and shrubs, for a period of TWO (2) years thereafter, ordinary wear and tear excepted;

(f) That the restoration of Public Properties shall be part of the Municipal Improvements to be constructed and installed by the Developer and the Developer shall be required to obtain Construction Completion Certificates and Final Acceptance Certificates for the restoration work;

(g) That the Developer shall indemnify and save harmless the Municipality from and against all losses, costs, claims, suits or demands of any nature (including all legal costs and disbursements on a solicitor and client basis) which may arise by reason of the performance of work by the Developer.

6. INSTALLATION OF OTHER UTILITIES

6.1 The Developer shall at its own expense be solely responsible for all costs and expenses relating to the installation, to the Municipality's satisfaction, of electric power and natural gas to the Development Area.

6.2 The said electric power and natural gas within the Development Area shall be installed within the roadways, utility lots or easement areas, in accordance with the Plans.

6.3 The Developer shall be responsible for making arrangements with Telus for the provision of telephone services to the Development Area and the Developer shall be solely responsible for all costs and expenses relating to the installation of such telephone services excepting the normal hook-up costs charged to the customer.

7. CONTRACTS FOR INSTALLATION OF THE MUNICIPAL IMPROVEMENTS

7.1 Notwithstanding anything contained in this Section, the Developer acknowledges, understands and agrees that the Developer shall be fully responsible to the Municipality for the performance by the Developer of all the Developer's obligations as set forth in this Agreement; AND FURTHER the Developer acknowledges, understands and agrees that the Municipality shall not be obligated in any circumstances whatsoever to commence or prosecute any claim, demand, action or remedy whatsoever against any person with whom the Developer may contract for the performance of the Developer's obligations.

7.2 The Developer covenants and agrees that any contract entered into between the Developer and a Third Party in respect to the performance of all or any of the Developer's obligations as set out in this Agreement to construct and maintain the Municipal Improvements, or any of them, shall provide:

(a) That the Third Party shall indemnify and save harmless the Municipality and the Developer from and with respect to any damages, claims or demands whatsoever (including all legal costs and disbursements on a solicitor and client basis) arising out of the performance of any work undertaken by the Third Party or arising in any way from the negligence of the Third Party's servants, agents or employees;

(b) That the Third Party shall provide reasonable proof of financial responsibility;

(c) That the Third Party shall comply with the provisions of the Workers Compensation Act for the Province of Alberta;

(d) That the Third Party will allow the Municipality access to the work for the purpose of inspection;

(e) That the works to be performed by the Third Party shall not be deemed to be duly and adequately completed under the contract except upon the issuance of a Construction Completion Certificate for the same by the Municipality;

(f) The Third Party shall coordinate with the Municipality work forces and others to facilitate the installation of utilities and shall protect such utilities from damage;

(g) That the Third Party will carry adequate public liability insurance of an amount and coverage satisfactory to the Municipality to protect the Third Party and the Municipality from any claims, actions or demands arising from the pursuance or purported pursuance of the work being performed by such Third Party.

8. COMPLIANCE WITH ALL PLANS AND SPECIFICATIONS

8.1 The Developer shall, at all times during the construction and installation of the Municipal Improvements comply fully with all terms, conditions, provisions, covenants and details as may be set out in the Plans, as approved by the Municipality, and such terms and conditions as may otherwise be required pursuant to this Agreement or be agreed upon in writing between the Municipality and the Developer.

8.2 The provisions of this Agreement shall be additional to and not in substitution for any law, whether Federal, Provincial or Municipal, prescribing requirements relating to construction standards and the granting of development, building and occupancy permits.

9. ACCEPTANCE OF MUNICIPAL IMPROVEMENTS:
TRANSFER OF MUNICIPAL IMPROVEMENTS TO MUNICIPALITY

9.1 For purposes of this Section, the Municipality and the Developer agree that no Municipal Improvement shall be considered complete unless and until:

(a) the Municipal Improvement has been fully constructed and installed in accordance with the approved Plans;

(b) the Municipal Improvement has been constructed and installed in accordance with the Design Standards and accepted engineering and constructed practices;

(c) all testing has been completed and the results approved by the Municipality;

(d) all easements, utility rights-of-way and restrictive covenants have been registered in a form acceptable to the Municipality;

(e) all Public Properties which have been disturbed or damaged have been fully restored by the Developer;

(f) the Municipal Improvement is suitable for the purpose intended.

9.2 When the Developer claims that the Municipal Improvements of the Development Area have been constructed and installed in accordance with the requirements of this Agreement, then the Developer shall give notice in writing of such claimed completion to the Municipality.

9.3 Within SIXTY (60) days of receipt of such claim of completion, the Municipality will notify the Developer in writing of its acceptance (by the issuance of a Construction Completion Certificate) or rejection of the Municipal Improvements so completed.

9.4 Notwithstanding the preceding paragraph, the Municipality may give notice to the Developer of the Municipality's inability to conduct an inspection within the said SIXTY (60) days due to adverse site or weather conditions, and in such an event the time limit for such an inspection shall be extended until SIXTY (60) days following the elimination of such adverse site or weather conditions.

9.5 It is understood and agreed between the Developer and the Municipality that the notices required under paragraphs 9.2 and 9.3 shall be given only between the Municipality and the Developer and in no event shall either the Municipality or the Developer give such notices through any contractor or sub-trade which may be engaged by the Developer in the construction of the Municipal Improvements.

9.6 In the event that any inspection contemplated in paragraph 9.3 or 9.4 reveals any deficiencies (ordinary wear and tear excepted) in relation to a particular Municipal Improvement, the Municipality may refuse to issue a Construction Completion Certificate for the Municipal Improvement and require the Developer to repair or replace the whole or any portion of any such Municipal Improvements; PROVIDED, that upon completion of the repairs or

replacement required to correct any such deficiencies, the Developer may request a further inspection and issuance of a Construction Completion Certificate.

9.7 It is understood and agreed between the Developer and the Municipality that the Municipality shall be at liberty in its sole discretion to issue a written conditional Construction Completion Certificate for the Municipal Improvements and such Certificate shall be conditional upon the completion of minor deficiencies by the Developer within a time specified by the Municipality; PROVIDED, that the commencement of the Guarantee Period in relation to any such deficiency, if rectified within THIRTY (30) days, shall be back-dated to the date of the said conditional Construction Completion Certificate; AND PROVIDED FURTHER, that the Guarantee Period in relation to any such deficiency, if not rectified within the said THIRTY (30) days, shall not commence until such time as such deficiency has been rectified by the Developer and received acceptance of the Municipality in accordance with this Agreement.

9.8 Not more than NINETY (90) days nor less than SIXTY (60) days prior to the expiration of any Guarantee Period for the Municipal Improvements or any portion the Developer shall give notice to the Municipality of expiration of the Guarantee Period for the Municipal Improvements and the Developer shall request a Final Acceptance in respect to the Municipal Improvements.

9.9 Within SIXTY (60) days of the receipt by the Municipality of a request for a Final Acceptance, the Municipality shall undertake an inspection of the Municipal Improvements and the Municipality shall within the said SIXTY (60) days advise the Developer in writing of any deficiencies (ordinary wear and tear excepted) in relation to the Municipal Improvements; PROVIDED, that the provisions of paragraph 9.4 shall also apply to any request for the issuance of a Final Acceptance Certificate.

9.10 In the event that any inspection contemplated in paragraph 9.9 reveals any deficiencies (ordinary wear and tear excepted) in relation to a particular Municipal Improvement the Municipality may refuse to issue the Final Acceptance of the Municipal Improvements and require the Developer to repair or replace the whole or any portion of any such Municipal Improvements; PROVIDED, that upon completion of the repairs or replacement required to correct any such deficiencies, the Developer may request that a further inspection and issuance of a Final Acceptance Certificate.

9.11 In the event that any inspection contemplated in paragraph 9.9 reveals that there are no deficiencies in relation to the Municipal Improvements, the Municipality shall issue in writing its Final Acceptance Certificate for the Municipal Improvements.

9.12 It is understood between the Municipality and the Developer that the Municipality shall be at liberty to issue a conditional Final Acceptance for the Municipal Improvements and such acceptance shall be conditional upon the completion of minor deficiencies by the Developer within THIRTY (30) days.

9.13 Upon the issuance of a Construction Completion Certificate by the Municipality for the Municipal Improvements, the Developer hereby acknowledges that all right, title and interest in the Municipal Improvements (excluding facilities owned by private utility companies) located on or under Public Properties (including utility rights-of-way and easement areas) vests in the Municipality without any cost or expense to the Municipality therefore, and the Municipal Improvements shall become the property of the Municipality.

9.14 Notwithstanding anything contained in this Agreement to the contrary, the Developer acknowledges and agrees that the Guarantee Period for the Municipal Improvements shall not expire before the issuance of a Final Acceptance Certificate for the Municipal Improvements by the Municipality to the Developer; PROVIDED, that in the event that either party refers to arbitration the Developer's right to the issuance of a Final Acceptance Certificate for the Municipal Improvement, the arbitrator shall, in accordance with the terms of this Agreement, determine the date upon which any such Final Acceptance Certificate is to be effective.

9.15 Following the issuance of a Construction Completion Certificate for the Municipal Improvements, the Municipality agrees that it shall assume the normal operation and maintenance (excluding repairs or matters arising from inadequate or deficient design or construction) of the Municipal Improvements excluding landscaping, fencing and facilities owned by private utility companies.

10. MAINTENANCE OF MUNICIPAL IMPROVEMENTS BY DEVELOPER

10.1 The Guarantee Period in respect to any of the Municipal Improvements shall commence with the Municipality's written Construction Completion Certificate for any such Municipal Improvements in good condition and repair (ordinary wear and tear excepted), and the Developer shall subject to Paragraph 9.15repair or replace the whole or any portion thereof during such Guarantee Period where such repair or replacement is required, as determined by the Municipality, as a result of any cause other than the neglect by the Municipality, its servants, agents or contractors in the use and operation thereof.

10.2 The Developer acknowledges and agrees that prior to the issuance of a Final Acceptance Certificate for any landscaping work, the Municipality shall be entitled to require the Developer to replace any grass which may have died or failed to achieve proper growth, as determined by the Municipality in its discretion.

10.3 The Developer covenants that it shall fully comply with the Design Standards and accepted engineering and construction practices, in undertaking and completing the repair or replacement of any of the Municipal Improvements pursuant to the requirements of this Section.

10.4 The Developer agrees that in the event of any emergency arising during the Guarantee Period, the Municipality being the sole judge of what constitutes an emergency, then the Municipality shall have the right in its discretion to undertake any repair or remedial work to the Municipal Improvements deemed necessary or appropriate by the Municipality and all costs and expenses incurred by the Municipality in that regard shall be paid by the Developer to the Municipality upon demand.

10.5 The Developer covenants and agrees that in the event that the Municipality is of the opinion that any repair or replacement required during the Guarantee Period is of a major nature, the Municipality shall be entitled, in its discretion, to require a further full Guarantee Period for the particular Municipal Improvement, or portion thereof, and such further Guarantee Period shall commence upon the Municipality issuing a Construction Completion Certificate for the repair or replacement work.

11. UTILITY EASEMENTS AND OTHER INSTRUMENTS

11.1 The Plans, as approved by the Municipality, shall designate rights-of-way of widths adequate to the needs of the Municipality and utility companies, for the construction and installation of Municipal Improvements and services, natural gas, power, and telephone service to the Development Area, and for storm drainage systems, and shall be of a width and in such locations as required by the Municipality.

11.2 Upon registration of a Plan of Subdivision, the Developer shall grant to the Municipality easements or utility rights-of-way for such purposes and shall register or cause to be registered such easements or utility rights-of-way contemporaneously with the registration of the Plan of Subdivision.

11.3 The Developer shall provide to the Municipality proof of the registration of all easements and utility rights-of-way required by the Municipality.

11.4 The Developer agrees that the easements and utility rights-of-way shall be in a form acceptable to the Municipality and shall be a first charge (excepting other easements and utility rights-of-way) and that the Developer shall obtain and register postponements of all liens, charges and encumbrances in favour of the easements.

11.5 Such easements or utility rights-of-way shall provide that the Municipality shall have the right either:

(a) to assign all or any parts of the rights thereby granted to operators of the respective utilities; or

(b) to grant permits or licenses to install, repair and replace gas, power and telephone lines, and all drainage systems.

11.6 The Developer covenants that it shall register or cause to be registered against the Development Area or other lands controlled by the Developer, in a form acceptable to the Municipality, restrictive covenants and other instruments which are required by any subdivision approval for the Development Area or otherwise required under the terms of this Agreement.

12. MUNICIPAL SERVICES

12.1 Upon issuance of Construction Completion Certificates for all Municipal Improvements required under this Agreement, the Municipality will provide thereto, as required, subject to the terms of this Agreement all municipal services which are normally supplied to all other similar parts of the Municipality and to the same standards and costs, subject to such limitations that may be imposed by reason of the progress of the Developer's work or the availability of such services.

13. MAINTENANCE OF BOULEVARDS AND OTHER PUBLIC AREAS

13.1 The Developer covenants and agrees that it shall, at the Developer's own cost and expense, be responsible for the cleanup and removal of all construction debris, foreign material and dirt from all Public Properties, including roadways, within and adjacent to the Development Area, subject to the following conditions:

(a) it shall be the responsibility of the Developer to monitor the condition of Public Properties and take immediate action as necessary to comply with the provisions of this paragraph;

(b) in the event that the Municipality considers that any cleanup or removal of construction debris, foreign material or dirt is required, the Developer shall, within FORTY-EIGHT (48) hours of receiving notice from the Municipality, take all necessary action as determined by the Municipality, failing which, the Municipality may take action and charge back all costs and expenses to the Developer;

(c) the Developer's obligations under this paragraph shall cease and determine when the Construction Completion Certificate has been issued.

13.2 The Municipality shall assume the normal maintenance of all other Public Properties which have been seeded to grass, such as parks, buffer strips, and the like, after satisfactory germination and establishment of grass sown by the Developer on such Public Properties, and after the expiration of the Guarantee Period.

14. LEVIES AND FEES

14.1 The Developer agrees that the Development Area will benefit from water and sewer facilities which will be utilized to provide municipal services to the Development Area, and accordingly, the Developer covenants and agrees to pay to the Municipality an off-site levy specified in Schedule “E”.

14.2 The Developer agrees to pay a $500.00 Development Agreement Fee as per the Municipalities fee schedule as adopted by Council.

15. INTEREST ON MONIES OWED TO MUNICIPALITY

15.1 Except as otherwise specifically provided in this Agreement, all sums or monies owed by the Developer to the Municipality shall bear interest calculated semi-annually and calculated from the date upon which such sum or monies are due and payable and such interest shall be calculated at a rate per annum equal to the Prime Rate plus TWO (2%) per cent and such interest rate shall be adjusted from time to time in accordance with any change to the Prime Rate.

15.2 In the event that the Municipality, pursuant to this Agreement, is holding any monies, for the purposes of security, belonging to the Developer, the Municipality shall invest such monies and upon the Municipality returning such monies, the Developer shall be entitled to both the principal amount and interest thereon at the Prime Rate less TWO (2%) percent (less any amounts lawfully owing from the Developer to the Municipality).

15.3 For purposes of calculating interest under paragraphs 15.1 and 15.2, the Prime Rate established on the first business day of a particular month shall be utilized and shall be deemed to be the Prime Rate for that entire month.

16. AMOUNTS PAYABLE UNDER THIS AGREEMENT

16.1 The Developer acknowledges and agrees that the Municipality and the Developer are properly and legally entitled to make provision in this Agreement, for the purposes specified herein, for the payment by the Developer to the Municipality of the various sums prescribed in this Agreement, AND FURTHER:

(a) The Developer acknowledges and agrees that the Agreement by the Developer to pay the said sums is an inducement offered by the Developer to the Municipality to enter into this Agreement;

(b) The Developer acknowledges that the Municipality has agreed to enter into this Agreement on the representation and agreement by the Developer to pay to the Municipality the sums specified in this Agreement;

(c) The Developer agrees that the Municipality is fully entitled in law to recover from the Developer the sums specified in this Agreement;

(d) The Developer hereby waives for itself and its successors and assigns any and all rights, defences, actions, causes of action, claims, demands, suits and proceedings of any nature or kind whatsoever, which the Developer has, or hereafter may have, against the Municipality in respect to the Developer's refusal to pay the sums specified in this Agreement;

(e) The Developer for itself and its successors and assigns hereby releases and forever discharges the Municipality from all actions, claims, demands, suits and proceedings of any nature or kind whatsoever which the Developer has, or may hereinafter have, if any, against the Municipality in respect to any right or claim, if any, for the refund or repayment of any sums paid by the Developer to the Municipality pursuant to this Agreement.

16.2 The Municipality and the Developer agree that any amounts of money presently or hereafter owing by the Developer to the Municipality pursuant to the provisions of this Agreement, whether by way of a liquidated or unliquidated claim, and howsoever arising, shall be a charge and encumbrance against lands consisting of the Development Area, and further, that the Municipality shall be entitled to recover any such monies owing, together with all costs on a solicitor and client basis, by enforcing the charge and encumbrance against the lands consisting of the Development Area.

17. DEFAULT BY THE DEVELOPER

17.1 The Developer covenants and agrees that it shall abide by the terms of the Agreement of Purchase and Sale entered into between the parties relating to the Development Area and that a default under that Agreement would allow the Municipality to terminate this Agreement. Termination of this Agreement would be effective upon the Municipality serving written notice upon the Developer. In the event that the Municipality terminates this Agreement, it is understood and agreed that any financial obligations of the Developer to the Municipality shall survive and the Municipality shall be entitled to enforce such financial obligations as if this Agreement remained in full force and effect.

17.2 In the event that the Municipality claims that the Developer is in default in the observance and performance of any of the terms, covenants or conditions of this Agreement, the Municipality may give the Developer THIRTY (30) days notice in writing of such claimed default and requiring the Developer to rectify same within the said period of THIRTY (30) days.

17.3 If the Developer denies that it is in default as claimed in such notice, the Developer shall within TEN (10) days of receipt of such notice request a reference to arbitration pursuant to the provisions of Section 18 hereof. If the

Arbitrator confirms the claimed default, the Developer shall, notwithstanding the provisions of paragraph 17.1, have a period of THIRTY (30) days from the receipt of the arbitration ruling within which to rectify such default.

17.4 The Developer agrees that in the event that the Municipality has given the Developer written notice of default and the Developer does not, within TEN (10) days of receipt of the written notice, dispute that it is in default, then the Developer shall conclusively be deemed to have acknowledged the default.

17.5 Notwithstanding anything to the contrary herein, in the event that the Municipality, in its discretion, considers it necessary to undertake any immediate work in connection with the construction, installation or repair of the Municipal Improvements in a situation which the Municipality considers to be an emergency, the Municipality shall immediately notify the Developer of such situation and shall be entitled to then cause such work to be done; PROVIDED, that upon completion of said emergency work, the Municipality shall give notice in writing to the Developer if the Municipality claims that such repair work was made necessary by reason of a default on the part of the Developer in the observance or performance of the terms, covenants and conditions of this Agreement, and if the Developer denies the claimed default, it shall within TEN (10) days request a reference to arbitration pursuant to the provisions of Section 18 hereof.

17.6 The Developer agrees that the Municipality shall, for purposes of undertaking any emergency work, have free and uninterrupted access to all portions of the Development Area and any other areas under the control of the Developer and that the Municipality shall not be hindered nor restricted in any manner whatsoever in obtaining or exercising such right of access.

17.7 The decision of the Arbitrator in any reference respecting a claimed default on the part of the Developer shall be final and binding upon the Municipality and the Developer.

17.8 The Municipality and the Developer agree that any rights and remedies available to the Municipality whether specified in this Agreement or otherwise available at law, are cumulative and not alternative and the Municipality shall be entitled to enforce any right or remedy in any manner the Municipality deems appropriate in its discretion without prejudicing or waiving any other right or remedy otherwise available to the Municipality.

18. ARBITRATION

18.1 Subject to any other provisions of this Agreement to the contrary, if any dispute or difference between the Parties shall arise under this Agreement, either party may give to the other notice of such dispute or difference and refer such dispute or difference to arbitration in accordance with the provisions of this Agreement.

18.2 Arbitration hereunder shall be by a reference to an independent person to be selected jointly by the Municipality and the Developer, and his decision shall be final and binding. In the event that the Municipality and the Developer shall fail to agree on an arbitrator within FORTY-EIGHT (48) hours of either party giving to the other party notice of a dispute or difference pursuant to paragraph 20.1 hereof, then an application shall be made to a Justice of the Court of Queen's Bench of Alberta to select the arbitrator.

18.3 All charges, fees and expenses of the arbitrator shall be borne and paid by the Municipality or the Developer, or proportionately by both the Municipality and the Developer, depending upon their respective fault as found by the arbitrator.

18.4 Nothing in this Agreement shall authorize any reference to arbitration as to any matter or question which under this Agreement is expressly or by implication required or permitted to be decided by the Municipality, the Committee of the Whole or the Council of the Municipality or as to the grounds upon which, or the mode in which, any opinion may have been formed or discretion exercised by the Municipality, the Committee of the Whole or the Council of the Municipality. In any such instance the discretion, decision, opinion or determination of the Municipality, the Committee of the Whole or the Council of the Municipality, as the case may be, shall be final and binding upon the Developer.

19. INDEMNITY AND SECURITY

19.1 The Developer shall indemnify and save harmless the Municipality from any and all losses, costs, damages, actions, causes of action, suits, claims and demands resulting from anything done or omitted to be done by the Developer in pursuance or purported pursuance of this Agreement.

19.2 The Developer covenants and agrees that it shall carry comprehensive liability insurance and that the following provisions shall apply to such insurance:

(a) the Municipality shall be a named insured in all public liability policies;

(b) all policies shall provide that an event of default on the part of the Developer, its servants or agents, shall not be an event of default on the part of the Municipality;

(c) none of the policies shall be cancelled unless THIRTY (30) days prior written notice of cancellation is first given to the Municipality;

(d) copies of all policies of insurance shall immediately be provided to the Municipality upon written request by the Municipality;

(e) the insurance policies shall have the following minimum limits of coverage:

(i) Public Liability or Property Damage - Bodily Injury - each person TWO MILLION ($2,000,000.00) DOLLARS; each accident FOUR MILLION ($4,000,000.00) DOLLARS - Property Damage (aggregate) each accident FIVE HUNDRED THOUSAND ($500,000.00) DOLLARS;

(ii) Automobile Public Liability and Third Party Property Damage - Owned and Non-Owned Vehicles – Bodily Injury - each person TWO MILLION ($2,000,000.00) DOLLARS; each accident FOUR MILLION ($4,000,000.00) DOLLARS - Property Damage, each accident FIVE HUNDRED THOUSAND ($500,000.00) DOLLARS.

19.3 In order to ensure to the Municipality full compliance by the Developer with the terms, covenants and conditions of this Agreement, the Developer hereby covenants and agrees that it shall deliver and deposit with the Municipality security in the form hereinafter prescribed and that the following provisions shall apply to determining the amount of the security and the time or times at which the security shall be deposited with the Municipality:

(a) the security shall be deposited by the Developer with the Municipality upon the execution of this Agreement;

(b) the security shall be an amount equal to the sum of the following amounts:

(i) FIFTY(50%) percent of the estimated costs of constructing and installing all of the Municipal Improvements;

(ii) such other amounts as are required elsewhere under the provisions of this Agreement;

(c) for purposes of this paragraph 21.3, the estimated cost for the Municipal Improvements shall be determined as follows:

(i) where actual tendered costs are available, the tendered costs shall be used;

(ii) where actual tendered costs are not available, the Developer's Consultant shall prepare cost estimates which shall be submitted to the Municipality for approval, and if approved by the Municipality, such cost estimates shall be used.

19.4 It is understood and agreed by the Developer that the Developer shall, during the currency of this Agreement (including the Guarantee Period for the Municipal Improvements prescribed by this Agreement), maintain in full force and effect all security and liability insurance prescribed herein.

19.5 The said security as above referred to shall consist of an Irrevocable Letter of Credit issued by a Chartered Bank or the Treasury Branch, or a Performance Bond and Maintenance Bond, or such other security as may be approved by the solicitors for the Municipality; PROVIDED, that all security shall be in terms and form to be approved by the Municipality's solicitors.

19.6 Any Irrevocable Letter of Credit provided as security by the Developer shall contain a covenant by the issuer that if the issuer has not received a release from the Municipality THIRTY (30)days prior to the expiry date of the security, then the security shall automatically be renewed, upon the same terms and conditions, for a further period of ONE (1) year.

19.7 Any security or insurance herein required to be deposited by the Developer may be required to be increased or decreased by the Municipality upon written notice to the Developer at any time during the currency of this Agreement if it shall appear to the Municipality in its discretion that the security or insurance deposited is excessive or insufficient in relation to the costs or protection to the Municipality, for which security or insurance has been provided.

19.8 The amount of security and insurance to be provided by the Developer to the Municipality may, in the sole and absolute discretion of the Municipality, be reduced on application by the Developer upon the Developer having received a Construction Completion Certificate or Final Acceptance Certificate for the Municipal Improvements or any of them, so completed; PROVIDED, that, after the issuance of any Construction Completion Certificates and prior to the issuance of Final Acceptance Certificates for all of the Municipal Improvements, the security shall not be less than FIFTEEN (15%) percent of the estimated costs of the Municipal Improvements.

19.9 In the event that the Municipality is of the opinion that:

(a) a default by the Developer has not been rectified by the Developer in accordance with the provisions of this Agreement.

(b) a default by the Developer has been rectified by the Municipality in accordance with the provisions of this Agreement and the Developer has failed to pay the costs and expenses of such rectification within THIRTY (30) days after receipt from the Municipality of an account therefor;

(c) emergency repair work has been done to Municipal Improvements by the Municipality in accordance with the provisions of this Agreement and the Developer fails to pay the costs and expenses of such repair work within THIRTY (30) days after receipt from the Municipality of an account therefor;

(d) the Developer by any act or omission is in default of any term, condition or covenant of this Agreement;

(e) the security to be provided by the Developer to the Municipality pursuant to this Agreement is due to expire within a period of SIXTY (60) days and the Developer has not deposited with the Municipality a renewal or replacement of such security in terms and form acceptable to the Municipality's solicitors;

the Municipality may invoke the provisions of this Section, and make demands as payee and beneficiary under the Irrevocable Letter of Credit provided by the Developer to the Municipality pursuant to the requirements of this Agreement.

19.10 In the event that the Municipality has negotiated or called upon the security to be deposited by the Developer with the Municipality in circumstances where the said security was due to expire within the said SIXTY (60) day period, then the Municipality shall be entitled to hold any funds thereby obtained in lieu of the security which has been negotiated or called upon.

19.11 In the event that the Municipality has negotiated or called upon the security to be deposited by the Developer with the Municipality, the Municipality may, at its option and discretion, use any funds thereby obtained in any manner the Municipality deems fit to discharge the obligations of the Developer pursuant to this Agreement.

20. DELIVERY OF DOCUMENTS TO MUNICIPALITY

20.1 Prior to the issuance of a Construction Completion Certificate for the above ground Municipal Improvements, the Developer shall, in addition to the requirements specified elsewhere in this Section, deliver to the Municipality all other documentation and information relating to the development of the Development Area which the Municipality considers, in its discretion, necessary or desirable for the delivery of municipal services to the Development Area and the Developer agrees that not less than thirty (30) days prior to its application for a Construction Completion Certificate for the above ground Municipal Improvements that the Developer shall request from the Municipality a list of all documents and information required by the Municipality.

20.2 Forthwith upon the completion of the construction and installation of the Municipal Improvements and the issuance of a Construction Completion Certificate for the same by the Municipality, the Developer shall, not later than SIX (6) months prior to the expiration of the Guarantee Period, deliver to the Municipality all inspection and testing records and "as built" Plans and records, as herein required, in a form and to standards specified by the Municipality which may include paper form, reproducible mylar, video tapes, computer records or design, or any other form required by the Municipality. The Final Acceptance Certificate shall not be issued until SIX (6) months have elapsed subsequent to the date of the submission of the records and the as built drawings; AND PROVIDED, that the Final Acceptance Certificate shall not be issued prior to the expiration of the Guarantee Period.

21. COMPLIANCE WITH LAW

21.1 The Developer shall at all times comply with all legislation, regulations and municipal bylaws and resolutions relating to the development of the Development Area by the Developer.

21.2 This Agreement does not constitute approval of any subdivision and is not a development permit, building permit or other permit granted by the Municipality, and it is understood and agreed that the Developer shall obtain all approvals and permits which may be required by the Municipality or any governmental authority.

21.3 Where anything provided for herein cannot lawfully be done without the approval or permission of any authority, person or board, the rights or obligations to do it do not come into force until such approval or permission is obtained; PROVIDED, that the parties will do all things necessary by way of application or otherwise in an effort to obtain such approval or permission.

21.4 If any provision hereof is contrary to law, the same shall be severed and the remainder of this Agreement shall be of full force and effect.

22. GENERAL

22.1 The validity and interpretation of this Agreement and of each clause and part hereof shall be governed by the laws of the Province of Alberta.

22.2 The parties to this Agreement shall execute and deliver all further documents and assurances necessary to give effect to this Agreement and to discharge the respective obligations of the parties.

22.3 A waiver by either party hereto of the strict performance by the other of any covenant or provision of this Agreement shall not, of itself, constitute a waiver of any subsequent breach of such covenant or provision or any other covenant or provision of this Agreement.

22.4 Whenever under the provisions of this Agreement any notice, demand or request is required to be given by either party to the other, such notice, demand or request may be given by delivery by hand to, or by registered mail sent to, the respective addresses of the parties being:

The Town of High Level
9813 – 102 Street
High Level, AB, T0H 1Z0
Fax: (780) 926-2899

AND

Developer

PROVIDED, HOWEVER, that such addresses may be changed upon TEN (10) days notice; AND PROVIDED, FURTHER, that if in the event that notice is to be served at a time when there is an actual or anticipated interruption of mail service affecting the delivery of such mail, the notice shall not be mailed but shall be delivered by hand.

22.5 The Developer covenants and agrees that in addition to the provisions contained in the text of this Agreement, the Developer shall be bound by the additional provisions found in Schedule "D" of this Agreement as if the provisions of Schedule "D" were contained in the text of this Agreement.

22.6 The Developer acknowledges and agrees that the Municipality shall be at liberty, pursuant to the Municipal Government Act (Alberta), upon the execution of this Agreement, to file at the Land Titles Office for the North Alberta Land Registration District a caveat against the Development Area for purposes of protecting the Municipality's interests and rights pursuant to this Agreement.

22.7 This Agreement shall not be assignable by the Developer without the express written approval of the Municipality. Such approval shall be subject to paragraph 22.8and may be withheld by the Municipality in its discretion.

22.8 It is understood between the Municipality and the Developer that no assignment of this Agreement by the Developer shall be permitted by the Municipality unless and until:

(a) The proposed assignee enters into a further agreement with the Municipality whereby such assignee undertakes to assume and perform all of the obligations and responsibilities of the Developer as set forth in this Agreement;

(b) The proposed assignee has deposited with the Municipality all insurance and security as required by the terms of this Agreement.

22.9 Time shall in all respects be of the essence in this Agreement.

23. EXECUTION OF AGREEMENT

23.1 The Developer hereby acknowledges that it is hereby executing this Agreement having been given the full opportunity to review the same and seek proper and independent legal advice and that the Developer is executing this Agreement freely and voluntarily and of its own accord without any duress or coercion whatsoever and that the Developer is fully aware of the terms, conditions and covenants contained herein and the legal effects thereof.

IN WITNESS WHEREOF the parties hereto have affixed their corporate seals, duly attested by the hands of their respective proper officers in that behalf, as of the day and year first above written.

Town of High Level

Per:_____

Per:_____

_____ Ltd.

Per:_____

Per:_____

SCHEDULE "A" - LEGAL DESCRIPTION OF LANDS

TOWN OF HIGH LEVEL
PART OF
PLAN
CONTAINING: _____ HECTARES, MORE OR LESS
EXCEPTING THEREOUT ALL MINES AND MINERALS
AND THE RIGHT TO WORK SAME

SCHEDULE "B" - THE DEVELOPMENT AREA

SCHEDULE "C" - MUNICIPAL IMPROVEMENTS

Municipal Improvements shall mean and include the following to be constructed in and adjacent to the Development Area.

(a) All sanitary sewer systems including holding tanks, service lines, mains and appurtenances; and

(b) All drainage systems, including storm sewers, storm sewer connections, provisions for weeping tile flow where a high water table or other subsurface conditions cause continuous flow in the weeping tile, storm retention ponds and associated works, all as and where required by the Municipality; and

(c) All water wells, pumps and lines, including all fittings, valves, and hydrants and looping as required by the Municipality, in order to safeguard and ensure the continuous and safe supply of water in the Development Area; and

(d) All concrete curbs, gutters, sidewalks and sub-grade, base and asphaltic pavement; and

(e) All lighting systems for streets, walkways, parking areas and Public Properties as and where required by the Municipality; and

(f) Such electrical conduit as may be required by the Municipality for the installation of traffic control signals and traffic control devices; and

(g) All traffic signs, street signs, development identification signs, zoning signs, and directional signs, berming and noise attenuation devices all as and where required by the Municipality; and

(h) All walkway systems, parks and landscaping on both private property and Public Property which are to be constructed and installed to the satisfaction of the Municipality, and in accordance with the landscaping Plan to be submitted for the approval of the Municipality; and

(i) Such construction or development of streets and lanes as may be required by the Municipality; including, but in no manner limited to, a second or temporary access for vehicular traffic from the Development Area; and

(j) The restoration of all Public Properties to the Municipality's satisfaction which are disturbed or damaged in the course of the Developer's work; and

(k) The relocation, to the Municipality's satisfaction, of all existing utilities and Municipal Improvements as required by the Municipality as a result of the installation and construction of other utilities and Municipal Improvements pursuant to this Agreement; and

(l) The establishment, or re-establishment, of any survey monuments or iron posts (including pins on individual lots) as and where and when required by the Municipality throughout and adjacent to the Development Area; and

(m) Public information signs, of a size and location to be approved by the Municipality, and to contain such public information regarding the completion of services and the completion of the construction of other facilities as may be required by the Municipality in order to provide proper and complete and up to date information to proposed purchasers and residents within the Development Area; and

(n) Such uniform fencing, (noise attenuation, or screen) either permanent or temporary, of a standard and of a design satisfactory to the Municipality, all of which is to be constructed and located to the satisfaction of the Municipality; and

(o) All utilities including electricity, cable television, natural gas and telephone. Such utilities to be provided in a location and a standard to be approved by the appropriate utility company and the Municipality.

(a)

SCHEDULE "D" - ADDITIONAL PROVISIONS

1. For further clarification it is agreed that the Plans for the Municipal Improvements shall include the following:

SCHEDULE "E" - LEVIES AND FEES

I. Offsite Levy

The Developer agrees to pay an off-site levies pursuant to Bylaw 673-97 or as amended or replaced;

SCHEDULE "F" - SECURITY

1. For purposes of calculating the security required to be deposited by the Developer pursuant to Section19, and subject to the provisions below, the cost estimates for the construction and installation of the Municipal Improvements are as follows:

Underground Improvements

Water Lines	$
Sewer Lines	$
Engineering and Contingency	$
Underground Subtotal	$

*Surface Improvements

Earthworks	$
Drainage Systems	$
Granular Base	$
Asphalt	$
Landscaping	$
Engineering and Contingency	$
Above Ground Subtotal	$

Total Value of all Municipal Improvements & Services	$

2. In the event that any of the costs for the construction and installation of the Municipal Improvements for the Development Area, as set out above, are estimates, and in the further event that actual tendered costs become available prior to the Developer commencing the construction and installation of the Municipal Improvements, THEN, the estimated costs set out above shall be adjusted in accordance with paragraph19.3.

DEVELOPMENT AGREEMENT

_____

BETWEEN:

The Town of High Level

AND

_____ Ltd.

_____

Subdivision:
Stage: Single Stage Development
File: Subdivision-
January 21, 2015

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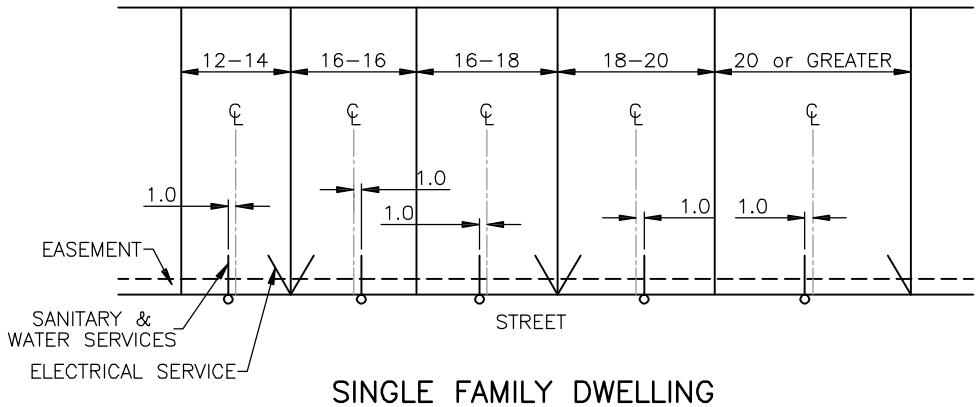
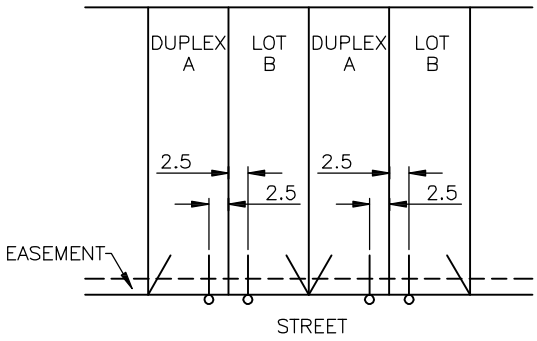
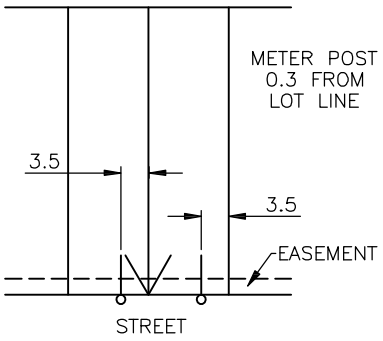


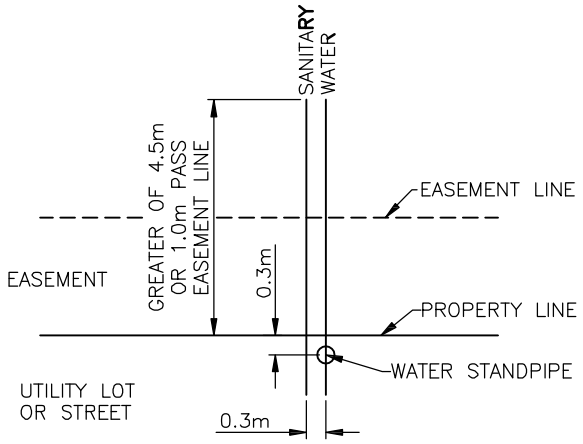
SINGLE FAMILY DWELLING



DUPLEX



MANUFACTURED
HOME



SERVICE DETAIL

LEGEND

SANITARY SEWER & WATER SERVICE

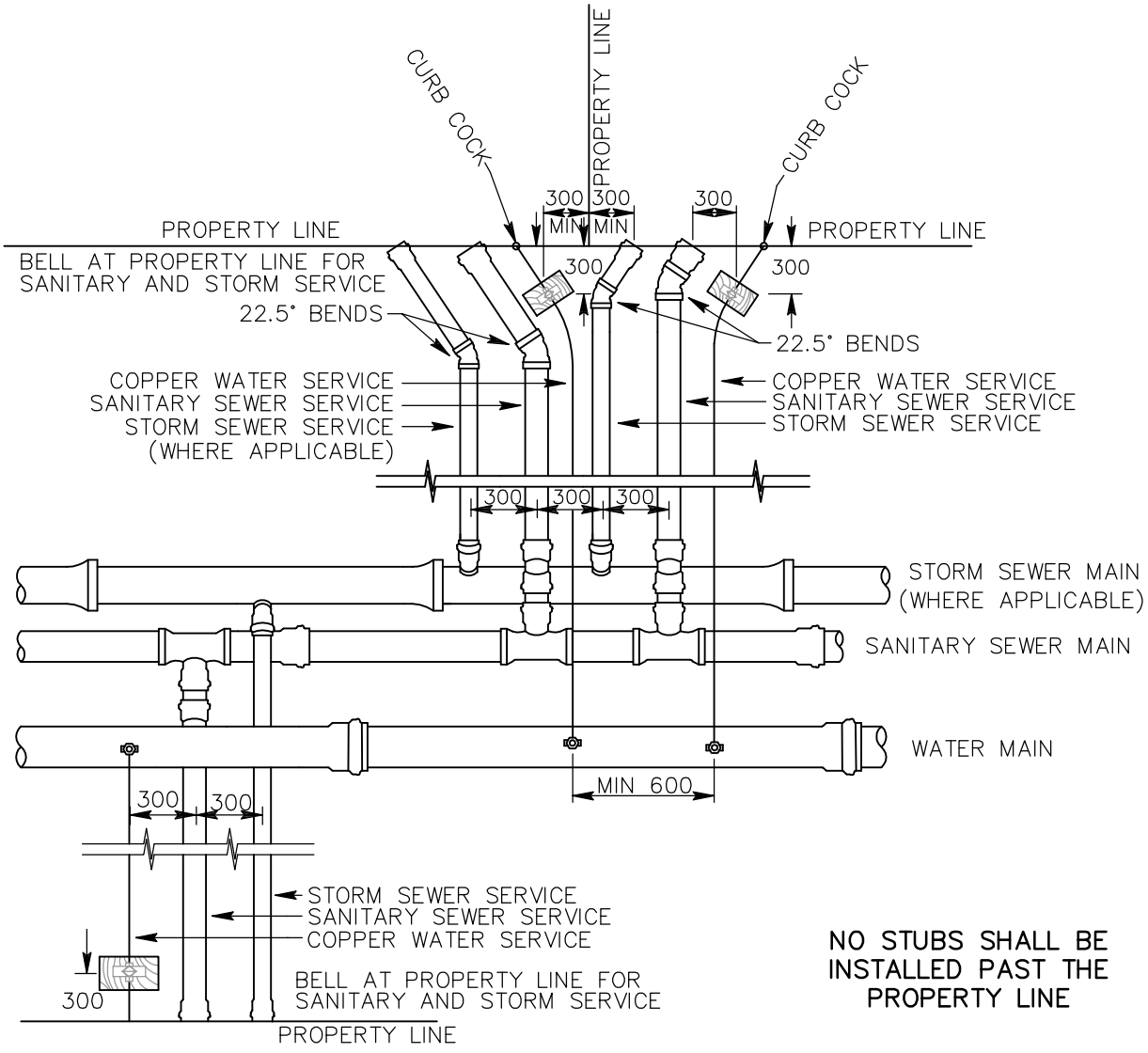
ELECTRICAL SERVICE

NOTES:

- STANDPIPE & CURB STOP TO BE LOCATED 0.30 FROM PROPERTY LINE.
- MINIMUM CLEARANCE FROM EDGE OF EL&P TRANSFORMER TO CENTRE OF WATER SHALL BE 3.30.
- EASEMENT WIDTH AS REQUIRED.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: FRONT YARD SERVICE LOCATIONS	FIGURE: 1

TYPICAL DOUBLE SERVICE



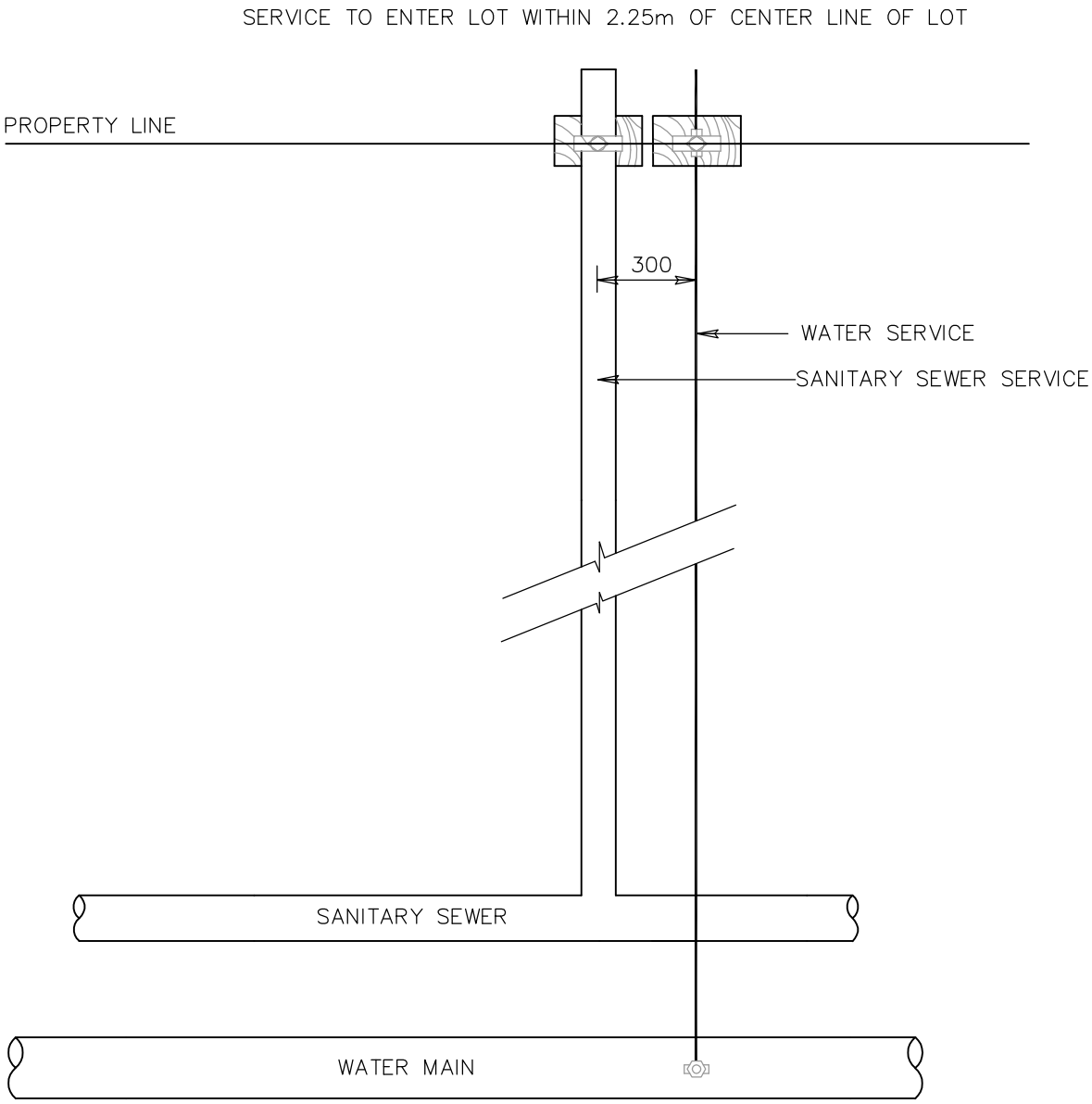
NO STUBS SHALL BE INSTALLED PAST THE PROPERTY LINE

TYPICAL SINGLE SERVICE

NOTES:

1. WATER AND SEWER SERVICES MAY BE EXTENDED TO EDGE OF 2.0m GAS EASEMENT.
2. THE MUNICIPALITY ACCEPTS NO RESPONSIBILITY FOR THE CONSTRUCTION OR MAINTENANCE OF SERVICES INSTALLED WITHIN THE EASEMENT.
3. MARK ENDS OF SERVICES AT EDGE OF GAS EASEMENT WITH A 50mm X 100mm X 750mm STAKE PROTRUDING 450mm ABOVE GROUND AND PAINTED BLUE. MARK THE CURB CONTROL VALVE WITH A SIMILAR STAKE PAINTED RED.
4. THE END OF COPPER WATER SERVICE PIPING SHOULD NOT BE CRIMPED CLOSED, PERMEABLE FILTER CLOTH MAY BE USED TO PREVENT INTRUSION OF DEBRIS AND TO ALLOW TESTING FLOW OF CURBSTOP.
5. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
6. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST–IN–PLACE AND PRECAST CONCRETE RESPECTIVELY.
7. SEWERLINE TO ALWAYS BE DOWNSIDE OF WATERLINE BASED ON SEWER FLOW DIRECTION.

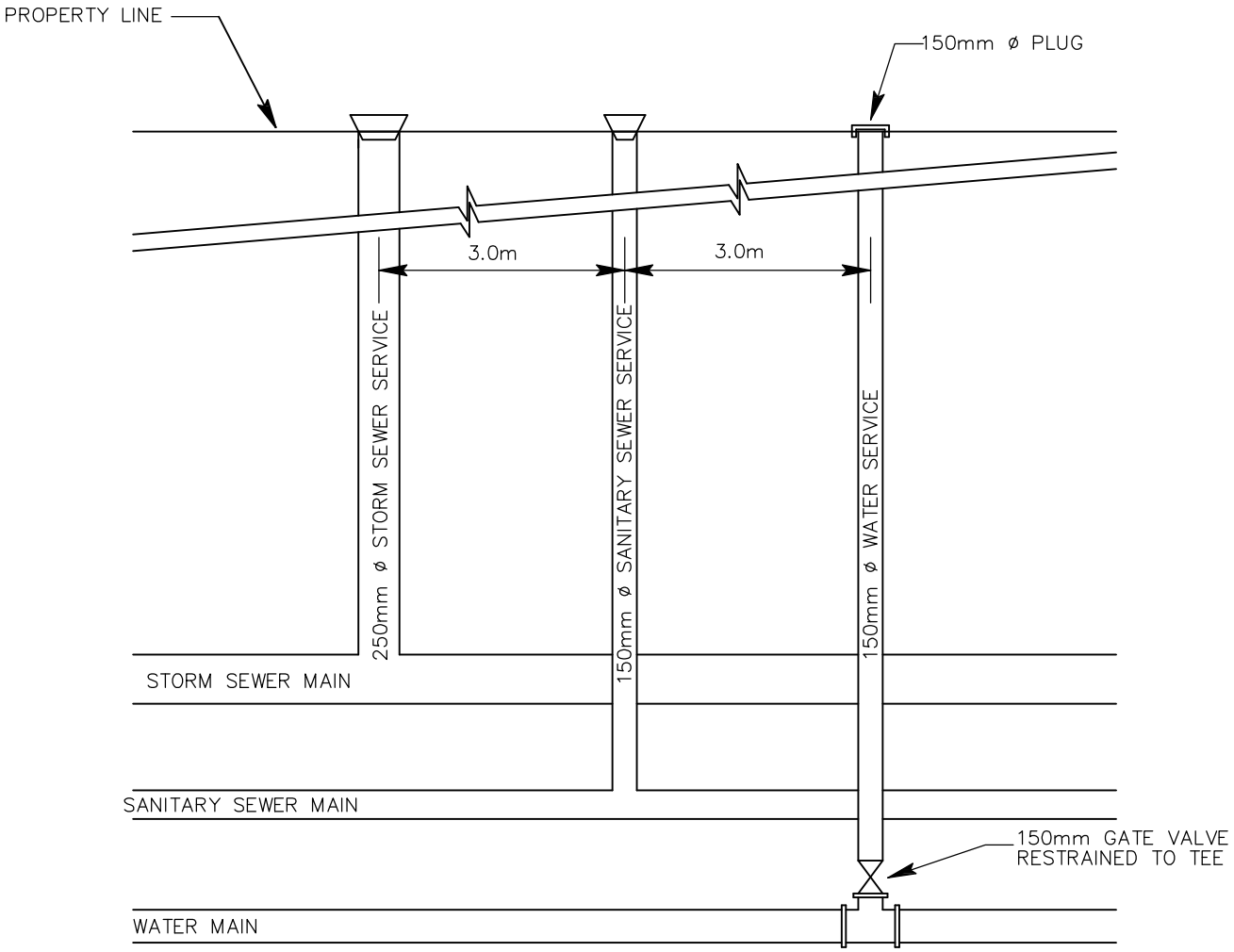
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: TYPICAL SERVICES (SINGLE & DUAL)	FIGURE: 2



NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. SERVICES MAY BE EXTENDED INTO PRIVATE PROPERTY TO EDGE OF GAS EASEMENT IN LANELESS SUBDIVISIONS.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: SINGLE LOW PRESSURE (SANITARY) SERVICE	FIGURE: 3

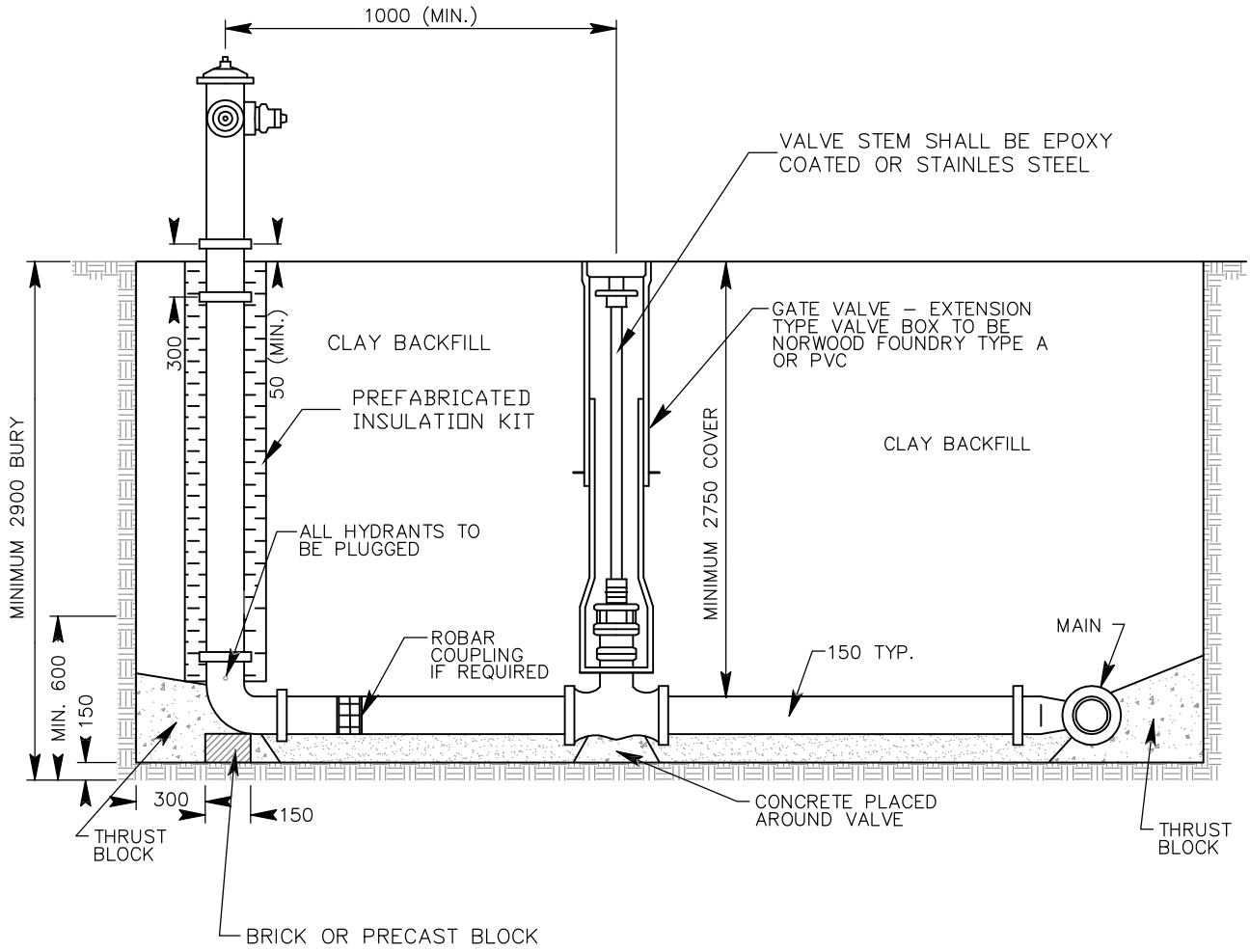


PLAN VIEW

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. SERVICES MAY BE EXTENDED INTO PRIVATE PROPERTY TO THE EDGE OF GAS EASEMENT (SEE FIGURE E–12 FOR DETAILS).

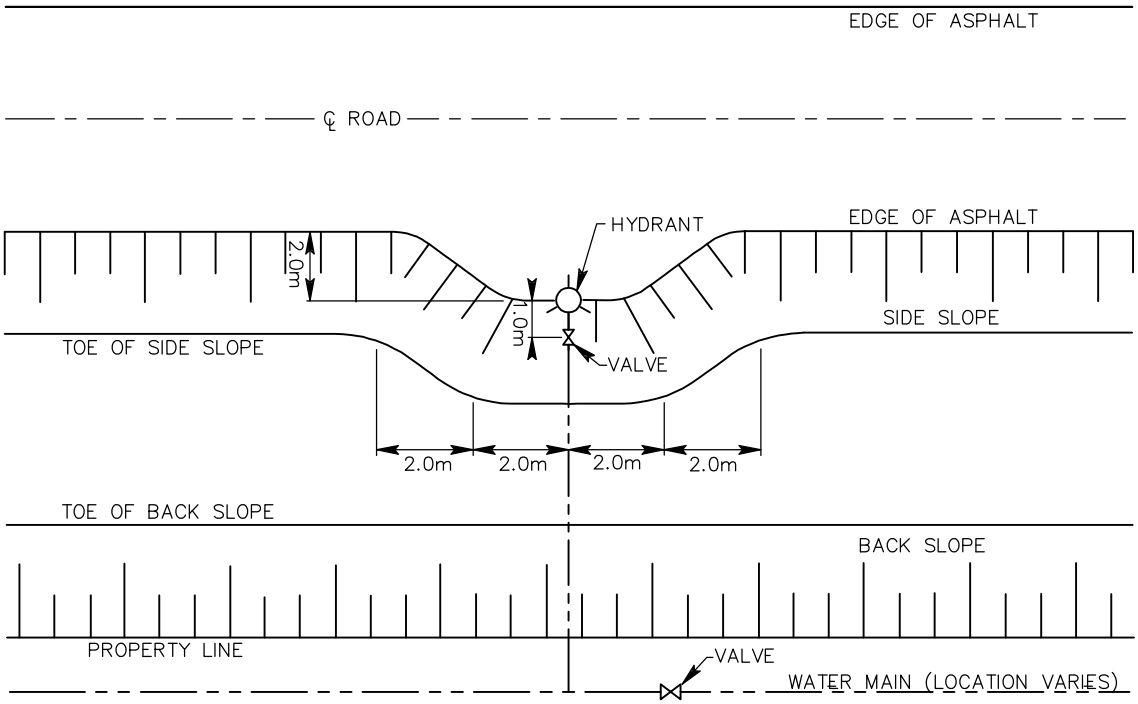
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: TYPICAL SINGLE SERVICE FOR COMMERCIAL LOT	FIGURE: 4



NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST–IN–PLACE AND PRECAST CONCRETE RESPECTIVELY.
3. HYDRANTS SHALL BE PAINTED IN ACCORDANCE WITH UTILITY DEPARTMENT SPECIFICATIONS.
4. 150mm FIRE HYDRANT OF APPROVED MAKE, AUTOMATIC SELFDRAINING c/w PUMPER NOZZLE.
5. WHERE WATER TABLE IS ABOVE BOTTOM OF HYDRANT, DRAIN SHALL BE PLUGGED.
6. SEE DRAWING D–28 FOR FURTHER DETAILS.
7. MECHANICAL RESTRAINTS SHOULD BE USED ON EVERY METAL TO PLASTIC PIPE JOINT CONNECTION.

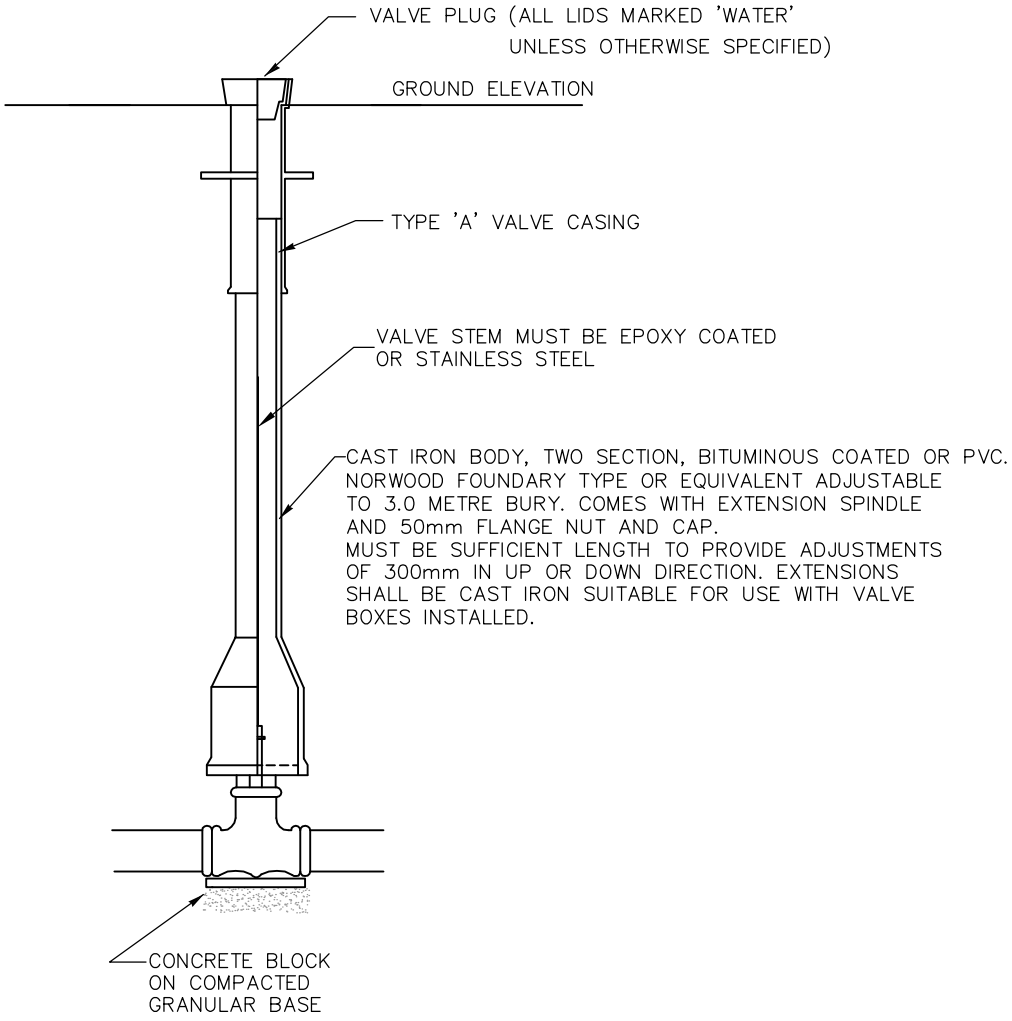
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: HYDRANT CONNECTION	FIGURE: 5



NOTES:

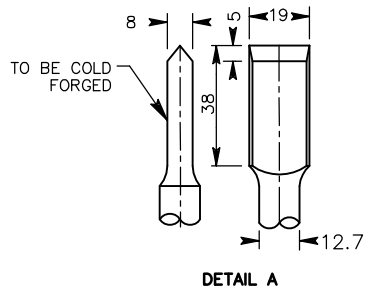
1. ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED.
2. WATER MAIN AND HYDRANTS MAY BE LOCATED EITHER SIDE OF ROAD.
3. STREET LIGHTS TO BE OPPOSITE SIDE OF WATERMAIN.
4. NOT GENERALLY APPLICABLE IN HIGH LEVEL. TO BE USED ONLY WHEN DIRECTED BY MUNICIPALITY.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: TYPICAL SHOULDER WIDENING FOR FIRE HYDRANT –RURAL STANDARD	FIGURE: 6

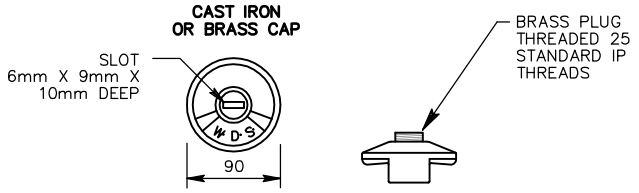


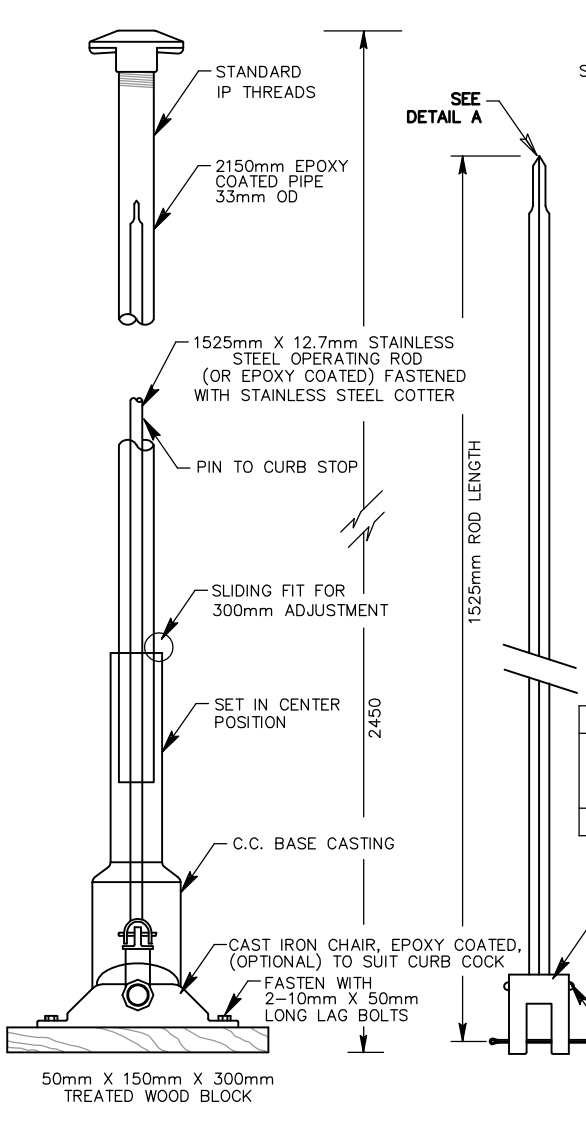
NOTES:
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

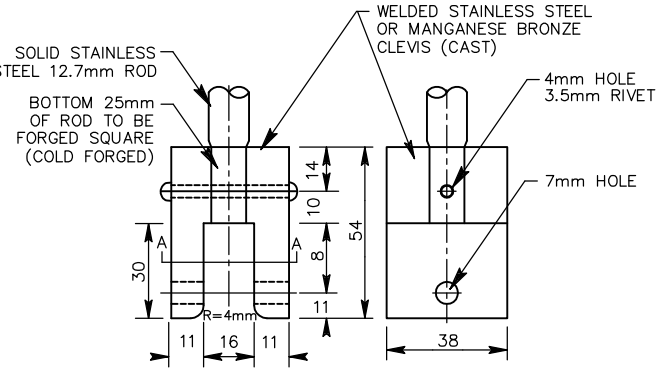
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: TYPE 'A' – VALVE CASTING DETAIL	FIGURE: 7



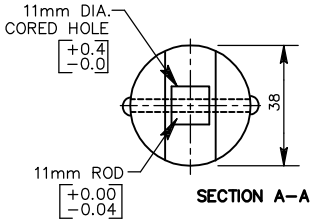
DETAIL A







DETAIL B



SECTION A–A

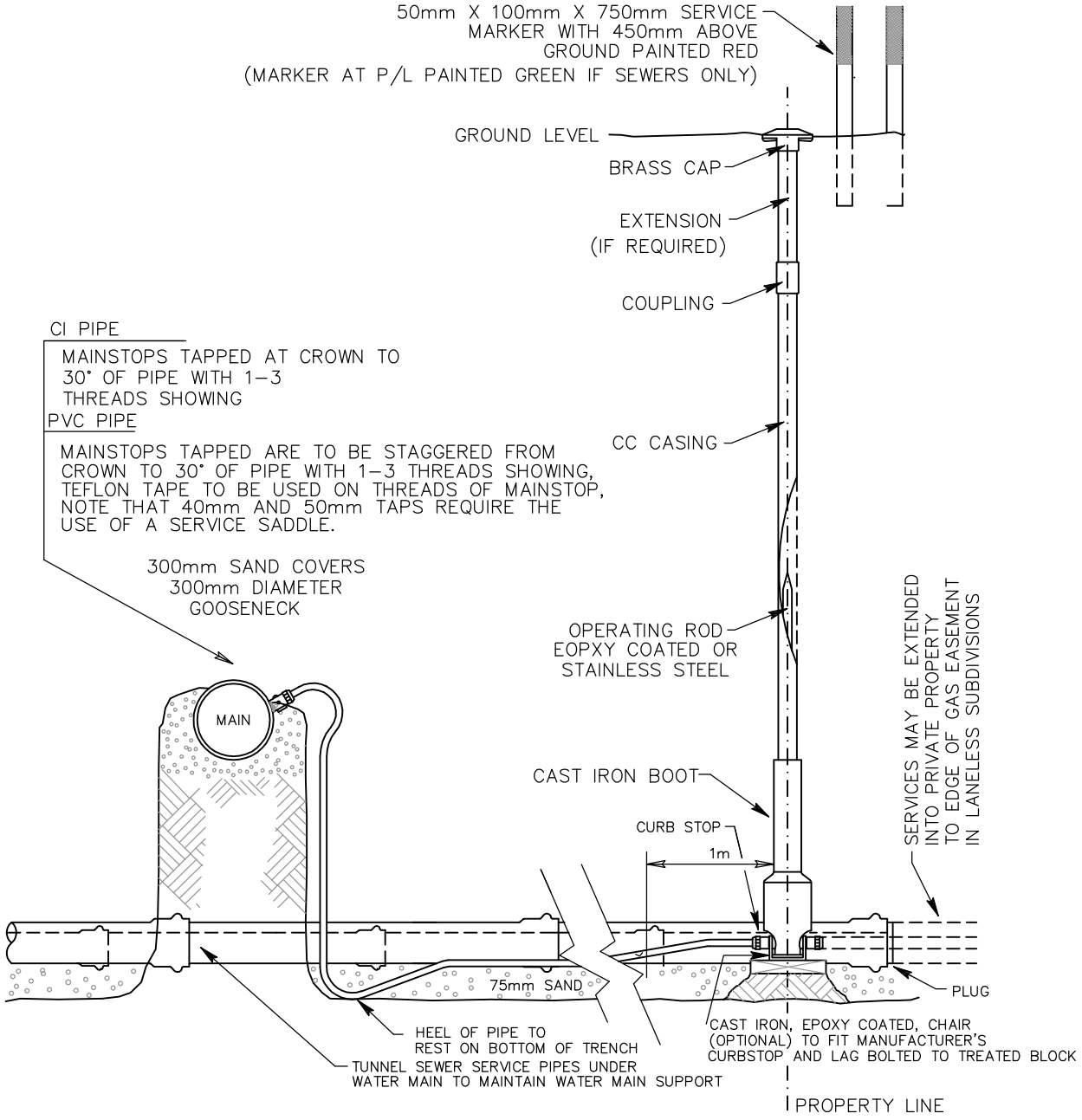
BRASS COTTER PIN

COTTER PIN					
NOMINAL DIAMETER	DIAMETER A		OUTSIDE EYE DIAMETER B MINIMUM	HOLE SIZE RECOMMENDED	LENGTH L
	MAX.	MIN.			
6.35mm	5.7mm	5.6mm	12.7mm	6.7mm	55mm

NOTES:

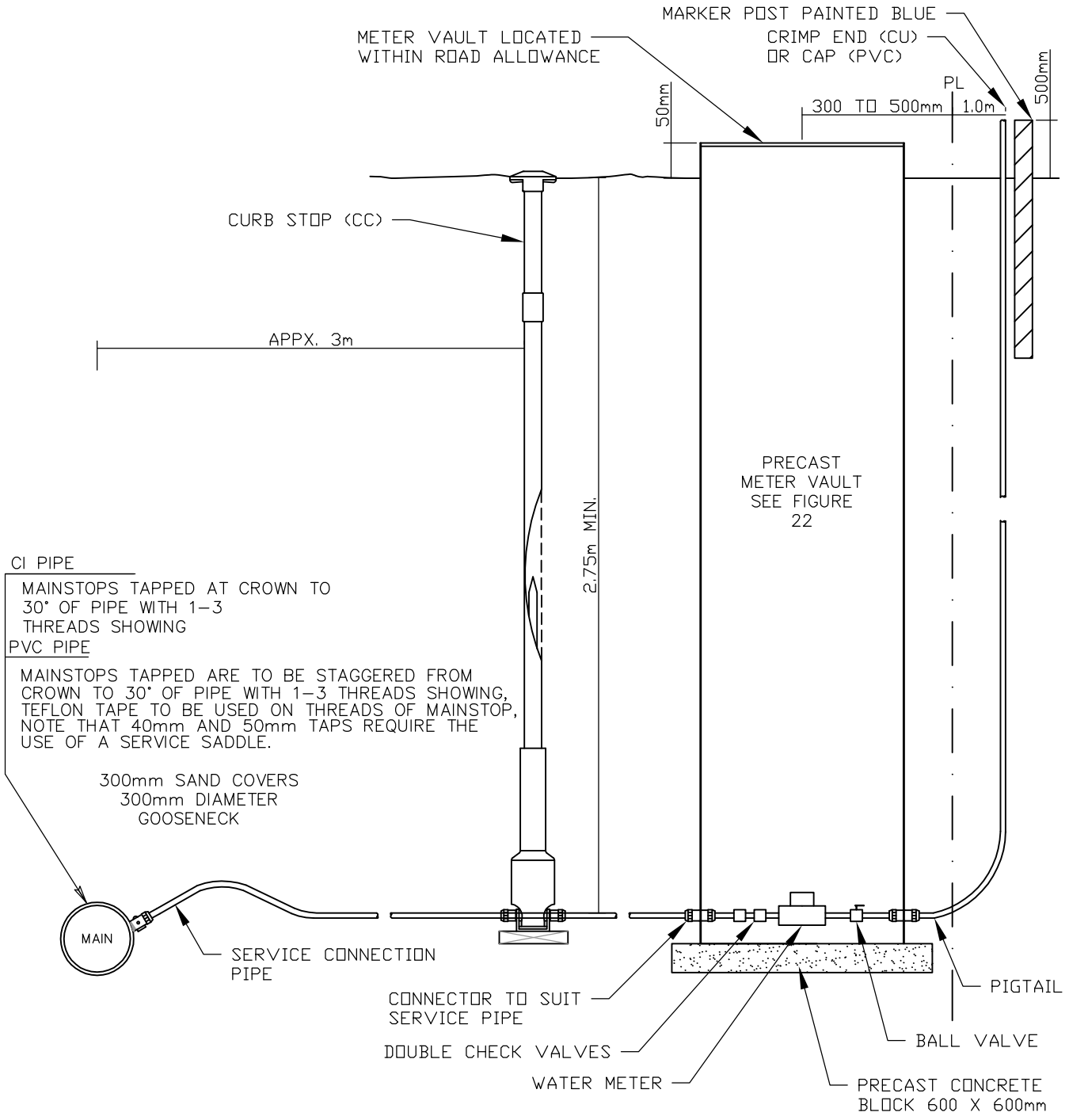
1. OPERATING ROD SHALL BE SUPPLIED AS A SINGLE UNIT COMPRISED OF A SOLID STAINLESS STEEL ROD, (A.S.T.M. 8554 – 94) ATTACHED TO A WELDED STAINLESS STEEL OR MANGANESE BRONZE CLEVIS WITH A STAINLESS STEEL RIVET.
2. THE MANUFACTURER'S NAME SHALL BE EMBOSSED ONTO THE CLEVIS.
3. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: SERVICE BOX DETAIL 50mm & SMALLER WATER SERVICE	FIGURE: 8



NOTES:
1. AN ADDITIONAL GOOSENECK IS REQUIRED AT EACH SEWER CROSSING.
2. MAINSTOP TAPS SHALL BE A MINIMUM OF 600mm APART, AND NO LESS THAN 300mm FROM A COUPLING OR COLLAR.
3. SERVICE PIPE SHALL BE ONE CONTINUOUS PIECE, SHOULD LENGTH EXCEED 20m, A DOUBLE UNION WILL BE ALLOWED. SIZE OF SERVICE MUST BE 25mm MIN. IF LENGTH OF SERVICE EXCEEDS 20m.
4. INVERT ELEV. OF WATER SERVICE PIPES AT P/L SHALL BE 2.59m BELOW ESTABLISHED FINISHED GRADE.
5. WHERE ENGINEER APPROVED COVER OVER WATER SERVICE TO BE LESS THAN 2.59m SERVICE IS TO BE INSULATED.
6. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

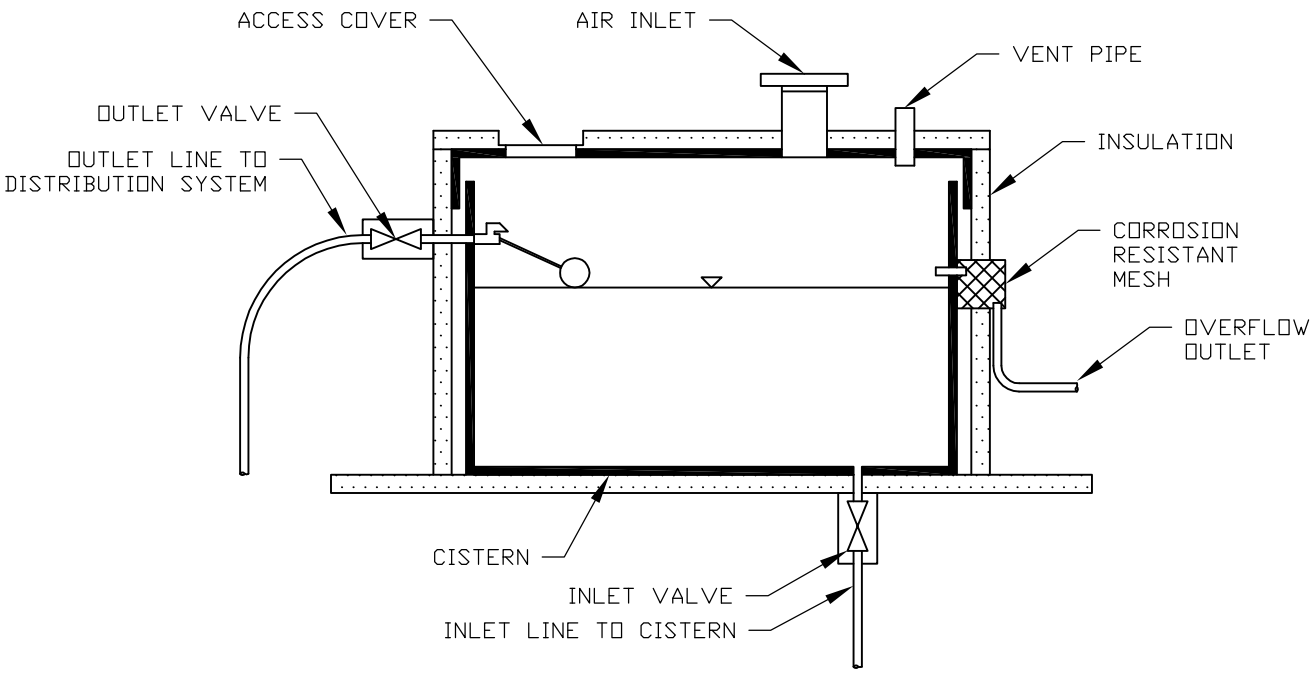
DATE: NOV, 2014	TOWN OF HIGH LEVEL TITLE: TYPICAL 50mm & SMALLER WATER SERVICE FOR 300mm & SMALLER WATER MAINS	ACAD – CIVIL DRAFTING STANDARD DETAILS FIGURE: 9A



NOTES:

1. AN ADDITIONAL GOOSENECK IS REQUIRED AT EACH SEWER CROSSING.
2. A SERVICE LINE CROSSING UNDER A HIGHWAY MUST HAVE A DETAILED DRAWING AND MEET ALL ALBERTA TRANSPORTATION SPECS. AND PERMITS.
3. MAINSTOP TAPS SHALL BE A MINIMUM OF 600mm APART, AND NO LESS THAN 300mm FROM A COUPLING OR COLLAR.
4. SERVICE PIPE SHALL BE ONE CONTINUOUS PIECE, SHOULD LENGTH EXCEED 20m, A DOUBLE UNION WILL BE ALLOWED. SIZE OF SERVICE MUST BE 25mm MIN. IF LENGTH OF SERVICE EXCEEDS 20m.
5. INVERT ELEV. OF WATER SERVICE PIPES AT P/L SHALL BE 2.59m BELOW ESTABLISHED FINISHED GRADE.
6. WHERE ENGINEER APPROVED COVER OVER WATER SERVICE TO BE LESS THAN 2.59m SERVICE IS TO BE INSULATED.
7. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

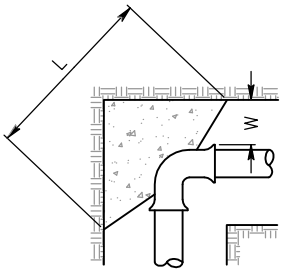
DATE: DEC, 2014	TOWN OF HIGH LEVEL TITLE: TYPICAL 50mm & SMALLER WATER SERVICE WITH METER VAULT	ACAD – CIVIL DRAFTING STANDARD DETAILS FIGURE: 9B
TOWN OF HIGH LEVEL		



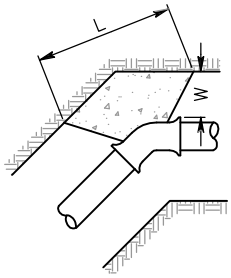
NOTES:

1. INSTALLATION AND/OR CONSTRUCTION, AND OPERATION OF CISTERNS OVER 500 LITERS REQUIRES MUNICIPALITY APPROVAL AND PERMIT.
2. CAREFUL SIZING OF THE CISTERN IS REQUIRED, BY A QUALIFIED IRRIGATION OR ENGINEERING PROFFESIONAL, TO ENSURE THE SIZE IS APPROPRIATE FOR THE CAPTURE VOLUME OF NON-POTABLE WATER.
3. ACCOUNT FOR FROST DEPTH AND FREEZE/THAW CYCLES WHEN SPECIFYING DEPTH AND TYPE OF BURIED OUTDOOR CISTERNS.
4. CISTERN OVERFLOWS MUST BE DIRECTED AWAY FROM BUILDING FOUNDATIONS AND OTHER PROPERTIES TO AVOID FLOODING OR DAMAGE TO THE FOUNDATION DURING LARGE RAIN EVENTS.
5. ELEVATED CISTERNS SUPPORT SYSTEM(S) MUST BE DESIGNED BY A QUALIFIED STRUCTURAL ENGINEER.

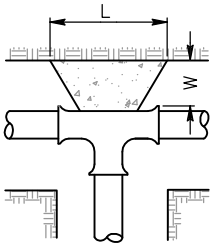
DATE: DEC, 2014	TITLE: TOWN OF HIGH LEVEL TYPICAL CISTERN	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL		FIGURE: 9C



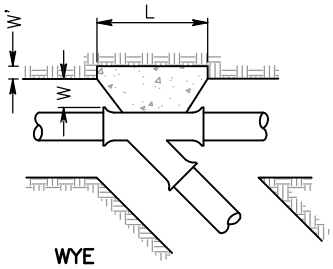
HORIZONTAL 90° BEND



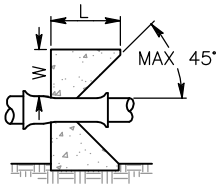
HORIZONTAL 45° BEND



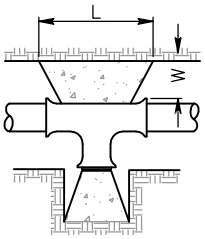
TEE



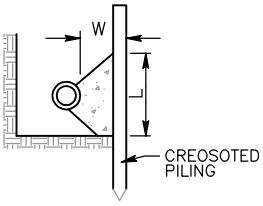
WYE

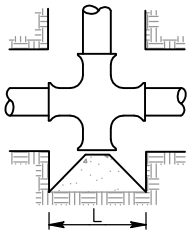


REDUCER

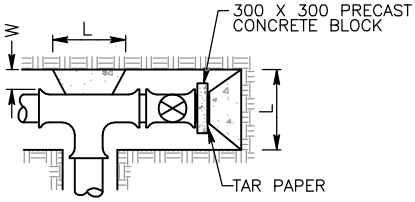


TEE WITH PLUG





CROSS WITH PLUG



TEE WITH VALVE

MINIMUM THRUST AREAS FOR FITTINGS AT 1035 kPa PRESSURE AND FOR SOILS WITH MINIMUM BEARING OF 9765 kg/m (NOT TO BE USED FOR SOFT CLAY, MUCK, PEAT, etc.)

TYPE OF FITTING	FITTING SIZE	OUTSIDE OF FITTING TO BEARING FACE	RECESS IN TRENCH WALL	LENGTH	HEIGHT	TYPE OF FITTING	FITTING SIZE	OUTSIDE OF FITTING TO BEARING FACE	RECESS IN TRENCH WALL	LENGTH	HEIGHT
	D	W	W'	L	H		D	W	W'	L	H
90° BEND	150	300		900	450	CROSS	150	300		600	450
	200	350		1060	600		200	350		825	600
	250	375		1445	750		250	375		975	825
	300	400		1650	900		300	400		1200	900
45° BEND	150	300		450	450	45° WYE	150	300	300	450	450
	200	350		600	600		200	350	400	600	600
	250	375		750	750		250	375	500	825	825
	300	400		900	900		300	400	600	900	900
22.5° BEND	150	300		450	230	REDUCER	150	300	150	450	450
	200	350		600	300		200	350	200	600	600
	250	375		750	450		250	375	250	825	825
	300	400		900	450		300	400	300	900	900
TEE	150	300		450	450	CAPS AND PLUGS (IF NOT BOLTED)	150	300		450	450
	200	350		600	600		200	350		600	600
	250	375		750	825		250	375		825	825
	300	400		900	900		300	400		900	900

DIMENSIONS APPLY TO THE LARGER DIAMETER END OF FITTINGS

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.
3. WHERE GROUND CANNOT BE EXCAVATED TO FREE STANDING UNDISTURBED SOIL, A SMALL PLANK SHEET PILING SHALL BE DRIVEN TO PROVIDE UNDISTURBED THRUST AREA. THE PILING IS TO BE DRIVEN PRIOR TO EXCAVATION FOR THRUST BLOCK. THE PILING SHOULD BE USED ONLY BELOW THE PERMANENT WATER TABLE.

DATE: NOV, 2014

TOWN OF HIGH LEVEL

TITLE:

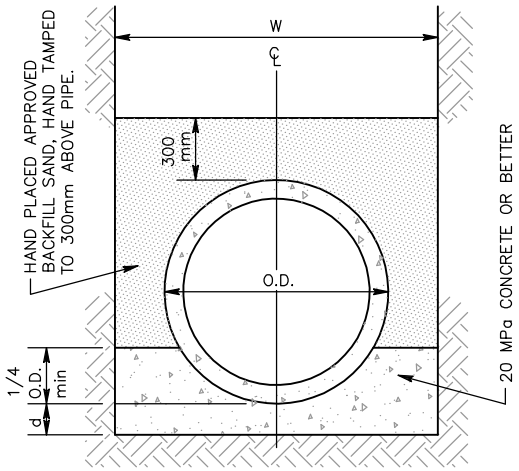
THRUST BLOCK DETAILS

ACAD – CIVIL DRAFTING STANDARD DETAILS

FIGURE: 10

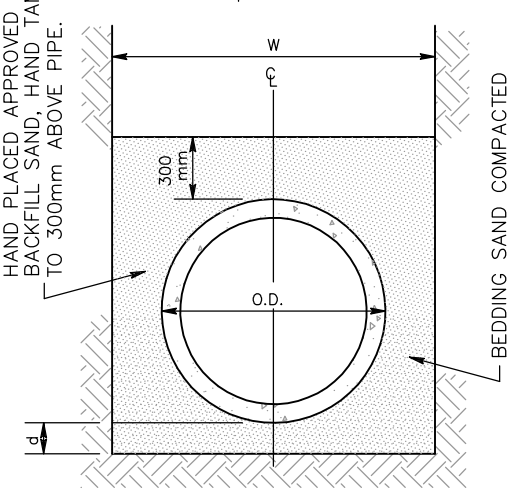
CLASS A BEDDING

L_f = 2.8



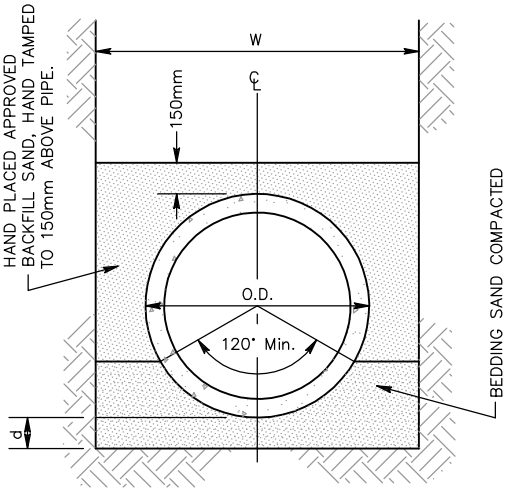
CLASS B BEDDING

L_f = 1.9



CLASS C BEDDING

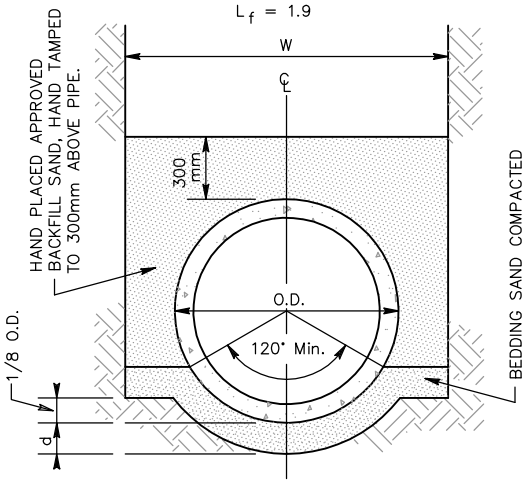
L_f = 1.5



CLASS B BEDDING

ALTERNATE – 375mm I.D. & UNDER

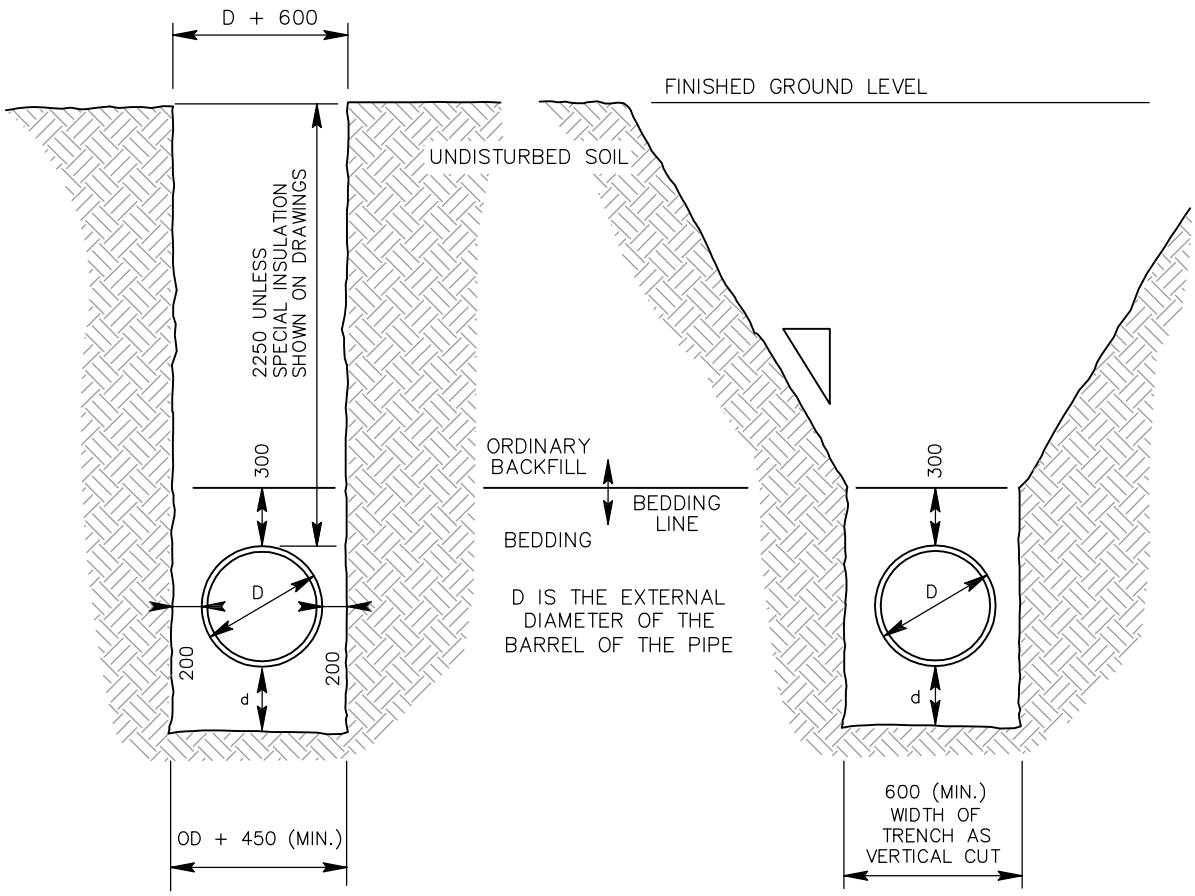
L_f = 1.9



NOTES:

1. W = TRENCH WIDTH – O.D. + 450mm (MINIMUM).
   - **1000mm max. FOR PIPES UP TO AND INCLUDING 400mm DIAMETER.**
   - **O.D. + 400mm max. (ON EITHER SIDE {800mm TOTAL}) FOR PIPE DIAMETERS 450mm AND ABOVE.**
2. O.D.= OUTSIDE PIPE DIAMETER.
3. I.D. = INSIDE PIPE DIAMETER.
4. L_f = LOAD FACTOR.
5. d = DEPTH OF BEDDING BELOW PIPE; 150mm MIN.
6. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
7. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST–IN–PLACE AND PRECAST CONCRETE RESPECTIVELY.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: STANDARD TRENCH BEDDING FOR CIRCULAR PIPES	FIGURE: 11



STANDARD TRENCH
VERTICAL CUT

STANDARD TRENCH
SLOPING CUT

(ALL EXCAVATIONS TO BE SLOPED OR SHORED
AS PER OCCUPATIONAL HEALTH AND SAFETY STANDARDS)

MAXIMUM TRENCH WIDTHS FOR SINGLE PIPES

1000mm – UP TO AND INCLUDING 400mm DIAMETER PIPE
600mm + OD – >400mm DIAMETER PIPE

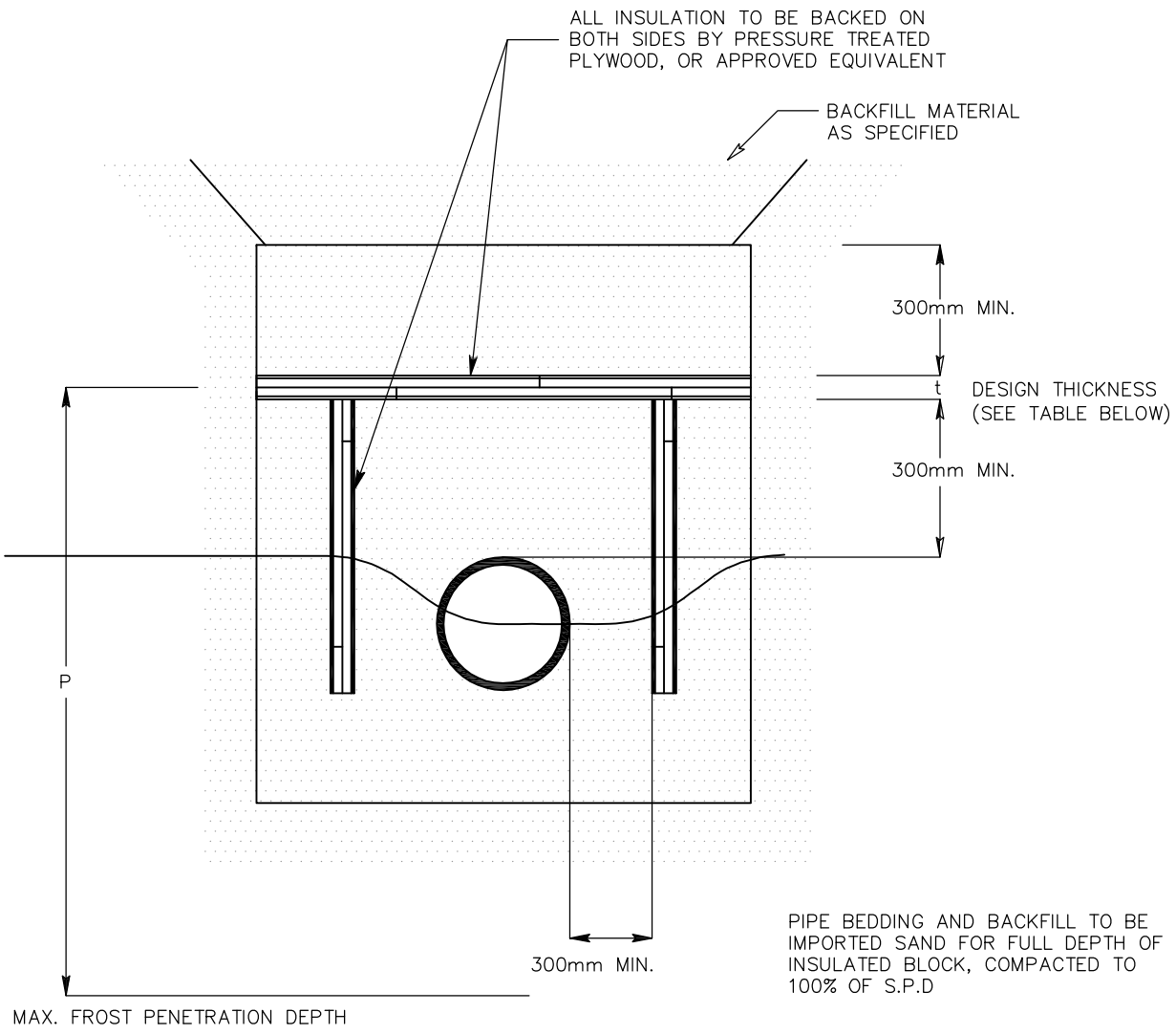
DEPTH OF BEDDING BELOW PIPE BARREL (d)

75mm – EXTERNAL DIAMETER OF 700mm AND BELOW
100mm – EXTERNAL DIAMETER GREATER THAN 700mm

NOTE:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: STANDARD TRENCH DIMENSIONS FOR CIRCULAR PIPE	FIGURE: 12



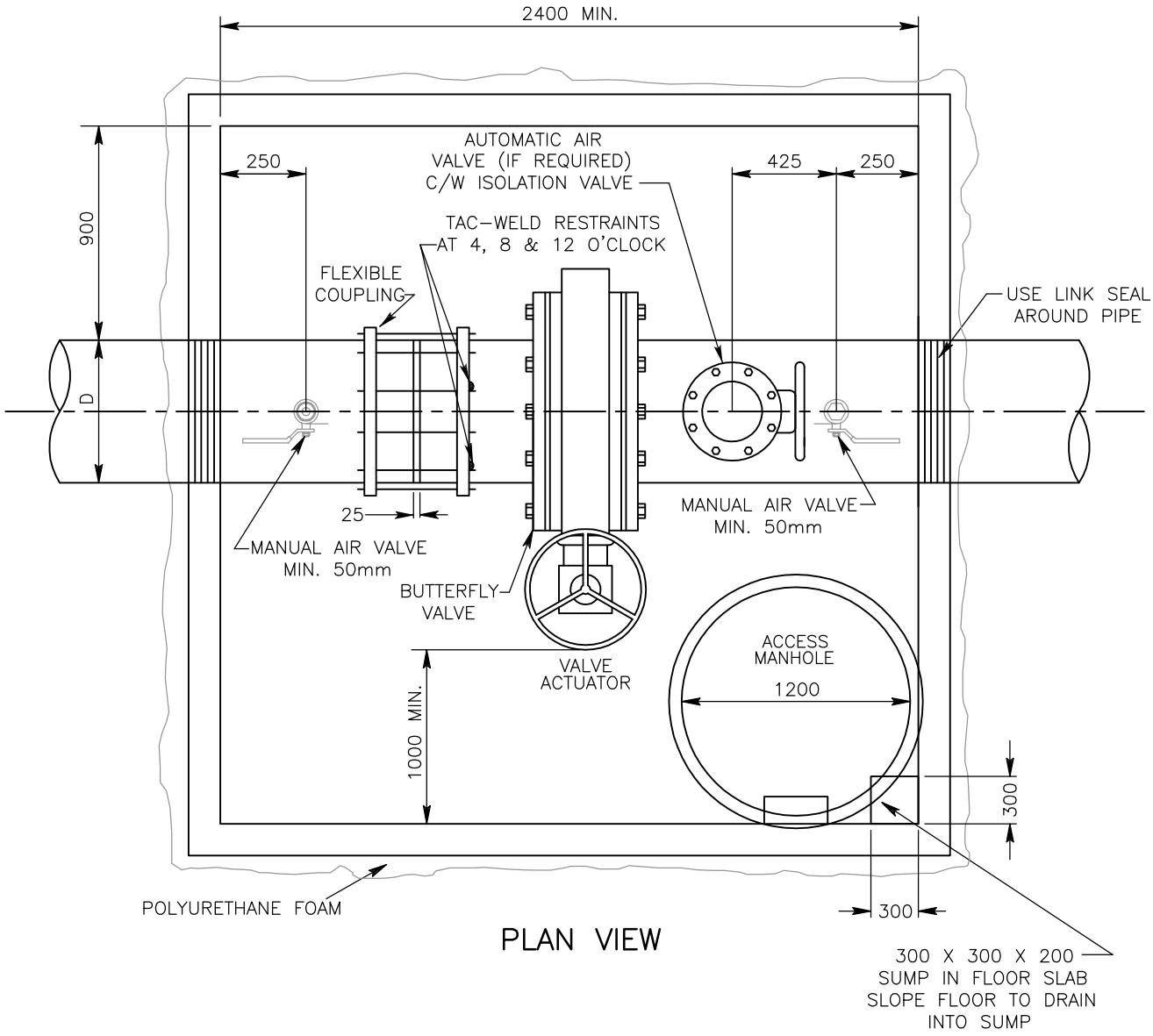
MINIMUM THICKNESS GUIDE			
SANDY SOIL		CLAY SOIL	
P	THICKNESS	P	THICKNESS
1600mm	100mm		
2100mm	150mm	1500mm	175mm
2400mm	200mm	2400mm	225mm

INSULATION TO BE MINIMUM 100mm THICKNESS

BACKFILLING TO BE CAREFULLY DONE TO PREVENT BREAKING OR CRUSHING THE INSULATION. CRUSHED SHEETS SHALL BE REMOVED AND REPLACED WITH SOUND SHEETS

NOTE:
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

DATE: NOV, 2014	TOWN OF HIGH LEVEL TITLE: INSULATION REQUIREMENTS FOR WATER MAINS / SERVICES	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL		FIGURE: 13

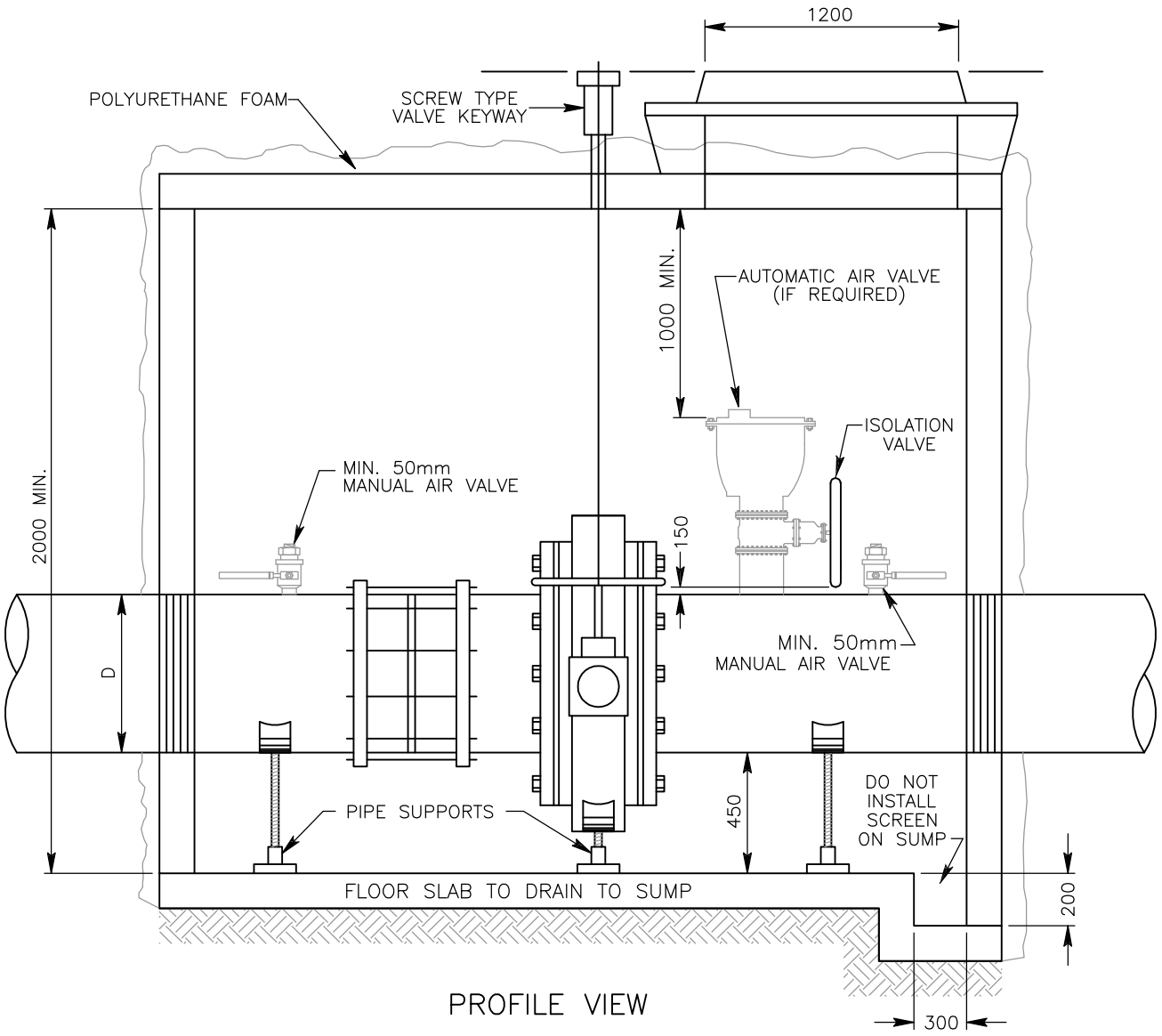


PLAN VIEW

NOTES:

1. ALL DIMENSIONS IM MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROVIDE 100mm THICK POLYURETHANE FOAM INSULATION AROUND EXTERIOR OF CHAMBER WALLS, ROOF AND MANHOLE RISER FOR CHAMBERS UTILIZING AUTOMATIC AIR VALVES. PROVIDE A FROST COVER FOR MANHOLE FRAME. COVER ALL INSULATION WITH APPROVED WATERPROOFING COMPOUND.
3. ALSO SEE FIGURE D-27.
4. FOR STEEL AND CONCRETE CYLINDER WATER MAINS, PROVIDE AN ELECTRICAL CONTINUITY BOND ACROSS THE VALVE AND COUPLING WHEN DIRECTED BY THE ENGINEER.

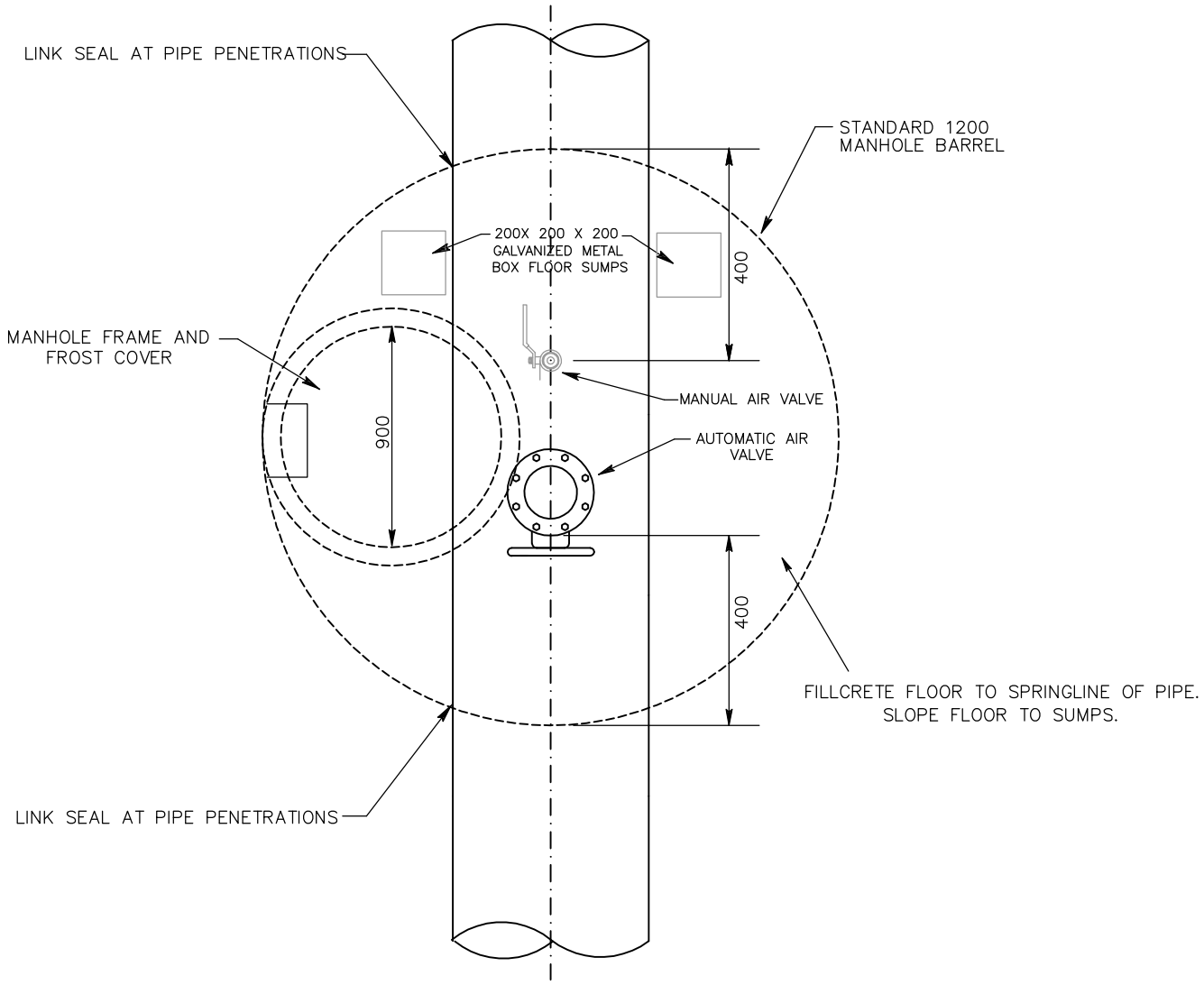
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: VALVE CHAMBER DETAIL (PLAN)	FIGURE: 14



PROFILE VIEW

NOTES:
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. ALSO SEE FIGURE D–26.

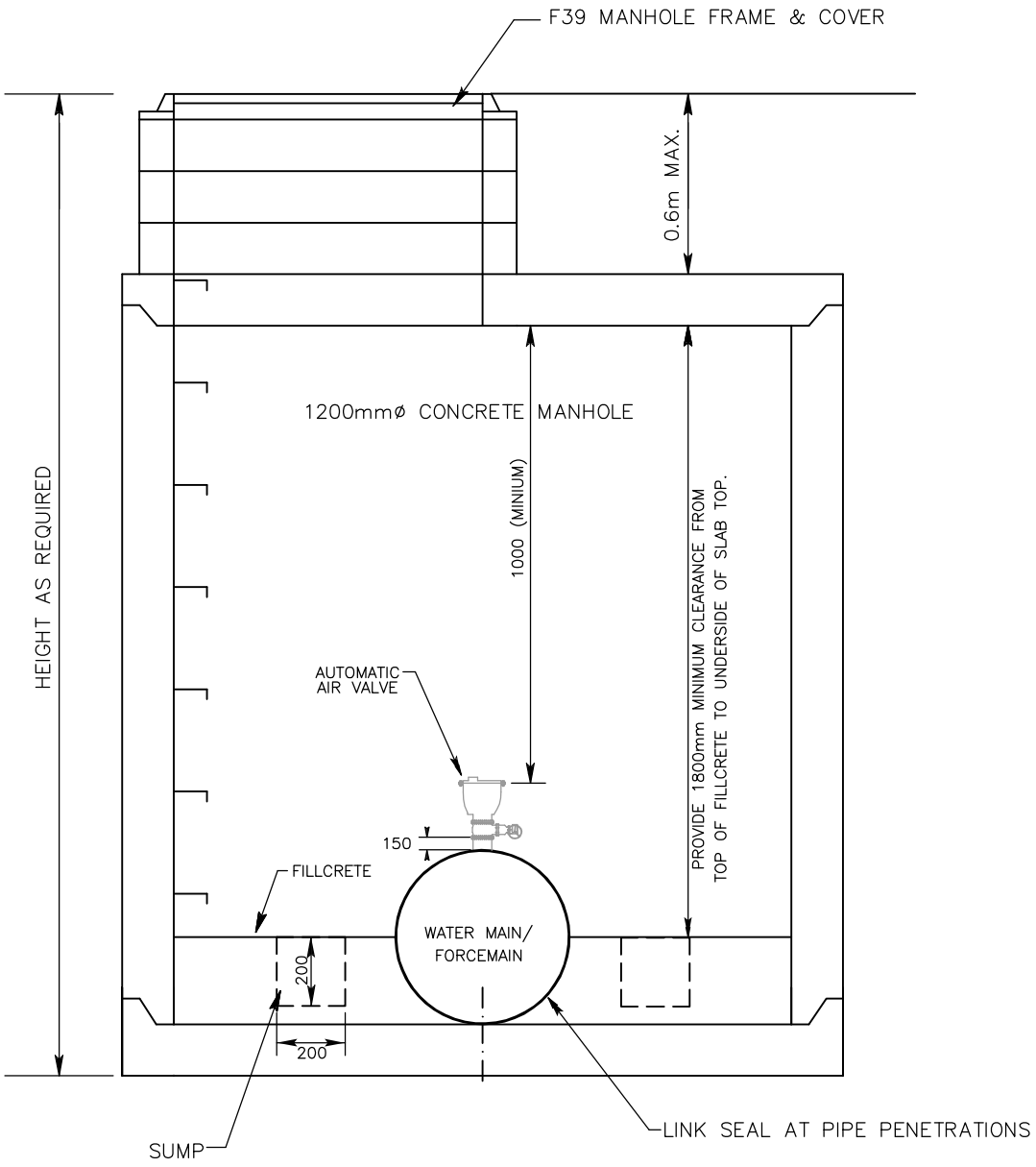
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: VALVE CHAMBER DETAIL (PROFILE)	FIGURE: 15



NOTES:

1. INSULATE EXTERIOR OF MANHOLE AND RISER WITH 100mm THICK POLYURETHANE FOAM INSULATION. TREAT WITH APPROVED WATERPROOFING COMPOUND.
2. FOR STEEL AND CONCRETE CYLINDER WATER MAINS, PROVIDE ELECTRICAL ACCESS WIRES WHEN DIRECTED BY THE ENGINEER.
3. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

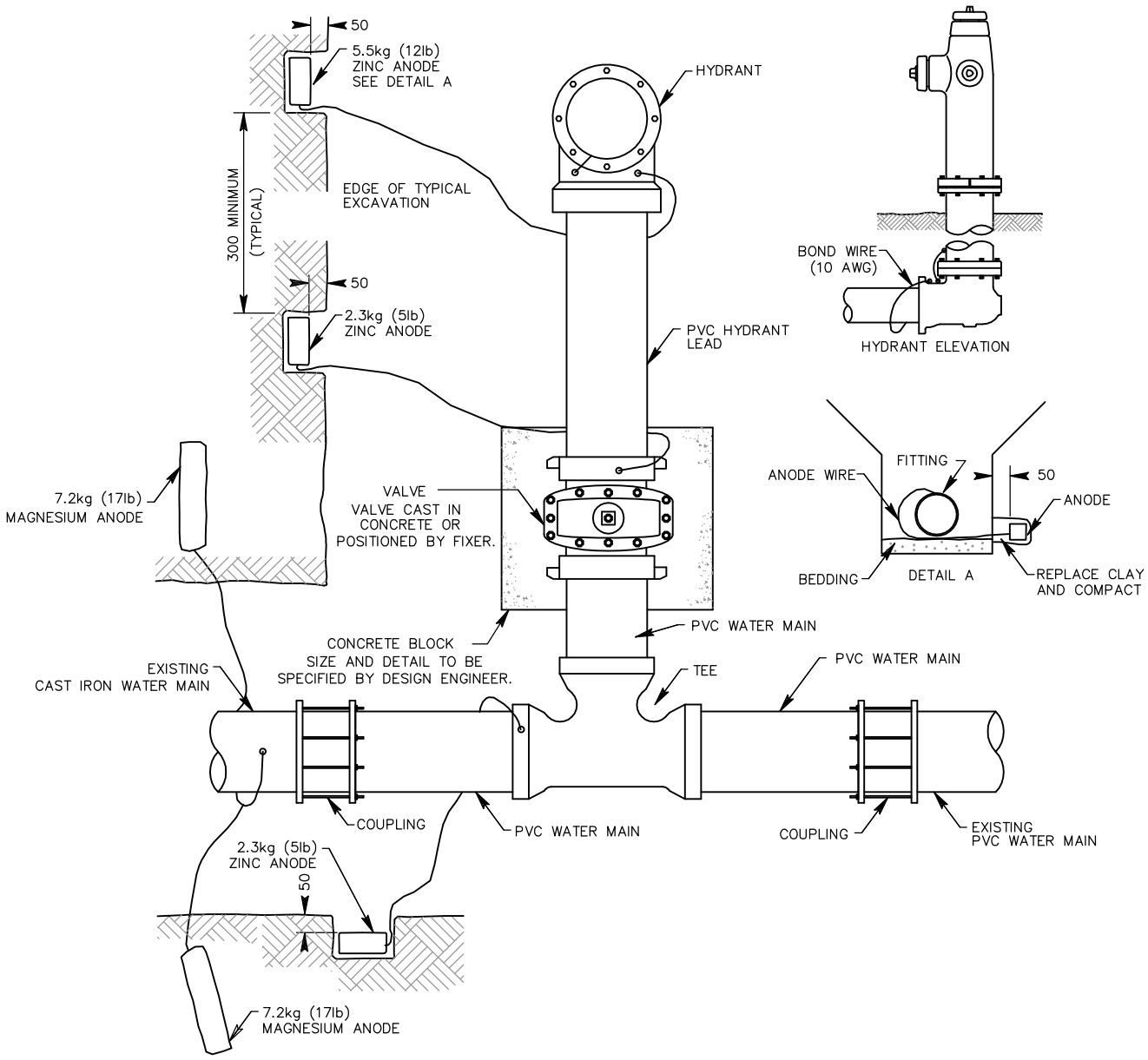
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: AUTOMATIC AIR VALVE CHAMBER DETAIL (PLAN)	FIGURE: 16



NOTES:

1. ALSO SEE FIGURE D–19.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
3. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST–IN–PLACE AND PRECAST CONCRETE RESPECTIVELY.

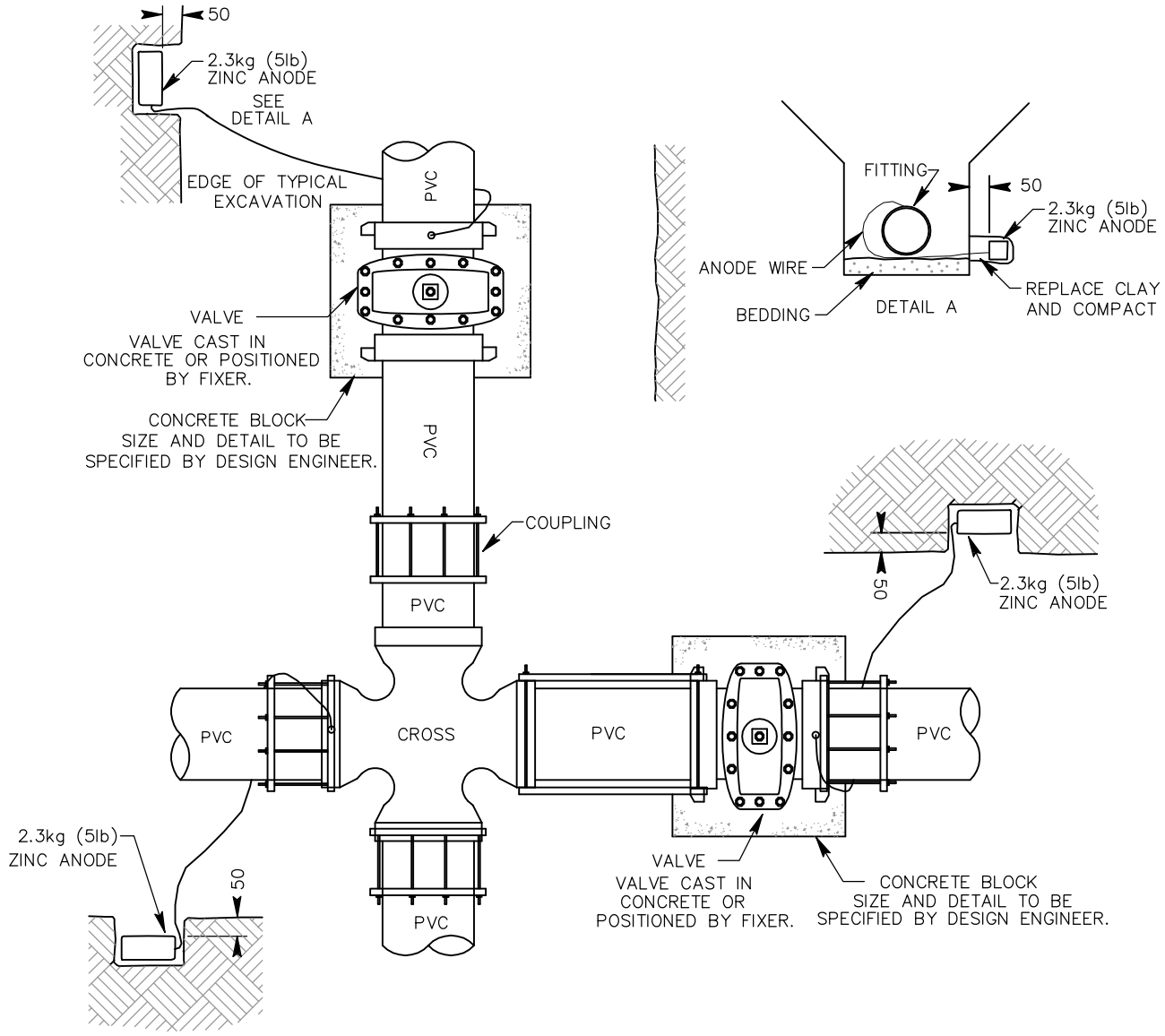
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: AUTOMATIC AIR VALVE CHAMBER DETAIL (PROFILE)	FIGURE: 17



NOTES:

1. MIN. DISTANCE FROM ANODE TO PIPE IS 150mm.
2. INSTALL ANODE AT APPROX. PIPE DEPTH IN NATIVE SOIL.
3. ALL ZINC ANODES ON FITTINGS AND VALVES ARE 2.3kg (5lb).
4. ALL ZINC ANODES ON HYDRANTS ARE 5.5kg (12lb).
5. ZINC ANODES TO BE EMBEDDED INTO TRENCH WALL TO PROVIDE FOR A MINIMUM OF 50mm OF NATIVE CLAY COMPLETELY SURROUNDING THE ANODE.
6. ANODES TO BE AT LEAST 300mm CLEAR OF THRUST BLOCK.
7. MECHANICAL RESTRAINTS SHOULD BE USED ON EVERY METAL TO PLASTIC PIPE JOINT CONNECTION.
8. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
9. EPOXY OR STAINLESS STEEL RESTRAINTS TO BE USED ON ALL VALVES.
10. PREFABRICATED INSULATION KITS ON HYDRANT IS NOT SHOWN FOR CLARITY.

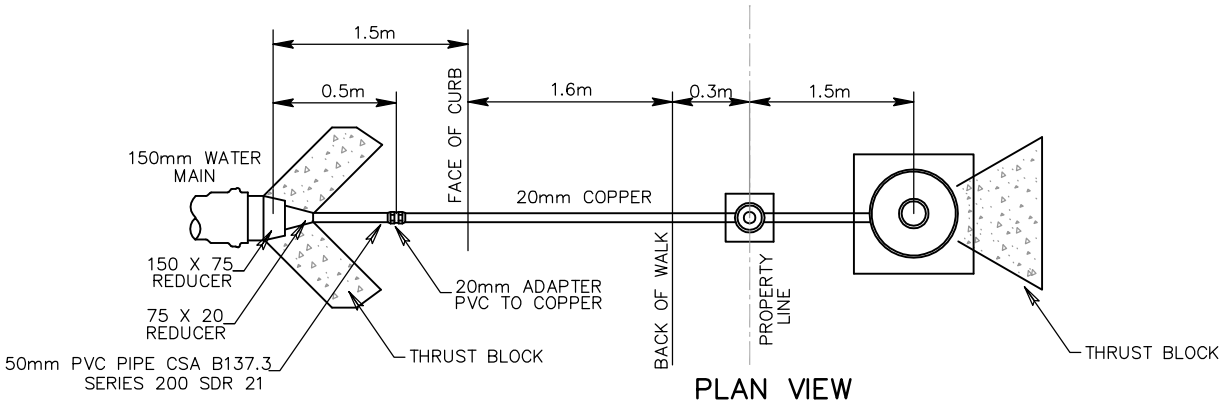
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: ANODE INSTALLATION AT HYDRANT	FIGURE: 18



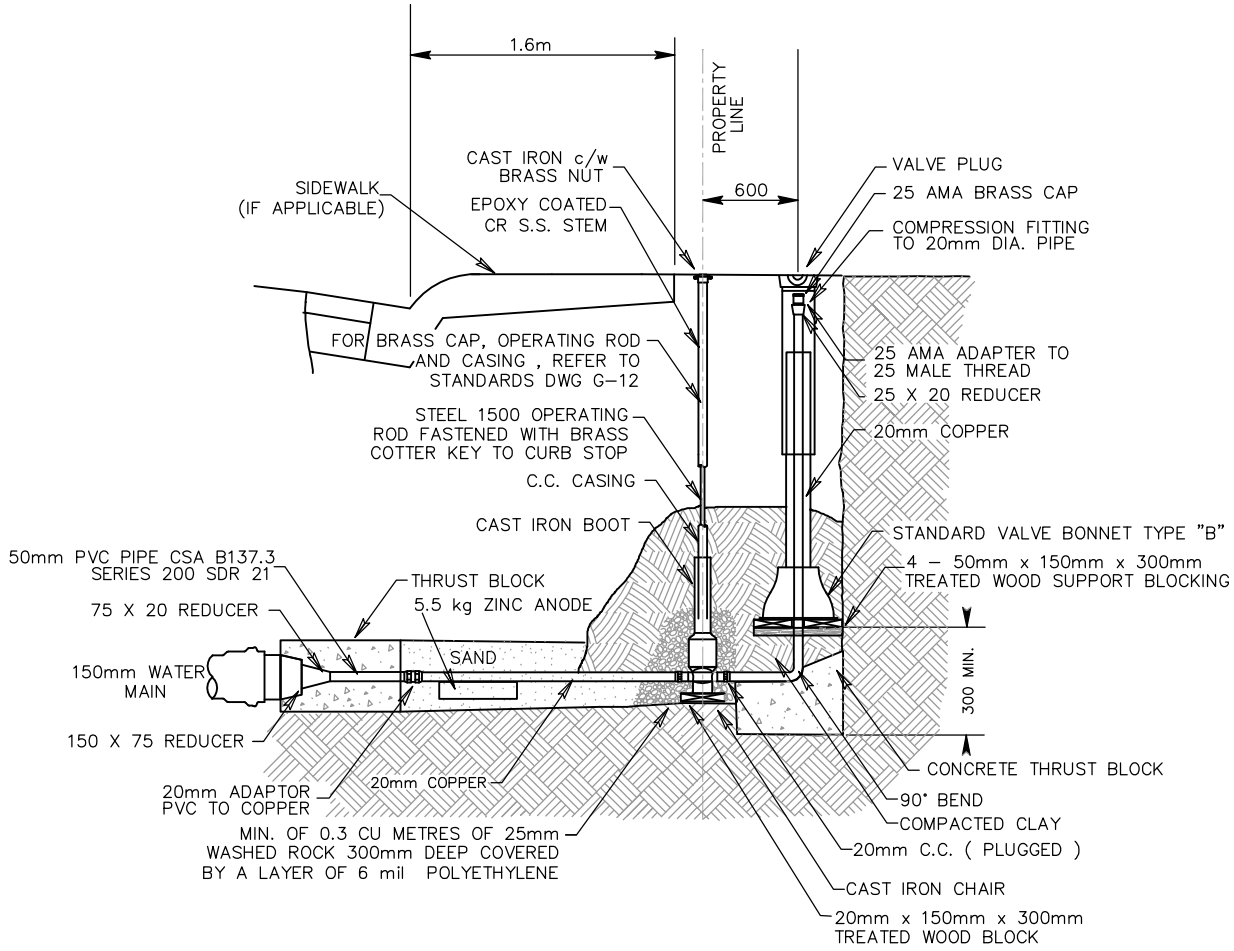
NOTES:

1. MINIMUM DISTANCE FROM ANODE TO PIPE, FITTING, VALVE OR HYDRANT IS 150mm.
2. INSTALL ANODE AT APPROX. PIPE DEPTH IN NATIVE SOIL.
3. ALL ZINC ANODES ON FITTINGS AND VALVES ARE 2.3kg (5lb).
4. ZINC ANODES TO BE EMBEDDED INTO TRENCH WALL TO PROVIDE FOR A MINIMUM OF 50mm OF NATIVE CLAY COMPLETELY SURROUNDING THE ANODE.
5. ANODES TO BE AT LEAST 300mm CLEAR OF THRUST BLOCK.
6. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: TYPICAL ANODE INSTALLATION AT STEEL OR IRON FITTINGS USED WITH PVC WATERMAINS	FIGURE: 19



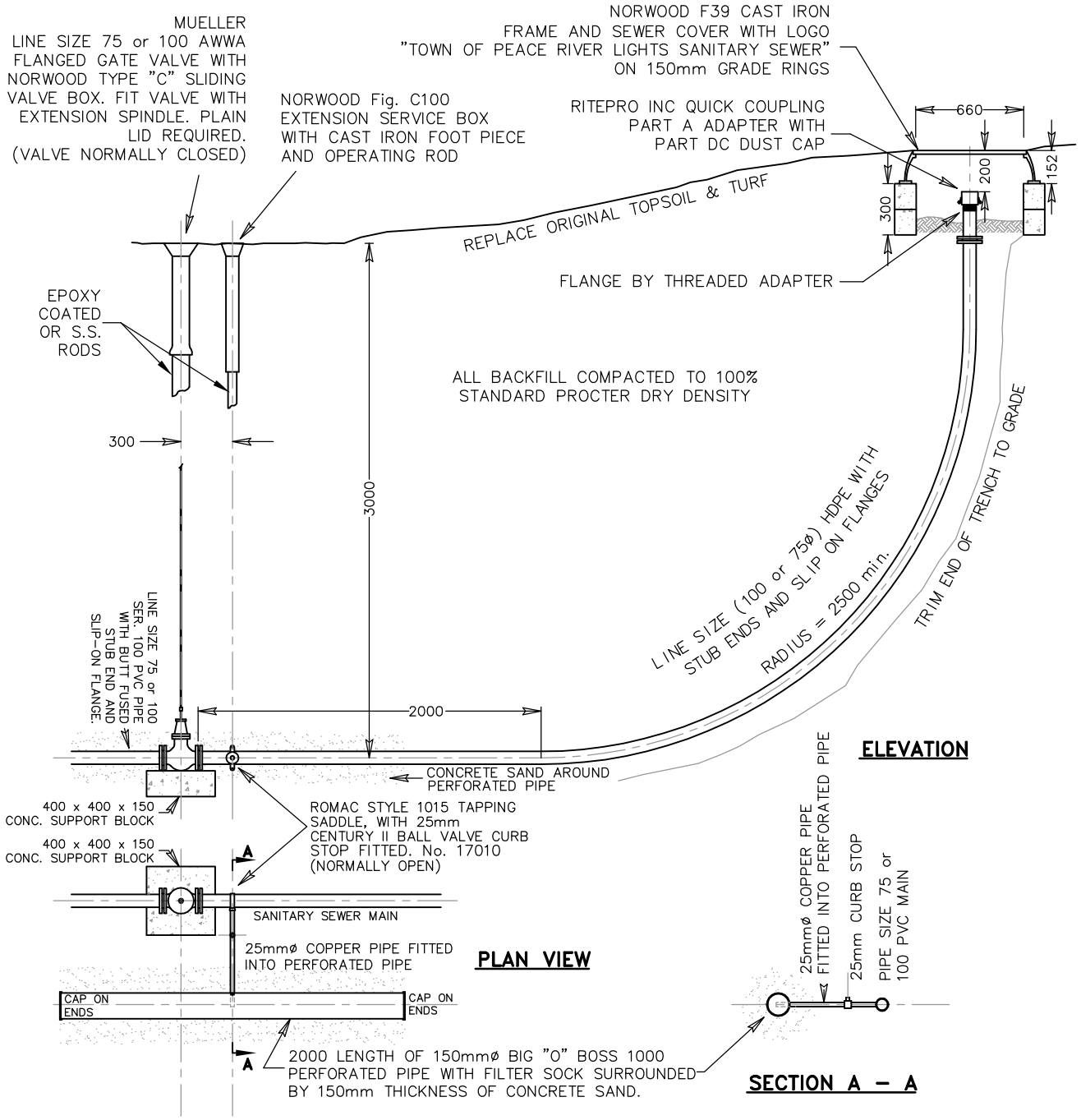
PLAN VIEW



NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: FLUSH POINT DETAIL	FIGURE: 20

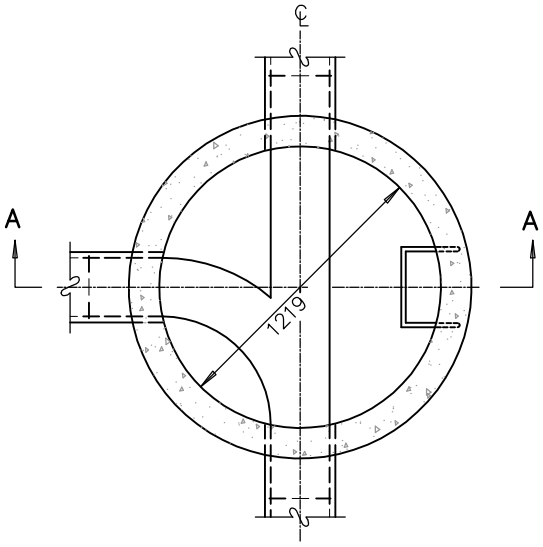


NOTES:

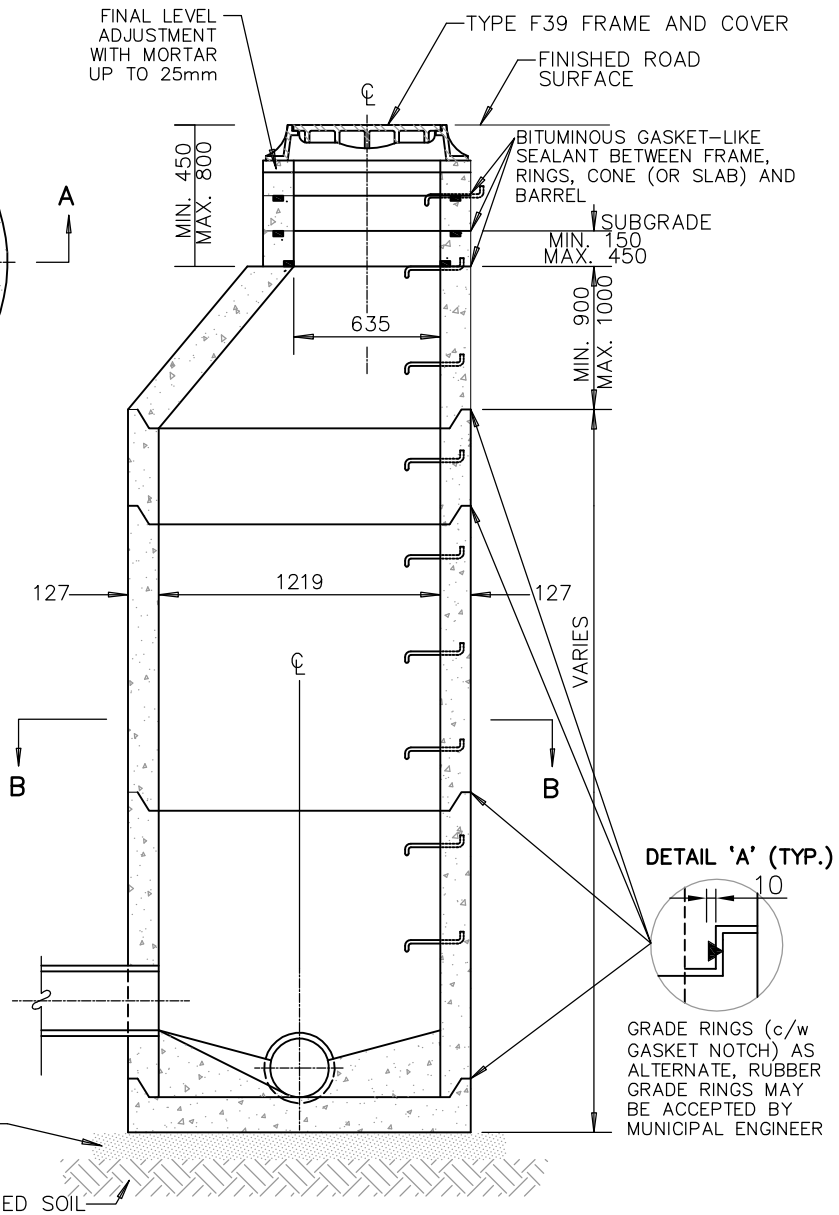
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

DATE: NOV, 2014	TOWN OF HIGH LEVEL TITLE: SANITARY CLEAN OUT DETAIL	ACAD – CIVIL DRAFTING STANDARD DETAILS FIGURE: 21

TOWN OF HIGH LEVEL



SECTION B–B

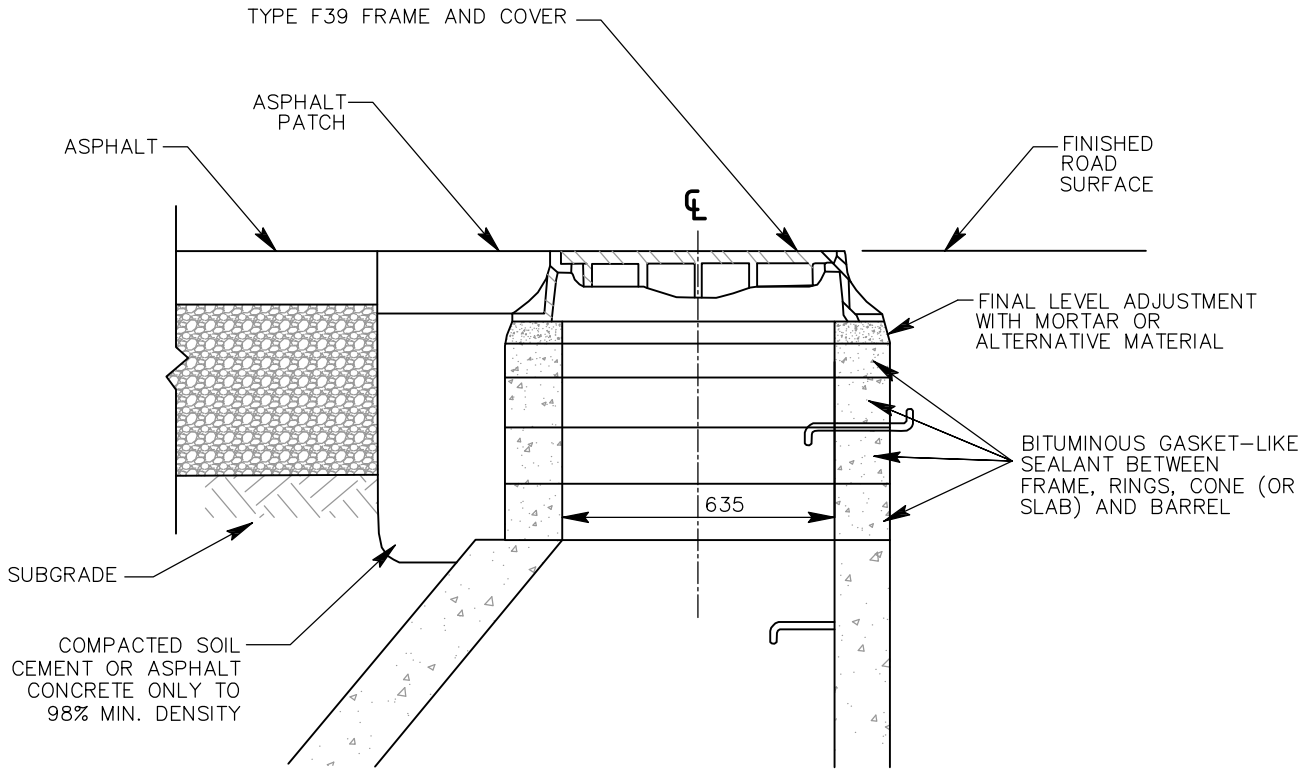


SECTION A–A

NOTES:

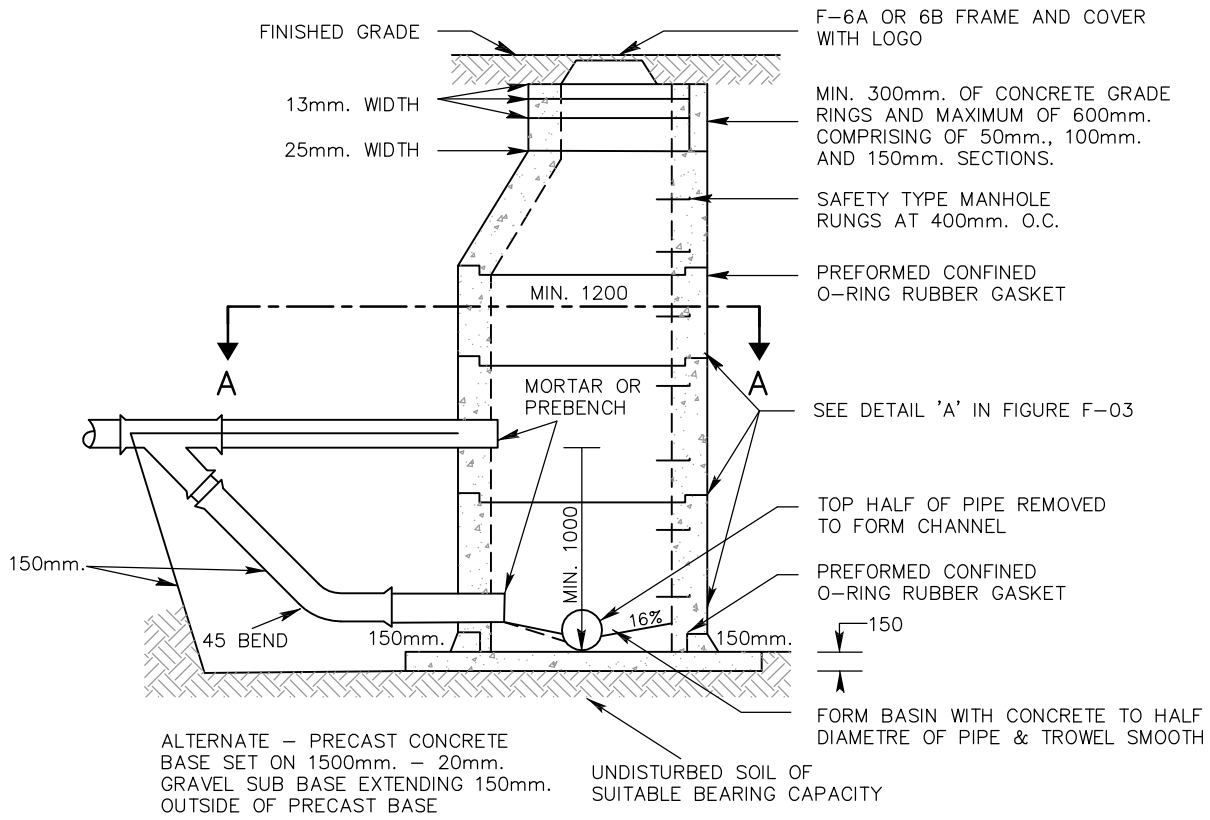
1. THIS STANDARD APPLIES TO MANHOLES ON PIPING OF MAXIMUM DIAMETER 600mm AND MINIMUM DEFLECTION ANGLE OF 120°.
2. 1500mm MANHOLE SHALL BE USED ON PIPING DIAMETER 750mm, 900mm AND 1050mm. FOR PIPE DIAMETER 1200mm AND LARGER, MANHOLE TEE RISERS SHALL BE USED.
3. PREBENCHED MANHOLE BASE UNITS WITH INTEGRAL GASKETS SHALL BE USED.
4. THE SEWER PIPING IS AN EXAMPLE ONLY, REFER TO PROJECT DRAWINGS FOR LAYOUT AND ELEVATIONS.
5. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
6. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST–IN–PLACE AND PRECAST CONCRETE RESPECTIVELY.

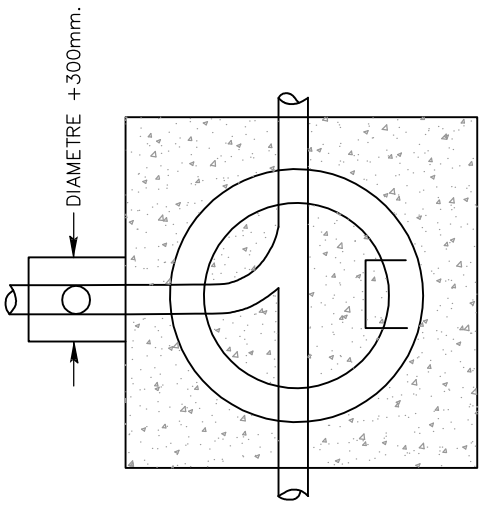
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: STANDARD 1200mm MANHOLE	FIGURE: 22



NOTES:
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST–IN–PLACE AND PRECAST CONCRETE RESPECTIVELY.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: NECK SECTION DETAILS FOR STANDARD 1200 MANHOLE	FIGURE: 23



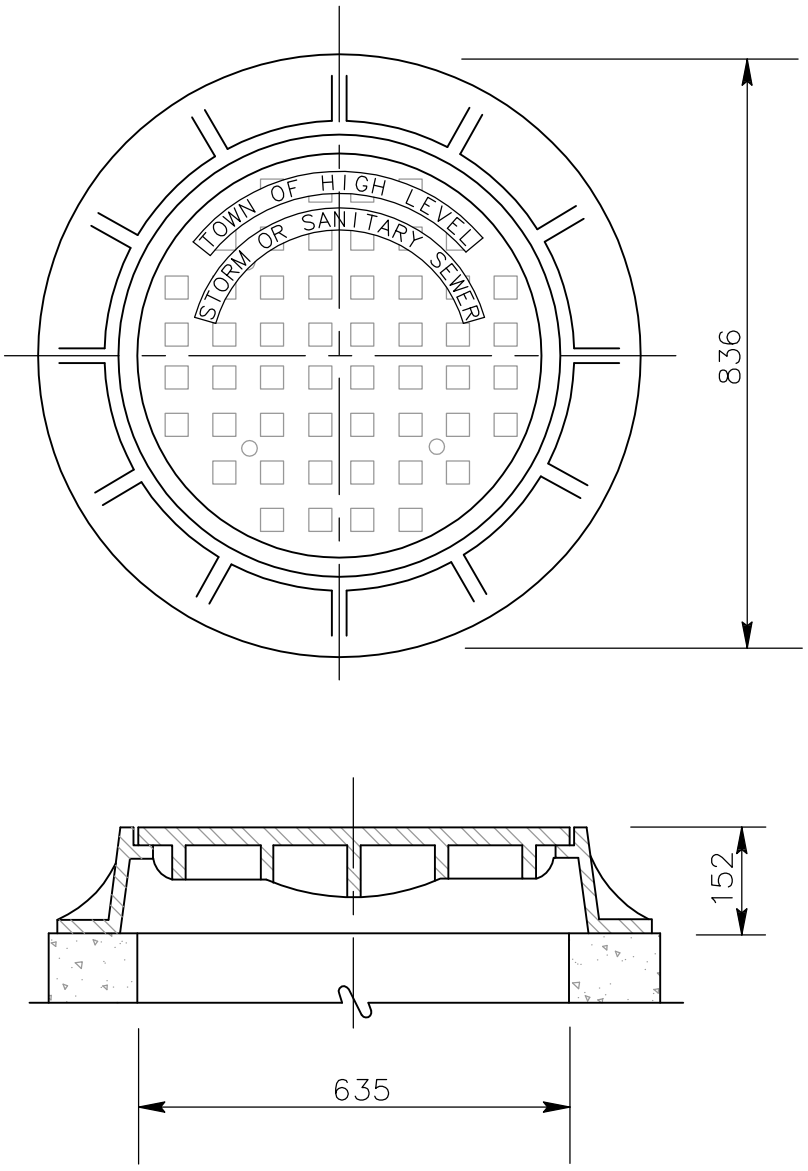


SECTION A–A
N.T.S.

NOTES:

1. ALL PRECAST MANHOLES MUST CONFORM TO A.S.T.M. SPECIFICATIONS C478.
2. POURED IN PLACE CONCRETE SHALL HAVE 28 DAYS COMPRESSIVE STRENGTH OF 25 MPa.
3. ALL JOINTS MORTARED INSIDE & OUT.
4. FORM FLOW THROUGH IN PARTIALLY SET CONCRETE AND TROWEL SMOOTH.
5. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
6. MAX DIST. FROM RIM TO TOP RUNG IS 800mm.
7. BACKFILL MH. WITH SELECT NATIVE MATERIAL.
8. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST–IN–PLACE AND PRECAST CONCRETE RESPECTIVELY.
9. ALL BARREL JOINTS TO BE GROUTED.

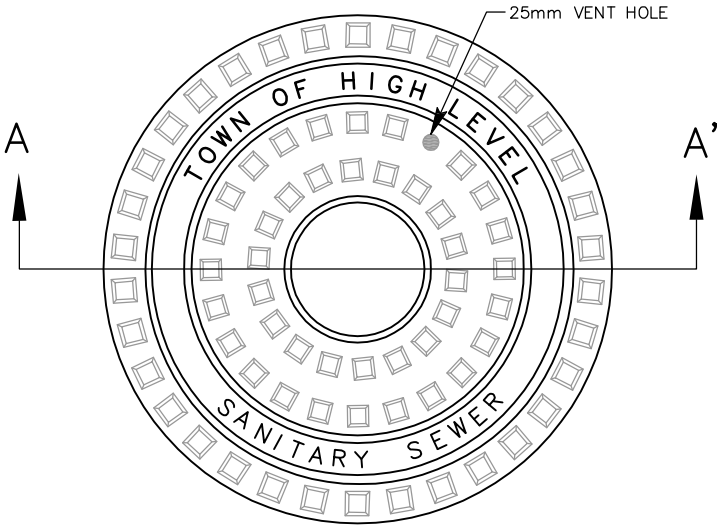
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: PRECAST EXTERNAL DROP MANHOLE	FIGURE: 24

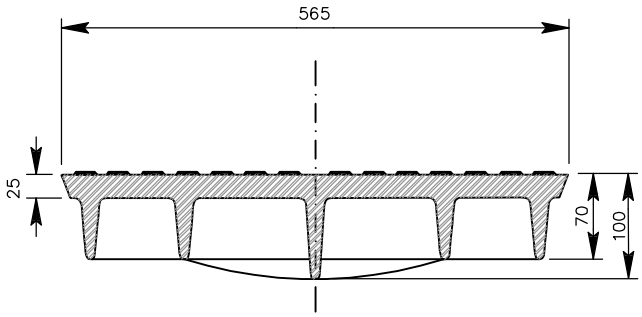


NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.
3. NOT GENERALLY APPLICABLE IN PEACE RIVER. TO BE USED ONLY WHEN DIRECTED BY MUNICIPALITY.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: TYPE F39 COVER & FRAME	FIGURE: 25



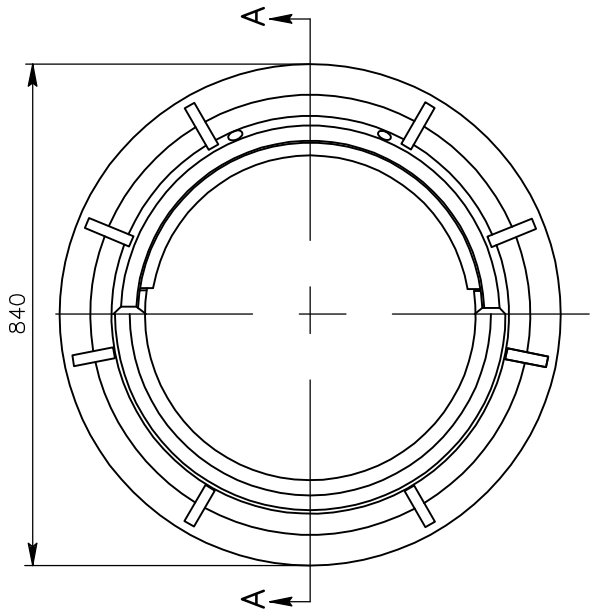


SECTION A–A'

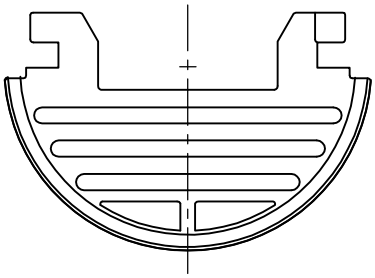
NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST–IN–PLACE AND PRECAST CONCRETE RESPECTIVELY.
3. F39 MANHOLE COVER, MASS 65 kg.

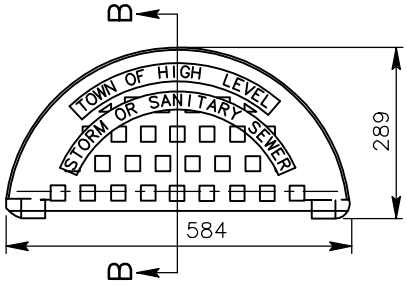
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: MANHOLE COVER–SANITARY SEWER	FIGURE: 26



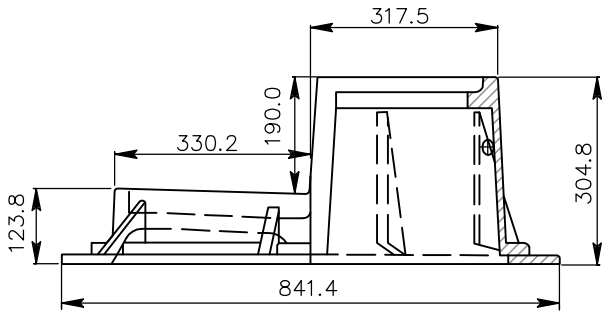
TOP VIEW (FRAME)



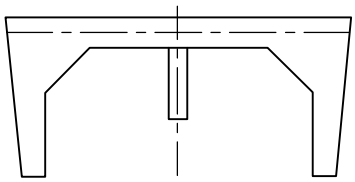
TOP VIEW – COVER (PART A)



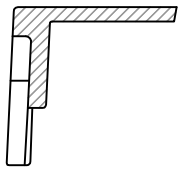
TOP VIEW – COVER (PART B)



SECTION A–A



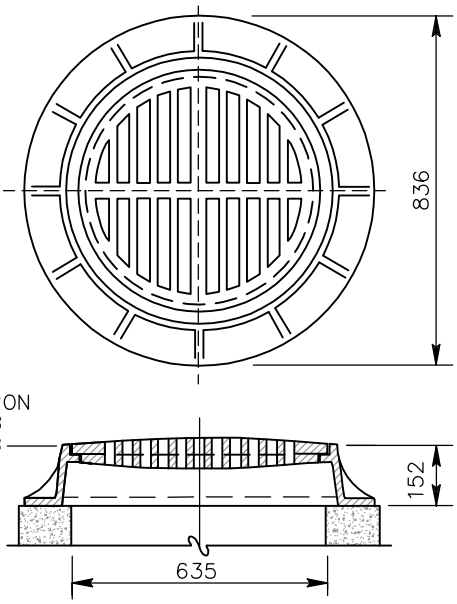
FRONT VIEW – COVER (PART B)



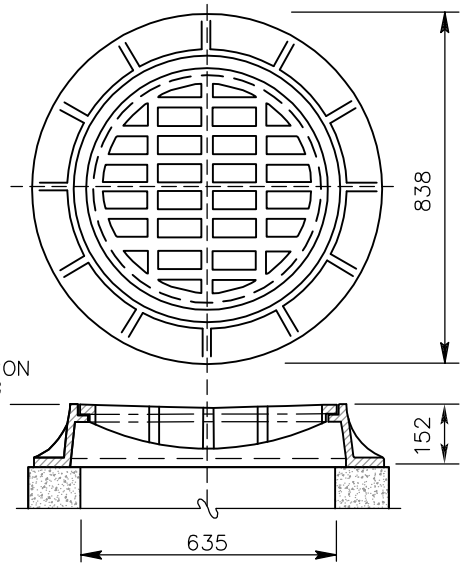
NOTES:

1. MATERIALS:
   - FRAME: GRAY IRON CLASS 20B.
   - COVER: PART A IRON CLASS 20B.
     PART B DUCTILE IRON GRADE 65–45–12.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

DATE: NOV, 2014	TOWN OF HIGH LEVEL TITLE:	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TWO PIECE TYPE 4A GRATING AND FRAME	FIGURE: 27



NO.6 ROUND TOP CATCHBASIN
OR MH FRAME & COVER

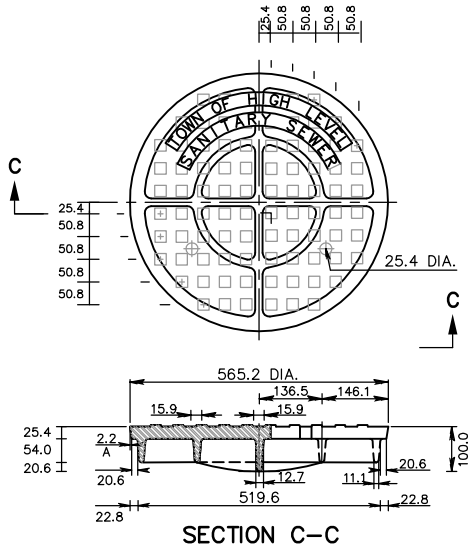


NO.8 LARGE PAVING AND CURB RAMP
CATCHBASIN OR MH FRAME & COVER

NOTES:
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

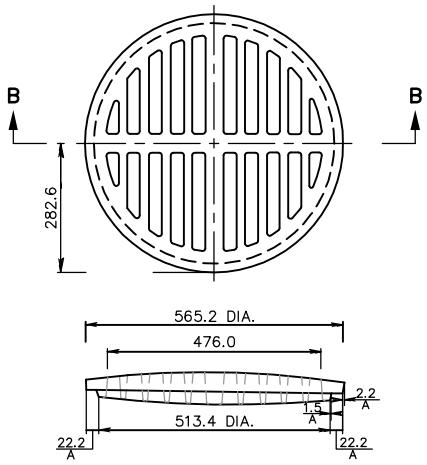
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: FRAME AND GRATING TYPE 6 AND 8	FIGURE: 28

No. 6A STANDARD MANHOLE COVER



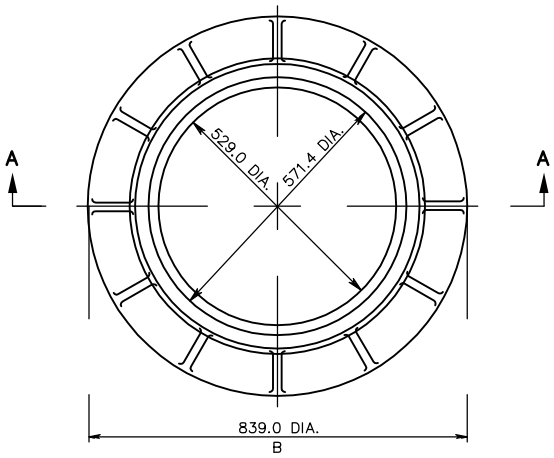
SECTION C–C

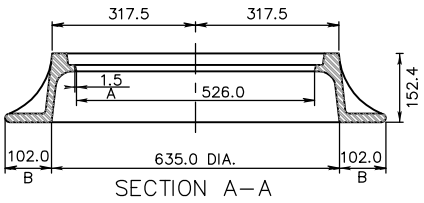
No. 6B STANDARD ROUND CATCH BASIN TOP



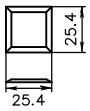
SECTION B–B

No.6 STANDARD FRAME FOR MANHOLE AND ROUND CATCH BASIN TOP





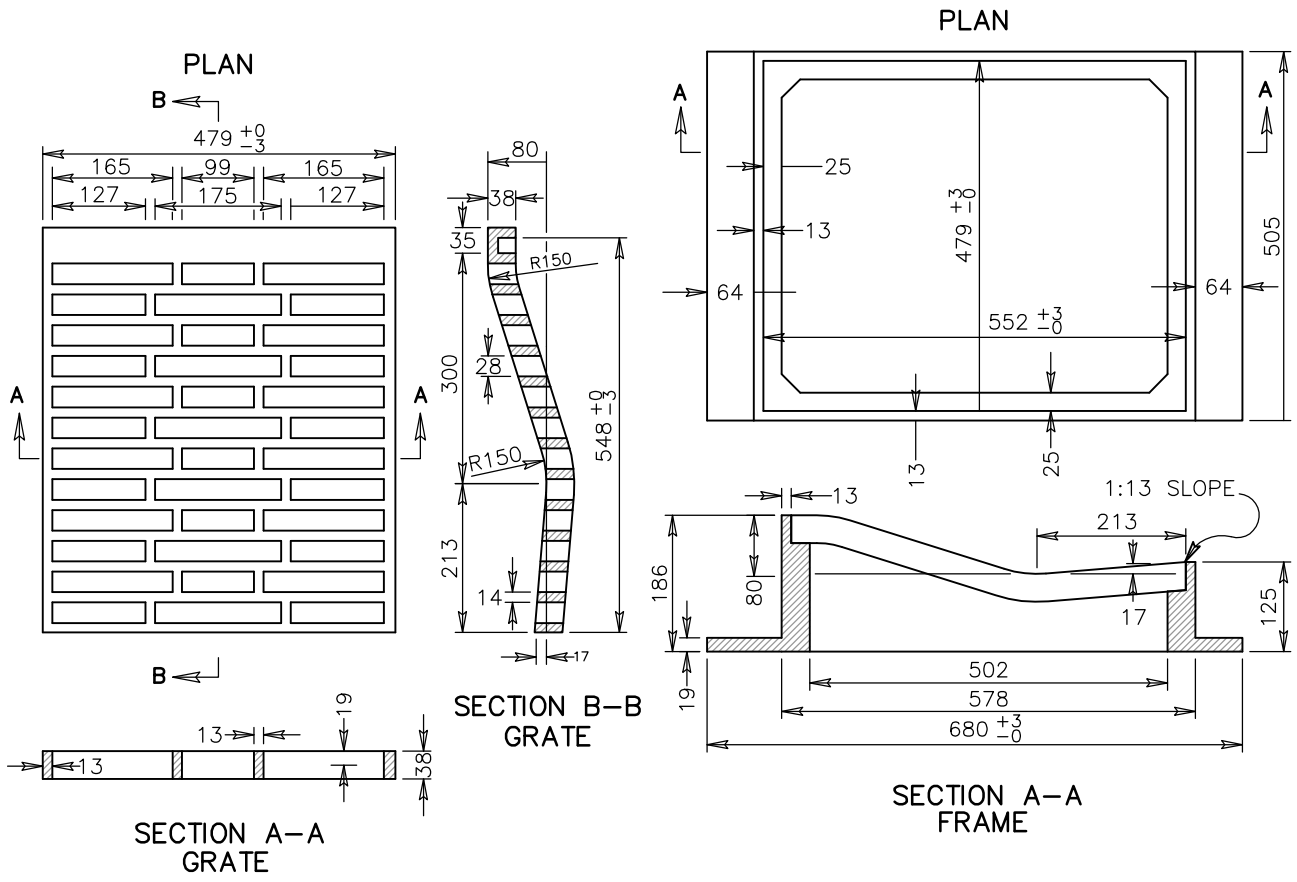
SECTION A–A



DETAIL OF CHECKERS

NOTES:
1. MATERIAL SPECIFICATION:
   DUCTILE IRON TO CONFORM TO A.S.T.M. A536 (LATEST EDITION) GRADE 80–60–03.
2. NF–90 FRAME AND COVER IS WATERTIGHT VARIATION OF NF–80.
   THERE ARE NO VENTING HOLES IN NF–90 COVER AND A GASKET IS
   PLACED BETWEEN THE FRAME AND COVER.
3. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
4. NOT GENERALLY APPLICABLE IN PEACE RIVER. TO BE USED ONLY WHEN DIRECTED BY MUNICIPALITY.

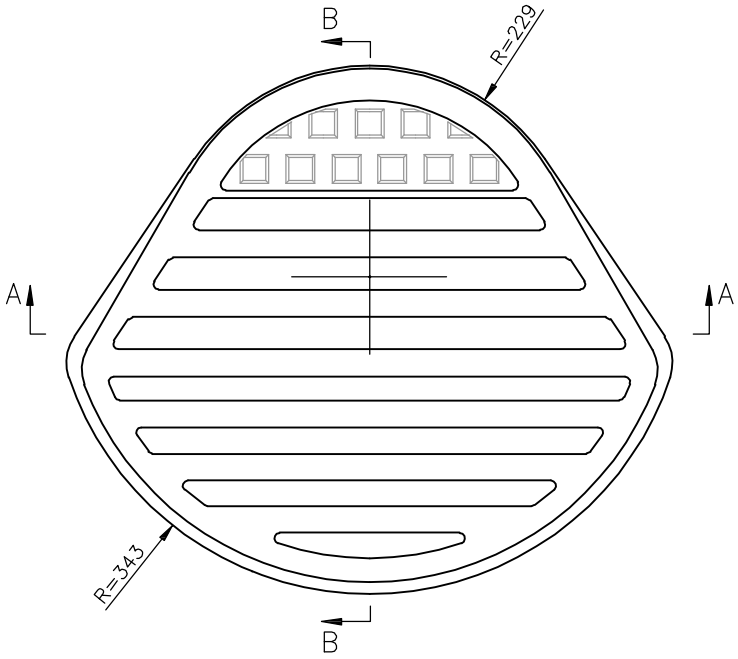
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: ROUND TOP CATCH BASIN AND MANHOLE	FIGURE: 29



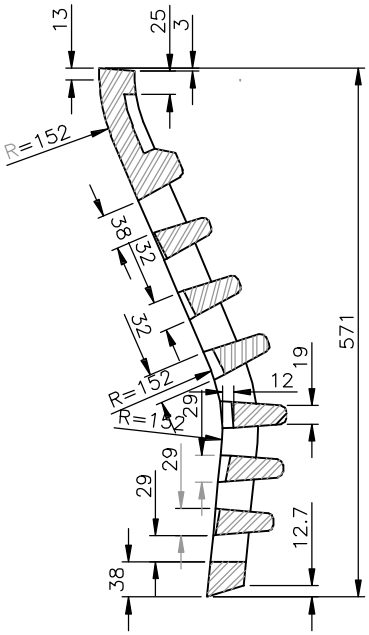
NOTES:

1. MATERIALS:
   - FRAME
     - GREY CAST IRON TO CONFORM TO CLASS 25B A.S.T.M. A48 (LATEST EDITION).
   - GRATE
     - DUCTILE IRON TO CONFORM TO A.S.T.M. A536 (LATEST EDITION) GRADE 80–55–06.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
3. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST–IN–PLACE AND PRECAST CONCRETE RESPECTIVELY.

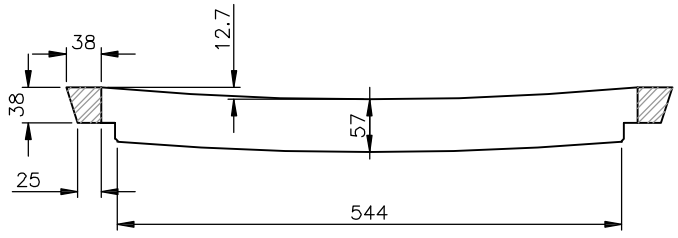
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: FRAME AND GRATING TYPE K–7	FIGURE: 30



PLAN



SECTION B–B

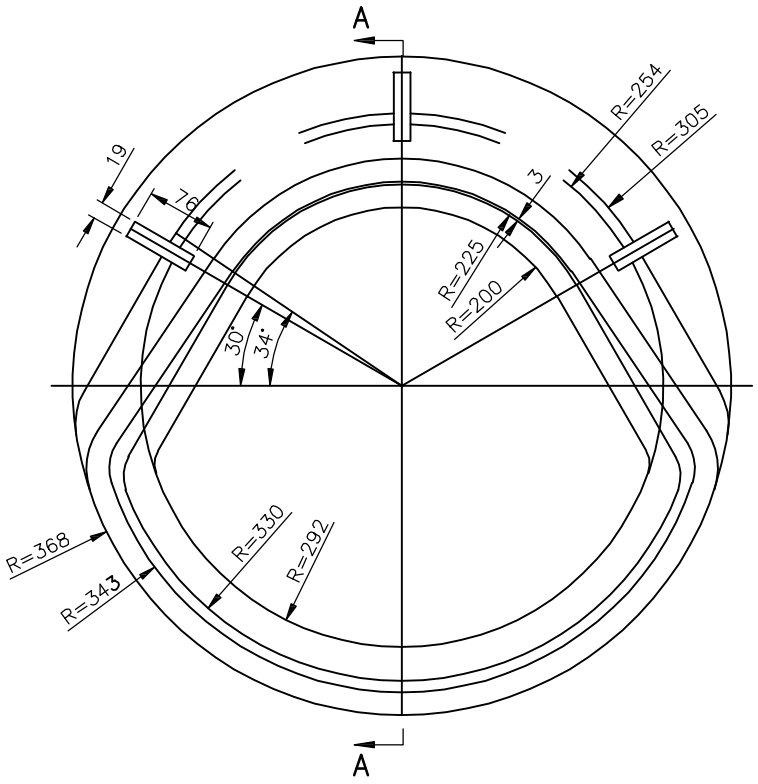


SECTION A–A

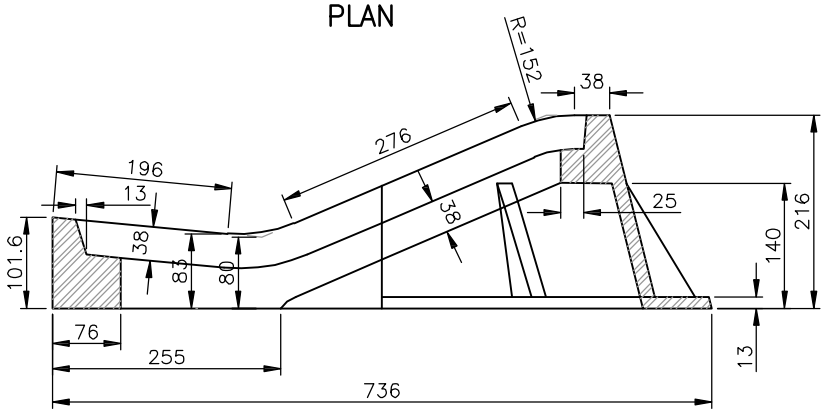
MATERIAL SPECIFICATIONS:

- NORWOOD F33 OR EQUAL
- CAST STEEL TO CONFORM TO GRADE 60–90 A.S.T.M. A48 CLASS 20 OR DUCTILE IRON TO CONFORM TO A.S.T.M. A455
- HOT DIPPED IN ASPHALT

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: F–33 CATCH BASIN GRATE	FIGURE: 31



PLAN

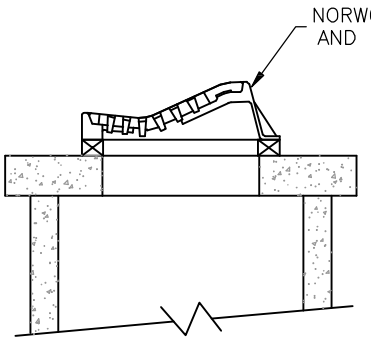


SECTION A–A

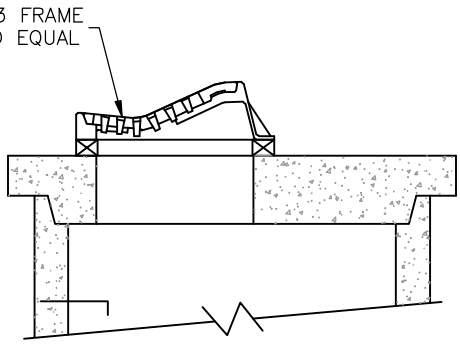
MATERIAL SPECIFICATIONS:

- GREY CAST IRON TO CONFORM TO CLASS 20 ASTM A48 (LATEST EDITION)
- MASS = 98KG

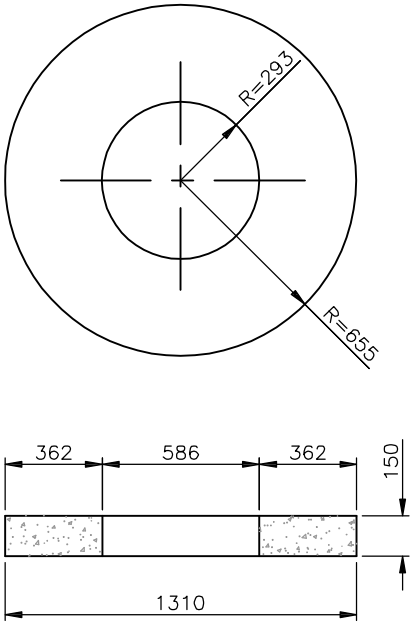
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: F–33 CATCH BASIN FRAME	FIGURE: 32



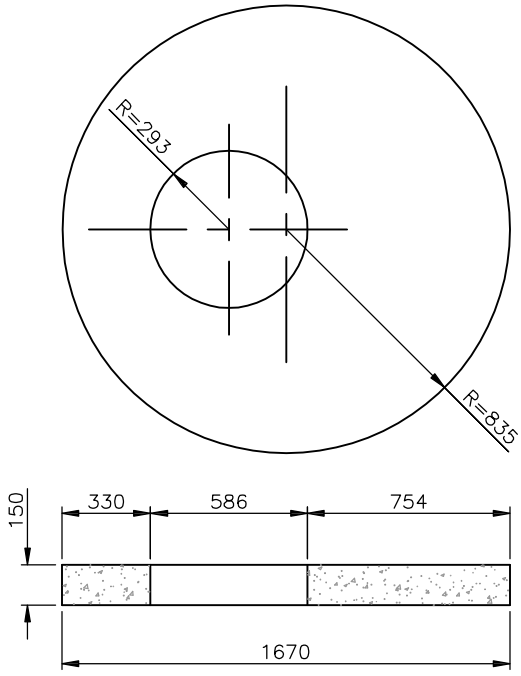
K–4 CATCH BASIN



K–4 CATCH BASIN MANHOLE

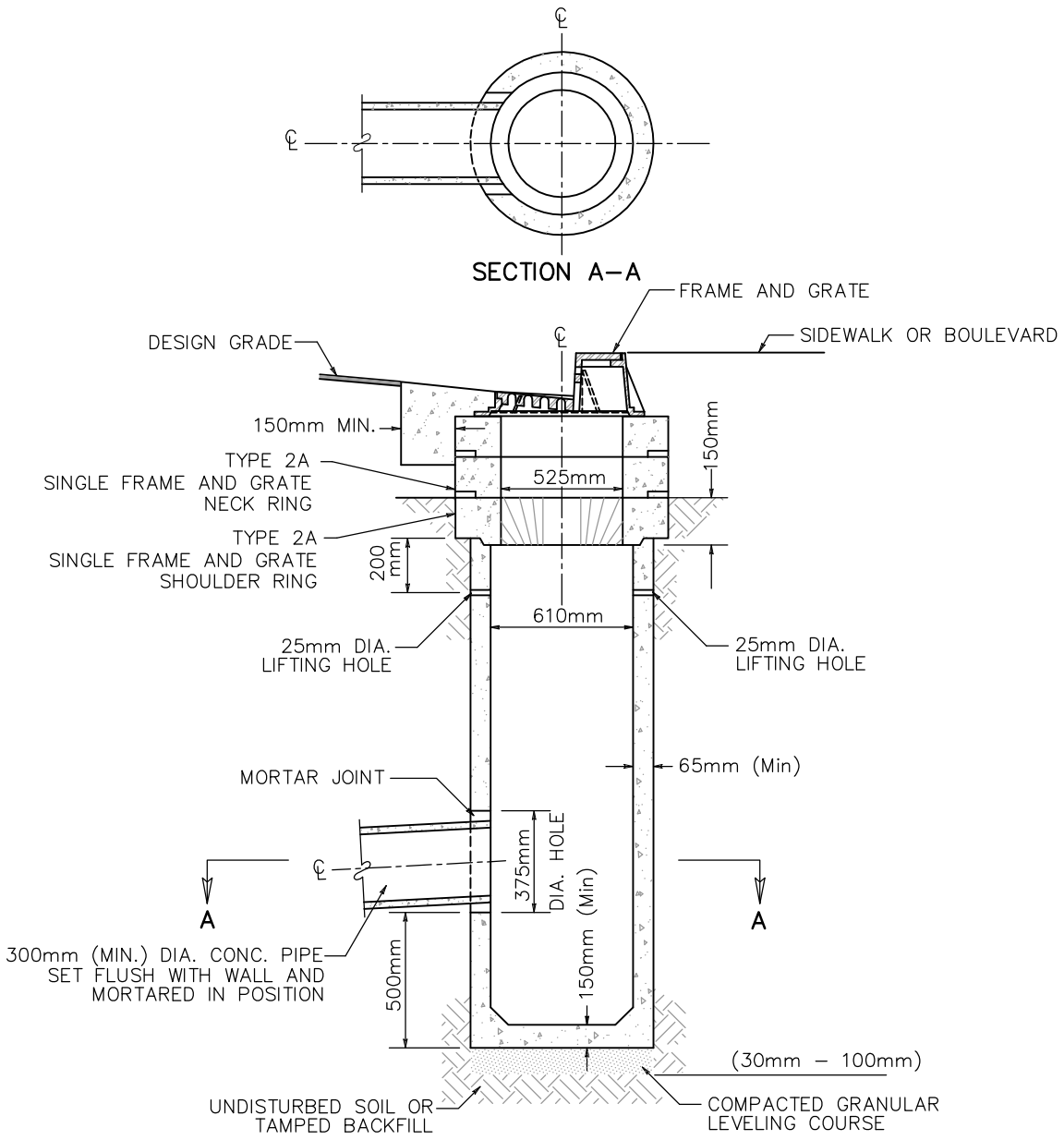


PRECAST K–4 CATCH BASIN TOP
FOR NF33 CB FRAME AND GRATE



PRECAST K–4 CATCH BASIN MANHOLE
TOP FOR NF33 CBMH FRAME AND GRATE

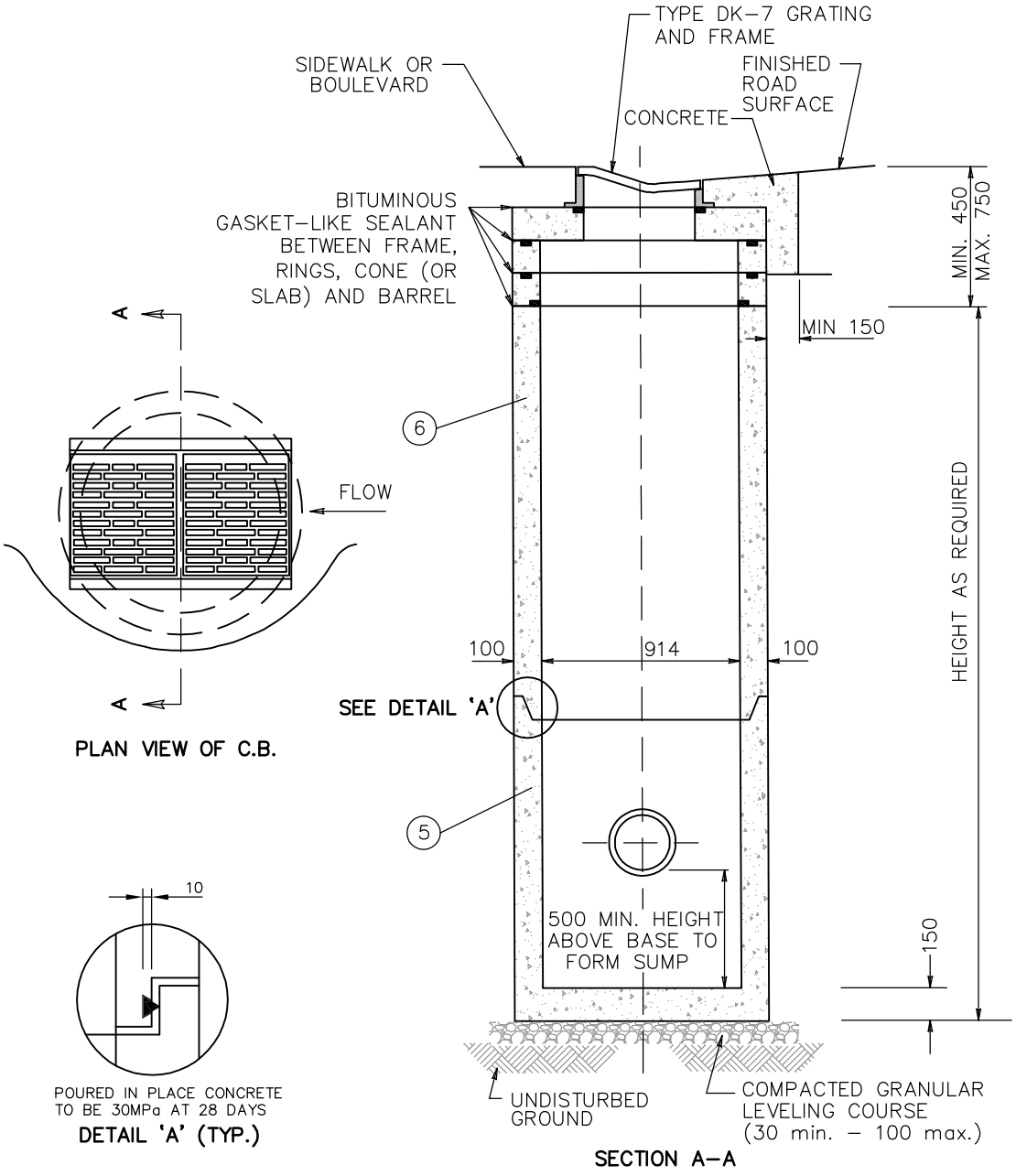
DATE: NOV, 2014	TOWN OF HIGH LEVEL TITLE: TYPE K–4 CATCH BASIN AND CATCH BASIN MANHOLE TOP SECTION	ACAD – CIVIL DRAFTING STANDARD DETAILS FIGURE: 33



NOTES:

1. RUBBER GASKET, KENT SEAL OR EQUIVALENT TO BE INSTALLED BETWEEN BARREL, ALL SHOULDER AND NECK RINGS AND CATCH BASIN FRAME.
2. ALL ROUGH JOINTS SHALL BE POINTED WITH MORTAR TO ENSURE SMOOTHNESS.
3. ALL CATCH BASIN COMPONENTS TO BE IN ACCORDANCE WITH ASTM C478.
4. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
5. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST–IN–PLACE AND PRECAST CONCRETE RESPECTIVELY.

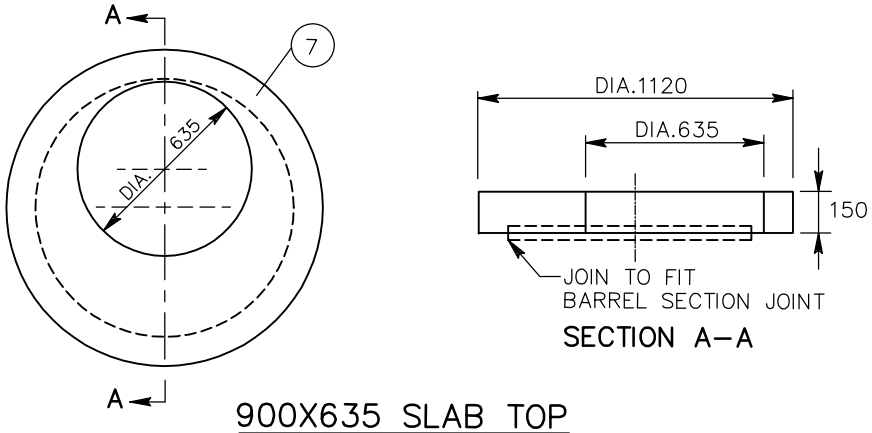
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: PRECAST 610mmØ CATCH BASIN	FIGURE: 34



NOTES:

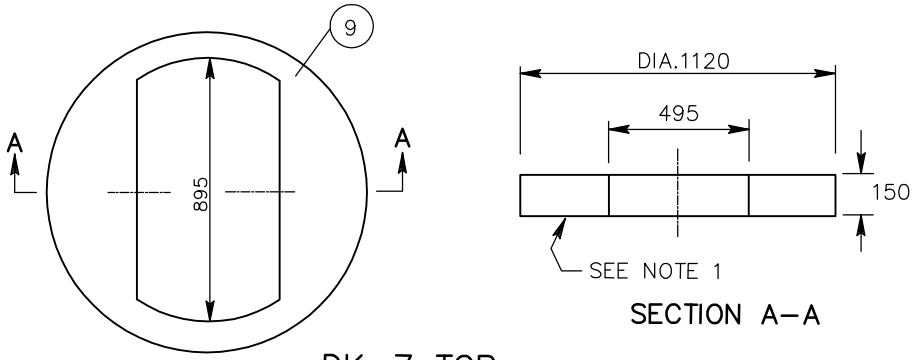
1. ITEM 5 COULD BE MADE UP FROM TWO ITEMS (BASE AND BARREL).
2. ITEM 6 COULD BE MADE UP FROM TWO ITEMS (SHOULDER RING SLAB TOP AND BARREL).
3. ITEMS 5 AND 6 COULD BE MADE AS ONE UNIT.
4. OPPOSITE ORIENTATION OF JOINS IS ACCEPTABLE.
5. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
6. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

DATE: NOV, 2014	TOWN OF HIGH LEVEL TITLE: STANDARD 900 CATCH BASIN WITH TYPE DK-7 GRATING AND FRAME	ACAD - CIVIL DRAFTING STANDARD DETAILS FIGURE: 35



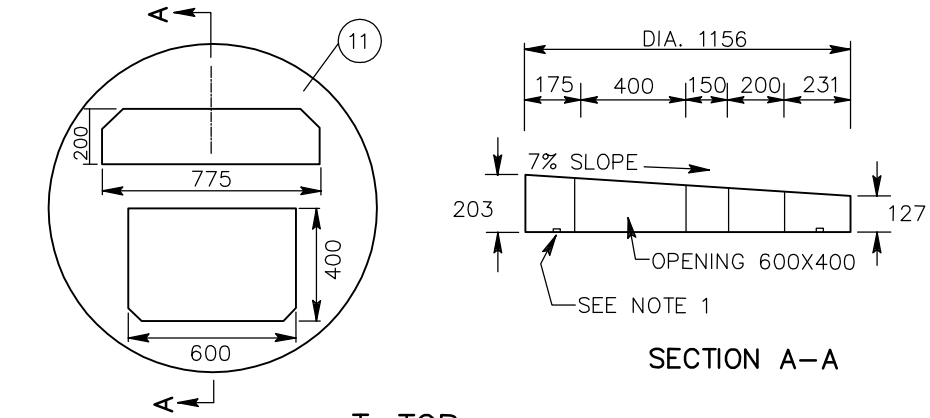
900X635 SLAB TOP

(TOP BELOW NECK FOR USE WITH 4A, 6, 8 FRAME AND GRATING)



DK–7 TOP

(SLAB TOP FOR USE WITH DK–7 FRAME AND GRATING)



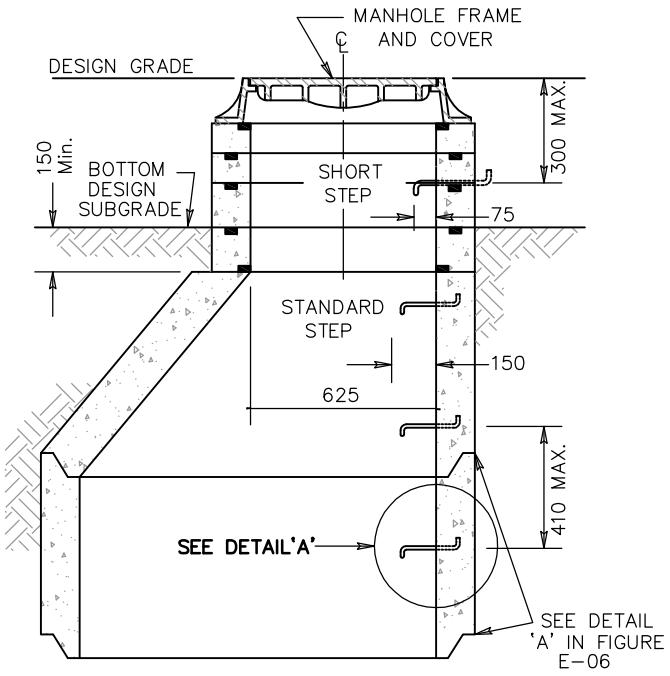
T–TOP

(TEE TOP FOR USE WITH F–5I WITH SIDE INLET)

NOTES:

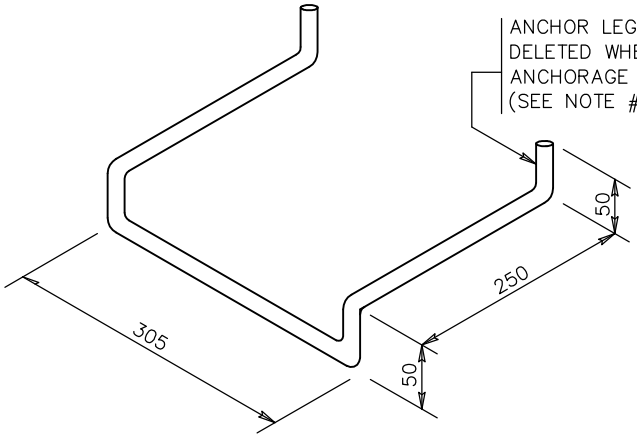
1. A CONCENTRIC GROOVE LOCATED AT MID CROSS SECTION, SUITABLE FOR SEALANT IS REQUIRED FOR NECK RINGS AND EXTENSION RINGS.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
3. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST–IN–PLACE AND PRECAST CONCRETE RESPECTIVELY.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: SLAB TOPS FOR STANDARD 900 CATCH BASIN	FIGURE: 36



TYPICAL MANHOLE SECTION

DETAIL 'A'



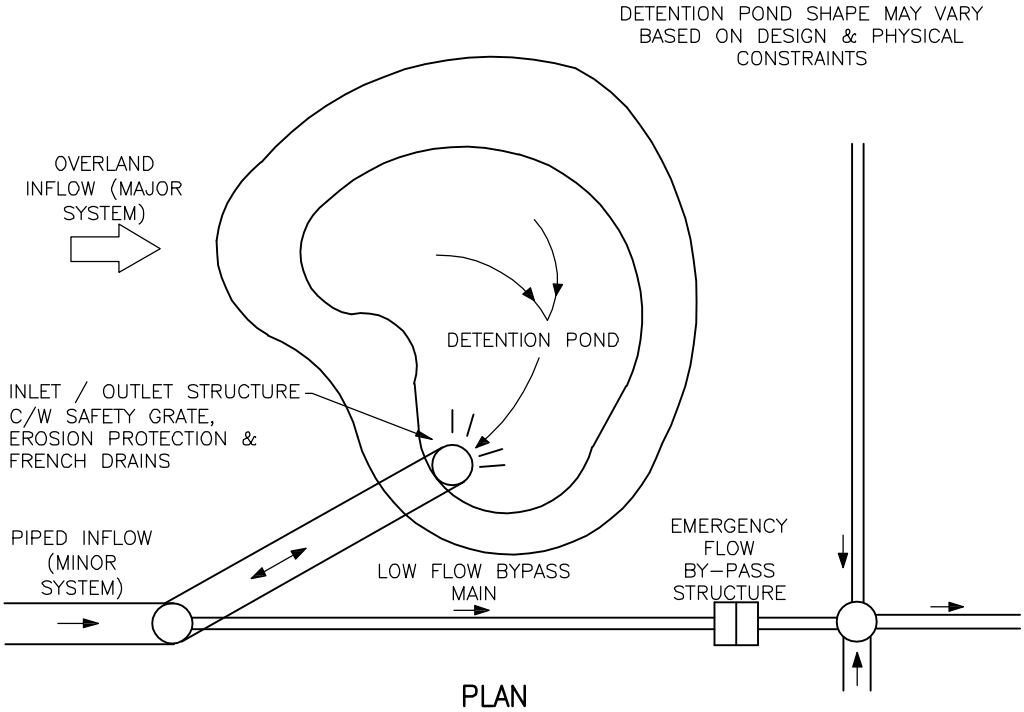
PLACEMENT:

1. EXCEPT WHERE SPECIFIED OTHERWISE, SAFETY STEPS SHALL BE INSTALLED IN ALL PRECAST MANHOLE SECTIONS & CONES, IN THE GRADE ADJUSTMENT SECTIONS AND IN CAST IN PLACE SECTIONS SO THAT WHEN THE VARIOUS SECTIONS ARE ASSEMBLED IN ANY COMBINATION THEY WILL FORM A CONTINUOUS VERTICAL LADDER WITH RUNGS EQUALLY SPACED AT A MAXIMUM OF 410mm TO WITHIN 300mm BELOW THE COVER AND TO WITHIN 600mm OF THE BASE OR BENCHING.
2. STEPS SHALL BE CAST FIRMLY IN PLACE OR SECURED WITH A SUITABLE MECHANICAL ANCHORAGE TO PREVENT PULLOUT, AND MAINTAIN WATER TIGHTNESS.
3. "STANDARD STEPS" SHALL PROJECT A DISTANCE OF 150mm MEASURED AT THE POINT OF EMBEDMENT.
4. A "SHORT STEP" WITH A PROJECTION OF 75mm SHALL BE INSTALLED WITHIN THE GRADE ADJUSTMENT SECTION, CAST INTO THE NECK OR FIRMLY MORTARED IN PLACE BETWEEN THE NECK RINGS, WITH THE ANCHOR LEGS OUTSIDE OF THE NECK RING.
5. EXCEPT AS SPECIFIED ABOVE, DESIGN AND INSTALLATION OF SAFETY STEPS SHALL CONFORM TO A.S.T.M. C478.
6. SAFETY STEPS SHALL BE ALIGNED ON CENTRELINE PERPENDICULAR TO THE MAIN FLOW CHANNEL. WHENEVER POSSIBLE, THE STEPS SHALL BE ALIGNED SO THAT A PERSON EXITING THE MANHOLE WOULD FACE ONCOMING TRAFFIC IF NOT CONFLICTING WITH THE PREVIOUS REQUIREMENT.

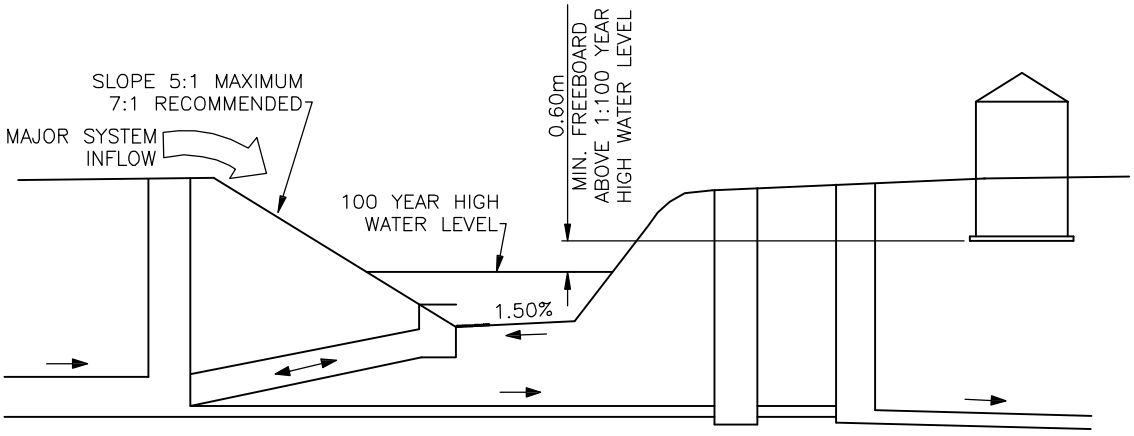
NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: SAFETY STEPS FOR MANHOLES	FIGURE: 37

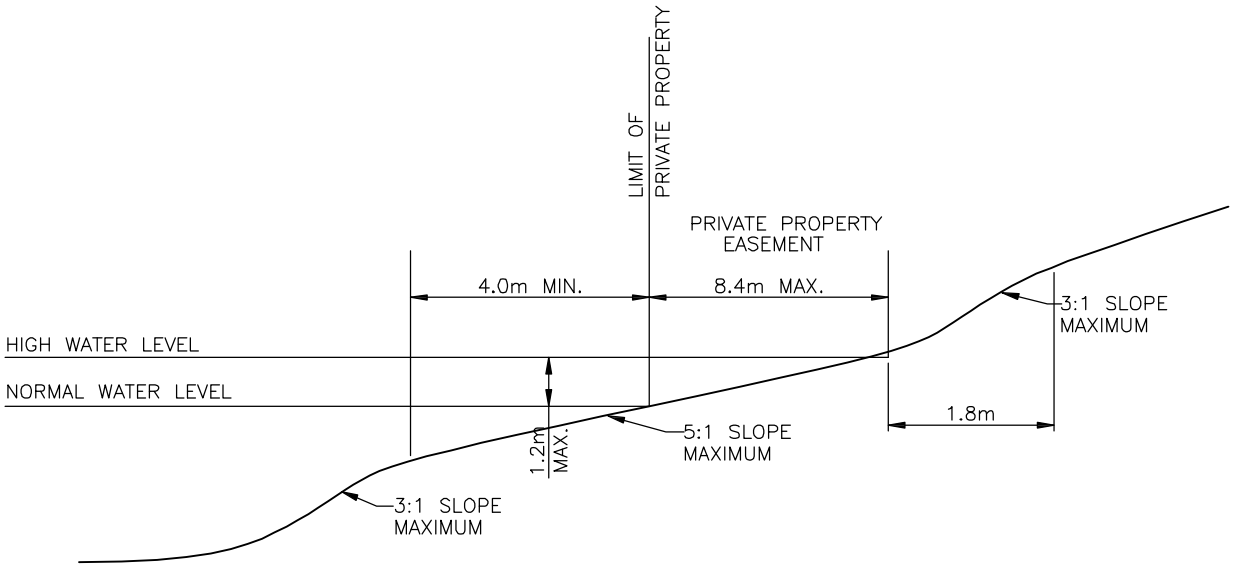


PLAN

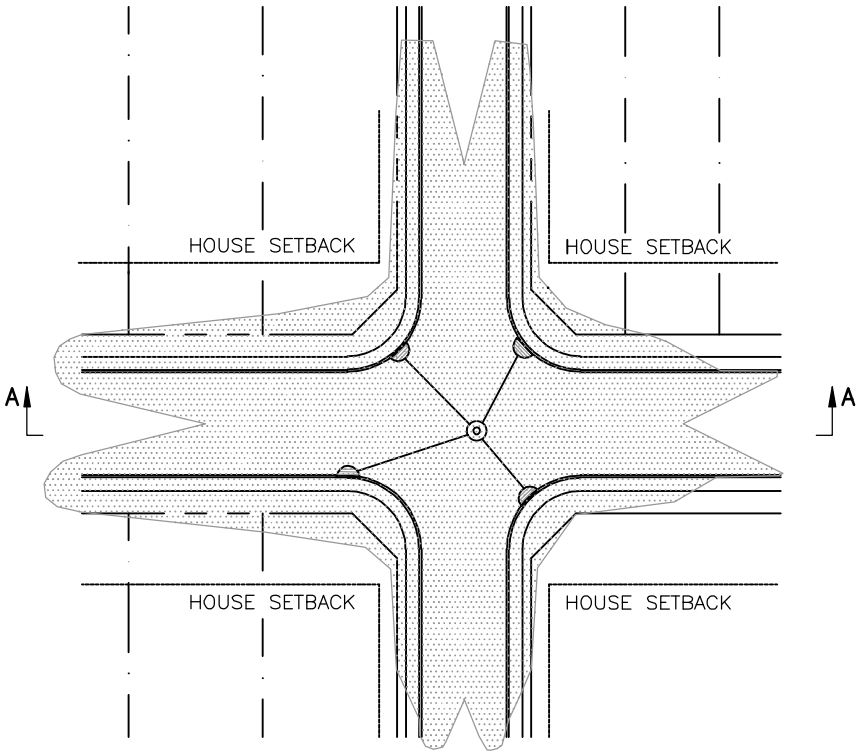


SECTION

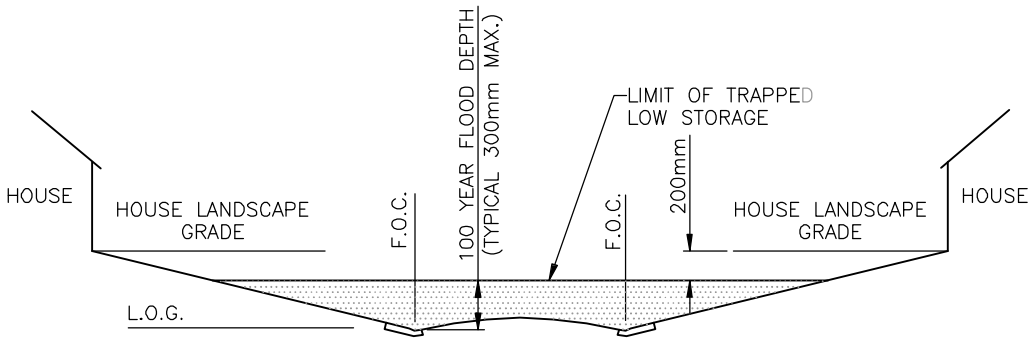
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: DRY STORMWATER STORAGE FACILITY	FIGURE: 38



DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: WEST POND CROSS SECTION	FIGURE: 39

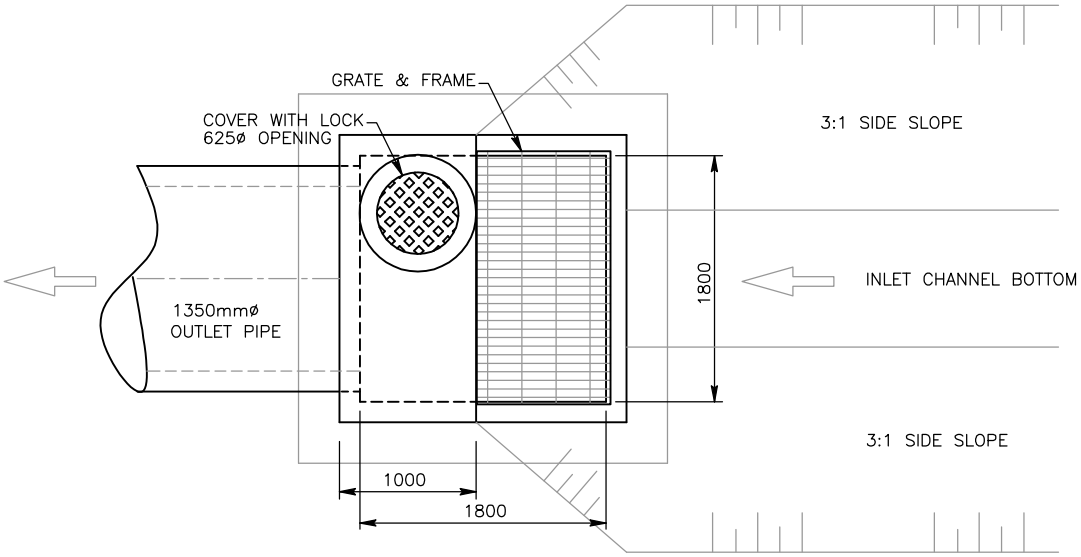


PLAN

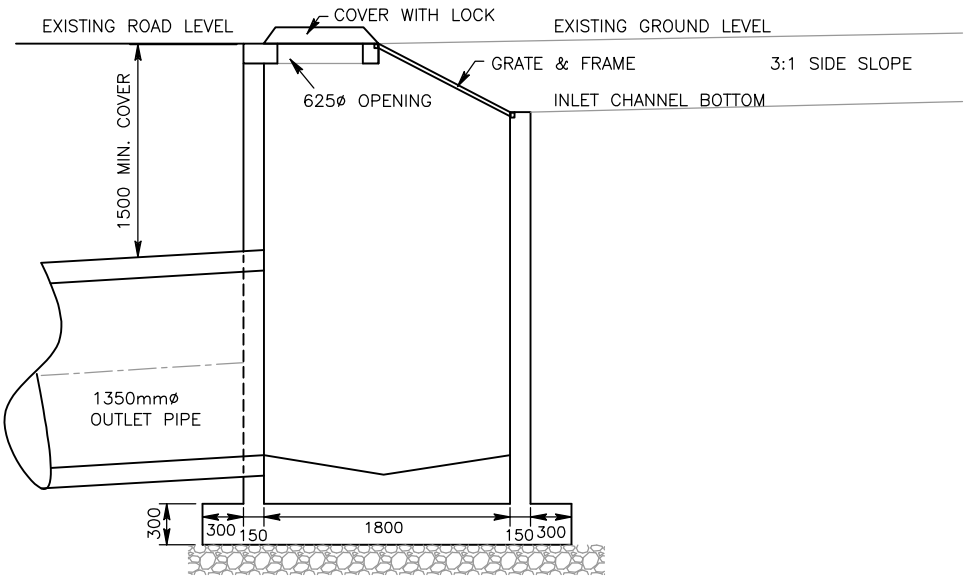


SECTION A–A

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: TYPICAL TRAPPED LOW STORAGE AREA	FIGURE: 40

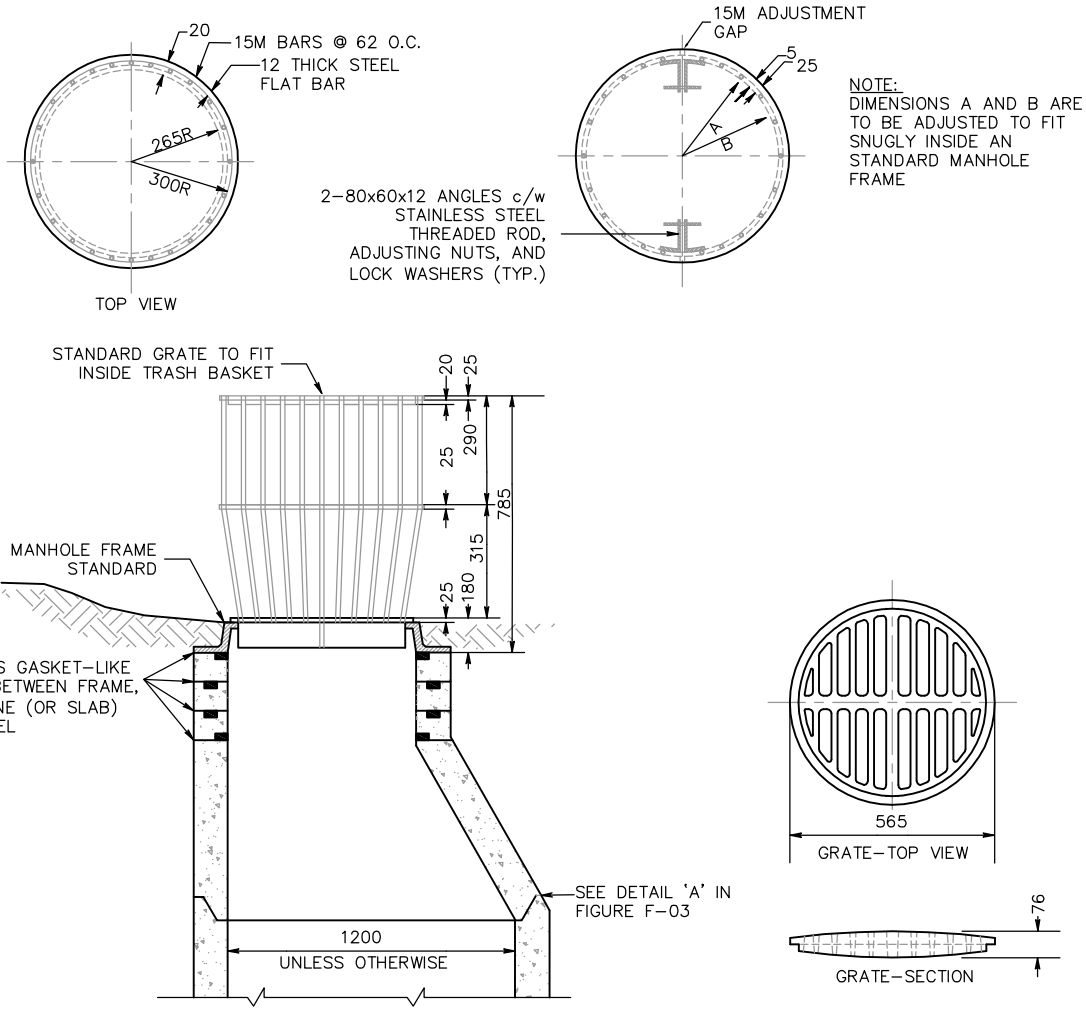


PLAN



NOTE:
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

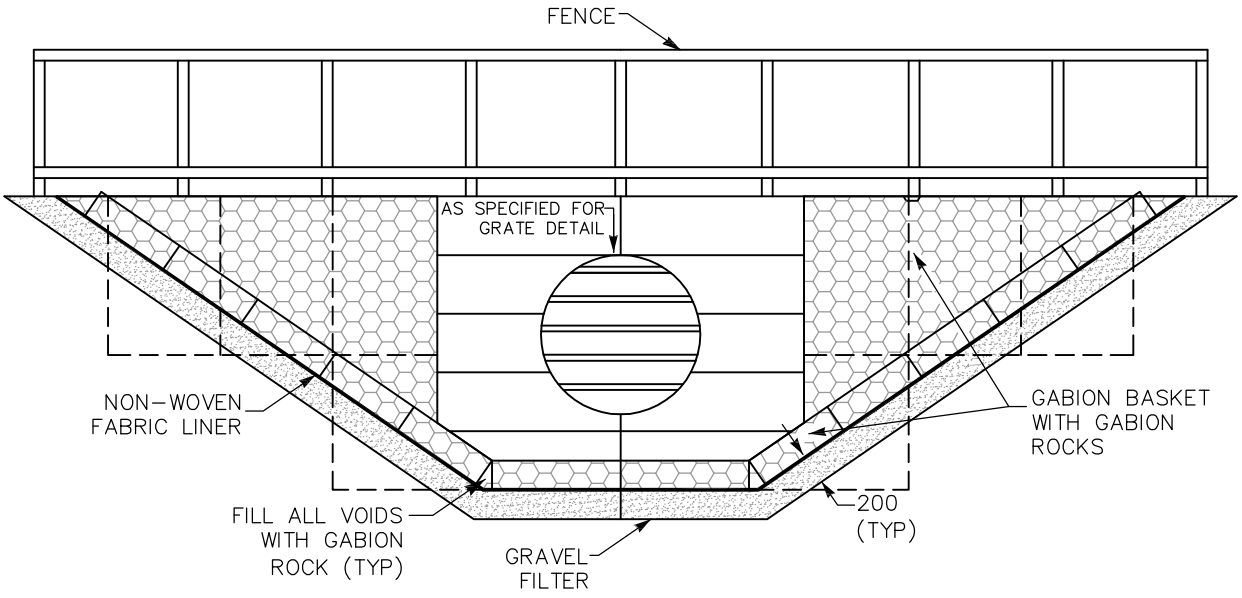
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: SWALE INLET STRUCTURE	FIGURE: 41A



NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST–IN–PLACE AND PRECAST CONCRETE RESPECTIVELY.
3. ALL BARREL JOINTS TO BE GROUTED.

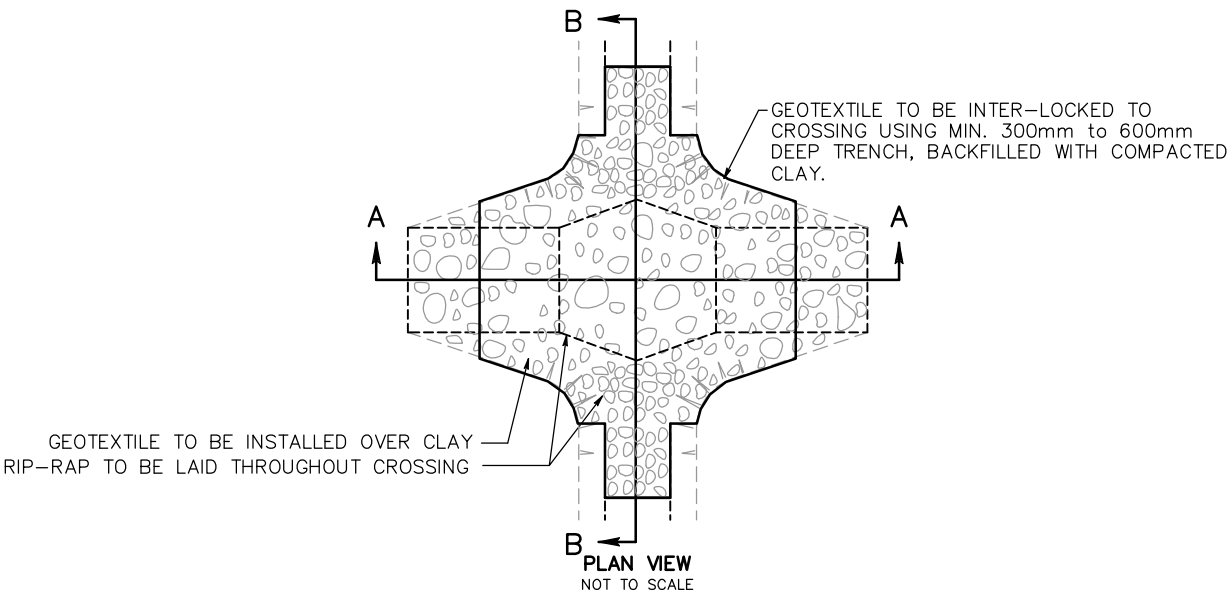
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: SWALE INLET STRUCTURE	FIGURE: 41B



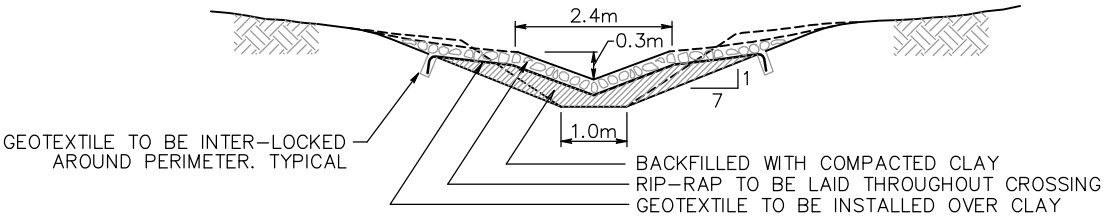
NOTE:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

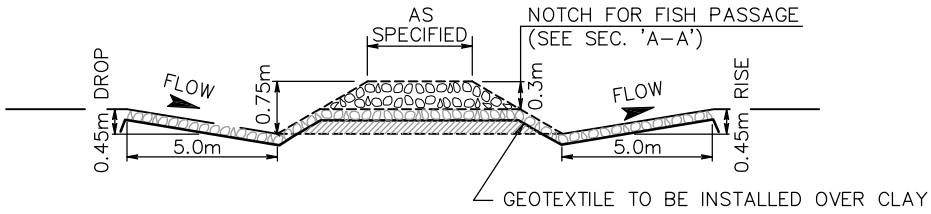
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: GABION BASKET DETAIL STORM SEWER OUTLET (OUTLETS GREATER THAN 0.9mø)	FIGURE: 42



PLAN VIEW
NOT TO SCALE



SECTION 'A-A'

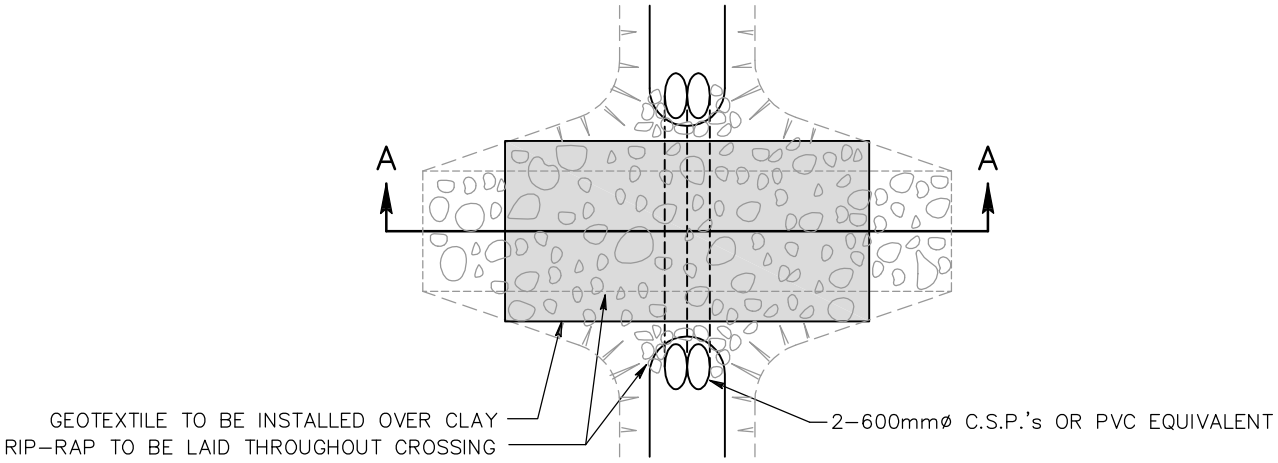


SECTION 'B-B'

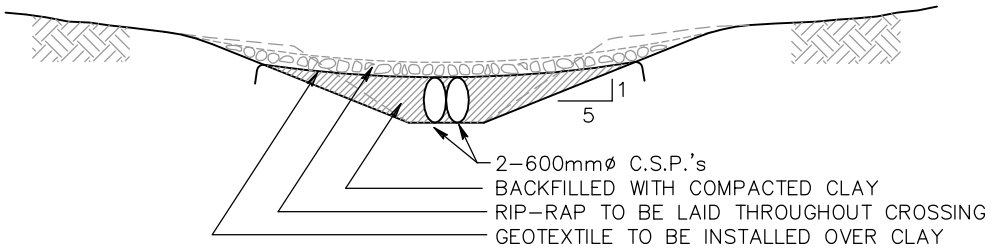
NOTES:

1. GEOTEXTILE OVERLAPS TO BE A MIN. OF 300mm.
2. ROCKED LINED CROSSING: USE 150mm-200mm ROCK, MAT THICKNESS 300mm.
3. EXTEND TO FULL WIDTH, LENGTH & SIDESLOPE OF CROSSING AS WELL AS UPSTREAM & DOWNSTREAM. SPRAY SLURRY MIX CONCRETE (5MPa) TO FILL VOIDS (TOP ONLY).
4. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: LOW LEVEL X-ING NO CULVERT	FIGURE: 43A

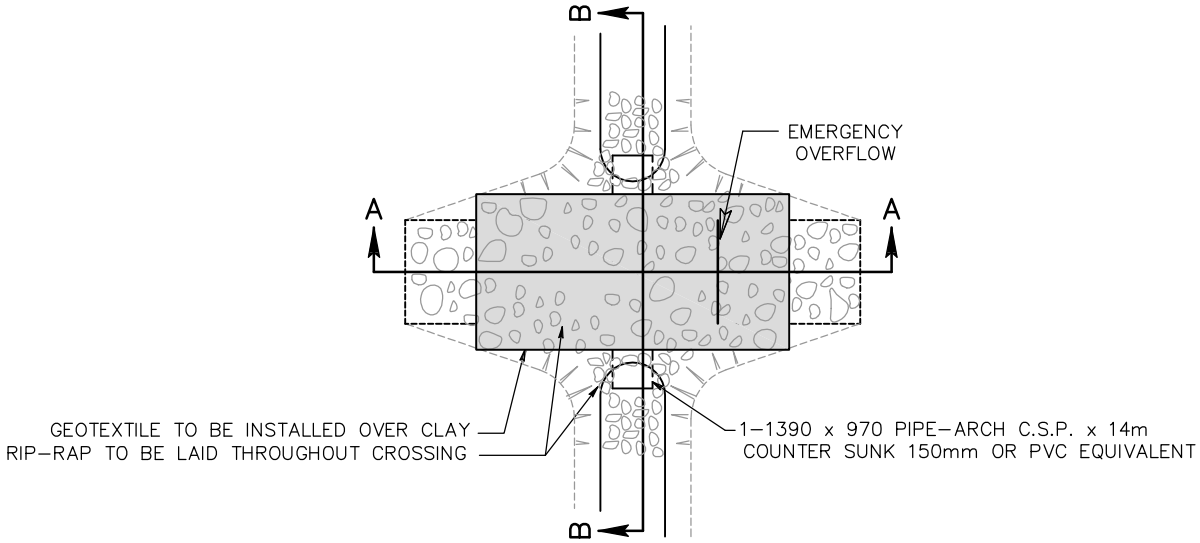


PLAN VIEW
Not to Scale

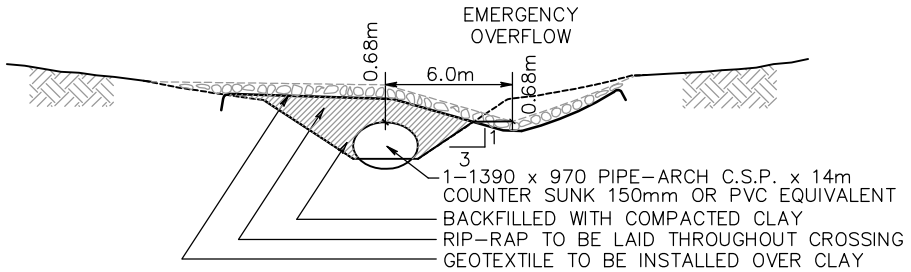


SECTION 'A–A'

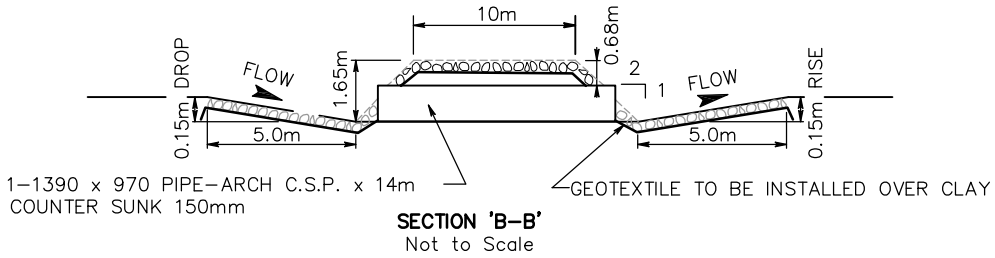
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: LOW LEVEL X–ING WITH CULVERT	FIGURE: 43B



PLAN VIEW
Not to Scale



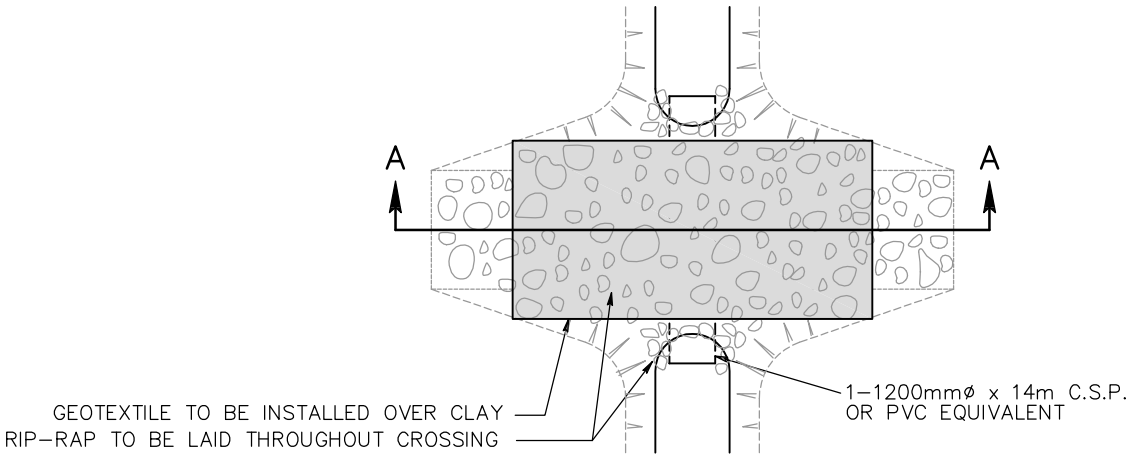
SECTION 'A–A'
Not to Scale



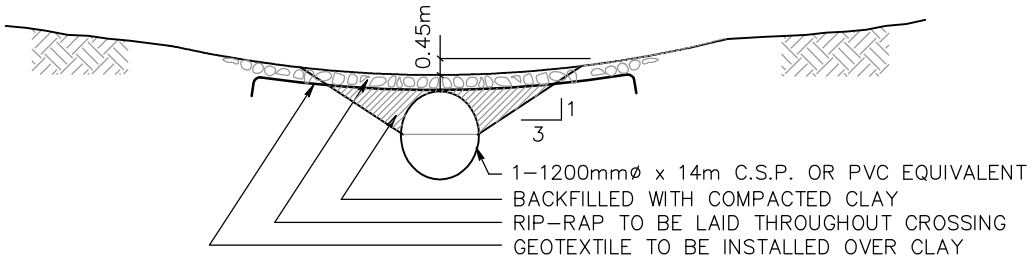
SECTION 'B–B'
Not to Scale

NOTES:
1. GEOTEXTILE OVERLAPS TO BE A MIN, OF 300mm.
2. ROCK LINED CROSSING: USE 150mm – 200mm ROCK, MAT THICKNESS 300mm.
3. EXTEND TO FULL WIDTH, LENGTH & SIDESLOPE OF CROSSING AS WELL AS UPSTREAM & DOWNSTREAM AND OVERFLOW CHANNEL.
4. SPRAY SLURRY CONCRETE (5MPa) TO FILL VOIDS (TOP ONLY).

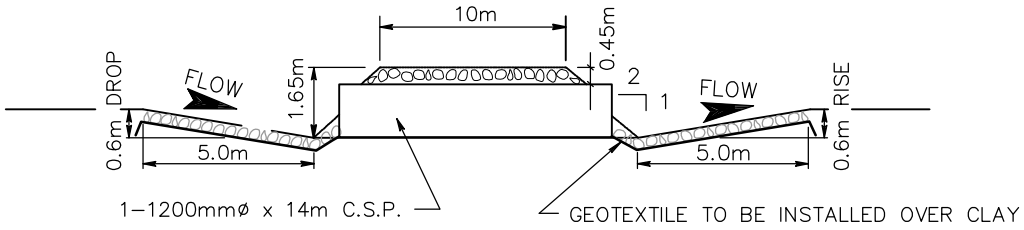
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: LOW LEVEL X–ING WITH CULVERT	FIGURE: 43C



PLAN VIEW
Not to Scale



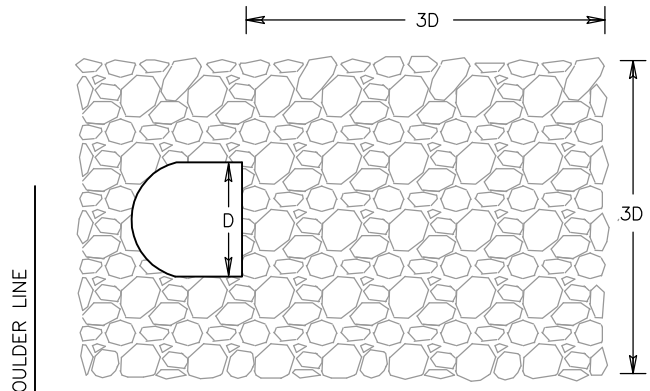
SECTION 'A–A'
Not to Scale



SECTION 'B–B'
Not to Scale

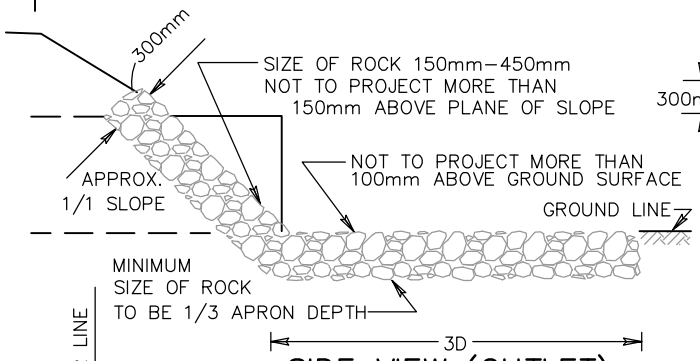
NOTES:
1. GEOTEXTILE OVERLAPS TO BE A MIN. OF 300mm.
2. ROCK LINED CROSSING: USE 150mm – 200mm ROCK, MAT THICKNESS 300mm.
3. EXTEND TO FULL WIDTH, LENGTH & SIDESLOPE OF CROSSING AS WELL AS UPSTREAM & DOWNSTREAM.
4. SPRAY SLURRY MIX CONCRETE (5MPa) TO FILL VOIDS (TOP ONLY).

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: LOW LEVEL X–ING WITH CULVERT	FIGURE: 43D

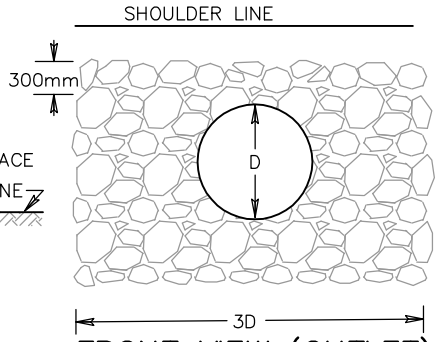


TOP VIEW (OUTLET)

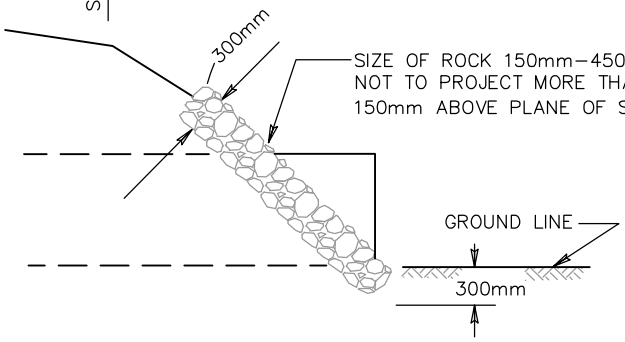
DIAMETER OF PIPE D	EQUIVALENT SIZE OF PIPE ARH
400mm	450mmX340mm
500mm	580mmX390mm
600mm	680mmX480mm
800mm	930mmX645mm
1000mm	1160mmX800mm
1200mm	1425mmX960mm
1400mm	1660mmX1090mm
1600mm	1870mmX1230mm
1800mm	2130mmX1400mm



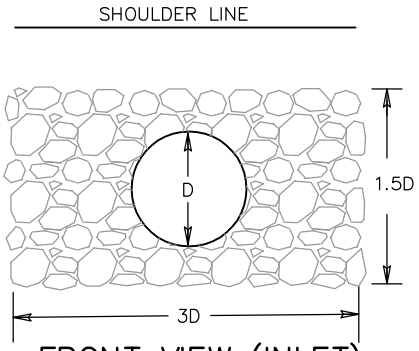
SIDE VIEW (OUTLET)



FRONT VIEW (OUTLET)



SIDE VIEW (INLET)



FRONT VIEW (INLET)

DIAMTER OF PIPE – D	300mm	500mm	600mm	800mm	100mm	1200mm	1400mm	1600mm	1700mm	1800mm
* QUANTITY	1	2	3	5	10	13	16	20	28	33
APRON DEPTH	300mm	500mm			600mm				750mm	

*TOTAL QUANTITY OF RIP–RAP IN CUBIC METRES

DATE: NOV, 2014

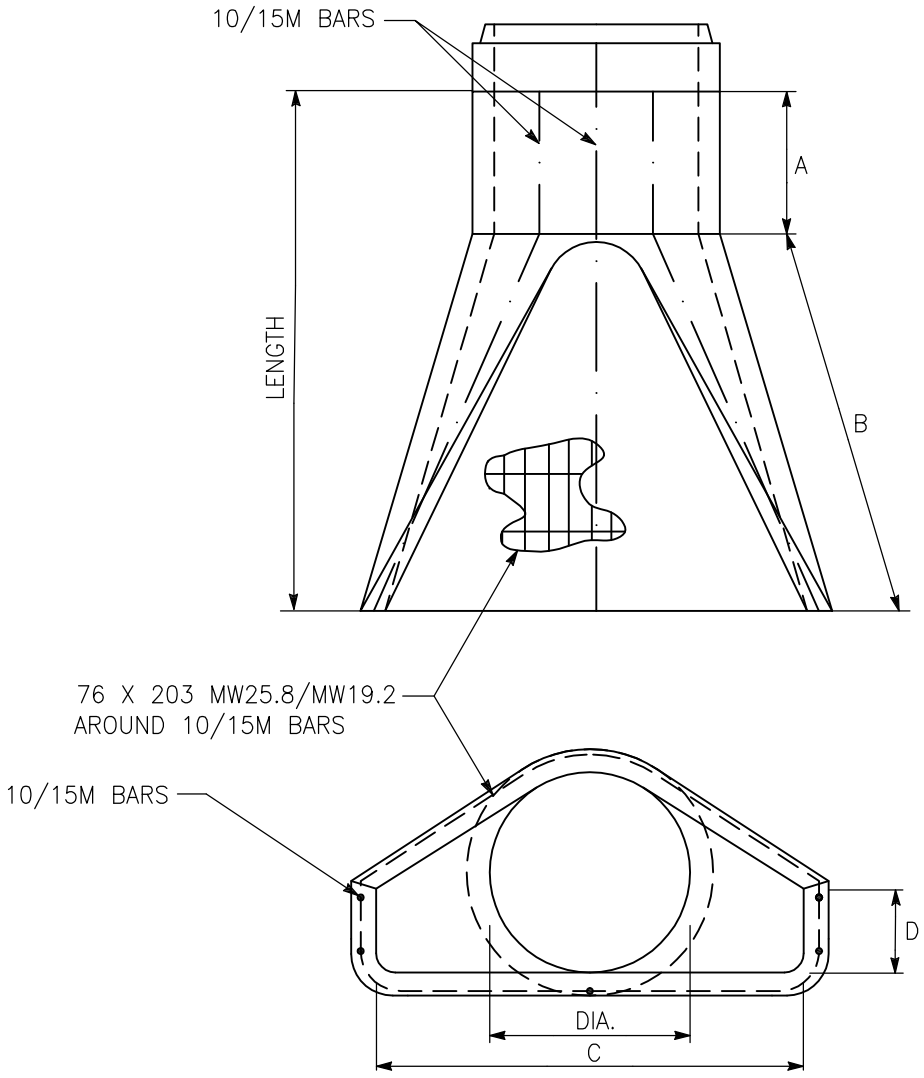
TOWN OF HIGH LEVEL

TITLE:

HAND PLACED RIP–RAP FOR PIPE CULVERTS

ACAD – CIVIL DRAFTING STANDARD DETAILS

FIGURE: 44



DIAMETER (mm)	ACTUAL DIMENSIONS			
	A	B	C	D
600	749	1168	1207	254
1050	889	1650	1981	533

NOTE : 1050mm CULVERT TO COME WITH GATE

NOTE:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

DATE: NOV, 2014

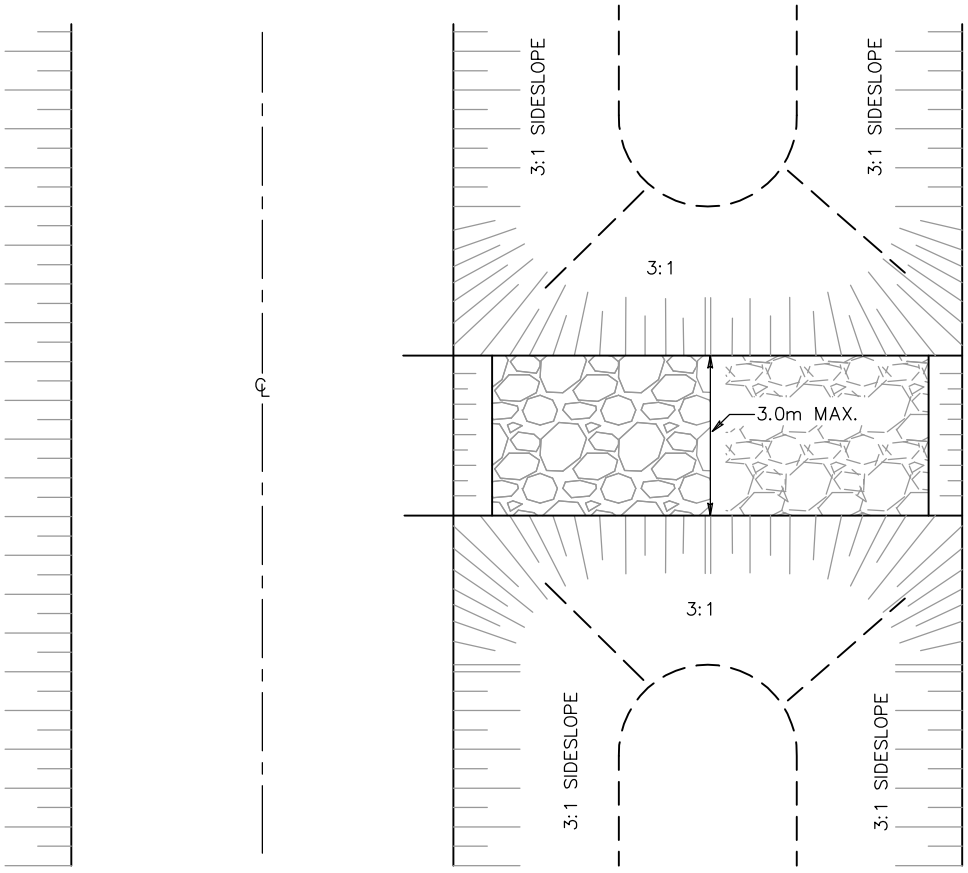
TOWN OF HIGH LEVEL

TITLE:

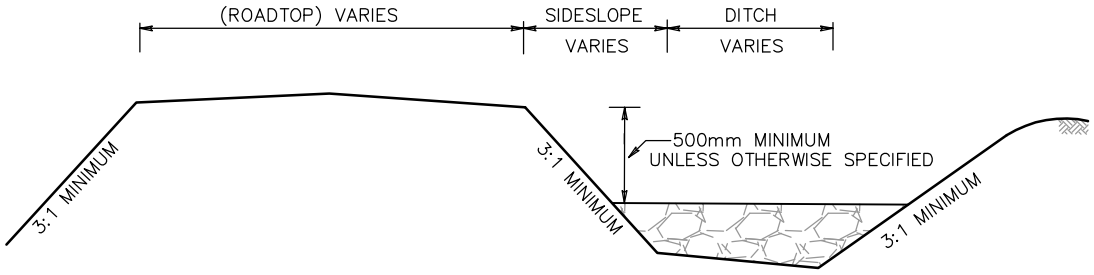
CONCRETE CULVERT FLARED END DETAIL

ACAD – CIVIL DRAFTING STANDARD DETAILS

FIGURE: 45

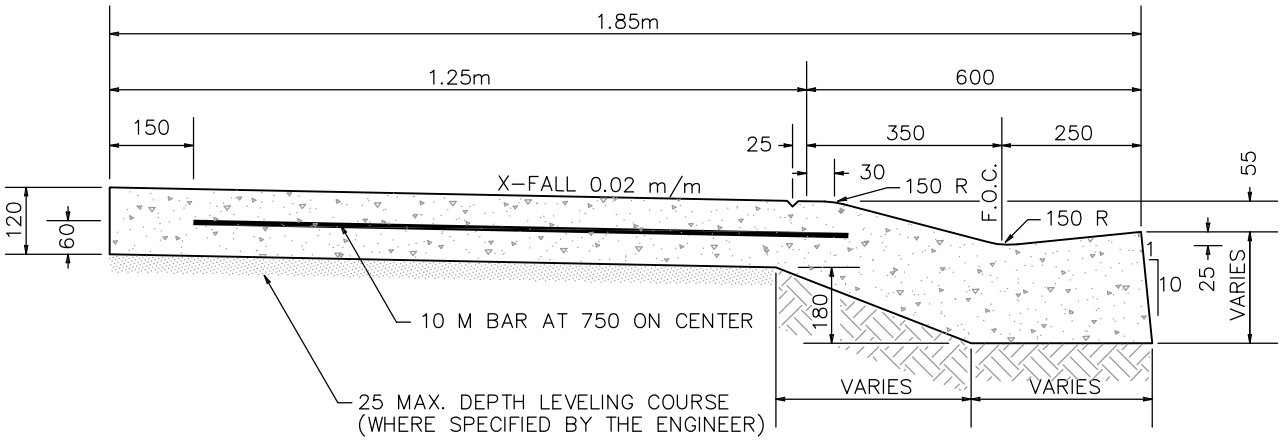


PLAN VIEW



TYPICAL CROSS–SECTION

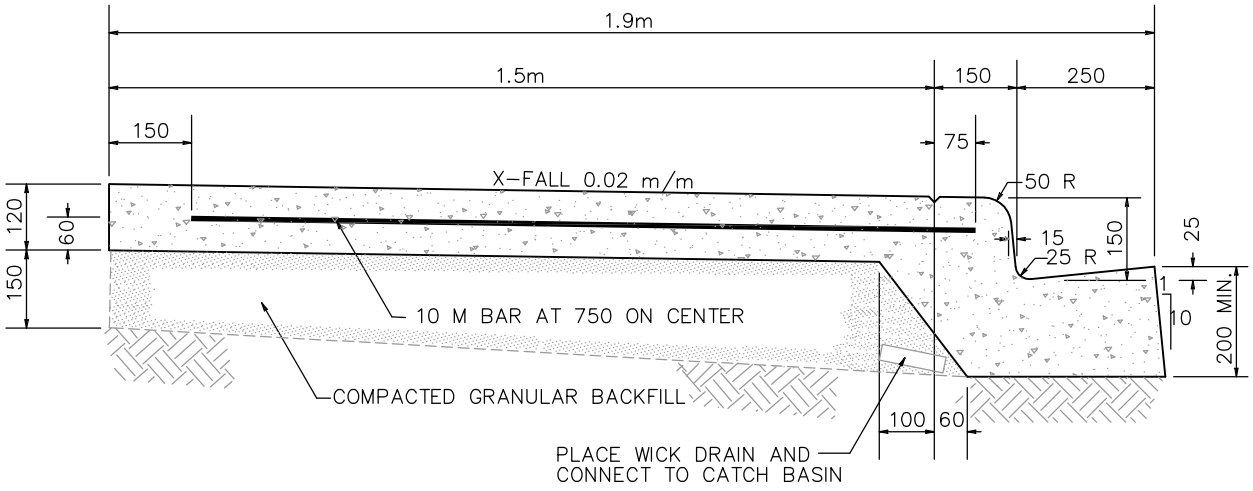
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: TYPICAL VIEWS OF A DITCH BLOCK	FIGURE: 46



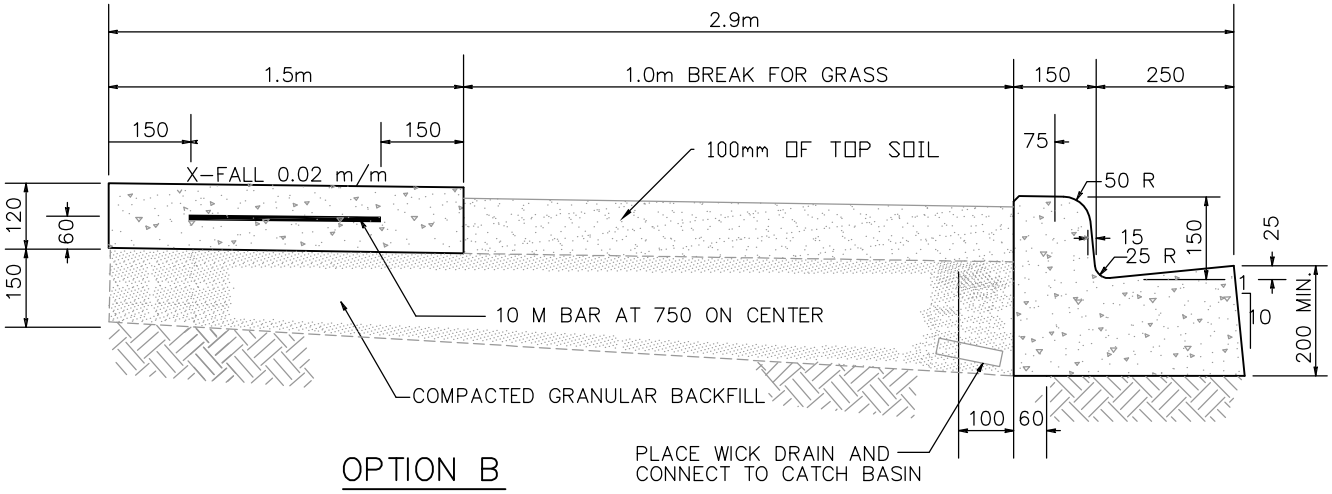
NOTES:

1. DEPTH OF GUTTER FACE TO MATCH ROAD STRUCTURE.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
3. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARD A23.1.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: ROLL FACE MONOLITHIC WALK & GUTTER	FIGURE: 47



OPTION A

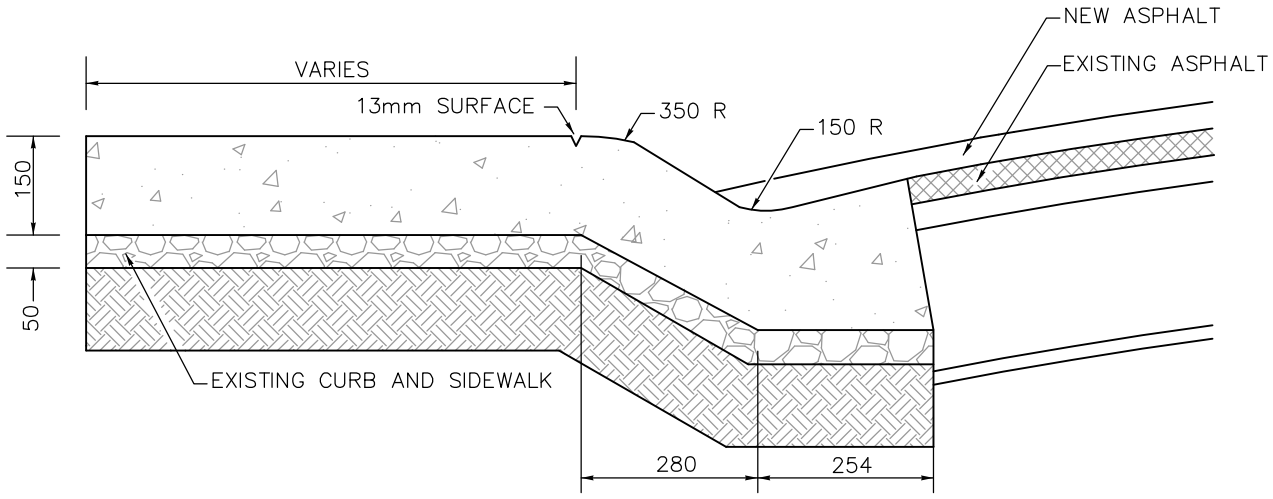


OPTION B

NOTES:

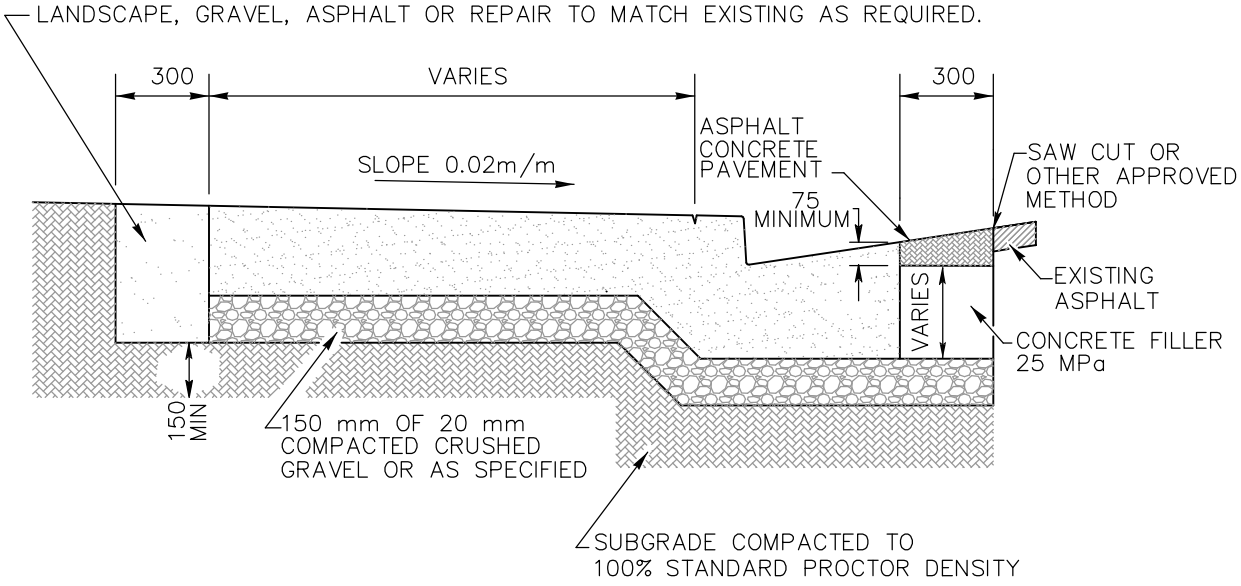
1. DEPTH OF GUTTER FACE TO MATCH ROAD STRUCTURE.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
3. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARD A23.1.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: 1.5m MONOLITHIC WALK WITH 150 CURB & GUTTER	FIGURE: 48



NOTES:
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARD A23.1.

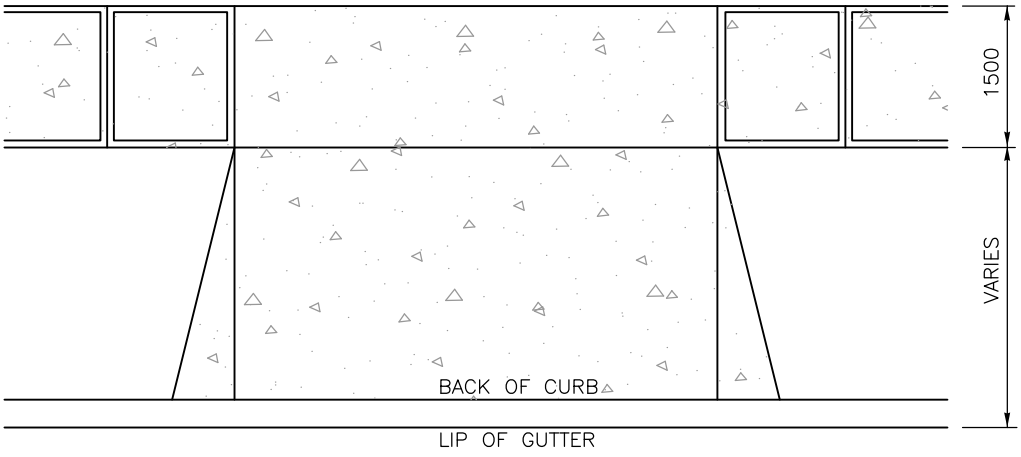
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: TYPICAL MATCH OF NEW OVERLAY & EXISTING CURB AND GUTTER	FIGURE: 49



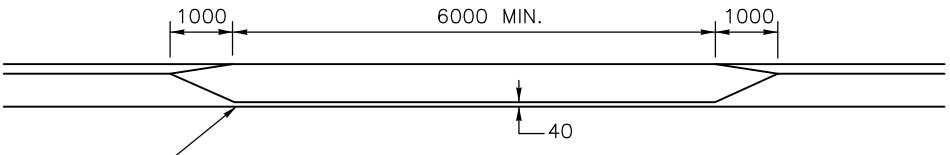
NOTES:

1. PLACE PAVING STONE OR CONCRETE SIDEWALK AS PER PLANS.
2. USE APPROPRIATE CURB AND GUTTER AS PER CONCRETE STRUCTURES DRAWINGS.
3. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
4. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARD A23.1.

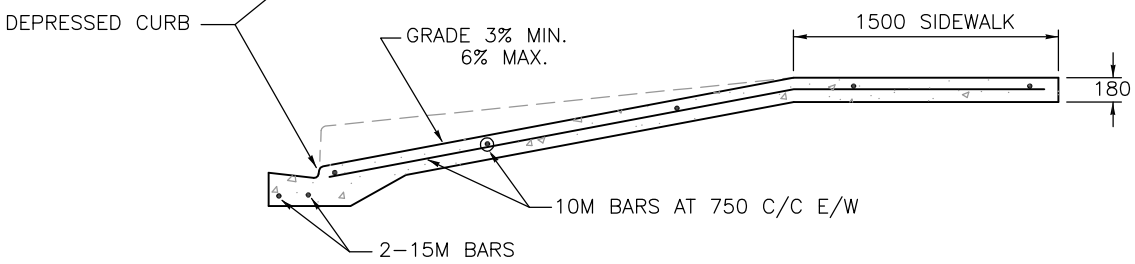
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: RECONSTRUCTION OF SIDEWALK	FIGURE: 50



PLAN



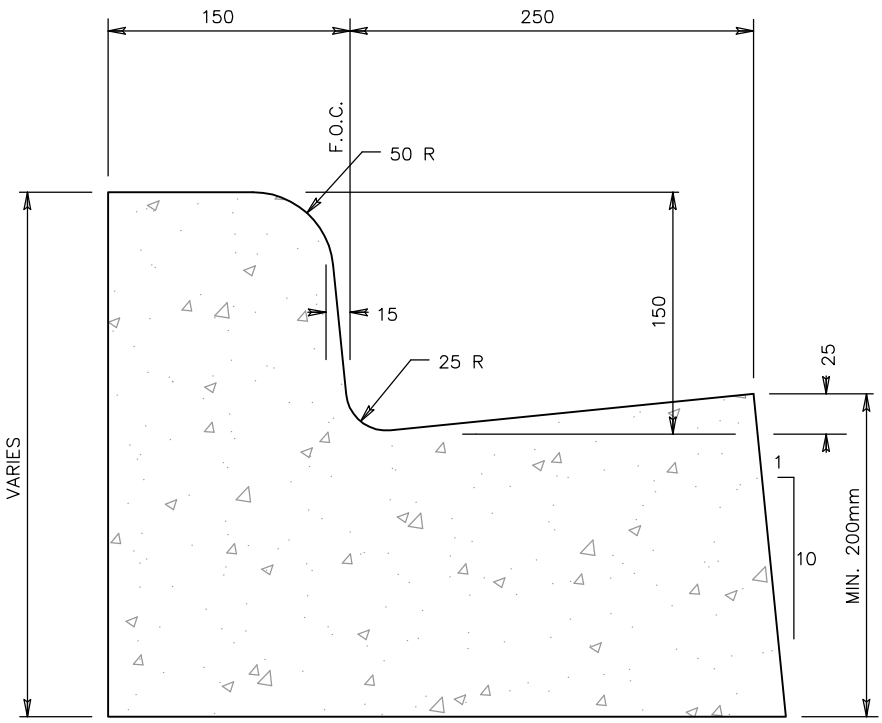
ELEVATION



SECTION

NOTES:
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. 30 MPa TYPE 50 SR CONCRETE.
3. SUBGRADE TO BE COMPACTED TO 97% STANDARD PROCTOR DENSITY.
4. 100mm DEPTH OF GRANULAR COMPACTED TO 98% S.P.D. TO BE PLACED BELOW THE CONCRETE.
5. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARD A23.1.

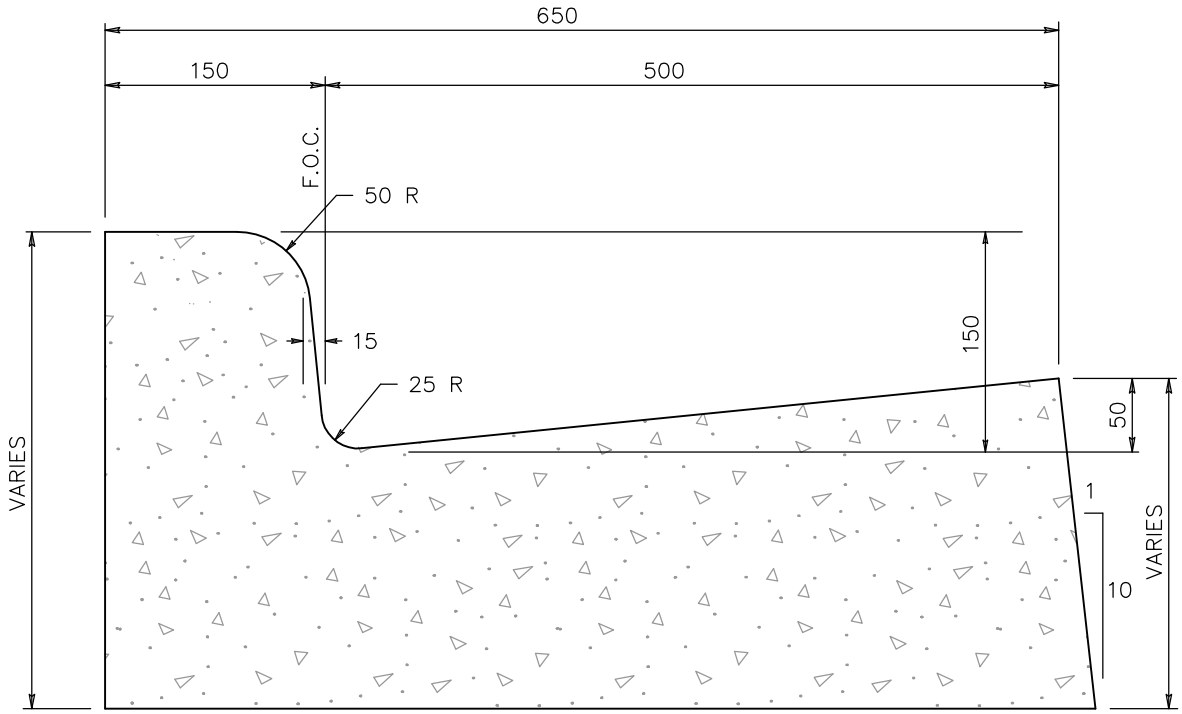
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: LANE OR COMMERCIAL CROSSING (HAND PLACED)	FIGURE: 51



NOTES:

1. DEPTH OF GUTTER FACE TO MATCH DEPTH OF ROAD STRUCTURE.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
3. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARD A23.1.

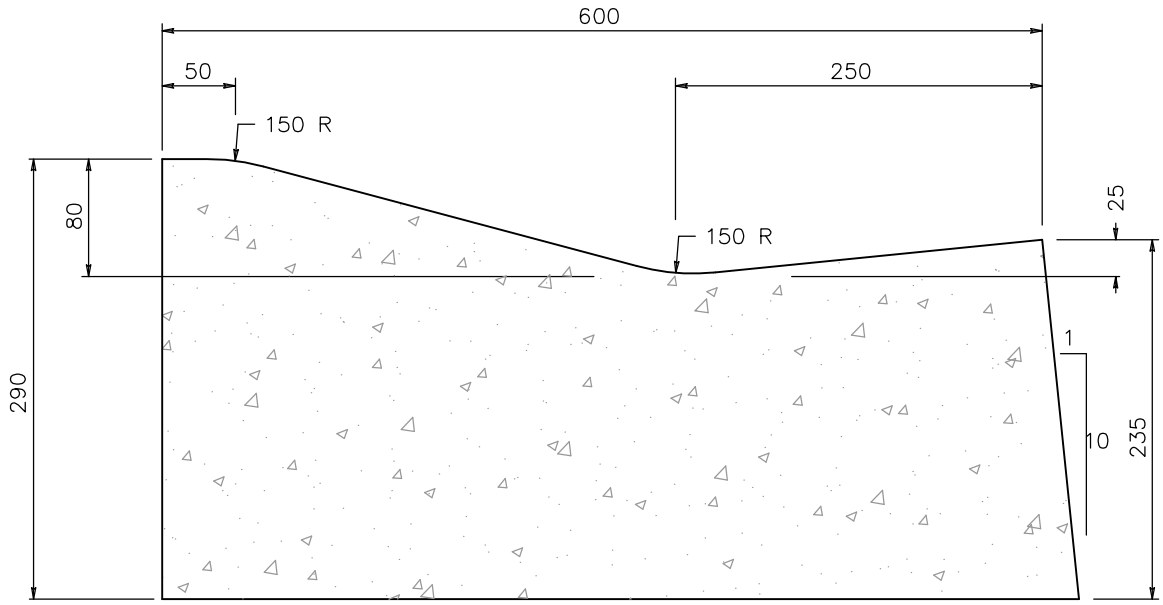
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: 150 CURB WITH 250 GUTTER	FIGURE: 52



NOTES:

1. DEPTH OF GUTTER FACE TO MATCH DEPTH OF ROAD STRUCTURE.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
3. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARD A23.1.

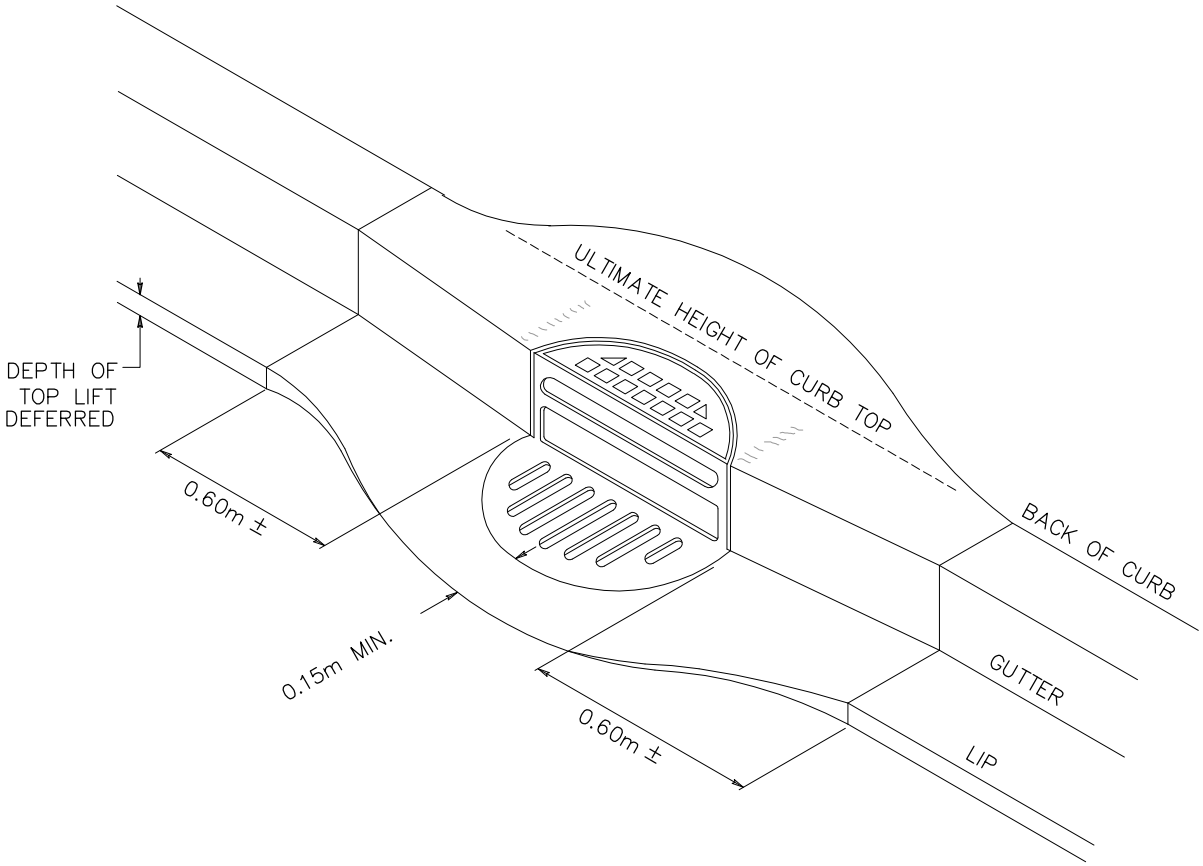
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: 150 CURB WITH 500 GUTTER	FIGURE: 53

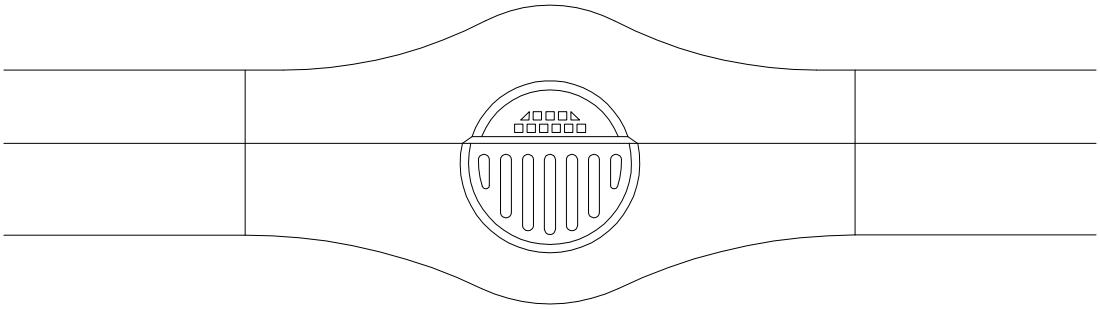


NOTES:

1. DEPTH OF GUTTER FACE TO MATCH DEPTH OF ROAD STRUCTURE.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
3. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARD A23.1.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: ROLL FACE CURB AND GUTTER	FIGURE: 54



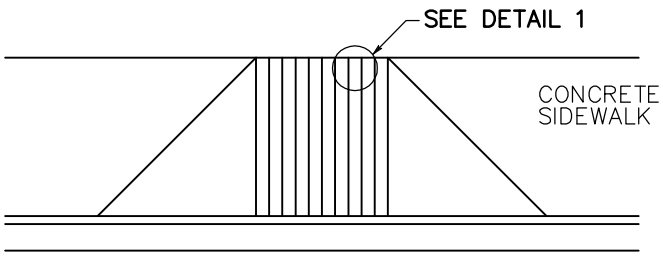


PLAN VIEW

NOTES:

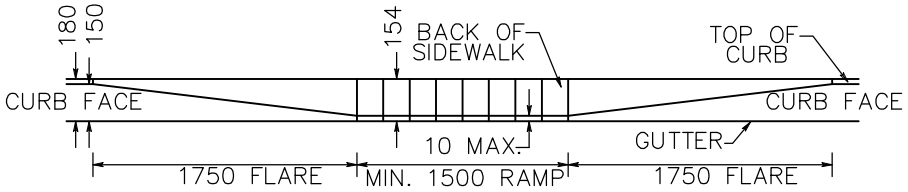
1. TYPICAL CURB & GUTTER TREATMENT AT CATCH BASIN WHEN ASPHALT TOP LIFT IS DEFERRED. LOCATION TO BE DETERMINED BY ENGINEER.
2. ALL DIMEMSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: DEPRESSED CURB AND GUTTER FOR CATCH BASIN	FIGURE: 55

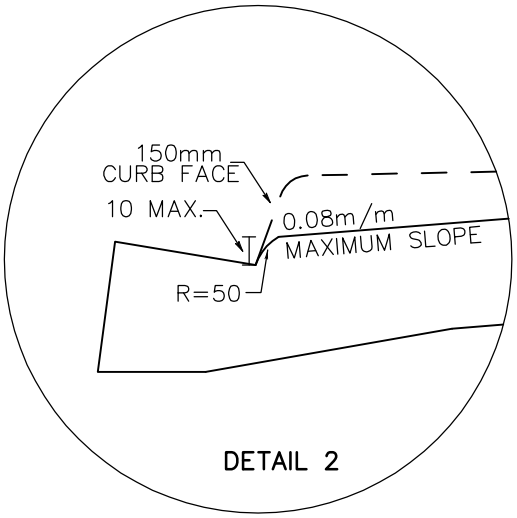


DETAIL 1

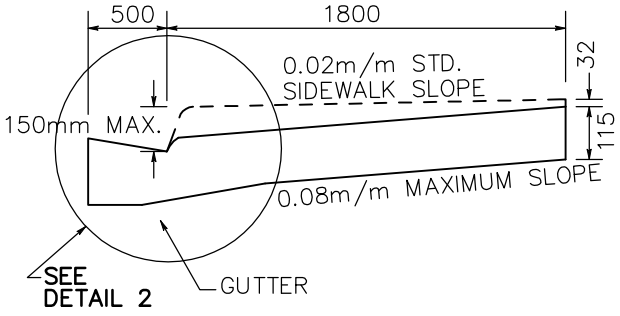
TYPICAL PLAN VIEW



TYPICAL ELEVATION



DETAIL 2

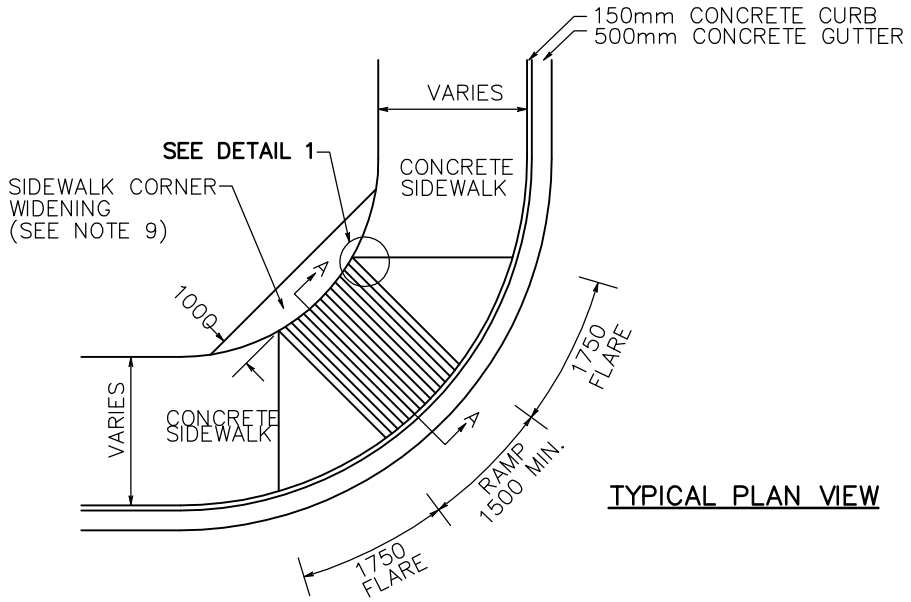


TYPICAL CROSS SECTION (A–A)

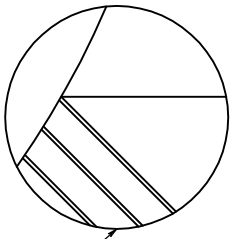
NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. RAMPS FOR USERS OF WHEELCHAIRS/BICYCLES SHOULD BE LOCATED AT ALL JUNCTIONS OF CROSSWALKS AND SIDEWALKS. RAMPS MUST BE LOCATED WITHIN A SIDEWALK.
3. GROOVES ON SIDEWALK RAMPS ARE TO ALERT PERSONS WHO ARE VISUALLY IMPAIRED OF THE CURB–CUT AND A STREET CROSSING.
4. WHERE CROSSWALKS ARE CONTROLLED BY SIGNALS WITH A PUSH–BUTTON SYSTEM, THE SIDEWALK AND RAMPS MUST ALLOW ACCESS FOR WHEELCHAIR TO PUSH BUTTON.
5. MINIMUM WIDTH OF RAMP IS 1500mm. IT MAY BE NECESSARY TO BUILD WIDER RAMPS IN BUSY URBAN AREAS WHERE VOLUME OF PEDESTRIAN TRAFFIC IS HIGH.
6. MAXIMUM RAMP SLOPE IS 0.08m/m.
7. WHERE THE SIDEWALK IS LESS THAN 1800mm WIDE, THE 0.08m/m MAX. SLOPE SHOULD NOT BE EXCEEDED AND THEREFORE THE BACK OF THE SIDEWALK MUST BE LOWERED ACCORDINGLY.
8. WHERE RIGHT–OF–WAY IS AVAILABLE, THE SIDEWALK IS TO BE WIDENED AT CORNER LOCATIONS AS SHOWN SO THAT AT LEAST A 1.0m WIDTH OF "FLAT" SIDEWALK IS PROVIDED ADJACENT TO THE RAMP.

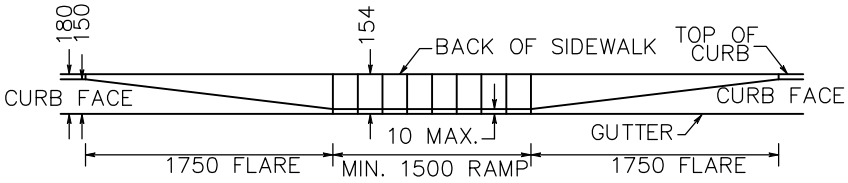
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: CONCRETE SIDEWALK RAMP FOR WHEELCHAIR OR BICYCLE ON TANGENT (TYPE 1)	FIGURE: 56



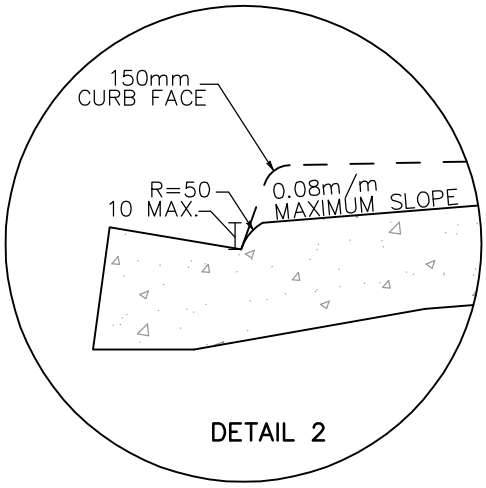
TYPICAL PLAN VIEW



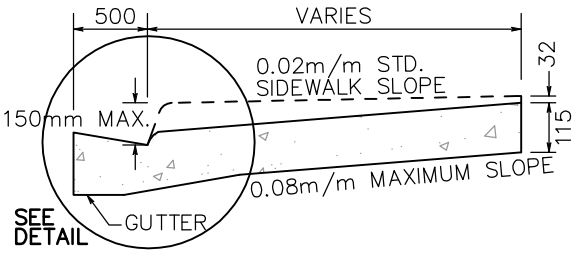
DETAIL 1



TYPICAL ELEVATION



DETAIL 2

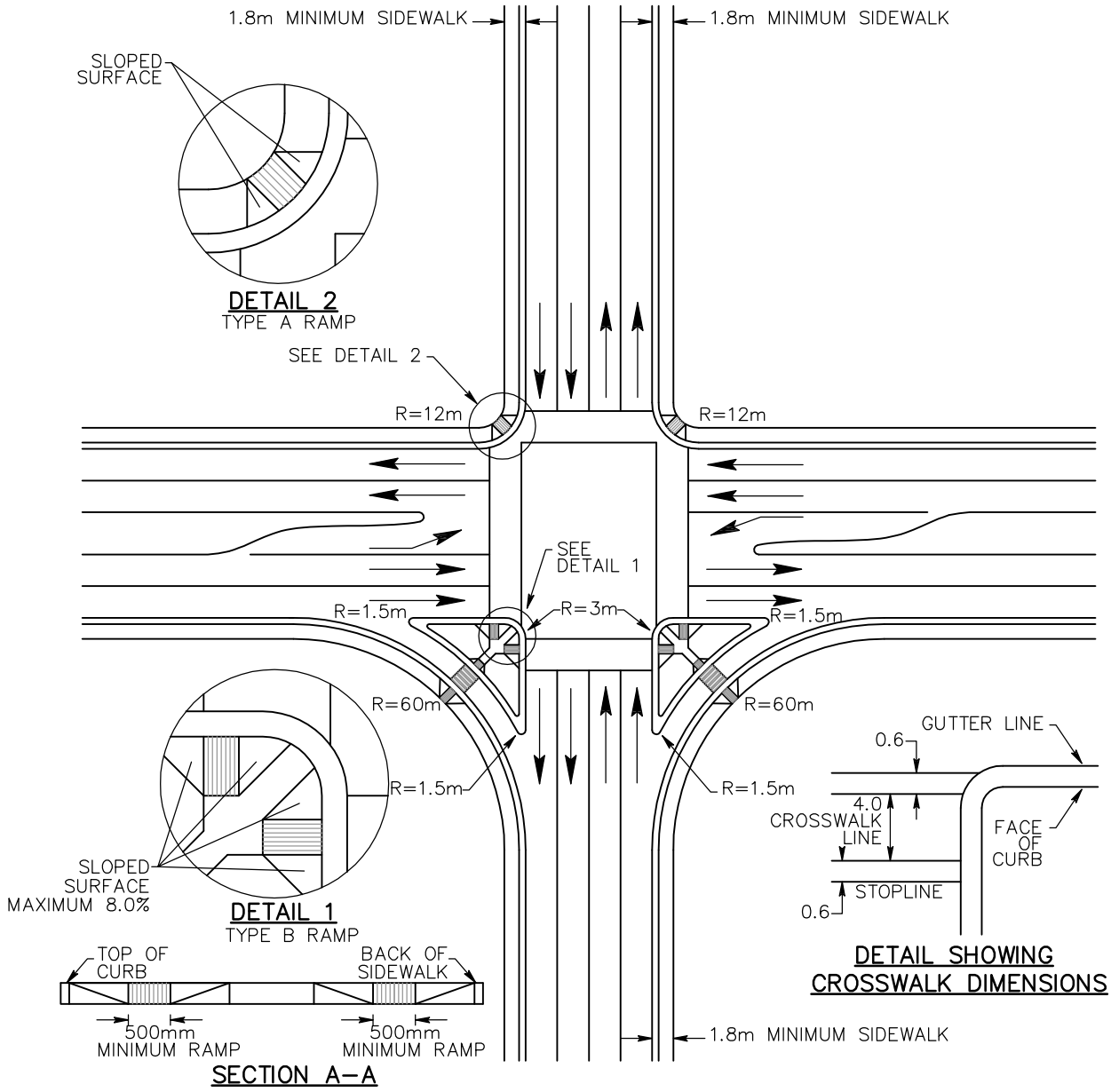


TYPICAL CROSS SECTION (A–A)

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE SPECIFIED.
2. RAMPS FOR USERS OF WHEELCHAIRS/BICYCLES SHOULD BE LOCATED AT ALL JUNCTIONS OF CROSSWALKS AND SIDEWALKS. RAMPS MUST BE LOCATED WITHIN A SIDEWALK.
3. GROOVES ON SIDEWALK RAMPS ARE TO ALERT PERSONS WHO ARE VISUALLY IMPAIRED OF THE CURB–CUT AND A STREET CROSSING.
4. WHERE CROSSWALKS ARE CONTROLLED BY SIGNALS WITH A PUSH–BUTTON SYSTEM, THE SIDEWALK AND RAMPS MUST ALLOW ACCESS FOR WHEELCHAIR TO PUSH BUTTON.
5. MINIMUM WIDTH OF RAMP IS 1500mm. IT MAY BE NECESSARY TO BUILD WIDER RAMPS IN BUSY URBAN AREAS WHERE VOLUME OF PEDESTRIAN TRAFFIC IS HIGH.
6. MAXIMUM RAMP SLOPE IS 0.08m/m.
7. WHERE THE SIDEWALK IS LESS THAN 1800mm WIDE, THE 0.08m/m MAX. SLOPE SHOULD NOT BE EXCEEDED AND THEREFORE THE BACK OF THE SIDEWALK MUST BE LOWERED ACCORDINGLY.
8. WHERE RIGHT–OF–WAY IS AVAILABLE, THE SIDEWALK IS TO BE WIDENED AT CORNER LOCATIONS AS SHOWN SO THAT AT LEAST A 1.0m WIDTH OF "FLAT" SIDEWALK IS PROVIDED ADJACENT TO THE RAMP.

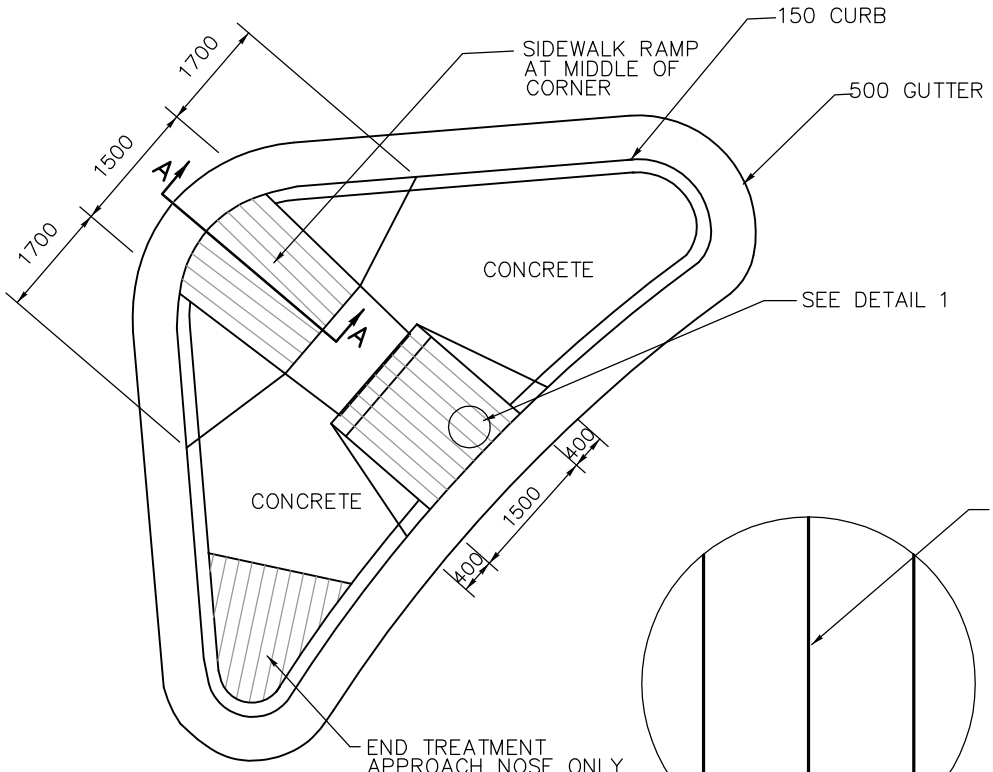
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: CONCRETE SIDEWALK RAMP FOR WHEELCHAIR OR BICYCLE ON CORNER (TYPE 2)	FIGURE: 57

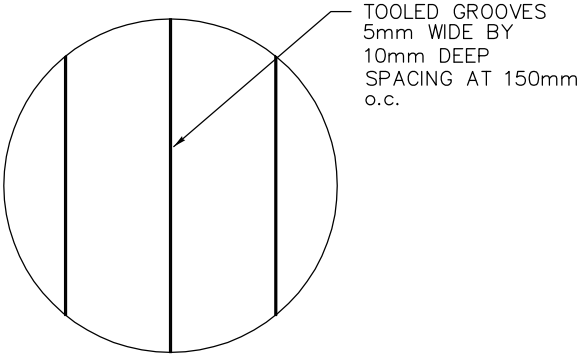


NOTES:

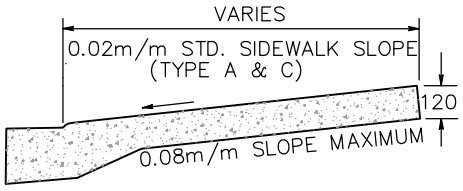
1. ALL DIMENSIONS IN METERS UNLESS OTHERWISE SPECIFIED.
2. SIDEWALK RAMPS MUST PROVIDE ACCESS DIRECTLY TO CROSSWALKS.
3. THE SELECTION OF CURB RAMP TYPE IS DEPENDANT ON THE LOCATION OF THE CROSSWALK RELATED TO THE CURB FACE. WHERE THE CURB RETURN RADIUS IS GREATER THAN OR EQUAL TO 4.0m, TWO TYPE 2 RAMPS CAN BE USED. WHERE THE CURB RETURN RADIUS IS LESS THAN 4.0m, TWP TYPE 1 RAMPS ARE REQUIRED.
4. WHERE CROSSWALKS ARE CONTROLLED BY SIGNALS WITH A PUSH–BUTTON SYSTEM, THE SIDEWALKS AND RAMPS MUST ALLOW ACCESS BY WHEELCHAIR TO THE PUSH–BUTTON.
5. ON A SHARP CORNER WHERE TWO TYPE 1 RAMPS ARE BEING USED, THE SLOPE ON THE FLARED AREAS BETWEEN TWO RAMPS CAN BE LESS THAN THE 0.08m/m MAXIMUM SHOWN. THIS WILL PROVIDE A SMOOTHER SIDEWALK FOR GENERAL USE ESPECIALLY FOR PEDESTRIANS WHO ARE NOT USING THE CROSSWALK.

DATE: NOV, 2014	TOWN OF HIGH LEVEL TITLE: LAYOUT OF CROSSWALKS & LOCATION & TYPE OF SIDEWALK RAMPS AT URBAN INTERSECTIONS	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL		FIGURE: 58





DETAIL 1

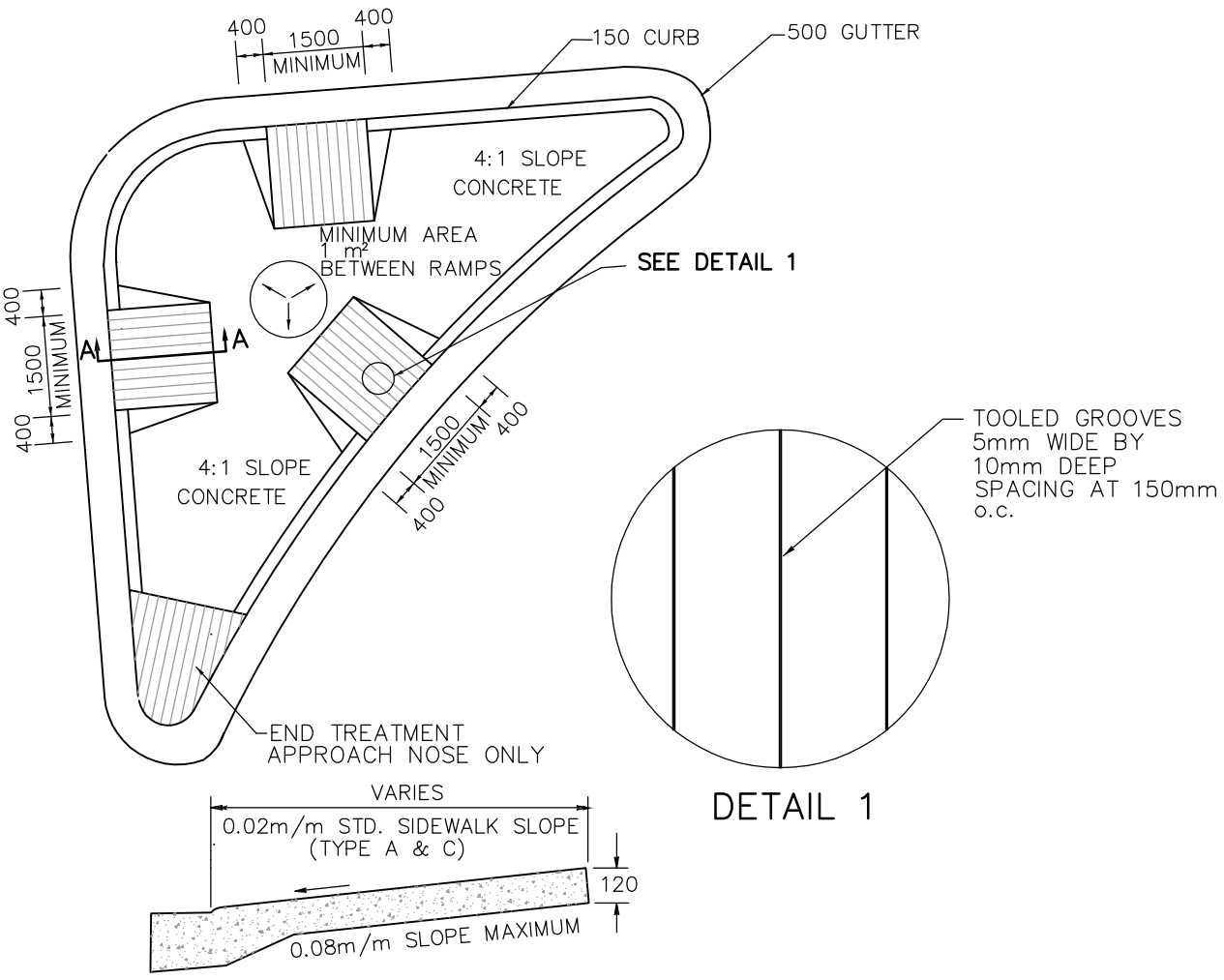


TYPICAL CROSS SECTION A–A

NOTES:

1. EXACT DIMENSIONS AND LAYOUT OF ISLAND ARE DICTATED BY LAYOUT OF INTERSECTION.
2. WHERE RAMP IS TO BE USED AS A TRANSITION, USE THE CENTER OF THE 1500mm RAMP AS THE CENTER OF THE TRANSITION.
3. CURBS AND RAMPS TO BE POURED MONOLITHICALLY.
4. IT MAY BE NECESSARY TO BUILD RAMPS WIDER AT HIGH VOLUME PEDESTRIAN TRAFFIC LOCATIONS.
5. WHEN THE CURB RETURN RADIUS IS LESS THAN 4.0m TWO RAMPS ARE REQUIRED.
6. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: SIDEWALK AND CROSSWALK LAYOUT OF SMALL ISLANDS AND MEDIANS, TYPE A	FIGURE: 59

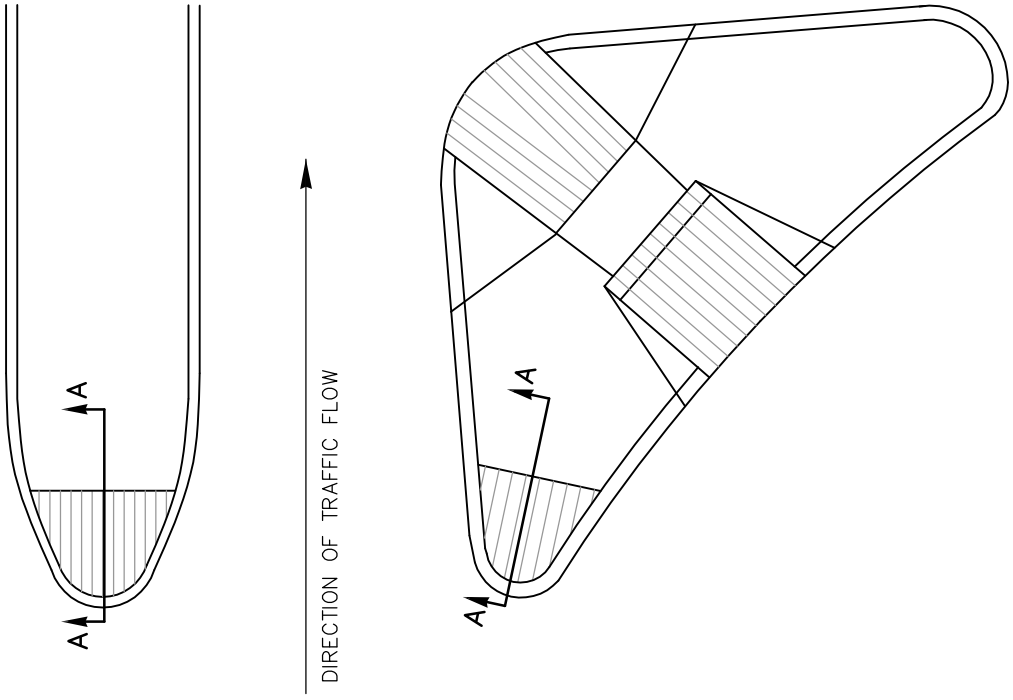


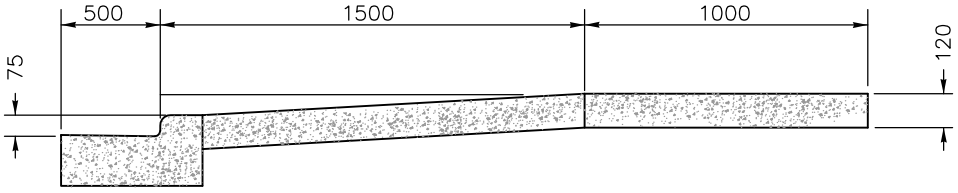
TYPICAL CROSS SECTION A–A

NOTES:

1. EXACT DIMENSIONS AND LAYOUT OF ISLAND ARE DICTATED BY LAYOUT OF INTERSECTION.
2. WHERE RAMP IS TO BE USED AS A TRANSITION, USE THE CENTER OF THE 1500mm RAMP AS THE CENTER OF THE TRANSITION.
3. CURBS AND RAMPS TO BE POURED MONOLITHICALLY.
4. IT MAY BE NECESSARY TO BUILD RAMPS WIDER AT HIGH VOLUME PEDESTRIAN TRAFFIC LOCATIONS.
5. WHEN THE CURB RETURN RADIUS IS LESS THAN 4.0m TWO RAMPS ARE REQUIRED.
6. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: SIDEWALK AND CROSSWALK LAYOUT OF SMALL ISLANDS AND MEDIANS, TYPE B	FIGURE: 60



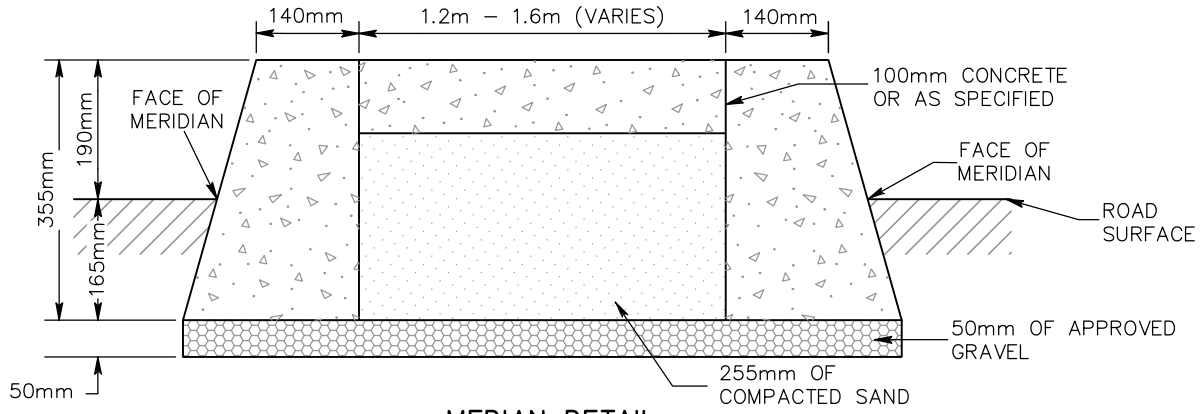


SECTION A A

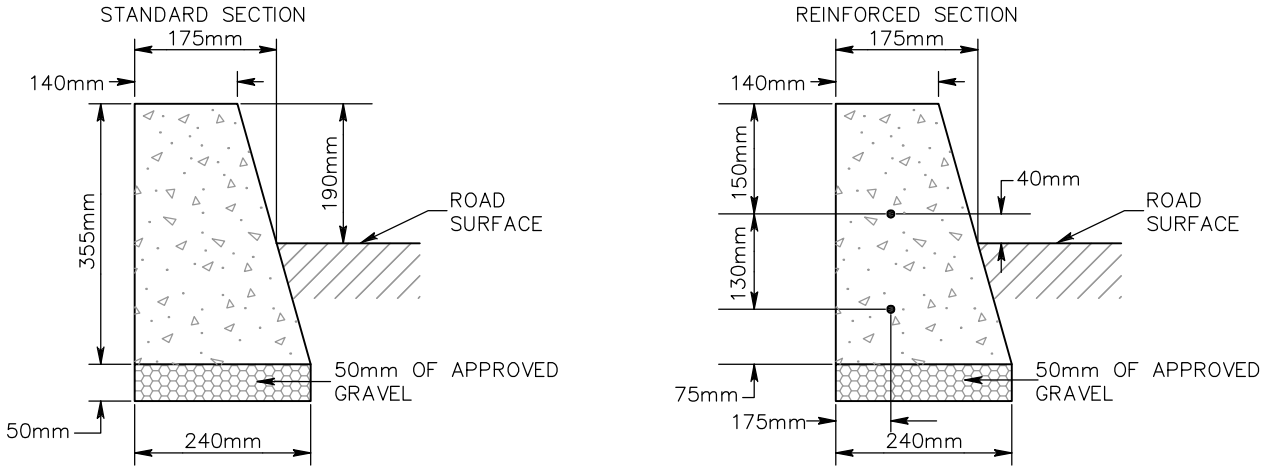
NOTE:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: ISLAND \ WIDE MEDIAN APPROACH NOSE	FIGURE: 61



MEDIAN DETAIL

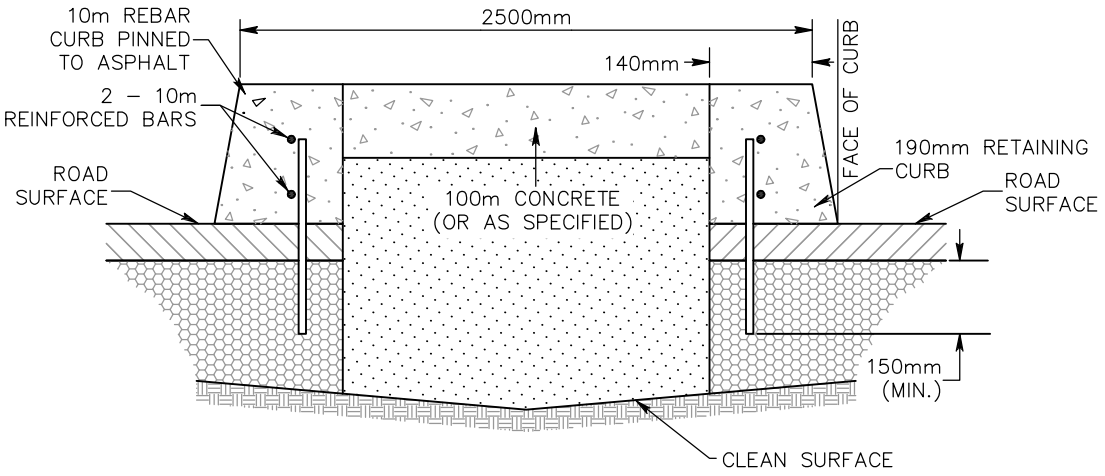


STANDARD CONCRETE CURB

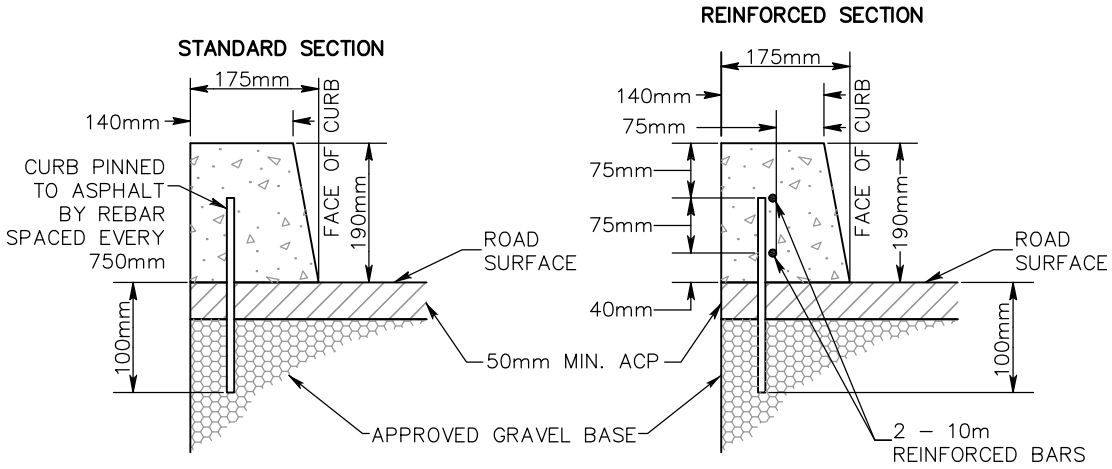
NOTES:

1. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARD A23.1.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: CURB & MEDIAN (GRAVEL BASE)	FIGURE: 62



MEDIAN DETAIL (PIN–ON CURBS)

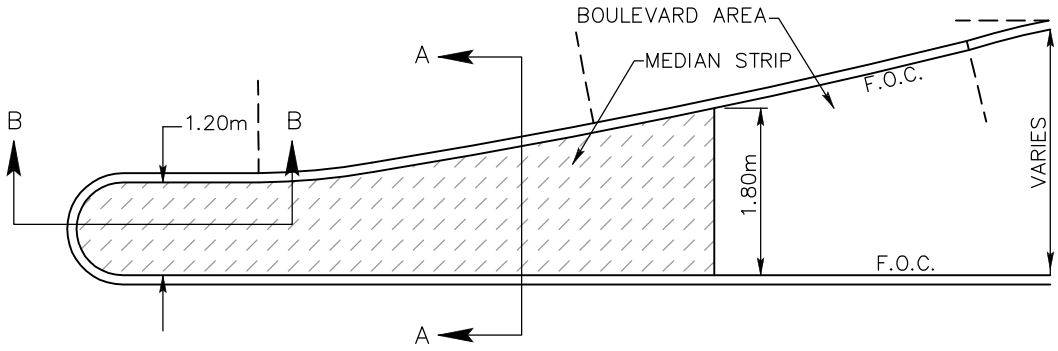


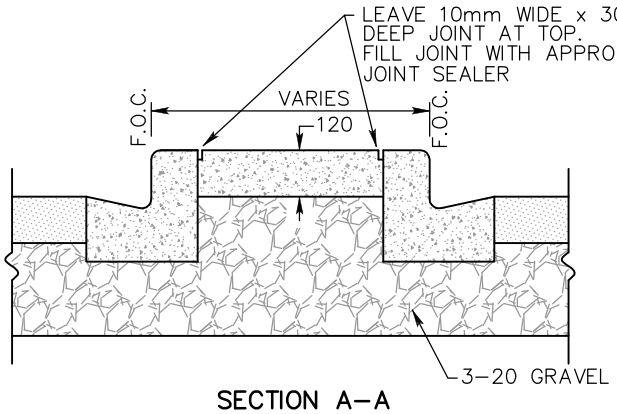
CONCRETE CURB (PIN–ON)

NOTES:

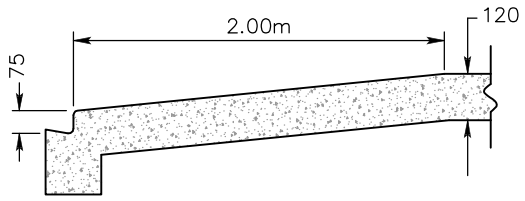
1. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARD A23.1.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: CURB AND MEDIAN (ASPHALT BASE–PIN ON)	FIGURE: 63

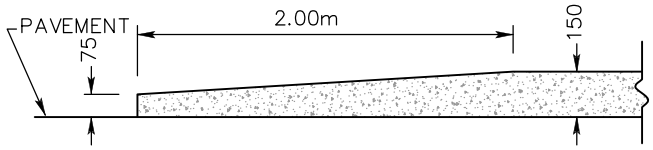




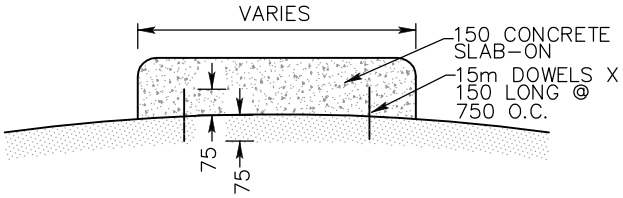
SECTION A–A



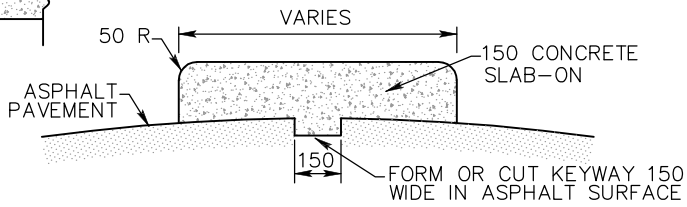
SECTION B–B



SECTION B–B



SECTION A–A

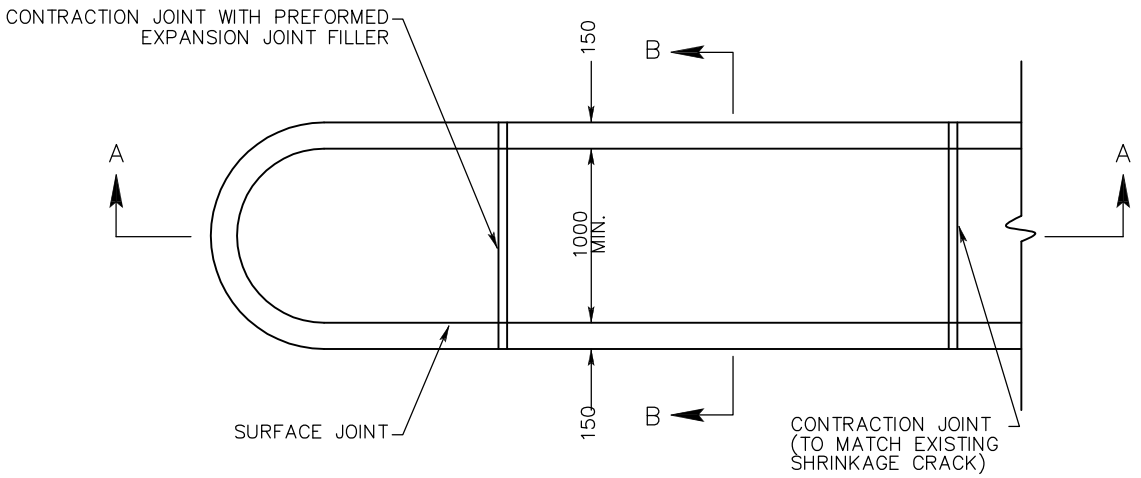


SECTION A–A

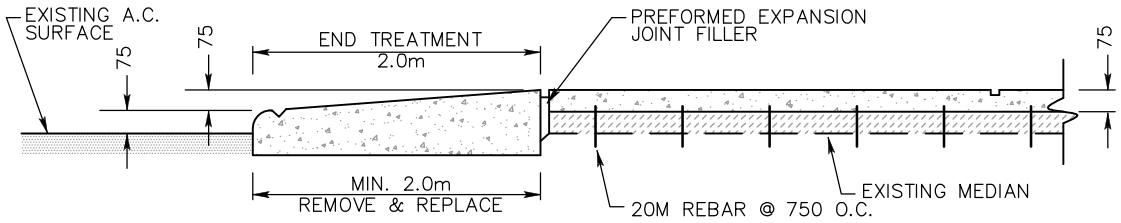
NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST–IN–PLACE AND PRECAST CONCRETE RESPECTIVELY.

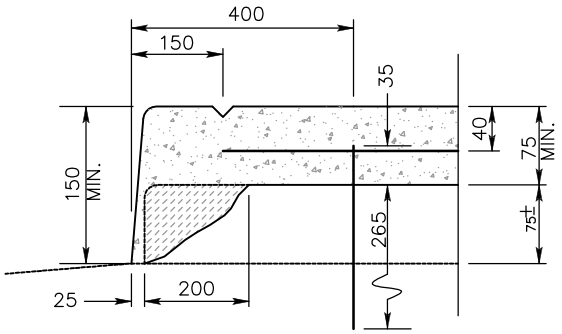
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: CENTRE MEDIAN END TREATMENT	FIGURE: 64



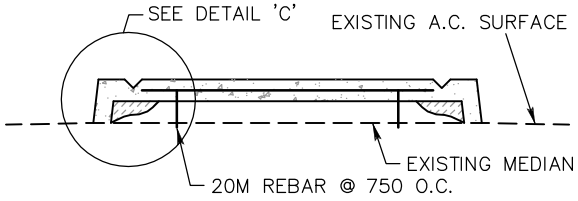
PLAN



SECTION A–A



DETAIL 'C'

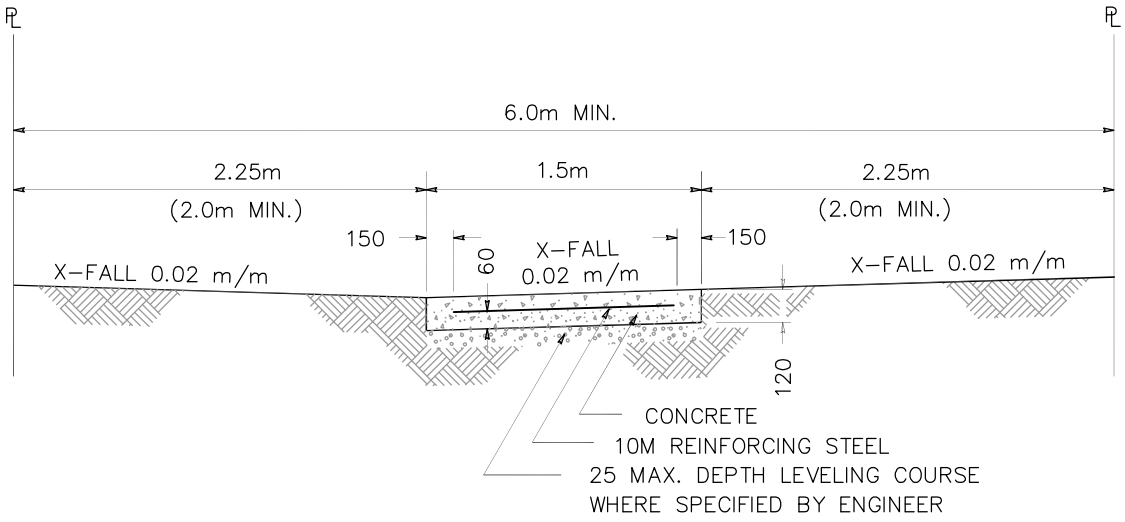


SECTION B–B

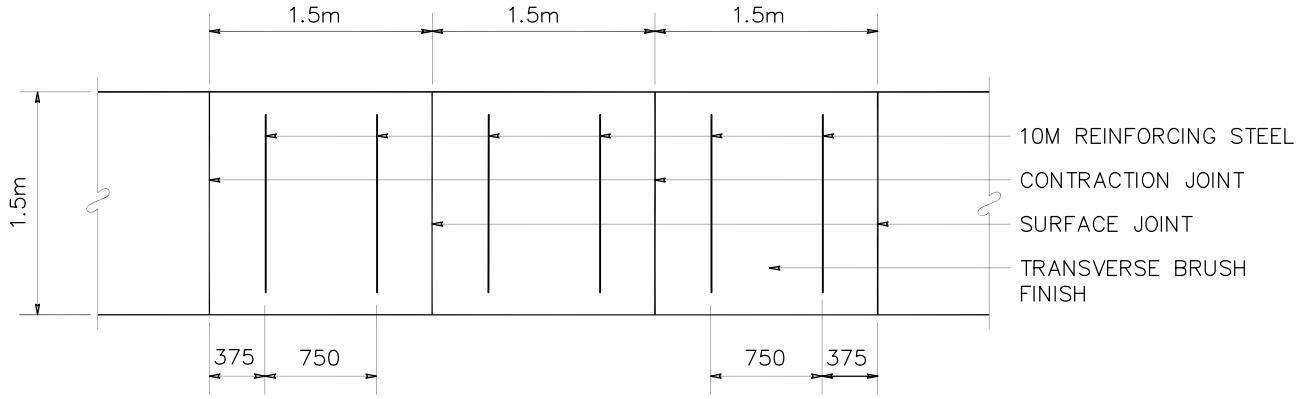
NOTES:

1. PREFORMED EXPANSION JOINT FILLER SHOULD ALSO BE PLACED AT MATCH TO EXISTING ISLAND.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
3. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARD A23.1.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: CENTRE MEDIAN REHABILITATION	FIGURE: 65



TYPICAL SECTION

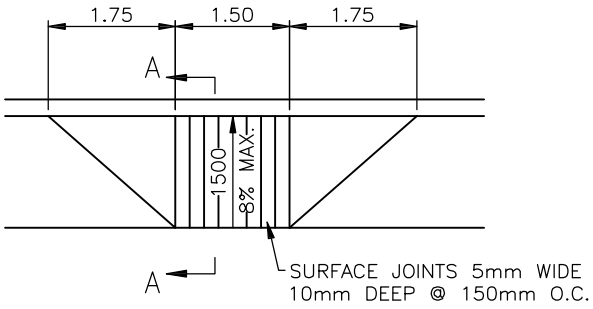


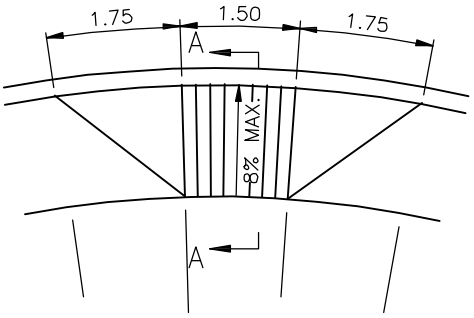
PLAN VIEW

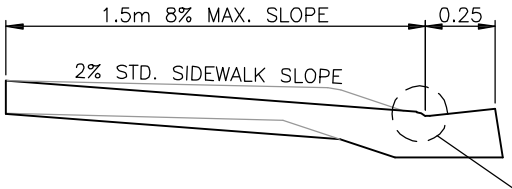
NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARD A23.1.

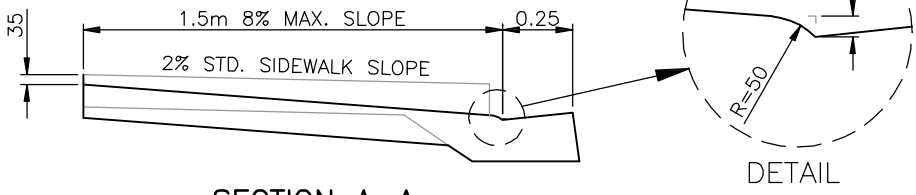
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: CONCRETE WALKWAY	FIGURE: 66



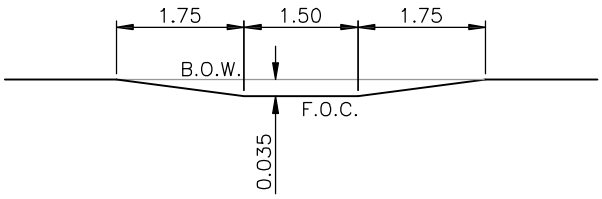




SECTION A–A
ROLLED MONOLITHIC SIDEWALK

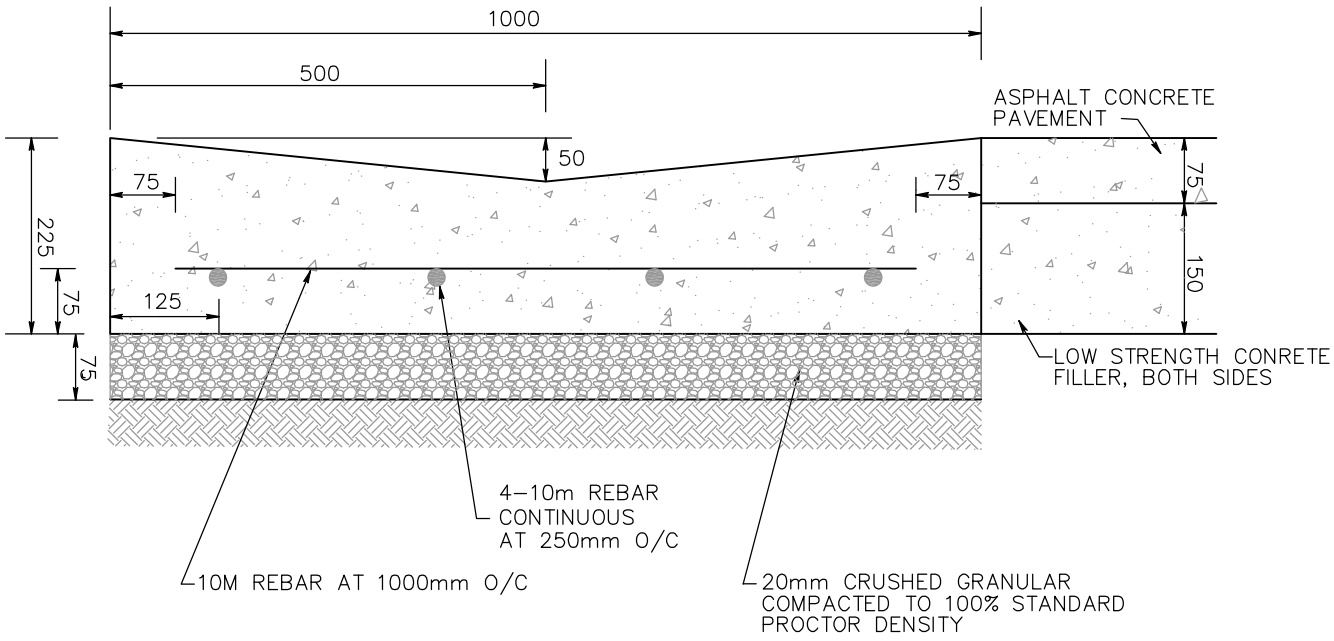


SECTION A–A
STANDARD MONOLITHIC SIDEWALK



BACK OF WALK PROFILE STANDARD
MONOLITHIC SIDEWALK

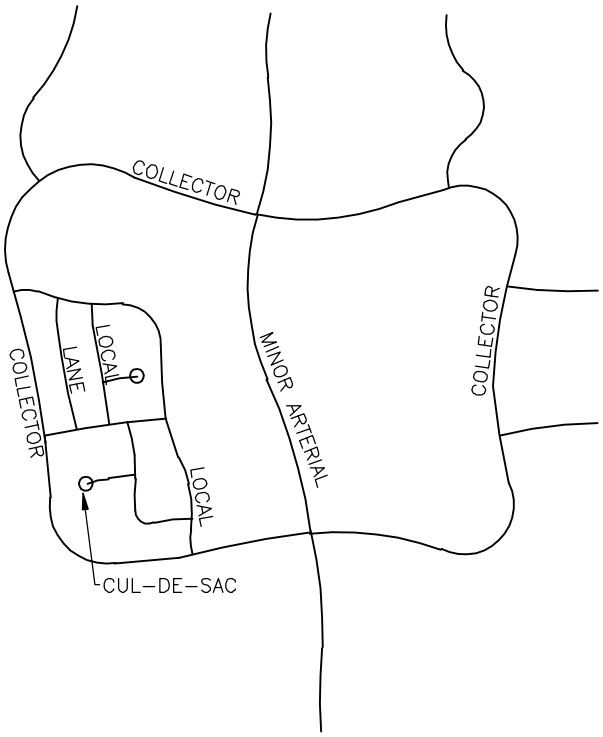
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: RESIDENTIAL PARAPLEGIC RAMP	FIGURE: 67



NOTES:

1. EXPANSION/CONTRACTION JOINT REQUIRED ON ONE END.
   IF DONE IN 2 POURS, ONLY CONSTRUCTION JOINT REQUIRED.
2. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
3. PROPORTIONING AND PRODUCING QUALITY CONCRETE
   AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT
   MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4
   FOR CAST–IN–PLACE AND PRECAST CONCRETE RESPECTIVELY.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: 1000mm CONCRETE SWALE	FIGURE: 68



LEGEND

- MINOR ARTERIAL
- COLLECTOR
- LOCAL
- PUBLIC LANE
- SIGNALIZED INTERSECTION
- CUL–DE–SAC

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: STREET CLASSIFICATIONS	FIGURE: 69

ROADWAY DESIGNATION	DESIGN ELEMENTS								
	TAC DESIGN CLASSIFICATION	DAILY SERVICE VOLUME (vpd)	RIGHT OF WAY WIDTH	HORIZONTAL ALIGNMENT MINIMUM RADIUS OF CURVATURE	MINIMUM ANGLE OF INTERSECTION (degrees)	INTERSECTIONS			
						PROPERTY LINE CORNER CUTOFF (m)			
						ARTERIAL ROADWAY	COLLECTOR ROADWAY	LOCAL ROADWAY	LANES
Minor Divided Arterial	UAD 80	20,000	36.00	250m	75	30X30	10X10	N/A	N/A
Minor Undivided Arterial	UAU 80	20,000	30.00	250m	75	30X30	10X10	N/A	N/A
Primary Divided Collector	UCD 60	<10,000	30.00	185m NC 135m RC	75	10X10	5X5	5X5	0
Primary Undivided Collector	UCU 60	<10,000	25.00	185m NC 135m RC	75	10X10	5X5	5X5	0
Residential Local	ULU 50	1,000	18.00	115m	75	N/A	5X5	5X5	0
COLLECTOR	UCU 60	5,000	22.00	185m	75	10X10	10X10	10X10	0
Industrial Collector	UCU 60	10,000	18.00	185m	75	10X10	10X10	10X10	0
Industrial Major	UCU 60	20,000	25.00	185m	75	10X10	10X10	10X10	0
Frontage (Service) Road	ULU 50	<3,000	20.00	115m	75	N/A	10X10	10X10	0
Lanes	N/A	<500	6.00	Not Permitted	75	N/A	0	0	5X5

DATE: NOV, 2014

TOWN OF HIGH LEVEL

TITLE:

ROADWAY GEOMETRIC DESIGN STANDARDS

ACAD – CIVIL DRAFTING STANDARD DETAILS

FIGURE: 70

ROADWAY DESIGNATION	DESIGN ELEMENTS									
	TAC DESIGN CLASSIFICATION	HORIZONTAL ALIGNMENT		MINIMUM K FOR VERTICAL CURVES	VERTICAL ALIGNMENT			INTERSECTIONS		
		RATE OF SUPERELEVATION (As per TAC)			ROAD GRADIENTS (%)			CORNER RADII (m)		
		DESIRABLE RATE (m/m)	MAXIMUM RATE (m/m)		MAXIMUM GRADE	DESIRED MAXIMUM GRADE	MINIMUM GRADES	ARTERIAL ROADWAY	COLLECTOR ROADWAY	LOCAL ROADWAY
Minor Divided Arterial	UAD 80	0.04	0.06	Crest and Sag K as per TAC Geometric Design for Canadian Roads (1999 Edition) and Section9 Clause 3.3	6.00	5.00	0.50	See Drawings	15.00	N / A
Minor Undivided Arterial	UAU 80	0.04	0.06		6.00	5.00	0.50		15.00	N / A
Divided Primary Collector	UCD 60	Normal Crown 0.02	Reverse Crown 0.02		9.00	6.00	0.50	15.00	8.00	8.00
Undivided Primary Collector	UCU 60	Normal Crown 0.02	Reverse Crown 0.02		9.00	6.00	0.50	15.00	8.00	8.00
Residential Local	ULU 50	Normal Crown 0.02			9.00	6.00	0.50	N / A	8.00	8.00
Industrial Collector	UCU 60	Normal Crown 0.02			6.00	6.00	0.50	See Drawing		
Collector	UCU 60	Normal Crown 0.02			8.60	6.00	0.50			
Industrial Major	UCU 60	Normal Crown 0.02			6.00	6.00	0.50	N / A	See Drawing	
Frontage (Service) Road	ULU 50	Normal Crown 0.02			6.00	6.00	0.50	N / A		
Gravel Lanes	20	N / A			9.00	6.00	0.80	N / A	N / A	N / A
Paved Lanes	20	N / A			9.00	6.00	0.50	N / A	N / A	N / A

DATE: NOV, 2014

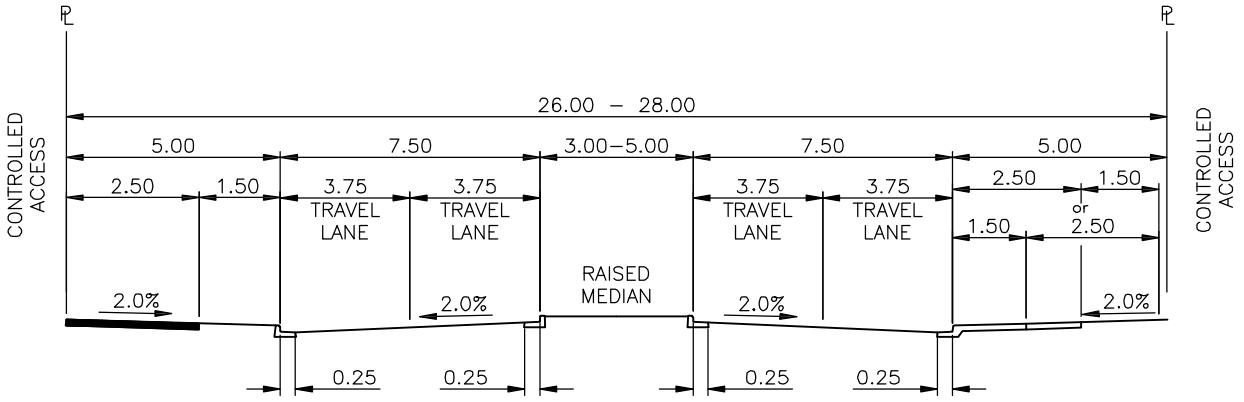
TOWN OF HIGH LEVEL

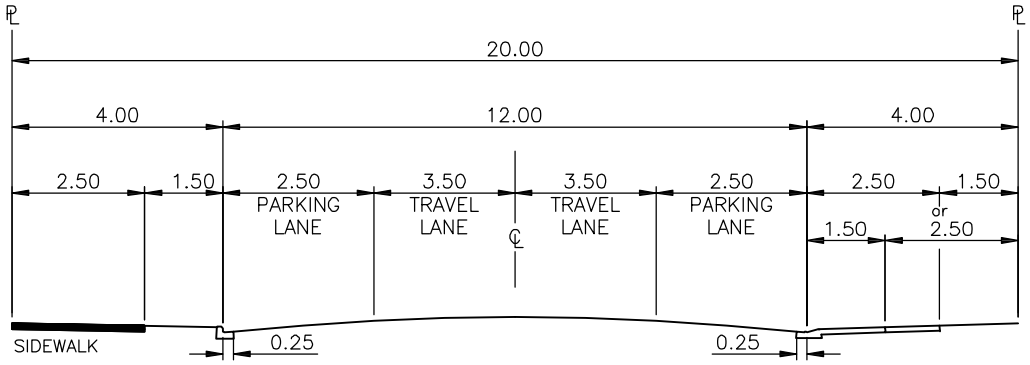
TITLE:

ROADWAY DESIGN STANDARDS

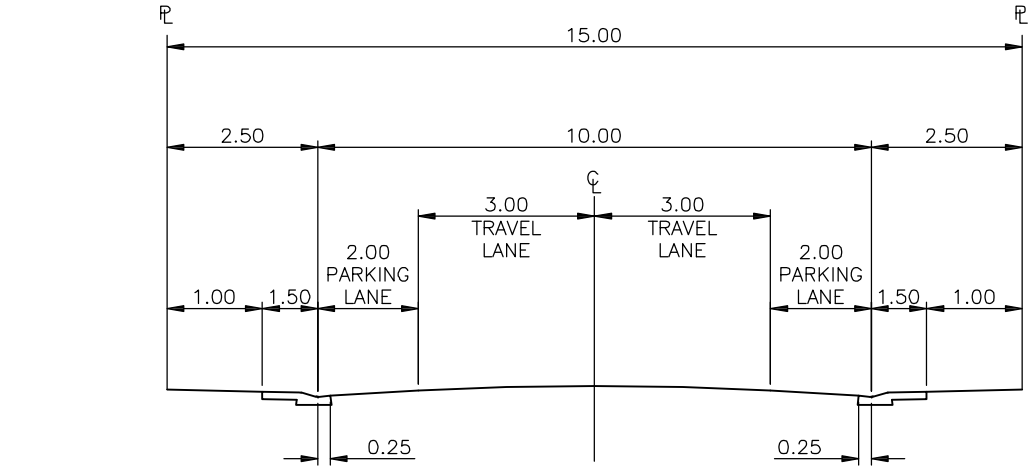
ACAD – CIVIL DRAFTING STANDARD DETAILS

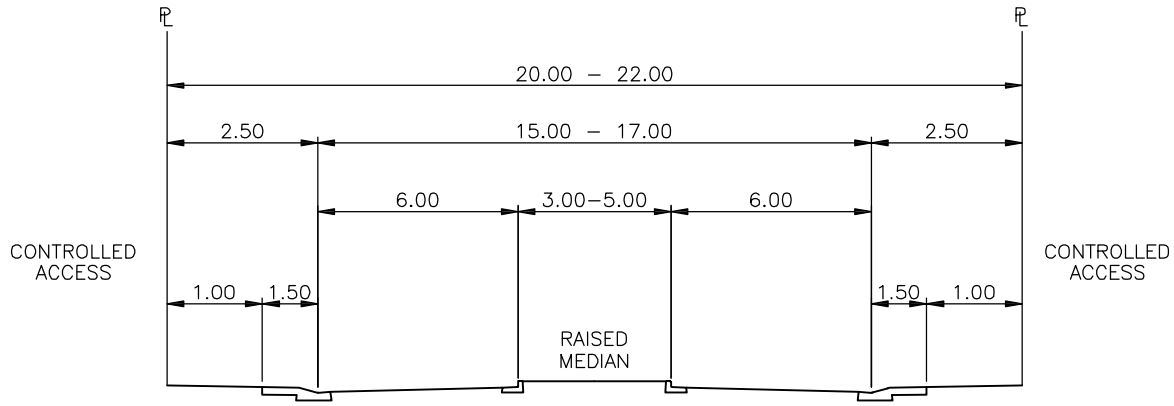
FIGURE: 71

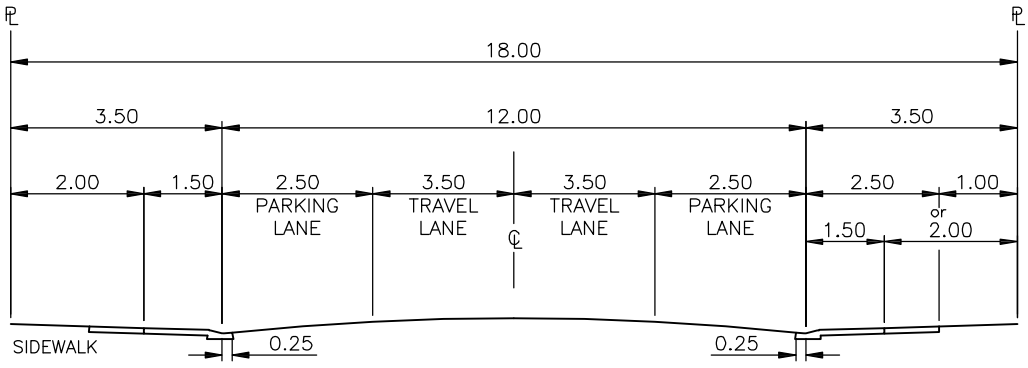




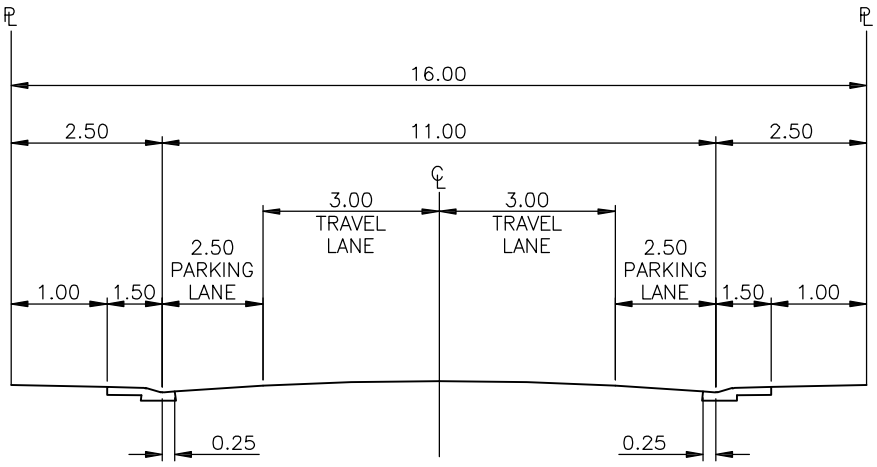
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: DIVIDED & UNDIVIDED RESIDENTIAL COLLECTOR ROADWAY	FIGURE: 72



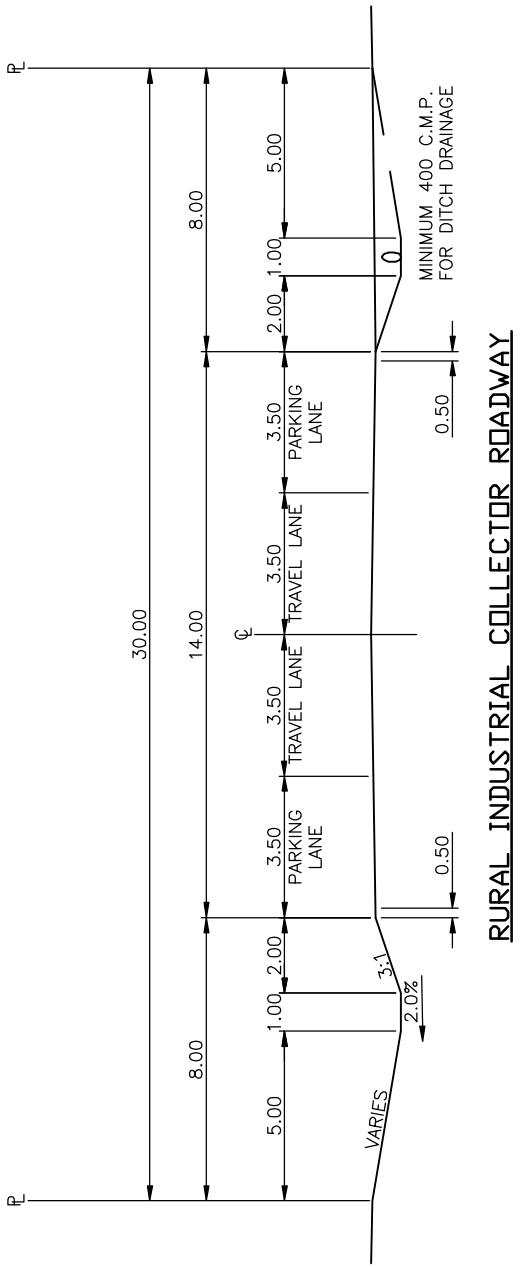




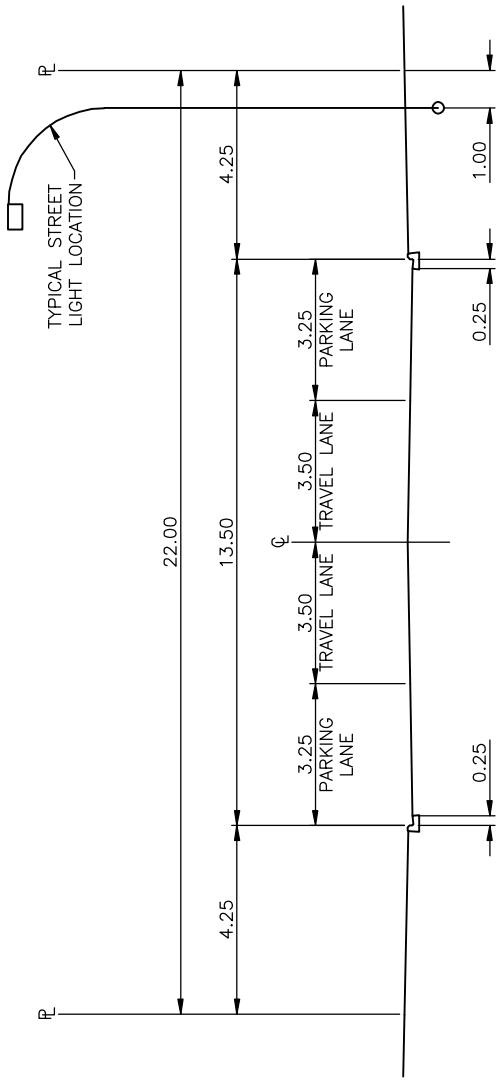
DATE: NOV, 2014	TOWN OF HIGH LEVEL TITLE: UNDIVIDED & DIVIDED RESIDENTIAL LOCAL ROADWAY	ACAD – CIVIL DRAFTING STANDARD DETAILS FIGURE: 73



DATE: NOV, 2014	TOWN OF HIGH LEVEL TITLE: UNDIVIDED RESIDENTIAL LOCAL ROADWAY	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL		FIGURE: 74

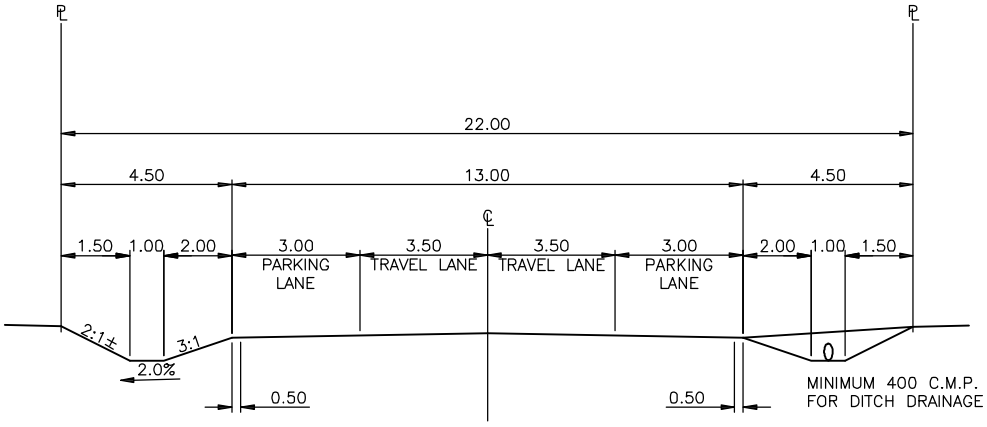


RURAL INDUSTRIAL COLLECTOR ROADWAY

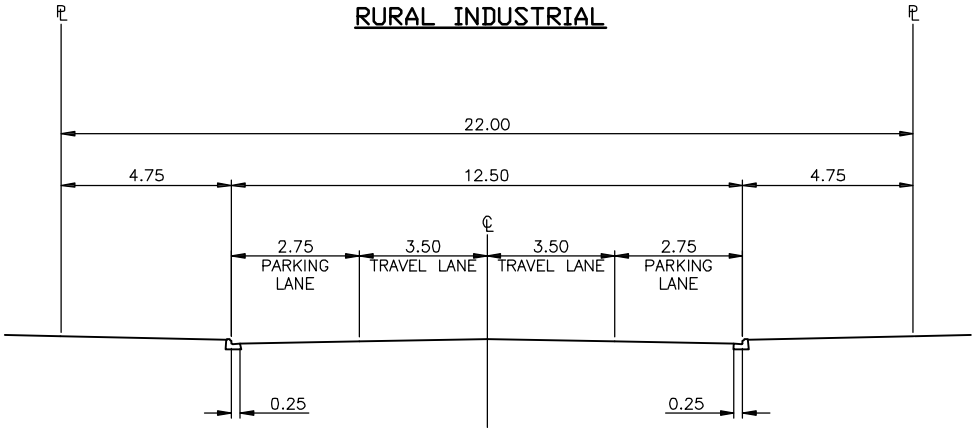


URBAN INDUSTRIAL COLLECTOR ROADWAY

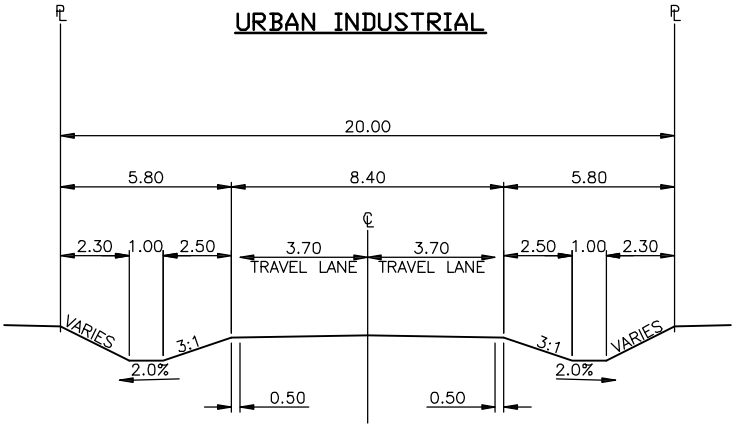
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: RURAL & URBAN UNDIVIDED INDUSTRIAL COLLECTOR ROADWAY	FIGURE: 75



RURAL INDUSTRIAL

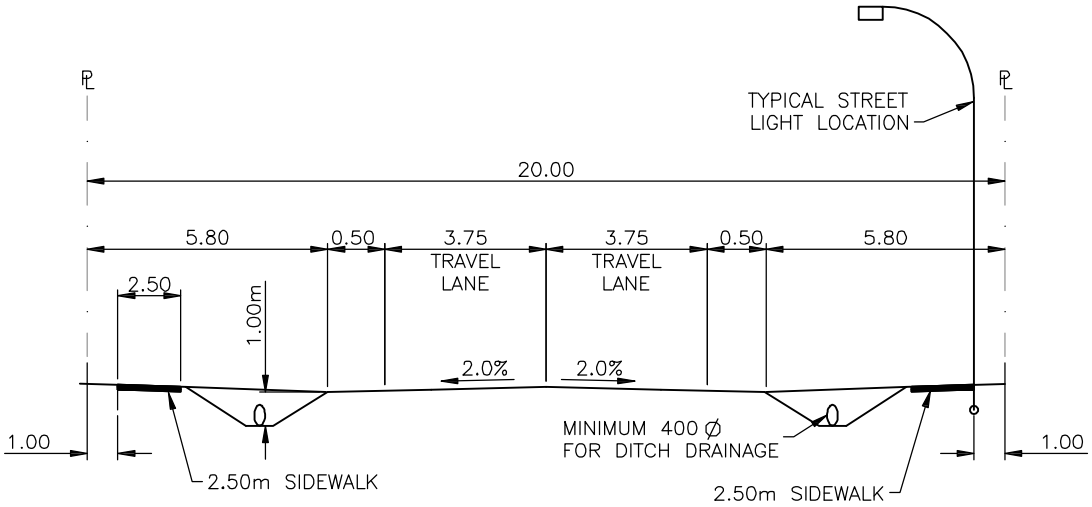


URBAN INDUSTRIAL



RURAL ROADWAY

DATE: NOV, 2014	TOWN OF HIGH LEVEL TITLE: RURAL & URBAN INDUSTRIAL LOCAL ROADWAYS & TYPICAL RURAL ROADWAY	ACAD – CIVIL DRAFTING STANDARD DETAILS FIGURE: 76

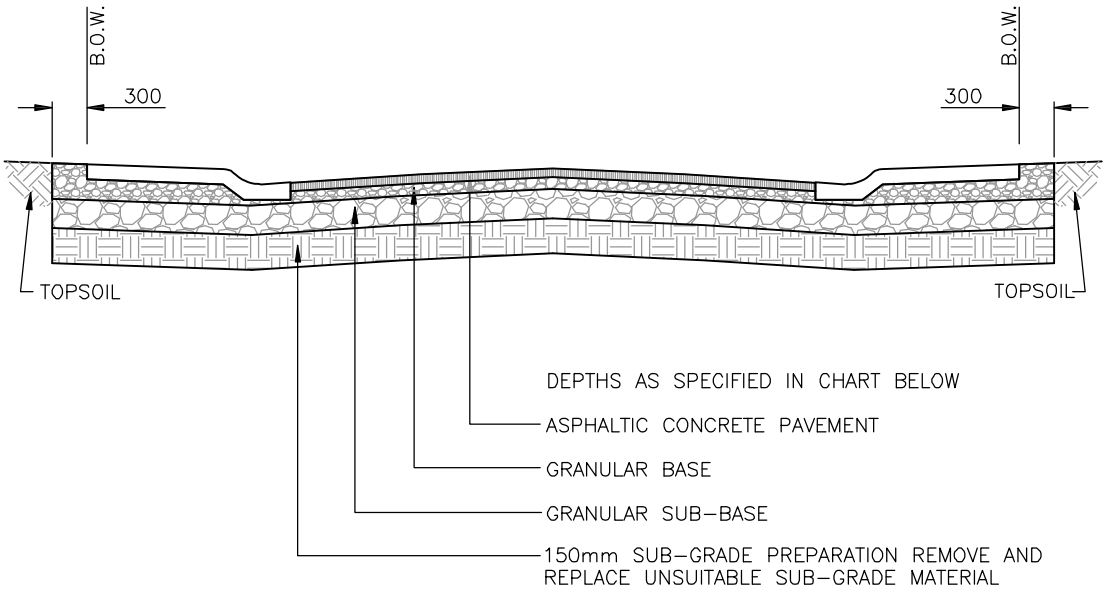


SEMI-URBAN ROADWAY WITH DITCHES

NOTES:

1. THIS ROAD CROSS SECTION MAYBE CONSIDERED IN RESIDENTIAL AREAS WHERE THE LOT AREA IS EQUAL TO OR EXCEEDS 0.5 ACRES.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: SEMI–URBAN ROADWAY	FIGURE: 77

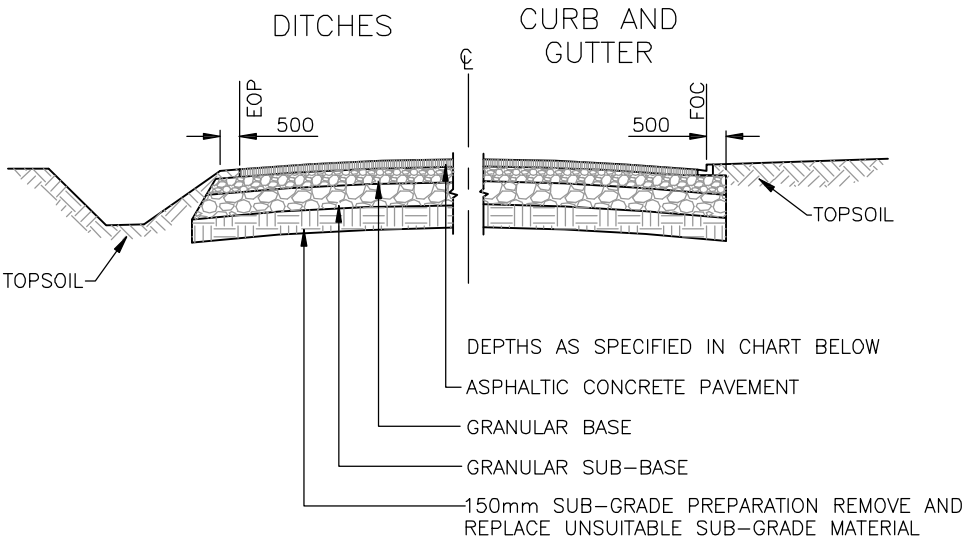


STANDARD RESIDENTIAL LOCAL AND COLLECTOR ROADWAY

MINIMUM DESIGN PAVEMENT STRUCTURE				
ROAD CLASSIFICATION	ASPHALTIC CONCRETE PAVEMENT (mm)	GRANULAR BASE (mm)	GRANULAR SUB-BASE (mm)	TOTAL DEPTH (mm)
RESIDENTIAL LOCAL	75	100	250	425
COLLECTOR	100	150	300	550

NOTE:
ROAD STRUCTURE TO BE BASED ON GEOTECHNICAL REPORT RECOMMENDATIONS.

DATE: NOV, 2014	TOWN OF HIGH LEVEL TITLE: RESIDENTIAL ROADWAY PAVEMENT STRUCTURE CROSS-SECTION	ACAD – CIVIL DRAFTING STANDARD DETAILS FIGURE: 78

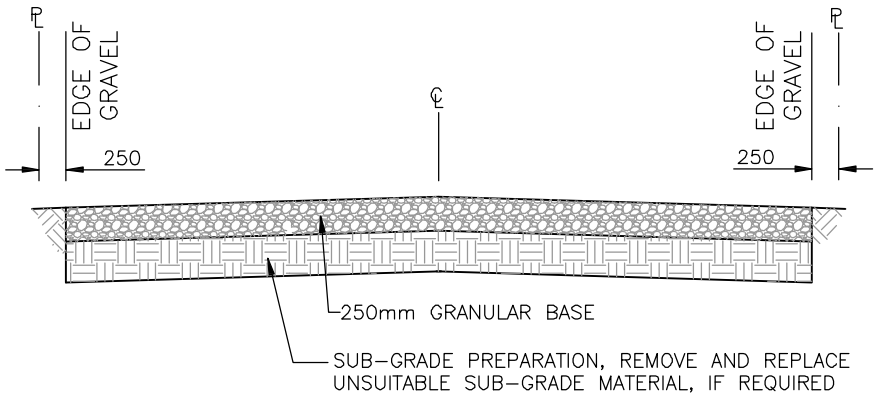


INDUSTRIAL LOCAL / COLLECTOR ROADWAY

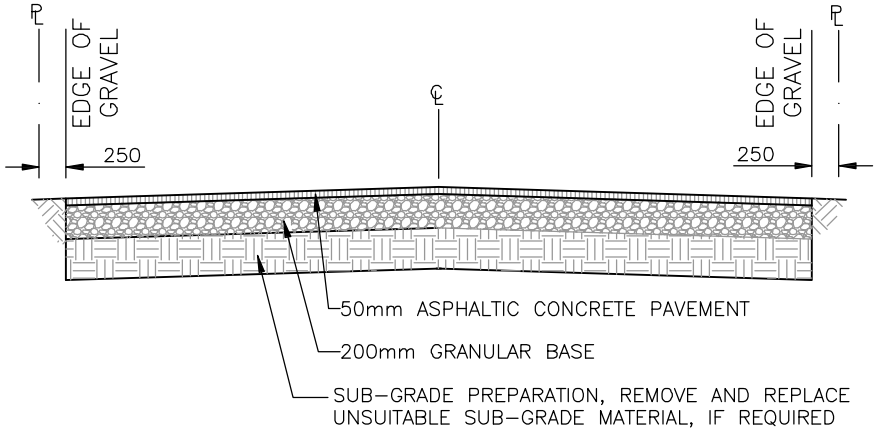
DESIGN PAVEMENT STRUCTURE				
ROAD CLASSIFICATION	ASPHALTIC CONCRETE PAVEMENT (mm)	GRANULAR BASE (mm)	GRANULAR SUB–BASE (mm)	TOTAL DEPTH (mm)
INDUSTRIAL LOCAL	75	150	300	525
INDUSTRIAL COLLECTOR	125	200	300	625

NOTE:
ROAD STRUCTURE TO BE BASED ON GEOTECHNICAL REPORT RECOMMENDATIONS.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: INDUSTRIAL ROADWAY PAVEMENT STRUCTURE CROSS–SECTION	FIGURE: 79



GRAVEL LANE



PAVED LANE

DESIGN PAVEMENT STRUCTURE				
ROAD CLASSIFICATION	ASPHALTIC CONCRETE PAVEMENT (mm)	GRANULAR BASE (mm)	GRANULAR SUB–BASE (mm)	TOTAL DEPTH (mm)
GRAVEL LANES	––	100	200	300
PAVED LANES	75	150	300	525

DATE: NOV, 2014

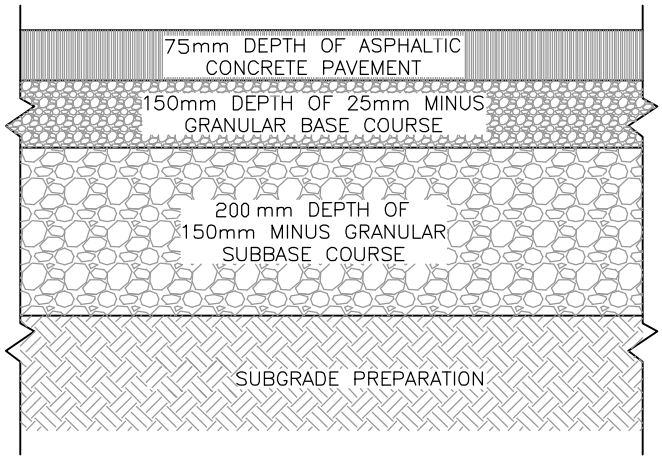
TOWN OF HIGH LEVEL

TITLE:

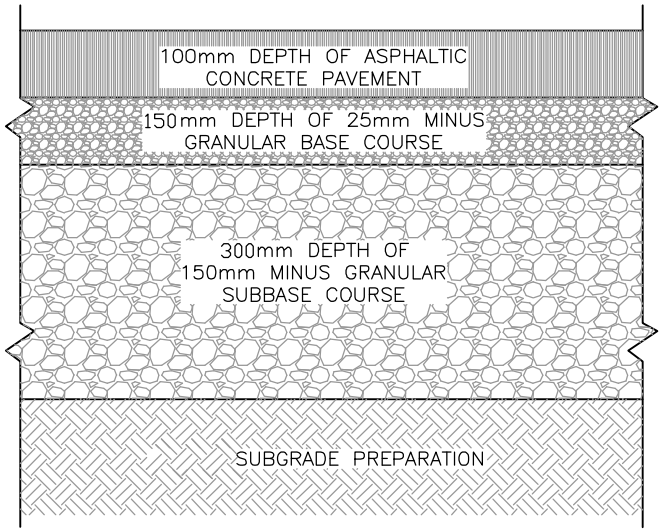
GRAVEL/PAVED LANE PAVEMENT STRUCTURE CROSS–SECTION

ACAD – CIVIL DRAFTING STANDARD DETAILS

FIGURE: 80

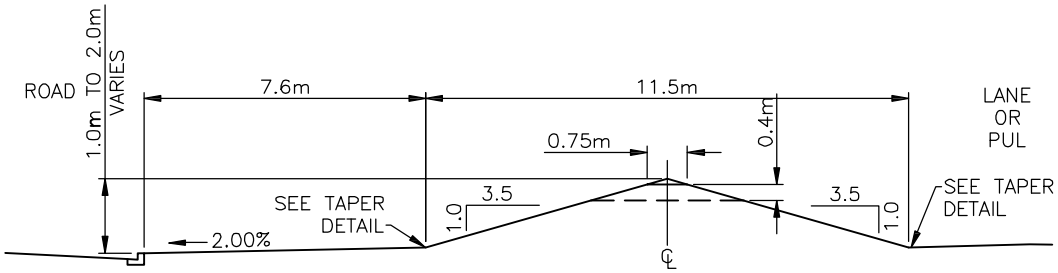


LIGHT DUTY PAVEMENT CONSTRUCTION

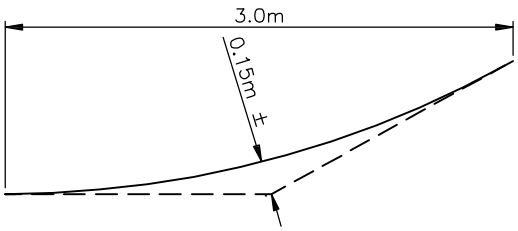


HEAVY DUTY PAVEMENT CONSTRUCTION

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: PARKING LOT PAVEMENT STRUCTURE CROSS–SECTION	FIGURE: 81



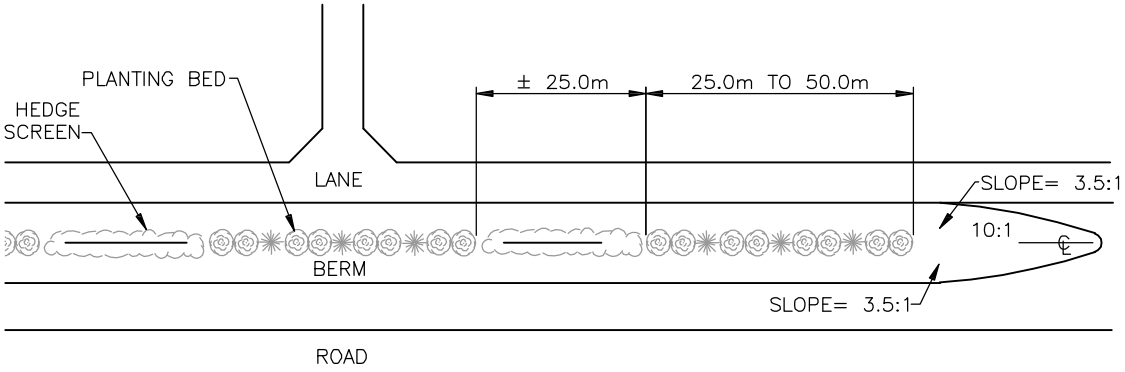
CROSS SECTION



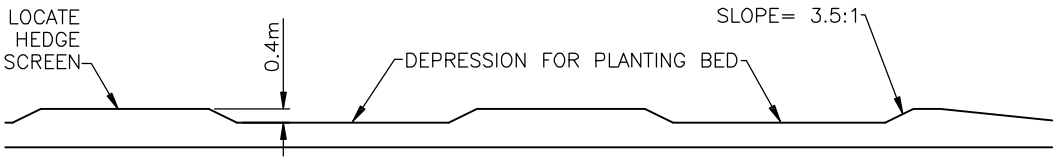
NOTE:

– PROVIDE A TAPER TO THE BERM ADJACENT TO THE BOULEVARD & PUBLIC UTILITY LOT/M.R. FOR MOWER TRANSITION

BERM TAPER DETAIL

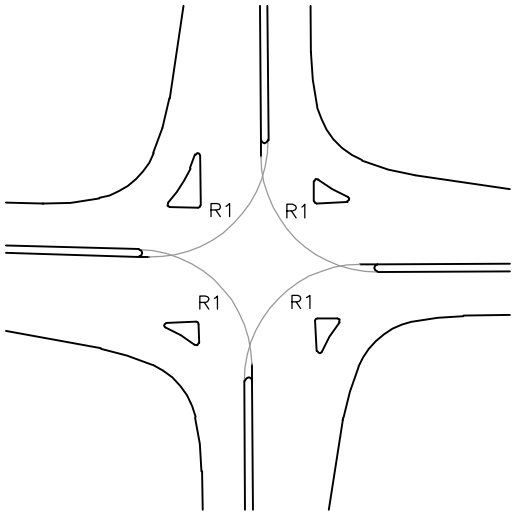


BERM PLAN VIEW

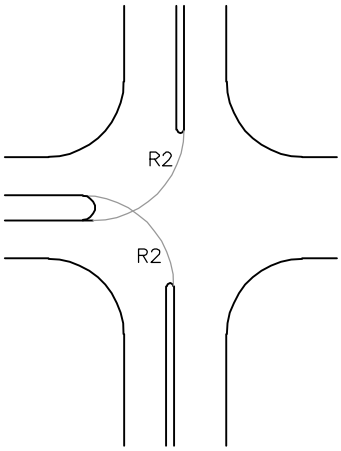


BERM ELEVATED VIEW

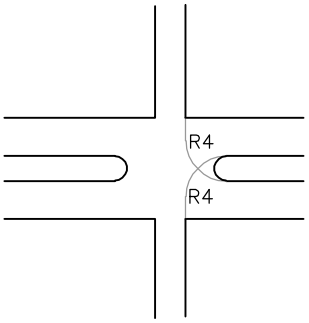
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: BERM CROSS–SECTION	FIGURE: 82



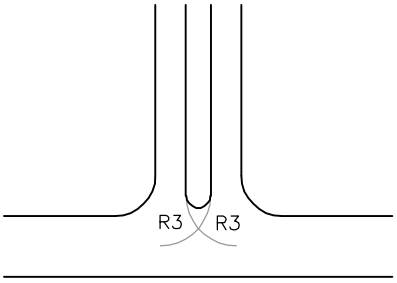
ARTERIAL TO ARTERIAL



ARTERIAL TO COLLECTOR



DIVIDED COLLECTOR OR
LOCAL TO LANE OR DRIVEWAY



COLLECTOR OR LOCAL TO
COLLECTOR OR LOCAL

TURNING RADII

ARTERIAL TO ARTERIAL	R1	22m
ARTERIAL TO COLLECTOR	R2	18m
COLLECTOR TO COLLECTOR	R3	15m
COLLECTOR TO LOCAL	R3	12m
LOCAL TO LOCAL	R3	10m
COLLECTOR / LOCAL TO LANE	R4	8m

DATE: NOV, 2014

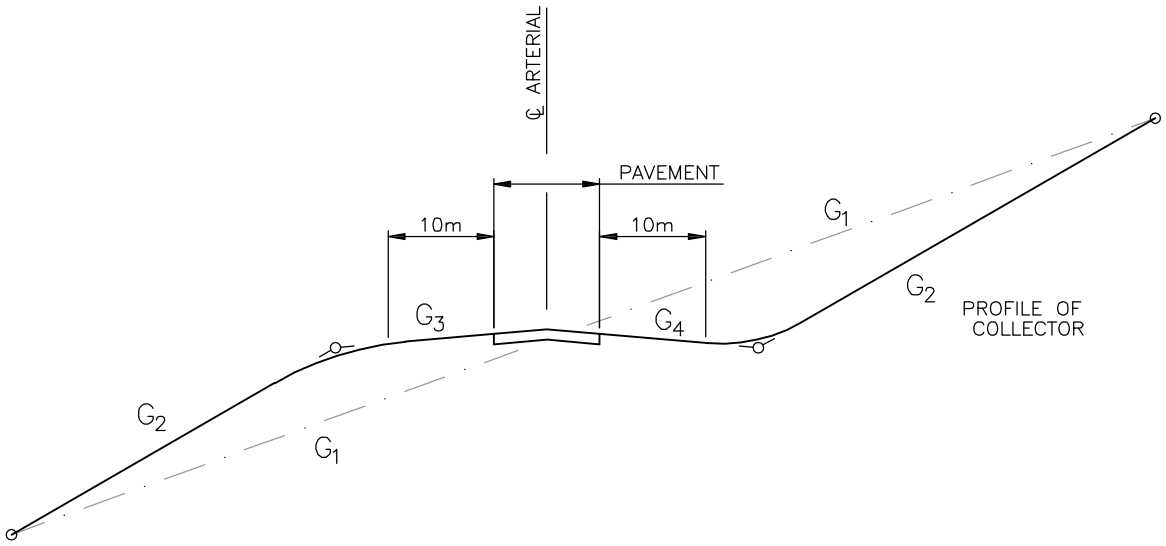
TOWN OF HIGH LEVEL

TITLE:

INTERSECTION CENTRE LINE CONTROL RADII

ACAD – CIVIL DRAFTING STANDARD DETAILS

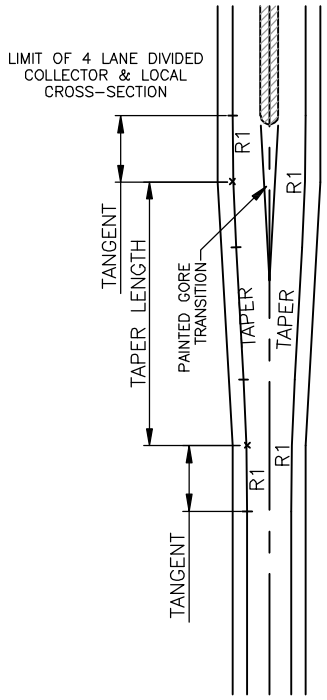
FIGURE: 83



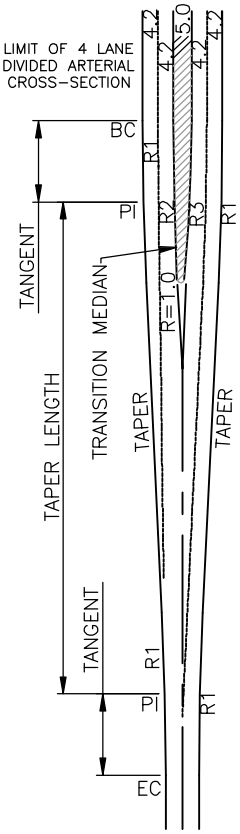
NOTES:

G_1	ORIGINAL GRADE OF MINOR ROAD
G_2	GRADE INTRODUCED TO ADJUST GRADE AT INTERSECTION
G_3 AND G_4	GRADE ON COLLECTOR CONFORMS TO CROSS SLOPE ON ARTERIAL ROADWAY (EG. 0.5% TO 5.0%, NORMAL CROWN TO SUPERELEVATION).

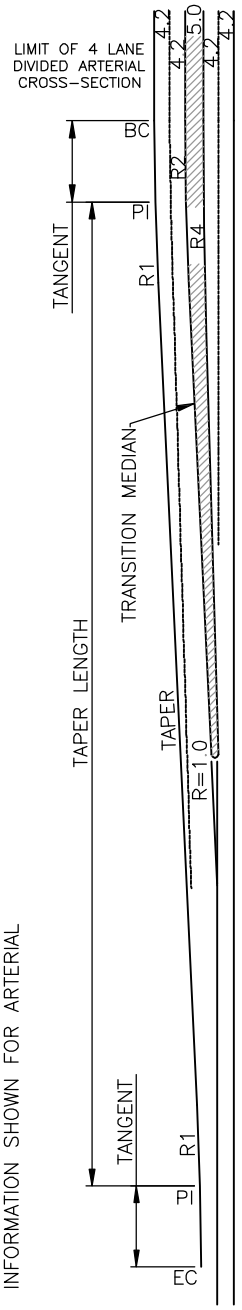
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: INTERSECTION GRADE ADJUSTMENT	FIGURE: 84



LOCAL / COLLECTOR CENTRELINE TRANSITION



ARTERIAL CENTRELINE TRANSITION



ARTERIAL OFFSET TRANSITION

OVERALL APPROACH OR DEPARTURE TAPER LENGTHS						
ROADWAY	DESIGN SPEED KM/H	TAPER RATIO	TRANSITION RADII (m)			
			R1	R2	R3	R4
LOCAL	50	15:1	500	---	---	---
COLLECTOR	60	18:1	700	---	---	---
ARTERIAL	70	21:1	930	921.6	475	2000
ARTERIAL	80	24:1	1200	1191.6	475	2000

ON 70 fm/hr DESIGN SPEED.
ROADWAY TRANSITIONSARE BASED
INFORMATION SHOWN FOR ARTERIAL

DATE:
NOV, 2014

TOWN OF HIGH LEVEL

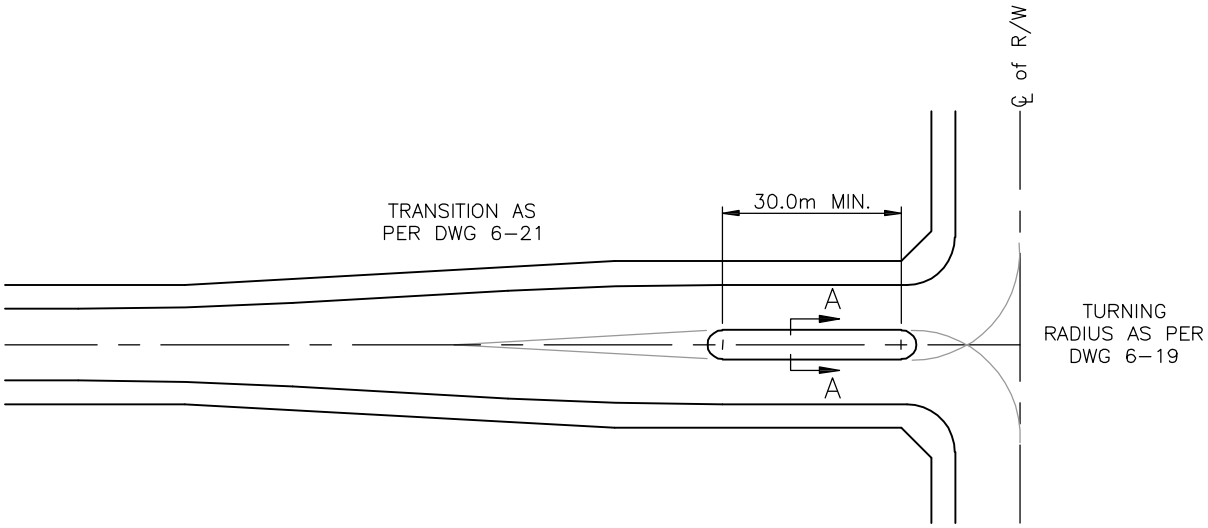
TITLE:

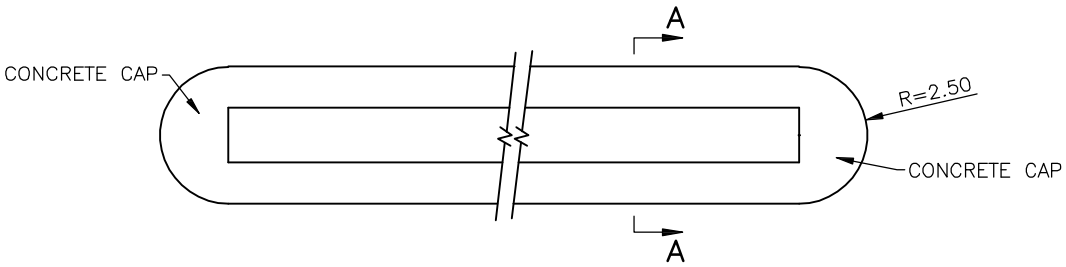
DIVIDED TO UNDIVIDED ROADWAY TRANSITION

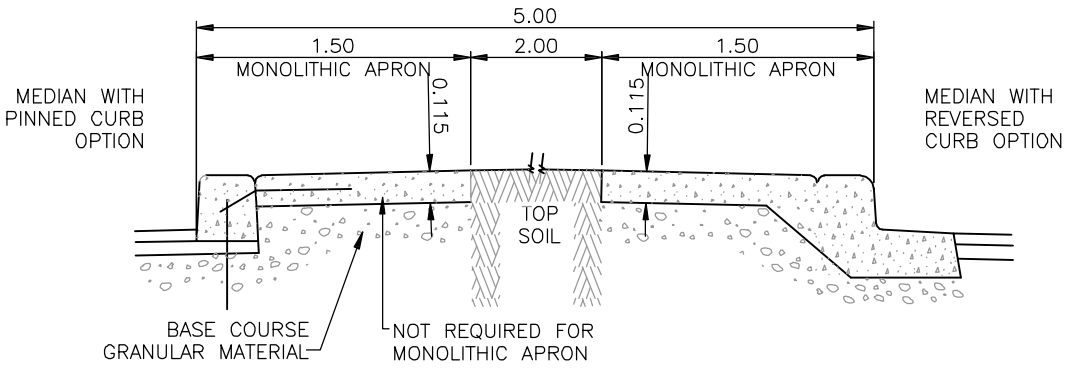
ACAD – CIVIL DRAFTING STANDARD DETAILS

FIGURE:

85





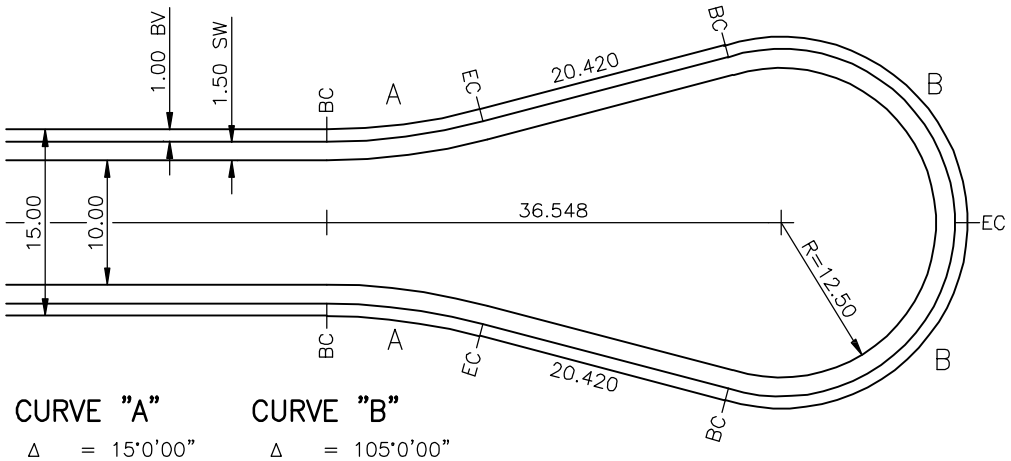


NOTE:

– PATTERNED CONCRETE OR PAVING STONES FOR APRON ARE PERMITTED

SECTION A–A

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: COLLECTOR AND LOCAL ROADWAY CENTER ISLAND	FIGURE: 86

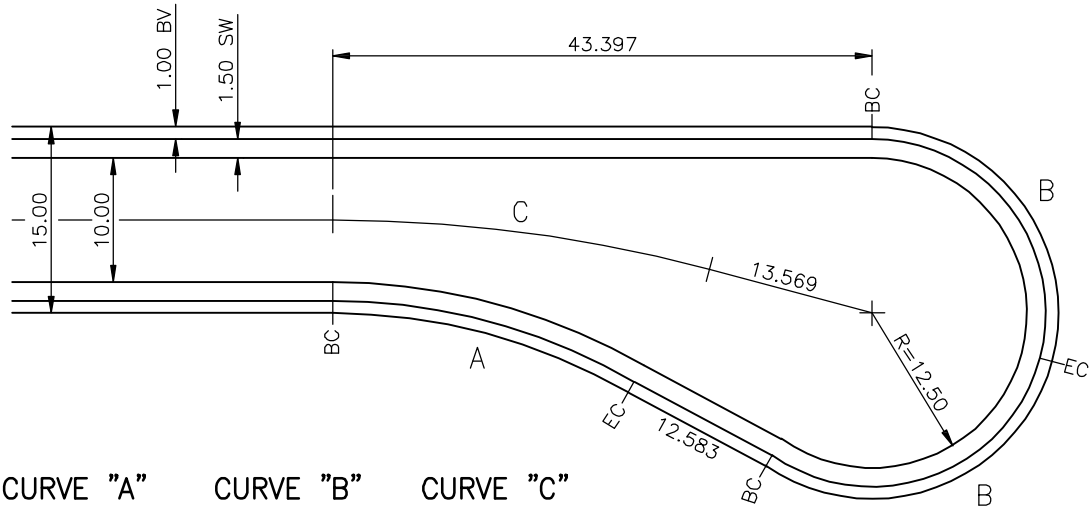


CURVE "A"

Δ = 15°0'00"
R = 50.000
ARC = 13.090
TAN = 6.583
(at property line)

CURVE "B"

Δ = 105°0'00"
R = 15.000
ARC = 27.489
TAN = 19.548
(at property line)



CURVE "A"

Δ = 30°0'00"
R = 50.000
ARC = 26.180
TAN = 13.398
(at property line)

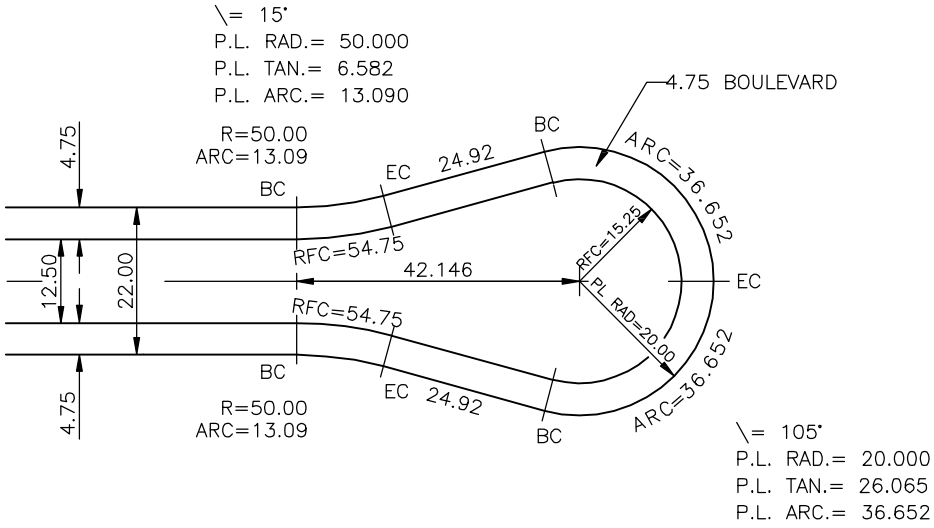
CURVE "B"

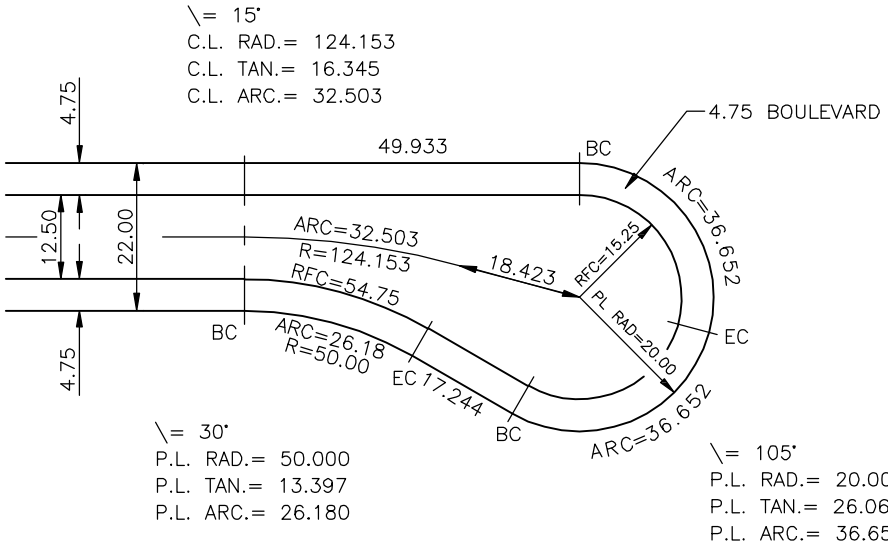
Δ = 105°0'00"
R = 15.000
ARC = 27.489
TAN = 19.548
(at property line)

CURVE "C"

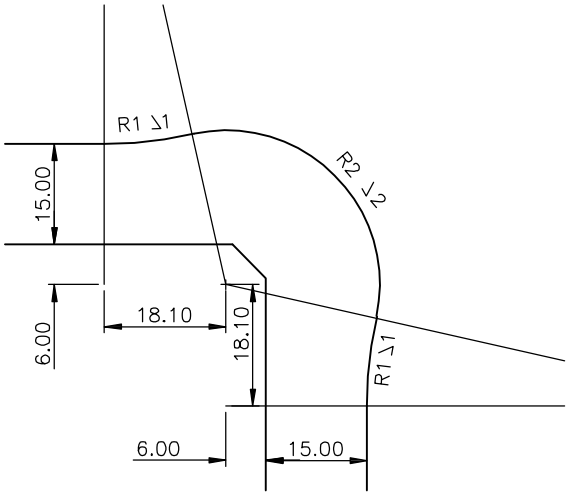
Δ = 15°0'00"
R = 117.033
ARC = 30.640
TAN = 15.408

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: 15/10 LOCAL RESIDENTIAL CUL – DE – SAC	FIGURE: 87



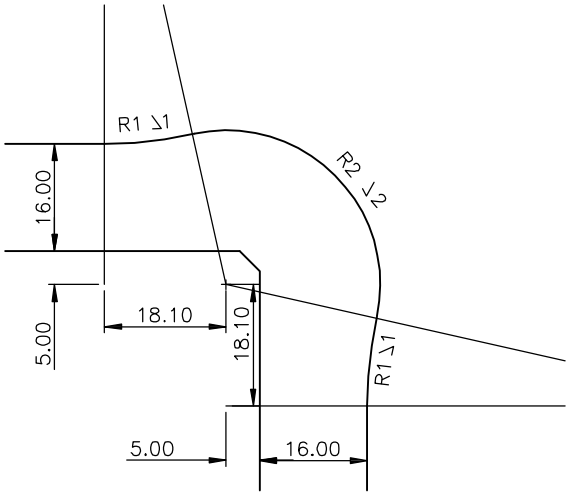


DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: 20/12.5 INDUSTRIAL ROAD CUL – DE – SAC	FIGURE: 88



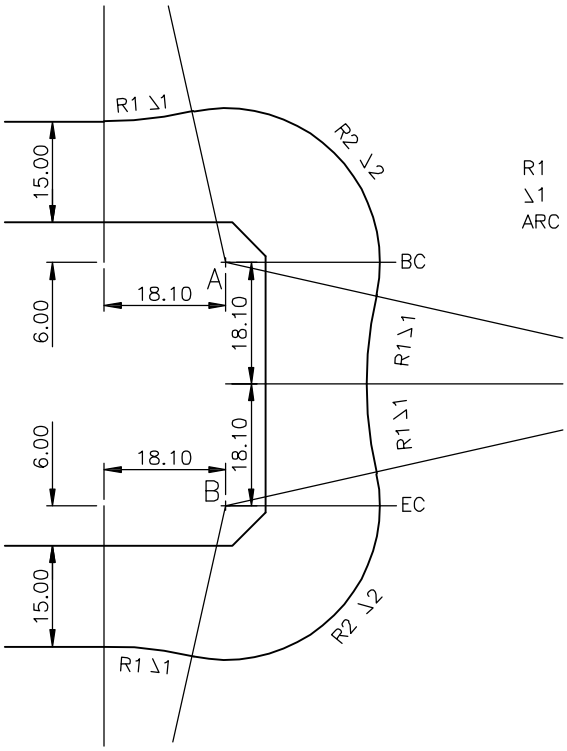
R1 = 60.00m
∆1 = 12° 36' 12"
ARC = 13.198

15 / 10 LOCAL ROADWAY



R2 = 23.00m
∆2 = VARIES
ARC = VARIES

16 / 11 LOCAL ROADWAY

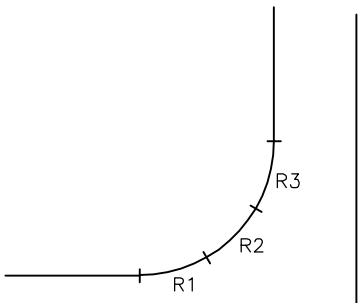


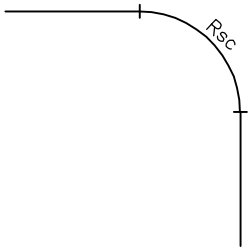
R1 = 60.00m
∆1 = 12° 36' 12"
ARC = 13.198

NOTES:

– IF DISTANCE BETWEEN A & B IS LESS THAN 36.2m, REPLACE 60m RADIUS CURVES WITH A TANGENT FROM B.C. TO E.C., WITH THE RIGHT-OF-WAY WIDTH INCREASING TO 17.0m (FOR 15/10 ROADWAY) OR 18.0m (FOR 16/10 ROADWAY)

DATE: NOV, 2014	TOWN OF HIGH LEVEL TITLE: LOCAL ROADWAY EXPANDED BULB CORNER ALTERNATIVES	ACAD – CIVIL DRAFTING STANDARD DETAILS FIGURE: 89



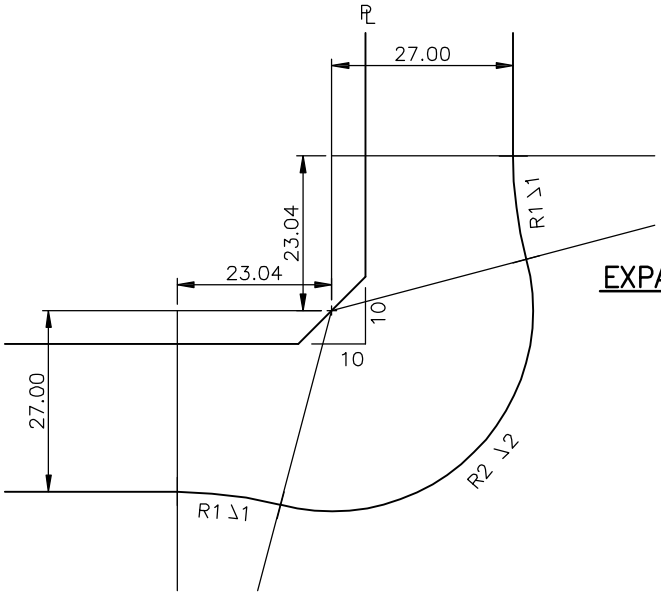


3 CENTERED COMPOUND CURVE

ANGLE OF TURN △	CURVE RADII R1 – R2 – R3	SYMETRICAL OFFSET
1. COLLECTOR TO COLLECTOR (WB-15)		
75° ± 7° 30'	50 – 15 – 50	1.83
90° ± 7° 30'	55 – 15 – 55	2.13
105° ± 7° 30'	60 – 15 – 55	2.44
2. a. COLLECTOR TO LOCAL b. LOCAL TO LOCAL – (SU-9)		
75° ± 7° 30'	40 – 15 – 40	0.65
90° ± 7° 30'	40 – 12 – 40	0.65
105° ± 7° 30'	30 – 11 – 30	0.92

SIMPLY CURVE RADIUS (Rsc)

1. COLLECTOR TO COLLECTOR	18.0
2. a. COLLECTOR TO LOCAL	15.0
b. LOCAL TO LOCAL	15.0



EXPANDED CORNER FOR INDUSTRIAL LOCAL

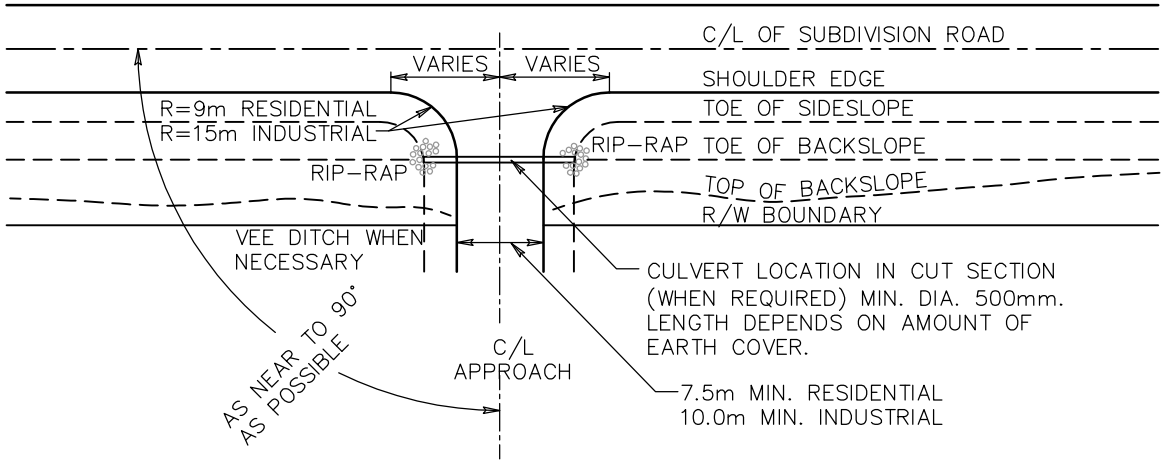
CURVE DATA

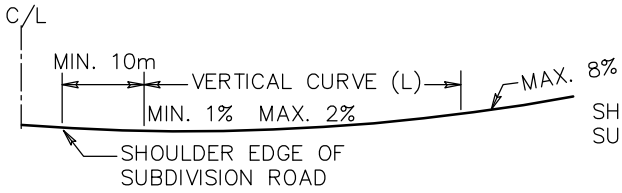
R1 = 60.00m
Δ1 = 14° 50' 96"

R2 = 30.00m
Δ2 = VARIES

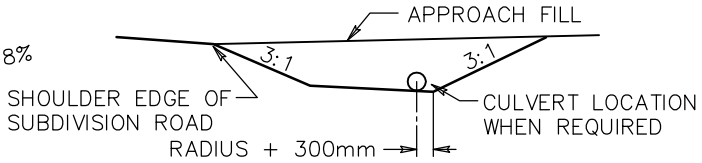
NOTE:
– ROAD RIGHT OF WAY WIDTH VARIES

DATE: NOV, 2014	TOWN OF HIGH LEVEL TITLE: INDUSTRIAL ROADWAY CORNER ALTERNATES & EXPANDED BULB CORNER	ACAD – CIVIL DRAFTING STANDARD DETAILS FIGURE: 90

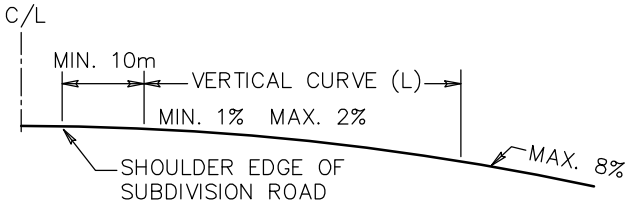




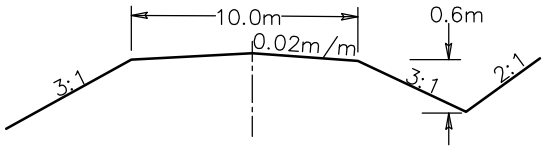
PROFILE – APPROACH IN CUT



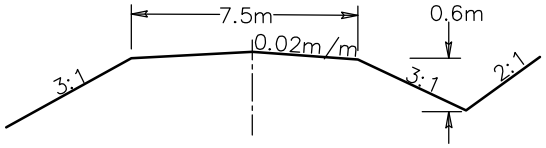
DETAIL OF DITCH & CULVERT LOCATION



PROFILE – APPROACH IN FILL



MINIMUM INDUSTRIAL APPROACH CROSS SECTION



MINIMUM RESIDENTIAL APPROACH CROSS SECTION

MINIMUM LENGTH OF VERTICAL CURVE		
ALGEBRAIC DIFFERENCE IN GRADIENT (%)	LENGTH L (METRES)	
	CREST	SAG
1	5	7.5
2	12	15
3	18	23
4	25	30
5	30	38
6	37	46
7		46
8		46
9		46

NOTE
ALL ENTRANCES ARE TO BE FROM THE INTERNAL ROAD SYSTEM AND ARE TO PROVIDE REASONABLE ACCESS TO THE LOTS, EACH LOT IS TO HAVE A PRIVATE APPROACH.

DATE: NOV, 2014

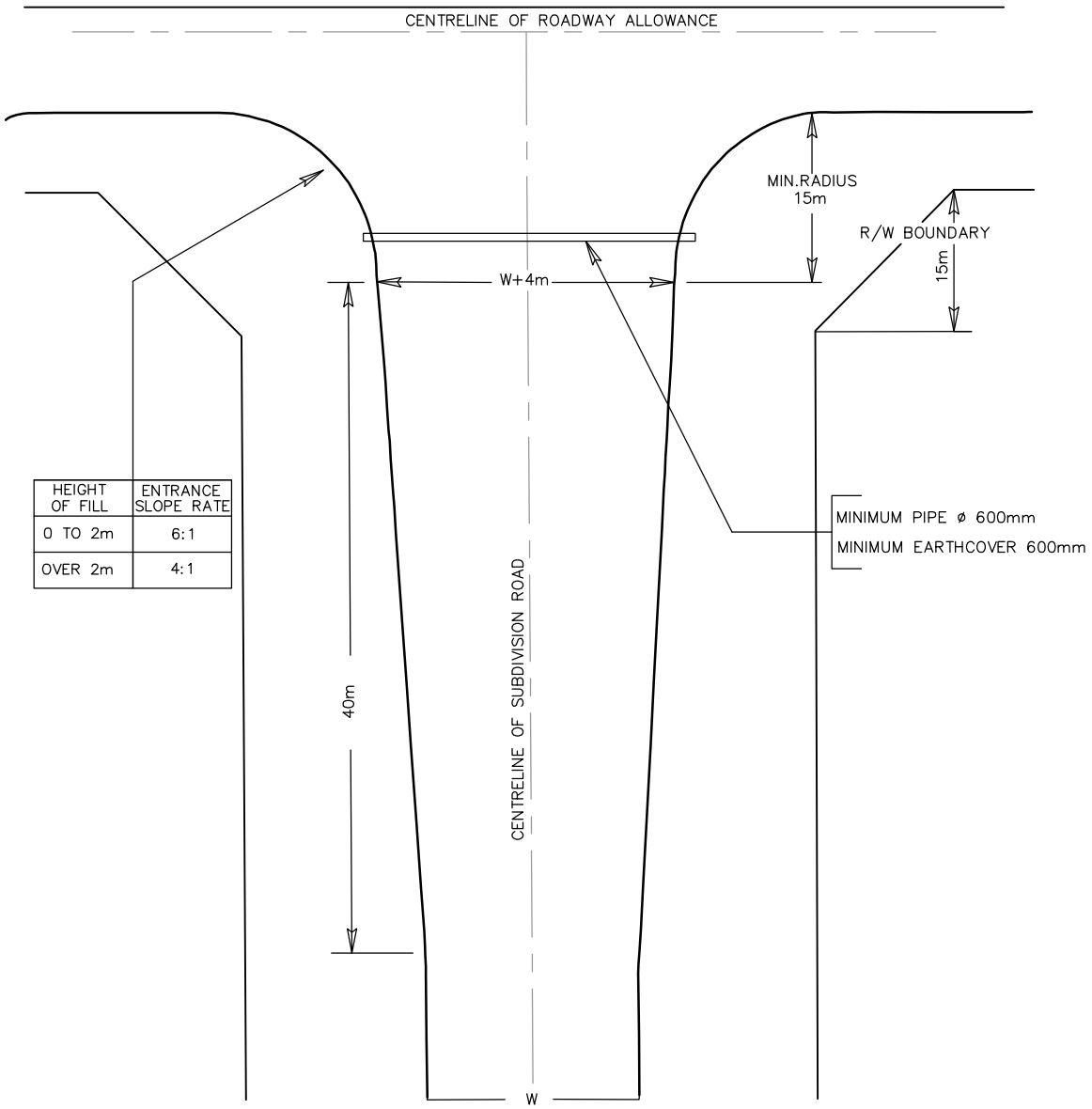
TOWN OF HIGH LEVEL

TITLE:

RESIDENTIAL / INDUSTRIAL APPROACH STANDARD

ACAD – CIVIL DRAFTING STANDARD DETAILS

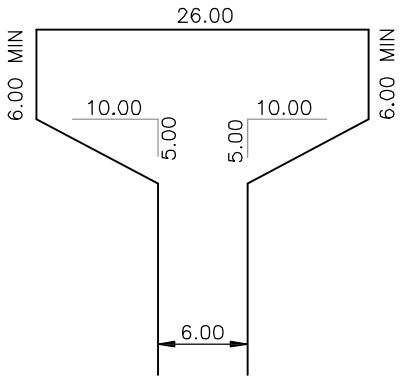
FIGURE: 91



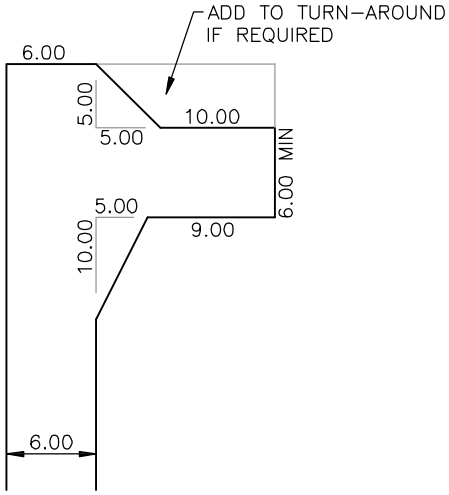
HEIGHT OF FILL	ENTRANCE SLOPE RATE
0 TO 2m	6:1
OVER 2m	4:1

W = FINISHED WIDTH

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: MAJOR INTERSECTION LAYOUT INDUSTRIAL RURAL STANDARD	FIGURE: 92



" T " TYPE

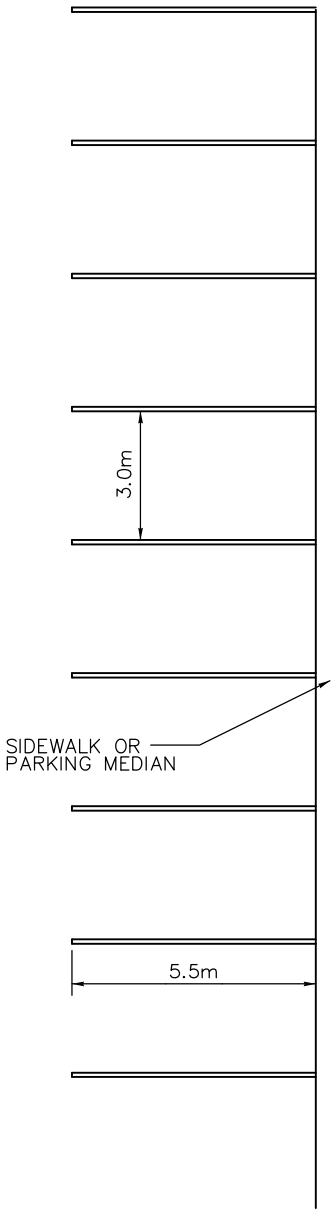


BRANCH TYPE

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: LANE TURN AROUNDS	FIGURE: 93

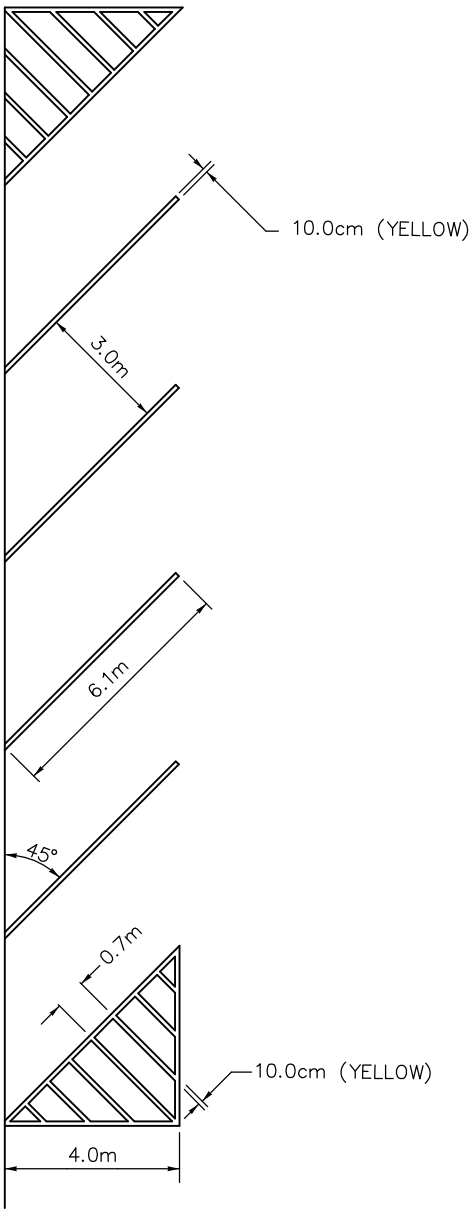
TYPE 1

90 DEGREE



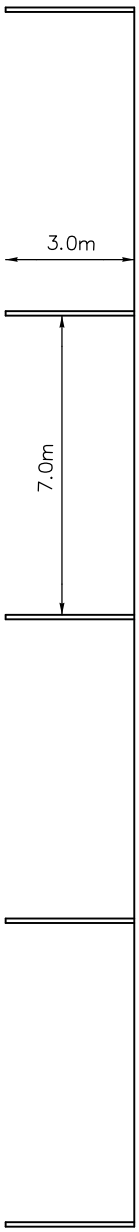
TYPE 2

ANGLE



TYPE 3

PARALLEL

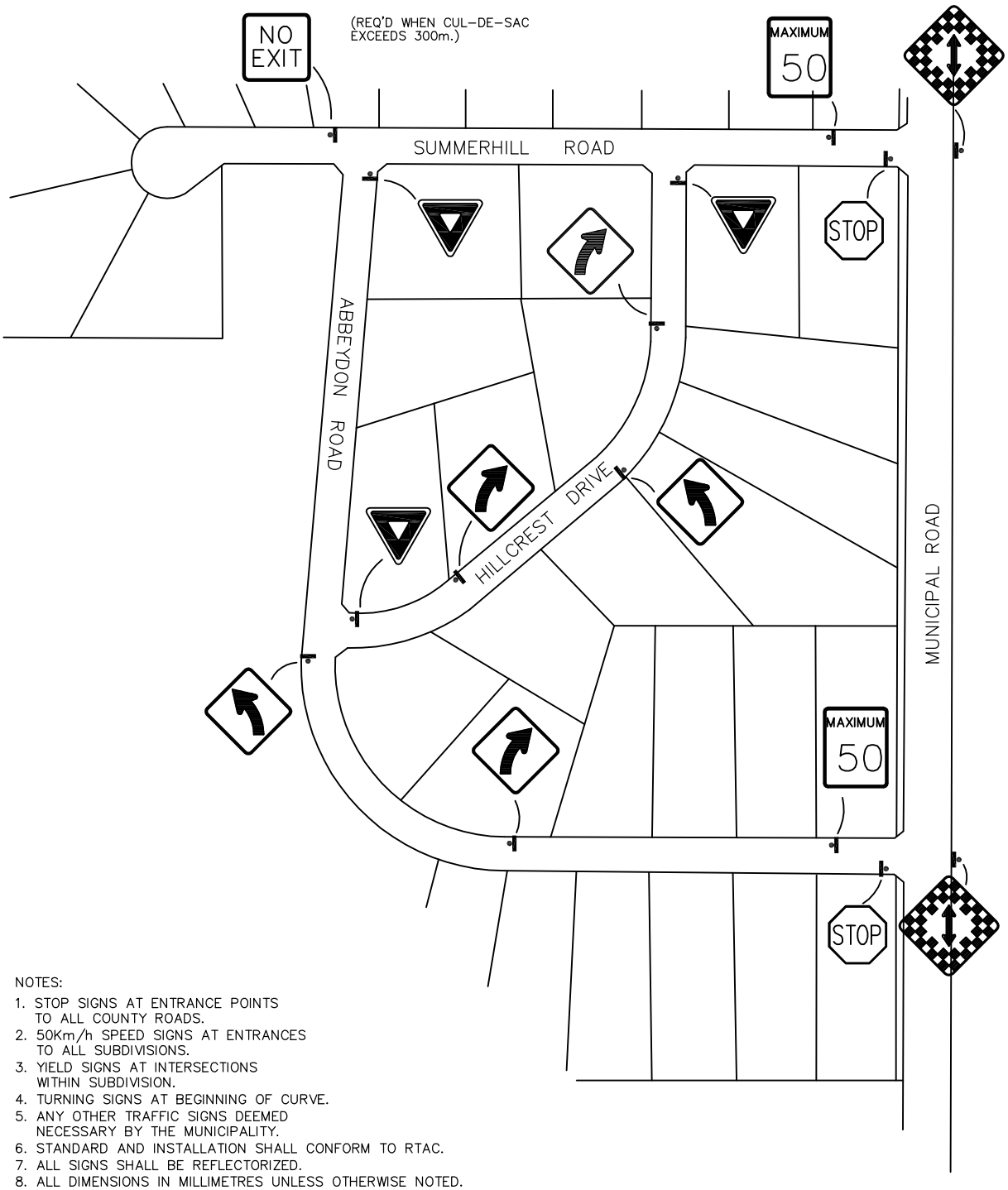


NOTE:

1. ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED.

DATE: NOV, 2014	TOWN OF HIGH LEVEL TITLE: PARKING LOT MARKINGS TYPE 1 AND 2	ACAD – CIVIL DRAFTING STANDARD DETAILS FIGURE: 94

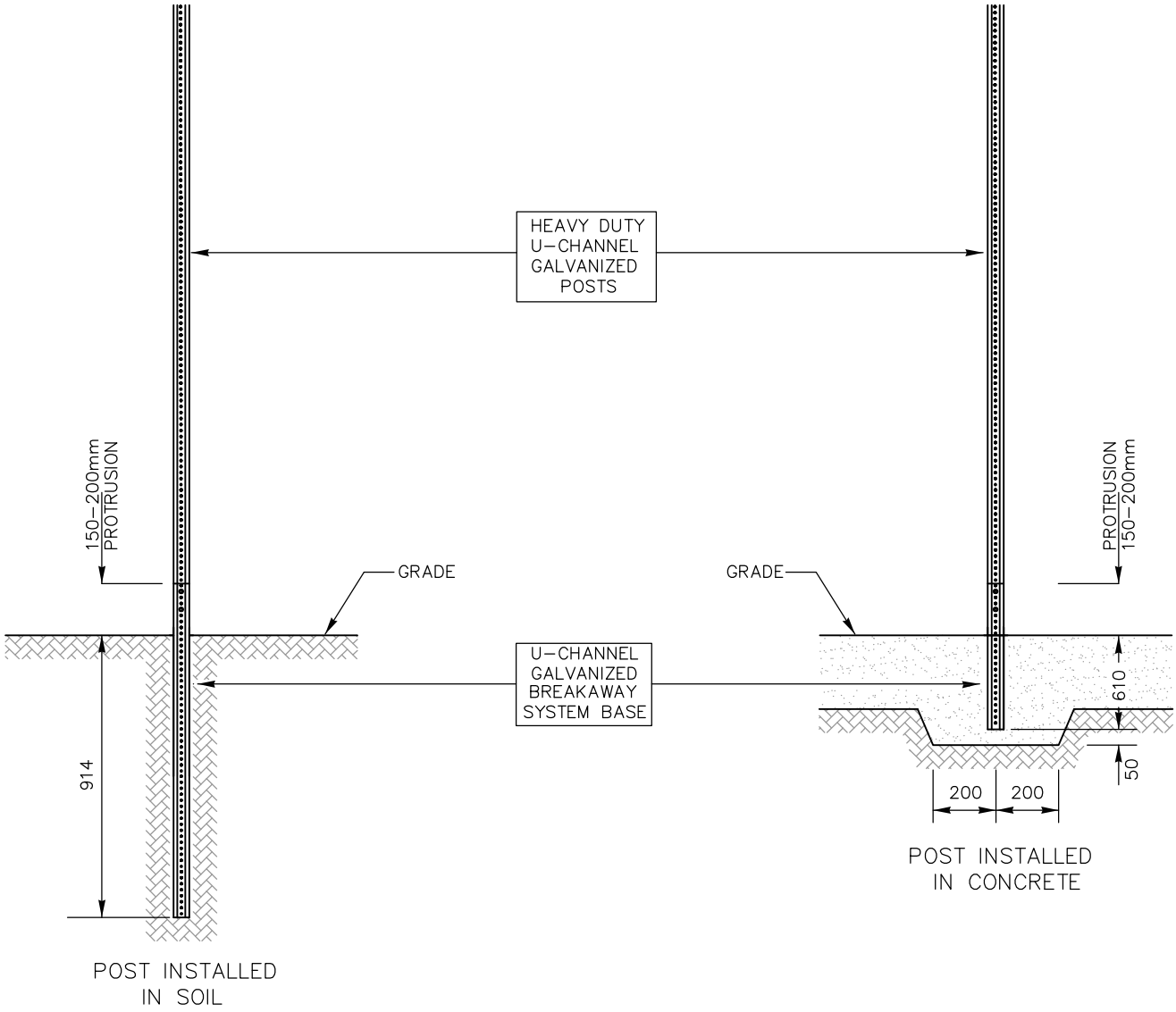
TOWN OF HIGH LEVEL



NOTES:

1. STOP SIGNS AT ENTRANCE POINTS TO ALL COUNTY ROADS.
2. 50Km/h SPEED SIGNS AT ENTRANCES TO ALL SUBDIVISIONS.
3. YIELD SIGNS AT INTERSECTIONS WITHIN SUBDIVISION.
4. TURNING SIGNS AT BEGINNING OF CURVE.
5. ANY OTHER TRAFFIC SIGNS DEEMED NECESSARY BY THE MUNICIPALITY.
6. STANDARD AND INSTALLATION SHALL CONFORM TO RTAC.
7. ALL SIGNS SHALL BE REFLECTORIZED.
8. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

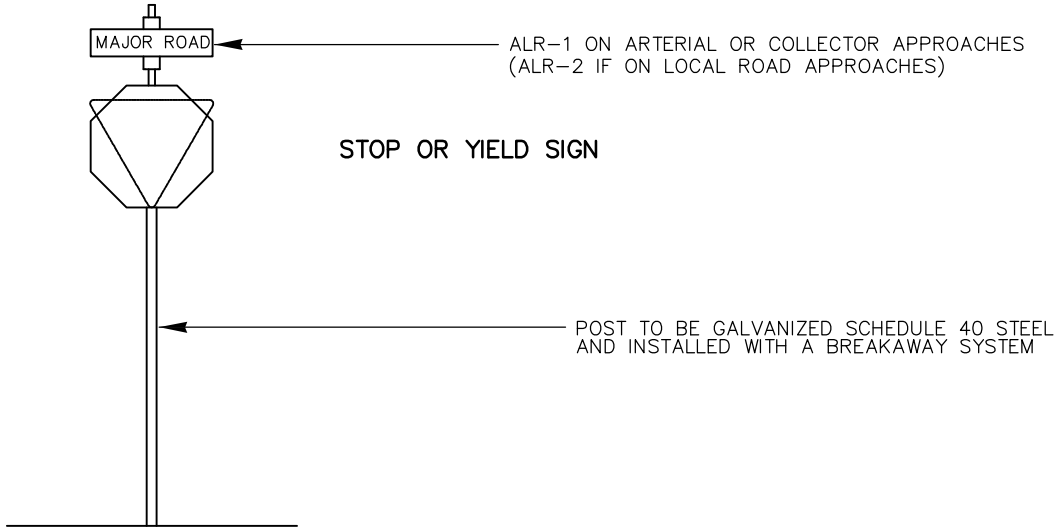
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: TYPICAL TRAFFIC SIGN LAYOUT RURAL STANDARD	FIGURE: 95



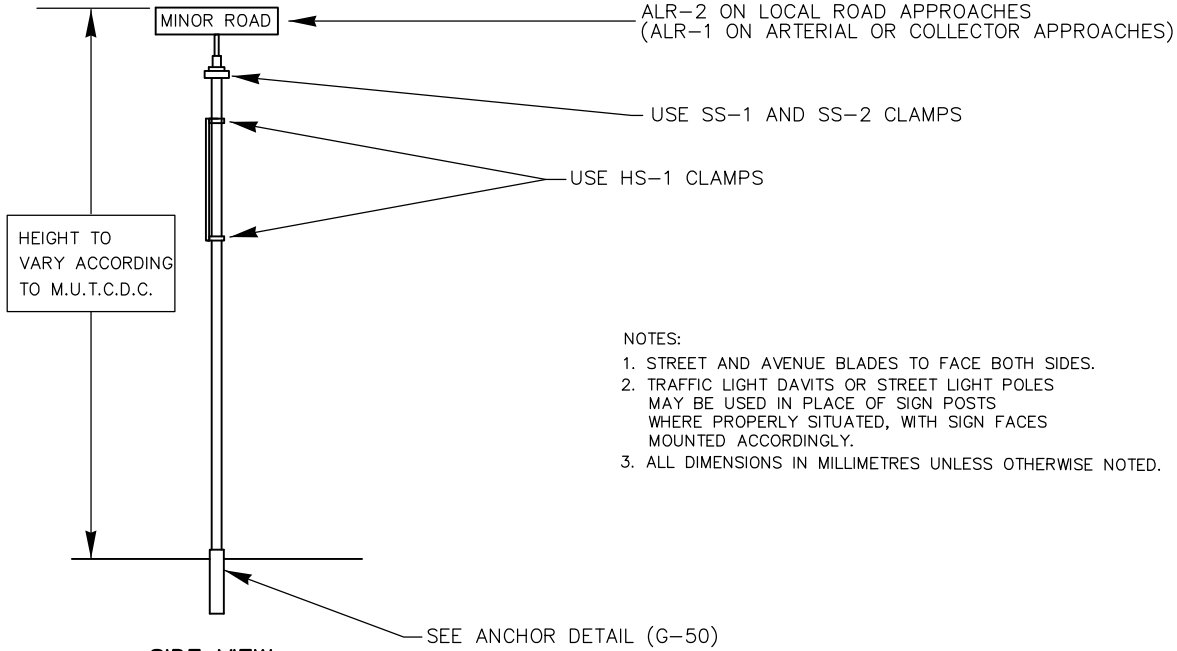
NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: SIGN POST ANCHOR DETAIL	FIGURE: 96



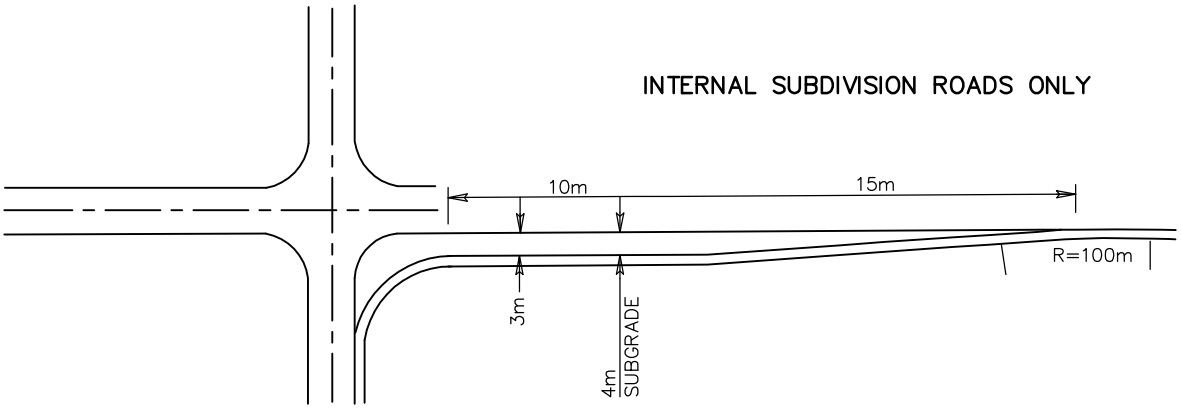
FRONT VIEW



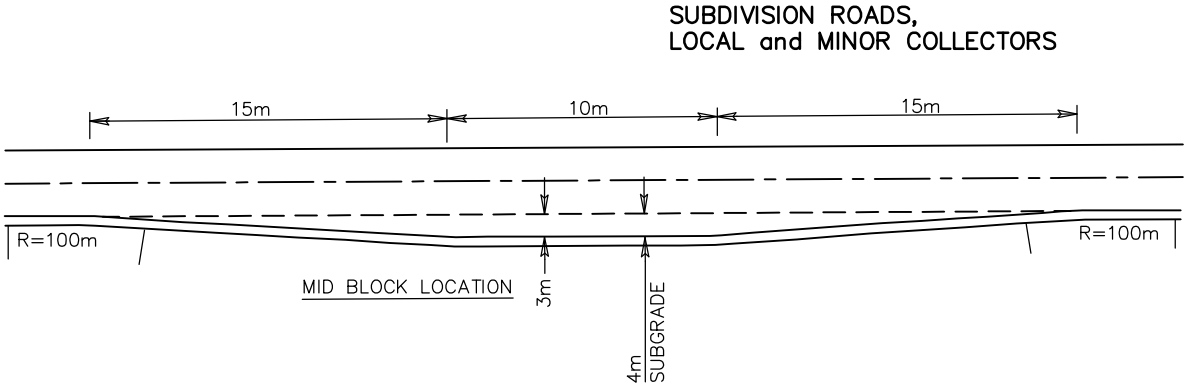
SIDE VIEW

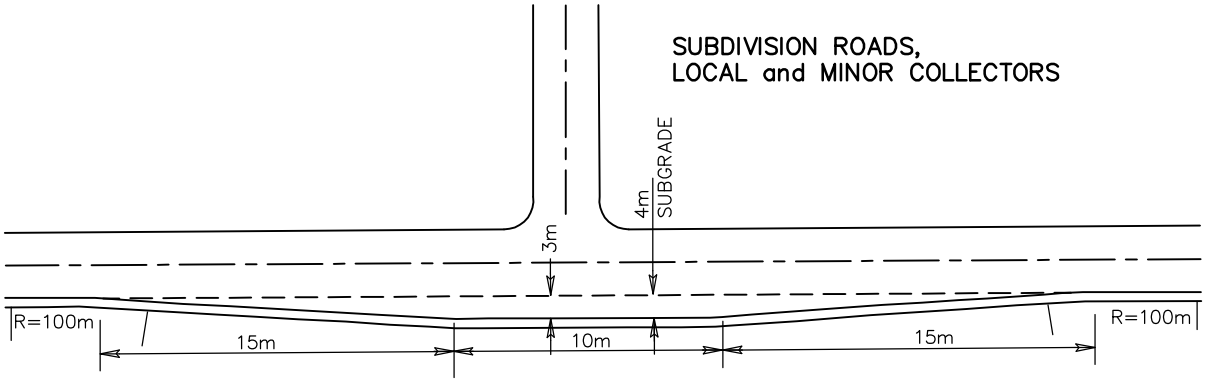
NOTES:
1. STREET AND AVENUE BLADES TO FACE BOTH SIDES.
2. TRAFFIC LIGHT DAVITS OR STREET LIGHT POLES MAY BE USED IN PLACE OF SIGN POSTS WHERE PROPERLY SITUATED, WITH SIGN FACES MOUNTED ACCORDINGLY.
3. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: SIGN MOUNTING DETAILS	FIGURE: 97



CORNER LOCATION

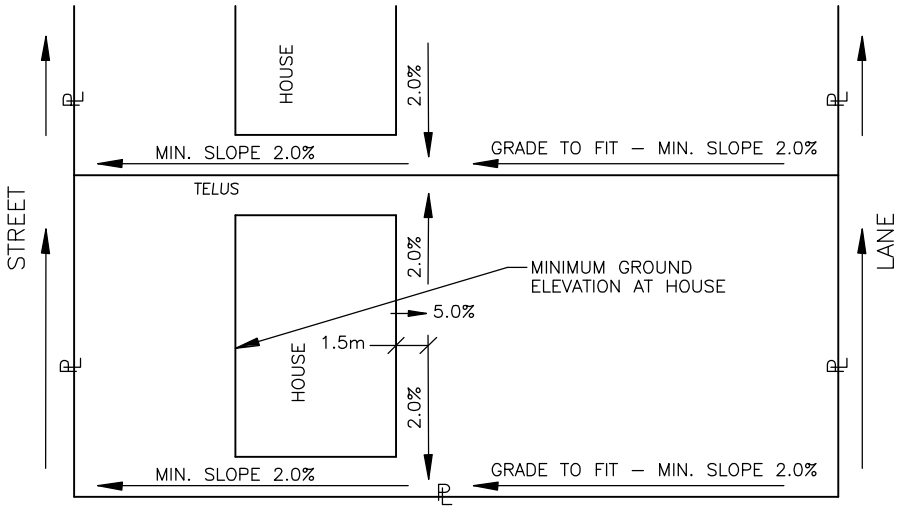




TEEL LOCATION

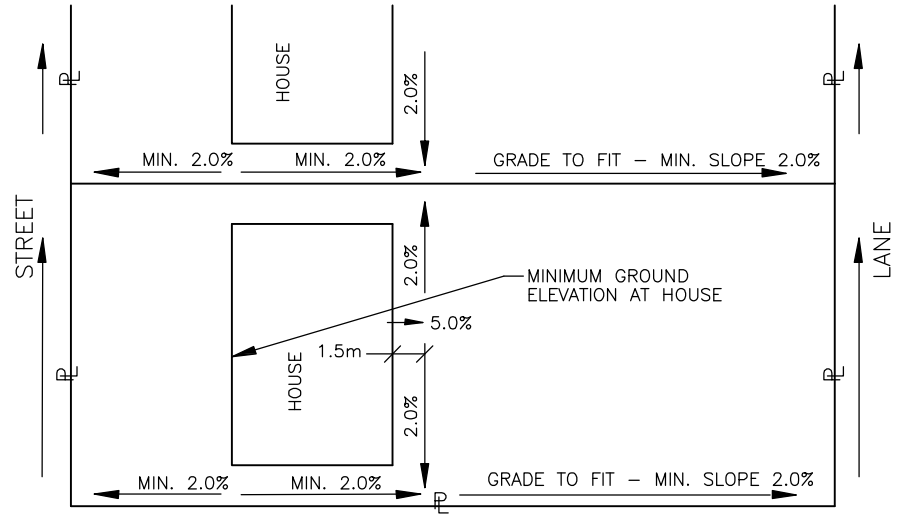
NOTE:
1. ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: TYPICAL MAILBOX PULLOUT LOCATIONS	FIGURE: 98



LOT GRADING – BACK TO FRONT DRAINAGE

N.T.S.



LOT GRADING – FRONT TO BACK DRAINAGE

N.T.S.

NOTE:

HOUSE BUILDERS TO PAY SPECIAL ATTENTION TO FOUNDATION DESIGN. THE FOUNDATION ON THE LOW SIDE OF THE LOT MAY REQUIRE CONSTRUCTION OF A "PONY WALL"

LOT TYPES

L	–	LEVEL LOT
LB	–	LEVEL LOT (BACK TO FRONT DRAINAGE)
W	–	FULL WALKOUT BASEMENT
WS	–	SPLIT LEVEL WALKOUT BASEMENT
(T)	–	TRANSITION LOT

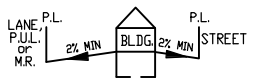
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: LOT GRADING	FIGURE: 99

BUILDING GRADE CERTIFICATE

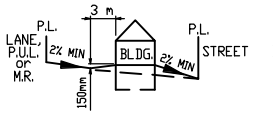
Town of High Level

Issued by: | No. 2002-000

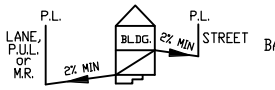
1. WHEN EXCAVATING IN A RIGHT OF WAY (EASEMENT), CHECK FOR UTILITIES.
2. STANDING AT THE WATER SHUTOFF AND FACING THE BUILDING, THE SANITARY SERVICE (PAINTED RED) IS ON THE LEFT SIDE OF THE WATER SERVICE.
3. ALL DIMENSIONS ARE IN METRES AND DECIMALS THEREOF. THE ELEVATIONS ARE IN METRES ABOVE GOEDETIC MEAN SEA LEVEL.
4. ELEVATIONS NOTED ON THE CERTIFICATE ARE WITHIN 100mm OF ACTUAL.
5. THE BUILDER MUST CONSTRUCT WITHIN 100mm OF THE DESIGN LANDSCAPE ELEVATION & ILLUSTRATED DRAINAGE PATTERNS UNLESS OTHERWISE APPROVED BY THE DEVELOPMENT OFFICER.
6. MIN AND MAX SLOPES ON LANDSCAPED AREAS TO BE 2% AND 10% RESPECTIVELY. AN INITIAL MIN GRADE OF 10% OVER A DIST. OF 1.5m IS TO BE PROVIDED AROUND ALL BUILDINGS.
7. MIN AND MAX DRIVEWAY SLOPES ARE 2% AND 8% RESPECTIVELY.
8. IF THE INFORMATION ON THIS CERTIFICATE HAS BEEN PREPARED BY A PRIVATE DEVELOPER OR THEIR AGENT, THE TOWN OF HIGH LEVEL ACCEPTS NO RESPONSIBILITY FOR ITS ACCURACY.



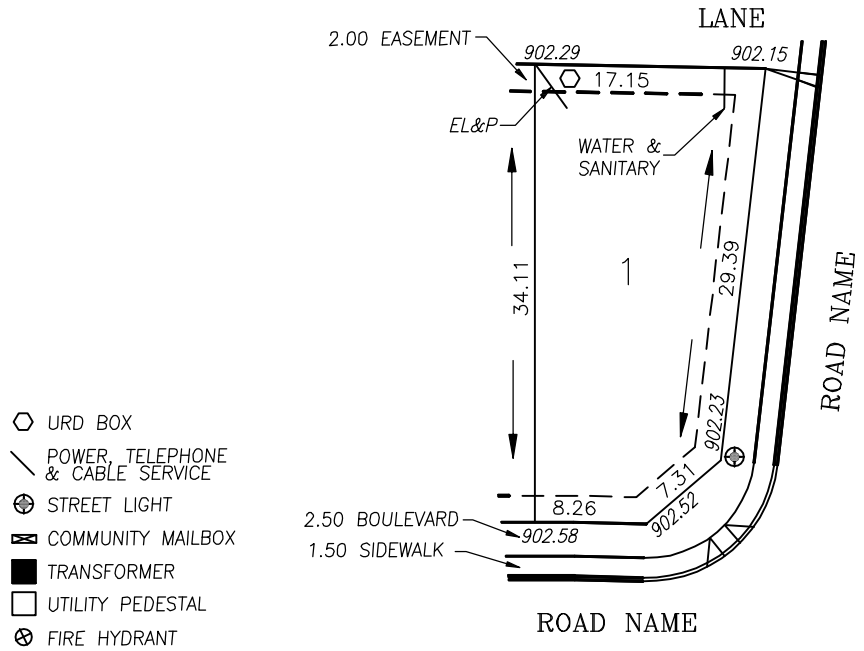
SPLIT DRAINAGE



BACK TO FRONT DRAINAGE



REARYARD BASEMENT WALKOUT SPLIT DRAINAGE



POWER SERVICE LOCATION IS 1.0m FROM BACKYARD LOTLINE

SANITARY & WATER SERVICE LOCATION IS CENTERED ON LOTLINE

TOP OF FOOTING:
MAX. DEPTH BELOW AVERAGE SIDEWALK = 2.43
LOWEST ELEVATION = 900.12

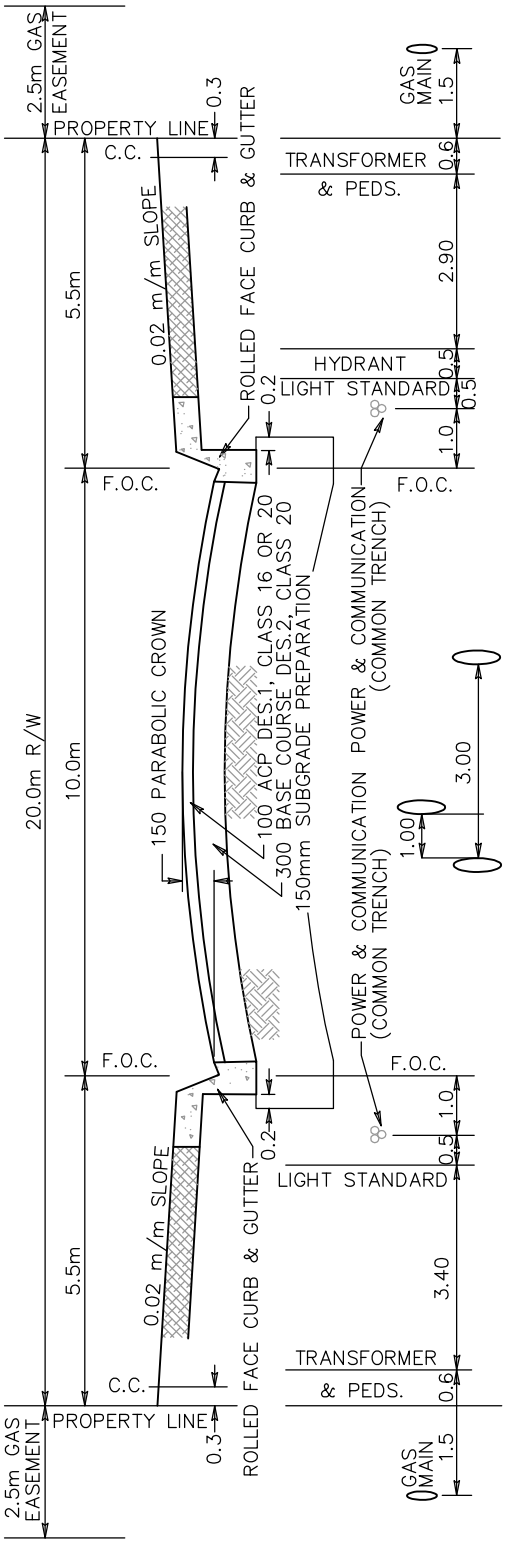
AS-BUILT SEWER INVERT ELEVATIONS:
SANITARY AT RIGHT OF WAY LINE = 899.28

CIVIC ADDRESS: _____
LOT: _____ BLOCK: _____ PLAN No.: _____
DEVELOPER: _____ SCALE: 1:500
DRAWN BY: _____ DATE: _____
APPROVED BY: _____ DATE: _____
RECEIVED BY: _____ DATE: _____

DESIGN LANDSCAPE ELEVATIONS
ELEV. AT FRONT OF HOUSE = 902.88
ELEV. AT REAR OF HOUSE = 902.88

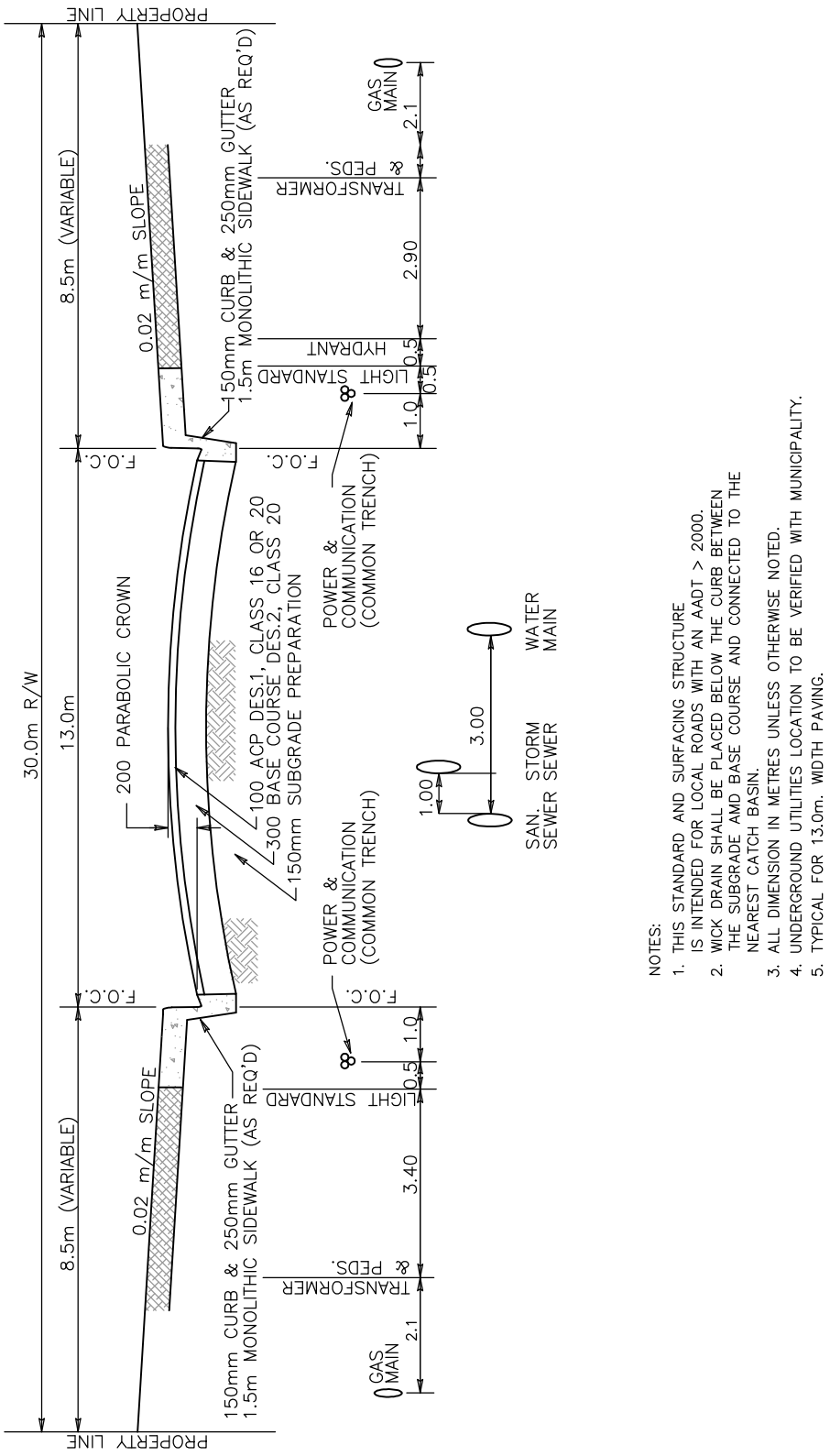
I CERTIFY THAT THE FINAL LANDSCAPE GRADE WILL BE (FRONT) _____
(REAR) _____
SIGNATURE OF OWNER OR REPRESENTATIVE _____

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: NEW RESIDENTIAL BUILDING GRADE CERTIFICATE	FIGURE: 100



NOTES:
1. THIS STANDARD AND SURFACING STRUCTURE IS INTENDED FOR LOCAL ROADS WITH AN AADT < 2000.
2. WICK DRAIN SHALL BE PLACED BELOW THE CURB BETWEEN THE SUBGRADE AMD BASE COURSE AND CONNECTED TO THE NEAREST CATCH BASIN.
4. UNDERGROUND UTILITIES LOCATIONS TO BE VERIFIED WITH MUNICIPALITY.

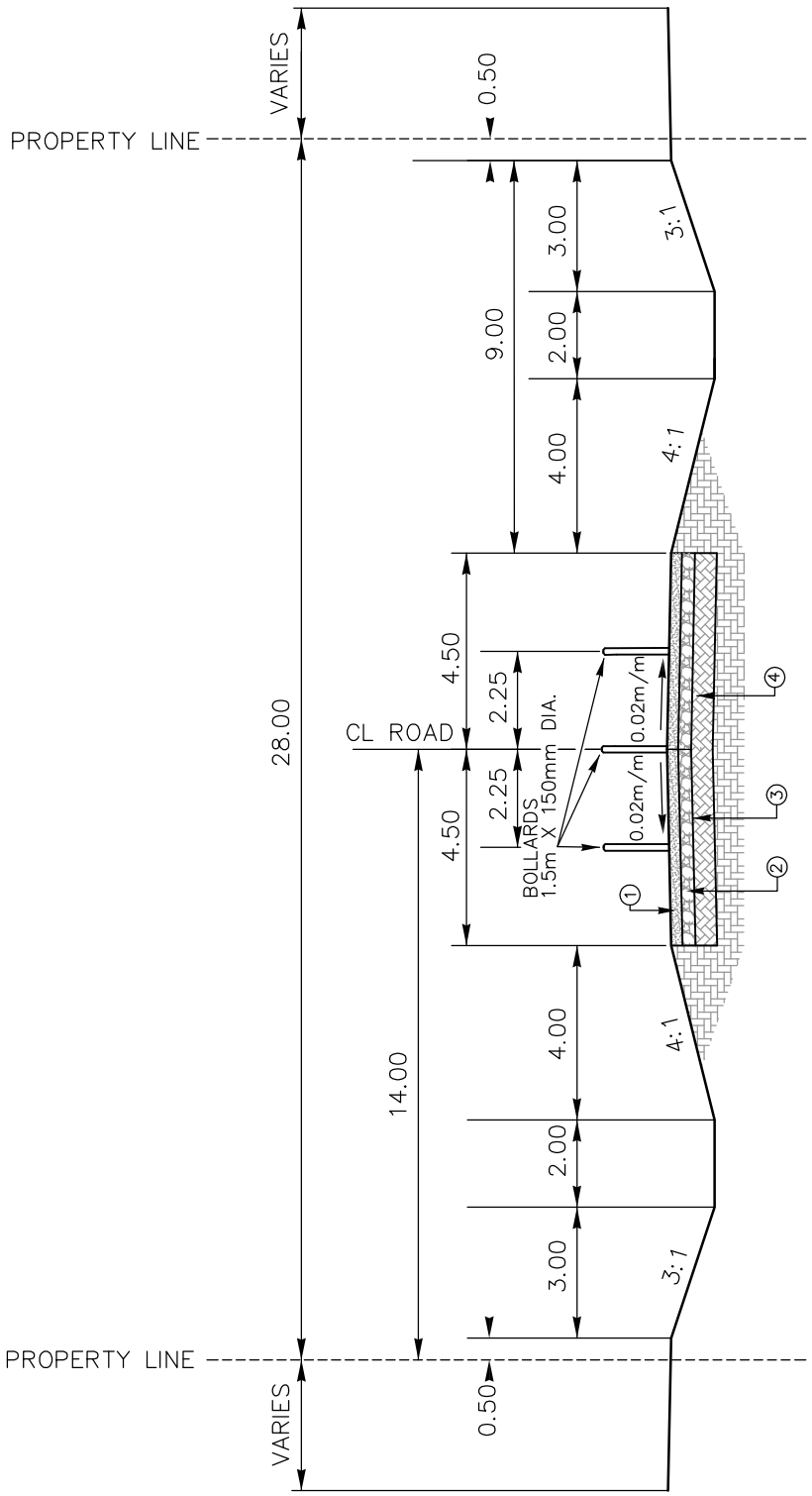
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: TYPICAL CROSS SECTION & UTILITIES LAYOUT URBAN 10.0m	FIGURE: 101



NOTES:

1. THIS STANDARD AND SURFACING STRUCTURE IS INTENDED FOR LOCAL ROADS WITH AN AADT > 2000.
2. WICK DRAIN SHALL BE PLACED BELOW THE CURB BETWEEN THE SUBGRADE AMD BASE COURSE AND CONNECTED TO THE NEAREST CATCH BASIN.
3. ALL DIMENSION IN METRES UNLESS OTHERWISE NOTED.
4. UNDERGROUND UTILITIES LOCATION TO BE VERIFIED WITH MUNICIPALITY.
5. TYPICAL FOR 13.0m. WIDTH PAVING.

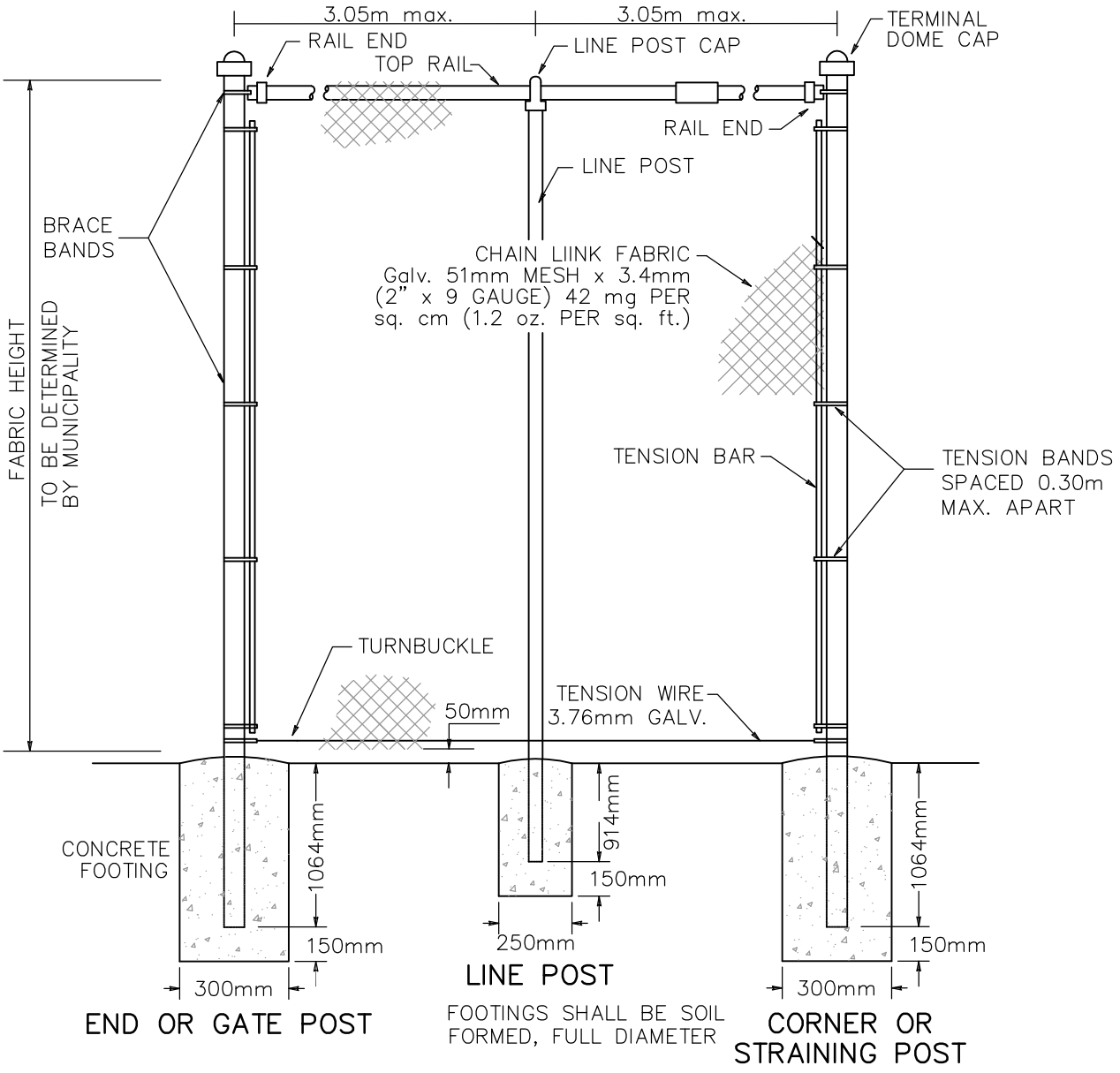
DATE: NOV, 2014	TOWN OF HIGH LEVEL TITLE: TYPICAL CROSS SECTION & UTILITIES LAYOUT URBAN 11.5m to 13.0m	ACAD – CIVIL DRAFTING STANDARD DETAILS FIGURE: 102



NOTES:

1. 50mm DEPTH COMPACTED GRAVEL/SHALE 10mm – 20mm DIAMETER.
2. 75mm DEPTH 20mm DIAMETER CRUSHED GRAVEL BASE COMPACTED TO 98% S.P.D.
3. WOVEN FABRIC UNDER GRAVEL (TENSAR SS1 GEOGRID/NILEX 2006 AMOCO GEOTEXTILE OR APPROVED EQUIVALENT).
4. 150mm DEPTH SUBGRADE COMPACTED TO 98% S.P.D. ON:
   A) NATIVE SUBGRADE – FREE OF TOPSOIL, ROOTS AND/OR DEBRIS.
   B) COMMON FILL – CLEAN CLAY OR GRANULAR MATERIAL PLACED OVER APPROVED SUBGRADE AND COMPACTED TO 98% S.P.D.
5. ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED.
6. TOWN OF HIGH LEVEL MAY ACCEPT ALTERNATE EASEMENT WIDTH.

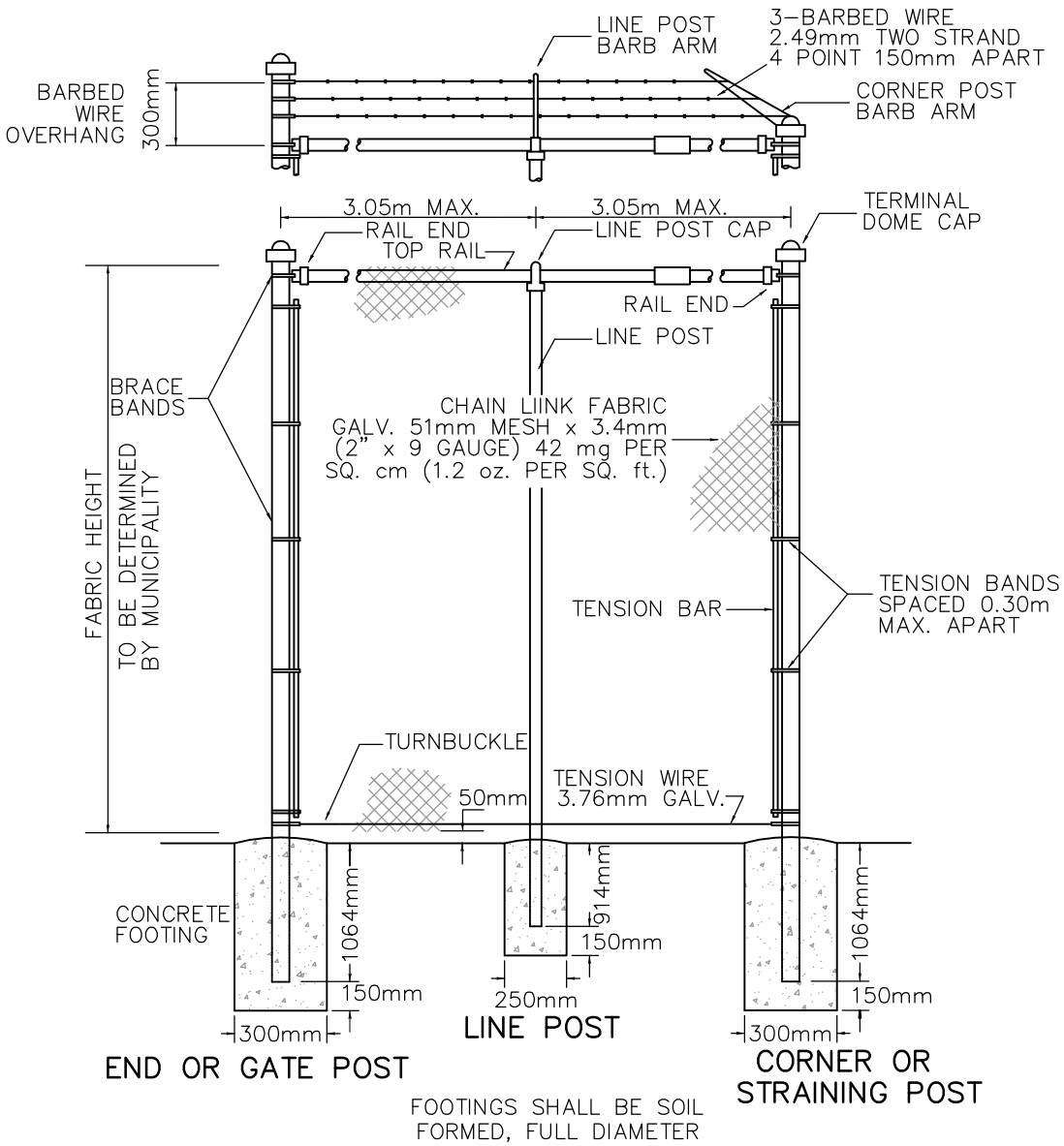
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: EMERGENCY LANE ACCESS DETAIL	FIGURE: 103



NOTES:

1. TOP RAIL: 33.4mm O.D. GALVANIZED STEEL. RAILS TO BE CONNECTED BY SLIP–ON SLEEVES.
2. LINE POSTS: 48.3mm O.D. GALVANIZED STEEL. SPACED 3.05m MAX. APART. STRAINING POSTS SHALL OCCUR AT MIN. 152m.
3. GATE POST: 88.9mm O.D. GALVANIZED STEEL FOR PANELS UP TO 3.05m (6.1m DOUBLE SWING GATE).
4. END OR CORNER POST: 88.9mm O.D. GALVANIZED STEEL.
5. CONCRETE: 20 MPa (2900 P.S.I.) STRENGTH IN 28 DAYS.
6. TIE WIRE: 3.55mm (9 GUAGE) ALUMINUM WIRE EVERY 305mm FOR LINE POSTS, EVERY 457mm FOR TOP RAIL.
7. ALL PIPES TO BE SUFFICIENT STRENGTH TO SUPPORT FABRIC WEIGHT AND TENSION, AND TO SUPPORT WEIGHT OF GATE.
8. ALL FITTINGS TO BE DESIGNED AND MANUFACTURED OF MATERIALS HAVING SUFFICIENT STRENGTH TO PERFORM THE NECESSARY FUNCTIONS.
9. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
10. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST–IN–PLACE AND PRECAST CONCRETE RESPECTIVELY.

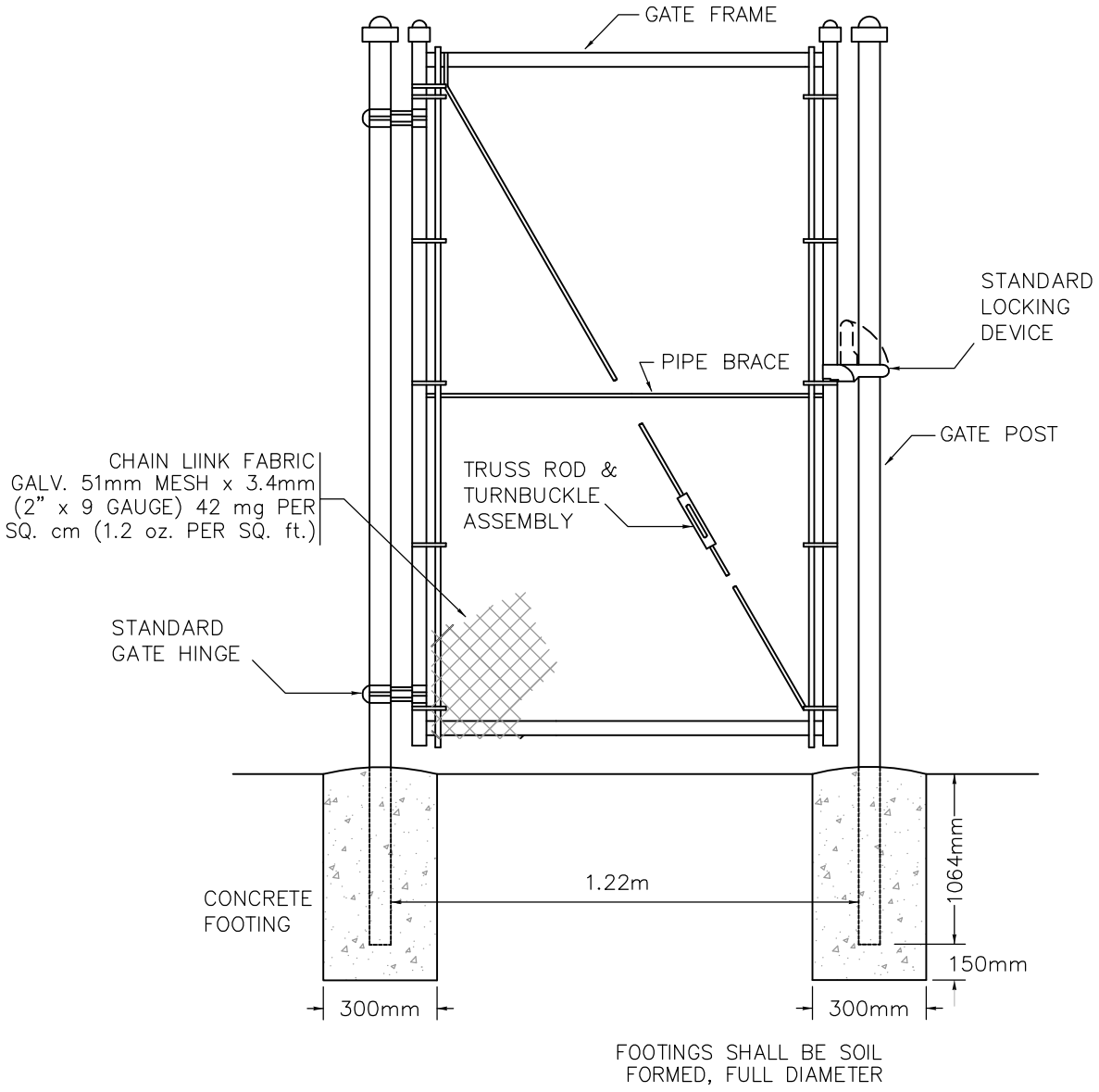
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: CHAIN LINK FENCE DETAIL	FIGURE: 104



NOTES:

1. TOP RAIL: 33.4mm O.D. GALVANIZED STEEL. RAILS TO BE CONNECTED BY SLIP-ON SLEEVES.
2. LINE POSTS: 48.3mm O.D. GALVANIZED STEEL. SPACED 3.05m MAX. APART. STRAINING POSTS SHALL OCCUR AT MIN. 152m.
3. GATE POST: 88.9mm O.D. GALVANIZED STEEL FOR PANELS UP TO 3.05m (6.1m DOUBLE SWING GATE).
4. END OR CORNER POST: 88.9mm O.D. GALVANIZED STEEL.
5. CONCRETE: 20 MPa (2900 P.S.I.) STRENGTH IN 28 DAYS.
6. TIE WIRE: 3.55mm (9 guage) ALUMINUM WIRE EVERY 305mm FOR LINE POSTS, EVERY 457mm FOR TOP RAIL.
7. ALL PIPES TO BE SUFFICIENT STRENGTH TO SUPPORT FABRIC WEIGHT AND TENSION, AND TO SUPPORT WEIGHT OF GATE.
8. ALL FITTINGS TO BE DESIGNED AND MANUFACTURED OF MATERIALS HAVING SUFFICIENT STRENGTH TO PERFORM THE NECESSARY FUNCTIONS.
9. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
10. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

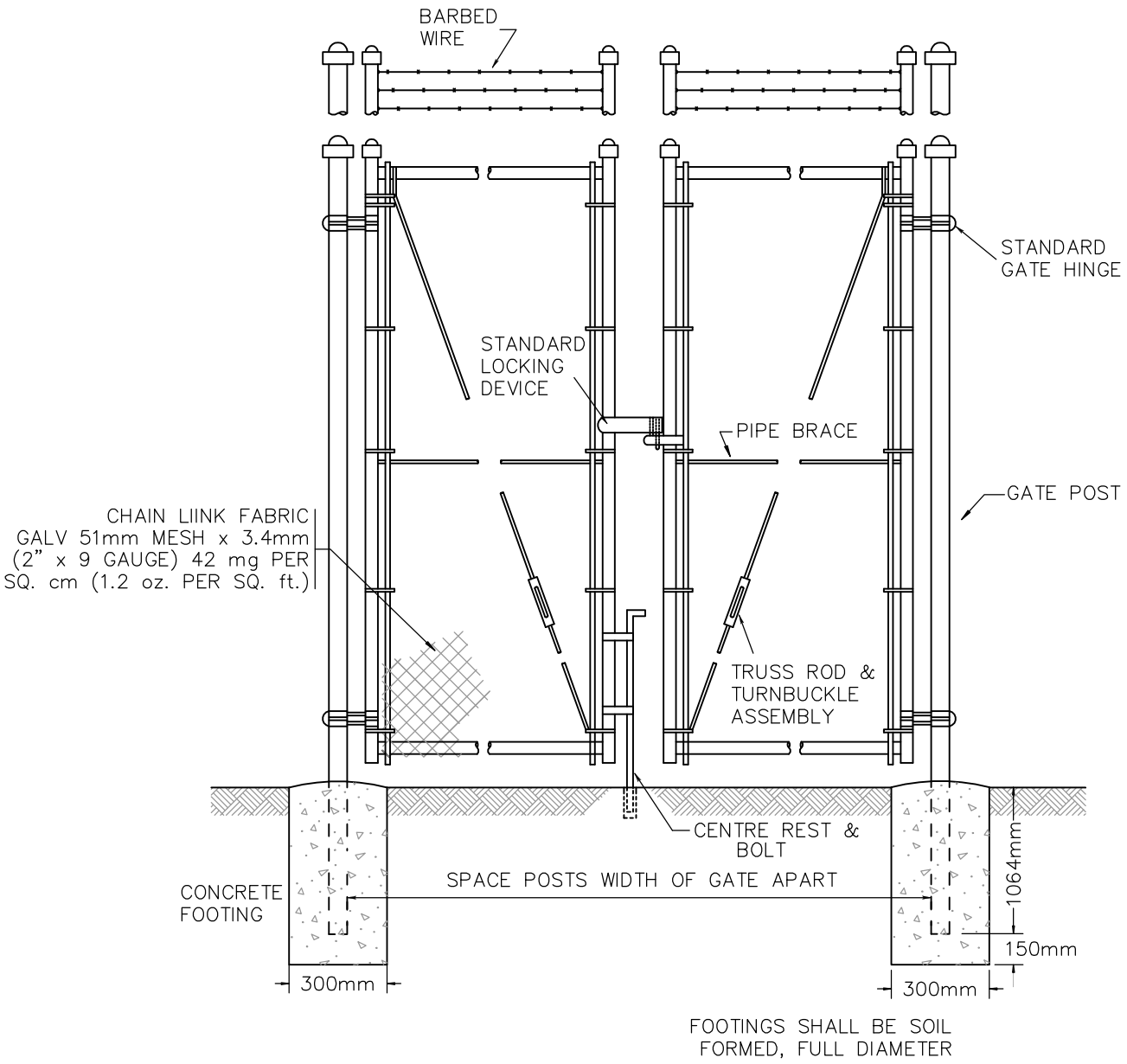
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: CHAIN LINK FENCE, BARBED DETAIL	FIGURE: 105



NOTES:

1. GATE POST: 88.9mm O.D. GALVANIZED STEEL FOR PANELS UP TO 3.05m (6.1m DOUBLE SWING GATE).
2. GATE FRAME: 41m O.D. GALVANIZED STEEL. WELDS TO BE ZINC PAINTED AFTER WELDING.
3. CONCRETE: 20 MPa (2000 P.S.I.) STRENGTH IN 28 DAYS.
4. ALL PIPES TO BE SUFFICIENT STRENGTH TO SUPPORT FABRIC WEIGHT AND TENSION, AND TO SUPPORT WEIGHT OF GATE.
5. ALL FITTINGS TO BE DESIGNED AND MANUFACTURED OF MATERIALS HAVING SUFFICIENT STRENGTH TO PERFORM THE NECESSARY FUNCTION.
6. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
7. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

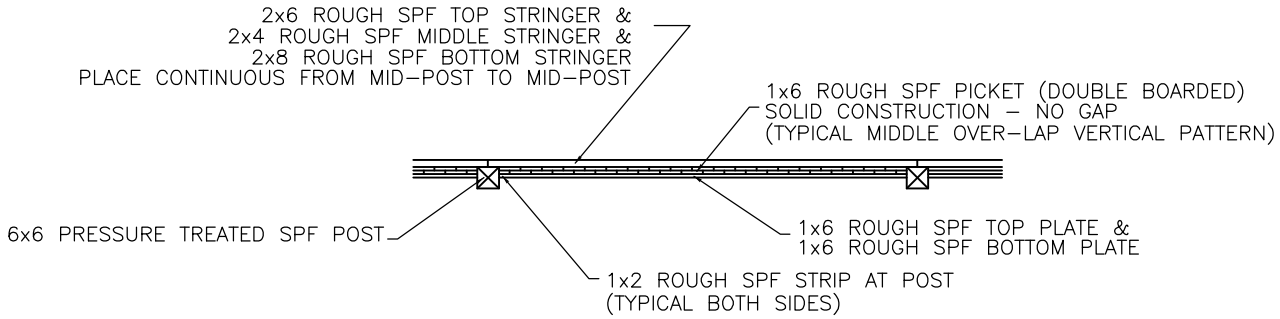
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: CHAIN LINK SINGLE GATE DETAIL	FIGURE: 106



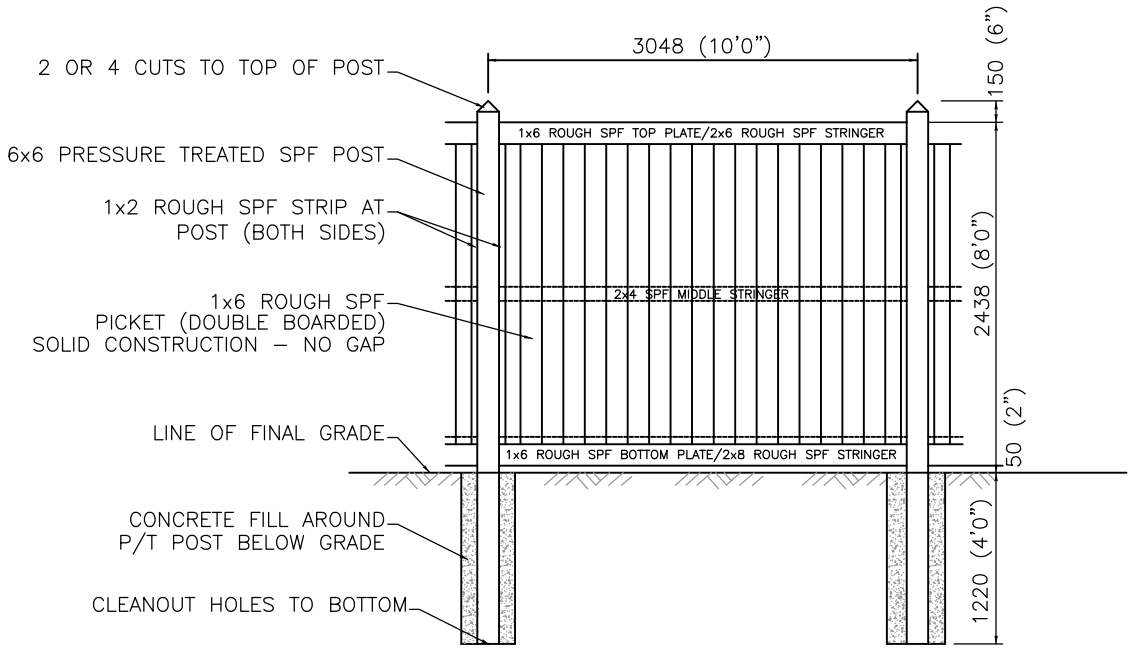
NOTES:

1. GATE POST: 88.9mm O.D. GALVANIZED STEEL FOR PANELS UP TO 3.05m (6.1m DOUBLE SWING GATE).
2. GATE FRAME: 41m O.D. GALVANIZED STEEL. WELDS TO BE ZINC PAINTED AFTER WELDING.
3. CONCRETE: 20 MPa STRENGTH IN 28 DAYS.
4. ALL PIPES TO BE SUFFICIENT STRENGTH TO SUPPORT FABRIC WEIGHT AND TENSION, AND TO SUPPORT WEIGHT OF GATE.
5. ALL FITTINGS TO BE DESIGNED AND MANUFACTURED OF MATERIALS HAVING SUFFICIENT STRENGTH TO PERFORM THE NECESSARY FUNCTION.
6. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
7. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: CHAIN LINK DOUBLE GATE DETAIL	FIGURE: 107



PLAN VIEW

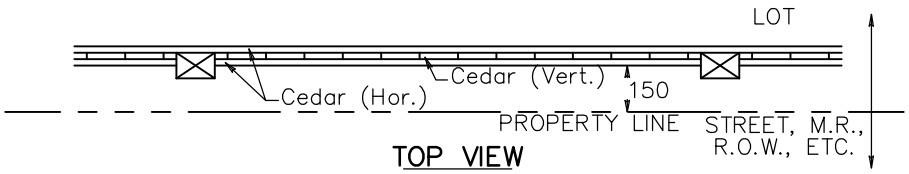


ELEVATION-SECTION

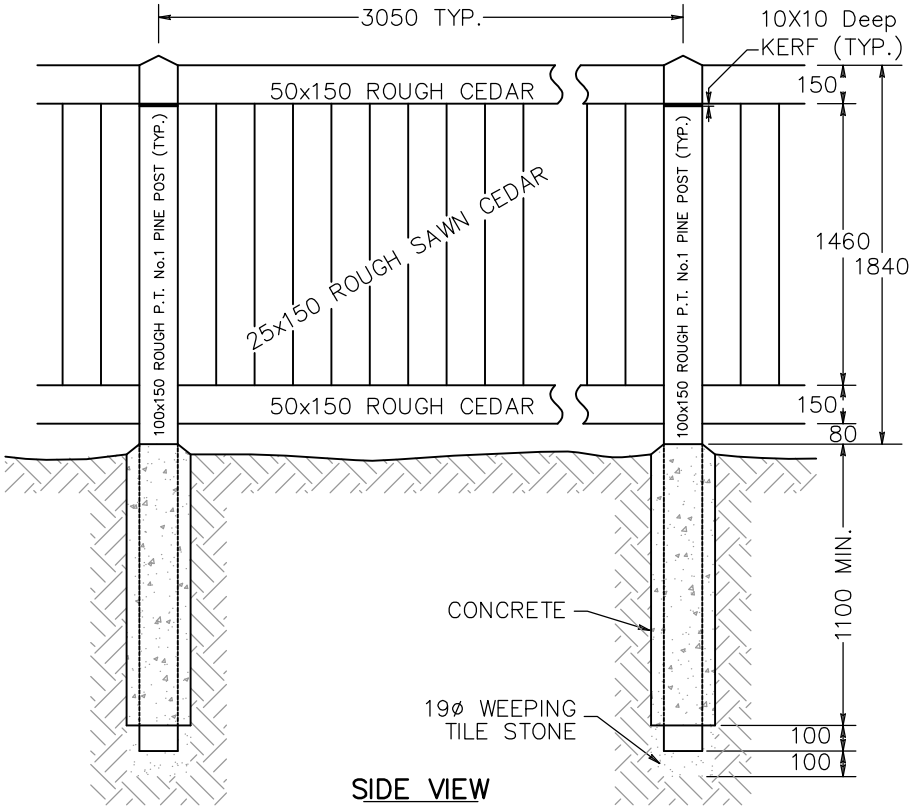
NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

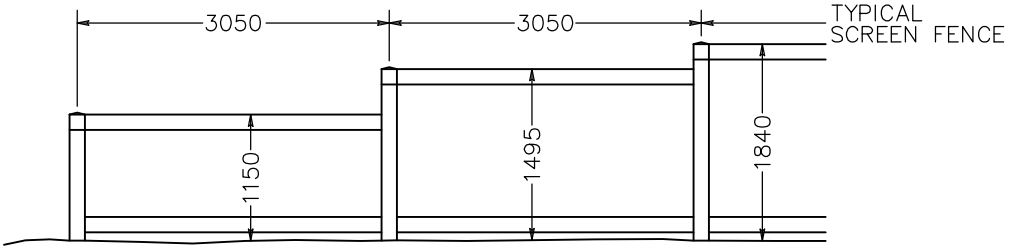
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD - CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: NOISE FENCE DETAIL	FIGURE: 108



TOP VIEW



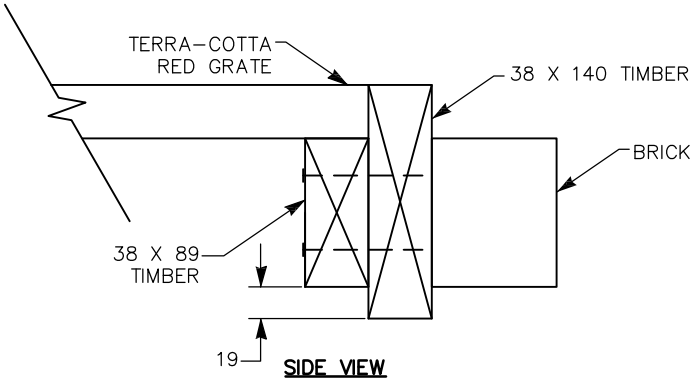
SIDE VIEW



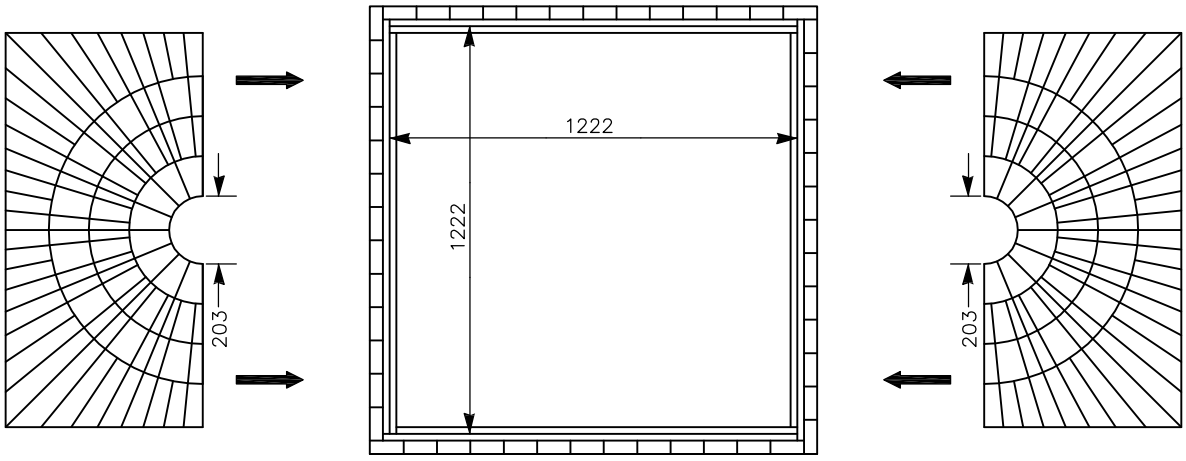
NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: WOOD SCREEN FENCE DETAIL	FIGURE: 109



SIDE VIEW



TOP VIEW

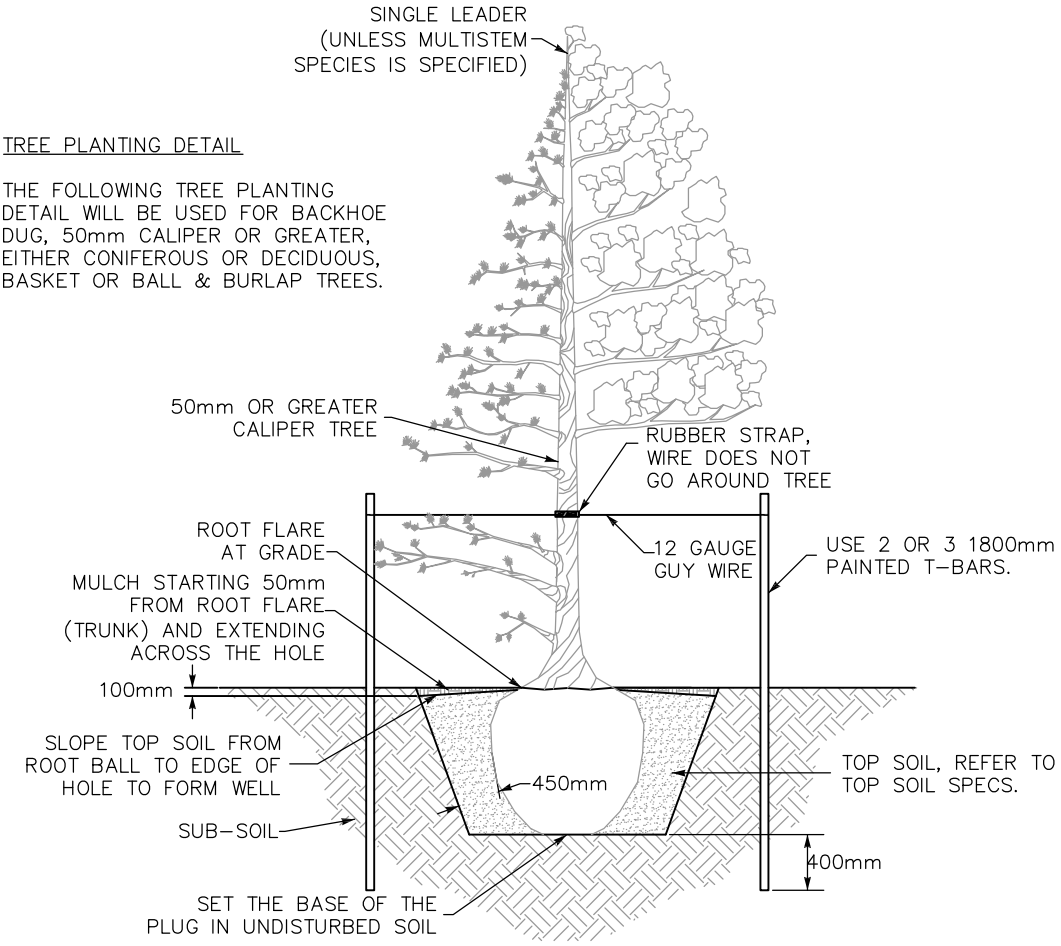
NOTES:

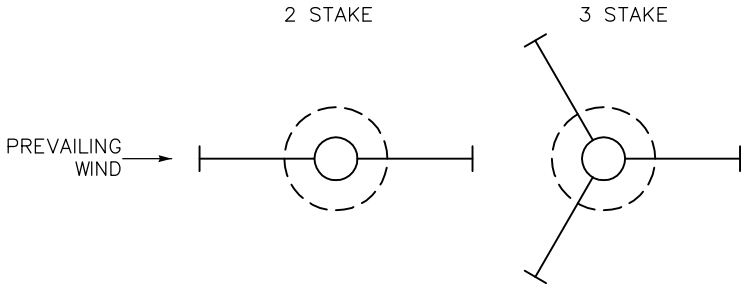
1. 1222mm OPENING IS CRITICAL TO ACCOMMODATE TREE GRATE.
2. 38mm X 89mm TIMBER TO BE NAILED ONTO 38mm X 140mm, TWO NAILS EVERY 300mm O/C.
3. ALL TIMBER IS TO BE PRESSURE TREATED.
4. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: TREE GRATE DETAIL	FIGURE: 110

TREE PLANTING DETAIL

THE FOLLOWING TREE PLANTING DETAIL WILL BE USED FOR BACKHOE DUG, 50mm CALIPER OR GREATER, EITHER CONIFEROUS OR DECIDUOUS, BASKET OR BALL & BURLAP TREES.

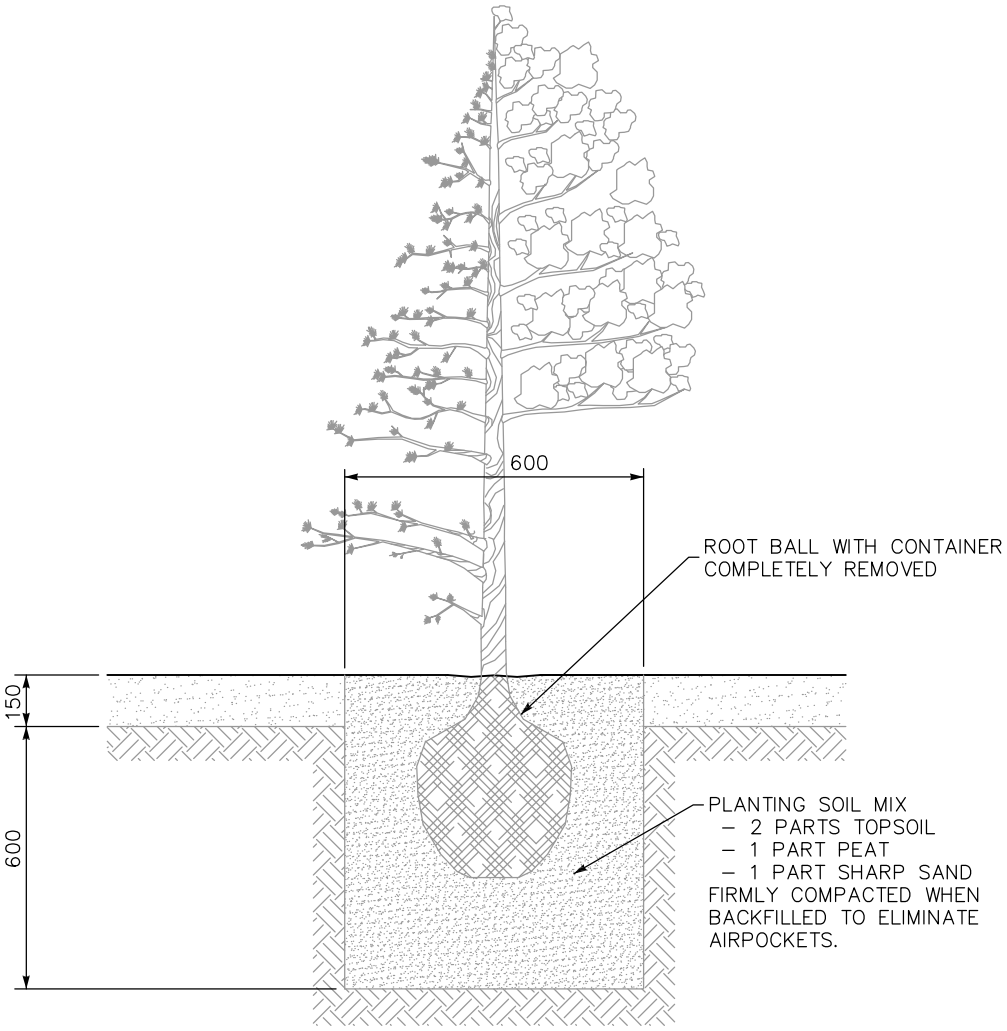




NOTES:

1. DO NOT ALLOW AIR POCKETS TO FORM WHEN BACK FILLING.
2. STAKE BEYOND EDGE OF ROOT BALL.
3. TREE SHOULD BE PLANTED 25-50mm BELOW GROUND LEVEL. FOR HEAVY CLAY SOILS, PLANT AT GROUND LEVEL. ALL TREES SHOULD HAVE A SOIL WELL CONSTRUCTED ABOVE GRADE.
4. REMOVE WIRE BASKET, CUT STRAPPING AND PULL BURLAP FROM TOP 1/3 OF ROOT BALL.
5. USE RUBBER STRAPS AT END OF ALL GUY WIRES TO PROTECT THE TREE AT POINT OF CONTACT.
6. PRUNE DEAD BRANCHES TO MAINTAIN NATURAL FORM OF TREE.
7. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

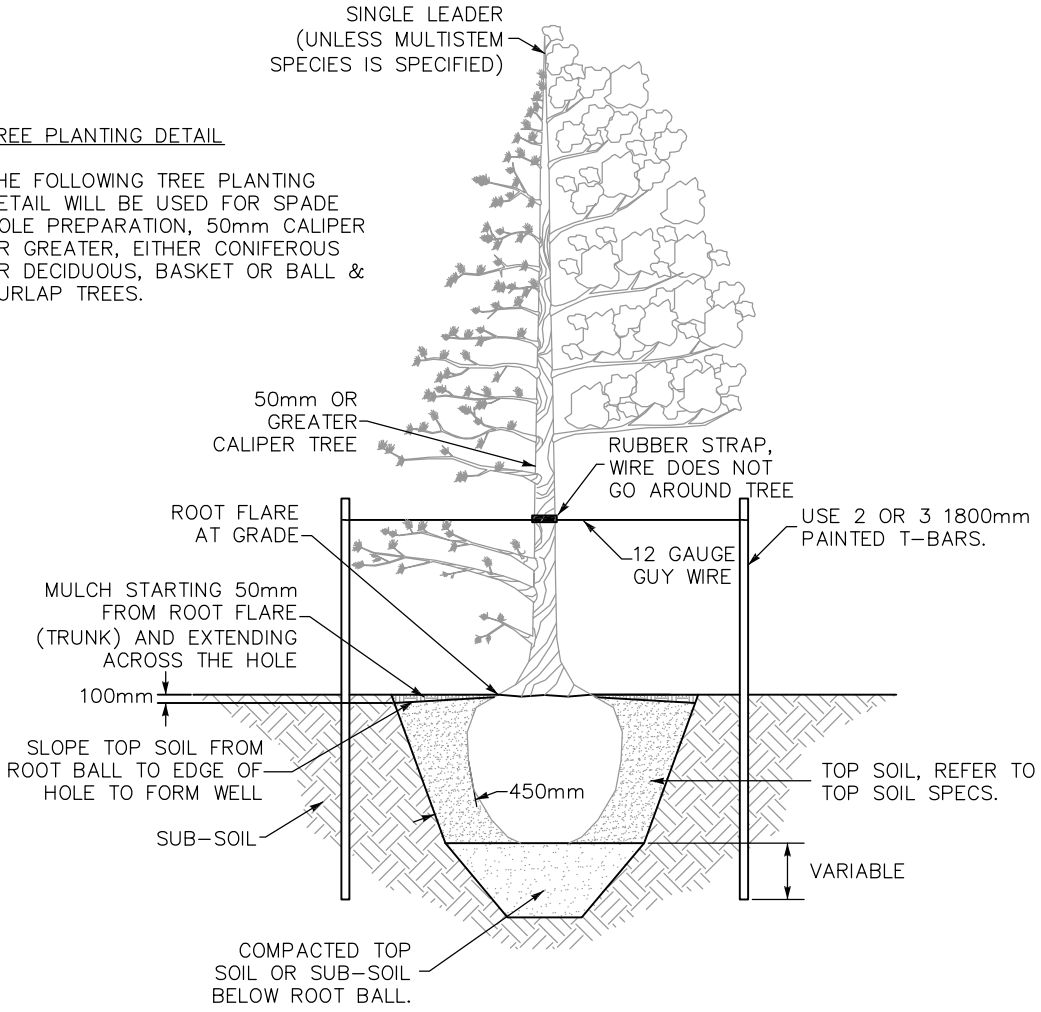
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: TREE PLANTING DETAIL 50mm OR GREATER CALIPER TREES (BACKHOE DUG)	FIGURE: 111

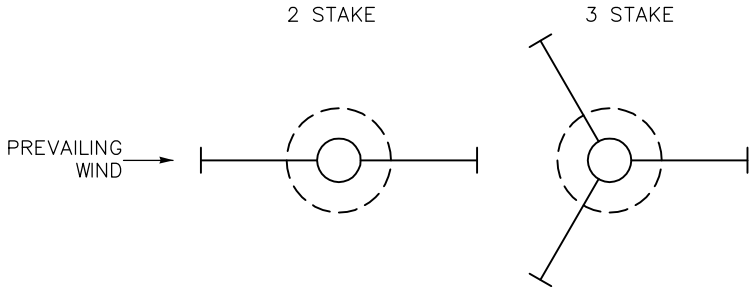


DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: SHRUB INSTALLATION	FIGURE: 112

TREE PLANTING DETAIL

THE FOLLOWING TREE PLANTING DETAIL WILL BE USED FOR SPADE HOLE PREPARATION, 50mm CALIPER OR GREATER, EITHER CONIFEROUS OR DECIDUOUS, BASKET OR BALL & BURLAP TREES.

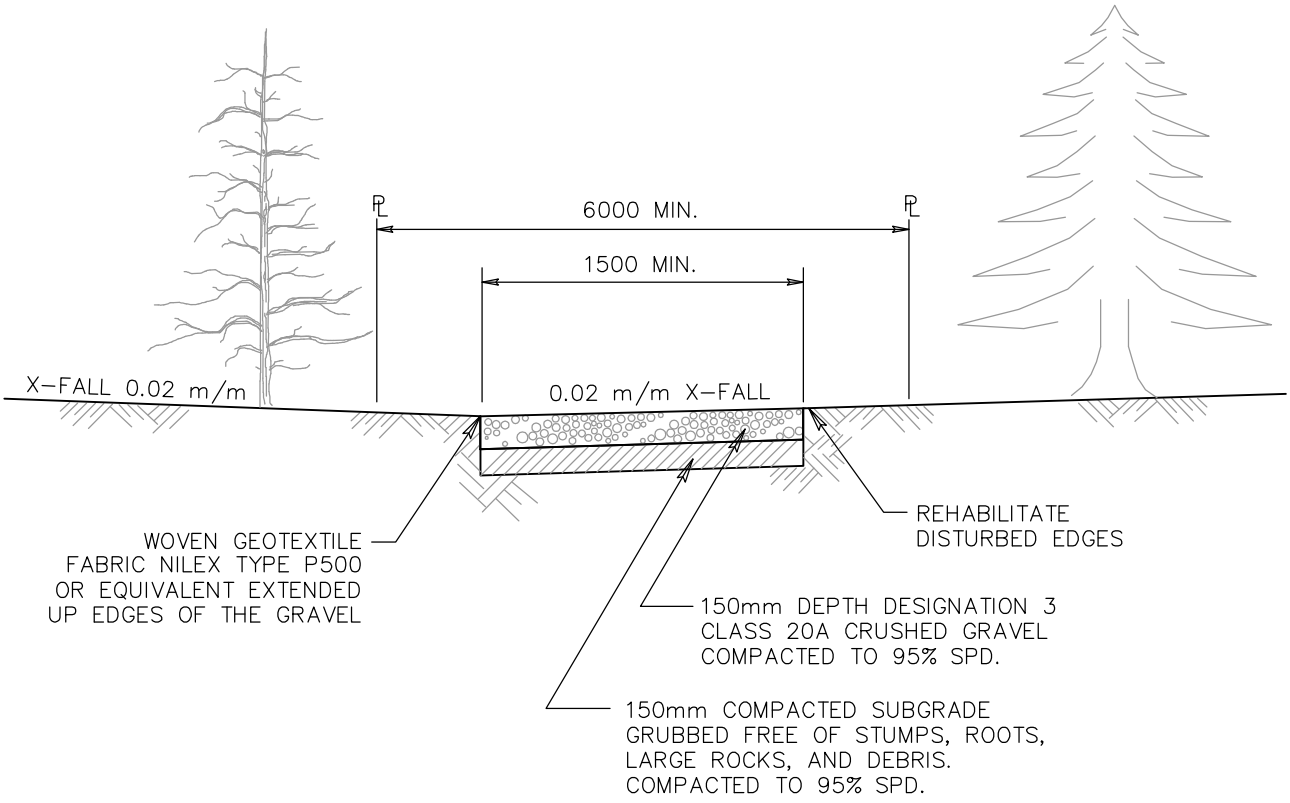




NOTES:

1. DO NOT ALLOW AIR POCKETS TO FORM WHEN BACK FILLING.
2. STAKE BEYOND EDGE OF ROOT BALL.
3. TREE SHOULD BE PLANTED 25-50mm BELOW GROUND LEVEL. FOR HEAVY CLAY SOILS, PLANT AT GROUND LEVEL. ALL TREES SHOULD HAVE A SOIL WELL CONSTRUCTED ABOVE GRADE
4. REMOVE WIRE BASKET, CUT STRAPPING AND PULL BURLAP FROM TOP TO 1/3 OF ROOT BALL.
5. USE RUBBER STRAPS AT END OF ALL GUY WIRES TO PROTECT THE TREE AT POINT OF CONTACT.
6. PRUNE DEAD BRANCHES TO MAINTAIN NATURAL FORM OF TREE.
7. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

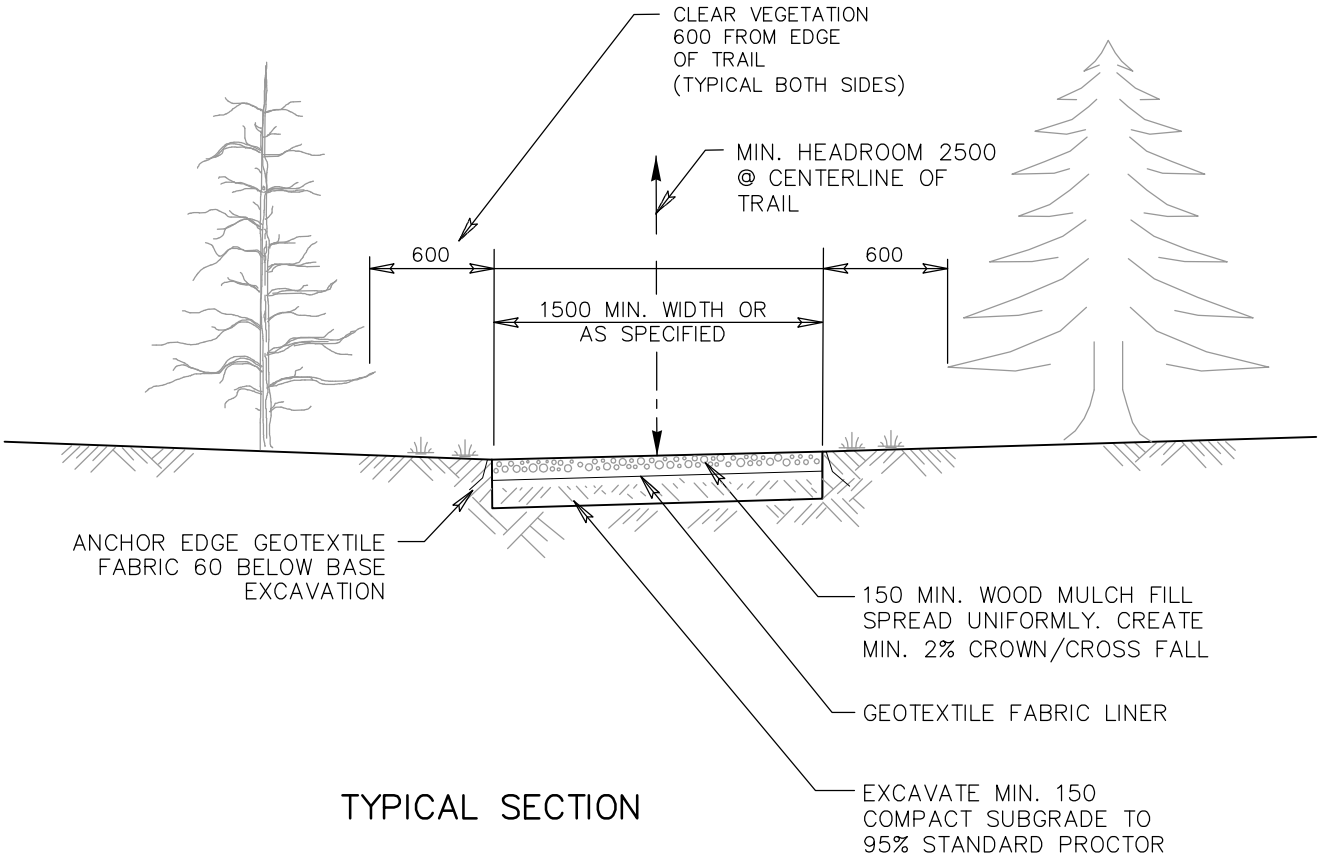
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: TREE PLANTING DETAIL 50mm OR GREATER CALIPER TREES (SPADE DUG)	FIGURE: 113



TYPICAL SECTION

NOTE:
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

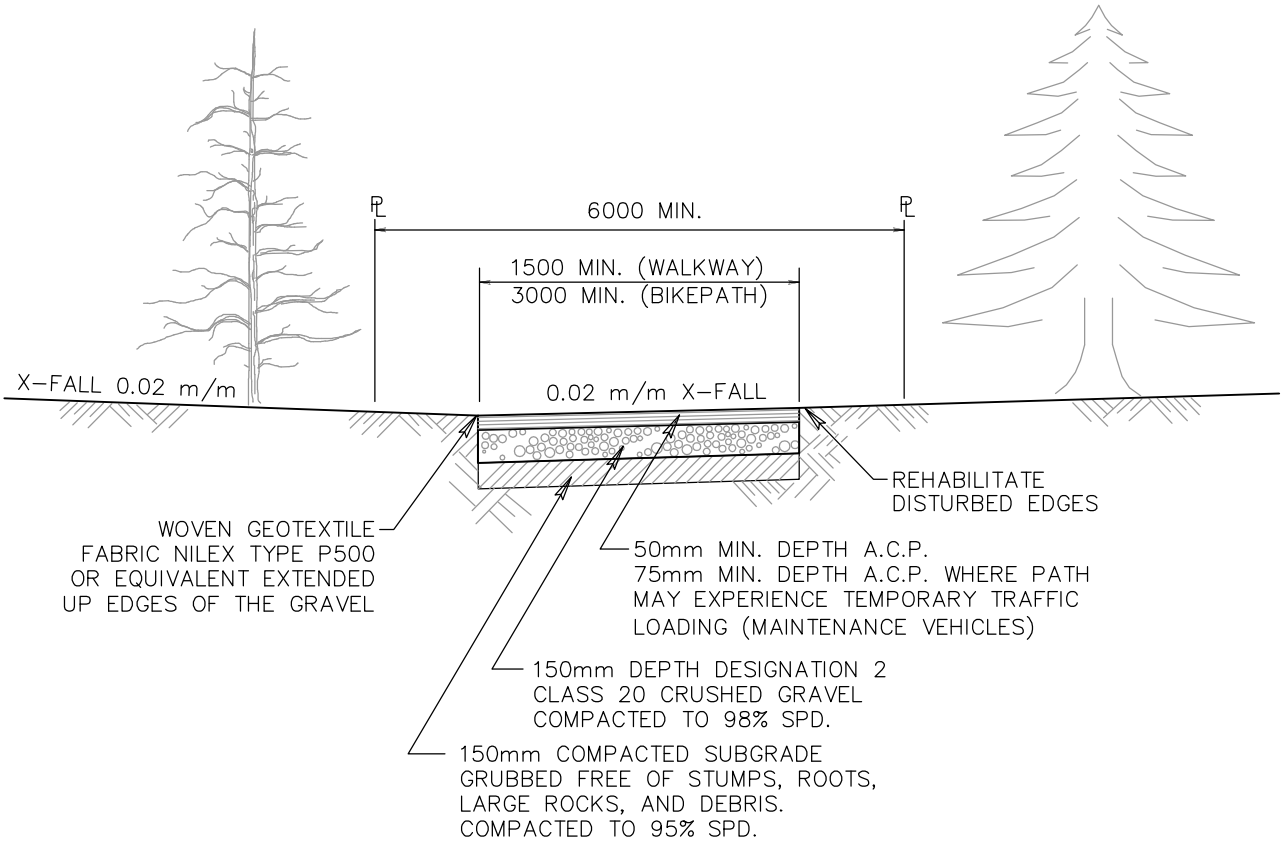
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: GRANULAR WALKWAY	FIGURE: 114



TYPICAL SECTION

NOTE:
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

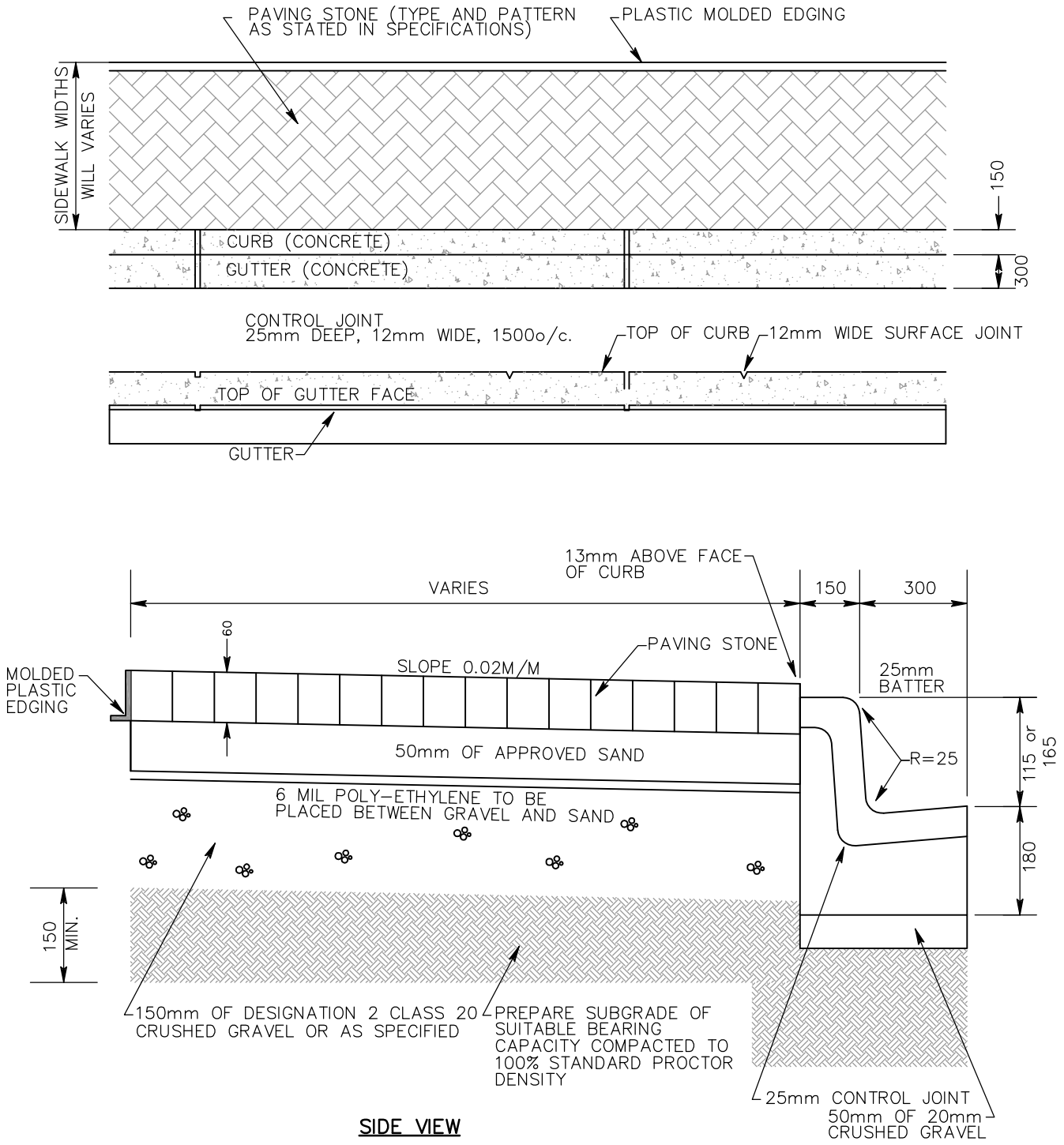
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: HIKING TRAIL	FIGURE: 115



TYPICAL SECTION

NOTE:
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

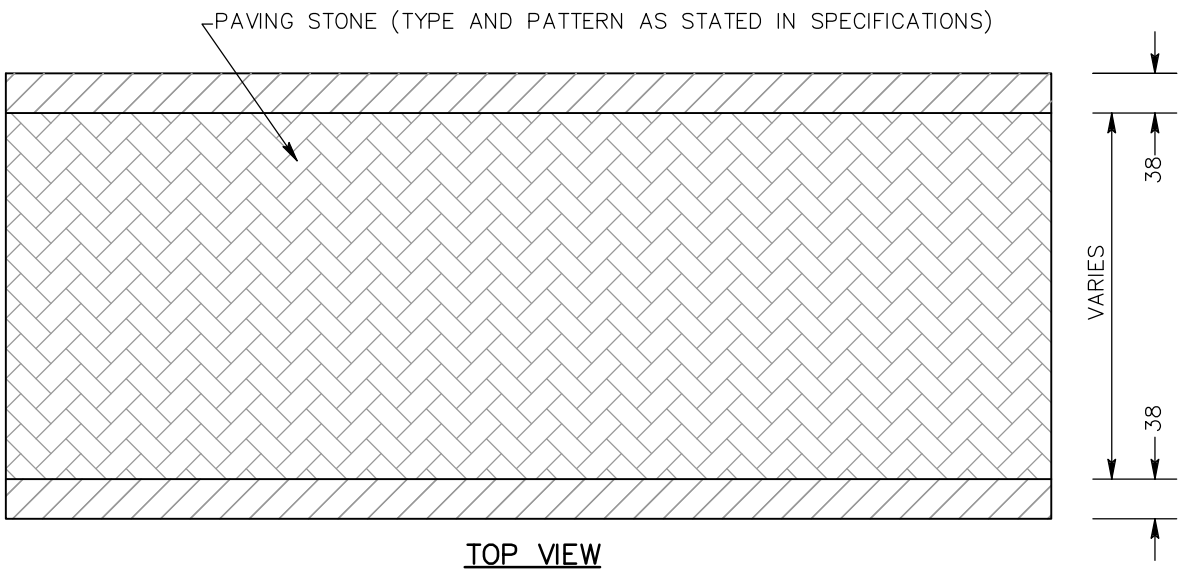
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: PAVED WALKWAY / BIKE PATH	FIGURE: 116



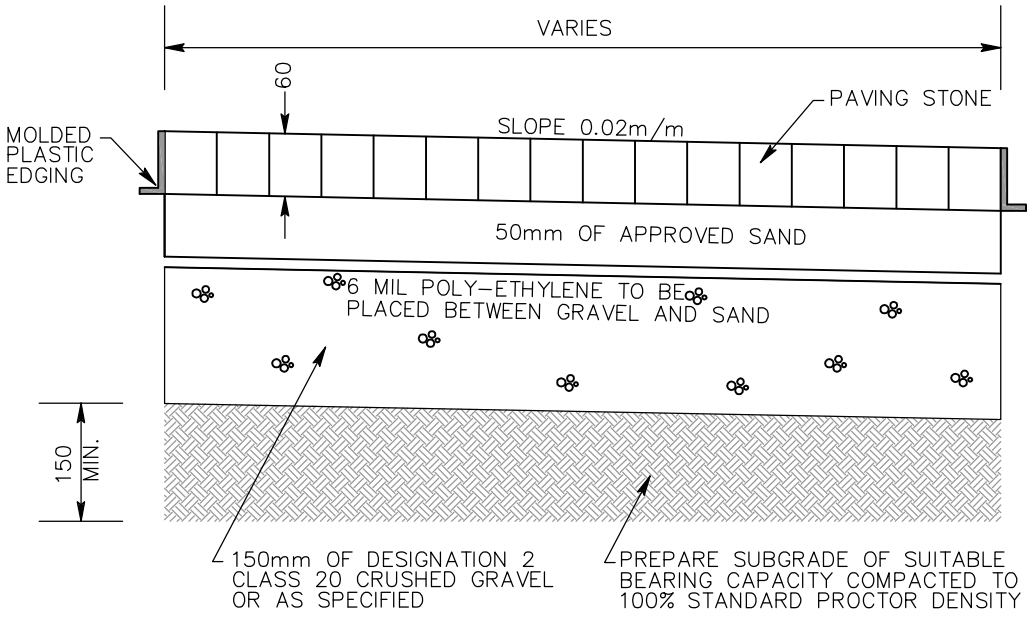
SIDE VIEW

NOTE:
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: COMBINATION STANDARD CURB & GUTTER WITH PAVING STONE SIDEWALK	FIGURE: 117



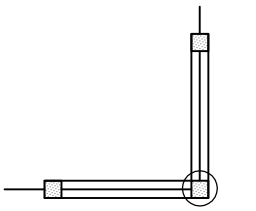
TOP VIEW



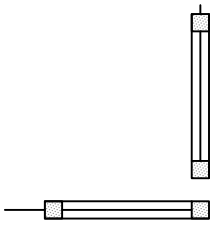
SIDE VIEW

NOTE:
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

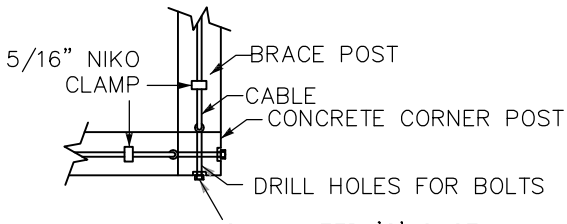
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: PAVING STONE WALKWAY DETAIL	FIGURE: 118



CLOSED CORNER
TOP VIEW

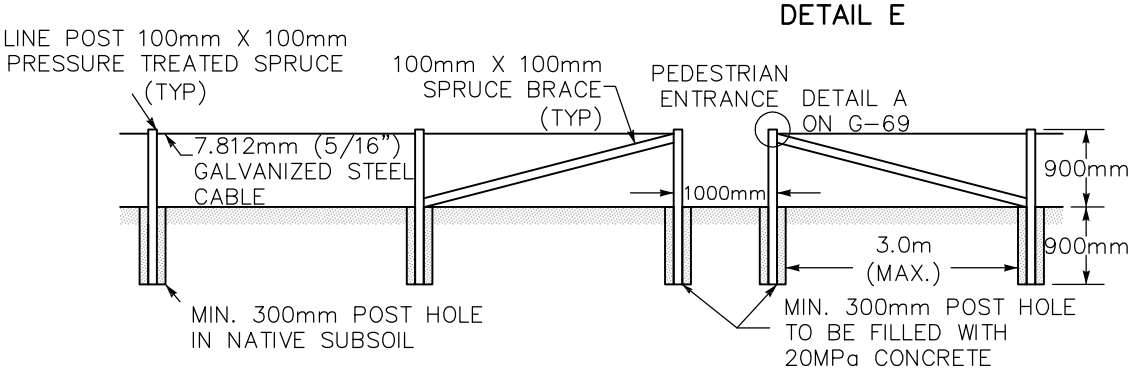


OPEN CORNER
TOP VIEW

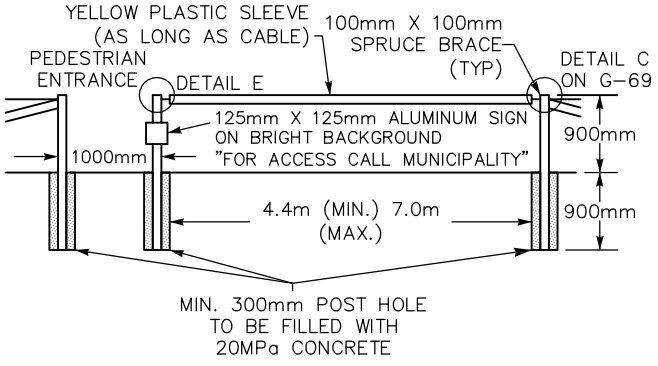


DETAIL D

DETAIL E



TYPICAL LONGITUDINAL SECTION C/W PEDESTRIAN ENTRANCE

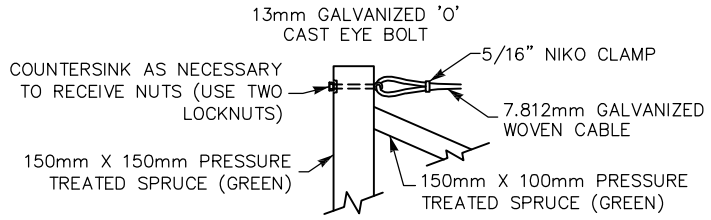


TYPICAL VEHICLE ENTRANCE GATE

NOTES:

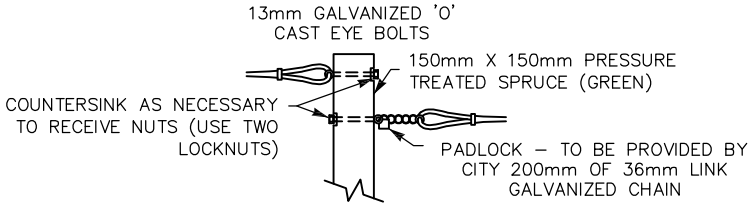
1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

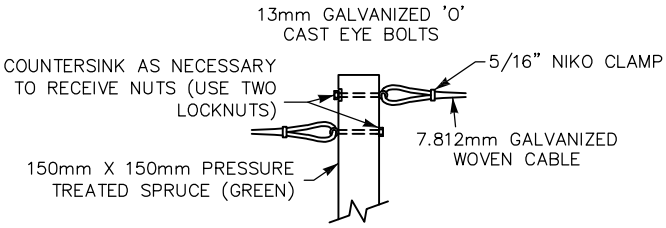
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: POST & CABLE DETAIL	FIGURE: 119



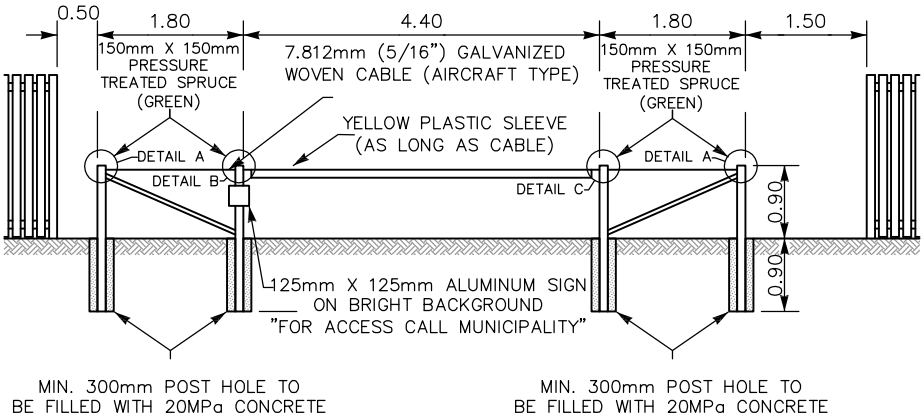
DETAIL A

DETAIL B





DETAIL C

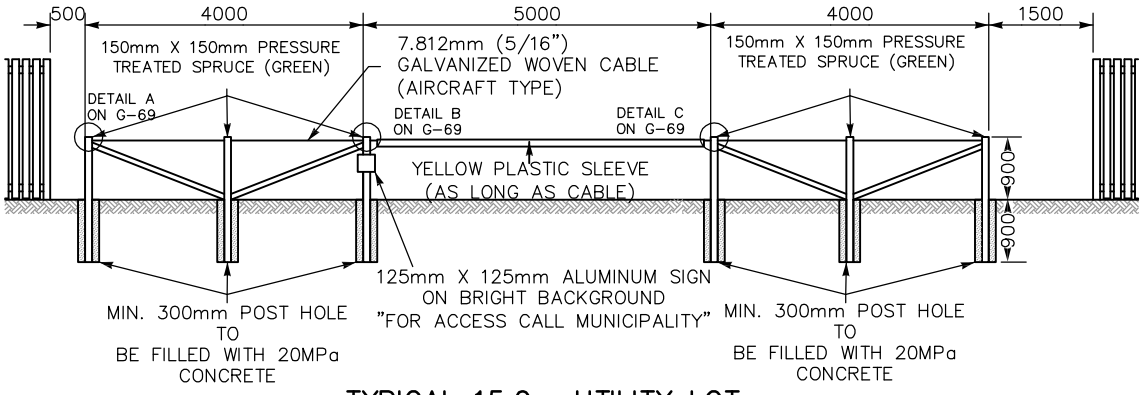


TYPICAL 10.0m UTILITY LOT BARRIER DETAIL

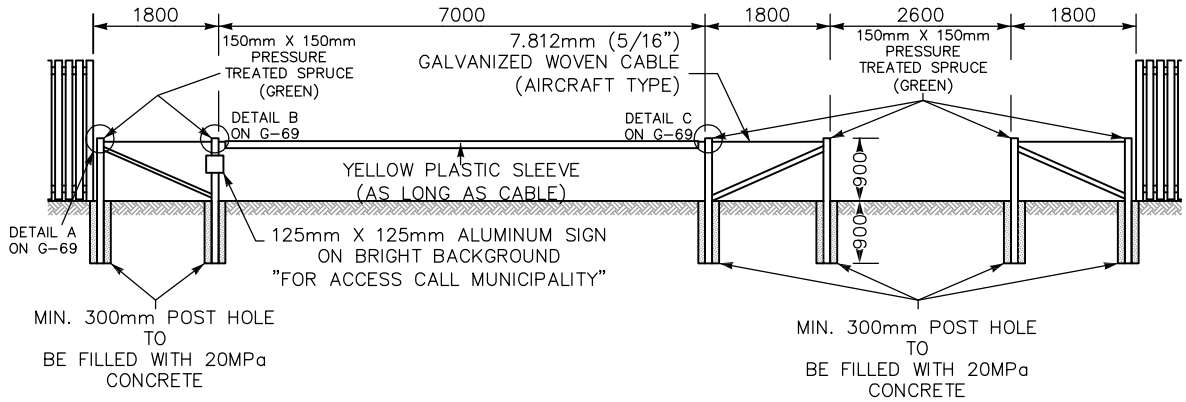
NOTES:

1. ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST–IN–PLACE AND PRECAST CONCRETE RESPECTIVELY.
3. 'O' BOLTS AND CABLE CLAMPS TO BE GALVANIZED EQUIVALENT TO PREVENT CORROSION.
4. DOUBLE LOCKNUTS ON 'O' BOLTS AND LOCKNUTS ON CABLE.
5. BARRIER DETAILS ARE TYPICAL AND MAY VARY SLIGHTLY DEPENDING ON ACTUAL FIELD DIMENSIONS.
6. PADLOCK TO BE SUPPLIED AT COST BY THE MUNICIPALITY.
7. SIGN TO BE INSTALLED.
8. FOR ACCESS CALL MUNICIPALITY.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: UTILITY LOT BARRIER (10 METRE)	FIGURE: 120



TYPICAL 15.0m UTILITY LOT
BARRIER DETAIL

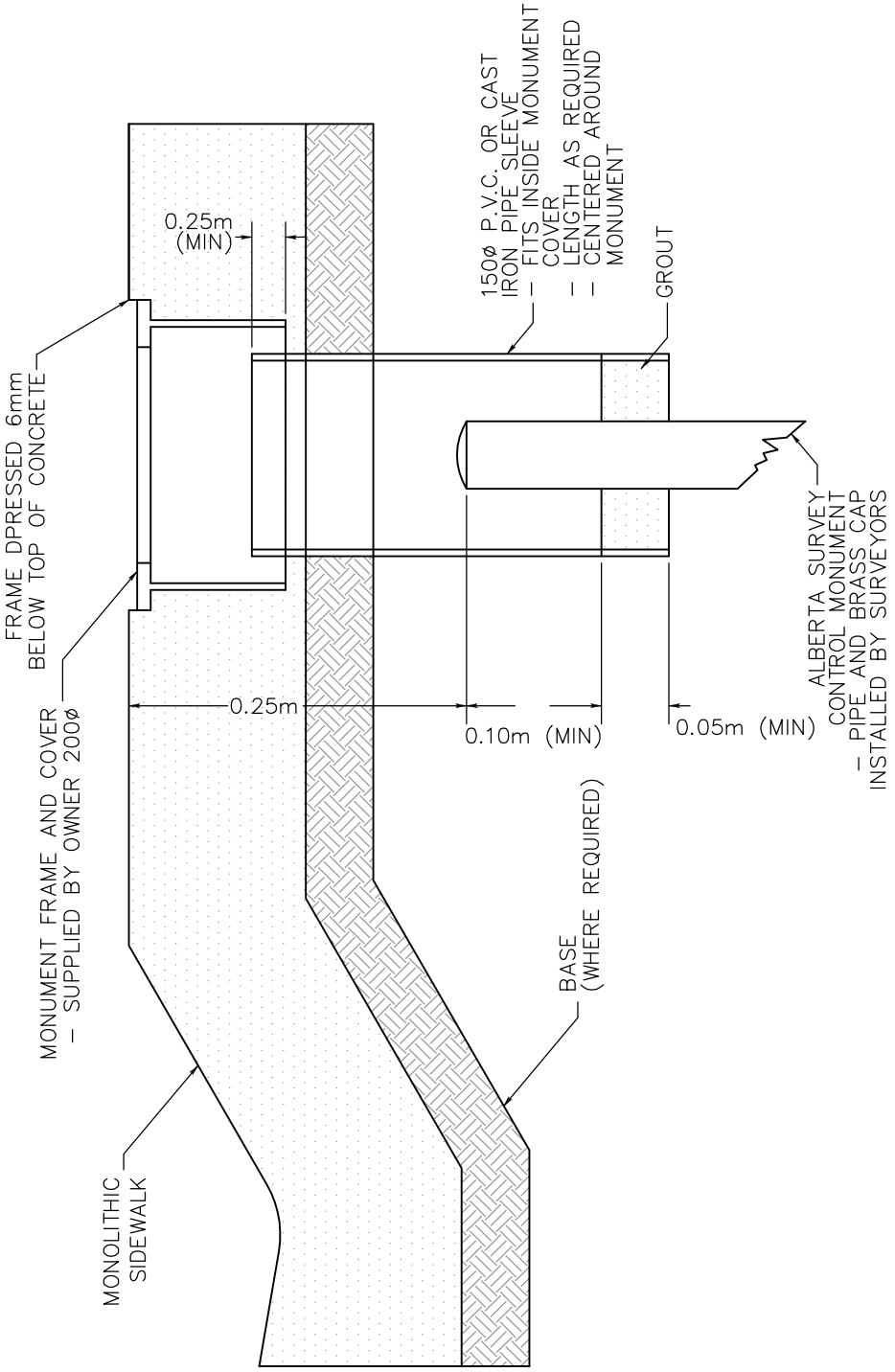


TYPICAL 15.0m UTILITY LOT BARRIER
FOR CENTER WALKWAYS

NOTES:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST-IN-PLACE AND PRECAST CONCRETE RESPECTIVELY.

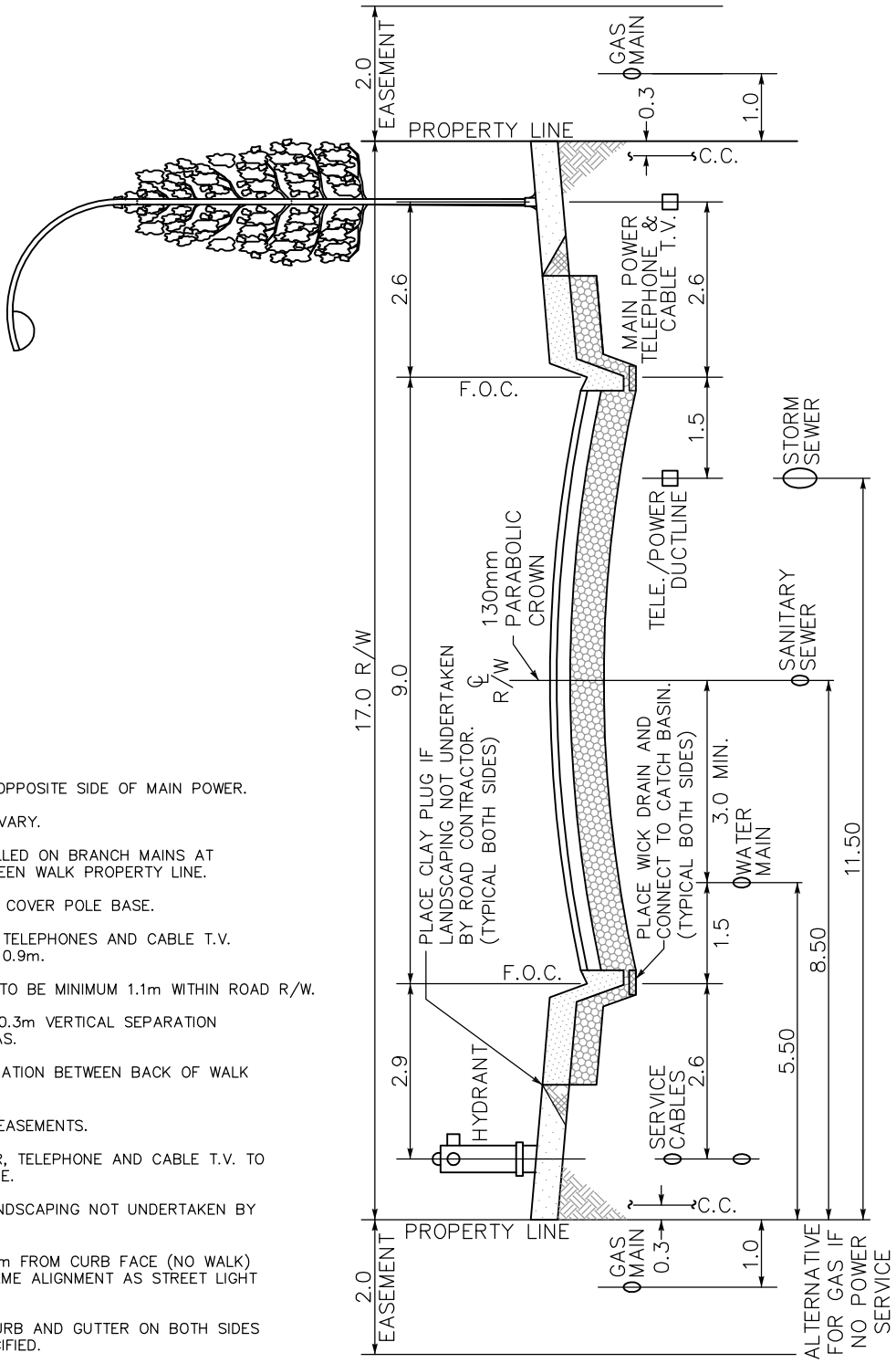
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: UTILITY LOT BARRIER (15 METRES)	FIGURE: 121



NOTE:

1. ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED.

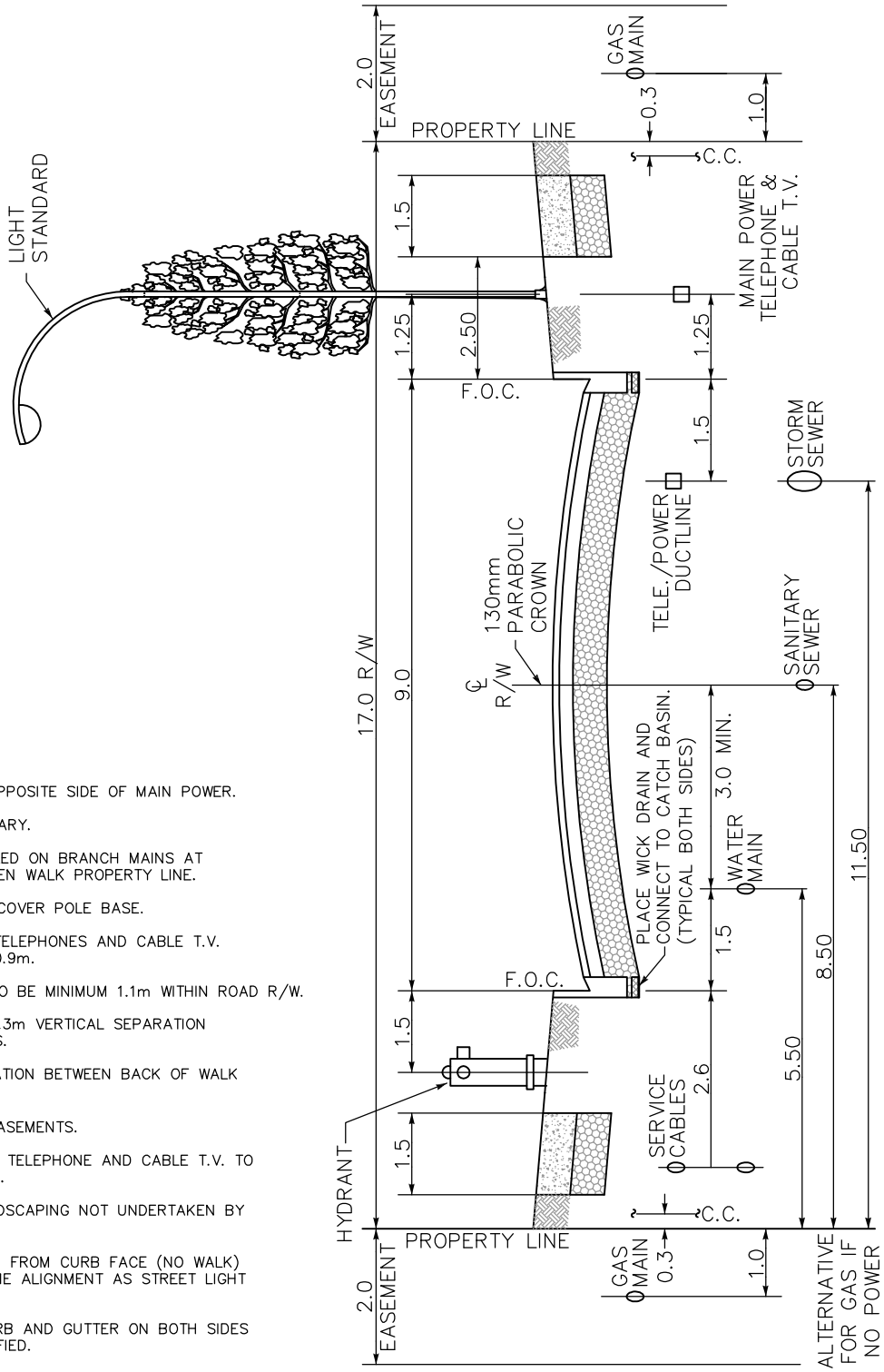
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: SURVEY MONUMENT COVER DETAIL	FIGURE: 122



NOTES:

1. WATER MAIN TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 0.9m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. GAS MAIN LOCATED ON EASEMENTS.
10. SERVICE BOX FOR POWER, TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
12. MIN. TREE OFFSET = 1.5m FROM CURB FACE (NO WALK) OR BOULEVARD WALK SAME ALIGNMENT AS STREET LIGHT WHERE APPLICABLE.
13. MONOLITHIC SIDEWALK CURB AND GUTTER ON BOTH SIDES UNLESS OTHERWISE SPECIFIED.
14. CROWNS ARE MEASURED FROM LIP OF GUTTER.
15. ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED.

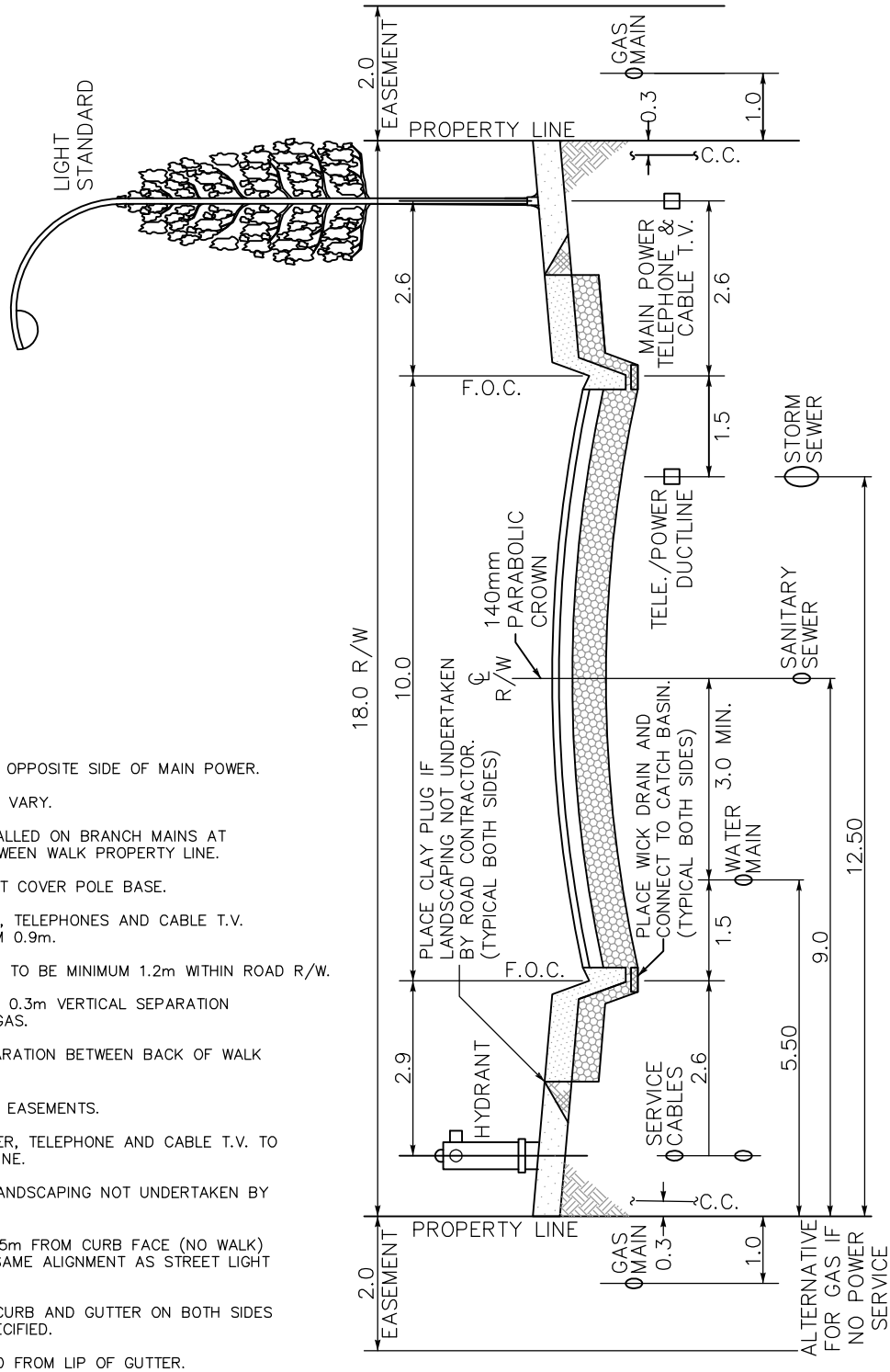
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: UTILITY LOCATION PLAN 9.0m LOCAL RESIDENTIAL	FIGURE: 123



NOTES:

1. WATER MAIN TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 0.9m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. GAS MAIN LOCATED ON EASEMENTS.
10. SERVICE BOX FOR POWER, TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
12. MIN. TREE OFFSET = 1.5m FROM CURB FACE (NO WALK) OR BOULEVARD WALK SAME ALIGNMENT AS STREET LIGHT WHERE APPLICABLE.
13. MONOLITHIC SIDEWALK CURB AND GUTTER ON BOTH SIDES UNLESS OTHERWISE SPECIFIED.
14. CROWNS ARE MEASURED FROM LIP OF GUTTER.
15. ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED.

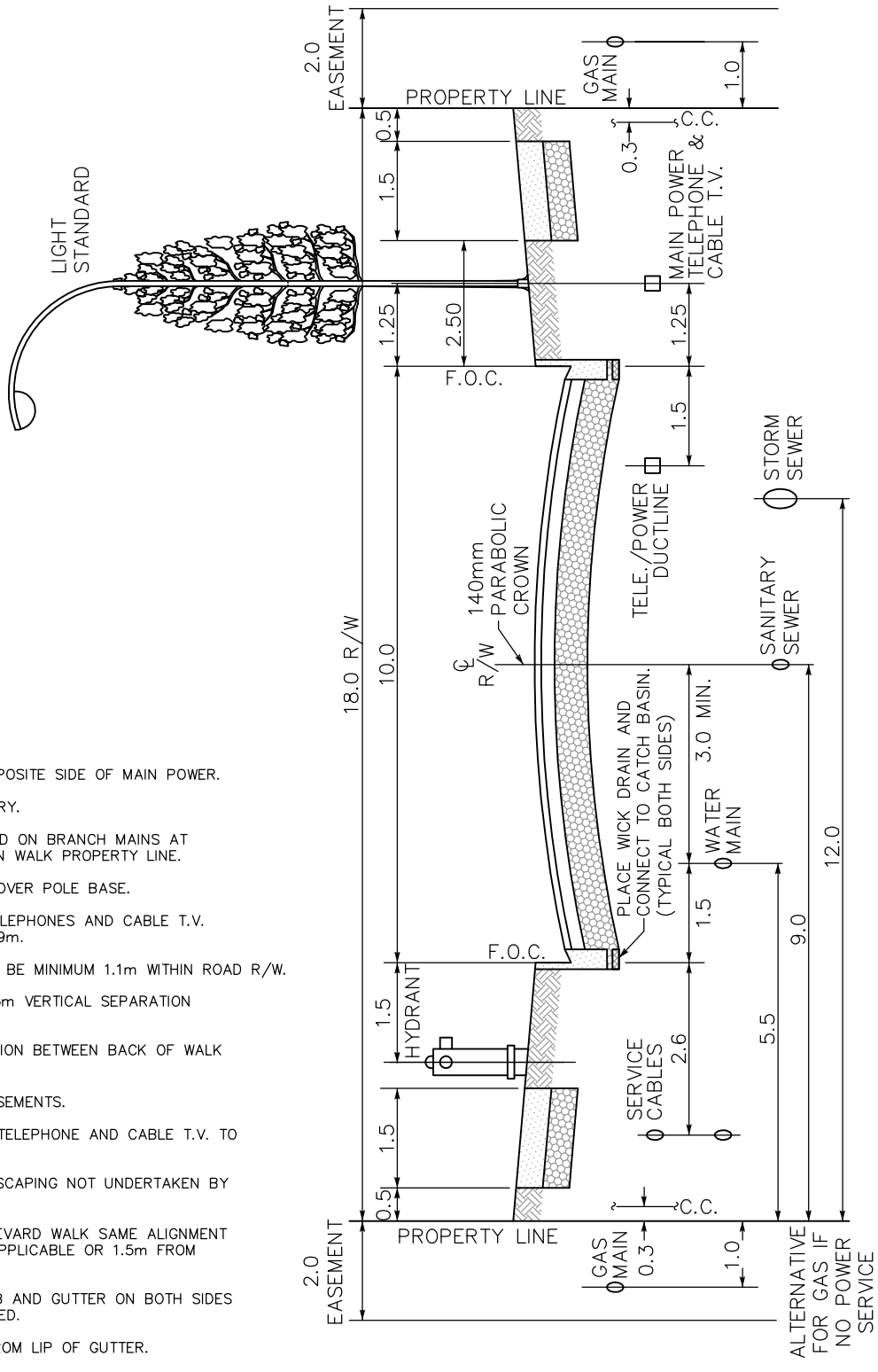
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: UTILITY LOCATION PLAN 9.0mLOCAL RESIDENTIAL (BLVD WALK)	FIGURE: 124



NOTES:

1. WATER MAIN TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 0.9m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.2m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. GAS MAIN LOCATED ON EASEMENTS.
10. SERVICE BOX FOR POWER, TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
12. MIN. TREE OFFSET = 1.5m FROM CURB FACE (NO WALK) OR BOULEVARD WALK SAME ALIGNMENT AS STREET LIGHT WHERE APPLICABLE.
13. MONOLITHIC SIDEWALK CURB AND GUTTER ON BOTH SIDES UNLESS OTHERWISE SPECIFIED.
14. CROWNS ARE MEASURED FROM LIP OF GUTTER.
15. ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: UTILITY LOCATION PLAN 10.0m LOCAL RESIDENTIAL (SF MONO WALK)	FIGURE: 125



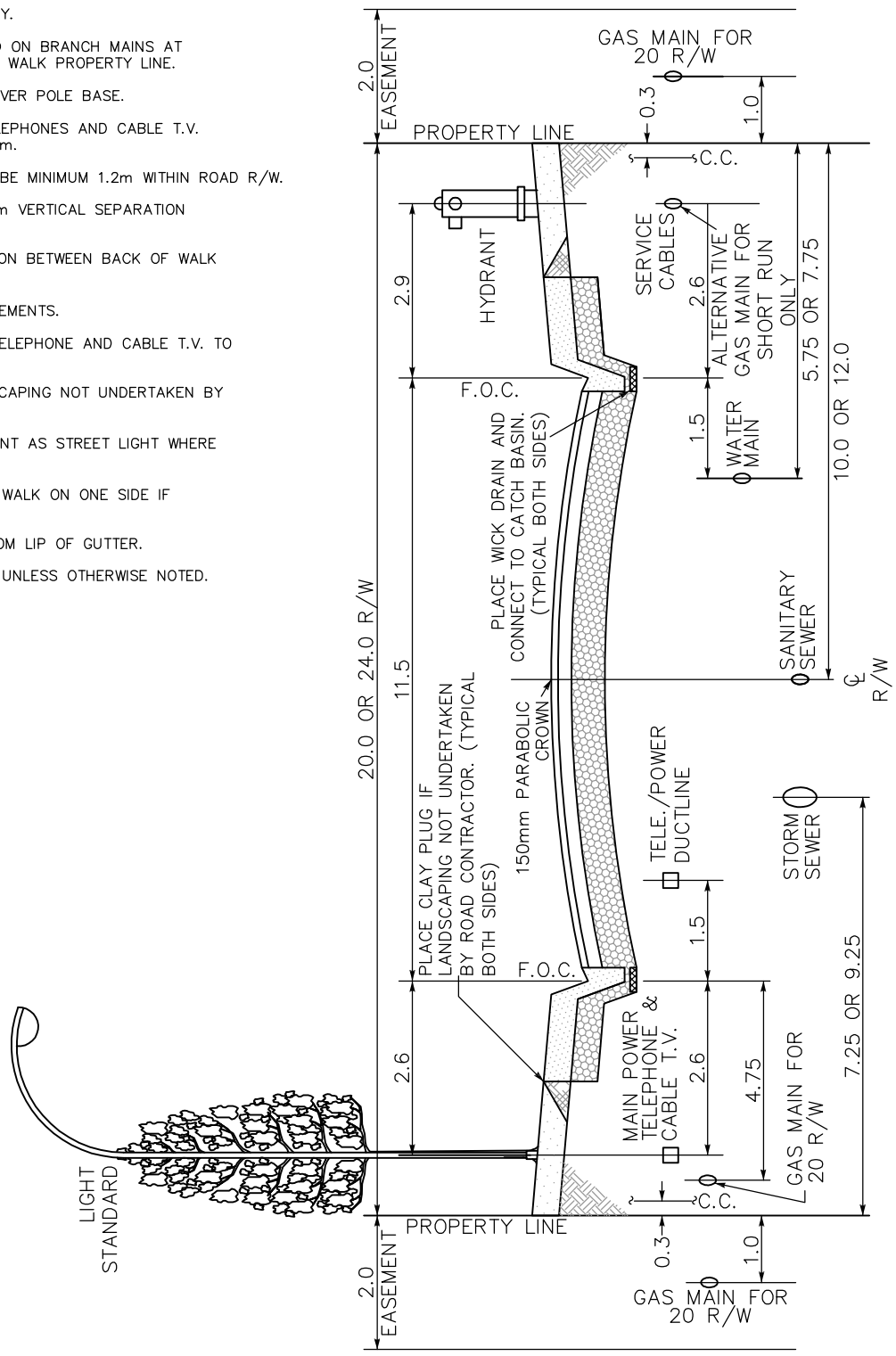
NOTES:

1. WATER MAIN TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 0.9m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. GAS MAIN LOCATED ON EASEMENTS.
10. SERVICE BOX FOR POWER, TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
12. MIN. TREE OFFSET = BOULEVARD WALK SAME ALIGNMENT AS STREET LIGHT WHERE APPLICABLE OR 1.5m FROM CURB FACE (NO WALK).
13. MONOLITHIC SIDEWALK CURB AND GUTTER ON BOTH SIDES UNLESS OTHERWISE SPECIFIED.
14. CROWNS ARE MEASURED FROM LIP OF GUTTER.
15. ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED.

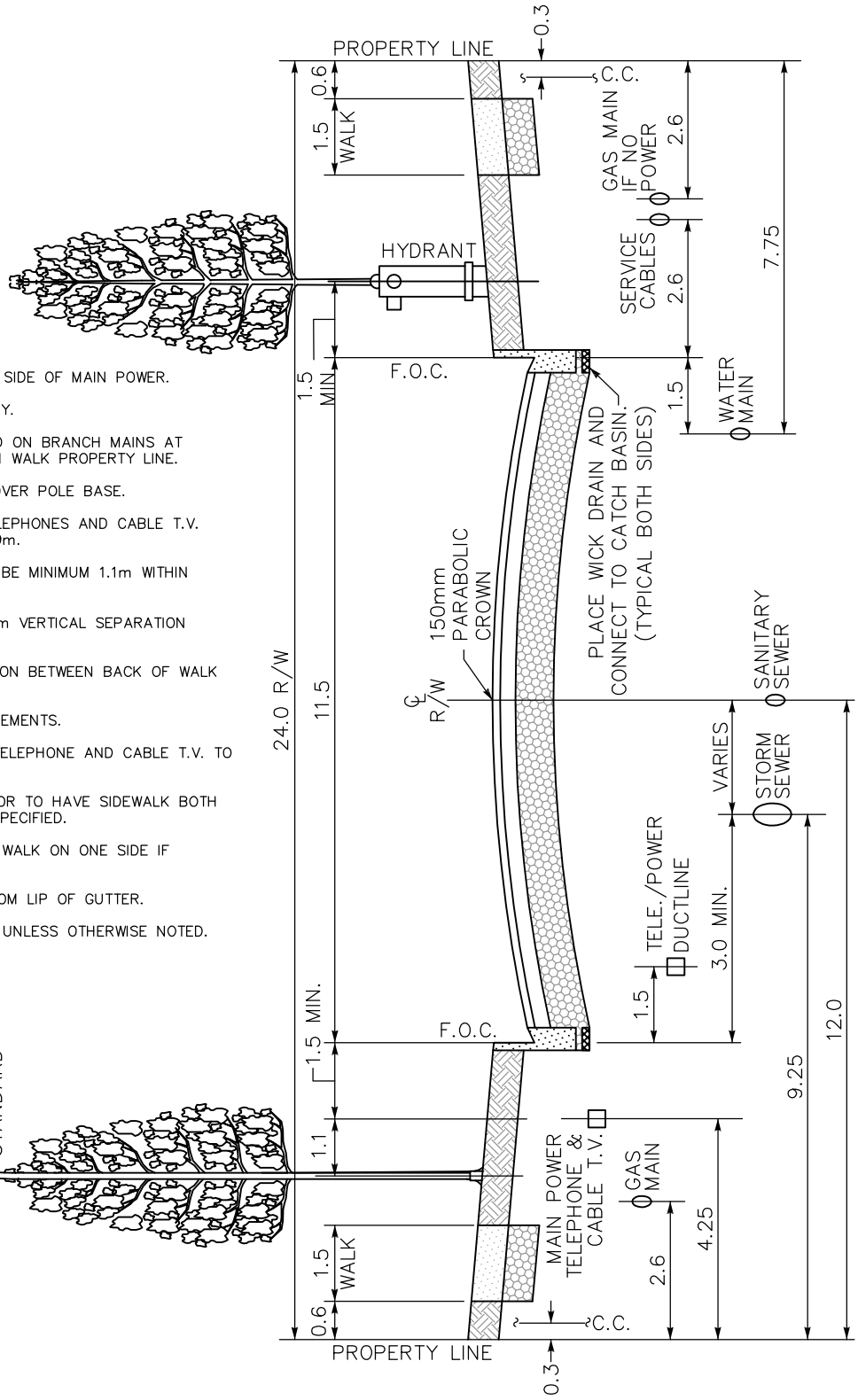
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: UTILITY LOCATION PLAN 10.0m LOCAL RESIDENTIAL (BLVD WALK)	FIGURE: 126

NOTES:

1. WATER MAIN TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 0.9m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.2m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. GAS MAIN LOCATED ON EASEMENTS.
10. SERVICE BOX FOR POWER, TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. PLACE CLAY PLUG IF LANDSCAPING NOT UNDERTAKEN BY ROAD CONTRACTOR.
12. TREE OFFSET SAME ALIGNMENT AS STREET LIGHT WHERE APPLICABLE.
13. 11.5m INDUSTRIAL TO HAVE WALK ON ONE SIDE IF DESIGNATED BUS ROUTE.
14. CROWNS ARE MEASURED FROM LIP OF GUTTER.
15. ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED.



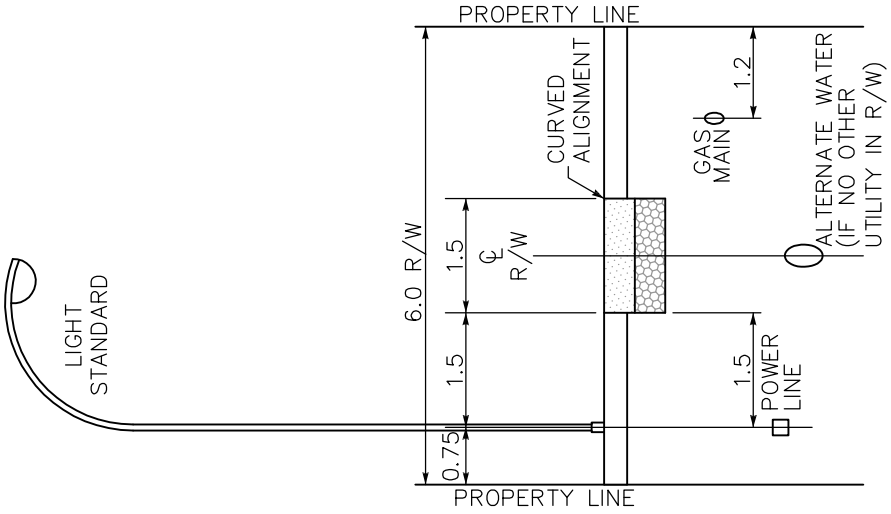
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: UTILITY LOCATION PLAN 11.5m COLLECTOR/LOCAL INDUSTRIAL CURBLINE WALK	FIGURE: 127

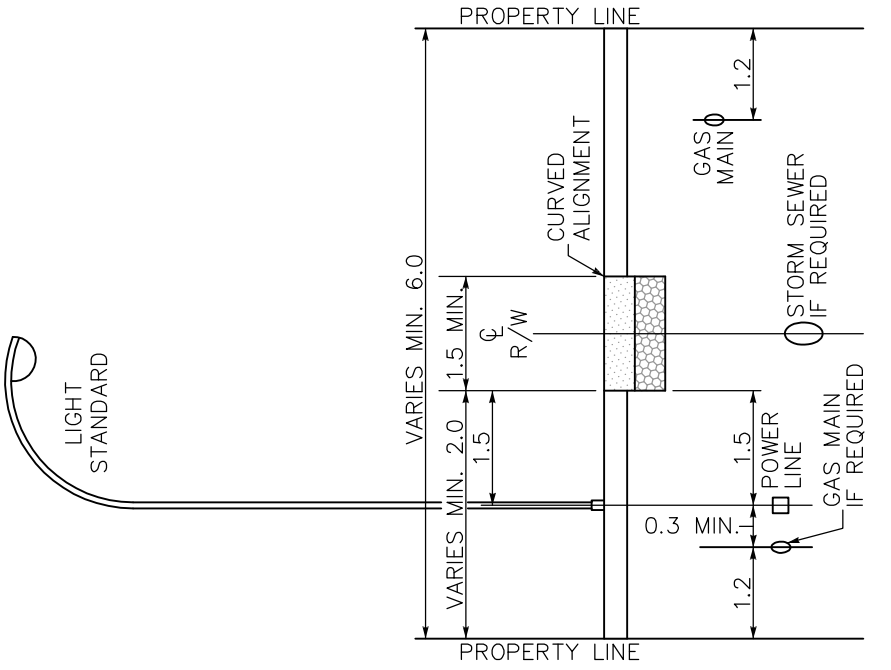


NOTES:

1. WATER TO BE ON OPPOSITE SIDE OF MAIN POWER.
2. PIPE SIZES AND DEPTH VARY.
3. HYDRANTS TO BE INSTALLED ON BRANCH MAINS AT INTERSECTIONS OR BETWEEN WALK PROPERTY LINE.
4. LANDSCAPING MUST NOT COVER POLE BASE.
5. DEPTH OF MAIN POWER, TELEPHONES AND CABLE T.V. TRENCH TO BE MINIMUM 0.9m.
6. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m WITHIN ROAD R/W.
7. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
8. MINIMUM OF 1.0m SEPARATION BETWEEN BACK OF WALK AND POWER.
9. GAS MAIN LOCATED ON EASEMENTS.
10. SERVICE BOX FOR POWER, TELEPHONE AND CABLE T.V. TO STRADDLE PROPERTY LINE.
11. 11.5m RESIDENTIAL COLLECTOR TO HAVE SIDEWALK BOTH SIDES UNLESS OTHERWISE SPECIFIED.
12. 11.5m INDUSTRIAL TO HAVE WALK ON ONE SIDE IF DESIGNATED BUS ROUTE.
13. CROWNS ARE MEASURED FROM LIP OF GUTTER.
14. ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: UTILITY LOCATION PLAN 11.5m COLLECTOR/LOCAL INDUSTRIAL BOULEVARD WALK	FIGURE: 128

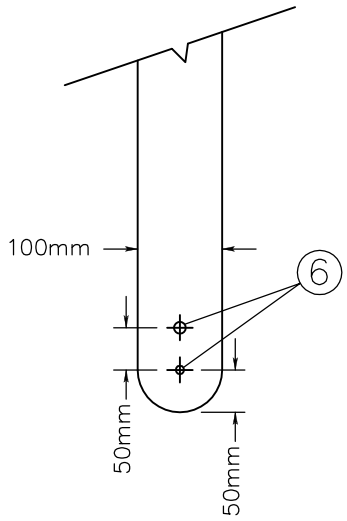




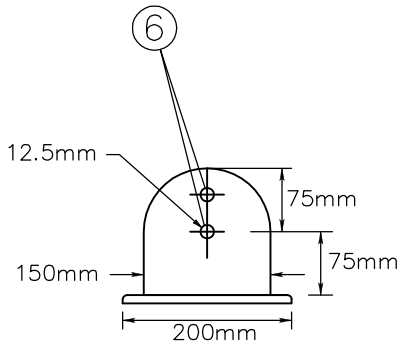
NOTES:

1. MAJOR WALK LOCATION VARIES IN R/W.
2. MINOR WALK LOCATION GENERALLY ON CENTER LINE.
3. LANDSCAPING MUST NOT COVER POLE BASES.
4. DEPTH OF POWER TRENCH TO BE APPROXIMATELY 0.9m.
5. DEPTH OF GAS TRENCH TO BE MINIMUM 1.1m.
6. REQUIRE A MINIMUM OF 0.3m VERTICAL SEPARATION BETWEEN POWER AND GAS.
7. REQUIRE MINIMUM 3.0m HORIZONTAL SEPARATION BETWEEN STORM SEWER AND POWER.
8. ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED.

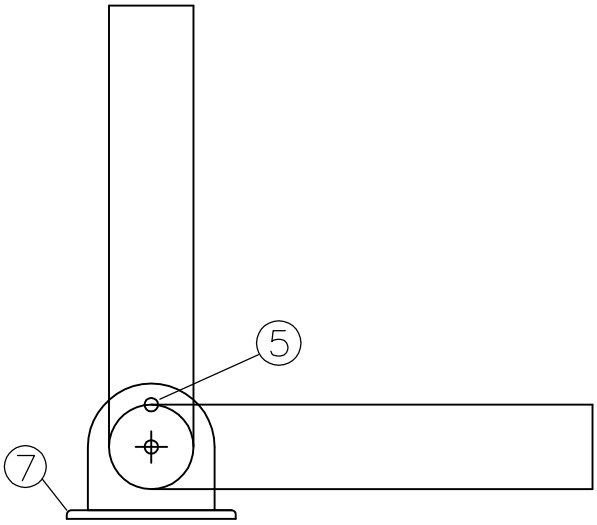
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: UTILITY LOCATION PLAN WALKWAYS	FIGURE: 129



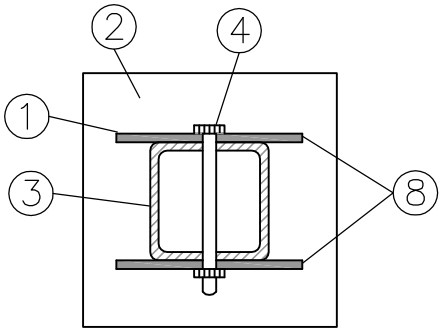
BOLLARD SECTION



BASE DETAIL



SIDE ELEVATION

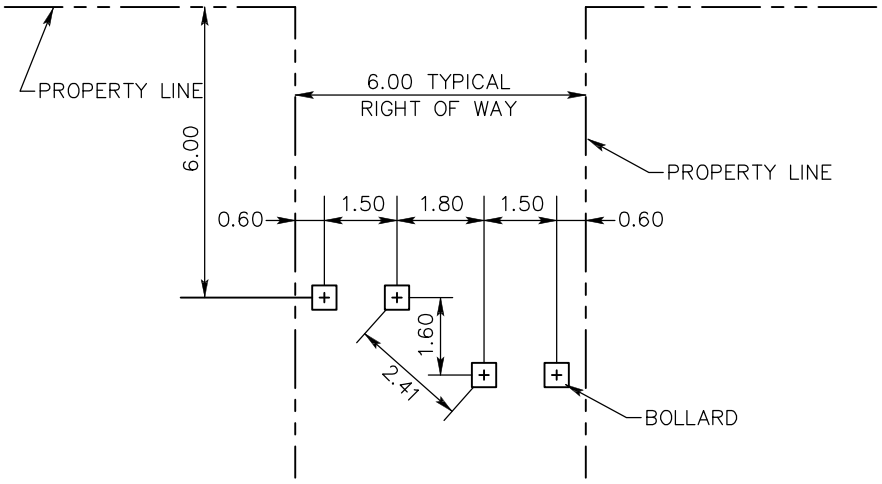


BASE CROSS SECTION

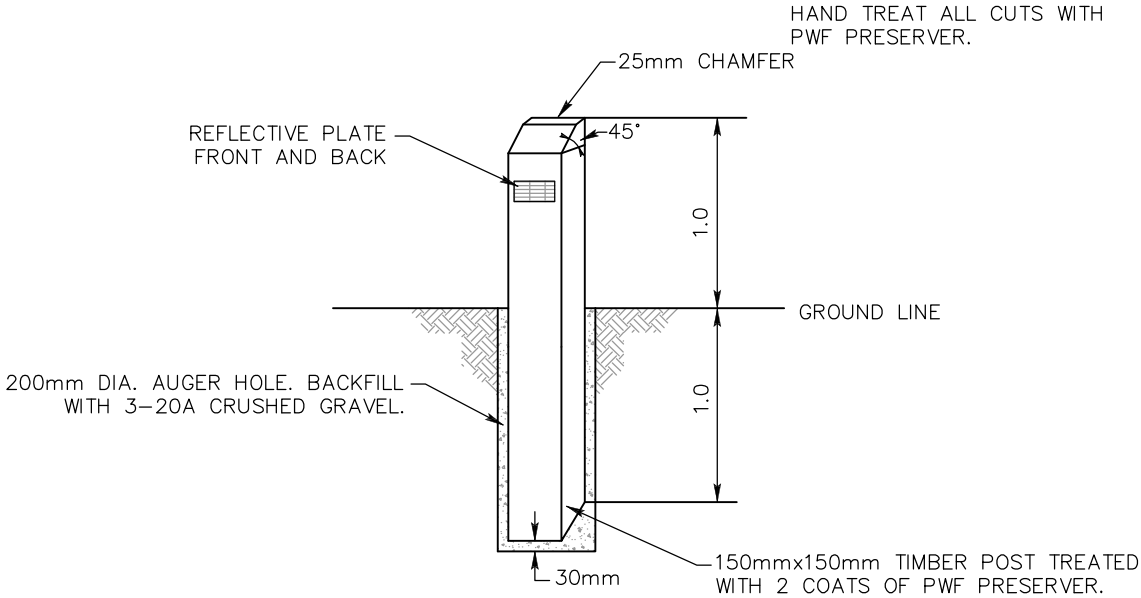
NOTES:

1. 12mm STEEL FLANGES WELDED TO BASE PLATE.
2. 200mm x 200mm x 12mm STEEL BASE PLATE c/w 4–19mm x 250mm STEEL ANCHOR OR TUBE WELDED TO BOTTOM.
3. 100mm x 100mm STEEL BOLLARD c/w TOP PLATE. 760mm IN LENGTH (YELLOW IN COLOR).
4. 12mm x 150mm BOLT c/w WASHERS AND NYLON LOCKING NUT.
5. 20mm x 150mm CLEVIS PIN.
6. HOLES DRILLED AS SHOWN.
7. CHAMFER TOP EDGES OF BASE PLATE.
8. TACK WELD.
9. SPECIFIC ANCHORING TO BE PRESCRIBED BY ENGINEER.
10. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: COLLAPSIBLE BOLLARD	FIGURE: 130



TYPICAL BOLLARD LAYOUT

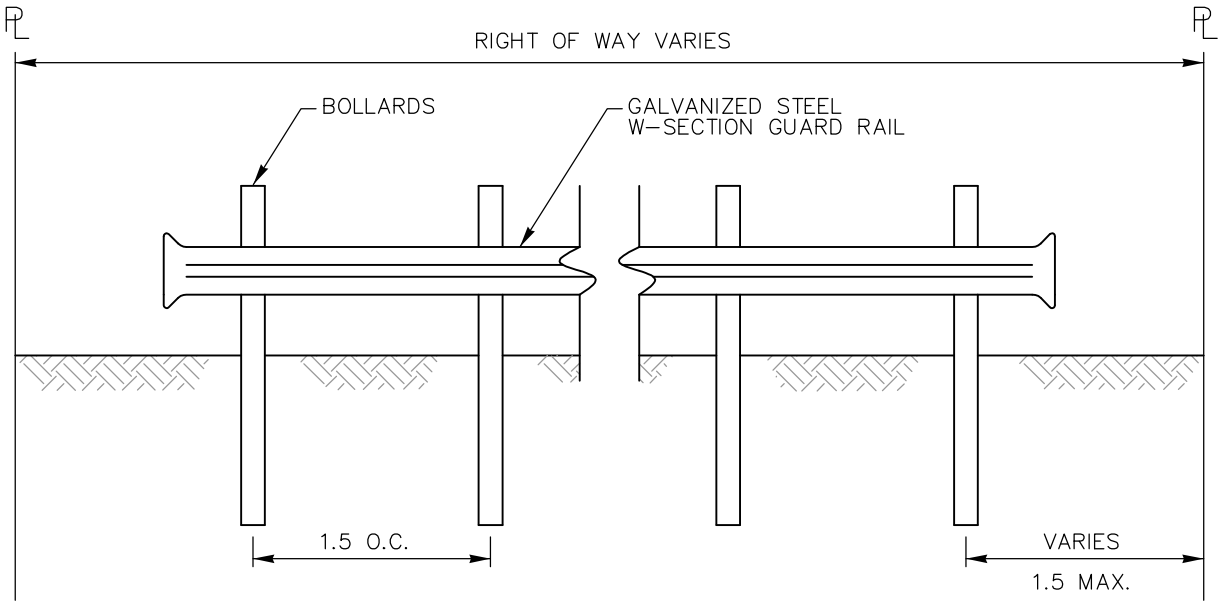


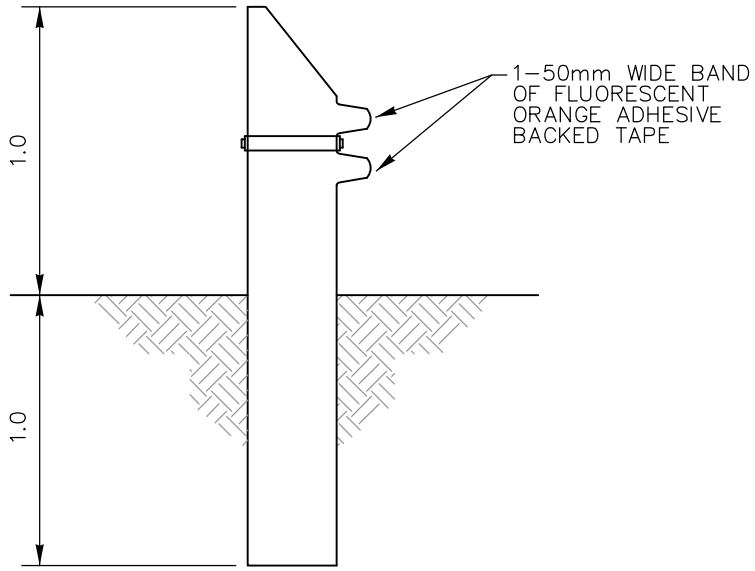
BOLLARD DETAIL

NOTES:

1. ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED.
2. PROPORTIONING AND PRODUCING QUALITY CONCRETE AS WELL AS ACCEPTANCE TESTS FOR THE CONSTITUENT MATERIALS ARE SPECIFIED IN CSA STANDARDS A23.1 AND A23.4 FOR CAST–IN–PLACE AND PRECAST CONCRETE RESPECTIVELY.

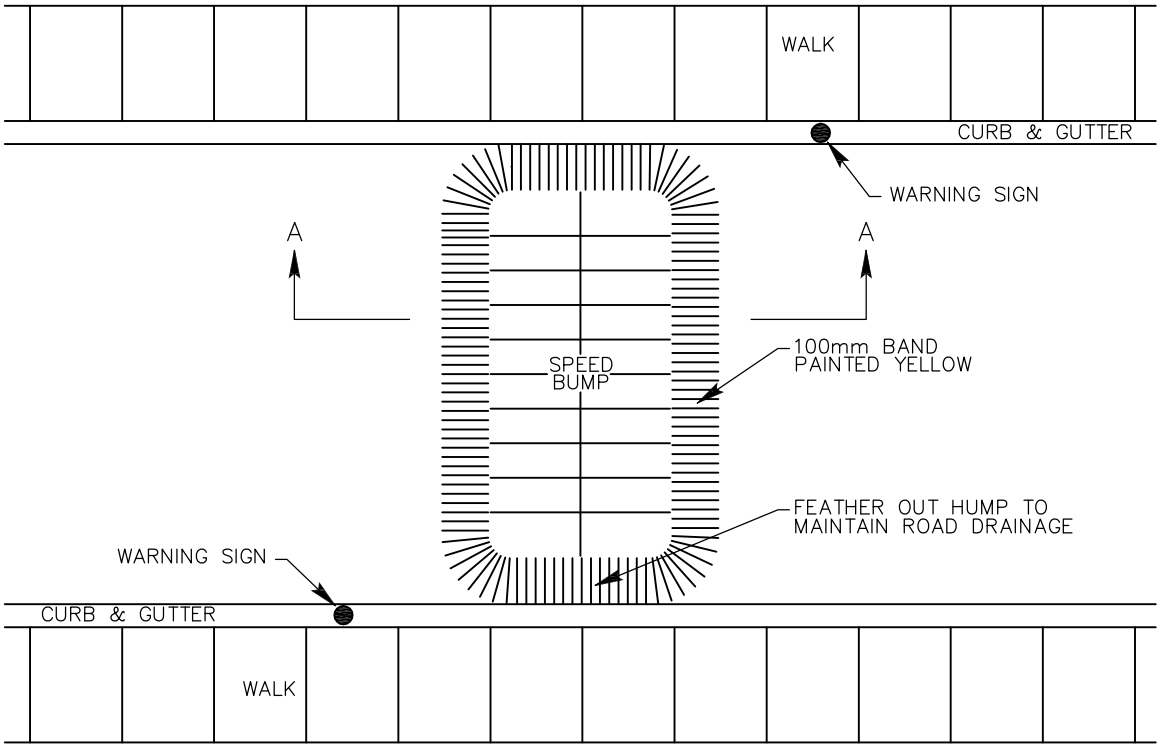
DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: TYPICAL BOLLARD LAYOUT AND INSTALLATION	FIGURE: 131



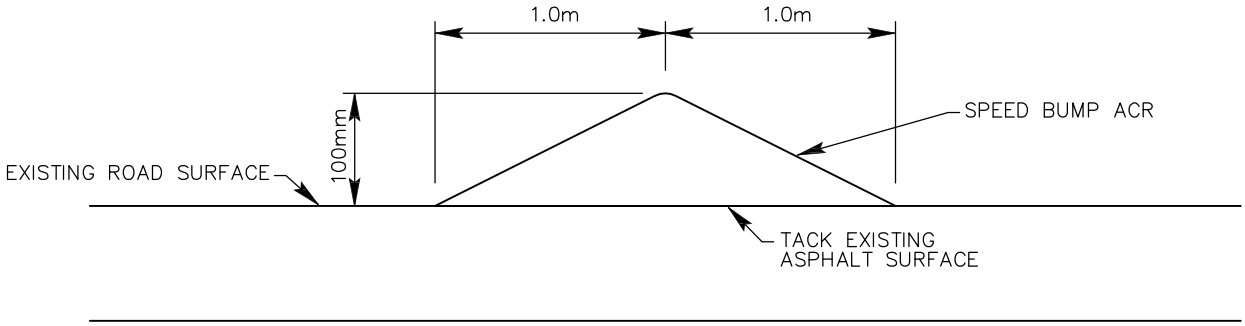


NOTES:
1. ALL HARDWARE TO BE GALVANIZED.
2. ALL DIMENSIONS IN METRES UNLESS OTHERWISE NOTED.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: TYPICAL BOLLARD WITH GALVANIZED STEEL W-SECTION	FIGURE: 132



PLAN



SECTION A–A

NOTE:

1. ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE NOTED.

DATE: NOV, 2014	TOWN OF HIGH LEVEL	ACAD – CIVIL DRAFTING STANDARD DETAILS
TOWN OF HIGH LEVEL	TITLE: ASPHALT SPEED BUMP	FIGURE: 133