Policy Area: HCV Assessments	**Subject: Special Resources**
Title of Policy: HCV Assessment Field Protocol – Soil & Hydrology Survey (HCV 4)	**Number:**
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Approved by: Loy Jones	

1. Rationale or background to policy

The objective of the soil and hydrology field surveys is to collect field data aimed at verifying the presence (or absence) of attributes or elements of important environmental services (HCV 4) or areas that provide fundamental ecosystem services in critical conditions or in vital situations (for instance, protecting watersheds or controlling erosion). HCV 4 is divided into 3 sub-types: (i) areas vital for water catchment (HCV 4.1), (ii) areas vital for controlling erosion (HCV 4.2) and (iii) areas that provide important buffers to destructive land fires. (HCV 4.3). All field surveys will be conducted following the guidance provided in the HCV Toolkit Indonesia (2008).

2. Policy statement

Members of the soil and hydrology assessment team work with an integrated approach to ensure field protocols for consistent data collection are followed on the ground and that all necessary data is collected and recorded accurately in the data sheets provided. These team members report to a senior soil and hydrology specialist responsible for ensuring that all soil and hydrology procedures are carried out correctly and that data and information collected from the field are analysed and then compiled in HCV 4 reports to the team leader.

3. Procedures

<u>PRE-SURVEYS</u>

The intentions of the pre-surveys are to:

1) Identify indications of the presence of HCV 4 attributes or elements,
2) Identify and map potential HCV 4 areas,
3) Better understand landscape contexts,
4) Ascertain conservation, natural resource and land use issues and potential threats to HCV 4, and
5) Set up methods, a survey draft, a research team, and a field activity schedule.

HCV 4 pre-survey core activities (**see Annex 1**) include:

1) Collecting data and information from companies on their current and planned development and management,
2) Collecting secondary data and information from various sources - reports, journals, books, statistical data, maps and interviews – on aspects of biodiversity and environmental services, particularly those linked to soil and water conservation and socio-cultural issues, and

3) Analysing and validating data and information collected and carrying out spatial analyses of base maps obtained.

Main outcomes of pre-surveys are:
1) Maps of potential HCV 4 areas in and around the study sites,
2) Lists of HCV 4 attributes or elements requiring ground truthing to ensure their existence,
3) Notes on natural resource and land use activities in and around the study sites (potential issues and threats to HCV 4), and
4) Notes on important issues in a landscape context,
5) Work maps as guidance for the HCV 4 study team during its time in the field. These work maps contain information on potential HCV 4 areas, land cover, contour lines, river networks, road networks and toponymy including locations and names of villages or settlements, mountain peaks or hilltops and river names.

FIELD SURVEYS

Field survey activities include:
1) **Participatory mapping -** involving parties in and around the study regions with knowledge and information regarding areas in and around the study regions. This process is carried out using potential HCV 4 area maps generated from pre-surveys as material for scrutiny. The soil and hydrology team acts as facilitator by posing key questions to participants in order to clarify pre-survey outcomes and to glean any new or additional information. Outcomes of this participatory mapping are clarified or confirmed potential HCV area maps and additional information on the presence of HCV attributes or elements.
2) **Ground truthing –** direct ground checks of land cover shown in GIS data interpretations and satellite imagery from the pre-survey stage. These direct checks take place at the same time as field data collection (see explanation below). This is conducted by HCV study teams together in the same place or separately in parallel for each field of study, depending on the distribution of locations thought to be potential HCV areas.
3) **Field data collection** is aimed at verifying the presence (or absence) of HCV environmental services attributes or elements in the study regions: (i) water catchment areas (HCV 4.1), (ii) erosion control locations (HCV 4.2), and (iii) regions that function as natural firebreaks (HCV 4.3). In order for data and information collection to run more effectively, easily and consistently, field inspections are orientated to object type. Activities in HCV 4 area identification processes are conducted by study object type using working guides like the one shown in **Annex 2**. With each type of study object the fundamental questions to answer are the **value, function and benefit of the environmental service**; what essential things the object can provide. Every study object discovered must be supplemented with: (i) toponymy[1], (ii) location description, (iii) current status (condition of the area, type and

[1]Scientific discussion about place name, origin, meaning, use and typology – the first part of the word comes from the Greek wordhttp://id.wikipedia.org/wiki/Bahasa_Yunani *tópos* (τόπος) meaning place followed by *ónoma* (ὄνομα) which means name. Toponymy is division of onomastics; the study of names. A toponymy is the name of a place, region or another

intensity of land use), (iv) threats and potential threats, (v) coordinates and (vi) photographic documentation.

4) **Interviews** with selected respondents - villagers or company employees with extensive knowledge or experience of the natural environment in study regions - are another means for obtaining information on the existence of HCV attributes or elements. Such information covers current and historical occurrences, and is always verified or validated through triangulation, whereby the truth or accuracy of any information given in interviews is checked by posing similar questions to other respondents.

POST SURVEY

Post survey activities include:

1) Compiling field data and information in accordance with HCV 4 studies with observation areas as their basis.
2) Analysis and justification of conclusions drawn that an area surveyed has, or does not have HCV attributes or elements and for establishing its HCV 4 area boundaries. Analysis methods can be seen in **Annex 3.**
3) Digitisation of HCV 4 areas on work maps. The digitisation process generates closed polygons. Boundaries of areas on maps represented by these closed polygons are declared HCV area indicative boundaries; indicative because they are based on investigations of area boundaries on maps and have yet to be delineated on the ground. The maps generated from this process are called indicative HCV 4 area maps[2].

4. List of References

Jennings, S. 2004. HCVF for conservation practitioners. ProForest, Oxford. UK

Jennings, S. *et al*. 2003. The High Conservation Value Forest Toolkit. Edition I. ProForest.

Jennings, S. and J. Jarvie. 2003. A Sourcebook for Landscape Analysis of High Conservation Value Forest. Version I. ProForest.

Kodoatie, R.J. and R. Syarief. 2008. *Pengelolaan Sumberdaya Air Terpadu*. Revised edition. Andi Publishers, Jogyakarta.

MacKinnon, K., G. Hatta, H. Halim and A. Mangalik. 1996. The Ecology of Kalimantan. Periplus Edition (HK) Ltd.

Michon, G. 2005. Domesticating Forest: How Farmers Manage Forest Resources. IRD, CIFOR,

part of the face of the Earth, including natural and man-made features, like rivers and cities.

[2] To produce definitive HCV area maps further field surveys are necessary to delineate the HCV area indicative boundaries (record their coordinates on the ground). The results of delineation are then mapped as revisions of the HCV area indicative boundaries from these HCV studies.

WAC, EU and FORREASIA.

Oldeman, L.R., Irsal Laus and Muladi, 1980. An Agroclimatic Map of Kalimantan, Irian Jaya and Bali, West and East Nusa Tenggara. Scale 1:2.500.000. Conttr. Centr. Res. Bogor Agricultural Institute.

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Rayes, M.L. 2007. *Metode Inventarisasi Sumberdaya Lahan*. Andi Publisher, Jogyakarta.

Stewart, C., George, P., Rayden, T and Nussbaum, R. 2008. Good practice guidelines for High Conservation Value assessments: A practical guide for practitioners and auditors. ProForest, Oxford. UK

Annex 1. HCV 4 pre-survey data and analysis

Environmental services HCV pre-surveys are aimed at answering the following key questions:

1) Does the study location cover a vital water catchment area, either for interests within the study area, or in a landscape context for others outside the study area? – Identification of HCV 4.1 potential.
2) Are there any areas in the study location that are vital for erosion control? – Identification of HCV 4.2 potential.
3) Are there any areas in the study location that are vital as natural fire breaks for preventing the spread of land fires? – Identification of HCV 4.3 potential.

To answer these questions data and information are collected, then analysed, and validated to test their legitimacy and accuracy. Sources of data and information collected and analysed in PT CSC environmental services HCV pre-assessments are presented in **Table 1**

Table 1. Data and information collected and analysed in PT CSC environmental service HCV pre-assessments

HCV type	Main sources of data-information
HCV 4	• Shuttle Radar Topography Mission Elevation Data (USGS, 2004). • Forest and Waterways Allocation maps for West Kalimantan, East Kalimantan, Riau and Jambi provinces (Ministry of Forestry, Directorate General of Forestry Planology, 2009). • West Kalimantan, East Kalimantan, Riau and Jambi provincial spatial plans (Provincial Regulation No.5 / 2004) (West Kalimantan Provincial Development Planning Agency) • 1:50,000 scale RBI maps (National Survey and Mapping Coordination Agency (*Bakosurtanal*) • West Kalimantan, East Kalimantan, Riau and Jambi provincial forestry office statistics • 1:250,000 scale RePPPort Land System map (1990) (Bakosurtanal) • Landsat 7 ETM+ path/row satellite imagery • 1:250,000 scale watershed maps (BPDAS – Ministry of Forestry) • 1:250,000 scale geological maps of West Kalimantan, East Kalimantan, Riau and Jambi provinces (Ministry of Energy and Mineral Resources Geological Resources Centre) • River Management Regional Unit Maps (Directorate of Water Resources Management – Ministry of Public Works) • 1:250,000 scale peatland distribution maps of West Kalimantan, East Kalimantan, Riau and Jambi provinces (Wetlands, 2004) • Climatology and rainfall satellite data (BMKG and TRMM (Tropical Rain Measurement Mission) • Hotspot maps – NOAA AVHRR (NOAA – USA) • Elevation maps (produced by the team based on SRTM data). • Gradient class maps (produced by the team based on SRTM-DEM data). • Land cover maps (produced by the team based on Landsat 7 ETM+ 2012 imagery). • Integrated geographical assessment of environmental conditions in water catchments: linking landscape ecology, environmental modelling and GIS. Journal of Environmental Management, Academic Press (Aspinal, R. and Pearson, 2000). • Urban Hydrology for Small Watersheds, Technical Release 55. (USDA, 1986). • References (see list of references)

Analyses conducted in the HCV 4 pre-surveys include:

1) Analyses of protected areas in and around study regions based on Area Function Allocation Maps and provincial and district spatial plans (*RTRWP* and *RTRWK*),
2) Analyses of surface hydrology (slope, surface flow direction, flow accumulation, watershed boundaries and flow networks),
3) Interpretation of water catchment areas, springs and seepage areas,
4) Interpretation and creation of land cover maps from satellite imagery (including open water bodies: lakes, wetlands, reservoirs etc.),
5) Interpretation of land systems, physiography and ecosystems based on land system maps,
6) Interpretation of peat areas based on land system maps, satellite imagery and peat maps, and
7) Interpretation of erosion-prone areas.

Output from the pre-survey stage are distribution maps of areas or locations thought to have the attributes or elements of potential HCV environmental services areas (HCV 4.1, HCV 4.2 and HCV 4.3).

Annex 2. Field guide for identification of HCV 4 areas

No.	Study object type	Actions taken
1	Hilly areas	- Estimating boundaries of the hilly area - Conducting assessments of physiographic conditions (topography, slope, surface form) - Assessing land cover condition and soil types (identifying species of vegetation growing) - Identifying water source areas (seepage belt, spring belt) - Identifying erosion and landslide-prone areas - Identifying rivers and tributaries
2	Lower courses / near the coast	- Estimating tidal zones (Zone A, B or C)[3] - Conducting assessments of physiographic conditions (flat or undulating) - Identifying vegetation around bodies of water to observe and determine the limit of tidal influence - Determining ecosystem boundaries (aquatic-ecotone-terestic)
3	Rivers	- Identifying river morphology (width, wetted perimeter, estimated depth, riverbank shape) - Establishing river type (based on genetics, water source and debit) - Assessing and measuring the river's current speed to determine water debit at the time of the survey - Estimating fluctuations in debit (done with vegetation and sediment proxy indicators) - Assessing water quality based on physical and biological proxy indicators (for instance, presence of aquatic insects and plants, colour, smell) - Estimating flood plains, landslides, ecology and security (as material for determining riparian zone width) - Collecting samples of substrate and measuring sediment depth to determine levels of erosion in water catchment areas - Identifying vegetation in riparian zones - Determining ecosystem boundaries (aquatic-ecotone-terestic)
4	Swamps / lakes / other open bodies of water	- Identifying swamp type and vicinity (lowland-inundation that retains rainwater, river water with an SPI value of 0 or TWI = ∞ (flow speed only determined by kinetik energy from currents entering the swamp, spring/seepage area) - Conducting estimations of area, depth and fluctuation (can be done with surrounding vegetation proxy indicators) - Identifying connectivity with other open bodies of water (rivers, other lakes etc.) - Identifying vegetation in and around the swamp/lake/other body of water - Determining ecosystem boundaries (aquatic-ecotone-terestic) - Testing / collecting soil substrate samples from the swamp bed to determine whether the area is peat or freshwater swamp
5	Swamps and peatland	- Measuring the height of peatland surface water - Measuring peat depth - Identifying peat type (*fibric, hemic, sapric*) - Assessing physiographic conditions around the peat area so they can be used to determine the peat formation process (*topogenous/ombrogenous*) - Identifying connectivity with other open bodies of water (rivers, other lakes etc.) - Identifying vegetation in and around the swamp/peatland area - Determining ecosystem boundaries (aquatic-ecotone-terestic)
6	Water sources: springs	- Determining water source type (spring or seepage)

[3] Zone A: tidal zones characterized by sea water coming inland (mangrove vegetation). Zone B: tidal zones characterized by mixing of salt and fresh water (brackish vegetation). Zone C: rising height of fresh water caused by pressure from high tide sea water (riparian fresh water vegetation).

No.	Study object type	Actions taken
	and seepage	- Measuring water source outflow debit - Assessing water quality based on physical and biological proxy indicators (for instance, presence of aquatic insects and plants, colour, smell) - Identifying main vegetation around water sources - Identifying physiography around water sources
7	Important water catchment areas	- For instance: karst (limestone) and/or other unique ecosystems that function as important water catchment areas - Taking necessary actions in accordance with conditions as explained in points 1-6 above

Annex 3. Establishing HCV 4 area boundaries

HCV 4 areas contain attributes or elements of life support systems in the form of environmental services. All or most of these attributes or elements are intrinsic to the location concerned. Therefore, studies of the extent and distribution of areas containing these attributes or elements is essential for determining the boundaries of such areas. The processes and analyses for establishing HCV 4 area boundaries by typology and natural characteristics are presented below.

(1) HCV 4 swamp areas that function as water catchment and flood control areas

To establish the boundaries of HCV swamp areas SRTM-DEM topographic data is analysed to obtain a topographic wetness index (TWI). In principle, this index shows potential permanently saturated areas which are classified into three classes: (i) low, (ii) medium and (iii) high. Areas with a high topographic wetness index have high potential for permanent saturation. Areas determined by the results of TWI analyses are then simulated with climate characteristics in study regions and flooding patterns in rivers to establish areas that are always inundated with water. The results of TWI studies are subsequently validated with data from field surveys. HCV area indicative boundaries are determined by digitising areas with high potential and areas that are permanently inundated.

(2) HCV 4 river and riparian zone areas

The boundaries of HCV area riparian zones are determined by calculating the effective width of the riparian area according to its function. Functions of riparian zones that become determining factors for HCV area boundaries are as follows:

- Flood control (for rivers that have flood plains) - determined by TWI analyses; a similar approach to those used for swamps.
- Riverbank morpho-erosion control (for rivers with steep riverbanks) - determined by studying river cross section and hydraulic depth morphology.
- Water quality protection - determined by studying land cover and surface flow direction in the river catchment area. Riparian zones with good vegetation cover proven to protect water quality in the river are determined based on observations on the ground.
- Aquatic habitat protection – determined by considering the preferred habitats of protected aquatic wildlife with important conservation value.
- River shade trees that ensure a balanced microclimate with temperatures and humidity appropriate to the metabolisms of living creatures in the surrounding area – determined by considering the preferred habitats of protected aquatic wildlife with important conservation value.
- Terestrial wildlife habitats and corridors – determined by considering the preferences of high conservation value wildlife that use riparian zones as habitats, corridors, or sources of food.

Indicative boundaries of these HCV areas are determined by following the most dominant of these seven functions.

(3) Hilly HCV 4 areas that function as water catchment and erosion control areas

Indicative boundaries of hilly HCV areas are determined by considering slope aspect, contour density, land cover and erosion hazard level in the location concerned. DEM data is used to obtain information on slope and contour density. Data from field observations and interpretations of land use based on satellite imagery are used to establish land cover conditions. The USLE erosion calculation method is used for determining the erosion hazard level.

Erosion hazard level is calculated using soil type, slope, and slope length factor coefficient value parameters. Separate erosion hazard level calculations are made for land by considering the presence and absence of vegetation cover in order to compare erosion levels before and after land clearance.

Indicative boundaries of these HCV areas are determined by following slope boundary, which is based on field data covering elevation and land cover in the place where the spring or seepage originates before becoming a water source or river.

(4) HCV 4 in the form of wetlands or bodies of water that function as natural fire breaks

Areas that can function as natural fire breaks are land that remains wet all year round and bodies of water that retain water throughout the year and are wide enough to prevent the spread of land fires. Information on land fire history can be secured during field surveys by looking at the remnants of past fires, from local people and from forest and land fire data obtained through analyses of satellite imagery. Land fire history and the results of field surveys will help greatly in determining whether an area can function as a fire break.

Indicative boundaries of these HCV areas are determined by digitising land that is wet all year round (TWI analysis) or bodies of water with historical evidence as natural fire breaks.

(5) HCV 4 areas in the form of important water sources

HCV areas that function as important water sources can include springs, rivers, reservoirs and lakes. Springs are protected by establishing boundaries at a radius of 200 metres from a spring. Vegetation cover and land morphology are analysed before establishing HCV area indicative boundaries for rivers, reservoirs and lakes. Good vegetation cover will protect water quality in areas that function as water sources. The width of a vegetation zone, which can protect water quality at source, is determined by calculating the potential for erosion and contamination in the surrounding area.