Rio Tinto Alcan

KMP SO_2 EEM Program – Technical Memo V02

Sensitive Ecosystems

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Prepared for:

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1 Sensitive Ecosystems

One of the actions under the EEM Plan called for investigation into whether there are sensitive ecosystems in the SO_2 assessment study area, and if so, whether they occur in areas already covered by the existing EEM sampling network for vegetation, soil and water.

Two sensitive ecosystems occur in the study area, according to the BC Conservation Data Centre (CDC): black cottonwood-red alder/salmonberry, and wet submaritime Sitka spruce/salmonberry. Both are located along the Skeena River (the thick green line shown in Figure 1). None of the lake or stream sampling sites under the EEM Plan are located near these ecosystems, although one vegetation sampling site is located nearby (map on the left in Figure 1).

Some EEM sampling sites do overlap polygons from the VRI that contain Sitka spruce, cottonwood or alder, but these polygons are along other waterways near Kitimat, not in the areas explicitly identified as sensitive ecosystems (map on the right in Figure 1). Alder Cottonwood represents almost one quarter of the VRI polygons in the study area, which is not unexpected since these tend to be the first species on a site. This is likely to be an overestimation of potentially sensitive systems because the polygons only show where the species occur, without analysis of species dominance or suitable soils. Further investigation would be needed to determine if some of these sites might be adequate surrogates for the CDC-listed ecosystems, or whether EEM sampling locations might need to be added in those known sensitive ecosystems.

A recent assessment carried out for the proposed LNG site outside of Kitimat identified 12 sensitive ecological communities in that area. Four of these (identified by an asterisk *) were dominant.

Blue-listed

- amabilis fir – Sitka spruce / devil's club
- western redcedar – Sitka spruce / skunk cabbage
- Sitka spruce / Pacific crab apple *
- Lyngbye's sedge / Douglas water hemlock estuary *
- cattail marsh
- Sitka sedge / hemlock / parsley marsh

Red-listed

- Sitka spruce / salmonberry *
- tufted hairgrass / meadow barley estuary
- tufted hairgrass / Douglas aster estuary
- Lyngbye's sedge estuary
- sweet gale / Sitka sedge fen
- Sitka willow / Pacific willow / skunk cabbage swamp *

All of these areas are found in the CWHvm1 area in the southern section of the study area (Figure 2). Since this area is more heavily sampled, it is likely that some of the sampling sites overlap these systems (Figure 2), but actually overlaying the two maps would be necessary to know which systems are being sampled. The maps we have do not contain sufficient information to identify which are the appropriate sensitive ecosystems.

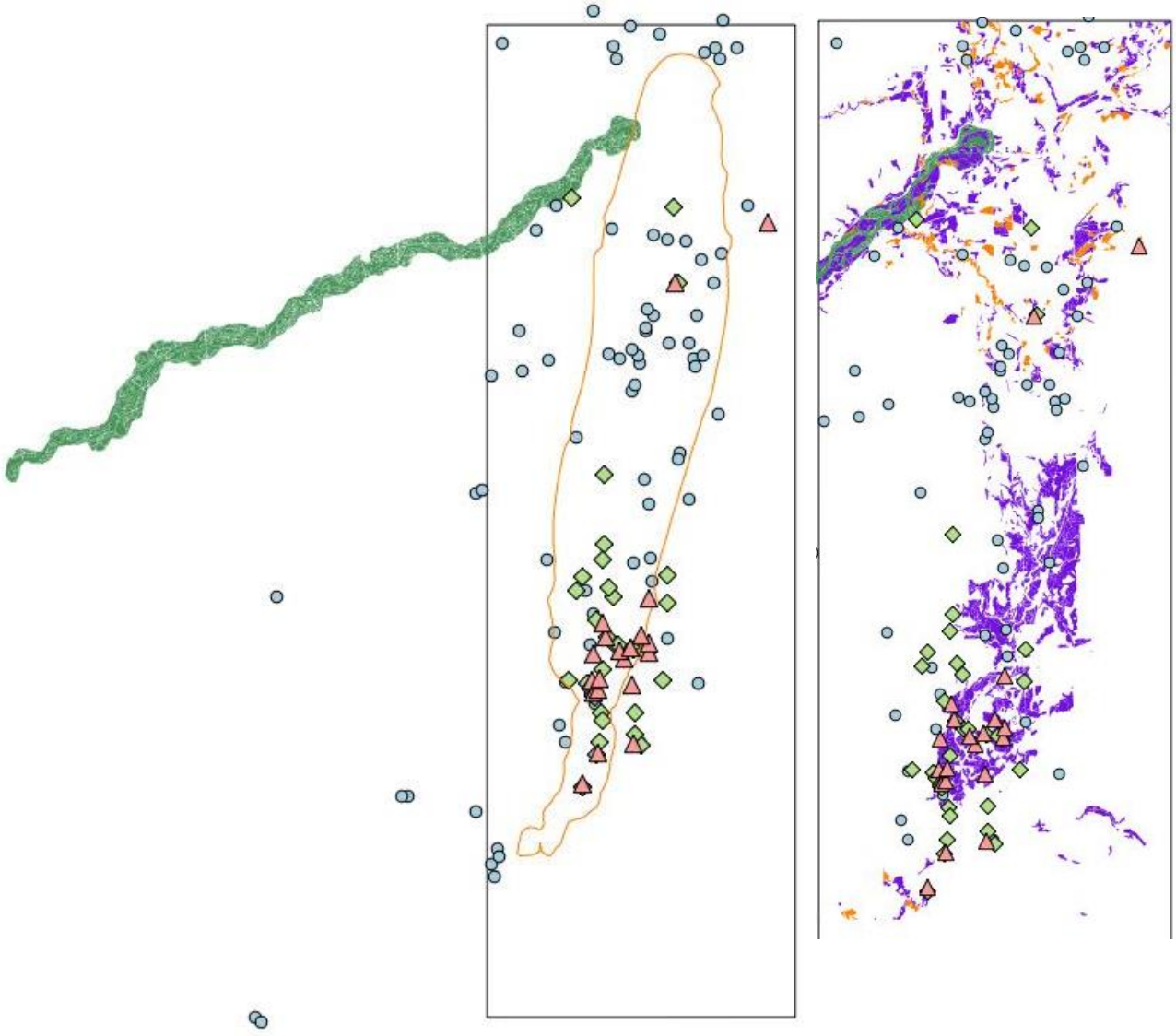

Figure 1: Map of the sensitive ecosystems and EEM sampling locations. The map on the left shows the location of the two sensitive ecosystems identified by the CDC (the thick green line). The map on the right shows the location of the presence of Sitka Spruce (orange) or Alder/Cottonwood (purple) in the study area, from VRI data. Colour legend for EEM sampling: pink triangles = atmospheric sampling stations, green diamonds = vegetation survey locations, and blue circles = water sampling locations. The orange line denotes the predicted 10 kg/ha/yr deposition isopleth. The thick green line = the location of the sensitive ecosystems. Note that only a subset of the air and water sampling locations will be sampled under the EEM plan, and soil sampling sites have not yet been determined.

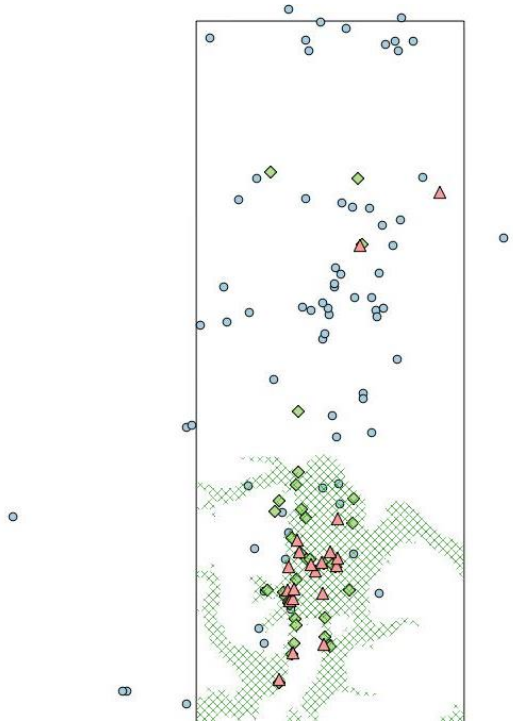

Figure 2: Map of the areas that might contain sensitive ecosystems and EEM sampling locations. The cross-hatched area shows the BEC variant (CWHvm1) in which all the sensitive ecosystems identified by the LNG study were found. Colour legend for EEM sampling: pink triangles = atmospheric sampling stations, green diamonds = vegetation survey locations, and blue circles = water sampling locations. Note that only a subset of the air and water sampling locations will be sampled under the EEM plan, and no soil sampling sets have yet been determined.

2 Sensitive Organisms

The CDC also identifies ten species at risk in the study area, which are listed in Table 1 and mapped in Figure 3. Only three of these species have been seen in the past 15 years. (That does not necessarily mean the others no longer occur in the area; just that they have not been seen.) The coastal tailed frog is the sole vertebrate on the CDC list, and it is present in many sites throughout the study area (isolated small red dots on the map in Figure 3). The moose moonwart is the only red-listed species, with 8 plants observed in 2006. The cryptic paw, found just south of Kitimat, is a recent listing for the CDC.

Table 1: CDC-listed species within the study area. Species in bold are those that have been observed within the last 15 years. (Source: BC CDC)

Vascular Plants	Fungi	Vertebrates
bog rush	**cryptic paw**	**coastal tailed frog**
bog adder's-mouth orchid	oldgrowth specklebelly	
white adder's-mouth orchid		
eminent bluegrass		
lance-fruited draba		

moose moonwort *red-listed*		
stalked moonwort		

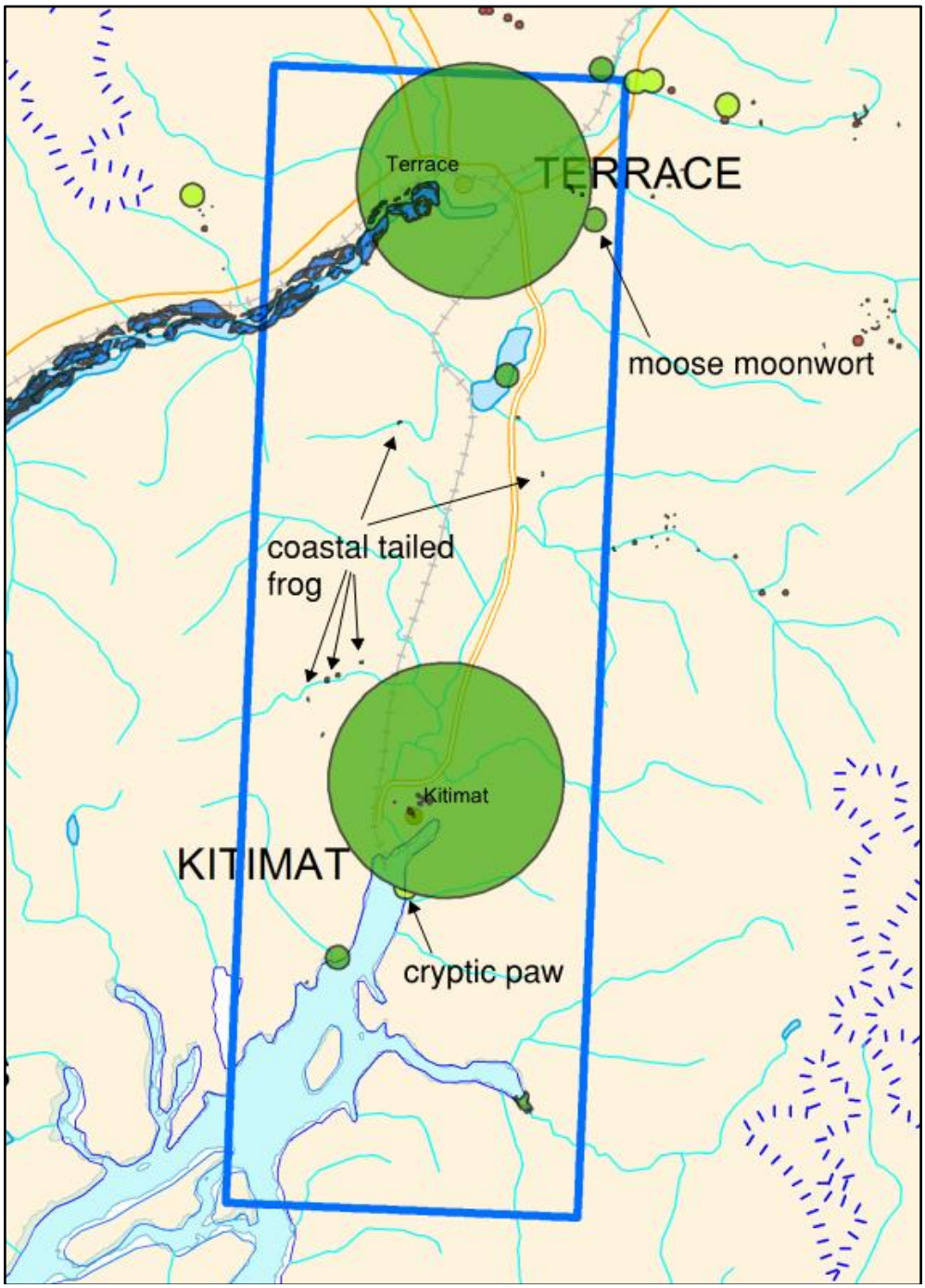

Figure 3: Map of the sensitive ecosystems and organisms in and near the study area. The blue rectangle indicates the study area. The dark blue polygons along the Skeena River represent the two sensitive ecosystems. The small red dots / specs are locations of coastal tailed frog (only a subset of these are noted on the map). Dark green circles are plants; lighter green circles are fungi. (Source: Maija Finvers, Terrain Information Specialist, Terrestrial Unit Head,

Ecosystem Information Section, Knowledge Management Branch, MOE www.env.gov.bc.ca/tei/)

3 Data Sources

We searched the following sites and sources for data for this analysis:

- Sensitive Ecosystem Initiative: we looked at the spatial coverage of work done thus far under this initiative, but most is concentrated on the areas in the southern interior and the south coastal systems, and there was no information that overlapped with the study area.
- GeoBC: we requested TEM and PEM data for the study area, but no data were available for this study area.
- iMapBC: we spent some time looking at different layers to see what might have appropriate information that would cover this study area.
- EcoCat: we searched the report catalogue (both keyword search and location search) for reports that might contain maps of the area. Most reports available within the study area reported on stream or fish conditions in order to get fishing permits. Few reports contained information that was directly relevant to this task, or maps were not available. One report, for example, described TEM work that had been done in the South Kalum area, but all data and the information in the report was completely non-spatial and, when spatial data were requested from the contact, they were not available. Another report on the EcoCat (EcoCat Report 10991) had a map of sensitive ecosystems that extended into the study area (those along the Skeena River corridor shown in Figure 1).
- BC MOE, Knowledge Information Branch: we contacted them directly, requesting any data that may be applicable for this task. They were able to send us complete PEM coverage, and partial TSM, and older TIM and NEM data (more on these data layers below). After searching through these files, it was clear that almost all the data in these files were soils and terrain data, and contained no explicit information about sensitive ecosystems. The staff at the Knowledge Branch also pointed us to the Ecocat reports that we had already seen, and recommended the Conservation Data Center (CDC) as a good source of information.
- Conservation Data Centre: This website allows users to view and search relevant areas for different species and ecosystems, but does not allow the download of such shapefiles that can then be overlaid with our sampling locations. The CDC map shown in Figure 3 was kindly provided by the MOE Knowledge Information Branch.

Data Sources that were used:

B.C. Conservation Data Centre. 2014. Occurrence Report Summary: 33798. B.C. Ministry of Environment. Available: https//www.maps.gov.bc.ca/eess/cdc

B.C. Conservation Data Centre. 2014. Occurrence Report Summary: 24052. B.C. Ministry of Environment. Available: https//www.maps.gov.bc.ca/eess/cdc

B.C. Conservation Data Centre. 2014. Occurrence Report Summary: 77863. B.C. Ministry of Environment. Available: https//www.maps.gov.bc.ca/eess/cdc
B.C. Conservation Data Centre. 2014. Occurrence Report Summary: 88523. B.C. Ministry of Environment. Available: https//www.maps.gov.bc.ca/eess/cdc
B.C. Conservation Data Centre. 2014. Occurrence Report Summary: 43828 B.C. Ministry of Environment. Available: https//www.maps.gov.bc.ca/eess/cdc
B.C. Conservation Data Centre. 2014. Occurrence Report Summary: 3534. B.C. Ministry of Environment. Available: https//www.maps.gov.bc.ca/eess/cdc
B.C. Conservation Data Centre. 2014. Occurrence Report Summary: 3640. B.C. Ministry of Environment. Available: https//www.maps.gov.bc.ca/eess/cdc
B.C. Conservation Data Centre. 2014. Occurrence Report Summary: 3630. B.C. Ministry of Environment. Available: https//www.maps.gov.bc.ca/eess/cdc
B.C. Conservation Data Centre. 2014. Occurrence Report Summary: 3716. B.C. Ministry of Environment. Available: https//www.maps.gov.bc.ca/eess/cdc
B.C. Conservation Data Centre. 2014. Occurrence Report Summary: 1880. B.C. Ministry of Environment. Available: https//www.maps.gov.bc.ca/eess/cdc
B.C. Conservation Data Centre. 2014. Occurrence Report Summary: 73835. B.C. Ministry of Environment. Available: https//www.maps.gov.bc.ca/eess/cdc
B.C. Conservation Data Centre. 2014. Occurrence Report Summary: 70597 B.C. Ministry of Environment. Available: https//www.maps.gov.bc.ca/eess/cdc
B.C. Conservation Data Centre. 2014. Occurrence Report Summary: 70598. B.C. Ministry of Environment. Available: https//www.maps.gov.bc.ca/eess/cdc

2014: LNG Canada Export Terminal Environmental Assessment Certificate Application: Section 5 Assessment of Potential Environmental Effects.

Map Layers:

http://a100.gov.bc.ca/pub/acat/public/viewReport.do?reportId=10991
Vegetation Resource Inventory (VRI) data
Maps of sampling locations within the study area.

Predictive Ecosystem Mapping (PEM) and Terrestrial Ecosystem Mapping (TEM) are different levels of mapping characteristics of the ecosystem. TEM mapping is generally done at a broader scale, from air or other remote sensed information. PEM is usually done at a smaller scale, and usually uses some form of modelling to relate known ecosystem attributes with other predicted site attributes. The basic PEM maps usually contain site series information, while some other PEM maps contain extra attributes that have been inferred or estimate. There were no TEM maps available for this area. We had complete coverage from a PEM map, but only giving site series information, and we had some coverage from TIM and TSM (two different terrain and soils maps).

The PEM map in this area had the three general categories of fields:

- those related to the identity of the project or polygon,
- those giving current Biogeoclimate information
- variables related to the site series of different components. Information about up to three different components can be recorded: the decile, site series, modifiers to the assumed site series, and map code.

TIM and TSM maps have many more fields, mostly related to the terrain and surface material. Like the PEM maps, there are all the fields related to the identity of the project or polygon. Also like the PEM, up to three different terrain components can be defined. Each component then has the following information that can be defined: decile, texture, surficial material, surficial qualifier, three different surface expressions, bedrock type, subterrain texture (up to three for each component), subsurficial material, subsurficial qualifier, subsurficial subtype, subsurface expression (up to three for each component). As well as these terrain components, there are also up to three geomorphological process classes. Each of these classes also has a qualifier, subtype, process, and process subtype.

Actual Variable Names:

PEM Maps

Fields related to the identity of the project or polygon TEIS_ID, PROJPOLYID, BAPID, FCODE, PROJ_TYPE, PROJ_SCALE, PROJ_ID, MAPSH_NBR, POLY_NBR, ECO_SEC, Shape, Area
Current Biogeoclimate information: BGC_ZONE, BGC_SUBZON, BGC_VRT, BGC_PHASE
Variables related to the site series of different components.
SDEC_1, SDEC_2, SDEC_3 = ecosystem decile, component 1, 2, or 3
SITE_S1, SITE_S2, SITE_S2 = site series number, component 1, 2, or 3
SITEAM_S1A, SITEAM_S2A, SITEAM_S3A = assumed site series, modifier 1, component 1, 2, or 3
SITEAM_S1B, SITEAM_S2B, SITEAM_S3B = assumed site series, modifier 2, component 1, 2, or 3
SITEMC_S1, SITEMC_S2, SITEMC_S3 = site series map code, component 1, 2, or 3
MC_ID1, MC_ID2, MC_ID3 = map code id, component 1, 2, or 3

TIM and TSM Data

TDEC_1, TDEC_2, TDEC_2 = decile of terrain, component 1, 2, 3
TTEX_1A, TTEX_1B, TTEX_1C, TTEX_2A, TTEX_2B, TTEX_2C, TTEX_3A, TTEX_3B, TTEX_3C = terrain texture 1 (A), 2 (B), or 3 (C) for component 1, 2, 3
SURFM_1, SURFM_2, SURFM_3 = surficial material for component 1, 2, 3
SURFM_Q1, SURFM_Q21, SURFM_Q3= surficial material qualifier for component 1, 2, 3
SURFM_ST1, SURFM_ST2, SURFM_ST3 = surficial material subtype for component 1, 2, 3
SURF_E1A, SURF_E1B, SURF_E1C, SURF_E2A, SURF_E2B, SURF_E2C, SURF_E3A, SURF_E3B, SURF_E3C = surface expression 1 (A), 2 (B), or 3 (C) for component 1, 2, 3
BEDROCK_1, BEDROCK_2, BEDROCK_3 = bedrock type, component 1, 2, 3
STTEX_1A, STTEX_1B, STTEX_1C, STTEX_2A, STTEX_2B, STTEX_2C, STTEX_3A, STTEX_3B, STTEX_3C = subterrain texture 1 (A), 2 (B), or 3 (C) for component 1, 2, 3
SSURFM_1, SSURFM_2, SSURFM_3 = subsurficial material for component 1, 2, 3
SSURFM_Q1, SSURFM_Q2, SSURFM_Q3= subsurficial material qualifier for component 1, 2, 3
SSURFM_ST1, SSURFM_ST2, SSURFM_ST3= subsurficial material subtype for component 1, 2, 3
SSURF_E1A, SSURF_E1B, SSURF_E1C, SSURF_E2A, SSURF_E2B, SSURF_E2C, SSURF_E3A, SSURF_E3B, SSURF_E3C = subsurface expression 1 (A), 2 (B), or 3 (C) for component 1, 2, 3
TTTEX_1C, TTTEX_1B, TTTEX_1A, TTTEX_2C, TTTEX_2B, TTTEX_2A, TTTEX_3C, TTTEX_3B, TTTEX_3A
TSURFM_1, TSURFM_2, TSURFM_3
TSURFM_Q1, TSURFM_Q2, TSURFM_Q3
TSURFM_ST1, TSURFM_ST2, TSURFM_ST3
TSURF_E1A, TSURF_E1B, TSURF_E1C, TSURF_E2A, TSURF_E2B, TSURF_E2C, TSURF_E3A, TSURF_E3B, TSURF_E3C
COMREL1_2, COMREL2_3

GEOP_1, GEOP_2, GEOP_3 = Geomorphological process class: first, second, third
GEOP_Q1, GEOP_Q2, GEOP_Q3 = qualifier: first, second, third
GEOP_ST1, GEOP_ST2, GEOP_ST3 = subtype: first, second, third
GEOP_INZ1, GEOP_INZ2
GEOP_INZ1A, GEOP_INZ1B, GEOP_INZ1C
GEOP_SCM1 = first process
GEOP_SCM1A. GEOP_SCM1B. GEOP_SCM1C, GEOP_SCM2A. GEOP_SCM2B. GEOP_SCM2C, GEOP_SCM3A. GEOP_SCM3B. GEOP_SCM3C = first process, subtype 1 (A), 2 (B), 3 (C) for component 1, 2, 3