Date of Submission	30 March 2019

IPL Project (IPL - 216) Annual Report Form 2019

1 January 2018 to 31 December 2018

1. Project Number (approved year) and Title:
   IPL-216 (2016) Diversity and hydrogeology of mass movements in the Vipava Valley, SW Slovenia

2. Main Project Fields
   (1) Technology Development
   ✓ A. Monitoring and Early Warning, B. Hazard Mapping, Vulnerability and Risk Assessment
   (2) Targeted Landslides: Mechanisms and Impacts
   A. Catastrophic Landslides, B. Landslides Threatening Heritage Sites
   (3) Capacity Building
   A. Enhancing Human and Institutional Capacities
   ✓ B. Collating and Disseminating Information / Knowledge
   (4) Mitigation, Preparedness and Recovery
   ✓ A. Preparedness, B. Mitigation, C. Recovery

3. Name of Project leader: Timotej Verbovšek, PhD, assoc. prof.
   Affiliation: University of Ljubljana, Faculty of Natural Sciences and Engineering, Department of Geology, Associate professor
   Contact: Aškerčeva 12, SI-1000 Ljubljana, fax: +386 1 4704560, phone: +386 1 4704615, timotej.verbovsek@ntf.uni-lj.si
   Core members of the Project:
   Names/Affiliations: (4 individuals maximum)
   Tomislav Popit, PhD, University of Ljubljana, Faculty of Natural Sciences and Engineering
   Jernej Jež, PhD, Geological Survey of Slovenia
   Ana Petkovšek, PhD, University of Ljubljana, Faculty of Civil and Geodetic Engineering
   Matej Maček, PhD, University of Ljubljana, Faculty of Civil and Geodetic Engineering

4. Objectives: (5 lines maximum)
   The northern slopes of the Vipava Valley are one of the areas in Slovenia with the highest landslide susceptibility. *First objective* is to create a landslide inventory of the Vipava Valley in GIS environment, to comprise the diversity of mass movements in this area. This will result in a database and a GIS map of different units with their lithological, geotechnical and rheological properties. *Second*, to perform a hydrogeological analysis of selected springs in this area, which are related to landslides. *Finally*, to monitor the movement of some of the selected landslides, according to available budget.

5. Study Area: (2 lines maximum)

   Study area is located in SW Slovenia, in the northern slopes of the Vipava Valley.

6. Project Duration (1 line maximum): 3 years, proposed 2017–2019 (officially started in 2016).

7. Report

1) Progress in the project: (30 lines maximum)

The project is running mostly according to plan. The geological and geomorphological investigations (mapping and GIS analyses) are still taking place, with the aim of creation of a detailed engineering-geological map in GIS environment. We have gained additional several detailed information about the boreholes in the wider area of Ajdovščina town, including the hydrogeological data of the sediments. Measurements in the Stogovce landslide indicate very uneven ground water surface with water levels fluctuating up to two meters during the year. Depth to water level ranges from approximately one meter to 25 m in the inclinometers. We have also performed measurements of physico-chemical parameters (temperature and electroconductivity) in the boreholes. These parameters show very different behavior in all measured boreholes, depending on their depth and location in the landslide. Results were presented in publications and proceedings (see below). A detailed georeferenced 3D model of Stogovce landslide was also constructed in August 2018 by measuring the landslide with UAV (DJI Phantom 4), and these measurements will be performed in future intervals to study the landslide movement.

In summary, besides the publications, some other activities were performed in 2018, among which we have promoted the Adriatic-Balkan network (ICL-ABN) network activities in the Vipava Valley (the topic of IPL-216 project) with joint field work with students of University of Ljubljana + University of Zagreb, Faculty of Mining, Geology and Petroleum Engineering to Stogovce, Slano blato and Podboršt landslides, in June 2018. Several investigations are recently taking place, with aim to be published in peer-reviewed journals.

2) Planned future activities or Statement of completion of the Project (15 lines maximum)

We will continue with our plan for last (third) year; with further activities focused on finalization of a map of the area with lithological, geotechnical and rheological properties of the mass movements. Also, we will finish the hydrogeological measurements of water related to Stogovce landslide. Future work will include rheological analyses and additional scanning and monitoring changes of the landslide surface with UAV and photogrammetry. Outcomes of the work were and will be presented at scientific meetings and published.

3) Beneficiaries of Project for Science, Education and/or Society (15 lines maximum)

Still, the beneficiaries were the mostly the *scientists*, as work on the project was presented at conference meetings and published in peer-reviewed paper, and the s*tudents*, as some of them are active in the research project topics. Also, we are collaborating with a Head of Civil Protection of the Ajdovščina Municipality, who

is informed with all major project findings important for CP activities.

Results: (15 lines maximum, e.g. publications)

Publications in 2018 include:

- **Landslides** - Verbovšek, Timotej, Popit, Tomislav. GIS-assisted classification of litho-geomorphological units using Maximum Likelihood Classification, Vipava Valley, SW Slovenia. Landslides : Journal of the international consortium on landslides, ISSN 1612-510X. [Print ed.], 2018, vol. 15, iss. 7, str. 1415-1424, doi: 10.1007/s10346-018-1004-2
- **Acta Geographica Slovenica** – Kocjančič M, Popit T, Verbovšek T, Gravitational sliding of the carbonate megablocks in the Vipava Valley, SW Slovenia, doi: 10.3986/AGS.4851
- **Landslides** - Errera, Gerardo, Mateos, Rosa María, García-Davalillo, Juan Carlos, Grandjean, Gilles, Poyiadji, Eleftheria, Maftei, Raluca, Filipciuc, Tatiana-Constantina, Jemec Auflič, Mateja, Jež, Jernej, Podolszki, Laszlo, et al. Landslide databases in the Geological Surveys of Europe. Landslides : Journal of the international consortium on landslides, ISSN 1612-510X. [Print ed.], 2018, vol. 15, issue 2, str. 359-379, doi: 10.1007/s10346-017-0902-z.
- **Geofluids** - PERANIĆ, Josip, ARBANAS, Željko, CUOMO, Sabatino, MAČEK, Matej. Soil-water characteristic curve of residual soil from a flysch rock mass. Geofluids, ISSN 1468-8123, 2018, letn. 2018, str. 1-15, ilustr. https://www.hindawi.com/journals/geofluids/2018/6297819/, doi: 10.1155/2018/6297819
- **5th Slovenian Geological Congress** - Jemec Auflič, Mateja, Mikoš, Matjaž, Verbovšek, Timotej, Bavec, Miloš. Recent developments in landslide research in Slovenia. V: Jemec Auflič, Mateja (ur.), Mikoš, Matjaž (ur.), Verbovšek, Timotej (ur.). Advances in landslide research : proceedings of the 3rd Regional Symposium on Landslides in the Adriatic Balkan Region, 11-13 October 2017, Ljubljana, Slovenia. Ljubljana: Geological Survey of Slovenia. 2018, str. 119-124.
- **5th Slovenian Geological Congress** - Verbovšek, Timotej, Mihevc, Nejc, Kočevar, Marko, Vrabec, Marko. Meritve premikov in podzemne vode na plazu Stogovce pri Ajdovščini = displacement and groundwater monitoring of the landslide Stogovce near Ajdovščina, SE Slovenia. V: Novak, Matevž (ur.), Rman, Nina (ur.). Zbornik povzetkov = Book of abstracts, 5. slovenski geološki kongres, Velenje, 3.-5. 10. 2018. Ljubljana: Geološki zavod Slovenije. 2018, str. 87-88.

Other activities in 2018 include:

- **Field work with students of University of Ljubljana + University of Zagreb,** Faculty of Mining, Geology and Petroleum Engineering (Adriatic-Balkan network ICL ABN) to Stogovce, Slano blato and Podboršt landslides, June 2018.

1) If you will change items 1)-6) from the proposal, please write the revised content in Red.
2) Please fill and submit this form by 30 March 2019 to ICL Network <icl-network@iclhq.org>