



Town of Cochrane

Requirements for Development 2023

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The following requirements apply to all individuals or parties wishing to develop a subdivision within the Town of Cochrane. Please note these guidelines are in addition to the City of Calgary guidelines.

1.0 PROCESS

1.1 Introduction

- 1.1.1 Requirements of the Design Guidelines and the Construction Specifications alone do not constitute the only conditions of development in Cochrane. The Planning and Civil Land Development Departments should be contacted to determine pertinent development requirements.
- 1.1.2 The Planning and Civil Land Development Departments aim to ensure that development is done safely and meets required industry standards and specifications. Any development must link effectively to the existing infrastructure, which includes sewers, water, roads, etc.
- 1.1.3 The Planning and Civil Land Development Departments also works with Alberta Environment (a provincial approval authority) to ensure development does not adversely impact systems, both man-made and natural, on a larger scale and that any local contaminants found are dealt with properly.

1.2 Review and Approval

Review will not commence until all required submissions have been received to the satisfaction of the Town of Cochrane. This includes all relevant reports and drawings.

- 1.2.1 The Town of Cochrane (Town) will review the submission and provide comments in writing to the applicant or appointed consulting engineer within 45 days. This applies to each submission.
- 1.2.2 For all submissions of the engineering drawings and reports, the applicant or appointed consulting engineer is to provide them in a digital format as per section 2.1. Please contact the Town for large file sharing arrangements.
- 1.2.3 When the submission adequately addresses all the requirements of the Civil Land Development Department, the applicant or appointed consulting engineer will receive written notification from the Town of Cochrane’s Civil Land Development Department.

Please be advised that approval of the Civil Land Development component of the project does not suggest overall approval of the project. All requirements of the Town of Cochrane Planning & Civil Land Development Departments must be met prior to commencement of any construction activities.

1.3 Development Standards

The developer shall construct the Public Utilities and Improvements in accordance with the following requirements in addition to the City of Calgary’s standards, set in the design guidelines and the construction specifications, which are in force and effect as of the date of the site servicing agreement, except when modified as follows:

- 1.3.1 Developers shall refer to the Town’s Subdivision Servicing Agreement and the Planning and Civil Land Development Departments for details with respect to the development process specific to the Town.
- 1.3.2 The following is a list of additional reference documents published by the Town:
 - I. **Land Use Bylaw (LUB)** refers to the document that prohibits, regulates, and controls the use and development of land and buildings in Cochrane.
 - II. **Municipal Development Plan (MDP)** refers to the document outlining Cochrane’s current, Council approved, plan for future development.
 - III. **Cochrane Sustainability Plan** refers to the document outlining Cochrane’s commitment to approach growth in a sustainable manner.
 - IV. **Area Structure Plan** refers to a high-level statutory planning document that outlines suitable land uses, park and open space locations, transportation networks and other key elements at the community scale.
 - IV. **Neighbourhood Plan** refers to a non-statutory planning document that outlines the framework for a neighbourhood’s development in greater detail, including lot and road layouts, specific proposed land uses and open space concepts. The Neighbourhood Plan is approved following the approval of an Area Structure Plan.

1.4 Construction Completion and Final Acceptance Procedures

- 1.4.1 All documentation shall be submitted in a digital format in a combined book-marked package. For inclusion in the Construction Completion Certificate (CCC) and Final Acceptance Certificate (FAC) submission package, please see the checklist found on the Civil Land Development page of the Town website. All text must be fully legible, or the submission may be rejected.
- 1.4.2 Construction Completion Certificates (CCC) can be back dated to the day of the inspection, provided the Town has received the complete submission package (mentioned above in 1.4.1) within 6 months of the inspection. If the complete package is not received within 6 months, the CCC will reflect the received date of the complete submission.

- 1.4.3 Final Acceptance Certificates (FAC) will not be issued until after the maintenance period has expired and the full scope of work is deemed complete. However, FAC inspections can be done up to 3 months before the maintenance expiry date to ensure the deficiencies are corrected ahead of time. A final inspection at the time of maintenance expiry for landscaping items will be at the discretion of the Manager of Parks and Open Spaces.

- 1.4.4 To further clarify the term “occupancy” as it relates to developer maintenance and the post FAC process, the Town will accept a lot that is loamed as occupied for the purpose of obtaining the 75% threshold for maintenance purposes. All lots that have not received loam or an alternative final landscaping product at the time of the post top lift inspection will be added to the post FAC list and monitored until completion. For more information on this process, please reference the applicable subdivision servicing agreement.

- 1.4.5 All municipal reserve (MR), municipal school reserve (MSR), environmental reserve (ER), public utility lot (PUL) and boulevard/median landscaping projects must apply for CCC and FAC as a complete land parcel. Individual components such as: trees, grass, playgrounds, pathways, etc. can not be separated into their own certificates.

2.0 DRAWINGS AND REPORT SUBMISSIONS

All developers or developer's consulting engineer are required to submit each of the following items for every proposed phase of subdivision development within the Town.

2.1 Engineering Drawings

Engineering drawings submitted for the purpose of obtaining approval for constructing infrastructure for a proposed subdivision must comply with the requirements set in [Appendix A](#) of this document.

All residential streets must align with the cross section provided in [Appendix B](#) of this document (15.5m Right of Way only).

All drawings issued for construction shall be signed and sealed by a Professional Engineer, licensed to practice in the Province of Alberta.

Approved final submissions of engineering drawings are to be submitted as follows:

- A complete set of engineering drawings in both CAD and PDF format. The PDF copy is to contain the Professional Engineer's signature and seal.

As-builts drawings are to be submitted as follows:

- A complete set of as-built drawings in CAD and PDF format.

2.2 Stormwater Management Report (SWMR)

All SWMRs must comply with requirements set in the latest version of the City of Calgary's Stormwater Management & Design Manual.

A breakdown of the estimated actual imperviousness by sub-catchment area within the subdivision, based on the product type is required. The lots, streets and lanes should be broken down and

the weighted imperviousness should be calculated for each sub-catchment. This breakdown is required, regardless of the assumed imperviousness noted in the approved Staged Master Drainage Plan (SMDP) to capture any changes, and to reflect the latest information regarding product types. Updates to approved SMDP or pond reports will not be required based on the detailed calculations provided with the SWMR.

All SWMRs are to be submitted as follows:

- 1 digital copy of the report in PDF format

2.3 Geotechnical Report

All geotechnical reports must comply with the minimum requirements set in [Appendix D](#) of this document.

All geotechnical reports are to be submitted as follows:

- 1 digital copy of the report in PDF format

[Appendix D](#) also contains minimum requirements for geotechnical and material testing during construction.

2.4 Erosion and Sediment Control Report (ESC)

All erosion and sediment control reports must comply with the current Town of Cochrane Erosion and Sediment Control Drawings and Report Guidelines

All ESC reports are to be submitted as follows:

- 1 digital copy of the report in PDF format

2.5 Additional Submissions

At the sole discretion of the Civil Land Development Department, the following submissions may be required on a project to project basis.

All reports are to be submitted as follows:

- 1 digital copy of the report in PDF format

2.5.1 Staged Master Drainage Plans and Pond Reports

An overall imperviousness of 67% (including roads, lanes and lots) for Single Family Residential land use shall be assumed for the SMDP and pond reports. All other land-uses can be considered as needed using the current City of Calgary Stormwater Management & Design Guidelines as minimum recommendations. Alternatively, detailed calculations can be used to demonstrate the estimated imperviousness for the overall outline plan area. The assumptions for imperviousness of various land uses should be clearly documented and to the satisfaction of Civil Land Development Services. Civil Land Development can be engaged at the early stages of the SMDP for feedback, if required.

2.5.2 Slope Stability Analysis Report

The Town of Cochrane requires that a comprehensive Slope Stability Analysis report be submitted for all slopes within or adjacent to a proposed phase of development. All reports must align with the requirements provided in [Appendix E](#).

2.5.3 Deep Fills Report

All Deep Fills Reports are to comply with the City of Calgary Standards.

2.5.4 Traffic Noise Analysis and/or Sound Attenuation Report

All Traffic Noise and/or Sound Attenuation Analysis reports are to comply with the current Noise Control Bylaw & City of Calgary Standards.

2.5.5 Traffic Impact Assessment

All Traffic Impact Assessment reports are to comply with the City of Calgary Traffic Impact Assessment Guidelines.

2.5.6 Traffic Management Plan

When construction related to a proposed subdivision will directly impact existing traffic and pedestrian conditions, the applicant must submit a Traffic Management Plan showing how traffic will be managed during construction as not to interfere with the flow of traffic or pedestrians. Please note that the Traffic Management Plan is subject to review and approval.

3.0 SPECIAL DESIGN STANDARDS

3.1 Waterworks

3.1.1 General

- 3.1.1.1 The current ***Cochrane Water System Master Plan*** outlines the design policies for water systems supplying future development areas. Those policies shall overrule the Design Guidelines in the event of a variance.
- 3.1.1.2 The Town reserves the right to review and approve the method by which developers complete all water tie-ins; hot-tap is the preferred tie-in method.

3.1.2 Valves

- 3.1.2.1 All valves shall open counter-clockwise.
- 3.1.2.2 All hydrant valves are to be located 1.0 m from the main, or as otherwise approved by the Town.

3.1.3 Hydrants

- 3.1.3.1 Hydrant steamer ports shall be equipped with a 5” Storz coupling and steamer port style cap; quick coupler style caps will not be accepted.
- 3.1.3.2 All “Temporary Flushing Hydrants” shall be clearly labeled as such on the engineering drawings and be clearly identified in the field by placing an out of service ring.
- 3.1.3.3 Hydrants are to conform to the yellow/lime green color scheme used in the City of Calgary. Hydrants are to be painted at the factory with corrosion resistant paint.
- 3.1.3.4 Hydrants approved for use:
 - i) Clow Brigadier (formerly McAvity M-67);
 - ii) AVK Model 2780—Nostalgic.
 - iii) Terminal City C71P (5” Storz)
- 3.1.3.5 All Hydrants must be installed with a minimum of 50 mm from the breakaway flange to finished ground, and a maximum of 760 mm from the center of the steamer port to finished ground.

3.1.4 Pressure Reducing Valves

- 3.1.4.1 Pressure reducing valves are required on all commercial, industrial and residential units. For residential services, the recommended pressure setting for reducing valves is 60 psi.
- 3.1.4.2 Pressure reducing valves approved for use:
 - i) Singer;
 - ii) Others, with approval of Water and Wastewater Department.
- 3.1.4.3 Valve vaults installed in the Town must have Link-Seal seals. Cast in-place seals will not be accepted.

3.1.5 Pressure & Bacteriological Testing

- 3.1.5.1 Pressure testing of watermains and services is to follow the latest version of the City of Calgary's Standard Specifications for Waterworks Construction.
- 3.1.5.2 Civil Land Development Department must be given notice of pressure testing no less than 24 hours prior to commencement. However, 48 hour notice is preferred. Attendance is at the discretion of the Civil Land Development Department.
- 3.1.5.3 All water used for flushing and pressure testing must be metered using a Town provided meter. Please contact the Water & Wastewater Department to obtain the required meter; a minimum of 48 hour notice is required.
- 3.1.5.4 Prior to bacteriological testing, positive residual chlorine must be >0.50 mg/L and <1.00 mg/L. Turbidity must be <0.10 NTU. Measuring instruments must be certified annually with proof of a monthly calibration check.

3.2 Wastewater & Stormwater

3.2.1 Sanitary Sewer Flows

- 3.2.1.1 A table of sanitary sewer design information shall be submitted to Civil Land Development Services for each phase of development. Please see the template in [Appendix C](#) for inclusion in the engineering drawing submission. All design parameters mentioned in the following sections are specified here.
- 3.2.1.2 Refer to the Alberta Environment Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems for the

calculation of peak dry weather flow (Q_{PDW}) and infiltration allowance (0.28 L/s/ha).

- 3.2.1.3 All sanitary sewer designs must include future contributing developments. This must be shown on the sanitary coversheet by including an upstream catchment plan.
- 3.2.1.4 All sanitary sewer designs must use a residential sewage generation of 240 liters per capita per day (Lpcd) as per the **Cochrane Sanitary Sewer Master Plan**. This does not account for infiltration, which is to be included as part of the peak wet weather design flow (Q_{PWW}) calculation.
- 3.2.1.5 All sanitary sewer designs must use a population density of 2.6 people per unit. If the density of the proposed subdivision is known to differ, rationale must be provided for Town review and approval.
- 3.2.1.6 Sanitary sewer pipe slope shall be determined using the minimum pipe diameter necessary for the design volume of sanitary sewer flow. If a larger pipe size is required due to the design grade of the subdivision, minimum flushing velocities must be demonstrated.

3.2.2 Inspection Manholes

- 3.2.2.1 Sanitary Inspection (Test) manholes must be installed on all industrial, commercial, and institutional (ICI) developments at the property line where the service connects to the main. Each unit must have a separate sanitary test manhole. If site conditions cannot accommodate the test manhole at the property line where the service connects to the main, agreements for Town access must be in place.
- 3.2.2.2 Change of use applications will require a test manhole on sites identified as having moderate to high risk of effluent containing restricted substances. Please follow the latest version of the City of Calgary Design Guidelines for Development Site Servicing Plans for a list of applicable change of use application types.

3.2.3 Manholes

- 3.2.3.1 The Town requires all manhole covers to be as per [Appendix G](#).
- 3.2.3.2 All unused manhole channels not connected to an incoming pipe must be filled in with mortar or other material approved by the Town.
- 3.2.3.3 At the sole discretion of the Town, additional mortar and/or modifications to the benching may be required on a case-by-case basis to reduce the potential for build-up.

- 3.2.3.4 All sanitary manholes located within trap lows must be fitted with a Parsons Insert, or an approved alternative.
- 3.2.3.5 To better accommodate winter maintenance operations, all manholes and valves must be installed level with the grade of asphalt.
- 3.2.3.6 Storm pipe slopes resulting in design velocities greater than 4.5 m/s (i.e., a 50% increase of the upper limit identified in the latest version of the City of Calgary Stormwater Management and Design Manual) shall be avoided. Drop manholes shall be provided in order to reduce the design velocities and minimize the chance of hydraulic jumps in the storm sewer system. The drop manholes shall be equipped with appropriate erosion protection such as steel or HDPE plates at the opposite wall of the manhole and at the bottom of the manhole in the case of the drop exceeding 1 m and flow rates exceeding 0.5 m³/s. The height of each drop shall be limited to 2 m.

3.2.4 CCTV Video / Deflection Testing

- 3.2.4.1 The Town requires that all CCTV video and deflection testing conforms to the latest version of the City of Calgary's Standard Specifications for Sewer Construction.
- 3.2.4.2 CCTV video inspections are required for all sanitary and storm pipes over and including 150mm in size, regardless of material.

3.2.5 Trap Lows

- 3.2.5.1 All trap lows must be fully contained within the constructed phase boundary.
- 3.2.5.2 To protect downstream infrastructure and residents from potential sediment release and flooding, all overland escape routes must only spill into fully constructed roadways, or along a previously approved and constructed overland spill route.

3.2.6 Pond Aeration

- 3.2.6.1 Stormwater wet ponds may require aeration, at the Town's discretion to combat the future buildup of algae and H₂S. The design of the aeration system shall be submitted with the Pond design drawings.

3.3 Service Connections

3.3.1 Lot Servicing

- 3.3.1.1 All lots including residential, multi-family, commercial and industrial shall be serviced by the developer with storm, sanitary and water connections.
- 3.3.1.2 Bedding material with a nominal aggregate size of 10 mm - 2.5 mm, > 85% passing 10 mm sieve and <10% passing the 2.5 mm sieve, may be used for residential services up to a maximum of 100 mm in diameter.

3.3.2 Service Abandonments

- 3.3.2.1 Infill developments requiring new services must abandon the existing services back to the main line. When feasible, the new services should be installed in the same alignment.

3.3.3 Water Service

- 3.3.3.1 A “CC” stamp shall be placed in the sidewalk at the location of the water service valve for each residential, commercial, or industrial lot. In the event that sidewalk is not present, the “CC” stamp is to be placed in the concrete gutter.
- 3.3.3.2 Developers must ensure proper notification is delivered to all affected residents/tenants prior to both Construction Completion Certificate (CCC) and Final Completion Certificate (FAC) inspections of service valves.
- 3.3.3.3 All CC valves located within concrete or asphalt must be encased by a white 100 mm PVC or ABS pipe with a removable cover. The pipe must extend 300 mm below the surface.
- 3.3.3.4 All residential water meters installed by the Town will be 20 mm.

3.3.4 Sanitary Services

- 3.3.4.1 All Sanitary service connections to industrial, commercial and institutional units shall be 150 mm minimum.

3.3.5 Storm Services

- 3.3.5.1 All storm services tied into concrete pipe shall use a saddle as the approved method of connection to the main.
- 3.3.5.2 Unless otherwise precluded by the geotechnical engineering reports, all residential lots must be serviced with a weeping tile subdrainage system connected to the storm service.
- 3.3.5.3 All sump pump discharges must be connected to the storm sewer service at the time of installation. Discharge of a sump pump to the surface is not permitted unless illustrated on the Building Grade Plan and approved by the Town.

3.4 Surface Features

3.4.1 Signs, Sign Posts and Street Blades

The Town has adopted the signage standards established by the Transportation Association of Canada's Manual of Uniform Traffic Control Devices of Canada. All developers conducting work within the Town of Cochrane must adhere to these guidelines. Please note that the following specifications are only the most commonly used signs and the TAC manual should be consulted for more detailed information.

- 3.4.1.1 All signs to be high intensity retro reflective sheeting (3M finish).
- 3.4.1.2 All stop signs to have "NO PARKING WITHIN 5m" at the bottom of the sign in White letters (TAC manual RA-1).
- 3.4.1.3 All yield signs to have "NO PARKING WITHIN 5m" at the bottom of the sign in White letters (TAC manual RA-2).
- 3.4.1.4 All Pedestrian crossing signs to have "NO PARKING WITHIN 5m of crosswalk" at the bottom of the sign in black letters (TAC Manual RA-4 L/R).
- 3.4.1.5 All islands must have median signs at both ends (TAC Manual RB-25/WA-36L).
- 3.4.1.6 All speed limit signs to have black letters on a white background (TAC manual RB-1). The Town's speed limits are 30 km/hr on residential roads and 50 km/hr on collector roads unless otherwise specified.
- 3.4.1.7 All posts to be 2 3/8" galvanized heavy wall pipe. All posts must be anchored with cast in-place concrete a minimum of 1.0 meter in the ground. Due to extra windy conditions in the Town, the concrete must be cured for at least 12 hours prior to attaching signs to the post.

- 3.4.1.8 With the exception of median signs on islands, all signs must be 2.1 m high from the bottom of the lowest sign to finish grade.
- 3.4.1.9 The leading or outside edge of the sign should be a minimum of 300 mm to a maximum of 1.5 m from the back of the curb.
- 3.4.1.10 All street blades to have black letters on a white background.
- 3.4.1.11 All street blades are to be located on top of Stop and Yield signs; however, street blades may be placed on Street Light posts with approval of the Town's Roads Department.
- 3.4.1.12 All developers and/or consultants planning to install signs must contact the Town's Roads Department for a pre-installation and fabrication meeting to address any specific site conditions.
- 3.4.1.13 All signs must be in place and approved by the Town's Roads Department prior to request for CCC inspection.

3.4.2 Crosswalks

- 3.4.2.1 All pedestrian crosswalk signs to have pedestrian symbol in black on a white background.
- 3.4.2.2 All pedestrian crosswalk signs to be double sided and placed on both sides of the road with the pedestrian symbol facing the road.
- 3.4.2.3 All pedestrian crossing signs located within school zones, playground zones, and roads with a speed limit of 50 km/hr or greater must have a vertical yellow-green crosswalk stick on both sides of the post and an inlaid Thermoplastic Zebra Bar style crosswalk.
- 3.4.2.4 Pedestrian crosswalks and crosswalk signs are not permitted in driveways.
- 3.4.2.5 All pedestrian crossings must connect to wheelchair ramps on both sides of the crossing.
- 3.4.2.6 Enhanced Solar LED crosswalks are required at regional pathways that intersect with Collector and Arterial roadways.

3.4.3 School and Playground Zones

- 3.4.3.1 All start and end of school zone signs must be black letters on a bright lime background.
- 3.4.3.2 All school zones signs must be black on a bright lime background with speed signs. Speed signs must be black numbering on a white background

and read “07:00-21:00 SCHOOL DAYS”. School zone signs are specific one-piece signs and need to be made to Town standards - see [Appendix H](#).

- 3.4.3.3 All playground zones signs to be black on a bright lime background with separate speed signs. Speed signs must be black numbering on a white background.
- 3.4.3.4 Speed limit changes must be posted at the end of school zones and playground zones. Please note that playground zones have different specifications depending on the type of play structure present. Please refer to the TAC manual for more details.
- 3.4.3.5 Enhanced Solar LED crosswalks are required in school zones; one crossing is required per frontage road. Location of the LED crosswalk(s) to be determined at the subdivision design review stage, at the Town’s discretion.
- 3.4.3.6 All school sites must be fenced at the Developer’s cost. Location and fence type will be reviewed and approved through the landscaping plan submissions.

3.4.4 Wheelchair Ramps

- 3.4.4.1 For safety reasons, the Town requires that wheelchair ramps are not located within driveways. Wheelchair ramps located at “T” intersections must be aligned with property line between lots.
- 3.4.4.2 The Town requires that all wheelchair ramps conform to the latest version of the City of Calgary’s Roads Construction Standard Specifications.
- 3.4.4.3 All wheel chair ramps must include detectable warning surfaces, as per the City of Calgary figures included in [Appendix F](#). The detectable warning surfaces must be unpainted cast iron (ASTM A48 CL35B).
- 3.4.4.4 Detectable warning surface approved supplier in the Town of Cochrane:
 - i) Trojan Industries (D&L Foundry) ADA Solutions Inc.

3.4.5 Canada Post Mailboxes

- 3.4.5.1 Mailboxes shall not be located within the extents of a trap low or at the discharge location of a swale.

3.4.6 Overland Water Infrastructure Testing

- 3.4.6.1 All swales must be cleared of debris, flushed with water, and remain clear prior to and during the FAC inspection.

- 3.4.6.2 Water testing of all concrete swales is required during FAC inspection of overland drainage features. Any swale or portion of a swale that is considered by the Town's Civil Land Development Department to be deficient shall be repaired or replaced at the sole discretion of the Town, and at no cost to the Town.
- 3.4.6.3 All roads and gutters must be clear of any debris and may require flushing with water during the FAC inspection. Deficient areas will be marked with spray paint.
- 3.4.6.4 At the sole discretion of the Civil Land Development department, water testing may be required at the time of CCC inspections. Testing may also be required on gutters and swales less than 2% in grade.
- 3.4.6.5 Developers must ensure proper notification is delivered to all affected residents/tenants prior to both CCC and FAC inspections of overland drainage facilities.

3.4.7 Line Painting and Road Markings

- 3.4.7.1 All line painting and road markings are to follow the TAC guidelines, the Manual of Uniform Traffic Control Devices for Canada (MUTCD) and/or specifications set out by Alberta Transportation, whichever the Roads departments feels is appropriate for the project.
- 3.4.7.2 All road marking and line painting specifications to be used must be indicated on the signage and road marking drawing at the time of drawing review.
- 3.4.7.3 Approved highway traffic paint to be applied at a minimum application rate of 38 liters per linear kilometer or at the discretion of the Roads department.
- 3.4.7.4 All stop signs must have an inlaid thermoplastic stop bar on the road after top lift. The inlaid Thermoplastic is to be 5-10 mm deep, struck off 2-3 mm above the surface over banding the groove by 10 mm.
- 3.4.7.5 All pedestrian crossings must have an inlaid Thermoplastic crosswalk pattern after top lift. The inlaid Thermoplastic is to be 5-10 mm thick, struck off 2-3 mm above the surface and over banding the groove by 10 mm. Regular paint is acceptable on first lift; markings to be repainted a maximum of once per year at the discretion of the Town. See TAC Manual for pattern requirements.
- 3.4.7.6 All traverse crosswalk lines are to be 200 mm in width.

- 3.4.7.7 Regular paint must be placed on the first lift of asphalt and is required for CCC issuance.
- 3.4.7.8 The Roads department must be contacted a minimum of 72 hours prior to any installation of line painting or road markings as they may request to be present to ensure quality application.
- 3.4.7.9 New technologies may be accepted at the discretion of the Roads department.
- 3.4.7.10 The Town reserves the right to require the installation of additional signage and/or road markings, not indicated on the approved signage and road marking drawing, at the time of CCC inspection.

3.4.8 Paved Roads and Lanes

- 3.4.8.1 Lanes shall be paved at the same time as base course of adjacent roads and roads having access to the lane.
- 3.4.8.2 Prior to application for CCC inspection, all asphalt within lanes must be placed in accordance with the latest version of the City of Calgary's Roads Construction Standard Specifications.
- 3.4.8.3 All structural asphalt designs must be submitted prior to surface approval.
- 3.4.8.4 All paved lane rehabilitation and new construction must follow the requirements outlined in [Appendix I](#).

3.4.9 Street Lighting

The Town has adopted the Street Lighting standards established by the latest version of the City of Calgary's Standard Specifications for Street Lighting Construction. All developers conducting work within the Town must adhere to these guidelines. Please note that the following specifications are in addition to, and supersede, the City of Calgary's standards:

- 3.4.9.1 The following is a list of lighting fixtures approved for use on public roads within the Town:
 - Standard Lights shall be COBRA HEAD LED lights, structure number 1460;
 - Decorative Lights shall be DOMUS LED lights, structure number 1488; Traditionaire (Coach) LED Lights, structure number 1474 - LED; or Contemporary Coach LED lights, structure number 1473 - LED.

3.4.9.2 At the discretion of Development services, alternate luminaires from the latest version of Fortis Alberta’s street lighting catalogue, with a maximum BUG Rating of B3/U3/G3, may be considered.

3.4.9.3 All designed illumination levels must comply with the Illuminating Engineering Society of North America (IESNA) guidelines.

3.4.10 Signs, Banners and Decorations

3.4.10.1 Any developer or builder, who wishes to install advertising signs, banners, decorations and/or fixtures interpreted by the Town as such, must obtain written approval from Development Services prior to installation. Any advertising signs, banners, decorations and/or fixtures interpreted by the Town as such, installed without written approval, will be removed at the cost of the developer(s) and/or builder(s) responsible for their installation.

3.4.10.2 Any developer or builder, who installs approved advertising signs, banners, decorations and/or fixtures interpreted by the Town as such, must maintain, repair, replace, or remove these elements to the satisfaction of the Town for the life of the Development.

3.4.10.3 Should the Town consider the maintenance of the above noted elements unsatisfactory, written notice will be issued by Development Services outlining the maintenance required.

3.4.10.4 Required maintenance must be completed within thirty days of notification by the Town.

3.4.10.5 It is the responsibility of the Developer to remove advertising banners, signage, and decorations installed in each phase on their behalf upon receiving the last FAC for that phase, unless otherwise directed by Development Services.

3.4.10.6 The life of the development shall be deemed concluded when the last FAC in the last phase of the community has been issued.

3.5 Parks and Pathways

3.5.1 Waste Containers, Bag Dispensers and Signage

3.5.1.1 A minimum of one waste container, a post with signage and one dog bag dispenser shall be installed at each access point to a pathway system.

- 3.5.1.2 Each signage post must include “YOU MUST LEASH AND CLEAN UP AFTER YOUR DOG” and “NO SMOKING WITHIN 5M OF PLAYGROUND/SPORTS FIELD”. See [Appendix H](#) for applicable Town of Cochrane signage diagrams.
- 3.5.1.3 Only Sudden Fun - Pet Waste Single Pull Bag dispensers shall be used.
- 3.5.1.4 Only Haul-all HBIS Hid-A-Bag I (265L) waste containers in Neufeldt green shall be used.
- 3.5.1.5 All parks related signage (location and material) to be approved by the Parks department during the landscaping drawing review.

3.5.2 Irrigation

- 3.5.2.1 Irrigation systems shall not be installed above or below a retaining wall or directly on, above, or below a slope in excess of 15%.
- 3.5.2.2 Irrigation systems must include a water meter and stub in for non-potable water source after a double check valve. The water meter sizing must be approved by the Water Wastewater Department and meters must be purchased through the Town Safety Codes Department.
- 3.5.2.3 Irrigation systems must be compatible with the Exact E.T climate based irrigation program.
- 3.5.2.4 Record As-built drawings of irrigation networks and details are required prior to application for CCC.

3.5.3 Pathways

- 3.5.3.1 All pathways must be 3 m wide paved asphalt with a 1 m buffer strip on each side.
- 3.5.3.2 The maximum slope permitted within the 1 m buffer strip is 5:1; exemption may be granted where environmental impact is a consideration, at the Town’s discretion.
- 3.5.3.3 All pathways intersecting concrete or vegetated swales shall be constructed with barrier free access and shall follow the City of Calgary Access Design Standards for covers and grates.

3.6 Site Conditions

3.6.1 Soil Conditions

3.6.1.1 All sites require the submission of a Geotechnical Report unless otherwise directed by the Civil Land Development Department. Additional reports may be requested at the discretion of the Civil Land Development Department.

3.6.1.2 Bearing Certificates, prepared by a qualified Geotechnical Engineer, are required for all residential lots in the Town. This also applies to all parcels developed with strip and pad footings.

3.6.2 Erosion and Sediment Control (ESC)

3.6.2.1 All Developments require the submission of an Erosion and Sediment Control plan in conformance with the Town’s Erosion and Sediment Control guidelines.

3.6.2.2 Developers and/or engineering consultants for the developer must ensure the adequate construction, implementation and maintenance of all erosion and sediment control devices indicated in the ESC report, drawings and details. Additional ESC devices, beyond those indicated in the above noted documents, may be required at the Civil Land Development Department’s discretion.

3.6.2.3 Developers and/or engineering consultants for the developer must ensure street sweeping and/or scraping is conducted within 24 hours of receiving written notice from the Town. The Town reserves the right to hire a sweeper on the Developer’s behalf should the Town feel, at its sole discretion, the sweeping schedule is not adequate.

3.6.3 Subdivision Lot Grading

3.6.3.1 Lot grading is to conform to the grades and tolerances outlined in the Town’s current Surface Drainage Bylaw.

4.0 AutoCAD Submission Standards

The standards described in this manual are to assist applicants in providing the required digital Computer Aided Drafting (CAD) information in the correct format and appearance for acceptance by the Town. ***These standards apply to coversheets only.*** Block profiles are to remain consistent with the City of Calgary’s Standard Block Profiles Specification, most recent version.

4.1 Drawing Format

All AutoCAD files submitted to the Civil Land Development Department are to be AutoCAD 2004 or newer. All other formats will not be accepted.

4.2 Drawing Submission

AutoCAD files (.dwg) must be placed on a CD/USB with the associated PDF files for the current submission. All information needed to reproduce the submitted PDF's is required to be included on the disc. The disk must be clearly labeled with the subdivision/development name, phase number (if applicable), Consultant information, and date submitted.

Please note that as-built drawing submissions in this format are required prior to the release of CCCs and FACs.

4.3 Drawing Presentation

A template for AutoCAD drawing submissions is available on the Town's website. Drawings submitted must conform to the following rules:

1. All drawing objects and text must be located in model space.
2. All drawing objects to be shown at actual length and in ground coordinates based on NAD83 3TM projection, central meridian -114 with no scaling, rotating, or shifting required. Local Datum is not permissible. The template available on www.cochrane.ca contains the Town of Cochrane's municipal boundary for a spatial representation of where the CAD data is to be located within model space.
3. Drawing must be purged of all definitions that are not used such as: layers, layer filters, text styles, dimension styles, blocks, etc.
4. Drawing must contain line work relevant only to the current submission (Existing and future information **not** pertaining to the development shall be removed). The line work of existing utilities is to be included when it has been tied into for reference purposes only.
5. All objects must be on its correct layer. *Figure 1: Standards Blocks and Layering Conventions* in the AutoCAD template provides a visual representation of what colors and line types are associated with each layer/object.
6. Duplicate objects and text are to be removed.
7. External References are to be bound within the drawing (and their layer names converted to conform). All other references that are not required are to be removed.

4.4 Digital Data Structure

All objects contained within the drawing are to be of the following:

- Line
- Point Feature
- Text
- Dimension

4.4.1 Line

All linear features within the drawing are to be on its correct layer. Linear features are created by the AutoCAD commands, line, circle, arc and polyline. Lines representing a segment of any utility are to be one segment from point feature to point feature. For example, a water main is drawn as a polyline or line from each valve, reducer, etc. to the next point feature. The lines representing utilities are not to be broken at curves; they are to be one polyline until the next point feature. The exceptions to this rule are water mains that have a 45° or greater bend; the bend is treated as a point feature without requiring symbolic representation.

4.4.2 Point Feature

Point features within the drawing are to be represented by a point or a block. Points or Blocks shall be 'snapped' to linear features. For a complete list of features to be represented by points or blocks, and how they are to appear, refer to *Figure 1: Standard Blocks and Layering Conventions* on pages 16-17. All blocks are to be inserted on the layer that corresponds with the feature. Point Features are not to be exploded.

4.4.3 Text

All text within the CAD file is to be in model space. Text is to be on a layer associated to its purpose, with a '-TXT' suffix. For example, text that is labeling water would be on the "WAT-TXT" layer. For a complete list of layer conventions, refer to *Figure 1: Standard Blocks and Layering Conventions* found within this document. Only true AutoCAD fonts are to be used.

4.4.4 Dimensions

All dimensions within the CAD file are to be in model space. Dimensions are to be on a layer associated to its purpose, with a '-DIM' suffix. For example, dimensions that are labeling water would be on the "WAT-DIM" layer.

4.5 Layer Naming Conventions

All drawings submitted to the Town of Cochrane are to follow a specific format for layer names. This assigned format ensures that the incorporation of CAD data into the Town's GIS system is accurate and complete. Please refer to *Figure 1: Standard Blocks and Layering Conventions* for all required layer names. Other information included in the submitted CAD file, but not listed within figure 1 must follow the same naming structure as outlined below:

11-222-333

- 1- Group: storm, sanitary, surface, water, pond, etc.
- 2- Actual Feature: manhole, lip of gutter, Watermain, etc.
- 3- Extra Definition: abandoned, material, existing, etc.

Figure 1

Town of Cochrane Standard Blocks and Layering Conventions

BLOCKS

GEO-BH		SAN-5A		STM-5A		WAT-HYD	
GEO-MW		SAN-5A-EX		STM-5A-EX		WAT-HYD-EX	
GEO-TP		SAN-CHMK		STM-1S		WAT-RED	
		SAN-FLOW		STM-1S-EX		WAT-RED-EX	
				STM-CB		WAT-VLV-LIN	
				STM-CB-EX			
				STM-CHMK			
				STM-FLOW			

LAYER AND LINETYPES

LAYER NAME	DESCRIPTION	APPEARANCE	ADDITIONAL
CONTOURS			
CNT-MJR-DD-MM-YYYY-XX	CONTOUR MAJOR		DATE OF WHICH SURVEY WAS CONDUCTED- IF DESIGN CONTOURS, DATE NOT APPLICABLE BUT DESCRIPTION TO SUIT.
CNT-MNR-DD-MM-YYYY-XX	CONTOUR MINOR		
*XX- ABBREVIATION OF WHAT THE CONTOURS ARE DISPLAYING- OG,EG,GW,ETC.			
GEOTECHNICAL			
GEO-BH	BOREHOLE		
GEO-MW	MONITORING WELL		
GEO-TP	TEST PIT		
LEGAL			
LGL-BLK	BLOCK LINE		
LGL-LOT	LOT LINE		
LGL-RW	RIGHT OF WAY		LABEL ACCORDINGLY
POND			
PND-BTM	POND BOTTOM		
PND-HWL	HIGH WATER LEVEL		
PND-INLT	POND INLET		
PND-NWL	NORMAL WATER LEVEL		
PND-OTLT	POND OUTLET		
SANITARY			
SAN-DIM	SANITARY DIMENSIONS		
SAN-FLOW	SANITARY FLOW ARROW		
SAN-FM	SANITARY FORCE MAIN		
SAN-LFT STA	SANITARY LIFT STATION		
SAN-MAIN	SANITARY MAIN		
SAN-MAIN-AB	SANITARY MAIN ABANDONED		
SAN-MH	SANITARY MANHOLE		
SAN-SRV	SANITARY SERVICE		
SAN-SYP	SANITARY SYPHON		
SAN-TXT	SANITARY TEXT		
SAN-XXX-EX	ANY EXISTING SANITARY INFO		

ALL BLOCKS AND LINETYPES ARE AVAILABLE IN THE COCHRANE-CAD TEMPLATE.dwt DISTRIBUTED WITH THIS MANUAL. THE TEMPLATE MAY ALSO BE REQUESTED FROM THE TOWN OF COCHRANE ENGINEERING OR GIS DEPARTMENTS.

CONTINUED ON NEXT PAGE.

Figure 1 cont'd

Town of Cochrane Standard Blocks and Layering Conventions

LAYER AND LINETYPES

LAYER NAME	DESCRIPTION	APPEARANCE	ADDITIONAL
SURFACE			
SF-DIM	SURFACE DIMENSIONS		
SF-EOP	EDGE OF PAVEMENT		
SF-EOP-TXT	EDGE OF PAVEMENT TEXT		
SF-FNC-BRB	BARBED WIRE FENCE		LABEL ACCORDINGLY
SF-FEN-CL	CHAIN LINK FENCE		LABEL ACCORDINGLY
SF-FNC-PC	POST AND CABLE FENCE		LABEL ACCORDINGLY
SF-FNC-WD	WOOD FENCE		LABEL ACCORDINGLY
SF-GDRL	GUARDRAIL		
SF-LOG	LIP OF GUTTER		
SF-LOG-TXT	LIP OF GUTTER TEXT		
SF-PATH	PATHWAY		
SF-STNAME	STREET NAME		
SF-SWL	SWALE		
SF-TXT	SURFACE TEXT		
SF-WALK	SIDEWALK		
SF-XXX-EX	ANY EXISTING SURFACE INFO		
STORM			
STM-CB	CATCH BASIN		
STM-CB-LEAD	CATCH BASIN LEAD		
STM-CVT	CULVERT		
STM-DIM	STORM DIMENSIONS		
STM-FLOW	STORM FLOW ARROW		
STM-MAIN	STORM MAIN		
STM-OTFL	STORM OUTFALL		
STM-SCTR	STORM SCEPTOR		
STM-SRV	STORM SERVICE		
STM-TRP LOW	STORM TRAP LOW		
STM-TXT	STORM TEXT		
STM-WTD	STORM WEEPING TILE		
STM-XXX-EX	ANY EXISTING STORM INFO		
WATER			
WAT-DIM	WATER DIMENSIONS		
WAT-FCLT	WATER FACILITIES		
WAT-FIT	WATER FITTINGS		
WAT-HYD	WATER HYDRANT		
WAT-HYD-LEAD	WATER HYDRANT LEAD		
WAT-MAIN	WATER MAIN		
WAT-MAIN-AB	WATER MAIN ABANDONED		
WAT-PMP-STA	WATER PUMP STATION		
WAT-RES	WATER RESERVOIR		
WAT-SRV	WATER SERVICE		
WAT-TXT	WATER TEXT		
WAT-VLT	WATER VAULT		
WAT-VLV-LIN	WATER VALVE-LINE		
WAT-VLV-PRV	WATER VALVE-PRV		
WAT-XXX-EX	ANY EXISTING WATER INFO		

ALL BLOCKS AND LINETYPES ARE AVAILABLE IN THE COCHRANE-CAD TEMPLATE.dwt DISTRIBUTED WITH THIS MANUAL. THE TEMPLATE MAY ALSO BE REQUESTED FROM THE TOWN OF COCHRANE ENGINEERING OR GIS DEPARTMENTS.

APPENDIX A

Drawing Submission Requirements for Subdivision Development

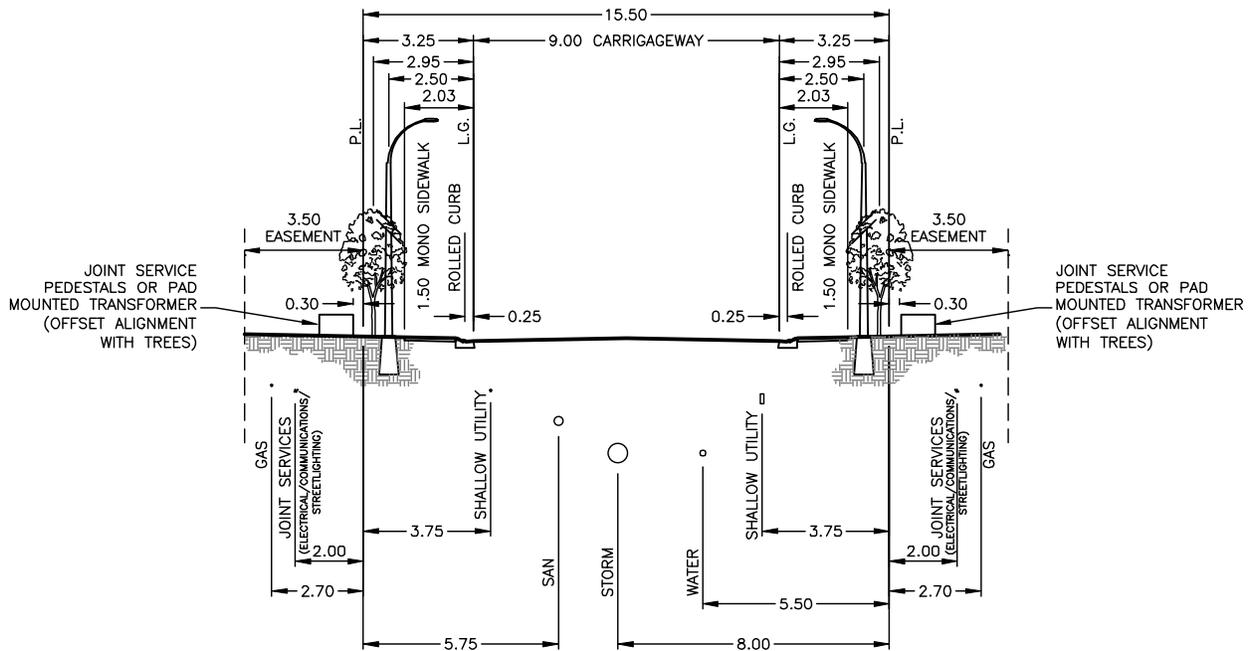
SUBDIVISION DRAWING REQUIREMENTS

Description	Drawing No.
Title Sheet and Index of Drawings	To Suit
Outline / Concept Plan	To Suit
Tentative Plan	To Suit
Roads and Sidewalks and Road Cross Sections	A
Sanitary Layout	B
Storm Layout	C
Water Mains	D
Building Grade Plan	E
Drainage Areas	F
Overland Drainage	G
Special Details	H
Pond Details	J
Signage and Road Marking Plan	SNG
Cut and Fill Plan	GRD (X)
Erosion and Sediment Control - Pre/Post Development / Details	ESC (X)
Landscaping Plan / Irrigation Network Details	LND
Turning Movements and Radii Plan **	TNR
Retaining Walls / Details / Design Calculations **	RTW (X)
Traffic and Noise Analysis Plan **	SND (X)
Site Plan **	SP (X)
Electrical **	ELT (X)
Mechanical **	M (X)
Structural **	S (X)
Plan / Block Profiles	XX

- All drawings are to be presented in the above order.
- All drawings to have a scale bar.
- (X) Denotes a numerical or alphanumeric identification to be determined by the consulting engineer when more than 1 of the drawing categories is required.
- (XX) Denotes a numerical or alphanumeric identification to be determined by the consulting engineer.
- (**) These drawings will be required at the discretion of the Civil Land Development department. This will be determined on a project to project basis.
- All watermain fittings (tees, reducers, bends, etc.) are to be shown and labelled with sizes.
- All valves are to be labeled VLV-XX.
- All hydrants are to be labeled HYD-XX.
- All sanitary manholes are to be labeled S-XX. Manhole types are to be shown.
- All storm manholes are to be labeled ST-XX. Manhole types are to be shown.
- All catch basins to be labeled CB-XX including type and ICD size when applicable. Labeling shall be required by each catch basin lead.
- All traffic sign locations are to be shown on the landscaping plan. Labeling the type of sign is not required.

APPENDIX B

Residential Street Cross Section



1 RESIDENTIAL
SCALE 1:200



NO.	DATE	REVISION	BY

Town of Cochrane			
RESIDENTIAL STREET CROSS SECTION			
SCALE: 1:200	DATE: DEC 9, 2019	DRAWING NO: RES XS-001	NOTES:
DRAWN BY: T.H.	CHECKED BY:		METRIC DIMENSIONS ARE IN METERS

APPENDIX C

Sanitary Design Table

Sanitary Subdivision Design Table

Area(s)	From MH	To MH	Catchment (ha)	Number # of units	Density	Incremental Population	Total Population	Peaking Factor ≥ 2.5	Design Flow (Q _{PDW}) L/s	Design Flow (Q _{PWW}) L/s	Nominal Size mm	Actual Size mm	Material	Slope %	Length m	Velocity Flowing Full m/s	Capacity Flowing Full (Qc) L/s	Q _{WWF} /Qc < 86% then ok	Actual Velocity m/s	

Alberta Environment Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems

If no existing data exists, the peak (population-generated) flow for a residential population may be determined by the following formula:

$$Q_{PDW} = \frac{G \times P \times Pf}{86.4}$$

where: Q_{PDW} = the peak dry weather design flow rate (L/s)
 G = the per capita average daily design flow (L/d)
 P = the design contributing population in thousands
 Pf = a "peaking factor".

The peaking factor (Pf) should be the larger of 2.5 or Harmon's Peaking Factor

where:

$$\text{Harmon's Peaking Factor} = 1 + 14/(4 + P^{1/2})$$

where:

P = the design contributing population in thousands.

Manning equation is generally used in sizing the sewers:

$$Q = \frac{1.00}{n} AR^{3/4} S^{1/2}$$

where: Q = Quantity of flow (m³/s)
 n = Roughness coefficient (common value used is 0.013; lower value may be used for PVC pipes based on manufacture's recommendation)
 A = Cross sectional area of flow (m²)
 R = Hydraulic Radius (m)
 S = Slope (m/m).

Flow rate at a depth of 80% of the sewer diameter is approximately 86% of the sewer full capacity. Therefore, the required flow capacity for sizing of the sewer is computed using the following relationship:

$$\text{Required sewer capacity} = \frac{\text{Estimated design flow}}{0.86}$$

Additional Parameters

Residential Average Daily Flow	240 L/Person/Day (Town of Cochrane Sanitary Sewer Master Plan)
Population Density	2.6 People/Unit (Used in future Cochrane Reservoir expansion projects)
Manning's n	0.013 Alberta Environment (See Mannings Equation)
Infiltration Allowance	0.28 L/s/ha (Alberta Environment)

Note: Determining the actual velocity requires the use of Manning's "Flow in Partially Full Pipes" graph

Hydraulic Radius m (Used in calculating V Flowing Full)

Flow Area m² (Used in calculating Qc)

APPENDIX D

Geotechnical Requirements

1.0 Geotechnical Report Requirements

A geotechnical report and investigation are required for every subdivision phase of development within the Town of Cochrane. This report is required in addition to any preliminary geotechnical investigation and reports carried out for the entire area of the subdivision. The geotechnical report must be signed and sealed by a qualified Geotechnical Engineer entitled to practice in the province of Alberta.

In addition to the City of Calgary Guidelines, the geotechnical report and investigation shall address all pertinent aspects including but not limited to:

- Purpose, site description and methodology.
- Subsurface soil conditions and groundwater levels.
- Geotechnical evaluations and recommendations including but not limited to site preparation, grading, excavations, foundations systems, soil bearing capacity, frost protection, concrete, weeping tile, lateral earth pressures, Utility trenches and roads.
- Retaining Wall design (if applicable)
- Slope Stability Analysis
- Site diagram and test hole locations
- Test Hole Logs
- Laboratory testing including but not limited to particle size distribution (sieve and hydrometer), Atterberg Limits, Sulphate content, moisture content, California Bearing Ratio (CBR), and unconfined compressive strength.

Additional information relevant to all aspects of the geotechnical report may be requested at the discretion of the Civil Land Development Department.

2.0 Geotechnical and Material Testing Requirements

In addition to the City of Calgary Guidelines, the Town of Cochrane requires that all contractors and consultants adhere to the following requirements pertaining to material testing for subdivisions. These requirements are applicable to all new construction **and** all existing subdivisions where outstanding soil, asphalt or concrete work is present.

2.1 Compaction Testing

All compaction testing must be carried out by a qualified geotechnical consultant. The Geotechnical consultant must monitor the backfill operation on a full time basis. Failure to have a geotechnical consultant on site during backfill operations may result in the issuance of a stop work order.

Density test must be carried out using a Nuclear Densometer in good standing with the Canadian Nuclear Safety Commission. The geotechnical consultant must ensure that a minimum of 98% of the Standard Proctor Maximum Dry Density is achieved in the field during all backfill operations. Representative soil samples are to be collected by the geotechnical consultant to ensure that accurate proctor density and moisture values are being used. The geotechnical consultant shall ensure that soil moisture contents in the field are as follows:

Fine Grained Soils to have moisture content of 0 to +3% of its optimum moisture content

Coarse Grained Soils to have moisture content of +/- 3% of its optimum moisture content.

2.1.1 Rough Grading

Density tests must be carried out at a minimum of 30 meter grids at no less than every 500 millimeters per total depth of fill.

2.1.2 Underground Utilities

Density tests must be carried out at every Manhole, Watermain Valve, Watermain Hydrant, and any other underground structure such as Valve Chambers, or oversized Manhole structures.

2.1.3 Service Connections

Density tests must be carried out at no less than every third service connection and at a minimum of every 500 millimeters of the total trench depth.

Tests must be located adjacent to the curb box or within the service trench.

2.1.4 Shallow Utilities Crossings

Density tests must be carried out on every shallow utility crossing trench at a minimum of every 300 millimeters of the total trench depth.

2.1.5 Roads, Lanes and Pathways Sub-grade

Density tests must be carried out at a minimum of 50 linear meters per total length at finished grade.

2.1.6 Roads, Lanes and Pathways Sub-base

Density tests must be carried out at a minimum of 50 linear meters per total length at finished grade. A particle size analysis is required.

2.1.7 Roads, Lanes and Pathways Base-course

Density test must be carried out at a minimum of 50 linear meters per total length at finished grade. A particle size analysis is required.

2.1.8 Sidewalk Sub-grade

Density test must be carried out at a minimum of 50 linear meters per total length at finished grade.

Please note that these requirements apply to all types of sidewalks.

2.1.9 Curb and Gutter Sub-grade

Density test must be carried out at a minimum of 50 linear meters per total length at finished grade.

Please note these requirements apply to both curbs and gutters individually.

2.1.10 Drainage Swales Sub-grade

Density tests must be carried out at a minimum of 50 linear meters per total length at finished grade.

2.1.11 Catch Basins

Density test must be carried out on every catch basin lead trench at a minimum of every 300 millimeters of the total trench depth.

2.2 Proof Rolls

Proof rolls are required for all sub-grade and base-course. The Civil Land Development department must be notified of all proof rolls and may choose to attend at our discretion.

Proof roll results must be submitted in the form of a drawing detailing all undercuts and any other recommendations made by the geotechnical consultant. All results and detailed rehabilitation recommendations must be provided to the Town prior to the release of the Paved Roads and Lanes CCC.

The Civil Land Development department reserves the right to reject any CCC or FAC application, or issue a stop work order in the field should these requirements not be met.

2.3 Drop Test on Bedding Gravels

As per The City of Calgary Guidelines, The Town of Cochrane requires drop tests on all bedding materials within the pipe zone during underground utilities construction, including catch basin leads.

The Drop Test will include Class 1A and 1B materials both for pipe 375 millimeters and smaller, and pipe larger than 375 millimeters in diameter.

Type 1 installation embedment must achieve a minimum of 95% of the SPD utilizing Class 1A or 1B material. Type 1 installation requires that the material, density and method of installation be certified by a Professional Engineer.

Type 2 installation embedment must achieve a minimum of 90% of the SPD utilizing Class 1A, 1B, or II material, or a minimum of 95% of the SPD utilizing Class III material.

Type 3 installation embedment must achieve a minimum of 85% of the SPD utilizing Class 1A, 1B, or II material, or a minimum of 90% of the SPD utilizing Class III material.

Type 4 installation embedment must be achieved with no extra compaction utilizing Class 1A, 1B, II or III material, or compacted to 85% of the SPD utilizing native materials.

Drop Test is required for every new phase of construction, and/or every time the material source changes. Drop test submissions must include a particle size analysis (sieve analysis), density test on each of the material types, drop distance and the location of the test and material source.

Drop test is a requirement before Construction Completion Certificates for underground utilities are issued by The Town of Cochrane.

2.4 Concrete Testing

All concrete testing must be carried out by a qualified materials testing consultant. All field-testing personnel must be CSA certified to test fresh concrete mixtures. All concrete testing must be performed using CSA approved testing equipment and following CSA guidelines for testing fresh concrete mixtures.

Concrete that does not meet the specified 28-day compressive strength, must be removed and replaced at no cost to the Town of Cochrane.

2.4.1 Sidewalks and Curb and Gutter

A minimum of two tests per each day of concrete placing, or one test per every 75 cubic meters of placed concrete are required, whichever is the greatest.

Should the Civil Land Development department authorize the placing of concrete in temperatures below 10 degrees Celsius; a minimum of three field cured cylinders are required. Field cured cylinders must be tested for compressive strength at 3, 7, and 28 days. Concrete placement and curing requirements shall comply with hot/cold requirements as per CSA A23.1, Sections 7.4.1.4 and 7.4.1.5.

These requirements apply individually to both sidewalks and curb & gutters.

These requirements apply to all concrete placing activities including hand poured tie-ins and FAC concrete maintenance repairs.

The Civil Land Development department reserves the right to reject any CCC or FAC application, or issue a stop work order in the field should these requirements not be met.

2.4.2 Drainage Swales

A minimum of one test per every 300 linear meters of swale is required.

Should the Civil Land Development department authorize the placing of concrete in temperatures below 10 degrees Celsius; a minimum of three field cured cylinders are required. Field cured cylinders must be tested for compressive strength at 3, 7, and 28 days.

2.4.3 Manhole Benching

A minimum of one test per every ten manholes benched is required should all ten manholes be benched on the same day.

If the ten manholes are benched on separate days, a minimum of one test per day of manhole benching is required.

2.5 Asphalt Testing

2.5.1 Paved Roads and Paved Lanes Asphalt Testing

All asphalt testing must be carried out by a qualified geotechnical consultant. In order to ensure that adequate asphalt densities are achieved during all asphalt placing operations, full time supervision by a qualified geotechnical consultant is mandatory. Failure to have a geotechnical consultant on site during all asphalt placing operations will result in the issuance of a stop work order.

Density test must be performed during the asphalt placing operations at every 50 linear meters. Density test must be carried out using a Nuclear Densometer in good standing with the Canadian Nuclear Safety Commission. The geotechnical consultant must ensure that a minimum of 96% of the maximum design density is achieved during all asphalt placing operations.

A minimum of one asphalt core is required at every 100 linear meters in order to ensure and confirm that the minimum design asphalt thickness was achieved.

A complete Marshall Test for Bituminous Mixtures is required for every asphalt sample collected.

A minimum of two Hot Mix asphalt samples per each day of asphalt placing operations are required. Each sample taken must contain the following information when the report is submitted to the Town:

- Time sample taken
- Exact location of where the sample was taken
- Type of mix of the sample
- Temperature of the sample at the time it was taken
- Ambient temperature at the time the sample was taken
- Source of sample

- Specific Lift information: first or final lift and lift thickness

Minimum placing temperatures as per the City of Calgary must be complied with at all times. The Civil Land Development department reserves the right to suspend or terminate asphalt placing operations between October 31st and May 1st, or should the ambient temperature fall below 4 degrees Celsius during placing operations.

Please note that these requirements apply to ALL asphalt placing operations including first lift and the top lift at FAC time.

All asphalt settlements and/or failures must be assessed by a qualified Geotechnical Engineer prior to any repairs being undertaken. Rehabilitations must be done as per Geotechnical Engineer's recommendations. All rehabilitation recommendations must be submitted to the Town prior to repairs being done.

The Town of Cochrane reserves the right to reject any CCC or FAC application, or issue a stop work order in the field should any of the requirements set forth in this document not be met

APPENDIX E

Slope Stability and Geotechnical Reporting Requirements

Slope Stability and Geotechnical Reporting Requirements

A Slope Stability Analysis can be provided as a standalone document or included within a Geotechnical Investigation Report (GIR).

Total slope height is the vertical height between the top of slope line and the bottom of slope line.

Top of Slope (TOS) or slope crest is the upper location within a profile where the slope angle transitions from less than 15% to greater than 15%.

Bottom of Slope (BOS) or slope toe is the lower location within a profile where the slope angle transitions from greater than 15% to less than 15%.

Current and high-resolution topography shall be completed for all Slope Stability Analysis

The TOS and BOS lines should be determined by topographic maps. If TOS and BOS lines are ambiguous, the Town of Cochrane shall be allowed to modify or determine the location of TOS and BOS lines.

Once rough grading and/or construction is complete, the project geotechnical engineer shall provide a compliance letter indicating a final inspection was completed and that final grades and loading conditions are consistent with those utilized in the Slope Stability Analysis.

When is a Slope Stability Analysis report required?

A Slope Stability Analysis is required when any slope within the property or across property lines exceeds 15% and are greater than 2 m in total slope height. This will not apply to walk out lots at the subdivision stage provided the slope has been evaluated previously and there is no change to the design.

Slope Stability Analysis Report Requirements

At a minimum, a Slope Stability Analysis shall include the following items:

- A **current** (*within 5 years*) topographical site plan with **0.5 m** contour intervals
 - LIDar, or a minimum 5 m survey grid
 - Additional survey for any top of slope, structures, site monuments, tree stands, etc.
 - Survey to be provided electronically (.dxf, .csv, etc.)
 - Report author to comment on whether survey accurately depicts current site conditions (verify that no slope movement or grading has occurred since survey was completed)
- Definition of the TOS and BOS lines throughout the development land
- Comments on any existing or potential causes of slope instability; septic fields, irrigation, pools, road construction (temporary or permanent), stormwater erosion, etc.
- The Geotechnical Investigation Report that summarizes the findings of the field investigation and laboratory testing

- Worst-case groundwater conditions based on post-development grades and how they were determined
- Analysis of any area known to have previous slope failures or major erosion within the vicinity of the site, that has the potential to affect or be affected by the development.
- Analysis of at least one cross section per 100 lineal meters of the slope and additional cross sections in areas of where specific concern or previous slope failures have been identified
- Inclusion of suitable surcharge loading conditions in each slope cross section as well as incorporation of anticipated building foundations
- Reporting a current and post-development Factor of Safety (FOS) for each cross section. A minimum FOS of 1.5 (1.0 for seismic) is required against slope failure
- Assessment of a safe set-back to property line to protect private property or buffer zone back from the crest and toe of the slope
- Details of remedial measures required to increase the FOS to an acceptable value.
- Additional comments should be provided to establish construction methodology that will allow slopes to remain stable during construction. When critical, additional slope cross sections should be provided to illustrate the slope FS during construction.
- Cohesion shall not be a permissible soil parameter unless accompanied with detailed laboratory testing as backup of the values used
- Each individual subsurface deposit shall have specific laboratory testing completed to determine soil parameters
- The internal friction angle of clay materials without specific Atterberg and Hydrometer testing shall be limited to 26 degrees
- The internal friction angle of silt materials without specific Atterberg and Hydrometer testing shall be limited to 26 degrees.
- The internal friction angle of sand materials without specific Hydrometer/Sieve testing shall be limited to 28 degrees.
- Details of a site-reconnaissance and observations should be provided. Theses should include a description of the terrain, soil or rock exposure, signs of potential instability (cracking, slumping or scarps), groundwater discharge, overland flow, erosion, and vegetation. Photographs should be provided for observations and a plan view of the location and direction of each photograph should be attached.
- The slope modeling input parameters, modeling software or method, and a direct printout of results should be provided.
- Shallow slope failure due to surface saturation should be reviewed separately from deep-seated slip surface failures.

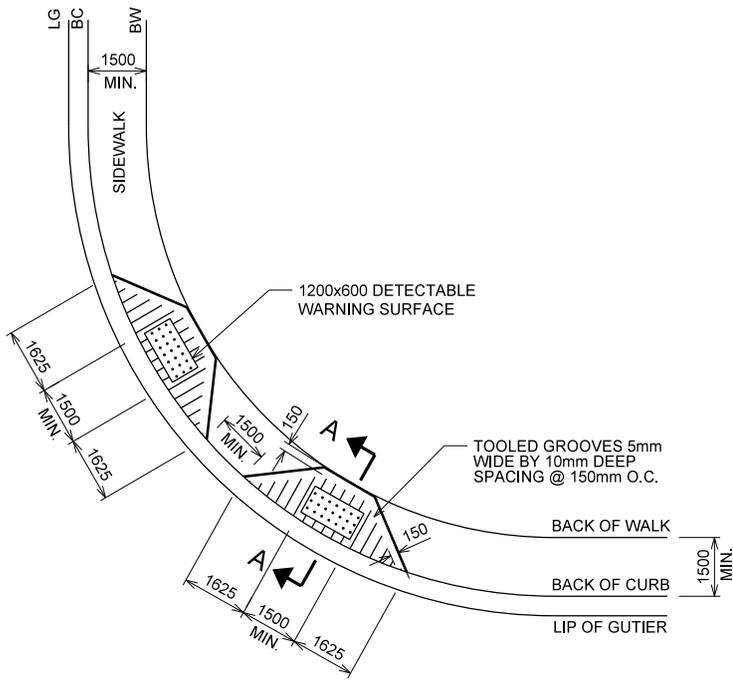
Geotechnical Field Investigation Requirements for Slope Stability Analysis

- Minimum of one borehole on the top of the slope every 100 lineal meters of slope, or a minimum of two boreholes above the slope for slopes with less than 100 lineal meters of slope over 15%
- Minimum of one borehole on the bottom of the slope every 200 lineal meters of slope, if possible. If not accessible, top of slope borehole depths are to be increased and/or additional top of slope boreholes should be drilled to allow for confident interpretation of bottom of slope subsurface conditions.
- Top of slope boreholes are to be drilled a minimum of 6 m below current grade elevation, or to 50% of the total slope height, whichever is deeper.
- If bedrock is encountered during drilling, the overall investigation should be able to demonstrate that it is not rafted (by drilling a minimum of 1.5 m into the bedrock). Coring may be necessary, depending on bedrock strength.
- In-situ strength testing (i.e. SPT) for every 1.5m of borehole drilled
- Water content testing to be completed for all samples collected
- Atterberg limits testing on representative samples of cohesive soils encountered in boreholes
- Laboratory testing to determine grainsize distribution of representative samples of cohesive soils, i.e. hydrometer testing
- Laboratory strength testing on representative, undisturbed soil samples for determining shear strength and friction angle of cohesive soils. Where slopes are to be constructed using engineered fill, laboratory strength testing is to be performed on remolded samples.

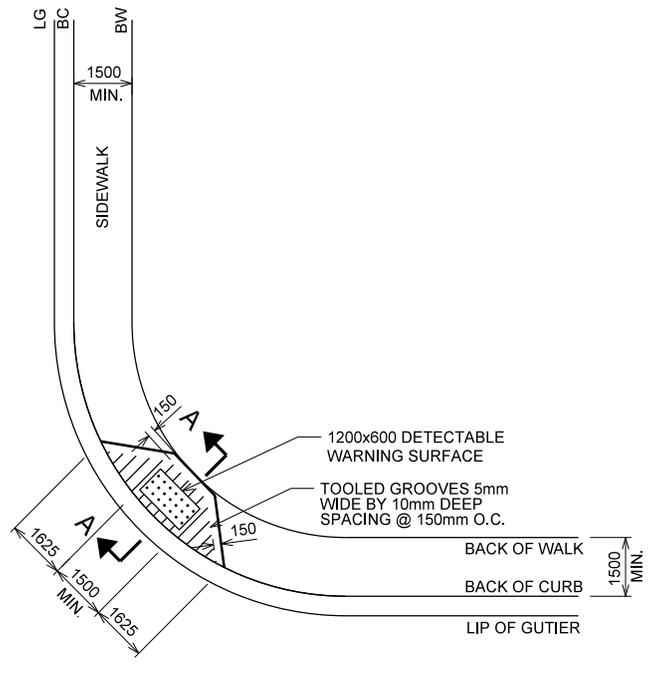
APPENDIX F

City of Calgary

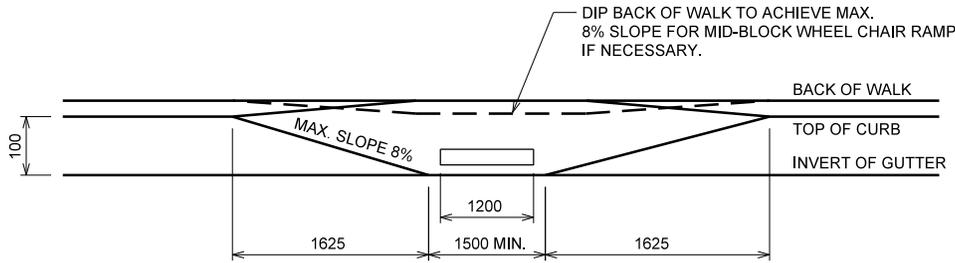
Detectable Warning Surfaces for Wheelchair Ramps



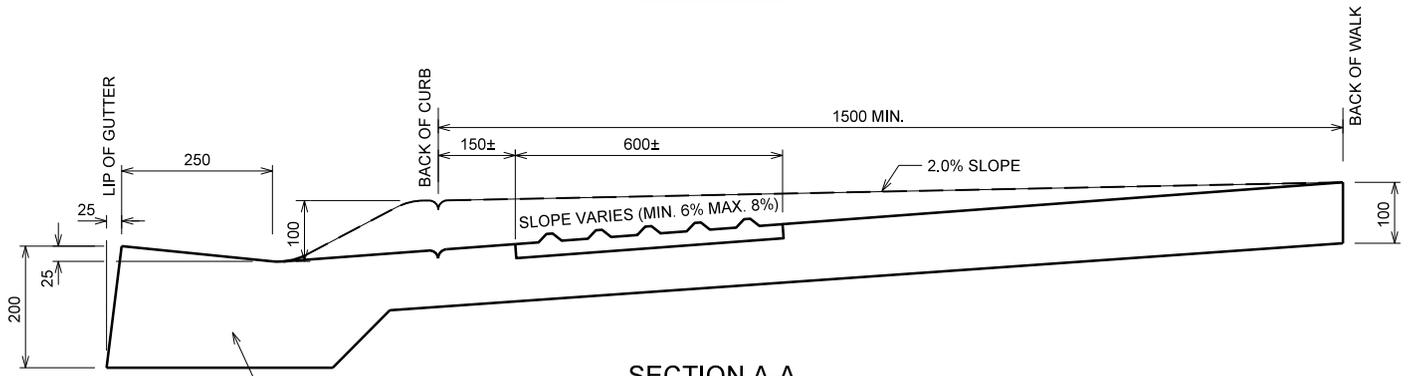
CORNER WHEEL CHAIR RAMP - DOUBLE
PLAN



CORNER WHEEL CHAIR RAMP - SINGLE
PLAN



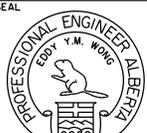
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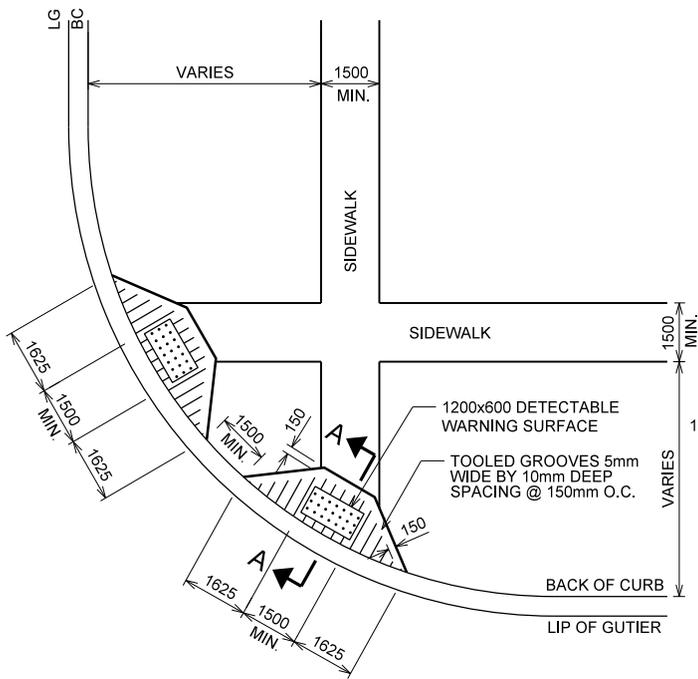


SECTION A-A

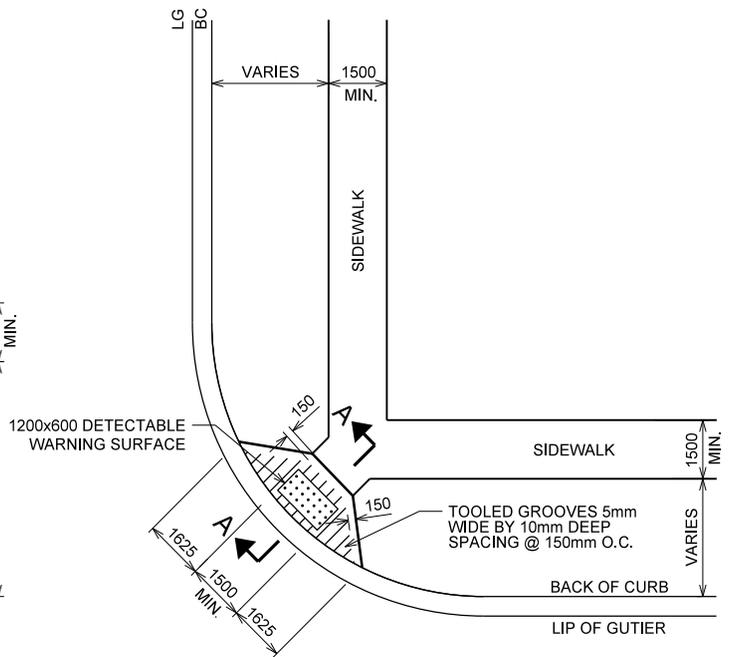
- NOTES:**
- TWO DIRECTIONAL WHEEL CHAIR RAMPS SHOULD BE INSTALLED AT ALL STREET INTERSECTION CORNERS (IF CORNER RADII AND CATCH BASIN LOCATIONS PERMIT).
 - MINIMUM 1.50m SEPARATION BETWEEN CORNER WHEEL CHAIR RAMPS.
 - MINIMUM WIDTH OF RAMP 1500.
 - RAMP SURFACE TO BE TEXTURED CONCRETE.
 - SPECIFICATIONS ARE TO MINIMUM STANDARDS. CONSIDERATION MUST BE GIVEN TO ADDRESS ACTUAL SOIL CONDITIONS AND ASSESS THE NEED FOR GRAVEL BASE, THICKER SLAB, REINFORCEMENT OR SUB-DRAINAGE SYSTEM.
 - INSTALL DETECTABLE WARNING SURFACE SO THAT THE TOP OF THE PLATE IS FLUSH WITH THE SURFACE OF THE ADJACENT SIDEWALK.

SEE STD. DWG.
454.1003.008

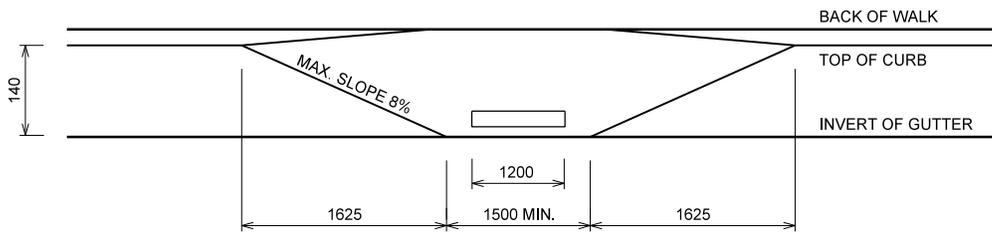
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No.	Date	Revision	App'd	No.	Date	Revision	App'd	No.	Date	Revision	App'd	No.	Date	Revision	App'd	No.	Date	Revision
PERMIT PERMIT TO PRACTICE CITY OF CALGARY Signature _____ Date _____ PERMIT NUMBER: P 04428 The Association of Professional Engineers and Geoscientists of Alberta		SEAL 		 THE CITY OF CALGARY ROADS DIMENSIONS ARE METRES OR MILLIMETRES UNLESS OTHERWISE NOTED 2:\permanent\StdRoadSpecs_2017\dwgs\4541013001_V8.dgn 03-MAY-2017 11:49				METRIC Drawn JL Date 2014-11 Designed EW Checked EW Scale: NTS				WHEEL CHAIR RAMP FOR MONOLITHIC SIDEWALK				Figure 42 File Number 454.1013.001		



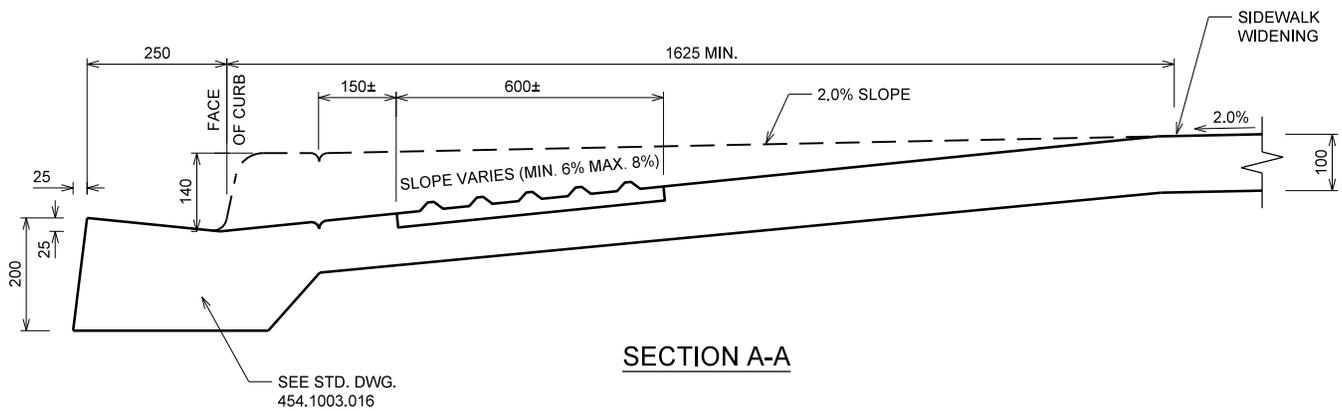
CORNER WHEEL CHAIR RAMP - DOUBLE
PLAN



CORNER WHEEL CHAIR RAMP - SINGLE
PLAN



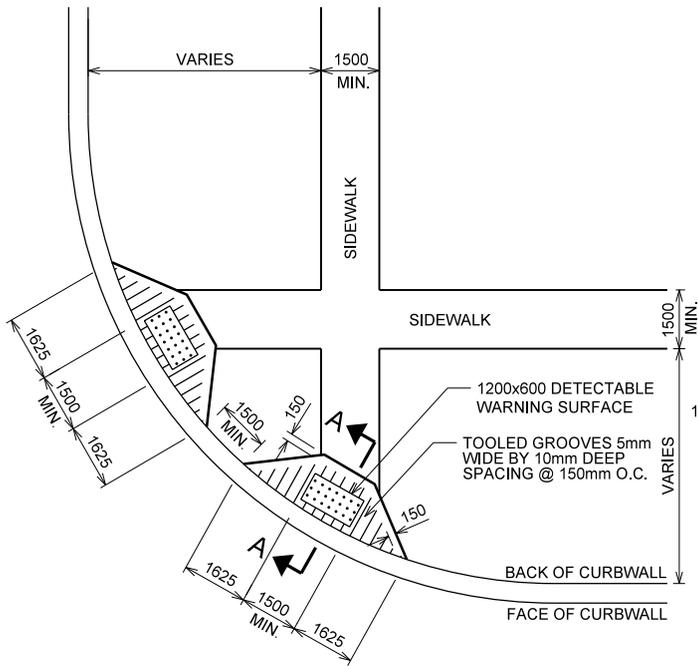
ELEVATION



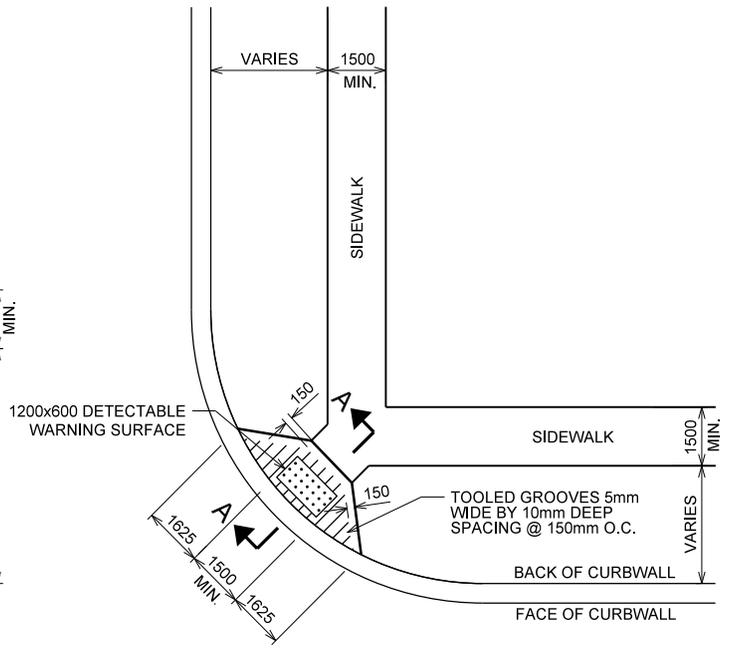
SECTION A-A

- NOTES:**
1. TWO DIRECTIONAL WHEEL CHAIR RAMPS SHOULD BE INSTALLED AT ALL STREET INTERSECTION CORNERS (IF CORNER RADII AND CATCH BASIN LOCATIONS PERMIT).
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 3. MINIMUM WIDTH OF RAMP 1500.
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 5. SPECIFICATIONS ARE TO MINIMUM STANDARDS. CONSIDERATION MUST BE GIVEN TO ADDRESS ACTUAL SOIL CONDITIONS AND ASSESS THE NEED FOR GRAVEL BASE, THICKER SLAB, REINFORCEMENT OR SUB-DRAINAGE SYSTEM.
 6. INSTALL DETECTABLE WARNING SURFACE SO THAT THE TOP OF THE PLATE IS FLUSH WITH THE SURFACE OF THE ADJACENT SIDEWALK.

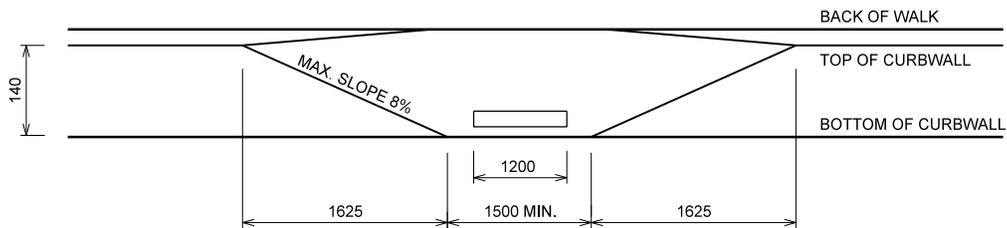
8	FEB. 2017	REVISE ZERO LIP, DETECTABLE WARNING SURFACE															
No.	Date	Revision	App'd	No.	Date	Revision	App'd	No.	Date	Revision	App'd	No.	Date	Revision	App'd	No.	Date
PERMIT PERMIT TO PRACTICE CITY OF CALGARY Signature _____ Date _____ PERMIT NUMBER: P 04428 The Association of Professional Engineers and Geoscientists of Alberta		SEAL 		 THE CITY OF CALGARY ROADS DIMENSIONS ARE METRES OR MILLIMETRES UNLESS OTHERWISE NOTED 2:\permanent\StdRoadSpecs_2017\dwgs\4541013012_V8.dgn 03-MAY-2017 11:50				METRIC Drawn JL 2014-11 Designed EW Checked EW Scale: NTS				WHEEL CHAIR RAMP FOR SEPARATE SIDEWALK				Figure 43 File Number 454.1013.012	
ISC: UNRESTRICTED																	



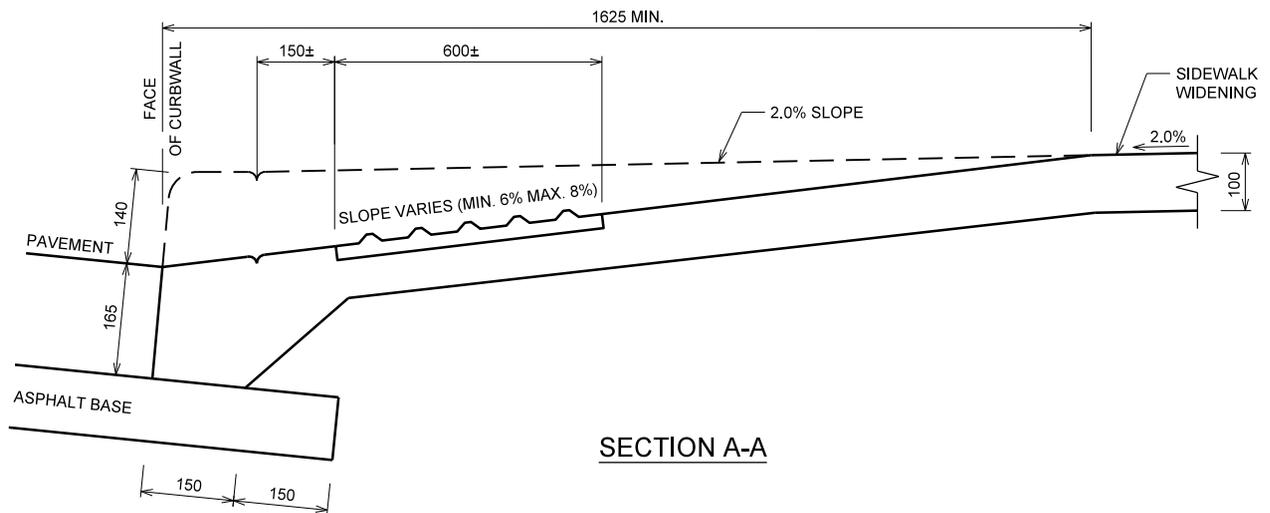
CORNER WHEEL CHAIR RAMP - DOUBLE
PLAN



CORNER WHEEL CHAIR RAMP - SINGLE
PLAN



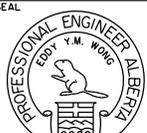
ELEVATION



SECTION A-A

NOTES:

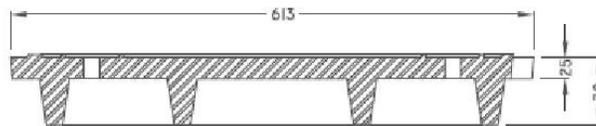
1. TWO DIRECTIONAL WHEEL CHAIR RAMPS SHOULD BE INSTALLED AT ALL STREET INTERSECTION CORNERS (IF CORNER RADII AND CATCH BASIN LOCATIONS PERMIT).
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8	FEB. 2017	REVISE ZERO LIP, DETECTABLE WARNING SURFACE													
No.	Date	Revision	App'd	No.	Date	Revision	App'd	No.	Date	Revision	App'd				
PERMIT PERMIT TO PRACTICE CITY OF CALGARY Signature _____ Date _____ PERMIT NUMBER: P 04428 The Association of Professional Engineers and Geoscientists of Alberta		SEAL 		 THE CITY OF CALGARY ROADS DIMENSIONS ARE METRES OR MILLIMETRES UNLESS OTHERWISE NOTED 2:\permanent\StdRoadSpecs_2017\dwgs\4541013017_V8.dgn 03-MAY-2017 11:51				METRIC Drawn JL Date 2014-11 Designed EW Checked EW Scale: NTS		WHEEL CHAIR RAMP WITH CURBWALL				Figure 44 File Number 454.1013.017	
ISC: UNRESTRICTED															

APPENDIX G

Manhole Lid Requirements

PLAN



SECTION

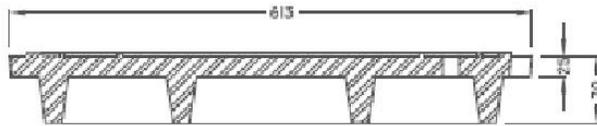
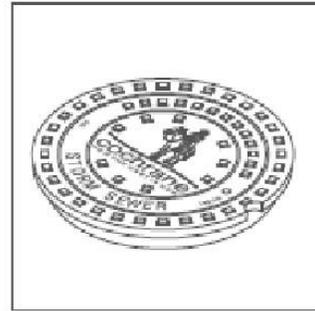
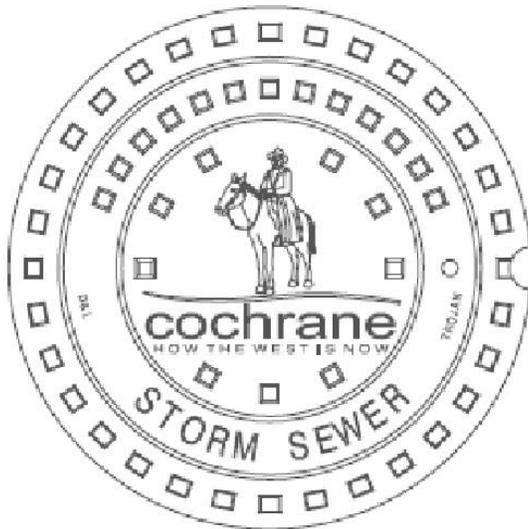
ISO 9001-2000 CERTIFIED

RATED FOR HS-20 LIVE LOAD

MEASUREMENTS IN MILLIMETERS

NO.	DATE	REVISION	BY	Town of Cochrane			
				TF-50 STANDARD COCHRANE SANITARY COVER			
				SCALE:	DATE:	DRAWING NO:	MATERIAL SPECIFICATIONS AND MASS:
				1:10	DEC 16, 2010	SAN-001	GREY CAST IRON TO CONFORM TO CLASS 20 A,S,T,M, A18 NOMINAL MASS 72KG
				DRAWN BY:	CHECKED BY:		METRIC
				R.S.			DIMENSIONS ARE IN MILLIMETERS

PLAN



SECTION

ISO 9001-2000 CERTIFIED

RATED FOR HS-20 LIVE LOAD

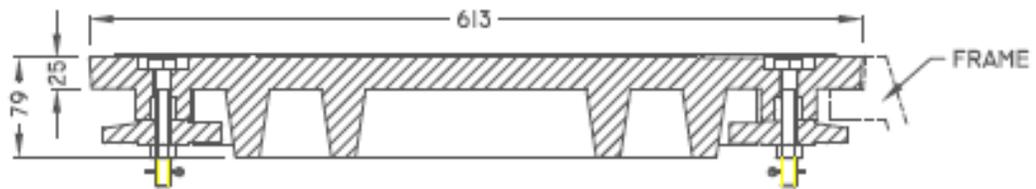
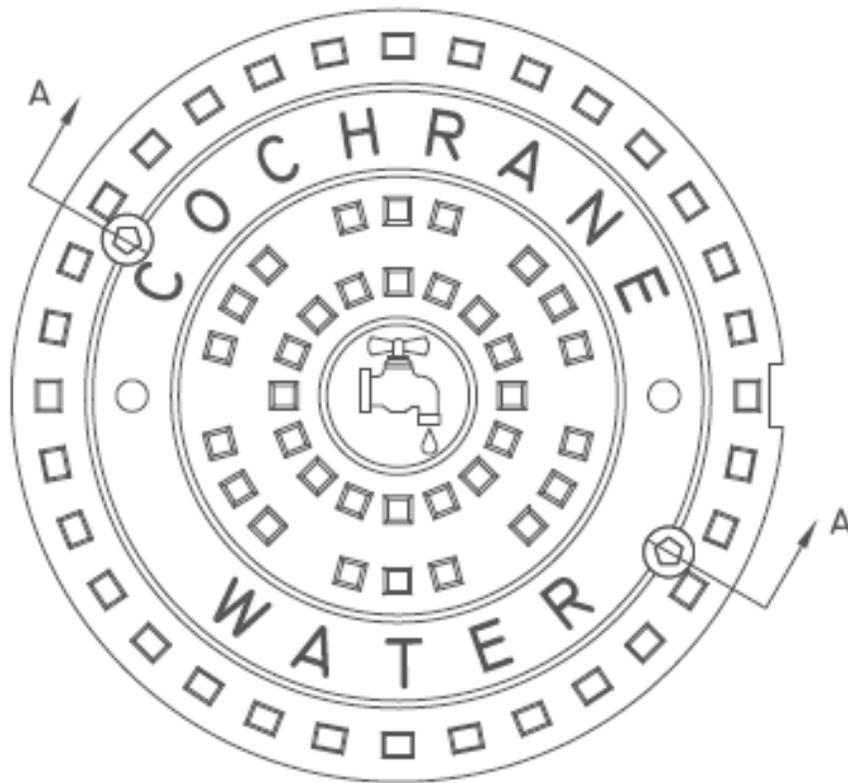
MEASUREMENTS IN MILLIMETERS

				Town of Cochrane			
				TF-50 STANDARD COCHRANE STORM COVER			
NO.	DATE	REVISION	BY	SCALE:	DATE:	DRAWING NO:	MATERIAL SPECIFICATIONS AND MASS:
				NTS		STM-001	GREY CAST IRON TO CONFORM TO CLASS 20 A,S,T,M, A48 NOMINAL MASS 72KG
				DRAWN BY:	CHECKED BY:		
				R. S.			
							METRIC
							DIMENSIONS ARE IN MILLIMETERS

WATER DOUBLE LOCK COVER

TF-50

PLAN



SECTION A-A

APPENDIX H

Town Signage

For Illustration Only

School Days:



Animal Bylaw:



Signage pertaining to the Smoking Bylaw:



APPENDIX I

Paved Lane Requirements

1.0 Recommendations for Rehabilitation of Existing Lanes

A recent pavement review showed that the existing lanes are experiencing structural failures. Any maintenance treatments, including patching, will be costly and ineffective in improving the lane condition and therefore are not recommended.

Surface rehabilitation options, such as mill and overlay, are not recommended due to the base weakness and the resurfacing would be expected to fail without base stabilization. Based on the site review, extent and severity of various distresses and failures, reviewed data, and engineering judgement, reconstruction of the failing lanes is recommended.

Pavement structures for reconstruction should follow the proposed standard sections presented in the enclosed Figure 3, as summarized in Section 2.0. Specific locations and isolated failures may warrant engineering review and customized recommendations. Construction activities should be closely monitored by engineering professionals with special attention to soil and granular compaction, subgrade stability by proof-rolling, and asphalt placement monitoring.

Longitudinal centre joint asphalt construction should be carefully monitored, and any segregation should be repaired during hot mix asphalt placement until the smoothness of the joint is uniform with the rest of the mat. Construction monitoring recommendations have been provided in Section 3.0 of this letter report. Areas of segregation can be temporarily repaired using slurry seals but as slurry seals typically only last three to five years, this is an ongoing maintenance item and repairs to segregation while the mat is still hot is a preferred method of repair.

2.0 New Lane Development

The following three sub-sections are presented for use in the Town's new lane development standards.

The location of the recommended minimum lane sections is enclosed in Figure 2 based on anticipated surficial geology deposits within the Town of Cochrane. Corresponding minimum cross-sections are enclosed in Figure 3, these structures are referenced in the development's geotechnical investigation report, or an alternate site-specific design be developed suitable for the conditions.

2.1 Quality Assurance and Construction Methodology

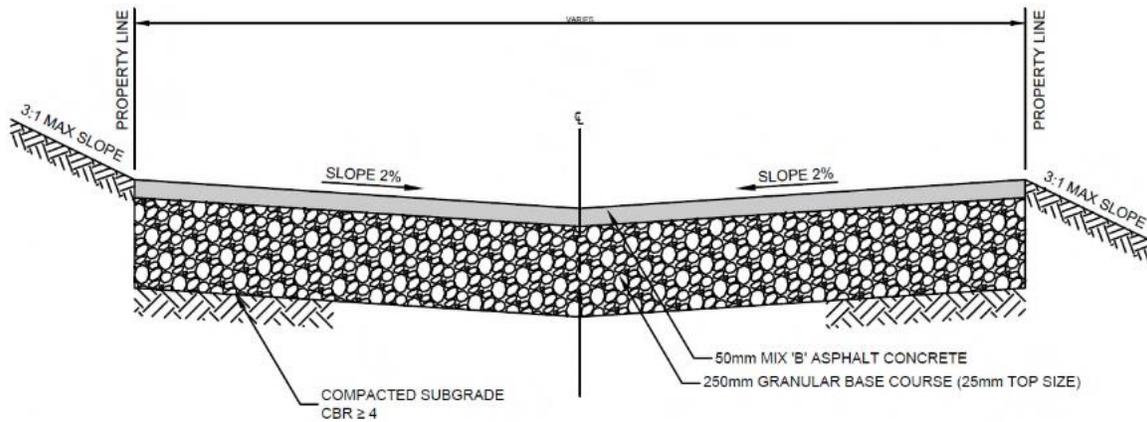
An adequate level of construction monitoring and inspection frequency is expected to reduce the occurrences of premature failure. All lane areas should be constructed utilizing quality control, quality assurance, and inspection to confirm all stages of construction have been completed in accordance with the project requirements. This would include:

- Subgrade inspection, compaction testing, and proof rolling reports.
- Granular sub-base and base course material compliance reports and compaction testing reports.
- Asphalt concrete pavement placement monitoring, loose mix sampling reports, and core testing reports.

Construction activities should be closely monitored by engineering professionals with special attention to soil and granular compaction, subgrade stability by proof-rolling, and asphalt placement monitoring. Longitudinal centre joint asphalt construction should be carefully monitored, and any segregation should be repaired during hot mix asphalt placement until the smoothness of the joint is uniform with the rest of the mat. Construction monitoring recommendations have been provided in Section 3.0.

In addition to noting the subgrade soil types identified in the site's geotechnical evaluation, observations of the prepared subgrade, including proof-roll and compaction monitoring, will help determine if the site soils are suitable for pavement construction. The proof-roll observations are intended to assess overall subgrade stability and to identify the location and extent of weak or unsuitable areas of subgrade. Once identified, these areas can be reworked, or additional measures implemented to strengthen the areas. In addition to site observations and proof-rolls, compaction monitoring of all subgrade and granular material placement should be completed.

The current lane structure for these conditions is presented below for reference. In any areas where this structure is used, the 50 mm and 200 mm thick layers of granular base and sub-base materials be replaced with a single layer of 250 mm granular base. This change is recommended due to the difficulty in properly placing and compacting a 50 mm thick layer of granular base without segregation.



Detail 1 – Current Paved Lane Structure

2.2 Structure Adjustment

Predominant site soil conditions within the Town of Cochrane warrant an increase in the pavement structure. A structure equivalent to The City of Calgary Residential Roads Standard **is required** based on observed conditions of existing residential roads in the community and strengthening requirements. The structure comparison is presented below in Table 1.

Table 1: Comparison of Asphalt Pavement Structures

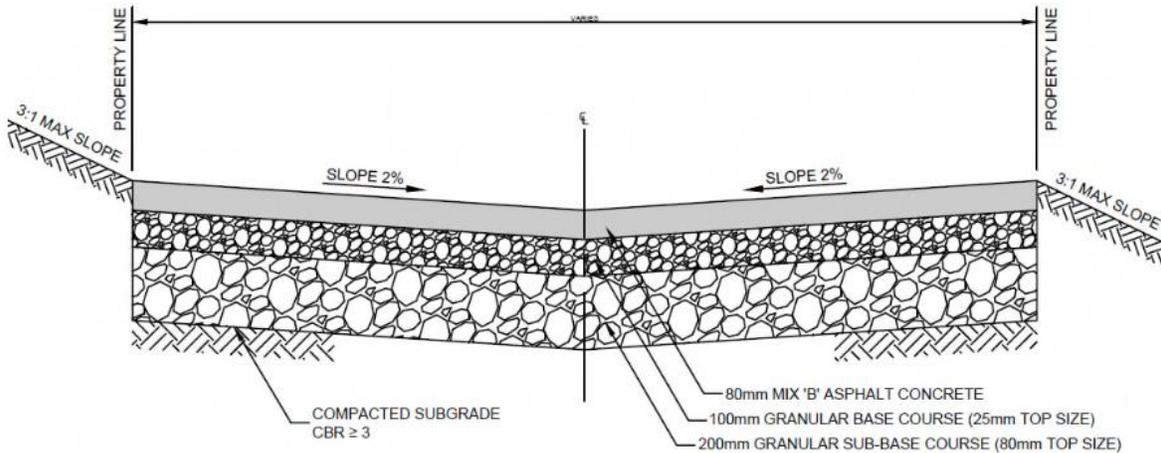
Standard Section	Design Thickness (mm)			Total Design Pavement Structure Thickness (mm)
	ACP (City Type B)	Crushed Granular Base (25 mm minus)	Crushed Granular Sub-Base (80 mm minus)	
Residential	80	100	200	380
Current Lanes	50	50	200	300

Notes: ¹ Asphalt Concrete Pavement (ACP)

The total pavement structure increases by 80 mm, including an additional 50 mm of crushed granular base and 30 mm of ACP. Much of the damage experienced by residential roads and laneways occurs during site development with the heavy construction traffic.

Furthermore, the placement of the full 80 mm of ACP during the Construction Completion Certificate (CCC) phase of the project shall be required, allowing adjacent properties to tie aprons, walkways, and landscaping elements into the final pavement elevation at the time of construction. Provided this staging, the heavy construction loading experienced by the lanes during the development period will be supported by the full ACP structure.

Note that increasing pavement structure without following the quality assurance and construction methodology recommendations detailed in Section 2.1 may not decrease the risk of lane failure.



Detail 2 – Increased Paved Lane Structure – Type 1 Areas

This lane pavement structure is recommended in all developments where silt or silty clay soils of low to medium plasticity are identified in the development’s geotechnical investigation as the primary subgrade soil type, and the California Bearing Ratio (CBR) is anticipated to be 3 or greater. Areas within the Town of Cochrane where this structure is anticipated to be appropriate are summarized in Figure 2.

2.3 Subsurface Drainage

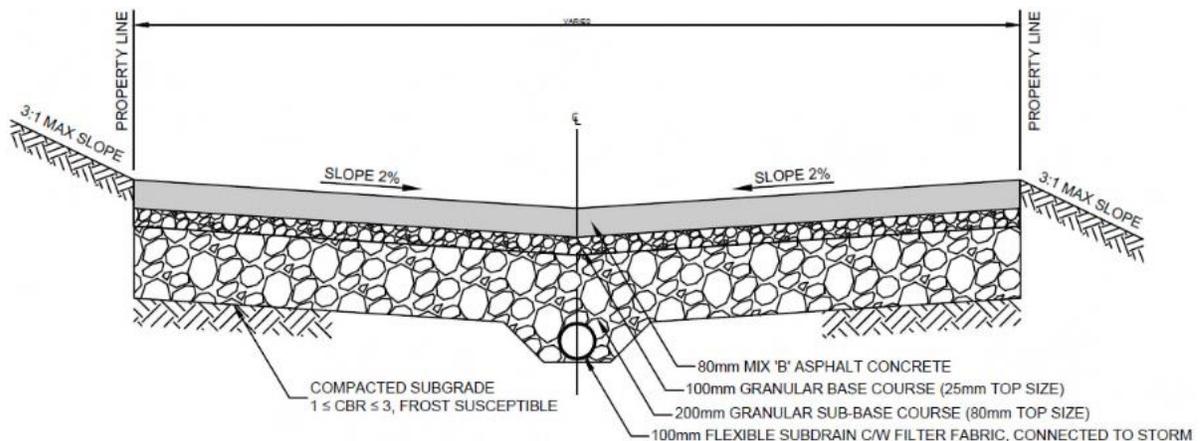
Subsurface drainage may be beneficial in selected locations where the subgrade conditions are poor and where the adjustment to the pavement structure would not eliminate the risk of subgrade saturation. It is required that the installation of a

subsurface drainage system be implemented in addition to the structure increase in these cases.

This subsurface drainage requirement is listed in The City of Calgary Roads Construction Standard Specifications, as follows:

Pavement designs shall include a review of subgrade drainage and/or water table concerns and shall provide continuous subdrains and recommendations for separation membranes, if required.

A 100 mm diameter flexible subdrain complete with filter sock installed under the reverse crown of new lanes below subgrade elevation will provide a continuous drainage pathway to the stormwater system. Adequately draining the subgrade and granular structure will help maintain the strength of the pavement and reduce the occurrence of localized failures due to moisture infiltration. A depiction of the typical cross-section is provided below in Detail 3.



Detail 3: Subdrain under Thickened Paved Lane Structure – Type 2 Areas

The Town requires an increase of the lane pavement structure to match the residential structure in combination with a subsurface drainage system in all developments where lacustrine silts, lacustrine silty clays, or low-plastic clay soils are identified in the development's geotechnical investigation as the primary subgrade soil type, and the CBR is anticipated to be less than 3. Areas within the Town of Cochrane where this structure is anticipated to be appropriate are summarized in Figure 2.

3.0 Design and Construction Details

3.1 Subgrade Preparation

Subgrade preparation must be undertaken prior to pavement construction. The recommended standard for subgrade preparation is a minimum of 98% Standard Proctor Maximum Dry Density (SPMDD) to achieve the subgrade support characteristics utilized in the pavement designs. Clay and silt soils should be compacted at a moisture content of -1% to +2% of the optimum moisture content (OMC) to maintain stability. Note that silts and silty clays may exhibit instability at moisture contents at or above optimum, which should be considered during subgrade preparation. Existing granular soils should be compacted at a moisture content of -3% to 0% of the OMC. A minimum

depth of subgrade preparation of 150 mm is in accordance with The City of Calgary Roads Construction Standard Specifications, Section 302.06.00.

Prior to placement of the granular materials, the subgrade should be proof-rolled to identify any soft areas. Subgrade areas, which may be determined to be structurally deficient through proof-rolling, should be strengthened by procedures to be evolved in the field. Strengthening procedures can include subexcavation of the subgrade for increased thickness of granular sub-base where only minimal strengthening is required. Where subgrades are weak, installation of separation membranes including non-woven and woven geotextile fabrics as well as installation of geogrids are optional.

The following are other subgrade requirements:

- Topsoil or organic material should not be present in the subgrade within the footprint of all the proposed roadways;
- Granular or asphalt materials are not to be placed on frozen material;
- Any soft or incompetent soils identified during excavation or proof-rolling are to be subexcavated and removed from the footprint of the proposed laneway; and
- The subgrade conditions should be observed by qualified personnel to confirm they can develop an adequate strength.
- If high-plastic clay subgrades are encountered, site-specific recommendations should be developed for localized implementation. Based on review of geotechnical reports for the communities, high-plastic clays are occasionally encountered.

3.2 Granular Base and Sub-Base Construction

The granular base/sub-base materials and construction methods should meet the requirements of The City of Calgary Roads Construction Standard Specifications, Section 303.00.00. The granular base and sub-base materials should be compacted to a minimum of 98% SPMDD.

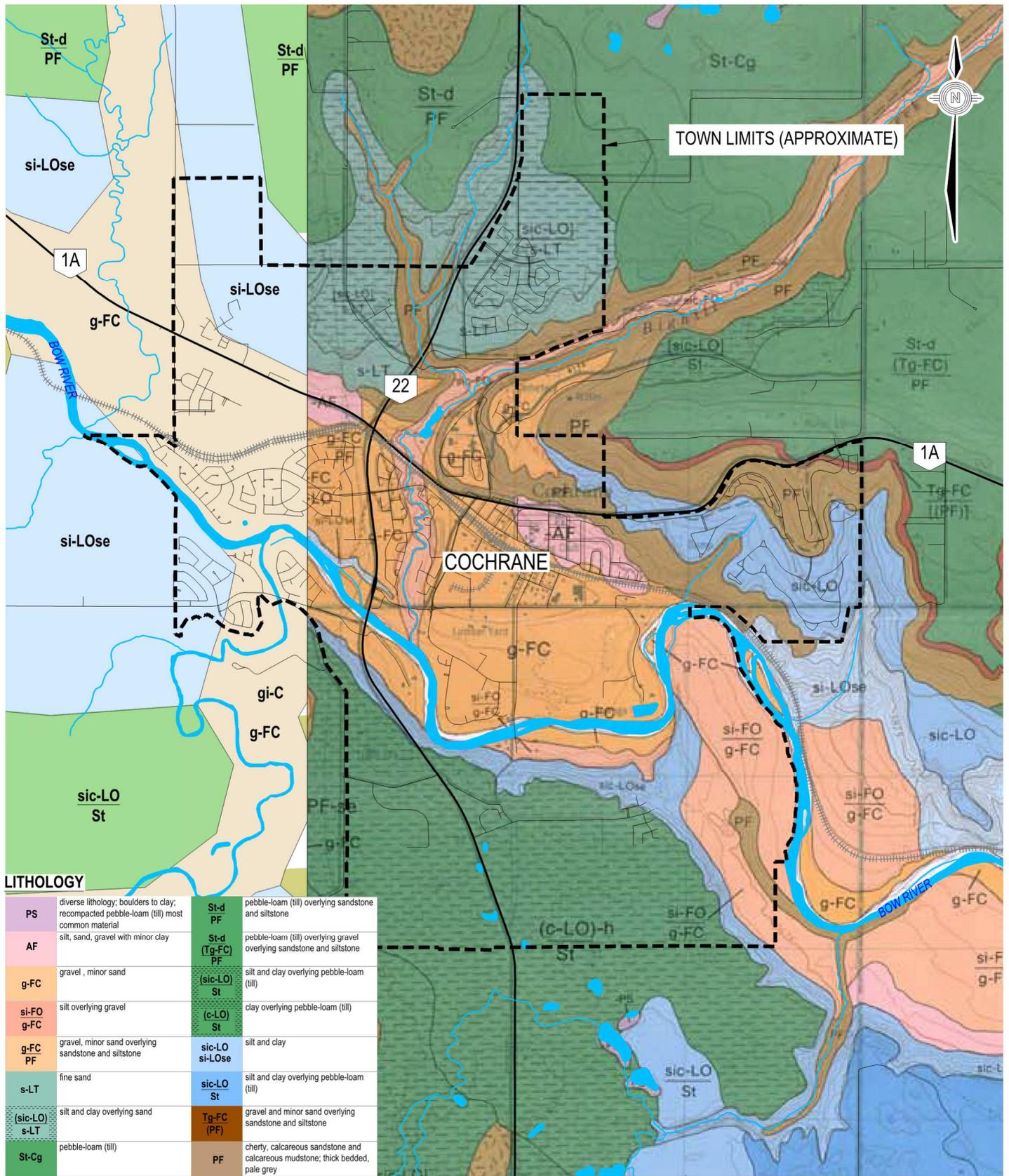
Granular base designs should include weeper holes installed into catch basin barrels and storm manholes at trapped lows to drain free moisture, which may periodically enter the granular base layer. The granular base materials supplied should be prequalified prior to delivery to site.

3.3 Asphalt Concrete Construction

The asphalt concrete materials and construction methods should meet the requirements of City of Calgary Roads Construction Standard Specifications, Section 307.00.00. Construction of the lanes should be in accordance with City of Calgary Roads Construction Standard Specifications, including File No. 454.1011.007 Asphalt Dished Lane Grading & Paving Requirement at Catch Basin, and Section 307.01.02, Table 8, Performance Grade Asphalt Binder Requirements for Different Road Classifications.

Any asphalt lift over 75 mm in thickness be compacted with a pneumatic rubber-tired roller to achieve specified compaction. The minimum compaction of 93% Maximum Theoretical Density (MTD) shall be obtained for all lanes in accordance with City of Calgary Roads Construction Standard Specifications, Section 307.00.00. Acceptance sampling and testing for compaction and thickness requirements shall be confirmed by core testing in accordance with the specifications.

Longitudinal joint construction in dished lanes should be carefully monitored by an experienced professional. Longitudinal joints often have significantly lower compaction than the majority of pavement and contain surface irregularities so when these joints also act as the drainage path, the risk of water infiltration into the base materials and subsequent lower service life are likely. Compaction values of no less than 91% of Maximum Theoretical Density should be achieved at the joints. Tack coat should be used on the joint and allowed to cure prior to placing the adjacent asphalt mat against a cold joint. Leaving a cold joint is not recommended, but if it is necessary, it should be left as a 90-degree butt joint and fully compacted. The butt joint can be achieved either using rakes or lutes during hot mix construction or if this is not possible the joint should be saw cut back from the edge a minimum 150 mm. Best practice for rolling longitudinal joints is to stop rolling from the hot side 150 mm away from the edge of the joint. The first roller pass uses vibration with the entire roller wheel on the hot lane about 150 mm away from the joint. This pushes the material between the roller and joint towards the joint during the initial roller pass, which crowds the mix at the joint producing a higher density. This method is only effective if all mats are being placed consecutively. The joint is then rolled when the adjacent hot mat is placed.



LITHOLOGY

PS	diverse lithology; boulders to clay; recompacted pebble-loam (till) most common material	St-d PF	pebble-loam (till) overlying sandstone and siltstone
AF	silt, sand, gravel with minor clay	St-d (Tg-FC) PF	pebble-loam (till) overlying gravel overlying sandstone and siltstone
g-FC	gravel, minor sand	(sic-LO) St	silt and clay overlying pebble-loam (till)
si-FO	silt overlying gravel	(c-LO) St	clay overlying pebble-loam (till)
g-FC PF	gravel, minor sand overlying sandstone and siltstone	sic-LO si-LOse	silt and clay
s-LT	fine sand	si-LO St	silt and clay overlying pebble-loam (till)
(sic-LO) s-LT	silt and clay overlying sand	Tg-FC (PF)	gravel and minor sand overlying sandstone and siltstone
St-Cg	pebble-loam (till)	PF	cherty, calcareous sandstone and calcareous mudstone; thick bedded, pale grey

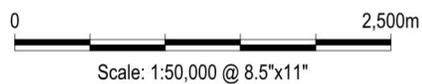
SOURCE
 GEOLOGICAL DATA BASED ALBERTA RESEARCH COUNCIL MAP, SURFACE MATERIALS OF THE CALGARY URBAN AREA: CALGARY SHEET NTS 82-0/1 DATED 1986.

CLIENT



**DEVELOPMENT STANDARDS RECOMMENDATIONS
 PAVED LANES, COCHRANE, ALBERTA**

SURFICIAL GEOLOGY

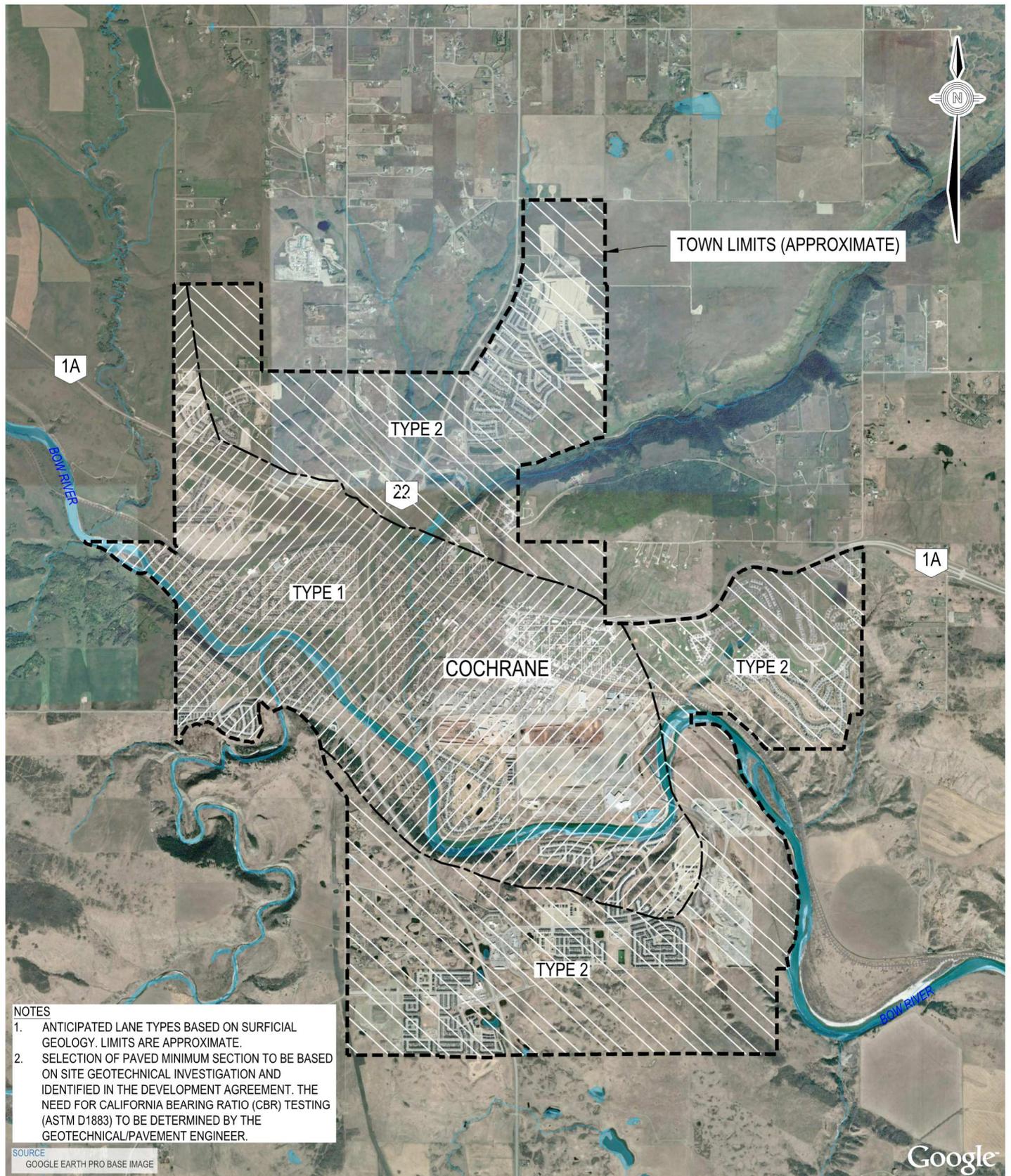


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Figure 1

C:\Riverend\Drafting\ENG.CGEO\CGEO04142\CAD\CGEO04142-01 Cochrane Surficial Geology Figure 1.dwg [FIGURE 1] October 01, 2021 - 4:35:59 pm (BY: HUGHES, LEANNE)

C:\Riverbend\Drafting\ENG.CGEO\CGEO04142\CAD\CGEO04142-01 Cochrane Lanes Pavement Type Figure 2.dwg [FIGURE 2] January 04, 2022 - 3:02:56 pm (BY: HUGHES, LEANNE)



NOTES

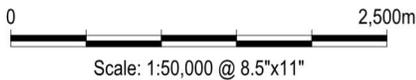
1. ANTICIPATED LANE TYPES BASED ON SURFICIAL GEOLOGY. LIMITS ARE APPROXIMATE.
2. SELECTION OF PAVED MINIMUM SECTION TO BE BASED ON SITE GEOTECHNICAL INVESTIGATION AND IDENTIFIED IN THE DEVELOPMENT AGREEMENT. THE NEED FOR CALIFORNIA BEARING RATIO (CBR) TESTING (ASTM D1883) TO BE DETERMINED BY THE GEOTECHNICAL/PAVEMENT ENGINEER.

SOURCE
GOOGLE EARTH PRO BASE IMAGE

Google

LEGEND

-  TYPE 1 PAVEMENT
-  TYPE 2 PAVEMENT



CLIENT

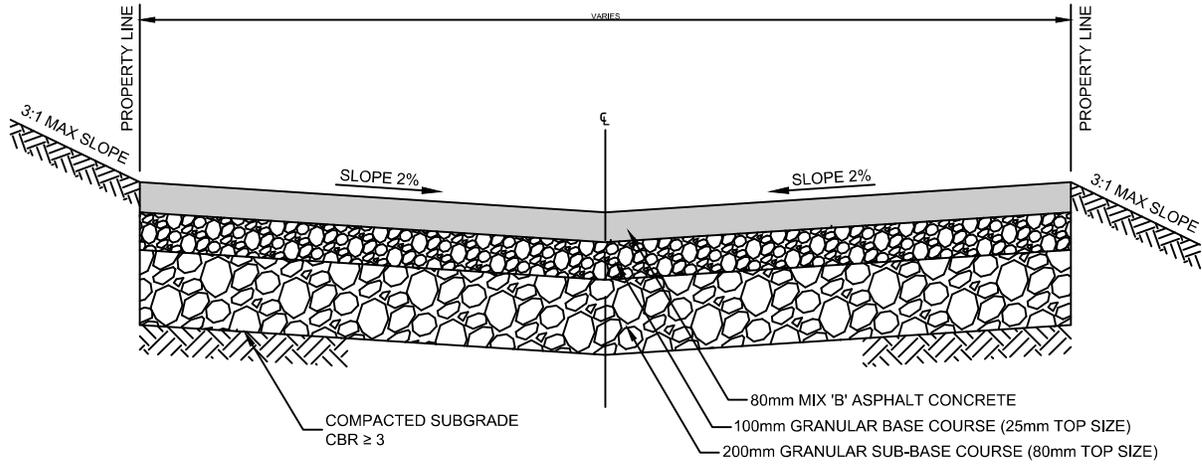


**DEVELOPMENT STANDARDS RECOMMENDATIONS
PAVED LANES, COCHRANE, ALBERTA**

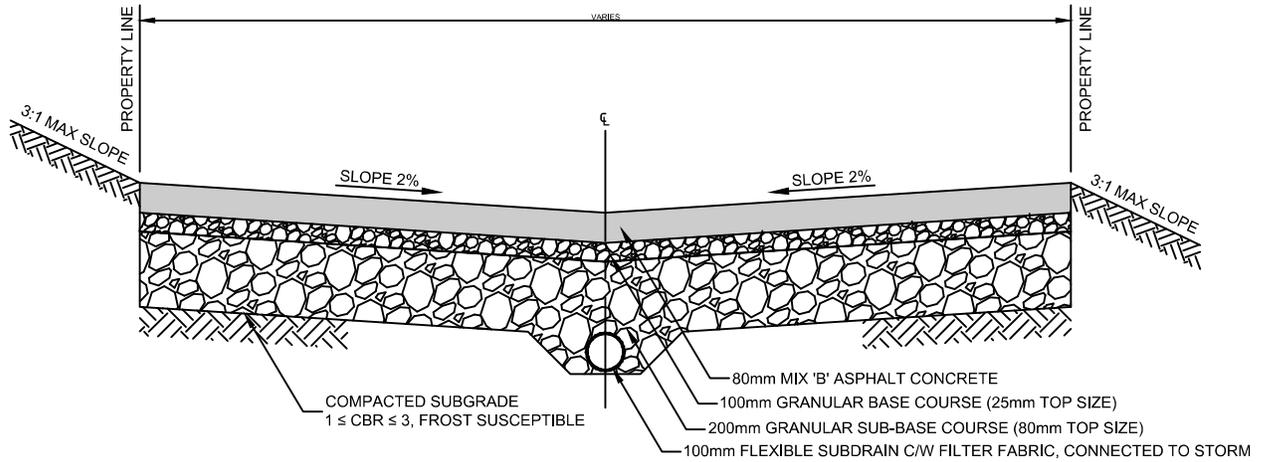
PAVEMENT TYPES

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Figure 2



TYPE 1 - THICKENED STRUCTURE FOR WEAK SUBGRADE SOILS



TYPE 2 - DRAINED STRUCTURE MOISTURE SENSITIVE OR FROST SUSCEPTIBLE SUBGRADE SOILS (IE. FROST SUSCEPTIBILITY BASED ON CANADIAN FOUNDATION ENGINEERING MANUAL, LOW PLASTIC CLAYS, VERY FINE SILTY SANDS, ETC.)

NOTES:

1. SECTIONS ARE TO MINIMUM STANDARDS, CONSIDERATION REQUIRED TO ADDRESS ACTUAL SOIL CONDITIONS AND ASSESS THE NEED FOR ADDITIONAL GRANULAR BASE, THICKER SURFACE LAYERS, SUB-DRAINAGE SYSTEMS, OR GEOSYNTHETIC REINFORCEMENT.
2. SELECTION OF PAVED MINIMUM SECTION TO BE BASED ON SITE GEOTECHNICAL INVESTIGATION AND IDENTIFIED IN THE DEVELOPMENT AGREEMENT. THE NEED FOR CALIFORNIA BEARING RATIO (CBR) TESTING (ASTM D1883) TO BE DETERMINED BY THE GEOTECHNICAL/PAVEMENT ENGINEER.
3. ALL MATERIALS TO MEET CURRENT ROADS SPECIFICATIONS REQUIREMENTS.
4. PROOF-ROLLING OF PREPARED SUBGRADE IS REQUIRED PRIOR TO GRANULAR MATERIAL PLACEMENT.
5. MINIMUM LONGITUDINAL LANE SLOPE OF 1%.

CLIENT  	Paved Lane Development Requirements Cochrane, Alberta				Figure 3
	Paved Lanes - Minimum Sections				
PROJECT NO. CGEO04142	DWN KY	CKD JP	REV 0		
OFFICE CGY	DATE December 2021				