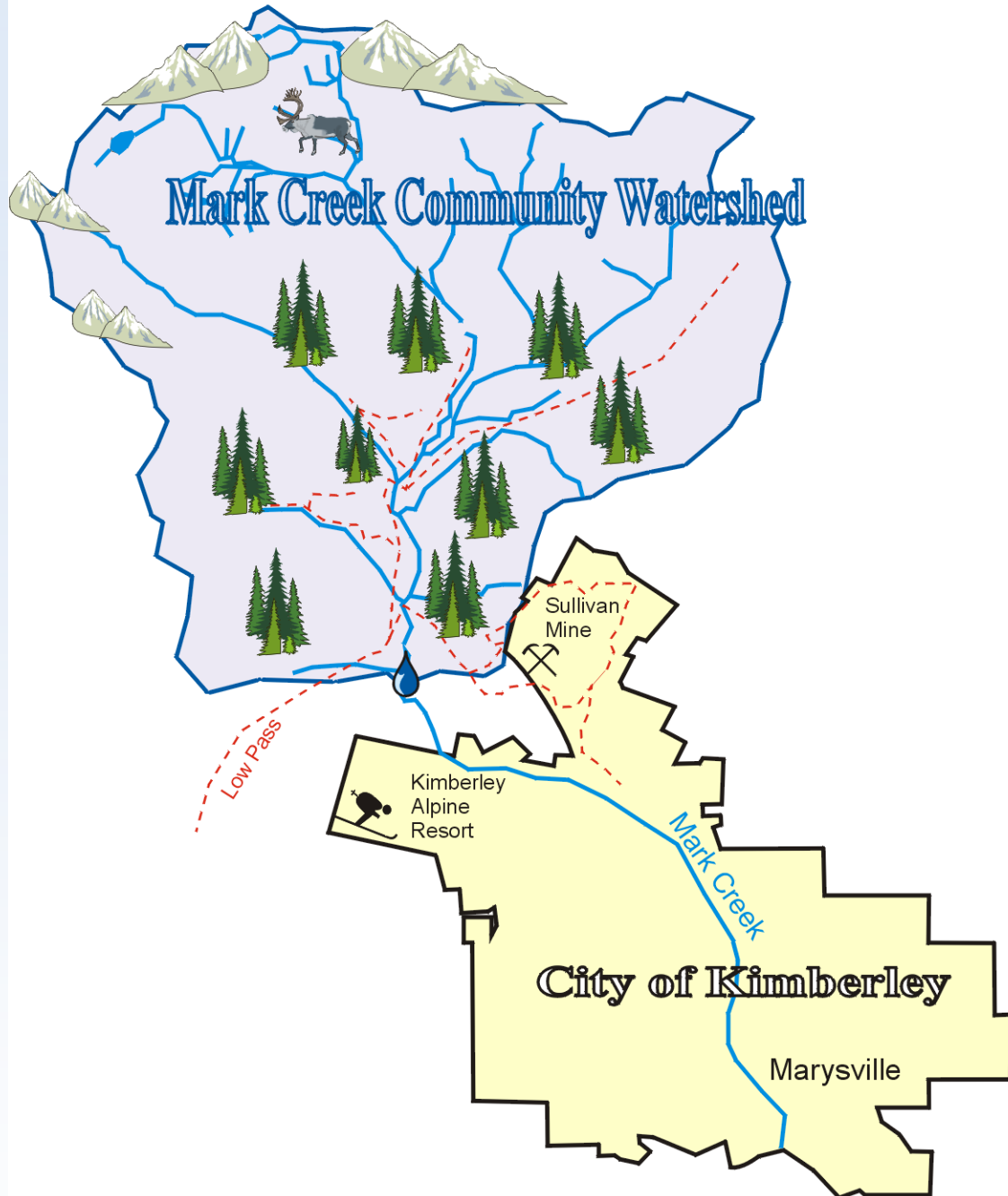


Mark Creek Integrated Watershed Management Plan



September 2017 Update

Addendum

Plan Revision – September 15, 2017

In acknowledgement that the Mark Creek Integrated Watershed Management Plan is a living document that needs to be reviewed and updated periodically, Sections 4 (Resource Management Objectives, Strategies, Guidelines &/or Standards) and 5 (Protective Measures) have been updated to current legislation references and forest management practices.

The original document will be archived for reference and the revised sections as well as this addendum will be inserted into the plan document.

This watershed plan was originally prepared in two versions: one version was in a loose-leaf binder for committee members who wished to remain active in the implementation, monitoring, review, and update processes; the other version was a bound document for public distribution and for Mark Creek IWMP planning team members who no longer wish to be involved with the implementation, monitoring, review and update processes. Only the public version of the plan has been updated.

Implementation and Monitoring Team Version	Public Version (For distribution to public and committee members that have chosen to not participate on the Implementation and Monitoring Team)
Binder with tabs	Bound document
11" x 17" Display Maps Envelopes with 1:20,000 maps (supplied on request)	8.5" x 11" display maps
Key plan and guidelines on blue paper	All white paper
Preventative measures on yellow paper	All white paper
Contingency plans on pink paper	All white paper
Background reports included	No background reports
Section for inserting future memoranda of agreement	No section for inserting future memoranda of agreement
Section for inserting future meeting minutes and correspondence	No section for inserting future meeting minutes and correspondence

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Plan Approval (for Historical Reference Purposes – the revisions to the plan are not being approved by a statutory decision maker)

After approximately 10 years of dedicated effort by the Mark Creek IWMP planning team, it pleases me to approve the Mark Creek Integrated Watershed Management Plan. Although the committee could not reach consensus on several issues, committee members provided me with options to consider as specified in the terms of reference for the planning process. I have given careful consideration to these options, the preferences of committee members, and my mandate under the *Forest Practices Code of British Columbia Act*.

I have decided upon a resource management direction that recognizes that water quality, quantity, and timing of flows are the primary resource values to be considered. I am satisfied that the provisions in this plan (including specific measures to protect water quality, a conservative rate of timber harvest, access management strategies, contingency plans, and implementation and monitoring procedures to be implemented consistent with the *Forest Practices Code of British Columbia Act*) will ensure that water quality and quantity and other environmental values are adequately conserved while generating a sustainable timber supply and other resource benefits.

The following Mark Creek Integrated Watershed Management Plan (IWMP) is approved to provide guidance in the preparation, evaluation, and approval of Operational Plans pursuant to the *Forest Practices Code of British Columbia Act*.

The Mark Creek IWMP will provide direction to all forest management activities within the Mark Creek Community Watershed that occur under the jurisdiction of the Ministry of Forests.

The Mark Creek IWMP will be used by the Ministry of Forests as a basis for reviewing proposed resource operations in the Mark Creek community watershed that are referred to the Ministry of Forests for review and comment.

The Mark Creek IWMP should also be used as the basis for ongoing liaison between government agencies, licensed stakeholders, and interested public groups with respect to resource management activities within the Mark Creek community watershed.

T. Wideski, RPF
District Manager
Cranbrook Forest District

Note: The revised plan is not being “approved” by a Statutory Decision Maker – The revised plan is an operational agreement between Mark Creek IWMP Watershed Advisory Committee members and forms the basis of agreement between the City of Kimberley and the Ministry of Forests, Lands and Natural Resource Operations.

Executive Summary

The Mark Creek Integrated Watershed Management Plan (IWMP) is the culmination of many years of effort between various provincial ministries, licensed stakeholders, and interested public. It contains a brief history of the planning process, a brief description of the watershed, resource management guidelines, preventative and contingency measures, provisions for ongoing monitoring, implementation and update, and considerable appended background information.

The most critical portions of the plan are:

- Chapter 4 which defines the resource management guidelines for the watershed,
- Chapter 5 which prescribes the preventative measures and contingency plans that need to be implemented when resource use operations occur within the community watershed,
- Chapter 6 which details implementation and monitoring of the plan,
- Appendix 9.1 which outlines the details of the water monitoring program,
- Appendix 9.2 which addresses access management on existing roads within the watershed,
- Appendix 9.3 which outlines proposed harvesting and forest road construction in the watershed. Forestry plans need to be consistent with the provisions of this integrated watershed management plan.

Post Script to Original Plan:

The plan has have been updated to reflect changes to Forestry legislation, generally accepted best practices and key personnel and contacts that have occurred since the original “IWMP” was signed. These updates are considered current to October 2016.

In addition, “post-scripts” have been inserted in a number of places throughout the text where a point of clarity was warranted in order to update original statements to current practices and/or standards.

References to the *Forest Practices Code of B.C. Act* in the Introduction section, as well as statements by the former MoFR District Manager have been left unchanged to provide historical context. Changes to forestry legislation in B.C. in the intervening years since the original Mark Creek IWMP was finalized have shifted statutory decision-making authority for certain decisions relating to the approval of forestry operations on Crown land. Of particular note, the District Manager is no longer responsible for issuing tenures relating to the BC Timber Sales Program (formerly the Ministry of Forests “Small Business Forest Enterprise Program”). This responsibility now lies with the Timber Sales Manager. Consequently, the original Memorandum of Understanding between the Ministry of Forests and Range and the City of Kimberley which, among other things, re-enforces the commitment on the part of both parties to be guided by the principles in the IWMP, was recently updated and signed by the Timber Sale Manager on behalf of the Ministry of Forests and Range and by City of Kimberley Officials. Since the plan was signed off, other agencies have assumed a role such as the Interior Health Authority (Drinking Water Officer) and provincial ministries have been reorganized.

Acknowledgments
(for Historical Reference Purposes only)

Completion of the Mark Creek Integrated Watershed Management Plan is a significant achievement. The production of this plan has been a lengthy and arduous task.

I believe that the water resource in particular, and all of the other natural resources of the Mark Creek watershed, will be managed to a very high standard as a result of this effort.

I would like to thank all of the members of the planning team and the participants in the water monitoring sub-committee for the care, energy and dedication they have invested in this process. I would also like to thank those members of the public, local council, interest groups and commercial operators who have come forward and provided constructive input during the planning process which has further enhanced the quality of the final product. I also wish to acknowledge the valuable contribution of aquatic resource and forestry professionals who prepared an independent review of the draft plan on behalf of the City of Kimberley.

My thanks to all who contributed to this planning process.

T. Wideski, R.P.F.
District Manager
Cranbrook Forest District

1.0 Introduction

1.1 Purpose

This plan has been prepared to develop and/or conserve resources in the Mark Creek Community Watershed (the planning area). Preservation and protection of water quality (including drinking water quality), quantity and timing of flows is the primary consideration of the Mark Creek Community Watershed Integrated Watershed Management Plan. The plan has been prepared in a manner consistent with the Kootenay Boundary Land Use Plan designation of integrated resource management.

1.2 History of Planning Process

A planning team was established in 1987 to solicit resource interests and issues and work on a resolution agreeable to all resource and other interests in the watershed. Planning team representation is noted in the terms of reference in Appendix 9.5.1 and planning team members are noted on the committee endorsement pages at the beginning of this document. The team completed an initial draft plan in 1993.

In January 1993, the Government of British Columbia appointed the Commission on Resources and Environment (C.O.R.E.) which convened its first meeting of the East Kootenay Land Use Planning process that year. At the same time, government was working on producing a *Forest Practices Code of British Columbia Act* which would be addressing management of community watersheds, and the City of Kimberley was planning to establish a new intake location which would change the actual area and resource concerns within the Mark Creek Community Watershed. The Mark Creek Community Watershed planning process was put on hold until these processes had run their course.

Following proclamation of the *Forest Practices Code of British Columbia Act* in July 1994, announcement of the East Kootenay Land Use Plan by government in March 1995, completion of the new water supply system by the City of Kimberley in May 1996 and a change of forest licensee operating area to the Ministry of Forests Small Business Forest Enterprise Program in January 1996, the terms of reference were updated to reflect these changes and an expanded committee was reconvened to complete the plan over the course of 1996. The planning team required additional time to fully debate the issues and complete the plan. As a result, the time frame was extended until the end of 1997. The deadline was further extended to allow time to complete the water quality monitoring section of the plan (see Appendix 9.1). The completed Mark Creek IWMP reflected the land use decision made by government, incorporated requirements of the *Forest Practices Code of British Columbia Act*, reflected the new intake location and recognized the new forestry operator in this area.

Since the original plan was approved, the Kootenay Boundary Higher Level Plan Order was legally established in 2002 which brought many of the objectives from the Kootenay Boundary Land Use Plan Implementation Strategy into a legal framework. The higher level plan has been amended nine (9) times since establishment including the removal of the caribou objective from

the plan (caribou habitat is now legally established through an Order under the Government Actions Regulation).

The Cranbrook West Recreation Management Strategy was completed on April 11, 2005, and remains a policy plan.

Legislation has changed including the replacement of the *Forest Practices Code of BC Act* with the *Forest and Range Practices Act* (FRPA). Other legislation has been introduced such as the *Drinking Water Protection Act* (2001) and associated regulations (2003), much of the *Health Act* has been repealed, the *Public Health Act* has been created (2008) and Regional Health Boards have been amalgamated (Kimberley Community Health Council became part of the Interior Health Authority). The *Water Sustainability Act* (2016) and related regulations came into effect on February 29, 2016 and replaced the *Water Act*. The WSA Section 43: Water Objectives provides authority to establish objectives in a regulation to provide a more consistent approach to considering water in natural resource decisions and local government planning. The objectives would support decision making to help reduce impacts to and to help sustain water quantity, water quality and aquatic ecosystems.

Also of note is that the Sullivan Mine officially ceased operation in 2001 and much of the original mine property has been de-commissioned. Significant changes were made to the water system and Cominco's water infrastructure and water licences were transferred to the City of Kimberley. Cominco is no longer a legal entity and has been integrated into a new company called "Teck" (*i.e.* Teck Resources Limited and its affiliates). The ski hill previously owned by the City of Kimberley was sold to Resorts of the Canadian Rockies and is now called Kimberley Alpine Resort.

1.3 Plan Area

The plan is focused primarily on the area above the water supply intake for the City of Kimberley. Some of the management objectives pertain to areas outside the watershed where they have the potential to affect the watershed (*i.e.* access routes, pest and fire control); where they lie between the municipal boundary of Kimberley and the watershed area, and common objectives pertain to both (*i.e.* visual quality objectives, recreation management); or where management in the watershed has the potential to impact external values (fisheries, caribou).

The setting of the watershed in relation to the Sullivan Mine, the City of Kimberley, Kimberley Alpine Resort and other geographic features is indicated on the map on the cover of this document.

The Mark Creek Community Watershed above the current water intake covers 9,541 hectares, or a little over one half of the total 16,800 hectare Mark Creek basin to its confluence with the St. Mary's River.

The area above the intake is 99.1 % Crown land, and 0.9% private land formerly held by Cominco Ltd. as shown in Appendix 9.4.1 and transferred to the City of Kimberley in 2009.

1.4 Physiography and Geomorphology

The Mark Creek basin is in south-eastern British Columbia on the eastern fringe of the Purcell mountains immediately west of a 20-30 km wide portion of the Rocky Mountain Trench. The main channel flows about 28 km generally south to its confluence with the St. Mary River just south of the City of Kimberley. The basin is about 22 km long by 12 km wide.

Elevation ranges from approximately 2600 m in the north-west height of land to approximately 1000 m at the confluence with the St. Mary River. The current intake is located at approximately 1350 m elevation approximately 12.7 km along the main channel from the confluence.

The landforms and soils within the Mark Creek watershed were formed during the last glacial period (Fraser Glaciation) which commenced approximately 1 million years ago and ended approximately 10,000 years ago. As the glaciers began subsiding, thick accumulations of meltwater sediments were deposited in the valley bottom. Water melting from the large Rocky Mountain Trench glacier flowed down the Mark Creek mainstem channel and eroded down through the thick accumulations of sediment to create a wide melt-water channel that is now occupied by the wetlands in sub-basin 5 at near the headwaters of Mark Creek.

Bedrock in the Mark Creek watershed comprises Precambrian metamorphosed sedimentary rocks of the Aldridge and overlying Creston formations and gabbro sills and dikes that intrude the Aldridge. Bedrock below mid-elevations is covered by a few to 30 metres, and possibly more, of glacial till.

It is worthy to note that there is Tertiary rusty cobble conglomerate in an isolated area a short distance downstream from the reservoir along the trail in the steep-walled valley between the Stemwinder mine and upper entrance of the Sullivan Mine & Railway Historical Society tourist railroad tunnel. What is believed to be deep Tertiary weathering of Aldridge strata was recognized in core from several diamond drill holes southwest and west of Sullivan Mine.

Mark Creek physiographic features were modified by the most recent glacial period which commenced some 20,000 years ago (Valentine, K.W.G. *et al.*, 1978, 1981). Glaciers created cirques at their heads and flowed generally out into the Rocky Mountain Trench. The only alpine glacier deposits in Mark Creek valley are minor moraines at higher elevations just below cirques. Alpine glaciation was followed by development of the Cordilleran ice sheet where up to 2 km of ice accumulated in the Rocky Mountain Trench. The ice sheet covered the mountains except for some of the highest peaks. The ice sheet surface extended uniformly across the province and was at its maximum advance about 15,000 years ago. Ice sheet melt commenced and was most rapid around the mountain peaks because of thermal build up in rock. Albedo of the ice limited melting away from the peak. Upper parts of valleys gradually became ice-free whereas the elevation of ice in the Rocky Mountain Trench was significantly higher. The excess mass of ice in the trench moved under its own weight into adjacent ice-free and melting valleys (Clague, 1973). Erratics sourced from earlier alpine glacier deposits in the nearby portion of the Rocky Mountain Trench that originally came from near Invermere, Skookumchuck Creek and TaTa Creek areas now define a “bath tub ring” at mid elevations throughout the Mark Creek basin (Ransom, 2003). Any alpine tills were extensively reworked. As melting progressed, water ponded between the glacier and mountains and formed ice contact lakes and periodic extremely energetic rivers. Thick silt deposits and the narrow Low Pass canyon are likely products of these

processes in the Mark Creek basin. The final stage of glacial melting was stagnation that resulted in the undulating topography with locally abundant kettles and probable kames. There was probably a small amount of final sculpting by water, most likely only rain in rivulets running in the undulating topography. Glacio-fluvial deposits are unlikely to have developed under the conditions prevailing in Mark Creek valley.

The Mark Creek basin generally has moderate slopes with steep headwaters and a main channel which ranges from floodplain in the upper middle reaches to incised canyon in the lower middle reach. The main Mark Creek channel at the intake is a fifth order stream composed of five major third to fourth order sub-basins. Three of the major headwater tributaries originate from a series of small alpine lakes all situated above 2000 metres in elevation in the northwest portion of the basin. Approximately 21 percent of the basin area is alpine with patchy or no forest cover.

Valentine *et al.* show that the lower elevations of the basin contain predominantly brunisol soils while the upper basin area is predominantly covered by humo-feric podzols. Brunisols are soils which have undergone only moderate change from the original parent material. Podzols are typically cool, moist, mountain forest soils with leaching, slow decomposition, and slow integration of organic matter.

Terrain and erosion hazard mapping were completed for the watershed in 1996 by R.T. Banting Engineering Ltd. The maps are shown in Appendix 9.4.2. The full written report associated with these maps is attached as a background report in the committee version of this plan (see Appendix 9.5.9). Terrain stability field assessments have been done on site-specific areas where development was proposed. These reports are housed with BC Timber Sales.

1.5 Climate

Updated Normals Data to 1981-2010

Detailed climate statistics obtained from the Cranbrook Airport, and Kimberley and Marysville areas, are provided by BC. Environment in the *Mark Creek Hydrology Data Summary and Analysis* (see Appendix 9.5.6). and *Canadian Climate Normals data*
http://climate.weather.gc.ca/climate_normals/index_e.html.

Temperature records obtained from the Cranbrook Airport (939 meter elevation and 30 kilometers to the south-east) from 1961-1990 indicate average monthly normals from -8.3° C in January to 18.2° C in July. Extremes of -40° C on Dec 30, 1968 and 37° C on July 21, 1985 were also noted. Records from 1981-2010 indicate average monthly normals from -6.1° C in January to 18.7° C in July. Mean annual temperature was slightly higher for the 1981-2010 period compared to the 1961-1990 period. Normal daytime temperatures remain below freezing for three months of the year. Temperature extremes in the watershed can be expected to vary from those observed at the Cranbrook Airport due to orientation and elevation differences. The mean annual precipitation at the Cranbrook airport for the period 1981-2010 was 385.3 mm. Mean annual precipitation for the period 1961-1990 was 384.5 mm. Of particular note is the decline in mean annual snowfall from 147.9 cm per year in 1961-1990 to 125.3 cm per year in 1981-2010 Normals data.

The overall trend supports the general warming trend toward drier summers and warmer, wet winters. Implications for pest management, particularly Mountain Pine Beetle (MPB), are also

significant as prolonged winter cold or fire is required to control their numbers. Since fire is actively suppressed in the region, cold periods are even more critical. A significant portion of Mark Creek is mature lodgepole pine that is highly susceptible to MPB infestation and resulting decline in forest health and increase in fire risk. Fire has the potential to significantly affect water quality in Mark Creek through the direct input of nutrients and suspended soils as unstable post-fire soils are washed into the creek by rain and snowmelt. It may also indirectly affect water quantity by accelerating runoff from deforested soils in the early years and by altering the water uptake and evapotranspiration rate of the forest as the forest regenerates.

Increased precipitation is expected at higher elevations within the watershed compared to Kimberley or Marysville. Adjusted figures indicate 1.9 times the precipitation in the basin compared to Marysville. Annual precipitation is estimated at 840 mm and 65 percent of this falls as snow. Maximum one-hour rainfall reached 22.2 mm and maximum 24-hour rainfall reached 41.0 mm.

Typically, snow begins to accumulate in mid-October and continues to accumulate until April. Light snow-packs melt by June 1 and heavy snow-packs last into July at higher elevations. Snowpacks appear to be melting earlier, and in 9 out of the 16 years from 2000-2015, snow was completely gone at the Sullivan Mine snow course by May 15th (see Figure below).

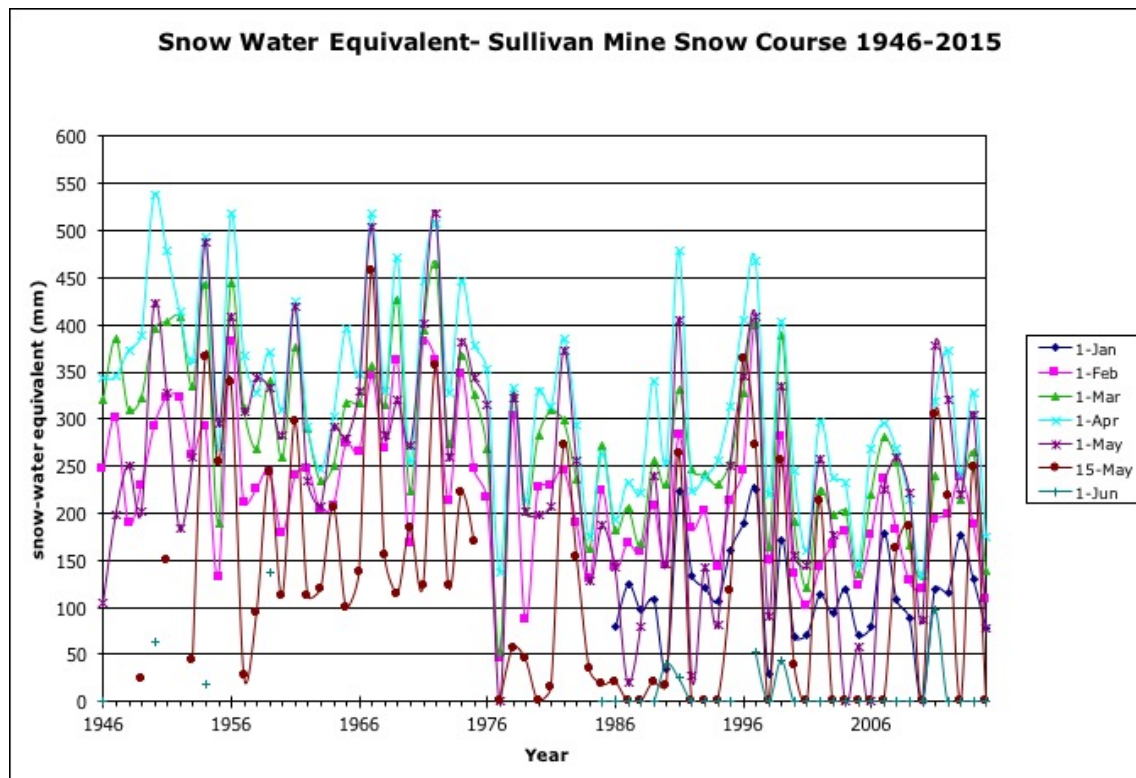


Figure 1. Snow Water equivalent, Sullivan Mine snow course 1945-2015.

The average growing season for natural vegetation is generally less than 6 months per year and declines with increasing elevation.

1.6 Biogeoclimatic Classification

Mark Creek lies on the western edge of the East Columbia Mountains Eco-section. The most current approved Biogeoclimatic Ecosystem Classification (BEC) mapping delineates five biogeoclimatic subzones in the basin. Most of the commercial forest is located in the two lower BEC subzones, namely the dry cool montane spruce (MSdk) subzone in the lower basin to about 1600 meter elevation, the dry cool Engelmann spruce - sub-alpine fir (ESSFdk) subzone on the main forested slopes up to about 2100 meter elevation. The upper elevations are classified into three separate units: dry cool Engelmann spruce - sub-alpine fir Upper (ESSFdk-u), dry cool Parkland Engelmann spruce – sub-alpine fir parkland (ESSFdk-p) and alpine tundra (ATun).

The MSdk is characterized by fairly productive sites for the dry climatic region, with spruce forming the predominant climax forest. Much of the area is currently covered with lodgepole pine which has regenerated following major pest epidemics and fires. This subzone is characterized by the absence of western red cedar and the presence of western larch.

The ESSFdk is the highest elevation productive forest area, characterized by areas of lodgepole pine forest and Engelmann spruce / sub-alpine fir forests (climax forest). Some Douglas-fir and western larch forest occur on the driest portions of the variant, and some mixed species forest is also present.

The ESSFdk-u is characterized by similar species to the ESSFdk with the addition of alpine larch and whitebark pine.

The ESSFdk – p is the highest elevation area below the tree line where tree growth is often stunted and concentrated in islands of trees in these high elevation areas due to deep snowpacks and short growing seasons.

The At-un is the area above the tree line where trees do not grow.

1.7 Area History

The earliest information available about Mark Creek comes from archaeological studies. An archaeological overview carried out by Wayne Choquette during 1996 indicates that approximately 10% of the watershed has moderate to high archaeological potential. Archaeological Impact Assessments conducted prior to forestry operations have subsequently identified a single location within the Mark Creek watershed yielding tourmalinite reduction flakes associated with tool making. There are no known bedrock tourmalinite sources in the drainage area above the reservoir.

A traditional use study which includes the Mark Creek drainage has been conducted by the Ktunaxa/Kinbasket Tribal Council (now called the Ktunaxa Nation Council). A brief preliminary traditional use study report with a map was also completed for the proposed expansion of the Kimberley Ski Hill. Permission from the Ktunaxa Council prior to the publication or distribution of traditional use study information is requested.

The traditional use map indicates the north side of North Star Mountain was the primary traditional hunting and trapping area in the Mark Creek Watershed area. Both shores of Mark Creek and Mather Creek were traditional fishing areas, but the St. Mary River was the major fishing and processing area. The commonly used traditional travel route from the south is along the St. Mary River to St. Mary Lake, but branches off south-east of North Star Mountain, passes the east base of North Star Mountain and goes north through the Mark Creek Watershed. Traditional vegetation gathering/processing areas are generally located around North Star Mountain and the confluence of Mark Creek and the St. Mary River. Known archaeological sites are located along the major streams, particularly near the confluence of Mark Creek and the St. Mary River, all below the community watershed intake.

Archaeological impact assessments have been undertaken by BC Timber Sales; a total of ten assessments since 2001. These assessments have yielded no findings with the exception of two, which identified archaeological sites.

Earliest historical records indicate that mineral exploration has been carried out in the area since the mid to late 1800's. The lead, zinc and silver North Star and Stenwinder deposits were staked in 1891 and the Sullivan in 1892. The community of Kimberley was established in 1896. A number of small companies carried out mining and smelting of Sullivan until 1909. In 1906, the Consolidated Mining and Smelting Company (Cominco Ltd. – now called Teck) was formed and in 1909 acquired the Sullivan Mine. CM&S carried out exploration and some mining at the Sullivan between 1909 and 1923 when the Sullivan went into full production. The Sullivan Mine officially ceased operation in 2001 and much of the original mine property has been de-commissioned

Exploration drilling in the watershed has been conducted since the 1920's and roads constructed since that time remain to this day. A dam to augment flow into Mark Creek was constructed on Hunter's Lake in the early 1900's but has since deteriorated.

Some timber harvesting took place in the early 1900's primarily to serve the mine and railway. Records of commercial harvesting are not available but it is considered likely that the lower slopes of the watershed had harvest entries in the early decades of the 1900's. Clearing of exploration sites, the reservoir, roadways, and fireguards for the 1985 Matthew Creek fire account for most of the timber harvesting that took place in the watershed prior to 2007. Plans to revive commercial timber harvesting were initiated at least by 1977, but mountain pine beetle and spruce bark beetle salvage operations elsewhere in the forest district, concerns over watershed management, and the desire to have an integrated watershed management plan delayed start-up.

In 1919, a large forest fire swept over approximately 57 percent of the watershed area. Most of the area of this vast fire is now covered with 90-year old lodgepole pine stands. A summary of the fire history by cause and size from 1950-1995 is provided in Table 1. This summary is for a larger area in which the Mark Creek Watershed makes up some 48 percent. It provides an indication of the frequency and severity of fires that could be anticipated in the general area. The remainder of the forested area of the watershed is covered with older than 140 year-old stands. A later catastrophic fire occurred in Matthew Creek just west of the Mark Creek Watershed in 1985.

Table 1a. Mark Creek Area Fire History - Fire Incidence 1950-1995
(Source: Ministry of Forests Protection Branch - Fire Reporting System)

	Total Number of Fires 1950-1995	Average Number of Fires Per Year
Total Number of fires	173	3.8
Lightning Caused fires	27	0.6
Recreation Caused fires	31	0.7
Railroad Caused fires	46	1.0
Industrial Caused fires	2	0.04
General Public Caused fires	67	1.5

Table 1b. Mark Creek Area Fire History - Area Burned 1950-1995
(Source: Ministry of Forests Protection Branch - Fire Reporting System)

	Total Area Burned 1950-1995 (hectares)	Average Area Burned Per Year (hectares)
Area Burned (Hectares)	192	4.2

From 1996-2010 one lightning-caused fire was recorded in Mark Creek Watershed.

Flood events have also been noteworthy in the history of Mark Creek. The Daily Townsman reports that in May of 1948 a heavy rainstorm (that rapidly melted the snowpack) led to the worst major flood on record. The flood waters tore through Kimberley damaging many homes and properties. "Twenty homes were lost, 50 damaged and over 100 vacated. Following the flood, the creek was straightened and lowered, and concrete walls were placed along some portions of Mark Creek, mainly within the city limits". There is also a report of a major flood event in 1916 (Jack Reynolds - Mark Creek IWMP Public Meeting, June 18, 1997).

2.0 Resource Descriptions, Current Infrastructure and Tenures

2.1 Water

2.1.1 Water Quantity and Timing of Flow Over Time

Watersheds can be characterized by their water yield, and the peak and low flows which indicate how rapidly the drainage discharges precipitation. The Water Survey of Canada has been monitoring Mark Creek at various locations since 1912. The *Mark Creek Hydrology Data Summary and Analysis* (see Appendix 9.5.6) was prepared by BC Environment based on records from 1961 to 1994. It indicates that low flows of about $0.17 \text{ m}^3/\text{second}$ can occur from December through March. Daily peak flows as high as $21.4 \text{ m}^3/\text{second}$ were recorded in May 1976. Maximum flows occur in May and June and begin to decline in July. A calculated peak instantaneous flow of $33 \text{ m}^3/\text{second}$ is likely to occur with a frequency of once every 200 years (*i.e.* the 200 year flood). A typical hydrograph (m^3/sec) of the 2009 record is incorporated as Figure 1 (Nanrich, 2009).

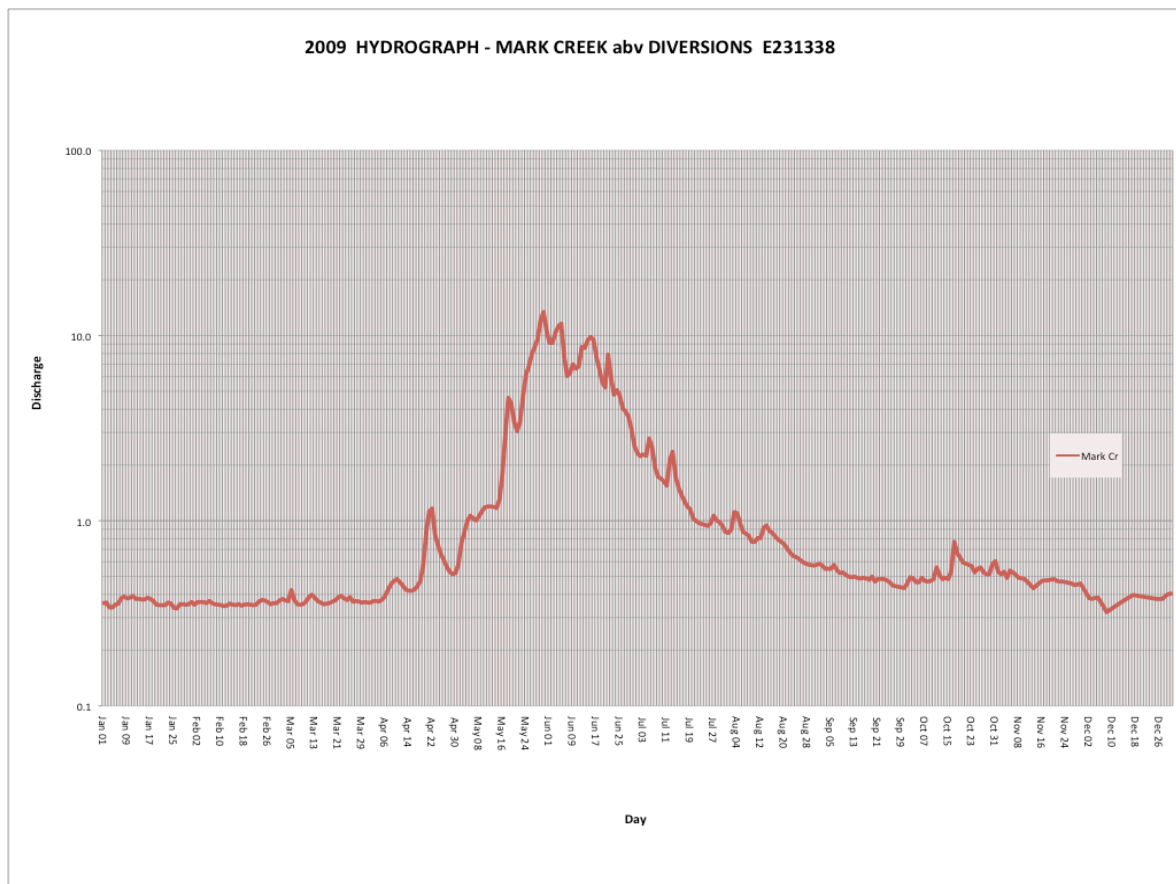


Figure 2. Typical hydrograph of Mark Creek

The normal annual average stream flow of 1.39 m³/second represents 471 mm of precipitation, or about 56 % of the estimated average precipitation for the Mark Creek Watershed. Assuming that the estimated precipitation for Mark Creek is correct, the balance of the precipitation evaporates, transpires, or moves through groundwater flow.

The “H60 line”, which is the elevation above which 60 percent of the watershed area lies, is 1700 metres; although this does not provide an accurate reflection of peak flow sensitive areas. In Mark Creek, mainstem peak flows are controlled by snow melt from the alpine areas in sub-basins 2, 3 and 5.

2.1.2 Water Quality Monitoring

The City of Kimberley has been sampling water quality since at least 1985. Cominco Ltd. has done a range of water quality monitoring at various sites since 1992. BC Environment assisted with a detailed baseline monitoring program including detailed chemical analysis from 1993 to 1995. The current water monitoring program, as outlined in Appendix 9.1, has been sampling water quality since May 1998. Annual reports are available from the City of Kimberley up to and including 2016. Sampling is on-going.

The focus of the water quality monitoring has been to try and characterize the range of natural and induced variability in sediment suspended in the water (turbidity and Total Suspended Solids), materials dissolved in the water (specific conductance and nutrients), trends in water temperature, pH and bacterial loads. Sampling for metals is also done to confirm that levels remain well below limits set for drinking water. Since water quality analysis is costly, the approach has been to monitor those parameters which serve as indicators of broader trends, and if an issue of concern arises, to then perform more detailed analysis.

Turbidity

Turbidity is a measure of the amount of suspended sediment in raw water. It is measured by shining light of a specific wavelength through a water sample and determining the amount of reflectance or scatter. As well as being an aesthetic consideration, certain types of turbidity (*e.g.* turbidity which is primarily organic in nature) can chemically tie up chlorine which can reduce the effectiveness of chlorination. Turbidity can also make it difficult to detect bacteria, viruses and protozoa. Guidelines for Canadian Drinking Water Quality (GCDWQ) (2017) recommend filtration of the water source and new guidelines are based only on filtered water. “Guidelines apply to individual filter turbidity for systems using surface water or groundwater under the direct influence of surface water. The decision to exempt a waterworks from filtration should be made by the appropriate authority based on site-specific considerations, including historical and ongoing monitoring data. To ensure effectiveness of disinfection and for good operation of the distribution system, it is recommended that water entering the distribution system have turbidity levels of 1.0 NTU or less. For systems that use groundwater, turbidity should generally be below 1.0 NTU.” Previous guidelines recommended a turbidity of 1 NTU or less for water entering a distribution system, but a maximum of 5 NTU if disinfection was not compromised. In BC, the GCDWQ have not been adopted into legislation.

The glacial till in Mark Creek is a source of inorganic particles which cause turbidity, but which do not react with chlorine. In the absence of regulations for unfiltered supplies, target water quality remains consistent with earlier guidelines which recommended an average maximum acceptable concentration for turbidity (*i.e.* 95% of the time) of 1 nephelometric turbidity unit (NTU) for water entering a distribution system. The BC Drinking Water Protection Act and Regulation do not set turbidity standards; however, the Province introduced treatment objectives in 2012 which do set turbidity objectives (see Filtration Exemption below).

The City of Kimberley has been monitoring turbidity at the chlorination plant since 1985. Turbidity is now monitored continuously using an in-line sensor and grab samples are taken weekly and submitted for lab analysis. Between July 2015 and July 2017 the continuous data (n=210,697) showed an average turbidity of 0.63 NTU and a range of 0.16 to 19.99 NTU. Bacterial counts were not correlated to turbidity.

Turbidity and peak flow were generally correlated and most of the higher turbidity readings occur during freshet, however, turbidity readings exceeding 5 NTU have also occur during non-freshet periods of the year, particularly if an extreme rain event occurs in the fall. Turbidity readings of less than 1 NTU are common during the low flow period.

Specific Conductance (Conductivity)

Specific conductance has been measured consistently throughout the sampling program because it is a very good indicator of the overall level of substances (ions) that make up the dissolved portion of a water sample. Increases in nutrients, salts and dissolved metals will all cause a corresponding increase in conductivity. Conductivity is simply the ability of water to conduct a current, and specific conductance normalizes this measurement to 25° C to account for changes in water density and viscosity (and thus conductivity) with changing temperature.

Microbiological Analysis

Bacteriological analysis has been done on raw and disinfected water generally weekly at the Mark Creek Chlorination plant and as far back as the 1960's. Analysis is performed on both raw water and disinfected water. Disinfected water refers to water extracted from Mark Creek, chlorinated at the treatment plant, and distributed to water users throughout the City of Kimberley. Two indicator bacterial counts, total coliform and faecal coliform were routinely tested until 2006, when the Guidelines for Canadian Drinking Water Quality recommended testing for *E. coli* instead of fecal coliforms (consistent with the *BC Drinking Water Protection Regulation*). These bacterial counts provide a general picture of water contamination.

Total coliform count indicates contamination from natural decaying of organic matter such as grass, leaves, humus type soil etc. Total coliforms include all coliform bacteria including some soil bacteria and fecal coliforms. Fecal coliforms are those excreted in the feces of warm-blooded animals and include *Enterococcus* species and *Escherichia* species. Within the *Escherichia* group, there are numerous strains: *E. coli* and *E. coli* H7 (Walkerton strain) amongst others. Microbiological analysis is very expensive and therefore samples are usually screened at the gross level (*e.g.* total coliforms, or total and fecal coliforms) in order to assess the overall bacterial load that might pose a threat to human health if the water were not disinfected. They are thus used as indicator organisms such that if the coliform levels are high, then it is possible that

the water is being contaminated by feces which may or may not contain other pathogens that could pose a health risk. Not all coliforms, or even all fecal coliforms, pose a risk to human health nor are they always linked to other pathogens that pose a health risk. For example, high numbers of soil bacteria, which may be perfectly harmless, can appear as elevated total coliform levels. For this reason, the funds spent on total coliform analysis for raw water samples were redirected to more specific analysis for *Enterococcus* in 2002 (to present).

The *BC Drinking Water Protection Regulation* sets the following standards for water quality in the distribution system (e.g. disinfected water):

Parameter	Standard
Fecal coliform bacteria	No detectable fecal coliform bacteria per 100 mL
<i>Escherichia coli</i> (<i>E. coli</i>)	No detectable <i>E. coli</i> per 100 mL
Total coliform bacteria	
(a) 1 sample in a 30 day period	No detectable total coliform per 100 mL
(b) more than 1 sample in a 30 day period	At least 90% of samples have no detectable total coliform bacteria per 100 mL and no sample has more than 10 total coliform bacteria per 100 mL

As expected in a natural system, Mark Creek raw water contains low levels of total coliform and most often faecal coliform as well, confirming the ongoing necessity of chlorination. Disinfected water from the Mark Creek system meets all microbial parameters under Canadian Guidelines and *BC Drinking Water Protection Regulation* with the exception of 3-log removal of protozoans. The latter standard could be achieved with the addition of UV disinfection.

Water Chemistry

Chemical analyses were carried out by contract laboratories for BC Environment from 1993 to 1995. The Committee identified seven sites that would be appropriate for sampling given its objectives. Funding for 1998/99 was provided by the Ministry of Environment's Forest Renewal BC allocation and by the City of Kimberley, but was not enough to implement the entire program. A scaled-down version at these three strategically prioritised sites, (Mark Creek above Diversion (site 7), Mark Creek at Midpoint (site 10), and Mark Creek at Sub-basin 2 (site 9)), was implemented during 1999 and 2000. The program was further amended in 2001 in order to assess the effect of upstream water quality on water quality at the point of distribution. Accordingly, the City of Kimberley's Chlorination Plant (site 4) replaced the Mark Creek at Sub-Basin 2 sampling station in 2001. Since 2002, raw water samples have been collected by Aqua-Tex Scientific Consulting Ltd., under contract to the City of Kimberley. The parameters and number of sites have varied over time; however, the following basic parameters have been tested since the inception of the program: specific conductance, Total Suspended Solids, pH, and turbidity. Sampling locations have been dropped and added, but all sites remain at their original location (*i.e.* have not been moved). The total number of sampling locations for the 2015 was eleven (11).

A remote continuous water quality monitoring station was installed at site 7 in 1998 to monitor temperature, pH, specific conductance and turbidity. From 1998 to 2000 it was operated during the ice-free months by Nanrich Water Management. It was not operational in 2001 due to a malfunction in the datalogger. The station was upgraded and resumed operation in 2002, and has been operated since that time by Aqua-Tex. Additional upgrades to equipment were made in the spring of 2014.

2.1.3 Water Quality Profile

Though there are over two decades of water quality data for upper Mark Creek, these data have never been synthesized into a single database. Data from 2001-2016 for specific conductance, TSS, pH, turbidity and bacteriology were analysed as part of the 2015 annual water quality report. These data form the basis for the water quality profile presented below. Nutrients and metals have been analysed periodically in the raw water system and metals are tested several times annually in the distribution system. Most metals for which the lab performs analysis are either routinely below detection limits or not a consideration for drinking water or aquatic life and are therefore not reported here. (They are tested as part of a standard analysis method and therefore are included in the reported results). Temperature is measured continuously from spring to fall by a remote monitoring station above the reservoir and by the City at the Chlorine Plant. These are the data summarized in the table below.

Treated water must comply with the *Drinking Water Protection Act and Regulations*. Compliance with aquatic life standards applies only to forestry operations where required by legislation, including the *CCME Guidelines for Aquatic Life*.

Filtration Exemption

The City of Kimberley currently disinfects Mark Creek water prior to distributing it to consumers, but does not filter it. The Drinking Water Treatment Objectives (Microbiological) for Surface Water Supplies in British Columbia Version 1.1 / November 2012 set exclusion criteria for surface water systems to operate without filtration. Filtration is an expensive treatment method to install, operate, maintain and replace, and can be a significant financial burden to municipalities like the City of Kimberley. This is one of the reasons why there is such a focus on maintaining low turbidity levels in the source water and why activities in the watershed must be done in ways to minimize the impact on source water turbidity.

The exclusion criteria in the treatment objective are:

A water supply system may be permitted to operate without filtration if the following conditions for exclusion of filtration are met, or a timetable to implement filtration has been agreed to by the drinking water officer:

1. Overall inactivation is met using a minimum of two disinfections, providing 4-log reduction of viruses and 3-log reduction of *Cryptosporidium* and *Giardia*.
2. The number of *E. coli* in raw water does not exceed 20/100 mL (or if *E. coli* data are not available less than 100/100 mL of total coliform) in at least 90% of the weekly samples from the previous six months. The treatment target for all water systems is to contain no detectable *E. coli* or fecal coliform per 100 mL. Total coliform objectives are

also zero based on one sample in a 30-day period. For more than one sample in a 30-day period, at least 90% of the samples should have no detectable total coliform bacteria per 100 ml and no sample should have more than 10 total coliform bacteria per 100 ml.

3. Average daily turbidity levels measured at equal intervals (at least every four hours) immediately before the disinfectant is applied are around 1 NTU, but do not exceed 5 NTU for more than two days in a 12-month period.

4. A watershed control program is maintained that minimizes the potential for fecal contamination in the source water. (Health Canada, 2003)

Applying the exclusion of filtration criteria does not mean filtration will never be needed in the future. A consistent supply of good source water quality is critical to the approach, but source quality can change. Therefore, the exclusion of filtration must be supported by continuous assessment of water supply conditions.

Changing source water quality can occur with changes in watershed conditions. Increased threats identified through ongoing assessment and monitoring may necessitate filtration. Maintaining the exclusion condition relies on known current and historic source water conditions, and provides some level of assurance to water suppliers that a filtration system may not be necessary unless the risk of adverse source water quality increases.

It is recommended that dual water treatment (*e.g.* chlorination and UV disinfection) should be applied to all surface water.

This Integrated Watershed Management Plan is a critical component of the watershed control program (item 4 above) that allows the City to maintain its filtration deferral.

2.1.3 Water Licences (Mark Creek, Matthew Creek, St. Mary River)

The City of Kimberley holds nine conditional water licences for drinking water. Of these, five are on Mark Creek: C106612 (dating to June 1920), C106613 (1953), C106849 (1920), C104339 (1992- storage only), and C117316 (1920). The City holds two water licenses on Matthew Creek (C070988, C060503) which serves Marysville, and three on the St. Mary River (C117318, C048939, C020477) for drinking water supply; however, the infrastructure is no longer in place to supply St. Mary River water to the City distribution system. The City's total licensed extraction from Mark Creek is 12,353,659 m³/yr or about 3.4 million litres/day. The storage license is 296,035.2 m³/yr.

Cominco Ltd. held two licences on Mark Creek originating from June 30, 1920 (F13626, F12396) for a total licensed extraction of approximately 22 million litres/day (0.28 m³/second). These licenses were transferred to the City of Kimberley following closure of the Sullivan Mine in 2001. These licensed withdrawals were rarely used to full capacity. Total licensed capacity is approximately 32 million litres per day.

Historical monitoring showed a peak combined water consumption for the City of Kimberley Mark Creek system and Cominco Ltd. of approximately 0.23 m³/second. Historical monitoring for the City of Kimberley alone was approximately 0.10 m³/second. This is consistent with

current demand which averages 0.087 m³/second (7541m³/day) in 2016. Water extraction is generally highest in late summer and if both Kimberley and Marysville withdraw maximum licensed volumes, they would together consume 0.20 m³/second or which is more than twice the low flow volume. However, since low flows are experienced primarily in the winter months when the city's domestic demand is substantially lower, the water supply needs of the licensed users are generally met. Snowmaking at Kimberley Alpine Resort can be a significant water use in winter. The water volume necessary to meet Kimberley Alpine Resort's requirements for snow making is not always available from Mark Creek. When this occurs, Kimberley Alpine Resort is required to reduce their snow making to levels that lower or eliminate their impact on the water supply to meet consumption needs.

Teck's only large connection to the city's water system is now the Drainage Water Treatment Plant off the Matthew Creek supply.

The City of Kimberley normally services the water needs for Marysville from Matthew Creek which lies west of Mark Creek. A new connecting line allows the city to serve Marysville with a full supply of Mark Creek water through a new PRV Station as described in section 2.1.4 below.

2.1.4 Current Water Delivery System

In 1995, the City of Kimberley completed a new intake structure about 1.5 km upstream from the old reservoir. The structure consists of a dam and intake which created a reservoir of approximately 272,000 m³. A new pipeline runs generally south-east from the intake to the chlorination facility located 3.0 km along the Mark Creek pipeline right-of-way. This delivery system then feeds several zones within the City of Kimberley. Water from this system was fed to the Cominco operations. Teck Cominco is no longer connected at the mine site. A new connecting line allows the city to serve Marysville with a full supply of Mark Creek water through a new PRV Station. It is set to activate if the Matthew Creek supply cannot keep up with the demand or if the Matthew Creek system is shut off for any reason. Until 1995 the water delivery system was run primarily by Cominco. The intake is now owned and operated by the City of Kimberley. The current structure of the delivery and distribution system is illustrated in Appendix 9.4.9.

Historically, Cominco operated a water supply system on the St. Mary River to supply water to Cominco's concentrator operation. It consisted of a series of four river pumps followed by additional transfer pumps and could supply 0.25 m³/sec to Cominco operations and all Kimberley zones except the Lois Creek residential area. This system is no longer operational, but demonstrates a feasible option for an alternate City water supply.

2.2 Fish and Aquatic Ecosystems

The watershed area has been divided into five sub-basins and a residual area for analysis of stream processes. A *Reconnaissance-Level Aquatic Biophysical Inventory of Mark Creek* was completed by Gary Norris, (Senior Inventory Technician, BC. Environment Fisheries Branch) in August of 1989. This study focused on fish habitat and indicated the presence of westslope cutthroat trout (*Onchorhynchus clarkii lewisi*, also known as Yellowstone Cutthroat trout) either confirmed or probable in each of the sub-basins. Westslope cutthroat trout are considered a species of special concern by COSEWIC and are listed on the Federal Species at Risk Act

(SARA) registry as a Schedule 1 species of special concern. The reservoir also provides important over-wintering habitat for cutthroat trout that cannot migrate down-stream to the main St. Mary River channel to over-winter.

The section of Mark Creek between the St. Mary River and the new intake contains several waterfalls and man-made modifications. Due to natural and man-made barriers, zinc concentrations, low amounts of good substrate, and low water flow; the potential for salmonid spawning and rearing is rated as poor below the reservoir. Nonetheless, fish are caught in the lower reaches of Mark Creek and recent (2012-2016) improvements to the channel through the City have created additional fish habitat where fish presence has been confirmed.

Upstream of the intake and reservoir, the presence of Westslope Cutthroat Trout has been confirmed in two of the major tributaries and is probable in two others. The fisheries inventory map (see Appendix 9.4.3) indicates the areas of most importance to fish, and the stream widths of the channel reaches. Stream channels were classified by first sampling a number of actual stream widths in the basin, and then correlating known widths with basin area. The relationship indicates that basins of less than 72 hectares tend to have less than 1.5 meter wide (S4) streams, basins between 72 hectares and 1082 hectares have 1.5 - 5.0 meter wide streams (S3), and basins larger than 1082 hectares have streams 5 meter or wider streams (S2). There are no streams over 20 metres wide (S1) in the Mark Creek Watershed. This stream classification methodology was used to determine the stream widths necessary to generate riparian mapping in accordance with former *Forest Practices Code* standards.

Near the midpoint of the main channel in sub-basin 5, lies a low gradient channel containing many inactive beaver dams and a wide floodplain. This area contains extensive sedge and blue-joint grass meadows which are important to moose and amphibians such as the Columbia spotted frog and Coeur d'Alene salamander. A pair of great blue herons is reported to feed here frequently during summer months (Doug Barraclough, personal communication). Side channels through this section of stream may be important rearing areas for westslope cut-throat trout.

2.3 Wildlife and Biological Diversity

2.3.1 Habitats

Several types of habitat are found in the Mark Creek Watershed.

The most sparsely vegetated areas above 2250 metres are typically called Engleman spruce sub-alpine fir parkland below the tree-line and alpine tundra above the tree-line. These subzones are characterized by short grasses such as alpine blue grasses, alpine fescues, sheep fescue, alpine timothy, alpine sedges, lichens and moss, intermixed with patchy and scattered Engleman spruce, sub-alpine fir, whitebark pine and sub-alpine larch below the tree-line. Whitebark pine (*Pinus albicaulis*) is an endangered species as listed in the SARA registry. In general, these forests are not commercially viable. This area at the top of sub-basins 2 and 3 is used by caribou, mountain goat, rock ptarmigan, pikas, hoary marmots, chipmunks, and golden-mantled ground squirrels.

The dry/cool Engelmann spruce/sub-alpine fir upper parkland subzone is located below the ESSF parkland sub-zone in the upper reaches of sub-basins 2, 3, and 4; and is characterized by mature and old whitebark pine and sub-alpine larch, and/or short Engelmann spruce and/or sub-alpine

fir. In general, these forests are on the margin of commercial viability. Soils are generally thin and rocky and vegetation is primarily composed of alpine grasses, sedges and terrestrial lichens. This habitat is important for Clarke's nutcracker, pikas, hoary marmots, grizzly bear, mountain goat, mountain caribou, and golden eagles. Nearly half of this zone is characterized by extensive stands of even-aged lodgepole pine which is in the young to mid-seral stage for this zone. This forest grows slowly due to a short growing season (<90 days) and cool temperatures during the growing season, between June and September.

Below this zone lies the dry/cool Engelmann spruce / sub-alpine fir subzone. Most of the lodgepole pine forest in this sub-zone is approximately 90 years of age as it regenerated after the 1919 wildfire. Sub-basins 1 and 3 contain significant areas of mature and old growth spruce and balsam with minor components of western larch and interior Douglas-fir (sub-basin 1). The dominant shrubs are false azalea and white flowered rhododendron, while the dominant forbs are black huckleberry, black grouseberry, meadow rue, low bilberry and arnica. The spruce/balsam forests provide important habitat for interior dependent species of birds and mammals such as goshawks, crossbills, grosbeaks, red squirrels, pine marten, and red-backed voles. Historically, it provided important feeding and bedding sites for caribou (year-round), however Caribou have been absent from the Mark Creek Watershed since 2005. Caribou were unsuccessfully reintroduced to the Mark Creek Watershed in 2012. The Ministry of Environment is exploring a second reintroduction in the future. Elk use the area during summer and fall months. Avalanche chutes in this zone provide important feeding sites for grizzly and black bear.

The dry/cool montane spruce subzone, is located below 1600 metres, contains forests of lodgepole pine, Engelmann spruce and/or sub-alpine fir, and mixed species forests. It also contains low gradient streams, wetland habitat, and extensive riparian zones. This riparian habitat contains the broadest array of deciduous and shrub vegetation as well as aquatic plants. This unit is used by bears, ungulates, small mammals and fur-bearers and is generally considered to support the widest diversity of plant and animal species along with important fish habitat. This area is also the most important for cavity nesting and other birds, and provides some winter range for moose.

Table 2a. Crown Forested Area by Biogeoclimatic Subzones and Seral Stage (Including Alpine Forest and NP Forest). 1999

Natural Disturbance Type	Biogeoclimatic Unit	Current Early Seral (0-40 Yrs)	Mid Seral (>40 and ≤ 100 yrs for MS, >40 and ≤ 120 yrs for ESSF)	Current Mature (>100 Years for MS, > 120 Years for ESSF and < 140 yrs)	Current Old (>140 Years)	Total All Seral Stages
NDT 3	MSdk ha	8.5	846.3	0	186.2	1,041.0
NDT 3	ESSFdk ha	20.4	3,632.1	162.9	2341	6,156.4
NDT 5	ESSFdkp ha	32.5	702.9	34.9	639	1,409.3
Total Crown Forested Area	All	61.4	5,181.3	197.8	3,166.2	8,606.7

Table 2. Crown Forested Area by Biogeoclimatic Subzones and Seral Stage (Including Alpine Forest and NP Forest) 2017

Natural Disturbance Type	Biogeoclimatic Unit	Current Early Seral (0-40 Yrs)	Mid Seral (>40 and ≤ 100 yrs for MS, >40 and ≤ 120 yrs for ESSF)	Current Mature (>100 Years for MS, > 120 Years for ESSF and < 140 yrs)	Current Old (>140 Years)	Total All Seral Stages
NDT 3	MSdk ha	462.6	826.8	86	252.7	1628.1
NDT 3	ESSFdk ha	1742.8	3077	25.7	1739.1	6584.6
NDT 5	ESSFdkp ha	0	0	0	.02	.02
Total Crown Forested Area	All	462.6	3903.8	111.7	1991.82	8212.72

Biophysical wildlife capability mapping has been carried out over a number of years by BC Environment (this function now resides with MoFLNRO). Ungulate biophysical mapping has been completed for a portion of this area. The Mark Creek Watershed provides important summer and fall range for elk, moose and deer. Moderate winter range potential for moose exists along the wetland complexes of the main channel in sub-basin 5.

Only a fraction of each biogeoclimatic unit has reached climatic climax vegetation due to periodic natural disturbances, the most recent of which is the massive wildfire of 1919.

2.3.2 Wildlife Tenures

A trapline has been continuously operated in the Mark Creek Watershed since 1926, partly to control beaver populations. No guide-outfitting territory has been allocated in the Mark Creek watershed.

2.3.3 Wildlife Use

Wildlife populations in the Mark Creek Watershed are not high for most species due to the limited abundance of key habitat types. With recent harvest activity, species that require early seral habitat will find larger amounts of suitable habitat within the watershed. Key mammal, bird and amphibian species that may be present in the watershed are outlined in Table 4.

Table 3. Key Wildlife Species Likely to Be Present in The Mark Creek Watershed.

	Endangered and/or Threatened Species	Sensitive and/or Vulnerable Species	Management Emphasis Species	General Management Species
Mammals				
	mountain caribou	grizzly bear	moose	Nb: Many other species and fauna are present in the Mark Creek Watershed which are not specifically identified as endangered, sensitive, or management emphasis species.
	badger	wolverine	elk	
		western long-eared myotis (bat)	white tail deer	
		townsend's myotis (bat)	mule deer	
			mountain goat	
			beaver	
			marten	
			mink	
			weasel	
			northern flying squirrel	
			ermine	
			cougar	
			bobcat	
			lynx	
			timber wolf	
			coyote	
			red fox	
			black bear	
Birds				
	Lewis' woodpecker	screech owl	northern goshawk	
		turkey vulture	great grey owl	
			grouse including ptarmigan	
			all raptors	
			western and mountain bluebirds	
			cavity nesting birds	
			waterfowl	
Amphibians				
	Coeur d'Alene salamander	western toad	long -toed salamander	
			skinks	
Plants				
	spurless touch-me-not			
	whitebark Pine			Nb: Whitebark Pine is ranked as "vulnerable" in BC, although it was identified as "endangered" by COSEWIC in April 2010 and is listed on the federal SARA registry as endangered.

2.4a Recreation

An Assessment of Risk Posed to Drinking Water From Recreational Activities was undertaken by the Mark Creek IWMP Implementation Committee in June 2003.

The City of Kimberley is opposed to recreation in the Mark Creek Community Watershed. This position was reinforced as recently as June 24, 2013 in two resolutions by City Council:

“That the City support the recommendation by the Mark/Matthew Creek Watershed Advisory Committee to not support any recreation in the Mark Creek watershed and not support any application for tenure in the watershed.”

Carried.

Furthermore that

“That the City of Kimberley send a letter to the Ministry of Forests, Land and Natural Resource Operations, stating that the City does not support recreation in the watershed.”

2.4b Visual Quality

Ministry of Forests’ visual landscape inventory updates were conducted in 1996. Visual Quality Objectives (VQO’s) were legally established by the District Manager in 2003.

The Mark Creek Watershed forms a significant visual backdrop for the Kimberley Alpine Resort, the City of Kimberley and traffic along Highway 95A. A visual landscape inventory was conducted in 1996 and took into account the proposed ski hill expansion to the north of the existing development. Approximately 40% of the watershed area is visible from the two viewpoints depicted in Appendix 9.4.4. The majority of these visible areas have a Visual Sensitivity Class of 2, meaning they are visually sensitive to alteration and important to viewers. Visual Quality Objectives for portions of the watershed were established by the District Manager in 2003.

2.5 Access

As stated earlier, access development in the watershed commenced approximately in the 1920’s along with mineral exploration and mine development. One road to the Mark/Matthew Creek ridge was constructed in 1985 as part of the fire control effort for the Matthew Creek fire. The City of Kimberley constructed a road to the current reservoir location in 1994-1995.

Appendix 9.2 depicts the current distribution of roads to and within the basin. Access via Teck’s private land is currently controlled by a locked gate situated below the watershed area on Teck’s private land. Access on the Mark Creek FSR through Low Pass is currently controlled by BCTS’s legal locked gate under Section 22.2 of FRPA and signed under Section 6.2 and 6.3 of the Forest Service Road Regulation.

Prior to 2003, there were 77 km of road within the watershed. As of January 2017, there were 52.4 kms of active Forest Service Road under the responsibility of BCTS of which 7.8 kms have been deactivated or rehabilitated and revegetated, 3.6 kms under road permit to Canfor, 0.7 kms under road permit to other licensees and 56.6 kms of non-status road, totaling 113.3 kms of road

within the Mark Creek watershed. Non-status roads are old Cominco/Teck mining/exploration roads built on Crown land under the *Mines Act* which remain in various conditions from 4x4 access to no access due to natural revegetation. Many of the non-status roads are being used by ATV users to access the watershed in various locations. Non-status roads also include roads held under road permit by BCTS licensees, now deactivated. Of the above roads, a total of 56.5 km has been deactivated and revegetated. A total of 4.5 km has been rehabilitated and revegetated.

Definitions of deactivation and rehabilitation are as follows:

- **Deactivation:** barricading of road where necessary to prevent access by motor vehicles, other than all-terrain vehicles; removal of all stream crossing structures; and stabilization of road prism to reduce likelihood of an adverse effect to natural resources. Measures include cross-ditching, water-bars, insloping, outsloping and other measures.
- **Rehabilitation:** restoration of site productivity by de-compacting compacted soils; returning displaced surface soils, retrievable side-cast and berm materials onto the area occupied by the road (recontouring); ensuring hydrologic stability; and either placing woody debris on the exposed soils, or revegetating the exposed mineral soils.

The valley corridor running north / south through the drainage is currently roaded. In addition, the Mark Creek basin contains two passes to the west, one subtle pass to the north and one pass to the east. Roads are built through the western passes but the north pass is not currently roaded. The Matthew Creek drainage, located immediately west of Mark Creek, has significant road access which links to the Mark Creek road network. Buhl Creek to the north has significant road access developed to within about five kilometers of Mark Creek and Lost Dog Creek to the east also has significant road access developed to within 300 m of the watershed.

Development of the Canfor road network to the east in the Houle and Kimberley Creek drainages has placed significant access pressure on the Mark Creek watershed. The City of Kimberley is working with Canfor and Teck to deactivate roads and remove bridges that provide access to the height of land along the eastern boundary of the Mark Creek watershed. This is in keeping with Kimberley City Council's June 24, 2013 resolution: "That the City of Kimberley work with Teck and Canfor to deactivate road access at key locations." The Watershed Advisory Committee works with BCTS to ensure cutblocks are not located along the height of land to the east, in order to prevent unplanned access to the watershed.

2.6 Cultural Heritage

An archaeological overview project was commissioned by the Ministry of Forests in 1996.

Archaeological potential was mapped by Wayne Choquette, archaeologist for the Ktunaxa/Kinbasket Tribal Council, at a scale of 1:20,000. The overview found that approximately 10% of the Mark Creek IWMP area, located generally in the Mark Creek pass area and adjacent to riparian areas, contained moderate to high archaeological potential.

Archaeological Impact Assessments conducted prior to forestry operations identified a single location within the Mark Creek watershed yielding tourmalinite reduction flakes associated with tool making. There are no known bedrock tourmalinite sources in the drainage area above the reservoir

Archaeological sites are protected under the Cultural Heritage Act. Currently BCTS completes an Archaeological Impact Assessment when a block or road is planned within or immediately adjacent to a Moderate or High AOA Polygon. Under FRPA there is an Objective to ensure Cultural Values other than Archaeological Sites are protected. Values such as Traditional Use areas and values post 1847 are managed under the provisions in the FSP. Data from archaeological assessments are retained on file by BCTS and the City of Kimberley.

2.7 Minerals and Energy

2.7.1 Mineral Potential

Potential for the discovery of mineralization in the Mark Creek area has been studied extensively by prospectors, exploration companies and government geological surveys from as far back as the latter half of the 1800's. In recent times this search has taken on new significance with the closure of the Sullivan Mine on December 21, 2001. For example, Cominco undertook a deep drilling program within the watershed in the 1990's in an attempt to locate a fault-displaced portion of the Sullivan ore body. Overall, the mineral potential is high, as evidenced by the existence of the Sullivan Mine (lead, zinc, silver, and lesser amounts of tin, copper, gold and iron) and other mineral occurrences in the immediate area. The Sullivan mine was in production for over 90 years, and was the origin of the community of Kimberley.

Aldridge Formation strata host the Sullivan deposit, occur throughout Mark Creek watershed and have been thoroughly been explored. Creston Formation strata overlie Aldridge and are observed at higher elevations to the north. The equivalent to the Creston Formation in the USA is called the Ravalli Group, that comprises the Burke (lowest), Revett and St. Regis formations. Revett (sometimes called "Spar Lake") copper deposits near Troy, Montana occur in the Revett Formation. Revett Formation in Canada is called informally "middle" Creston Formation. There are no middle Creston strata in the Mark Creek watershed.

Cominco carried out several extensive exploration programs in the Mark Creek watershed area from the 1920s until 1998. The work consisted of prospecting, geological mapping, geophysics, soil geochemistry and diamond drilling. The main objective of this work was to locate the faulted offset of Sullivan north of the Kimberley Fault, something that had been recognized since the 1920s. By 1998 Cominco determined that any mineralization where the displaced mineralization was projected was too deep and hot to mine. Stikine Gold Corporation optioned the Cominco claims north of the Kimberley Fault and finally discovered the faulted continuation of the Sullivan deposit. Between 2004 and 2007 Stikine drilled 3 deep (2766, 2460 and 2696 metres long) holes and intersected mineralized intervals of the Sullivan ore horizon 7.0, 0.8 and 0.5 metres thick respectively. The mineralization was predominantly pyrrhotite (iron sulphide) with no significant zinc, lead or silver (30 to 50 metres of mineralization with over 20% lead + zinc would be needed to consider for possible mining). That the ore horizon thins to the north and is unlikely to be any shallower in the watershed has essentially sterilized any further exploration of this target.

The locations of the three drill holes developed by Stikine are called SD-1, SD-2 and SD-3. They are located in the central portion of the watershed all on the west side of the creek. The first site SD-1, is located in the lower portion of Sub-basin 2, just upstream of sample site 9, near the confluence with the mainstem. This site was previously investigated by Cominco. SD-2 is

located on a bench above the wetlands at the boundary of the divide between sub-basins 2 and 3, also near the mainstem of the creek. The site is on the uphill side of the road. SD-3 is located on a ridge, almost due north of SD-2, in sub-basin 3. The spur road which accesses the drilling location has been decommissioned.

One other company has done diamond drilling in the Mark Creek watershed. In the 1950s Western Mining Company drilled about 8 short holes in the north and northeast forks of Mark Creek, north of Cominco claims. This drilling was in strata shallower than that explored by Cominco and Stikine and further reduces, but does not eliminate, the likelihood of mineralization being discovered in the watershed.

Mineral potential maps have been prepared for parts of Southeast BC by the provincial government. These are consensus-based with input from various government and industry experts and are intended for background information for government planning purposes and for mining companies contemplating exploration programs. These studies are intended for evaluating areas with little or no hard exploration work. The watershed is relatively well explored and the value of the vintage mineral potential study is academic.

2.7.2 Energy Potential

The potential for discovery of oil and natural gas is considered low by the Ministry of Mines, due to the geological history of the area.

The Mark Creek stream channel has limited potential for minor small scale hydro-electric development but may not be at an economic scale. No plans or interest in hydro-electric development have been received to date. The City of Kimberley has installed micro-hydro generation at the Mark Creek dam to generate chlorine on-site for disinfection of drinking water.

Geothermal gradients of about 28 to 29 °C per km obtained in the deep drilling programs in Mark Creek valley are of interest but insufficient to drive serious electrical power generation where 50 °C per km is standard. The existing geothermal gradient is of sufficient interest, however, that a niche operation of some sort might be possible with subsidy providing a proxy profit.

2.7.3 Mineral Tenures

Approximately 70% of the Mark Creek Watershed area is covered by valid mineral tenures, including many Crown Grants. Crown Grants are held in fee simple, while holders of other mineral tenures are required to carry out assessment work to keep their tenures in good standing. Teck holds all the current tenures within the basin. Appendix 9.4.6 indicates the extent and location of mineral tenures in the watershed.

Many of the roads constructed in the basin were developed as part of the exploration activities.

2.8 Forests and Timber

Updated inventory pending

The forests and timber values in the Mark Creek Watershed were re-inventoried by the Ministry of Forests in 1991 to 1992. Forest measurements using aerial photography, estimates from helicopter flights and ground measurements were carried out in 1964, 1979 and 1991.

Approximately 65 data sources were used to generate the forest and timber estimates for Mark Creek. It should be noted however that the volume estimate resulting from the measured forest parameters are designed to be statistically valid on an entire timber supply area. The estimates would be less reliable on a sub-unit of the timber supply area, such as the Mark Creek drainage. The Mark Creek watershed is 9530 hectares. When private land, roads, water bodies, alpine and non-productive forest are excluded, 7250 ha of Crown forested land remains. When the following netdowns are applied: non-commercial cover, inoperable areas, environmentally sensitive areas, low productivity sites, deciduous types, non-merchantable forest types, existing roads, trails and landing, not satisfactorily restocked areas, and areas within the Engelmann spruce/sub-alpine fir upper and parkland biogeoclimatic variants; the Crown forested landbase that is suitable and available for harvesting is 5284 hectares. Table 6 contains the details of this netdown process using the 1995 Cranbrook Forest District Timber Supply Review (TSR-I) sequential netdown logic.

Table 4. Summary of Mark Creek Timber Resource (1999)

	Classification	Area in Ha	% of Total
Total Area	Mark Creek Community Watershed	9538	100.1***
	Private Land	82	0.9
	Water bodies	95	1.0
	Rock, clearings etc.	169	1.8
	Alpine and Brush	513	5.4
	Alpine Forest and Non-Productive Forest.	1294	13.6
	Crown Forest	7385	77.4
Crown Forest Area*	Total Crown Forest	7385	100.1***
	Age 0-20	0	0.0
	Age 21-40	41	0.6
	Age 41-60	823	11.1
	Age 61-80	3292	44.6
	Age 81-100	125	1.7
	Age 101-120	36	0.5
	Age 121-140	163	2.2
	Age 141-250	2811	38.1
	Age >250	94	1.3
Crown Forest Area*	Total Crown Forest	7385	100.1***
	lodgepole pine dominated	5700	77.2
	Engelmann spruce, sub-alpine fir and whitebark pine dominated	1521	20.6
	Douglas-fir, western larch dominated	159	2.2
	Other	5	0.1
TSR I Net Timber Harvesting Landbase (net of NCC, inoperable, ESA reductions, low sites, deciduous types, non-merchantable forest types, existing roads, trails and landings, NSR, and ESSF Parkland areas) **	TSR I Net Timber Harvesting Land Base	5193**	

continued on next page

Table 4: Summary of Mark Creek Forest and Timber Resource (continued)

	Classification	Area in Ha or Volume in cubic metres	% of Total
TSR I Net Timber Harvesting Landbase**	Area (hectares)	5193**	99.9***
	Age 0-20	0	0.0
	Age 21-40	4	0.1
	Age 41-60	251	4.8
	Age 61-80	2181	42.0
	Age 81-100	121	2.3
	Age 101-120	15	0.3
	Age 121-140	78	1.5
	Age 141-250	2474	47.6
	Age >250	69	1.3
TSR I Net Timber Harvesting Landbase**	Area (hectares)	5193**	99.9***
	Site Index <2.5 m at Breast Height Age 50	0	0.0
	Site Index 2.5-7.4	69	1.3
	Site Index 7.5-12.4	719	13.8
	Site Index 12.5-17.4	3000	57.8
	Site Index 17.5-22.4	1363	26.2
	Site Index 22.5-27.4	42	0.8
TSR I Net Timber Harvesting Landbase**	Area (hectares)	5193**	100.0
	Primarily lodgepole pine stands	4272	82.3
	Primarily spruce/balsam stands	766	14.8
	Primarily Douglas-fir/larch stands	153	2.9
	Other Stands	2	0.0
TSR I Net Timber Harvesting Landbase**	Net Merchantable Volume	1,140,775m ³	100.0
	Primarily lodgepole pine stands	914,868	80.2
	Primarily spruce/balsam stands	217,899	19.1
	Primarily Douglas-fir/larch stands	7,854	0.7
	Other stands	154	0.0
TSR I Net Timber Harvesting Landbase**	Average annual productivity (average of natural and managed stands)	11,330m ³ /yr	99.9***
	Primarily lodgepole pine stands	9,499m ³ /yr	83.8
	Primarily spruce/balsam stands	1,522m ³ /yr	13.4
	Primarily Douglas-fir/larch stands	309m ³ /yr	2.7
	Other stands	0m ³ /yr	0.0

*Crown Forest Area includes all land that has continuous forest cover and excludes alpine forest and non-productive forest types.

**TSR I net timber harvesting landbase is the Crown forested landbase available for timber harvesting but does not yet exclude riparian reserve zones, wildlife tree patches, caribou management areas, and other forms of reserved lands. An additional portion of this net timber harvesting landbase is further constrained by other resource management requirements and only partially contributes to timber supply.

*** The sum of the categories may in some cases add to 99.9%, or 100.1% due to arithmetic rounding.

Table 5. Summary of Mark Creek Timber Resource (updated to 2014; 2017 numbers to be added at later date)

	Classification	Area in Ha	% of Total
Total Area	Mark Creek Community Watershed	9530	100.0 %
	City Land	77	0.8%
	Water bodies	99	1.0%
	Rock, clearings etc.	142	1.5%
	Alpine, non-vegetated	506	5.3%
	Alpine Forest and Non-Productive Forest.	1456	15.3%
	Crown Forest	7250	76.1%
Crown Forest Area*	Total Crown Forest	7250	100.0 %
	Age 0-20	253	3.5%
	Age 21-40	22	0.3%
	Age 41-60	45	0.6%
	Age 61-80	816	11.3%
	Age 81-100	3290	45.4%
	Age 101-120	174	2.4%
	Age 121-140	198	2.7%
	Age 141-250	2403	33.1%
	Age >250	48	0.7%
Crown Forest Area*	Total Crown Forest	7250	100.0
	lodgepole pine dominated	5284	72.9%
	Engelmann spruce, sub-alpine fir and whitebark pine dominated	1683	23.2%
	Douglas-fir, western larch dominated	280	3.9%
	Deciduous dominated	3	0.0%

* Crown Forest Area includes all land that has continuous forest cover and excludes alpine forest and non-productive forest types.

Appendix 9.4.7 graphically depicts the age class distribution of the forest stands in the Mark Creek watershed. All the Crown land portion of the basin has been assigned to BC Timber Sales as an operating area. This program is managed directly by the Ministry of Forests Lands and Natural Resource Operations. Road construction is done by contractors under daily supervision by BCTS officials or trained designates and timber sales are dispensed through competitive bid, sealed tenders from qualified applicants. Deposits are held for each timber sale to ensure compliance, and BC Timber Sales can take over obligations not completed by licensees.

2.9 Forage

Due to the forested character of the basin, and the extent of the post-fire lodgepole pine stands, most of the forage potential lies in the alpine, although this is changing with recent harvesting. Ungulate populations are increasing in the watershed as forage increases. Wetland and riparian vegetation and understory browse complement the high elevation summer forage with spring and fall browse for wildlife.

3.0 Issues and Interests

3.1 Land Use Direction from Higher Level Plans

Following the work of the Commission on Resources and Environment in 1994-1995, the BC Government announced the East Kootenay Land Use Plan in March 1995. This plan placed the Mark Creek Watershed and surrounding area into a zone to be managed for integrated resource management. This zone is intended to:

"provide for a broad range of resource use and recreation activities. In some areas within the zone, where sensitive values are minimal, resource development will be managed intensively with the goal of substantially increased production. In other areas where sensitive values are higher resource development will be managed in a way that respects those values."

The plan further lays out the following broad management objectives which apply to this zone:

- "Sustainable timber harvesting and related forestry, mineral and other sub-surface resource exploration and development, and sustainable cattle grazing will proceed".
- "Tourism, recreation (motorized and non-motorized), guide-outfitting, trapping, hunting, fishing and agro-forestry will proceed".
- "Government regulations and standards - including BC's *Forest Practices Code of British Columbia Act* - apply to all resource activities in the zones."
- "Resource development, and the sites on which it occurs, will be locally guided in a manner which respects sensitive values."

The Kootenay Boundary Land Use Plan (March 1995) also makes commitments regarding safeguarding of watersheds, stating:

- "This plan recognizes the importance of safeguarding water supplies for communities and residents of the region. Community watershed guidelines from the *Forest Practices Code of British Columbia Act* will be applied to protect domestic watersheds, including the requirement to complete watershed assessments on all community and high value fishery watersheds. Management guidelines for proposed development will be tied to the results of these assessments. (Note: the FPCBC Act has been replaced by the Forest and Range Practices Act. Under FRPA a hydrological assessment is required for community watersheds).
- "Licensed water users will be considered stakeholders in public planning and management processes involving watersheds. Watershed restoration will be undertaken on a priority basis across the region through Forest Renewal BC." (Note: FRBC no longer exists; until 2010, funding was available under the Forest Investment Account, now the Land Based Investment Program of Ministry of Forests, Lands and Natural Resource Operations).

The Kootenay Boundary Land Use Plan Implementation Strategy (June 1997) provides objectives and guidelines for caribou, grizzly bear, biodiversity, regional connectivity, ungulate management, visual quality, backcountry recreation and other values. These were considered in the development of the management guidelines in Chapter 4. Higher level plan objectives were

established under the Kootenay Boundary Higher Level Plan Order which was approved in October 2002. The caribou objectives are:

Biogeoclimatic Unit	Forest Cover and Forest Practice Requirements
Subalpine Parkland	No timber harvesting
ESSF – above Caribou Line (as shown in Map 3.1) and below subalpine parkland	Maintain a minimum 70% of the forested area in age class 8 or older forests. Forested areas exclude the forest cover inventory labels alpine and alpine forest.
ESSF – below Caribou Line (as shown in Map 3.1)	Maintain 30% of the forested area in age class 8 or older. At least one-third of this 30% is to be age class 9. On an additional 20% (minimum) of the area, employ partial cutting prescriptions which maintain suitable caribou habitat attributes

The Cranbrook West Recreation Management Strategy includes the Mark Creek Watershed, although it remains a policy plan that represents best management practices. At the time the CWRMS was being developed, the City of Kimberley submitted a formal letter to the CWRMS team and the Minister reinforcing its position of no recreation in the Mark Creek Community Watershed.

3.2 Recommendations From The Commission On Resources And Environment

The Commission on Resources and Environment also had a number of goals and recommendations regarding "domestic" (community) watersheds.

- "to protect domestic watersheds"
- "to maintain water quality, quantity and timing of flow"
- "to restore watersheds damaged by past development"
- "to ensure full public participation in water decisions, including involvement in the development of water policy, standards and regulations"
- "to eliminate the need for treatment of water supplies as a result of development activities"
- "to ensure accountability and assignment of liability for damage to consumptive use watersheds"
- "For all consumptive use watersheds, determination of an appropriate level of management by a joint stakeholder committee based upon a watershed sensitivity and risk assessment."
- "legislation should be enacted to protect and monitor the water quality, quantity and timing of flow for present and potential uses (and for high value fishery watersheds) for both surface and subsurface waters".
- "in watersheds deemed appropriate for development, a contingency plan within provincial guidelines agreed to by licensed water users, development proponents and responsible ministries should be in place before any development permits are issued".
- "progress on domestic watershed planning in the region be reinforced and enhanced by various means, consistent with the requirements of the *Forest Practices Code of British Columbia Act* and community watershed guidelines"
- "watershed research and restoration projects be developed and implemented by accessing funding sources such as Forest Renewal BC."

Under the *Forest & Range Practices Act*, the [Government Actions Regulation](#) (GAR) directs how the B.C. provincial government establishes land designations or stewardship measures for forest and range values.

Types of decisions supported by the GAR:

- Decisions about categories of species, including
 - Species at risk
 - Regionally important wildlife
 - Ungulates
- Decisions that trigger practice requirements for protection of
 - Wildlife
 - Natural resource features
 - Wildlife habitat features
 - Temperature sensitive streams
- Land use decisions for managing, protecting or designating
 - Wildlife habitat areas
 - Ungulate winter ranges
 - Community watersheds
 - Fisheries sensitive watersheds
 - Lakeshore management zones
 - Scenic areas

The following orders exist for the Mark Creek Watershed.

U-4-013 Caribou – No harvest zone

http://www.env.gov.bc.ca/wld/documents/uwr/u-4-013_order_09Dec09.pdf

U-4-006 Moose, Deer, Elk, Bighorn Sheep, Mtn Goat – Conditional harvest

http://www.env.gov.bc.ca/wld/documents/uwr/uwr_u4_006.pdf

WHA 4-045 Data Sensitive – No harvest Zone

<http://www.env.gov.bc.ca/wld/frpa/iwms/wha.html>

3.3 Local Resource Interests and Issues

A review of issues, concerns and interests was prepared as part of the terms-of-reference for this plan. An open house session was conducted on February 23, 1989 and public and agency interests identified at the open house have been added to the Terms of Reference (see Appendix 9.5.1). A second open house and public meeting was held on June 18, 1997 to solicit public input on the draft Mark Creek IWMP and the results from this open house can be found in Appendix 9.5.14. This plan is intended to address issues and interests within the scope of the terms of reference.

As a result of public input, representatives of Friends of the Watershed and Wildsight were invited to participate as members of the Mark Creek Watershed Advisory Committee.

3.4 Interior Watershed Assessment Procedure

Watershed assessment in the Mark Creek watershed has been guided by the provisions of both the Community Watershed Guidebook and the Interior Watershed Assessment Guidebook. The following procedure reflects the guidance from these publications, and is deemed to be an interim step until the forthcoming new ABCFP/APEG guidelines for professional Practice in watershed assessment (forecast for publication in late 2017).

Terrain and erosion hazard mapping has been completed. An interior watershed assessment (Level 1) was completed by Apex Geoscience in June 2001 in accordance with the *Interior Watershed Assessment Procedure Guidebook (September 1995)* (see Appendix 9.5.3 and Appendix 9.5.4). This initial "IWAP" has subsequently been periodically updated to reflect changed circumstances and plans. The findings and recommendations from the original IWAP for each sub-basin of Mark Creek are summarized below. An updated provincial hydrological assessment procedure is expected in the next year. The location of the sub-basins are delineated on most of the maps in Appendix 9.4 of this plan.

Sub-basin 1

1. Initiate an assessment of sediment sources (refer to Moore, 1994).
2. Do not allow additional harvesting above and around sensitive soils.
3. Rehabilitate roads near streams, and avoid construction of more roads on sensitive soils or adjacent to riparian management areas.
4. Minimize additional stream crossings.
5. Future proposed development should be limited in sub-basin 1 to less than 20 percent equivalent clearcut area (ECA) and disturbances to the riparian area should be avoided to minimize the potential for channel impacts.
6. A detailed site assessment is required on any potentially unstable slope.

Sub-basin 2

1. There are no harvesting or equivalent clear-cut area (ECA) implications.
2. A detailed site assessment is required on any potentially unstable slope.

Sub-basin 3

1. There are no harvesting or equivalent clear-cut area (ECA) implications.
2. A detailed site assessment is required on any potentially unstable slope.

Sub-basin 4

1. There are no harvesting or equivalent clear-cut area (ECA) implications.
2. A detailed site assessment is required on any potentially unstable slope.

Sub-basin 5

1. There are no harvesting or equivalent clear-cut area (ECA) implications.
2. A detailed site assessment is required on any potentially unstable slope.

Residual Area

1. Initiate an assessment of sediment sources (refer to Moore, 1994).
2. Do not allow additional harvesting above and around sensitive soils.

3. Rehabilitate roads near streams, and avoid construction of more roads on sensitive soils or adjacent to riparian management areas.
4. Minimize additional stream crossings.
5. There are no harvesting or equivalent clear-cut area (ECA) implications.
6. A detailed site assessment is required on any potentially unstable slope.

This initial information has been updated by more current reports. These include the following documents prepared by Streamworks Unlimited (*a.k.a* Streamworks Consulting - Al Bates, P.Eng., Water Resource Engineer) as outlined in the table below. A summary of actions taken by BCTS in response to the recommendations within each report is shown in the right-hand column:

Table 6. Summary of IWAP studies and updates and recommendations arising from each

Report	Recommendations	Actions Taken By BCTS
Mark Creek Watershed Assessment Update, Streamworks Unlimited, July 2005	<ol style="list-style-type: none"> 1. Ensure that all road construction and forest harvesting maintain natural drainage and near-surface drainage patterns, and avoid concentrating and/or diverting surface runoff, especially when working above areas mapped as potentially unstable. 2. Institute routine annual and/or post-runoff event inspections of drainage structures to ensure proper and continued function. 3. Address all “High” and “Moderate” priority sites identified in Table 3 (of 2005 report). Consider addressing “Low” priority sites as routine maintenance, or undertake if road improvements and/or other works are scheduled in the vicinity. 4. During block layout, identify classify and map any permanent or ephemeral defined channels. Apply riparian buffers according to the Best Management Practices for Riparian Management Zones in the Interior and the Community Watershed Guidebook. 	<ol style="list-style-type: none"> 1. All BCTS road construction designed to meet these requirements. 2. Scheduled annual inspection of all roads. 3. Complete 4. Layout and Site Plans address all identified streams, as required by the BC Timber Sales Forest Stewardship Plan.
Letter to Sandi Best Re: Mark Creek Community Watershed 2001-2005 Forest Development Plan –	<ol style="list-style-type: none"> 1. No concerns identified with proposed development. 	

Amendment # 1 (Streamworks Unlimited, July 14, 2006)		
Letter to Al Pollard Re: Proposed Harvesting in Mark Creek Community Watershed (Streamworks Unlimited, September 28, 2007)	<ol style="list-style-type: none"> 1. Management practices aimed at protecting small channels as described in the Forest Stewardship Plan for BC Timber Sales in the Rocky Mountain Forest District (September 15, 2006) should be followed in all cases where defined channels are identified during block layout. 2. Non-pine species and existing understory vegetation should be maintained to the extent possible in the vicinity of any creeks. 3. If block G071-D(P20) encompasses or lies above any steep terrain along the creek, this should be reviewed by a terrain stability specialist. Site drainage, including skid trails within the block, should be directed away from the steeper areas and the creek. 4. Existing resource roads (ATV access) in subbasin 1 that will not be upgraded as part of the current harvest plan, should be reviewed for potential drainage problems and/or instabilities and appropriately deactivated. 	<ol style="list-style-type: none"> 1. Layout and Site Plans address all identified streams, as required by the BC Timber Sales Forest Stewardship Plan. 2. Riparian reserves of 2 tree lengths utilized on all streams. 3. Block Site Plan for TSL A83083 Block 2 (formerly P20) consistent with recommendations. 4. All BCTS roads complete
Letter to Al Pollard Re: Proposed Harvesting/Salvage in Mark Creek Community Watershed (Streamworks Unlimited, August 1, 2008)	<ol style="list-style-type: none"> 1. In Block A84236 (4), disturbance to the channel should be minimized through construction of a temporary skid trail crossing, used during the winter or dry season, and removed prior to freshet. If more permanent installations are required, a terrain stability specialist should be consulted for roads and structures on slopes >40%. 2. In Block A84235(3), extra care should be taken to ensure natural (dispersed) drainage conditions are 	<ol style="list-style-type: none"> 1. Block Site Plan for TSL A84236 Block 4 consistent with recommendations. 2. Block Site Plan for TSL A84235 Block 3 consistent with recommendations. 3. Layout and Site Plans address all identified streams, as required by the BC Timber Sales Forest Stewardship Plan. 4. Review complete

	<p>maintained. This may involve flagging watercourse routes during spring runoff to ensure they are properly considered during harvest operations.</p> <ol style="list-style-type: none"> 3. Management practices a Management practices aimed at protecting small channels as described in the Forest Stewardship Plan for BC Timber Sales in the Rocky Mountain Forest District (September 15, 2006) should be followed in all cases where defined channels are identified during block layout. 4. If upgrades are not planned, unused (old mining) roads in the watershed should be assessed for potential issues and deactivated where necessary. 	
<p>Letter to Al Pollard Re: Proposed Development in Mark Creek Community Watershed (Streamworks Unlimited, August 14, 2009)</p>	<ol style="list-style-type: none"> 1. Conditions in the watershed should be monitored into the future in anticipation of MPB related mortality. 2. Non-pine stands, especially in sub-basins 2 and 3, should be maintained as healthy canopy cover to maintain watershed resource sustainability and avoid compounding the problem of potential MPB associated mortality. 3. Where the access road to Cutting Permit A84728 is in close proximity to the creek, improvements to road width would avoid further encroachment on the channel. 4. A new creek crossing required to access proposed blocks G71-1314 and 1315 should be upgraded to a larger more stable structure (old log culvert to be removed). 	<ol style="list-style-type: none"> 1. Annual hydrologic review of watershed has taken place since 2005. 2. Harvesting plans continue to target lodgepole pine. 3. Complete 4. Complete

Letter to George Edney Re: Hydrological Review of the Mark Creek Community Watershed (Streamworks Unlimited, December 15, 2010)	<ol style="list-style-type: none"> 1. Conditions in the watershed should be monitored into the future in anticipation of MPB related mortality. 2. Non-pine stands, especially in sub-basins 2 and 3, should be maintained as healthy canopy cover to maintain watershed resource sustainability and avoid compounding the problem of potential MPB associated mortality. 3. Further harvesting in Sub-basin 1 should be deferred until some hydrological recovery of existing blocks has been achieved and/or the threat of widespread beetle infestation has diminished. 	<ol style="list-style-type: none"> 1. Annual hydrologic review of watershed has taken place since 2005. 2. Harvesting plans continue to target lodgepole pine. 3. No new harvesting proposed since 2010 in sub-basin 1.
Letter to George Edney Re: Hydrological Review of the Mark Creek Community Watershed (Streamworks Unlimited, November 30, 2011)	<ol style="list-style-type: none"> 1. Intermittent and poorly defined watercourses identified in several areas currently proposed for harvest and/or road development be afforded a minimal level of protection, mostly by excluding machinery and maintaining non-pine, deciduous and/or juvenile stems in the riparian zone. 	<ol style="list-style-type: none"> 1. Complete as per Site Plans
Letter to Gerry Grady Re: Hydrological Review of the Mark Creek Community Watershed (Streamworks Unlimited, November 10, 2014)	<ol style="list-style-type: none"> 1. Continue to target mature pine stands in low hydrological risk areas such as sub-basin 5 and the Residual Area is a valid approach to beetle management in the watershed. 	<ol style="list-style-type: none"> 1. Harvest plans directed to pine stands in sub-basin 5 and residual area.
Letter to Steve Knowles Re: Hydrological Review of the Mark Creek Community Watershed (Streamworks Unlimited, March 30, 2016)	<ol style="list-style-type: none"> 1. A potential sediment source at an existing culvert above Mark creek near the reservoir may be improved by the addition of more armoring below the culvert outlet, or a half-round corrugated flume to protect the slope below the road. 2. A review by a terrain specialist of a slope failure located above the second crossing is recommended to 	<ol style="list-style-type: none"> 1. Half-culvert flume installed 2016. 2. Review by terrain specialist, 2016. 3. Ground level inspection of Mark Creek from Bridge 2 to reservoir, 2016.

	<p>determine the potential for a connection between harvesting upslope of the failure. If this site is considered to be a significant, chronic source of sediment, some artificial armouring of the toe may be prescribed. The site should be monitored to determine if conditions do deteriorate to the point where action is justified. Seeding and planting may help stabilize the slope.</p> <p>3. A ground level inspection of the Mark Creek channel between the first and second crossings is recommended to determine extent of potential sediment sources and relative stability of the current channel situation.</p>	
Letter to Steve Knowles Re: Hydrological Update of the Mark Creek Community Watershed (Streamworks Unlimited, June 15, 2016)	1. Periodic monitoring of slide above second crossing is required.	1. Ongoing monitoring.
Letter to Steve Knowles Re: Proposed Harvest in the Mark Creek Community Watershed (Streamworks Unlimited, October 25, 2016)	1. None.	

3.5 Resource Management Zone Objectives

The Mark Creek Watershed occupies a portion of Landscape Unit C08 which is designated as an intermediate biodiversity resource management zone under the Kootenay Boundary Higher Level Plan Order. The Order sets out the percentage of forest area in each BEC Unit within LU C08 to be maintained as old forest.

4.0 Resource Management Objectives, Strategies, Guidelines and/or Standards

The following section lays out resource management strategies that are considered to give primary emphasis to the maintenance of water quality, quantity and timing of flows while considering ecosystem health and the needs of other interests and resource sectors in the Mark Creek Watershed.

The term “water quality” is generally used to describe the chemical, physical and biological characteristics of water in relation to a particular use, such as drinking water. The mechanisms by which streamflow is generated, and its routing through and over the landscape, are major determinants of the quality of water in a watershed. Geology and geochemical weathering also play significant roles as do other natural processes and land-use activities that occur in a given area. Nutrient levels can be affected by decomposing organic materials, underlying geology, internal nutrient cycling in lakes and wetlands, the nature and type of nitrogen fixing plants and bacteria, and the seasonal movement of accumulated nutrients from soils, particularly in riparian and wetland areas.

Forests can affect water quality in many ways. Riparian forests provide a source of organic materials (*e.g.* litterfall and insect-drop) to drive in-stream food webs, and shade to moderate water temperatures. Their roots stabilize streambanks and prevent erosion. They also store large quantities of water that provide baseflows to streams during the dryer months. Natural processes such as blowdown, wildfire and landslides can create temporarily increased concentrations of nutrients, sediment and even increase stream temperatures. Interactions between the vegetation and soil also modify the chemistry of precipitation, and alter the chemistry of water as it moves through soil. Land-use activities that remove or disturb forest vegetation or hydrochemical pathways may therefore change the quality of water (Pike *et al.*, 2010).

“Forest vegetation directly affects the amount of water available for streamflow through the interception of rain and snow, the evaporation of intercepted water, and through transpiration... Altering forest vegetation can have an important influence on water balances at the site and watershed scale. In the hydrologic cycle, the forest canopy is the first surface that intercepts and stores precipitation, resulting in some amount (depending on canopy characteristics) returning to the atmosphere through sublimation and evaporation. Water also returns to the atmosphere through transpiration and by evaporation from the forest floor, soil surface, and open water bodies, such as lakes and wetlands. Forest vegetation reduces the rate at which snow melts and hence the rate of soil moisture recharge and downslope flow” (Winkler *et. al.*, 2010).

“Groundwater contributes to the generation and regulation of streamflow in watersheds, and the sustainability of many wetlands, ponds and lakes. The position of the water table (and distribution of pore water pressure) can also strongly influence slope stability” (Winkler *et. al.*, 2010). In cases where the water table rises rapidly because of a large storm event or increased runoff (*e.g.* concentration of flow by a culvert), soils may be weakened and the potential for slope failure increases.

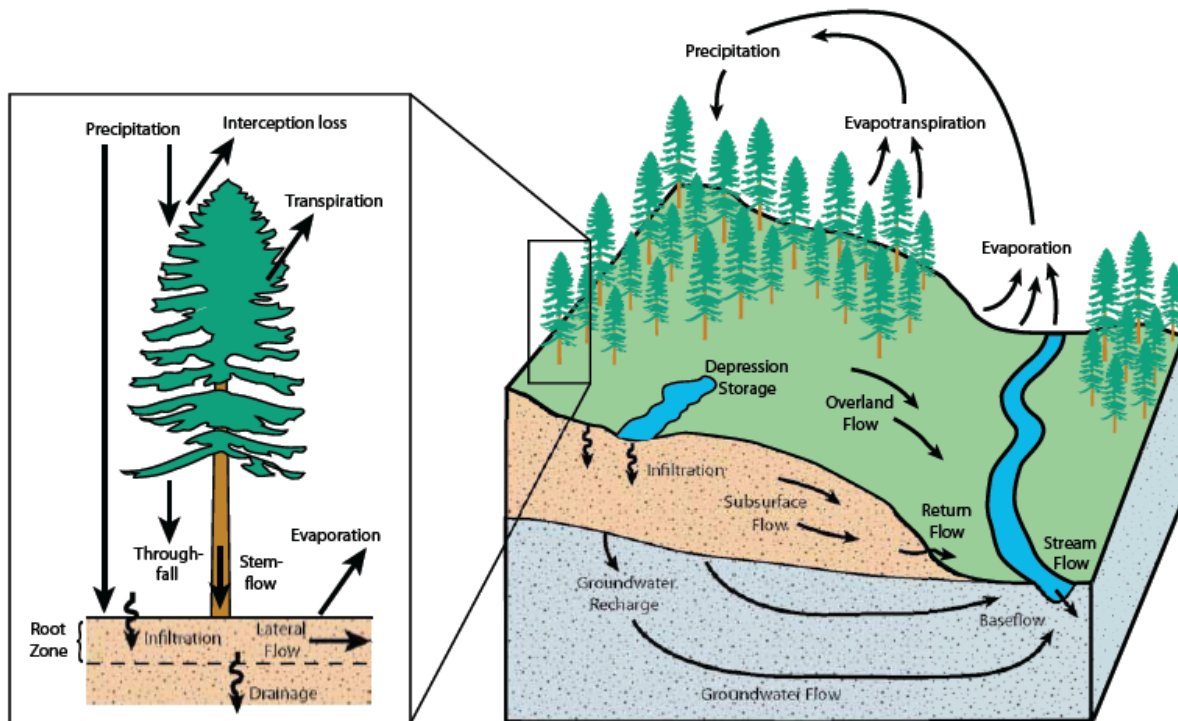


Figure 3. The hillslope hydrologic cycle and stand water balance (Source: Winkler *et al.*, 2010).

Cumulative Effects

There has been considerable discussion and debate in BC, amongst the public, government and resource-users, about cumulative effects of resource management and extraction (Auditor General of BC, 2015). The term *cumulative effects* refers to changes to the environment, social and economic values caused by the combined impact of past, present and potential future human activities and natural processes. The Province of BC has recently implemented a Cumulative Effects Framework (CEF) which will be fully implemented by 2021. Initial values recommended for inclusion in this framework are: forest ecosystem biodiversity, riparian ecosystems, water quantity and quality, air quality, priority fish and wildlife species, visual quality, cultural heritage resources, resource capability, economic well-being and social well-being. The assessment for aquatic ecosystems, as one of three priority values, is expected by late 2017. The CEF overview report notes that “resource monitoring and inventory information are fundamental to the CEF, and the quality and effectiveness of cumulative effects assessment is highly dependent upon the quality and currency of the data available for assessment in each area” (Government of BC, (2014). With the implementation of this framework, it is expected that there will be new guidelines developed that will better integrate the assessment of cumulative effects into resource management decisions.

4.1 Water

Vision:

To maintain or enhance water quality, minimize extreme low and peak flows, and manage activities in the Mark Creek Watershed so that the development and/or conservation of resources continues to provide the City of Kimberley, and other licensed water users, with an adequate quantity of high-quality water.

Objectives (historical, for reference):

- Prepare preventative measures to protect water quality, and contingency plans to deal with any unexpected water supply impacts.
- Prepare a water monitoring program to help assure that these objectives are being achieved (see Appendix 9.1).
- In the absence of a mountain pine beetle infestation and/or catastrophic losses due to wildfires or windthrow, 3 years of water quality baseline data will be gathered before new road construction and/or resource extraction occurs.

Objectives (Current):

- Routinely review and update preventative measures to protect water quality, and contingency plans to deal with any unexpected water supply impacts.
- Maintain a water monitoring program to help assure that these objectives continue to be achieved.
- Five years of baseline data were collected prior to construction of new roads. In future, the monitoring program will be modified to include short-term, site-specific impacts of new developments and to assess long-term trends, particularly under the influence of a changing climate. In practice, this will likely be achieved by monitoring above and below development sites. These data will be used in conjunction with watershed-wide water quality and quantity data to monitor effects.
- Design roads, skid trails and ditchlines to avoid/prevent the release of deleterious substances into water courses (*e.g.* sediment, hydraulic oil, etc.)
- Retain qualified professionals to assess risks and slope stability where there is potential for failures to connect with and release sediment into streams.

4.2 Fish and Aquatic Ecosystems

Vision:

To maintain or enhance water quality, quantity, and timing of flow to maintain the quality and integrity of aquatic ecosystems.

Objectives:

- Maintain a minimum flow of 0.09 m³/sec downstream from the dam to provide for downstream aquatic ecosystems and fisheries values. This minimum flow may be reduced only if the reservoir is unable to provide the minimum water necessary for the City of Kimberley industrial, commercial, and domestic use, and any reduction is consistent with current legislation, and the terms of the water licence(s).

- When available, the optimum minimum flow downstream from the dam to be maintained for aquatic ecosystems and fisheries is 0.15 m³/sec.
- Protect and maintain the integrity of riparian areas and their ecological functions including:
 - Dissipating energy associated with high water flow, thereby reducing erosion and improving water quality;
 - Capturing sediment and aiding floodplain development;
 - Improving floodwater retention and groundwater recharge;
 - Developing root masses that stabilize streambanks against erosion;
 - Maintaining channel characteristics including large woody debris;
 - Shading the stream, moderating water temperature and providing nutrients and food supply for in-stream aquatic processes;
 - Providing wildlife habitat; and
 - Maintaining pre-harvest quality and quantity of water.
- Design roads, skid trails and ditchlines to avoid/prevent the release of deleterious substances into water courses (*e.g.* sediment, hydraulic oil, etc.)
- Retain qualified professionals to assess risks and slope stability where there is potential for failures to connect with and release sediment into streams.

Note: the volume of water released from the cone valve at the base of the dam is 0.9 m³/sec
(Source: City of Kimberley)

The combined results of studies in the interior of BC indicated that only 49% of the variability in annual water yield and <25% of the variability in peak flows was explained by ECA alone (Winkler *et. al.*, 2015). “When using ECA as an indicator of potential hydrologic change, it must be understood that – although ECA assumptions are supported to some extent by field research at the stand and small watershed scale – there is no evidence that stand-scale ECAs are additive at the watershed scale, or that the tool can be interpreted the same way in all watersheds... Furthermore, ECA is an unsuitable index for determining temporarily cumulative effects because it considers only the recovery of the driving variable (*e.g.* increased streamflow or sedimentation) and not the time necessary for resulting downstream effects to recover (*e.g.* channel width or fish habitat). The relative location of the disturbance to streams and the routing of water and sediment through space and time are not considered in the calculation of ECA and the predicted physical changes are not related to fisheries, domestic water supplies or other beneficial water uses. Equivalent clearcut area also assumes a stationary climate, which may not be applicable over a typical rotation; thus, predicted future hydrologic response to disturbance may be different than under the current hydroclimatic regime...the limitations of ECA as an indicator of change do not preclude its use as one of a suite of indicators used in risk assessment or in management decisions but must be considered in its application” (Winkler and Boon, 2017).

4.3 Wildlife and Biological Diversity

Vision:

Maintain the diversity of vegetation, wildlife species, and ecosystems found in the Mark Creek Watershed.

Objectives:

- Protect habitat for rare, endangered and threatened wildlife species of the Mark Creek watershed as per current legislation (*e.g.* FRPA and the Species at Risk Act (SARA)). Habitat areas have been identified for rare or threatened vegetation and wildlife species as well as for locally rare ecosystems including locally rare old growth. These habitat areas are incorporated into the forest ecosystem network. A single Wildlife Habitat Area has been identified for the Coeur d'Alene Salamander.
- Protect the integrity and suitability of ecosystems particularly for grizzly bear and caribou by limiting recreational use and industrial development in caribou habitat areas, reducing conflicts by developing roads in locations not heavily used by wildlife (particularly bears), and limiting access and all-terrain vehicle disturbance including snowmobiles.
- Sustain or enhance present levels of biodiversity and functional habitat.
- Ensure adequate potential old growth recruitment areas are maintained to provide future OGMA's in perpetuity.
- Implement intermediate stand and landscape seral stage distribution consistent with the Kootenay Boundary Higher Level Plan Order and Government Action Regulation. Landscape level management will include the designation of old growth management areas, forest ecosystem networks (FENs), regional biodiversity connectivity corridors, and specific seral stage distribution targets. Stand level management will include provision for wildlife tree patches, coarse woody debris, riparian management and reserve zones, and wildlife habitat features (WHFs) such as nest sites, mineral licks, wallows, seeps, and denning sites.

Background:

- A map of the levels of harvesting constraint and a map of the forest ecosystem network (FEN) developed for the Mark Creek drainage in 1999 is depicted in Figure 2. This FEN allocated a significant portion of the old growth management areas to areas adjacent to riparian areas and afforded additional protection to water quality. The Old Growth Management Areas (OGMA's) specified on the map in Figure 2 were considered to be potential old growth recruitment areas (POGRA's) at that time and were to be managed accordingly. The spatially explicit OGMA's and FEN connectivity corridors identified on the maps were not formally designated in the Kootenay Boundary Higher Level Plan Order (KBHLPO), although OGMA percentage targets were legally established by BEC. FEN is a term that is no longer used in Forest Stewardship Plans; however, the Province has established legal targets for OGMA's for the entire Landscape Unit, of which the Mark Creek Watershed is one part, through the Kootenay-Boundary Higher Level Plan Order. The entire Landscape Unit (C08) consists of the Mark and Matthew Creek watersheds. There is

no regional requirement for connectivity corridors *per se*, these have been replaced by species-specific orders under the Government Action Regulation (GAR). That said, the Mark Creek Watershed Advisory Group wishes to maintain both mature seral (*i.e.* Old Growth) characteristics and wildlife connectivity specifically within the Mark Creek Watershed and not just on a regional basis. To that end, the following guidelines will apply:

Guidelines:

The forest ecosystem network (FEN) depicted in Figure 2 is one example for maintaining connectivity corridors. Alternative scenarios can achieve a similar result. Connectivity corridors may be moved, provided that connectivity objectives and existing mature stand attributes, as described below, can be maintained and similar hectares of equal value are managed.

Specific guidelines for maintaining connectivity in the Mark Creek Watershed are as follows:

- Minimize the number, length and width of rights-of-way for roads especially in OGMA's and connectivity corridors.
- Deactivate temporary roads that are no longer in use. Untenured roads will be deactivated as funding is made available. Rehabilitate roads in OGMA's and connectivity corridors.
- When a natural disturbance such as wildfire, windthrow, or an extensive insect outbreak occurs within a connectivity corridor, the appropriate management action should be based on an evaluation of the disturbance's effect on the landscape level connectivity and an evaluation of the potential risk to water quality, and adjacent forest. Options to maintain connectivity using adjacent unaffected areas should be examined. No net loss of the existing seral stage distribution within the connectivity areas should be the goal. Connectivity should be maintained to the greatest degree possible within the limitations presented by the disturbance.

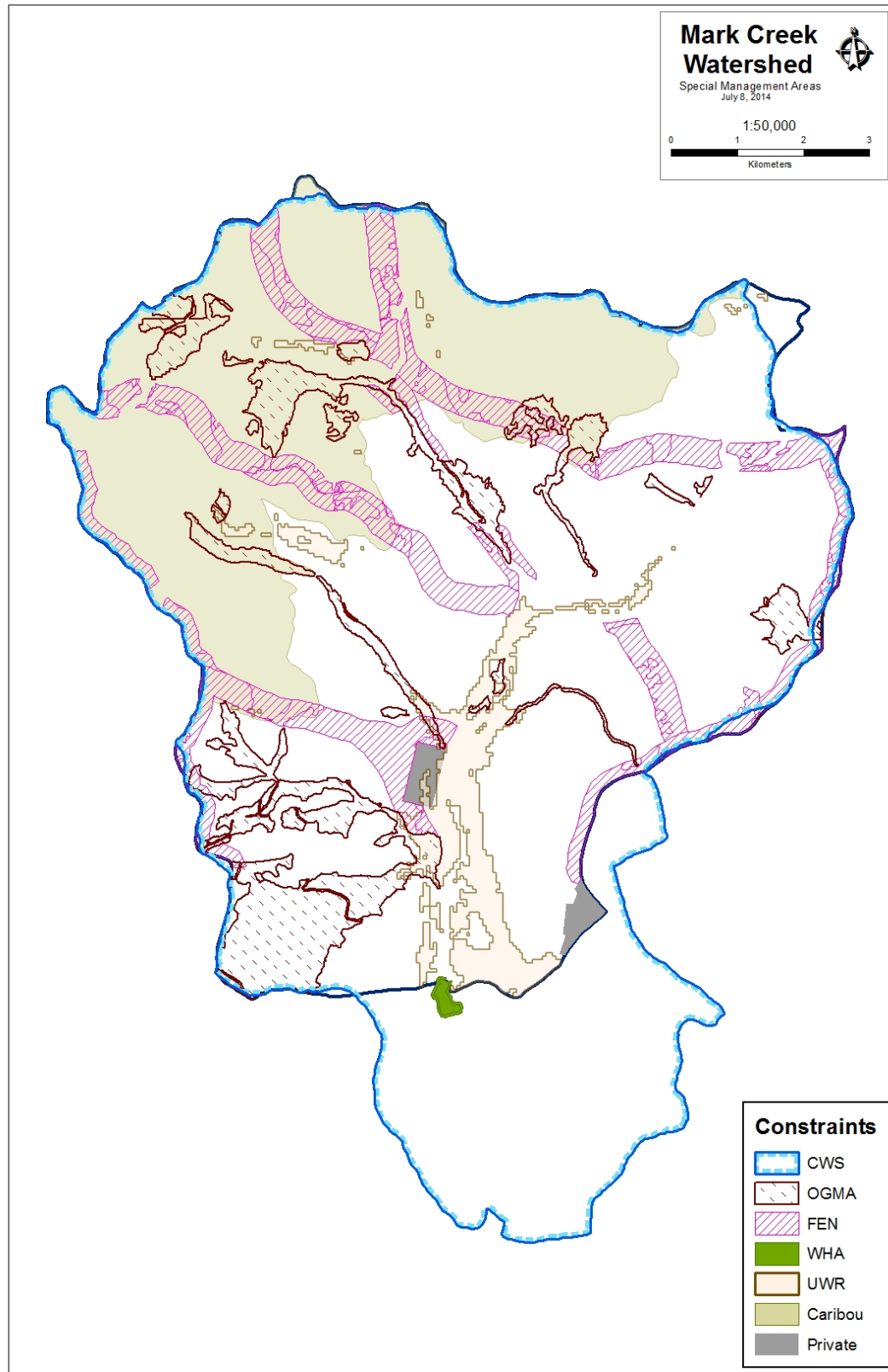
The practices described for connectivity areas above are currently applied as best management practices on all blocks.

- Desired attributes of connectivity habitat are as follows:
 - standing dead trees
 - retain some existing snags
 - retain some living trees in the connectivity areas to provide for future snag recruitment
 - retain snags during spacing and thinning where it is safe to do so
 - create snags as required to achieve objectives
 - leave snags and snag recruitment trees in patches rather than as individual trees where possible
 - coarse woody debris
 - leave existing decaying logs on site
 - retain woody debris
 - distribute woody debris as evenly as possible
 - large living trees
 - reserve all vets where it is safe to do so

- where possible, leave snag recruitment trees in patches rather than as individual trees
 - tree species diversity
 - minor species and rare species should be retained as much as possible
 - promote deciduous component in the stand
 - where ecologically appropriate, favor species with long rotations (western larch, Douglas-fir, Engelmann spruce) rather than species with short rotations (lodgepole pine, sub-alpine fir)
 - structural diversity
 - maintain a variety of canopy layers (vertical structure) where ecologically appropriate.
 - encourage spatial patchiness to produce a partially open or patchy forest canopy (horizontal structure)
 - functional soil ecosystems
 - minimize soil disturbance
 - minimize compaction
 - understory plant communities
 - maintain species diversity of existing understory plant communities and increase vigor by encouraging partially open or patchy forest canopies.
- For an area to be considered as effective connectivity habitat it should be a minimum 400 metres in width.
 - The long-term goal is for 65% or more of the forested areas within the connectivity corridor to be in mature and old seral stages.

A significant portion of the old growth management areas are located adjacent to riparian areas to provide additional protection to water quality. Harvesting within an OGMA is not allowed under normal conditions. The only harvesting that would be considered within an OGMA is in situations where this harvesting is required to prevent widespread tree mortality inside and/or outside of the OGMA or FEN (*e.g.* mountain pine beetle infested trees, spruce bark beetle infested trees, etc.), and/or where the harvesting is specifically designed to enhance old growth characteristics of the stand. If there is a need to construct a road or complete beetle or fire salvage in an OGMA, it is incumbent on the licensee (BCTS) to replace an equivalent area with stands with suitable old growth qualities within the Mark Creek drainage to maintain the level of old growth retention for the Landscape Unit. Replacement of such equivalent areas is preferred within the same sub-basin.

Figure 4. Map of Forest Ecosystem Network and different Harvesting Constraints in the Mark Creek Watershed – One possible connectivity scenario



4.4a Recreation

Vision:

Restrict recreational use with the primary objective of maintaining water quality, quantity and timing of flow.

Objectives:

4.4.2 Recreation Management Objectives:

- Recreational use of the reservoir is not permitted.
- Any and all recreational use in the watershed is not supported by the City of Kimberley.

4.4b Visual Quality

Vision:

Maintain visual quality of the Mark Creek Watershed for both tourists and residents of the City of Kimberley.

Objectives:

4.4.3 Visual Quality Objectives (VQO):

- Manage for a VQO of partial retention as viewed from Kootenay House and the top of the Eureka ski run.
- Manage for a VQO of partial retention as viewed from Cominco Gardens in the City of Kimberley and from the main street in Marysville.
- Where there are demonstrated forest health or protection concerns (*e.g.* major insect or disease infestations or fires), the partial retention VQO may be reduced to a modification VQO with suitable documented justification. In such cases, efforts will still be made to achieve a partial retention VQO wherever possible.
- Mine development activities may exceed the prescribed visual quality objective, but must strive to achieve a VQO of partial retention wherever possible.

4.5 Access Management

Vision:

Maintain and regulate a minimum safe, stable and controllable road network that does not compromise other watershed objectives while maintaining required access for efficient resource development, fire control and forest management.

Objectives:

- Carry out terrain and erosion hazard assessments, and a hydrologic assessment prior to planning a road infrastructure.
- Deactivate and/or rehabilitate all unnecessary or unstable roads as soon as possible, as funding allows.
- The Low Pass route is to remain the primary route for forest management access.
- Recreational motorized use is discouraged in the watershed.
- Develop and maintain a Total Chance Plan that illustrates pre-established routes for new roads in the event of fire or emergency.

4.6 Cultural Heritage

Vision:

Protect significant cultural heritage features.

Objectives:

- Conduct cultural heritage inventory and impact assessments on all high and moderate archaeological potential areas prior to resource development.
- Any significant cultural heritage features or values discovered will be reviewed for required protective measures.

4.7 Minerals and Energy

Vision:

To maintain access and opportunities for mineral exploration and development while ensuring maintenance of high quality domestic water supplies and minimizing environmental impacts.

Objectives:

- Where possible, exploration below the caribou line, and outside the riparian reserve zone, will be conducted from existing road systems, with as little new development as possible. New development will be planned and co-ordinated between BCTS and the Ministry of Forests, Lands and Natural Resource Operations and the Ministry of Energy and Mines to minimize total road development.
- Exploration above the caribou line will use low impact access methods in the initial and early stages. More advanced projects will have opportunities for road access, when and if previous results indicate road access is required for further evaluation.

- Inactive disturbed sites will be reclaimed to their original vegetation cover type as soon as possible following exploration.
- Any roads constructed for mineral exploration, and not needed for ongoing mine development, will be fully rehabilitated as soon as possible following completion of the exploration activity.

4.8 Timber Management

Vision:

Plan and implement timber harvest in a manner that optimizes the long-term productivity and sustainability of forest resources while accommodating the needs of other forest users and minimizing the impact on biotic communities, water quality, quantity and timing of flows. Provide a supply of wood fiber to the local forest industry.

Objectives:

4.8.1 Rate and Timing of Harvest

- Overall rates of cut will be regulated by:
 1. the results of a hydrologic risk assessment for the area, and
 2. other conditions described elsewhere in this plan and in the Community Watershed Guidebook. Timing and periodicity of harvest will be managed within the broad objective of minimizing the duration of active logging activities.
- The harvest rate for any given 5-year period is approximately 63 hectares (0.74%) per year and is expected to result in approximately 317 hectares, or 3.7% of the forested area of the watershed being harvested in each 5-year period. At this rate of harvest, the total harvest after the first twenty years will be approximately 1,268 hectares, or 15% of the forested area of the watershed. The total area available for harvest over the long term is currently estimated to be approximately 3,989 hectares.
- A high percentage of the drainage will be maintained in a hydrologically greened up condition to maintain water quantity and quality.

Maximum ECA by Sub-basin is as follows:

Sub-basin 1 - 20%
 Sub-basin 2 - 10%
 Sub-basin 3 - 10%
 Sub-basin 4 - 20%
 Sub-basin 5 - 35%
 Residual Sub-basin - 40%

Note that all blocks and roads will be reviewed in the context of a hydrological assessment by a qualified registered professional using current practices and standards.

4.8.2 Cut Block Size

Cutblock size will vary with site characteristics and silviculture systems. All blocks and roads will be reviewed in the context of a hydrological assessment completed by a qualified registered professional. This assessment will provide site-specific recommendations on cut block size and roads.

Default cut block sizes, in the absence of the above hydrological assessments and agreement from the Watershed Advisory Committee, will be limited to openings less than 40 hectares in the MSdk biogeoclimatic subzone and 20 hectares in the ESSFdk biogeoclimatic subzone, as recommended in the Community Watershed Guidebook.

Average cutblock size for clear-cut areas will be 20 hectares or less in the MSdk biogeoclimatic subzone and 10 hectares or less in the ESSFdk biogeoclimatic subzone, as recommended in the Community Watershed Guidebook.

A cut block must also not be harvested unless the adjacent cut block has at least 75% of the net area to be reforested stocked such that the average height of the tallest 10% of the trees is a minimum of 2.5 metres.

If a catastrophic event (*e.g.* fire) occurs, or an escalating mountain pine beetle infestation cannot be controlled within these cut block size limitations, the cut block size may be increased to salvage mortality, reduce the risk of spread of the mountain pine beetle, and/or to reduce the risk of extensive denudation of the watershed, subject to a hydrological assessment as above.

Harvesting in visual areas that have established Visual Quality Objectives will need to have completed visual impact assessments which assesses whether the proposed activity will achieve VQO's, using the categories of visually altered forest landscape as defined in section 1.1 of the Forest Planning and Practices regulation.

4.8.3 Distribution of Cutblocks in the Landscape

- Timber harvesting activities will generally be distributed to minimize the total length of active road in the watershed and thereby minimize the sedimentation risk associated with active roads.
- See section 4.3 for areas reserved from harvesting that will contribute to water quality and biodiversity objectives.
- Cutblocks will be planned to ensure that mature and old connectivity both within the watershed and with adjacent landscape units will be maintained.
- No timber harvesting will occur on areas with a high likelihood of landslides if harvested (class V terrain).

4.8.4 Silviculture Systems

- No clearcutting will occur on areas which are subject to a moderate likelihood of landslides and have a high risk of landslide debris entering directly into streams, unless a qualified registered professional has determined that clearcutting the area will not significantly increase the risk of a landslide.
- A broad range of silviculture systems may be applied to proposed cutblocks. Site-specific evaluations will determine the system with the greatest potential to meet the overall management objectives for the watershed.
- Partial cutting systems will be the preferred harvesting method and will be prescribed wherever feasible to minimize the overall impacts of harvesting on non-timber values. Where partial cutting has a moderate to high risk of windthrow hazard and/or other factors combine to indicate that this is not the most appropriate system for a given site, clear-cut systems and/or modified clear-cut systems will be used and other resource values will be accommodated through the planning of the spatial and temporal distribution of harvesting.
- At the stand level, forest structural components important for maintaining stand level biodiversity will be retained within and/or adjacent to cutblocks. These components may include some or all of the following: standing green trees, dead trees, coarse woody debris, understory plant communities, wildlife tree patches, and other forest structural components.

4.8.5 Harvesting Methods

- A variety of harvesting methods is expected to be appropriate and will range from ground-based methods to cable and aerial methods. Harvest methods will be selected on a site-specific basis giving top priority to maintaining water quality and minimizing environmental impacts.

4.8.6 Harvesting Priorities

- Harvesting will initially be concentrated in stands of predominantly lodgepole pine greater than 80 years of age. This approach will target those stands generally considered to be at greatest risk from infestation by mountain pine beetle in the short term.
- Secondly, harvesting will be directed into lodgepole pine dominated stands of younger age classes to reduce the long-term risk of mountain pine beetle infestations that could cause extensive denudation of the watershed over a very short period of time.
- Periodic salvage of damaged, dead or diseased timber resulting from blowdown, pest infestations and/or other events is also expected to occur. Instances of damage or mortality to timber will be assessed as they become known. The assessment will determine the potential risks posed to nearby forests, the economics of salvage and the potential environmental risks associated with salvage. Where salvage potential is confirmed, these areas will be given top priority for harvest.

4.8.7 Basic Silviculture

- Cutblocks will be restocked by planting with seedlings of species which naturally occur on or adjacent to the area harvested.

- The regeneration of stands of multiple tree species following harvesting will be promoted to maintain stand level biodiversity and minimize the potential impact of future pest infestations on timber supply, and water quality, quantity, and timing of flows.
- Where feasible, stands of pure lodgepole pine will be restocked with a mix of species following harvesting to minimize the impact of mountain pine beetle in the future.
- Site preparation methods will be selected to minimize detrimental site disturbance while providing forest floor conditions which promote the establishment of native tree species.
- Control of competing vegetation on cutblocks will be accomplished primarily through cultural techniques during harvesting and site preparation.
- Application of chemical herbicides to control competing vegetation on cutblocks will not be prescribed in the Mark Creek Community Watershed.

4.8.8 Incremental Silviculture

- Periodic thinning and/or pruning of young stands may be prescribed to enhance timber quality and/or improve yields on overstocked sites. These activities will be planned and scheduled to minimize the length of active forest road and the potential risks to the environment and other forest uses.

4.8.9 Skid Trails/ Skid Roads

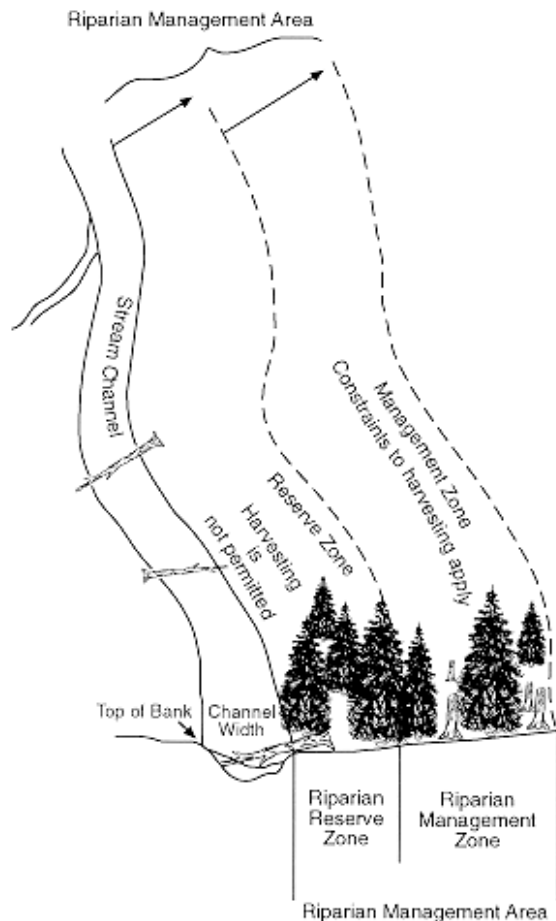
- Excavated or bladed trails are not permitted on areas where there is a very high soil erosion hazard or a very high risk of sediment delivery. Excavated or bladed trails may be permitted on areas of high risk of soil erosion hazard and a moderate, or high risk of sediment delivery to streams if it is deemed to be acceptable by a qualified professional, based on a site assessment and appropriate prescriptions are provided and implemented to protect stream health. In areas with moderate ratings for both soil erosion and sediment delivery, excavated or bladed trails are permitted.

		Sediment Delivery Risk			
		L	M	H	VH
Surface Erosion Risk	L	OK	OK	QRP/No	No
	M	OK	OK	QRP/No	No
	H	QRP/No	QRP/No	QRP/No	No
	VH	No	No	No	No

- Assessment of surface erosion risk will be undertaken on a site-specific basis on each proposed block. Sediment delivery risk will be determined utilizing mapping provided Banting (1996) see Appendix 9.4.2.
- Excavated or bladed trails are not permitted on areas where there is a moderate likelihood of landslides unless a qualified professional has determined that the trail can be located, constructed and rehabilitated without significantly increasing the risk of landslides, and where there is a low likelihood of landslide debris entering into a stream and/or causing damage to private property or public utilities.
- In general, where ground-based harvest methods are prescribed, the use of bladed skid trails will be avoided wherever possible. Where bladed skid trails are necessary, these trails will be fully reclaimed as soon as possible following harvesting.

4.8.10 Harvest Planning

- As required by legislation, a forest stewardship plan (FSP) will be prepared prior to the approval of any timber harvesting or road building in the Mark Creek Watershed by BC Timber Sales.
- An Operating Plan will be referred annually for comment to the Watershed Committee showing the proposed locations and sizes of upcoming cutblocks and roads.
- *All new proposed forest developments will be referred to the Watershed Committee for comment prior to approval through the Operating Plan.*
- A site plan will be prepared for each proposed cutblock containing details of the proposed silviculture systems, harvest methods and results & strategies in accordance with the FSP including cultural heritage resources, green-up, invasive plants, riparian, soils, visual quality and wildlife tree retention.
- Regardless of their size, all streams in Mark Creek are to be treated as S4 or better (*i.e.* there are no S5 or S6 streams in the watershed)
- Minimum riparian reserve zones of two tree lengths in width will be established on all streams within the watershed, regardless of their size or classification (includes dry and ephemeral channels). No harvesting is to take place in these reserve zones.
- Tree length will be considered average mature tree height in the area where the stream is present.
- A riparian reserve as defined in FRPA means: “an area described under Division 3 [Riparian areas] of Part 4 [Practice requirements], that (a) is a portion of a riparian management area, and (b) is established to protect fish, wildlife habitat, biodiversity and the water values of the riparian reserve zone.:



(source, FPC Riparian Management Area Guidebook, 1995).

For all non-classified drainages (NCD), including seasonal and intermittent streams, a 5-metre machine free zone and designated crossings will be established. A QRP will include NCDs, seeps and springs in the block-specific hydrological assessment. An NCD is defined as a watercourse that is often associated with water flows over organic beds consisting of accumulated organic materials such as decomposed or whole leaves, roots, twigs and moss and which may be mixed with silt/organic mud deposits which may be covered in mosses or herbaceous vegetation. These drainages are often found at the headwaters of drainages or in areas of low topographic relief. Flow in these channels is usually seasonal. The potential for scour in these channels is consequently low and is confirmed by the presence of an **organic bed**. These channels sometimes emerge immediately down slope from groundwater seeps. Seepage sites and other areas where unchannelled surface water occurs due to a seasonally elevated water table are also not streams. (BCTS Practices Documents to Determine Fish Presence/Absence June 2010, pg. 9.).

4.8.11 Fire Suppression

- Use fire prevention measures to reduce the risk of large catastrophic fires.
- Undertake aggressive initial attack on all wildfires to reduce the risk of large catastrophic fires.
- Resource maps will be provided to the Wildfire Management office as they are updated.

4.9 Forage Management

Vision:

To manage for levels of forage, including arboreal lichens, herbs, grasses and shrubs, of sufficient quality and quantity as required by native ungulate populations.

Objectives:

- Maintain the seral distribution prescribed in the Biodiversity Guidebook for intermediate biodiversity emphasis to produce a variety of understory and open forage types, primarily targeted at wildlife needs.
- Maintain forage opportunities for caribou.
- No domestic livestock use and/or grazing will be permitted in the Mark Creek Community Watershed.
- Aggressively control noxious weeds primarily through manual methods.
- As invasive plant species are observed in the watershed, they will be reported to the East Kootenay Invasive Plant Council for removal/treatment.
- Grass seeding for erosion control and revegetation of exposed soils will use seed mixes containing minimal palatable grasses in order to discourage ungulates.

5.0 Protective Measures

5.1 Preventative Measures

This section outlines requirements for resource management activities that are designed to reduce the risk of a detrimental impact to the water supply that could potentially be caused by large scale natural processes or resource management activities.

The water resource could potentially be negatively impacted by natural events or by resource management activities. Specific types of potential water quality impairment include:

1. excessive sedimentation,
2. chemical contamination,
3. water-borne disease contamination,
4. increased peak flows (that cause unnatural changes to stream morphology),
5. decreased low flows (below the range of natural variation), and
6. detrimental changes to stream temperature and/or the amount of direct sunlight entering the stream.
7. increased duration of high flows that cause excessive channel scour.

This section outlines preventative measures to minimize the risk of negative impacts on water quality and/or quantity that specific resource management activities could potentially produce.

5.1.1 Water Supply or Quality Disruption

Sections 10, 12, 13 and 14 of the **Drinking Water Protection Act** have provisions for reporting and notifying in the event of water supply or quality disruptions. Essentially, water suppliers are required to have emergency response and contingency plans to address emergency or abnormal operational circumstances. Any threats that are likely to result in the drinking water not being potable must be reported and users of the water system must be notified of potential hazards.

Under Section 24 of the Drinking Water Protection Act, persons required to report spills under Section 11 of the Public Health Act and Section 79 of the Environmental Management Act must also report the event to a Drinking Water Officer if the event may result in a threat to drinking water.

Emergency response and contingency plans

- 10** (1) In the case of a prescribed water supply system, the water supplier must have a written emergency response and contingency plan in accordance with the regulations, to be implemented in the event of an emergency or abnormal operational circumstances affecting its water supply system or drinking water source.
- (2) The drinking water officer may order a water supplier to review and update its emergency response and contingency plan.

Notice if immediate reporting standard not met

- 12** (1) If a monitored parameter in relation to a water supply system fails to meet an established immediate reporting standard for that system, the laboratory conducting the analysis must immediately give notice to
- (a) the water supplier,
 - (b) the drinking water officer, and
 - (c) the medical health officer.
- (2) In addition, a water supplier who receives notice under subsection (1) must give immediate notice to the drinking water officer advising that the water supplier has been notified by the laboratory as required by this section.
- (3) For the purposes of this section, the person giving the immediate notice must
- (a) take all reasonable steps to give this notice by speaking directly to or by telephone with
 - (i) each person required to be notified,
 - (ii) a person designated for this purpose by the person required to be notified, or
 - (iii) a person answering the telephone number designated for this purpose by the person required to be notified, and
 - (b) follow with notice in writing to each person within 24 hours.

Water supplier must report threats to drinking water

- 13** (1) In addition to the requirements under section 12, a water supplier must immediately notify the drinking water officer if the supplier considers there is a threat that is likely to result in the drinking water provided by its water supply system not meeting the requirements of section 6 [*water supply systems must provide potable water*].
- (2) Notice required by subsection (1) must be given in accordance with section 12 (3).

Public notice of threats to drinking water

- 14** (1) The drinking water officer may request or order a water supplier to give public notice in a manner approved by the drinking water officer, or in accordance with the directions of the drinking water officer, if
- (a) the drinking water officer has received a report under section 12 [*notice if immediate reporting standard not met*],
 - (b) the drinking water officer has received a report under section 13 [*water supplier must report threats*], or
 - (c) the drinking water officer considers that there is, was or may be a threat to the drinking water provided by a water supply system.
- (2) In addition to any requirement under subsection (1), if a water supplier

(a) has received a report under section 12 or considers that there may otherwise be a drinking water health hazard in relation to its water supply system, and
(b) is not able to immediately notify the drinking water officer,
the water supplier must immediately give notice of the possible hazard to the users of drinking water from that water supply system.

Requirement to report threats to drinking water

24 (1) If a person

(a) is required to report under

(i) section 11 [*mandatory reporting of health hazards*] of the *Public Health Act* in respect of a toxic spill, or

(ii) section 79 (5) [*spill prevention and reporting*] of the *Environmental Management Act*, and

(b) considers that the event reported may result in a threat to drinking water,
the person must also promptly report the situation to the drinking water officer.

(2) Despite any other enactment, if a regulation designates

(a) persons employed in the public service of the Province, or

(b) officials acting under the authority of a specified enactment

for the purposes of this section, by title or otherwise, those designated must report to the drinking water officer any situation they observe, or of which they become aware, that they consider may be a threat to drinking water.

1.0 Objective: Ensure that the impacts of any short-term disruptions to the water supply (planned or accidental) are minimized.

5.1.1.1 Preventative Measures

- 2.1 The City of Kimberley has constructed a reservoir that ensures that adequate water is available during most periods of low flow. The City of Kimberley has a number of storage tanks within the water supply system. However, the main supply zone within the city is supplied directly from the reservoir at the Mark Creek Dam.
- 2.2 If the Mark Creek supply is compromised, the only way to keep the main part of the City in water is to fill the Lois Creek Reservoir with water trucks from another source. South Kimberley (Marysville) can be supplied by Matthew Creek.
- 2.3 If planned operations are likely to affect the quality or quantity of the water supply, the person(s) planning the operations must contact the City of Kimberley at least two weeks prior to the planned disruption and have prior approval before commencing operations. Approval may require those planning the disruption to maintain an alternate water supply and clean the intake works.

- 2.4 The City of Kimberley monitors water quality and if water quality falls below acceptable standards, contingency plans must be implemented immediately to correct any problems and notify the water system users (*i.e.* consumers).
- 2.5 The City of Kimberley will require the person(s) planning a water disruption, or conducting resource use activities, to maintain liability insurance naming the City of Kimberley as co-insured as a disruption in the water supply may limit the City's fire fighting ability.

5.1.2 Fire Preparedness, Prevention, and Suppression Requirements

1.0 Objective: Minimize the risk of a catastrophic wildfire that could significantly reduce the watershed's forest cover which in turn could have undesirable effects on peak flows, low flows and/or water quality. Any uncontrolled fire in the watershed should be controlled by 10:00 a.m. or sooner on the day following discovery.

2.0 Preventive Measures

- 2.1 The Ministry of Forests, Lands and Natural Resource Operations, Wildfire Management Branch, is to prepare a fire operations plan which outlines, among other things, priority zones, restrictions within community watersheds, and rehabilitation requirements. An updated Emergency contact list and current resource maps for Mark Creek will be provided to the Wildlife Management Branch as required. Current resource maps show the total chance road network.
- 2.2 Public access into the watershed is discouraged, both to protect water quality and to reduce risk of human-initiated fires.
- 2.3 All operators active during the fire season must prepare and implement a fire preparedness plan. This plan must include worker training, procedures for personnel to follow in the event of a fire, and procedures for equipment availability necessary to suppress fires.
- 2.4 All forest fire prevention requirements including; fire suppression equipment, early shift, shut-down procedures, watchpersons and other forest fire prevention requirements must be adhered to.
- 2.5 In case of a fire caused by industrial operations, the contractor/licensee must take immediate action to control the fire, and immediately report the fire to the Ministry of Natural Resource Operation (phone: 1-800-663-5555).
- 2.6 In case of a fire, the Ministry of Forests, Lands and Natural Resource Operations will take action to control the fire. Resources will be allocated to the watershed with full recognition that it is a community watershed, that a catastrophic fire in the watershed could affect water quality and quantity for a long period of time, and that the City of Kimberley could potentially be at risk if the fire burned over the height of land and into the city's boundaries.
- 2.7 Fire-fighting foams and retardants approved for use in community watersheds can be used to control wildfires. Direct application to waterbodies should be avoided. The amount of fire fighting foams and retardants used should be minimized as much as possible. If fire-fighting foams and/or retardants are used, the City of Kimberley must be contacted immediately. If any firefighting foams and/or retardants are inadvertently

applied to waterbodies that may enter the drinking water supply, the medical health officer must be promptly notified.

5.1.3 Prescribed Burning

1.0 Objective: Minimize the risk of a large catastrophic wildfire that could significantly reduce the watershed's forest cover, which in turn could have undesirable impacts on peak flow, low flow and/or water quality. To achieve this objective, reduce fuel loading and create fuel management corridors. Ensure that the risk of escape of any prescribed burn is minimized. Only proceed with broadcast burning if the benefits at the watershed level (in terms of reducing fuel loading and reducing the risk of catastrophic fire) are greater than the risk of an escaped burn.

2.0 Preventative Measures

- 2.1 Prescribed burning will only be used in the watershed for the purposes of reducing fuel loading, decreasing the risk of wildfire damage, establishing fuel management corridors, removing pest-infested trap trees, and reducing the potential for debris to enter watercourses.
- 2.2 All planned burns must be carried out under an approved Prescribed Fire Burn Plan approved by Wildfire Management Branch
- 2.3 A Prescribed Fire Burn Plan must be prepared for each block which outlines the conditions, methods, safeguards and contingencies that will be used for the prescribed burn. This plan must ensure that the risk of the prescribed burn escaping beyond the planned boundaries of the burn is minimized. The plan must be submitted to the Wildfire Management Branch for approval before the burn can proceed.
- 2.4 The plan must be designed to minimize the potential for erosion and sedimentation (*e.g.* minimize mineral soil fireguards - use hose-lay and sprinkler system, spring burn, build narrow fireguards with an excavator with numerous cross ditches, etc.).
- 2.5 Fuels used for prescribed burn ignition must be handled as per the fuel handling procedures outlined in the fuel handling preventative measures. Heavy equipment must be used as outlined in the heavy equipment preventative measures. Personnel must adhere to the human waste preventative measures.
- 2.6 If the prescribed burn escapes outside of the approved boundaries, immediate suppression action must be taken and the Wildfire Management Branch must be notified immediately.

5.1.4 Forest Fuel Fire Hazard Reduction

1.0 Objective: Minimize the risk of ignition and spread of potential wildfire(s) that could significantly reduce forest cover in the watershed and compromise the water supply. One method of reducing the risk of catastrophic wildfire is to control the quantity and distribution of forest fuels following management activities.

2.0 Preventative Measures

- 2.1 Continuous areas of juvenile spacing will be less than 350 hectares in any decade.
- 2.2 Fuels used for igniting piles must be handled as per the fuel handling procedures outlined in the fuel handling preventative measures. Heavy equipment used for fire hazard reduction must be used as outlined in the heavy equipment preventative measures. Personnel implementing fire hazard reduction activities must adhere to the human waste preventative measures.
- 2.3 Slash and other woody debris must be removed from road rights-of-way either by chipping, piling and burning, or hauling it away. Large wood and stumps intended for road reclamation post-harvest may be stored on road rights-of way.
- 2.4 Road right-of-way widths should be minimized.

5.1.5 Fuel Handling (petroleum products for heavy equipment, chainsaws, helicopters, etc. including fuels, oils, anti-freeze, etc.)

1.0 Objective: Ensure that all chemical products are handled in a manner that minimizes the risk of spills and ensure that any spill of chemicals is quickly contained and cleaned-up.

2.0 Preventative Measures

- 2.1 All operations must comply with ISO 14001 certification standards and procedures (or equivalent) for fuel transport and storage as contained in the BC Timber Sales Environmental Management System, Environmental Field Procedure 6, Appendix 9.3. Criteria include: double-walled tanks, adequate containment and spill response materials, and regular inspection.
- 2.2 Fuel tankers and/or large fuel storage tanks must not be stored in the watershed unless adequate site containment is in place and the tank is secure from vandalism.
- 2.3 The maximum amount of fuel that can be transported by any vehicle at any given time is limited to a maximum of 450 litres of fuel.
- 2.4 All refueling operations must take place at least 100 metres away from the reservoir, outside of riparian management areas, and at least 50 metres away from any stream, lake, and/or wetland. Adequate barriers between the re-fueling operation and the water body must be in place before the commencement of the re-fueling operation. All refueling operations must implement adequate precautions to ensure that any fuel that spills during re-fueling operations is not absorbed into the soil and that it is quickly contained and absorbed (place poly plastic and absorbent sheets to cover the area where drips or spills may occur). All absorbed material must be placed in leak-proof containers and transported outside of the watershed to a suitable approved waste disposal site.
- 2.5 All personnel using fuel or other petrochemicals must have current spill containment and spill clean-up training.
- 2.6 All personnel using fuel or other petrochemicals must have immediate access to a fuel spill clean-up kit. All fuel spills must be immediately contained, absorbed, and removed from the watershed. As per BCTS Environmental Management System-Fuel Handling Environmental Field Procedure #06, minimum spill kit requirements are as follows:

SPILL KIT (Minimum Requirements)		
<p>In Equipment / Machinery (excavators, skidders) Spill kits must be present on equipment, (appropriate for type and potential size of spill).</p> <ul style="list-style-type: none"> Spill kits must include a minimum of: <ul style="list-style-type: none"> ➤ 1 - large heavy duty plastic bag or another suitable container, ➤ absorbent pads (or equivalent absorbent material). Personal protective safety gear as required for the type of spill. 	<p>Vehicles carrying auxiliary fuel (e.g. Pick-up truck box tanks or multiple small containers) Spill kits must be present in vehicles transporting and dispensing fuels.</p> <ul style="list-style-type: none"> Spill kits must include a minimum of: <ul style="list-style-type: none"> ➤ 3 – Heavy duty plastic bags or suitable container(s), ➤ 10 – absorbent pads (or equivalent absorbent material) appropriate for the type of spill, ➤ 3 – 3"x 48" absorbent booms/socks, ➤ biomediation product, ➤ 1 - shovel, ➤ 1 - container of emergency tank sealant (i.e. Plug-N-Dike, Seal-It or equivalent). Personal protective safety gear as required for the type of spill. 	<p>Stationary or Mobile Fuel Storage & dispensing (tanks or multiple-drum caches) Spill kits must be present at points where fuel is dispensed.</p> <ul style="list-style-type: none"> Spill kits must include a minimum of: <ul style="list-style-type: none"> ➤ 5 – Large heavy duty plastic bags, or one open topped containment drum (or equivalent), ➤ 20 – absorbent pads (or equivalent absorbent material) appropriate for the type of spill, ➤ 6 – 3"x 48" absorbent booms/socks, ➤ 2 – 10' linkable marine booms (if near marine operations), ➤ 1 - shovel, ➤ 1 - container of emergency tank sealant (i.e. Plug-N-Dike, Seal-It or equivalent). Personal protective safety gear as required for the type of spill.

2.7 All spills within the watershed must be reported immediately to the City of Kimberley. If any poisonous, noxious or polluting liquid enters any watercourse, the City of Kimberley and the Drinking Water Protection Officer must be informed immediately.

2.8 All spills over 100 litres must be reported to the Provincial Emergency Programme.

2.9 Through BCTS Environmental Management System any spill exceeding 25 litres (5 litres for antifreeze or methyl hydrate) or any amount spilled into or immediately adjacent to a stream, lake or running water must be internally reported.

2.10 BCTS has installed two permanent storage huts containing spill response materials and information. Signs providing directions to the locations of these spill huts have been placed along roads in the watershed. In addition, several roadside portable spill containment stations have been installed along road ways. These portable stations are moved from time to time to be located near active forestry operations.

Feature	Latitude	Longitude	Road/Kilometer Location
Spill Hut #1	49° 43' 18.093" N	116° 2' 28.805" W	12.7 km on Mark Creek Main, turn left onto the non-status road follow it down 1.1 km to the Spill Hut #1.
Spill Hut #2	49° 44' 33.446" N	116° 2' 25.833" W	15.0 km on Mark Creek Main turn left onto Mark Creek North for 200m to 15.2 km and Spill Hut #2.
Portable Spill Kit #1	49° 45' 57.174" N	116° 0' 39.756" W	19.8 km on Mark Creek Main.
Portable Spill Kit #2	49° 45' 47.922" N	115° 59' 26.143" W	19.5k m on Mark Creek North.

Absorbents

Quantity	Product
100	17"x19" pads - white, oil only
10	17"x19" pads - grey, universal
8	8"x18" small pillows - white, oil only
12	15"x20" large pillows - white, oil only
6	3"x10' socks - white, oil only
6	3"x4' socks - white, oil only
2	3"x4' socks - grey, universal
12	3"x20' socks - white, oil only
4	5"x20' socks - white, oil only
2	8"x20' socks - white, oil only
1	10lb plug and dyke
1	plug and dyke pattie
1	18"x19"x100' sweep
3	5 gallon buckets oil gator
1	20kg absorbent granule

Equipment & PPE

Quantity	Product
2	neoprene drain covers
3	silt fences, (rolls)
0	telescopic shovel
7	disposable plastic bags
0	large zip-lock freezer bags, (packages)
1	barrier tape, (rolls)
4	nitrate gloves, (pair)
4	chemical splash goggles, (pairs)
4	disposable poly-coated overalls, (pairs)

8	sand bags
1	shovels, (spade)
1	snow shovel
0	coconut matting, (rolls)
0	2' wooden stakes
2	2"x6"x10'
0	ribbon, (rolls)
2	spray paint
2	8'x10' tarps
4	1/4"x100' rope
100	11" multi-purpose ties
0	shop towels, (paper towel)
1	brooms
14	3/4"x3' rebar
1	water gate
1	25kg grass seed

- 2.11 If any amount of petrochemical enters a stream or is in imminent danger of entering a stream, spill booms must be deployed across the stream. The first cross-stream boom is placed across the watercourse and secured in place, then two side-stream booms are placed immediately downstream of the first cross stream boom along each streambank, and anchored into place. The second cross-stream boom is then placed across the watercourse to butt up against the downstream ends of the two side-stream booms and secured in place. The second set of side-stream booms is then placed along each stream bank downstream of the second cross-stream boom and anchored into place. Finally, a third cross-stream boom is placed across the watercourse and secured in place to butt up against the second set of side-stream booms. Ensure that the total width of the stream channel is covered and that the ends of the booms are snug against the stream bank to prevent the free passage of water under the ends of the booms. In winter, ice on a stream may have to be removed with equipment to permit spill boom deployment.
- 2.12 Depending on the volume of contaminant spilled into the water, the booms may have to be replaced at intervals throughout the mop-up procedure. The booms need to be replaced if there is any indication that the booms are no longer effectively absorbing the spilled material. Boom replacement should occur frequently to ensure that the booms have maximum absorbent capability. For large quantity spills, deploy 3 new cross stream booms and 4 new side stream booms downstream of the original boom configuration as per the procedures noted above and then remove the upstream booms. For small quantity spills, place two new side stream booms behind the last downstream boom, deploy a new cross stream boom behind the two new side stream booms, remove the lead cross stream boom (boom farthest up stream) and remove the lead side stream booms. Repeat this procedure as required.
- 2.13 Operators of equipment must check their machines daily and report any fluid losses to the ministry authorizing their operations. Even losses of small amounts of fluid may require investigation and treatment. Any machinery that loses fluids will not be permitted to work in the watershed until the problem is fixed.

- 2.14 Equipment (including pick-up trucks) entering the watershed must be free of excessive petroleum product contaminants.
- 2.15 If a fuel or oil spill occurs (regardless of the size of the spill), utilize personal protective equipment and immediately stop the source of the spill, contain the spill, and absorb the spilled materials

5.1.6 Pesticide Use Requirements / Restrictions (including Herbicides)

- 1.0 Objective:** Ensure that appropriate safeguards are in place to prevent any pesticide contamination of the water supply.
- 2.0 Preventative Measures**
 - 2.1 Application of chemical herbicides to control competing vegetation on cutblocks will not be prescribed in the Mark Creek Watershed. Noxious weeds will be aggressively controlled primarily through the use of manual methods. The use of pesticides is to be minimized and requires adequate justification and approval of the Watershed Advisory Committee prior to proceeding.
 - 2.2 Biological control agents may be used within the watershed, but only if the Watershed Advisory Committee determines that use of the biological control agent is necessary and that the benefits of using the agents are greater than the potential risks.
 - 2.3 All pesticides (including biological control agents) must be applied by licensed applicators with certified personnel and must adhere to all pertinent federal and provincial legislation and regulation.
 - 2.4 The same procedures outlined for fuel handling are also applicable to the handling of pesticides in the watershed.

5.1.7 Fertilization Use Requirements / Restrictions

- 1.0 Objective:** Ensure that appropriate safeguards exist to prevent fertilizer contamination of the water supply.

2.0 Preventative Measures

- 2.1 Fertilizer may only be used for the purposes of vegetation establishment for erosion control.
- 2.2 Fertilizer used as part of an erosion control strategy (*e.g.* hydro-seeding) will be appropriate to achieve erosion control objectives and will be selected on the basis of minimizing risk to water quality.
- 2.3 Fertilizers will not be stored in the watershed.
- 2.4 Spill kits must be on site at all times that fertilizer is being transported or used in the watershed. Any spill regardless of size must be immediately contained, absorbed, and cleaned up by the person(s) using the fertilizer. If any fertilizer enters the water supply, the City of Kimberley and the Ministry of Forests, Lands and Natural Resource Operations must be notified immediately, and the Drinking Water Protection officer must be promptly notified. All contaminated soil and other contaminated material may have to be removed from the watershed and disposed of in an appropriate manner as required by the Ministry of Environment.

5.1.8 Heavy Equipment Use Requirements / Restrictions

- 1.0 Objective:** Ensure that heavy equipment (also referred to as machinery) is operated in the watershed in a manner that minimizes the risk of sedimentation and water contamination.
- 2.0 Preventative Measures**
- 2.1 Machinery must be in good mechanical condition. Machinery with oil, hydraulic fluid, antifreeze, fuel or other fluid leaks are not allowed to operate in the watershed. If fluid leaks develop when the machinery is operating in the watershed, operations must cease immediately and spill clean-up procedures outlined in the fuel spill contingency plan must be implemented immediately.
- 2.2 When servicing equipment, an impermeable mat with an adequate amount of absorbent material (to absorb any fluid leakage) must be placed under the equipment. All liquid waste products that result from servicing machinery must be collected, placed in impermeable containers and removed to an appropriate waste disposal site outside of the watershed.
- 2.3 In non-emergency situations, forestry operations are restricted to periods when the risk of sedimentation of streams from the proposed activities is moderate or low. If the use of machinery is likely to result in a moderate or high risk of sedimentation of streams, (primarily during rainfall and/or runoff events), the machinery cannot be used until the risk of sedimentation is moderate or low. The risk of sediment production may be reduced by a change in weather conditions or the implementation of an approved erosion and sediment control strategy. In emergency situations such as emergency road repairs and fire control activities, operation of machinery during less than ideal conditions (*i.e.* when the risk of sedimentation is higher than "low") may be necessary. Prior notification of the Ministry of Forests, Lands and Natural Resource Operations, City of Kimberley, and Ministry of Environment is necessary in this situation. Permission to operate may be granted with specific restrictions.
- 2.4 Any equipment operations that have the potential to result in a high risk of erosion and sediment delivery to streams must have an approved erosion and sediment control plan in place. This plan may include protective measures such as: sediment traps, settling ponds, biofiltration, cross ditching, water-barring, ditching, restrictions on season and/or conditions of harvest, and/or installing temporary culverts that can be removed prior to break-up (when the soil is frozen), etc. As these measures will usually be less effective in controlling sediment movement than the final rehabilitation measures, harvesting operations should be completed as quickly as possible after the initiation of harvest.
- 2.5 Any equipment operations that have [the potential to result in erosion and sediment delivery to streams] a high risk of erosion and sediment delivery to streams must have an approved rehabilitation plan prior to the commencement of operations. This plan must outline the measures that will be implemented to minimize the amount of sediment that reaches streams, and must specify the implementation time-frames for each part of the

plan. The plan should be implemented as soon as possible following the completion of works and the time-frames for each part of the plan should be specified.

- 2.6 Ground skidding. See section 4.8.9
- 2.7 Machinery is not allowed to operate within 5 metres of any stream bank with the exception of approved stream crossings unless specific mitigative measures are prescribed by a qualified professional (*e.g.* Operating on snowpack of sufficient depth to prevent damage to streamside soils).
- 2.8 Any violations of the above must be immediately reported to the Ministry of Forests, Lands and Natural Resource Operations and the Ministry of Environment, and corrective measures implemented immediately. If any substance that is, or may be a health hazard enters a stream, the drinking water officer must be promptly notified.

5.1.9 Human Waste

1.0 Objective: Ensure that human waste does not contaminate the water supply.

2.0 Preventative Measures

- 2.1 All operators must have self-contained portable toilet(s) available for employees to use when in the watershed. The operator must instruct their employees that the use of the self-contained portable toilet is mandatory for urination and defecation when working in the watershed. Any non-compliance with this instruction may constitute grounds for substantial fines specified in the contract and / or contract cancellation.
- 2.2 The contractor must make arrangements to remove human waste from the portable toilets on an "as required basis" and remove and dispose of this material in a safe manner as required by provincial regulations.
- 2.3 Recreational use of the watershed is not supported by the City of Kimberley.
- 2.3 All primary access points will be gated and locked to prevent unauthorized vehicular access into the watershed.
- 2.4 All secondary access points into the watershed will be gated and/or permanently deactivated to prevent unauthorized vehicular access into the watershed.
- 2.5 All access points (primary and secondary) will be posted with signs indicating access restrictions in force, the importance of the water resource and that recreational use of the watershed is discouraged.

5.1.10 Road Construction / Maintenance / Deactivation

- 1.0 Objective:** Ensure that the risk of sediment delivery to streams due to activities associated with roads is minimized, while maintaining adequate access to watershed resources.
- 2.0 Preventative Measures**
- 2.1 Follow all requirements of existing contractual obligations and all pertinent legislation including the Forest and Range Practices Act and the Mines Act.
- 2.2 Roads within the community watershed will be constructed in a way to minimize the cleared right of way width while still providing a road of sufficient standard to provide adequate user safety and environmental stability. Road systems will be planned to minimize total length of permanent roads and number of stream crossings. Follow the guidelines outlined in chapter 9 of the Community Watershed Guidebook which emphasize increased standards for inventorying, planning and monitoring roads within community watersheds.
- 2.3 When grading road-surfaces, care should be taken to avoid disturbing established vegetation in ditches and on road-sides in order to minimize the amount of exposed mineral soil.
- 2.4 Deactivate or rehabilitate all temporary and unnecessary roads as soon as practicable (within approximately 18 months of harvest completion). Ensure that deactivation activities only disturb existing vegetation where absolutely necessary. Wherever possible, rehabilitation is preferred over deactivation to discourage watershed access.
- 2.5 All roads, including deactivated roads, will be inspected periodically.
- 2.6 During road building activities in the watershed, all efforts will be made to reduce and/or eliminate sedimentation flow. Culvert inlets and outlets will be armoured with large rock where erodible soils are present, step sumps will also be constructed and ditches armoured with rock in high-risk erosion areas. Straw baling and silt fencing will be used where erodible soils are present. Newly constructed roads will be seeded with Mark Creek Erosion Control Mix seed blend immediately after construction or the following spring if construction is in the late fall or winter.
- 2.7 All BCTS FSR roads within the watershed will be inspected by a qualified inspector twice annually and after all major weather events. Bridges, culverts and high risk areas are to be checked for erosion and obstruction. If an issue is discovered and there is risk of causing sedimentation into Mark Creek or its tributaries, remedial action is to be deployed immediately. During spring freshet events, heavy equipment will be located in the watershed and put on standby for emergency deployment.
- 2.8 Maintenance items resulting from annual inspections are to be scheduled for repair by priority of potential to create sedimentation into Mark Creek. Maintenance repairs are to

be performed by a qualified contractor and supervised by BCTS official or qualified designate.

- 2.9 BCTS will deactivate or rehabilitate all roads in the watershed that are deemed no longer in use for forestry activities and /or roads that have a high risk of sedimentation into Mark Creek or its tributaries. BCTS officials will determine the level of deactivation based on the forecasted use of the road requirements, location/risk of the road. Roads that will be used in the near future for forestry or are required for fire control/erosion control no deactivation will be performed, classed as MR - Maintained Road. Roads that are inactive for up to 5 years but are required for future development or silviculture access will be temporarily deactivated with cross ditches and/or waterbars backing up culverts, classed as TD - Temporary Deactivation. Roads that will be inactive for more than 5 years are to be permanently deactivated with cross ditches and/or waterbars, unstable fill slopes pulled back to the road center or further and bermed at the start, classed as PD - Permanent Deactivation. Roads located within cutblocks and are no longer required for future development or roads that are not required for fire/erosion control or any other forestry related activity will be fully rehabilitated, classed as RR - Rehabilitated Road. Fully rehabilitated roads will have all bridges/culverts removed and the fill slope fully pulled back to recontour the site to its original shape.

When determining level of deactivation, BCTS will consider sections 2.4 and 4.4 of this plan and the position that no unauthorized access or recreation is desired in this community watershed.

All deactivated roads will be grass seeded with Mark Creek Erosion Control Mix seed blend.

BCTS will complete a signed and sealed deactivation prescription by a qualified professional, on all FSR roads to be deactivated in the watershed.

All deactivated BCTS FSR roads within the watershed will be inspected annually by a qualified inspector until vegetation has been successfully established and periodically thereafter.

5.1.11 Mineral Exploration and Drilling Requirements

1.0 Objective: Ensure that the risk to water quality due to activities associated with mineral exploration drilling operations is minimized.

2.0 Preventative Measures

- 2.1 Drilling fluids are to be contained in an imperviously-lined closed-circuit recycle system and sump. No direct discharges are permitted. All used drilling fluids and drill sludge are to be regularly removed from the area and disposed of at an approved disposal site. All core samples are to be transported outside of the community watershed for storage.
- 2.2 Any drilling fluid additives shall be of a non-toxic type (not harmful to humans, fish, or wildlife) and be acceptable for use in a community watershed. The product material safety data sheets (MSDS) shall be supplied to the Ministry of Forests, Lands and Natural Resource Operations, the Ministry of Environment and the Watershed Advisory Committee for their review and approval.
- 2.3 The drill shall be set up on an impermeable oil absorbing matting. A steel pan capable of containing 200% of the fuel tank capacity will be placed under the drill. The fuel tank/containment pan will be boxed in and roofed to prevent exposure to rain and snow.
- 2.4 An impermeable berm or other containment system shall be constructed at strategic locations sufficient to intercept and contain any inadvertent spills from the drill or equipment.
- 2.4 An impermeable berm or other containment system shall be constructed to divert any spills from the drill to the sump.
- 2.5 All drill holes shall be capped immediately after each hole is drilled. If the drill hole begins to leak water (artesian) then the hole shall be permanently plugged with cement.
- 2.6 If a gravity supply for water cannot be used and a supply pump is required, deleterious elements shall not be permitted to enter the watercourse.
- 2.7 The water pump shall be set up as far from the watercourse as practical in a tray sufficiently large to contain twice the amount of fuel at the pump and any heaters in winter. Riparian vegetation must be left intact. The pump, fuel tank and tray shall be covered to prevent rain or snowmelt from entering the containment tray. Any fuel or oil spills or leaks shall be expeditiously cleaned up and repaired. No fuel is to be stored adjacent to a watercourse and must be inaccessible to wildlife.
- 2.8 A soil berm and a barrier of oil absorbent matting or like material shall be placed between the pump and the watercourse so that any inadvertent spills are intercepted and prevented from entering the creek.

- 2.9 If a fuel or oil spill of any size occurs it must be reported immediately to the City of Kimberley and cleaned up immediately. If necessary utilize personal protective equipment and immediately stop the source of the spill, contain it and place absorbent material as needed. See fuel handling preventative measures for detailed procedures.
- 2.10 Portable toilet facilities must be supplied and maintained for workers. Toilets must be securely anchored and regularly pumped out.
- 2.11 Fuel to be transported to site by pick-up truck using heavy-walled tidy tanks. No bulk storage of fuel to occur on site. Only replacement quantities of engine oil, hydraulic fluid and gasoline for small motors should be kept on site.
- 2.12 All fuels and petrochemicals should be securely stored with proper containment measures.
- 2.13 Readily accessible spill kits should be kept on site and on all vehicles transporting petrochemicals within the watershed.
- 2.14 All personnel involved in the drilling operation must be trained on appropriate practices within the community watershed including waste handling, spill response, fire control and response, safe conduct including safe travel speeds and awareness of watershed protocols (*e.g.* keeping gates locked, no recreation, awareness of forestry activities in the area).
- 2.15 Signs should be placed near the drill site and near the junction with the main road to alert other users of the presence of the drilling operation.
- 2.16 Roads must be maintained such that risk of sedimentation in Mark Creek and its tributaries is minimal. Drilling activities may need to be suspended, particularly during spring break up, if weather conditions do not permit adequate road maintenance. A clear understanding of road use and maintenance responsibilities and timing of use of each road (*i.e.* access via Teck vs. access via Low Pass Road) should be established as soon as possible and before activities commence.
- 2.17 Additional water quality monitoring should occur upstream and downstream of the proposed site.
- 2.18 The site should be regularly inspected to ensure that best management practices are maintained and to catch potential problems before they become significant. Photos should be used to document site activities.
- 2.19 If further development is not imminent, the drill site and associated roads must be reclaimed and recontoured, the drill hold capped, and the site reseeded with clean weed-free seed to prevent erosion. The site should be monitored to ensure establishment of ground-cover.

5.2 Emergency Response and Contingency Plan

The Drinking Water Protection Act Section 10 and Drinking Water Protection Regulation Section 13 contain provisions for Water Suppliers to maintain an Emergency Response and Contingency Plan to respond to emergency or abnormal operational circumstance that could affect the water supply system or drinking water source.

Drinking Water Protection Act Section 10

- 10** (1) In the case of a prescribed water supply system, the water supplier must have a written emergency response and contingency plan in accordance with the regulations, to be implemented in the event of an emergency or abnormal operational circumstances affecting its water supply system or drinking water source.
- (2) The drinking water officer may order a water supplier to review and update its emergency response and contingency plan.

Drinking Water Protection Regulation Section 13

- 13** (1) In this section, "**public health inspector**" means a public health inspector as defined in the *Health Act*.
- (2) A water supplier must include the following in an emergency response and contingency plan:
- (a) the names and telephone numbers of
 - (i) the management personnel for the water supply system,
 - (ii) the drinking water officer, medical health officer and public health inspector, and
 - (iii) other agencies and officials specified by the drinking water officer;
 - (b) the persons referred to in paragraph (a) to be contacted in each type of emergency or abnormal operational circumstance;
 - (c) the steps to follow in the event of an emergency or abnormal operational circumstance;
 - (d) protocols to follow respecting public notice if an immediate reporting standard is not met.
- (3) A water supplier must
- (a) make the emergency response and contingency plan accessible to the staff of the water supplier, and
 - (b) provide a copy of the emergency response and contingency plan to the drinking water officer.
- (4) A water supplier must make a summary of the emergency response and contingency plan accessible to the users served by its water supply system.

(5) A water supplier must not include in the summary referred to in subsection (4) any information that may reasonably pose a risk to the water supply system.

The following contingency plan outlines the procedures that must be followed in the event of an emergency situation that has the potential to result in a detrimental impact to water quality or quantity. [Possible deterioration of water quality and/or quantity over the long term is not part of this contingency plan. Issues regarding long term water quality and/or quantity are dealt with in the water quality monitoring portion of the plan].

5.2.1 Objective

Identify remedial procedures, determine contacts, and assign responsibilities to ensure that any planned or accidental water supply disruption is properly managed and quickly resolved.

5.2.2 Background Information

The City of Kimberley's primary source of water is the Mark Creek reservoir which supplies approximately 80% of residents. The other 20% (primarily Marysville residents) are supplied by Matthew Creek. The City has the capability to supply the entire community with water from Mark Creek.

Any disruption in the Mark Creek water supply would result in water supply problems for the City of Kimberley. If the disruption lasted long enough to consume water stored in the water system, no readily available alternative water supply would be available. Emergency water supplies could potentially be brought to the community with tanker trucks under the Provincial Emergency Program (PEP).

5.2.3 Emergency Response

The City of Kimberley's Emergency Response Plan (ERP) is designed to cover most contingencies affecting water supply in the Community Watershed. This plan should be immediately invoked in case of emergency which may affect water quality or quantity.

Depending on the nature and extent of the water supply disruption, the lead agency may create an emergency response team that may consist of any of the following agencies and /or licensees:

- Ministry of Health - Interior Health Authority
- Ministry of Forests, Lands and Natural Resource Operations.
- Ministry of Environment - Environmental Protection Division
- Ministry of Forests, Lands and Natural Resource Operations- Wildfire Management Branch
- Representative from licensee / contractor that caused the disruption
- Representative from water licensees (City of Kimberley)
- Provincial Emergency Program as required
- Outside experts as required

If the emergency response team identifies non-compliance with legislation, regulations, and/or contractual obligations, a compliance and enforcement team composed of members from the appropriate agencies will be formed to continue the investigation and determine appropriate enforcement actions.

5.2.4 Economic Considerations Related to Compensation and Bonding

In the event of a water supply disruption resulting from the activities of a person, company or agency engaged in resource management, recreation or other activities (forestry or mining) the person, company or agency responsible for the disruption may be responsible for the following costs:

- the costs incurred by the City of Kimberley to supply the minimum domestic water requirements to the areas of the city affected by the disruption.
- the costs incurred by the City of Kimberley to communicate the necessity for any water restrictions to the citizens of Kimberley.
- in the event of a long-term disruption to water supply, the additional costs incurred by the City of Kimberley to supply water to the residents until the problem has been rectified.

All forestry tenure holders working in the watershed will be required to have a minimum of \$5,000,000 of liability insurance and/or performance bonds to ensure that adequate funds will be available to cover the cost of any water supply disruption that results from their activities.

In the case of permitted mineral exploration activities, the District Manager of the Ministry of Mines will ensure that reclamation security bonding, in an amount adequate for restoration of all disturbances related to the exploration project, is held by the government, and that permit conditions require a very high standard of operation as per government legislation and policies.

6.0 Implementation and Monitoring

6.1 Implementation and Monitoring Team

All participants involved in the preparation of the Mark Creek Integrated Watershed Management Plan were invited to have ongoing involvement on the Mark Creek IWMP Implementation and Monitoring Team (*a.k.a.* Watershed Advisory Committee or WAC). Ongoing involvement means receiving meeting minutes and implementation proceedings, and participating as members of the WAC to monitor subsequent operational plans, development activities and issues that may affect the Mark Creek Community Watershed. The Watershed Advisory Committee also oversees activity in the Matthew Creek watershed. Those who wish to continue to participate in the WAC and those who do not wish to do so, are listed in the following table.

Organization	Representative	Ongoing Involvement	No Further Involvement
Canfor (Matthew Creek)	Ian Johnson	x	
City of Kimberley - Council	Albert Hoglund alt. Kent Goodwin	x	
City of Kimberley - Staff	Operations Manager	x	
City of Kimberley - Drinking water contractor	Cori Barraclough	x	
Friends of Mark Creek	Kathy Murphy/ Blake Rawson	x	
Interior Health Authority	Dan Byron	x	
Kimberley Alpine Resort	vacant	x	
Kimberley Trails Society	Brett Price	x	
Ministry of Forests Lands and Natural Resource Operations, Area Forester for BCTS	Steve Knowles	x	
Ministry of Forests Lands and Natural Resource Operations, Stewardship Forester	Scott Hicks	x	
Ministry of Environment - Water Management	vacant	x	
Ministry of Energy and Mines, Mines Branch	vacant	x	
Ministry of Forests, Lands Natural Resource Operations – Water Stewardship	vacant	x	
Teck	Dana Hagggar		x
Ktunaxa Kinbasket Tribal Council	Sophie Pierre		x

Regional District of East Kootenay	vacant		x
Licensed trapper	Mark Creek trapper- Doug Barraclough	x	
	Matthew Creek trapper	x	
Wildsight	Dave Hale	x	
Wildsight	Andrea Chapman	x	

Additional participants may be invited to join the WAC by majority agreement of the WAC. The WAC will be chaired by the City of Kimberley. In the event that the City of Kimberley no longer wishes to chair the WAC, then a new chair will be selected by the committee.

A WAC meeting and field trip will be held at least once annually to monitor and follow up on objectives of this plan. WAC meetings will review activities that have occurred over the previous year (if any), review water monitoring data and forest health survey results, review all proposed activities (including forest development and mineral exploration), and identify action items for each participant to implement over the following year. Regular field trips help to ensure that committee members are able to track changes (good and bad) over time and see the outcome of previous decisions.

Meeting minutes and plan amendments will be prepared and forwarded to WAC participants and to those who request a copy.

Periodically, the plan will be reviewed for effectiveness at achieving overall objectives. This overall review should occur at least once every five years on a date to be identified by the WAC.

In the event of a major fire or insect infestation, a meeting of the WAC will be called to review the options for dealing with the situation and, if necessary, consider amending portions of the IWMP.

6.2 Implementation Responsibilities and Requirements

All operations within the watershed must be consistent with legislated and regulatory requirements and with the provisions of this integrated watershed management plan, particularly chapters 4 and 5.

It is recognized that many of the following implementation requirements will be subject to agencies or organizations obtaining sufficient funding. Lack of funding may halt, or change the timing of planned implementation activities. However, lack of funding does not negate the intent of this plan or the management objectives specified in Chapter 4.

6.2.1 Water

Activity	Strategy/Guideline	Responsibility
Water Licensing	Comply with terms of water licenses and maintain minimum flow for fish.	City of Kimberley
Delivery System	Maintain the current intake structure, complete with reservoir system, to accommodate fluctuations in water flow and demand.	City of Kimberley
Delivery System	Maintain delivery system with chlorination facilities, backup supply, and local reservoirs.	City of Kimberley
Chlorination	Maintain chlorination facility and treatment to respond to variations in natural water quality levels.	City of Kimberley
Monitoring Chlorination	Monitor chlorination effectiveness and resultant levels of trihalomethanes.	City of Kimberley
Debris Control	Control debris on reservoir	City of Kimberley
Water Quality and Quantity Monitoring	Monitor water quality, and quantity. See Appendix 9.1	City of Kimberley
Resource Use Activities	All operators will be required to have measures in place to ensure that human and industrial waste products are contained and removed from the watershed.	All resource users
Monitoring	Monitor domestic water quality to ensure management strategies are achieving desired results.	City of Kimberley
Monitoring	Monitor raw water quality and quantity to ensure management strategies are achieving desired results	City of Kimberley and BCTS

6.2.2 Fish and Aquatic Ecosystems

Activity	Strategy/Guideline	Responsibility
Riparian Management	During the WAC review meetings, all proposed activities within the riparian management areas will be reviewed for consistency with legislation, regulations, and the objectives of this plan.	Watershed Advisory Committee
Fishing	Continue to manage fishing through regulations.	MoFLNRO

6.2.3 Wildlife and Biological Diversity

Activity	Strategy/Guideline	Responsibility
Control beaver population and manage fur-bearers	Maintain trapping program under existing trapline.	MoFLNRO and Licensed trapper
Hunting	Continue to manage hunting through regulations.	MoFLNRO
Protect caribou herd	No hunting of caribou. Access restrictions on caribou zone.	MoFLNRO

6.2.4 Recreation and Visual Quality

Activity	Strategy/Guideline	Responsibility
Recreational Activities	The City of Kimberley does not support recreational activity in the watershed.	MoFLNRO City of Kimberley
Visual Impact Assessment	A visual impact assessment is required for all proposed cutblocks that are visible from the viewpoints identified in section 4.4.3 of this plan.	BCTS

6.2.5 Access Management

Activity	Strategy/Guideline	Responsibility
Planning	Carry out terrain hazard and erosion hazard mapping for overall planning reference.	BCTS
Co-ordinated Access Management	Co-ordinate access planning, development, maintenance, and reclamation between forest management, mineral exploration, and mine development. Minimizing detrimental impacts on water, fisheries, and wildlife will be the major consideration.	BCTS MoFLNRO MoEM City of Kimberley Teck
Information signs	Install and maintain information signs at entry points to the community watershed. These signs advise that the area is a community watershed and indicate the restrictions on public use of the area.	City of Kimberley BCTS
Physical Closures	Maintain physical closures on all road access points to the watershed.	Resource users City of Kimberley BCTS Teck
Regulatory Closures	Impose regulatory closures to limit non-commercial/ non-industrial use of the watershed in the caribou zone. Regulatory closures to limit non-commercial/ non-industrial use of the watershed outside of the caribou zone may be implemented if deemed necessary to protect drinking water quality.	MoFLNRO City of Kimberley
Helicopter Access	Monitor access opportunities to ensure that there are sufficient helicopter landing sites to facilitate fast efficient fire control	MoFLNRO

6.2.6 Cultural Heritage

Activity	Strategy/Guideline	Responsibility
Archaeological Overview Assessment	Complete an archaeological overview assessment of the Mark Creek Watershed to identify areas with significant potential for archaeological values. Completed.	MoFLNRO
Known Cultural Heritage Resources	If a resource user / permittee has knowledge of any known cultural heritage resources or protected heritage property in the area proposed for development, they must communicate this information to the applicable regulatory agency at the time that development is proposed.	Resource user / Permittee
Cultural Heritage (Archaeological Impact Assessment)	Activities must comply with the Heritage Conservation Act.	Resource user / Permittee
Archaeological Values	If a previously unknown cultural heritage resource or protected heritage property is encountered, the discoverer of the value(s) must report the presence	Resource user / Permittee, MoFLNRO, MoEM

6.2.7 Minerals and Energy

Activity	Strategy/Guideline	Responsibility
Tenure Disposition	Follow <i>Mineral Tenure Act</i> . Consider a conditional staking reserve on sensitive terrain and archaeological sites	MoFLNRO MoEM
Application/Notice of Work	Follow Mineral Exploration Code requirements, including those specific to community watersheds. Referrals will be sent to the chairperson of the Mark and Matthew Creek WAC for all proposed Applications / Notices of Work. The chairperson will immediately notify the appropriate WAC members and co-ordinate a response within the stipulated referral period. Prepare contingency plan for operations.	MoFLNRO Applicant Chairperson of the Mark and Matthew Creek Watershed Advisory Committee
Exploration Road Construction and Maintenance	Referrals will be sent to the chairperson of the Mark and Matthew Creek WAC for all proposed exploration road construction. The chairperson will immediately notify the appropriate WAC members and co-ordinate a response within the stipulated referral period. Deactivate and/or rehabilitate all unnecessary or unstable roads as soon as possible. Follow Mineral Exploration Code requirements, including those specific to community watersheds.	Proponent Chairperson of the Mark Matthew Creek Watershed Advisory Committee Enforcement by MoFLNRO

Activity	Strategy/Guideline	Responsibility
Exploration Drilling and Trenching	<p>Referrals will be sent to the chairperson of the Mark Matthew Creek WAC for all proposed exploration drilling and trenching. The chairperson will immediately notify the appropriate WAC members and co-ordinate a response within the stipulated referral period.</p> <p>Minimize ground disturbance and work off of existing roads where possible.</p> <p>Follow Mineral Exploration Code requirements, including those specific to community watersheds.</p> <p>Remove core samples (generally done but unnecessary) and disperse drilling solid waste on forest floor away from any creek outside of the community watershed.</p> <p>Ensure waste water from drilling is contained and removed off-site for proper disposal</p>	<p>Proponent</p> <p>Chairperson of the Mark Matthew Creek Watershed Advisory Committee</p> <p>Enforcement by MoFLNRO</p>
Production	<p>Follow Environmental Assessment Procedures.</p> <p>Follow <i>Environmental Assessment Act</i>.</p>	<p>Proponent</p> <p>Enforcement by MoFLNRO</p>
Site Reclamation	<p>Referrals will be sent to the chairperson of the Mark Creek WAC for all proposed reclamation. The chairperson will immediately notify the appropriate WAC members and co-ordinate a response within the stipulated referral period.</p> <p>Follow Reclamation Code requirements, including those specific to community watersheds, and the Environmental Assessment Approval requirements. As the preceding is fairly general, a letter outlining what specific reclamation is required and has been agreed upon is necessary.</p>	<p>Proponent</p> <p>Chairperson of the Mark Matthew Creek Watershed Advisory Committee</p> <p>Enforcement by MoFLNRO</p>

6.2.8 Forests and Timber

Activity	Strategy/Guideline	Responsibility
Tenure Disposition	Issue Timber Sale Licences.	BCTS
Inventory	Maintain a current inventory of the forest resources to facilitate planning and monitoring.	MoFLNRO
Referrals	Operational plans are to be referred to the WAC for review prior to approval by the senior officials. See Standard Operating Procedure as agreed to by BCTS and City of Kimberley (Appendix 9.5)	BCTS Chairperson of the Mark Matthew Creek Watershed Advisory Committee
Fire Prevention	Follow requirements of the Wildfire Act. Carry out hazard abatement to control combustible fuels.	Resource Users
Fire Suppression	Prepare an annual fire operations plan that includes the Mark Creek Community Watershed area. Escalate readiness with increasing risk. Take aggressive initial attack on all wildfires.	MoFLNRO Resource users
Pest Management	Monitor insect and disease activity annually. Carry out control measures as warranted with preference for biological control methods.	MoFLNRO

6.2.9 Forage

Activity	Strategy/Guideline	Responsibility
Noxious Weeds	Control noxious weeds primarily through manual methods.	MoFLNRO

7.0 Glossary

access management: Operational planning that identifies the requirements for all road construction, reconstruction, maintenance and deactivation.

biodiversity (biological diversity): The diversity of plants, animals, and other living organisms in all their forms and levels of organization, including genes, species, ecosystems, and the evolutionary and functional processes that link them.

broadcast burning: The prescribed and controlled use of fire to reduce the amount of slash on a site, to lower the hazard for wildlife, to prepare a site for reforestation, or to improve range land.

brushing: A silviculture activity using chemical, manual, grazing or mechanical means to control competing forest vegetation and reduce competition for space, light, moisture and nutrients with crop trees or seedlings.

critical habitat: Part or all of a specific place occupied by a species or a population which is recognized as essential for its survival.

cultural heritage: Refers to archaeological sites, First Nations traditional use sites, and structural and landscape features of cultural or historical significance.

deactivate: barricading of road where necessary to prevent access by motor vehicles, other than all-terrain vehicles; removal of all stream crossing structures; and stabilization of road prism to reduce likelihood of an adverse effect to natural resources. Measures include cross-ditching, water-bars, insloping, outsloping and other measures.

Drinking Water Officer: for the purposes of this plan, a drinking water officer has the same meaning as Section 3 of the Drinking Water Protection Act, and can include a Medical Health Officer and an Environmental Health Officer delegated a power or duty of a Drinking Water Officer

Equivalent Clearcut Area (ECA): describes a second-growth block in terms of its hydrological equivalent as a clearcut. As second growth develops, the hydrological impact on a site is reduced. The rate of reduction is expressed in proportion to the height of the second growth. For example, a 20 ha block with 6 m tree heights is 50 per cent recovered so the ECA of the block is 10 ha (20 ha x 50 per cent). On average, a stand must be at least 9 m tall before it can be considered 90 per cent hydrologically recovered. The ECA is used in calculating the peak flow index.

Peak flow index describes the risk of a change in peak flows for an entire watershed. It is calculated as part of the watershed assessment procedure (WAP), one component of the peak flow hazard. All the cutblocks in a watershed are tabulated with their ECAs. A weighting factor then is applied, based on the elevation band of the cutblock. All the weighted ECAs are added to arrive at the peak flow index for the watershed. This number is further increased depending on the amount of road in the watershed.

In summary, the ECA is a measure of the site hazard for peak flows in a cutblock. The peak flow index is a measure of the watershed hazard for peak flows. A stand that is 9 m tall is 90 per cent recovered – the maximum that a second growth stand will attain in a normal rotation.

faecal coliforms: A group of bacteria predominantly inhabiting the intestinal tract of humans and animals but occasionally found elsewhere. A general indicator of contamination.

fish habitat: Spawning grounds and nursery, rearing, food supply and migration areas upon which fish depend directly or indirectly in order to carry out their life processes.

forest ecosystem network (FEN): A planned landscape zone that serves to maintain or restore the natural connectivity within a landscape unit, by spatially linking fully protected areas, sensitive areas, classified areas, and old growth management areas.

fuel management: The planned manipulation or reduction of forest fuels for forest management and other land use objectives by: prescribed fire; mechanical, chemical or biological means; or alteration of the stand structure and species composition.

Giardia: An organism (specifically *Giardia lamblia*) that can infect humans via cysts, causing Giardiasis or "beaver fever". It is often present in streams and rivers that contain human or animal faeces. Cysts from human sources are more infectious to humans.

green-up: The process of re-establishing vegetation following logging to achieve specific management objectives, for example, rate of harvest control, visual cover for wildlife, or hydrological recovery.

intake management area: 100 metres upslope of the community watershed intake.

juvenile spacing: A thinning operation in which non-merchantable trees are felled; usually the thinned stems are left on the ground in the stand. Also known as non-commercial or pre-commercial thinning.

landscape unit: A planning area based on topographic or geographic features such as a watershed or series of watersheds, and established by the district manager.

mass wasting: Movement of soil and surficial material by gravity.

modification: The modification visual quality objective (VQO) allows alterations to dominate the original characteristic landscape. However, alterations must borrow from natural line and form to such an extent and on such a scale that they are comparable to natural occurrences.

modified roaded (MR): A Recreation Opportunity Spectrum (ROS) class where there are industrial resource extraction activities and resource roads.

old growth forest: Forest that contains live and dead trees of various sizes, species, composition, and age class structure. An old growth forest is a dynamic but slowly changing ecosystem (includes "climax" forests but not sub-climax or mid-seral forests). The age and structure of old growth varies with microclimate, forest type and biogeoclimatic zone.

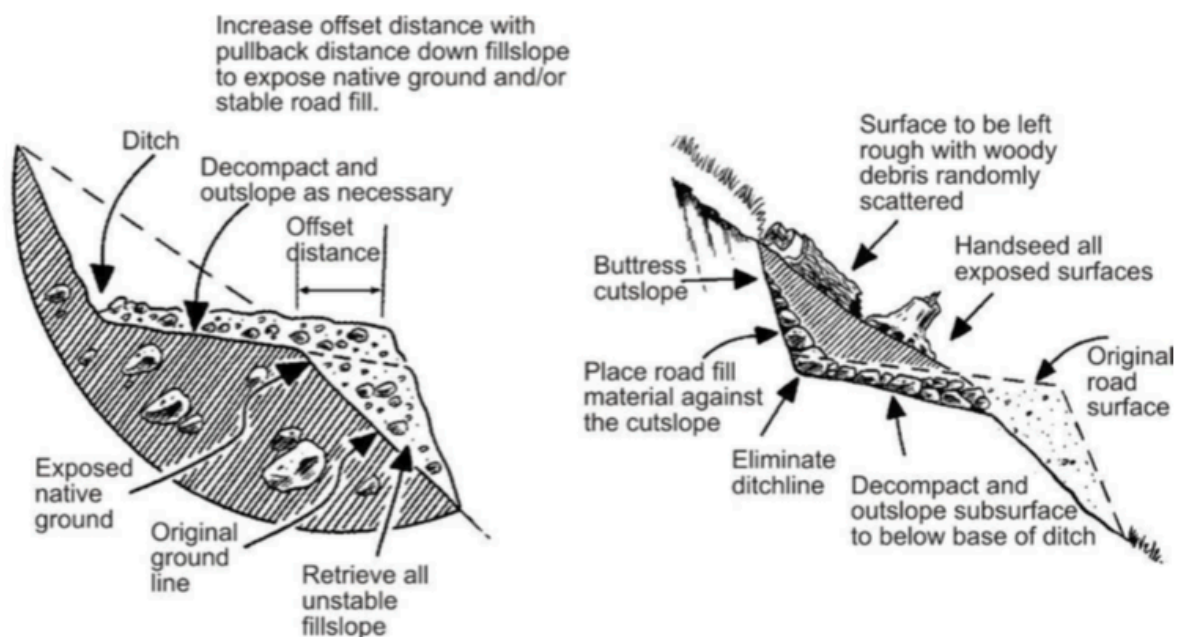
operable forest: Forest land available for timber extraction; *i.e.* forest which is accessible, has stable soils, contains merchantable timber and is otherwise economically viable to harvest, and which is not designated as a park or wilderness area, or for any use incompatible with timber production.

overview assessment: A preliminary identification and assessment of the potential archaeological, cultural or heritage resources of an area.

partial retention: The partial retention visual quality objective (VQO) requires that alterations remain visually subordinate to the characteristic landscape. Repetition of the line form, colour and texture is important to ensure blending with the dominant elements.

recreation opportunity spectrum (ROS): The Recreation Opportunity Spectrum (ROS) is divided into a number of classes ranging from Primitive to Urban. These classes describe the continuum of combinations of recreational activities, social and physical settings, and probable recreational experience opportunities.

rehabilitated road: restoration of site productivity along a road corridor by de-compacting compacted soils; returning displaced surface soils, retrievable side-cast and berm materials onto the area occupied by the road; and either placing wood debris on the exposed soils, or revegetating the exposed mineral soils to ensure hydrologic stability. See diagram below:



riparian management area (RMA): A classified area of specific width surrounding or adjacent to streams, lakes, riparian areas and wetlands, and which may also include adjacent upland areas. It is measured from bankfull height or the edge of the area to either the specified RMA distance, the top of the inner gorge, or the edge of the floodplain.

riparian reserve zone: An areas adjacent to a waterbody where no forest harvesting activities are permitted.

second-growth forest: A forest that has replaced a former or old growth forest, and is in an immature condition.

semi-primitive non-motorized (SPNM): A Recreation Opportunity Spectrum (ROS) class where there is a relatively high degree of remoteness and naturalness, no, or very low recreation facility development, no or very low site modifications, area is greater than 1,000 hectares, and very little or no motorized use.

semi-primitive motorized (SPM): A Recreation Opportunity Spectrum (ROS) class similar to semi-primitive non-motorized (SPNM) except for greater motorized use; a relatively high degree of remoteness and naturalness, no, or very low recreation facility development, no or very low site modifications, and area is greater than 1,000 hectares.

seral stages: The stages of ecological succession of a plant community, for example, from young to old stage; the characteristic sequence of biotic communities that successively occupy and replace each other, altering in the process some components of the physical environment over time.

silviculture: The art and science of manipulating and controlling the establishment, growth, composition, health and quality of forests and woodlands, in order to meet desired objectives.

site preparation: The manual, mechanical, or chemical treatment of a site designed to create or maintain favorable microclimate conditions for the establishment, survival and growth of regenerating trees. Treatments include chopping, diskings, bedding, raking, burning, scarifying and chemical spraying.

successional stages: The sequence of communities that progressively occupy an area over time; or, the process of change by which these communities replace each other.

trihalomethanes (THM's): Organic halogens, breakdown products of chlorination.

visually sensitive area: Areas that are visible from communities, public use areas, and travel corridors - including roadways and motorways - and any other viewpoint so identified through referral or planning processes.

visual quality objectives (VQO): A management objective that reflects the desired level of visual quality based on the physical characteristics and social concern for an area. The term refers to the degree of human alteration to the landscape that is socially acceptable.

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9.0 Appendices

Appendix 9.1 Water Monitoring Program

9.1.1 Background

The Mark Creek Water Monitoring Technical Committee (WMTC) came into existence during the development of the Mark Creek Integrated Watershed Management Plan (IWMP). This sub-committee no longer exists and the role has been taken over by the larger Mark Matthew Creek Watershed Advisory Committee. The primary goal of the Mark Creek IWMP is to ensure that land-based activities are conducted in such a way as to maintain water quality, quantity and timing of flows (including maximum daily flow, duration of flow, peak flow and maintenance of base flows) for Mark Creek water resources and the users of these resources. To develop this type of management plan and meet its objectives in the future, it is essential to understand the water quality and quantity of Mark Creek. As a designated community watershed, Mark Creek serves as the primary water source for the City of Kimberley.

Some portions of the creek are also important for supporting aquatic organisms including fish and amphibians. There is a resident population of westslope cutthroat trout above the City of Kimberley reservoir. These trout are listed as a species of “special concern” in BC and by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). It is also listed as “Special Concern” in Canada on Schedule 1 of the Species at Risk Act (SARA). Between the dam and the City of Kimberley, the fisheries and aquatic life values are marginal because of the channelized streambed and other impacts from mining and urbanization. Recent 2012-2016 improvements to Mark Creek through the City have significantly improved aquatic habitat in the urban area. Mark Creek from the point below the Marysville Falls to the St. Mary River supports an important westslope cutthroat trout population as well as other fish species (kokanee, trout, mountain whitefish, burbot, largescale sucker and others). Water quality, water quantity and biological monitoring is being conducted on Mark Creek by several agencies and individuals for various purposes.

In recognition of the importance of Mark Creek and the need to integrate water monitoring with respect to collection methods and data reliability, the Mark Creek IWMP committee assembled the parties responsible for conducting these monitoring programs and formed the Mark Creek WMTC. The WMTC was comprised of representatives from various levels of government, agencies or industries either conducting, or with interests in, monitoring programs in the Mark Creek Watershed. The committee was chaired by the Environmental Assessment Section Head for the Ministry of Environment Lands and Parks and included representation from the East Kootenay Community Health Services Society (EKCHSS), City of Kimberley, Ministry of Forests, Cominco Ltd., Water Survey of Canada as well as a representative from Forest Renewal BC's Water Resources Inventory Program, delivered through the Ministry of Environment Lands and Parks. Several years after the committee was formed, budget cuts within the Ministry of Environment limited the participation of Ministry employees and the Forest Renewal BC program was cancelled. With the closure of the Sullivan Mine, Cominco's involvement was reduced and with closure of the local Water Survey of Canada office, their involvement ended. The committee was thus absorbed into the Watershed Advisory Committee and monitoring is on-

going by the City of Kimberley above the dam and Teck continues to take water quality samples in lower Mark Creek.

9.1.2 Purpose

The primary purpose of the Mark Creek water quality monitoring program is to ensure that water quality and quantity data are adequate and reliable for the purposes of assisting in informed watershed management decisions for activities within the designated community watershed. A secondary purpose for the WMTC was to ensure data being collected in other portions of the watershed, by other agencies or industries for other reasons, was gathered in a manner consistent with that of the community watershed, however this function no longer exists.

The Mark Creek WMTC developed a water quality / quantity monitoring program for inclusion in the Mark Creek IWMP, which summarized the existing water quality monitoring being conducted while recognizing the various uses and goals of monitoring in the watershed. This program has been adapted to assess patterns of land use (*e.g.* road construction, timber harvesting and mining exploration) and scaled down to reflect budgetary constraints.

Due to the cancellation of the Forest Renewal BC program and the loss of staff positions within several government ministries, the WMTC was subsumed under the Mark/Matthew Creek Watershed Advisory Committee.

The specific objectives of the water quality and quantity monitoring program upstream of the community watershed intake are to:

- document and characterize water quality and natural variability in Mark Creek over a range of hydrological conditions (including extreme events such as drought and floods),
- focus on the physical, chemical and biological water quality variables which may be affected by land use activities (road building, logging, mining exploration, recreation),
- sample upstream tributaries as funding allows, to enable identification of negative impacts which may result from activities within the watershed, and
- provide adequate water quality information which can then be delivered to the purveyor, the licensee, Interior Health, and the Ministry of Forests, Lands and Natural Resource Operations in a timely manner to trigger investigative and corrective action.

The objectives of water quality monitoring being conducted at sites downstream of the community watershed intake are focused on tracking point and non-point source impacts from the Sullivan Mine and the urbanization within the lower watershed. This monitoring has also been optimized with respect to variables, detection limits and sampling frequencies, to allow for future development of water quality objectives specific to those impacts. Teck maintains this monitoring program.

9.1.3 Limitations

It is recognized that the continued implementation of the Mark Creek water quality monitoring program is subject to the availability of sufficient funding. The original program was designed to

gather information for several different purposes and has been scaled down to basic parameters required by the Drinking Water Protection Act and Regulations or which provide insight into effects of land use on water quality. The FRBC grab sampling program commenced in May 1998 and ran until fall 2000. In August 2001, the City of Kimberley took over responsibility for the grab sampling which has been undertaken by Aqua-Tex Scientific under contract since that time. Partial funding is contributed by BCTS. In its current form, the grab sampling program consists of water chemistry and bacteriological sampling for the following parameters: total suspended solids (TSS), turbidity, specific conductance, pH, fecal coliforms, enterococcus and *E. coli*. Over the course of 1998-2016 other parameters including nutrients and metals have been periodically sampled.

9.1.4 Current Water Monitoring Program Mark Creek, Above and Below Intake

9.1.4.1 DESCRIPTION OF EXISTING MONITORING SITES

Site 1 - Mark Creek at Marysville (0200029/ CT01)

- located between Marysville Falls and St. Mary River
- Teck takes 13 grab samples per year on the following schedule: 5 equally-spaced samples from mid-March to mid-April (to check for attainment of 30-day Aquatic Life Guidelines) then once per month for the months of May, June, July, August, September, October, November and February.
- Parameters measured are: Aluminum, ammonia (total as N), arsenic (total), cadmium (total and dissolved), cobalt, copper (total), fluoride, hardness, iron (total), lead (total), manganese, non-filterable residue (*i.e.* TSS), sulphate, zinc (total and dissolved).

Site 2 - Mark Creek at the Kimberley Arena

- No longer sampled

Site 3 - Mark Creek at Sorenson Way (E215225/MY16)

- located at Sorensen Way bridge
- Teck takes 13 samples per year on the following schedule: 5 equally-spaced samples from mid-March to mid-April (to check for attainment of 30-day Aquatic Life Guidelines) then once per month for the months of May, June, July, August, September, October, November and February.

Site 4 - Chlorination Plant for the Distribution System (Site E219680)

- City of Kimberley continuously monitors turbidity, temperature, rainfall and chlorine residual
- City of Kimberley measures total, faecal coliforms and *E. coli* weekly (also at Matthew Creek chlorination plant)

Site 5 - Mark Creek upstream of the Lower Mine Yard (Site 0200037. MY 12)

- Teck takes 13 samples per year on the following schedule: 5 equally-spaced samples from mid-March to mid-April (to check for attainment of 30-day Aquatic Life Guidelines) then once per month for the months of May, June, July, August, September, October, November and February.

Site 7 - Continuous Monitor Site 08NG085 Upstream of the City Reservoir

- located on the mainstem of Mark Creek, downstream of all sub-basins
- remote equipment continuously monitors water temperature, turbidity, conductivity and water level during the ice-free months of approximately April-October
- monitors the quality of water entering the reservoir from Mark Creek
- easy access where the road crosses the stream
- historical WSC gauging station for comparison with present water levels
- present Teck sampling location (E219528 and MY 19)

Site 9 - Grab Sampling Site E231341 Sub-basin 2

- located on the stream draining sub-basin 2, prior to its confluence with the Mark Creek mainstem
- grab sampling program commenced in May 1998.
- harvesting in sub-basin 2 is limited because much of sub-basin 2 is inoperable or constrained by caribou habitat requirements. Any future logging in this sub-basin would likely affect a relatively small proportion of this sub-basin. The present (Oct 2015) ECA for this basin is 2.8% with a further 1.9% proposed in the near future.

Site 10 - Grab Sampling Site E231340 Upstream of Sub-basin 2

- located on the mainstem of Mark Creek above sub-basins 1 and 2, downstream of sub-basins 3, 4, 5 and part of the residual area.
- grab sampling program commenced in May 1998
- easy access where road crosses stream at a permanent bridge
- this site will monitor changes in the upper north and east portions of the watershed where logging began. The establishment of this site prior to logging set baseline data, which can be compared to data collected following the commencement of logging activities, for impact assessment purposes.

Site 14 - Grab Sampling Site E248855 Downstream of all initial cutblocks (6)

- located on a tributary draining the east slope of the residual area
- grab sampling program commenced in March 2002
- six cutblocks were proposed for the initial harvesting in Mark Creek. They were all on the east side of the main stem. This site was intended to capture cumulative effects of all six cutblocks.

Site 15 - Grab Sampling Site E248856 Downstream of upper three cutblocks

- located on a tributary draining the east slope of sub-basin 5
- grab sampling program commenced in March 2002
- this site was established prior to the harvest of the first six cutblocks proposed for Mark Creek and was intended to assess effects close to the boundary (downstream) of the largest three blocks prior to dilution with drainage from unlogged areas.

Site 16 - Grab Sampling Site E248857 at Mark Creek Headwaters

- located at the top of the watershed, upstream of all forestry activity and acts as a control
- difficult access due to in-growth of access trail and deep winter snow
- grab sampling program commenced in June 2003
- This site was established prior to harvesting

Site 18 - Grab Sampling Site E278989 upstream of Drill Site #2 (SD2)

- located near the outlet of sub-basin 3, prior to the confluence with drainage from sub-basins 4 and 5.
- grab sampling program commenced in fall of 2004

Site 19 - Grab Sampling Site E278990 downstream of the first bridge

- located at the first bridge on the Mark Creek FSR. Drains sub-basin 1
- grab sampling program commenced in February 2007 to assess effects of logging on Teck's private land (now owned by City of Kimberley)

Site 20 – Grab Sampling Site E278991 at upper wetland

- located at the outlet of the wetland that receives drainage from the whole of sub-basin 5
- grab sampling program commenced in 2008.

Table 9.1.4.1: EXISTING SITES FOR THE MARK CREEK WATER MONITORING PROGRAM

Site #	WSC #/ EMS number	Location	Reporting Agency	Type of Sampling	Sampling Frequency	Status	Priority
1	08NG088	Mouth of St. Mary River	Teck	Hydrometric Monitoring	Continuous	Current	High
1	08NG088	Mouth of St. Mary River	Teck	Water Quality Grab Sampling	13 times per year (5 in 30 in spring)	Current	High
2		Kimberley Arena	Teck	none	none	archive	low
3	08NG087	Sorensen Way Bridge	Teck	Hydrometric Monitoring	Continuous	Current	High
3	08NG087	Sorensen Way Bridge	Teck	Water Quality Grab Sampling	13 times per year (5 in 30 in spring)	Current	High
4		Chlorination Plant	City of Kimberley	Turbidity, Temperature, Chlorine, Rainfall	Continuous	Current	High
4		Chlorination Plant	City of Kimberley	Water Quality Grab Sampling	Monthly, except weekly during freshet and extra sampling during extreme events	Current	High
5		Lower Mine Flume	Teck	Water Quality Grab Sampling	13 times per year (5 in 30 in spring)	Current	High
7	08NG085	Main-stem Upstream of Reservoir	City of Kimberley	Water level, temperature, turbidity, conductance	Continuous	Current	High
7	08NG085	Main-stem Upstream of Reservoir	City of Kimberley	Water Quality Grab Sampling	Monthly except weekly during freshet and extra sampling	Current	High

					during extreme events		
9	E231341	Sub-basin 2	City of Kimberley	Water Quality Grab Sampling	Monthly except weekly during freshet and extra sampling during extreme events	Current	High
10	E231340	Sub-basin 3, 4 and 5 and part of Residual Area	City of Kimberley	Water Quality Grab Sampling	Monthly except weekly during freshet and extra sampling during extreme events	Current	High
14	E248855	Residual Area	City of Kimberley	Water Quality Grab Sampling	Monthly except weekly during freshet and extra sampling during extreme events		
15	E248856	Sub-basin 5	City of Kimberley	Water Quality Grab Sampling	Monthly except weekly during freshet and extra sampling during extreme events	Current	
16	E248857	Headwaters	City of Kimberley	Water Quality Grab Sampling	Summer months only due to access	Current	

					constraints		
18	E278989	Sub-basin 3	City of Kimberley	Water Quality Grab Sampling	Monthly except weekly during freshet and extra sampling during extreme events	Current	
19	E278990	Sub-basin 1	City of Kimberley	Water Quality Grab Sampling	Monthly except weekly during freshet and extra sampling during extreme events	Current	
20	E278991	Sub-basin 5	City of Kimberley	Water Quality Grab Sampling	Monthly except weekly during freshet and extra sampling during extreme events	Current	

9.1.5 Potential Enhancements for Water Monitoring Program

9.1.5.1 Potential Additional Sampling Sites

As of 2016, ten sites are regularly monitored, including one remote monitoring site. Hydrometric monitoring has been reduced to water level only, but flow monitoring (volume) should be conducted to assess the effects of land-use and changing weather patterns not only on peak flow, but also on maximum daily flow, flow duration, and low flows. Additional remote monitoring higher in the watershed would provide a better characterization of runoff timing and volume, and a weather station within the watershed would better characterize precipitation events, temperature extremes and evaporation, to enable water balance assessments.

Grab sampling currently seeks to strike a balance between gathering routine background data and trying to obtain samples during extreme high and low flow events in order to assess the full range of variability.

At present, there is a poor understanding of bedload movements within the channel. Additional information on bedload should be linked to data on suspended sediments and sources of turbidity. Bedload accumulation in the reservoir is of particular interest to the City since it directly affects reservoir capacity.

Periodic re-testing for nutrients and metals should continue.

An analysis of benthic invertebrates, for comparison to the 1998 study, would serve as an additional measure of water quality impact.

9.1.5.3 Description of Potential Additional Monitoring Sites

Site 6 Grab Sampling of Tributary Stream that Flows Directly into the Reservoir

- located south of sub-basin 1 in the residual area near Low Pass
- this tributary does not join the mainstem of Mark Creek, and drains directly into the reservoir
- this tributary has been identified as a source of sediment in the past
- no regular sampling at present
- easy access where existing road crosses stream
- cutblocks are proposed in this sub-basin

9.1.5.4 Potential Bedload Study

Mark Creek presents a unique opportunity to measure bedload in a watershed since Mark Creek has an old dam (previous reservoir) which has collected bedload for about 70 years. An estimate of the accumulation of bedload behind the dam (including nearby piles of dredged bedload) could be completed by an experienced engineering firm and an annual rate of bedload accumulation could be calculated. Subsequent measurements of bedload accumulation behind the new dam could be made in the future and average rates of current bedload accumulations behind the new dam could be calculated. The average rate of current bedload accumulation could then be compared against historical rates of bedload accumulation providing a measure of impact of watershed activities on sediment yield.

9.1.6 Recommended Monitoring Standards

All sampling, reporting and quality assurance / quality control should follow the RIC (Resources Inventory Committee) guidelines as noted in documents listed below, unless otherwise stated:

1. Cavanagh, N., R.N. Nordin, L.G. Swain and L.W. Pommen, 1994. Ambient Fresh Water and Effluent Sampling Manual (Field Test Edition). Water Quality Branch, Environmental Protection, BC Environment, Victoria, B.C.
2. Cavanagh, N., R.N. Nordin, L.G. Swain and L.W. Pommen, 1994. Lake and Stream Bottom Sediment Sampling Manual (Field Test Edition). Water Quality Branch, Environmental Protection, BC Environment, Victoria, B.C.
3. Cavanagh, N., R.N. Nordin, and P.D. Warrington, 1994. Biological Sampling Manual (Field Test Edition). Water Quality Branch, Environmental Protection, BC Environment, Victoria, B.C.
4. Cavanagh, N., L.W. Pommen, L.G. Swain & R.N. Nordin. 1998. Guidelines for Interpreting Water Quality Data. Water Quality Branch, BC Environment, Victoria, BC.
5. Anderson, S.M. and E.T. White, 1996. Field Manual for Automated Water Quality Monitoring (Draft). Water Quality Branch, Environmental Protection, BC Environment, Victoria, B.C.

Variables to be monitored in this program are partially based on historical water quality data. The chemical, physical and biological characteristics that are most sensitive to forestry activities are measured. Standard water quality parameters are being measured to determine if water quality objectives for this watershed are being met. **Table 9.1.6** lists the water quality parameters, their detection limits, the most sensitive user, BC water quality criteria, and whether any of the water quality data since 1992 available from the various reporting agencies has exceeded these criteria (as far as can be reasonably ascertained). As data is accumulated over time, the spatial and

temporal variability of water quantity and water quality characteristics of Mark Creek will be better understood.

- grab samples are taken at each site approximately monthly during non-freshet and approximately during freshet and low flows. These grab samples are measured for temperature, pH, turbidity, total suspended solids and conductivity as well as fecal coliform and *E.coli*. Event sampling to capture storms and periods of drought is also incorporated into the program. Sampling during winter (Dec/Jan) is not undertaken if weather conditions are stable.
- A summary report and recommendations is generated on an annual basis by the City's contractor and forwarded to the Mark Creek IWMP for review and implementation. This report includes background information, sampling regimes and sampling methodologies and incorporates all the data in the form of tables and graphs. Any resulting trends and seasonal and temporal variations are described. General conclusions are made regarding the structure and functioning of the ecosystem as well as recommendations for modifications to the monitoring program.
- This monitoring program should continue for the entire duration of land use within the Mark Creek Watershed.

Table 9.1.6: WATER QUALITY PARAMETERS FOR MARK CREEK MONITORING PROGRAM

Parameter	Detection Limit in mg/L	Most Sensitive Water Use
Aluminum - dissolved	0.001	freshwater aquatic life
Antimony - total	0.0002	drinking water
Arsenic - total	0.0002	drinking water
Barium - total	0.0002	drinking water
Beryllium - total	0.0002	freshwater aquatic life
Boron - total	0.01	drinking water
Cadmium - total	0.00004	freshwater aquatic life
Calcium - total	0.0002	freshwater aquatic life
Chromium - total	0.0002	freshwater aquatic life
Cobalt - total	0.0002	freshwater aquatic life
Copper - total	0.0002	freshwater aquatic life
Fluoride - total	0.05	freshwater aquatic life
Iron - total	0.01	drinking water
Lead - total	0.0002	freshwater aquatic life
Magnesium - dissolved	0.01	drinking water
Manganese - total	0.0002	drinking water
Mercury - total	0.00005	freshwater aquatic life
Molybdenum - total	0.0002	wildlife
Nickel - total	0.0002	freshwater aquatic life
Phosphorus -total	0.002	drinking water
Potassium - dissolved	0.002	livestock
Selenium -total	0.0004	freshwater aquatic life

**Table 9.1.6: WATER QUALITY PARAMETERS FOR MARK CREEK MONITORING PROGRAM
(Con't)**

Parameter	Detection Limit in mg/L	Most Sensitive Water Use
Silver - total	0.00002	freshwater aquatic life
Sodium - dissolved	0.01	drinking water
Titanium - total	0.0002	drinking water
Vanadium - total	0.0002	drinking water
Zinc - total	0.001	freshwater aquatic life
Temperature	0.01 °C	freshwater aquatic life
pH	0.01 pH units	drinking water
Specific Conductance	1µS/cm	drinking water
Total Alkalinity (CaCO ₃)	0.5 mg/L	freshwater aquatic life
Sulphate - dissolved	0.5 mg/L	freshwater aquatic life
Hardness (CaCO ₃)	0.2 mg/L	drinking water
Chlorophyll A		freshwater aquatic life
Turbidity	0.1 NTU	drinking water
Total Suspended Solids	1 mg/L	freshwater aquatic life
Total Dissolved Solids	10 mg/L	drinking water
Nitrate and Nitrite	0.02 mg/L	drinking water
True Colour	5 colour units	drinking water
Coliform - Faecal	1 CFU/cL	drinking water
Coliform - Total		drinking water

9.1.7 Recommendations for Quality Assurance/Quality Control

- quality assurance / quality control of the continuous monitors should continue to be provided by the contractor for the water quality data.
- all meters used to gather discrete temperature, pH, dissolved oxygen, conductivity and turbidity readings must be properly maintained and calibrated prior to use in the field.
- the data generated by the continuous monitors should be downloaded and visually inspected quarterly to determine if there are any anomalies resulting from instrumentation error or water quality/quantity impacts, and any instrumentation errors should be corrected as soon as possible.
- water quality probes on the continuous monitors should be field calibrated according to the manufacturer's specifications and annually checked and calibrated by the supplier (Forest Technology Systems), or when portable meter measurements indicate that additional calibration is necessary.
- portable meters should be tested monthly against water quality standards before being taken out into the field
- quality assurance / quality control of the grab samples consists both of internal and external checks on methodology, analytical procedures and results, indicating possible sources of error and contamination and ensuring that the data generated is of the highest achievable quality. Blanks (deionized water), field duplicates (two samples collected sequentially from the same site) and reference samples (prepared samples using known amounts of chemical constituents) should be taken at each site at a frequency of 10% of total sample visits. These quality assurance / quality control visits should take place during freshet, summer and low flows.

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Appendix 9.2 Mark Creek Co-ordinated Access Management Plan Summary

Objectives:

- Identify access needs for the future.
- Determine responsibilities for roads (maintenance / deactivation).
- Determine road management classes (*i.e.* level of maintenance / deactivation required).
- Restrict unauthorized access

Road Management Classes:

MR = Maintained Road

Main road. May be closed during snowpack or wet periods.

TD = Temporary Deactivation

Seasonal deactivation. Water-barred. Closed for up to 5 years

PD = Permanent Deactivation

Closed for more than 5 years. Not driveable by pick-up truck.

RR = Rehabilitated Road

Fully rehabilitated road. All bridges and culverts removed, fill slope fully pulled back and recontoured. Full forest re-establishment.

**MARK CREEK
CO-ORDINATED ACCESS MANAGEMENT PLAN
SUMMARY**

February 2017 (to be updated annually)

A. Non-BCTS Roads

Road Start	Road End	Road Name	Road Length	Current State	Planned State	Length Deactivated	Length Rehab
0	1000	1.0.a	1000	Maintained	Maintained	0	
0	1843	1.0d	1843	Maintained	Maintained	0	
0	537	1.0e	537	Maintained	Maintained	0	
0	600	1.0j	600	Deactivated	Deactivated	600	
0	600	1.0k	600	Deactivated	Deactivated	600	
0	3000	1.0l	3000	Deactivated	Deactivated	3000	
0	4200	1.0m	4200	Deactivated	Deactivated	4200	
0	180	1.1.1	180	Deactivated	Deactivated	180	
0	100	1.1.2	100	Deactivated	Deactivated	100	
0	120	1.1.3	120	Deactivated	Deactivated	120	
0	1800	1.1.4	1800	Deactivated	Deactivated	1800	
0	1600	1.1.4.1	1600	Deactivated	Deactivated	1600	
0	440	1.1.4.1.2	440	Deactivated	Deactivated	440	
0	400	1.1.4.1.3	400	Deactivated	Deactivated	400	
0	120	1.1.4.1.4	120	Deactivated	Deactivated	120	
0	200	1.1.4.1.4.1	200	Deactivated	Deactivated	200	
0	80	1.1.4.2	80	Deactivated	Deactivated	80	
0	140	1.1.4.3	140	Deactivated	Deactivated	140	
0	1000	1.1.4.4	1000	Deactivated	Deactivated	1000	
0	1000	1.1.4.4.1	1000	Deactivated	Deactivated	1000	
0	340	1.1.4.5	340	Deactivated	Deactivated	340	
0	1400	1.1.4.6	1400	Deactivated	Deactivated	1400	
0	640	1.1.4.6.1	640	Deactivated	Deactivated	640	
0	100	1.1.4.6.1.1	100	Deactivated	Deactivated	100	
0	800	1.2	800	Deactivated	Deactivated	800	
0	280	1.2.1.1	280	Deactivated	Deactivated	280	
0	120	1.4	120	Deactivated	Deactivated	120	
0	300	1.5	300	Deactivated	Deactivated	300	
0	1900	1.6	1900	Maintained	Maintained	1900	
0	360	1.6.1	360	Deactivated	Deactivated	360	
0	520	1.7	520	Deactivated	Deactivated	520	
0	2500	1.8.2.a	2500	Maintained	Maintained	2500	
0	600	1.8.2.b	600	Deactivated	Deactivated	600	
0	1000	1.8.2.c	1000	Deactivated	Deactivated	1000	
0	240	1.8.2.1	240	Deactivated	Deactivated	240	
0	840	1.8.2.2	840	Deactivated	Deactivated	840	
0	140	1.8.2.3	140	Deactivated	Deactivated	140	
0	260	1.8.2.4	260	Deactivated	Deactivated	260	

0	720	1.8.3	720	Deactivated	Deactivated	720
0	1440	1.8.4	1440	Deactivated	Deactivated	1440
0	740	1.9	740	Deactivated	Deactivated	740
0	1800	1.10.c	1800	Deactivated	Deactivated	1800
0	400	1.10.1	400	Deactivated	Deactivated	400
0	612	1.10.2	612	Deactivated	Deactivated	612
0	720	1.10.3	720	Deactivated	Deactivated	720
0	1200	1.10.5	1200	Deactivated	Deactivated	1200
0	1840	1.10.6	1840	Deactivated	Deactivated	1840
0	200	1.10.6.1	200	Deactivated	Deactivated	200
0	360	1.10.6.2	360	Deactivated	Deactivated	360
0	120	1.11	120	Deactivated	Deactivated	120
0	600	1.13.a	600	Deactivated	Deactivated	600
0	1240	1.13.2	1240	Deactivated	Deactivated	1240
0	160	1.14	160	Deactivated	Deactivated	160
0	460	1.15	460	Deactivated	Deactivated	460
0	260	1.16	260	Deactivated	Deactivated	260
0	1400	1.17	1400	Deactivated	Deactivated	1400
0	500	1.17.1	500	Deactivated	Deactivated	500
0	1400	1.18	1400	Deactivated	Deactivated	1400
0	1600	1.13.c	1600	Deactivated	Deactivated	1600
0	4600	1.13.1.b	4600	Deactivated	Deactivated	4600
0	300	1.13.1.1	300	Deactivated	Deactivated	300
0	100	1.13.1.2	100	Deactivated	Deactivated	100
Totals			54072		50692	0

B. BCTS Roads

Road Start	Road End	Road Name	Road Length	Current State	Planned State	Length Deactivated	Length Rehab
0	1347	CR0252.16 Sullivan Hill Fsr	1347	Maintained	Deactivated		
1347	1944	CR0252.16 Sullivan Hill Fsr	597	Maintained	Deactivated		
1944	2477	CR0252.16 Sullivan Hill Fsr	533	Maintained	Deactivated		
2477	3830	CR0252.16 Sullivan Hill Fsr	1353	Maintained	Deactivated		
3830	5585	CR0252.16 Sullivan Hill Fsr	1755	Maintained	Deactivated		
10475	15475	CR0252.20MarkCkMain	5000	Maintained	Deactivated		
15475	15767	CR0252.20MarkCkMain	292	Maintained	Deactivated		
15768	16889	CR0252.20MarkCkMain	1121	Maintained	Deactivated		
0	729	CR0252.21MarkMainSpur6000	729	Deactivated	Deactivated	729	
0	1341	CR0252.22MarkCentral	1341	Maintained	Deactivated		
1341	2752	CR0252.22MarkCentral	1411	Maintained	Deactivated		
2752	3162	CR0252.22MarkCentral	410	Maintained	Deactivated		
0	1207	CR0252.23Mark MainSpur8000	1207	Rehab	Rehab		1207
0	6611	CR0252.24MarkNorthMainline	6611	Maintained	Deactivated		
0	1504	CR0252.26MarkNorthSpur9000	1504	Maintained	Deactivated		

1504	3568	CR0252.26MarkNorthSpur9000	2064	Maintained	Deactivated		
0	2365	CR0252.29MarkNorth Spur1000	2365	Maintained	Maintained		
2365	2820	CR0252.29MarkNorth Spur1000	455	Maintained	Rehab		
0	700	CR0252.30HighpassSpur1000	700	Maintained	Deactivated		
700	2042	CR0252.30HighpassSpur1000	1342	Maintained	Deactivated		
0	1555	CR0252.33Highpass Mainline	1555	Maintained	Deactivated		
0	2002	CR0252.34HighpassSpur2000	2002	Maintained	Deactivated		
0	489	CR0252.35HighpassSpur2200	489	Maintained	Deactivated		
0	2046	CR0252.38Marck South	2046	Maintained	Deactivated		
0	324	CR0252.40ReservoirBrA	324	Rehab	Rehab		324
0	1139	CR0252.39ReservoirSpur	1139	Rehab	Rehab		1139
0	115	CR0252.41MarkSouthBr A	115	Rehab	Rehab		115
0	706	CR0252.42MarkSouthBrB	706	Rehab	Rehab		706
0	1415	CR0252.43MarkCkEast	1415	Maintained	Deactivated		
0	722	CR0252.44MarkCkSpur9000	722	Maintained	Deactivated		
0	273	CR0252.45MarkCkBrA	273	Maintained	Deactivated		
2026	3296	CR0252.46MarkSouthSpur2000	1270	Maintained	Deactivated		
3297	5828	CR0252.46MarkSouthSpur2000	2531	Maintained	Deactivated		
0	2250	CR0252.47MarkSouthSpur2500	2250	Deactivated	Deactivated	2250	
0	547	CR0252.49MarkMainSpur7000	547	Rehab	Rehab		547
0	440	CR0252.50MarkMainSpur5000	440	Rehab	Rehab		440
0	671	CR0252.51SullivanHillBranchA	671	Maintained	Deactivated		
0	1073	CR0252.52Mark North Spur5000	1073	Maintained	Deactivated		
0	385	CR0252.53Mark North Spur4000	385	Maintained	Deactivated		
0	302	XCRR17399Sec1	302	Deactivated	Deactivated	302	
0	699	CRR15634Sec3	699	Deactivated	Deactivated	699	
0	274	CRR15634Sec4	274	Deactivated	Deactivated	274	
0	375	XCRR16954sec1	375	Deactivated	Deactivated	375	
0	557	XCRR16954sec3	557	Deactivated	Deactivated	557	
0	132	XCRR16954sec5	132	Deactivated	Deactivated	132	
0	171	CRMkCrMain (deact)	171	Deactivated	Deactivated	171	
Total			54600			5489	4478

9.2.1. Map of Current Resource Roads in the Mark Creek Watershed

Blocks and Forest Cover:

BLOCK STATE	PLANNING STATUS					
	Information (SMT/CI)	FRIPA	Proposed	OP Plan Complete	Declared	A-Approved
PP - Proposed						
WIP - Work in Progress						
ADV - Annual Developed Volume						
HB - Harvest Start						
LG - Logging Complete						
RG - Regen Met						
GU - Green-up Met						
GU not GU - Free Growing not Greened Up						
GU - Free Growing						
X - Deferred or Dropped						

Other Black States

Other Block States

- Unknown
- Surrendered Block
- Block in Write Off bucket
- SP Exempt (hatching on top of block fill)
- Results Openings >= 2003
- Results Openings >= 1987
- FTEN Layer Openings (from Ex A's)

Block C1

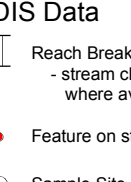
Block 30

- NP
- Res
- Time
- Disp
- WT
- Def
- Exp

Management Areas:

- | | |
|------|--|
| | BCTS Kootenay Business Area |
| | BCTS Operating Area |
| | BCTS FDU |
| | BCGS 20K Mapsheet Grid |
|
 | |
| | National Parks |
| | Provincial Park |
| | Protected Area |
| | Conservation Area or Ecological Reserve |
| | Recreation Area |
| | Woods or Community Forest |
| | Private |
| | Crown but NO HARVEST |
| | Undetermined Ownership - may be Crown or federal may be required |
| | Tanitolis Lots with Lot Numbers |
| | Indian Reserves |
| | Railway Reserve
Railway Reserve / Railway uses No Timber Rights
Conserved railway / Railway uses Timber Rights |
| | Xmas Tree Permit |
| | Special Use Permit |
| | Quarry |

LRW TRIM Waterbodies

- Wetlands
- FDIS Data**
- Reach Break
 - stream class for downstream section where available
 - Feature on stream
 - Sample Site
- Visual**
- Stability Class V
- Stability Class IV
- Unstable Terrain
- Potentially Unstable Terrain
- 
- The legend is divided into two sections. The top section, titled 'FDIS Data', lists three items: 'Reach Break' (represented by a vertical line with a horizontal bar at the top), 'Feature on stream' (represented by a red dot), and 'Sample Site' (represented by a black dot). The bottom section, titled 'Visual', lists four terrain stability categories: 'Stability Class V', 'Stability Class IV', 'Unstable Terrain', and 'Potentially Unstable Terrain'. To the right of these categories is a legend box containing a purple square with a white circle inside, which has the letters 'PR' in purple.

Streama

- FDP Fish Data, Unknown Source**
- | | |
|-------------|--|
| S1 | Fish Bearing Streams Confirmed S1-S4 |
| S4 | Non Fish Bearing Streams Confirmed S5-S4 |
| (S1) | Fish Bearing Streams Unconfirmed S1-S4 |
| (S4) | Non Fish Bearing Streams Unconfirmed S5-S4 |
- Quality Objectives:**
- | |
|---------------------------|
| Partial Quality Objective |
| Partial Quality Objective |
| Partial Retention |
| Modification |
| Non Viable |

Access Management:

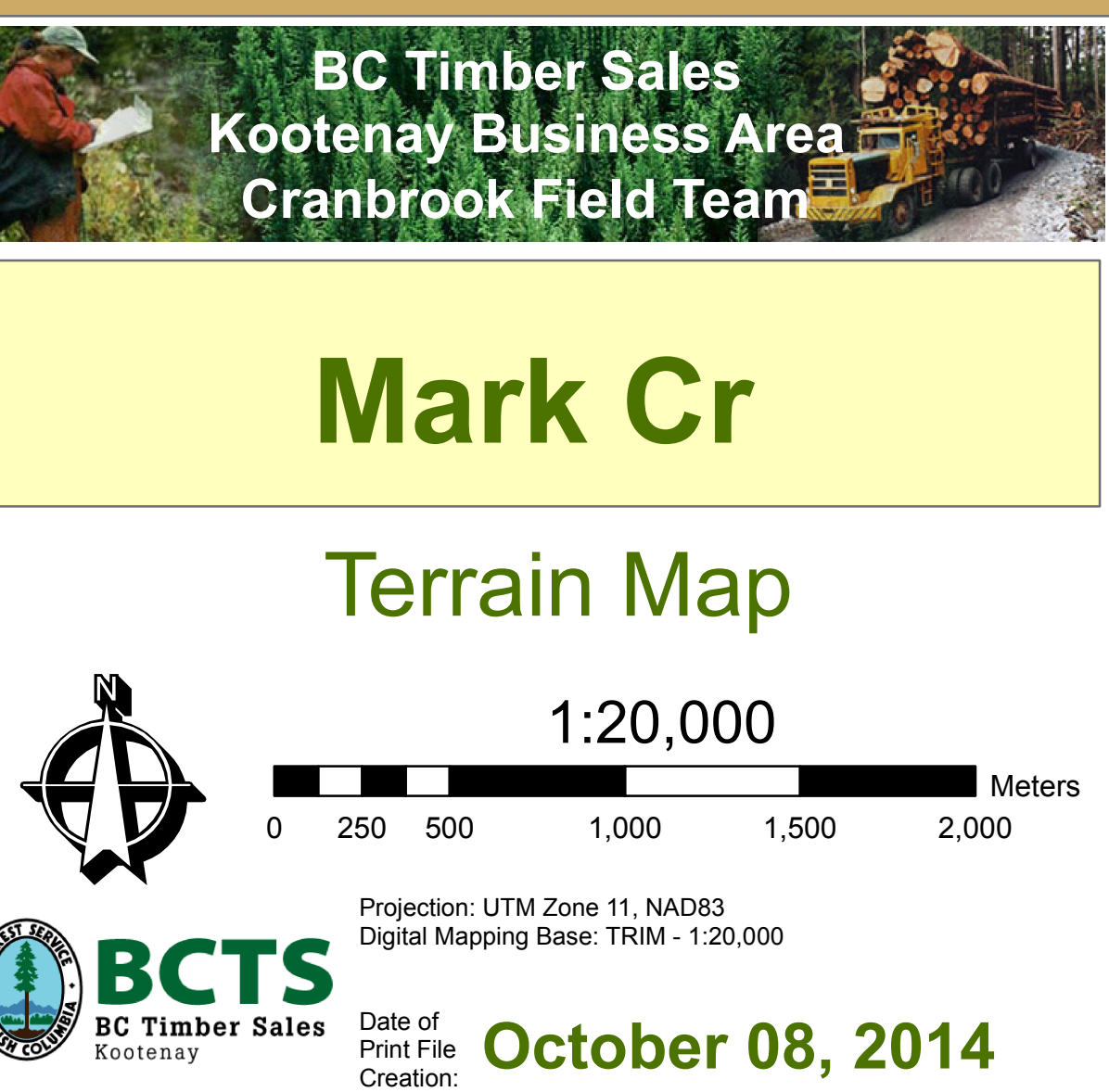
- Congee Roads:**
(from Statue 56)
-  Existing Maintained Road
 -  Deactivated Road
 -  BCTS Planned Road
 -  Unknown
 -  Wilderness
 -  Road Permit
 -  BCTS FSR
 -  MOFF FSR
- BCGW:**
-  Airport Transportation
 -  Ferry Route
 -  Rough Road or Trail
 -  Trail
 -  Spur
 -  Road (Gravel or Unimproved)
 -  Bridge
 -  Rail Line
 -  Road Paved

Concrete Structures:

- Legend:**
- Bridge Proposed
 - Bridge
 - Bridge Permanent
 - Bridge Semi Perm
 - Bridge Temporary
 - Bridge Removed
 - Bridge Condemned
 - Access Control or
 - Access Control or
 - Catguard Proposed
 - Catguard
 - Gate Proposed
 - Gate
 - Road Blockage or
- Legend:**
- 100m Contour Line
 - 20m Contour Line
 - Electrical Substation
 - Mines, Pit
 - Fence
 - Transmission Line
 - Pipeline

- Change Features:**
-  Water Trough
 -  Fence
 -  Corral
 -  Cattleguards
 -  Bluffs
 -  Gate
 -  Exclosure
 -  Pump
 -  Spring
 -  Spring with Trough
 -  Tank
 -  Well

- 1000000



Appendix 9.3 Fuel Management

BC Timber Sales
Environmental Management System
ENVIRONMENTAL FIELD PROCEDURE
EFP 06 FUEL HANDLING

Purpose and Scope

This Environmental Field Procedure (EFP) applies to all BCTS clients (Licensee, Permittee and Contractor workers) and BCTS staff who are responsible for fuel handling within the scope of BCTS EMS program. The purpose of this document is to bring together legislative requirements, industrial standards and best management practices as it relates to fuel handling, storage and transportation. The primary fuel used within the forest industry is diesel fuel found under Class 3, Flammable Liquids. This EFP is intended to help promote good fuel management, and is not intended to supersede legislative requirements or criteria. Applicable Acts and Regulations include: Transportation of Dangerous Goods Act and Regulations, BC Motor Vehicle Act and Regulations, Environmental Management Act and Regulations, Hazardous Products Act and Regulation, Contaminated Sites Act and Regulations, Workers' Compensation Act and OHS Regulations.

Table	Contents	Page #
1	Small Fuel Containers <230 L Includes drums, pails and canisters typically used to transport, store and dispense small quantities of fuel, oil, solvents and antifreeze	2
2	Small Mobile (Truck Box) Tanks <450L Ancillary tank located in the box of a pickup truck used to transport, store and dispense fuel	3
3	Large Mobile Tanks >450 L to 3000L Ancillary tank typically located in the box of a pickup truck used to transport, store and dispense fuel	4
4	Highway Tanks & TC Portable Tanks, Generally >3000L Used to transport fuel. Sometimes used to store and dispense fuel.	5
5	Large Stationary Skid Tanks >3000L Used to store and dispense fuel, rarely used to transport fuel	6
6	Definition of Terms In an effort to keep this document short and to the point, some terms and clauses were used that may require further explanation or interpretation. The Definition of Terms is also used to provide examples. Transport Canada contact information	7 to 9 9
7	Spill Kit Requirements This section outlines minimum spill kit content requirements for BCTS clients	10

BC Timber Sales

Environmental Management System

ENVIRONMENTAL FIELD PROCEDURE

EFP 06 FUEL HANDLING

TABLE #1 SMALL FUEL CONTAINERS (Volumes <230L) Drums, Jerry Cans, Pails, Canisters				Legend	
				■ Legal Requirement	☒ BCTS Requirement ☒ Information
TYPE	CONDITION, DESIGN & MAINTENANCE	STORING & SECURING	DISPENSING	TRANSPORT (see column 2 for securing details)	PREVENTION & RESPONSE
SMALL FUEL CONTAINERS (Volumes < 230L)	<ul style="list-style-type: none"> ■ Must be filled and capped so that under normal conditions there will be no leakage that would endanger public or worker safety ☒ Containers must be in good condition – not damaged, rusting or leaking. <p>Construction Standard</p> <ul style="list-style-type: none"> ☒ Containers must be specifically designed for the product. <ul style="list-style-type: none"> ■ Containers <u>less than 30 liters</u> are exempt from TDG requirements but are still governed under WHMIS. <p>Inspections</p> <ul style="list-style-type: none"> ☒ Licensees/ Contractors must self inspect containers on a regular basis, (plastic containers usually every 5 years), and replace fatigued containers immediately and document. 	<ul style="list-style-type: none"> ☒ Do not store small containers in Riparian Management areas or Marine Environments wherever practicable ☒ Do not smoke where fuel is stored or dispensed <p>Labeling</p> <ul style="list-style-type: none"> ■ Any container over 30 liters must have appropriate safety marks: <ul style="list-style-type: none"> • Label or Placard as required, • UN number and • Shipping Name ■ TDG safety marks on the outside of an enclosed unit must be visible if containers are stored within an enclosed unit. ■ WHMIS labeling or appropriate <u>Product Identification</u> is required when storing hazardous products <p>Securing</p> <ul style="list-style-type: none"> ■ As per manufactures recommendations, containers must be secured to prevent shifting, swaying, damage or escape from the vehicle ■ Tie down straps must have safe <u>combined</u> working load ratings <u>greater</u> than the secured load. 	<ul style="list-style-type: none"> ■ Maintain current Safety Data Sheets (SDS) in a location available to worker ☒ Do not dispense fuel in Riparian Management areas or Marine Environments wherever practicable. ☒ Dispense all flammable and combustible substances only from drums in an upright position ☒ Do not fill containers beyond their safe filling level (<u>approximate safe level</u> – 90%) ☒ Store the hose above the pump (and drum) to avoid siphoning. 	<ul style="list-style-type: none"> ■ Drums must be properly arranged by: <ul style="list-style-type: none"> • Stacking in an upright, vertical position • Separating and Protecting through use of boards, stakes or sides on the vehicle to protect the load from moving ■ If multiple containers of Class 3 (diesel or gasoline) products are transported and the <u>combined capacity</u> exceeds 2000L, the following conditions apply: <ul style="list-style-type: none"> • A shipping document must be completed for the goods hauled • The operator must have TDG training and possess a certificate • The load must have placards on all visible sides ■ Drum transport are exempt from TDG Regs Parts 2, 3, 4 & 7 provided: <ul style="list-style-type: none"> • Drum residue <10% • If more than 10 drums then DANGER Placards are required on all four sides • Document the primary class, 'residue drums', and number of drums 	<ul style="list-style-type: none"> ■ Take reasonable measures to prevent leaks & spills ☒ Where dispensing fuel in higher risk areas consider utilizing additional Spill Control and Prevention Measures (see Table #6). <p>Fire Control and Response</p> <ul style="list-style-type: none"> ☒ Maintain and self-inspect one suitable B:C-rated fire extinguisher ensuring it's: <ul style="list-style-type: none"> • not actuated or tampered with • shows no obvious physical damage, (i.e. corrosion, leakage, or clogged nozzle) to prevent its operation • pressure gauge reading or indicator is in operable range • safety seal or pin in place; • product id/WHMIS label in place • located in appropriate location, and • document self-inspections

BC Timber Sales
Environmental Management System
ENVIRONMENTAL FIELD PROCEDURE
EFP 06 FUEL HANDLING

TABLE #2 SMALL MOBILE (TRUCK BOX) TANKS (Volumes: <450L)

TABLE #2 SMALL MOBILE (TRUCK BOX) TANKS (Volumes: <450L)				Legend		
				■ Legal Requirement	☑ BCTS Requirement	☐ Information
TYPE	CONDITION, DESIGN, & MAINTENANCE	STORING & SECURING	DISPENSING	TRANSPORT (see column 2 for securing details)		PREVENTION & RESPONSE
SMALL MOBILE (TRUCK BOX) TANKS (Volumes: <450L)	<ul style="list-style-type: none">■ Must be filled and capped so that under normal conditions there will be no leakage that would endanger public or worker safety☑ Containers must be in good condition – not damaged, rusting, or leaking <p>Construction Standard</p> <ul style="list-style-type: none">■ Diesel: a spec or non-spec tank may be used. This tank capacity (450L or less) is exempt from the specifications standards under the TDG regulation.■ Gasoline: a <u>spec tank is required</u> and must show the spec plate of the design standard.■ Spec tanks may include:<ul style="list-style-type: none">• UN Standard IBC UN 31A and UN31B IBC Portable Tanks as per CAN/CGSB 43.146 (2002)• ULC/ORD 142.13■ All Gasoline spec tanks must be tested and inspected by a Transport Canada (TC) Registered facility every 5 years. Proof that tests and inspections were conducted by a TC Registered facility within the last 5 years must be available upon request. <p>Inspections</p> <ul style="list-style-type: none">☑ Licensees/ Contractors must self inspect tanks on a regular basis, and replace fatigued tanks immediately and document.	<ul style="list-style-type: none">■ Use a pressure relief cap that meets manufacturers design specifications☑ Do not store small mobile tanks in riparian management areas or marine environments wherever practicable☑ Do not smoke where fuel is stored or dispensed <p>Securing</p> <ul style="list-style-type: none">■ As per manufactures recommendations, tanks must be appropriately secured to prevent shifting, swaying, damage or escape from the vehicle■ Tie down straps must have safe <u>combined</u> working load ratings <i>greater</i> than the secured load	<ul style="list-style-type: none">■ Use dispensing pumps designed for the products being handled■ Use an appropriate hose and nozzle (in accordance with ULC standards) for dispensing fuel■ Make sure there is suitable bonding (i.e. wire lined hose) to prevent static charges when dispensing gasoline.■ Maintain current SDS in a location available to workers☑ Hoses and nozzles must be maintained and not leak.☑ Do not dispense fuel in riparian management areas or marine environments wherever practicable.☑ Operators must stay with the nozzle <u>at all times</u> while dispensing fuel☑ Nozzles must be secured in drip containment after use or in an <u>upright</u> position so that it's above the tank.☑ Close valves when finished dispensing☑ Store hose in a safe manner to prevent damage and leaks (i.e. coiled on top of tank)☑ Do not fill tanks beyond their safe filling level (<i>approximate safe level – 90%</i>)☑ Keep fuel and equipment on level ground	<ul style="list-style-type: none">■ If multiple tanks of Class 3 product (diesel or gasoline) are carried on the vehicle and the <u>combined capacity</u> exceeds 2000 liters, the following conditions apply:<ul style="list-style-type: none">• A shipping document must be completed for the goods hauled• The operator must have a TDG training and possess a valid certificate• The load must be placarded on all visible sides <p>Safety Labeling & Spec Plates</p> <ul style="list-style-type: none">■ WHMIS labeling or appropriate <u>Product Identification</u> is required when storing hazardous products■ Maintain visible safety marks:<ul style="list-style-type: none">• Label or placard• UN number and• Shipping name■ TDG safety marks must be visible on the tank or any enclosed storage unit■ Spec plates, decals or associated documentation--(ensuring paperwork is linked to the specific tank) must identify the following:<ul style="list-style-type: none">• Container Type & Standard• Manufacturer and Date• Re-certification Date and TC Registered Facility		<ul style="list-style-type: none">■ Take reasonable measures to prevent leaks & spills☑ Where dispensing fuel in higher risk areas consider utilizing additional Spill Control and Prevention Measures (see Table #6).☑ Where tanks are stored on the ground, collision protection is required. (see Table #6) <p>Fire Control and Response</p> <ul style="list-style-type: none">☑ Maintain and self-inspect one suitable B:C-rated fire extinguisher ensuring it's:<ul style="list-style-type: none">• not actuated or tampered with• shows no obvious physical damage, (i.e. corrosion, leakage, or clogged nozzle) to prevent its operation• pressure gauge reading or indicator is in operable range• safety seal or pin in place;• product id/WHMIS label in place• located in appropriate location, and• document self-inspections

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TABLE #3 LARGE MOBILE TANKS (Volumes: >450L – 3000L)

				Legend	
				☐ Legal Requirement	☒ BCTS Requirement
TYPE	CONDITION, DESIGN, & MAINTENANCE	STORING AND SECURING	DISPENSING	TRANSPORT (see column 2 for securing details)	PREVENTION & RESPONSE
LARGE MOBILE TANKS (Volumes: >450L – 3000L)	<ul style="list-style-type: none"> ■ Must be filled and capped so that under normal conditions there will be no leakage that would endanger public or worker safety ☑ Containers must be in good condition – not damaged, rusting, or leaking <p>Construction Standard</p> <ul style="list-style-type: none"> ■ All Tanks: used to transport fuel (regardless of volume) must be designed, and constructed to a mobile tank standard and display a spec plate. ■ Spec Tanks: used for diesel and gasoline may have one of the following spec plates: <ul style="list-style-type: none"> • UN Standard IBC UN 31A and UN31B IBC Portable Tanks as per CAN/CGSB 43.146 (2002) • ULC/ORD 142.13 ■ Non-Spec Tanks may no longer be used. Any tank without a spec plate is non-spec. <p>Inspections</p> <ul style="list-style-type: none"> ■ All Spec tanks (listed above) must be tested and inspected by a Transport Canada (TC) Registered facility every 5 years. Proof that tests and inspections were conducted by a TC Registered facility within the last 5 years must be available upon request. ☑ Licensees/ Contractors must self inspect tanks on a regular basis, and replace fatigued tanks immediately and document. 	<ul style="list-style-type: none"> ■ Use a pressure relief cap that meets manufacturers design specifications ☑ Do not leave vehicles carrying auxiliary fuel in riparian management areas or marine environments wherever practicable. ☑ Do not smoke where fuel is stored or dispensed <p>Securing</p> <ul style="list-style-type: none"> ■ As per manufactures recommendations, tanks must be appropriately-secured to prevent shifting, swaying, damage or escape from the vehicle or trailer ■ Tie down straps must have safe <u>combined</u> working load ratings <i>greater</i> than the secured load to ensure the tank is integrally mounted 	<ul style="list-style-type: none"> ■ Use an appropriate hose and nozzle (in accordance with ULC Standards) for dispensing fuel ■ Use dispensing pumps designed for the products being handled. ■ Make sure there is suitable bonding (i.e. wire lined hose) to prevent static charges when dispensing gasoline ■ Maintain current SDS in a location available to workers ☑ Hoses and nozzles must be maintained and not leak ☑ Do not dispense fuel in riparian management areas or marine environments wherever practicable. ☑ Operators must stay with the nozzle <u>at all times</u> while dispensing fuel ☑ Nozzles must be secured in drip containment after use or in an <u>upright</u> position so that it's above the tank. ☑ Keep fuel and equipment on level ground ☑ Close valves when finished dispensing ☑ Store hose in a safe manner to prevent damage and leaks (i.e. coiled on top of tank) ☑ Do not fill tanks beyond their safe filling level (<i>approximate safe level</i> – 90%) 	<ul style="list-style-type: none"> ■ If multiple tanks of Class 3 product (diesel or gasoline) are carried on the vehicle and the <u>combined capacity</u> exceeds 2000 liters, the following conditions apply: <ul style="list-style-type: none"> • A shipping document must be completed for the goods hauled • The operator must have a TDG training and possess a certificate • The load must be placarded on all visible sides. ■ If large mobile tanks are transported on a trailer, the trailer must be Motor Vehicle Requirements, (GVW, brakes, lights and axels etc.). <p>Safety Labeling & Spec Plates</p> <ul style="list-style-type: none"> ■ Maintain visible safety marks: <ul style="list-style-type: none"> • Label or placard, (placard if exceeding 500 kg) • UN number and • Shipping name ■ TDG Placards must be visible ■ Spec plates, decals or associated documentation--(ensuring paperwork is linked to the specific tank) must identify the following: <ul style="list-style-type: none"> • Container Type & Standard • Manufacturer and Date • Re-certification Date and TC Registered Facility <p>Labeling</p> <ul style="list-style-type: none"> ■ WHMIS labeling or appropriate <u>Product Identification</u> is required when storing hazardous products 	<ul style="list-style-type: none"> ■ Take reasonable measures to prevent leaks & spills ☑ Where dispensing fuel in higher risk areas consider utilizing additional Spill Control and Prevention Measures (see Table #6). ☑ Where tanks are stored on the ground, collision protection is required. (see Table #6) <p>Fire Control and Response</p> <ul style="list-style-type: none"> ☑ Maintain and self-inspect one suitable B:C- rated fire extinguisher ensuring it's: <ul style="list-style-type: none"> • not actuated or tampered with • shows no obvious physical damage, (i.e. corrosion, leakage, or clogged nozzle) to prevent its operation • pressure gauge reading or indicator is in operable range • safety seal or pin in place; • product id/WHMIS label in place • located in appropriate location, and • document self-inspections

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TABLE #4 HIGHWAY & TC PORTABLE TANKS
(Fuel Trucks & Pup-Trailers with Volumes > 3000L)

				Legend	
				■ Legal Requirement	☑ BCTS Requirement
				☐ Information	
TYPE	CONDITION, DESIGN & MAINTENANCE	STORING AND SECURING	DISPENSING	TRANSPORT (see column 2 for securing details)	PREVENTION & RESPONSE
HIGHWAY & TC PORTABLE TANKS (Volume > 3000L)	<ul style="list-style-type: none"> ■ Must be filled and capped so that under normal conditions there will be no leakage that would endanger public or worker safety Construction Standard ■ All Tanks: used to transport fuel and sometimes to store and dispense fuel. Tanks must designed, constructed and/or tested to a design standard specification and display a visible and legible spec plate to that standard. <ul style="list-style-type: none"> • TC44 Portable Tanks as per CSA B626 • UN Standardized Portable Tanks as per CSA B625-13 Standard ■ Fuel Trucks must meet the following: <ul style="list-style-type: none"> • CSA B620-03 Highway and Portable Tanks for TDG • Spec tank built after 2003 may transport diesel or gasoline ■ Non-Spec Tanks may no longer be used. Any tank without a spec plate is non-spec. Inspections ■ All Highway and Transport Canada (TC), Portable Tanks must be tested and inspected by a TC Registered facility every five years. Proof that tank tests and inspections were conducted by a TC Registered Facility must be available upon request. ☑ Licensees/ Contractors must self inspect tanks on a regular basis, and replace fatigued tanks immediately and document. ☑ Tanks must be in good condition—not damaged, rusting or leaking 	<ul style="list-style-type: none"> ■ Use a pressure relief hatch that meets manufacturers design specifications ☑ Do not leave fuel truck or pup trailer in riparian management areas or marine environments wherever practicable. ☑ Do not smoke where fuel is stored or dispensed Securing ■ Fuel truck tanks must be integrally mounted to the unit Labeling ■ Product identification is an acceptable substitute for supplier or workplace labels and may be affixed to the sides of the tank compartments and piping 	<ul style="list-style-type: none"> ■ Use an appropriate hose and nozzle (in accordance with ULC standards) for dispensing fuel ■ Use dispensing pumps designed for the products being handled ■ Make sure there is suitable bonding (i.e. wire lined hose) to prevent static charges when dispensing gasoline ■ Maintain current SDS in a location available to workers ☑ Do not dispense fuel in riparian management areas or marine environments wherever practicable. ☑ Hoses and nozzles must be maintained and not leak ☑ Dispensing gasoline fuel directly from a fuel truck into the equipment is NOT permitted ☑ Close valves when finished dispensing ☑ Operators must stay with the nozzle at all times while dispensing fuel ☑ Store hose in a safe manner to prevent damage and leaks (i.e. coiled on top of tank) ☑ Do not fill containers beyond their safe filling level (<i>approximate safe level – 90%</i>) ☑ Keep fuel and equipment on level ground 	<ul style="list-style-type: none"> ■ Fuel trucks and pup-trailers used to transport products on public roads must meet Motor Vehicle requirements (i.e. GVW, brakes, lights, axles, etc.) and TDG requirements (Placards & Documentation) ■ When the total capacity of a fuel tank exceeds 2000 liters, the shipper/driver is required to: <ul style="list-style-type: none"> • Complete a shipping document for the goods hauled or residue last contained • Maintain a valid TDG training certificate • Placard the load on all four sides ■ Non-Spec tanks may no longer be used. Safety Labeling & Spec Plates ■ Maintain visible safety marks: <ul style="list-style-type: none"> • Label or placard and, • UN number and • Shipping name ■ TDG Placards must be visible on all four sides ■ Spec plates, decals or associated documentation—(ensuring paperwork is linked to the specific tank) must identify the following: <ul style="list-style-type: none"> • Container Type & Standard • Manufacturer and Date • Re-certification Date and TC Registered Facility 	<ul style="list-style-type: none"> ■ Take reasonable measures to prevent leaks & spills ☑ Where dispensing fuel in higher risk areas consider utilizing additional Spill Control and Prevention Measures (see Table #6). Fire Control and Response ☑ Maintain and self-inspect one suitable B:C-rated fire extinguisher ensuring it's: <ul style="list-style-type: none"> • not actuated or tampered with • shows no obvious physical damage, (i.e. corrosion, leakage, or clogged nozzle) to prevent its operation • pressure gauge reading or indicator is in operable range • safety seal or pin in place • product id/WHMIS label in place • located in appropriate location, and • document self-inspections

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TABLE #5 LARGE STATIONARY SKID TANKS (Generally Volumes > than 3000L)

				Legend	
				■ Legal Requirement	☑ BCTS Requirement
				☐ Information	
TYPE	CONDITION, DESIGN & MAINTENANCE	STORING AND SECURING	DISPENSING	TRANSPORT (see column 2 for securing details)	PREVENTION & RESPONSE
LARGE STATIONARY SKID TANKS (Volume >3000L)	<ul style="list-style-type: none"> ■ Spec Tanks: used for diesel or gas and will generally have one of the following markings: <ul style="list-style-type: none"> • ULC-S601 AST Horizontal Tanks • ULC-S653 AST Steel Tanks • ULC-S602 AST Steel Tanks • ULC-S630 AST Vertical Tanks • CAN/ULC-S643-M • ULC-C142.18 Rectangular Steel Tank • ULC-C142.17 Vertical Steel Tank. ■ Non-Spec Tanks: All non-spec tanks must be taken out of operation. Any tank without a spec plate is non-spec. <p>All tanks must be constructed and maintained to conform to a ULC specification for stationary above ground tanks.</p> <ul style="list-style-type: none"> ☑ All tanks must be designed, constructed to a design standard specification and must bear a visible and legible specification plate to that standard. ☑ Stationary Tanks are not designed as mobile tanks. Prior to moving, the tank (usually a ULCS-601 spec tank) must be emptied to the maximum extent and in accordance with the Equivalent Level of Safety Permit (see table # 6 for details). ☑ Tanks must be in good condition – not damaged, rusting, or leaking. <p>Inspections</p> <ul style="list-style-type: none"> ☑ Licensees/ Contractors must inspect tanks on a regular basis, and replace fatigued tanks immediately and document. 	<ul style="list-style-type: none"> ■ Use a pressure relief cap that meets manufacturers design specifications ■ Store nozzle & hose in a safe manner to prevent damage and leaks (i.e. on a retractor, hose reel or coiled) ☑ Do not place stationary skid tanks in riparian management areas or marine environments, unless no other area is practicable. ☑ Do not smoke where fuel is stored or dispensed <p>Storage</p> <ul style="list-style-type: none"> ☑ Large stationary skid tanks must be: <ul style="list-style-type: none"> • Above ground, doubled wall with a positive containment monitoring leak protection feature, (vacuum gauge, visual port or dipstick); <p>Securing</p> <ul style="list-style-type: none"> ■ As per manufactures recommendations, tanks must be appropriately secured to the skid to prevent shifting, swaying, damage or escape and, ■ Tanks must be mounted to a fire-resistant cradle and skid 	<ul style="list-style-type: none"> ■ Use dispensing pumps designed for the products being handled ■ Use an appropriate hose and nozzle (in accordance with ULC standards) for dispensing fuel ■ Make sure there is suitable bonding to prevent static charges when dispensing gasoline ■ Maintain current SDS in a location available to workers ☑ Hoses and nozzles must be maintained and not leak ☑ Do not dispense fuel in riparian management areas or marine environments wherever practicable. ☑ Operators must stay with the nozzle <u>at all times</u> while dispensing fuel ☑ Store nozzle & hose in a safe manner to prevent damage and leaks (i.e. on a retractor, hose reel, coiled or above the tank to prevent siphoning) ☑ Close valves when finished dispensing ☑ Do not fill tanks beyond their safe filling level (<i>approximate safe level – 90%</i>) ☑ Keep fuel and equipment on level ground 	<ul style="list-style-type: none"> ■ When moving a skid tank (with or without fuel) having a total capacity of diesel greater than 2000 liters you must follow TDG Regulations <ul style="list-style-type: none"> • Complete a shipping document for the goods hauled or remaining in the tank • Maintain a valid TDG training certificate • Ensure that all conditions of the Equivalent Level of Safety Permit are met.(see table #6) ■ All Skid-type tanks are considered stationary tanks (i.e. non-mobile tanks) and must: <ul style="list-style-type: none"> • Be emptied (5% or less) prior to moving • Be moved only from point to point in accordance with the Equivalent Level of Safety Permit (see table #6 for details). <p>Labeling</p> <ul style="list-style-type: none"> ■ Maintain visible safety marks: <ul style="list-style-type: none"> • Label or placard, • UN number and • Shipping name ■ TDG Placards must visible on all four sides ■ WHMIS labeling or appropriate <u>Product Identification</u> is required when storing hazardous products 	<ul style="list-style-type: none"> ■ Take reasonable measures to prevent leaks & spills ☑ Where dispensing fuel in higher risk areas consider utilizing additional Spill Control and Prevention Measures (see Table #6). ☑ Where tanks are stored on the ground, collision protection is required. (see Table #6) <p>Fire Control and Response</p> <ul style="list-style-type: none"> ☑ Maintain and self-inspect one suitable B:C-rated fire extinguisher ensuring it's: <ul style="list-style-type: none"> • not actuated or tampered with • shows no obvious physical damage, (i.e. corrosion, leakage, or clogged nozzle) to prevent its operation • pressure gauge reading or indicator is in operable range • safety seal or pin in place; • product id/WHMIS label in place • located in appropriate location, and • document self-inspections

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Table #6 Definition of Terms

Additional Spill Control Prevention	<ul style="list-style-type: none"> • Re-assess the environmental risk and implement additional control measures • Review the BCTS Fuel Handling Environmental Field Procedure 06 to ensure procedures address the risk factors • Review Spill Response awareness and preparedness, conduct a spill drill and increase monitoring of dispensing area locations • Enhance minimum Spill Kit requirements as outlined in Table #7 • Move the fuel storage to a lower risk location • Add secondary containment or double-walled containers • Collision Protection e.g. guard logs • Tarps for containment • Materials to block culverts when needed • Sandbags and PVC pipe for underflow containment • Sandbags for diversions and upstream eddy containment
B:C Fire Extinguisher	<p>The number represents the size of fire the extinguisher will put out under normal use (non-expert)</p> <ul style="list-style-type: none"> • An 80 rated fire extinguisher will cover 15.25 square meters • A 40 rated fire extinguisher will cover 9.15 square meters. Therefore two 40 rated fire extinguishers will cover the same area as one 80 rated fire extinguisher • The B:C represents the type of fires: "B" fire is for flammable liquids, while a "C" fire is for electrical
Bioremediation Product	Any form of nutrients, bacteria or enzymes that when added and mixed with the soil, will enhance the biological breakdown of petroleum hydrocarbon contaminated soil. This product is intended for small leaks, drips and spills that are below the reportable quantities and not impacting surface water or groundwater.
Breakaway valve	An in-line device containing a flutter valve that, upon accidental separation of the hose, will automatically close and prevent fuel from being discharged
Collision Protection	A barrier sufficient to alert the operator and prevent accidental damage to the container and release of the product.
Enclosed space	Any structure enclosed by three sides
Equivalent Spill Response Equipment	<p>In an attempt to provide some flexibility in the minimum requirements of a spill kit, the following equivalent standards are listed. The intention of this equivalent list is to provide alternatives where conditions might be warranted:</p> <ul style="list-style-type: none"> ○ 5 Absorbent pads (for petroleum hydrocarbons) = 2L of Sphag Sorb (peat moss) ○ 5 Absorbent pads (for antifreeze) = 2L of Sphag Sorb (peat moss) ○ 5 Absorbent pads (for solvents) = 2L of Sphag Sorb (peat moss) ○ Plug-N-Dike = Bentonite clay or "drillers clay" ○ One large heavy duty plastic bag = One five (5) gallon pail ○ Containment boom = log boom with tarp "skirt"

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Table #6 Definition of Terms

<p>Equivalent Level of Safety (Permit) issued by Transport Canada</p>	<p>Permit No.: SH7544 (Ren 5) Permit Holder: The valid members of The Forest Products Association of Canada Mode of Transport: Road Issue Date: Expiry Date:</p> <p style="text-align: center;">CONDITIONS</p> <p>This Permit for Equivalent Level of Safety authorizes the valid members of The Forest Products Association of Canada to handle, offer for transport and transport and authorizes any person to handle or transport on behalf of the permit holder, by road vehicle, dangerous goods that are Class 3, Packing Group II or Packing Group III in means of containment that do not comply with Part 5 of the Transportation of Dangerous Goods (TDG) Regulations if:</p> <p>(a) The means of containment:</p> <p>(i) is not intended for the transportation of dangerous goods and the presence of dangerous goods is due only to the use of the means of containment for the processing, storage, or use of the dangerous goods at fixed locations;</p> <p>(ii) prior to moving, is emptied to the maximum extent possible, and the residual amount of the dangerous goods never exceeds the lesser of the following volume in content when in transport:</p> <p>(A) 500 liters or (B) 5% of the capacity of the means of containment,</p> <p>(iii) is designed, constructed, closed, secured and maintained so that under normal conditions of transport, including handling, there will be no accidental release of dangerous goods that could endanger public safety; and,</p> <p>(iv) when inverted, will not release dangerous goods;</p> <p>(b) The means of containment is loaded and secured on the means of transport in such a way as to prevent, under normal conditions of transport, damage to the means of containment or to the means of transport that could lead to an accidental release of the dangerous goods;</p> <p>(c) The permanent shipping document that accompanies the dangerous goods includes the following information legibly and indelibly printed: "Dangerous Goods Permit No. by road vehicle or its French equivalent;</p> <p>(d) Equipment used to heat and circulate production fluids such as petroleum crude oil, in oilfield applications are excluded from the application of this permit.</p> <p><i>Note:</i> The issuance of this Permit for Equivalent Level of Safety in no way reduces the permit holder's responsibility to comply with any other requirements of the <i>Transportation of Dangerous Goods Regulations</i> not specifically addressed in this Permit.</p>
<p>Fuel Storage Facility</p>	<p>Any location where fuel in excess of 500 litres is stored on a BCTS tenure</p>
<p>Large Means of Containment</p>	<p>A means of containment with a capacity greater than 450 litres. For example, a highway cargo tank, large slip tank etc.</p>

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Table #6 Definition of Terms

Safety Data Sheets (SDS)--formerly MSDS	SDS--are summary documents that provide information about the hazards of a product and advice about safety precautions under the Workplace Hazardous Materials Information System (WHMIS).
Plug-N-Dike	Commercial product name for bentonite clay also known as "drillers clay". It is not the intention for BCTS to endorse a single product name over other products of a similar and equal nature.
Small Means of Containment	A means of containment with a capacity less than or equal to 450 litres. For example, a drum, jerry cans, or intermediate bulk container.
Spec Tank	A "Spec Tank" or "Specification Tank" is a means of containment that complies with one of the specifications set out in one of the Safety Standards referred to in Part 5 of the TDG regulations. An example of a "spec tank" would be a TC406 highway tank meeting all of the TC406 specification requirements described in CSA Standard B620-03 <i>Highway Tanks and Portable Tanks for the Transportation of Dangerous Goods</i> .
TC	Transport Canada: Federal Agency that oversees the transportation of dangerous goods on land, sea and air
TDG	Transportation of Dangerous Goods Regulation
ULC	Underwriters Laboratory of Canada (Engineering Standards) Mobile tanks built to ULC Standards (142.13) have been replaced by the Canadian General Standards Board (CGSB) Standard (43.146)
UN Number	United Nations Number: Used to identify a specific dangerous good. Diesel: UN 1202; Gasoline UN 1203
Workplace Hazardous Materials Information System (WHMIS) Labelling & product identification	Hazardous products in the workplace must be identified through one of the following means: <ul style="list-style-type: none"> • Supplier label • Workplace Label (attached when no supplier label was provided or the supplier label is lost or removed) <ul style="list-style-type: none"> ○ Name of the product ○ Safety precautions ○ Reference to SDS • Product Identifier (name of the product, color coding, etc)

TRANSPORT CANADA CONTACT INFORMATION

Transport Canada welcomes your questions, comments and suggestions. You can contact them by e-mail, mail or telephone and they will address your concerns as quickly as possible. See website link below for details!

<http://www.tc.gc.ca/eng/contact-us.htm>

Leak Test and Inspection Facilities for Highway and TC Portable Tanks, (Registered per Standard CSA B620) can be found at the Transport Canada website link below!

<http://wwwapps.tc.gc.ca/saf-sec-sur/3/fdr-rici/highway/tanks.aspx>

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Table #7

SPILL KIT
(Minimum Requirements)

In Equipment / Machinery (excavators, skidders)

Spill kits must be present on equipment, (appropriate for type and potential size of spill).

- Spill kits must include:
 - One large heavy duty plastic bag or other suitable container
 - Absorbent pads (or equivalent absorbent material)
- Personal protective safety gear as required for the type of spill

Vehicles carrying auxiliary fuel (e.g. pick-up truck box tanks or multiple small containers)

Spill kits must be present in vehicles transporting and dispensing fuels

- Spill kits must include a minimum of:
 - 3 - Heavy duty plastic bags or suitable container(s),
 - 10 - absorbent pads (or equivalent absorbent material) appropriate for the type of spill,
 - 3 – 3"x 48" absorbent booms/ socks,
 - bioremediation product,
 - One shovel
 - A container of emergency tank sealant (i.e. Plug-N-Dike, Seal-it or equivalent)
- Personal protective safety gear as required for the type of spill

Stationary or Mobile Fuel Storage & dispensing (tanks or multiple-drum caches)

Spill kits must be present at points where fuel is dispensed.

- Spill kits must include a minimum of:
 - Five large heavy duty plastic bags, or one open topped containment drum (or equivalent),
 - 20 absorbent pads (or equivalent absorbent material) appropriate for the type of spill,
 - 6 – 3"x 48" absorbent booms/ socks,
 - Two 10' linkable marine booms (if near marine operations),
 - bioremediation product,
 - One container of emergency tank sealant (i.e. Plug-N-Dike or equivalent),
 - One shovel
- Personal protective safety gear as required for the type of spill



STOP WORK

and contact your project supervisor and the BCTS representative if:

- You are uncertain of the project plan, your responsibilities, or the location of hazardous/sensitive areas.
 - A previously unidentified resource feature, resource value (e.g. cultural) or sensitive area is found.
 - You experience unfavorable weather or site conditions that could cause environmental damage.
 - You observe conditions that have the potential for immediate environmental damage.
- You believe the project plan will not work.

Appendix 9.4 Inventory Maps

9.4.1 Map of Wildlife Connectivity, Riparian Reserves, OGMAs

See Figure 4

9.4.2 Terrain Stability, Surface Soil Erosion and Sediment Yield Map (With Interpretations for Timber Harvesting)

Terrain Stability
Surface Soil Erosion and
Sediment Yield Map
Mark Creek Watershed
TSL 'C'

STANDARD MAPS, INC. 1980
Landscape Design Division
1000 N. 1st St., Suite 100
Bismarck, ND 58101

Legend

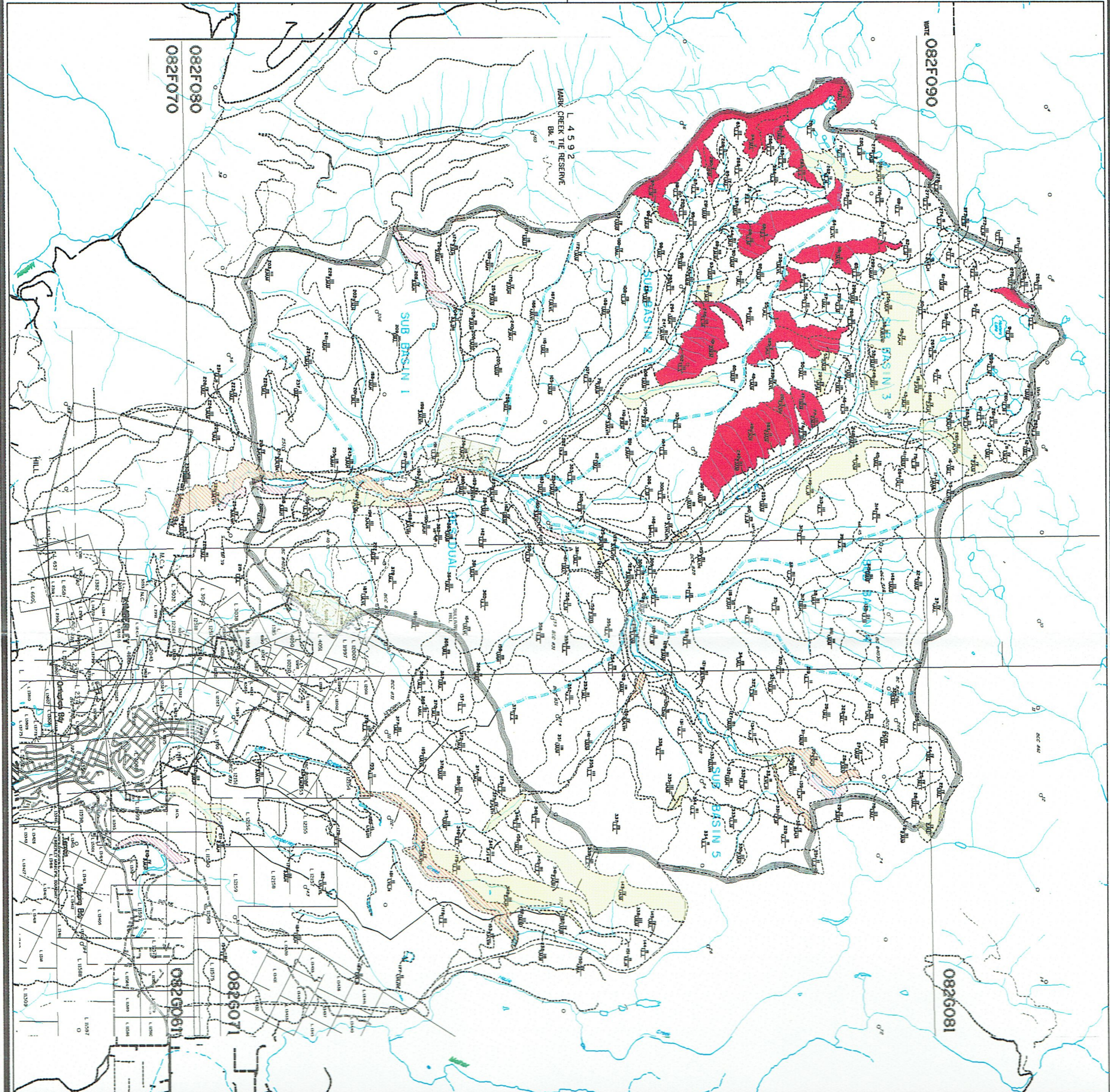
Symbol	Description
[Red Box]	NO TREES PLANTED
[Yellow Box]	PLANTED OR PLANTING TO BE PLANTED
[Hatched Box]	NO PLANTING REQUIRED

Notes

1	NO TREES PLANTED
2	PLANTED OR PLANTING TO BE PLANTED
3	NO PLANTING REQUIRED

Scale

0	100	200	300	400	500	600	700	800	900	1000
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Map Sheet Numbers

Map Sheet Number	Map Sheet Number	Map Sheet Number	Map Sheet Number	Map Sheet Number	Map Sheet Number
082F090	082G081	082F070	082G061	082F060	082G051

Terrain Stability Map
Mark Creek Watershed
TSL 'C'

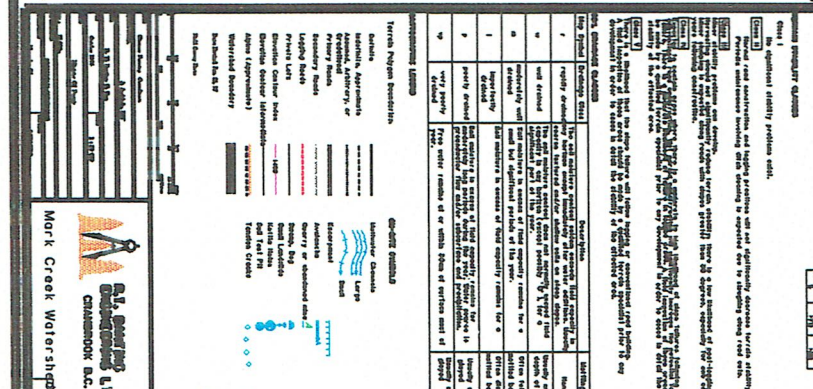
STANDARD MAPS, INC. 1980
Landscape Design Division
1000 N. 1st St., Suite 100
Bismarck, ND 58101

Legend

Symbol	Description
[Red Box]	NO TREES PLANTED
[Yellow Box]	PLANTED OR PLANTING TO BE PLANTED
[Hatched Box]	NO PLANTING REQUIRED

Notes

1	NO TREES PLANTED
2	PLANTED OR PLANTING TO BE PLANTED
3	NO PLANTING REQUIRED



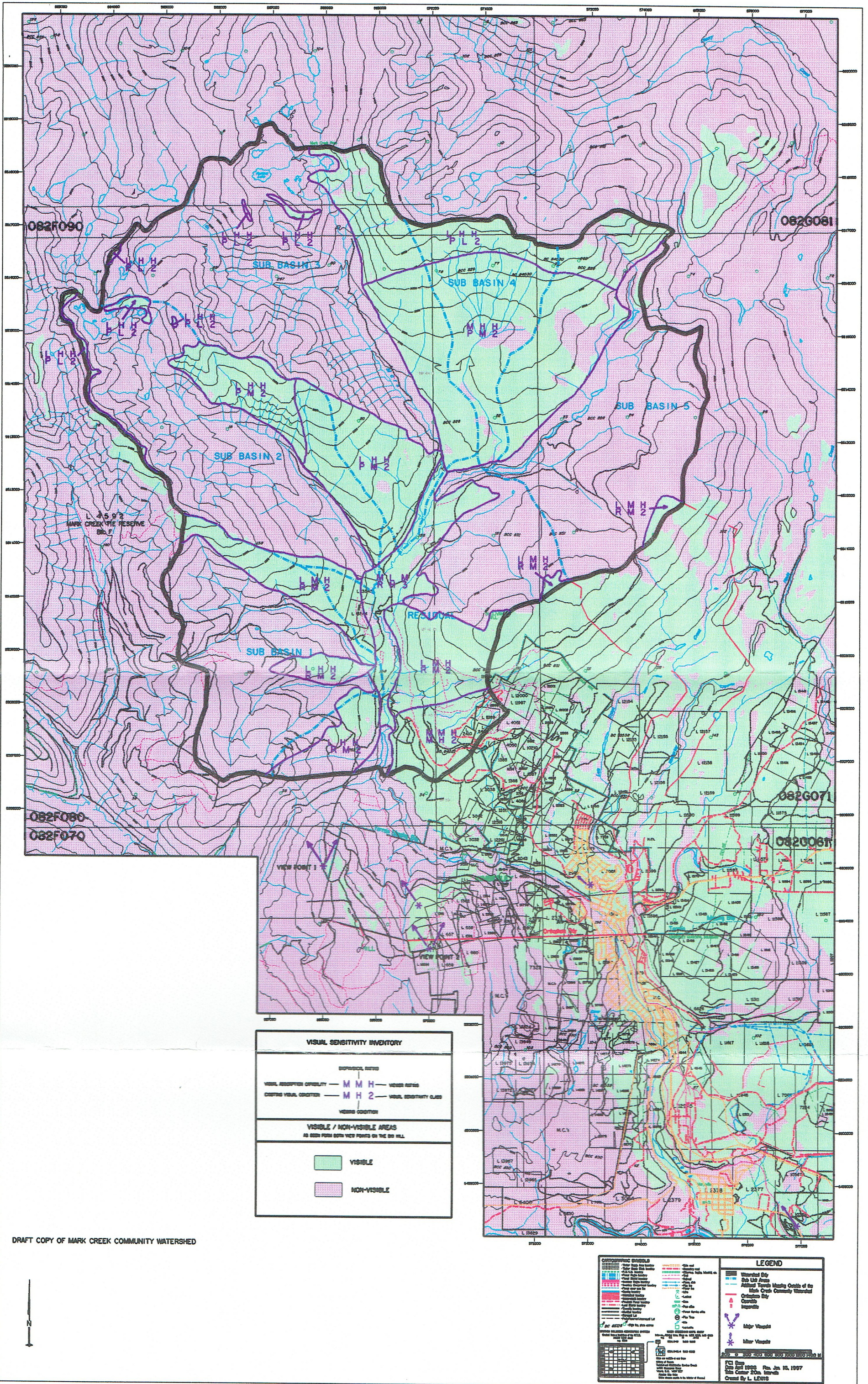
9.4.3 Fisheries Inventory Map

—N—

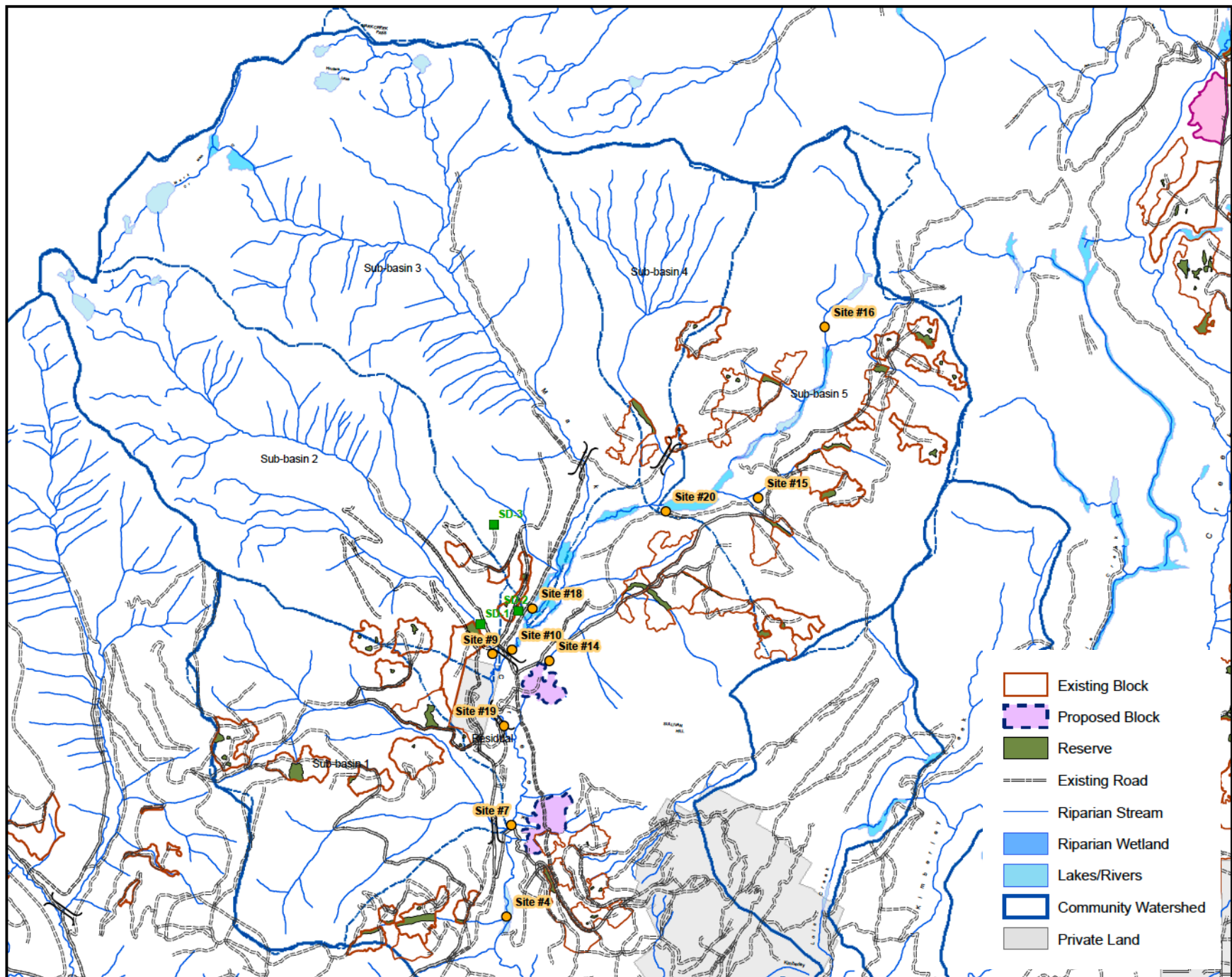
[illegible]

9.4.4 Visual Sensitivity Inventory Map

MARK CREEK COMMUNITY WATERSHED VISUAL SENSITIVITY INVENTORY

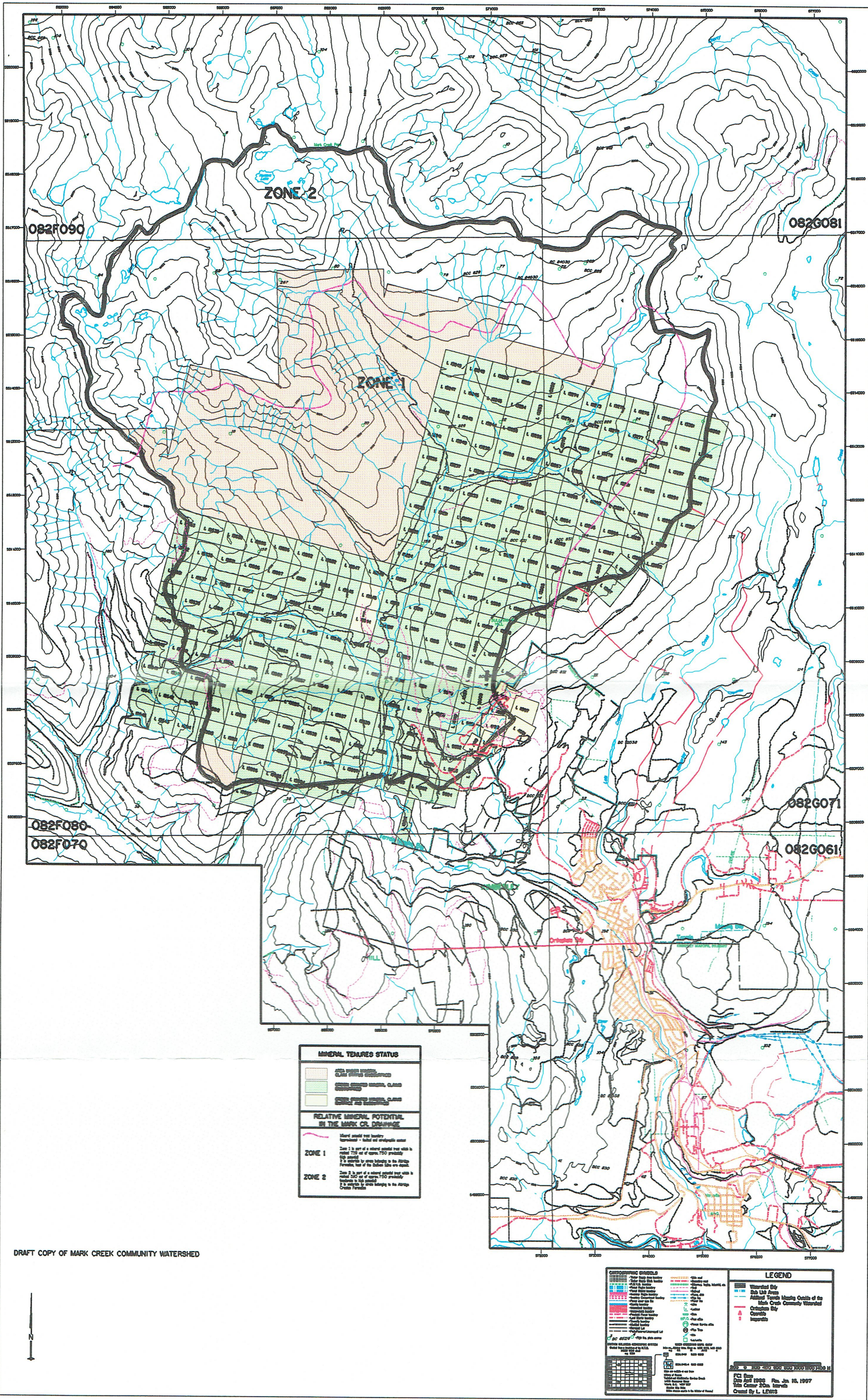


9.4.5 Water Monitoring Sites and Existing Access Map



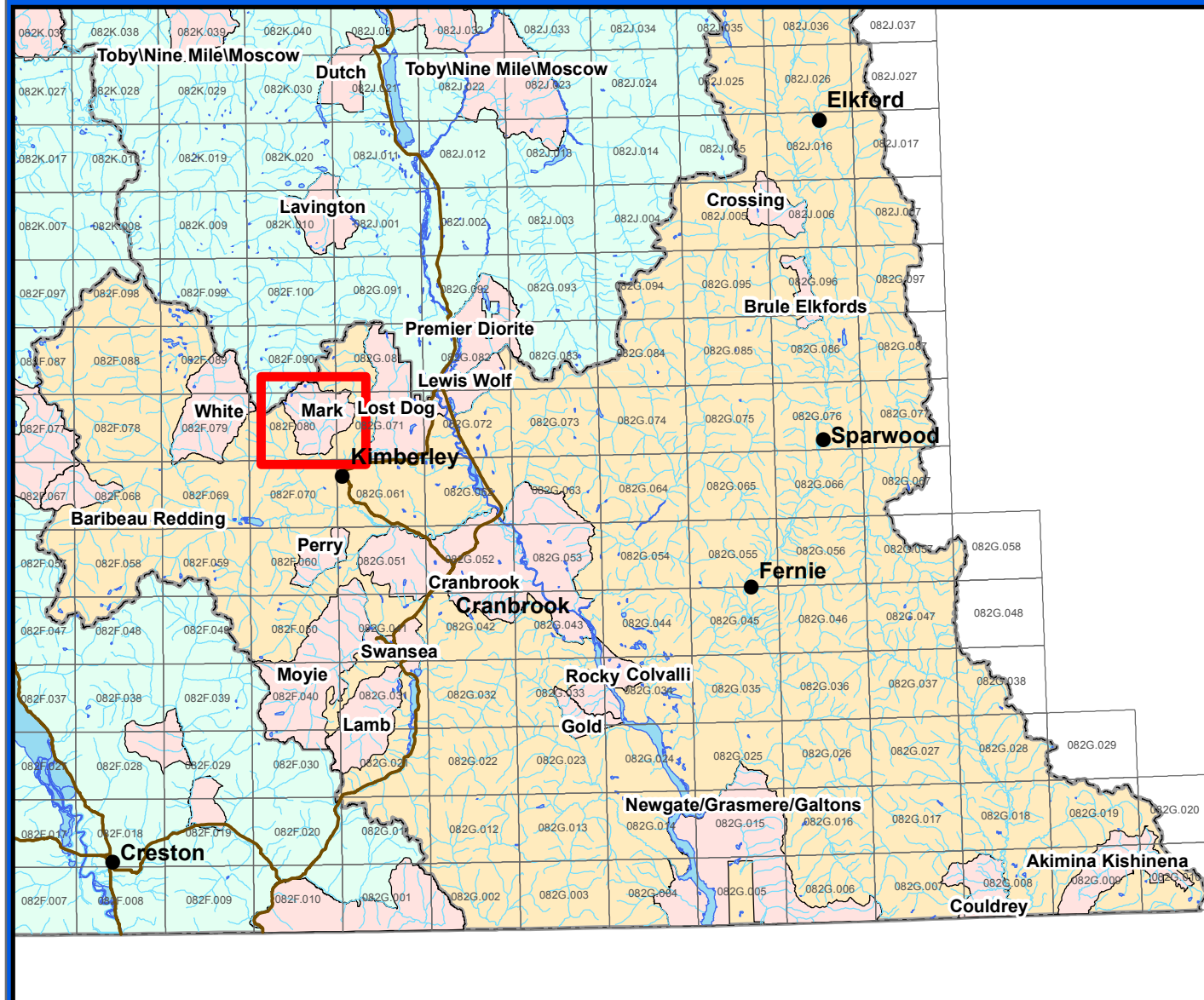
9.4.6 Mineral Tenure Status and Mineral Potential Map

MARK CREEK COMMUNITY WATERSHED
MINERAL TENURES STATUS (10/96) and RELATIVE MINERAL POTENTIAL



9.4.7 Forest Stand Age Classes Map

Updated Age Classes Map to follow. Current Resource Map included here.



Blocks and Forest Cover:

BLOCK STATE	PLANNING STATUS
PP - Proposed	FRPA Information 190/121
WIP - Work In Progress	Proposed
ADV - Annual Developed Volume	OP Plan Complete
HB - Harvest Start	Declared
LC - Logging Complete	A-Approved
GU - Greenup Mat	
FG not GU - Free Growing not Greened Up	
FG - Free Growing	
X - Deferred or Dropped	

Other Block States

- Unknown
- Surrounded Block
- Block in VMA Offshoot
- SP Exempt (hatching on top of block ID)
- Results Openings >= 2003
- Results Openings >= 1987
- FTEN Layer Openings (from Ex As)

Block SU

- WIP
- Reserves
- Timber Reserve
- Dispersed WTRA
- WTR/WTRA
- Deferred
- Experiment Research

VMA Opening

- VMA Opening
- VMA Opening

Management Areas:

- BCTS Kootenay Business Area
- BCTS Operating Area
- BCTS 20K Mapsheet Grid
- National Parks
- Provincial Park
- Protected Area
- Conservation Area or Ecological Reserve
- Recreation Area
- Woodlot
- Community Forest
- Private
- Down but NO HARVEST
- Undetermined Ownership - may be issues
- Crown but referral may be required
- Tenure Lots with Lot Numbers
- Indian Reserves
- Xmas Tree Permit
- Special Use Permit
- Quarry
- Crown Grant Application - Tentative
- Licence of Occupation - Tenure
- Licence of Occupation - Application
- Forestry Licence to Cut
- Domestic Waterbodies
- Community Waterbodies

Streams and Wetlands:

- LRWD TRIM Waterbodies
- Wetlands
- Streams
- FDIS Data
- Reach Break - stream data for downstream section where available
- Feature on stream
- Sample Site

FDP Fish Data, Unknown Source

- Fish Bearing Streams Confirmed S1-S4
- Non Fish Bearing Streams Confirmed S5-S8
- Fish Bearing Streams Unconfirmed S1-S4
- Non fish Bearing Streams Unconfirmed S5-S8

Access Management:

- Congea Roads: (from Status 18)
- Existing Maintained Road
- Decommissioned Road
- BCTS Planned Road
- Unknown
- Wilderness
- Road Permit
- BCTS FSR
- MOF FSR

BCGW:

- Airport Transportation
- Ferry Route
- Rough Road or Trail
- Trail
- Spoil
- Road (Gravel or Unimproved)
- Bridge
- Rail Line
- Road Permit

Congea Structures:

- Bridge Proposed
- Bridge
- Map Congea Existing
- Bridge Permanent
- Bridge Semi Permanent
- Bridge Temporary
- Bridge Removed
- Bridge Containment
- Access Control or Barrier Proposed
- Access Control or Barrier
- Cataguard Proposed
- Cataguard
- Gate Proposed
- Gate
- Road Blockage or Washout

Deactivation Activities:

- Covert Proposed
- Plan Covert Existing
- Covert Over 900 (from 1987)
- Covert Proposed
- Arch Pipe
- Access Type
- Unknown
- 2WD
- 4WD
- ATV
- FOOT
- NONE

TRIM Features:

- Mines, Pit
- Fence
- Covert
- Cataguard
- Bluffs
- Gate
- Exclosure
- Spring
- Spring with Trough
- Tank
- Well

Range Features:

- Water Troughs
- Fence
- Covert
- Cataguard
- Bluffs
- Gate
- Exclosure
- Spring
- Spring with Trough
- Tank
- Well

BC Timber Sales
Kootenay Business Area
Cranbrook Field Team

Mark Cr

Resource Map

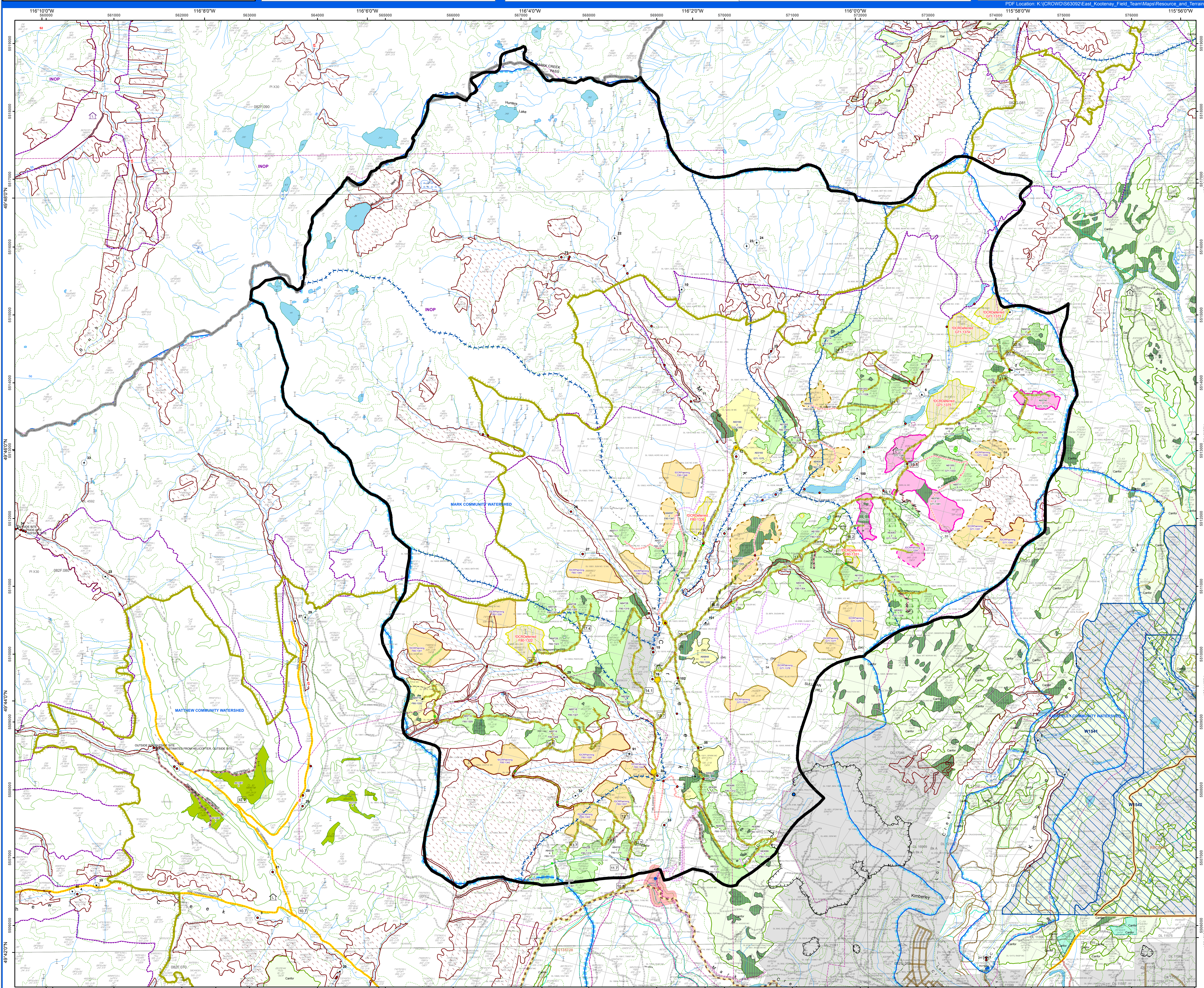
1:20,000

0 250 500 1,000 1,500 2,000 Meters

Projection: UTM Zone 11, NAD83
Digital Mapping Base: TRIM - 1:20,000
2014 Vegetation Resource Inventory

Date of Print File: **March 31, 2017**
Creation:

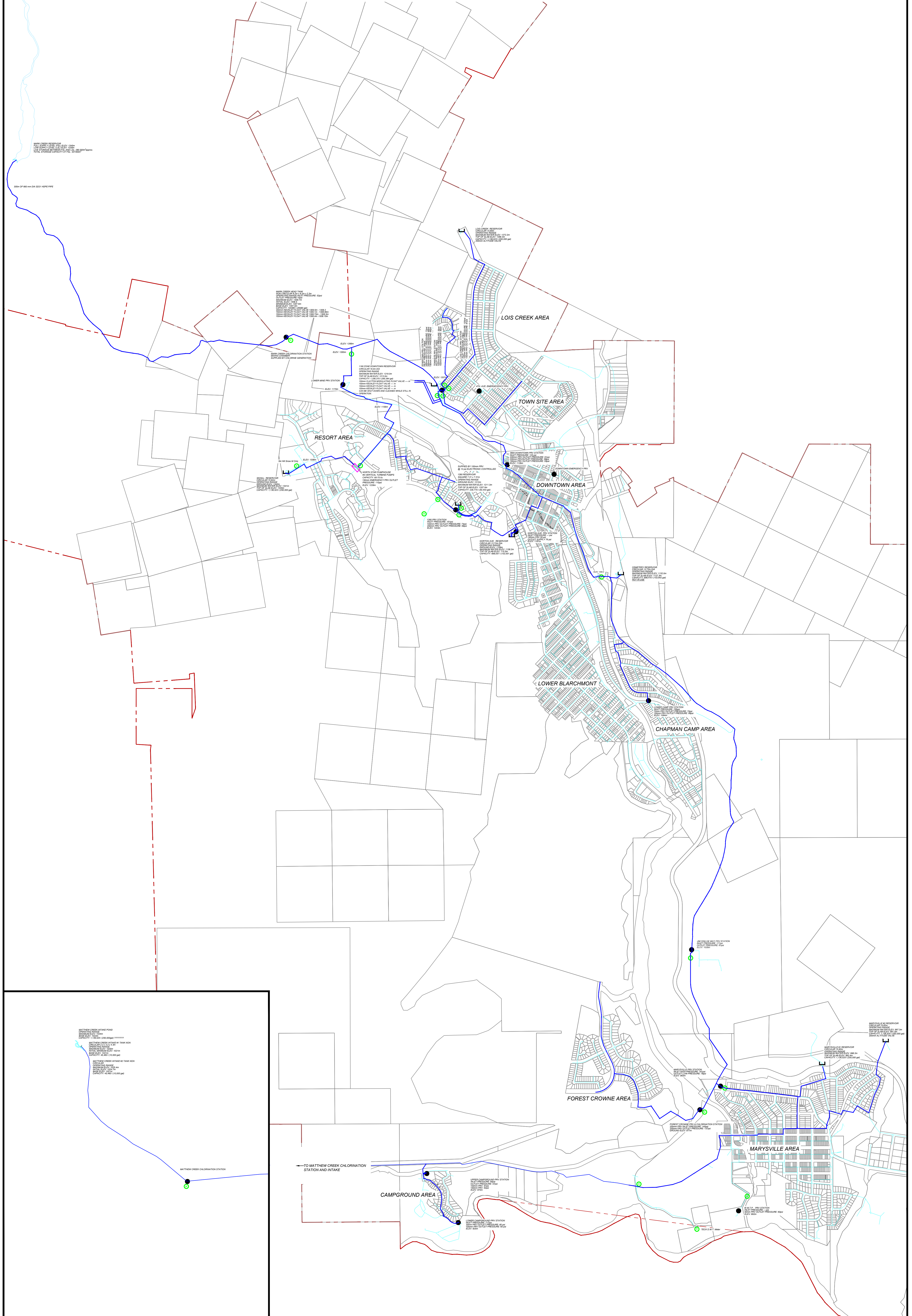
PDF Location: K:\CROWD\S63092\East_Kootenay_Field_Team\Maps\Resource_and_Terrain



9.4.9 City of Kimberley Water System Map

KIMBERLEY WATER DISTRIBUTION SYSTEM

UPDATED: 2017



Appendix 9.5 Standard Operating Procedure for Referrals

THIS AGREEMENT made the 29th day of February, 2016 (the "Effective Date").

BETWEEN:

City of Kimberley
hereinafter referred to as the "City".

AND:

BC Timber Sales, Kootenay Business Area
hereinafter referred to as "BCTS".

WHEREAS the City is the owner of various roads within the City of Kimberley, hereinafter referred to as the "Lands";

AND WHEREAS BCTS intends to auction a timber sale that will require the successful bidder to use for travel a certain defined part of the Lands as set out in yellow in Schedule A attached hereto (the "Permitted Travel Area"), for the purpose of transporting logs through and out of the City of Kimberley;

AND WHEREAS the hauling of logs via trucks across the Lands may damage the road surface on the Lands;

NOW, in consideration for the mutual covenants contained herein, the parties agree as follows:

1. Subject to the terms and conditions set out in that license, the City agrees to grant a non-exclusive license of use to the successful bidder to allow the bidder to use the Permitted Travel Area for the purpose of transporting logs through and out of the City of Kimberley, thereby facilitating BCTS' intended auction of a timber sale.
2. BCTS shall require the successful bidder, as part of the agreement between BCTS and the successful bidder, to enter into the non-exclusive license agreement referenced in paragraph 1, a copy of which is attached hereto as Schedule "A".
3. In order to assist the City in tracking the loads of logs transported through the Permitted Use Area, BCTS will advise the City in writing of the total number of truck loads that were transported through and out of the City in the Permitted Travel Area on the 25th day of each month following the month in which trucks travelled through the Permitted Use Area, as indicated on the BC Harvest Billing System.

SCHEDULE A

LICENSE OF USE FOR TRAVEL

THIS LICENSE made the ___ day of February, 2016 (the "Effective Date").

BETWEEN:

The City of Kimberley
hereinafter referred to as the "City".

AND:

hereinafter referred to as the "Licensee".

WHEREAS the City is the owner of various roads within the City of Kimberley, hereinafter referred to as the "Lands";

AND WHEREAS The Licensee wishes to use for travel a certain defined part of the Lands as set out in yellow in Schedule A attached hereto (the "Permitted Travel Area"), for the purpose of transporting logs through and out of the City of Kimberley;

AND WHEREAS the hauling of logs via trucks across the Lands may damage the road surface on the Lands;

NOW, in consideration for the mutual covenants contained herein, the parties agree as follows:

1. Subject to the terms and conditions set out in this License, the City agrees to grant a non-exclusive license of use to the Licensee.
2. It is expressly acknowledged by the Licensee that the Licensee does not acquire any interest in any part of the Permitted Travel Area under this License. The City does not grant to the Licensee either by this License, through prescription or otherwise any interest in the Lands other than the right to use the Permitted Travel Area pursuant to the terms of this License. All of the City's rights, statutory or otherwise, other than those specifically granted under this License, remain in force.
3. This License will be in effect starting on the Effective Date and will automatically terminate 6 months from the Effective Date.

4. Without limiting any of its other rights or remedies, the City may terminate this License without giving the Licensee any prior notice if the Licensee breaches any of the Licensee's obligations under this License.
5. The Licensee, its employees, agents and contractors, shall not build, construct, erect, or make any improvements to the Permitted Travel Area without the City's express permission in writing. The Licensee shall not store any items on the Permitted Travel Area without the City's express permission in writing.
6. The Licensee, its employees, agents and contractors shall not transport loaded trucks on any roads on the Lands other than within the Permitted Travel Area.
7. The Licensee, its employees, agents and contractors shall not at any time transport trucks with loads weighing in excess of 64 tonnes per load on the Permitted Travel Area. Notwithstanding the foregoing, the Licensee, its employees, agents and contractors shall at all times abide by all road weight restrictions imposed by the City that apply to the roads within the City.
8. The Licensee will pay to the City a license fee of \$56 plus GST per truck, for use of the Permitted Travel Area, payable within 30 days after the end of the month in which trucks travelled through the Permitted Use Area, without invoice or notice from the City ("License Fee"). The Licensee will advise the City in writing of the total number of truck loads that were transported through and out of the City in the Permitted Travel Area on the first day of each month following the month in which trucks travelled through the Permitted Use Area.
9. The Licensee and its employees, agents and contractors must use the Permitted Travel Area in a socially and environmentally responsible manner, causing no harm and creating no nuisance to others and must abide by all bylaws of the City at all times. The Licensee takes responsibility for the use of the Permitted Travel Area by the Licensee and its employees, agents and contractors. The Licensee agrees to fully indemnify the City for any and all environmental damage caused by the Licensee and any of its employees, agents and contractors.
10. The Licensee hereby expressly agrees TO WAIVE ANY AND ALL CLAIMS that the Licensee has or may in the future have against the City, its employees, insurers, successors and assigns (all of whom are hereinafter collectively referred to as "THE RELEASEES"), and TO RELEASE THE RELEASEES from any and all liability for any loss, damage, expense or injury including death that the Licensee and its employees, agents or contractors may suffer, resulting from the use of the Permitted Travel Area, DUE TO ANY CAUSE WHATSOEVER, INCLUDING NEGLIGENCE, BREACH OF CONTRACT, OR BREACH OF ANY STATUTORY OR OTHER DUTY OF CARE, INCLUDING ANY DUTY OF CARE OWED UNDER THE OCCUPIERS LIABILITY ACT SBC 1996, c. 337, as amended, ON

THE PART OF THE RELEASEES, AND ALSO INCLUDING THE FAILURE ON THE PART OF THE RELEASEES TO SAFEGUARD OR PROTECT THE LICENSEE, ITS EMPLOYEES, AGENTS OR CONTRACTORS FROM THE RISKS, DANGERS AND HAZARDS OF ANY USE of the Permitted Travel Area.

11. The Licensee agrees to fully indemnify and defend the City for any and all claims for any loss, damage, expense or injury, including death, that the City, its officers, employees, agents or contractors may suffer as a result of the actions of the Licensee and any of its employees, agents and contractors in using the Permitted Travel Area.

12. Nothing contained or implied in this License shall affect any of the City's rights, powers or defences under any statutes, regulations, bylaws or resolutions, all of which may be fully exercised in relation to the Lands as if this License had not been granted.

13. The parties to this Licence acknowledge that they have had the opportunity to receive legal advice with respect to the terms of this License and with respect to their obligations and rights set out herein.

THE LICENSEE

Signature

Date:

Witness Signature

Print Name:

Date:

Signature

Date:

Witness Signature

Print Name:

Date:

THE CITY

City of Kimberley

Mayor

Corporate Officer