Schedule "A"
attached hereto and forming
part of Bylaw 317

East Bella Vista Highlands Neighbourhood Plan

February 2005

Prepared for:

DC Properties Ltd.
35490 Jewel Court
Abbotsford, BC
V3G 3B3

Prepared by:

NEW TOWN
PLANNING SERVICES

In association with:

Golder Associates

SUMMIT
ENVIRONMENTAL CONSULTANTS LTD

Ward Consulting Group

R.D. LEWIS & ASSOCIATES LTD.

CITY OF VERNON

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1.0 OVERVIEW

1.1 FRAMEWORK FOR IMPLEMENTATION

The East Bella Vista Neighbourhood Plan prescribes the implementation procedures and land use expectations for this sector of the City of Vernon. The site is 226 ha in size and is located on an upland area adjacent to downtown Vernon. Phasing will follow the orderly extension of urban services and other major public works projects. Initiating the development is the Cressman Heights property. This property will be advanced for land use zoning approval concurrently with the Neighbourhood Plan.

The Plan area is presently an expanse of rolling rangelands and rocky outcroppings. Tassie Creek and other environmentally sensitive features such as cliff areas and very steep slopes are protected from development. The balance of the property is considered for urban uses.

The East Bella Vista Neighbourhood Plan establishes the infrastructure, land use, density, development permit areas, parks and environmental management for the site's future subdivision and implementation.

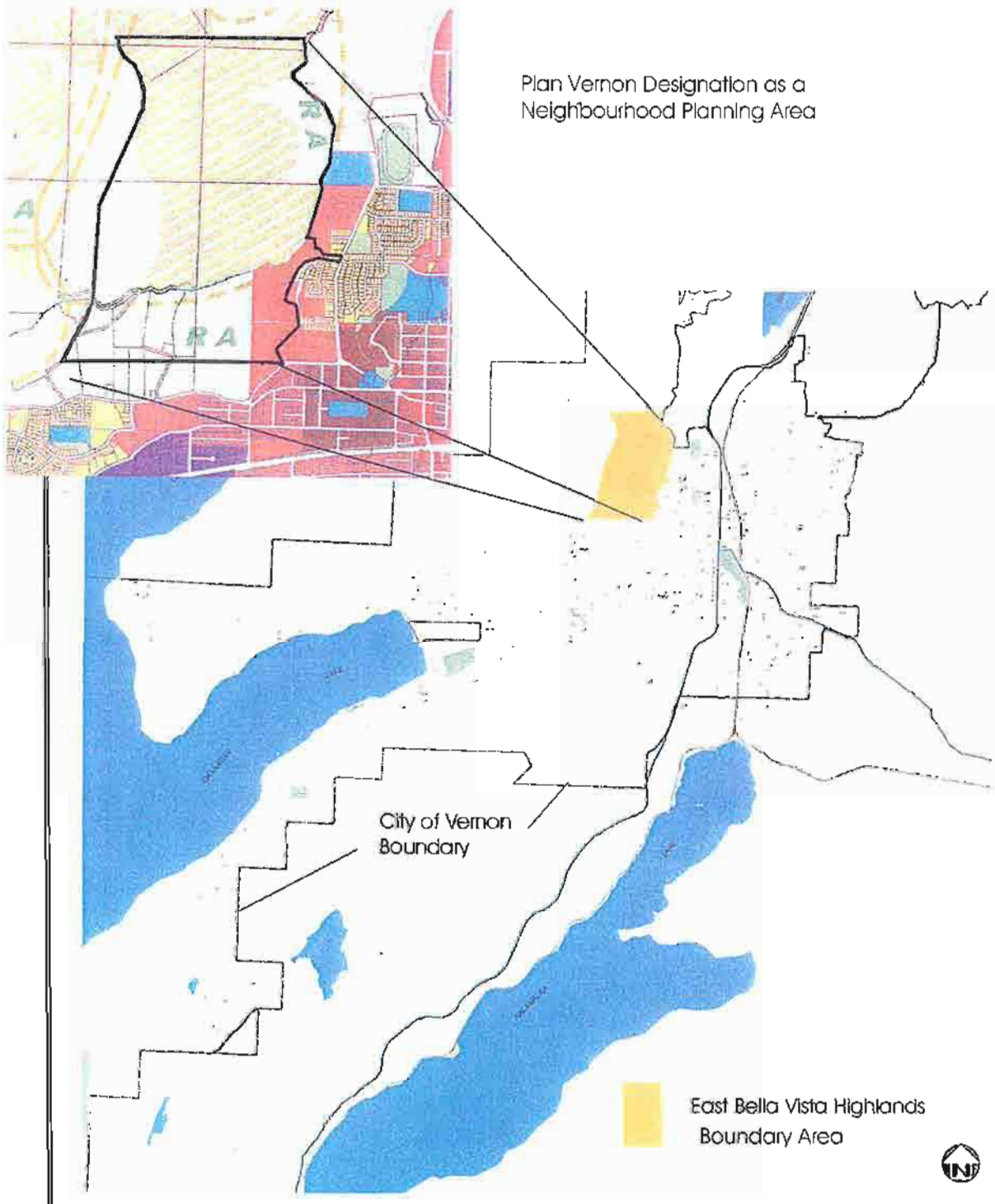
1.2 DEVELOPMENT PLAN AREA

The property fronts on the built portions of Vernon just northwest of downtown. An assembly of hills and rock outcroppings adjacent to the City extend north and west as rolling grasslands. This 226 ha (558 acre) property is accessed via a network of future roadways. An arterial road connection will link Alexis Park Drive to the proposed West Bypass.

The East Bella Vista Neighbourhood Plan study area borders the western edge of the Alexis Park Drive neighbourhoods and the eastern edge extends along properties fronting on Old Kamloops Road. A block of ALR land fronts the southerly boundary and the north and west boundaries abut open rangeland. See Figure 1 - of the East Bella Vista Highlands Neighbourhood Plan Boundary Location within Vernon.

Because of the arid hillside qualities of the site and its visibility to the central city, the transition to a neighbourhood with its cultured landscaping and buildings is going to represent a change in the setting of the city. Preserving the cliff faces and setting buildings back from the escarpment edges are some of the measures proposed to meld the new community with the established context.

The East Bella Vista Neighbourhood Plan proposes a comprehensively planned community. The first development stages will complete the northwestern quadrant of the established Downtown Centre. A new Town Centre is proposed in the northern portion of the Plan area. As a general principle, the Town Centre will offer a diversity of land uses,



NEW TOWN PLANNING SERVICES INC.

EAST BELLA VISTA HIGHLANDS
LOCATION WITHIN VERNON

PROJECT No.: 1335
DRAWN BY: WJZ
DATE: SEPT 23, 2004
SCALE: NTS

FIGURE NO. 1

housing forms and complementary institutional and commercial services. Mixed use development within and about the core zone of the Town Centre will give way to residential uses. The density of housing units will reduce as the distance from the Town Centre increases. A business park is proposed adjacent to the Town Centre and the West Bypass

1.3 RELATIONSHIP TO PLAN VERNON

1.3.1 Official Community Plan

The Official Community Plan of the City of Vernon (Plan Vernon) presents the long-range planning policies and forms the structure to guide the future development of the City. Plan Vernon is founded on the protection of natural features, orderly growth, effective use of infrastructure, functional transportation and economic fulfillment.

The East Bella Vista Neighbourhood Plan area is identified in Plan Vernon as a sector for future growth that requires a neighbourhood plan prior to formal development approval consideration. Plan Vernon policies establish the requirements for the Neighbourhood Plan and offer direction for the future uses within the Plan area.

Plan Vernon's direction to the East Bella Vista Neighbourhood Plan area includes policies related to residential development, Town Centre Services, parks, environment, agriculture, transportation, and infrastructure management. The policies that provide the greatest direction to this area are referenced below.

Residential Policies

The East Bella Vista Highlands is an area forecast for a significant amount of housing development. Key residential Plan Vernon Policies include:

- Develop Vernon's urban areas to the densities outlined in the Plan in order to achieve maximum use of municipal infrastructure and retain several compact neighbourhood areas within the community. (Policy A1)

- To provide variety and flexibility in the provision of housing Council will consider single-family and multi-family within a Neighbourhood Planning Area. (Policy A2)

- Prepare detailed Neighbourhood Plans involving consultation with the public and addressing a full range of planning requirements. (Policy A9)

- To create pleasant and attractive neighbourhoods, minimum design standards may be established for residential and commercial development. (Policy A12)

- Strive for a mix of housing forms comprised of 40-50% single family and 50-60% multiple family within Neighbourhood Plan areas. (Policy A18)

Rural Agricultural Policies

Section D of Plan Vernon addresses the relationship between the urban and the rural setting within the City. The Plan area neighbours along part of its southern and western boundaries are subject to the requirements of the Agricultural Land Reserve. Policies regarding agricultural interface management include:

- Require buffer strips to protect agricultural operations where non-agricultural properties are adjacent to land with agricultural uses, particularly the ALR. (Policy D6)

- The City will work towards preparing zoning that facilitates agritourism in agricultural areas. (Policy D7)

- Rural Agricultural policies will apply to the Urban Growth Areas until a Neighbourhood Plan has been prepared and the land has been redesignated for other uses. (Policy D13)

Parks and Outdoor Recreation

Policy Section E outlines Plan Vernon policies supporting the provision of park and outdoor recreation services. Reference to the following policies is reflected in this Plan:

- Park requirements within urban growth areas shall be confirmed through the neighbourhood planning process. (Policy E12)

- Council will give trail development a high priority in the community. (Policy E14)

- The City of Vernon endorses the Ribbons of Green Trail System Plan completed by GVPRD and as illustrated on Map 3C. (Policy E16)

- Council will consider requests to establish private parkland areas. (Policy E20)

Environmental & Heritage

Policy Section F outlines Plan Vernon policies supporting the protection of Vernon's significant environmental and heritage attributes. These policies include:

- Every effort must be made to maintain areas of environment sensitivity. Neighbourhood Plans for new development areas shall include an Environmental Impact Assessment. (Policy F1)

- Every effort shall be made to construct roads and buildings that minimize disturbance of local vegetation and slopes. (Policy F5)

Utility Services

Section J is pertinent to water supply, sewage management and storm drainage. Key policies include:

- The water service will be an extension of the Greater Vernon Service.
- All new development shall be serviced by an extension of the City's sewage collection system. (Policy J2)
- New development requires stormwater detention systems that will maintain the post-development runoff condition at the pre-development level. (Policy J3)

2.0 VISION

The East Bella Vista Neighbourhood Plan area is seen as an extension of the fabric of the City that fosters sustainable growth. Overall, the Plan area will be redeveloped to accommodate approximately 1,750 new residences. Orderly growth will commence with the initial development of the Cressman Heights land as a predominantly residential expansion of the City's core area.

Over time, a new commercial core will evolve at the intersection of the highway bypass and the principal north/south arterial road. Located at the crossroads of the proposed Highway 97 West Bypass and the Bella Vista Highlands new collector road, a strong cross-highway connection is vital to creating a Town Centre that serves the whole community. The Plan proposes a public park above the West Bypass as it cuts through the heart of the Town Centre. This plaza overtop of a 150m long section of the highway is proposed as a means to counter the divisive affects of this major road facility.

The Town Centre will be the density and economic focus of this part of Vernon and will consist of commercial services in mixed-use buildings. The Town Centre will be pedestrian friendly and will focus on quality public open-spaces.

Parks are located to capitalize on the outstanding views, naturally occurring oases and large level areas for future sports fields. Trails course through the subject lands and connect to the Ribbons of Green along the Grey Canal alignment.

Though the Plan area is a large tract of property, it will be developed into precincts that sustain a comfortable neighbourhood scale. Natural separations between the development nodes result from the steeper slopes where the ecology and topography will remain undisturbed.

Hillside infrastructure standards are proposed for the Plan area. These standards are adopted to provide effective servicing and access while minimizing environmental and contextual impact.

2.1 PLANNING PRINCIPLES

The goal of the East Bella Vista Neighbourhood Plan is to accept growth based on the principles of sustainable environmental, social livability, fiscal balance and market desirability as outlined below.

1. Utility services extend existing infrastructure by:
- Installing extensions of the GVWU and City utilities to provide services for water and sewer;
- Managing stormwater to pre-development flow rates.

2. Achieve a balance of intervention and ecological protection by:
- Emphasizing and implementing environmental sustainability;

- Minimizing development intervention in the environmentally sensitive areas during the construction of the community;
- Providing a package of Hillside Development Standards;
- Providing for functional options to the motor vehicle;
- Sustaining wildlife patterns.

3. Town Centre Strategies:
- Mix residential and commercial land uses in the core area;
- Centralize transit services in the Town Centre;
- Create a promenade link to the Town Square
- Encourage 'walk-ability' within the core area;
- Surround the core area with multiple family development;
- Implement high standards of public space.

4. Hillside Development Strategies:
- Selectively place development nodes;
- Service as prescribed by the Hillside Development Standards;
- Detail Development Permit standards for private works.

2.2 CONCEPTUAL FRAMEWORK PLAN

The East Bella Vista Highlands Neighbourhood Plan is proposed as a smart growth implementation strategy. It purports the extension of services, the blending of land uses, the use of environmentally friendly infrastructure, and a walkable, desirable and socially vibrant Town Centre.

2.2.1 Hillside Built Form & Land Use

- Integrate road services and home sites to minimize disturbance of the existing hillside;
- Encourage slope adaptive architecture;
- Encourage clustering of single and two family housing within common land or multiple family architectural forms through density transfer;
- Require Development Permits for buildings on land with slopes in excess of 30%.

2.2.2 Town Centre Built Form & Land Use

- Locate the Town Centre at the juncture of the Highway 97 Bypass and the principal arterial road;
- Create the Town Centre to be the 'hub' of this sector of Vernon;
- Optimize views to Lake Okanagan from a primary public plaza;
- Consider a subgrade section of the Highway Bypass, covered by a public square to permit an integrated and walkable core area;
- Adapt the urban form to the contours of the land;
- Encourage pedestrian and transit access rather than vehicle access to the core area;
- Promote mixed use development comprised of commercial on lower storeys and residential use above;

- Provide multiple family housing which decreases in density as it moves away from the core area, leading to outer precincts with suburban densities.

2.2.3 Parks & Community Facilities

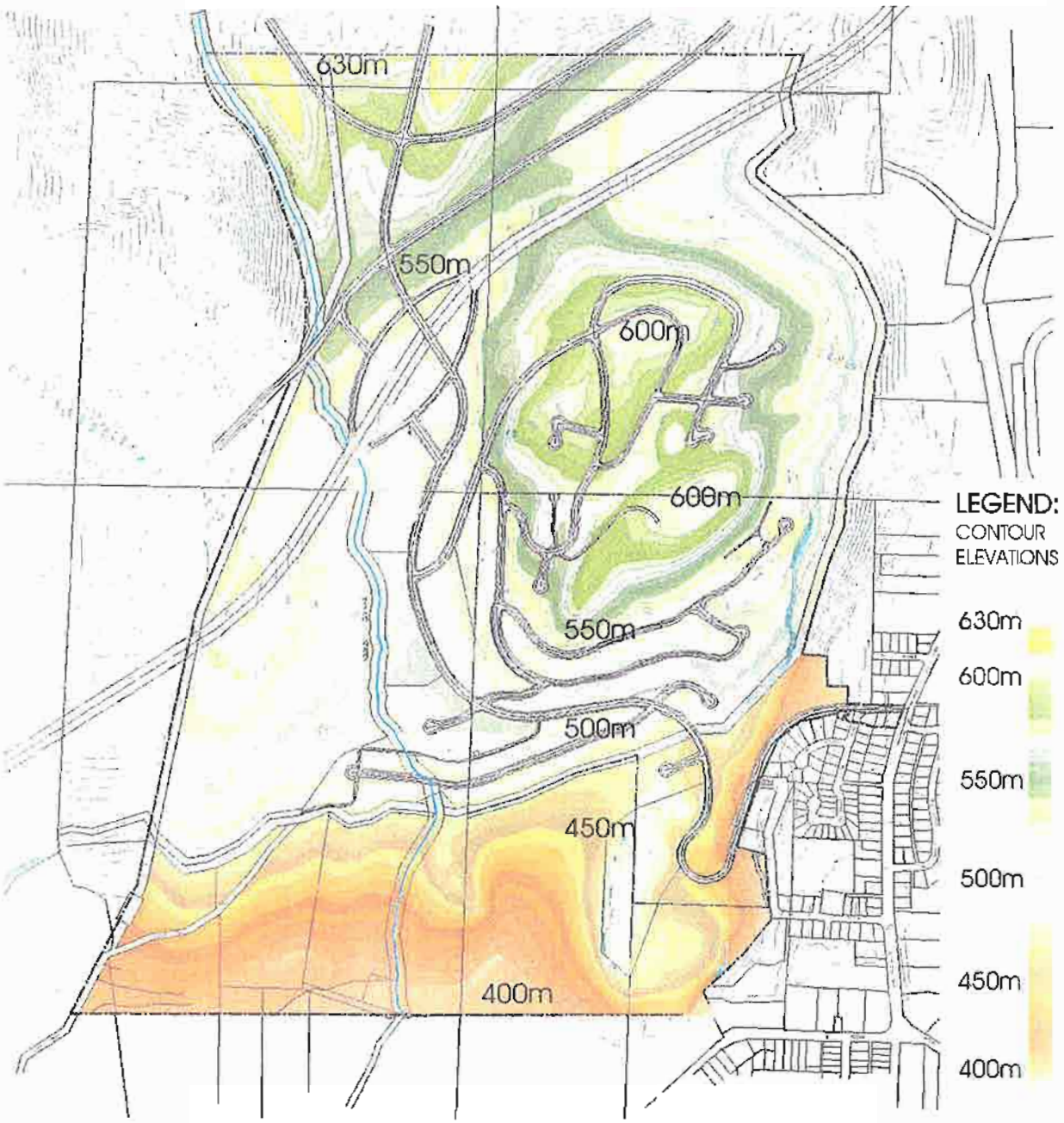
- Propose land for public park within the Plan area that is consistent with the GVSC standards;
- Identify unique sites and great vantage points for passive park use;
- Identify parks, trails and playing fields;
- Connect a web of trails to the Ribbons of Green network;
- Propose a significant urban plaza in the Town Centre above a recessed section of the Highway Bypass.
- Play field parks adjacent to the school site.

2.2.4 Transportation & Circulation

- Employ Hillside Development Standards to minimize development impact on the hillside terrain;
- Extend a collector road facility through the Neighbourhood Plan area to Alexis Park Drive at 39th Avenue;
- Upgrade 39th Avenue & Alexis Park Drive intersection as warranted;
- Connect a network of cycling lanes to the Town Centre;
- Provide a transit 'hub' in the Town Centre;
- Provide a network of trails and sidewalks that permit ready access by pedestrians;
- Integrate natural area trails along the Grey Canal and Tassie Creek.

2.2.5 Environmental Balance

- Provide for wildlife corridors;
- Sustain environmentally sensitive areas;
- Protect the natural watercourses of Turtle Pond and Tassie Creek.



NEW TOWN
PLANNING SERVICES
INC.

EAST BELLA VISTA HIGHLANDS
LAND FORM ANALYSIS

PROJECT No.: 1335
DRAWN BY: WJZ
DATE: Mar 4, 2003
SCALE: NTS

FIGURE NO. 2

3.0 LAND USE

The Future Land Use designations for the East Bella Vista Highlands are illustrated by **Figure 3 - Future Land Use Plan.** The principal uses are residential with 58% of the land forecast for housing

Land Use	Area (ha)	Area (%)
One and Two Family Residential	93.7	42.5 %
Cluster One and Two Family Residential	7.8	3.5 %
Town Centre Mixed Use	2.2	1%
Low Density Multiple Family Residential	7.3	3.3 %
Medium Density Residential	18.4	8.3 %
Commercial Business Park	14.2	6.4 %
Institutional (Public School Building Site)	1.1	0.5 %
Agriculture	65.0	29.4 %
Park, Openspace and Trail System	11.0	5.0 %
Total Development Lands*	220.7	100%

Table 1 – Land Use Area Table

* Land used for West Bypass not Included

The East Bella Vista Highlands Neighbourhood Plan offers a blend of housing forms combining Town Centre and Hillside Standards of land use planning. The ratio is 50% multiple family to 50% single detached or semi detached residences and is in accordance with the goals of Plan Vernon as well as established Town Centre planning principles.

3.1 DEVELOPMENT FORM AND CHARACTER GUIDELINES

The East Bella Vista Highlands Neighbourhood Plan promotes a smart growth balance seeking livability and environmental sustainability. Development Permits will be required for development of land with a slope in excess of 30%, as well as for all multiple family residential or mixed-use Town Centre development.

FUTURE LAND USE LEGEND:

- CLIFFS AND STEEP SLOPES (NO DISTURB AREA - PROTECTED FROM DEVELOPMENT)
- RIBBON OF GREEN (GREY CANAL)
- PUBLIC PARK
- TASS F CREEK GREENWAY
- RURAL / FARMS
- TOWN CENTRE CORE - MIXED USE
- MEDIUM DENSITY MULTIPLE FAMILY RESIDENTIAL
- LOW DENSITY MULTIPLE FAMILY RESIDENTIAL
- ONE AND TWO FAMILY RESIDENTIAL
- ONE AND TWO FAMILY CLUSTER RESIDENTIAL
- SCHOOL SITE
- BUSINESS SITE

ROAD CLASSIFICATION LEGEND.

- WEST BYPASS
- 14m COLLECTOR NO LOAD CONDITION A
- 16m COLLECTOR SINGLE LOAD CONDITION B
- 18.5m COLLECTOR DOUBLE LOAD CONDITION C
- 12.5m LOCAL NO LOAD CONDITION A
- 14.5m LOCAL SINGLE LOAD CONDITION B
- 17m LOCAL DOUBLE LOAD CONDITION C
- 6m LANE CONDITION A

NEW TOWN PLANNING SERVICES INC.

EAST BELLA VISTA HIGHLANDS
FUTURE LAND USE PLAN

PROJECT No.: 1335
DRAWN BY: WJZ/RBM
DATE: JAN 28, 2005
SCALE: NTS

FIGURE NO. 3

3.1.1 Hillside Suburban Residential Development

Housing units can be clustered or building lots subdivided into freehold parcels on hillsides that are proven to be sound development property. Development will require geotechnical engineering verification of site suitability.

3.1.2 Multiple Family Development

Multiple family residential development is forecast in three locations within the Plan area. First, an extension of the established medium density multiple family urban fabric of the City is proposed at the base of the mountain adjacent to 35th Avenue and fronting on the extension of 39th Avenue access road. The second area proposed for low density multiple family residential is adjacent to the large park beside Tassie Creek. Finally, multiple family residential is proposed within the new Town Centre, in the form of mixed-use development and conventional low and medium density housing adjacent to the pedestrian oriented Town Centre and school.

3.1.3 Mixed Use Town Centre Development

The Town Centre is the centre for services for the neighbourhood and the social heart of this sector of Vernon. The transportation design of the West Bypass seeks to minimize friction and maximize the separation between intersections. Opposing this desire is the need for the Town Centre to serve residents on both sides of the West Bypass and help create a cohesive community. To facilitate both the Ministry of Transportation and the City of Vernon's goals, the Town Centre's public square bridges over the Bypass allowing the through traffic an unobstructed flow while allowing for access to the Town Centre. The plaza is a cross-community linkage over a 150-metre length of the West Bypass.

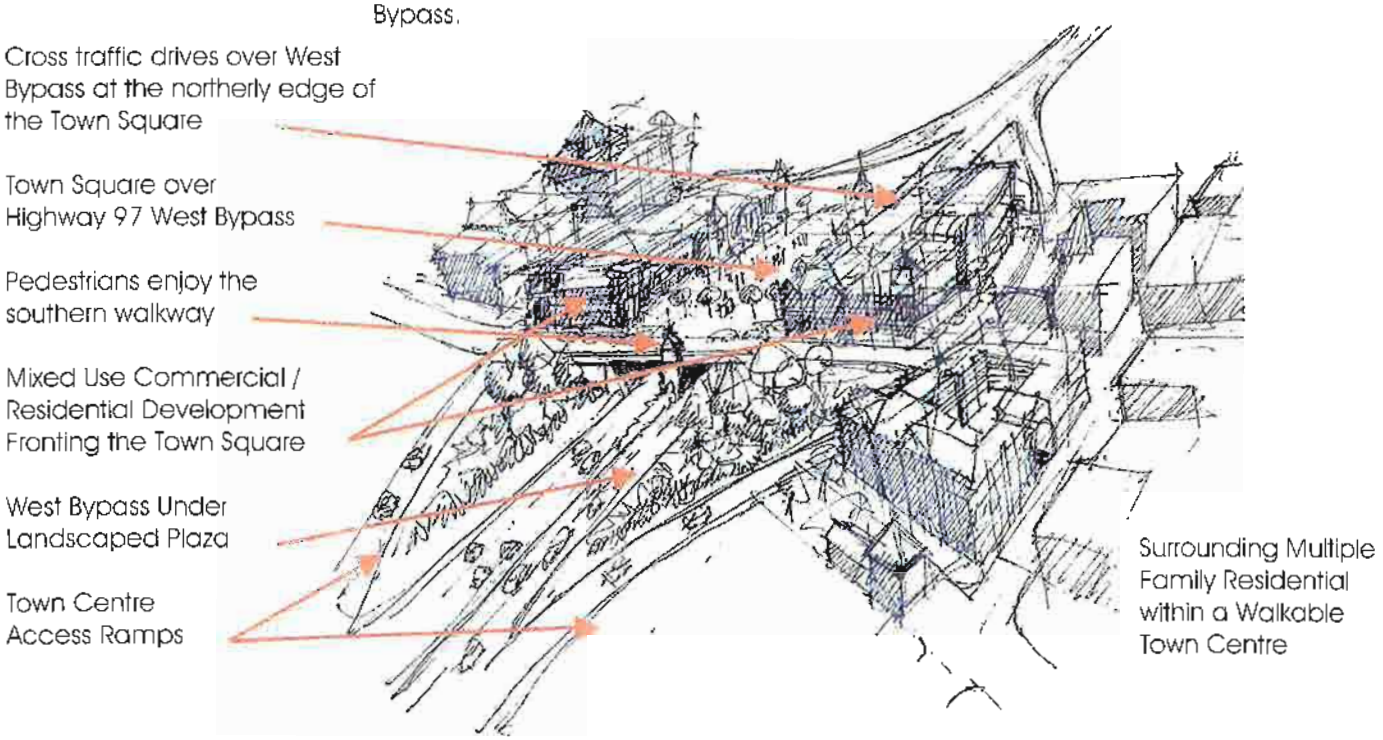


Figure 4 – Schematic Diagram of Town Centre & West Bypass

3.1.4 Highway / Tourist Commercial

Large-scale retail and tourist services are not expected to be a major land use in the Plan area.

3.1.5 Business Park

A Business Park is proposed on a hillside plateau separate from the other residential uses and adjacent to the Highway 97 West Bypass. This area will have some auto oriented uses.

3.2 POPULATION

The 1,750 units within the Plan area will house approximately 3,900 residents. The following population table outlines the occupancy of the residences within the various residential forms.

Unit Type	Number of Units	PPU	Subtotal
Mixed Use Town Centre	150	2.0	300
Low Density Multiple Family Residential	175	2.4	420
Medium Density Multiple Family Residential	600	2.0	1,200
One & Two Family Residential	825	2.4	1,980
TOTAL	1,750	2.28 (Avg.)	3,900

Table 2 - Population Table

The East Bella Vista Highlands Neighbourhood Plan encompasses the area for 1,750 residences. The overall Bella Vista Highlands is estimated by the City of Vernon to have 5,100 housing units. This larger development is proposed on a much larger area than that within the boundaries of this Neighbourhood Plan. However, the servicing and access roadway system is designed to accommodate development beyond the Neighbourhood Plan area boundaries.

4.0 PARK AND OPENSPACE

The public parks are identified in Figure 5 – Park and Trail Network Plan and have been selected to the standards of the GVSC. A total of 11.0 hectares have been dedicated as park. This represents 5.0% of the land proposed for development. The trail system follows the wildlife corridor alignments and connects to the pedestrian system within the neighbourhood and to the Ribbons of Green network via the Grey Canal right-of-way.

4.1 PUBLIC PARKS

The East Bella Vista Highlands Neighbourhood Plan proposes a number of parks.

Park 1 – Bella Vista Lookout Park

The outstanding view from this 600-meter high elevation extends in a panoramic rotation from the north, over Swan Lake, the expanse of the City and to Okanagan Lake. This area is envisioned as a passive space for peaceful enjoyment and relaxation.

Park 2 - Rocky Ridge Park

This park space protects a significant natural landmark at the foot of Turtle Mountain. This site is a hikers destination and is connected by a side trail to the Grey Canal Ribbon of Green.

Park 3 - Tassie Creek Park

Tassie Creek extends the length of the Plan area along a generally north to south alignment. Adjacent to the creek is a large flatter area suitable for active sports and playing fields. This park abuts the proposed school site.

Park 4 Town Centre Square

This park is the public square over the West Bypass at the core of the Town Centre. This is a park constructed on a landscaped slab with the Bypass flowing below and the abutting mixed used commercial / residential development fronting the Town Square.

4.2 TRAIL SYSTEM

The trail system is a network of pathways that connects residents with the citywide Ribbons of Green and the Town Centre. The system surface will have a permeable walking surface designed to permit moisture to pass naturally into the ground thereby minimizing the disturbance of the natural functions of the ecology. The trail is suitable for walking and cycling. Rollerblades and skateboards are not suited to this surface finish.

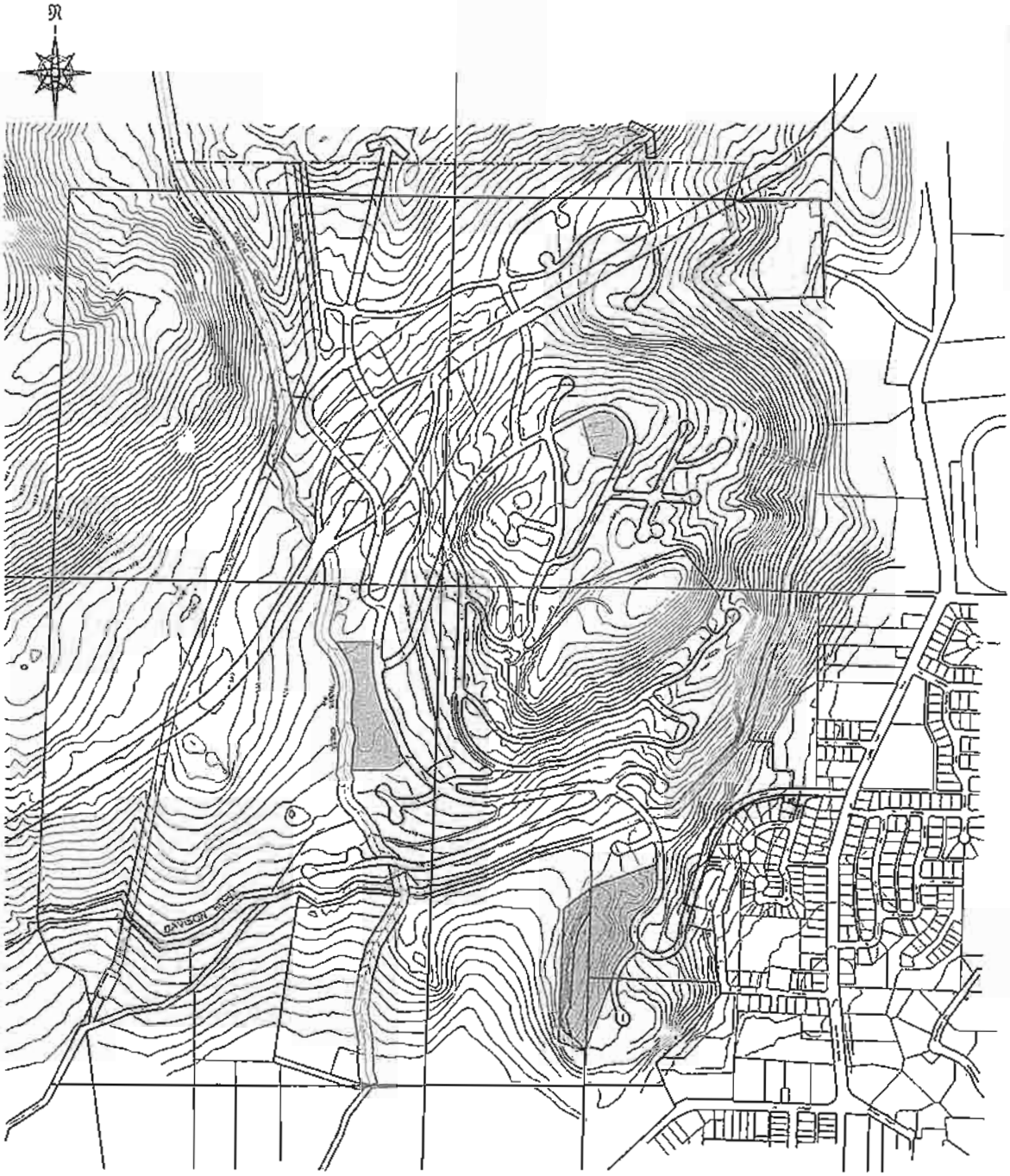
4.3 PARK AND TRAIL POLICIES

4.3.1 Develop parks in accord with the Figure 5 - Park and Trail Network Plan and GVSC standards;

4.3.2 Build a trail network that conforms to environmentally sustainable principles and connects to the Town Centre and the Ribbons of Green.

4.3.3 Connect the Ribbons of Green trail to the Rocky Ridge Park with a minimum 8m wide right of way.

4.3.4 Consider an underpass for the Ribbons of Green crossing of the 39th Avenue Extension.



LEGEND:

- RIBBON OF GREEN (GREY CANAL)
- PUBLIC PARK
- TASSIE CREEK GREENWAY

NEW TOWN PLANNING SERVICES INC.

EAST BELLA VISTA HIGHLANDS
PARK AND TRAIL NETWORK PLAN

PROJECT No.: 1335
DRAWN BY: WJZ
DATE: SEPT 23, 2004
SCALE: NTS
FIGURE NO. 5

5.0 ENVIRONMENTAL IMPACT ASSESSMENT

An Environmental Impact Assessment (EIA) has been undertaken by Summit Environmental Consultants Ltd. (December 2004). This report is attached as **Appendix A - Environmental Impact Assessment**. The EIA identifies the potential environmental impacts of the proposed neighbourhood and makes recommendations for mitigation.

The focus of the EIA is on the property proposed for zoning and initial development. Assessment of the balance of the plan is based on the literature and the general characteristics of the development site.

The report concludes that, based on the conceptual plan for the neighbourhood, environmental impacts on the subject site are expected to be minor and can be mitigated with careful site design, reclamation of desirable habitat lost to development and standard techniques to maintain watercourse quality.

The development proposes to adhere to the mitigation strategy proposed in the Summit EIA report. **Section 5.8 - The Environmental Impact Management Policies** detail these actions. The categories below offer a brief summary of the Summit report.

5.1 ECOLOGY

The site is situated in the Interior Douglas Fir Biogeoclimatic Zone, Okanagan very dry-hot variant, grassland stage (IDFxh1a) (Lloyd et al., 1990). The ecology of the area reflects the shortage of moisture in much of this zone. The subject site is comprised of rolling grasslands marked by gullies caused by erosion over the centuries. Outside of the occasional Ponderosa Pine, trees are limited to the moister sites. The site is also part of the area known as the North Okanagan Grasslands. It has been used for cattle grazing for over 80 years. This use, along with public access, has led to a proliferation of noxious weeds including knapweed and sulphur cinquefoil.

The marsh, the thickets of shrubs, the copse of aspen and the steep cliffs on the easterly and south-easterly portions of the plan area are significant ecological resources.

5.2 VEGETATION

Vegetation within the area is consistent with the North Okanagan Grasslands. It is mostly comprised of shrub-steppe and shrubland habitats with a few small copses of deciduous trees. Noxious weeds have invaded approximately two thirds of the grasslands. A number of gravel pits are present on the property but are no longer in use. These ground-altering disturbances have further disrupted the natural ecology.

Thickets of shrubs located in the draws and gullies provide Saskatoon, Hawthorn, Common Snowberry and Oregon Grape west of the marsh and augment the grassland ecology.

5.3 WETLANDS

Wetlands are limited to the seasonal pond and Tassie Creek. The small marsh located near the east-facing cliffs functions as a wet "island" within a generally very dry environment and contributes to the overall biodiversity of the area. The balance of the development property lacks any other surface water.

The plan area includes Tassie Creek. This seasonal creek runs only during freshet and storm events. The proposed no-disturb buffer offers an opportunity for ecological reclamation.

5.4 FISH & WILDLIFE ASSESSMENT

Tassie Creek is a non-fish bearing watercourse. The balance of the Plan area is void of habitat suitable for fish.

The rock cliffs and talus slopes may provide habitat for a number of rare, threatened and endangered animals although there are no recorded sightings of any listed species. The actual presence or absence of those species was not confirmed but could include Western Harvest Mouse, Great Basin Spadefoot Toad, Western Rattlesnake, Swainson's Hawk and others. Wildlife species observed included mule deer, coyote, Northern Pocket Gopher and various bird species.

5.5 WILDLIFE CORRIDORS

Two principle wildlife corridors are identified for the Neighbourhood Plan area. The first follows Tassie Creek and connects to the valley floor. This corridor alignment is provided for with the proposed streamside setback that requires no disturbance within 30m of both sides of the top of bank. This alignment should be kept free of any fencing or other obstructions that could impede foraging movements. The proposed no-disturb buffer offers an opportunity for ecological reclamation.

A second principle corridor follows the general alignment of the Grey Canal Ribbon-of-Green and leads from the Swan Lake area westward around the cliffs and ultimately connecting to the balance of the Bella Vista Highlands and Lake Okanagan beyond.

A secondary corridor connects the Ribbons-of-Green corridor to the marsh and across the road to the upland protected open-space.

5.6 THREATENED OR ENDANGERED SPECIES

The subject property contains habitat for rare and endangered wildlife species. Although no species were observed, there is some potential for rare and endangered species using the site for occasional foraging and potential habitat.

5.7 ENVIRONMENTAL SENSITIVITY ANALYSIS

Environmentally sensitive areas include the marsh, the aspen copse, Tassie Creek, the cliffs and talus slopes.

5.8 ENVIRONMENTAL IMPACT MANAGEMENT POLICIES

5.8.1 Preserve the marsh as open-space with no surface runoff being directed into the pond and sustain existing plants. Buffer 10-15m around the marsh with native vegetation. Limit human access with plantings and fencing.

5.8.2 Provide a minimum 30m wide natural connection to the slopes below the marsh and limit human access;

5.8.3 Retain an natural corridor to the upslope across the road from the marsh.

5.8.4 Provide arch culverts to facilitate small mammal travel as shown in Appendix A - Environmental Impact Assessment;

5.8.5 Create a 20-30m wide connector including a large portion of the aspen copse at the narrow crossing of the Ribbon of Green corridor. Areas lacking in vegetation should be replanted with native trees and shrubs at a spacing of 1 per m^2.

5.8.6 If there is to be a trail underpass, it should be as wide as possible.

5.8.7 Existing mature Ponderosa pine on the site should be preserved if at all feasible.

5.8.8 Where reasonable, existing thickets should be retained. If lost to development, opportunities to reclaim alternative sites to balance the loss is required.

5.8.9 Encourage the use of native species and xeriscaping in the landscape planning of private property.

5.8.10 No land activities are permitted between April 1 and July 31 to protect bird nests. Development can only proceed within this period if a survey has concluded that no nests are present.

5.8.11 Prior to finalizing detailed development plans, plant and wildlife surveys should be conducted.

5.8.12 Maintain 30 metre wide buffers to Tassie Creek with the proposed trail on the outer edge of the set-back.

5.8.13 Design the storm system to maintain post-development flows to pre-design levels and encourage infiltration and sediment trapping capacity.

5.8.14 Prepare a sediment and erosion control plan during construction. Follow the guidelines in Land Development Guidelines of the Protection for Aquatic Habitat.

5.8.15 Minimize areas of impervious surfaces.

5.8.16 Educate homeowners on the ecological impacts of fertilizers and herbicides/pesticides.

5.8.17 Prior to any land disturbing development activities or land use zoning consideration, an Environmental Impact Assessment is required for all lands within the Neighbourhood Plan boundaries. Appendix A Environmental Impact Assessment, Summit Environmental Consultants (February 2005) addresses the Cressman property.

5.8.18 Land designated as highly sensitive such as the Turtle Pond riparian area and the cliff faces shall be protected with no-build covenants.

5.8.19 Retain an experienced environmental consultant to assist in siting decisions, and an experienced environmental monitor to oversee construction within all sensitive habitats. An implementation strategy to manage environmental considerations for each phase of construction will be provided with servicing and building permit applications.

6.0 TRAFFIC STUDY

Ward Consulting Ltd. completed a Traffic Impact Study (December 2004) to assess the changes in the traffic patterns that result from the development of the Plan area. The existing and future traffic assessment was based on data from the City of Vernon. A copy of the report is attached as Appendix B – Traffic Impact Assessment.

6.1 DEVELOPMENT TRAFFIC GENERATION

Based on the Ministry of Transportation Trip Generation Rates Manual, the study compares the background traffic conditions and how they will be affected by the development.

6.2 COMMERCIAL DEVELOPMENT TRAFFIC

The Commercial Development Traffic is generated from the Town Centre area. It is not forecast that any other economic area or services will be included elsewhere in the Plan area. The 2.2 hectares is likely to host 5,500 m^2 of commercial uses. The traffic generated by these uses will be facilitated on the highway bypass and the split arterial road that provide crossings through the Town Centre.

6.3 ACCESS / EGRESS

The access to the Plan area is via 39th Avenue with an intersection at Alexis Park Drive. The intersection of 35th Street and 39th Avenue will be closed to deter short-cutting traffic from using 35th Street to access Alexis Park Drive. The present alignment of the 39th Avenue and Alexis Park Drive intersection is offset and will require realignment to create a safer condition. Ultimately, a traffic control signal is warranted at this location. It is practical to coordinate the realignment of the intersection with the installation of the signal. The signal is warranted after the development of 100 units. Up to this limit, the existing staggered alignment will offer acceptable service.

The realigned intersection will service the East Bella Vista Highlands area until the 1,140 units are built. After that point, a second access is warranted. This access will follow the general alignment of the Highway Bypass or use the West Bypass if it is in place.

See Figure 10 Roads and Classifications to review the proposed hillside road cross-sections.

6.4 TRAFFIC MANAGEMENT POLICIES

6.4.1 Upgrade and signalize the intersection of 39th Avenue and Alexis Park Drive after 100 units are developed;

6.4.2 Seek confirmation of the final alignment of the West Bypass to permit a second access to be placed in accord with that alignment if the second access predates the West Bypass;

6.4.3 Construct a second route of access once 1140 units are developed.

7.0 DEVELOPMENT SERVICING

R.D. Lewis and Associates Ltd. prepared an East Bella Vista Highlands Servicing Strategy to address the onsite and offsite infrastructure requirements for the Plan area.

Construction of the development servicing will comply with City of Vernon Bylaw regulations limiting, among other things, noise, dust, and hours of operation. Blasting for bedrock is likely required. Pre and post blasting home inspections are offered for existing residences and full restitution is insured.

7.1 WATER SERVICE

The East Bella Vista Highlands Development will be supplied with water from the integrated Greater Vernon Water Utility (GVWU) and the City of Vernon supply system in accordance with the OCP Policy J-1.
The skeleton water system is shown on Figure 6. The pressure zones have been designated by GVWU.

Design Criteria

The following design criteria will be applied to the Preliminary and Final Designs of the water system.

Maximum Day Demand (MDD)	1,800 Litres/capita/day
Peak Hourly Flow (PHF)	1.5 MDD
Fire Flow (FF)	
Single Family Development	3,600 Litres/min. for 90 minutes
Multi Family Development	5,400 Litres/min. for 105 minutes
Reservoir Volume	V = 1.25 (0.25 MDD) + (FF x duration)
Capita per Dwelling Unit (DU)	2.5 Residential
	2.0 Multi Family
Pressure Zones	479m, 533m, 572m, 619m & 665m
Highest Pressure	897 kPa (91.0m)
Lowest Pressure	313 kPa (32.0m)
Velocity in Mains	2.0 m/second operational
	4.0 m/second at MDD + FF
Pump Capacity	MDD + FF in 24 hours

The Neighbourhood Plan area and an extended area to the north will have approximately 5,100 dwelling units as estimated by the City of Vernon. The Neighbourhood Plan area accounts for 1,750 of the 5,100 dwelling units.

Description

The Cressman Heights water supply will be from the 479 Zone main on Alexis Park Drive at 39th Avenue. A booster pump station will be located in the southeast corner of the property and will pump to the 572 Reservoir. The 572 Zone and the 533 Zone will serve all of the Cressman Heights Development except for the proposed strata on the northeast corner of the property.

The remainder of the Neighbourhood Plan Area will be served by a booster off the Old Kamloops Road with a trunk main in the West Bypass Highway, and or a

booster station located at Bella Vista Road, with a trunk main up the Tassie Creek Valley.

The GVWU are currently planning the installation of a large diameter supply main that will serve the properties to the north of Kin Park on the Old Kamloops Highway. This main would also be available to supply water to the north of the Neighbourhood Plan Area. The supply main could be constructed in conjunction with the construction of the West Bypass Highway.

The GVWU is also planning to upgrade the supply main on Bella Vista Road with an extension to Allenby Road. This main would also be available to supply water up through the Davidson Road rights-of-way and into the Neighbourhood Plan Area.

The size of the mains would be determined by future design and use of an overall water model now being developed by the Greater Vernon Water Utility.

Water mains will be sized at final design in accordance with the Design Criteria.

7.2 WATER SERVICE POLICIES

7.2.1 Provide a service infrastructure adequate for the servicing standards and in accord with the GVSC water services requirements;

7.2.2 Oversize infrastructure facilities to allow for service to the future stages of the Plan area;

7.2.3 Encourage water-smart strategies in development and landscaping.

7.2.4 Undertake a water model assessment as part of a Servicing Agreement assessment of demand.

7.3 SANITARY SEWER SERVICE

The City of Vernon policy requires connection of a proposed development within the Neighbourhood Plan Area to the City's existing urban sewer system. The proposed sewer system is shown on Figures 7A and 7B – Sanitary Sewer Utility.

Figure 7A – Sanitary Sewer Catchment shows the extent of lands within and beyond the Neighbourhood Plan area that will require sewer in the future. The City of Vernon estimates about 5100 dwelling units at build out in this area.

The sewer catchment area is divided by a prominent ridge that runs generally north – south. Lands to the east of the ridge slope steeply to the existing development in the City of Vernon. The lands, to the west of the ridge, slope gently to the south through the Tassie Creek Valley. The majority of the neighbourhood development sewers will drain through the Tassie Creek Valley (90%). The proposed Cressman Heights Development (10%) will drain within itself to the existing sewers on Alexis Park Drive at 39th Avenue. The other future sewers will not connect to the Cressman system.

Figure 7B shows the proposed system utilizing conventional gravity sewers and a limited number of lift stations where necessary. The gravity sewer mains, for the most part, will be located in roadways and dedicated rights-of-way and provide

standard gravity services to all dwellings. Sewage from the Neighbourhood Plan Area will flow to the existing sewers through two connection points.

1. The Cressman Heights development sewage will flow by gravity to the sewer mains located on Alexis Park Drive at 39th Avenue. (The sewer capacity on Alexis Park Drive and downstream is discussed below.)

2. The remainder of the Neighbourhood Plan Area will flow south and west down the Tassie Creek Valley to a trunk main to be constructed from Bella Vista Road to the Sewage Treatment Plant.

The Developer will design the Cressman Heights Sanitary Sewers. The other trunk mains will be modeled and designed by the City of Vernon.

The capacity of the Alexis Park Drive and the sewer main route to the major trunk sewer on 43rd Avenue has been reviewed. The review included tallying the number of dwelling units from the City of Vernon data and subsequently estimating the contributing populations to derive flows from manhole to manhole. The estimated peak flows in the existing sewers plus the estimated peak flow from the Cressman Heights Development was compared to the capacity of the pipes in the existing system. The resultant flows were also compared to the findings of a sewage flow investigation undertaken by City forces in approximately 1998. It appears that the existing sewer system has sufficient capacity to contain the additional flows from the Cressman Heights Development as shown on Figure 7B – Sanitary Sewer Utility. It should be noted that the existing sewer main in Alexis Park Drive at 39th Avenue does not flow to the north or east. There are separate sewers that begin approximately at 39th Avenue and flow to the north and east. The Cressman Heights Development will connect into the sewer in Alexis Park Drive that flows to the south. The existing sanitary sewer on 38th Avenue will be diverted into the Alexis Park Drive south sewer.

The City of Vernon investigated sewage flows and infiltration in this area in 1998 and undertook a video survey of the Alexis Park Drive sewer. The sewer is over 25 years old, with a large amount of asbestos concrete and reinforced concrete pipe, both of which show serious deterioration of the pipe crown probably due to hydrogen sulphide gases attacking the concrete. The City plans to replace these sewers within 5 years. The cost of upsizing of pipe or the full replacement cost if the City does not have a capital budget for replacement when the Cressman Heights Development requires sewers will be borne by Cressman Heights. The size of pipes will be confirmed by computer modeling and designed by the City of Vernon.

Figure 7B shows a temporary lift station in the southwest corner of the Cressman Heights Development. This lift station will be decommissioned at the cost of the Developer of adjacent lands when the sewers are extended to Agnew Road and to the Sewage Treatment Plant.

7.4 SANITARY SEWER SERVICE POLICIES

7.4.1 Provide a sewer infrastructure to meet The City of Vernon Engineering Standards;

7.4.2 Oversize infrastructure facilities to allow for service to future stages of development of the Plan area.

7.5 DRAINAGE SERVICE

The City of Vernon Drainage System Policy requires that the Post-Development flows from a catchment area be equal to or less than the Pre-Development grassland condition flows from the same catchment area. The drainage system proposed conforms to this Policy.

The Neighbourhood Plan catchment areas drain basically to Tassie Creek on the western flank with a smaller amount of drainage that will remain mostly undisturbed to the east into the Vernon Creek catchment area.

The flows will be controlled with detention ponds at critical points that will also provide sedimentation and floatation treatment of the drainage flows. The size of the detention ponds will be determined at the time of final design of utilities.

Storm water flows in excess of the 1:10 year design will be routed as surface flows down roadways and designated overland flow routes. The Grey Canal route west of the Cressman Heights Development has been identified as a potential overland flow route.

In early discussions with the City of Vernon it was requested that drainage be diverted from the Vernon Creek catchment areas as much as feasible. Figure 8 shows the Pre-Development drainage catchment areas and watercourse routes for the Neighbourhood Plan. Catchment C1 and C2 are the two main areas that flow east into the Vernon Creek catchment. Figure 9 shows the proposed Post-Development drainage and storm sewer routes. Catchment 1 has been reduced from 12.92 ha to 11.76 ha and Catchment 2 has been reduced from 21.59 ha to 13.33 ha by diverting the storm flow from the development areas west to a detention pond located in the southwest corner of the property that in turn drains to Tassie Creek. The Post-Development flows from Catchments C1 and C2 will be less than the Pre-Development flows. Detention ponds and upsizing of the downstream storm sewers will not be necessary in this part of the Cressman Heights Development.

The capacity of Tassie Creek at Bella Vista Road has been reduced by the construction of adjacent development and undersized storm sewers. These downstream components will require upgrading. The investigation, design and upgrading will be undertaken at the time of design of the Cressman Heights Development.

7.6 DRAINAGE SERVICE POLICIES

7.6.1 Employ ground recharge best management practices where practical;

7.6.2 Retain the runoff based on City of Vernon Bylaw standards.

7.6.3 Mitigate natural runoff as required by the Servicing Standards.

7.7 STREETS AND ROAD STANDARDS

All streets and roads within the Neighbourhood Plan area will be to the standards of the City of Vernon or an alternate standard approved to minimize the disturbance of the hillsides..

The present connection for vehicle access to the Plan area is the 35th Avenue roadway west of Alexis Park Drive. The principal access to the Neighbourhood Plan area and the Cressman Heights will be by a planned collector road from Alexis Park Drive following a 39th Avenue location as shown on Figure 10 - Roads & Classifications. This major road will also connect with planned roads and a highway interchange west of the proposed commercial zone in the Neighbourhood Plan.

35th Avenue is currently constructed to a local road standard without sidewalks or concrete curb and gutter and subsequently is a sub-standard for consideration of an access to the site.

The second classification of roads will be standard local roads, built to the City of Vernon standards, which will service building lots and multi-family sites.

The third classification will be access lanes and one-way lanes as shown on Figure 10– Roads & Classifications.

The roads will be designed and built to the City of Vernon hillside Street Design Standards where the maximum grade will be 12%.

All of the recommendations in the Environmental Impact Assessment will be incorporated into the road design and construction.

The West Bypass has been proposed by the City of Vernon and the Ministry of Transportation. In addition, the route was walked with City Engineering staff and was concluded to be feasible.

7.8 STREETS & ROADS POLICIES

7.8.1 Construct the vehicle road network generally as illustrated in Figure 10 - Roads & Classifications and Figure 11 - Road Cross-Sections;

7.8.2 Design to the hillside standards proposed in the Plan to minimize environmental impact;

7.8.3 Minimize cut and fill impacts on the ecology;

7.8.4 Sustain vintage Ponderosa pine trees where practical.

7.8.5 Include traffic sound attenuation and landscape treatments buffering the Town Centre from the Truck Bypass, and between the 39th Avenue Extension and the established single family neighbourhoods.

7.9 OFFSITE UPGRADES

The preliminary water, sewer and storm drainage design does not require upgrades to any existing utilities. As well, the water system will be able to serve the needs of other land owners within, or outside, the Plan area. Other oversized infrastructure facilities for utilities and stormwater management may be required of the developer.

It is expected that Latecomer Agreements will offer the developer cost recovery for the oversized systems.

Offsite intersection upgrades with additional turning lanes may be required as identified in the Traffic Impact Assessment (Ward 2004).

7.10 POLICIES FOR OFFSITE UPGRADES

7.10.1 Stage implementation of offsite works (if any are shown to be required during detailed design) to respond to the burden placed by the new residents as the property is occupied;

7.10.2 Utility Extensions are to be to the prevailing servicing standards;

7.10.3 Cost recovery for the excess and extended services is under the direction of the City of Vernon and will be undertaken by Latecomer Agreement, Specified Area Bylaw or other means.

7.11 UTILITY SERVICES

The following shallow services for the East Bella Vista Highlands Plan area are available.

Power
A primary distribution of BC Hydro cable extends along Alexis Park Drive and will be extended to the Plan area.

Gas
A natural gas main, high-pressure, is located at the west boundary of the Neighbourhood Plan area.

Telephone
Telus has the capacity to serve the Plan area.

Media
Cable service will be an extension of the established service.

7.12 POLICIES FOR UTILITY SERVICES

7.12.1 All power and communication distribution and service facilities shall be underground;

7.12.2 Provide for high-speed technology linkages where practical;

7.12.3 Minimize disturbance of the ecology with service infrastructure;

7.12.4 Place network underground systems in accord with the standard road cross-sections discussed in Section 7 of the Neighbourhood Plan.

8.0 SUBDIVISION AND STAGING PLAN

8.1 SUBDIVISION

The Plan area is comprised of several larger parcels. The existing boundaries of these parcels will be adjusted to best suit the needs of land development principles to accommodate more intensive uses.

Subdivision into market lots and development plots will conform to the general requirements of the Zoning Bylaw for lot configuration and minimum area. Applications to create useable development sites are expected subsequent to the adoption of the Neighbourhood Plan and Zoning approvals.

8.2 STAGING PLAN

The staging of development is predicated on the orderly extension of infrastructure services.

8.2.1 Stage 1

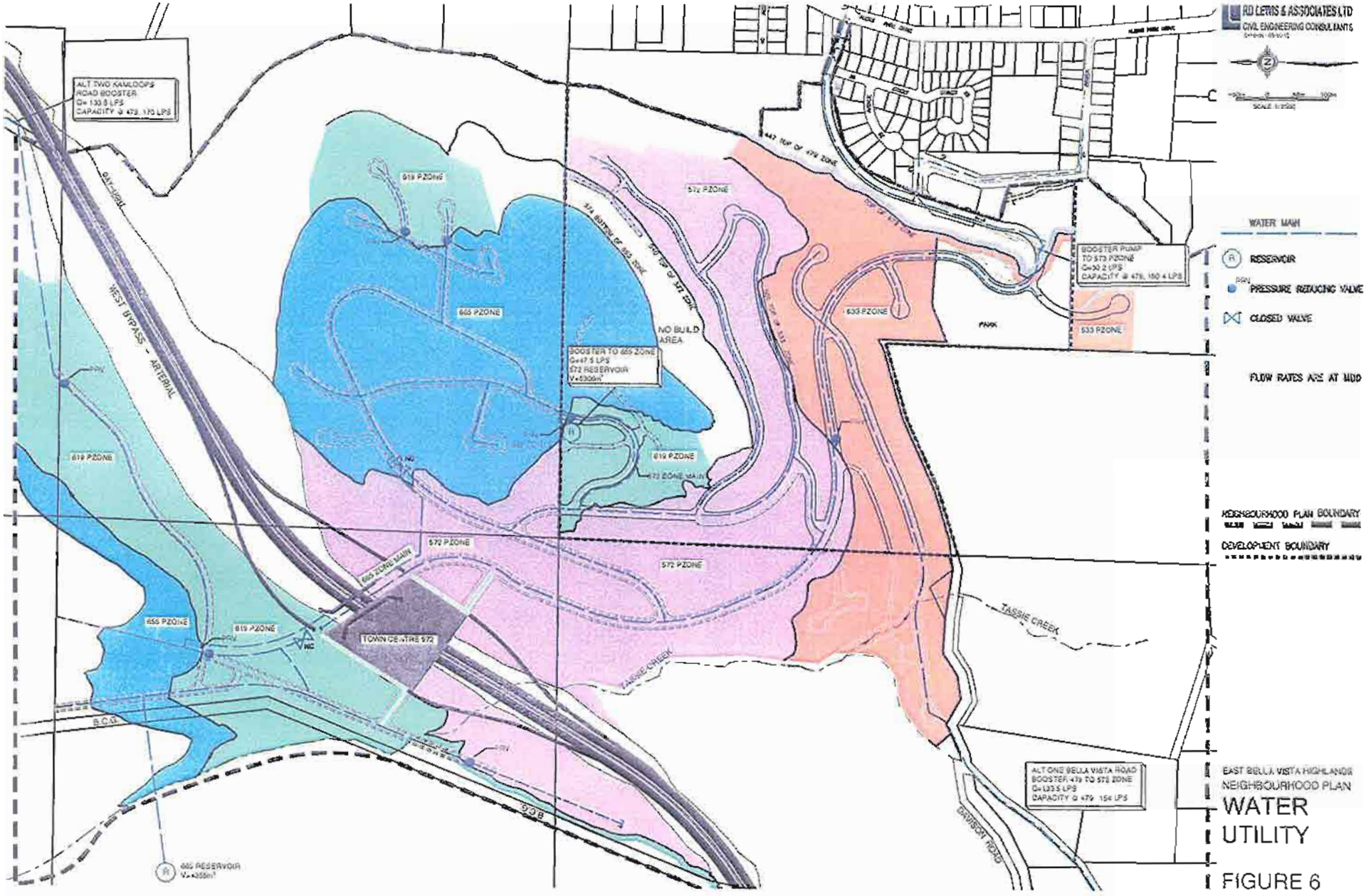
The first stage includes the development of the property proposed for zoning approval - the collector road extension from 39th Street to the west boundary of the proposed zoned property. Residential development of the zoned land will follow market demand. The first phase of this development will be within the 479 Zone of water service.

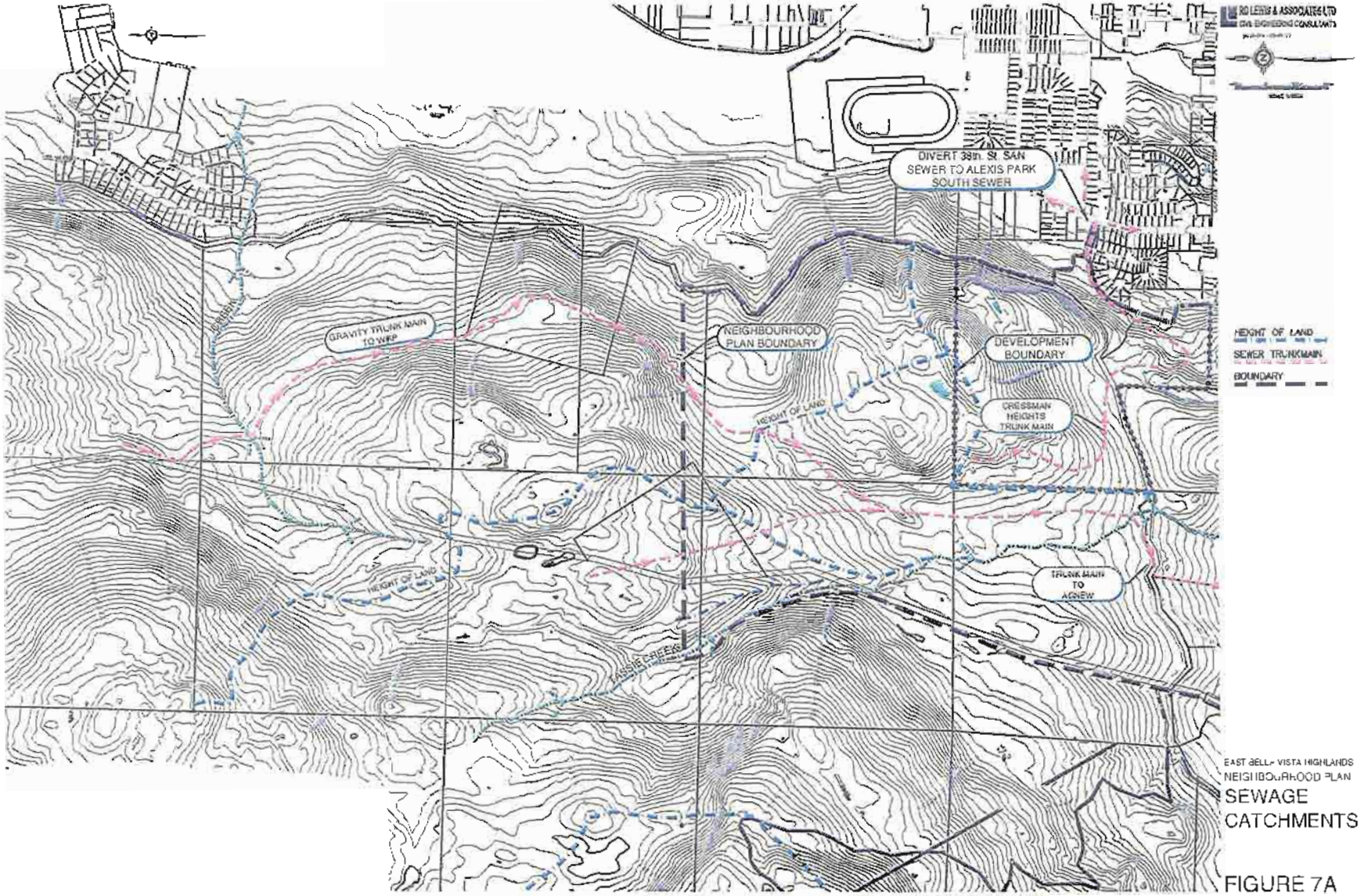
8.2.2 Stage 2

The second stage develops the ¼ section to the north of the land proposed for zoning concurrently with the Neighbourhood Plan.

8.2.3 Stage 3

The third stage completes the Town Centre and corresponds with the extension of the West Bypass.

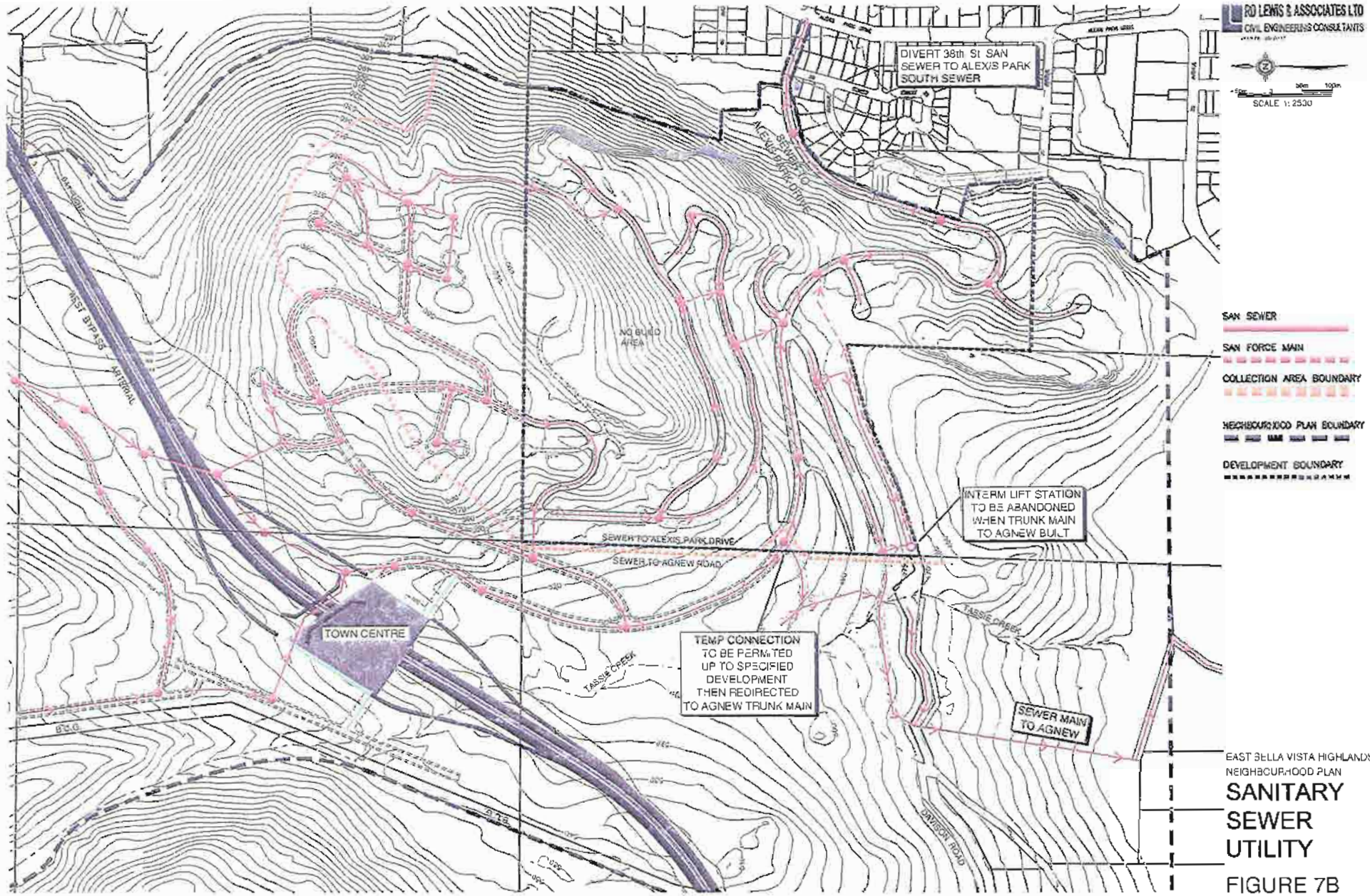

RD LEWIS & ASSOCIATES LTD
CIVIL ENGINEERING CONSULTANTS
ALT TWO KAMLOOPS ROAD BOOSTER
Q= 133.8 LPS
CAPACITY @ 479, 170 LPS
819 PZONE
665 PZONE
572 PZONE
633 PZONE
BOOSTER PUMP TO 572 PZONE
Q=30.2 LPS
CAPACITY @ 479, 150.4 LPS
BOOSTER TO 665 ZONE
Q=47.5 LPS
572 RESERVOIR
V=4300m³
NO BUILD AREA
WEST BYPASS - ARTERIAL
665 ZONE MAIN
572 ZONE MAIN
TOWN CENTRE 572
TASSIE CREEK
B.C.G.
665 RESERVOIR
V=4350m³
ALT ONE BELLA VISTA ROAD BOOSTER 479 TO 572 ZONE
Q=133.5 LPS
CAPACITY @ 479 154 LPS
DAVIDSON ROAD
WATER MAIN
RESERVOIR
PRV
PRESSURE REDUCING VALVE
CLOSED VALVE
FLOW RATES ARE AT MDD
NEIGHBOURHOOD PLAN BOUNDARY
DEVELOPMENT BOUNDARY
EAST BELLA VISTA HIGHLANDS NEIGHBOURHOOD PLAN
WATER UTILITY
FIGURE 6



EAST BELLA VISTA HIGHLANDS
NEIGHBOURHOOD PLAN

SEWAGE
CATCHMENTS

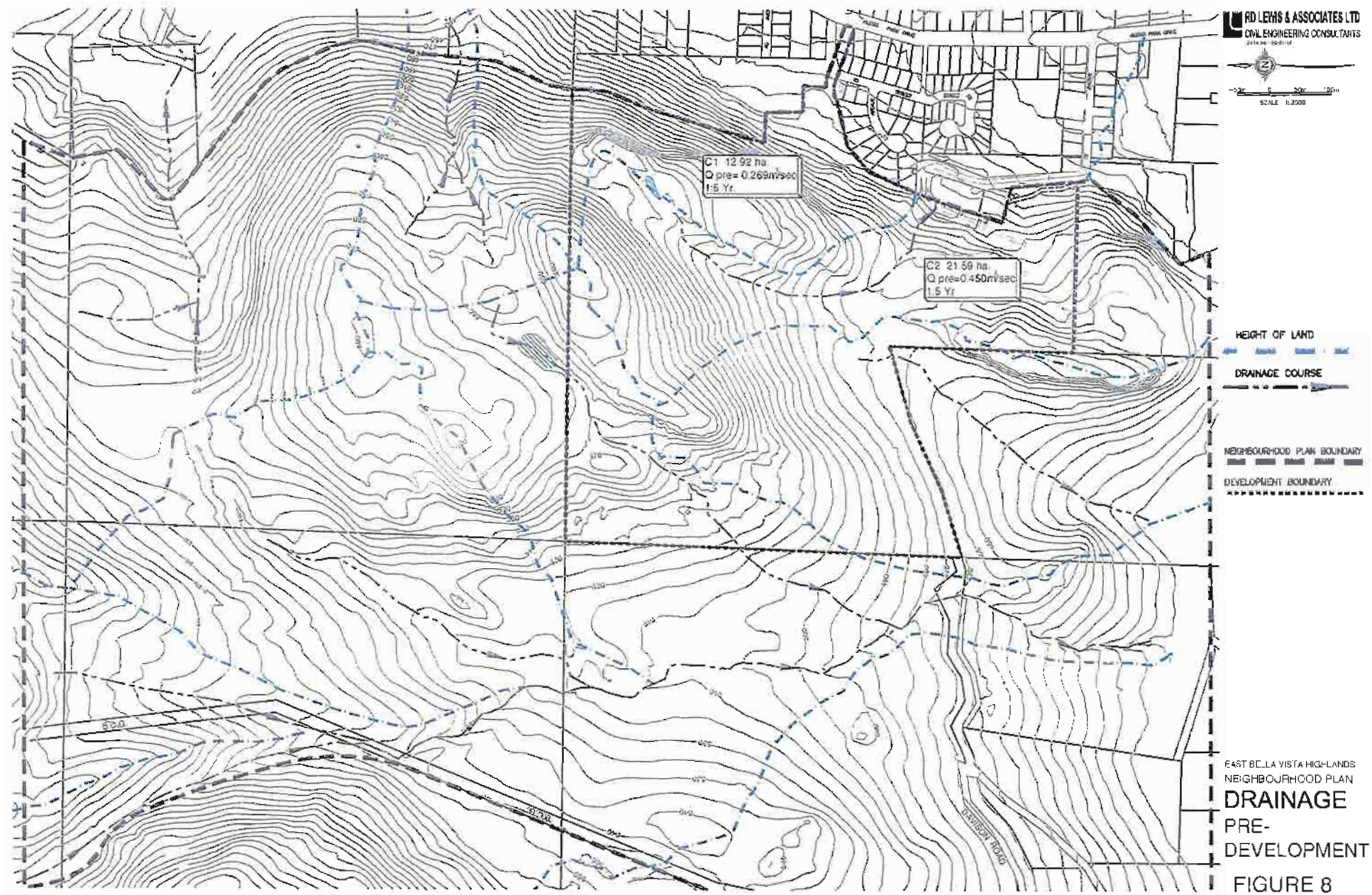
FIGURE 7A

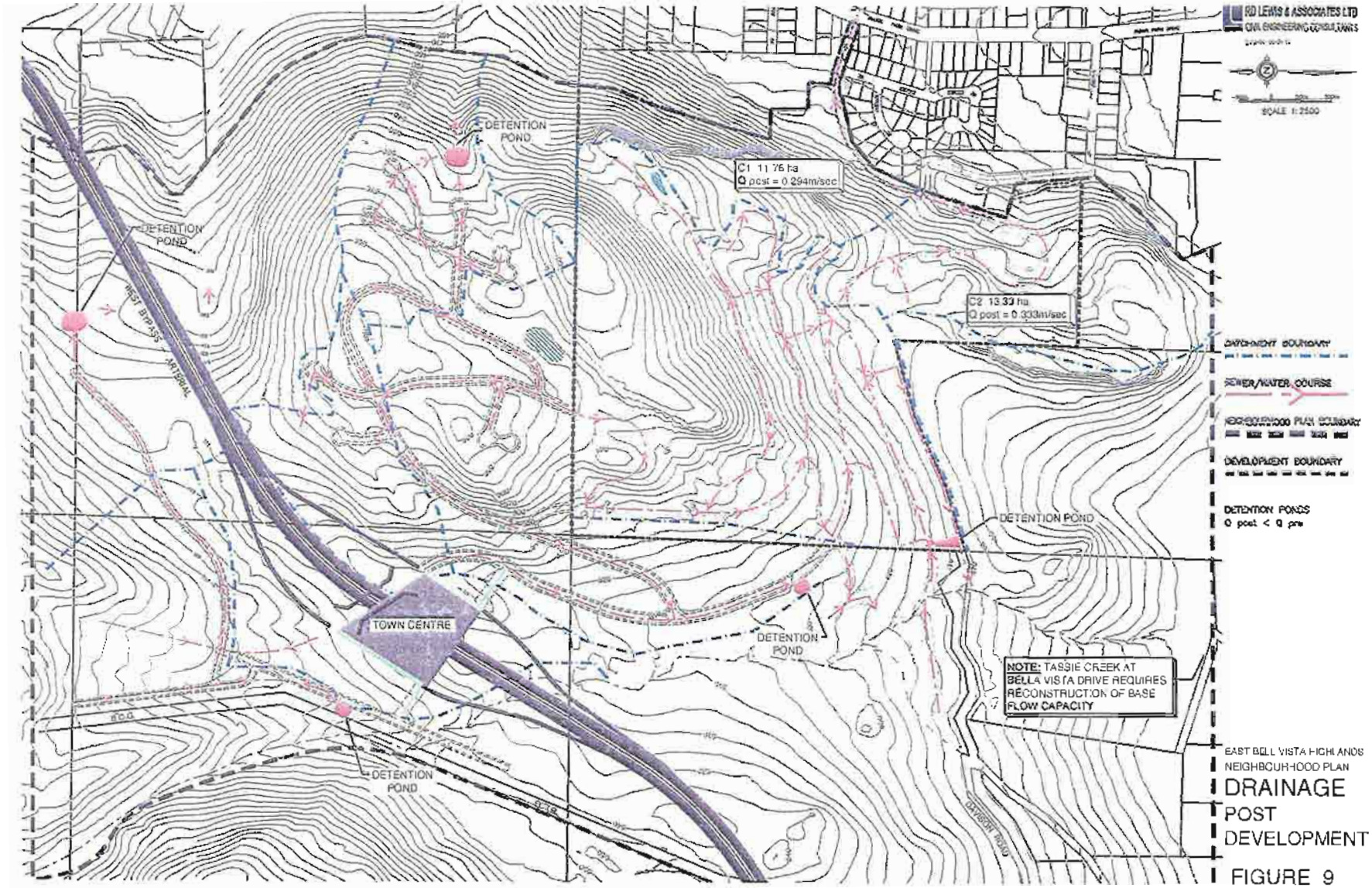


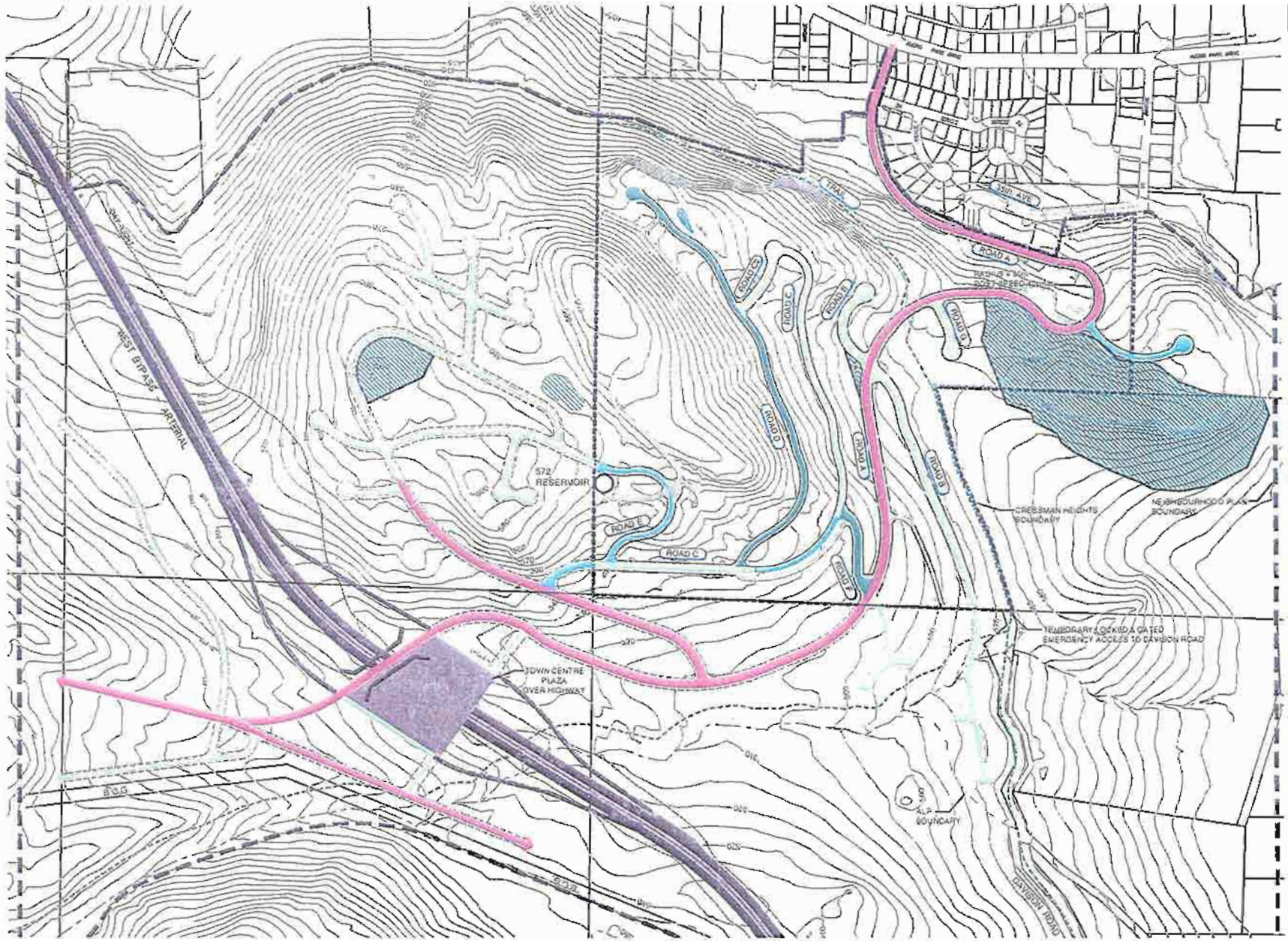
EAST BELLA VISTA HIGHLANDS NEIGHBOURHOOD PLAN

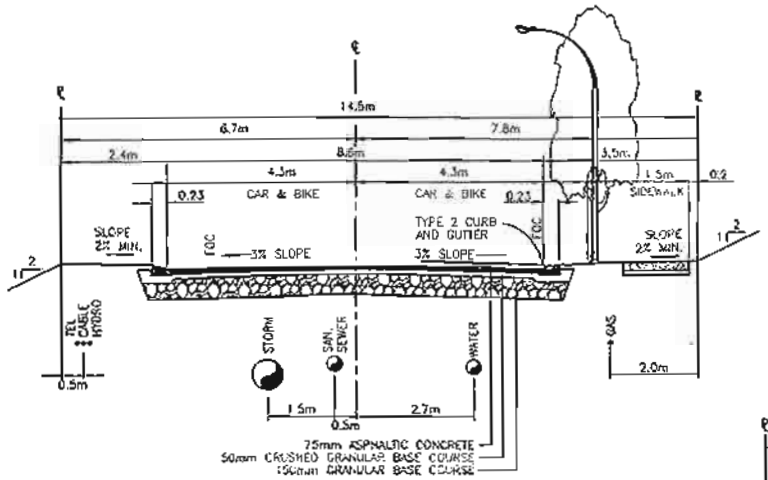
SANITARY SEWER UTILITY

FIGURE 7B

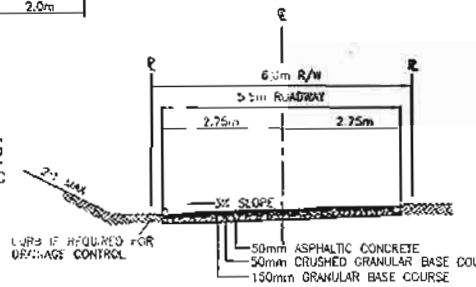

RD LEWIS & ASSOCIATES LTD
CIVIL ENGINEERING CONSULTANTS
SCALE 1:2500
C1 12.92 ha
Q pre= 0.269m³/sec
1:5 Yr
C2 21.59 ha
Q pre=0.450m³/sec
1:5 Yr
HEIGHT OF LAND
DRAINAGE COURSE
NEIGHBOURHOOD PLAN BOUNDARY
DEVELOPMENT BOUNDARY
DAVIDSON ROAD
EAST BELLA VISTA HIGHLANDS
NEIGHBOURHOOD PLAN
DRAINAGE
PRE-
DEVELOPMENT
FIGURE 8


RD LEWIS & ASSOCIATES LTD
CIVIL ENGINEERING CONSULTANTS
SCALE 1: 2500
DETENTION POND
C1 11.76 ha
Q post = 0.294m/sec
DETENTION POND
C2 13.33 ha
Q post = 0.333m/sec
WEST BYPASS ARTERIAL
CATCHMENT BOUNDARY
SEWER/WATER COURSE
NEIGHBOURHOOD PLAN BOUNDARY
DEVELOPMENT BOUNDARY
DETENTION PONDS
Q post < Q pre
DETENTION POND
TOWN CENTRE
DETENTION POND
NOTE: TASSIE CREEK AT BELLA VISTA DRIVE REQUIRES RECONSTRUCTION OF BASE FLOW CAPACITY
DETENTION POND
EAST BELL VISTA HIGHLANDS
NEIGHBOURHOOD PLAN
DRAINAGE
POST
DEVELOPMENT
FIGURE 9

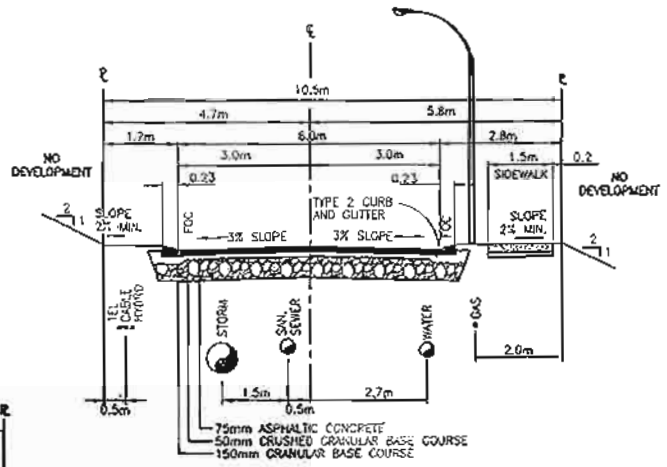

RD LEWIS & ASSOCIATES LTD
CIVIL ENGINEERING CONSULTANTS
SCALE 1:2500
14.5m COLLECTOR NO LOAD CONDITION A,B,C
12.5m LOCAL NO LOAD CONDITION A
14.5m LOCAL SINGLE LOAD CONDITION B
17m LOCAL DOUBLE LOAD CONDITION C
6m LANE CONDITION A
DESIGN SPEED 50km/h
EAST BELLA VISTA HIGHLANDS NEIGHBOURHOOD PLAN
ROADS
FIGURE 10
WEST BYPASS - ARTERIAL
572 RESERVOIR
ROAD A
ROAD B
ROAD C
ROAD D
ROAD E
ROAD F
ROAD G
ROAD H
TOWN CENTRE PLAZA OVER HIGHWAY
CRESSMAN HEIGHTS BOUNDARY
NEIGHBOURHOOD PLAN BOUNDARY
TEMPORARY LOCKED & GATED EMERGENCY ACCESS TO DAVISON ROAD
ALR BOUNDARY
DAVISON ROAD
BOG



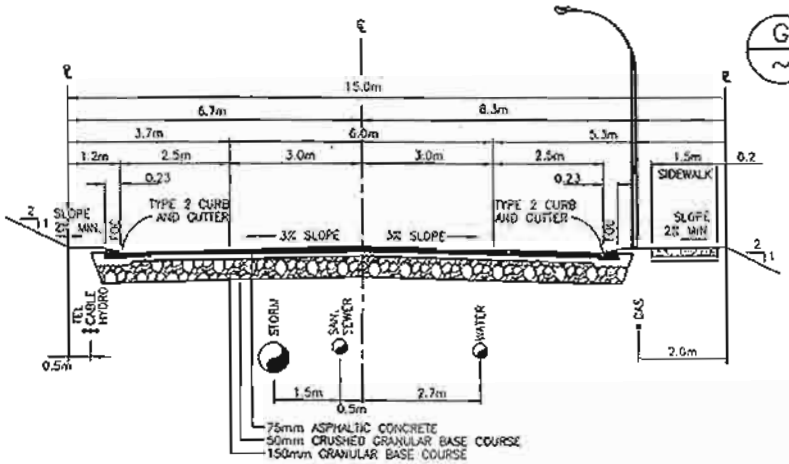
A COLLECTOR ROAD NO ACCESS
1:50
CONDITION A, B, C



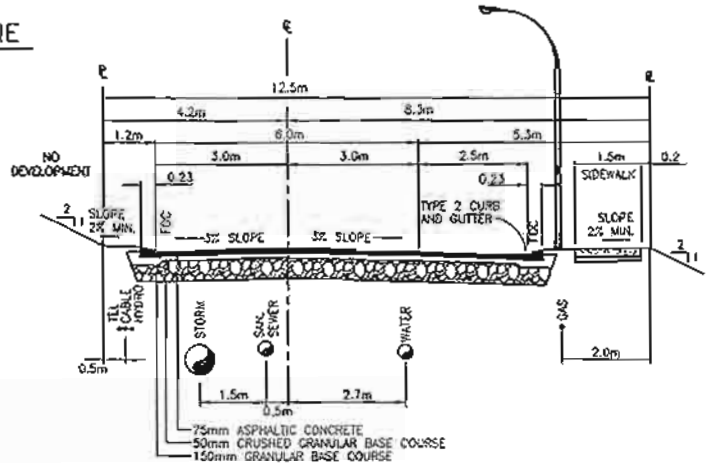
G 6.0m LANE
1:50



D LOCAL ROAD (NO DEVELOPMENT)
1:50
CONDITION A



F LOCAL ROAD (DEVELOPMENT BOTH SIDES)
1:50
CONDITION C

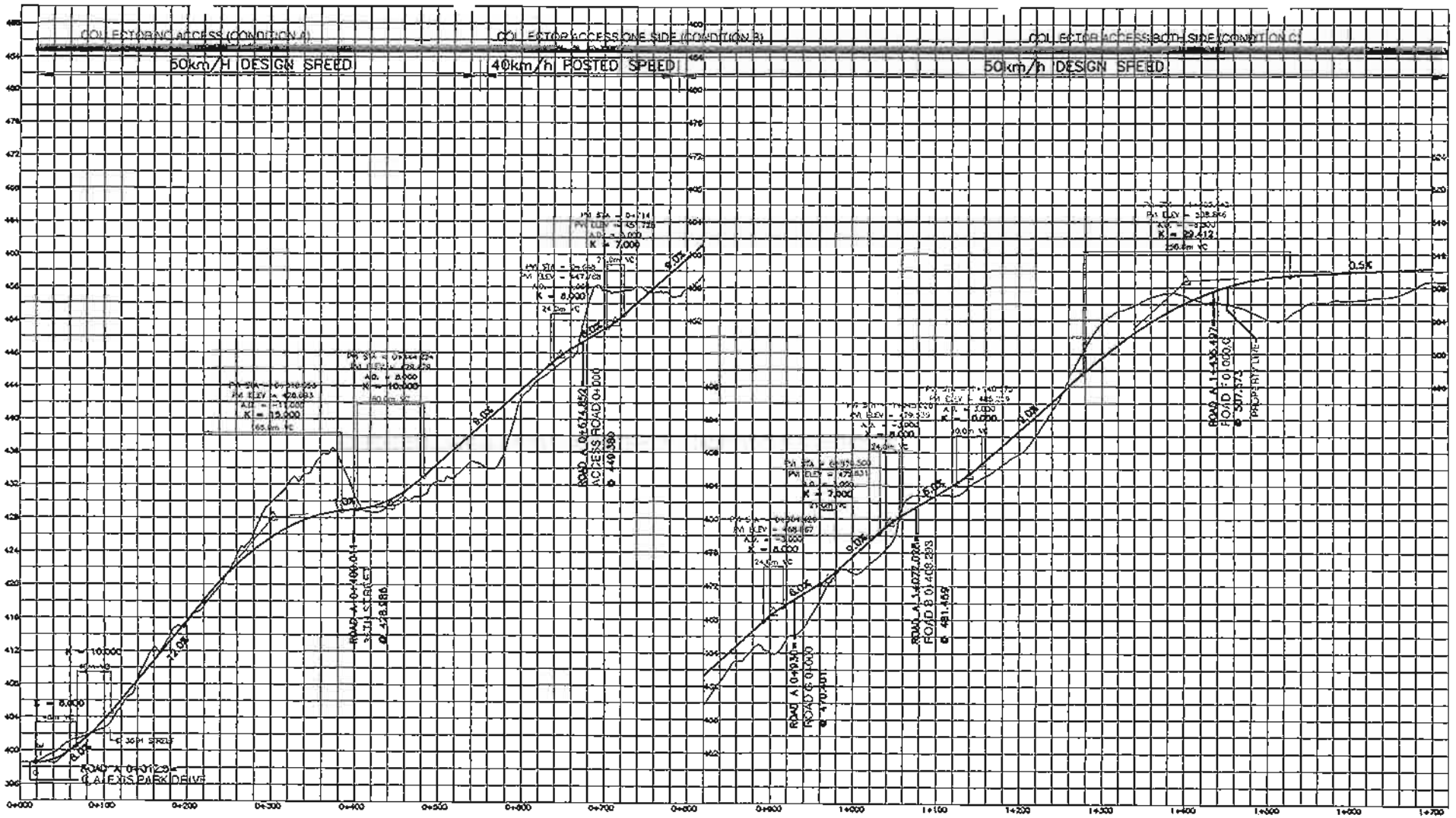


E LOCAL ROAD (DEVELOPMENT ONE SIDE)
1:50
CONDITION B

EAST BELLA VISTA HIGHLANDS
NEIGHBOURHOOD PLAN

TYPICAL SECTIONS

FIGURE 11



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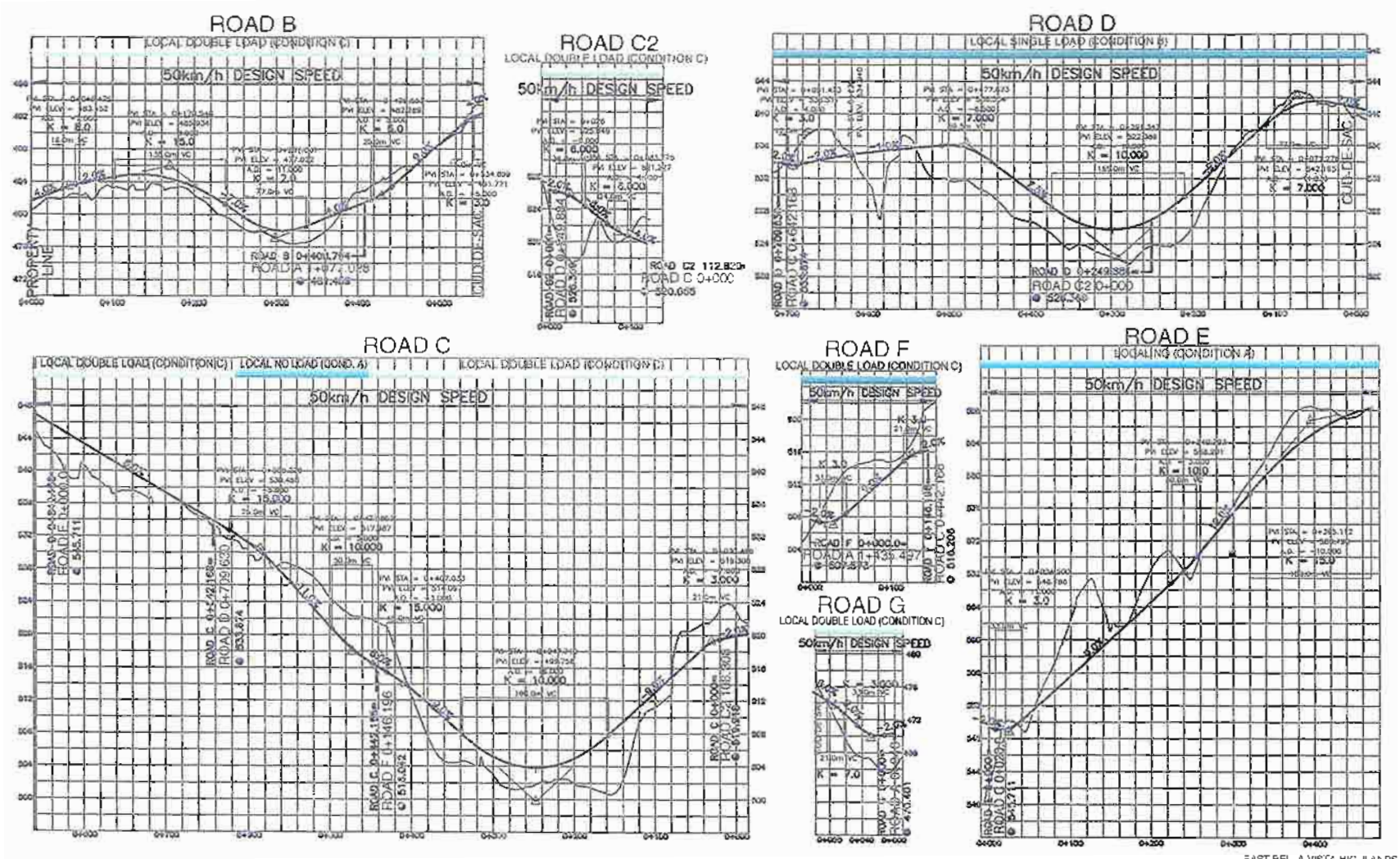
CIVIL ENGINEERING CONSULTANTS

HORIZ.
VERT.
SCALE 1:2000

EAST BELLA VISTA HIGHLANDS
NEIGHBOURHOOD PLAN

ROAD A PROFILE

FIGURE 12A



RD LEKS & ASSOCIATES LTD
CIVIL ENGINEERING CONSULTANTS

HORIZ.

VERT.

EAST BEL. A VISTA HIGHLANDS
NEIGHBOURHOOD PLAN

ROAD PROFILES

FIGURE 12B

9.0 GEOTECHNICAL ASSESSMENT

9.1 DEVELOPMENT POTENTIAL

Golder and Associates Ltd. completed a Geotechnical Hazard Assessment (July 2004). See Appendix C – Geotechnical Hazard Assessment.

The subsurface condition is composed of volcanic bedrock of basaltic and andesite lava. Surface soil is shallow consisting of sand and gravel with a varying level of silt content and silty clay. Deposits vary and care is needed with foundation design within areas with varied subsurface conditions.

As a hillside development, a set of standards will be required to assure development integrity from land related movement. These standards include site suitability criteria based on a setback from the toe of slope caused by a line at a ratio of 1.75 horizontal to 1 vertical unless the foundation is on bedrock.

No geotechnical hazards were noted on the undeveloped site. However, the construction of roads and development servicing will require blasting of bedrock and new hazards may be created. A set of performance conditions is required to keep the future development safe from hazards that may result from development. Although no geotechnical hazards were noted, it is recommended to scale some natural cliffs to further improve safety.

Excluding surficial organic soils and any fills, the proposed residential development can be supported on conventional spread and strip footings that are founded on native loose to dense granular deposits, stiff layered clay, competent bedrock or engineered fills. Retaining walls and foundations will be designed to disperse hydrostatic pressure. Roadworks over the silty clay deposits require a supplemental sub-base.

Perimeter foundation drains around homes and retaining walls should connect to the storm management system in areas where the soils are not suitable for recharge practices. Sulphate resistant concrete is required for works within the silty clay deposits.

Geotechnical engineering inspection and approval of subgrade foundation soils is recommended. Construction compaction should be monitored in accord with the City of Vernon's requirements.

9.2 GEOTECHNICAL POLICIES

9.2.1 Provide geotechnical hazard protocol to assess and mitigate potential hazards that result from development;

9.2.2 Set buildings back from the toe of the slope based on a building line formed by a line from the toe extending 1.75 horizontal to 1 vertical;

9.2.3 For bedrock locations, Policy 9.2.2 does not apply, provided the foundation site has been inspected and approved by a geotechnical engineer;

9.2.4 Consider scaling the steep bedrock slopes adjacent to the future 39th Avenue extension;

9.2.5 Within clay deposits, extend footings 1.2 metres below the existing ground surface;

9.2.6 Avoid foundations that are partially on bedrock unless the foundation is engineered and the site is approved by a geotechnical engineer;

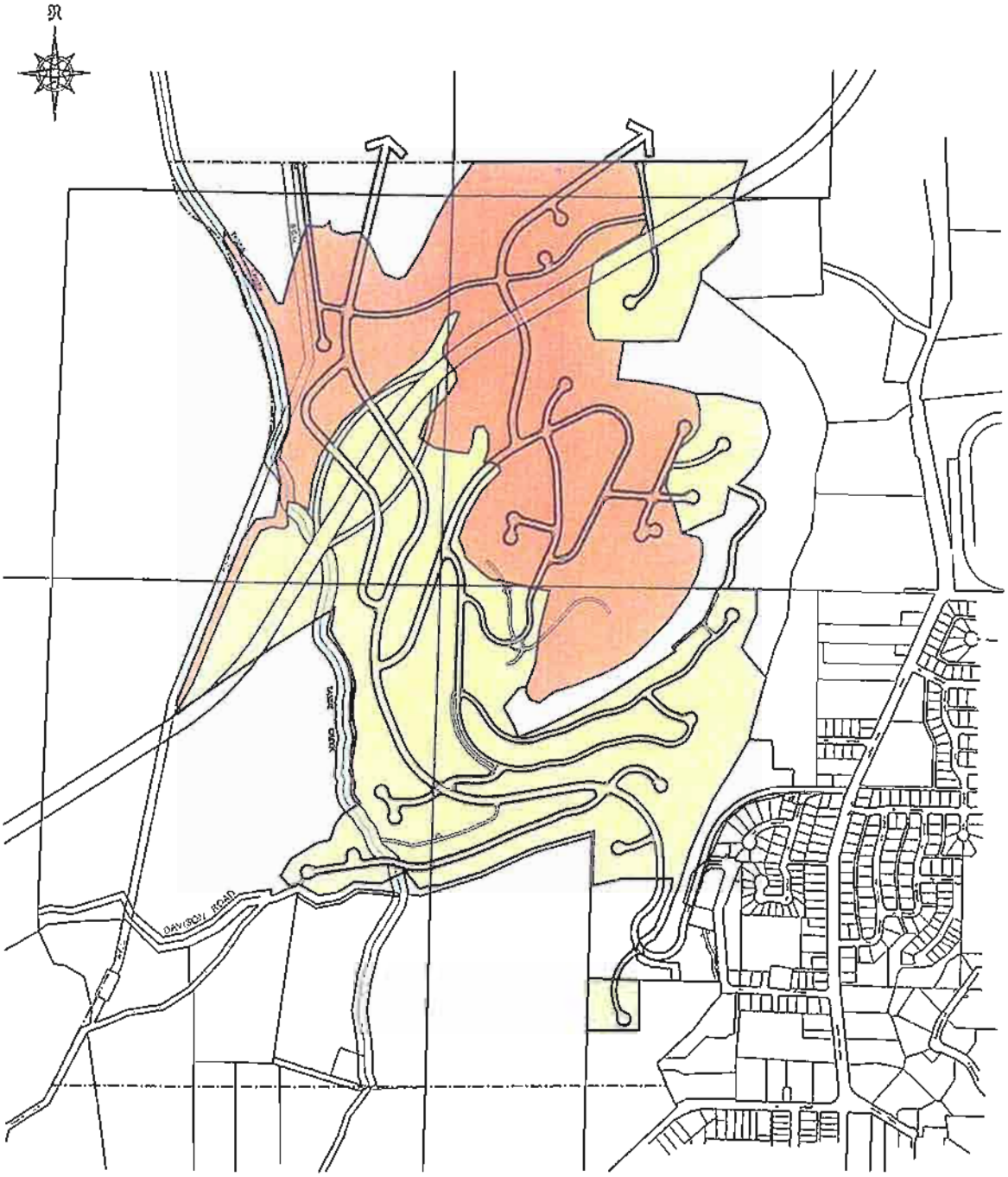
9.2.7 Geotechnical inspection is recommended for specific building footprint subsurface condition suitability;

9.2.8 Implement the development preparation recommendations outlined in Appendix C – Geotechnical Hazard Assessment;

9.2.9 Use sulphate resistant concrete to an S-2 class of exposure for all foundation and infrastructure works in the silty clay parts of the Plan area;

9.2.10 Manage stormwater to pre-development flows and ensure that it is not concentrated and directed over unprotected slopes.

9.2.11 Undertake best management practices to reduce the potential for rockfall and rolling rock hazards.



DEVELOPMENT STAGING LEGEND:

STAGE 1

STAGE 2

NEW TOWN PLANNING SERVICES INC.

EAST BELLA VISTA HIGHLANDS
DEVELOPMENT STAGING

PROJECT No.: 1335
DRAWN BY: WJZ
DATE: SEPT 23, 2004
SCALE. NTS
FIGURE NO. 13

10.0 AGRICULTURAL LAND RESERVE

10.1 ALR BUFFER

The properties in the south and west of the Plan area are subject to the Agricultural Land Reserve (ALR) regulations. As a consequence, the development must buffer the interface between the urban and farm uses.

The buffer along the Grey Canal - Ribbons of Green trail skirts the south end of the development land within the Neighbourhood Plan area. This trail will average 10 metres in width. Adjacent to the trail will be a fencing and landscaping treatment in accord with the ALC requirements.

The land with urban uses in the southeast corner of the Plan area has a trail leading to a large park abutting the ALR. Fencing is expected to prevent trespass and plantings may also be considered.

The only other ALR intervention proposed by this Neighbourhood Plan is the Highway 97 West Bypass road alignment across ALR designated land.

10.2 ALR POLICIES

10.2.1 Construct a buffer in accord with the ALC policy requirements;

10.2.2 Secure endorsement for the Highway 97 Bypass alignment through the affected ALR land;

10.2.3 Register a covenant on all private property with an interface boundary with ALR lands confirming the right to farm those lands.

10.2.4 Encourage intensified agricultural and agri-tourism opportunities within the ALR designated properties.

10.2.5 Discourage subdivision into smaller parcels.

10.2.6 Encourage value added agricultural ventures.

11.0 ARCHAEOLOGICAL HERITAGE

11.1 ARCHAEOLOGICAL IMPACT ASSESSMENT

Golder Associates Ltd. is completing an Archeological Impact Assessment of the Cressman Property. No development disturbance of the land within the Neighbourhood Plan Boundary is permitted prior to an Archaeological Impact Assessment being undertaken. These activities are subject to the following policies.

11.2 HERITAGE POLICIES

11.2.1 Undertake an Archaeological Impact Assessment prior to any development disturbance of the land within the Neighbourhood Plan boundary.

11.2.2 Any unrecorded archaeological features encountered during construction should be promptly reported to Archaeology Planning and Assessment, and the Okanagan Indian Band shall be promptly notified of any newly discovered sites.

11.2.3 Subject to the Provincial authority, dedicate rights of ownership of cultural First Nations artifacts to the OKIB.

11.2.4 Modify or stop any land altering activities in the immediate vicinity of any previously unidentified site in order that it not be adversely impacted. Determine, in consultation with Archaeology Planning and Assessment and the Okanagan Indian Band, an acceptable mitigation strategy.

11.2.5 Acknowledge post – contact First Nations Cultural Heritage and manage any archaeological features or artifacts in a similar manner to pre-contact resources.

APPENDIX A

Environmental Impact Assessment,

Summit Environmental Consultants (February 2005)

ENVIRONMENTAL IMPACT ASSESSMENT OF THE CRESSMAN PROPERTY DEVELOPMENT: EAST BELLA VISTA NEIGHBOURHOOD

Prepared for:

DC Properties Ltd.
c/o New Town Services
1450 Pandosy Street
Kelowna, BC
V1Y 1P3

Prepared by:

Summit Environmental Consultants Ltd.
17A – 100 Kalamalka Lake Road
Vernon, B.C.
V1T 7M3

Project # 822-01.01

February 2005

SUMMIT
ENVIRONMENTAL CONSULTANTS LTD. (ISO 9001 AND 14001 CERTIFIED)
#17 - 100 KALAMALKA LAKE RD
VERNON, BC
TEL 250 545 3672 FAX 250 545 3654
www.summit-environmental.com

February 15, 2005

Reference: 822-01.01

DC Properties Ltd.
c/o New Town Services
1450 Pandosy Street
Kelowna, BC
V1Y 1P3

Attention: Mr. Keith Funk

Re: East Bella Vista Development Environmental Assessment

Summit Environmental Consultants Ltd. is pleased to provide the report for the above-noted project.

The proposed East Bella Vista Development has incorporated a number of the recommendations of Martin (1993) and the Natural Features Inventory (Clarke, et al., 1993), and the development footprint is primarily on areas that have been disturbed by historic and on-going land uses. For example, the proposed open space areas retain almost all of the cliffs and rocky outcrops that provide important habitat for snakes, bats, and certain flowering plants. The plan also calls for preservation of the only marsh on-site, preservation of the aspen copse near the "neck", creation of 30 m wide setbacks on the east side of Tassie Creek, and a detention pond to maintain runoff to pre-development levels. The areas of cliffs and steep slopes, the marsh and the aspen copse are the habitats with the greatest potential to contain the rare, threatened and endangered species that may be present on-site. We provide a list of recommended mitigation activities that, if implemented, will reduce the impacts of the proposed development.

The assessment and our conclusions are restricted to the effects of the proposed East Bella Vista Development only and did not consider the potential impacts of development within the entire East Bella Vista Highlands.

Please call if you have any questions.

Yours truly,

Summit Environmental Consultants Ltd.

Susan Stoddart, R.P.Bio.
Biologist

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1.0 INTRODUCTION

1.1 PROJECT BACKGROUND

DC Properties Ltd. ("DC Properties") is planning to develop a residential community in the eastern part of the East Bella Vista Highlands area of Vernon, B.C., to be known as East Bella Vista Development (Figure 1.1). The property is currently zoned a mixture of A2 (small holdings) and RM2 (multiple housing residential). Planning for a residential development on this site began in 2001 with another proponent. Under Policy A9 of the City of Vernon Official Community Plan (OCP), known as Plan Vernon, an environmental impact assessment (EIA) is required to support consideration of the neighbourhood plan by City of Vernon Council. An EIA report was prepared under the direction of the original proponent in 2001. However, the original development proposal did not move forward and the City of Vernon did not complete the environmental review of that proposal. In 2004 DC Properties assumed control of the development site and prepared an updated development proposal that would retain the same general vision for the property as a residential community, but which involves some key changes in design.

In June 2004 DC Properties retained Summit Environmental Consultants Ltd. to complete an EIA of the proposed development on their behalf. This report presents the result of the EIA and provides recommendations for mitigation. It builds on the work completed by a number of previous investigators but includes new information.

1.2 PROJECT OBJECTIVES

The general objectives of this study are to identify potential environmental impacts of the proposed East Bella Vista Development ("the project") and provide recommendations to avoid or reduce any impacts that are identified. **Although land use planning has been completed for the entire East Bella Vista Highlands area ("the Highlands") this assessment report only addresses the project area and is limited to potential impacts on vegetation, wildlife and wildlife habitat, and aquatic resources from the East Bella Vista Development.** Figures 1.1, 3.1, 4.1, and 4.2 show the boundaries of the entire East Bella

Vista Highland area and the boundaries of the initial development area that is covered by this report.

Specific tasks completed to achieve the objectives are:

1. Assemble and review existing information on the site and adjacent areas;
2. Complete a field reconnaissance of the East Bella Vista Development area;
3. Describe the baseline environment, including known and potential occurrences of rare or endangered wildlife species;
4. Describe the proposed development;
5. Determine potential environmental impacts of the proposed development; and
6. Develop a mitigation strategy to avoid or minimise any identified environmental effects.

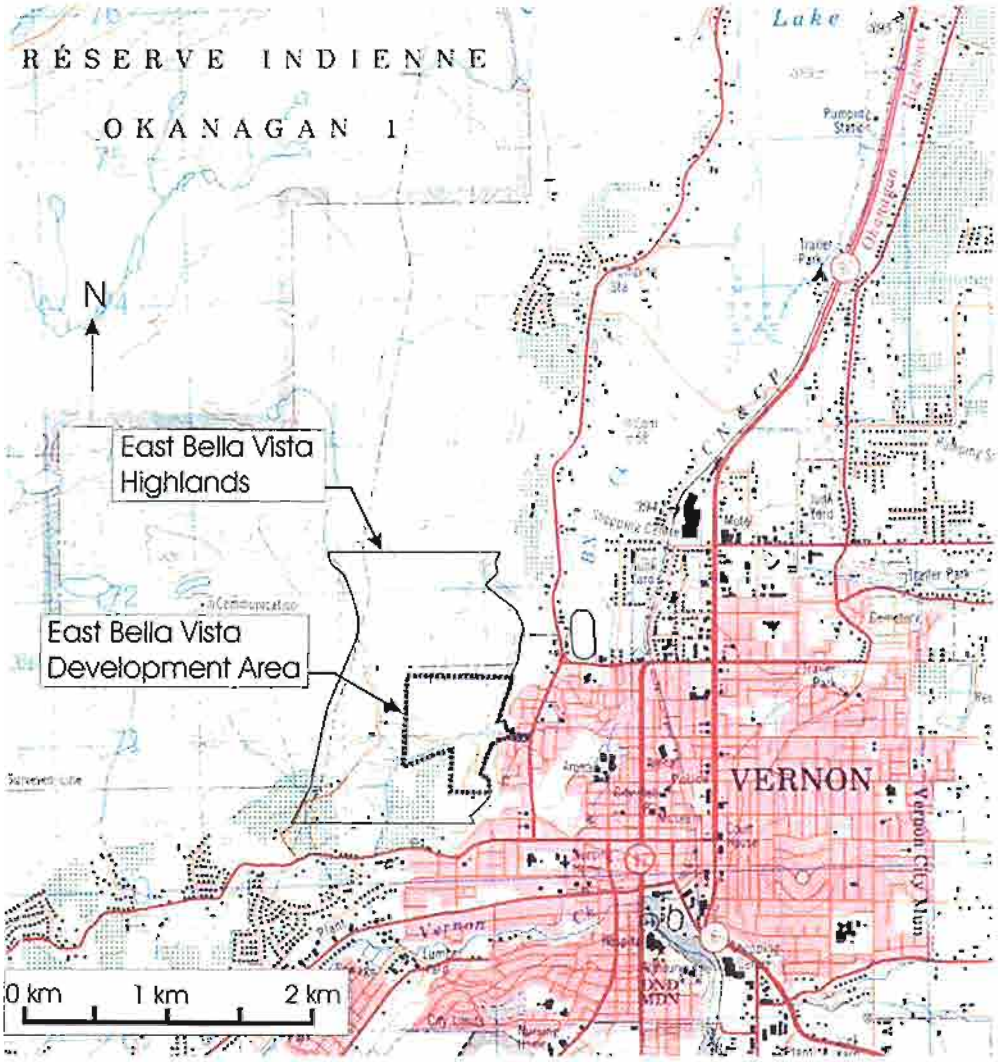


Figure 1.1. Location of East Bella Vista Development.

2.0 METHODS

The EIA was completed through a review of existing information (maps, reports, and databases) and two field reconnaissance surveys. Site reconnaissance for the original proposal was completed by Hugh Hamilton, P.Ag. and Martin Gebauer, R.P.Bio. in November, 2001. An additional site reconnaissance for this report was completed by Susan Stoddart, B.Sc., R.P.Bio. in July 2004. In addition to assessing potential impacts of the proposed development, the assessment sought to evaluate a number of potential concerns raised by the Ministry of Water, Land and Air Protection (MWLAP) in letters dated August 31, 2001 and February 7, 2002 (Latimer, 2001 and 2002 – See Appendix B) after the neighbourhood plan developed by the previous proponent had been referred to MWLAP for comment by the City of Vernon. Subsequent to the involvement of the previous proponent and prior to DC assuming control of the development site, a Sensitive Ecosystem Inventory (SEI) was completed for the Bella Vista - Goose Lake Range, which includes the project area (Iverson, 2002 and Sarell and Hancy, 2003). The results of the SEI were considered in this report. Finally, the assessment considered comments provided by the North Okanagan Naturalists Club (Bailey, 2001) and the Allan Brooks Nature Centre Society (Clarke, 2001).

3.0 GENERAL SITE AND PROJECT DESCRIPTION

The project area is located about 1.7 km west of downtown Vernon at elevations ranging from about 410 m to 620 m above sea level. Bedrock is a complex mixture of sedimentary rocks (shale, sandstone, conglomerate, and limestone) and volcanic rocks (andesite and basalt flows) (Kidston, 1993). Soils on the rocky knoll (i.e. Turtle Mountain) on the eastern part of the site are predominantly Orthic Black soils of the Nickel Plate series, formed on colluvium (Ministry of Environment, 1978). They are somewhat thin (10 cm-100 cm over bedrock) with moderate to high coarse fragments and good drainage. Soils on the western side of the property are Armstrong series soils, formed on morainal deposits generally deeper than 100 cm. These are Orthic Black soils with moderate coarse fragments, good drainage, and slow perviousness.

Published agricultural land capability ratings for the property are primarily Class 6 – capable for grazing only, limited by topography and shallow bedrock (Canada Land Inventory, 1977).

The development area is located in the Interior Douglas fir biogeoclimatic zone, Okanagan very dry hot variant, grassland phase (IDFxh1a) (Lloyd et al., 1990). Within this biogeoclimatic zone, and in the project area, most trees are limited to moister areas, although there are occasional Ponderosa pine trees[1] in the drier areas. Plants typically present on the south facing slopes and areas with well-drained soils include big sagebrush, prairie rose, arrow-leaved balsamroot, bluebunch wheatgrass, and Idaho fescue. In moister sites, vegetation includes trembling aspen, wild rose, tall Oregon grape, and Kentucky bluegrass.

The project area and surrounding area form part of what is known as the North Okanagan grasslands. Historically, the project area was used for cattle grazing, a practice that has likely occurred for more than 80 years and continues today. Although no longer in use, there are several gravel pits and quarries in the project area as well as a number of old tracks and trails. Noxious weeds, most notably diffuse knapweed and sulphur cinquefoil, are abundant in the project area, most likely the result of transportation of seed stock by vehicles and cattle (Martin, 1993). Although the site is privately held, hikers routinely access the site from Alexis Park Road and Davison Road.

This assessment is based on conceptual plans for the East Bella Vista Development. The proposed development, illustrated in Figure 3.1, includes:

- Low-density multiple family housing (average density of 19 units/ha);
- One and two family residential (average density of 8 units/ha);
- Medium density housing including townhouse and apartments (average density of 35 units/ha);

[1] A species list with scientific names is provided in Appendix A.

- Parks and trails; and
- Open space areas to be left in a natural condition.

Proposed landscaping emphasizes xeriscaping (i.e. landscaping with native drought-tolerant plants), and the natural attributes of the property are expected to be emphasized in marketing. All areas within the Agricultural Land Reserve (ALR) will remain so.

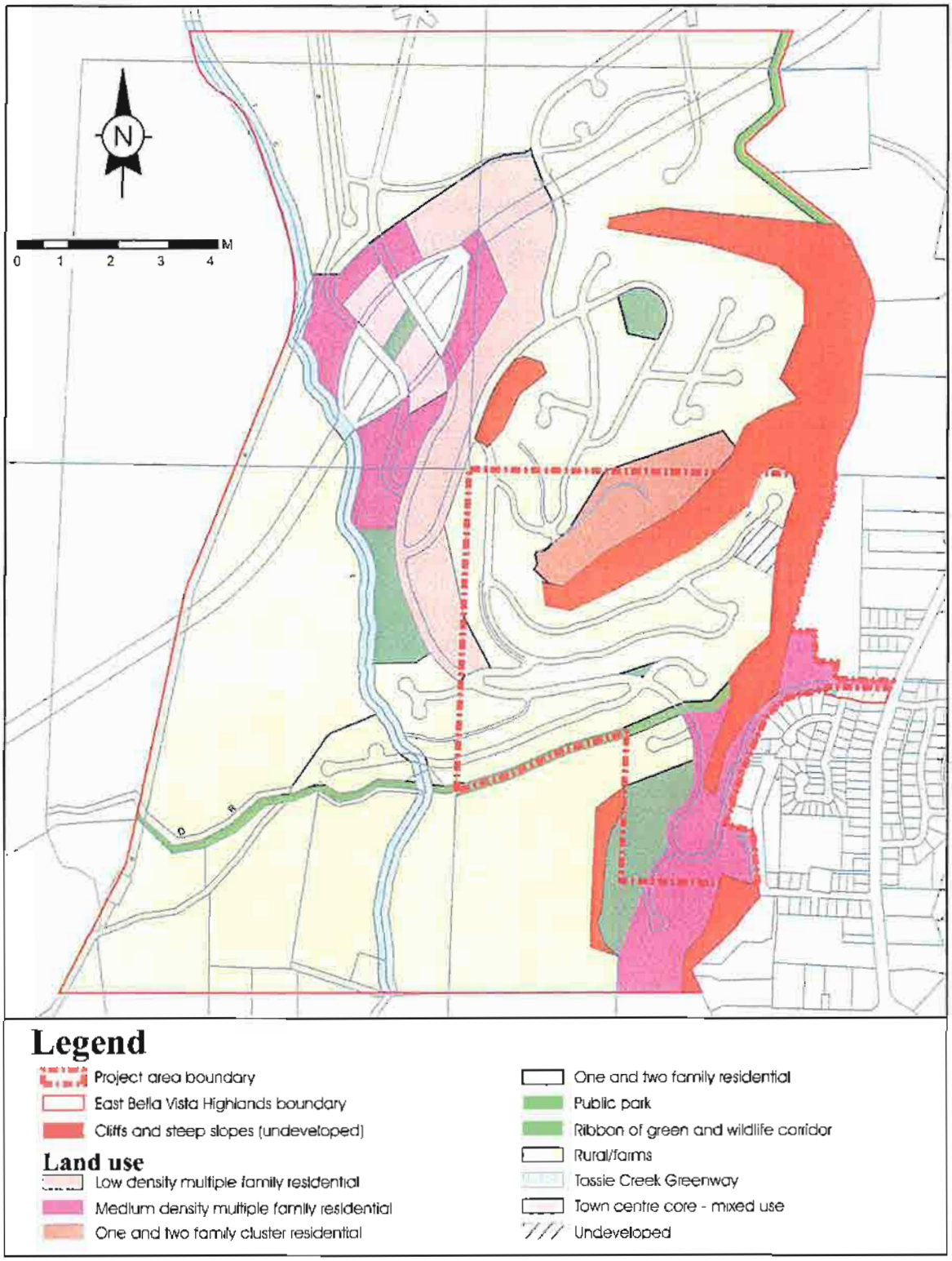


Figure 3.1. Conceptual plan for the East Bella Vista Development.

4.0 ENVIRONMENTAL ASSESSMENT

4.1 TERRESTRIAL ECOSYSTEMS, VEGETATION AND WILDLIFE

4.1.1 Baseline Environment

As noted above, the development area is located within the IDFxh1a biogeoclimatic phase, which is often referred to as the North Okanagan Grasslands. It is mostly comprised of shrub-steppe and shrubland habitats, with a few small copses of deciduous trees. These copses of trees and thickets of shrubs have high biodiversity values due to their relative rarity within the project and general area. Approximately two-thirds of the East Bella Vista Development area would be categorized as moderately to heavily disturbed from the invasion of noxious weeds, aggregate extraction, and off-road vehicle travel. Nevertheless, portions of the site are reasonably good examples of the North Okanagan grasslands. A small marsh is located in a low area above the east-facing cliffs. Vegetation within the marsh is comprised largely of great bulrush and other aquatic plants, although a large weeping willow is located on the marsh edge. Although small, the marsh functions as a wet "island" within a generally very dry environment, and thus, like the copses of trees and thickets of shrubs, contributes to the overall biodiversity of the East Bella Vista Development area. The marsh, cliffs and steep slopes, and the aspen copse are shown on Figure 4.1.

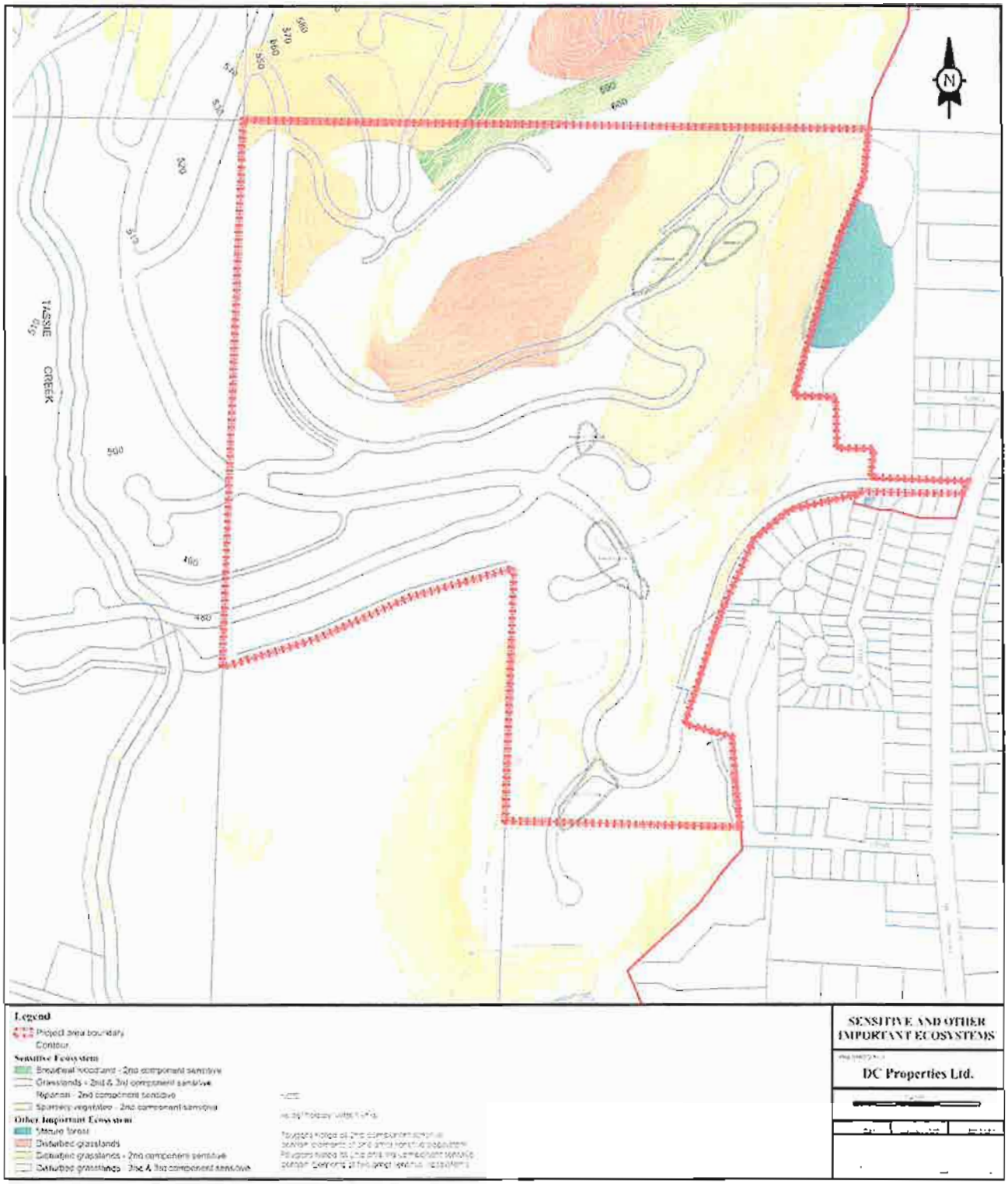
A number of reconnaissance-level biological surveys have previously been completed on the site and adjacent areas. Martin (1993) categorized the East Bella Vista Development area as a "fairly typical example" of the IDFxh1a, but noted the amount of disturbance from its natural state. Plant species identified, in addition to the ones noted in Section 3.0, included brittle prickly pear, desert parsley, saskatoon, Douglas maple, hawthorn, chokecherry, and longhorn plectritus. Martin (1993) identified several areas in good ecological condition, notably steep east and southeast facing slopes, steep rock cliffs, a copse of saskatoon and Douglas maple in the northwest part of the East Bella Vista Development area, and the marsh. A field reconnaissance completed specifically for this assessment confirmed that a significant proportion of the open shrub-steppe areas in the East Bella Vista Development area is

disturbed with high densities of invasive weeds, but vegetation plots have not been completed.

A natural features inventory completed for the Greater Vernon Parks and Recreation Department (GVPRD) included the Turtle Mountain area, although the report authors did not visit the site and relied on views from nearby areas and general knowledge of the North Okanagan Grasslands (Clarke, et al., 1993). They note that the cliffs and talus slopes offer habitat that is locally uncommon and that a number of rare, threatened and endangered animals *could* be present based on the site's characteristics, including western harvest mouse, great basin spadefoot toad, western rattlesnake, Swainson's hawk, and others. The actual presence or absence of those species was not confirmed.

The Sensitive Ecosystem Inventory (SEI) completed for the Bella Vista – Goose Lake Range identified two "sensitive ecosystems"[2] and one "important ecosystem"[3] within the East Bella Vista Development area (Iverson, 2002). The sensitive ecosystems identified were the Sparsely Vegetated and Broadleaf Woodland ecosystems. The only "important ecosystem" identified by the SEI is the "Disturbed Grassland" ecosystem. These ecosystems are described in Table 4.1 below and are shown on Figure 4.1.

2 Sensitive ecosystems are defined in the SEI as one of seven ecosystem types that are ecologically fragile or are provincially rare, and are relatively unmodified by human influences.
3 Other important ecosystems are partially defined in the SEI as modified ecosystems that provide many natural values including wildlife habitat, wildlife corridors, buffers between developed areas and sensitive ecosystems, and sources of potential recruitment for some sensitive ecosystems.



(Map polygons from Iverson, 2002 superimposed on proposed road network)

Figure 4.1. Location of Sensitive Ecosystems, Other Important Ecosystems and natural features of the project area.

Table 4.1. Sensitive and other important ecosystems present in the East Bella Vista Development area.

Sensitive Ecosystem	Ecosystem Description[1]
Sparsely Vegetated	This ecosystem occurs on sites where exposed bedrock or rocks limit the places where vegetation can grow. They include cliffs, rock outcrops and talus slopes with sparse shrub or grass/herb cover. Many of these ecosystems are rare and their coarse or shallow soils make them sensitive to disturbance. They provide important habitat for bats, snakes, and raptor nests.
Broadleaf Woodlands	This ecosystem occurs on sites where the climax vegetation includes a broadleaf overstory. This ecosystem occurs in moister areas and is similar to riparian ecosystems but usually does not include waterbodies. In the project area the broadleaf ecosystem is comprised of aspen copses (thickets) located in broad, moist depressions within grassland areas. Aspen copses provide cover, food and nesting habitat for many species, including those that are cavity nesters.
Other Important Ecosystem	
Disturbed Grasslands	Disturbed grasslands still provide many of the important habitat values associated with grasslands but they have some weeds (20 to 50% noxious weeds) or have lost many climax grassland species. Given the very limited extent of remaining grasslands, these are important sites for grassland restoration and maintenance of many grassland values including habitat for many rare and endangered species.

[1] Descriptions taken from Iverson, 2001

It is important to note that disturbed grasslands, as defined in the SEI, are unlikely to recover on their own without intensive restoration activities. That is, without active weed removal, replanting with native vegetation, limiting access and other activities these areas would remain disturbed, and possible become more disturbed (e.g. weed propagation) over time. It is also important to note that, while providing valuable information on the ecological resources in the Bella Vista – Goose Lake Range area, the SEI is not a regulatory document.

The SEI project also included habitat summaries, species-habitat modeling and habitat suitability[4] mapping for ten wildlife species considered at risk in B.C. (Sarell and Haney, 2003). These species are a subset of the large number of rare or endangered wildlife that *potentially* occur in the Bella Vista – Goose Lake Range. The species considered are listed in Table 4.2.

Table 4.2. Rare or endangered wildlife considered in the Bella Vista – Goose Lake Range SEI.

Scientific Name	Common Name	Prov. Status[1]	COSEWIC Status[2]
Spea intermontana	Great Basin Spadefoot	Blue	Threatened
Crotalus oreganos	Northern Pacific Rattlesnake	Blue	-
Pituophis catenifer	Gopher Snake	Blue	Threatened
Buteo swainsoni	Swainson's Hawk	Red	-
Numenius americanus	Long-billed Curlew	Blue	Special Concern
Otus kennicotti macfarlanei	Interior Western Screech-owl	Red	Endangered
Icteria virens	Yellow-breasted Chat	Red	Endangered
Spizella breweri breweri	Brewer's Sparrow	Red	-
Ammodramus savannarum	Grasshopper Sparrow	Red	-
Taxidea taxus	Badger	Red	Endangered

[1] Provincial Status: Blue-listed species are considered to be Vulnerable in British Columbia. Vulnerable taxa are of special concern because of characteristics that make them particularly sensitive to human activities or natural events. Red-listed species have or are candidates for Extirpated, Endangered, or Threatened status in British Columbia. Extirpated taxa no longer exist in the wild in British Columbia, but do occur elsewhere. Endangered taxa are facing imminent extirpation or extinction. Threatened taxa are likely to become endangered if limiting factors are not reversed.

[2] Committee on the Status of Wildlife in Canada (COSEWIC) status:
Endangered = facing imminent extirpation in Canada or extinction
Threatened = likely to become endangered in Canada if limiting factors are not reversed
Special Concern = particularly sensitive to human activities or natural events

[4] Suitability is the ability of the habitat in its current condition to support a species.

The habitat suitability maps presented in the SEI concur with observations made during field work in that the highest value habitats for these species within the East Bella Vista Development area are found in pockets of different habitats, specifically:

- the marsh;
- thickets of shrubs located in draws and gullies. Notable examples include a diverse pocket of Saskatoon, hawthorn, common snowberry, and tall Oregon grape just west of the marsh, and a thicket on the southern boundary;
- steep rock cliffs, some with significant caves and crevices; and
- the copse of trembling aspen located on the eastern edge of the East Bella Vista Development area where the property narrows and a collector road is proposed (Figure 4.1). This area is referred to as "the neck".
-

A search of the B.C. Conservation Data Centre database of rare element occurrences was commissioned for this assessment. The request asked for all records within four kilometres of the centre of the East Bella Vista Development site (UTM coordinates 337300 E, 5571400 N). The results indicated the presence of six red-listed plants, six blue-listed plants and one red-listed vertebrate animal (Table 4.3). The CDC search did not find any records of red or blue-listed plant communities.

None of the species in Table 4.2 have been confirmed to occur within the East Bella Vista Development area. Most of the plants in Table 4.3 occur on moist to wet sites, which suggest they would only present near the marsh and Tassie Creek. Development is not planned within these areas. In addition to the species listed in Table 4.2 and 4.3, there are several additional rare or endangered species that could occur in the project area. As a detailed plant and wildlife inventory was not conducted as part of this assessment, it cannot be stated conclusively that red or blue-listed plants, animals, or plant communities are absent from the project area, only that no record has been submitted.

Wildlife species observed during field visits included mule deer (a group of six were seen near the west boundary of the Turtle Mountain Uplands area, plus numerous tracks and pellet groups), coyote, northern pocket gopher, and ten bird species (Appendix A). This list of wildlife is not exhaustive and many more species are likely to use the area. For example, Christmas Bird Count data indicates there are additional bird species that frequent the project area (Bodkin, pers. comm., 2005).

Table 4.3. Rare element occurrences within four kilometres of the centre of the project site (CDC, 2004).

Species	Common Name	Status	Preferred Habitat[1]
Vascular Plants			
Azolla mexicana	Mexican Mosquito Fern		Sloughs and pools
Berula erecta	Cut-leaved Water-Parsnip	Red	Wet to moist shorelines, streambanks, ditches, and open areas
Carex amplifolia	Bigleaf Sedge	Blue	Moist meadows, swamps and bogs
Carex hystricina	Porcupine Sedge	Blue	Swamps, shorelines and wet meadows
Cuscuta pentagona	Field Dodder	Blue	Parasitic, especially on Legumes
Cyperus erythrorhizos	Red-rooted Cyperus	Red	Moist to wet lakeshores
Cyperus squarrosus	Awned Cyperus	Blue	Moist to wet, often sandy sites
Epipactis gigantean	Giant Helleborine	Blue	Moist streambanks, calcareous fens, marshes and swamps, and around hot springs
Impatiens aurella	Orange Touch-me-not	Blue	Moist streambanks and meadows
Marsilea vestita	Hairy Water-clover	Red	Inundated lake margins
Salix amygdaloides	Peach-leaf Willow	Red	Moist to mesic floodplains and lakeshores
Verbena hastata var. *scabra*	Blue Vervain	Red	Moist to wet ditches, meadows and marshes
Vertebrate Animal			
Ammodramus savannarum	Grasshopper Sparrow	Red	Breed in dry, moderately open grasslands, avoiding areas with extensive shrub cover

[1] Information sources include Douglas et al. (2002) and Fraser et al. (1999).

4.1.2 Potential Impacts

The footprint of the proposed neighbourhood plan has been designed in such a way as to take into account the previous suggestions of Martin (1993) to preserve a number of ecological values, specifically the marsh, cliffs and talus slopes, and several areas of steep slopes. As a result, most of the proposed development is slated to take place on shrub-steppe areas that are generally already disturbed. Although the disturbed areas could be restored to a more natural state through active intervention (e.g. weed removal, reclamation of trails, etc.), they are unlikely to return to a natural state on their own.

To determine the extent of footprint impacts from the proposed development, we determined the proportion of each sensitive ecosystem overlaid by proposed development. We understand that lots containing portions of the cliffs and steep slope areas will be bound by a "no build" covenant to protect these areas and that "no-build" covenants will also apply to areas near the aspen copse and connector area near the neck.

Table 4.4 summarizes the extent of footprint impacts. It is important to note that these impacts assume the footprint is comprised of the entire area designated for development. Therefore the estimates in Table 4.4 are conservative and the spatial extent of the impacts will likely be lower than indicated. Only 5.2 ha out of a total project area of 44.8 were identified as containing sensitive ecosystems in the SEI. Of that area, approximately 2.9 ha of sensitive ecosystem is zoned for development.

Table 4.4. Proportion of Sensitive Ecosystems and Other Important Ecosystems to be developed.

Ecosystem Type	Total Area (ha) (% of total area)	Area to be Developed[2] (ha)	Proportion of ecosystem to be Developed (%)
"Sensitive Ecosystem" (SE)[1]			
Sparsely Vegetated	4.7 (10.5%)	2.4	51
Broadleaf Woodland[3]	0.5 (1.1%)	0.5	100
"Other Important Ecosystem" (OIE)[1]			
Disturbed Grasslands	11.6 (25.9%)	7.8	68
Not designated as SE or OIE	28.0 (63%)	26.7	95
Total Area	**44.8 (100%)**	**37.4**	**83.5**

[1] As defined in Iverson, 2001

[2] The areas in this column do not include cliffs and steep rocky slopes where no development will occur.

[3] The polygon for this OIE does not include the aspen copse referred to in this report and is a portion of a much larger polygon identified as Broadleaf Woodland that extends outside of the project area.

In their August 31, 2001 and February 7, 2002 letters, MWLAP identified several concerns with respect to wildlife habitat. Each is discussed in turn below.

The potential for development to isolate the marsh, limiting the movement of terrestrial animals to the open spaces that will be maintained on site. The marsh is currently a considerable distance from any other wetland, pond, or watercourse and there is likely low probability that amphibians move far from the marsh on a regular basis. However, other wildlife species would access the marsh as a source of water, and some connection to both upslope and downslope areas would be beneficial. The current plan shows a road ending in a cul-de-sac just north of the marsh, but the road to the south stops about 40 m from the marsh. Thus a connection to the cliffs and steep slopes to the east of the marsh area is feasible. Following review of a draft version of this report, DC Properties has committed to creation of a 30 m wide connection between the marsh and the steep area to the east where no development is planned. Figures 3.1 and 4.2 shows the proposed location of this connection. DC Properties has also committed to retention of an undeveloped corridor connecting the marsh to upslope areas to the west. Although the access road will cross this connecting area

(Figures 3.1 and 4.2), retention of natural vegetation between the pond and upslope areas will provide connectivity between habitat types. This connection may be of particular importance to the Great Basin Spadefoot toad as moderate and high value living habitat is located south and west of the marsh (Iverson, 2004). As part of the connecting corridor to the west, a dry culvert should be placed under the road to facilitate small animal movement.

Connectivity. North to south connectivity within the Highlands is currently provided in the plan by the 30 m setback along Tassie Creek and by the park and open space along the site's eastern boundary. Connection of open space in the eastern portion to the western portion of the project area (and the remainder of the Highlands) is provided by the Ribbon of Green Trail and a "connector" at the top of the neck. The connector is 20 m wide and will connect the undeveloped eastern portion of the project area to the western portion of the Highlands. The connector will also protect the aspen copse located northeast of the neck. As noted above, the conceptual plan currently shows this area as zoned for housing. However, we understand that "no-build" covenants will be in place to protect this "connector". The connector should be thickly planted with native trees and shrubs. Planting as much of the fill area as possible with native shrubs can further enhance connectivity at this location. Thorny shrubs should be planted close to the trail in this area to discourage human access into the aspen copse and the connector. With the exception of the underpass, the proposed trail will be located beside this connector, resulting in a 30 to 32 m wide corridor that wildlife can use.

The proposed "ribbons of green" trail is approximately 10 m to 12 m wide, and extends along the eastern boundary of the project area, under the connector road, and along the southern boundary of the project area to its western edge. An underpass is proposed for the trail where it crosses the road, and it is likely that wildlife would also use the underpass, especially at night. The proposed trail will provide a corridor connecting the eastern and western portions of the Highlands.

Roads and Small Animal Mortality. Many of the areas in the project area with high potential for snake hibernacula to be present are to be left as open space and retain connection to

grassland areas where foraging would take place (i.e. the east-facing slopes located north of the East Bella Vista Development area). As noted above, a pedestrian underpass is planned for the "neck" area and animals are also expected to make use of it. In general, reptiles, amphibians, and small mammals will also make use of culverts to pass under roads, particularly if located where roads cross natural draws with shrub cover. A road is planned for the north side of the marsh. A culvert should be installed under the road at this location to facilitate wildlife travel (see Figure 4.2). Where feasible, additional culverts should be installed beneath roads to facilitate small animal travel. Possible locations are shown on Figure 4.2.

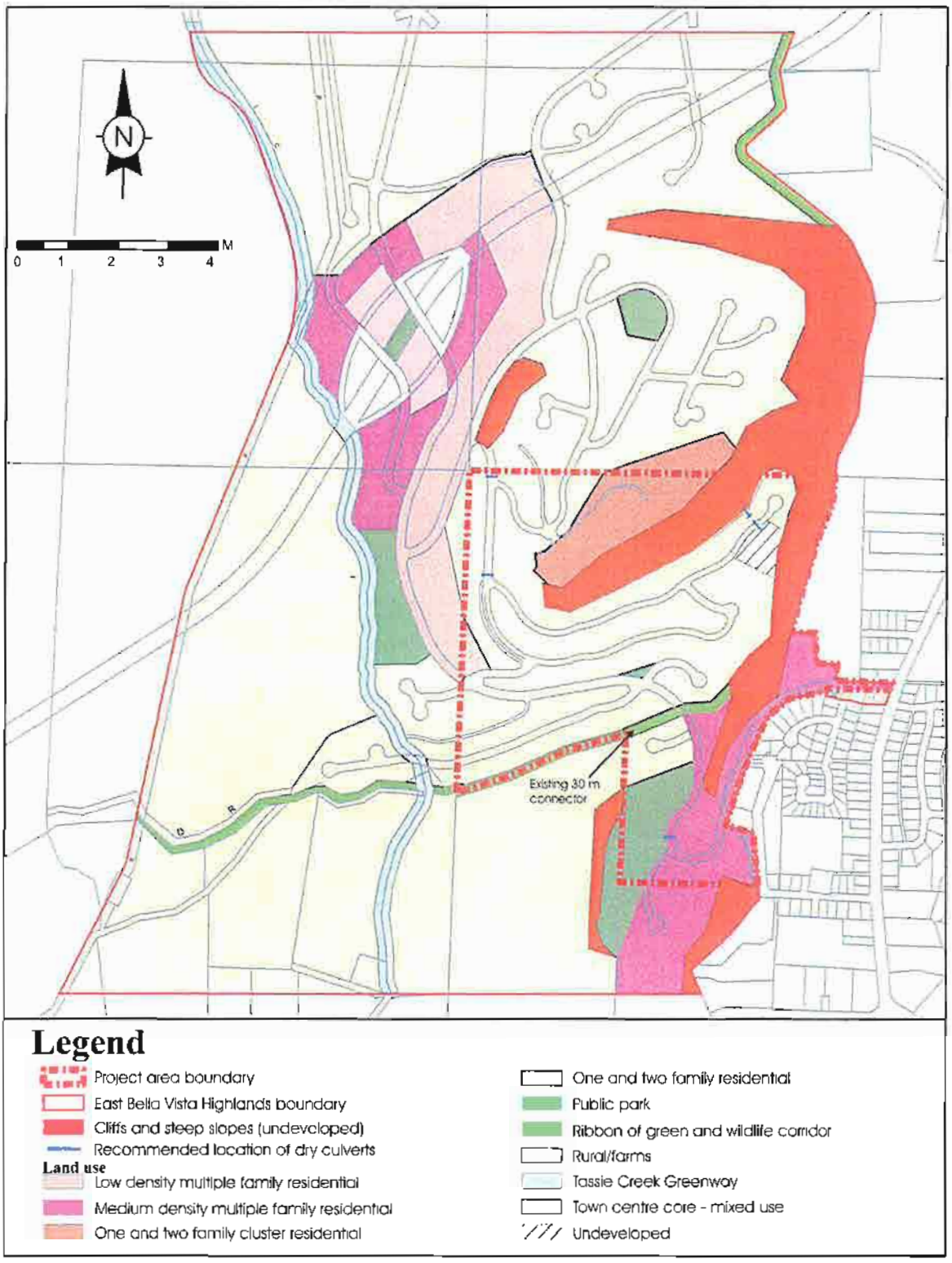


Figure 4.2. Proposed location of connectors and dry culverts.

The design of these culverts should be customized to the access needs of the wildlife species expected to use them. For example, the use of barriers or low fencing systems may be useful in guiding some species to the tunnel entrance (as suggested by Latimer, 2002). Also, access culverts should be buried to about one-third to one half of the culvert depth and filled with soil to ground level. This will provide a natural substrate that will be more suitable for small animal travel than corrugated pipe.

4.1.3 Mitigation Strategy

Recommended steps to minimize effects on terrestrial habitat values are as follows:

- As planned, preserve the marsh as open space. No surface runoff should be directed into the marsh and the existing native plants should be maintained. Buffers of about 10-15 m should be maintained around the marsh with native vegetation. Gaps in the buffers should be planted with thorny native species (e.g., hawthorn, wild rose) to limit human access, except perhaps to a specially designed viewing platform;
- As planned, create a 30 m wide connector between the marsh and the cliffs and steep slopes to the east as well as a corridor between the marsh and the upslope areas to the west, as shown on Figures 3.1 and 4.2. A low fence is suggested as a way to discourage human access into the connector (unless the neighbouring property line already has a fence);
- For the road located north of the marsh, a partially buried culvert should be installed to facilitate small mammal travel (Figure 4.2). Other partially buried culverts should be installed at locations where roads cross natural draws and gullies. Design of these access points should include features that direct animals to the tunnel entrance (e.g. barriers or low fencing structures);
- As planned, create a 20 m to 30 m wide connector including a large portion of the aspen copse in "the neck". Unvegetated areas in this connector and fill areas alongside the

connector road should be thickly (≥ 1 plant/m^2) planted with native trees and shrubs (provided they do not form a hazard for drivers);

- The trail underpass at "the neck" should be as wide as possible;
- Existing mature Ponderosa pine on the site should be preserved if at all feasible;
- Where reasonable, existing thickets of saskatoon, hawthorn, and snowberry should be retained. If it is necessary to remove any such thickets, opportunities should be sought to plant these species in draws and gullies in the open space areas (e.g., in areas where grazing may have reduced shrub cover);
- Emphasize the use of native plants in landscaping of common areas, and encourage native plants in the landscaping of private property (Note: The target market for the development is understood to be people over 50 years of age. These people are expected to be receptive to xeriscaping because of its lower maintenance requirements compared to irrigated lawns and gardens);
- Land activities should not occur during the sensitive nesting period of birds between 01 April and 31 July. All active bird nests are fully protected under the B.C. *Wildlife Act* and it is an offence to destroy nests occupied by a bird, its eggs or its young. Development can only proceed within this period if a survey has concluded that no nests are present; and
- Finally, prior to finalizing detailed development plans, plant and wildlife surveys should be conducted in areas to be developed in April or May, 2005. Although no development is planned in areas with the highest potential to contain rare and endangered species (i.e. the marsh, cliffs and steep slopes, and the aspen copse), it is possible that rare and endangered species are present in the remainder of the project area. Information collected during the surveys can be used to refine the mitigation strategies outlined here.

4.2 AQUATIC RESOURCES

4.2.1 Baseline Environment

There are no streams within the East Bella Vista Development area. The nearest creek is Tassie Creek which flows in a south to north direction and is located just west of the proposed development (Figure 1.1). While the development area does not extend to Tassie Creek, the creek is included in the surrounding area (i.e. East Bella Vista Highlands) that will be assessed at a later date. This creek is ephemeral, flowing only during storm events and during spring freshet. Downstream of the study area Tassie Creek flows through residential and commercial areas until it reaches Vernon Creek near the sewage treatment plant. The 300 m long section of Tassie Creek south of Davison Road has an average gradient of about 18%. From Davison Road to the north property boundary the average channel gradient is about 7%.

There are no records of fish presence in Tassie Creek in the FishWizard database (BC Fisheries and Fisheries and Oceans Canada. 2004). Fish are unlikely to be present anywhere north of Bella Vista Road due to the ephemeral nature of the stream, the lack of headwater lake, and steep gradients south of the project area.

Vernon Creek, located approximately 750 m south of the East Bella Vista Development area, is a fish-bearing stream. Species known to occur in Vernon Creek include Burbot, Carp, Kokanee, Northern Pikeminnow, Prickly Sculpin, Rainbow Trout, Redside Shiner, Sculpin, and Sucker (BC Fisheries and Fisheries and Oceans Canada. 2004).

As described above, there is one wetland within the project area (Figure 4.1). It is a marsh that is about 2,000 m^2 (0.2 ha) in size, including the riparian zone. The maximum area of open water is about 600 m^2 and standing water is rare during the summer months. Groundwater likely remains close to the surface, however, given the observed vigor of the bulrush in the marsh.

4.2.2 Potential Impacts

As noted above, the proposed development does not encroach on Tassie Creek. However, conceptual plans for the Highlands includes a 30 m riparian buffer along each bank of Tassie Creek. The proposed 30 m setback is more than adequate to protect existing riparian values and avoid direct impacts to riparian function.

The default riparian setback for Tassie Creek under the new Riparian Areas Regulation (RAR) of the *Fish Protection Act* is 30 m. This setback exceeds that required to protect riparian functions associated with large woody debris (e.g. bank stability and channel morphology), shading, and food and nutrient input. However, the RAR assessment methodology defaults to 30 m setbacks for the protection of the filtering capacity of the riparian areas.

Native vegetation is expected to become re-established in the set-back after development in the natural/open space areas because of the anticipated reduction in grazing pressure. This should result in a net improvement in riparian function (i.e., shade, litter) compared to baseline conditions. While a walking trail is proposed for the Tassie Creek corridor (Figure 3.1), within the 30 m setback, the trail can be designed to avoid impacts to the filtering capacity of creekside vegetation.

Potential impacts on the marsh and recommended mitigation measures are presented in Section 4.1.

At present about half of the East Bella Vista Development Area drains towards the east while the remainder (23.32 ha) drains towards the southwest. The proposed stormwater drainage plan for the East Bella Vista Development area will result in a small increase in the area of the site that drains towards the southwest (to 28.27 ha).

The drainage plan include construction of a detention pond in the southeast corner of the East Bella Vista Development area that has been sized to maintain post-development flows to pre-development levels. If this is done there will be no change in the size of peak flows in Tassie

Creek and negligible potential for increased channel scour. The detention pond will also reduce sediment concentrations in storm runoff that might otherwise be transported to Tassie Creek and onto Vernon Creek.

MWLAP has expressed concern that the detention pond could "concentrate many contaminants" (Latimer, 2001: p. 3). The area of the development that will drain to the proposed detention pond will be all low-density housing. Thus any contaminants in stormwater would tend to be those associated with residential developments, primarily sediment and small amounts of hydrocarbons and lawn chemicals. Hydrocarbons and many common lawn chemicals are biodegradable, suggesting little potential for concentration to levels toxic to wildlife in the detention pond given the drainage area involved. Nevertheless, as pointed out in the MWLAP letter, there could be some benefit in incorporating infiltration capacity into the stormwater system where soils are adequate for this purpose (i.e. infiltration chambers, where feasible). From a water quality perspective this would enhance the settling of sediment and thus reduce the potential for contaminant transfer since chemicals tend to bind with fine sediment. Regular maintenance of catchbasins and sumps would be needed to minimize sediment remobilization.

Additional activities that would reduce the amount of contaminants reaching the detention basin should be considered. These include:

- Including a sediment forebay in the design of the detention basin. This would enable sediment to be easily trapped and cleaned out on occasion;
- Minimizing the are of impervious surfaces throughout the site; and
- Educating homeowners on the impacts of fertilizers and herbicides/pesticides, and placing the "yellow fish" symbol on catch-basins.

4.2.3 Mitigation Strategy

Recommended mitigation steps to minimize the potential for effects on aquatic biota and off-site water quality are as follows:

- As planned, maintain 30 m wide buffers to Tassie Creek. The proposed trail should be on the outer edge of the set-back;
- As planned, the storm system should be designed to maintain post-development flows to pre-design levels. Ideally the system would include some infiltration and sediment trapping capacity (such as a sediment forebay) to minimize the risk of contaminant transfer off-site;
- A sediment and erosion control plan should be developed and implemented during construction of the development. This plan should follow the guidelines in Land Development Guidelines for the Protection of Aquatic Habitat (Chilibeck et al., 1992), adapted to site conditions. Key elements of the sediment control procedures would include installing temporary fencing or equivalent to ensure that the 30 m setback along Tassie Creek is not disturbed, use of silt fences across natural drainage paths when upslope soils are disturbed, minimizing the area of exposed soils at any one time, and revegetating disturbed areas as soon as possible;
- The area of impervious surfaces should be minimized; and
- The developer should consider educating homeowners on the impacts of fertilizers and herbicides/pesticides.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The East Bella Vista Development Neighbourhood Plan has incorporated a number of the recommendations of Martin (1993) and the Natural Features Inventory (Clarke, et al., 1993), and the development footprint is primarily on areas that have been disturbed by historic and on-going land uses. The proposed open space areas retain almost all of the cliffs and rocky outcrops that provide important habitat for snakes, bats, and certain flowering plants. The plan also calls for preservation of the only marsh on-site, preservation of the aspen copse near the "neck", creation of 30 m wide setbacks on the east side of Tassie Creek, and a detention pond to maintain runoff to pre-development levels. The areas of cliffs and steep slopes, the marsh and the aspen copse are the habitats with the greatest potential to contain the rare, threatened and endangered species that may be present on-site (see Section 4.2.1). Some of the areas that will be developed include ecosystems defined as sensitive in the Bella Vista – Goose Lake Range SEI. This includes 2.4 ha of Sparsely Vegetated ecosystem and 0.5 ha of Broadleaf Woodland.

Following are the key recommendations to minimize the environmental impacts of the proposed development. Other recommendations are provided in Sections 4.1.3 and 4.2.3.

1. As planned, maintain a 30 m wide connection between the marsh and the slopes below it to the east and retention of an undeveloped corridor connecting the marsh to upslope areas to the west. To facilitate small animal movement from the marsh area to the west, a dry culvert should be placed under the road to facilitate small animal movement.
2. The marsh should be left in a natural condition and a buffer should be retained. Weeds should be manually removed from the buffer area and any areas lacking shrub cover should be planted with thorny species to discourage human access.
3. The aspen copse near the "neck" should be protected and a minimum 20 m wide connector retained along the trail. Thickly plant native shrubs on fill areas and along the ribbon of green trail in the area.
4. Wherever reasonable, mature trees and thickets of tall shrubs should be preserved.

5. Wildlife and plant surveys should be conducted in areas where development is proposed. If rare or endangered species are present then this mitigation strategy should be refined to reflect their presence.
6. A number of partially buried culverts should be installed beneath collector roads where the roads cross dry gullies to facilitate passage by small animals. Use of barriers or low fencing systems should be considered to direct animals to the tunnel entrances.
7. The landscaping scheme for common areas should use native, drought-tolerant plants and xeriscaping should be promoted among individual homeowners. A terrestrial ecologist should be included in the landscape design process to help select plants and identify opportunities for site restoration.
8. Where soil conditions allow, incorporate on-site infiltration capacity into the stormwater system and maintain the system accordingly.
9. A detailed erosion and sedimentation control plan for construction should be put in place prior to site development.
10. A qualified environmental professional should be retained to assist with detailed site planning to ensure that the areas designated for conservation are protected.

If implemented, these mitigation strategies will significantly reduce the impacts of the proposed development. **This conclusion is restricted to the effects of the proposed East Bella Vista Development only and does not consider the potential impacts of development within the entire East Bella Vista Highlands.** As noted by most other commentators, other developments are proposed for private lands within the North Okanagan Grasslands, and the cumulative impact of habitat loss is a serious concern. The only protected area of North Okanagan Grasslands is Kalamalka Lake Provincial Park, although other areas (e.g., portions of Okanagan IR #1) are unlikely to be developed in the near future.

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Appendix A

SPECIES LIST

Appendix A. Species List: Plants and animals confirmed present on East Bella Vista Development site

Plants

Arrow-leaved balsamroot	*Balsamorhiza sagittata*
Big sagebrush	*Artemisia tridentata*
Bluebunch wheatgrass	*Agropyrum spicatum*
Brittle prickly pear	*Opuntia fragilis*
Chokecherry	*Prunus virginiana*
Common snowberry	*Symphoricarpus albus*
Desert parsley	*Lomatium ssp.*
Douglas maple	*Acer glabrum*
Great bulrush	*Scirpus lacustris*
Hawthorn	*Crataegus douglasii*
Idaho fescue	*Festuca idahoensis*
Kentucky bluegrass	*Poa pratensis*
Longhorn plectritis	*Plectritis macrocera*
Mountain ash	*Sorbus scopulina*
Parsnip-flowered buckwheat	*Eriogonum heracleoides*
Ponderosa pine	*Pinus ponderosa*
Prairie rose	*Rosa woodsii*
Red-ossier dogwood	*Colnus stolinefera*
Reindeer moss	*Cladonia Rangiferina*
Rusty steppe moss	*Tortula ruralis*
Saskatoon	*Amelanchier alnifolia*
Silverleaf phacelia	*Phacelia hastata*
Tall Oregon grape	*Mahonia aquifolium*
Tarragon	*Artemisia dracunculus*
Trembling aspen	*Populus tremuloides*
Weeping willow	*Salix ssp.*
Wild rose	*Rosa sp.*

Animals

American crow	*Corvus brachyrynchos*
Black-billed magpie	*Pica pica*
California quail	*Callipepla californica*
Common raven	*Corvus corax*
Coyote	*Canis latrans*
Dark-eyed junco	*Junco hyemalis*
Downy woodpecker	*Picoides pubescens*
House finch	*Carpodacus mexicanus*
Northern flicker	*Colaptes auratus*
Pine siskin	*Carduelis pinus*
Ring-necked pheasant	*Phasianus colchicus*
Long-eared owl	*Asio otus*
Mule deer	*Odocoileus hemionus*
Northern pocket gopher	*Thomomys talpoides*
Yellow-bellied marmot	*Marmota flaviventris*

Appendix B

MWLAP Correspondence

BRITISH COLUMBIA

File No.:58000-32-11
(1999SIP0309)

August 31, 2001

City of Vernon
3400 30th Street
Vernon, BC
V1T 5E6

Attention: D.M Rintoul

RE: Neighbourhood Plan for Lot A, Plan 35064, Sec.4,Tp.8,ODYD (4400 35th Ave.) Turtle Mtn.

The Ministry of Water Land and Air Protection has reviewed the subject Neighbourhood Plan. The plan does recognize that the site may support rare plant and wildlife species as well as several unique features that are likely important to wildlife and that the Turtle Mountain area provides a large corridor connecting the Goose Lake and the Bella Vista Range. However, it does not appear to address how impacts to these species might be minimized and how the connectivity over the landscape for these species might be addressed. The stated goal of the plan is to preserve environmentally sensitive areas and unique natural features. Specifically the original plan states that 30% of the plan area (the revised plan states-20%) is to be retained in its natural state. While this seems as though enough area is preserved, on closer scrutiny it appears that 39% of the area is undevelopable with slopes over 30% and this area coincides with the areas preserved in their natural state. Protecting these steep areas is not necessarily conducive to protecting important habitats and maintaining a diversity species.

Also of concern is planning development for this area appears to have been done in isolation of the Bella Vista and Goose Lake areas. As noted in the report the Turtle Mountain area provides a corridor connecting these areas. These areas are comprised of some of the largest areas of undeveloped grasslands within the North Okanagan. Without defining locations of special habitats and species capabilities for these other areas in conjunction with Turtle Mountain development it may preclude options to balance development with the maintenance of grassland species and connectivity over the landscape.

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Specific comments pertaining to the report text are as follows.

- Tassie Creek which is located on the eastern side of the neighbourhood plan outside the area slated for this rezoning is stated in the revised documents to comply with the new Streamside Protection Regulations. It is assumed from this comment that the buffer areas have been increased but no widths have been stated within the report.

- The small vernal pond may provide a potential site for spadefoot toad and other amphibian species on years where there is sufficient rainfall for the pond to remain wetted through a portion of the summer. The viability of maintaining these species depends upon maintaining the integrity of these breeding areas as well as enough area around these features to minimize impacts to adjacent habitats and dispersal routes. The small buffer noted within the revisions is not likely to meet this need. In addition, the uniqueness of this feature on a very dry site and its proximity to a small vegetated gully and the adjacent rock slopes together form a highly diverse habitat feature. Development in this area resulting in fragmentation is likely to have a negative impact on the diversity of species using this habitat. This area should be left intact as fragmenting it with single family homes will reduce the complexity of this habitat by removing the features that make it unique

- p.18 *states " Much of the habitat to support this possible wildlife exists in the areas of the site that are proposed to remain undeveloped. The proposed natural space areas and trails provide habitat and corridors that may be needed by the varied wildlife species".* With only the steep area preserved and narrow trails (15 m corridors) as connectivity corridors it is unlikely that the requirements of wildlife species will be met.

- The development policies make no mention of sediment control. The Golder Associates report makes mention of the site containing fine sediments clay and sand which can all become a problem during runoff periods during the developmental stage. Prior to the start of clearing and earth moving a sediment and erosion plan should be designed to deal with these concerns over the various phases of the development.

- The storm systems for both the original plan and the revised plan make use of detention ponds to maintain pre development flows. Recognizing that much of the site contains shallow soils making infiltration more difficult we would encourage that consideration be made to use of these systems wherever possible. This mentioned within page 41 of the original report but it is not detailed within the revisions. The maintenance of pre development flow patterns is particularly important to maintaining vegetation within the gullies in very dry habitats. The use of detention ponds a sole method of maintaining pre development flows can deal with the flow

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concerns but may have an impact habitat features on the site. It can provide a habitat sink to amphibians in particular. Amphibians are highly sensitive to water quality changes. The wet detention ponds concentrate many contaminants and can be highly attractive to amphibians in dry terrain where breeding areas are scarce. Where wet ponds are needed, but are combined with infiltration systems and other methods that address water quality concerns, many of the contaminants can be removed.

- Page 42 of the original report discusses some of the issues around the development of road systems. Road systems can have a major impact on the mortality of snakes, amphibians and small mammals. Where roads bisect important habitats or cross dispersal and migration corridors (i.e. to and from hibernicula sites), these roads can have a major impact on species survival. Consideration needs to be given to these concerns with the development of a final design in order to reduce road impacts.

In summary we have some major concerns with the planning of this site in isolation of the adjacent grasslands areas. We would be pleased to meet and discuss these concerns at your convenience.

Yours truly,

Susan Latimer, RP Bio.
Senior Habitat Officer
Vernon

cc: Craig Beeson, MELP, Kamloops
Kees Ruurs, GVPRD
Conen Enterprises Ltd. c/o R.D. Lewis & Assoc., 718A Notre Dame Dr.,Kamloops, BC, V2C-5N8

Ministry of Environment, Lands and Parks
BC Environment
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Aug 29, 2001.

North Okanagan Naturalists' Club
P.O. Box 473, Vernon, B.C., V1T 6M4

Re: Turtle Mountain Uplands application for Neighbourhood Plan and Rezoning

Dear Mr. Rintoul:

Thank you for the opportunity to respond to the Conen Enterprises application to proceed with a neighbourhood plan for the Turtle Mountain Upland. I apologize for my tardy response but, unfortunately, the person responsible for clearing our P.O. Box was on vacation when the envelope was delivered and I received it only recently.

The Turtle Mountain Uplands project is likely only the first of several that will in due course be proposed for the Bella Vista/Goose Lake Range. As such, we feel it demands special consideration, as it will set a precedent for any subsequent developments. As we pointed out earlier, this area is an intact representative of an endangered grassland ecosystem and we suggested that the whole area be considered in the first instance as a single block and that a sizeable portion of the best grassland be identified for preservation. If the whole area is developed piecemeal over time with small, non-sustainable portions of grassland retained within each development, dismemberment of the whole will be the result and the area will cease to be a viable representative of this fast-disappearing ecotype. We should like to see some consideration given to these points before the Turtle Mountain project is approved.

With respect to the present proposal, the areas designated Natural Area/Open space are fragile and likely to be degraded by human activities. The steep slope immediately northwest of the pond is very unstable and will not withstand being walked on. In particular, it will be destroyed if children from the nearby residences use it as a playground. In that same area and in the other large open area designated as 'Open Space' in Fig. 4.1, bed rock is near the surface or actually exposed and the fragile flora (including all-important mosses and lichens) would likely not withstand pedestrian use. Excessive wear of these areas due to foot traffic would not just degrade plants but would also have undesirable consequences for the vertebrate and invertebrate animals dependent on them.

We feel that the area designated as open space around the pond is too small and, thus, vulnerable to disturbance of the habitat of amphibians, reptiles and birds. As well, being surrounded by residential properties, its use as a watering hole for large animals would be prevented. Furthermore, surrounding strata residences being close to the pond, water usage with conventional landscaping could have undesirable side effects. Some water used on gardens and lawns would inevitably find its way into the pond and would likely change the nature of the pond and surrounding flora.

We feel that no attempts should be made to "enhance" the pond area by extra watering or the planting of exotic plant species. The same consideration applies to the Natural/Open Areas. Xeriscape landscaping would be the most appropriate method for the whole development.

Attempts to produce conventional landscaping around houses and in communal strata areas would require the use of imported top soil and lots of water as soil cover would be thin and water holding capacity low. Excess water percolating into the soil could make its way downslope and this could undermine the stability of the steeper terrain as well as alter the nature of the flora in open areas.

The best of the native grassland (big sage and bluebunch wheat grass) is located in the areas designated for strata development and would likely be destroyed entirely. The main part is close to the northern boundary. It might be possible to pre-empt a portion of this terrain to provide an animal corridor connecting the northernmost of the two large natural areas to the open area along Tassie Creek and thence northwest.

We note that part of the property, especially the disturbed areas, is badly infested with weeds, particularly knapweed and toad flax. In the interest of preventing their further spread into the grasslands to the west and north, we would like to know what the developers plan to do to eliminate these weeds.

Yours Sincerely

Peter Bailey

Peter Bailey, Chairman, Conservation Committee,
North Okanagan Naturalists' Club.

BRITISH COLUMBIA

File No.:58000-32-11
(1999SIP0309)

February 7, 2002

City of Vernon
3400 30th Street
Vernon, BC
V1T 5E6

Attention: D.M. Rintoul

RE: Turtle Mtn. Uplands Neighbourhood Plan & Turtle Mountain Development Zoning Application (including Summit Environmental 6/12/01 Assessment.

These comments are made reference to the revised plan, which includes some revisions resulting from the Ministry of Water Land and Air Protection August 31, 2001 letter and a report by Summit Environmental. This assessment and report was apparently undertaken to address potential impacts to the proposed development and to address the potential concerns raised in an earlier letter from this Ministry. The assessment was undertaken November 7 and 10, 2001 and was not the optimal timing for observing species occurrence as most species. In addition, as noted in the report, the few species cited as present in the CDC for species occurrence does not necessarily preclude the presence of other red and blue listed species, as inventory and records for this area are lacking. However, the report is suitable for addressing the concerns of our earlier letter.

Ministry comments in this letter will be confined to discussion of the findings of this report and their application to the development. Page 8 of the Summit report makes reference to a low probability of amphibians moving far from the small seasonal wetland. Most species of amphibians remain within 1000 meters of wetlands, dryland species such as the spadefoot toads have been known to travel almost twice that distance. The suggestion is made by Summit that a 30 meter connection to the P2 area would be beneficial. While it allows for a connection to other habitats, this still results in fragmentation of the several types of habitats (vernal pond, shrub thicket, grassland and steep slope) all within a close proximity. The Ministry recommends that these habitat features be retained intact and interconnected as a functioning unit. The value of each of these habitats in isolation is less than retaining them interconnected. The risks to the functionality of these habitats could be reduced by ending the road south of the pond and leaving these habitats intact or revising the design to reduce modification, fragmentation and isolation of the individual habitats.

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The addition of culverts to facilitate small mammal travel is a good addition. The type and width of culvert structure should be further developed as the subdivision proceeds so that the design is suitable to address the access needs of the wildlife species expected to use them. Some designs also require the use of barriers or low fencing systems to guide them to a tunnel entrance. Depending upon the location, it is expected that snakes and possibly amphibians may also use the culverts.

The reference to the pond and no introduction of surface runoff needs to be considered in conjunction with the other comments regarding the fragmentation of habitats and maintaining existing flows to the area. Diverting historic flows away from the pond will likely impact the water balance and reduction in water flow to the pond.

The sediment control plan should be applicable to the entire site as all drainage eventually reaches a fish bearing creek system via either overland or through discharge of stormwater.

The Summit report makes reference to earlier ministry comments regarding contaminants. It suggests that contaminants are not likely an issue due to the fact that it is low-density housing and contaminants would be those associated with residential housing. While contaminates in industrial areas may be more of a concern, studies have found that conditions toxic to frog metamorphosis in some residential stormwater ponds. Nitrate levels associated with fertilizers have also been shown to cause death and abnormalities in amphibians. Nitrate and phosphorous levels in urban runoff can be as high as those in agricultural areas. Sodium chloride associated with winter and spring runoff of stormwater has been associated with frog egg mortality. Herbicides and pesticides are also contaminants in urban runoff and they have been associated with both lethal and sublethal impacts to amphibians. One study found it in 25 to 90% of all runoff samples contained common commercial weed-killers used by homeowners. In dry areas where water sources are often scarce the concern is that species will be attracted to detention areas. The pollutant concentrations in stormwater runoff from arid watersheds tend to be higher than that of humid watersheds. To reduce the risk of contaminants to these ponds some of the best management practices that can be used include but are not limited to;

- Prevent access to the storm system by encouraging retention at the source through the use of hydraulic disconnects and infiltration methods.
- Use of extended detention basins with a sediment forebay
- Education of homeowners on the impacts of fertilizers and herbicides/pesticides
- Minimize use of impervious surfaces and disturbance of the natural landscape
- Consideration should be given to potential impacts and reducing the risk to the receiving environment during design of the stormwater system and site development.

The Ministry generally agrees with the findings of the Summit report. The resubmitted plan takes into consideration some of the concerns identified by both the previous Ministry letter and those identified by Summit Environmental report. The plan makes several references to

minimizing site disturbance and impact. However, with the detail given the impact of the development could vary widely depending upon the final design and application of BMP's to reduce impacts to wildlife, habitats and runoff water quality and quantity.

Some specific comments pertaining to the plan are:

- There is reference to a 15 meter wildlife corridor in 4.5.2. It is not clear whether this 15 meters is to also contain a hiking trail. Fifteen meters is very narrow to provide much of a connectivity link and provision for a trail within this link would increase disturbance levels and likely limit wildlife use. There is also reference to enhancement of the seasonal pond. The enhancement method is not identified so it is unknown whether this will have a positive or negative impact to wildlife habitats.

- In the section 4.5.3 it is mentioned that materials from slope cuts will side-cast except in highly visible areas only. This does not take into consideration risks to sensitive habitats and wildlife.

- The proposed road into the pond area also impacts one of the significant thickets. This was discussed earlier in the letter.

- The road plan at the NW of the site may have impacts on the connectivity to the significant vegetation patch at the north boundary of the site. Plans for this site and any connection to the property to the north should take this into consideration. In this regard plans for the development of the rezoning area connectivity concerns beyond the zoning application and Neighbourhood Plan area should also be considered.

If you have any questions please contact the undersigned.

Yours truly,

Susan Latimer, RP Bio.
Ecosystem Officer
Environmental Stewardship Division
Vernon

cc: Craig Beeson, WLAP, Kamloops
Summit Environmental, Vernon
Ed. Stranks, City of Vernon
Conen Enterprises Ltd. c/o RD Lewis & Assoc., 718A Notre Dam Dr., Kamloops V2C 5N8

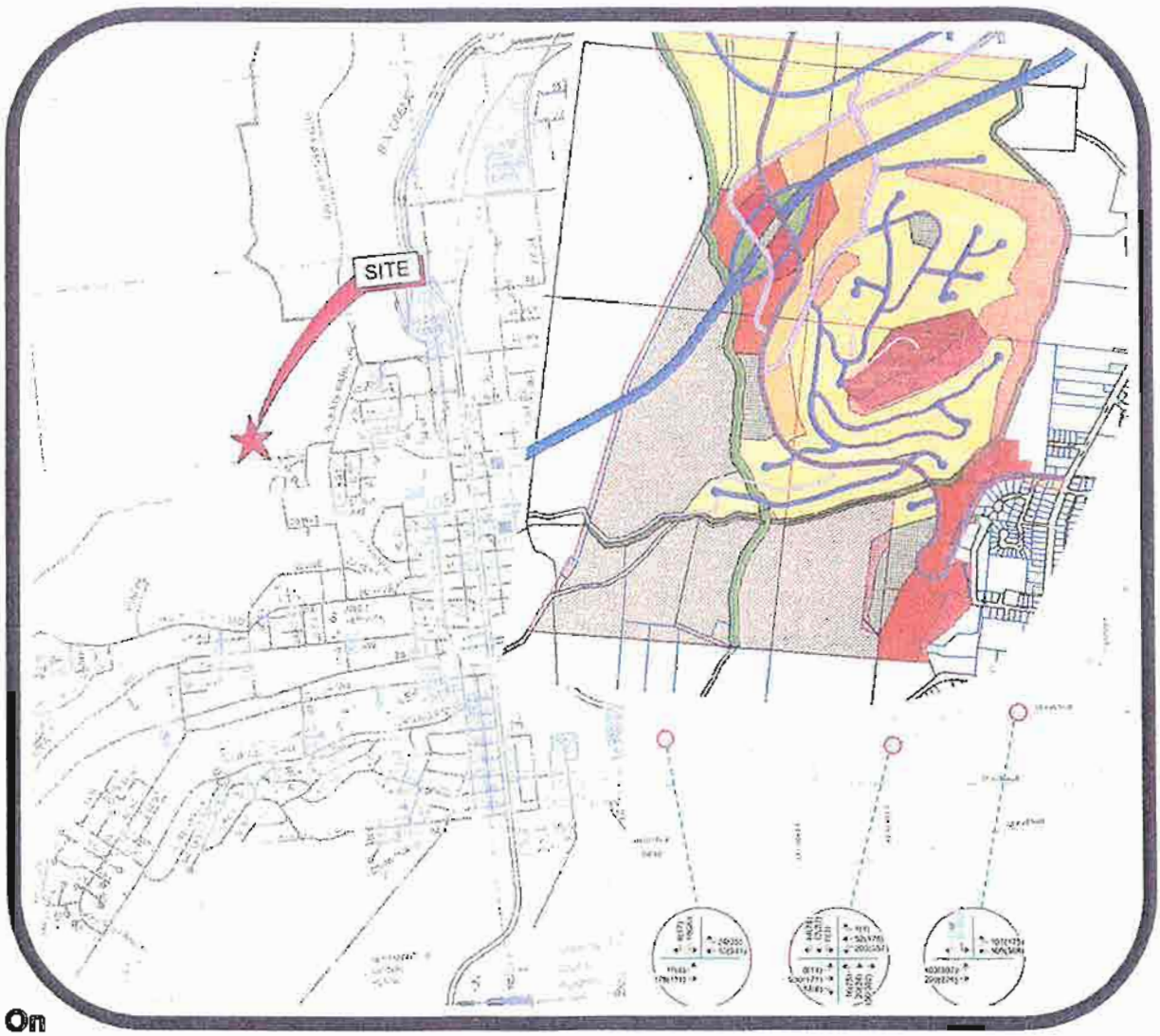
APPENDIX B

Traffic Impact Assessment

Ward Consulting Group Ltd. (December 2004)

Report to

CITY OF VERNON



On

TRAFFIC IMPACT OF PROPOSED BELLA VISTA HEIGHTS DEVELOPMENT ALEXIS PARK DRIVE/30 AVENUE

ward consulting group

ward consulting group

- Traffic Impact
- Parking
- Transportation Planning
- Corridor Studies
- Traffic Operations
- Transit
- Trucking
- Network Modelling
- Bicycles/Pedestrians

Email: lisa@newtownservices.net

March 4, 2005

New Town Planning Services
1450 Pandosy Street
Kelowna, BC V1Y 1P3

Attention: Mr. Keith Funk

Dear Keith:

Re: Traffic Implications of Proposed Business Park

In response to your request, we have now considered the implications of changing some of the residential lands in the proposed East Bella Vista Highlands Future Land Use Plan from "residential" as previously proposed to "business park." It is understood that this business park land will be located towards the north end of the Highlands Plan Area and that this business park will not be established until such time as the West Bypass shown in your Figure No. 3 as running a southwest to northeast orientation across the northwest quadrant of the Plan is in place. Furthermore, this business park is outside of the Phase 1 lands of DC Properties Ltd.

Tables 3.1 and 3.2 of our report of December 29, 2004 documented the trip generation calculations for our study. Table 3.1 covered Phase 1 which included 530 residential units whereas Table 3.2 covered build-out conditions with 1,898 residential units made up of a mixture of housing types. It is understood that with this business park in place, the number of units is reduced to 1,750 and for the purpose of the traffic study the number of single family units reduces from 912 to 827 and the townhouses reduce from 242 to 179.

The trip generation rates – primarily the Institute of Transportation Engineers (ITE) equations fir the different residential uses – were applied to the revised number of housing units in order to establish the reduction in trips resulting from the removal of these 150 housing units. This found that in the weekday a.m. peak hour, there would be a reduction of 84 trips and in the p.m. peak hour there would be a reduction of 103 trips.

It is understood that the business park is to cover 14.2 hectares of land, this being equivalent to 35 acres. The ITE *Trip Generation Manual* has rates for a business park (Code 770) are provided based on number of employees, square feet of gross floor area, and acres of land. In the absence of other data, the acres category was used. The appropriate rates for this use were then applied to the area of land available and then reduced by 15% to account for the fact that the intensity of development is likely to be lower as this is located on the outskirts of Vernon and not in a large urban city. The total number of trips expected to be generated by the proposed business park is 561 in the a.m. peak hour and slightly lower at 501 in the p.m. peak hour. When the reduction in trip generation rates resulting from the elimination of some of the housing units is take into account, this means a net increase of 477 trips in the a.m. peak hour and 398 trips in

the p.m. peak hour. When these are added onto the total trips given in Table 3.2, this means an increase of 42% in the a.m. peak hour (from 1,129 to 1,606) and 30% in the p.m. peak hour (from 1,343 to 1,741). The revised trip table is provided in Table 3.2R.

Table 3.2R
Trip Generation – Build Out

Component	Units	a.m. peak					p.m. peak				
	(Ha)	Rate	Total	%in	In	Out	Rate	Total	%in	In	Out
Single Family	825	0.71	595	25	149	446	0.86	718	65	465	251
Townhouse	179	0.44	82	17	14	68	0.52	97	67	65	32
Apartment	744	0.50	368	20	73	295	0.57	427	65	278	149
Business Park (Ha)	14.2	46.6	561	85	477	84	46.6	501	20	100	401
Total	1,748		1,606		713	893		1,741		908	833

rates are based on ITE equations

The report undertook an analysis of the 39 Avenue/39A Avenue intersection at different levels of full development and concluded that once it exceeded the 60% level, i.e., 1,140 dwelling units, then an additional access will be required. The same holds true with this business park development replacing some of the 758 units that exceed this 1,140 threshold. It is essential that an alternative access, this presumably being the proposed West Bypass, be in place before this business park can be developed. Once such a new road is in place, there will be adequate capacity on this road for the business park.

It is considered very unlikely that traffic oriented to this business park arriving from the south on Alexis Park Drive would use the 39 Avenue route to travel to this park given that they can continue north on Alexis Park Drive and enter from the northeast corner. Although it may be slightly longer, this Alexis Park Drive route is certainly faster and less circuitous. Taking 39 Avenue will mean having to deal with traffic entering and exiting the traffic stream since it circulates through the East Bella Vista area and will no doubt experience significant numbers of local residential vehicles starting or ending their trips.

I trust that this provides the information you require at this time. Please do not hesitate to call if you have any further questions.

Yours truly,

T. J. WARD CONSULTING GROUP INC.

Trevor J. Ward, P. Eng., M.B.A.
President

TJW:js

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- Traffic Impact
- Parking
- Transportation Planning
- Corridor Studies
- Traffic Operations
- Transit
- Trucking
- Network Modelling
- Bicycles/Pedestrians

December 29, 2004

New Town Planning Services
1450 Pandosy Street
Kelowna, BC V1Y 1P3

Attn: Keith Funk

Dear Keith:

Re: Traffic Impact of Proposed Bella Vista Heights Development

In response to your request, we have now undertaken a study to determine the traffic impact of the proposed Turtle Mountain development to be located west of Alexis Park Drive and north of 30 Avenue in the City of Vernon. The study has also addressed the issue of determining how much development in the broader Bella Vista Heights area is able to be served by 39A Avenue which serves as the primary access to the development area and connects to Alexis Park Drive.

The attached report presents a summary of our work, findings, and conclusions. I trust that it provides the information you require at this time in order to address the issues raised by the City's Engineering Department. Please do not hesitate to call if you have any further questions.

Yours truly,

T.J. WARD CONSULTING GROUP INC.

per Trevor J. Ward, P.Eng., M.B.A.
President

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T.J. Ward Consulting Group Inc.
810 – 1111 Melville Street, Vancouver, B.C. V6E 3V6
Tel: (604) 688-8826
Fax: (604) 688-9562

1.0 INTRODUCTION

DC Properties Ltd. is proposing to develop a large block of land referred as the Turtle Mountain Development for residential purposes. When completed, it will ultimately consist of 530 units, with a mixture of both single and multi-family units. This will be Phase I. The development is to be located a short distance west of Alexis Park Drive and north of the line of 35 Avenue. There is the potential for further residential developments in the future to the north and west of this block and this will result in a total of 1,898 units in the Bella Vista Highlands area. The location of the site in the broader area is shown in Exhibit 2.1.

On the current plan for the development, the only access proposed to the site was via 39A Avenue which intersects Alexis Park Drive. There is a secondary access to 35 Avenue which will serve only 23 townhouse units in the new development.

The City requested that a traffic impact study be undertaken to determine the impact of traffic generated by the proposed development on the adjacent roads and assess what improvements if any, are required. The study also sought to address how much of the total development could be served by the proposed 39A Avenue access.

2.0 BACKGROUND CONDITIONS

2.1 Road Network

The primary roads of interest in this study are as follows:

(a) Alexis Park Drive - This is designated by the City as a major arterial road (based on Plan Vernon) and runs in a north-south direction commencing at 30 Avenue and continuing north past 43 Avenue (as Old Kamloops Highway) into the Regional District. It has one travel lane in each direction and on-street parking is permitted along both sides. In the vicinity of 35 Avenue, it has a wide pavement width of approximately 15.5 metres but tapers both north and south of here. It has curb and gutter and sidewalks along both sides. Traffic using Alexis Park Drive has the right-of-way at all intersections except at its southern terminal point at 30 Avenue which is controlled by traffic signals. Between 30 Avenue and the line of 37 Avenue it has a grade of approximately 4% - 5.5%. This road is actually 37 Street at the very south end south of 32 Avenue.

(b) 30 Avenue - This is also designated by the City as a major arterial road east of Alexis Park Drive/37 Street and a minor arterial road west of Alexis Park Drive/37 Street, and runs in an east-west direction. It has one travel lane each way with on-street parking permitted and a signalized intersection with Alexis Park Drive. It has two lanes on each approach at this intersection with a dedicated right turn lane for vehicles arriving from the east and a centre left turn lane for vehicles arriving from the west. It has a signalized intersection with Highway 97/32 Street to the east. At its west end, it turns south as 41 Street and Bella Vista Road continues west from this point.

(c) 35 Avenue - This collector road commences at Alexis Park Drive and travels west for approximately 200 metres. It then makes a 90° right hand turn and goes north as 39 Street. It has a pavement width of 8.3 metres with curb and gutter and sidewalk along both sides. Although only wide enough for one travel lane in each direction, on-street parking is not prohibited. It has a grade of approximately 7% and flattens slightly to 5.5% as it approaches Alexis Park Drive.

(d) 39 Avenue – This minor arterial road runs from Alexis Park Road in the west to Black Rock Road. There is one travel lane in each direction.

(e) 39A Avenue – This is a local road that serves a small enclave of single family homes on the west side of Alexis Park Drive.

(f) 43 Avenue - This is another four lane major arterial road that connects Alexis Park Drive at its west end, crosses 32 Avenue/Highway 97, and then continues east beyond 27 Street and Pleasant Valley Road. It has signalized intersections at Highway 97 and Alexis Park Drive.

(g) Bella Vista Road – This road, which is designated as a minor arterial road, has a rural cross-section and runs west from the 30 Avenue/41 Street intersection to serve the scattered residential communities of West Vernon along the north side of Okanagan Lake.

(h) Davison Road – This is a rural local road that commences at Bella Vista Road and then extends north and north-west serving only a few farm houses. It has no curb and gutter or sidewalk.

2.2 Traffic Controls

The only traffic signals within this study area are at the intersections of 30 Avenue and 43 Avenue on Alexis Park Drive. Both 43 Avenue and 30 Avenue also have traffic signals at their intersections with Highway 97/32 Street further to the east. All other streets that intersect Alexis Park Drive, 30 Avenue and Bella Vista Road are stop-controlled.

The channelization of each of the intersections requested to be analyzed in this study are given in Table 2.1.

Table 2.1
Existing Intersection Laning Configuration

		EB			WB			NB			SB			Sig-	Prior
E-W Street	N-S Street	L	T	R	L	T	R	L	T	R	L	T	R	nal?	-ity
30 Avenue	Alexis Park Dr	1	1	n/a	n/a	1	1	n/a	n/a	n/a	1	n/a	1	Y	--
35 Avenue	Alexis Park Dr	-	n/a	-	n/a	n/a	n/a	-	1	n/a	n/a	1	-	N	N/S
39 Avenue	Alexis Park Dr	n/a	n/a	n/a	-	n/a	-	n/a	1	-	-	1	n/a	N	N/S
39A Avenue	Alexis Park Dr	-	n/a	-	n/a	n/a	n/a	-	1	n/a	n/a	1	-	N	N/S
Bella Vista Rd	Davison Rd	-	1	n/a	n/a	1	-	n/a	n/a	n/a	-	n/a	-	N	E/W
30 Ave	41 St	-	1	-	-	1	-	-	1	1	-	1	1	N	W

Note: - or - means no dedicated left or right turn lane but shared with the adjacent through lane
n/a - means movement not appropriate

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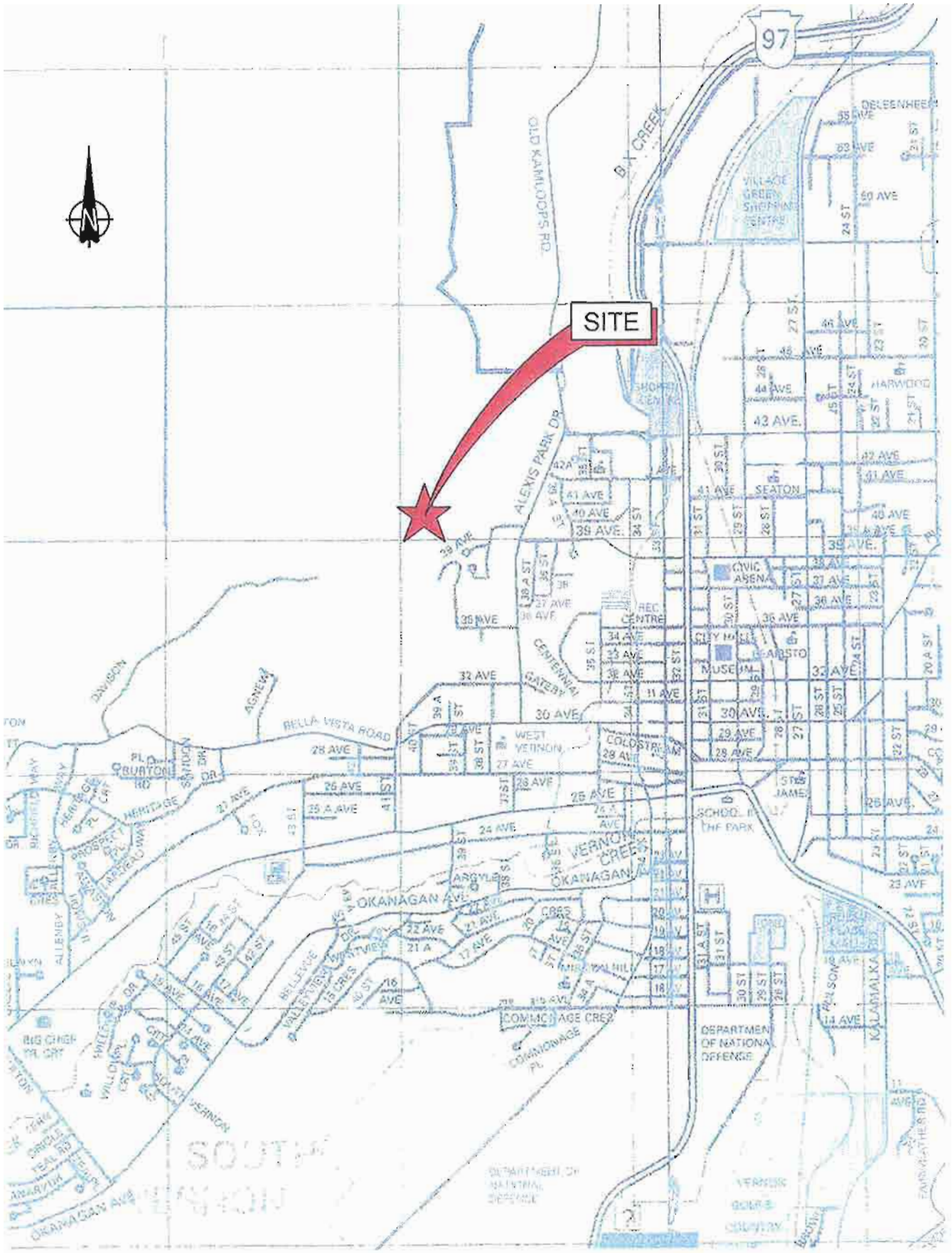
EXHIBIT **2.1**

SITE LOCATION



2.3 Traffic Volumes

New traffic volumes were recorded at five intersections, these being 30 Avenue, 39 Avenue, and 39A Avenue on Alexis Park Drive as well as Bella Vista Road/Davison Road and 30 Avenue/41 Street in the morning and afternoon peak periods in 2004 as part of this study. The resultant 2004 volumes are shown in Exhibit 2.2. The traffic count data for 35 Avenue was based on a previous study and factored up. The traffic volumes show that there are approximately 1,040 vehicles on Alexis Park Drive in the p.m. peak hour of which 480 or 46% are northbound and 560 or 54% are southbound. On 30 Avenue east of Alexis Park Drive, the two-way volume is 990 with 430 or 43% being eastbound and 560 or 57% being westbound. At the intersection of Alexis Park Drive and 30 Avenue, the heaviest turning movements are the eastbound left turn with 310 veh/h and the southbound right turn with 400 veh/h.

Existing volumes on 35 Avenue and 39A Avenue are very minimal because of their short lengths and the small amount of development that they serve. The traffic volumes at the east end of 35 Avenue were recorded at 95 two-way in the p.m. peak hour of which 55 were westbound and 50 eastbound. Volumes on 39 Avenue are higher at 280 with 170 westbound and 110 eastbound.

2.4 Road Network

The City's Major Road Network indicates that the only changes proposed to the road network in this area is to connect 30 Avenue to 32 Avenue in the vicinity of 35 Street and designate this as a major arterial road. In the currently drafted version of Plan Vernon, 35 Avenue is shown as being upgraded to a collector road classification from Alexis Park Drive to the west through to the lands covered by the proposed development. The City has also indicated that there is the potential for a bypass of the City located to the northwest of the development. This is considered very long term.

2.5 Future Background Traffic Volumes

Existing volumes in the vicinity of the site were factored up by 3% per annum to represent future volumes at the desired horizon years of 2005, 2010 and 2015. These factored up volumes were then used as the background volumes prior to superimposing the traffic generated by the proposed development on top. These are shown in Exhibits 2.3, 2.4, and 2.5.

2.6 Transit

There is transit service currently running along Alexis Park Drive - Route #3 with a 30 minute headway Monday to Saturday. This route connects Village Green Mall to Downtown Vernon.

2.7 Land Uses

Most of the land on both sides of Alexis Park Drive are single family. However, in the vicinity of 30

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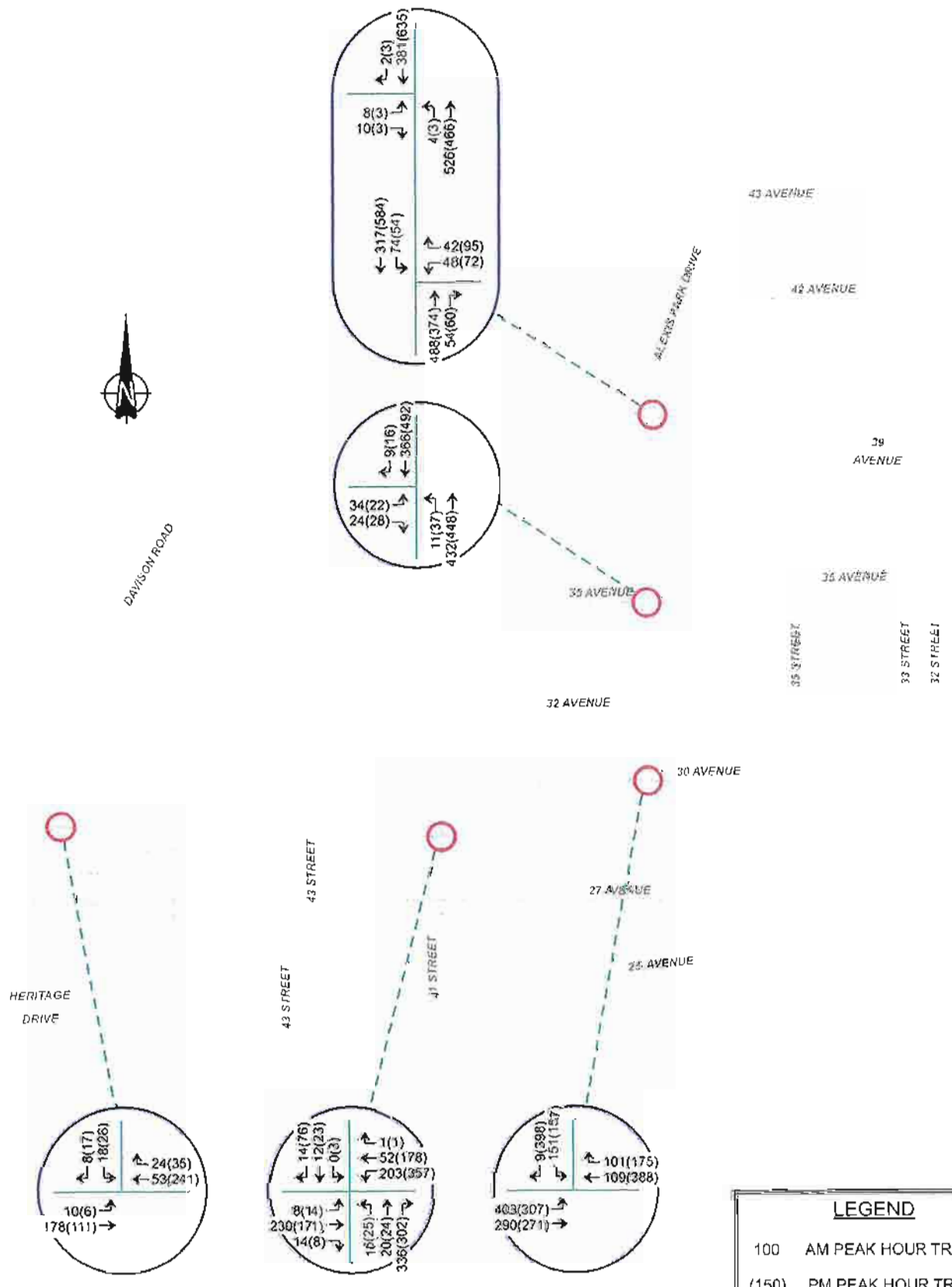
EXHIBIT 2.2
2004 EXISTING TRAFFIC VOLUMES



LEGEND	
100	AM PEAK HOUR TRAFFIC
(150)	PM PEAK HOUR TRAFFIC

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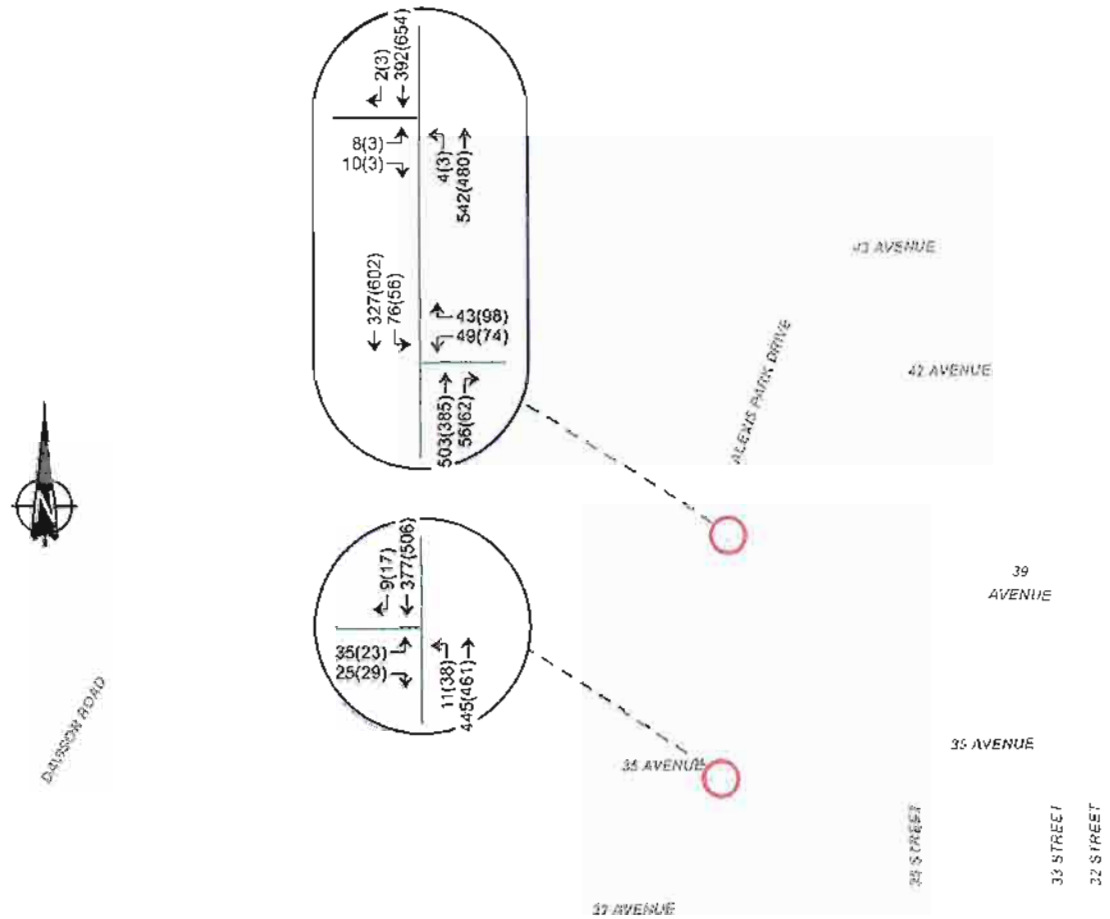
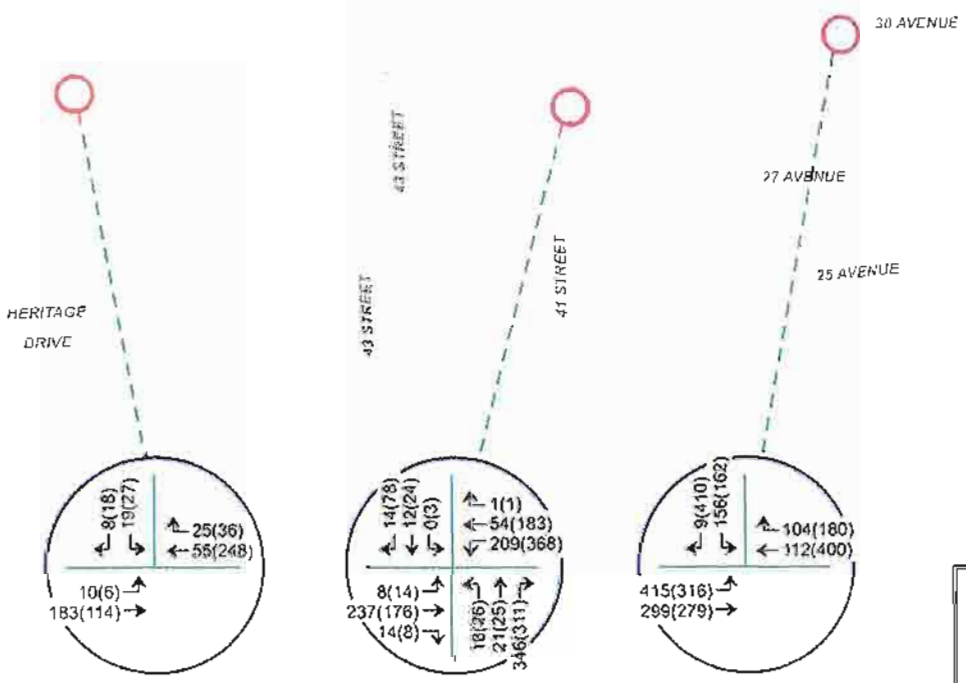
EXHIBIT 2.3
2005 BACKGROUND TRAFFIC VOLUMES





LEGEND	
100	AM PEAK HOUR TRAFFIC
(150)	PM PEAK HOUR TRAFFIC

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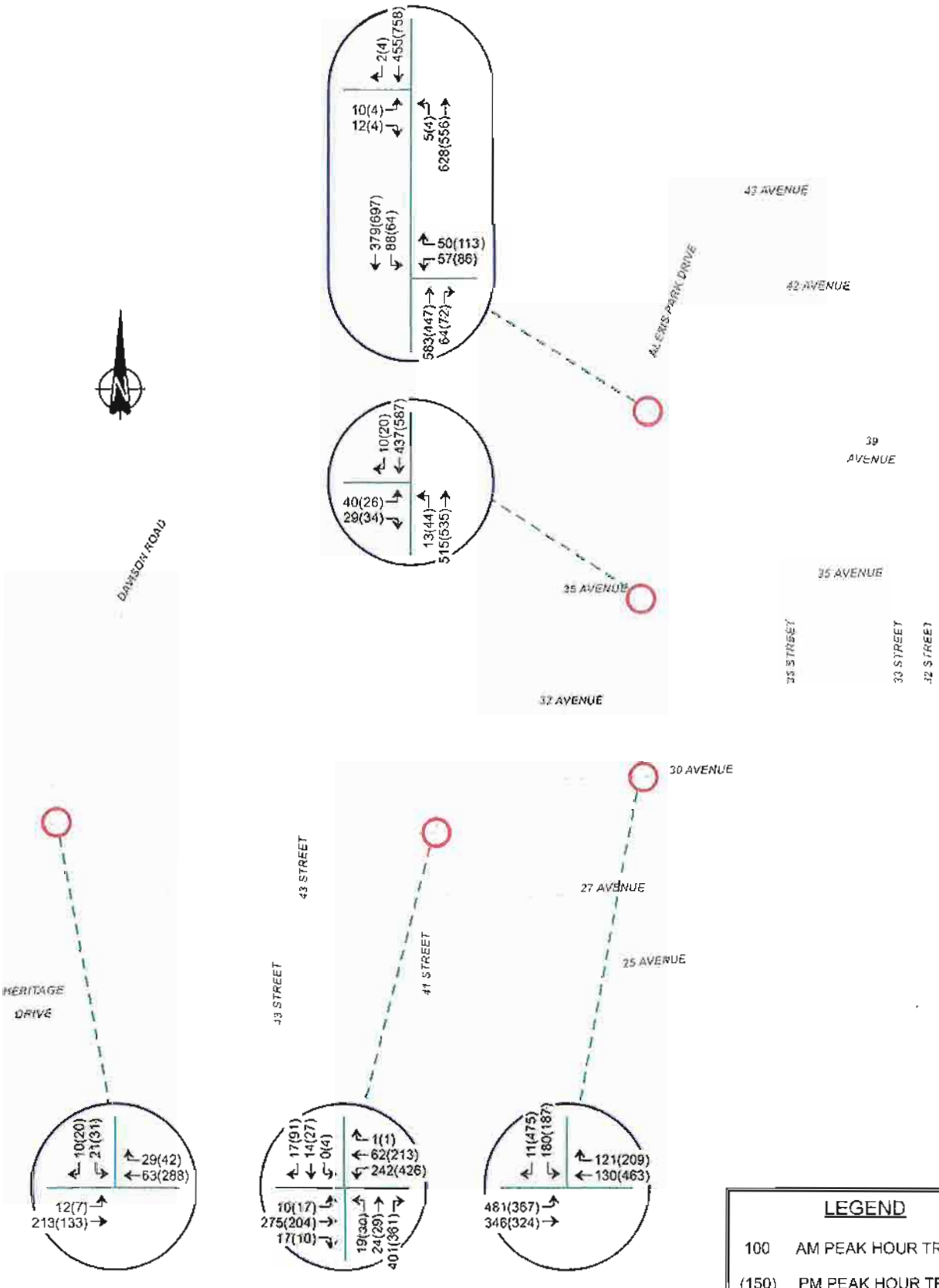
EXHIBIT 2.4
2010 BACKGROUND TRAFFIC VOLUMES



LEGEND	
100	AM PEAK HOUR TRAFFIC
(150)	PM PEAK HOUR TRAFFIC

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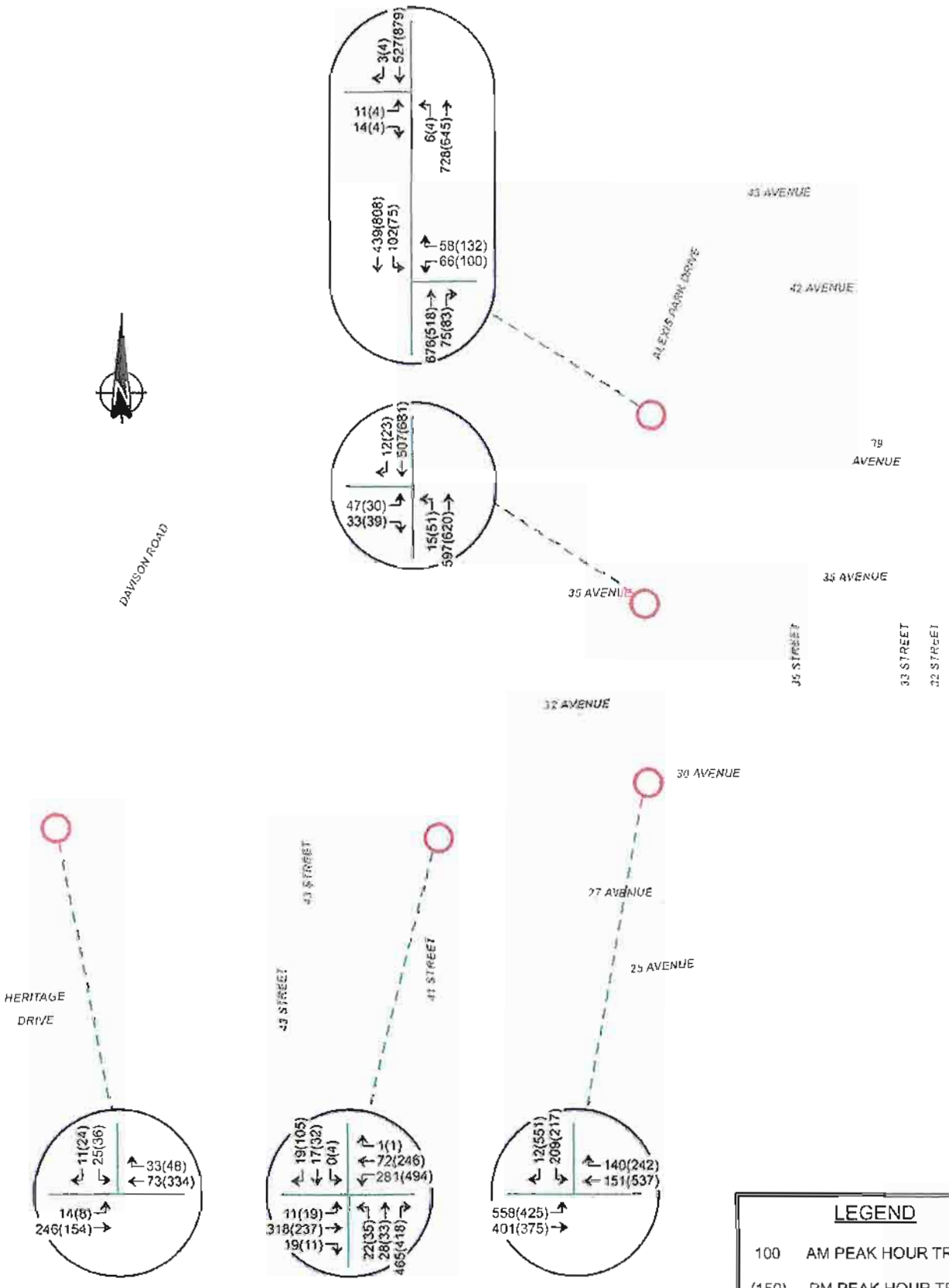
EXHIBIT 2.5
2015 BACKGROUND TRAFFIC VOLUMES



Avenue there are a number of multi-family developments. There is a large block of vacant land on the east side of Alexis Park Drive in the vicinity of its intersection with 35 Avenue. The subject property is presently vacant as, are for all practical purposes, the adjacent lands to the south, west and north.

2.8 Intersection Performance

The level of service at the key intersections were analyzed using the Highway Capacity Manual methods using SYNCHRO6. For signalized intersections, the operational analysis methodology gives three indicators for the overall performance of an intersection and for the individual turning movements. The first is the volume to capacity ratio (v/c) where the volume is the number of vehicles wishing to make a certain movement, and capacity is the maximum number of vehicles that can be accommodated in an hour. This takes into account the number of lanes available for the movement, whether the movement is protected or permitted, conflicting traffic, the cycle length, and the amount of green time the movement receives. The higher the v/c ratio, the more congested the intersection becomes. When the v/c ratio is greater than 1.00, this indicates that more vehicles wish to make a given movement than are able to, due to the limited capacity. The second measure, the average delay per vehicle, is based on the cycle length, the green time for each movement and the v/c ratios. The third measure is the level of service which is established from the average delay. The larger the average delay - and the higher the v/c ratio - the worse is the level of service. Table 2.2 shows the relationship between level of service, delay and v/c ratio.

Table 2.2
Volume/Capacity, Reserve Capacity vs. Level of Service

	Signalized Intersection		Unsignalized Intersection
LoS	Stopped Delay/Vehicle (s/veh)	Delays	Avg. Ttl Delay
A	≤ 10.0	Little or no delay	≤ 10
B	> 10.0 and ≤ 20.0	Short traffic delays	> 10 and ≤ 15
C	> 20.0 and ≤ 35.0	Average traffic delays	> 15 and ≤ 25
D	> 35.0 and ≤ 55.0	Long traffic delays	> 25 and ≤ 35
E	> 55.0 and ≤ 80.0	Very long traffic delays	> 35 and ≤ 50
F	> 80.0	Failure	> 50

The generally accepted guidelines for determining whether or not a signalized intersection needs to be upgraded is that all individual movements should operate with a v/c ratio of 0.90 or less. If this threshold is not achieved, any signal changes required to achieve these levels should be identified.

These cover changes to signal timings and phasing, for example adding advanced phases for left turn movements and possible elimination of certain turning movements, but not the provision of additional capacity with extra through or turn lanes. When traffic generated by a development is added to an intersection and the v/c ratio of a specific movement that was less than 0.90 under background conditions is now greater than 0.90, then improvements must be identified to allow the intersection to operate at the 0.90 value. If the intersection was above 0.90 under background conditions, then the original v/c ratios must not be exceeded, i.e., the operation of the intersection

must be no worse as a result of the development.

The performance of unsignalized intersections was also reviewed using the methodology for such intersections in the *Highway Capacity Manual*. The methodology estimates the capacity of each movement based on the conflicting pedestrian and traffic volumes. An operational level of service is assigned to the movement based on the volume and capacity and the relationship between the two was included in Table 2.2.

While the overall level of service and delay for an unsignalized intersection provide a measure of overall performance, it is commonly turning movements at such intersections which are the primary focus of interest. With only low turning volumes from the minor road and high through volumes on the main road, delays to turning vehicles can become excessive. As delays increase, turning vehicles will attempt to turn across unacceptable gaps which can present safety concerns.

The key intersections in the vicinity the site were analyzed under the 2005, 2010 and 2015 background conditions using the standard HCS methodology as implemented in SYNCHRO06 and the results are given in Tables 2.3 to 2.8 and are summarized below.

(a) 30 Avenue/Alexis Park Drive – This intersection will operate as an acceptable level of service under background conditions through to 2010 horizon year. By 2015, an eastbound advanced green phase will be needed since without this phase, the intersection will operate at a v/c ratio of 0.95 in the p.m. peak hour.

(b) 35 Avenue/Alexis Park Drive - At this unsignalized intersection, the eastbound left and right turn movements on 35 Avenue, which share a common single lane as they approach Alexis Park Drive, will operate at no worse than Level of Service D through to 2015 in both peak hours and this is certainly considered acceptable for traffic exiting from a local road at an unsignalized intersection. The maximum v/c ratio is 0.38.

(c) 39 Avenue/Alexis Park Drive – In the 2005 and 2010 horizon year this intersection will operate at an acceptable level. The critical time period will be the 2010 p.m. peak hour when 39 Avenue traffic will operate at a v/c ratio of 0.89 and Level of Service F in the p.m. peak hour. By 2015 the v/c ratio will be greater than 1.00. This indicates that shortly after 2010 improvements will be required and a signal is recommended.

(d) 39A Avenue/Alexis Park Drive – The intersection will operate well through to 2015. No improvements are needed. The maximum v/c ratio will be 0.06 in the p.m. peak hour of 2015 and the Level of service will be D.

(e) Bella Vista Road/Davison Road – This intersection will also operate well through to 2015 with the maximum v/c ratio being 0.12 and the Level of Service B.

(f) 30 Avenue/41 Street – This four leg intersection is stop controlled for all legs except the east leg which has priority. Since SYNCHRO cannot analyze such an intersection, the intersection was analyzed with only north-south traffic facing a stop sign. Under these assumptions the intersection will operate well in the a.m. peak hour through to 2015. In the

p.m. peak hour a separate northbound left turn lane is recommended by 2010 to reduce v/c ratios; however, delays would still be long. Only a signal would rectify this. By 2015 the intersection will need to be signalized with eastbound and westbound left turn lanes as well as a westbound advanced green phase.

Table 2.3
Intersection Analysis
30 Avenue/Alexis Park Drive

		Eastbound			Westbound			Northbound			Southbound			Overall
		L	T	R	L	T	R	L	T	R	L	T	R	
Background														
2005 am	v/c	0.55	0.27		0.10	0.11					0.38	0.02		0.55
	delay	9.7	6.0		5.3	1.7					14.9	8.3		8.2
	LoS	A	A		A	A					B	A		A
2010 am	v/c	0.69	0.33		0.12	0.13					0.43	0.03		0.69
	delay	14.0	6.7		5.5	1.7					16.8	8.3		10.3
	LoS	B	A		A	A					B	A		B
2015 am	v/c	0.81	0.38		0.14	0.15					0.49	0.03		0.81
	delay	21.6	7.4		5.8	1.7					18.7	8.1		13.7
	LoS	C	A		A	A					B	A		B
2005 pm	v/c	0.77	0.30		0.43	0.21					0.34	0.60		0.77
	delay	18.6	6.5		7.5	1.6					16.2	5.7		9.1
	LoS	B	A		A	A					B	A		A
2010 pm	v/c	0.87	0.31		0.44	0.22					0.44	0.74		0.87
	delay	25.8	6.3		7.4	1.4					22.3	11.4		12.3
	LoS	C	A		A	A					C	B		B
2015 pm	v/c	0.95	0.32		0.46	0.22					0.59	0.93		0.95
	delay	38.1	5.7		6.9	1.0					37.1	32.8		20.7
	LoS	D	A		A	A					D	C		C
add EB	v/c	0.82	0.32		0.86	0.35					0.59	0.79		0.86
adv grn	delay	29.9	6.0		33.5	3.9					31.3	12.4		20.2
	LoS	C	A		C	A					C	B		C
Combined														
2005 am	v/c	0.58	0.28		0.10	0.13					0.50	0.08		0.58
	delay	11.1	6.8		6.1	1.8					16.3	6.1		9.5
	LoS	B	A		A	A					B	A		A
2010 am	v/c	0.75	0.35		0.13	0.16					0.55	0.08		0.75
	delay	16.8	7.6		6.3	1.8					18.4	6.0		12.0
	LoS	B	A		A	A					B	A		B
2015 am	v/c	0.85	0.39		0.15	0.17					0.63	0.09		0.85
	delay	22.1	7.8		6.1	1.6					23.1	6.6		14.8
	LoS	C	A		A	A					C	A		B
2005 pm	v/c	0.83	0.29		0.42	0.28					0.43	0.62		0.83
	delay	23.6	6.9		7.9	1.7					17.6	6.4		10.4
	LoS	C	A		A	A					B	A		B
2010 pm	v/c	0.90	0.30		0.43	0.29					0.56	0.76		0.90
	delay	27.5	6.2		7.3	1.3					26.4	13.0		13.3
	LoS	C	A		A	A					C	B		B
2015 pm	v/c	0.98	0.31		0.44	0.29					0.74	0.97		0.98
	delay	52.7	5.7		7.0	1.1					46.5	43.9		26.7
	LoS	D	A		A	A					D	D		C
EB adv grn	v/c	0.84	0.32		0.89	0.45					0.70	0.79		0.89
	delay	32.3	6.2		38.3	4.2					35.0	12.7		21.9
	LoS	C	A		D	A					D	B		C

v/c = volume to capacity ratio; delay = average delay per vehicle in seconds; LoS = Level of Service

Table 2.4
Intersection Analysis
35 Avenue/Alexis Park Drive

		Eastbound			Westbound			Northbound			Southbound			Overall
		L	T	R	L	T	R	L	T	R	L	T	R	
Background														
2005 am	v/c	0.17						0.01						
	delay	16.4						8.2						
	LoS	C						A						
2010 am	v/c	0.23						0.01						
	delay	19.6						8.4						
	LoS	C						A						
2015 am	v/c	0.34						0.02						
	delay	25.8						8.6						
	LoS	C						A						
2005 pm	v/c	0.18						0.04						
	delay	18.7						8.7						
	LoS	C						A						
2010 pm	v/c	0.25						0.05						
	delay	23.6						9.1						
	LoS	C						A						
2015 pm	v/c	0.38						0.07						
	delay	33.7						9.5						
	LoS	D						A						
Combined														
2005 am	v/c	0.25						0.01						
	delay	20.2						8.5						
	LoS	C						A						
2010 am	v/c	0.34						0.02						
	delay	25.3						8.7						
	LoS	D						A						
2015 am	v/c	0.48						0.02						
	delay	36.1						9.0						
	LoS	E						A						
2005 pm	v/c	0.25						0.05						
	delay	23.8						9.0						
	LoS	C						A						
2010 pm	v/c	0.36						0.06						
	delay	32.6						9.4						
	LoS	D						A						
2015 pm	v/c	0.54						0.08						
	delay	52.5						9.9						
	LoS	F						A						

v/c = volume to capacity ratio; delay = average delay per vehicle in seconds; LoS = Level of Service

Table 2.5
Intersection Analysis
39 Avenue/Alexis Park Drive

		Eastbound			Westbound			Northbound			Southbound			Over
		L	T	R	L	T	R	L	T	R	L	T	R	all
Background														
2005 am	v/c				0.34						0.09			
	delay				23.2						9.1			
	LoS				C						A			
2010 am	v/c				0.49						0.11			
	delay				34.3						9.5			

		Eastbound L	T	R	Westbound L	T	R	Northbound L	T	R	Southbound L	T	R	Over all
	LoS				D						A			
2015 am	v/c				0.75						0.14			
	delay				69.5						10.1			
	LoS				F						B			
2005 pm	v/c				0.61						0.06			
	delay				33.4						8.5			
	LoS				D						A			
2010 pm	v/c				0.89						0.07			
	delay				76.4						8.8			
	LoS				F						A			
2015 pm	v/c				1.38						0.09			
	delay				252						9.2			
	LoS				F						A			
signal	v/c				0.60		-	0.52		-	-	0.86		0.86
	delay				19.1		-	7.3		-	-	18.4		14.6
	LoS				B		-	A		-	-	B		B
Combined														
2005 am	v/c				0.59		-				0.18			
	delay				43.5		-				9.7			
	LoS				E		-				A			
2010 am	v/c				0.87		-				0.21			
	delay				94.4		-				10.3			
	LoS				F		-				B			
2015 am	v/c				1.35		-				0.26			
	delay				270		-				11.2			
	LoS				F		-				B			
signal	v/c				0.44		-	0.65		-	0.76	0.44		0.76
SBL	delay				14.5		-	8.8		-	30.2	5.9		10.7
	LoS				B		-	A		-	C	A		B
2005 pm	v/c				1.12		-				0.12			
	delay				135		-				9.2			
	LoS				F		-				A			
2 WB lanes	v/c				0.73		0.39				0.12			
	delay				92.9		16.3				9.2			
	LoS				F		C				A			
2010 pm	v/c				1.60		-				0.13			
	delay				336		-				9.6			
	LoS				F		-				A			
signal	v/c				0.55		-	0.63		-	0.44	0.75		0.75
SBL	delay				8.8		-	9.4		-	12.0	12.6		10.8
	LoS				B		-	A		-	B	B		B
2015 pm	v/c				2.44		-				0.16			
	delay				717		-				10.1			
	LoS				F		-				B			
signal	v/c				0.62		-	0.70		-	0.63	0.84		0.84
SBL	delay				11.2		-	11.6		-	25.5	17.7		15.0
	LoS				B		-	B		-	C	B		B

v/c = volume to capacity ratio; delay = average delay per vehicle in seconds; LoS = Level of Service

Table 2.6
Intersection Analysis
39A Avenue/Alexis Park Drive

		Eastbound L	T	R	Westbound L	T	R	Northbound L	T	R	Southbound L	T	R	Over all
Background														
2005 am	v/c	0.05						0.00						
	delay	14.9						8.2						

		Eastbound			Westbound			Northbound			Southbound			Over	
		L	T	R	L	T	R	L	T	R	L	T	R	all	
	LoS	B						A							
2010 am	v/c	0.08						0.01							
	delay	17.3						8.4							
	LoS	B						A							
2015 am	v/c	0.10						0.01							
	delay	20.5						8.6							
	LoS	C						A							
2005 pm	v/c	0.02						0.00							
	delay	18.9						9.1							
	LoS	C						A							
2010 pm	v/c	0.04						0.01							
	delay	22.9						9.5							
	LoS	C						A							
2015 pm	v/c	0.06						0.01							
	delay	29.2						10.1							
	LoS	D						B							
Combined															
2005 am	v/c	0.73		-				0.06							
	delay	35.7		-				8.4							
	LoS	E		-				A							
2010 am	v/c	0.88		-				0.06							
	delay	60.0		-				8.7							
	LoS	F		-				A							
2015 am	v/c	1.10		-				0.07							
	delay	126		-				8.9							
	LoS	F		-				A							
2 EB lanes	v/c	0.69		0.41				0.07							
	delay	82.2		16.9				8.9							
	LoS	F		C				A							
2005 pm	v/c	0.91		-				0.26							
	delay	97.9		-				10.9							
	LoS	F		-				B							
2 EB lanes	v/c	0.62		0.29				0.26							
	delay	114		17.4				10.9							
	LoS	F		C				B							
2010 pm	v/c	1.22		-				0.29							
	delay	210		-				11.8							
	LoS	F		-				B							
2 EB lanes	v/c	0.88		0.34				0.29							
	delay	211		20.4				11.8							
	LoS	F		C				B							
2015 pm	v/c	1.70		-				0.33							
	delay	430		-				13.0							
	LoS	F		-				B							
signal, NBL,	v/c	0.46		-				0.67		0.47			0.84	0.08	0.84
NB adv grn,	delay	13.2		-				29.2		5.1			20.9	2.3	15.2
SBR	LoS	B		-				C		A			C	A	B

v/c = volume to capacity ratio; delay = average delay per vehicle in seconds; LoS = Level of Service

Table 2.7
Intersection Analysis
Bella Vista/Davidson Avenue

		Eastbound			Westbound			Northbound			Southbound			Overall
		L	T	R	L	T	R	L	T	R	L	T	R	
Background														
2005 am	v/c	0.01									0.04		-	
	delay	7.4									9.9		-	

		Eastbound			Westbound			Northbound			Southbound			Overall
		L	T	R	L	T	R	L	T	R	L	T	R	
	LoS	A									A		-	
2010 am	v/c	0.01									0.05		-	
	delay	7.4									10.2		-	
	LoS	A									B		-	
2015 am	v/c	0.01									0.06		-	
	delay	7.5									10.6		-	
	LoS	A									B		-	
2005 pm	v/c	0.01									0.08		-	
	delay	7.9									11.1		-	
	LoS	A									B		-	
2010 pm	v/c	0.01									0.09		-	
	delay	8.0									11.8		-	
	LoS	A									B		-	
2015 pm	v/c	0.01									0.12		-	
	delay	8.2									12.6		-	
	LoS	A									B		-	
Combined														
2005 am	v/c	0.01									0.04		-	
	delay	7.4									10.1		-	
	LoS	A									B		-	
2010 am	v/c	0.01									0.05		-	
	delay	7.5									10.3		-	
	LoS	A									B		-	
2015 am	v/c	0.01									0.06		-	
	delay	7.5									10.8		-	
	LoS	A									B		-	
2005 pm	v/c	0.01									0.08		-	
	delay	7.9									11.3		-	
	LoS	A									B		-	
2010 pm	v/c	0.01									0.10		-	
	delay	8.0									12.0		-	
	LoS	A									B		-	
2015 pm	v/c	0.01									0.13		-	
	delay	8.2									12.9		-	
	LoS	A									B		-	

v/c = volume to capacity ratio; delay = average delay per vehicle in seconds; LoS = Level of Service

Table 2.8
Intersection Analysis
30 Avenue (Bella Vista)/41 Street

		Eastbound			Westbound			Northbound			Southbound			Over
		L	T	R	L	T	R	L	T	R	L	T	R	all
Background														
2005 am	v/c	0.01			0.18			-	0.16	0.49	-	0.07	0.02	
	delay	7.3			8.4			-	22.0	14.0	-	23.0	8.6	
	LoS	A			A			-	C	B	-	C	A	
2010 am	v/c	0.01			0.21			-	0.24	0.60	-	0.10	0.02	
	delay	7.4			8.7			-	28.6	16.9	-	30.0	8.7	
	LoS	A			A			-	D	C	-	D	A	
2015 am	v/c	0.01			0.26			-	0.36	0.73	-	0.18	0.02	
	delay	7.4			9.1			-	42.1	23.3	-	46.2	8.7	
	LoS	A			A			-	E	C	-	E	A	
2005 pm	v/c	0.01			0.29			-	0.58	0.40	-	0.30	0.10	
	delay	7.7			8.7			-	85.2	12.1	-	57.9	9.8	
	LoS	A			A			-	F	B	-	F	A	
2010 pm	v/c	0.01			0.35			-	1.08	0.48	-	0.61	0.12	
	delay	7.7			9.1			-	256	13.5	-	141	10.1	
	LoS	A			A			-	F	B	-	F	B	

		Eastbound			Westbound			Northbound			Southbound			Over
		L	T	R	L	T	R	L	T	R	L	T	R	all
add NBL	v/c	0.01			0.35			0.72	0.36	0.48	-	0.61	0.12	
	delay	7.7			9.1			194	67.6	13.5	-	141	10.1	
	LoS	A			A			F	F	B	-	F	B	
2015 pm	v/c	0.02			0.41			-	2.57	0.59	-	1.43	0.15	
	delay	7.8			9.7			-	1005	16.0	-	541	10.5	
	LoS	A			A			-	F	C	-	F	B	
Sig, EBL,	v/c	0.06	0.46	-	0.71	0.21	-	-	0.19	0.45	-	0.09	0.24	0.71
WBL, WB	delay	13.0	15.1	-	14.4	5.2	-	-	15.4	3.0	-	14.6	4.7	9.6
adv grn	LoS	B	B	-	B	A	-	-	B	A	-	B	A	A
Combined														
2005 am	v/c	0.01			0.19			-	0.17	0.49	-	0.07	0.02	
	delay	7.4			8.4			-	23.5	14.2	-	24.6	8.7	
	LoS	A			A			-	C	B	-	C	A	
2010 am	v/c	0.01			0.22			-	0.25	0.60	-	0.11	0.02	
	delay	7.4			8.7			-	31.2	17.2	-	32.6	8.8	
	LoS	A			A			-	D	C	-	D	A	
2015 am	v/c	0.01			0.27			-	0.39	0.74	-	0.20	0.02	
	delay	7.4			9.1			-	47.0	24.0	-	51.5	8.8	
	LoS	A			A			-	E	C	-	F	A	
2005 pm	v/c	0.01			0.30			-	0.63	0.42	-	0.34	0.10	
	delay	7.7			8.8			-	98.8	12.5	-	65.6	9.8	
	LoS	A			A			-	F	B	-	F	A	
2010 pm	v/c	0.01			0.36			-	1.19	0.51	-	0.68	0.12	
	delay	7.8			9.3			-	307	14.2	-	173	10.2	
	LoS	A			A			-	F	B	-	F	B	
add NBL	v/c	0.01			0.36			0.80	0.39	0.51	-	0.68	0.12	
	delay	7.8			9.3			232	74.9	14.2	-	173	10.2	
	LoS	A			A			F	F	B	-	F	B	
2015 pm	v/c	0.02			0.43			-	2.98	0.62	-	1.73	0.15	
	delay	7.8			9.9			-	1223	17.1	-	718	10.6	
	LoS	A			A			-	F	B	-	F	B	
add NBL,	v/c	0.02			0.43			2.30	0.68	0.62	1.07	0.66	0.15	
SBL	delay	7.8			9.9			1073	163	17.1	1557	160	10.6	
	LoS	A			A			F	F	B	F	F	B	

v/c = volume to capacity ratio; delay = average delay per vehicle in seconds; LoS = Level of Service

Table 2.9
Intersection Analysis
39 Avenue/39A Avenue/Alexis Park Drive
(as a reconfigured intersection)

		Eastbound			Westbound			Northbound			Southbound			Over
		L	T	R	L	T	R	L	T	R	L	T	R	all
Backgroun d														
2005 am	v/c	-	0.08	-	-	0.40	-	0.00			0.08			
	delay	-	21.3	-	-	28.6	-	8.0			9.0			
	LoS	-	C	-	-	D	-	A			A			
2010 am	v/c	-	0.13	-	-	0.61	-	0.00			0.10			
	delay	-	27.9	-	-	47.7	-	8.1			9.5			
	LoS	-	D	-	-	E	-	A			A			
2015 am	v/c	-	0.22	-	-	0.82	0.16	0.00			0.13			
w WBR	delay	-	41.7	-	-	132	15.6	8.3			10.1			
	LoS	-	E	-	-	F	B	A			B			
2005 pm	v/c	-	0.05	-	-	0.73	-	0.00			0.06			
	delay	-	27.5	-	-	49.5	-	8.9			8.5			
	LoS	-	D	-	-	E	-	A			A			
2010 pm	v/c	-	0.08	-	-	0.90	0.22	0.00			0.07			

		Eastbound			Westbound			Northbound			Southbound			Over
		L	T	R	L	T	R	L	T	R	L	T	R	all
w WBR	delay	-	41.5	-	-	137	13.3	9.2			8.8			
	LoS	-	E	-	-	F	B	A			A			
2015 pm	v/c	-	0.03	-	-	0.63	-	-	0.54	-	-	0.86	-	0.86
	delay	-	17.1	-	-	20.2	-	-	7.9	-	-	18.2	-	14.9
	LoS	-	B	-	-	C	-	-	A	-	-	B	-	B
Combined														
2005 am	v/c	-	0.57	-	-	0.28	-	-	0.58	-	-	0.47	-	0.58
	delay	-	14.4	-	-	10.6	-	-	10.0	-	-	8.8	-	10.6
	LoS	-	B	-	-	B	-	-	B	-	-	A	-	B
2010 am	v/c	-	0.59	-	-	0.32	-	-	0.74	-	-	0.61	-	0.74
	delay	-	15.5	-	-	11.4	-	-	13.2	-	-	11.2	-	12.8
	LoS	-	B	-	-	B	-	-	B	-	-	B	-	B
2015 am	v/c	-	0.61	-	-	0.38	-	-	0.82	-	-	0.73	-	0.82
	delay	-	17.0	-	-	12.7	-	-	18.0	-	-	15.6	-	16.6
	LoS	-	B	-	-	B	-	-	B	-	-	B	-	B
add LT	v/c	0.27	0.42	-	0.28	0.20	-	0.08	0.72	-	0.59	0.43	-	0.72
lanes	delay	16.4	9.0	-	16.7	7.7	-	5.6	11.9	-	24.4	7.0	-	11.1
	LoS	B	A	-	B	A	-	A	B	-	C	A	-	B
2005 pm	v/c	-	0.34	-	-	0.59	-	-	0.75	-	-	0.80	-	0.80
	delay	-	11.7	-	-	16.6	-	-	15.9	-	-	16.7	-	16.0
	LoS	-	B	-	-	B	-	-	B	-	-	B	-	B
2010 pm	v/c	-	0.37	-	-	0.69	-	-	0.81	-	-	0.89	-	0.89
	delay	-	14.8	-	-	22.4	-	-	19.2	-	-	22.7	-	20.9
	LoS	-	B	-	-	C	-	-	B	-	-	C	-	C
2015 pm	v/c	-	0.45	-	-	0.91	-	0.86	0.51	-	-	0.95	-	0.95
	delay	-	24.0	-	-	56.3	-	21.5	7.3	-	-	30.0	-	30.7
	LoS	-	C	-	-	E	-	C	A	-	-	C	-	C
add LT	v/c	0.25	0.28	-	0.40	0.54	-	0.71	0.54	-	0.20	0.79	-	0.79
lanes	delay	23.7	12.2	-	24.3	16.0	-	31.6	7.4	-	6.2	12.7	-	13.1
	LoS	C	B	-	C	B	-	C	A	-	A	B	-	B

v/c = volume to capacity ratio; delay = average delay per vehicle in seconds; LoS = Level of Service

2.9 39A Avenue/39 Avenue/Alexis Park Drive

At this intersection, 39A Avenue is offset from 39 Avenue, with 39A Avenue on the west side of Alexis Park Drive being north of 39 Avenue on the east side of Alexis Park Drive. This makes left turn movements from Alexis Park Drive into either leg difficult, since the two left turn paths overlap. The limited distance between the two intersections, 36 metres centre to centre, limits the amount of left turn storage that can occur between the two intersections. The background traffic volume turning left into 39 Avenue is currently 74 veh/h in the a.m. peak hour and 54 veh/h in the p.m. peak hour. These volumes require approximately 18 metres and 14 metres of storage, respectively. There is approximately 25 metres of storage space available between the two intersections. Under background conditions, a signal will be needed at the 39 Avenue intersection just after 2010, and at this time it is recommended that the 39A Avenue leg of the intersection be moved south to align with 39 Avenue. Prior to re-alignment and signalization, two westbound lanes are recommended to provide sufficient capacity. The operation of the reconfigured intersection is shown in Table 2.9.

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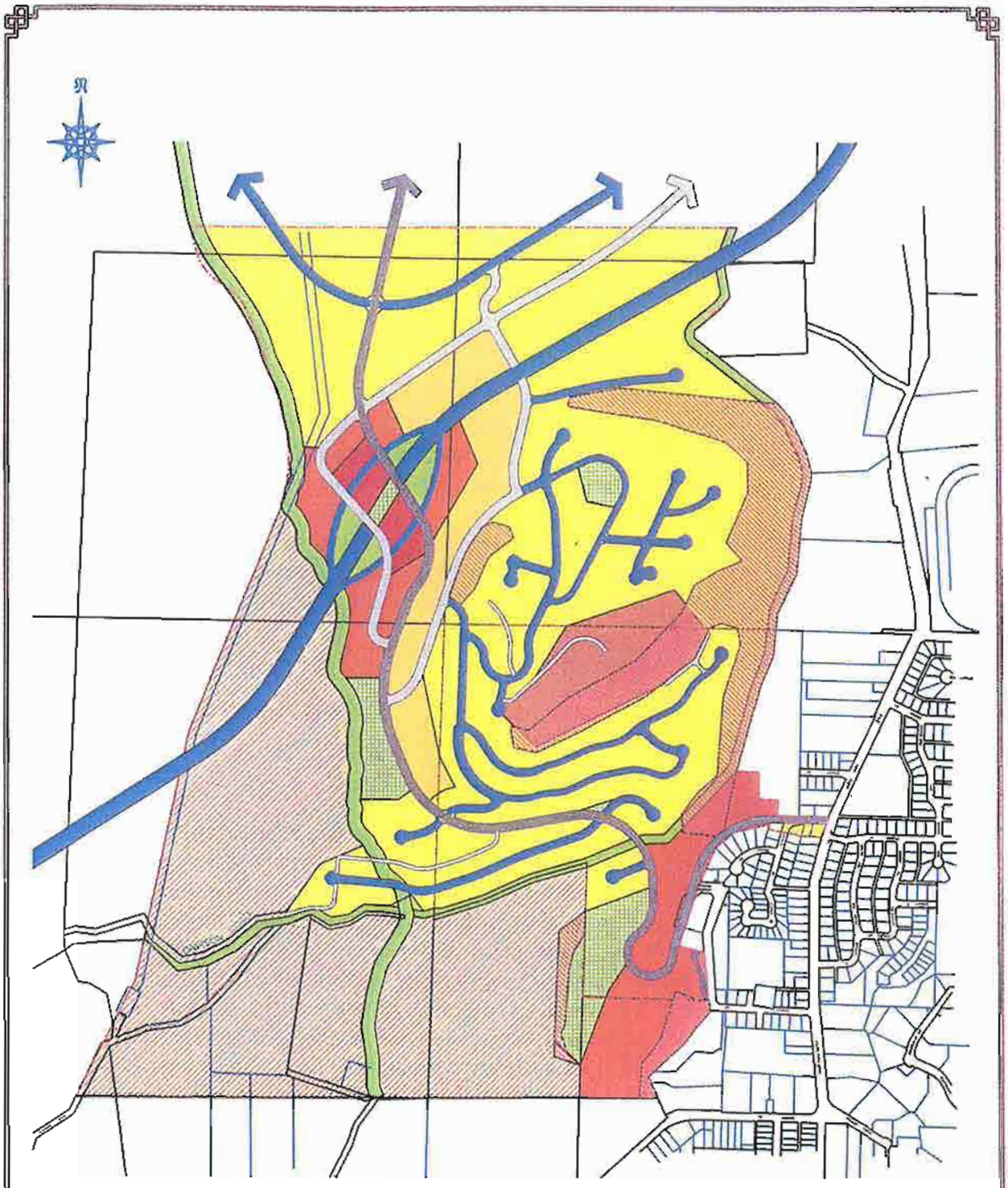
EXHIBIT 3.1
BELLA VISTA HIGHLANDS LAND USE PLAN



FUTURE LAND USE LEGEND:

- CLIFFS AND STEEP SLOPES
- RIBBON OF GREEN (GREY CANAL)
- PUBLIC PARK
- TASSIE CREEK GREENWAY
- TRAILS
- RURAL / FARMS
- TOWN CENTRE CORE - MIXED USE
- MEDIUM DENSITY MULTIPLE FAMILY RESIDENTIAL
- LOW DENSITY MULTIPLE FAMILY RESIDENTIAL
- ONE AND TWO FAMILY RESIDENTIAL
- ONE AND TWO FAMILY CLUSTER RESIDENTIAL

ROAD CLASSIFICATION LEGEND:

- HIGHWAY 97 BYPASS
- ARTERIAL CONDITION -C
- COLLECTOR CONDITION -C
- LOCAL CONDITION -B
- LANEWAY

3.0 PROPOSED DEVELOPMENT

3.1 Size and Mix

Based on the information provided, the proposed ultimate development is to consist of 1,898 residential units covering a variety of different types of residential units when the ultimate build out occurs. Phase I of the development on the lands owned by DC Properties Ltd. will consists of 530 units and the main focus of this report. The current concept plan for the entire development is given in Exhibit 3.1.

3.2 Access

Access to the site will initially be taken via an extension of 39A Avenue west of Alexis Park Drive. If the proposed bypass of Vernon is built, there is a possibility of an access to this from Alexis Park Drive north of 43 Avenue; however, this will be well into the future.

As the site develops, the current offset intersections of 39A Avenue and 39 Avenue will need to be rebuilt to form a standard four legged intersection and signalized to increase its capacity and improve operations. As development further proceeds, an additional access will be needed.

Another existing road, 35 Avenue, will serve approximately 23 units of townhouses, and will not initially be connected to the remainder of the development.

3.3 Trip Generation

As is already noted, the development is to consist of a mixture of single-family, two-family, low and medium density multiple family (assumed to be townhouses) and a mixed use town centre with condominium units. The standard trip generation rates in the ITE's *Trip Generation Manual* were applied to these unit numbers by type in order to determine the amount of traffic expected to be generated by the development in the a.m. and p.m. peak hour. Trip generation rates given are based on the ITE equations with take into account internal trips within the development. For larger developments, the equation rates are considered to be more appropriate as they allow the per unit rate to decrease as the size of the development increases, reflecting the fact that some residents will visit friends, go to school, or do shopping within a larger development since there is more likelihood of having these types of facilities in a larger development. The commercial component of the development in the town centre was considered to primarily serve the development, and therefore will not generate any external trips. The trip generation shown in Tables 3.1 and 3.2 applies to external trip only, and thus the commercial component is not included.

It is noted that the proposed development with 530 residential units is expected to generate 337 trips two-way in the morning peak hour and 432 trips in the afternoon peak hour. The majority of morning trips leave the development, while the majority of afternoon trips arrive at the development. With the full development of 1,898 units, 1,129 a.m. peak hour and 1,343 p.m. peak hour trips will be generated by the development.

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EXHIBIT 3.2
SITE TRAFFIC VOLUMES

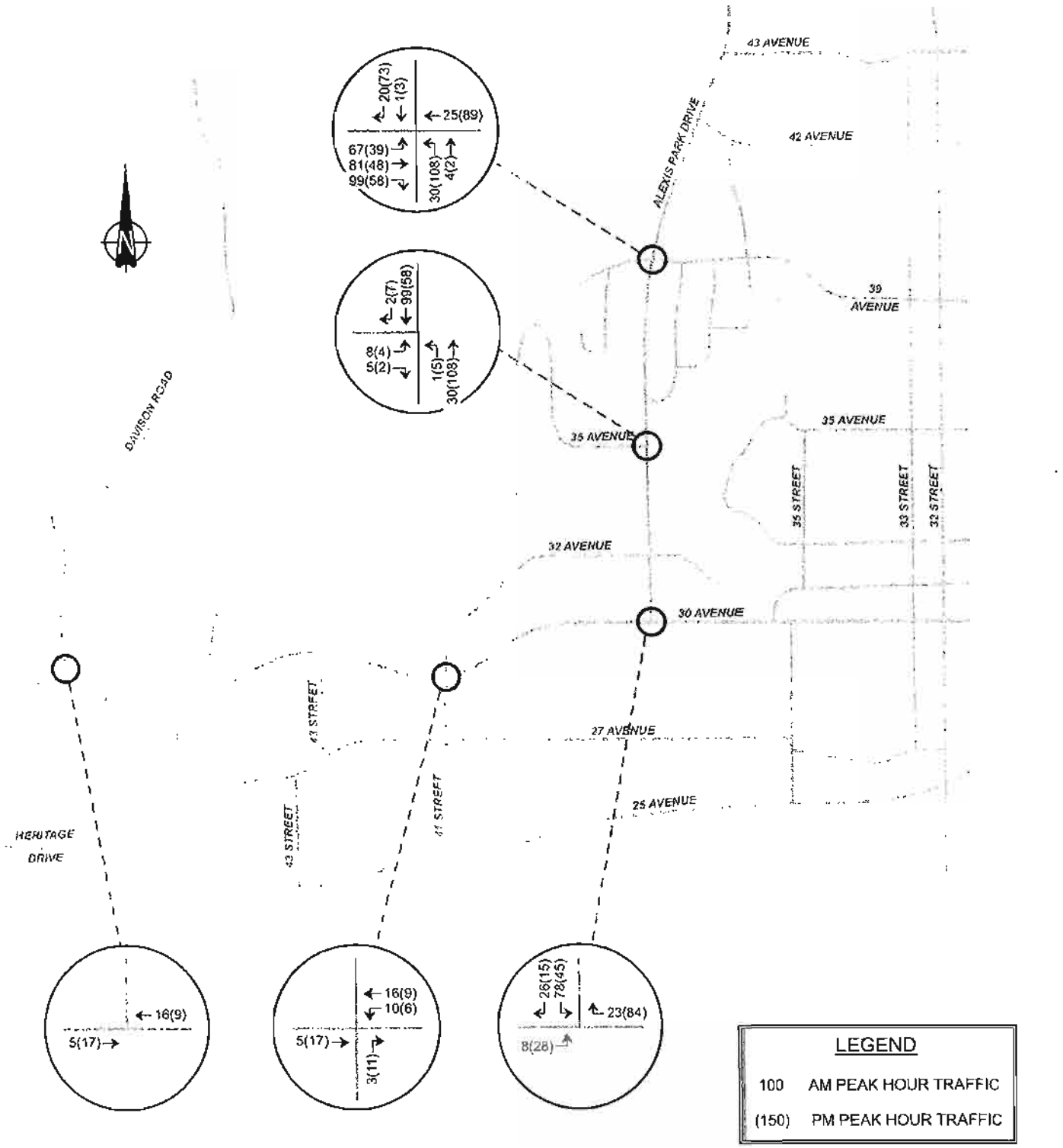

Table 3.1
Trip Generation – Phase I

Component	Units	a.m. peak					p.m. peak				
		Rate	Total	%in	In	Out	Rate	Total	%in	In	Out
Single Family	282	0.73	207	25	52	155	0.97	273	65	177	96
Apartment	225	0.51	114	20	23	91	0.63	141	65	92	49
Townhouse (35 Ave)	23	0.69	16	17	3	13	0.78	18	67	12	6
Total	530		337		78	259		432		281	151

rates are based on ITE equations

Table 3.2
Trip Generation – Build Out

Component	Units	a.m. peak					p.m. peak				
		Rate	Total	%in	In	Out	Rate	Total	%in	In	Out
Single Family	912	0.71	648	25	162	486	0.86	784	65	510	274
Townhouse	219	0.44	97	17	17	80	0.52	114	67	76	38
Apartment	744	0.50	368	20	73	295	0.57	427	65	278	149
Townhouse (35 Ave)	23	0.69	16	17	3	13	0.78	18	67	12	6
Total	1898		1129		255	874		1343		876	467

rates are based on ITE equations

3.4 Trip Distribution

The trips estimated to be generated by the development were distributed to the road network based on 39A Avenue being the only access route serving this site, except for the 23 townhouses which will access 35 Avenue. All trips were assigned to this route and then distributed to the north and to the south on Alexis Park Drive and to the east on 39 Avenue, depending on what part of the municipality they were oriented to. Since this is to be primarily a residential development, it was assumed that the majority of the trips are oriented to and from places of employment and, therefore, particularly to the downtown. The resultant distribution is given in Table 4.4.

Table 4.4
Trip Distribution

Direction	Percentage
North on Old Kamloops via Alexis Park	3%
East on 43 Avenue via Alexis Park	24%
East on 39 Avenue	33%
West on 30 Avenue/Bella Vista	6%
South on 41 Street	4%
East on 30 Avenue	30%

3.5 Trip Assignment

Based on the trip generation and distribution shown above, the site traffic was assigned to the road network. This assignment is shown in Exhibit 3.2 for the Phase I development.

4.0 IMPACT OF DEVELOPMENT

4.1 Combined Volumes – Turtle Mountain

The trips generated by the proposed 530 unit development and assigned to the road network were then superimposed on the projected background traffic at the 2005, 2010 and 2015 horizon years and combined volumes are given in Exhibits 4.1, 4.2 and 4.3 respectively for the Phase I development.

4.2 Intersection Analysis

The key intersections were again analyzed and results are discussed below. Results are detailed in the second half of Tables 2.3 to 2.9.

(a) 30 Avenue/Alexis Park Drive – With the site traffic in place, this intersection will operate well in 2005 and 2010; however by 2015 an eastbound advanced green phase is recommended due to the high volume of eastbound left turning traffic. This was the case with background traffic volumes.

(b) 35 Avenue/Alexis Park Drive – With the development in place, the delay to the eastbound movements out of 35 Avenue will be increased. In both the a.m. and p.m. peak hours, the v/c ratios will remain below 0.90 through to 2015 and no improvements are needed. The critical time period is the p.m. peak hour when the eastbound movements will operate at Level of Service F and a v/c ratio of 0.54 in the 2015 horizon year.

(c) 39 Avenue/Alexis Park Drive – A second westbound lane is recommended by 2005 to separate left turns and right turns and in turn increase the capacity for the westbound movements. By the 2010 horizon year a signal and a southbound left turn lane would be needed to reduce v/c ratios to acceptable levels due to p.m. peak hour conditions. These results assume that the intersection is an isolated intersection, and not in close proximity to the 39A Avenue intersection. Section 4.3 gives a further discussion of this and the 39A Avenue intersection.

(d) 39A Avenue/Alexis Park Drive – With the site traffic in place, a second eastbound lane is recommended to increase the capacity for eastbound movements. By 2015 a traffic signal, northbound left turn lane, southbound right turn lane and a northbound advanced green phase will be needed. The critical time period at this intersection is the p.m. peak hour. These results assume that the intersection is an isolated intersection, and not in close proximity to the 39A Avenue intersection. Section 4.3 gives a further discussion of this and the 39A Avenue intersection.

(e) Bella Vista/Davidson – With the site traffic in place, this intersection will continue to operate well, and no improvements are required.

(f) 30 Avenue/41 Street – This intersection will need upgrading by 2010 due to p.m. peak hour

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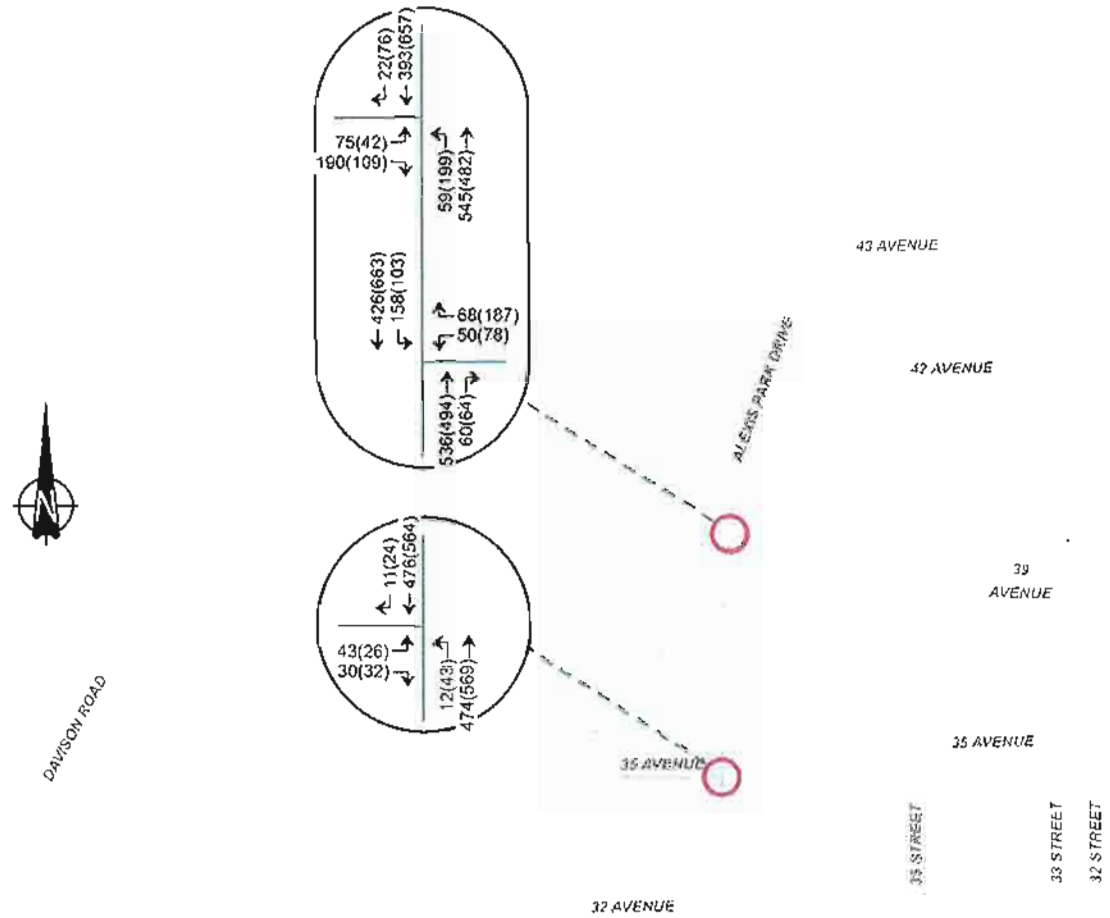
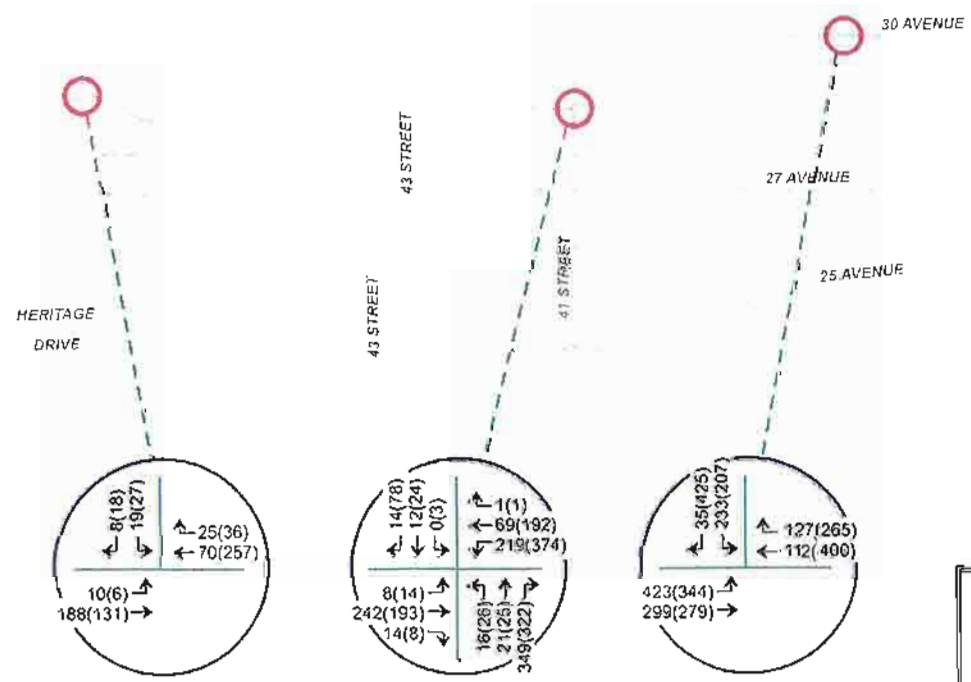
EXHIBIT 4.1
2005 COMBINED TRAFFIC VOLUMES





LEGEND	
100	AM PEAK HOUR TRAFFIC
(150)	PM PEAK HOUR TRAFFIC

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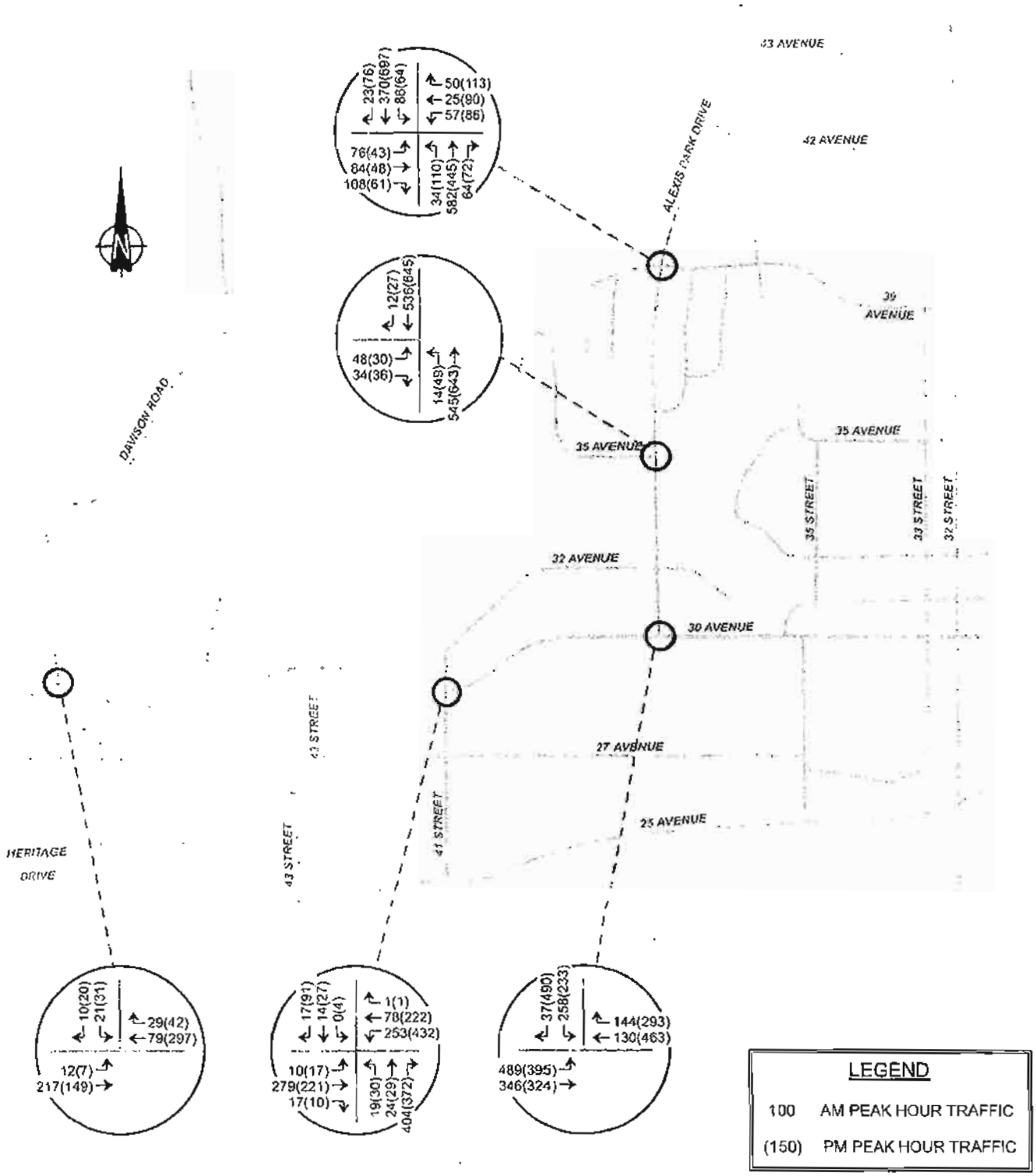
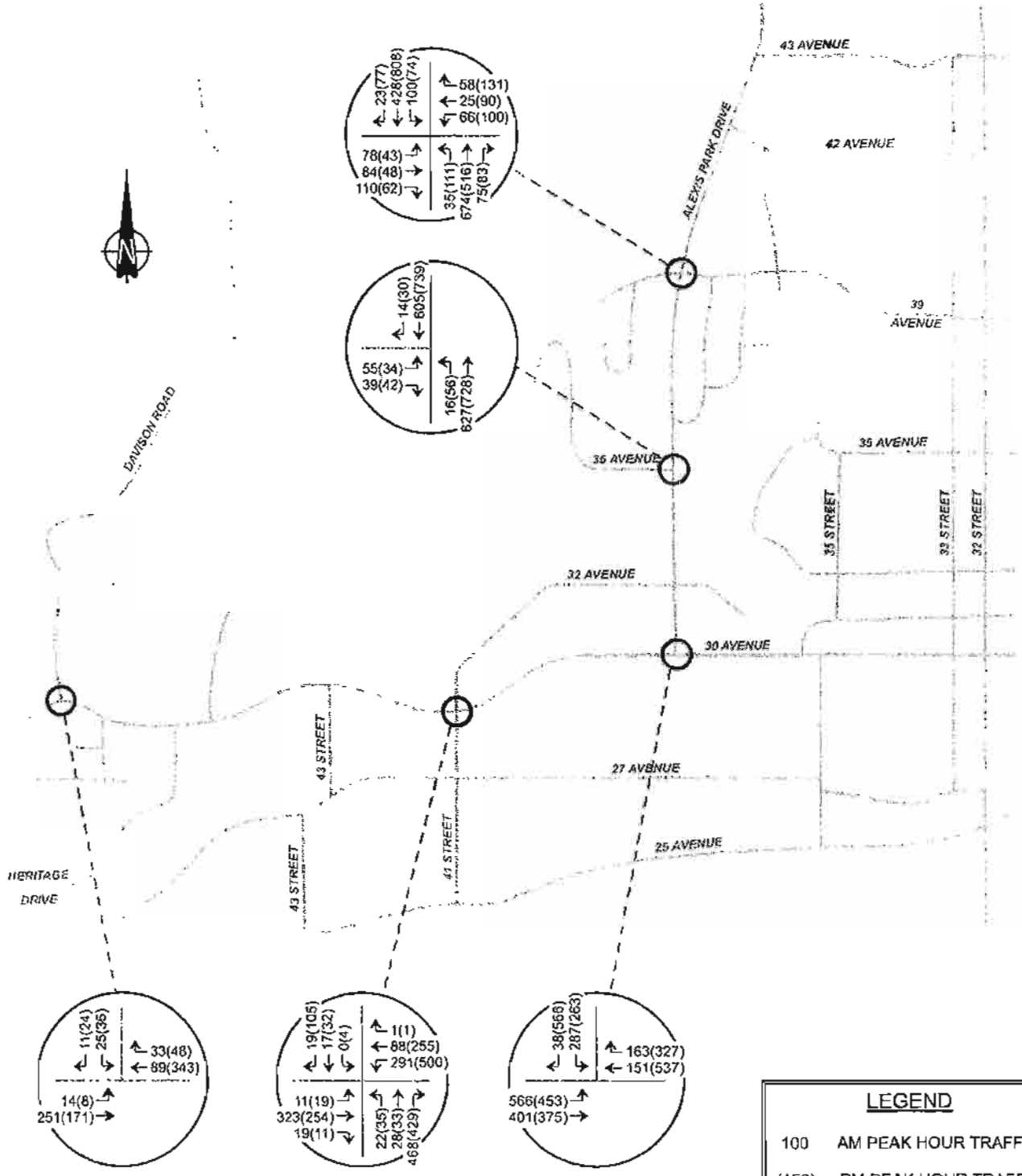
EXHIBIT 4.2
2010 COMBINED TRAFFIC VOLUMES



LEGEND	
100	AM PEAK HOUR TRAFFIC
(150)	PM PEAK HOUR TRAFFIC

ward consulting group

EXHIBIT 4.3
2015 COMBINED TRAFFIC VOLUMES



LEGEND	
100	AM PEAK HOUR TRAFFIC
(150)	PM PEAK HOUR TRAFFIC

(b) The intersection of 39 Avenue/Alexis Park Drive will need to be signalized by 2015 in order to meet capacity requirements.

(c) At the intersection of Bella Vista/41 Street will need a northbound left turn lane by 2010 to reduce v/c ratios and a signal to reduce delays. By 2015 the intersection will need to be signalized with eastbound and westbound turn lanes as well as a westbound advanced green phase.

(d) The other intersections analyzed operate well and no further improvements are required.

5.2 Combined Traffic Conditions

(a) The proposed Phase I development of 530 units is estimated to generate a total of 337 trips in the p.m. peak hour and 432 trips in the p.m. peak hour. The full development of almost 1,900 units will generate 1,129 a.m. peak hour trips and 1,343 p.m. peak hour trips.

(b) The existing 39 Avenue/39A Avenue can accommodate only a limited amount of traffic due to the offset between the two. As a result, this intersection should be rebuilt when approximately 100 units of the development have been build to provide for a standard four leg intersection with left turn lanes. The western approach to this intersection should be made as flat as possible to allow vehicle storage to occur off of any significant grade. Signalization with left turn lanes will be needed at the same time or very shortly thereafter. With a signal in place, this intersection, if fully channelized, could handle the site traffic of up to 60% of the ultimate 1,900 units. At this point, a second site access will be needed.

(b) At the signalized intersection of 30 Avenue/Alexis Park Drive, an eastbound advanced green phase will be needed by 2015 as was the case under background conditions.

(d) At the intersection of Bella Vista Road/41 Street a northbound left turn lane is recommended by 2010 and a southbound lane is also recommended by 2015 as a result of increased site traffic.

		Eastbound			Westbound			Northbound			Southbound			Over
		L	T	R	L	T	R	L	T	R	L	T	R	all
	LoS	B	B	A	B	B	A	A	B	A	B	A	A	B
2015 pm		2.95		0.57										
40%		1249		32.6										
		F		D										
w signal	v/c	0.26	0.19	0.23	0.41	0.36	0.33	0.73	0.41	0.08	0.16	0.65	0.10	0.73
	delay	21.8	20.4	6.1	22.8	21.3	5.5	31.7	6.1	1.5	5.6	9.5	1.4	10.9
	LoS	C	C	A	C	C	A	C	A	A	A	A	A	B
50%		5.59		0.70				0.58						
		*		42.9				18.3						
		F		E				C						
w signal	v/c	0.39	0.25	0.29	0.44	0.47	0.34	0.73	0.41	0.08	0.15	0.63	0.12	0.73
	delay	27.6	24.2	6.7	27.2	25.8	6.4	26.1	5.6	1.2	4.9	8.6	1.1	11.3
	LoS	C	C	A	C	C	A	C	A	A	A	A	A	B
60%		11.1		0.84				0.70						
		*		60.2				23.1						
		F		F				C						
w signal	v/c	0.53	0.29	0.32	0.46	0.55	0.34	0.74	0.40	0.07	0.14	0.62	0.13	0.76
	delay	36.8	28.9	7.4	32.6	31.3	7.3	26.7	5.6	1.1	4.9	8.4	1.0	12.8
	LoS	D	C	A	C	C	A	C	A	A	A	A	A	B
70%	v/c	0.66	0.32	0.34	0.47	0.60	0.33	0.78	0.42	0.08	0.18	0.91	0.21	0.91
w signal	delay	47.5	31.6	7.4	36.0	36.2	7.4	37.6	6.3	1.1	12.3	29.5	2.3	22.0
	LoS	D	C	A	D	D	A	D	A	A	B	C	A	C

v/c = volume to capacity ratio; delay = average delay per vehicle in seconds; LoS = Level of Service

4.5 Access Road Cross Section

If 39A Avenue is the sole access for the development it will need to accommodate over 13,000 vehicles per day. At this volume, the road will need to be classified as a Minor Arterial Road. A right of way width of at least 25 to 30 metres will be needed. As a result, 39A Avenue will need to be upgraded to a Minor Arterial standard with:

- a minimum pavement width of 14.8 metres to accommodate four lanes with no parking,
- wider pavement width and lanes on curves,
- sidewalks and boulevards should be provided, and
- a design speed of 50 to 60 km/h.

If another access road is provided, then 39A Avenue can be expected to carry significantly less traffic. The actual volume will depend on the location and capacity of the second access. If it is assumed that traffic will be reduced by 50%, then this road will need to handle 6,000 to 7,000 vehicles per day. A collector road could potentially handle this volume.

5.0 SUMMARY OF CONCLUSIONS

5.1 Background Traffic Conditions

(a) Based on background traffic conditions, the signalized intersection of 30 Avenue/Alexis Park Drive will need to have an eastbound advanced green phase added by 2015.

4.5 Ultimate Build Out

With the ultimate build out in place, the signalized 39 Avenue/39A Avenue intersection, even assuming full channelization, will be unable to handle the traffic delivered to it. This intersection could handle approximately 60% of the full development of 1,900 units. When further development proceeds, then an additional access will be needed. A summary of the operation of the 39 Avenue/39A Avenue/Alexis Park Drive intersection is shown in Table 4.1 for various levels of development (40%, 50%, 60%, and 70% of the full development) both as a stop controlled intersection and as a signalized intersection. This intersection clearly cannot function as an unsignalized intersection. As can be seen from the table, the critical time period is the p.m. peak hour. At 60% development the v/c ratio is 0.76, approaching the 0.90 threshold, while at the 70% level the v/c ratio has increased to 0.91, indicating that further upgrades or another access route is needed, with the latter being preferred.

In the past Ward Consulting Group has recommended that any residential development with more than 350 units should have more than one access route because of concerns over the necessity for emergency vehicles to access the development should there be a closure of some form. It is acknowledged that there is no technical literature supporting this position. It can therefore only be regarded as desirable, not essential.

A second access is potentially possible at the northeast corner of the development to Alexis Park Drive/Old Kamloops Road (at approximately Haney Road north of 43 Avenue) which would provide access to Highway 97 via 43 Avenue or a future extension of 48 Avenue.

Table 4.1
Intersection Analysis
39 Avenue/39A Avenue/Alexis Park Drive

		Eastbound			Westbound			Northbound			Southbound			Over
		L	T	R	L	T	R	L	T	R	L	T	R	all
Combined														
2015 am		1.04		0.59				0.09						
40%														
39A Ave		168		21.7				9.1						
		F		C				A						
w signal	v/c	0.33	0.27	0.31	0.22	0.08	0.14	0.11	0.66	0.08	0.48	0.42	0.04	0.66
	delay	15.5	14.5	4.1	14.9	13.7	5.3	6.1	10.3	1.9	14.8	7.2	2.5	9.4
	LoS	B	B	A	B	B	A	A	B	A	B	A	A	A
50%		1.38		0.79				0.11						
		294		33.8				9.2						
		F		D				A						
w signal	v/c	0.40	0.33	0.36	0.23	0.10	0.14	0.13	0.61	0.08	0.44	0.39	0.04	0.61
	delay	16.0	14.7	4.0	15.1	13.8	5.2	6.5	9.8	2.0	14.1	7.1	2.4	9.3
	LoS	B	B	A	B	B	A	A	A	A	B	A	A	A
60%		1.76		0.86				0.13						
		458		42.2				9.3						
		F		E				A						
w signal	v/c	0.43	0.36	0.39	0.23	0.10	0.13	0.15	0.62	0.08	0.45	0.39	0.05	0.62
	delay	16.5	15.0	3.9	15.0	13.6	5.1	7.2	10.6	2.1	15.6	7.7	2.5	9.8
	LoS	B	B	A	B	B	A	A	B	A	B	A	A	A
70%	v/c	0.45	0.38	0.40	0.22	0.11	0.12	0.21	0.74	0.09	0.54	0.47	0.06	0.74
w signal	delay	17.0	15.3	3.8	15.1	13.6	5.0	7.9	12.7	2.2	18.0	8.8	2.5	10.9

conditions, as was the case with background traffic. Adding a northbound left turn lane would meet the v/c requirements; however, delays would still be long. A signal would be needed to reduce delays. By 2015, a southbound left turn lane will also be needed in order to meet the v/c requirements.

4.3 39A Avenue/39 Avenue/Alexis Park Drive

As detailed under background conditions, the 39 Avenue leg and the 39A Avenue leg of this intersection are offset by a distance of 36 metres, centre to centre. There is approximately 25 metres of storage space available between the two intersections. With the Phase I site traffic in place, there will be approximately 200 vehicles per hour making the northbound left turn movement from Alexis Park Drive at 39A Avenue requiring 50 metres of storage, significantly more than is available. As a result of this volume combined with the southbound left turning volume, it is recommended that this intersection be realigned when approximately 100 units have been built and occupied. Beyond this level, left turn conflicts will become significant and storage will be a problem. A signal will be needed shortly after this to ensure traffic can exit from 39 Avenue/39A Avenue to Alexis Park Drive, and realigning and signalizing the intersection at the same time would be desirable. Table 2.9 shows intersection analysis assuming that the intersection is signalized. When this intersection is rebuilt, left turn lanes should be provided as they will be needed in the future. Right turn lanes should also be allowed for when the site expands further.

4.4 39A Avenue

The west approach of 39 Avenue to Alexis Park Drive is steep, with a proposed grade of 12% reducing to 0% at the Alexis Park Drive intersection. At 65 metres from the intersection (equivalent to the Stopping Sight Distance) the slope is approximately 10%, while at 35 metres from the intersection (equivalent to the braking distance) the grade is approximately 6%.

Transportation Association of Canada (TAC) guidelines for grade for a 50 km/h design speed are 8% for an urban collector and 6% for an urban arterial. In mountainous terrain, these values increase to 15% and 10% respectively. Therefore the 12% grade away from the intersection meets the mountainous collector road guidelines. TAC's recommended K values are 6 for an illuminated road, and this is provided for in the latest design.

TAC guidelines for a minor road crossing a major road state that for 20 metres on the approach to the intersection the grade of the minor road should typically be 2%. On 39A Avenue the average grade will be approximately 2.5% (an a maximum of 4.1%), slightly over the recommended. Additional flattening would be desirable. In fact, the ideal according to TAC is a flat approach for a signalized intersection. TAC also recommends that the vehicle storage area be as flat as possible. Based on Phase I of the development, and assuming left turn lanes on all legs of the Alexis Park Drive intersection, the estimated eastbound queues will reach 20 metres, the same distance as above. With 60% of the ultimate development in place and full intersection channelization, including right turn lanes on all legs, the queues would reach 30 to 35 metres, where the average grade would be 3.7% and a maximum of 6.6%

APPENDIX C

Geotechnical Hazard Assessment

Golder and Associates (July 2004)

Golder Associates Ltd.

#220 - 1755 Springfield Road
Kelowna, British Columbia, Canada V1Y 5V5
Telephone (250) 860-8424
Fax (250) 860-9874

July 8 2004 04-1440-145

DC Properties Ltd.
c/o New Town Planning Services Inc.
1450 Pandosy Street
Kelowna, BC V1Y 1P3

Attention: Mr. Keith Funk

RE: GEOTECHNICAL ASSESSMENT FOR SUBDIVISION DEVELOPMENT PLAN EAST BELLA VISTA HIGHLANDS – TURTLE MOUNTAIN VERNON, B.C.

Dear Sir:

As requested, Golder Associates Ltd. (Golder) has conducted a geotechnical assessment at the above referenced property (See Figure 1). The purpose of the assessment was to address the geotechnical issues related to development of the subject property by construction of residential single and multi-family units together with the associated infrastructure works including the construction of an access road off 39th Avenue.

It should be noted that the scope of this report is limited to the geotechnical aspects of the proposed subdivision development and does not include any investigations, analytical testing or assessments of possible soil and groundwater contamination, biological considerations or sediment control measures.

This report should be read in conjunction with "***Important Information and Limitations of This Report***" which is appended following the text. The reader's attention is specifically drawn to this information, as it is essential for the proper use and interpretation of this report. The City of Vernon as approving regulatory authorities are designated as authorized users of this report and may rely upon its content for planning and development purposes.

1.0 METHODOLOGY

The field investigation was conducted on July 7, 2004 and consisted of excavating eleven test pits within the accessible areas of the upper flatter portions of the site and at the lower portion of the proposed access road, as shown on Figure 2. The test pits were extended to depths between 1.6 and 3.3 m below the existing ground surface using a rubber tired backhoe. The subsurface conditions encountered in each test pit were logged in the field by a member of our geotechnical staff. Detailed descriptions of the soil conditions encountered are summarized on the attached Record of Test Pits log sheets. Upon completion, each test pit was backfilled with the excavations spoils and compacted by tamping with the backhoe bucket.

Representative samples of the various soil strata encountered in the test pits were collected and brought back our Kelowna laboratory for further examination and testing. Laboratory testing consisted of moisture content determination and sulphate testing. The sulphate tests were conducted by Caro Environmental Services.

Upon receipt of topographical information for the subject property, a detailed ground reconnaissance was conducted on July 23, 2004. The reconnaissance included noting the site conditions as well as identifying potential geotechnical hazards such as past or recent slope instability, rockfall/rolling rock and areas of groundwater discharge.

2.0 SITE DESCRIPTION AND PROPOSED DEVELOPMENT

The subject area is located west and north of Alexis Park Drive and Bella Vista Road, respectively with agricultural land located immediately to the west and south west sides of the property. Figure 3 presents an overlay of the general site topography and legal boundaries relative to an aerial photograph for general reference purposes. Figure 4 presents several photographs showing various site conditions together with general comments.

Two bedrock ridges extend in a northeast-southwest direction along the west and east sides of the study area. The west and east ridges rise to a geodetic elevation of about 605 and 540 m, respectively.

Figures 2 and 3 delineate the approximate areas of exposed and/or shallow bedrock together with areas where previous earthwork was undertaken. The area where exposed and/or shallow bedrock exists is generally limited to the higher elevations and along the steeper slope portions of the site. The bedrock exposed at surface is generally weathered and fractured. The weathered and fractured bedrock in the areas designated as "*bedrock excavation*" on Figures 2 and 3 has been subexcavated to a more competent bedrock surface. Observations also indicate some gravel extraction was carried out along the west

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Standard of Care: Golder Associates Ltd. (Golder) has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practicing in British Columbia, subject to the time limits and physical constraints applicable to this report. No other warranty, express or implied is made.

Basis and Use of the Report: This report has been prepared for the specific site, design objective, development and purpose described to Golder by the Client. The factual data, interpretations and recommendations pertain to a specific project as described in this report and are not applicable to any other project or site location. Any change of site conditions, purpose, development plans or if the project is not initiated within eighteen months of the date of the report may alter the validity of the report. Golder can not be responsible for use of this report, or portions thereof, unless Golder is requested to review and, if necessary, revise the report.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client. ***No other party may use or rely on this report or any portion thereof without Golder's express written consent. Golder will consent to any reasonable request by the Client to approve the use of this report by other parties as Approved Users.*** The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, and only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client can not rely upon the electronic media versions of Golder's report or other work products.

The report is of a summary nature and is not intended to stand alone without reference to the instructions given to Golder by the Client, communications between Golder and the Client, and to any other reports prepared by Golder for the Client relative to the specific site described in the report. ***In order to properly understand the suggestions, recommendations and opinions expressed in this report, reference must be made to the whole of the report. Golder can not be responsible for use by any party of portions of the report without reference to the entire report.***

Unless otherwise stated, the suggestions, recommendations and opinions given in this report are intended only for the guidance of the Client in the design of the specific project. The extent and detail of investigations, including the number of test holes, necessary to determine all of the relevant conditions which may affect construction costs, techniques and equipment choice, scheduling and sequence of operations would normally be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual data presented in the report, as to how subsurface conditions may affect their work.

5.7 Sulphate Tests

According to the CSA requirements for concrete subject to sulphate attack, these results indicate the potential degree of sulphate attack in contact with the tested soils is negligible, except for TP 1, Sa2 where the sample indicates severe sulphate conditions. As noted in TP 2 at a depth of 0.1 to 0.9 m, a white precipitate was observed within the desiccated silty clay. This condition is typical of for soils having a high sulphate concentration. It should be noted that sulphate concentrations generally increase with repeated wetting and drying cycles which results in a higher potential for sulphate attack at ground surface. Based on this information, it is recommended that consideration be given in using concrete that provides protection for an S-2 class of exposure for all manhole structures and foundations located within the silty clay deposits.

6.0 INSPECTION AND TESTING SERVICES

It is recommended that provisions be made for a geotechnical engineer to inspect and approve the exposed subgrade soils for structures during construction. Further, it is recommended that insitu density tests be carried out in any granular fills placed to confirm satisfactory compaction is achieved.

We trust the foregoing provides you with the information that you require at this time. Should you require additional information or have any questions, please do not hesitate to contact the undersigned at your earliest convenience.

Yours very truly,

GOLDER ASSOCIATES LTD.

Roger Therrien, AScT
Senior Geotechnical Technologist

Reviewed by G. Imada, P. Eng.
Associate & Senior Geotechnical Engineer

GI/RT/at

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5.5 Roadways

The California Bearing Ratio (CBR) values for compacted shot rock fill and/or intact bedrock will be greater than 6. In areas where the residential roads overlie these subgrade conditions, the pavement structure should be designed in accordance with the minimum City of Vernon's requirements as follows.

Asphalt	75 mm
Crushed Gravel Base	50 mm
Pitrun Subbase	150 mm

Within areas where the subgrade will be founded within silty clay deposits, the pavement structure should consist of the following:

Asphalt	75 mm
Crushed Gravel Base	50 mm
Pitrun Subbase	150 mm
Supplemental Subbase (for CBR <3)	300 mm

5.6 Site and Subsurface Drainage

It should be noted that development of the area will increase the potential for surface flows to concentrate. These concentrated surface flows from driveways and roofs must be collected and disposed of in an approved manner. Under no circumstance should this water be permitted to discharge or flow in an uncontrolled manner down soil slopes.

Perimeter foundation drains should also be provided around all homes as well as behind retaining walls.

Considering the silty clay deposits along the south portion of the site together with surficial and/or shallow bedrock, disposal of collected surface and roof water should not be discharged using conventional drywells, rockpits or infiltration trenches. It is recommended that surface, roof runoff and perimeter drains be connected to a storm sewer system.

Final site grading should provide for positive flow of surface runoff away from the proposed homes and foundation walls. Final grading alongside the house foundations should be carried out such that positive drainage will be maintained even when considering settlement of the backfill materials.

Depending upon the degree of weathering or fracturing of the rock, it is expected that some excavation will be possible with high capacity excavators equipped with rippers. However, it is expected that majority of the bedrock will require conventional drilling and blasting techniques.

To minimize possible damage to the adjacent properties, it will be necessary to limit the ground vibrations created from blasting to a specified limit of 50 mm/sec or less. The ground vibrations can be controlled to this level by using normal good industry practice in design and conduct of blasting procedures.

It is recommended that vibration monitoring be carried out to confirm this criteria is followed. Preblast surveys of existing homes in the immediate vicinity of the blast should also be carried out. In addition, strict precautions should be in place to prevent fly rock damage to neighboring buildings, through use of blast mats or other suitable measures.

5.4.4 Underground Utilities

The recommended temporary cut slope for trench excavations in the soils encountered at this site is 1 horizontal to 1 vertical. Near vertical cuts may be employed providing a "cage" or other approved support system is used. If near vertical cuts are utilized, construction traffic should not be permitted adjacent to the excavation unless shoring systems are designed to carry the resulting surcharge loading.

Groundwater seepage is not expected to be encountered in the utility trenches. Should any seepage be encountered, conventional sump techniques will provide an adequate means of controlling seepage in the utility trenches.

To provide even support of the pipes over various subgrade conditions, it is recommended that a sand bedding layer be placed beneath the pipe. This bedding layer should be at least 200 mm thick.

The excavation spoil materials consisting of granular and/or clay deposits will be suitable for use as backfill in the trenches. In roadway areas where clay is encountered, it is recommended that the clay spoils be used for trench backfill to maintain similar soil conditions to non-trenched roadway areas. It is also recommended that all clay peaks between service trenches and/or abrupt changes in the trench side slopes be eliminated or/or flattened. This will help to minimize differential movements within the roadway during the spring thaw. The surficial organic soils are not considered suitable for trench backfill material.

All structural/road embankment fills should be placed in horizontal lifts not exceeding 300 mm in thickness and should be compacted to 90 and 95 percent of modified Proctor maximum dry density (ASTM D1557), respectively.

Structural/road embankment fills constructed on sloping ground should be keyed into the slope in a continuous series of steps, extended a minimum of 1.0 m width into the natural slope. This treatment will minimize the risk of a potential weak zone or slip plane between the fills and native slope soils. It is anticipated that most of the material from the stepped "key" excavation can be incorporated in the adjoining embankment fills.

No organic soils or frozen material should be placed in the embankment. In addition, embankment fills or the pavement structure should not be placed on the foundation subgrade or on the embankment if these surfaces are frozen. Embankment materials should also not be placed into ponded water or excessively wet soil or fill surfaces or on surfaces covered with snow.

It is recommended that the fill surfaces should be crowned or sloped during and after construction to avoid ponding of water.

5.4.3 Cut and Fill Slopes

It is recommended that temporary cut slopes in the soils observed at the site be developed at angles no steeper then 1 horizontal to 1 vertical for dry conditions. Steeper slopes may be considered provided suitable shoring is used.

Permanent cut and un-reinforced fill slopes should be constructed at angles no steeper than 1.5 horizontal to 1 vertical. These slopes should be provided with a suitable vegetative cover to minimize potential saturation and subsequent surface sloughing or raveling.

For permanent excavations in bedrock encountered at the site, it is recommended that a design cut slope of not more than ¼ horizontal to 1 vertical should be considered. It is also recommended that a geotechnical engineer should inspect the exposed surface during excavation of rock slopes to determine whether it is necessary to consider rock bolting, flatter slopes and/or benches to provide a stable rock slope configuration.

It is strongly recommended that blasting design and sequencing be selected to minimize the potential for loosening, fracturing or over-break beyond the final rock cut face. Depending upon the height of the steep rock cuts and the potential for rockfall or raveling, provision may be required for a suitable catchment ditch at the toe of the cut slope (see MoT Section 440.C for solid rock cut sections).

experienced geotechnical personnel and confirmed as suitable prior to footing construction.

The footings may also be founded on compacted granular fills placed and compacted in accordance with the recommendations presented in Section 5.4.2.

5.3 Retaining Walls and Below Grade Basement Walls

Permanent retaining walls, basements or other below grade structures that can not tolerate or are restrained from movements should be designed considering a coefficient of earth pressure at rest of 0.45. Retaining walls that can tolerate deflections of 25 mm in 3.0 m of wall height may be designed using a coefficient of active earth pressure of 0.3. A soil unit weight of 2000 kg per cu. m may be used in the design calculation.

Free draining backfill should be placed behind the retaining wall and a positive drainage system should be provided behind the walls to prevent possible build up of hydrostatic pressures. This material should be compacted using only lightweight compaction equipment.

5.4 General Site Development

The following provides general comments and recommendations regarding site development. It should be noted that a specific geotechnical investigation is recommended for proposed residential structures to further determine specific subsurface conditions at the proposed building footprint.

5.4.1 Stripping

It is recommended that all vegetation, surficial organic soils and fills be completely subexcavated from beneath the proposed building sites and roadways as well as any site grade fill areas. If desired, the surficial organic soils could be stockpiled and used for landscaping purposes. This material is not suitable for use as general grade/embankment fills.

5.4.2 Structural/Road Embankment Fills

Structural fills used beneath buildings can consist of imported 150 mm minus pit run sand and gravel or on site excavation spoil material consisting of native granular soils and/or well graded blast rock. Road embankment fills can consist of any on site excavation spoil material excluding the organic soils and desiccated clay.

Based on our observations of the extent of the rolling rock within the vicinity of TP 1, it is our opinion that proposed lots located downslope of the designated hazard line are not likely to be subject to a rockfall/rolling rock hazard from the relatively steep bedrock face that is located to the west. However, it is recommended that consideration be given to scaling the steep bedrock slopes west of TP1.

Considering the proposed construction for the extension of 39th Avenue to provide access to the property, it recommended that a catchment ditch/berm be constructed along the west side of the roadway. It is recommended that the construction of such works be implemented according to the Ministry of Transportation (MoT) guidelines (see MoT Section 440.C for solid rock cut sections).

5.2 Foundation Design

Excluding the surficial organic soils and any fills, the proposed residential structures can be supported on conventional strip and/or spread footings founded on the native loose to dense granular deposits, stiff layered clay strata, competent bedrock or engineered fills. Within the clay deposits, all footings should extend to a minimum depth of 1.2 m below the existing ground surface such that the base of the footings is not founded within the upper desiccated native clay. The desiccated clay strata is subject to volume change as a result of changes in soil moisture content, which can create differential swelling and/or shrinkage movements beneath the building foundations resulting in potential distress to the foundations and structure.

For preliminary design purposes, an allowable bearing pressure of 95 kPa may be used in design of the footings founded on the loose to dense granular deposits or compacted granular fills (see Section 5.4.2). On bedrock, an allowable bearing of 240 kPa may be considered. Provided that the foundation materials are not loosened or disturbed, it is anticipated that foundations designed for these bearing pressures will be subject to settlements of less than 25 mm.

However, it is recommended that foundation support of structures partially on fill or the loose to dense natural soils and partially on intact rock should be avoided to minimize the potential for abrupt differential settlement at the boundary between the rock and soil/fill foundation support of the building. Where complete support either on rock or on suitable fill or natural soils is not possible, it is recommended that provision be made for additional reinforcing or other suitable treatment to minimize the impact of potential abrupt differential settlement of up to 25 mm.

It should be noted that the minimum footing width should be in accordance with the B.C. Building Code requirements. The foundation subgrade soils should be inspected by

4.0 SULPHATE TEST RESULTS

The following table summarizes sulphate test results carried out by Caro Environmental Services on selected samples.

Test pit No.	Sample No./Depth, m	Percent Soluble Sulphates
TP 1	Sa 1 @ 0.5	0.030
TP 1	Sa 2 @ 1.6	0.250
TP 3	Sa 1 @ 2.0	0.001

5.0 GEOTECHNICAL ASSESSMENT AND RECOMMENDATIONS

5.1 Site Suitability and Residential Construction

At the time of this investigation, no geotechnical hazards were noted within the existing, undeveloped site. However, it is expected that development of the site with construction of the roadways and excavations for the residential buildings may create potential slope instability and rockfall/rolling rock. As such, it is recommended that site grading be such that surface runoff is not permitted to flow down slopes in an uncontrolled manner. Protection from rockfall/rolling rock hazards can include scaling bedrock cuts, removal of cobbles and boulders from the slopes and/or construction of rock protection works that can consist of either a catchment ditch and/or berm or a heavy gauge chain link fence. The depth or height of ditch and/or berm or chain link fence should be a minimum of 1.2 m. Depending on the height of the steep slopes or rock cuts and the orientation of these cuts with respect to rock mass characteristics such as joints, fractures and bedding, additional, more detailed examination and treatment measures may be needed to minimize the potential for rockfall or instability.

Where lots include or are located adjacent to slopes greater than 30 degrees, the residential building should be located within a safe building area. For current planning and design, it is recommended that the safe building line be established by extending an imaginary 1.75 horizontal to 1 vertical line up from the toe of the steep slope. The point where this line intersects the ground surface is defined as the safe building line and all structures as well as fills should be located or offset at or behind this line. It is recommended that the safe building line be established in the field by a competent professional survey company. The foregoing criteria can be waived if the residential building is founded on competent bedrock, as confirmed by detailed examination of the foundation area and the slopes below the residential site conducted by an experienced geotechnical engineer.

3.2 Soil Deposits

The test pit results indicate that the shallow soil deposits encountered across the site generally consist of sand and gravel with varying a silt content, silty gravelly sand (till-like deposits) and silty clay.

A surficial silty clay strata was encountered at TP 1, TP 2, TP 3, TP 4 and TP 6, which varied in thickness from 0.6 and 3.0 m. The upper portion of the silty clay strata was noted to be desiccated to a depth of about 1.1 m at TP 3. Underlying the clay strata was granular deposits consisting of sand, silty sand and gravelly silty sand. Underlying the desiccated silty clay, a 1.2 m thickness of talus slope wash material was encountered at TP 2 which extended to a depth of 2.1 m.

At the remaining test pit locations, a compact to dense till-like deposit was encountered which generally consisted of gravelly silty sand with cobbles grading to a silty sand and gravel with occasional layers of gravelly sand and/or sand and gravel.

The moisture content of the silty clay strata varied between 15.4 percent for a desiccated sample to an average of 36.5 percent within the fissured silty clay. Within the compact to dense silty sand and gravel deposits, moisture contents varied between about 3.8 and 9.1 percent with an average of 6.1 percent. The remaining finer grained deposits such as silty sand and sand deposits, moisture contents varied between 14.2 and 15.9 percent.

Some surficial mineral fill was noted at TP 5, TP 9 and TP 11 which extended to a depth of 1.5 m. These fills are inferred to be part of the site earthworks that were previously carried out.

3.3 Groundwater Conditions

At the time of the investigation, groundwater seepage was not encountered within any of the test pits. It is anticipated that shallow groundwater seepage could be present along the base of the gullies, and bedrock depressions between both bedrock ridges, especially during spring freshets and during periods of sustained precipitation. It is also possible that minor groundwater flows could occur during the spring freshet along the till-like deposit contact.

side of the bedrock ridge as shown on Figures 2 and 3. Extraction of gravel was terminated at the underlying dense gravelly silty sand deposit (till-like deposit).

Further observations did not indicate any apparent evidence of slope instability and/or areas at risk from rockfall/rolling rock hazards, except for the area along the east toe of the steep slope at the west end of 39th Avenue in the vicinity of TP 1 where occasional angular rock fragments noted.

A wet depression (old pond) area was noted between the two bedrock ridges, as shown on Figures 2 and 3. At the time of the reconnaissance, standing water was not observed, however, water reed growth with thick underbrush growth together with a large diameter willow tree were noted within the limits of this area. No evidence of groundwater seepage was noted along the base of the gully located down-gradient of the depression.

A series of fill end-dumps were noted in the vicinity of TP 1 and along the toe of the bedrock slope north of TP 2 and west of the existing access road.

In general, the subject area is grassed covered with localized areas with tree and underbrush growth. Mature coniferous tree growth was generally limited to the slopes along the east side of the study area.

It is understood that it is proposed to develop the subject property by construction of residential single and multi-family units and associated infrastructure works including the construction of a site access road extending west off 39th Avenue. It is our understanding that the proposed subdivision will be serviced by the City of Vernon's sanitary sewer system and possibly the storm sewer system.

3.0 SUBSURFACE CONDITIONS

3.1 Bedrock Conditions

Golder previously has conducted several geotechnical investigations in the vicinity of the subject property for others. The results of those investigations indicate the west highland area overlooking Vernon is generally underlain by surficial and/or shallow bedrock. A review of the Geological Survey of Canada for the Vernon Map Area indicates that the bedrock within the study area is volcanic and generally consists of basaltic and andesite lava, and flow breccia, local sandstone and conglomerates.

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT (CONTINUED)

Soil, Rock and Groundwater Conditions: Classification and identification of soils, rocks, and geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgement, and boundaries between different soil, rock or geologic types or units may be transitional rather than abrupt. Accordingly, Golder docs not warrant or guarantee the exactness of the descriptions

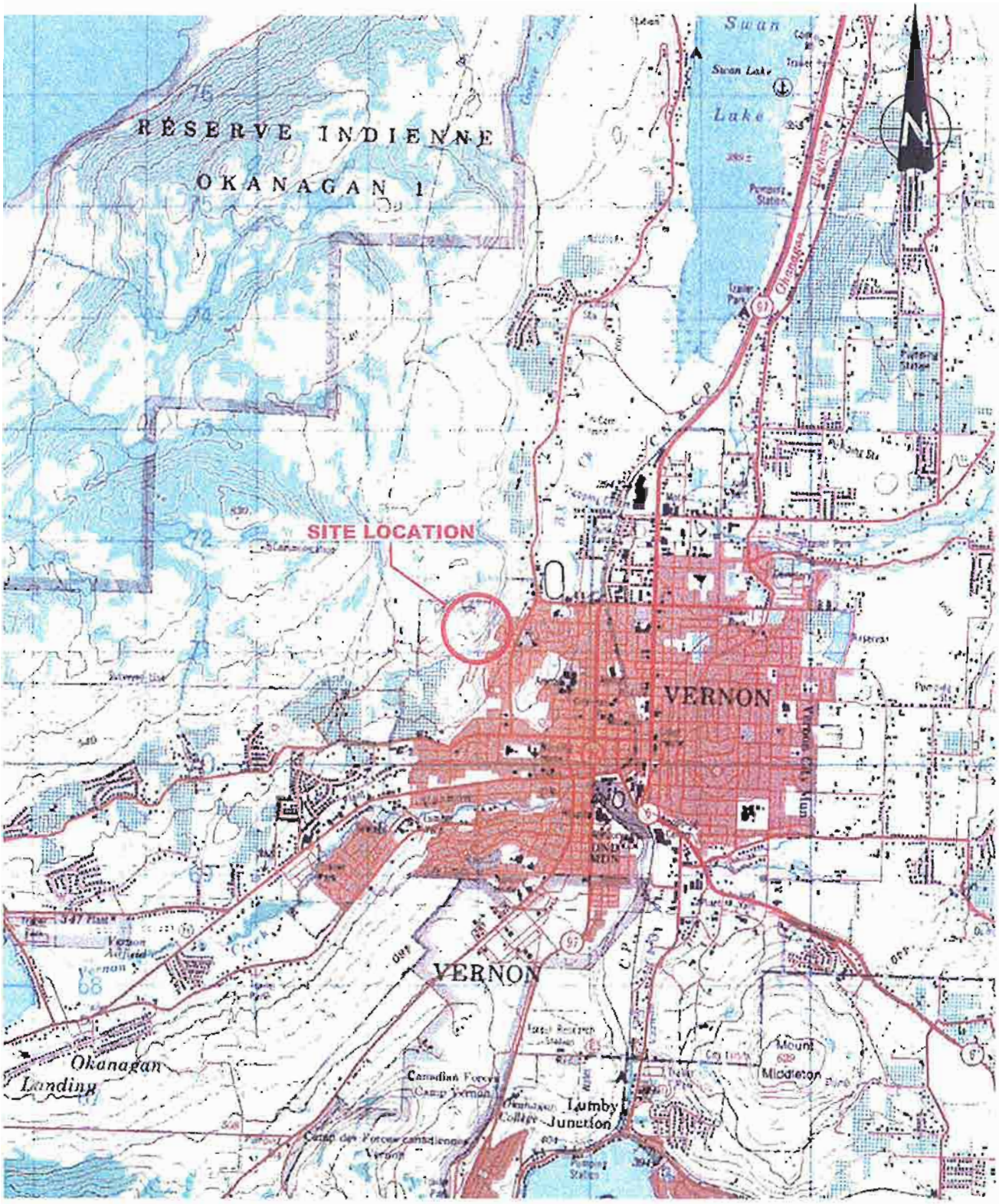
Special risks occur whenever engineering or related disciplines are applied to identify subsurface conditions and even a comprehensive investigation, sampling and testing program may fail to detect certain conditions. The environmental, geologic, geotechnical, geochemical and hydrogeologic conditions that Golder interprets to exist between sampling points may differ from those that actually exist.

Groundwater conditions shown in the factual data and described in the report are the observed conditions at the time of their measurement. Groundwater conditions may vary between reported locations and can be affected by annual, seasonal and special meteorological conditions or tidal fluctuations. Groundwater conditions may also be altered by construction activity on or in the vicinity of the project site.

Sample Disposal: All contaminated samples and materials shall remain the property and responsibility of the Client for proper disposal. Golder will dispose of all uncontaminated soil and/or rock samples 90 days following issue of this report or, upon written request of the Client, will store uncontaminated samples and materials at the Client's expense.

Follow-Up and Construction Services: All details of the design and proposed construction may not be known at the time of submission of Golder's report. Golder should be retained to review the final design, project plans and documents prior to construction, to confirm that they are consistent with the intent of Golder's report.

During construction, Golder should be retained to perform sufficient and timely observations of encountered conditions to confirm and document that the subsurface conditions do not materially differ from those interpreted conditions considered in the preparation of Golder's report and to confirm and document that construction activities do not adversely affect the suggestions, recommendations and opinions contained in Golder's report. Adequate field review, observation and testing during construction is necessary for Golder to be able to provide letters of assurance, in accordance with the requirements of many regulatory authorities.



Golder Associates
Kelowna, British Columbia

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REVIEW	

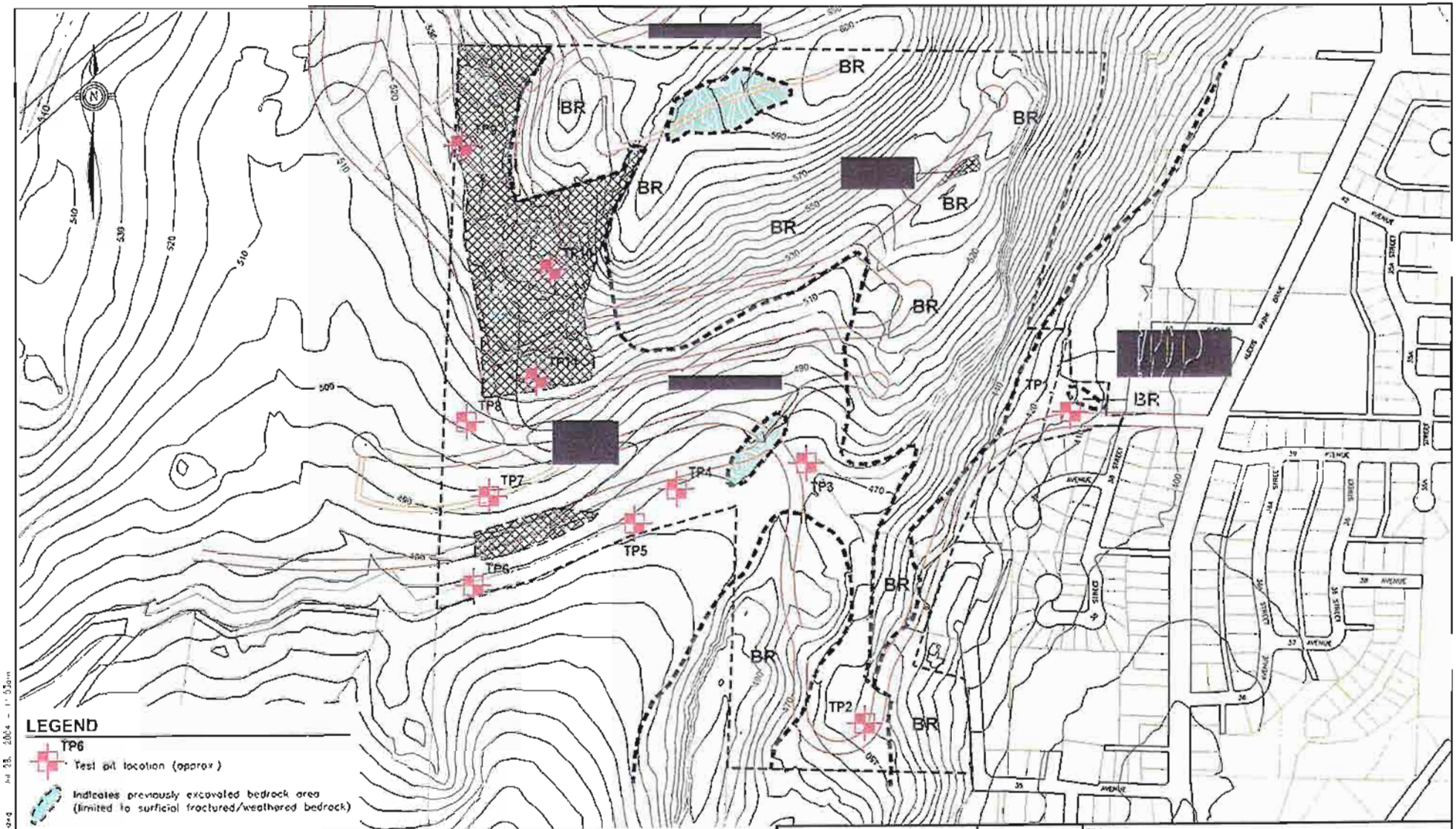
TITLE

KEY PLAN

FILE No	Figure 01.cwg
PROJECT No.	04-1440-145 | REV 0

East Bella Vista - Vernon

FIGURE 1


TP1
TP2
TP3
TP4
TP5
TP6
TP7
TP8
BR
LEGEND
TP6
Test pit location (approx.)
Indicates previously excavated bedrock area (limited to surficial fractured/weathered bedrock)
BR
Indicates area of surface and/or shallow bedrock (approx.)
REFERENCES
1.)Topography and legal base provided by New Town Planning Services
0 40 80 120 160 200
Scale in Meters
Golder Associates
Kelowna, British Columbia
SCALE 1:4000
DATE 7/23/2004
DESIGN RT
CADD RT
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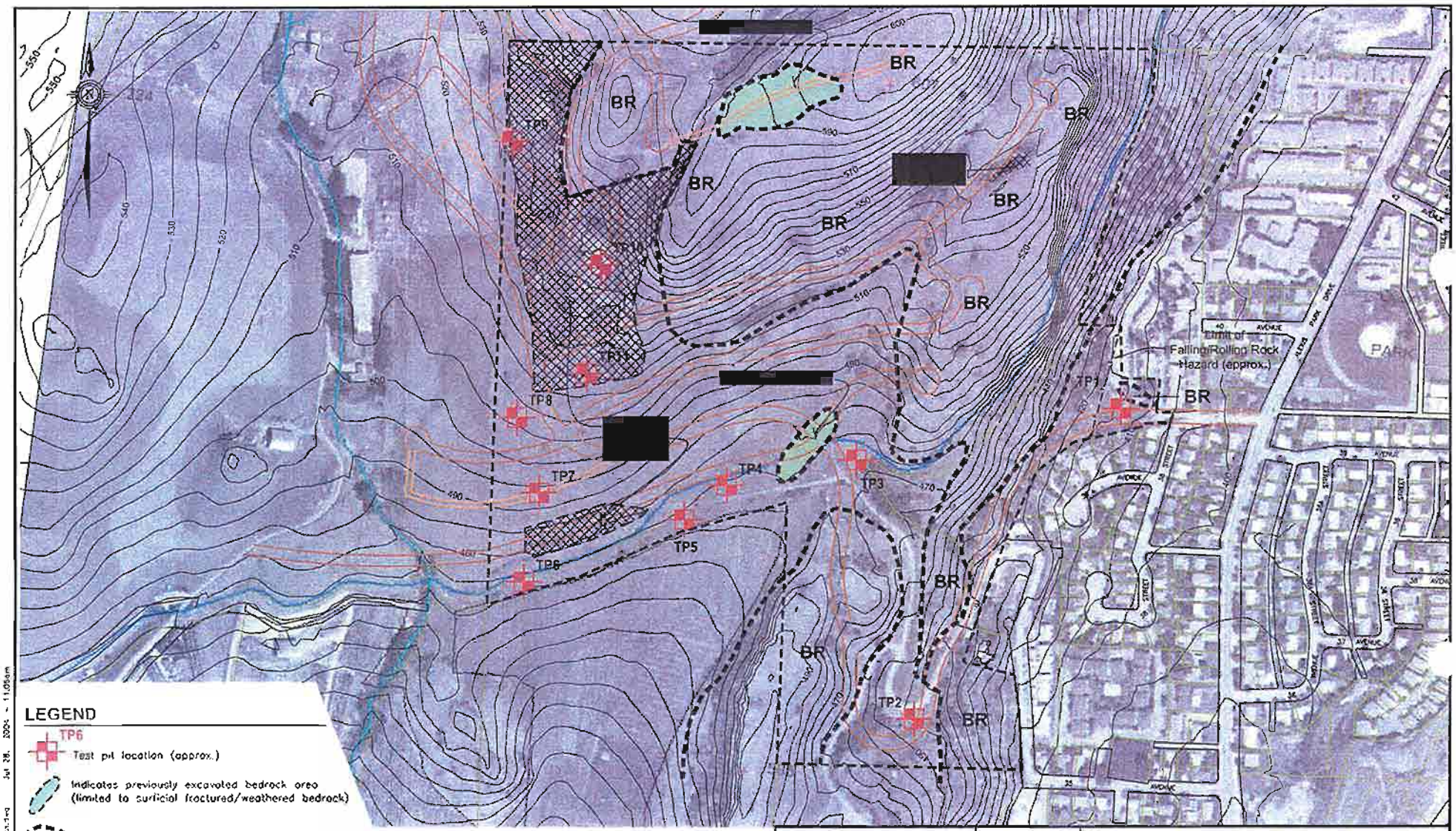
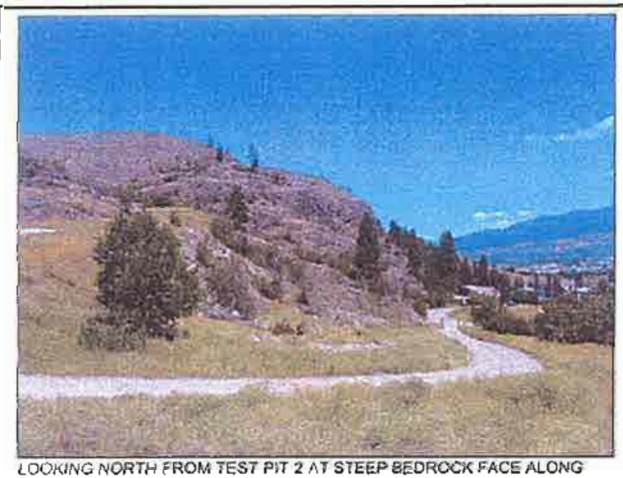
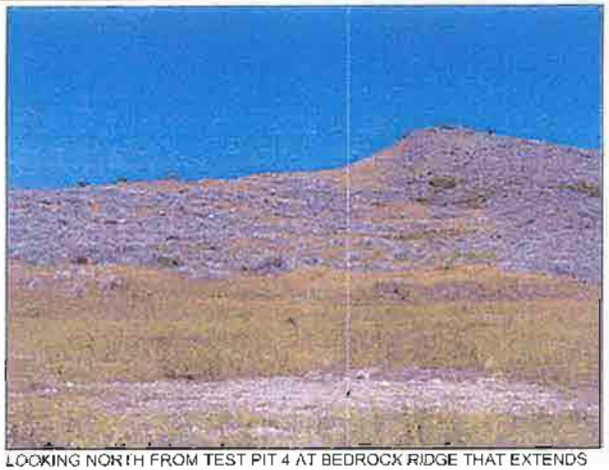
FILE No. 2004_SITEPLAN.DWG
PROJECT No. 04-1440-145
REV. 0
TITLE
TEST PIT LOCATION PLAN
DC PROPERTIES
FIGURE 2

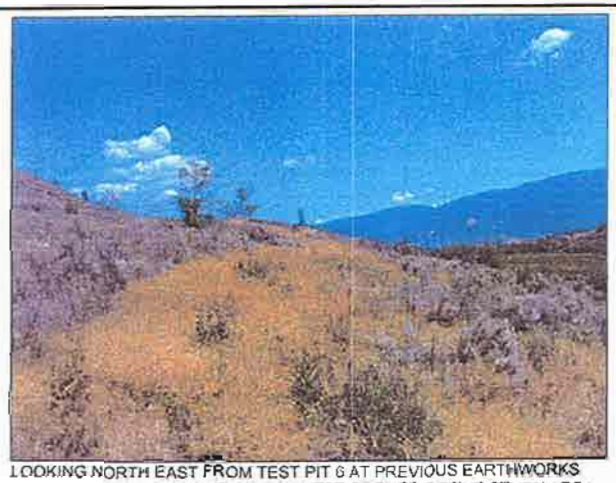

BR
TP1
TP2
TP3
TP4
TP5
TP6
TP7
TP8
TP9
TP10
Limit of Falling/Rolling Rock Hazard (approx.)
PARK
LEGEND
TP6
Test pit location (approx.)
Indicates previously excavated bedrock area (limited to surficial fractured/weathered bedrock)
BR
Indicates area of surface and/or shallow bedrock (approx.)
REFERENCES
1.)Topography and legal base provided by New Town Planning Services
0 40 80 120 160 200
Scale in Meters
Golder Associates
Kelowna, British Columbia
SCALE 1:4000
DATE 7/23/2004
DESIGN RT
CADD RT
CHECK
REVIEW
FILE No. 2004_SITEPLAN.DWG
PROJECT No. 04-1440-145
REV. 0
TITLE
TEST PITS AND AIR PHOTO OVERLAY
DC PROPERTIES
FIGURE 3



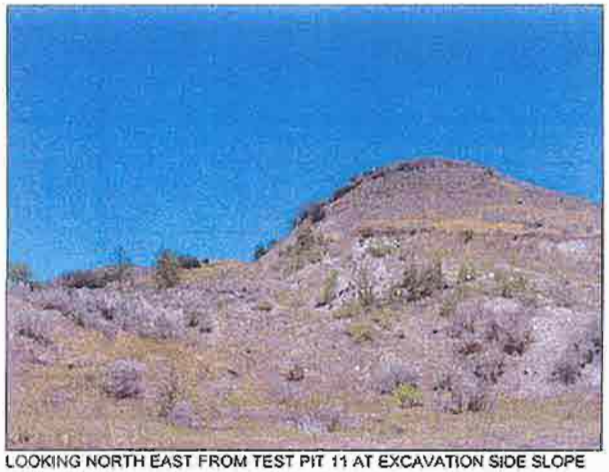
LOOKING NORTH FROM TEST PIT 2 AT STEEP BEDROCK FACE ALONG EAST SIDE OF THE STUDY AREA. OCCASIONAL SCATTERING OF OLD, ANGULAR FALLING ROCK FRAGMENTS ALONG THE TOE OF THE BEDROCK AND TALUS SLOPE



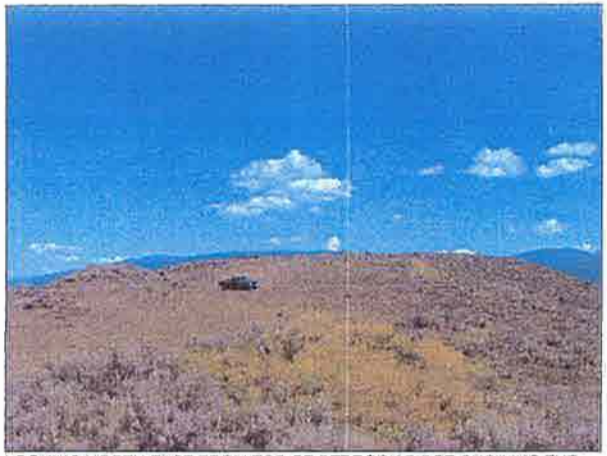
LOOKING NORTH FROM TEST PIT 4 AT BEDROCK RIDGE THAT EXTENDS TO AN ELEVATION OF ABOUT 690m. NOTE THE CHANGE IN GRASS COVER INDICATING APPROXIMATE SOIL/BEDROCK CONTACT



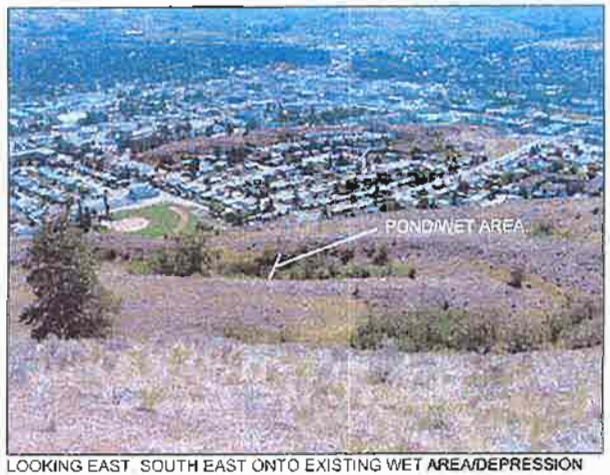
LOOKING NORTH EAST FROM TEST PIT 6 AT PREVIOUS EARTHWORKS AREA LOCATED NEAR THE SOUTH WEST CORNER OF THE STUDY AREA.



LOOKING NORTH EAST FROM TEST PIT 11 AT EXCAVATION SIDE SLOPE FROM PREVIOUS EXTRACTION OPERATION. EXPOSED SIDE SLOPE MATERIAL GENERALLY CONSISTS OF DENSE GREY SILTY SAND AND GRAVEL (TILL-LIKE) AT OVERALL SLOPE ANGLES OF ABOUT 50° TO 70°.



LOOKING NORTH EAST FROM TOP OF BEDROCK RIDGE SHOWING THE PREVIOUS STRIPPING OF THE UPPER FRACTURED/WEATHERED BEDROCK SURFACE.



LOOKING EAST SOUTH EAST ONTO EXISTING WET AREA/DEPRESSION WHERE REED GROWTH AND LARGE WILLOW TREE AND UNDERBRUSH EXISTS.

Golder Associates
Kelowna, British Columbia

SCALE	Not to Scale
DATE	7/23/2004
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FILE No.	Site Photos.DWG
PROJECT No.	04-1440-145
REV.	0

TITLE: SITE PHOTOGRAPHS (July 23, 2004)

DC PROPERTIES

FIGURE 4

Drawing by: Site Photos.dwg on: Jul 28, 2004 at: 1:41pm

RECORD OF TEST PITS

July 21, 2004 04-1440-145

Test Pit No.	Depth (m)	Description	Sample/ Depth (m)
TP 1	0.0 – 0.8	Firm to stiff dark brown desiccated silty **CLAY**, trace silt with organics at the surface.	Sa 1 @ 0.5m MC=15.4%
	0.8 – 1.6	Stiff to very stiff brown grey fissured silty **CLAY**, occasional light brown silt lenses.	Sa 2 @ 1.6m MC=34.4%
TP 2	0.0 – 0.1	Firm to stiff dark brown organic silty **CLAY**.	
	0.1 – 0.9	Stiff to very stiff brown desiccated silty **CLAY**, with white precipitate residue.	
	0.9 – 2.1	Loose to compact dark brown sharp and irregular shaped **COBBLES**, trace to some sandy silt. **(Talus, slope wash)**	
	2.1 – 2.4	Loose to compact mottled brown silty **SAND**, some gravel with dark brown organic silt pockets throughout.	Sa @ 2.3m MC=14.2%
TP 3	0.0 – 0.6	Firm dark brown clayey **SILT** with organics at the surface.	
	0.6 – 1.1	Firm to stiff brown desiccated silty **CLAY**, trace silt.	
	1.1 – 3.0	Stiff brown layered moderately fissured silty **CLAY**, trace light brown silt lenses and brown fine sand pockets.	Sa 1 @ 2.0m MC=38.6%
	3.0 – 3.3	Loose to compact oxidized brown medium **SAND**, some gravel, trace silt.	Sa 2 @ 3.2m MC=15.4%
		Near groundwater seepage conditions noted with existing water valve and vent pipe noted approximately 10 north from test pit location.	

RECORD OF TEST PITS

July 21, 2004 04-1440-145

Test Pit No.	Depth (m)	Description	Sample/ Depth (m)
TP 4	0.0 – 0.2	Firm dark brown clayey **SILT** with organics at the surface.	
	0.2 – 0.6	Firm to stiff desiccated silty **CLAY**, trace silt.	
	0.6 – 1.7	Compact to dense brown silty **SAND** and **GRAVEL** with cobbles and boulders.	Sa 1 @ 1.7m MC=9.1%
	1.7 – 2.3	Compact interlayered brown slightly oxidized silty fine **SAND** and brown sandy **SILT**, trace gravel.	Sa 2 @ 2.1m MC=15.9%
		Near seepage conditions with increasing depth.	
TP 5	0.0 – 0.8	Firm to stiff brown silty **CLAY** with organics at the surface and occasional pieces of concrete. **(FILL)**	
	0.8 – 3.0	Compact to dense brown grey gravelly **SAND**, some silt with cobbles. **(Till-like)**	Sa 1 @ 1.5m MC=6.5%
TP 6	0.0 – 0.3	Loose dark brown organic **SILT**. **(TOPSOIL)**	
	0.3 – 0.7	Firm to stiff dark brown fissured silty **CLAY**, some silt with a porehole structure.	
	0.7 – 2.2	Compact to dense brown grey gravelly silty **SAND**, with cobbles. **(Till-like)**	Sa 1 @ 1.3m MC=4.9%
TP 7	0.0 – 0.5	Loose dark brown organic **SILT**. **(TOPSOIL)**	
	0.5 – 1.6	Compact light brown silty **SAND** and **GRAVEL** with cobbles grading to a light brown sandy **SILT** and **GRAVEL** with cobbles.	Sa 1 @ 1.4m MC=3.8%
	1.6 – 2.9	Compact to dense brown-grey **SAND** and **GRAVEL**, some silt with cobbles. **(Till-like)**	

RECORD OF TEST PITS

July 21, 2004 — 04-1440-145

Test Pit No.	Depth (m)	Description	Sample/ Depth (m)
TP 8	0.0 – 0.1	Loose dark brown organic **SILT**. (**TOPSOIL**)	
	0.1 – 0.8	Loose to compact light brown fine sandy **SILT** and **GRAVEL** with cobbles and boulders grading to a silty fine **SAND** and **GRAVEL**.	
	0.8 – 2. 0	Compact to dense brown grey **SAND** and **GRAVEL**, some silt with cobbles. (**Till-like**)	
TP 9	0.0 – 0.9	Loose brown silty **SAND** and **GRAVEL** mixed with grey silty **SAND** and **GRAVEL** with cobbles. (**FILL**)	
	0.9 – 2.8	Compact brown **SAND** and **GRAVEL**, trace silt grading to a gravelly **SAND**, trace silt with cobbles.	Sa 1 @ 1.8m MC=4.5%
	2.8 – 3.2	Compact oxidized brown medium gravelly **SAND**.	Sa 2 @ 3.0m MC=5.7%
TP 10	0.0 – 0.3	Loose to compact brown **SAND** and **GRAVEL**, trace to some silt.	
	0.3 – 1.7	Compact to dense brown grey gravelly **SAND** trace to some silt grading to a **SAND** and **GRAVEL** with a trace to some silt and cobbles. (**Till-like**)	

RECORD OF TEST PITS

July 21, 2004 — 04-1440-145

Test Pit No.	Depth (m)	Description	Sample/ Depth (m)
TP 11	0.0 – 0.3	Loose to compact brown sandy **GRAVEL**, trace silt with organics at the surface. (**FILL**)	
	0.3 – 1.5	Loose to compact dark brown sandy **SILT** and **GRAVEL** with cobbles and boulders intermixed with brown silty **SAND** and **GRAVEL**. (**FILL**)	
	1.5 – 2.7	Compact to dense brown grey **SAND** and **GRAVEL**, some silt with cobbles.	Sa 1 @ 2.2m MC=7.7%

NOTES:

1) No groundwater seepage encountered within any of the excavated test pits at the time of the investigation unless otherwise noted.
2) MC=7.8% indicates laboratory moisture content determination of the representative sample collected at the referenced sample number and depth.