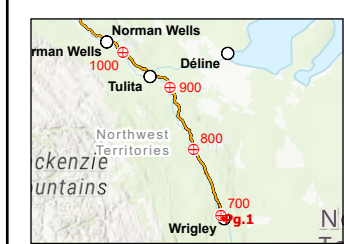


Appendix B LSA Terrain Mapping



Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Data Sources: Government of Northwest Territories
 3. Background: World Topographic Map: Northwest Territories, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCAN, Parks Canada
 World Imagery: Maxar
 World Hillshade: Esri, USGS and LIDAR-derived hillshade provided by GNWT
 4. Terrain mapping conducted in 2D using available airphotos, ortho-imagery and LIDAR data. Refer to Soils, Terrain and Permafrost TDR for detailed methodology

- ➔ Seepage Flow Direction
- ⇓ Gully
- ↳ Landslide Scar
- Surficial Material**
- Anthropogenic Material
- Bedrock
- Colluvium
- Eolian
- Fluvial Material
- Glaciofluvial Material
- Glaciolacustrine Material
- Morainal Material (till)
- Organic Material
- Water
- Terrain Mapping

- ⊕ Mackenzie Valley Highway Kilometre Post
- Mackenzie Valley Highway Extension Project
- Local Study Area
- All-Season Road
- Winter Road
- Mackenzie Valley Fibre Link
- Norman Wells to Zama Lake Pipeline (Enbridge)
- District Boundary
- Region Boundary
- Settlement Area Boundary

Surficial Material

Anthropogenic	A
Colluvium	C
Eolian	E
Fluvial	FG
Glaciofluvial	FG
Glaciolacustrine	LG
Morainal (till)	M
Water Body	N
Organic	O
Bedrock	R

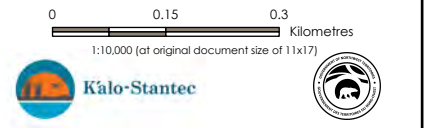
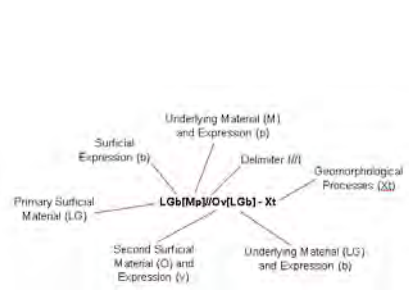
Delimiter and Qualifier
 / The component in front of the symbol is more extensive than the one that follows
 // The component in front of the symbol is considerably more extensive than the component that follows
 A Geomorphological process initiation zone
 A Active

Surface Expression

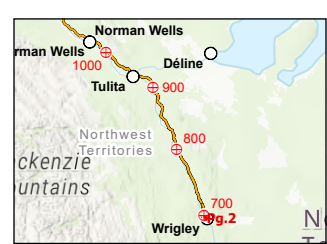
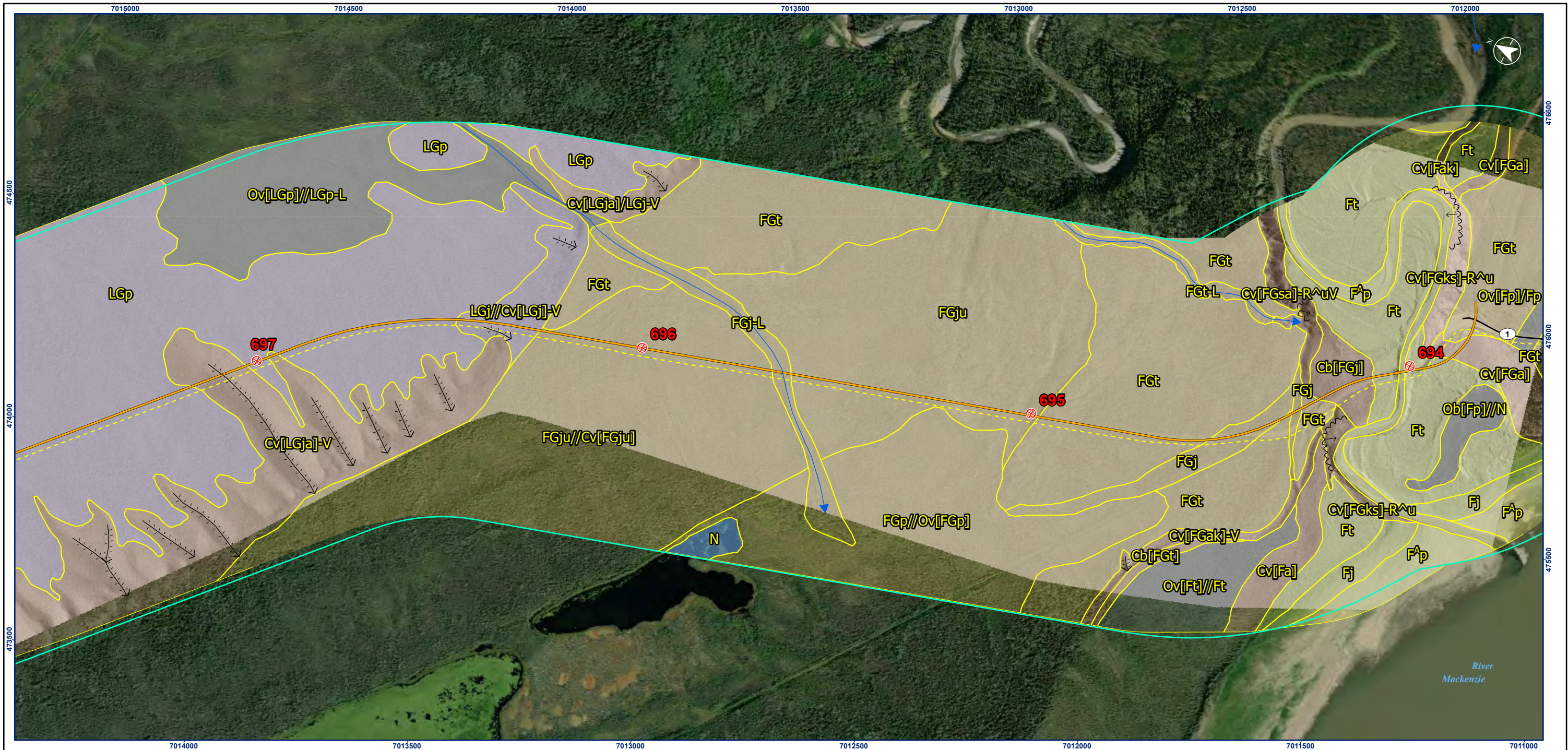
moderate slope (> 27-49%)	a
blanket (> 1 m)	b
cone	c
depression	d
fan	f
hummocky	h
gentle slope (6-26%)	j
moderate steep slope (50-70%)	k
rolling	m
plain	p
ridged	r
steep slope (> 70%)	s
terraced	t
undulating	u
veneer (< 1 m)	v

Geomorphological Process

Permafrost Process	
Thermokarst	Xt
Thaw flow	Xf
Ice wedge	Xw
Thermo-erosion	Xe
Mass Movement Process	
Slow mass movement	F
Tension crack	Fk
Rapid mass movement	R
Rockfall	Rb
Debris flow	Rd
Debris slide/avalanche	Rs
Rotational slump	Ru
Hydrological Process	
Channeled by meltwater	E
Kettled	H
Surface seepage	L
Inundation	U
Gully	V



Project Location: Wrigley to Norman Wells, NWT
 Prepared by CES on 2021-02-08
 TR by OP on 2023-03-14
 Client/Project: 144903025-0065 REVA
 Government of Northwest Territories
 Mackenzie Valley Highway
 Figure No. B.1
 Title: LSA Terrain Mapping



Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Data Sources: Government of Northwest Territories
 3. Background: World Topographic Map: Northwest Territories, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCAN, Parks Canada
 World Imagery: Maxar
 World Hillshade: Esri, USGS and LIDAR-derived hillshade provided by GNWT
 4. Terrain mapping conducted in 2D using available airphotos, ortho-imagery and LIDAR data. Refer to Soils, Terrain and Permafrost TDR for detailed methodology

- ➔ Seepage Flow Direction
- ⇒ Gully
- ⚡ Landslide Scar
- Surficial Material**
- Anthropogenic Material
- Bedrock
- Colluvium
- Eolian
- Fluvial Material
- Glaciofluvial Material
- Glaciolacustrine Material
- Morainal Material (till)
- Organic Material
- Water
- Terrain Mapping

- ⊕ Mackenzie Valley Highway Kilometre Post
- Mackenzie Valley Highway Extension Project
- Local Study Area
- All-Season Road
- Winter Road
- Mackenzie Valley Fibre Link
- Norman Wells to Zama Lake Pipeline (Enbridge)
- District Boundary
- Region Boundary
- Settlement Area Boundary

Surficial Material

Anthropogenic	A
Colluvium	C
Eolian	E
Fluvial	F
Glaciofluvial	FG
Glaciolacustrine	LG
Morainal (till)	M
Water Body	N
Organic	O
Bedrock	R

Surface Expression

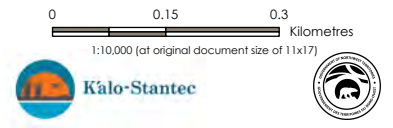
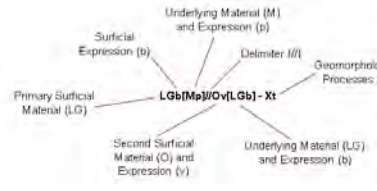
moderate slope (27-49%)	a
blanket (> 1 m)	b
cone	c
depression	d
fan	f
hummocky	h
gentle slope (6-26%)	j
moderate steep slope (50-70%)	k
rolling	m
plain	p
ridged	r
steep slope (>70%)	s
terraced	t
undulating	u
veneer (< 1 m)	v

Delimiter and Qualifier

- / The component in front of the symbol is more extensive than the one that follows
- // The component in front of the symbol is considerably more extensive than the component that follows
- ^ Geomorphological process initiation zone
- A Active

Geomorphological Process

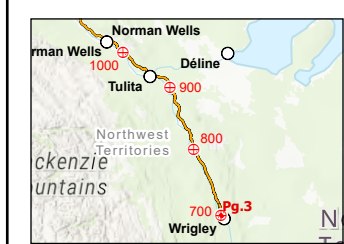
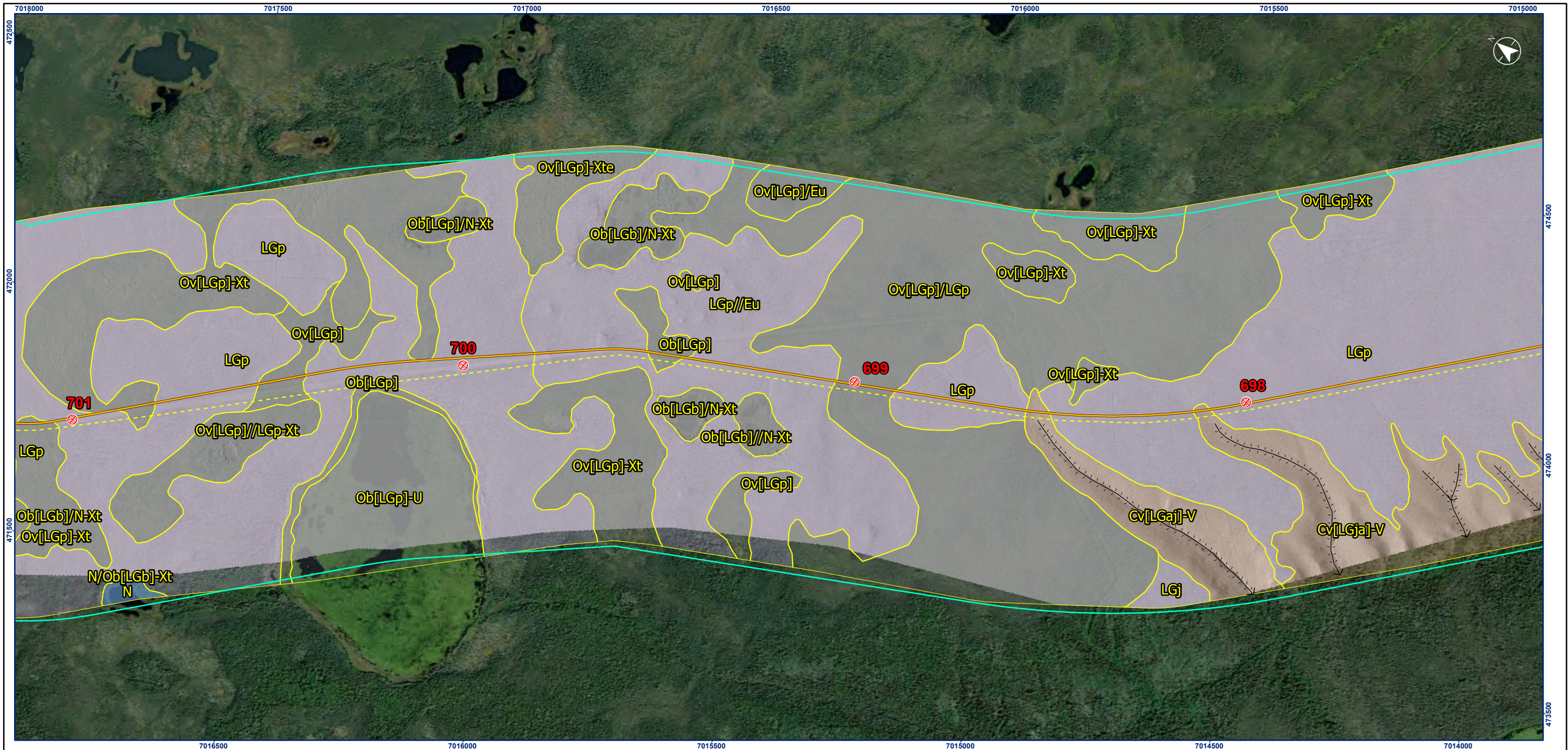
- Permafrost Process**
- Thermokarst Xt
 - Thaw flow Xf
 - Ice wedge Xw
 - Thermo-erosion Xe
- Mass Movement Process**
- Slow mass movement F
 - Tension crack Fk
 - Rapid mass movement R
 - Rockfall Rb
 - Debris flow Rd
 - Debris slide/avalanche Rs
 - Rotational slump Ru
- Hydrological Process**
- Channeled by meltwater E
 - Kettled H
 - Surface seepage L
 - Inundation U
 - Gully V



Project Location: Wrigley to Norman Wells, NWT
 Client/Project: 144903025-0065 REV A

Government of Northwest Territories
 Mackenzie Valley Highway
 Figure No. B.2
 Title: LSA Terrain Mapping

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.



Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Data Sources: Government of Northwest Territories
 3. Background: World Topographic Map: Northwest Territories, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCAN, Parks Canada
 World Imagery: Maxar
 World Hillshade: Esri, USGS and LIDAR-derived hillshade provided by GNWT
 4. Terrain mapping conducted in 2D using available airphotos, ortho-imagery and LIDAR data. Refer to Soils, Terrain and Permafrost TDR for detailed methodology

- ➔ Seepage Flow Direction
- ⇩ Gully
- ↳ Landslide Scar
- Surficial Material**
- Anthropogenic Material
- Bedrock
- Colluvium
- Eolian
- Fluvial Material
- Glaciofluvial Material
- Glaciolacustrine Material
- Morainial Material (till)
- Organic Material
- Water
- Terrain Mapping

- ⊕ Mackenzie Valley Highway Kilometre Post
- Mackenzie Valley Highway Extension Project
- Local Study Area
- All-Season Road
- Winter Road
- Mackenzie Valley Fibre Link
- Norman Wells to Zama Lake Pipeline (Enbridge)
- ▭ District Boundary
- ▭ Region Boundary
- ▭ Settlement Area Boundary

Surficial Material

Anthropogenic	A
Colluvium	C
Eolian	E
Fluvial	FG
Glaciofluvial	FG
Glaciolacustrine	LG
Morainial (till)	M
Water Body	N
Organic	O
Bedrock	R

Surface Expression

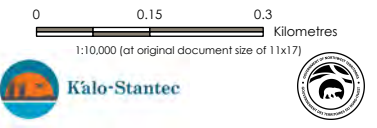
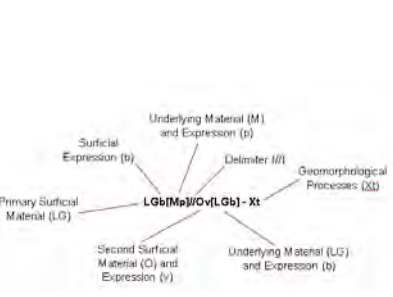
moderate slope (27-49%)	a
blanket (> 1 m)	b
cone	c
depression	d
fan	f
hummocky	h
gentle slope (6-26%)	j
moderate steep slope (50-70%)	k
rolling	m
plain	p
ridged	r
steep slope (>70%)	s
terraced	t
undulating	u
veneer (< 1 m)	v

Delimiter and Qualifier

/	The component in front of the symbol is more extensive than the one that follows
//	The component in front of the symbol is considerably more extensive than the component that follows
A	Geomorphological process initiation zone
^	Active

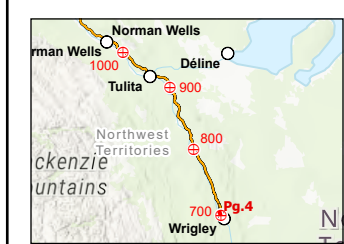
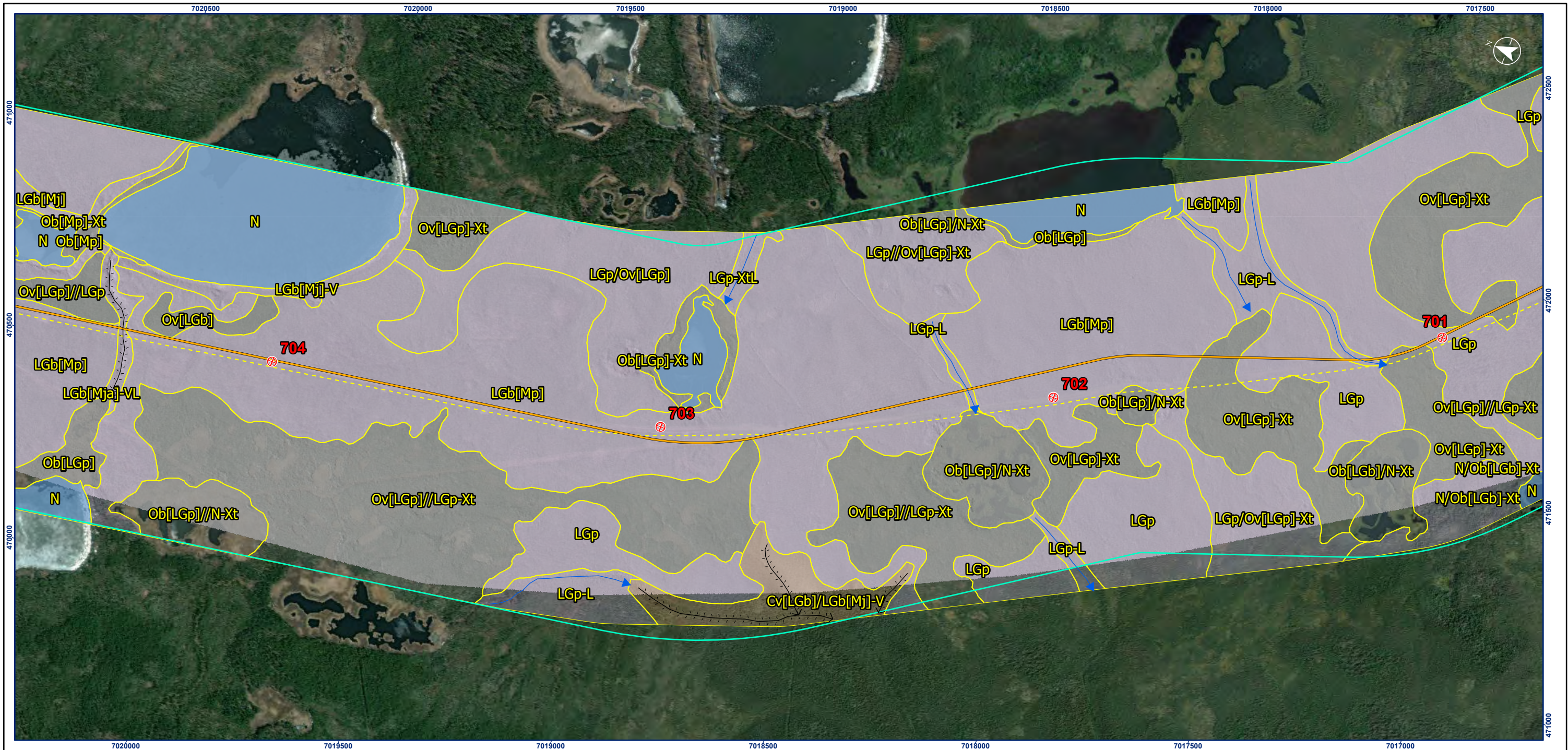
Geomorphological Process

Permafrost Process	
Thermokarst	Xt
Thaw flow	Xf
Ice wedge depression	Xw
Thermo-erosion	Xe
Mass Movement Process	
Slow mass movement	F
Tension crack	Fk
Rapid mass movement	R
Rockfall	Rb
Debris flow	Rd
Debris slide/avalanche	Rs
Rotational slump	Ru
Hydrological Process	
Channeled by meltwater	E
Kettled	H
Surface seepage	L
Inundation	U
Gully	V



Project Location: Wrigley to Norman Wells, NWT
 Prepared by CES on 2021-02-08
 TR by OP on 2023-03-14
 Client/Project: 144903025-0065 REV A

Government of Northwest Territories
 Mackenzie Valley Highway
 Figure No. **B.3**
 Title: **LSA Terrain Mapping**



Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Data Sources: Government of Northwest Territories
 3. Background: World Topographic Map: Northwest Territories, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCAN, Parks Canada
 World Imagery: Maxar
 World Hillshade: Esri, USGS and LIDAR-derived hillshade provided by GNWT
 4. Terrain mapping conducted in 2D using available airphotos, ortho-imagery and LIDAR data. Refer to Soils, Terrain and Permafrost TDR for detailed methodology

- ➔ Seepage Flow Direction
- ⤵ Gully
- ⤴ Landslide Scar
- Surficial Material**
- Anthropogenic Material
- Bedrock
- Colluvium
- Eolian
- Fluvial Material
- Glaciofluvial Material
- Glaciolacustrine Material
- Morainal Material (till)
- Organic Material
- Water
- Terrain Mapping

- ⊕ Mackenzie Valley Highway Kilometre Post
- Mackenzie Valley Highway Extension Project
- Local Study Area
- All-Season Road
- Winter Road
- Mackenzie Valley Fibre Link
- Norman Wells to Zama Lake Pipeline (Enbridge)
- ⬜ District Boundary
- ⬜ Region Boundary
- ⬜ Settlement Area Boundary

Surficial Material

Anthropogenic	A
Colluvium	C
Eolian	E
Fluvial	F
Glaciofluvial	FG
Glaciolacustrine	LG
Morainal (till)	M
Water Body	N
Organic	O
Bedrock	R

Surface Expression

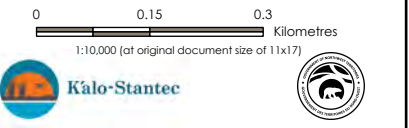
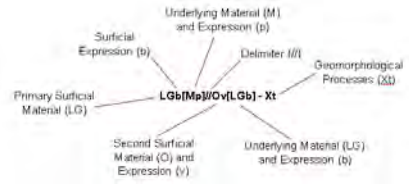
moderate slope (27-49%)	a
blanket (> 1 m)	b
cone	c
depression	d
fan	f
hummocky	h
gentle slope (6-26%)	j
moderate steep slope (50-70%)	k
rolling	m
plain	p
ridged	r
steep slope (>70%)	s
terraced	t
undulating	u
veneer (< 1 m)	v

Delimiter and Qualifier

- / The component in front of the symbol is more extensive than the one that follows
- // The component in front of the symbol is considerably more extensive than the component that follows
- ^ Geomorphological process initiation zone
- A Active

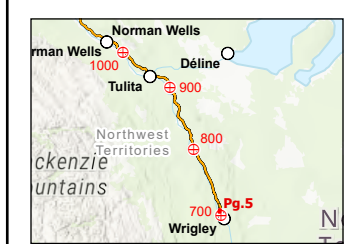
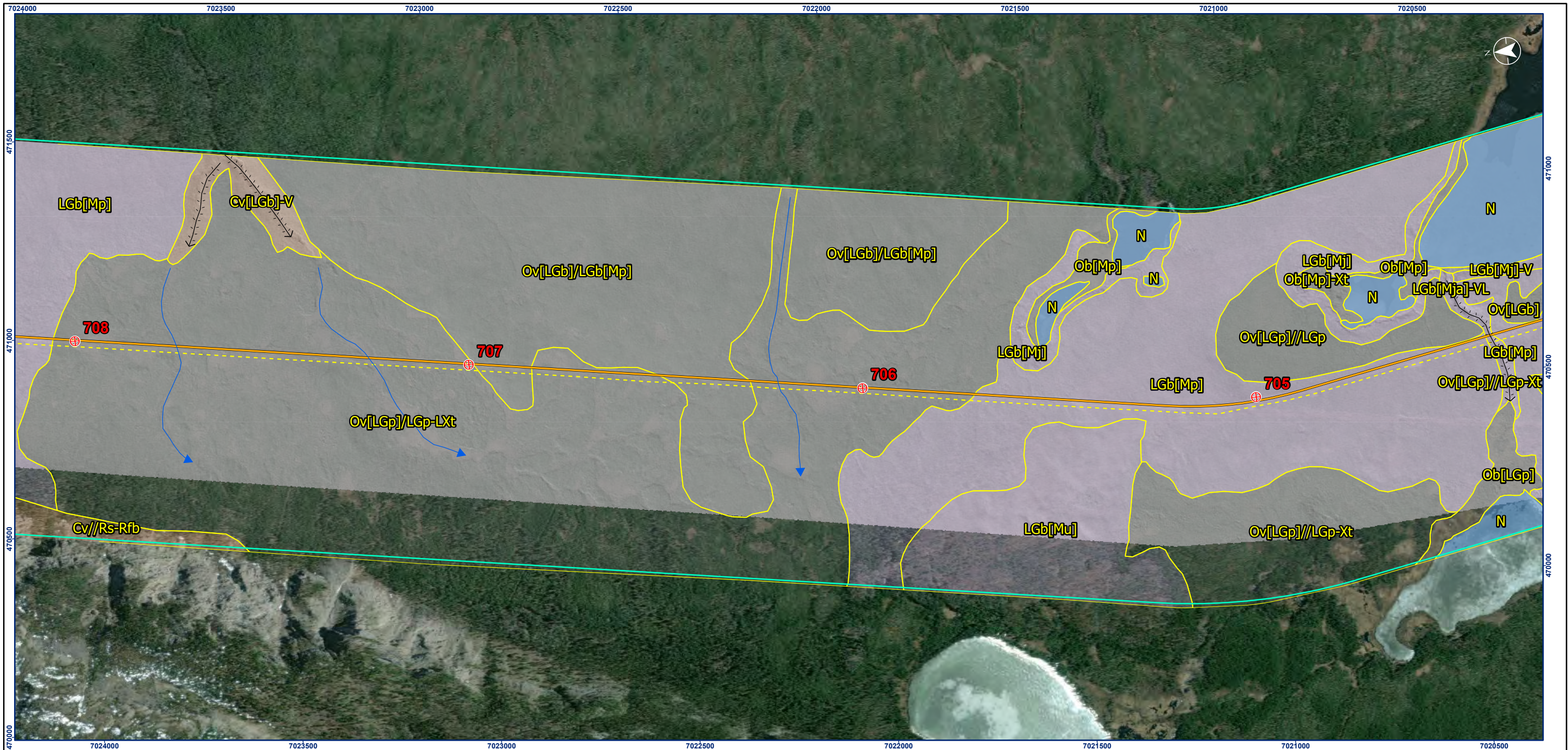
Geomorphological Process

- Permafrost Process**
- Thermokarst Xt
 - Thaw flow Xf
 - Ice wedge Xw
 - Thermo-erosion Xe
- Mass Movement Process**
- Slow mass movement F
 - Tension crack Fk
 - Rapid mass movement R
 - Rockfall Rb
 - Debris flow Rd
 - Debris slide/avalanche Rr
 - Rotational slump Ru
- Hydrological Process**
- Channeled by meltwater E
 - Kettled H
 - Surface seepage L
 - Inundation U
 - Gully V



Project Location: Wrigley to Norman Wells, NWT
 Prepared by CES on 2021-02-08
 TR by OP on 2023-03-14
 Client/Project: 144903025-0065 REVA

Government of Northwest Territories
 Mackenzie Valley Highway
 Figure No. B.4
 Title: LSA Terrain Mapping



Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Data Sources: Government of Northwest Territories
 3. Background: World Topographic Map: Northwest Territories, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCAN, Parks Canada
 World Imagery: Maxar
 World Hillshade: Esri, USGS and LIDAR-derived hillshade provided by GNWT
 4. Terrain mapping conducted in 2D using available airphotos, ortho-imagery and LIDAR data. Refer to Soils, Terrain and Permafrost TDR for detailed methodology

- ➔ Seepage Flow Direction
- ⇓ Gully
- ⤴ Landslide Scar
- Surficial Material**
- Anthropogenic Material
- Bedrock
- Colluvium
- Eolian
- Fluvial Material
- Glaciofluvial Material
- Glaciolacustrine Material
- Morainal Material (till)
- Organic Material
- Water
- Terrain Mapping

- ⊕ Mackenzie Valley Highway Kilometre Post
- Mackenzie Valley Highway Extension Project
- Local Study Area
- All-Season Road
- Winter Road
- Mackenzie Valley Fibre Link
- Norman Wells to Zama Lake Pipeline (Enbridge)
- District Boundary
- Region Boundary
- Settlement Area Boundary

Surficial Material

Anthropogenic	A
Colluvium	C
Eolian	E
Fluvial	F
Glaciofluvial	FG
Glaciolacustrine	LG
Morainal (till)	M
Water Body	N
Organic	O
Bedrock	R

Delimiter and Qualifier

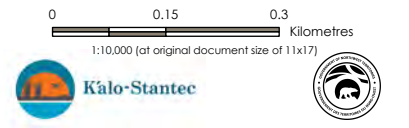
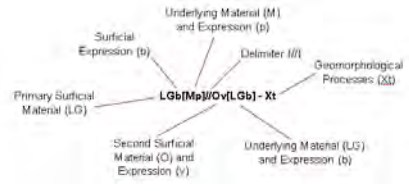
- / The component in front of the symbol is more extensive than the one that follows
- // The component in front of the symbol is considerably more extensive than the component that follows
- ^ Geomorphological process initiation zone
- A Active

Surface Expression

moderate slope (27-49%)	a
blanket (> 1 m)	b
cone	c
depression	d
fan	f
hummocky	h
gentle slope (6-26%)	j
moderate steep slope (50-70%)	k
rolling	m
plain	p
ridged	r
steep slope (>70%)	s
terraced	t
undulating	u
veneer (< 1 m)	v

Geomorphological Process

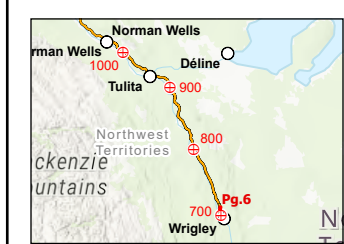
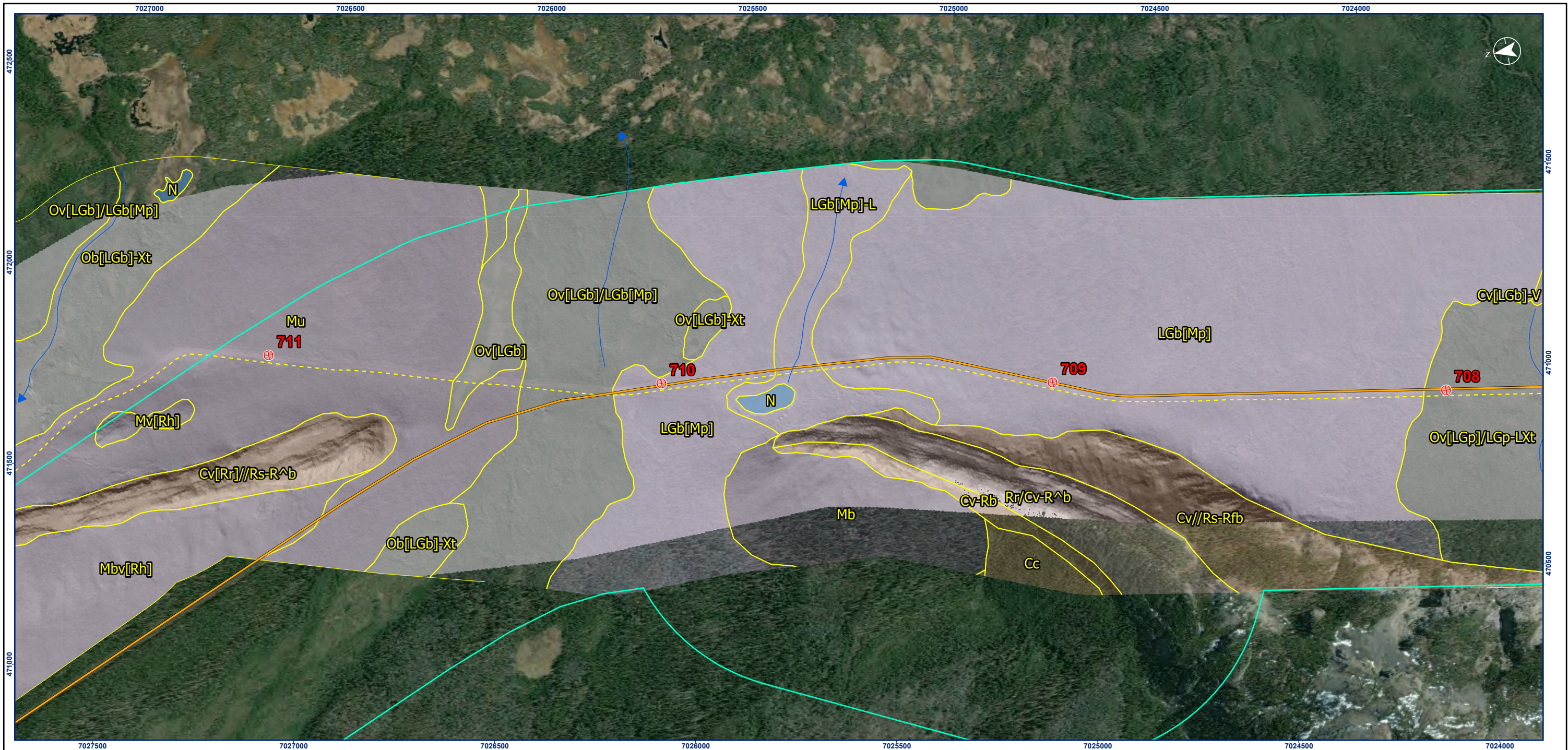
- Permafrost Process**
- Thermokarst Xt
 - Thaw flow Xf
 - Ice wedge Xw
 - Thermo-erosion Xe
- Mass Movement Process**
- Slow mass movement F
 - Tension crack Fk
 - Rapid mass movement R
 - Rockfall Rb
 - Debris flow Rd
 - Debris slide/avalanche Rs
 - Rotational slump Ru
- Hydrological Process**
- Channeled by meltwater E
 - Kettled H
 - Surface seepage L
 - Inundation U
 - Gully V



Project Location: Wrigley to Norman Wells, NWT
 Prepared by CES on 2021-02-08
 TR by OP on 2023-03-14

Client/Project: Government of Northwest Territories
 Mackenzie Valley Highway

Figure No. **B.5**
 Title: **LSA Terrain Mapping**



Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Data Sources: Government of Northwest Territories
 3. Background: World Topographic Map: Northwest Territories, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCAN, Parks Canada
 World Imagery: Maxar
 World Hillshade: Esri, USGS and LIDAR-derived hillshade provided by GNWT
 4. Terrain mapping conducted in 2D using available airphotos, ortho-imagery and LIDAR data. Refer to Soils, Terrain and Permafrost TDR for detailed methodology

- Seepage Flow Direction
- ⇓ Gully
- ↳ Landslide Scar
- Surficial Material**
- Anthropogenic Material
- Bedrock
- Colluvium
- Eolian
- Fluvial Material
- Glaciofluvial Material
- Glaciolacustrine Material
- Morainal Material (till)
- Organic Material
- Water
- Terrain Mapping

- ⊕ Mackenzie Valley Highway Kilometre Post
- Mackenzie Valley Highway Extension Project
- Local Study Area
- All-Season Road
- Winter Road
- Mackenzie Valley Fibre Link
- Norman Wells to Zama Lake Pipeline (Enbridge)
- District Boundary
- Region Boundary
- Settlement Area Boundary

Surficial Material

Anthropogenic	A
Colluvium	C
Eolian	E
Fluvial	F
Glaciofluvial	FG
Glaciolacustrine	LG
Morainal (till)	M
Water Body	N
Organic	O
Bedrock	R

Surface Expression

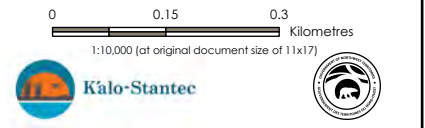
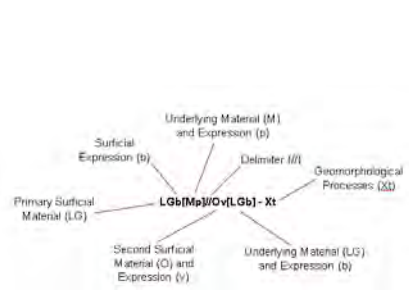
moderate slope (27-49%)	a
blanket (> 1 m)	b
cone	c
depression	d
fan	f
hummocky	h
gentle slope (6-26%)	j
moderate steep slope (50-70%)	k
rolling	m
plain	p
ridged	r
steep slope (>70%)	s
terraced	t
undulating	u
veneer (< 1 m)	v

Delimiter and Qualifier

/	The component in front of the symbol is more extensive than the one that follows
//	The component in front of the symbol is considerably more extensive than the component that follows
A	Geomorphological process initiation zone
^	Active

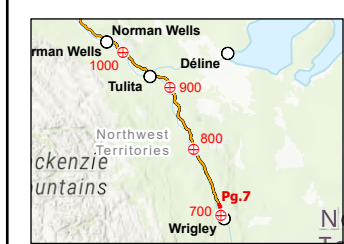
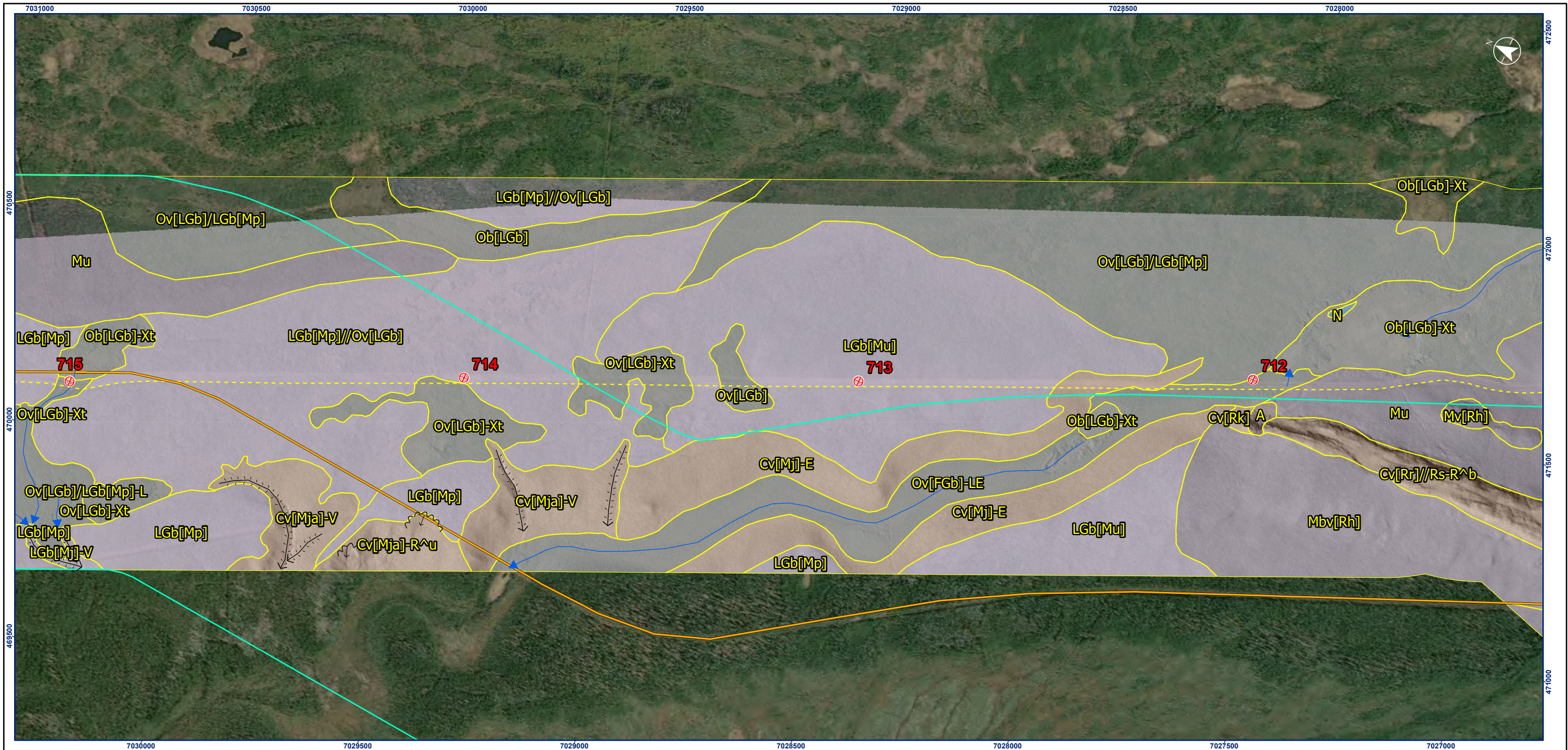
Geomorphological Process

Permafrost Process	Xt
Thermokarst	Xf
Thaw flow	Xw
Ice wedge	Xe
Thermo-erosion	
Mass Movement Process	F
Slow mass movement	Fk
Tension crack	R
Rapid mass movement	Rb
Rockfall	Rd
Debris flow	Rs
Debris slide/avalanche	Ru
Rotational slump	
Hydrological Process	E
Channeled by meltwater	H
Kettled	L
Surface seepage	U
Inundation	V
Gully	



Project Location: Wrigley to Norman Wells, NWT
 Prepared by CES on 2021-02-08
 TR by OP on 2023-03-14
 Client/Project: 144903025-0065 REV A

Government of Northwest Territories
 Mackenzie Valley Highway
 Figure No. B.6
 Title: LSA Terrain Mapping



Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Data Sources: Government of Northwest Territories
 3. Background: World Topographic Map: Northwest Territories, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCAN, Parks Canada
 World Imagery: Maxar
 World Hillshade: Esri, USGS and LIDAR-derived hillshade provided by GNWT
 4. Terrain mapping conducted in 2D using available airphotos, ortho-imagery and LIDAR data. Refer to Soils, Terrain and Permafrost TDR for detailed methodology

- ➔ Seepage Flow Direction
- ↘ Gully
- ↖ Landslide Scar
- ↗
- Surficial Material**
- Anthropogenic Material
- Bedrock
- Colluvium
- Eolian
- Fluvial Material
- Glaciofluvial Material
- Glaciolacustrine Material
- Morainal Material (till)
- Organic Material
- Water
- Terrain Mapping

- ⊕ Mackenzie Valley Highway Kilometre Post
- Mackenzie Valley Highway Extension Project
- Local Study Area
- All-Season Road
- Winter Road
- Mackenzie Valley Fibre Link
- Norman Wells to Zama Lake Pipeline (Enbridge)
- District Boundary
- Region Boundary
- Settlement Area Boundary

Surficial Material

Anthropogenic	A
Colluvium	C
Eolian	E
Fluvial	F
Glaciofluvial	FG
Glaciolacustrine	LG
Morainal (till)	M
Water Body	N
Organic	O
Bedrock	R

Delimiter and Qualifier

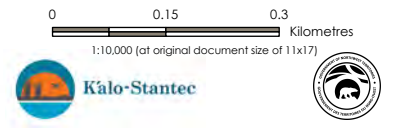
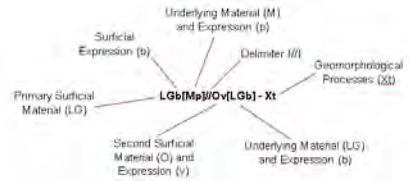
- / The component in front of the symbol is more extensive than the one that follows
- // The component in front of the symbol is considerably more extensive than the component that follows
- ^ Geomorphological process initiation zone
- A Active

Surface Expression

moderate slope (> 27-49%)	a
blanket (> 1 m)	b
cone	c
depression	d
fan	f
hummocky	h
gentle slope (6-26%)	j
moderate steep slope (50-70%)	k
rolling	m
plain	p
ridged	r
steep slope (> 70%)	s
terraced	t
undulating	u
veneer (< 1 m)	v

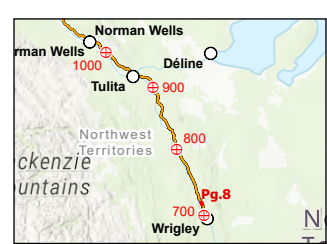
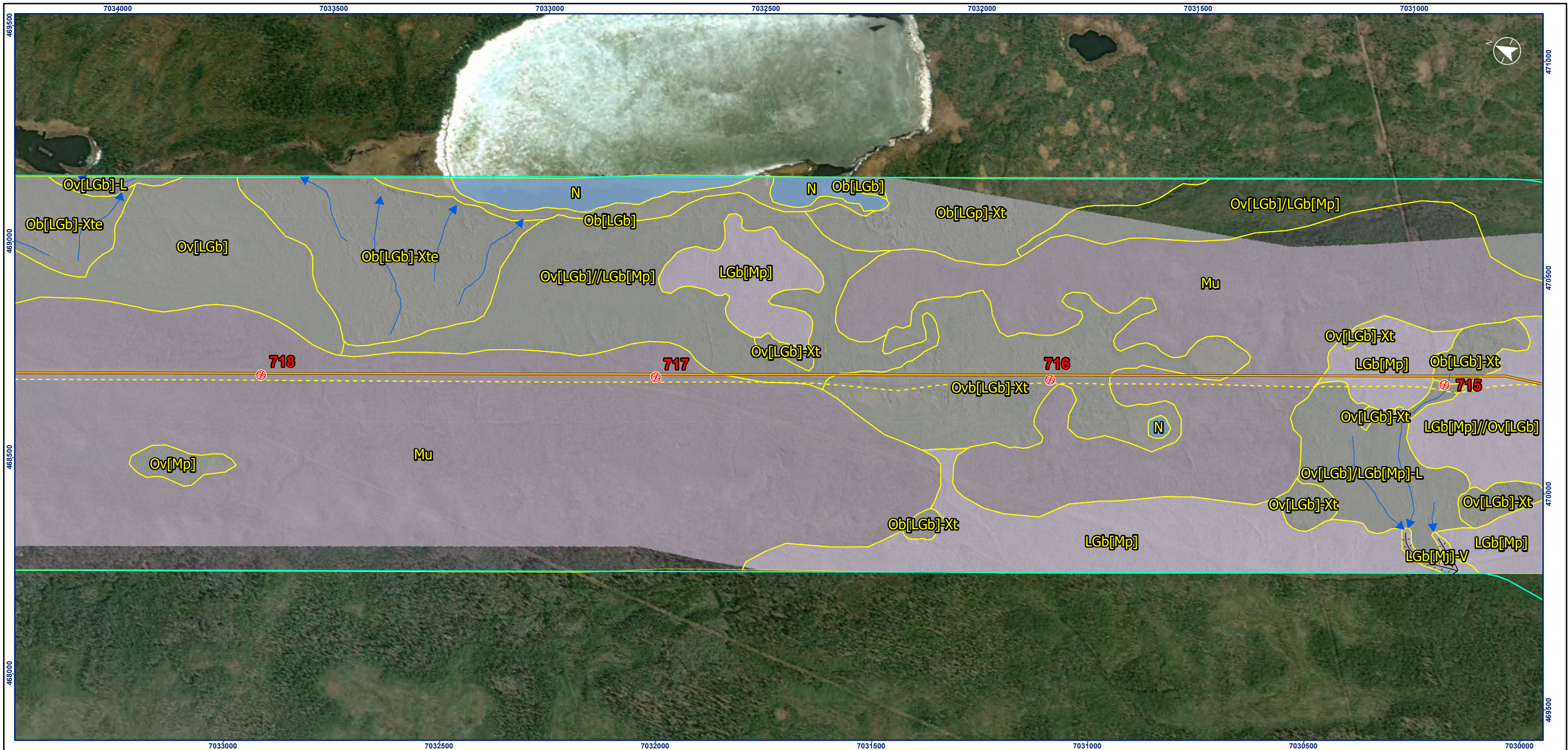
Geomorphological Process

- Permafrost Process**
- Thermokarst Xt
 - Thaw flow Xf
 - Ice wedge Xw
 - Thermo-erosion Xe
- Mass Movement Process**
- Slow mass movement F
 - Tension crack Fk
 - Rapid mass movement R
 - Rockfall Rb
 - Debris flow Rd
 - Debris slide/avalanche Rs
 - Rotational slump Ru
- Hydrological Process**
- Channeled by meltwater E
 - Kettled H
 - Surface seepage L
 - Inundation U
 - Gully V



Project Location: Wrigley to Norman Wells, NWT
 Client/Project: 144903025-0065 REV A

Government of Northwest Territories
 Mackenzie Valley Highway
 Figure No. B.7
 Title: LSA Terrain Mapping



Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Data Sources: Government of Northwest Territories
 3. Background: World Topographic Map: Northwest Territories, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCAN, Parks Canada
 World Imagery: Maxar
 World Hillshade: Esri, USGS and LIDAR-derived hillshade provided by GNWT
 4. Terrain mapping conducted in 2D using available airphotos, ortho-imagery and LIDAR data. Refer to Soils, Terrain and Permafrost TDR for detailed methodology

- ➔ Seepage Flow Direction
- ⚡ Gully
- ⚡ Landslide Scar
- Surficial Material**
- Anthropogenic Material
- Bedrock
- Colluvium
- Eolian
- Fluvial Material
- Glaciofluvial Material
- Glaciolacustrine Material
- Morainal Material (till)
- Organic Material
- Water
- Terrain Mapping

- ⊕ Mackenzie Valley Highway Kilometre Post
- Mackenzie Valley Highway Extension Project
- Local Study Area
- All-Season Road
- Winter Road
- Mackenzie Valley Fibre Link
- Norman Wells to Zama Lake Pipeline (Enbridge)
- District Boundary
- Region Boundary
- Settlement Area Boundary

Surficial Material

Anthropogenic	A
Colluvium	C
Eolian	E
Fluvial	F
Glaciofluvial	FG
Glaciolacustrine	LG
Morainal (till)	M
Water Body	N
Organic	O
Bedrock	R

Surface Expression

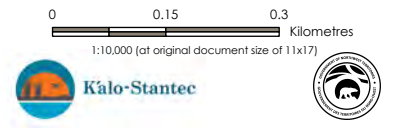
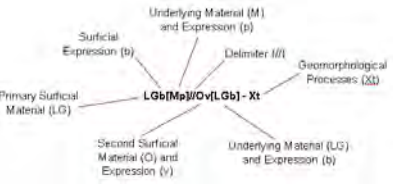
moderate slope (27-49%)	a
blanket (> 1 m)	b
cone	c
depression	d
fan	f
hummocky	h
gentle slope (6-26%)	j
moderate steep slope (50-70%)	k
rolling	m
plain	p
ridged	r
steep slope (>70%)	s
terraced	t
undulating	u
veneer (< 1 m)	v

Delimiter and Qualifier

/	The component in front of the symbol is more extensive than the one that follows
//	The component in front of the symbol is considerably more extensive than the component that follows
A	Geomorphological process initiation zone
A	Active

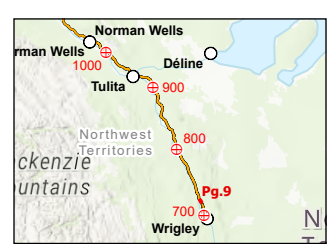
Geomorphological Process

Permafrost Process	
Thermokarst	Xt
Thaw flow	Xf
Ice wedge	Xw
Thermo-erosion	Xe
Mass Movement Process	
Slow mass movement	F
Tension crack	Fk
Rapid mass movement	R
Rockfall	Rb
Debris flow	Rd
Debris slide/avalanche	Rs
Rotational slump	Ru
Hydrological Process	
Channeled by meltwater	E
Kettled	H
Surface seepage	L
Inundation	U
Gully	V



Project Location: Wrigley to Norman Wells, NWT
 Prepared by CES on 2021-02-08
 TR by OP on 2023-03-14
 Client/Project: 144903025-0065 REV A

Government of Northwest Territories
 Mackenzie Valley Highway
 Figure No. **B.8**
 Title **LSA Terrain Mapping**



Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Data Sources: Government of Northwest Territories
 3. Background: World Topographic Map: Northwest Territories, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCan, Parks Canada
 World Imagery: Maxar
 World Hillshade: Esri, USGS and LIDAR-derived hillshade provided by GNWT
 4. Terrain mapping conducted in 2D using available airphotos, ortho-imagery and LIDAR data. Refer to Soils, Terrain and Permafrost TDR for detailed methodology

- ➔ Seepage Flow Direction
- ⇩ Gully
- ↳ Landslide Scar
- Surficial Material**
- Anthropogenic Material
- Bedrock
- Colluvium
- Eolian
- Fluvial Material
- Glaciofluvial Material
- Glaciolacustrine Material
- Morainal Material (till)
- Organic Material
- Water
- Terrain Mapping

- ⊕ Mackenzie Valley Highway Kilometre Post
- Mackenzie Valley Highway Extension Project
- Local Study Area
- All-Season Road
- Winter Road
- Mackenzie Valley Fibre Link
- Norman Wells to Zama Lake Pipeline (Enbridge)
- District Boundary
- Region Boundary
- Settlement Area Boundary

Surficial Material

Anthropogenic	A
Colluvium	C
Eolian	E
Fluvial	F
Glaciofluvial	FG
Glaciolacustrine	LG
Morainal (till)	M
Water Body	N
Organic	O
Bedrock	R

Surface Expression

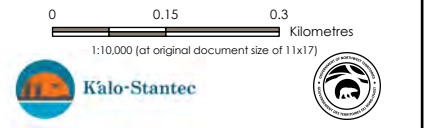
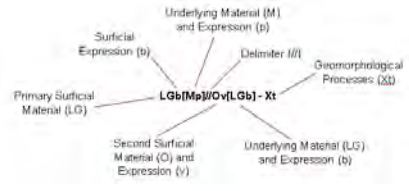
moderate slope (27-49%)	a
blanket (> 1 m)	b
cone	c
depression	d
fan	f
hummocky	h
gentle slope (6-26%)	j
moderate steep slope (50-70%)	k
rolling	m
plain	p
ridged	r
steep slope (>70%)	s
terraced	t
undulating	u
veneer (< 1 m)	v

Delimiter and Qualifier

- / The component in front of the symbol is more extensive than the one that follows
- // The component in front of the symbol is considerably more extensive than the component that follows
- A Geomorphological process initiation zone
- A Active

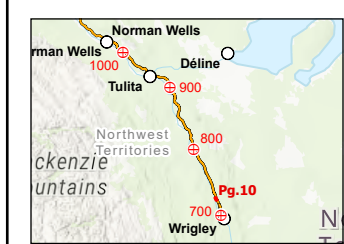
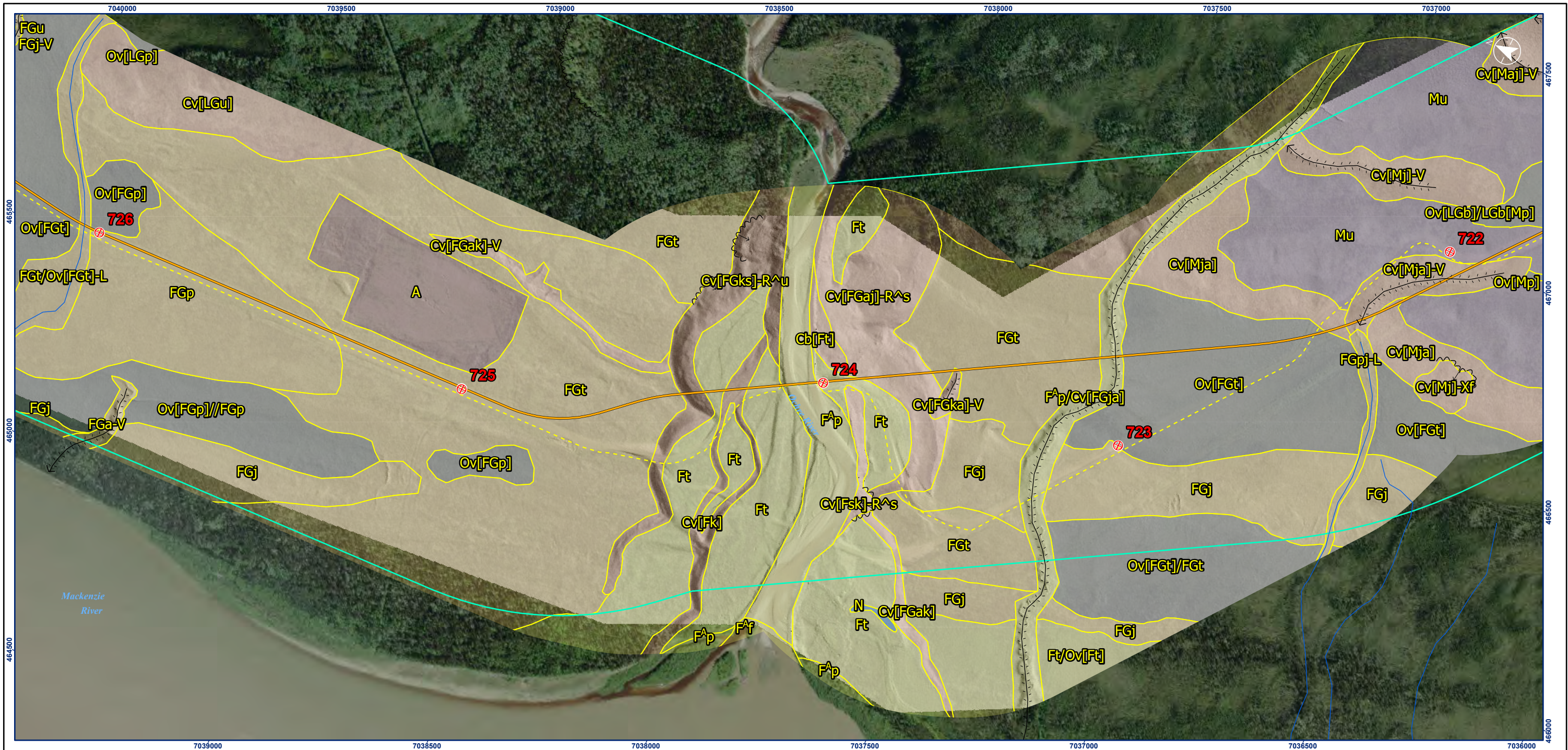
Geomorphological Process

- Permafrost Process**
- Thermokarst Xt
 - Thaw flow Xf
 - Ice wedge Xw
 - Thermo-erosion Xe
- Mass Movement Process**
- Slow mass movement F
 - Tension crack Fk
 - Rapid mass movement R
 - Rockfall Rb
 - Debris flow Rd
 - Debris slide/avalanche Rs
 - Rotational slump Ru
- Hydrological Process**
- Channeled by meltwater E
 - Kettled H
 - Surface seepage L
 - Inundation U
 - Gully V



Project Location: Wrigley to Norman Wells, NWT
 Prepared by CES on 2021-02-08
 TR by OP on 2023-03-14
 Client/Project: 144903025-0065 REV A

Government of Northwest Territories
 Mackenzie Valley Highway
 Figure No. B.9
 Title: LSA Terrain Mapping



Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Data Sources: Government of Northwest Territories
 3. Background: World Topographic Map: Northwest Territories, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCAN, Parks Canada
 World Imagery: Maxar
 World Hillshade: Esri, USGS and LIDAR-derived hillshade provided by GNWT
 4. Terrain mapping conducted in 2D using available airphotos, ortho-imagery and LIDAR data. Refer to Soils, Terrain and Permafrost TDR for detailed methodology

- ➔ Seepage Flow Direction
- ⚡ Gully
- ⚡ Landslide Scar
- Surficial Material**
- Anthropogenic Material
- Bedrock
- Colluvium
- Eolian
- Fluvial Material
- Glaciofluvial Material
- Glaciolacustrine Material
- Morainial Material (till)
- Organic Material
- Water
- Terrain Mapping

- ⊕ Mackenzie Valley Highway Kilometre Post
- Mackenzie Valley Highway Extension Project
- Local Study Area
- All-Season Road
- Winter Road
- Mackenzie Valley Fibre Link
- Norman Wells to Zama Lake Pipeline (Enbridge)
- District Boundary
- Region Boundary
- Settlement Area Boundary

Surficial Material

Anthropogenic	A
Colluvium	C
Eolian	E
Fluvial	FG
Glaciofluvial	FG
Glaciolacustrine	LG
Morainial (till)	M
Water Body	N
Organic	O
Bedrock	R

Surface Expression

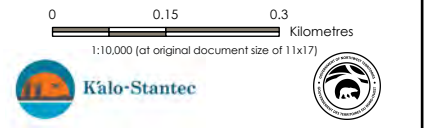
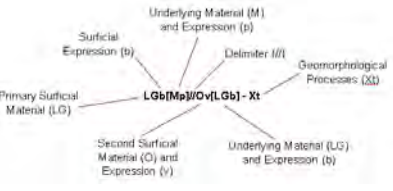
moderate slope (27-49%)	a
blanket (> 1 m)	b
cone	c
depression	d
fan	f
hummocky	h
gentle slope (6-26%)	j
moderate steep slope (50-70%)	k
rolling	m
plain	p
ridged	r
steep slope (>70%)	s
terraced	t
undulating	u
veneer (< 1 m)	v

Delimiter and Qualifier

/	The component in front of the symbol is more extensive than the one that follows
//	The component in front of the symbol is considerably more extensive than the component that follows
A	Geomorphological process initiation zone
A	Active

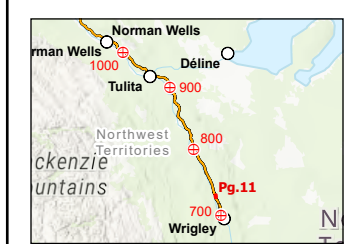
Geomorphological Process

Permafrost Process	
Thermokarst	Xt
Thaw flow	Xf
Ice wedge	Xw
Thermo-erosion	Xe
Mass Movement Process	
Slow mass movement	F
Tension crack	Fk
Rapid mass movement	R
Rockfall	Rb
Debris flow	Rd
Debris slide/avalanche	Rs
Rotational slump	Ru
Hydrological Process	
Channeled by meltwater	E
Kettled	H
Surface seepage	L
Inundation	U
Gully	V



Project Location: Wrigley to Norman Wells, NWT
 Prepared by CES on 2021-02-08
 TR by OP on 2023-03-14
 Client/Project: 144903025-0065 REV A

Government of Northwest Territories
 Mackenzie Valley Highway
 Figure No. **B.10**
 Title: **LSA Terrain Mapping**



Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Data Sources: Government of Northwest Territories
 3. Background: World Topographic Map: Northwest Territories, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCAN, Parks Canada
 World Imagery: Maxar
 World Hillshade: Esri, USGS and LIDAR-derived hillshade provided by GNWT
 4. Terrain mapping conducted in 2D using available airphoto, ortho-imagery and LIDAR data. Refer to Soils, Terrain and Permafrost TDR for detailed methodology

- ➔ Seepage Flow Direction
- ⤵ Gully
- ⤴ Landslide Scar
- Surficial Material**
- Anthropogenic Material
- Bedrock
- Colluvium
- Eolian
- Fluvial Material
- Glaciofluvial Material
- Glaciolacustrine Material
- Morainal Material (till)
- Organic Material
- Water
- Terrain Mapping

- ⊕ Mackenzie Valley Highway Kilometre Post
- Mackenzie Valley Highway Extension Project
- Local Study Area
- All-Season Road
- Winter Road
- Mackenzie Valley Fibre Link
- Norman Wells to Zama Lake Pipeline (Enbridge)
- ⬜ District Boundary
- ⬜ Region Boundary
- ⬜ Settlement Area Boundary

Surficial Material

Anthropogenic	A
Colluvium	C
Eolian	E
Fluvial	F
Glaciofluvial	FG
Glaciolacustrine	LG
Morainal (till)	M
Water Body	N
Organic	O
Bedrock	R

Delimiter and Qualifier

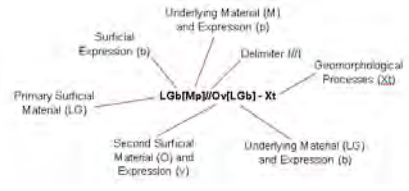
- / The component in front of the symbol is more extensive than the one that follows
- // The component in front of the symbol is considerably more extensive than the component that follows
- ^ Geomorphological process initiation zone
- A Active

Surface Expression

moderate slope (27-49%)	a
blanket (> 1 m)	b
cone	c
depression	d
fan	f
hummocky	h
gentle slope (6-26%)	j
moderate steep slope (50-70%)	k
rolling	m
plain	p
ridged	r
steep slope (>70%)	s
terraced	t
undulating	u
veneer (< 1 m)	v

Geomorphological Process

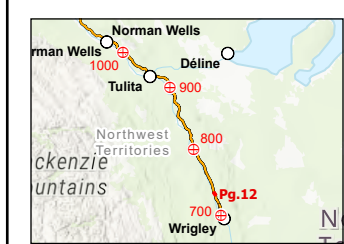
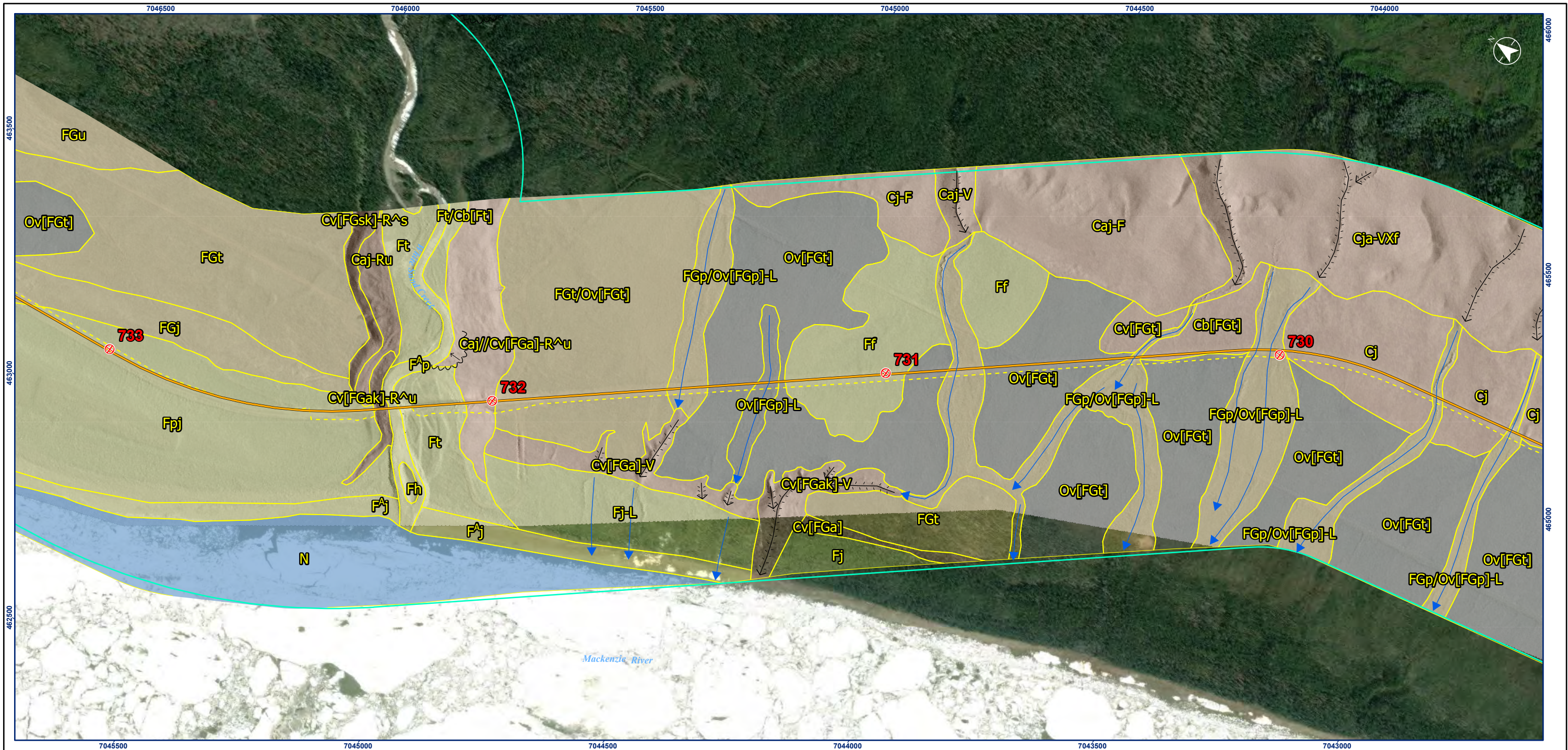
- Permafrost Process**
- Thermokarst Xt
 - Thaw flow Xf
 - Ice wedge Xw
 - Thermo-erosion Xe
- Mass Movement Process**
- Slow mass movement F
 - Tension crack Fk
 - Rapid mass movement R
 - Rockfall Rb
 - Debris flow Rd
 - Debris slide/avalanche Rr
 - Rotational slump Ru
- Hydrological Process**
- Channeled by meltwater E
 - Kettled H
 - Surface seepage L
 - Inundation U
 - Gully V



0 0.15 0.3 Kilometres
 1:10,000 (at original document size of 11x17)

Project Location: Wrigley to Norman Wells, NWT
 Prepared by CES on 2021-02-08
 TR by OP on 2023-03-14

Client/Project: Government of Northwest Territories
 Mackenzie Valley Highway
 Figure No. B.11
 Title: LSA Terrain Mapping



Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Data Sources: Government of Northwest Territories
 3. Background: World Topographic Map: Northwest Territories, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCAN, Parks Canada
 World Imagery: Maxar
 World Hillshade: Esri, USGS and LIDAR-derived hillshade provided by GNWT
 4. Terrain mapping conducted in 2D using available airphotos, ortho-imagery and LIDAR data. Refer to Soils, Terrain and Permafrost TDR for detailed methodology

- ➔ Seepage Flow Direction
- ⤵ Gully
- ⤴ Landslide Scar
- Surficial Material**
- Anthropogenic Material
- Bedrock
- Colluvium
- Eolian
- Fluvial Material
- Glaciofluvial Material
- Glaciolacustrine Material
- Morainal Material (till)
- Organic Material
- Water
- Terrain Mapping

- ⊕ Mackenzie Valley Highway Kilometre Post
- Mackenzie Valley Highway Extension Project
- Local Study Area
- All-Season Road
- Winter Road
- Mackenzie Valley Fibre Link
- Norman Wells to Zama Lake Pipeline (Enbridge)
- District Boundary
- Region Boundary
- Settlement Area Boundary

Surficial Material

Anthropogenic	A
Colluvium	C
Eolian	E
Fluvial	F
Glaciofluvial	FG
Glaciolacustrine	LG
Morainal (till)	M
Water Body	N
Organic	O
Bedrock	R

Surface Expression

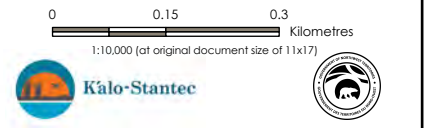
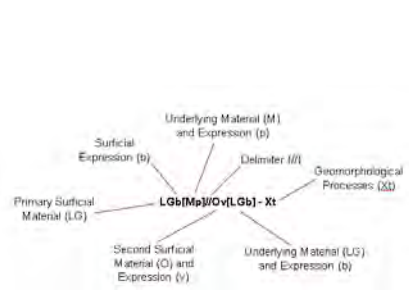
moderate slope (27-49%)	a
blanket (> 1 m)	b
cone	c
depression	d
fan	f
hummocky	h
gentle slope (6-26%)	j
moderate steep slope (50-70%)	k
rolling	m
plain	p
ridged	r
steep slope (>70%)	s
terraced	t
undulating	u
veneer (< 1 m)	v

Delimiter and Qualifier

/	The component in front of the symbol is more extensive than the one that follows
//	The component in front of the symbol is considerably more extensive than the component that follows
^	Geomorphological process initiation zone
A	Active

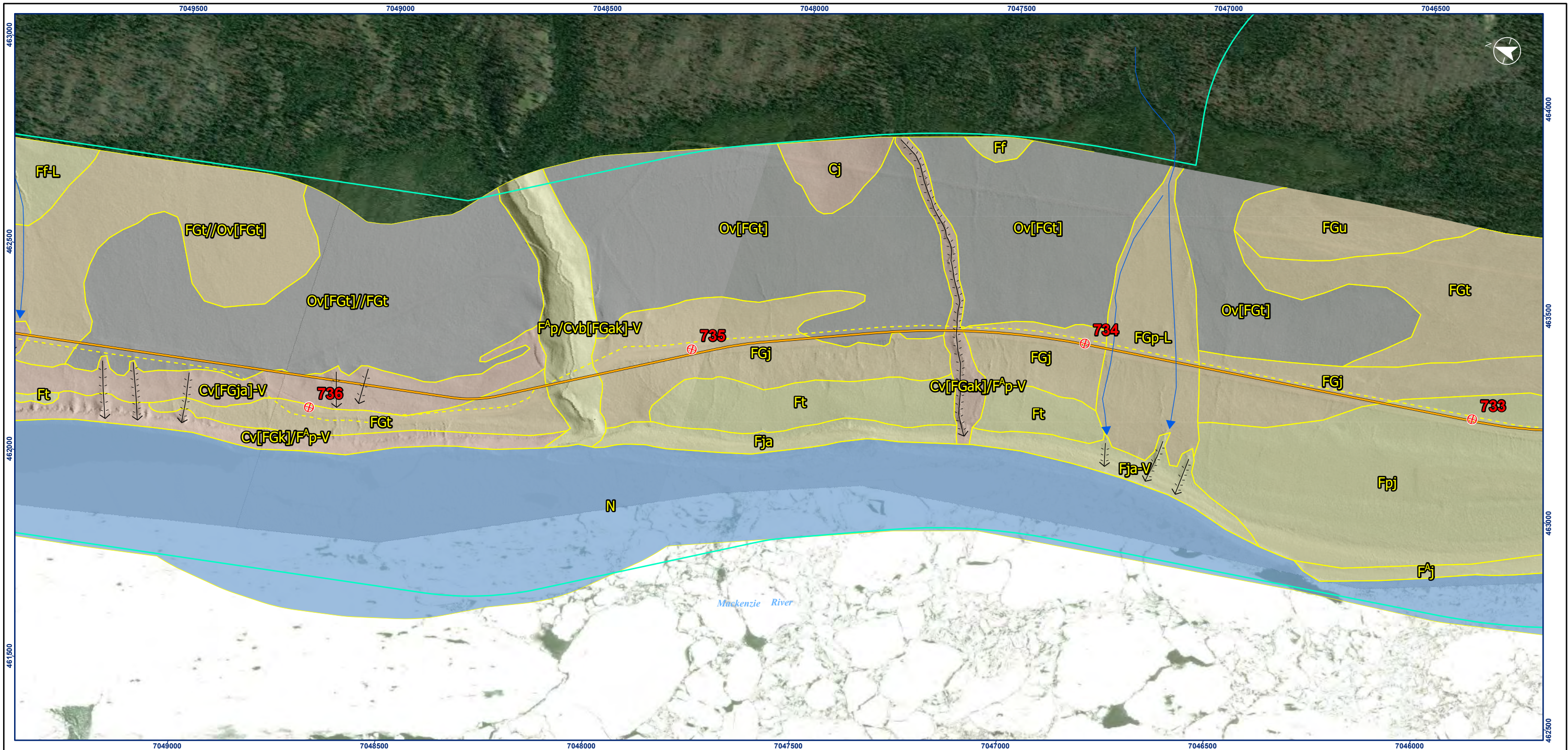
Geomorphological Process

Permafrost Process	Xt
Thermokarst	Xf
Thaw flow	Xw
Ice wedge	Xe
Thermo-erosion	
Mass Movement Process	F
Slow mass movement	Fk
Tension crack	R
Rapid mass movement	Rb
Rockfall	Rd
Debris flow	Rs
Debris slide/avalanche	Ru
Rotational slump	
Hydrological Process	
Channeled by meltwater	E
Kettled	H
Surface seepage	L
Inundation	U
Gully	V



Project Location: Wrigley to Norman Wells, NWT
 Prepared by CES on 2021-02-08
 TR by OP on 2023-03-14
 Client/Project: 144903025-0065 REV A

Government of Northwest Territories
 Mackenzie Valley Highway
 Figure No. **B.12**
 Title: **LSA Terrain Mapping**



Notes

- Coordinate System: NAD 1983 UTM Zone 10N
- Data Sources: Government of Northwest Territories
- Background: World Topographic Map: Northwest Territories, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCAN, Parks Canada
- Terrain mapping conducted in 2D using available airphotos, ortho-imagery and LIDAR data. Refer to Soils, Terrain and Permafrost TDR for detailed methodology

World Imagery: Maxar
World Hillshade: Esri, USGS and LIDAR-derived hillshade provided by GNWT

Legend

- Seepage Flow Direction
- Gully
- Landslide Scar
- Surficial Material**
- Anthropogenic Material
- Bedrock
- Colluvium
- Eolian
- Fluvial Material
- Glaciofluvial Material
- Glaciolacustrine Material
- Morainal Material (till)
- Organic Material
- Water
- Terrain Mapping

- Mackenzie Valley Highway Kilometre Post
- Mackenzie Valley Highway Extension Project
- Local Study Area
- All-Season Road
- Winter Road
- Mackenzie Valley Fibre Link
- Norman Wells to Zama Lake Pipeline (Enbridge)
- District Boundary
- Region Boundary
- Settlement Area Boundary

Surficial Material

Anthropogenic	A
Colluvium	C
Eolian	E
Fluvial	F
Glaciofluvial	FG
Glaciolacustrine	LG
Morainal (till)	M
Water Body	N
Organic	O
Bedrock	R

Surface Expression

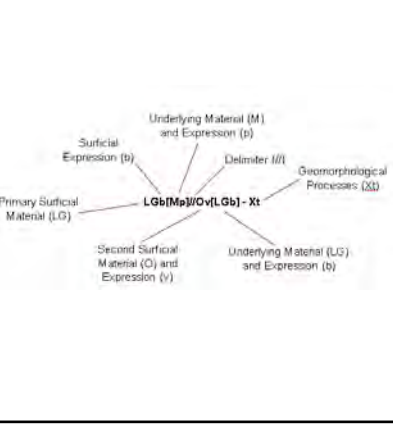
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blanket (> 1 m)	b
cone	c
depression	d
fan	f
hummocky	h
gentle slope (6-26%)	j
moderate steep slope (50-70%)	k
rolling	m
plain	p
ridged	r
steep slope (>70%)	s
terraced	t
undulating	u
veneer (< 1 m)	v

Delimiter and Qualifier

/	The component in front of the symbol is more extensive than the one that follows
//	The component in front of the symbol is considerably more extensive than the component that follows
A	Geomorphological process initiation zone
A	Active

Geomorphological Process

Permafrost Process	
Thermokarst	Xt
Thaw flow	Xf
Ice wedge	Xw
Thermo-erosion	Xe
Mass Movement Process	
Slow mass movement	F
Tension crack	Fk
Rapid mass movement	R
Rockfall	Rb
Debris flow	Rd
Debris slide/avalanche	Rs
Rotational slump	Ru
Hydrological Process	
Channeled by meltwater	E
Kettled	H
Surface seepage	L
Inundation	U
Gully	V



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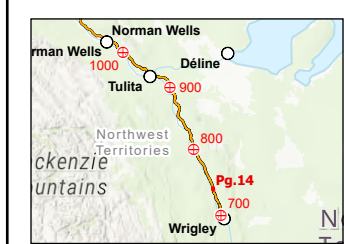
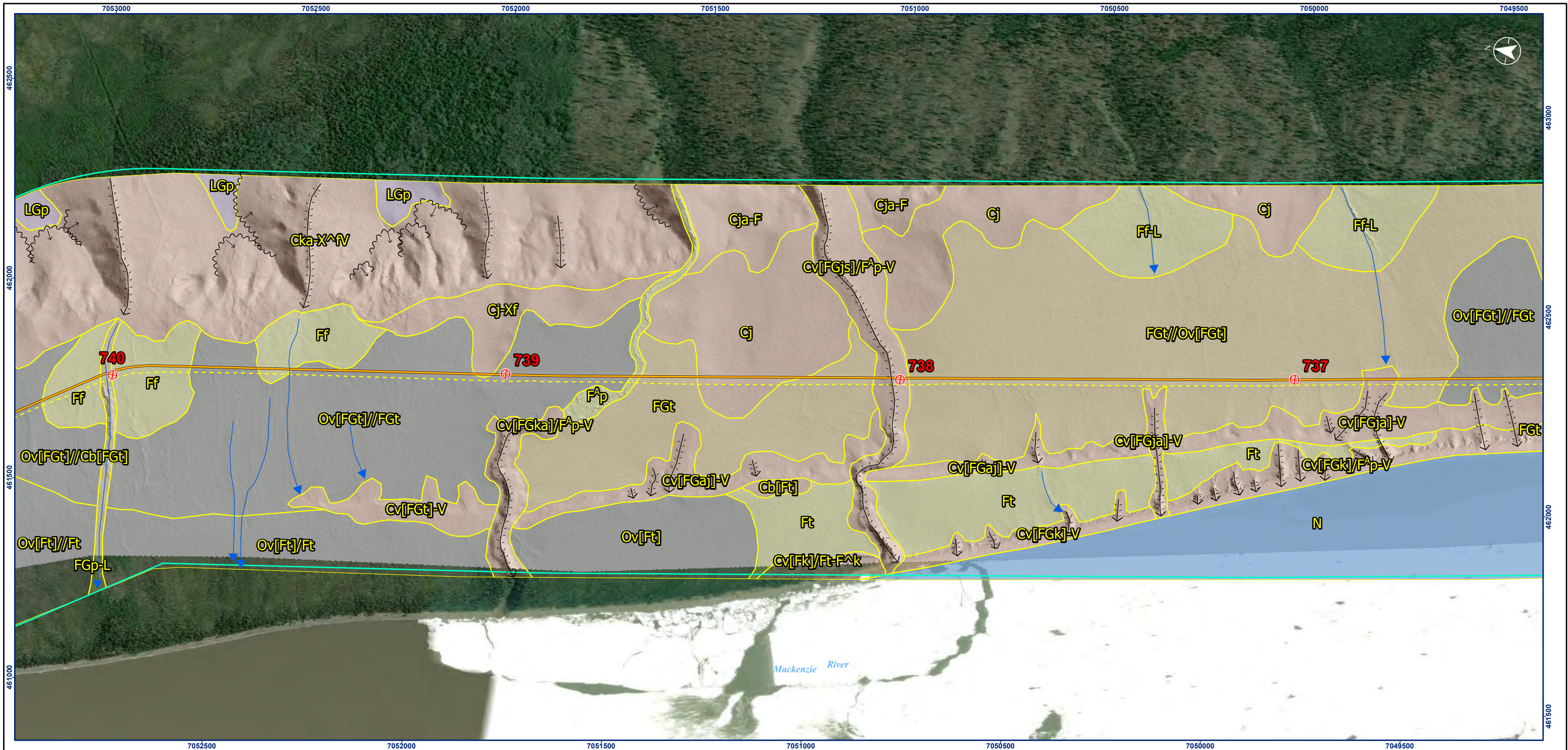
Kalo-Stantec

Project Location: Wrigley to Norman Wells, NWT
Prepared by CES on 2021-02-08
TR by OP on 2023-03-14

Client/Project: 144903025-0065 REVA

Government of Northwest Territories
Mackenzie Valley Highway

Figure No. **B.13**
Title: **LSA Terrain Mapping**



Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Data Sources: Government of Northwest Territories
 3. Background: World Topographic Map: Northwest Territories, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCan, Parks Canada
 World Imagery: Maxar
 World Hillshade: Esri, USGS and LIDAR-derived hillshade provided by GNWT
 4. Terrain mapping conducted in 2D using available airphotos, ortho-imagery and LIDAR data. Refer to Soils, Terrain and Permafrost TDR for detailed methodology

- Seepage Flow Direction
- ⇩ Gully
- ⇩ Landslide Scar
- Surficial Material**
- Anthropogenic Material
- Bedrock
- Colluvium
- Eolian
- Fluvial Material
- Glaciofluvial Material
- Glaciolacustrine Material
- Morainal Material (till)
- Organic Material
- Water
- Terrain Mapping

- ⊕ Mackenzie Valley Highway Kilometre Post
- Mackenzie Valley Highway Extension Project
- Local Study Area
- All-Season Road
- Winter Road
- Mackenzie Valley Fibre Link
- Norman Wells to Zama Lake Pipeline (Enbridge)
- District Boundary
- Region Boundary
- Settlement Area Boundary

Surficial Material

Anthropogenic	A
Colluvium	C
Eolian	E
Fluvial	F
Glaciofluvial	FG
Glaciolacustrine	LG
Morainal (till)	M
Water Body	N
Organic	O
Bedrock	R

Surface Expression

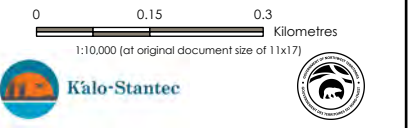
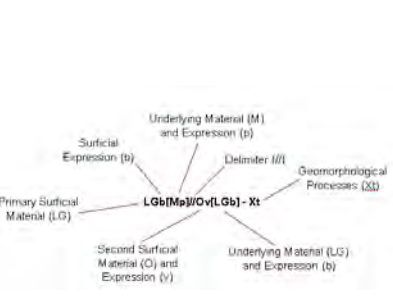
moderate slope (27-49%)	a
blanket (> 1 m)	b
cone	c
depression	d
fan	f
hummocky	h
gentle slope (6-26%)	j
moderate steep slope (50-70%)	k
rolling	m
plain	p
ridged	r
steep slope (>70%)	s
terraced	t
undulating	u
veneer (< 1 m)	v

Delimiter and Qualifier

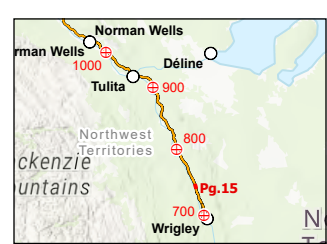
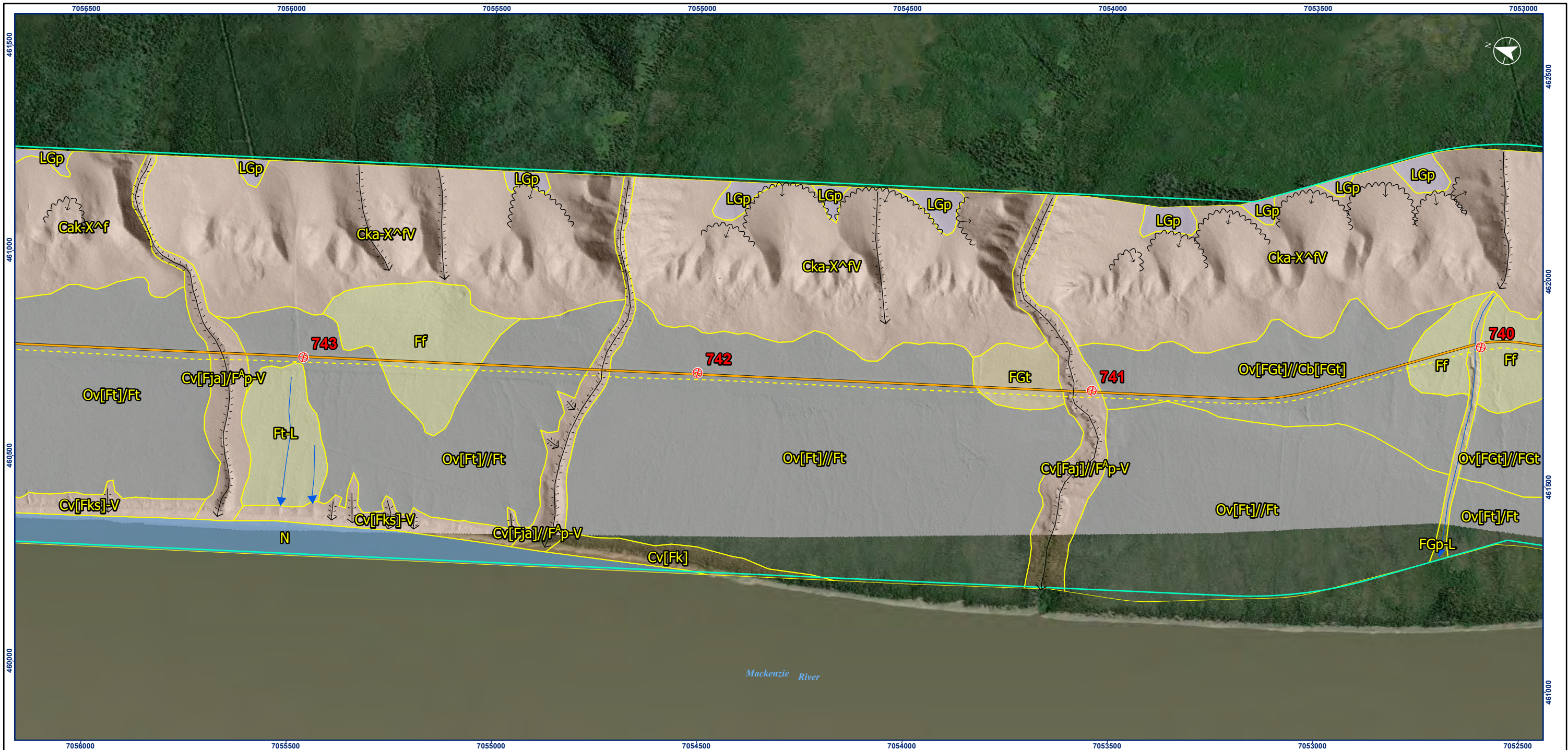
/	The component in front of the symbol is more extensive than the one that follows
//	The component in front of the symbol is considerably more extensive than the component that follows
A	Geomorphological process initiation zone
^	Active

Geomorphological Process

Permafrost Process	Xt
Thermokarst	Xf
Thaw flow	Xw
Ice wedge depression	Xe
Thermo-erosion	
Mass Movement Process	F
Slow mass movement	Fk
Tension crack	R
Rapid mass movement	Rb
Rockfall	Rd
Debris flow	Rs
Debris slide/avalanche	Ru
Rotational slump	
Hydrological Process	
Channeled by meltwater	E
Kettled	H
Surface seepage	L
Inundation	U
Gully	V



Project Location: Wrigley to Norman Wells, NWT
 Client/Project: 144903025-0065 REV A
 Government of Northwest Territories
 Mackenzie Valley Highway
 Figure No. B.14
 Title: LSA Terrain Mapping



Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Data Sources: Government of Northwest Territories
 3. Background: World Topographic Map: Northwest Territories, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCan, Parks Canada
 World Imagery: Maxar
 World Hillshade: Esri, USGS and LIDAR-derived hillshade provided by GNWT
 4. Terrain mapping conducted in 2D using available airphotos, ortho-imagery and LIDAR data. Refer to Soils, Terrain and Permafrost TDR for detailed methodology

- ➔ Seepage Flow Direction
- ⤵ Gully
- ⤴ Landslide Scar
- Surficial Material**
- Anthropogenic Material
- Bedrock
- Colluvium
- Eolian
- Fluvial Material
- Glaciofluvial Material
- Glaciolacustrine Material
- Morainal Material (till)
- Organic Material
- Water
- Terrain Mapping

- ⊕ Mackenzie Valley Highway Kilometre Post
- Mackenzie Valley Highway Extension Project
- Local Study Area
- All-Season Road
- Winter Road
- Mackenzie Valley Fibre Link
- Norman Wells to Zama Lake Pipeline (Enbridge)
- District Boundary
- Region Boundary
- Settlement Area Boundary

Surficial Material

Anthropogenic	A
Colluvium	C
Eolian	E
Fluvial	F
Glaciofluvial	FG
Glaciolacustrine	LG
Morainal (till)	M
Water Body	N
Organic	O
Bedrock	R

Delimiter and Qualifier

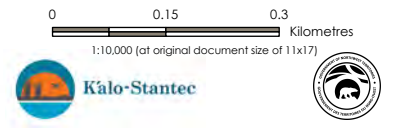
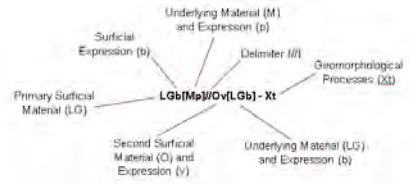
- / The component in front of the symbol is more extensive than the one that follows
- // The component in front of the symbol is considerably more extensive than the component that follows
- A Geomorphological process initiation zone
- Active

Surface Expression

moderate slope (27-49%)	a
blanket (> 1 m)	b
cone	c
depression	d
fan	f
hummocky	h
gentle slope (6-26%)	j
moderate steep slope (50-70%)	k
rolling	m
plain	p
ridged	r
steep slope (>70%)	s
terraced	t
undulating	u
veneer (< 1 m)	v

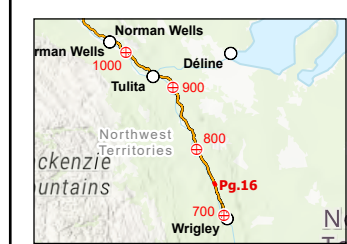
Geomorphological Process

- Permafrost Process**
- Thermokarst Xt
 - Thaw flow Xf
 - Ice wedge Xw
 - Thermo-erosion Xe
- Mass Movement Process**
- Slow mass movement F
 - Tension crack Fk
 - Rapid mass movement R
 - Rockfall Rb
 - Debris flow Rd
 - Debris slide/avalanche Rs
 - Rotational slump Ru
- Hydrological Process**
- Channeled by meltwater E
 - Kettled H
 - Surface seepage L
 - Inundation U
 - Gully V



Project Location: Wrigley to Norman Wells, NWT
 Client/Project: 144903025-0065 REV A
 Prepared by CES on 2021-02-08
 TR by OP on 2023-03-14

Government of Northwest Territories
 Mackenzie Valley Highway
 Figure No. **B.15**
 Title: **LSA Terrain Mapping**



Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Data Sources: Government of Northwest Territories
 3. Background: World Topographic Map: Northwest Territories, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCAN, Parks Canada
 World Imagery: Maxar
 World Hillshade: Esri, USGS and LIDAR-derived hillshade provided by GNWT
 4. Terrain mapping conducted in 2D using available airphotos, ortho-imagery and LIDAR data. Refer to Soils, Terrain and Permafrost TDR for detailed methodology

- ➔ Seepage Flow Direction
- ⇩ Gully
- ⇩ Landslide Scar
- Surficial Material**
- Anthropogenic Material
- Bedrock
- Colluvium
- Eolian
- Fluvial Material
- Glaciofluvial Material
- Glaciolacustrine Material
- Morainal Material (till)
- Organic Material
- Water
- Terrain Mapping

- ⊕ Mackenzie Valley Highway Kilometre Post
- Mackenzie Valley Highway Extension Project
- Local Study Area
- All-Season Road
- Winter Road
- Mackenzie Valley Fibre Link
- Norman Wells to Zama Lake Pipeline (Enbridge)
- District Boundary
- Region Boundary
- Settlement Area Boundary

Surficial Material

Anthropogenic	A
Colluvium	C
Eolian	E
Fluvial	F
Glaciofluvial	FG
Glaciolacustrine	LG
Morainal (till)	M
Water Body	N
Organic	O
Bedrock	R

Surface Expression

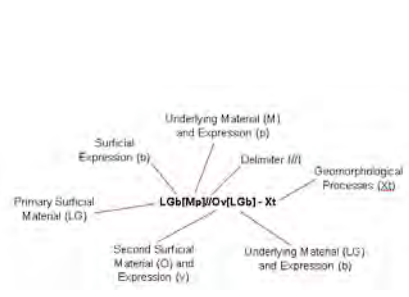
moderate slope (27-49%)	a
blanket (> 1 m)	b
cone	c
depression	d
fan	f
hummocky	h
gentle slope (6-26%)	j
moderate steep slope (50-70%)	k
rolling	m
plain	p
ridged	r
steep slope (>70%)	s
terraced	t
undulating	u
veneer (< 1 m)	v

Delimiter and Qualifier

- / The component in front of the symbol is more extensive than the one that follows
- // The component in front of the symbol is considerably more extensive than the component that follows
- A Geomorphological process initiation zone
- A Active

Geomorphological Process

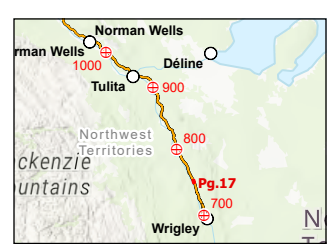
- Permafrost Process**
- Thermokarst Xt
 - Thaw flow Xf
 - Ice wedge Xw
 - Thermo-erosion Xe
- Mass Movement Process**
- Slow mass movement F
 - Tension crack Fk
 - Rapid mass movement R
 - Rockfall Rb
 - Debris flow Rd
 - Debris slide/avalanche Rs
 - Rotational slump Ru
- Hydrological Process**
- Channeled by meltwater E
 - Kettled H
 - Surface seepage L
 - Inundation U
 - Gully V



Scale: 0, 0.15, 0.3 Kilometres
 1:10,000 (at original document size of 11x17)
 Kalo-Stantec logo

Project Location: Wrigley to Norman Wells, NWT
 Prepared by CES on 2021-02-08
 TR by OP on 2023-03-14
 Client/Project: 144903025-0065 REV A
 Government of Northwest Territories
 Mackenzie Valley Highway
 Figure No. B.16
 Title: LSA Terrain Mapping

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Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Data Sources: Government of Northwest Territories
 3. Background: World Topographic Map: Northwest Territories, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCAN, Parks Canada
 World Imagery: Maxar
 World Hillshade: Esri, USGS and LIDAR-derived hillshade provided by GNWT
 4. Terrain mapping conducted in 2D using available airphotos, ortho-imagery and LIDAR data. Refer to Soils, Terrain and Permafrost TDR for detailed methodology

- ➔ Seepage Flow Direction
- ⇒ Gully
- ↳ Landslide Scar
- Surficial Material**
- Anthropogenic Material
- Bedrock
- Colluvium
- Eolian
- Fluvial Material
- Glaciofluvial Material
- Glaciolacustrine Material
- Morainal Material (till)
- Organic Material
- Water
- Terrain Mapping

- ⊕ Mackenzie Valley Highway Kilometre Post
- Mackenzie Valley Highway Extension Project
- Local Study Area
- All-Season Road
- Winter Road
- Mackenzie Valley Fibre Link
- Norman Wells to Zama Lake Pipeline (Enbridge)
- District Boundary
- Region Boundary
- Settlement Area Boundary

Surficial Material

Anthropogenic	A
Colluvium	C
Eolian	E
Fluvial	F
Glaciofluvial	FG
Glaciolacustrine	LG
Morainal (till)	M
Water Body	N
Organic	O
Bedrock	R

Surface Expression

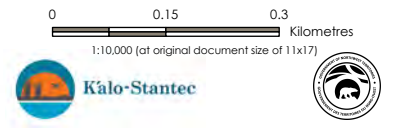
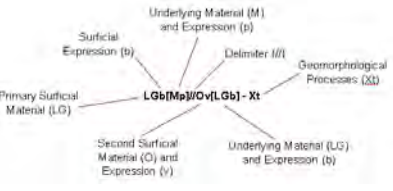
moderate slope (27-49%)	a
blanket (> 1 m)	b
cone	c
depression	d
fan	f
hummocky	h
gentle slope (6-26%)	j
moderate steep slope (50-70%)	k
rolling	m
plain	p
ridged	r
steep slope (>70%)	s
terraced	t
undulating	u
veneer (< 1 m)	v

Delimiter and Qualifier

/	The component in front of the symbol is more extensive than the one that follows
//	The component in front of the symbol is considerably more extensive than the component that follows
A	Geomorphological process initiation zone
A	Active

Geomorphological Process

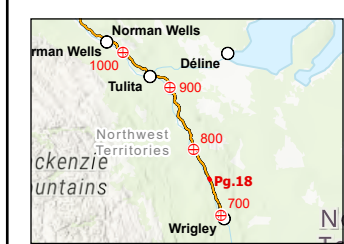
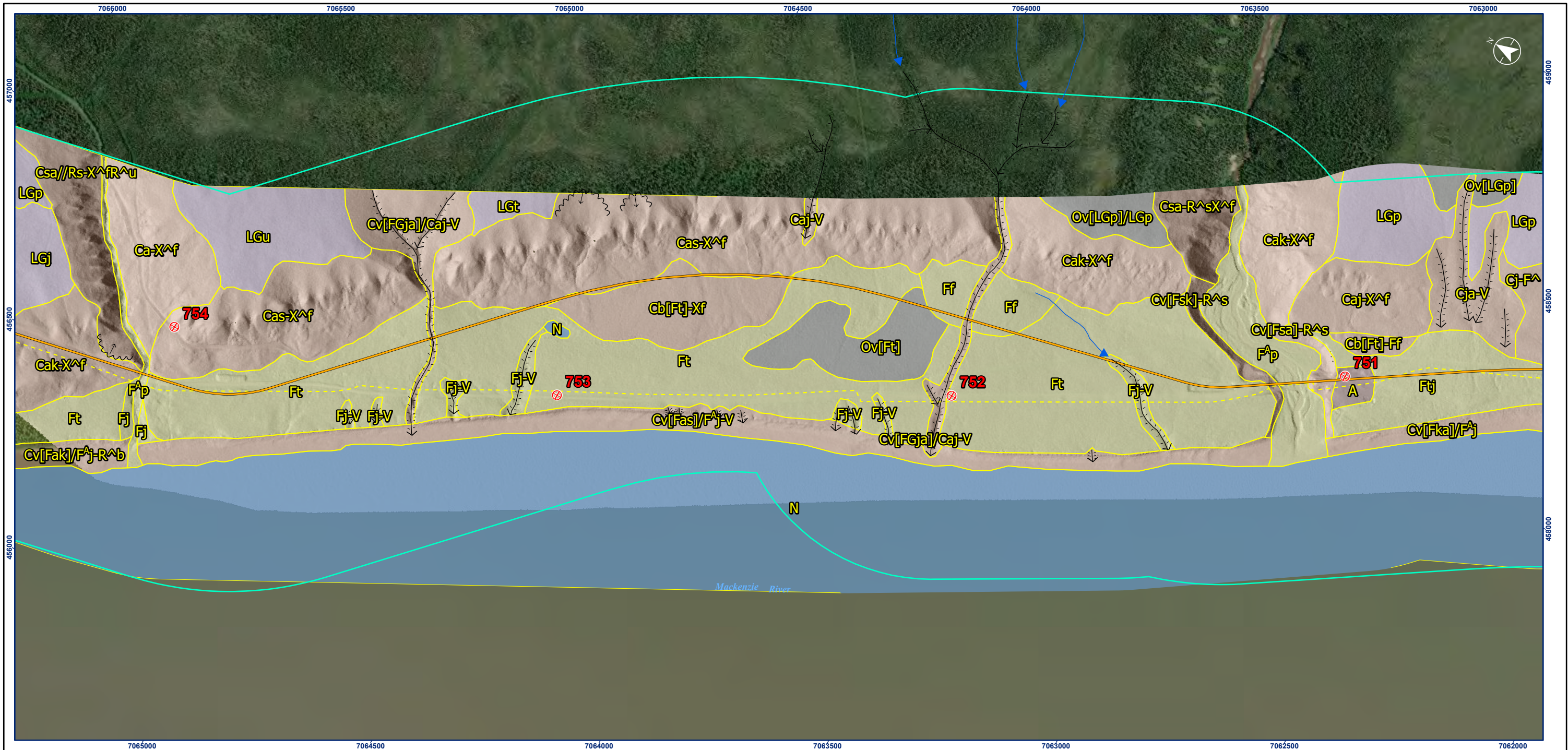
Permafrost Process	Xt
Thermokarst	Xf
Thaw flow	Xw
Ice wedge	Xe
Thermo-erosion	
Mass Movement Process	F
Slow mass movement	Fk
Tension crack	R
Rapid mass movement	Rb
Rockfall	Rd
Debris flow	Rs
Debris slide/avalanche	Ru
Rotational slump	
Hydrological Process	E
Channeled by meltwater	H
Kettled	L
Surface seepage	U
Inundation	V
Gully	



Project Location: Wrigley to Norman Wells, NWT
 Client/Project: 144903025-0065 REV A

Government of Northwest Territories
 Mackenzie Valley Highway
 Figure No. **B.17**
 Title: **LSA Terrain Mapping**

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Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Data Sources: Government of Northwest Territories
 3. Background: World Topographic Map: Northwest Territories, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCAN, Parks Canada
 World Imagery: Maxar
 World Hillshade: Esri, USGS and LIDAR-derived hillshade provided by GNWT
 4. Terrain mapping conducted in 2D using available airphotos, ortho-imagery and LIDAR data. Refer to Soils, Terrain and Permafrost TDR for detailed methodology

- ➔ Seepage Flow Direction
- ⤵ Gully
- ⤴ Landslide Scar
- Surficial Material**
- Anthropogenic Material
- Bedrock
- Colluvium
- Eolian
- Fluvial Material
- Glaciofluvial Material
- Glaciolacustrine Material
- Morainal Material (till)
- Organic Material
- Water
- Terrain Mapping

- ⊕ Mackenzie Valley Highway Kilometre Post
- Mackenzie Valley Highway Extension Project
- Local Study Area
- All-Season Road
- Winter Road
- Mackenzie Valley Fibre Link
- Norman Wells to Zama Lake Pipeline (Enbridge)
- District Boundary
- Region Boundary
- Settlement Area Boundary

Surficial Material

Anthropogenic	A
Colluvium	C
Eolian	E
Fluvial	F
Glaciofluvial	FG
Glaciolacustrine	LG
Morainal (till)	M
Water Body	N
Organic	O
Bedrock	R

Surface Expression

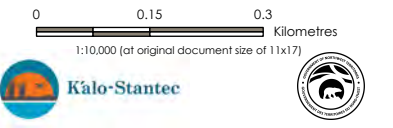
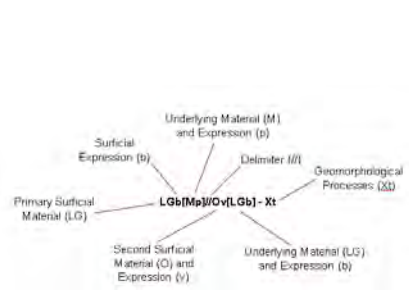
moderate slope (27-49%)	a
blanket (> 1 m)	b
cone	c
depression	d
fan	f
hummocky	h
gentle slope (6-26%)	j
moderate steep slope (50-70%)	k
rolling	m
plain	p
ridged	r
steep slope (>70%)	s
terraced	t
undulating	u
veneer (< 1 m)	v

Delimiter and Qualifier

/	The component in front of the symbol is more extensive than the one that follows
//	The component in front of the symbol is considerably more extensive than the component that follows
A	Geomorphological process initiation zone
A	Active

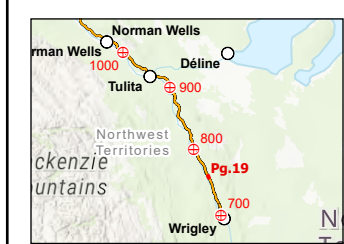
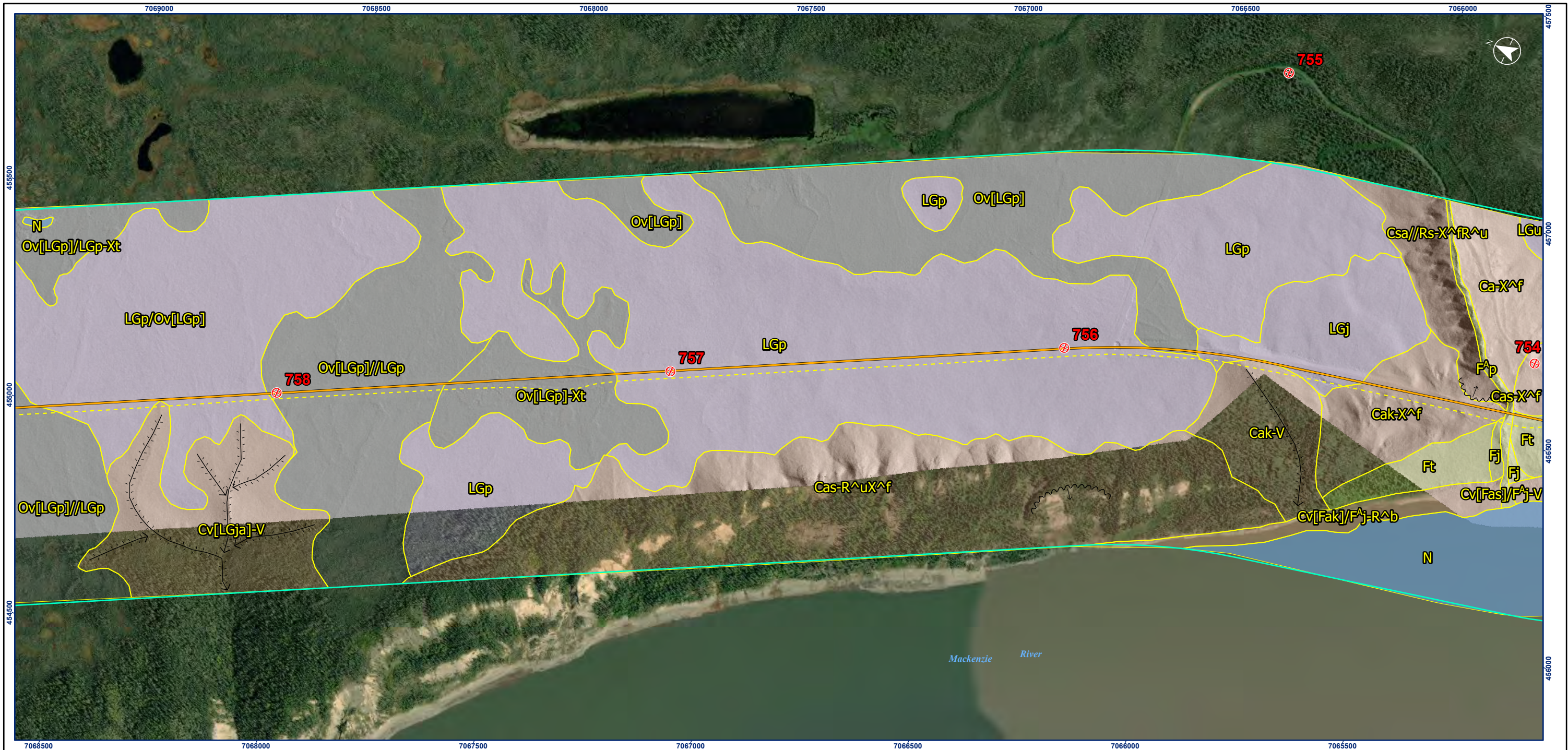
Geomorphological Process

Permafrost Process	Xt
Thermokarst	Xf
Thaw flow	Xw
Ice wedge	Xe
Thermo-erosion	
Mass Movement Process	F
Slow mass movement	Fk
Tension crack	R
Rapid mass movement	Rb
Rockfall	Rd
Debris flow	Rs
Debris slide/avalanche	Ru
Rotational slump	
Hydrological Process	
Channeled by meltwater	E
Kettled	H
Surface seepage	L
Inundation	U
Gully	V



Project Location: Wrigley to Norman Wells, NWT
 Client/Project: 144903025-0065 REV A

Government of Northwest Territories
 Mackenzie Valley Highway
 Figure No. **B.18**
 Title: **LSA Terrain Mapping**



Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Data Sources: Government of Northwest Territories
 3. Background: World Topographic Map: Northwest Territories, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCAN, Parks Canada
 World Imagery: Maxar
 World Hillshade: Esri, USGS and LIDAR-derived hillshade provided by GNWT
 4. Terrain mapping conducted in 2D using available airphotos, ortho-imagery and LIDAR data. Refer to Soils, Terrain and Permafrost TDR for detailed methodology

- ➔ Seepage Flow Direction
- ⇒ Gully
- ↯ Landslide Scar
- Surficial Material**
- Anthropogenic Material
- Bedrock
- Colluvium
- Eolian
- Fluvial Material
- Glaciofluvial Material
- Glaciolacustrine Material
- Morainal Material (till)
- Organic Material
- Water
- Terrain Mapping

- ⊕ Mackenzie Valley Highway Kilometre Post
- Mackenzie Valley Highway Extension Project
- Local Study Area
- All-Season Road
- Winter Road
- Mackenzie Valley Fibre Link
- Norman Wells to Zama Lake Pipeline (Enbridge)
- District Boundary
- Region Boundary
- Settlement Area Boundary

Surficial Material

Anthropogenic	A
Colluvium	C
Eolian	E
Fluvial	F
Glaciofluvial	FG
Glaciolacustrine	LG
Morainal (till)	M
Water Body	N
Organic	O
Bedrock	R

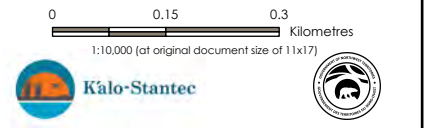
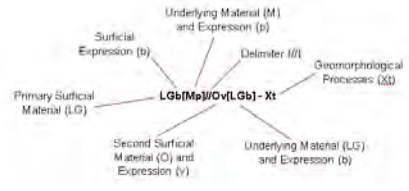
Delimiter and Qualifier
 / The component in front of the symbol is more extensive than the one that follows
 // The component in front of the symbol is considerably more extensive than the component that follows
 A Geomorphological process initiation zone
 A Active

Surface Expression

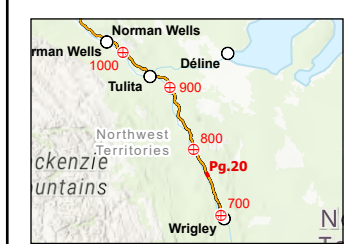
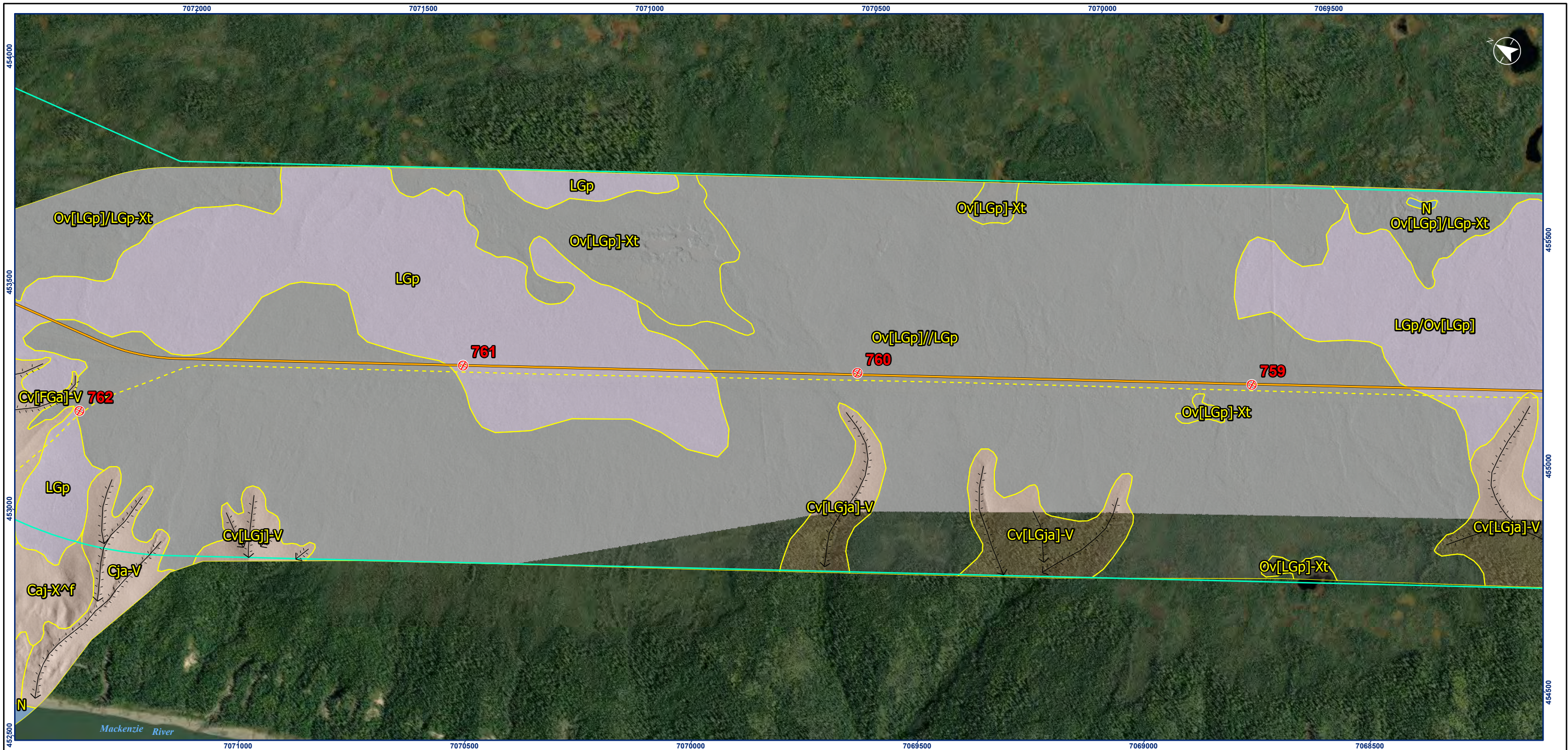
moderate slope (27-49%)	a
blanket (> 1 m)	b
cone	c
depression	d
fan	f
hummocky	h
gentle slope (6-26%)	j
moderate steep slope (50-70%)	k
rolling	m
plain	p
ridged	r
steep slope (>70%)	s
terraced	t
undulating	u
veneer (< 1 m)	v

Geomorphological Process

Permafrost Process	
Thermokarst	Xt
Thaw flow	Xf
Ice wedge	Xw
Thermo-erosion	Xe
Mass Movement Process	
Slow mass movement	F
Tension crack	Fk
Rapid mass movement	R
Rockfall	Rb
Debris flow	Rd
Debris slide/avalanche	Rs
Rotational slump	Ru
Hydrological Process	
Channeled by meltwater	E
Kettled	H
Surface seepage	L
Inundation	U
Gully	V



Project Location: Wrigley to Norman Wells, NWT
 Prepared by CES on 2021-02-08
 TR by OP on 2023-03-14
 Client/Project: 144903025-0065 REV A
 Government of Northwest Territories
 Mackenzie Valley Highway
 Figure No. B.19
 Title: LSA Terrain Mapping



Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Data Sources: Government of Northwest Territories
 3. Background: World Topographic Map: Northwest Territories, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCAN, Parks Canada
 World Imagery: Maxar
 World Hillshade: Esri, USGS and LIDAR-derived hillshade provided by GNWT
 4. Terrain mapping conducted in 2D using available airphotos, ortho-imagery and LIDAR data. Refer to Soils, Terrain and Permafrost TDR for detailed methodology

- ➔ Seepage Flow Direction
- ⇩ Gully
- ⇩ Landslide Scar
- Surficial Material**
- Anthropogenic Material
- Bedrock
- Colluvium
- Eolian
- Fluvial Material
- Glaciofluvial Material
- Glaciolacustrine Material
- Morainal Material (till)
- Organic Material
- Water
- Terrain Mapping

- ⊕ Mackenzie Valley Highway Kilometre Post
- Mackenzie Valley Highway Extension Project
- Local Study Area
- All-Season Road
- Winter Road
- Mackenzie Valley Fibre Link
- Norman Wells to Zama Lake Pipeline (Enbridge)
- District Boundary
- Region Boundary
- Settlement Area Boundary

Surficial Material

Anthropogenic	A
Colluvium	C
Eolian	E
Fluvial	F
Glaciofluvial	FG
Glaciolacustrine	LG
Morainal (till)	M
Water Body	N
Organic	O
Bedrock	R

Surface Expression

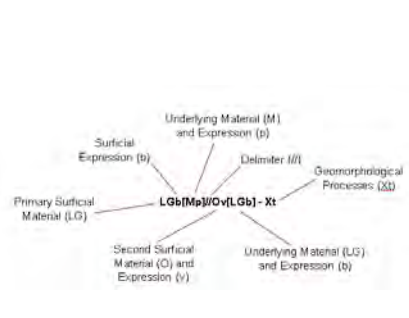
moderate slope (27-49%)	a
blanket (> 1 m)	b
cone	c
depression	d
fan	f
hummocky	h
gentle slope (6-26%)	j
moderate steep slope (50-70%)	k
rolling	m
plain	p
ridged	r
steep slope (>70%)	s
terraced	t
undulating	u
veneer (< 1 m)	v

Delimiter and Qualifier

/	The component in front of the symbol is more extensive than the one that follows
//	The component in front of the symbol is considerably more extensive than the component that follows
^	Geomorphological process initiation zone
A	Active

Geomorphological Process

Permafrost Process	
Thermokarst	Xt
Thaw flow	Xf
Ice wedge	Xw
Thermo-erosion	Xe
Mass Movement Process	
Slow mass movement	F
Tension crack	Fk
Rapid mass movement	R
Rockfall	Rb
Debris flow	Rd
Debris slide/avalanche	Rs
Rotational slump	Ru
Hydrological Process	
Channeled by meltwater	E
Kettled	H
Surface seepage	L
Inundation	U
Gully	V

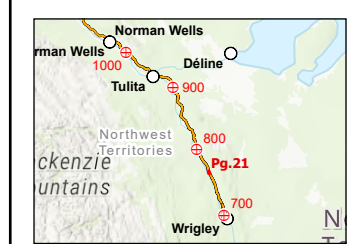
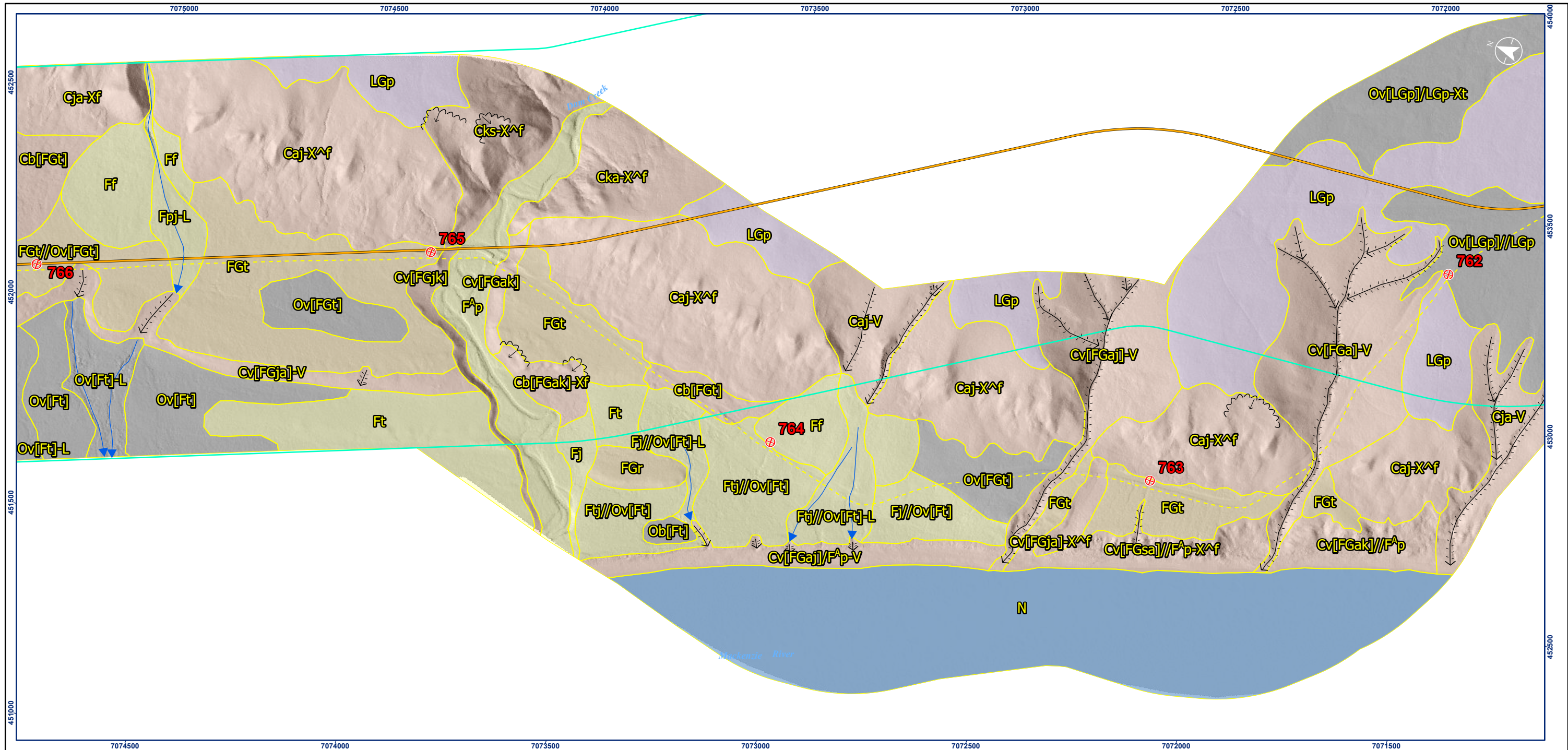


0 0.15 0.3 Kilometres
 1:10,000 (at original document size of 11x17)

Kalo-Stantec

Project Location: Wrigley to Norman Wells, NWT
 Prepared by CES on 2021-02-08
 TR by OP on 2023-03-14
 Client/Project: 144903025-0065 REV A

Government of Northwest Territories
 Mackenzie Valley Highway
 Figure No. **B.20**
 Title: **LSA Terrain Mapping**



Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Data Sources: Government of Northwest Territories
 3. Background: World Topographic Map: Northwest Territories, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCAN, Parks Canada
 World Imagery: Maxar
 World Hillshade: Esri, USGS and LIDAR-derived hillshade provided by GNWT
 4. Terrain mapping conducted in 2D using available airphotos, ortho-imagery and LIDAR data. Refer to Soils, Terrain and Permafrost TDR for detailed methodology

- ➔ Seepage Flow Direction
- ⚡ Gully
- ⚡ Landslide Scar
- Surficial Material**
- Anthropogenic Material
- Bedrock
- Colluvium
- Eolian
- Fluvial Material
- Glaciofluvial Material
- Glaciolacustrine Material
- Morainal Material (till)
- Organic Material
- Water
- Terrain Mapping

- ⊕ Mackenzie Valley Highway Kilometre Post
- Mackenzie Valley Highway Extension Project
- Local Study Area
- All-Season Road
- Winter Road
- Norman Wells to Zama Lake Pipeline (Enbridge)
- ⬛ District Boundary
- ⬛ Region Boundary
- ⬛ Settlement Area Boundary

Surficial Material

Anthropogenic	A
Colluvium	C
Eolian	E
Fluvial	F
Glaciofluvial	FG
Glaciolacustrine	LG
Morainal (till)	M
Water Body	N
Organic	O
Bedrock	R

Surface Expression

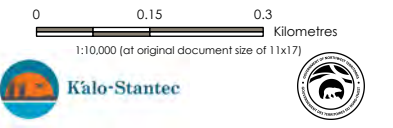
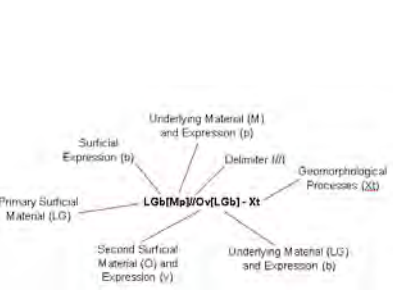
moderate slope (27-49%)	a
blanket (> 1 m)	b
cone	c
depression	d
fan	f
hummocky	h
gentle slope (6-26%)	j
moderate steep slope (50-70%)	k
rolling	m
plain	p
ridged	r
steep slope (>70%)	s
terraced	t
undulating	u
veneer (< 1 m)	v

Delimiter and Qualifier

/	The component in front of the symbol is more extensive than the one that follows
//	The component in front of the symbol is considerably more extensive than the component that follows
A	Geomorphological process initiation zone
A	Active

Geomorphological Process

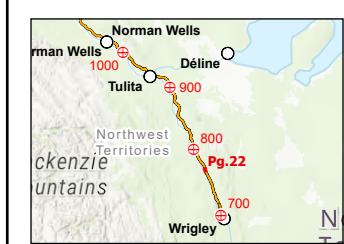
Permafrost Process	Xt
Thermokarst	Xf
Thaw flow	Xw
Ice wedge	Xe
Thermo-erosion	
Mass Movement Process	F
Slow mass movement	Fk
Tension crack	R
Rapid mass movement	Rb
Rockfall	Rd
Debris flow	Rs
Debris slide/avalanche	Ru
Rotational slump	
Hydrological Process	
Channeled by meltwater	E
Kettled	H
Surface seepage	L
Inundation	U
Gully	V



Project Location: Wrigley to Norman Wells, NWT
 Client/Project: 144903025-0065 REV A

Government of Northwest Territories
 Mackenzie Valley Highway
 Figure No. B.21
 Title: LSA Terrain Mapping

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Notes
 1. Coordinate System: NAD 1983 UTM Zone 10N
 2. Data Sources: Government of Northwest Territories
 3. Background: World Topographic Map: Northwest Territories, Esri, HERE, Garmin, FAO, NOAA, USGS, EPA, NRCAN, Parks Canada
 World Imagery: Maxar
 World Hillshade: Esri, USGS and LIDAR-derived hillshade provided by GNWT
 4. Terrain mapping conducted in 2D using available airphotos, ortho-imagery and LIDAR data. Refer to Soils, Terrain and Permafrost TDR for detailed methodology

- Seepage Flow Direction
- ⇩ Gully
- ⇩ Landslide Scar
- Surficial Material**
- Anthropogenic Material
- Bedrock
- Colluvium
- Eolian
- Fluvial Material
- Glaciofluvial Material
- Glaciolacustrine Material
- Morainal Material (till)
- Organic Material
- Water
- Terrain Mapping

- ⊕ Mackenzie Valley Highway Kilometre Post
- Mackenzie Valley Highway Extension Project
- Local Study Area
- All-Season Road
- Winter Road
- Mackenzie Valley Fibre Link
- Norman Wells to Zama Lake Pipeline (Enbridge)
- District Boundary
- Region Boundary
- Settlement Area Boundary

Surficial Material

Anthropogenic	A
Colluvium	C
Eolian	E
Fluvial	F
Glaciofluvial	FG
Glaciolacustrine	LG
Morainal (till)	M
Water Body	N
Organic	O
Bedrock	R

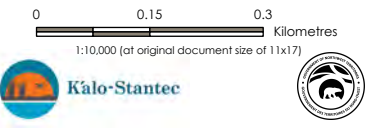
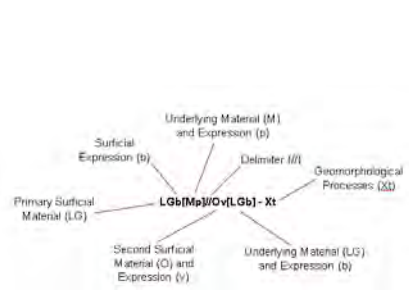
Delimiter and Qualifier
 / The component in front of the symbol is more extensive than the one that follows
 // The component in front of the symbol is considerably more extensive than the component that follows
 A Geomorphological process initiation zone
 A Active

Surface Expression

moderate slope (27-49%)	a
blanket (> 1 m)	b
cone	c
depression	d
fan	f
hummocky	h
gentle slope (6-26%)	j
moderate steep slope (50-70%)	k
rolling	m
plain	p
ridged	r
steep slope (>70%)	s
terraced	t
undulating	u
veneer (< 1 m)	v

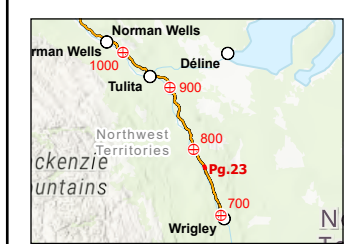
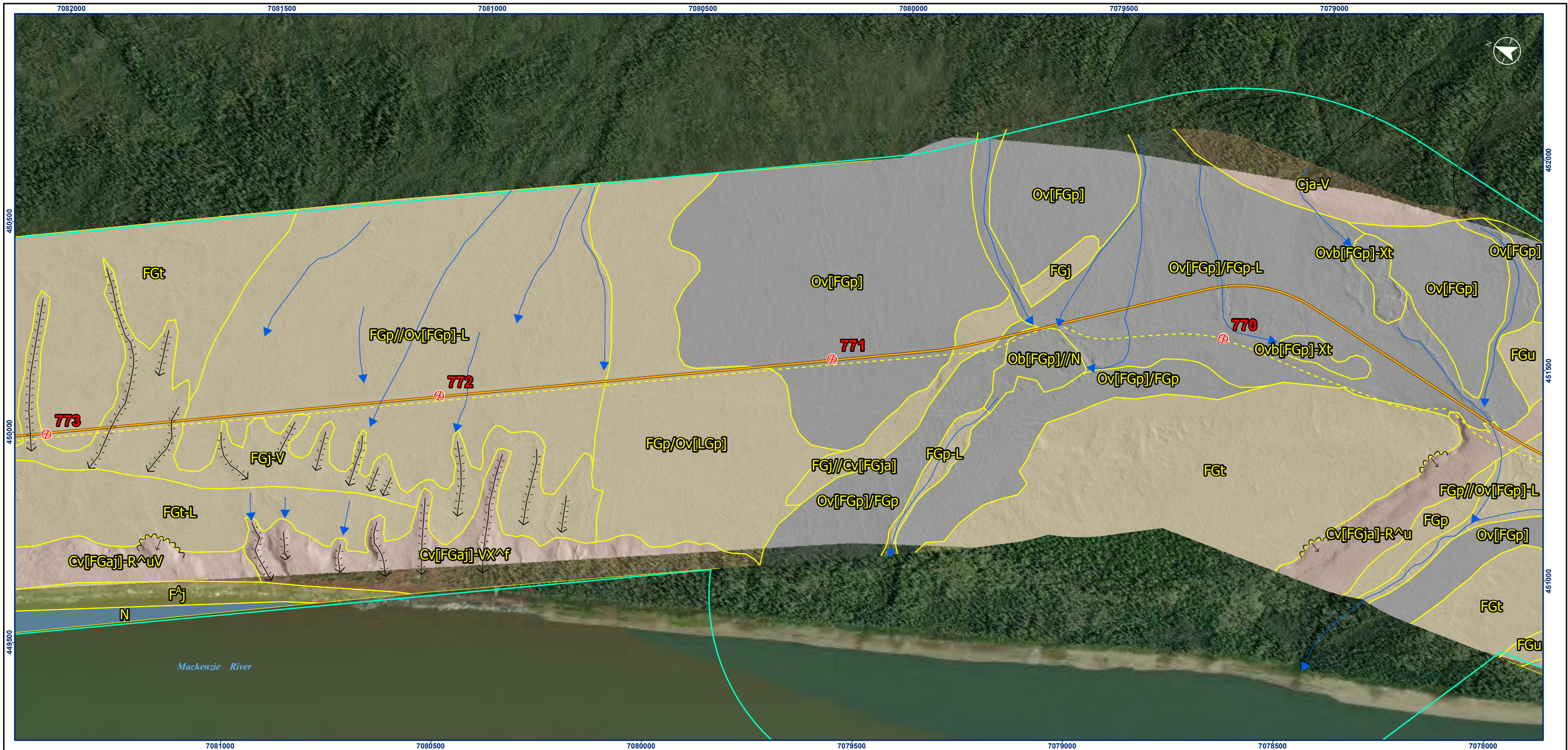
Geomorphological Process

Permafrost Process	Xt
Thermokarst	Xf
Thaw flow	Xw
Ice wedge	Xe
Thermo-erosion	
Mass Movement Process	
Slow mass movement	F
Tension crack	Fk
Rapid mass movement	R
Rockfall	Rb
Debris flow	Rd
Debris slide/avalanche	Rs
Rotational slump	Ru
Hydrological Process	
Channeled by meltwater	E
Kettled	H
Surface seepage	L
Inundation	U
Gully	V



Project Location: Wrigley to Norman Wells, NWT
 Client/Project: 144903025-0065 REV A

Government of Northwest Territories
 Mackenzie Valley Highway
 Figure No. B.22
 Title: LSA Terrain Mapping



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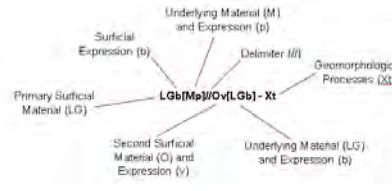
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- Channeled by meltwater E
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- Surface seepage L
- Inundation U
- Gully V



0 0.15 0.3 Kilometres
 1:10,000 (at original document size of 11x17)
Kalo-Stantec

Project Location: Wrigley to Norman Wells, NWT
 Prepared by CES on 2021-02-08
 TR by OP on 2023-03-14
 Client/Project: 144903025-0065 REVA

Government of Northwest Territories
Mackenzie Valley Highway
 Figure No. **B.23**
 Title: **LSA Terrain Mapping**



Project Location

Client/Project

Figure No.

Title